SERVICE MANUAL

GENERAL ELECTRIC REFRIGERATORS

WITH

SCOTCH-YOKE MACHINES

GENERAL ELECTRIC REFRIGERATORS

WITH

SCOTCH-YOKE MACHINES

TYPES CE, CF, CG, CH, CJ, CK, DK, FBA & LK

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PREPARED BY

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APPLIANCE AND MERCHANDISE DEPT.

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FOREWORD

EVERY General Electric refrigerating machine is carefully designed, manufactured, tested and inspected at the factory in order to give satisfactory performance. Occasionally, however, there will arise conditions and circumstances which will necessitate adjustment by a competent serviceman.

While only a relatively small percentage of General Electric refrigerating machines require such special service, much of which is of a minor nature, still it must be remembered that every service call represents a critical point in the customer's good will toward the General Electric Company, the distributor and the dealer from whom the refrigerator was purchased. Consequently, the service required should be rendered quickly, courteously and efficiently.

This manual is prepared as a reference and a guide to assist the serviceman in giving competent service. While much information is included, it is arranged and indexed so that various details can be easily located. Although the great majority of servicemen will use but a few of the adjustments given, the less common adjustments are also included so that they are available if they should ever be needed.

General Electric Scotch-yoke machines, so named because of their compressor design, have been manufactured in many different types and sizes. This manual describes these various Scotch-yoke machines and gives in detail all service adjustments that may be found necessary.

Service information on other types of household refrigerating machines manufactured by the General Electric Company is available in similar Product Service Manuals.

DESCRIPTION OF MACHINES

DIFFERENT TYPES

Standard General Electric Household Refrigerators manufactured since 1934 are equipped with Sealed refrigerating machines, known generally as Scotch-yoke machines. The name "Scotch-yoke" comes from the design of the compressor used which is described in detail in this section of the Manual. These machines have been adapted to many different cabinets and numerous design changes have been made, resulting in a large number of different types, sizes and forms. However, the fundamental parts and the compressor construction have remained essentially the same so that their operation and service adjustments are similar.

Scotch-yoke machines can be considered under five groups:

MONITOR TOP CK MACHINES

All of the component parts are assembled into a compact unit which sits on top of the cabinet. The machine and cabinet are shipped independently, and it is only necessary to set the machine on the cabinet in the home.

The compressor is located within a steel case which is surrounded by the smooth circular plate condenser held in place by radiating fins. The compressor and condenser assembly is mounted on the cabinet top section, generally called the "box top". The float valve is located on the rear of the box top.

The evaporator (or evaporators in the case of CK-35 machines) is suspended from the lower side of the box top. Evaporators on CK machines are made of stainless steel, except those on the replacement CK-2E and CK-30H machines manufactured in 1942 which are porcelain enameled steel.

The control is mounted on the front center of the condenser and the starting relay is attached to the condenser toward the rear.

All Monitor Top Machines, except CK-30G, CK-35G and CK-35H, use sulphur dioxide (SO^2) for the refrigerant. CK-30G, CK-35G and CK-35H machines are charged with Freon-12 (F-12).

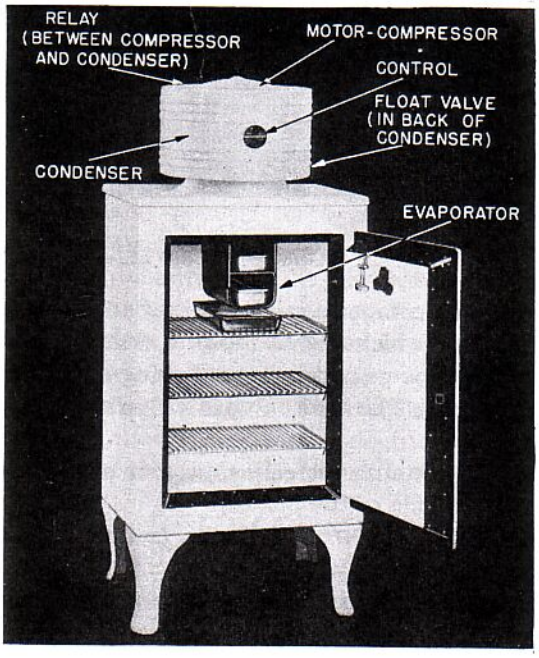

Fig. 1
CK Machine on Cabinet

FLATOP MACHINES
CE, CF, CH, CJ AND FBA

The arrangement of parts is such that the compressor case is located in the base compartment of the cabinet. The machine is assembled to the cabinet in the factory instead of in the home.

The compressor is within the steel case which, on the larger capacity models, has fins. A flat-plate condenser is used on the majority of these machines. It is mounted on the back of the cabinet.

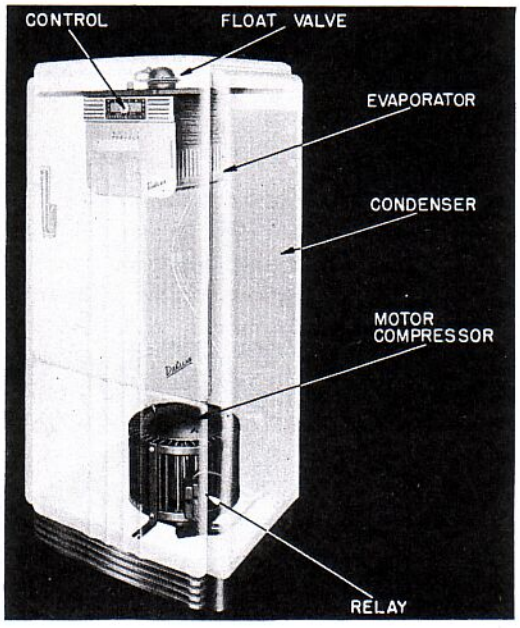

Fig. 2
CF Machine in Cabinet

The larger capacity units have a tall condenser nearly as high as the cabinet while the lower capacity units have a short condenser. Because of anticipated limited circulation, the CH-1 machine has a motor-driven fan on the front of the compressor case. A finned tube condenser with a fan is used in place of a plate condenser on CE-140, CE-34 and CE-340 machines.

The float valve is mounted on a top plate. When the machine is installed in a cabinet, the float valve is within the cabinet top section.

The evaporator (or evaporators in the case of CE-34 and CE-340 machines) is suspended from the top plate. Stainless steel was the material used for evaporators up until the latter part of 1941 when several models were introduced with porcelain enameled steel evaporators.

The control is attached to the escutcheon plate across the front of the evaporator on all models, except the CF-22C and G where it is in the cabinet top section. The starting relay is located on the right side of the compressor case.

Sulphur dioxide (SO_2) is the refrigerant in the majority of Flatop models. Freon-12 (F-12) is used in a few models as follows: CF-1F, CF-2F and R, CF-28B, CF-22A, CE-34A, B, C, D, and E, and CE-340.

LIFTOP LK MACHINES

The parts are so connected that the machine cannot be removed from the cabinet. The whole refrigerator is handled and shipped together.

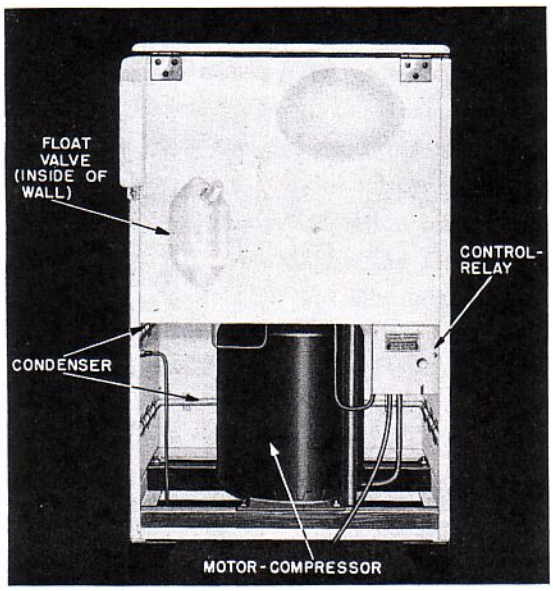

Fig. 3
LK Machine in Cabinet

The compressor case is in the base compartment of the cabinet. The condenser consists of tubing attached to the inner surface of the cabinet outer case. The float valve is located in the cabinet insulation in the back. A special evaporator is mounted on the rear wall of the cabinet inner liner.

The control and starting relay are attached to a plate in the rear of the cabinet base compartment. On some models, the control and starting relay are combined.

The refrigerant is sulphur dioxide (SO_2).

BALLTOP CG MACHINES

This machine is similar to a Monitor Top in that it sits on top of the cabinet, and the machine and cabinet are shipped separate.

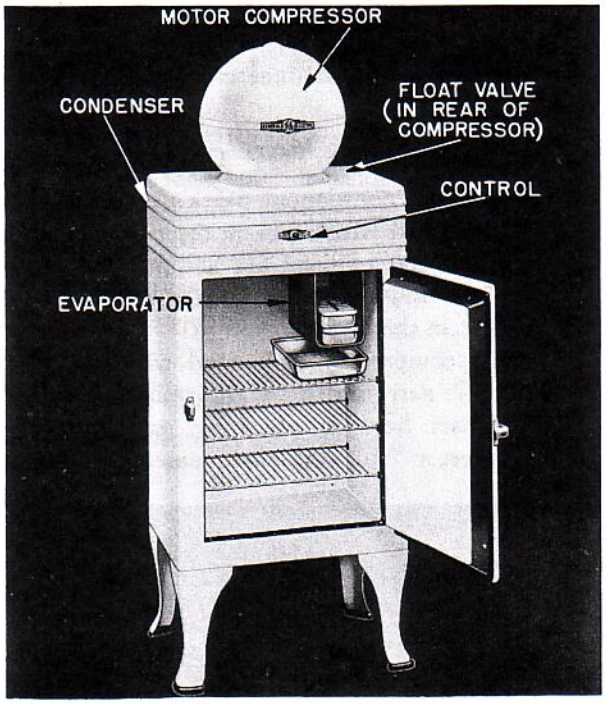

Fig. 4
CG Machine on Cabinet

The compressor case is in the form of a smooth sphere which sits on top of a rather thick box top. The condenser consists of tubing in the sides of the box top. The float valve is within the box top at the rear.

The stainless steel evaporator is attached to the lower side of the box top.

The control-starting relay combination is located up in the box top.

Sulphur dioxide (SO_2) is the refrigerant.

UNDER-THE-DRAIN DK MACHINE

This machine includes a CK compressor and condenser assembly mounted beside the cabinet.

The top plate and evaporator assembly is in the top of the cabinet. The machine is assembled to the cabinet at the factory.

The compressor unit may be on either side of the cabinet and is designed to go under a sink with the cabinet under the drainboard. It is a regular CK compressor unit with a circular condenser held by radiating fins to the compressor case. The float valve is mounted on the top plate.

The stainless steel evaporator is suspended from the top plate.

The control is mounted on the escutcheon plate across the front of the evaporator. The starting relay is attached to the condenser toward the rear.

The refrigerant is sulphur dioxide (SO_2).

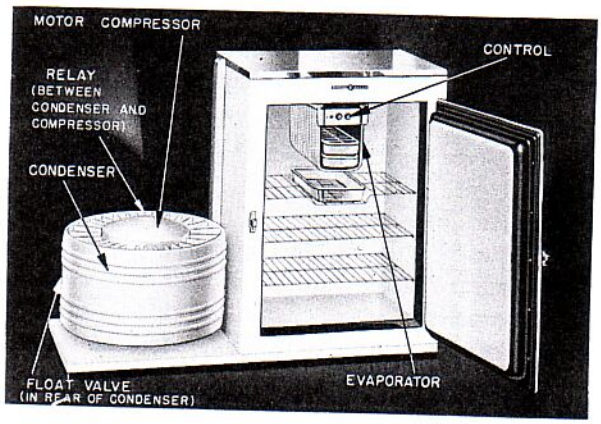

Fig. 5
DK Machine in Cabinet

CONSTRUCTION AND OPERATION

General Electric refrigerating machines are designed and manufactured to have a long trouble-free life, to perform their refrigeration service efficiently throughout their whole life, and to have reserve capacity enough to meet abnormal load conditions. Each machine has the following essential parts:

The Refrigerant liquid evaporates and removes heat from inside the cabinet. The resulting vapor is compressed and cooled, and the heat is dissipated into the surrounding atmosphere.

The Evaporator holds the refrigerant within the cabinet where evaporation and cooling takes place.

The Compressor removes the evaporated refrigerant vapor from the evaporator, compresses it and discharges it into the condenser.

The Condenser cools the compressed refrigerant vapor until it becomes a liquid again.

The Float Valve collects the condensed liquid refrigerant and returns it to the evaporator to make the cycle continuous.

The Control automatically regulates the operation of the refrigerating machine by turning the electric current on and off so as to maintain the evaporator temperature within proper limits.

The Starting Relay automatically starts the compressor motor when the electric current is turned on by the control.

REFRIGERANT

The refrigerant is a liquid which in evaporating removes heat from inside the cabinet. The resulting vapor is compressed and cooled, and the heat is dissipated into the surrounding atmosphere.

Sulphur dioxide (SO_2) is used in the majority of General Electric hermetically sealed refrigerating machines with the Scotch-yoke compressor. Freon-12 is used in a few models.

A comparison of the pressure-temperature characteristics of these two refrigerants is given in the following table:

Temperature °F.	Pressure, lbs./sq. in., gauge (approx).	
	SO_2	Freon-12
5	6 in. vacuum	12
15	0.5	18
25	5	25
40	12	37
50	19	47
62	28	60
73	38	74
85	51	92
110	85	136

In a normal room temperature (between 70° and 80° F.) for an SO_2 machine, the evaporator will average around atmospheric pressure, and the case pressure will be between 40 and 50 pounds per square inch. Under similar conditions, the evaporator of an F-12 machine will average about 18 pounds per square inch, and the case will be between 75 and 90 pounds per square inch.

EVAPORATOR

The evaporator holds the refrigerant which in evaporating removes heat from the air in the cabinet, from food placed in the cabinet, and from water and desserts placed in the evaporator. Stainless steel was used for all evaporators up until the latter part of 1941 when models were introduced with porcelain enamel on steel.

FT. WAYNE TYPES

The evaporators used on the first Scotch-yoke machines, CK-30B and CK-35B, are known as Ft. Wayne types, since they were originally designed for Open-type refrigerating machines manufactured in the General Electric Plant in Ft. Wayne, Indiana.

There is a bright, polished finish on these evaporators instead of a dull finish as on all Schenectady type stainless steel evaporators. There are two equal-sized headers on each single evaporator with a large equalizer tube between them. The refrigerated shelf (or shelves) is independent of the body of the evaporator and is joined to it near the front and rear corners.

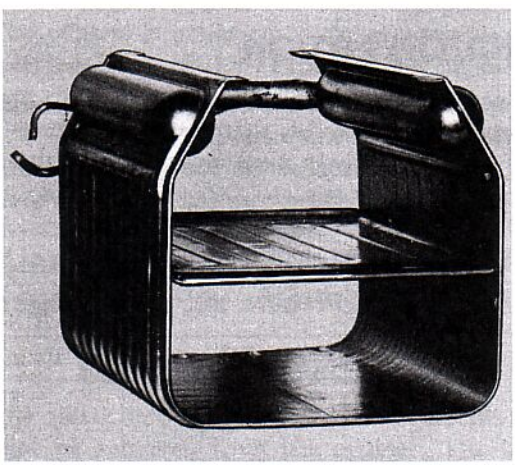

Fig. 6
CK-30B Evaporator

The CK-30B machine has a single wide evaporator with one refrigerated shelf. It is center mounted. The CK-35B machine has two narrow evaporators with an equalizer tube between their adjacent headers. Each of the CK-35B evaporators has two refrigerated shelves.

As on other Scotch-yoke machines, these evaporators are designed so that they are flooded with liquid refrigerant. The refrigerant circulation is as follows:

From the float valve of a CK-30B machine, the liquid tube splits into two injector tubes, each of which goes into one of the two sets of parallel tubes of the shelf.

The shelf discharges through the shelf joints into the parallel tubes of the sides. These tubes extend from two small sub-headers in the bottom to two small sub-headers near the top, the latter having channels at both ends connected to the main headers. Refrigerant vaporizing throughout the flooded evaporator rises above the liquid level in the headers and then enters the equalizer tube to which the suction line is connected.

The liquid tube of a CK-35B machine divides into two tubes, each of which passes through the rear wall of an equalizer tube, forward through the right header, and down through the first vertical channel of the right side to the bottom of the evaporator. Inside the bottom of the evaporator the tube separates into two injector tubes which go up through channels on each side, through the shelf joints and then discharge into the series path of the shelf.

From the shelf, the circulation is the same as previously described for the CK-30B evaporator.

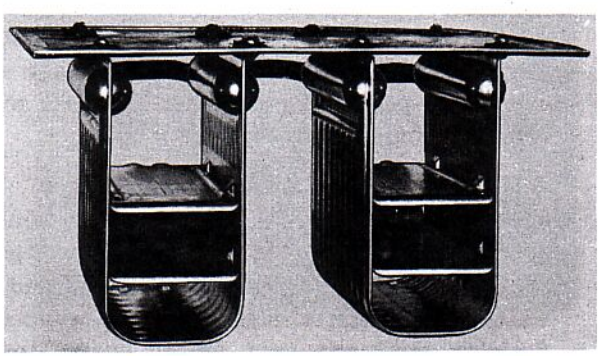

Fig. 7
CK-35B Evaporator

SCHENECTADY STAINLESS STEEL TYPES

The standard CK-2 evaporator (also used on CF-2, CF-21, CJ-2, and later CK-30 machines) has a single header on the left side. The refrigerated shelf is integral with the rest of the evaporator.

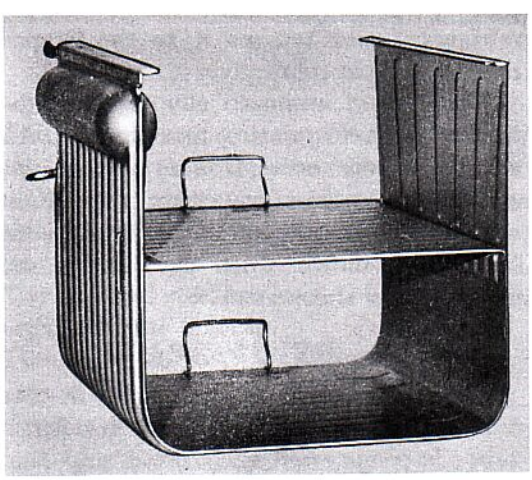

Fig. 8
CK-2 Evaporator
(CF-2; CF-21; CJ-2; CK-30C, D, E & G)

Channels and header sections are pressed in two sheets of stainless steel. The two sheets are welded together between the channels and around the edges, and then the evaporator is formed into shape. The width is sufficient to accommodate two standard ice trays side by side.

The series section forms the refrigerated shelf and the lower half of the right side. The parallel section consists of several sets of U-shaped channels running across the bottom and up the left side. An injector from the series section discharges into the bottom of each pair of channels, and the upper end of each channel joins the bottom of the header.

Within the header near the center a baffle forms a zone near the end of the suction tube, where the surface of the liquid is relatively quiet.

Fig. 9
Cut-away Evaporator Showing Baffle

The height of the evaporator was increased slightly for 1938 machines, and the space between the shelf and the bottom freezing surface was made higher to accommodate a removable shelf in certain models.

The circulation of refrigerant is as follows:

The liquid tube from the float valve joins the upper end of the rear channel which terminates just below the header on the left side. The rear channel carries the liquid across the bottom of the evaporator. The passage narrows down at the rear right corner, passes half way up the right side, then across the shelf. The series path continues back and forth across the shelf, and up and down the lower part of the right side.

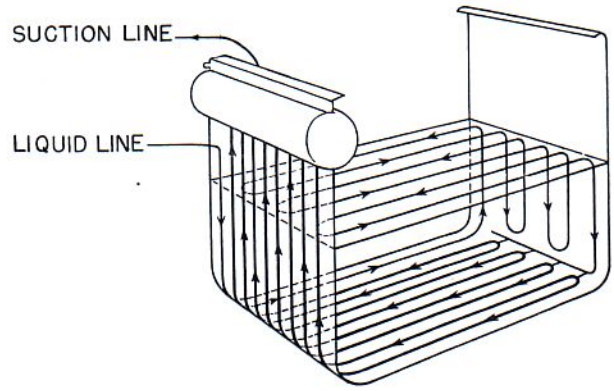

Fig. 10
Refrigerant Path in CK-2 Evaporator

After that the refrigerant enters a small sub-header extending from front to rear along the lower right-hand corner of the evaporator. Small injector tubes lead from the sub-header to parallel pairs of U-shaped channels going across the bottom, up the left side, and into the header. The suction tube enters about the center of the header, and its open end is above the liquid level in the zone formed by the baffle where the surface is relatively quiet.

The standard CK-1 evaporator (also used on CF-1, CF-11, FBA-1, and CG-1B machines) is similar to the CK-2 evaporator except that it is only wide enough to accommodate a single ice tray on a freezing surface. Its height has always been the same since it never has had a removable shelf.

On the first CK evaporators the control bulb is held against the first parallel channel on the left side. During 1935 the clamp was changed so that the contact is with the second channel.

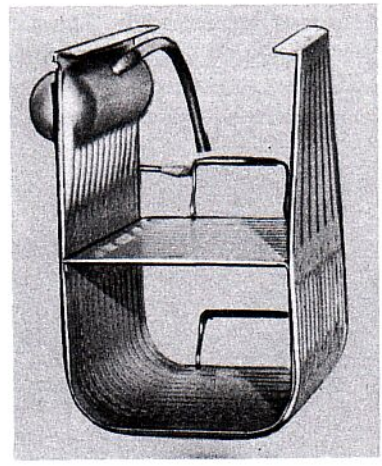

Fig. 11
CK-1 Evaporator
(CF-1, CF-11, FBA-1 and CG-1B)

Beginning with 1936 models, a door was added over the front opening of CK type evaporators.

On CK-1B and CK-2B machines, the evaporator is mounted on the right side of top plate. On all other CK machines, it is center mounted. On all CF models made through 1940, the evaporator is center mounted. On 1941 CF machines, it is on the right side. Certain CJ-2 models have it in the center; others on the side.

On the CFS-1 machine, a liquid leg is added to a standard CK-1 evaporator. The evaporator is in the center.

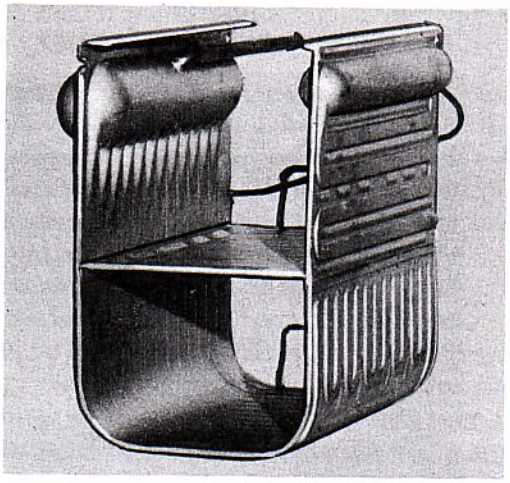

Fig. 12
CFS-1 Evaporator

The shallow evaporator used on CH-1, CJ-1, and CE-140 machines has no shelf. The series part includes only the right side. It is mounted on the right side of the top plate. The control bulb is in contact with the second parallel channel on the bottom. This evaporator is narrower on 1937 and 1938 models than on later models. The wider evaporator will hold two Quick trays side by side.

The CG-1A evaporator is similar in shape to a CK-1 evaporator except that it has no refrigerated

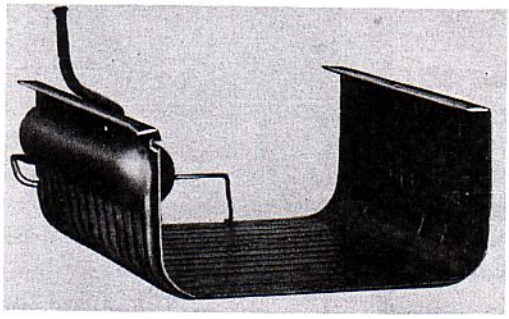

Fig. 13
CJ-1 Evaporator
(CH-1, CE-140)

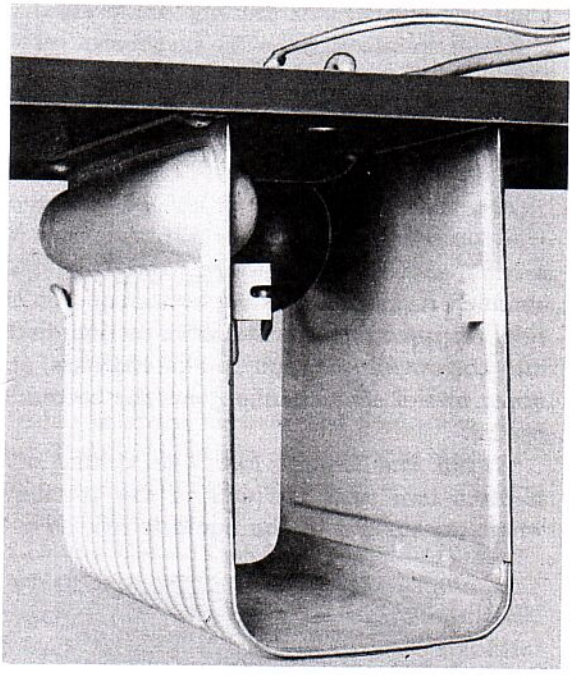

Fig. 14
CG-1A, DK-1 Evaporator

shelf or right side. There is no series part; the liquid tube from the float valve joining the small sub-header along the lower right corner, from where the injector tubes lead to the parallel U-shaped channels. The CG-1B machine has a standard CK-1 evaporator. On both of these machines the evaporator is mounted to the right.

The DK evaporator is like that on the CG-1A machine except that it is center mounted.

On CK-35C and subsequent CK-35 machines, a CK-1 and a CK-2 evaporator are used. The CK-2 evaporator is on the right and the CK-1 evaporator on the left with its header toward the right. The two headers are joined by an equalizer tube. The unrefrigerated leg (upper right half) of the CK-2 evaporator is bent on an angle so as to allow the installation in certain cabinets.

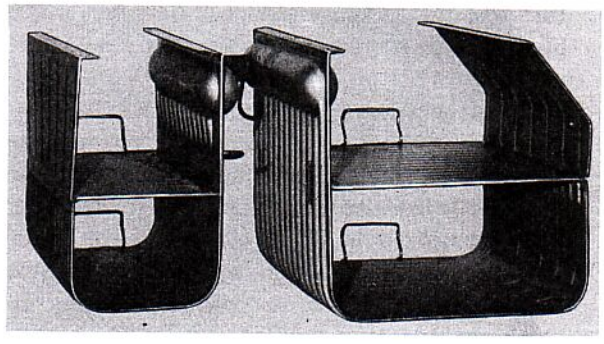

Fig. 15
CK-35C Evaporators

The bend of this part is further altered on later CK-35 machines to allow its use in some additional cabinets.

A few "special" CK-35B machines were made with a combination of Schenectady evaporators similar to those used on CK-35D except that the leg was bent down even farther.

The CE-34M machine has two standard CK-2 evaporators, one above the other, with the headers on the right. The headers are connected by an equalizer tube. Because of the reversed position of the evaporators, the control bulb is at the right rear of the upper evaporator. The evaporators are on the left side of the cabinet.

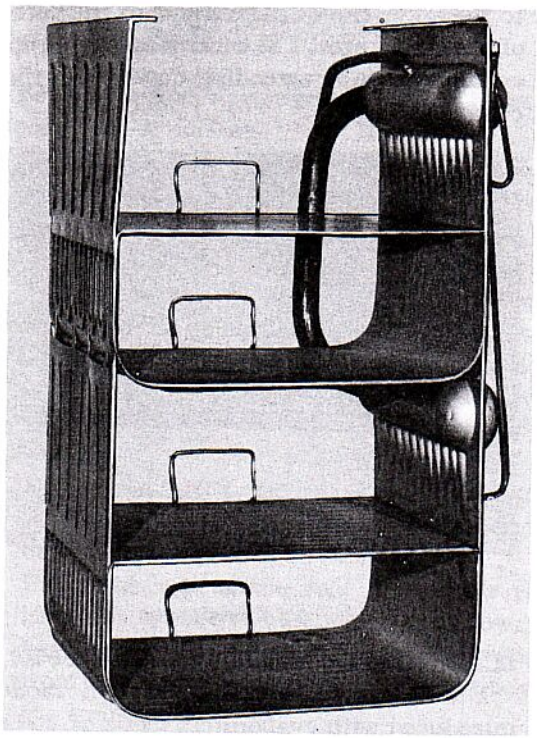

Fig. 16
CE-34M Evaporator

CE-340 machines are used to replace CE-34M machines, so have the same arrangement of evaporators.

On all CE-34 machines except the CE-34M, two standard CK-2 evaporators are mounted side by side, with the headers next to each other and connected by an equalizer tube. The control bulb is in its usual position on the right evaporator. The lower half of the back opening is closed on CE-34D and E machines and there is a removable shelf in one evaporator.

On CF-28 machines, first built in 1938, the upper right portion of an otherwise standard CK-2 evaporator is refrigerated by means of a set of horizontal tubes in series between the float valve and the shelf. The evaporator is center mounted on CF-28 machines up through 1940 and some models have a removable shelf.

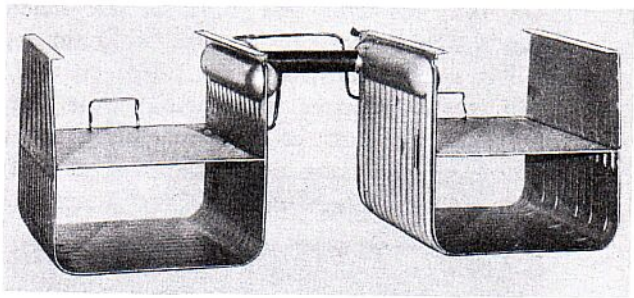

Fig. 17
CE-34A, B, C, D and E Evaporators

CF-22A and B machines have the same arrangement, which is usually referred to as a "liquid leg." The evaporator is center mounted. The lower half of the back opening is closed to give a colder, frozen storage space and there is a removable shelf.

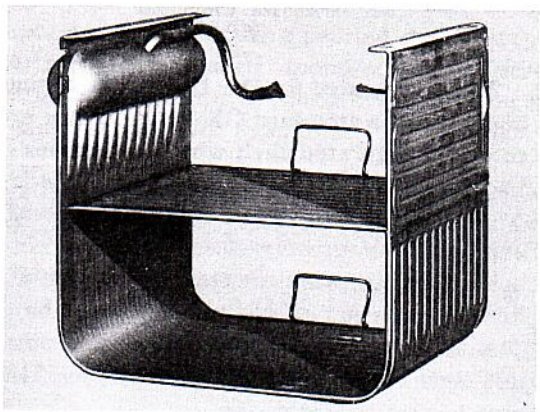

Fig. 18
CF-28A, B, C and D Evaporator
(CF-22A and B)

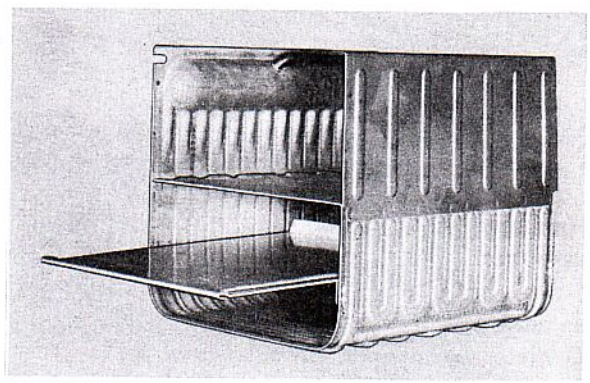

Fig. 19
Evaporator with Removable Shelf

On 1941 CF-28E and 1942 CF-2R machines using a CK-2 evaporator with a liquid leg, a small header is formed in the upper part of the liquid leg to improve the frosting under certain conditions. For both of these machines the evaporator is on the right side. The lower half of the back opening is closed on the CF-2R machine.

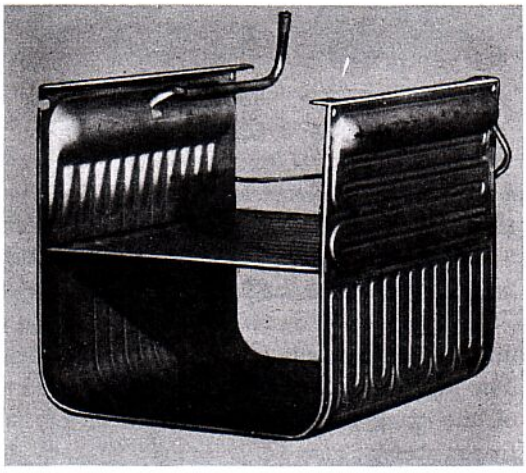

Fig. 20
CF-28E Evaporator
(CF-2R)

The evaporator for the 1941 CF-22C machine is higher than a standard CK-2 evaporator and has a second refrigerated shelf which is in series between the float valve and the liquid leg. There is a small header on the top of the liquid leg. The back of this evaporator is entirely closed. The control bulb is held in contact with the top center part of the left header instead of against one of the parallel channels on the left side as found on all other stainless steel evaporators of the CK type. This evaporator is on the right side.

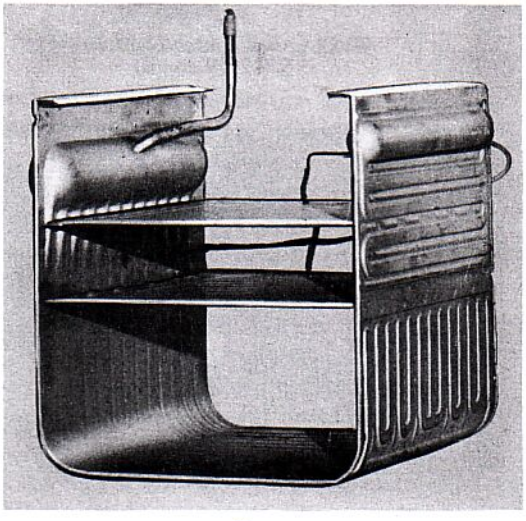

Fig. 21
CF-22C Evaporator

The LK evaporator has an inverted L section connected to a spherical header in back of the cabinet inner liner. The vertical part of the evaporator is attached to the liner; the horizontal part forms the freezing surface for the ice trays. Liquid refrigerant from the float valve enters the series channel of the vertical part of the evaporator about a third of the way up from the bottom, and passes back and forth across the evaporator to the horizontal part of the channel across the top. Small injector tubes lead from here into the series channel going back and forth across the horizontal shelf of the evaporator. This channel finally goes back and enters about the center of the spherical header. From the extension below the header, a tube goes to the lower end of the channel in the vertical part of the evaporator. The control bulb goes up into an open-ended tube extending down from the header extension.

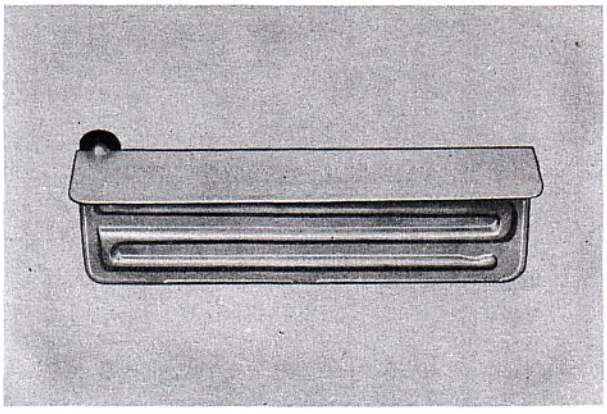

Fig. 22
LK Evaporator

SCHENECTADY PORCELAIN TYPES

During the latter part of 1941, models were introduced with evaporators made of steel, porcelain enameled blue or white. Each evaporator has a larger header on the left side and a smaller one on the right. The whole right side is refrigerated. The refrigerated shelf (two shelves in the case of the CF-22G machine) is made separate from the body of the evaporator and is attached by screws which go into angle pieces at the corners. Rubber washers are used to protect the enamel.

The evaporator is suspended from the right side of the top plate by chrome steel supports.

The rear end of each refrigerated shelf is curved upward to form a stop for the ice trays. A chrome steel stop is bolted to the rear of the lower freezing surface.

The control bulb is clamped against the center of the top of the left header by a chrome steel piece held by a single hex-head cap screw.

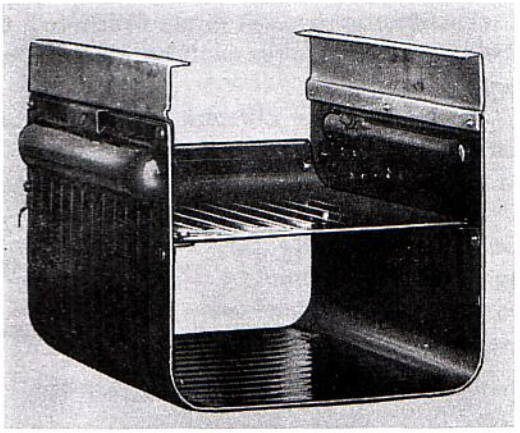

Fig. 23
CF-2M Evaporator
(CJ-2H, CF-28H, CK-30H)

The circulation of refrigerant in the standard evaporator is as follows:

Liquid refrigerant from the float valve enters the left connection at the back of shelf, circulates back and forth from front to rear, and leaves the shelf at the right rear connection.

A tube, leading from there, enters the small header on the right side about two thirds the way back on the inner side, and extends down along the bottom of the header. Small holes in the tube allow the refrigerant to pass into the header.

Below the small header are five sets of U tubes. In one leg of each set is a "bubbler" which is designed to maintain circulation.

From the top of the rear end of the small header is an outlet tube which goes down the back end of the right side and into a channel from rear to front along the lower right bend of the evaporator.

Small injector tubes lead from this channel to the bottom of each pair of parallel U tubes that go across the bottom and up the left side into the bottom of the left header. A baffle in the center of this header forms a zone where the surface of the liquid is relatively quiet. The suction tube comes into this section.

The standard evaporator is enameled dark blue on CJ-2H, CF-2M, CF-28-H12, and replacement CK-30H machines, but white on a few CF-2N machines. It is used without the shelf on replacement CK-2E machines and is blue enameled.

The CF-22G evaporator, enameled white, is higher than the standard one, to accommodate an extra refrigerated shelf above the regular shelf, and in series between it and the float valve. The rear opening is covered with a painted steel plate.

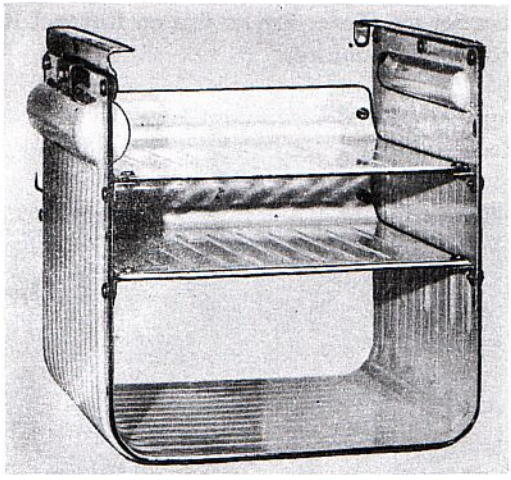

Fig. 24
CF-22G Evaporator

The two standard evaporators are white on CE-34H machines. There is a removable shelf in the right one. The large headers, which are not next to each other as on previous CE-34 models, are joined by a small equalizer tube as well as a series connection. The rear opening of each evaporator is covered by a painted steel plate.

A refrigerated shelf mounted in a vertical position is used as the complete evaporator on some remanufactured LK machines.

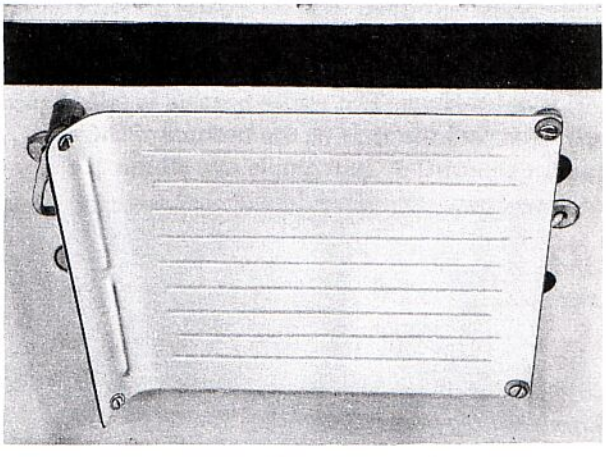

Fig. 25
Substitute LK Evaporator

COMPRESSOR

The compressor removes the evaporated refrigerant vapor from the evaporator, compresses it and discharges it into the condenser.

There are radiating fins on the compressor case of all Monitor Top CK and Under-the-Drain DK models. On Flatops, there are fins on the larger capacity machines, but none on most of the lower capacity machines or on those with a finned tube

condenser. There are no fins on Liftop LK or Balltop CG machines.

The compressor unit is mounted on three springs in the drawn steel base. A steel case covers the compressor unit and is welded to the base.

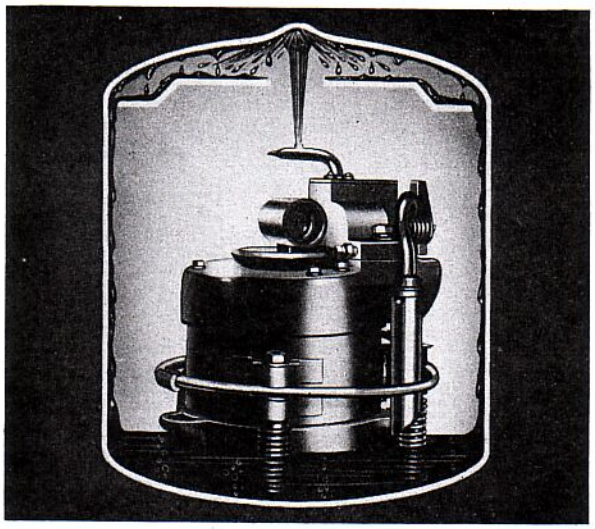

Fig. 26
Compressor Unit

The compressor consists of a reciprocating piston operating in a stationary cylinder. The piston is actuated through a sliding yoke (Scotch yoke) by a crank on the upper end of a vertical shaft.

The shaft is of hardened steel and runs in cast-iron bearings. The upper bearing is self-aligning. A rotary oil pump is at the bottom of the shaft.

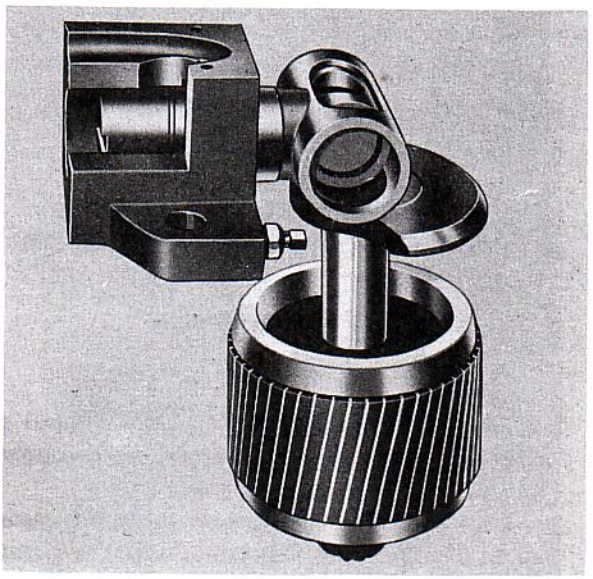

Fig. 27
Compressor Mechanism

The electric motor is direct connected, the rotor being pressed onto the shaft between the two bearings.

There are three different compressor unit sizes in 110-volt, 60-cycle machines:

Size	Stroke, Inch	Refrigerant	Motor Horsepower (60 Cycle)
1	0.53	SO_2	1/8 or 1/10*
2	0.66	SO_2	1/8
	0.53	F-12	1/8
3	0.85	SO_2	1/6
	0.66	F-12	1/6

*1/10-hp motor in most CJ-2B and CJ-2C machines.

The diameter of all pistons is 1¼ inches. The approximate full-load speed of 60-cycle units (including those with a two-phase motor operated from a direct-current supply through a rotary converter) is 1740 rpm. The speed of 25-cycle units is 1440 rpm.

DESIGN CHANGES

The arrangement of compressor parts has remained the same since this Scotch-yoke design was introduced in 1934. Minor improvements have been made in some of the parts as better manufacturing

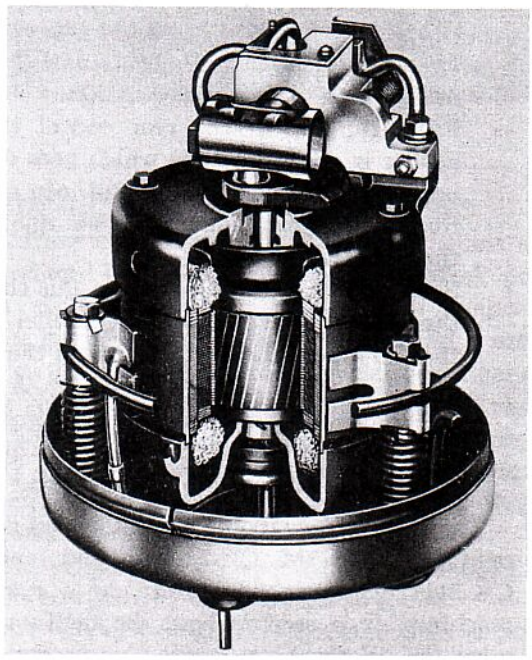

Fig. 28
Motor-compressor Assembly (Older Design)

methods were developed. Many of these changes

The height and weight of the stator core were reduced.

The bearing bracket castings were made lighter.

The oil trough below the valve plate was cast integral with the upper bearing bracket rather than being bolted to it.

The intake muffler was changed from two concentric tubes so joined that the refrigerant vapor enters holes in the upper part of the outer one, passes down between the tubes, and

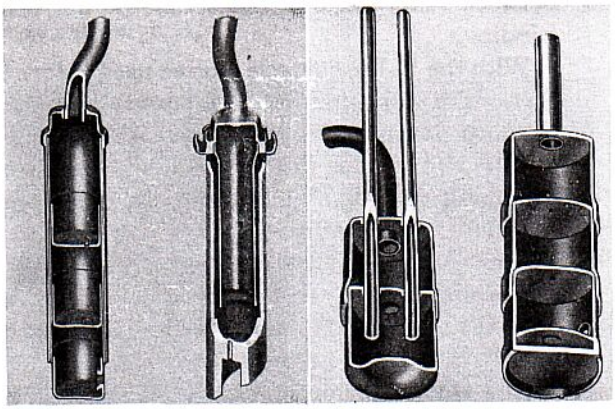

Fig. 29
1936 Mufflers 1937 Mufflers

up through the inner tube. The new arrangement has two circular chambers, one above the other with two small inlet pipes bringing the refrigerant vapor from near the top of the cylinder into the lower chamber. From there, it passes through a hole into the upper chamber.

The discharge muffler was changed in the way it was assembled but remained a series of three chambers with small holes between them.

The mounting springs were made lighter to compensate for the lighter unit.

The oil squirter at the top was altered in shape.

The suction line of Flatop models entered the side of the case, instead of through the base.

With the introduction of 1938 models, some additional alterations were made:

The compressor mounting originally had the upper spring plugs bolted to three brackets welded on the stator. With the new arrangement the lower bearing bracket has three feet cast integral with it. Tapered holes are drilled in these feet; the wider part being downward. The three supporting springs have their upper ends ground to the same taper. The lower bearing bracket sits on the springs but it is not connected to them.

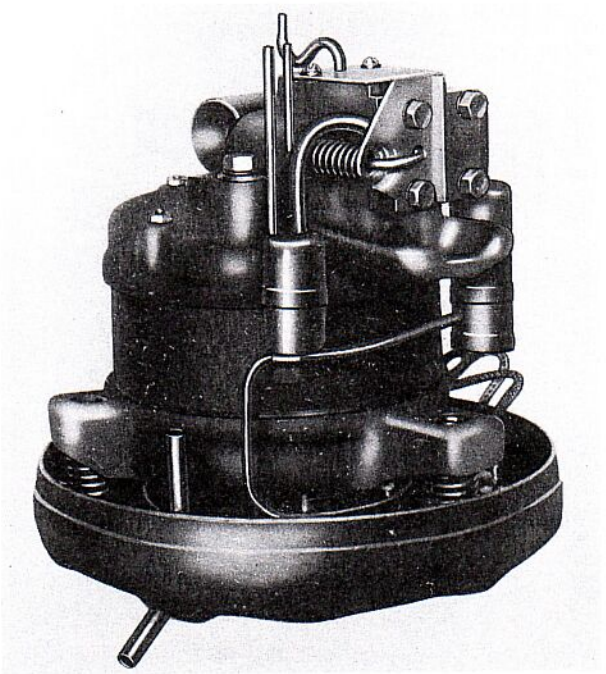

Fig. 30
Motor-compressor Assembly (1938 Design)

Brackets, welded to the compressor case, enclose, but do not touch the lower bearing bracket feet to prevent excess movement of the compressor unit during handling and shipping. The bumper ring was eliminated. An evacuation purging screw socket was added to the top of the compressor case dome, and the pinched-off by-pass tube around the float needle was eliminated. A Duprene rubber plug is fitted in above the purging screw to prevent its being used in the field.

The oil deflector, formerly welded to the bottom of the motor rotor, was eliminated due to a change in the upper bearing bracket.

COMPRESSOR MOTOR

The motor stator is held between the two bearing brackets of the compressor unit and the rotor is

Fig. 31
Motor Stator

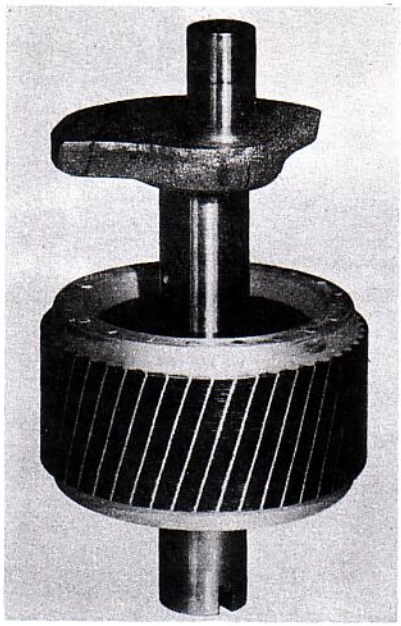

Fig. 32
Motor Rotor

pressed on the shaft. Cotton insulation covers the windings of all SO_2 machines. Formex insulation is used on all except some of the early Freon-12 models. The rotor had cast aluminum bars and end rings up until shortly after the beginning of 1942 when brazed copper bars were substituted.

Electric current is brought into the sealed-in motor through metal-glass leads in the base. Fused glass seals and insulates the electrical conductor from the steel sheath.

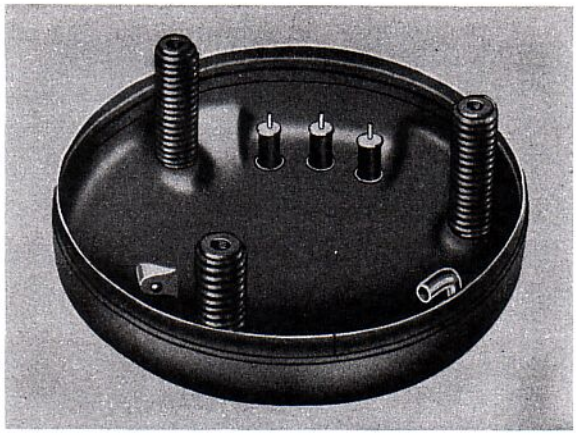

Fig. 33
Metal-glass Leads in Base

The compressor motor in most 1/8- and 1/10-hp, 60-cycle machines is of the resistance split-phase induction type with the higher resistance winding in the circuit only during the momentary starting period. While running, the motor operates single

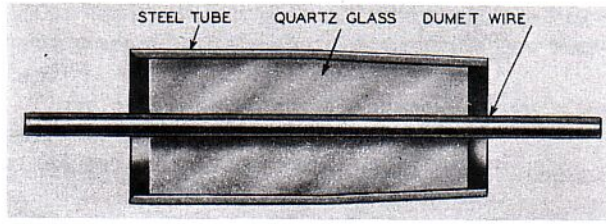

Fig. 34
Metal-glass Lead

phase. The resistance of the starting winding is between four and five times that of the running winding.

With the 1/6-hp, 60-cycle motors used before 1939, there is a capacitor in series with the starting winding. Its purpose is to increase the starting torque and reduce the starting current. At the beginning of 1939, this motor was redesigned to eliminate the capacitor.

The 1/10-hp, 25-cycle motor used with "two" size compressors does not have a capacitor in series with the starting winding; but the 1/8-hp, 25-cycle motor on "three" size compressors does.

The special motor in CFS-1 machines has two capacitors in the starting winding circuit. This starting winding is in the circuit when the machine is running and one capacitor is in series with it. The other capacitor is put in parallel with the first one during the momentary starting period.

The motor in certain CK machines, designed to be run from direct current service through a rotary converter, has two independent phases.

REFRIGERANT CIRCULATION

The interior of the compressor case is on the low-pressure side of the pump, and is connected directly with the evaporator header through the suction tube.

On the suction stroke, refrigerant vapor is drawn into the cylinder from the compressor case. Before entering the cylinder, the vapor passes through the suction muffler and by the intake valve, which

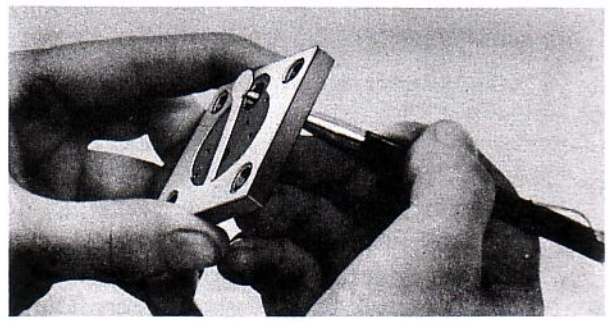

Fig. 35
Intake Valve

opens into the cylinder as the piston goes back. The intake valve is of the reed type with an enlarged circular end which covers the intake port in the valve plate.

On the compression stroke, the intake valve closes. The pressure of the refrigerant vapor is increased until it is sufficient to lift the rim of the thin circular disc of spring steel, which forms the discharge valve. This disc is pinned at the center and is backed by a heavier piece which allows a certain lift for the outer edge. The disc seats on the outer side of the valve plate and covers several small holes through it.

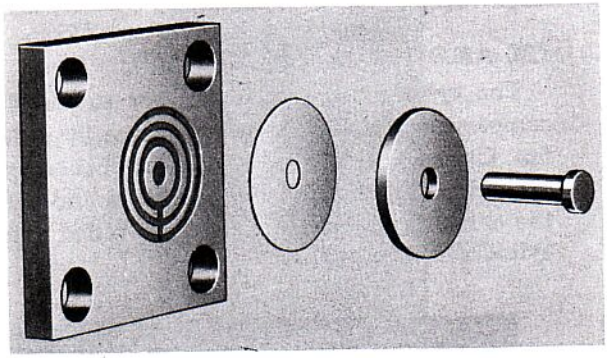

Fig. 36
Discharge Valve

From the valve plate, the compressed vapor goes through the discharge muffler, which consists of three chambers with small openings between them. The vapor then travels through a coiled tube in the oil under the compressor unit, and out through the base. The coiled tube makes a flexible connection between the spring-mounted compressor unit and the outside of the compressor base. The hot compressed vapor loses some of its heat to the oil in the base. The heating of this oil tends to keep the condensation of liquid refrigerant in the base to a minimum. The high-pressure tube carries the vapor from the compressor to the condenser.

OIL CIRCULATION

The oil in the compressor base performs three important functions:

1. All moving parts are lubricated under pressure.
2. The unloader valve is operated by oil pressure to apply the pumping load after the compressor is up to speed, and remove the load as it slows down when stopping.
3. The path of the oil is such that heat from the bearings, cylinder, stator and compressed refrigerant is carried to the walls of the compressor case from where it is dissipated.

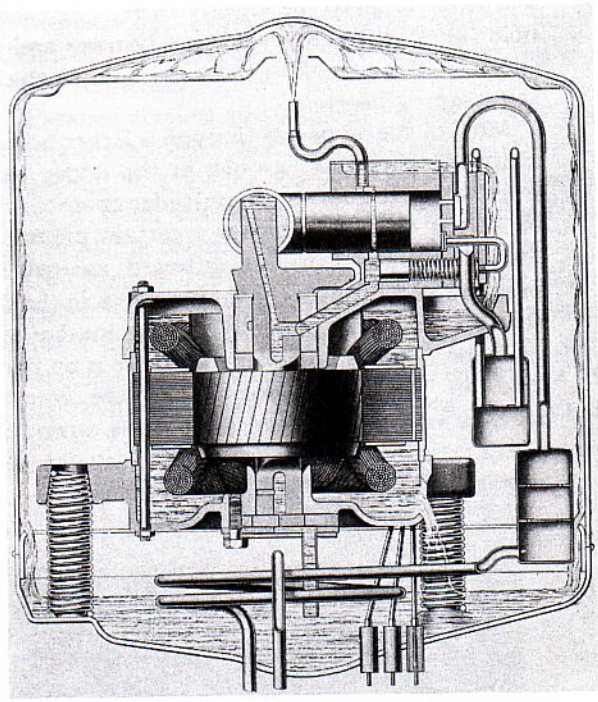

Fig. 37
Oil Circulation

A special grade of mineral oil is used. For CK-2 size compressors, the oil charge is about two quarts. The pumping rate is around three quarts/minute.

A small two-blade rotary oil pump is located at the bottom of the compressor shaft. Two small blades are in a slot across the bottom of the shaft and turn with it. They sweep around a cylinder which is off the center line of the shaft. As a blade moves along, the space behind it increases and oil is taken into the cylinder. The space ahead decreases and oil is forced out.

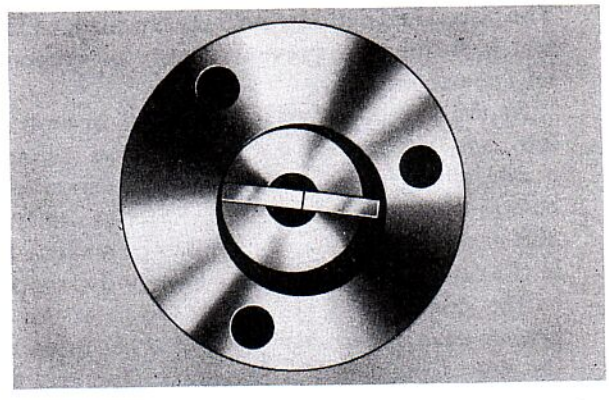

Fig. 38
Oil Pump

Oil from the base passes through the oil pump from where it is forced up a hole drilled through the center of the shaft. A small hole off to the side

allows oil to go to the lower bearing. Another small hole takes oil to the crank pin bearing and to the slider. A third small outlet carries oil to the upper self-aligning bearing.

Most of the oil passes through a larger hole in the shaft to an annular groove in the upper bearing, from where it goes to the unloader chamber. When oil in the chamber reaches a certain pressure, the unloader plunger moves outward against spring pressure and releases the intake valve so that it can seat on the valve plate. While the intake valve is held open by the unloader rod, there is no pumping load on the compressor. When the compressor reaches about half speed as it slows down, the oil pressure is reduced sufficiently to let the plunger come in and hold the intake valve open.

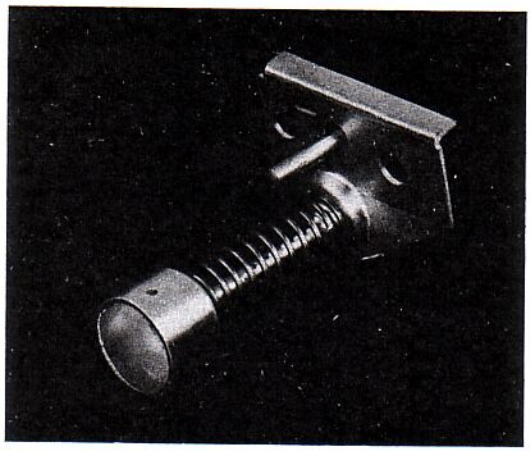

Fig. 39
Unloader

From the unloader chamber, the oil passes around the piston in an annular groove in the cylinder wall. The piston and cylinder surfaces are oiled, and an oil seal is formed to prevent escape of compressed refrigerant vapor.

At the top of the cylinder, the oil stream splits into two parts. Half of it passes up through a nozzle which directs it against the center of the compressor case dome. On all except the early CK-30B and CK-35B machines, there is a slight bulge in the center of the dome to properly deflect the oil to the sides. A shield across the top of the compressor case collects the oil and lets it drain down the side of the case in a thin sheet. The heat which the oil has picked up from the compressor unit is transferred to the case from where it is dissipated.

The other half of the oil flows out over the end of the cylinder where it picks up heat from the cylinder and the valve plate. Then it flows down into a trough which carries it to the space in the upper bearing bracket. A non-magnetic dam prevents oil from getting down into the air gap. The upper ends of the windings are immersed in the oil.

The oil seeps through spaces between the wires and through the cotton insulation to the space in the lower bearing bracket where the lower ends of the windings are located. Heat is absorbed directly from the windings and the stator core.

From the lower bearing bracket, the oil returns to the sump in the base.

CONDENSER

The condenser cools the compressed refrigerant vapor until it becomes a liquid.

CK AND DK MACHINES

The cylindrical plate condenser surrounds the compressor case and is held in place by radiating fins. Channels are pressed in two steel sheets which are welded together around the edges and between the channels. The sheets are then rolled into the cylindrical form and welded.

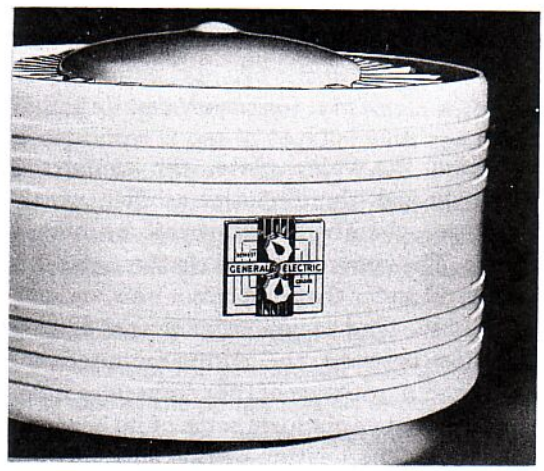

Fig. 40
Condenser on CK Machine

The diameter of the condenser for CK-1 and CK-2 machines is the same but is larger for CK-3 machines which have two concentric cylindrical plates separated by fins.

On CK-2 and CK-3 size machines, there is a turn of half-round copper tubing around and in contact with the underside of the box top to give additional condenser surface. This auxiliary turn is omitted on CK-1 size machines.

Compressed refrigerant vapor enters the top channel at the back, circulates around and down through the three top and then the three bottom channels. From the end of the lowest turn, the liquid refrigerant goes to the auxiliary turn of

tubing under the box top of CK-2 and CK-3 size machines, and from there, to the float valve. On CK-1 machines, the refrigerant goes directly from the condenser to the float valve.

FLATOP MACHINES

The flat plate condenser is used on most Flatop models. When the machine is installed in the cabinet, the condenser is attached to the back of the cabinet. The compressor case is bolted to brackets on the lower part of the condenser.

CF-2 size machines have the standard tall condenser but lower capacity models including CH-1, CJ-1, CJ-2, and FBA-1 machines have a short condenser.

Parallel vertical channels are pressed into two sheets of steel which are welded together around the edges and between the channels. All of the channels enter a small header across the top, and all are joined at the bottom by another small header.

Compressed refrigerant vapor from the high-pressure tube enters near the bottom of the second channel from the left edge. Liquid refrigerant collects in the lower header and is forced from there by pressure difference to the float valve on the top plate.

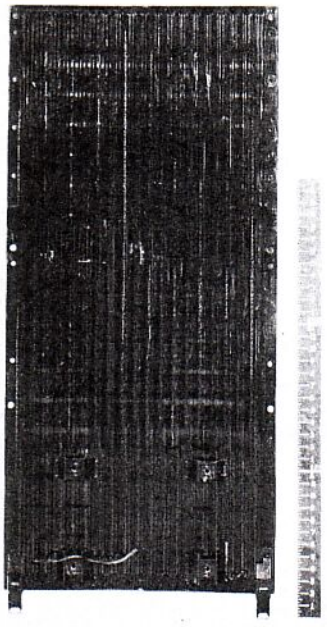

Fig. 41
Standard Condenser

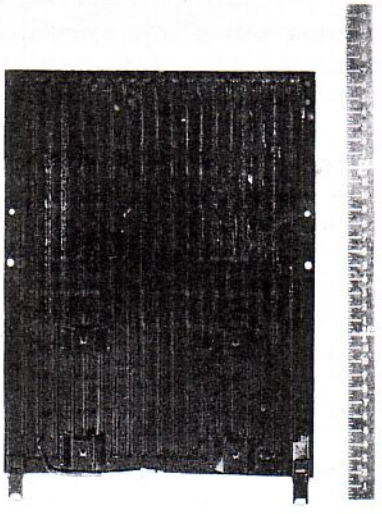

Fig. 42
Short Condenser

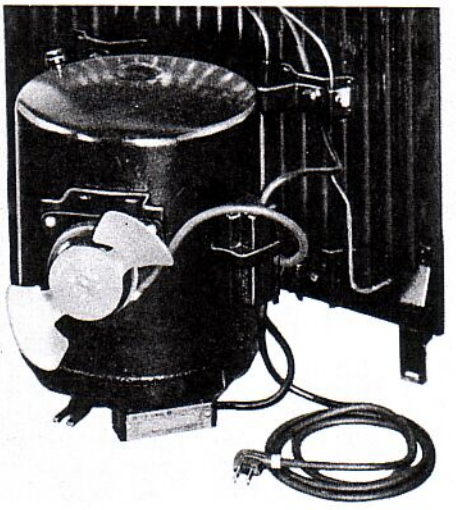

Fig. 43
Fan on CH-1 Machine

Because of possible restricted air circulation due to the refrigerator being built-in, a fan motor is mounted on the front of the CH-1 compressor case.

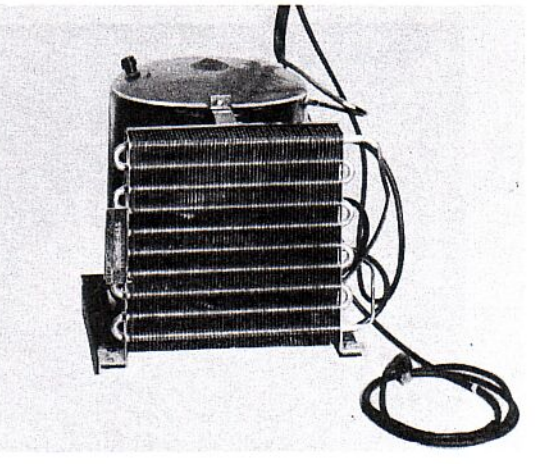

Fig. 44
Condenser on CE Machine

A fan-cooled, finned tube condenser instead of a plate condenser is used on the CE-140 machine because it is mounted down beside its cabinet, and on CE-34 and CE-340 machines because of their large refrigerating capacity.

A liquid receiver is found on all CE-34 and CE-340 machines charged with Freon-12.

LIFTOP MACHINES

The Liftop condenser is made up of half-round copper tubing in contact with two sides and the front inner surfaces of the cabinet outer case.

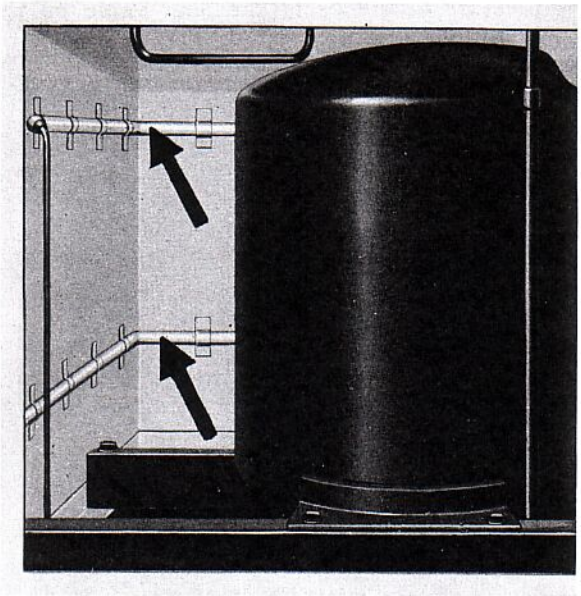

Fig. 45
Condenser on LK Machine

BALLTOP MACHINES

This condenser is made of horizontal tubes pressed into the vertical part of the cabinet top section and backed by steel strips line-welded to it.

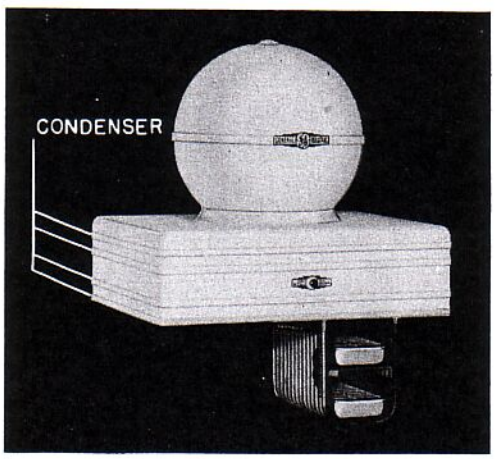

Fig. 46
Condenser on CG Machine

FLOAT VALVE

The float valve collects the condensed liquid refrigerant and releases it to the evaporator to make the refrigeration cycle continuous.

The float mechanism is essentially the same in all Scotch-yoke machines. The float ball operates a needle valve through a lever arrangement, pivoting on locking pins.

On top of the shell, there is a purging screw socket used for evacuating and charging. The purging screw can be opened with a special splined wrench.

The shell was changed from the original cylindrical shape to a spherical form along with the introduction of 1940 models.

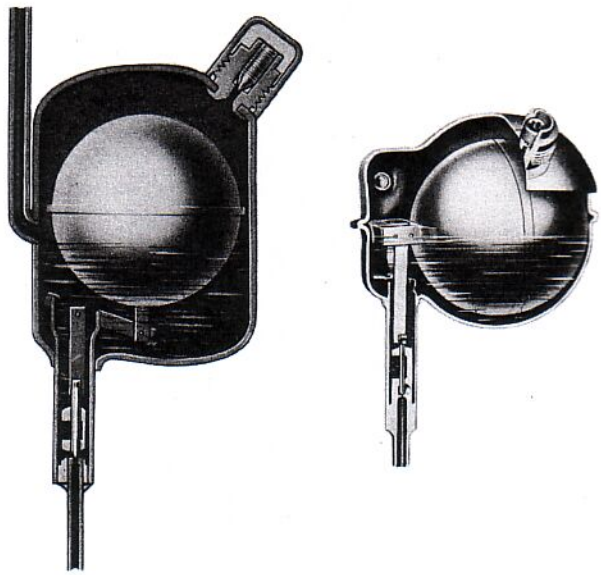

Fig. 47
Cylindrical Float Valve — Spherical Float Valve

The valve seat is at the bottom of an Everdur tube extending down from the float base to below the enameled top plate. Since Everdur is a relatively poor conductor, heat from the liquid in the float shell is kept from readily flowing down to the valve seat where expansion and cooling takes place.

On all Flatop and Under-the-Drain machines, and on all Monitor Tops beginning with the Form C model (introduced in the latter part of 1935), there is a turn of the suction tube around and in contact with the float valve, after the suction tube leaves the evaporator header and before it goes to the compressor case. Also, all Freon-12 machines and those with SO_2 having a 3 size compressor, except CF-22 models, have additional turns of the suction line around and in contact with the tube extending below the float valve. The latter arrangement is known as the heat interchanger. This use of

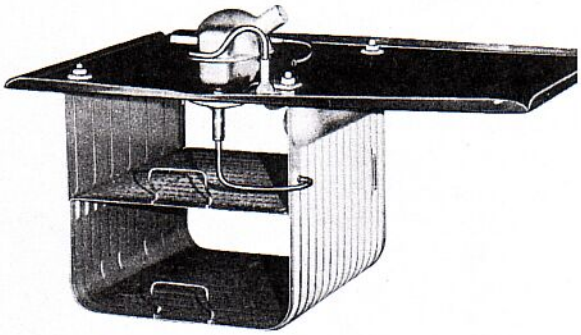

Fig. 48
Top Plate, Evaporator and Float Valve

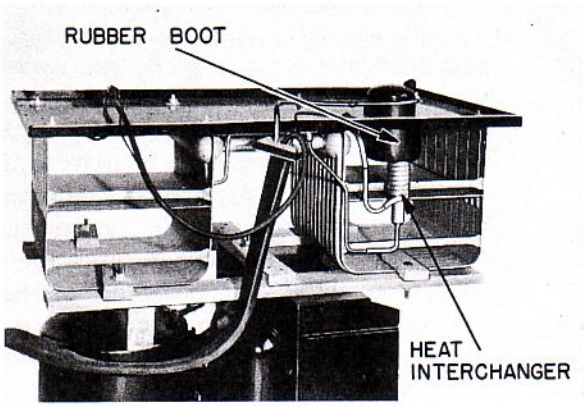

Fig. 49
Float Valve on CE-34 Machine

the cool suction line withdraws heat from the warm liquid refrigerant entering the evaporator. With the Freon-12 and larger SO_2 machines, the result is an appreciable increase in capacity and efficiency.

The float valve of Monitor Top machines is located in the rear of the cabinet top with the upper part above the box top and the rest down in the insulation. The Liftop float valve is in the insulation

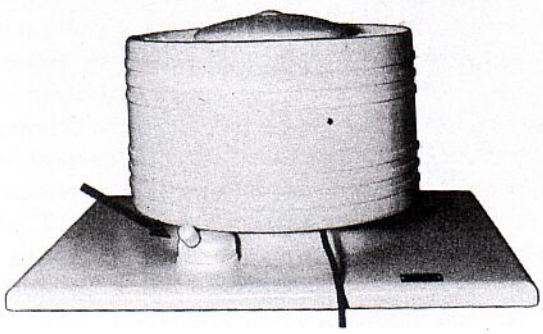

Fig. 50
Float Valve on CK Machine

in the back of the cabinet with only the purging screw socket coming through the outer case. (See page 2.) The Balltop float valve is in the insulation in the rear of the cabinet top section. It is possible to get at the purging screw by removing a small circular plate on the back of the box top.

The float valve of Flatop and Under-the-Drainboard machines is mounted above the top plate. In the beginning, a section of the top plate was drawn down to receive the float valve. With the introduction of the CF Form C models in the latter part of 1935, a rubber "boot" replaced the dished section. When the spherical float valve was brought out on 1940 models, the rubber boot was eliminated on all except CH-1 machines, and the top plate was dished slightly. The top plate on 1942 machines with porcelain evaporators has no depression under the float valve. The float valve of FBA-1 machines is attached to the rear of the evaporator.

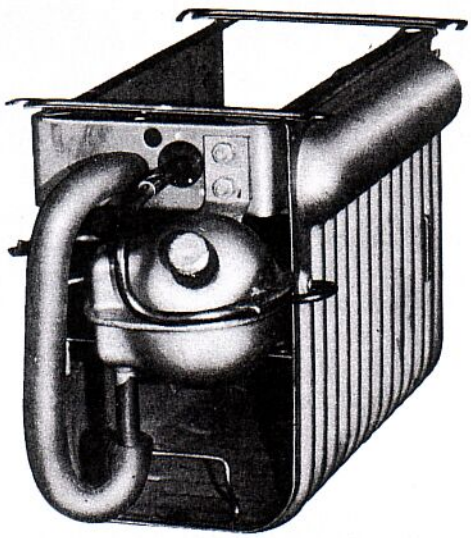

Fig. 51
Float Valve on FBA Evaporator

CONTROL

Note: Since a complete description and explanation of the operation is included in the section on "Temperature Controls", only a brief description will be given here. See page 45.

The control automatically regulates the operation of the refrigerating machine by turning the electric current on and off, so as to maintain the evaporator temperature within proper limits.

Two-knob controls are used on all Monitor Top and Under-the-Drain machines, on the first Liftop model (LK-1A), and on all early Flatop models up through 1937.

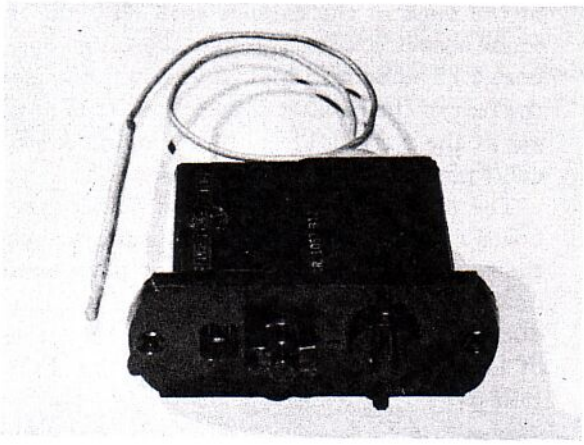

Fig. 52
Two-knob Control

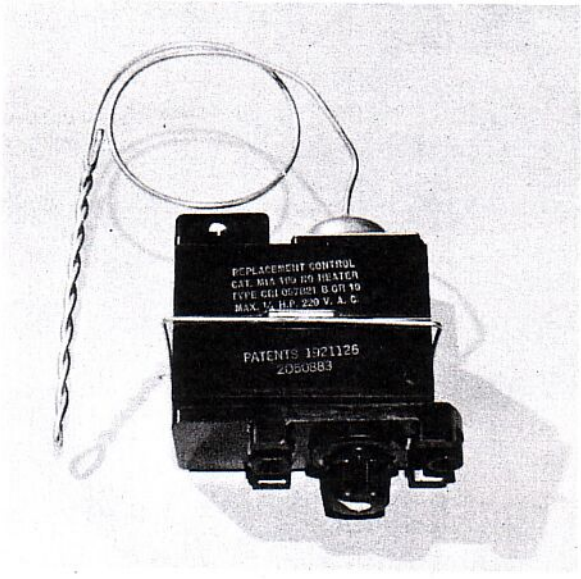

Fig. 53
Single-knob Control

Single-knob controls are found on all Flatop models from 1938 through 1942.

A control-relay combination is assembled to all Balltops and to all Liftops except the LK-1A.

The functions performed by the control are:

1. Provides manual starting and stopping. By moving the knob to the "off" position, the user can stop the machine from operating. When the knob is moved away from the "off" position, the machine will operate.

2. Maintains proper evaporator and cabinet temperatures. The machine operates in cycles to keep the evaporator within certain temperature limits. These limits are such that the evaporator freezing surfaces are kept below the freezing temperature, and the proper and safe food storage conditions are maintained in the cabinet.

3. Furnishes a manual means of changing the evaporator temperature limits a certain amount to give faster freezing, and to raise or lower the cabinet air temperature to compensate for variations in operating conditions or to satisfy the preference of the user. The control-relay combination used in Balltops and on later Liftops does not have such a temperature adjustment.

4. Automatically starts up the refrigerating machine and keeps it running when a tray of water is placed on an evaporator freezing surface, under most operating conditions.

5. Gives a means of defrosting the evaporator while still maintaining a moderate amount of refrigeration in the cabinet. The control-relay combination does not have a defrosting device.

6. Includes overload protection to the refrigerating machine motor (in the case of the two-knob control and the control-relay combination; not the single knob control).

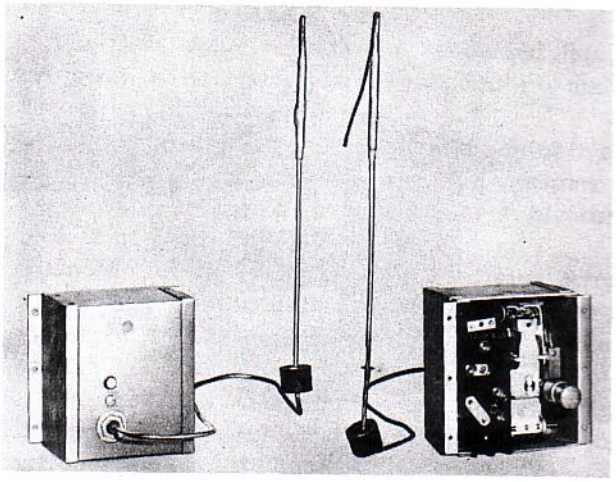

Fig. 54
Control-relay Combination
(Rear and Front Views)

The control is essentially a switch which makes and breaks the electric circuit to the motor. The contacts can be opened or closed by either movement of the knob, or by the contraction and expansion of a vapor-filled metallic bellows whose pressure is proportional to the evaporator temperature. A tube from the bellows extends down to and is in contact with the evaporator. The bellows operates against the pressure of a spring whose compression can be varied to alter the evaporator temperature limits.

The defrosting device comprises a means of adding the pressure of a second spring in parallel

with the temperature spring to raise the "cut on" temperature limit well above the melting point.

The overload in the two-knob control is made up of a ratchet wheel on a spindle in a sleeve which is centered in a spiral heater. A drop of solder holds the end of the spindle to the sleeve. All of the current to the motor passes through the heater. If the current becomes excessive, the solder is melted and the ratchet wheel releases a dog which trips the contact arm to open the contacts. To restart the machine, it is necessary to wait until the solder solidifies and then reset the dog on the ratchet wheel by turning knob "off", then "on".

The overload in the control-relay combination includes a bimetallic strip with a grid heater close to it. The two metals of the strip have different rates of expansion so that the free end of the strip moves outward and trips the contacts open when excessive current passes through the heater.

There is no overload in a single-knob control. Machines with a single-knob control have the overload incorporated in the starting relay.

STARTING RELAY

Note: A complete description will be found in the section on "Starting Relays", page 69.

The starting relay automatically starts the compressor motor when the electric current is turned on by the control. To start one of these split-phase motors, it is necessary to connect into the circuit a secondary winding, called the starting winding, until the motor is up to speed.

All alternating current machines have a starting relay but direct current ones do not.

The Type E-3 relay was used on 1934 and 1935 CK-30B and CK-35B Monitor Top, and LK-1A Liftop machines.

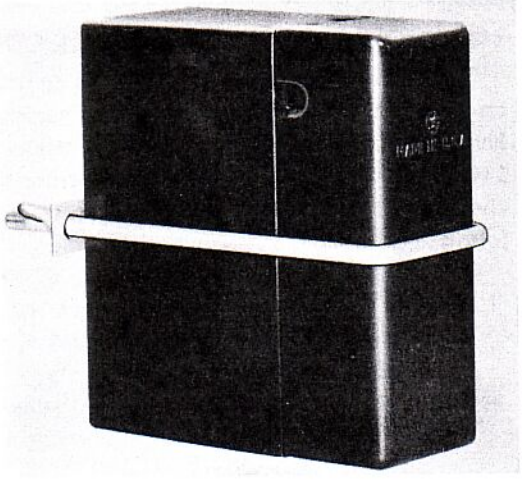

Fig. 55
Starting Relay—Type N

The Type E relay was introduced on CK-1 machines late in 1934, and continued on all Monitor Top, Flatop and Under-the-Drain models through 1937. The control-relay combination on Balltops and later Liftops has a Type E relay.

The Type N relay was assembled only to early 1938 Flatop machines.

The Type R relay followed the Type N relay, and is used on all subsequent Monitor Top and Flatop machines.

The starting relay includes a coil in series with the running winding. When starting, the motor draws several times its normal running current. This heavier current, passing through the series coil, moves an armature which closes the starting contacts, and connects the starting winding in parallel with the running winding. As the motor comes up to speed, the current decreases until the armature is released and the contacts are opened.

A bimetallic overload device is mounted on the back of the Type N relay, and alongside the relay part in the Type R relay. All of the current drawn by the motor passes through a small heater which is close to a bimetallic strip. If the current becomes excessive, the strip flexes until a pair of contacts opens the circuit to the machine. When the strip cools down, the contacts close again.

There is a bimetallic overload in the control-relay combination used on Balltop and later Liftop machines but it must be manually reset by pushing in on a knob.

A solder-pot overload is in the control of machines having the Type E-3 and E relays. It must be reset by turning the control knob.

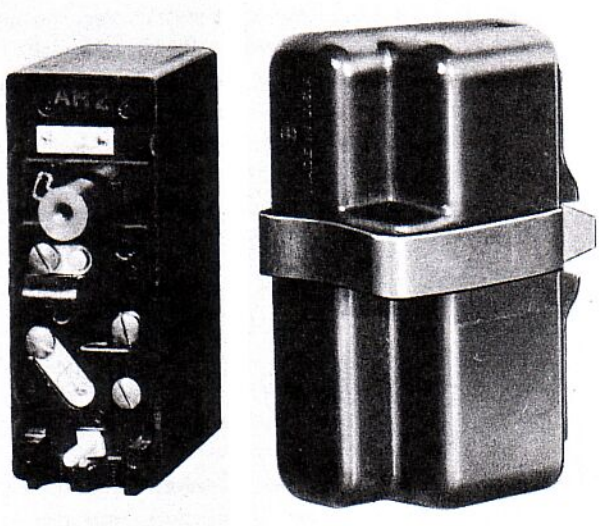

Fig. 56
Starting Relays
Type E Type R

POWER SUPPLY

Scotch-yoke machines are designed for operation on certain types of electric service. If a machine is connected to the wrong electric service even for an instant, the motor may be damaged. The connecting of a machine to any electric service other than that recommended voids the manufacturer's warranty on the machine.

110-VOLT, 60-CYCLE CURRENT

Because the regular N.E.M.A. rating for household service remains 110 volts (although actual nominal voltages range between 115 and 120), standard machines are rated 110 volts but are actually designed for and tested on 115-volt, 60-cycle current. Such machines have the number "16" after the form letter on the rating plate; for example CF-2-D16.

All standard machines except those CJ-2 machines of 1/10 horsepower, will operate satisfactorily on 110-volt, 50-cycle current without a transformer to reduce the applied voltage. However, they will not perform satisfactorily on 110-volt, 40-cycle current even with a transformer to reduce the applied voltage.

A standard machine will not operate on 25-cycle or direct current.

Warning—To connect a standard machine to 25-cycle or direct current even for an instant may seriously damage the motor.

While the rated voltage is 110, a standard machine will operate satisfactorily on any voltage between 100 and 130.

When the voltage at the machine at the time of starting is less than 100 volts and the machine is operating under heavy load conditions, it may not start and the overload will trip off.

Warning—A machine should not be installed where the voltage goes below 90 periodically or for any extended period of time.

When the voltage is above 130 and the machine is operating under heavy load conditions, the current to the motor may be sufficient to trip the overload.

220-VOLT, 60-CYCLE CURRENT

A standard machine must not be connected directly to 220-volt service because damage to the motor will result in a few seconds.

Note: The only exception allowed is the momentary (not over a second) application of 220 volts to start a stalled machine. This should not be repeated over three or four times and then only after allowing a minute or two between applications.

A standard machine can be used if connected to the low voltage side of a 220/110-volt transformer. Connections should be so made that an average of 115 volts is applied to the machine. The minimum voltage to the machine during starting should not be less than 100; the maximum during running, not over 130.

110-VOLT, 50-CYCLE CURRENT

All standard machines, except CJ-2B, CJ-2C, CJ-2D and CJ-2E, can be used directly on 110-volt, 50-cycle current provided that the maximum voltage is not over 125.

On circuits where the maximum voltage goes above 125 volts, a 110/97-volt transformer is recommended. The minimum applied voltage at the time the machine starts should not be allowed to go below 90. Some machines with early Type N and early Type R relays may not run properly on 50-cycle power; refer to the chapter on "Starting Relays." Because of limited refrigeration capacity and unsatisfactory relay operation, CJ-2 machines with 1/10 horsepower motors cannot be used on 50-cycle power.

220-VOLT, 50-CYCLE CURRENT

Standard machines must not be connected directly to a 220-volt circuit except momentarily to jolt a stalled machine.

Any standard machine, except a CJ-2B, CJ-2C, CJ-2D or CJ-2E, can be used if connected to the low voltage side of a 220/110-volt transformer. Connections should be so made that an average of 110 volts is applied to the machine. The minimum applied voltage at the time of starting should not be allowed to go below 90; the maximum during running, not above 125.

110-VOLT OR 220-VOLT, 40-CYCLE CURRENT

The use of a standard 110-volt, 60-cycle machine on 110-volt, 40-cycle current is not recommended. Even in temperate climates and with either a 110/97-volt or a 110/90-volt transformer to reduce the applied voltage, it is not recommended for the following reasons:

a. The unloader in a standard 60-cycle machine is designed to open at an average compressor speed corresponding to 37 cycles; consequently, it may stay open all the time in some machines on 40 cycles and part of the time under heavy load conditions in others.

b. Unless the applied voltage is reduced to an average of 80 and a maximum of 90, the

current to the motor will cause excess heating and shortened life.

c. The capacity of the refrigerating machine is reduced one-third.

A standard machine must never be connected directly to a 220-volt, 40-cycle circuit; the motor will be damaged in a few seconds.

110-VOLT, 25- AND 30-CYCLE CURRENT

Special machines are designed for installation on 25-cycle service. The figure "12" appears after the form letter on the rating plate. The marking "25-cycle" is stenciled in white on the compressor case top of Flatop machines.

These machines can be used satisfactorily on 30-cycle service.

They cannot be used on anything except 25- or 30-cycle service.

The rated voltage is 110 but machines are designed for an average of 115, maximum of 130 and minimum of 100.

220-VOLT, 25- AND 30-CYCLE CURRENT

The special 110-volt, 25-cycle machines must never be connected directly to 220-volt service except momentarily to jolt a stalled machine.

They can be used when connected to the low voltage side of a step-down transformer. Connections should be made so that an average voltage of 115 is applied to the machine with a minimum of 100 during the starting period and a maximum of 130 while running.

115- OR 230-VOLT, DIRECT CURRENT

Special Monitor Top CK machines were designed for use on direct current electric service. However, a rotary converter must be used with these machines since their motors are for two-phase alternating current. The rotary converter furnishes the machine with alternating current converted from direct current. See "Wiring Diagrams" on page 112.

These special machines have a two-phase, 80-volt, 60-cycle, 1/6-hp motor. Because of the two independent phases, there are four metal-glass leads from the motor through the compressor case. The compressors of these machines are identical to those of standard 60-cycle machines.

The controls differ from those on standard machines since they have three connections instead of two, one of which is a mid-tap between the contacts and the overload heater. This connection places the overload in the main line and the contacts in the contactor coil circuit. Since the motor is the same, there are only two different controls for these machines, one with a 115-volt overload heater and one with a 230-volt overload heater.

No starting relay is required since a two-phase motor requires no starting circuit or special motor winding.

The 115-volt and 230-volt machines are the same except for the overload heater in the control but there is a two-to-one (2:1) step-down transformer in the 230-volt converter. The transformer steps down the 230-volt converter output of two-phase, 160-volt, 60-cycle current to two-phase, 80-volt, 60-cycle current. By changing the control and using the proper converter, the 115-volt and 230-volt machines can be interchanged.

Rotary converter service instructions are described in detail on pages 47–51 inclusive, of the Domestic Product Manual for DR Machines.

The special CK machines for direct current operation also can be operated on 110-volt, 60-cycle alternating current providing a d.c.-a.c. adapter is installed in place of the converter.

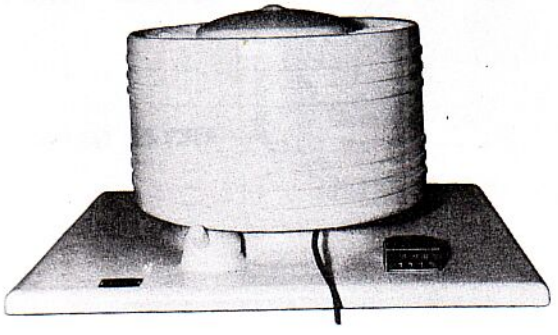

Fig. 57
Rear of CK-2-C1 Direct Current Machine

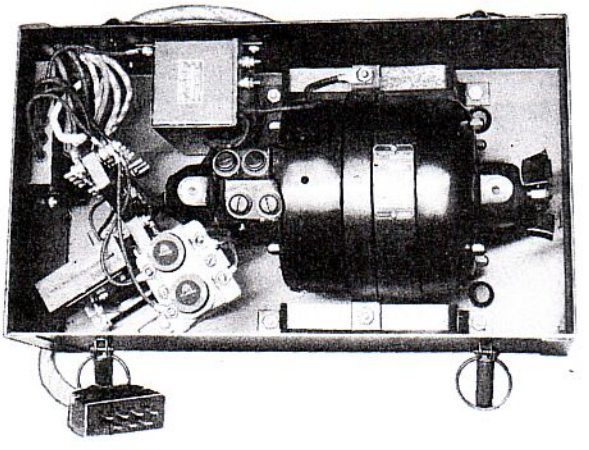

Fig. 58
Rotary Converter

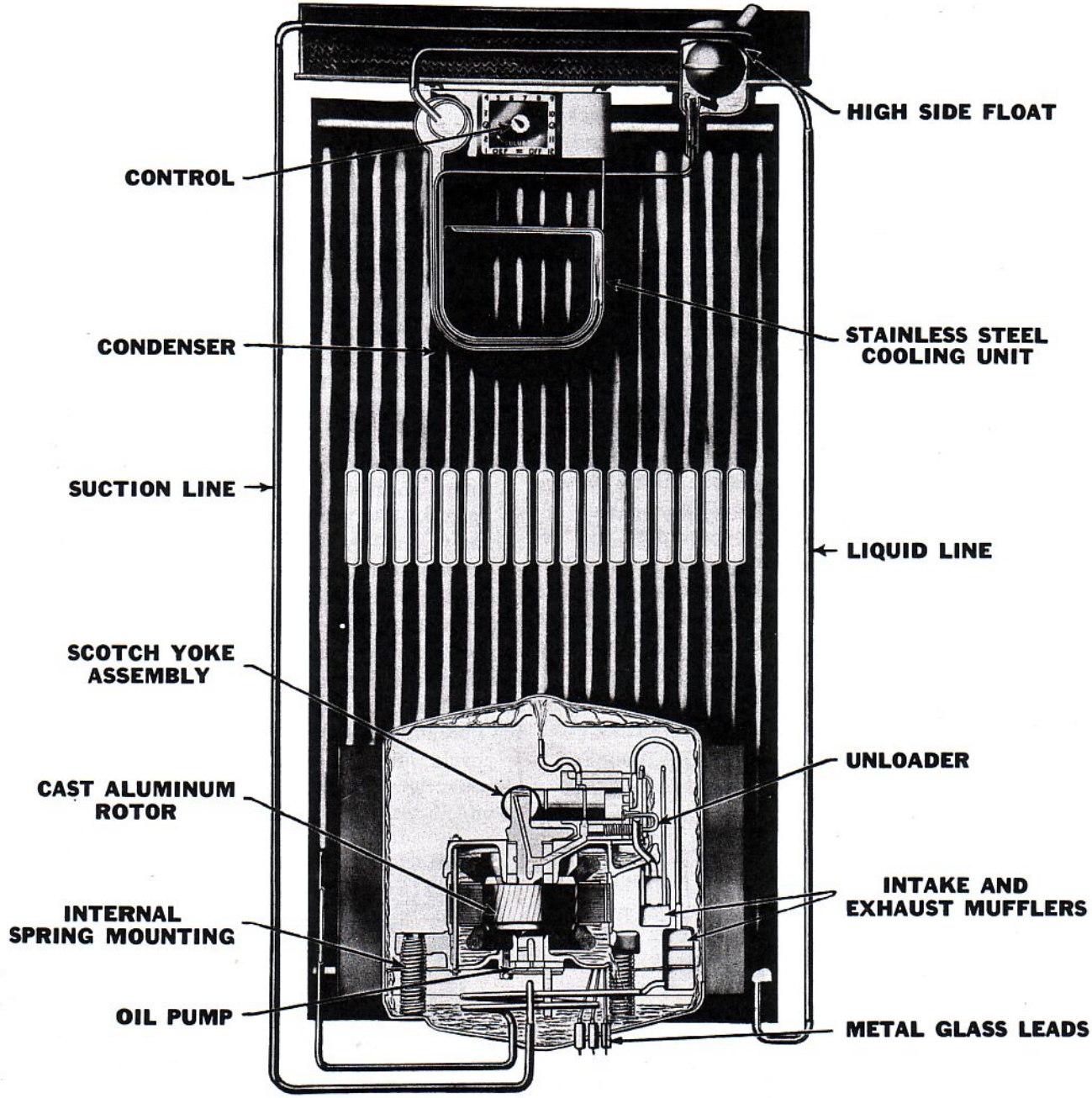

Fig. 59
Cross-sectional Chart
Typical Flatop Machine

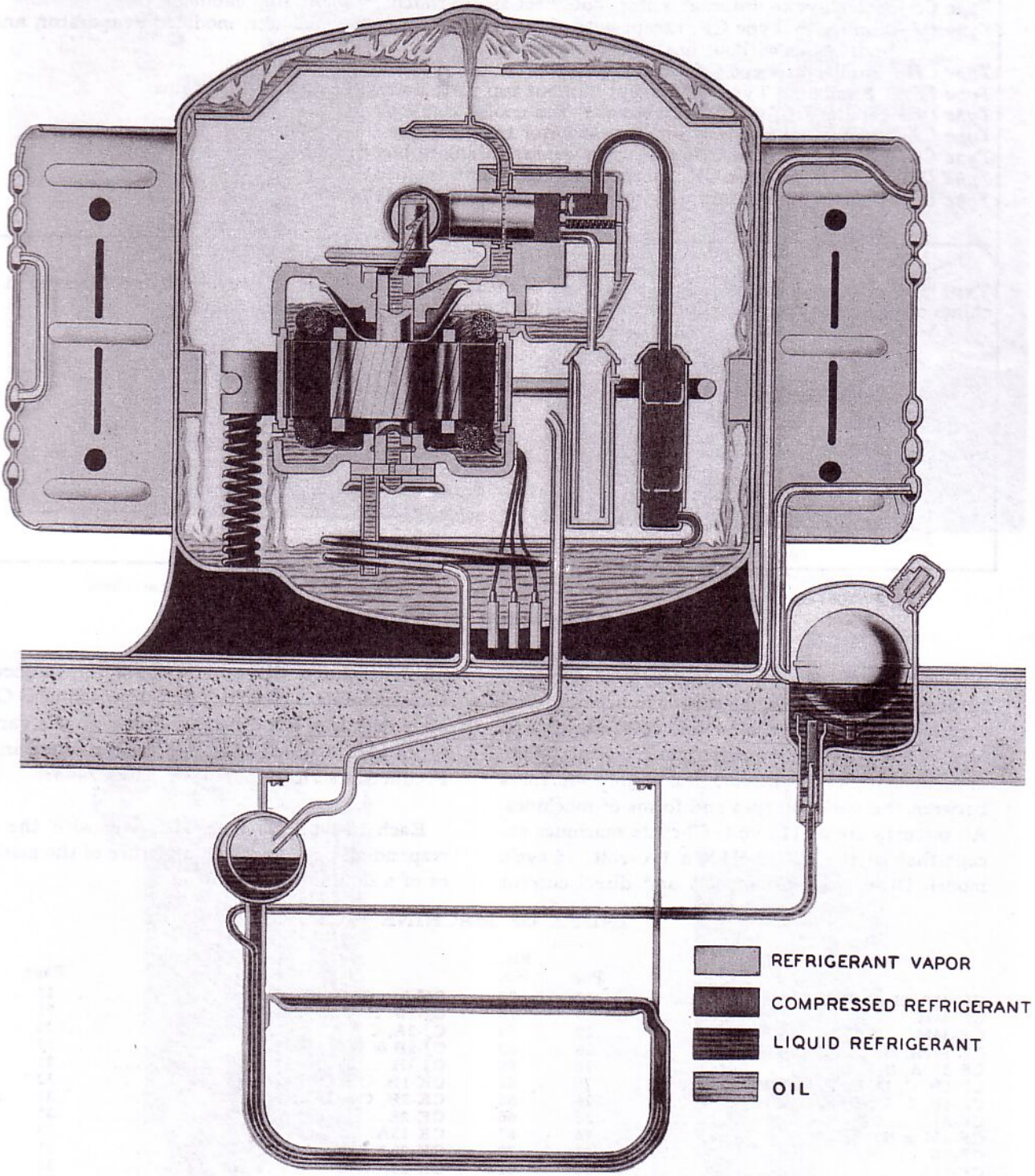

Fig. 60
Cross-sectional Chart
CK Machine

NOMENCLATURE

Type CF—Scotch-yoke, internal motor, flat sheet-steel condenser, for Flatop cabinets
Type CJ—Similar to Type CF, except with shorter flat sheet-steel condenser, modified evaporator, and in most cases without fins on compressor case
Type CH—Similar to Type CJ, except with shorter tubing and fan
Type FBA—Similar to Type CF, except without top plate and without compressor fins
Type CE—Similar to Type CF, except with fan-cooled condenser
Type CK—Scotch-yoke, internal motor, Monitor top
Type CG—Similar to Type CK, except condenser tubing in box top walls
Type DK—Similar to Type CK, except mounted beside cabinet
Type LK—Scotch-yoke, internal motor, condenser tubing inside cabinet walls

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Type letters are followed by the numerical size of the machine, then form letters for minor differences in machines of the same type, and finally, numerals indicating power supply. For example, CF-2-D16

TYPE	SIZE	FORM	POWER SUPPLY
CF	2	D	16

Power supply numerals are used as follows:
16—110 volt, 60 cycle, a.c.
12—110 volt, 25 cycle, a.c.
1—110 volt d.c.
2—220 volt d.c.

MACHINE PICTURES

The following pages contain representative pictures of Scotch-yoke refrigerating machines. Pictures of all machines are not included since many forms have a similar appearance. However, there are sufficient pictures to show the major differences between the various types and forms of machines. All pictures are of 110-volt, 60-cycle machines except that of the CF-28-H12, a 110-volt, 25-cycle model. Other 25-cycle models and direct-current machines have the same general appearance as corresponding 110-volt, 60-cycle machines. Complete details of the differences between the various types and forms of machines can be found in the Product Descriptive Table on pages 34–37.

Each machine is indexed below with the corresponding page on which a picture of the machine or of a similar one is shown.

INDEX OF MACHINE PICTURES

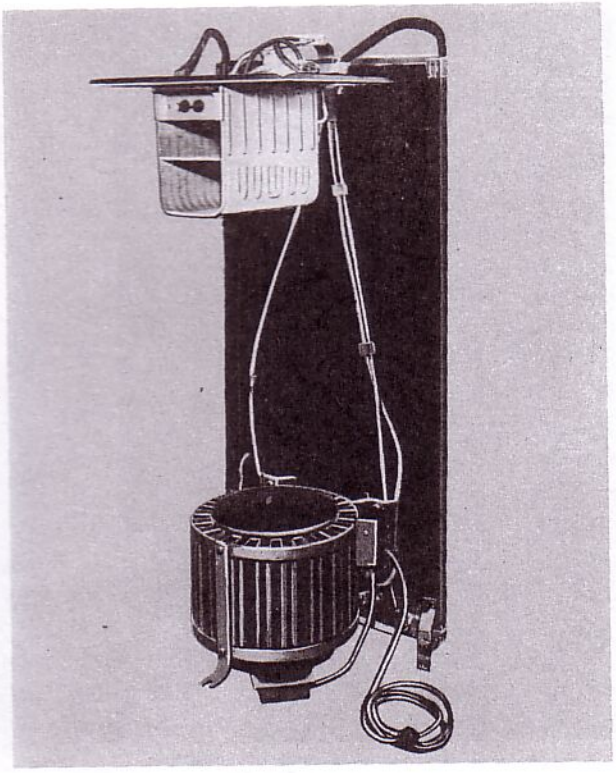


Fig. 61
CF-1B Machine
Similar machines: CF-1C, D, E, F, G & H
CF-11A

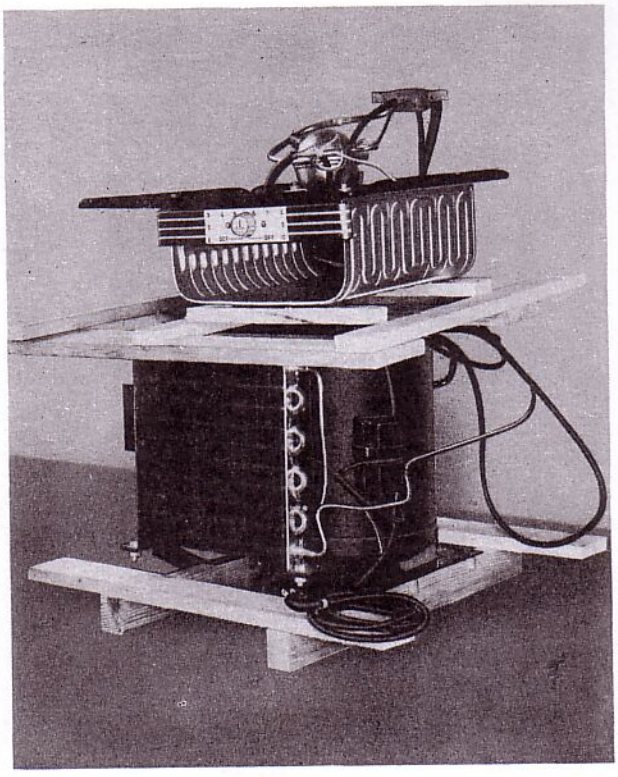


Fig. 63
CE-140D Machine
Similar machines: CE-140A, B & C

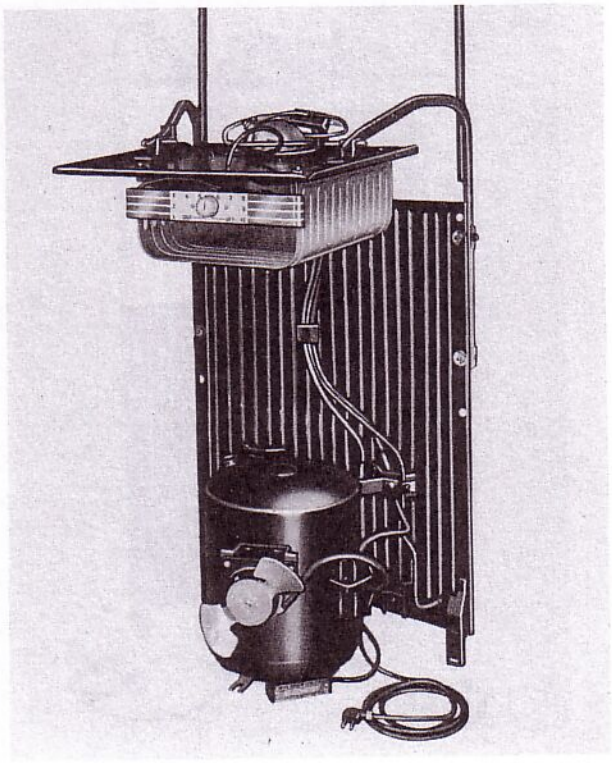


Fig. 62
CH-1E Machine
Similar machines: CH-1A, B, C & D

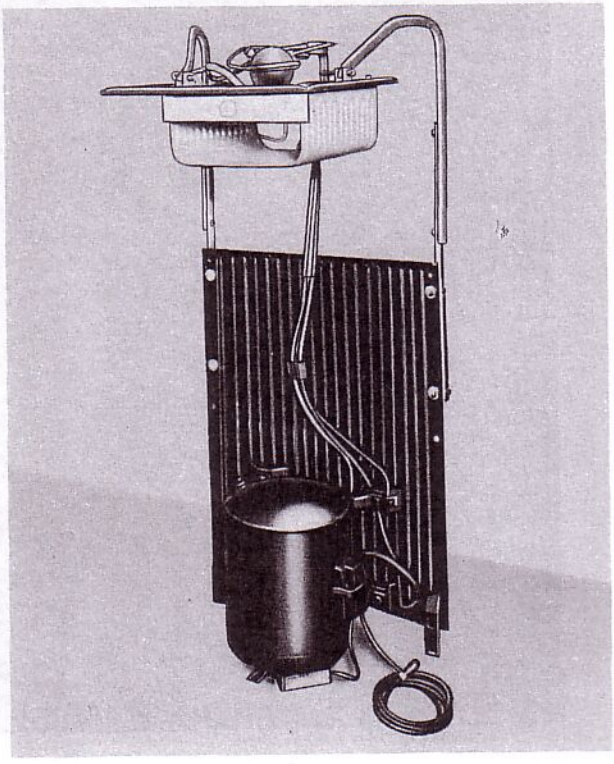


Fig. 64
CJ-1E Machine
Similar machines: CJ-1A, B, C & D

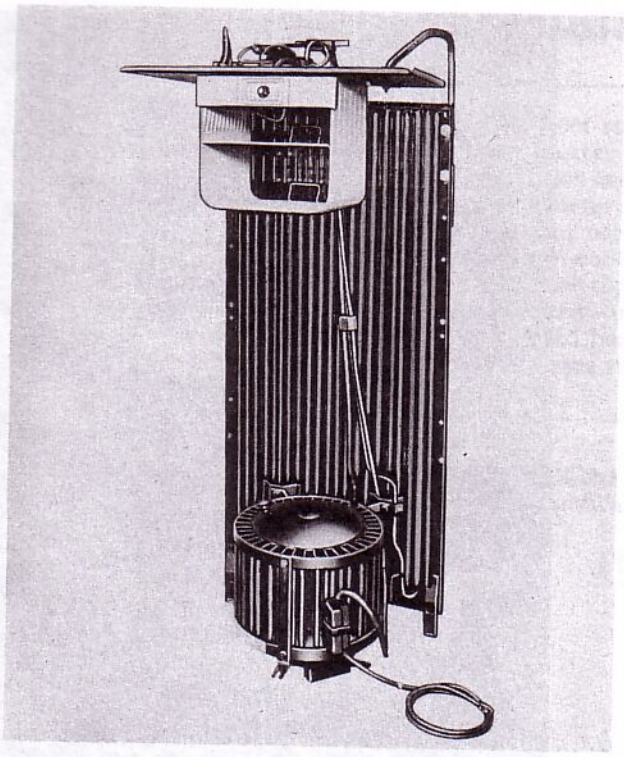


Fig. 65
CF-2H Machines
Similar machines: CF-2B, C, D, E, F & G
CF-21A

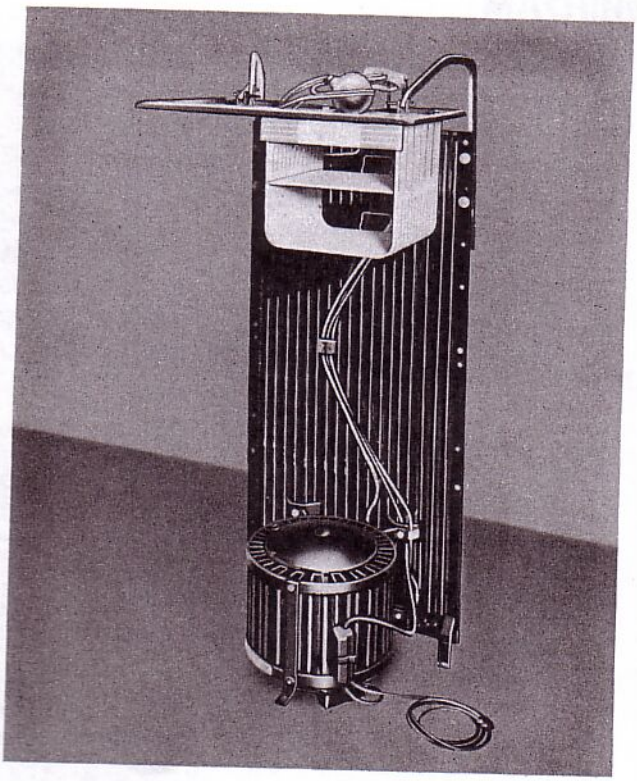


Fig. 66
CF-2J Machine

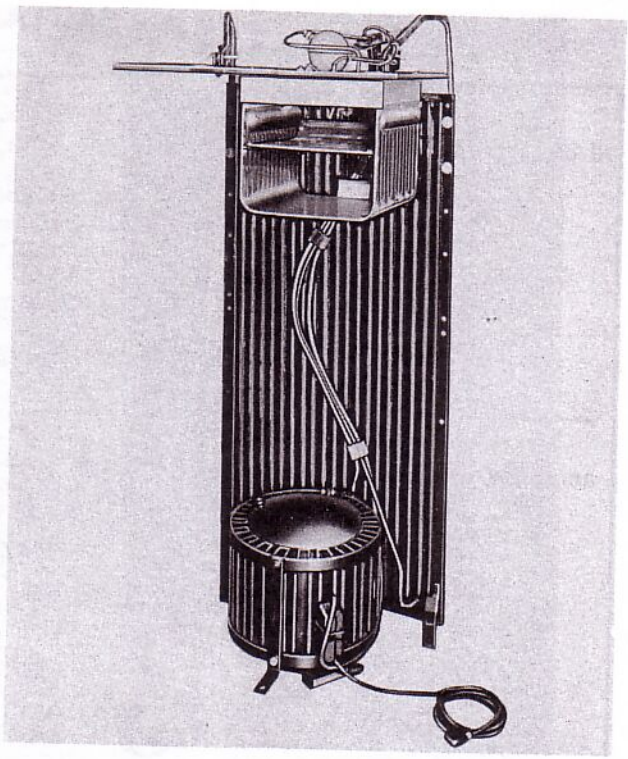


Fig. 67
CF-2M Machine
Similar machine: CF-2N

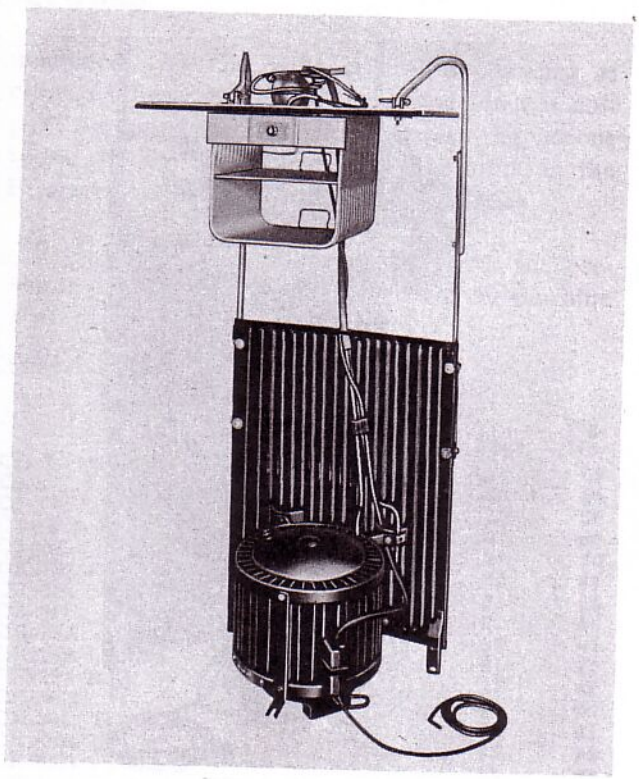


Fig. 68
CJ-2A Machine
Similar machines: CJ-2C & E

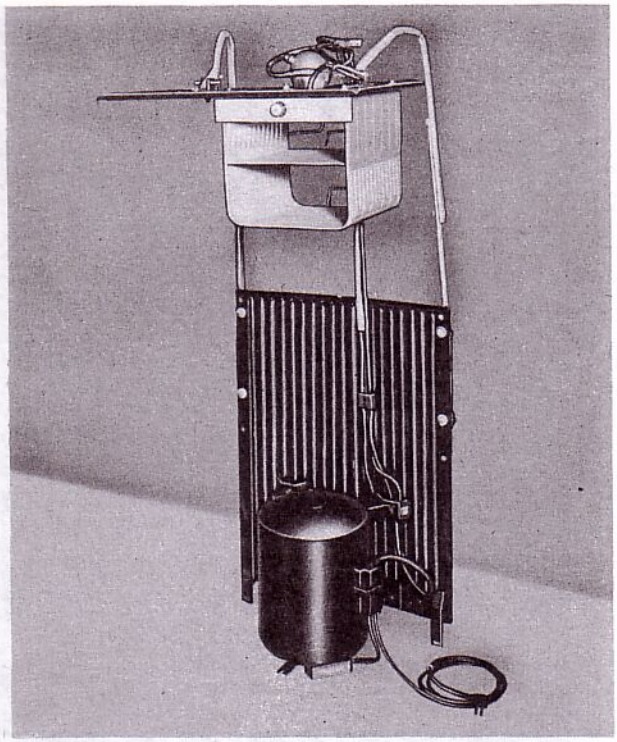


Fig. 69
CJ-2B Machine
Similar machine: CJ-2D

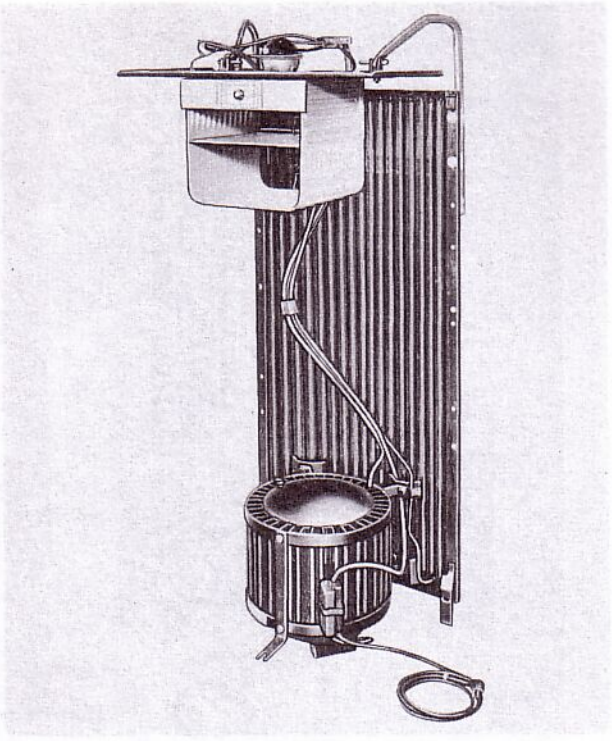


Fig. 71
CF-28D Machine
Similar machines: CF-28A, B & C

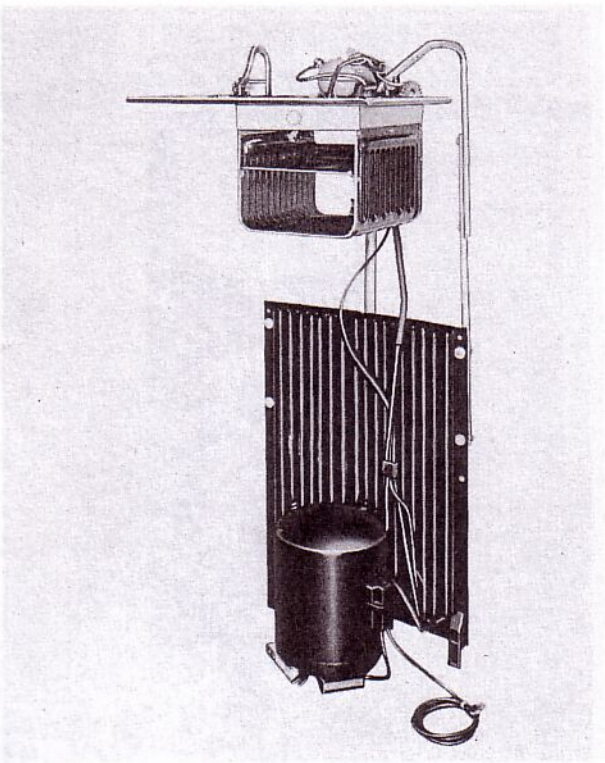


Fig. 70
CJ-2H Machine

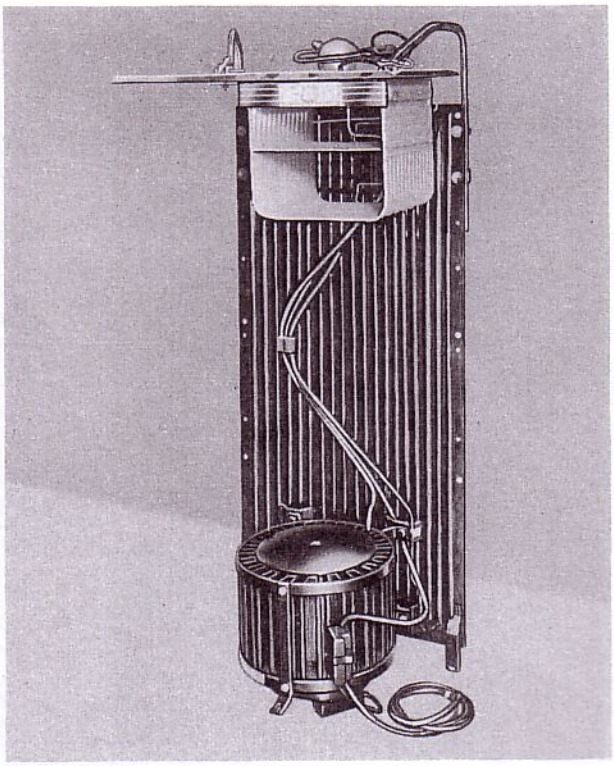


Fig. 72
CF-28E Machine
Similar machine: CF-2R

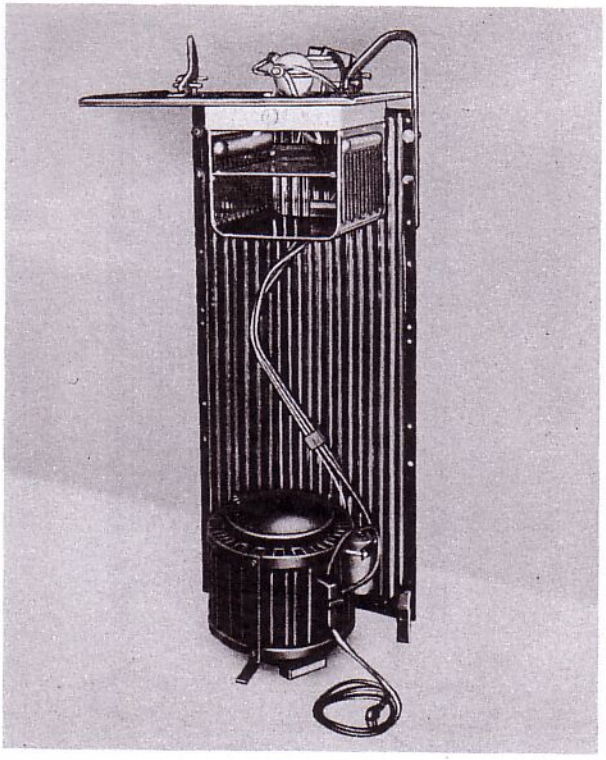


Fig. 73
CF-28-H12 Machine

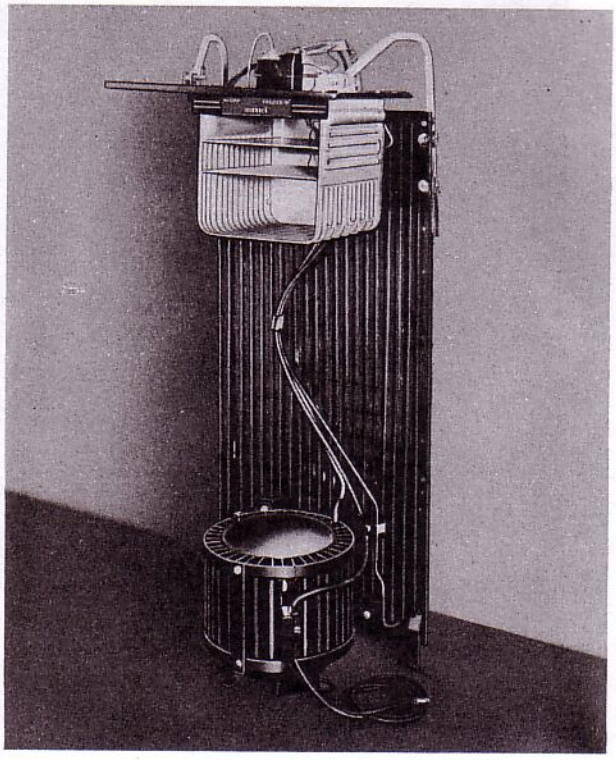


Fig. 75
CF-22C Machine

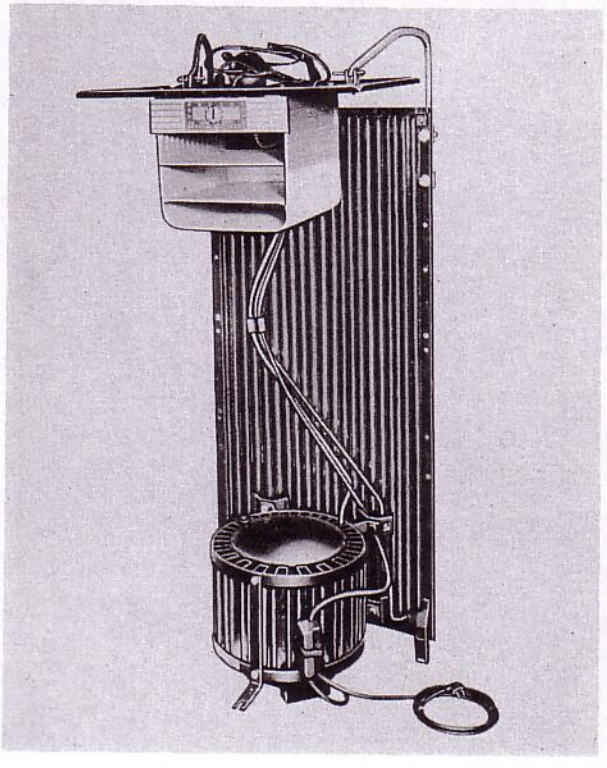


Fig. 74
CF-22A Machine
Similar machine: CF-22B

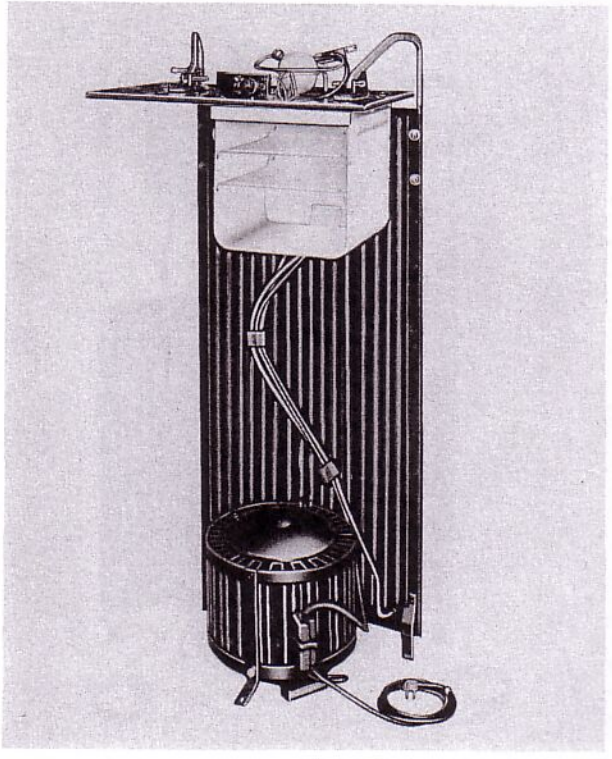


Fig. 76
CF-22G Machine

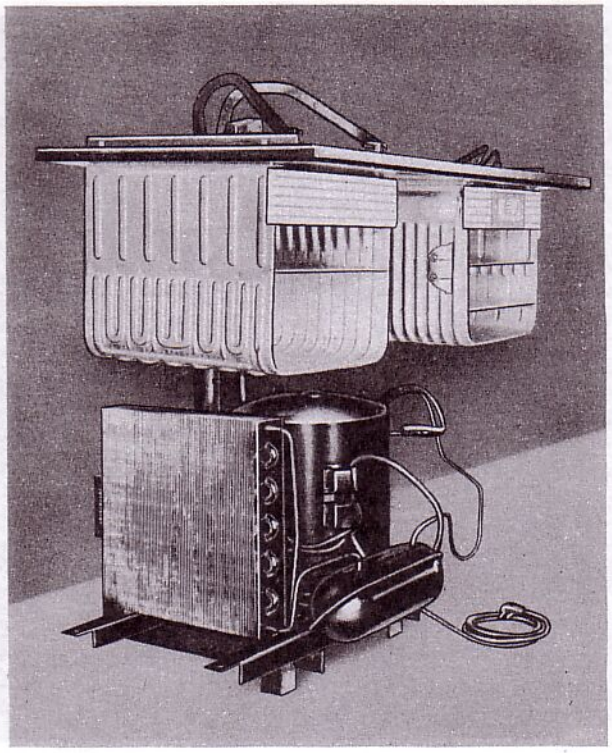


Fig. 77
CE-34D Machine
Similar machines: CE-34A, B, C & E

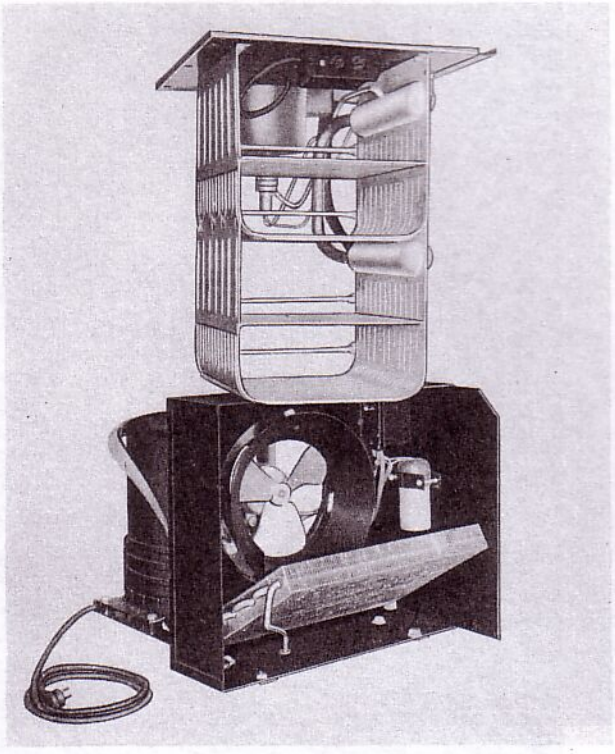


Fig. 79
CE-34M Machine

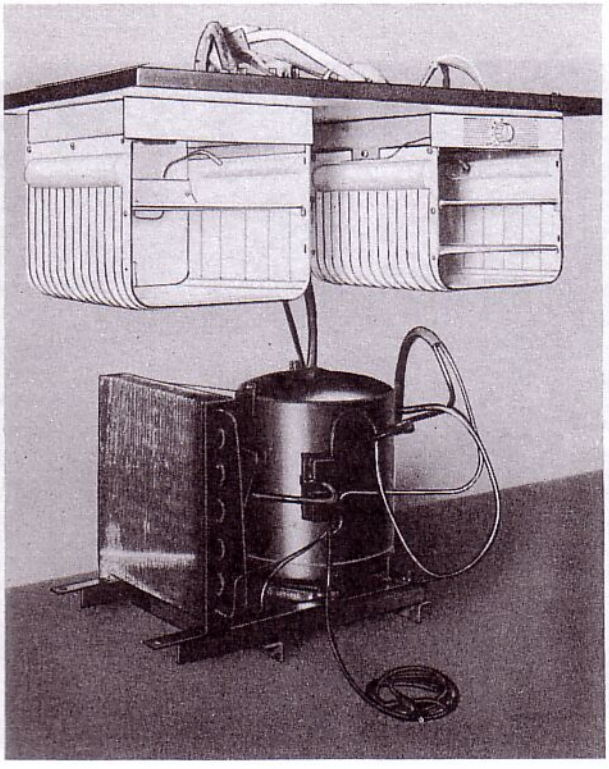


Fig. 78
CE-34H Machine

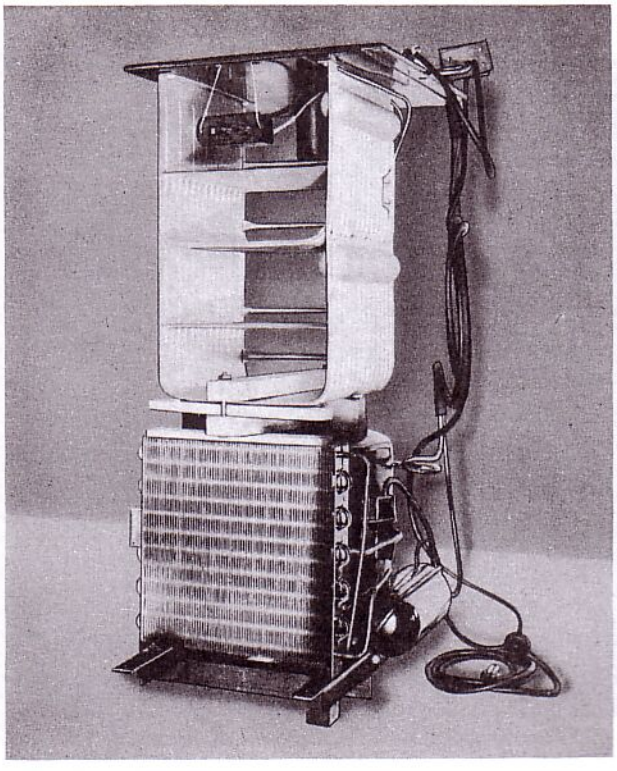


Fig. 80
CE-340C Machine
Similar machines: CE-340A & B

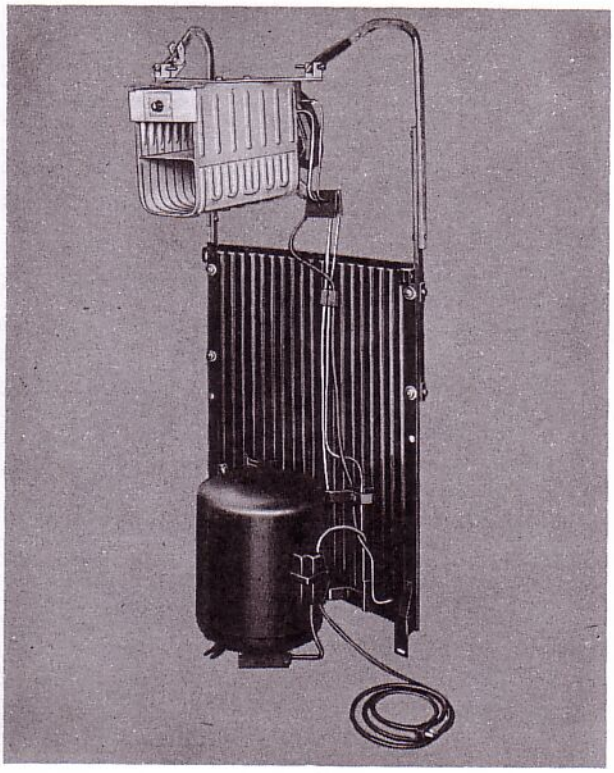


Fig. 81
FBA-1A Machine

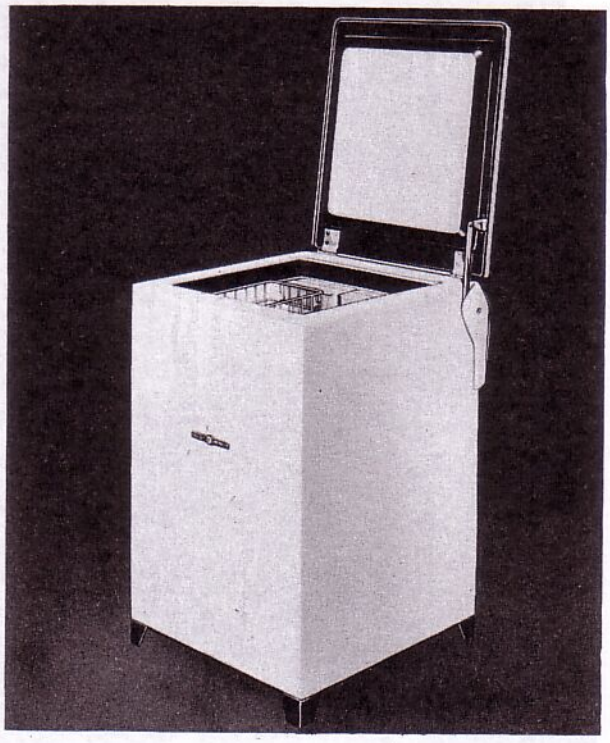


Fig. 83
LK-2A Refrigerator
Similar models: LK-1A & 1B

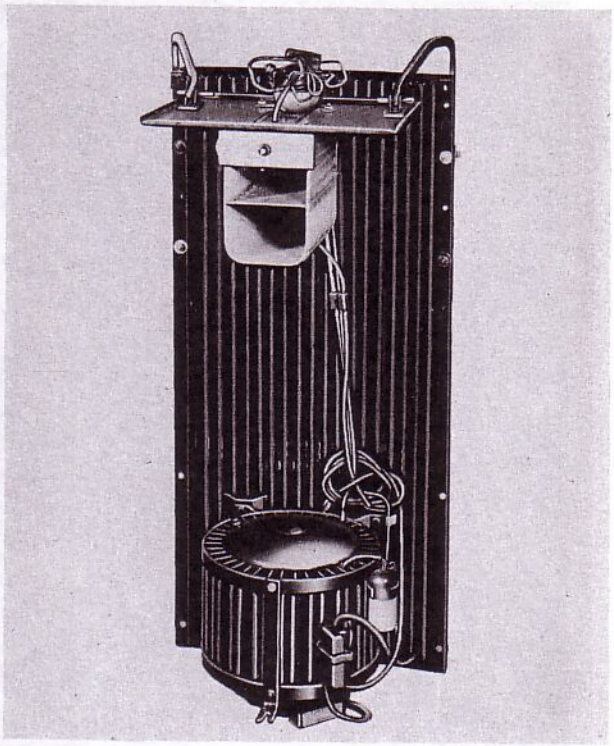


Fig. 82
CFS-1A Machine

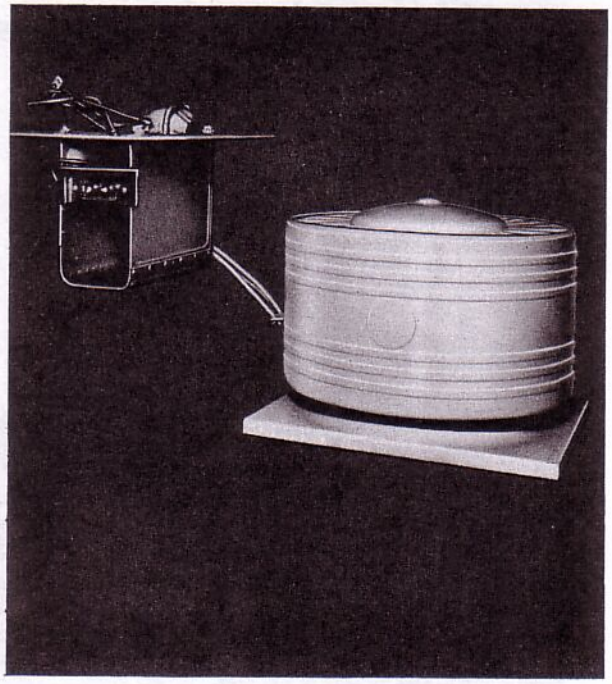


Fig. 84
DK-1A Machine

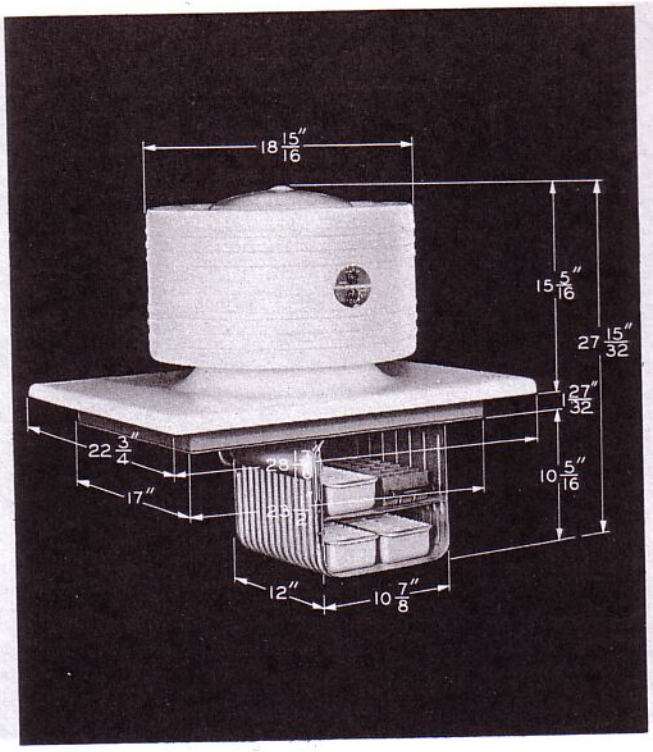


Fig. 85
CK-2B Machine
Similar machines: CK-2C & D

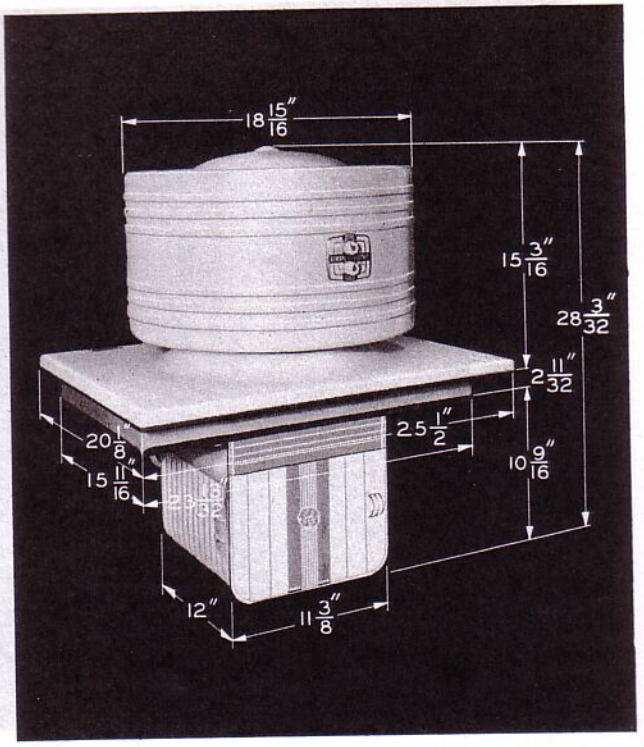


Fig. 87
CK-26B Machine
Similar machine: CK-26A

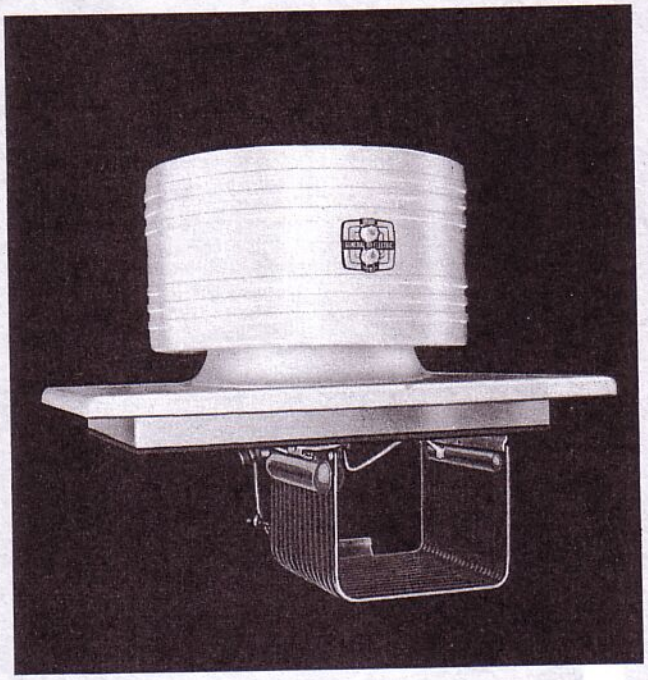


Fig. 86
CK-2E Machine

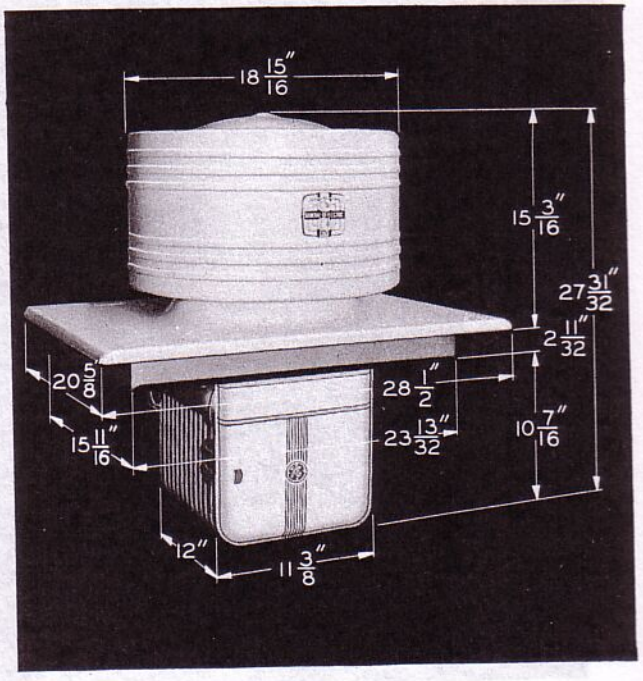


Fig. 88
CK-28A Machine
Similar machine: CK-28B

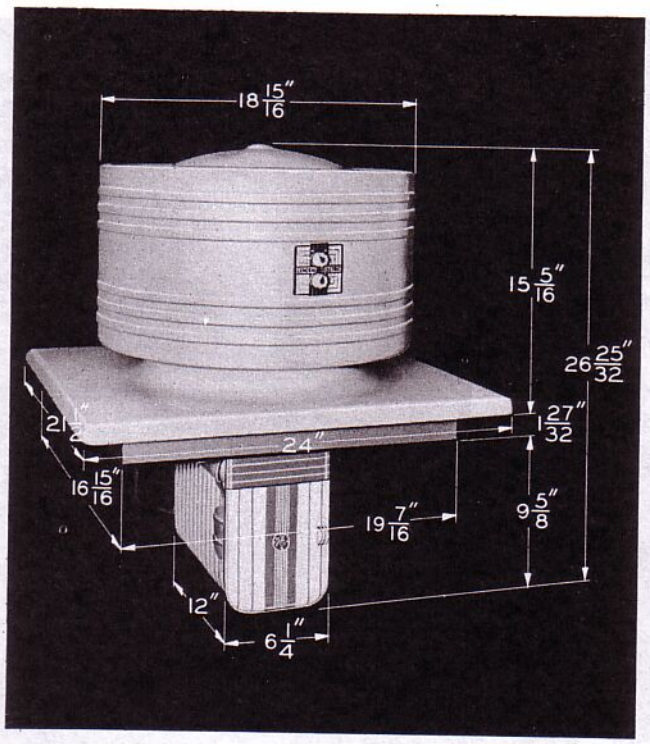


Fig. 89
CK-1D Machine
Similar machines: CK-1B & C

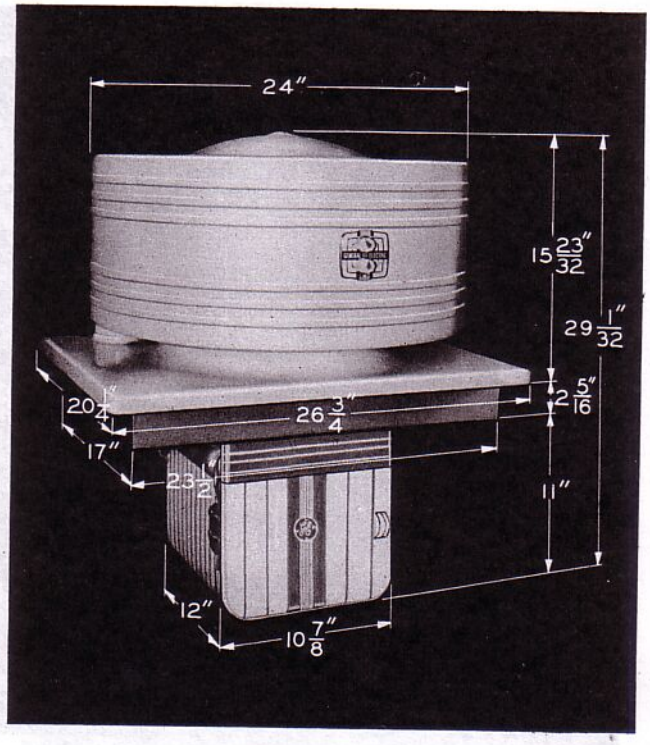


Fig. 91
CK-30E Machine
Similar machines: CK-30C & D

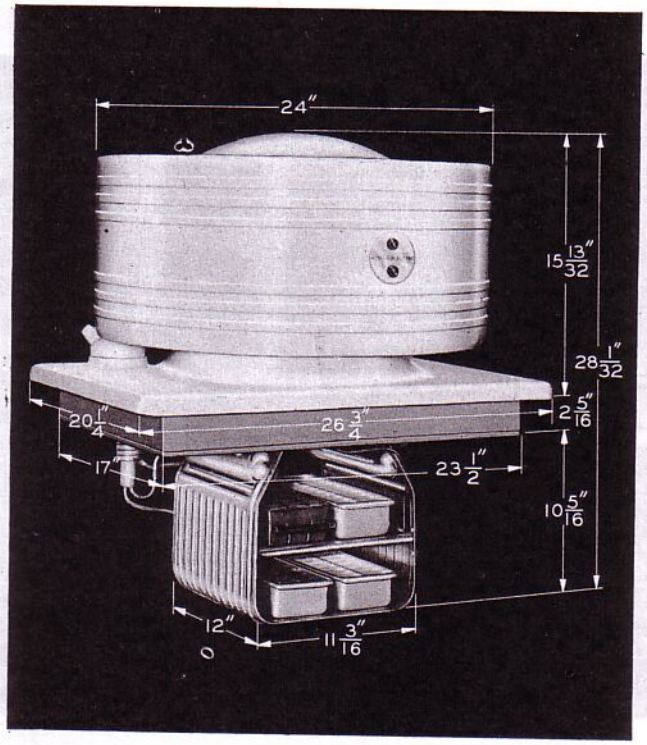


Fig. 90
CK-30B Machine

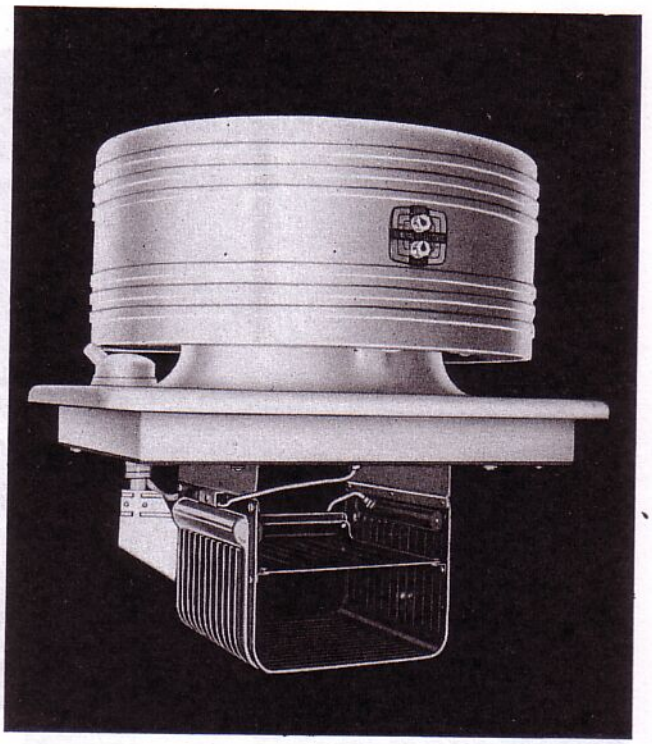


Fig. 92
CK-30H Machine

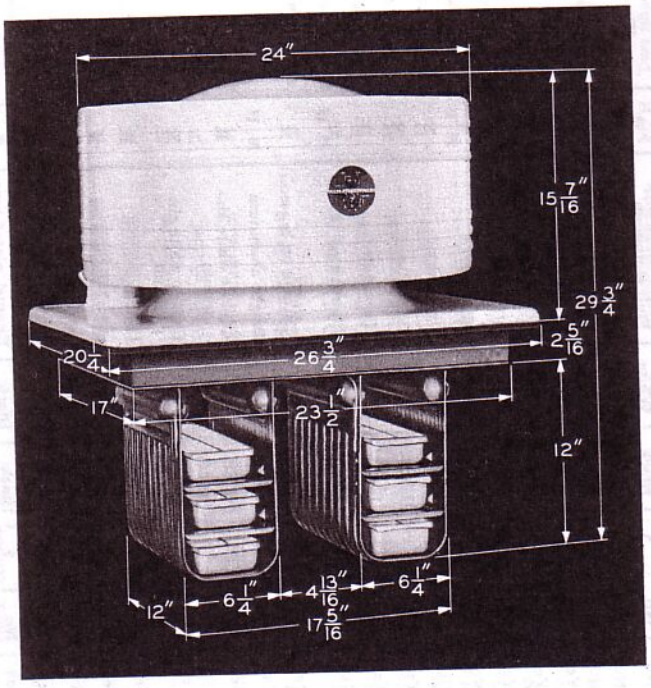


Fig. 93
CK-35B Machine

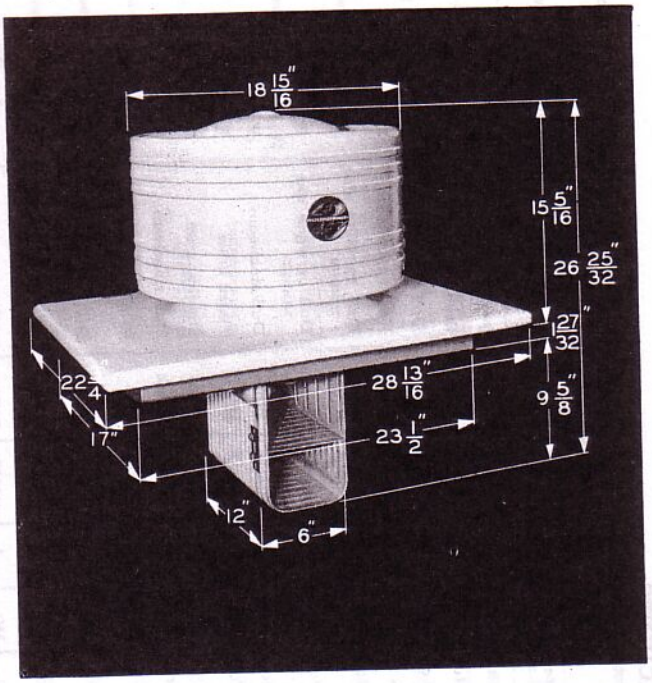


Fig. 95
CK-15A Machine

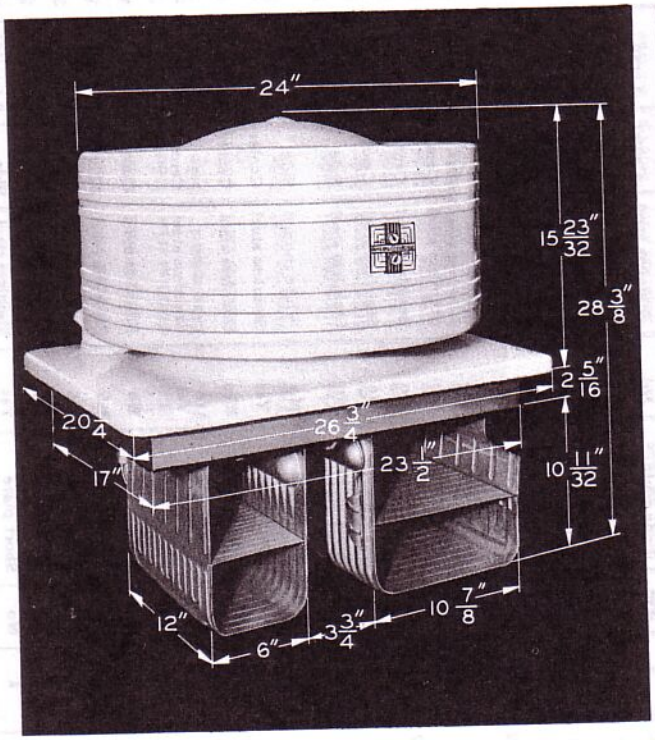


Fig. 94
CK-35D Machine
Similar Machines: CK-35B "Special"
CK-35C & E

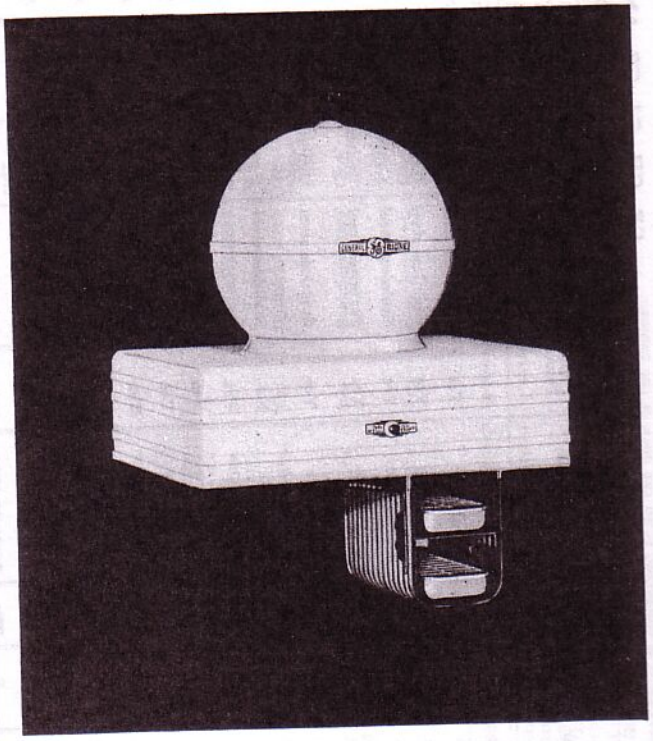


Fig. 96
CG-1B Machine
Similar machine: CG-1A

PRODUCT DESCRIPTIVE TABLE

CF, CH, CJ, CE, AND FBA MACHINES

Model	Year	Refr.	Comp. Size (B)	Case Fins	Condenser	Float Boot	EVAPORATOR							CONTROL			Escutcheon Plate	Relay Type	Fan Motor	Fan Blades
							Material	Mount	Width	Refr. Shelf	Alum Shelf	Refr. Leg	Back	Knobs	Knob Color	Pointer Color				
CF-1B	1935	SO_2	2	Yes	Long plate	Yes	Stainless steel	Center	1 tray	Yes	No	No	No	2	Black	Black	Plated brass	E	—	—
CF-1C	1936	SO_2	2	Yes	Long plate	Yes	Stainless steel	Center	1 tray	Yes	No	No	No	2	Black	Black	Stainless steel	E	—	—
CF-1D	1937	SO_2	2	Yes	Long plate	Yes	Stainless steel	Center	1 tray	Yes	No	No	No	2	Black	Black	Dull aluminum	E	—	—
CF-1E	1938	SO_2	2	Yes	Long plate	Yes	Stainless steel	Center	1 tray	Yes	No	No	No	1	White	Blue	Bright aluminum	N, R	—	—
CF-1F	1939	F-12	2	Yes	Long plate	Yes	Stainless steel	Center	1 tray	Yes	No	No	No	1	White	Blue	Dull or white aluminum	R	—	—
CF-1G	1939	SO_2	2	Yes	Long plate	Yes	Stainless steel	Center	1 tray	Yes	No	No	No	1	White	Blue	Dull or white aluminum	R	—	—
CF-1H	1940	SO_2	2	Yes	Long plate	No	Stainless steel	Center	1 tray	Yes	No	No	No	1	Black	White	Dull aluminum	R	—	—
CF-2B	1935	SO_2	2	Yes	Long plate	Yes	Stainless steel	Center	2 tray	Yes	No	No	No	2	Black	Black	Plated brass	E	—	—
CF-2C	1936	SO_2	2	Yes	Long plate	Yes	Stainless steel	Center	2 tray	Yes	No	No	No	2	Black	Black	Stainless steel	E	—	—
CF-2D	1937	SO_2	2	Yes	Long plate	Yes	Stainless steel	Center	2 tray	Yes	No	No	No	2	Black	Black	Dull aluminum	E	—	—
CF-2E	1938	SO_2	2	Yes	Long plate	Yes	Stainless steel	Center	2 tray	Yes	No Yes	No	No	1	White	Blue	Bright aluminum	N, R	—	—
CF-2F	1939	F-12	2	Yes	Long plate	Yes	Stainless steel	Center	2 tray	Yes	No Yes	No	No	1	White	Blue	Dull or white aluminum	R	—	—
CF-2G	1939	SO_2	2	Yes	Long plate	Yes	Stainless steel	Center	2 tray	Yes	No Yes	No	No	1	White	Blue	Dull or white aluminum	R	—	—
CF-2H	1940	SO_2	2	Yes	Long plate	No	Stainless steel	Center	2 tray	Yes	No	No	No	1	Black	White	Dull aluminum	R	—	—
CF-2J	1941	SO_2	2	Yes	Long plate	No	Stainless steel	Side	2 tray	Yes	No Yes	No	No	1	Blue(E)	Blue	Bright aluminum	R	—	—
CF-2M	1942	SO_2	2	Yes	Long plate	No	Blue enamel	Side	2 tray	Yes	No	Yes	No	1	Blue(E)	Blue	White enamel	R	—	—
CF-2N	1942	SO_2	2	Yes	Long plate	No	Blue enamel	Side	2 tray	Yes	No	Yes	No	1	Blue(E)	Blue	White enamel	R	—	—
CF-2R	1942	F-12	3	Yes	Long plate	No	Stainless steel	Side	2 tray	Yes	No	Yes	Half	1	Blue(E)	Blue	White enamel	R	—	—
CF-11A	1940	SO_2	2	Yes	Long plate	No	Stainless steel	Center	1 tray	Yes	No	No	No	1	Illum.	Blue	Illuminated	R	—	—
CF-21A	1940	SO_2	2	Yes	Long plate	No	Stainless steel	Center	2 tray	Yes	Yes	No	No	1	Illum.	Blue	Illuminated	R	—	—
CF-22A	1940	F-12	3	Yes	Long plate	No	Stainless steel	Center	2 tray	Yes	Yes	Yes	Half	1	Illum.	Blue	Illuminated	R	—	—
CF-22B	1940	SO_2	3	Yes	Long plate	No	Stainless steel	Center	2 tray	Yes	Yes	Yes	Half	1	Illum.	Blue	Illuminated	R	—	—
CF-22C	1941	SO_2	3	Yes	Long plate	No	Stainless steel	Side	2 tray	2	No	Yes	Full	Dial	White	Red numbers	Illuminated (F)	R	—	—
CF-22G	1942	SO_2	3	Yes	Long plate	No	White enamel	Side	2 tray	2	No	Yes	Full	1	White	Blue	Chrome on brass(G)	R	—	—
CF-28A	1938	SO_2	2	Yes	Long plate	Yes	Stainless steel	Center	2 tray	Yes	Yes	Yes	No	1	White	Blue	Bright aluminum	N, R	—	—
CF-28B	1939	F-12	2	Yes	Long plate	Yes	Stainless steel	Center	2 tray	Yes	Yes	Yes	No	1	White	Blue	Dull or white aluminum	R	—	—
CF-28C	1939	SO_2	2	Yes	Long plate	Yes	Stainless steel	Center	2 tray	Yes	Yes	Yes	No	1	White	Blue	Dull or white aluminum	R	—	—
CF-28D	1940	SO_2	2	Yes	Long plate	No	Stainless steel	Center	2 tray	Yes	No	Yes	No	1	Black	White	Dull aluminum	R	—	—
CF-28E	1941	SO_2	2	Yes	Long plate	No	Stainless steel	Side	2 tray	Yes	No	Yes	No	1	Blue(E)	Blue	Bright aluminum	R	—	—
CF-28H	1942	SO_2	2	Yes	Long plate	No	Blue enamel	Side	2 tray	Yes	No	Yes	No	1	Blue(E)	Blue	White enamel	R	—	—
CFS-1A	1940	SO_2	2	Yes	Long plate	No	Stainless steel	Center	1 tray	Yes	No	Yes	No	1	Black	White	Dull aluminum	R	—	—
CJ-1A	1937	SO_2	2	No	Short plate	Yes	Stainless steel	Side	2 tray(A)	No	No	No	No	2	Black	Black	Enamel, plated brass	E	—	—
CJ-1B	1938	SO_2	2	No	Short plate	Yes	Stainless steel	Side	2 tray(A)	No	No	No	No	1	White	Blue	Dull aluminum	N, R	—	—
CJ-1C	1939	SO_2	2	No	Short plate	Yes	Stainless steel	Side	2 tray	No	No	No	No	1	White	Blue	Dull aluminum	R	—	—
CJ-1D	1940	SO_2	2	No	Short plate	No	Stainless steel	Side	2 tray	No	No	No	No	1	Black	White	Dull aluminum	R	—	—
[redacted]																				

Model	Year	Refr.	Comp. Size (B)	Case Fins	Condenser	Float Boot	EVAPORATOR							CONTROL			Escutcheon Plate	Relay Type	Fan Motor	Fan Blades
							Material	Mount	Width	Refr. Shelf	Alum. Shelf	Refr. Leg	Back	Knobs	Knob Color	Pointer Color				
CJ-2A	1940	SO_2	2	Yes	Short plate	No	Stainless steel	Center	2 tray	Yes	No	No	No	1	Black	White	Dull aluminum	R	—	—
CJ-2B	1941	SO_2	1	No	Short plate	No	Stainless steel	Side	2 tray	Yes	No	No	No	1	Black(E)	Black	Dull aluminum	R	—	—
CJ-2C	1941	SO_2	1	No	Short plate	No	Stainless steel	Center	2 tray	Yes	No	No	No	1	Black	White	Dull aluminum	R	—	—
CJ-2D	1941	SO_2	1	No	Short plate	No	Stainless steel	Side	2 tray	Yes	No	No	No	1	Black(E)	Black	Dull aluminum	R	—	—
CJ-2E	1941	SO_2	1	No	Short plate	No	Stainless steel	Center	2 tray	Yes	No	No	No	1	Black	White	Dull aluminum	R	—	—
CJ-2H	1942	SO_2	1	No	Short plate	No	Blue enamel	Side	2 tray	Yes	No	Yes	No	1	Blue(E)	Blue	White enamel	R	—	—
FBA-1A	1940	SO_2	2	No	Short plate	No	Stainless steel	Center (D)	1 tray	Yes	No	No	No	1	Black	White	Dull aluminum	R	—	—
CH-1A	1937	SO_2	2	No	Short plate	Yes	Stainless steel	Side	2 tray(A)	No	No	No	No	2	Black	Black	Enamel, plated brass	E	One phase	3
CH-1B	1938	SO_2	2	No	Short plate	Yes	Stainless steel	Side	2 tray(A)	No	No	No	No	1	White	Blue	Dull aluminum	N, R	Two phase	2
CH-1C	1939	SO_2	2	No	Short plate	Yes	Stainless steel	Side	2 tray	No	No	No	No	1	White	Blue	Dull aluminum	R	Two phase	2
CH-1D	1940	SO_2	2	No	Short plate	Yes	Stainless steel	Side	2 tray	No	No	No	No	1	Black	White	Dull aluminum	R	Small two ph.	2
CH-1E	1941	SO_2	2	No	Short plate	Yes	Stainless steel	Side	2 tray	No	No	No	No	1	Blue(E)	Blue	Bright aluminum	R	Small two ph.	2
CE-140A	1938	SO_2	2	No	Finned tube	Yes	Stainless steel	Side	2 tray(A)	No	No	No	No	1	White	Blue	Dull aluminum	N, R	Two phase	2
CE-140B	1939	SO_2	2	No	Finned tube	Yes	Stainless steel	Side	2 tray	No	No	No	No	1	White	Blue	Dull aluminum	R	Two phase	2
CE-140C	1940	SO_2	2	No	Finned tube	No	Stainless steel	Side	2 tray	No	No	No	No	1	Black	White	Dull aluminum	R	Small two ph.	2
CE-140D	1941	SO_2	2	No	Finned tube	No	Stainless steel	Side	2 tray	No	No	No	No	1	Blue(E)	Blue	Bright aluminum	R	Small two ph.	2
CE-34M	1937	SO_2	3	No	Slant fin tube	Yes	Stainless steel	One above other	2-2 tray	Yes	No	No	No	2	Black	Black	Dull aluminum	E	One phase	3
CE-34A	1938	F-12	3	No	Slant fin tube	Yes	Stainless steel	Side by side	2-2 tray	Yes	No	No	No	1	White	Blue	Bright aluminum	N, R	Two phase (C)	2
CE-34B	1939	F-12	3	No	Slant fin tube	Yes	Stainless steel	Side by side	2-2 tray	Yes	No	No	No	1	White	Blue	White aluminum	R	Two phase (C)	2
CE-34C	1939	F-12	3	No	Vert. fin tube	Yes	Stainless steel	Side by side	2-2 tray	Yes	No	No	No	1	White	Blue	White aluminum	R	Two phase (C)	2
CE-34D	1940	F-12	3	No	Vert. fin tube	No	Stainless steel	Side by side	2-2 tray	Yes	One	No	Half	1	Illum.	Blue	Illuminated	R	Small two ph.	2
CE-34E	1941	F-12	3	No	Vert. fin tube	No	Stainless steel	Side by side	2-2 tray	Yes	One	No	Half	1	Illum.	Blue	Illuminated	R	Small two ph.	2
CE-34H	1942	SO_2	3	No	Vert. fin tube	No	White enamel	Side by side	2-2 tray	Yes	One	Yes	Full	1	Blue(E)	Blue	White enamel	R	Small two ph.	2
CE-340A	1938	F-12	3	No	Slant fin tube	Yes	Stainless steel	One above other	2-2 tray	Yes	No	No	No	2	Black	Black	—	N, R	Two phase (C)	2
CE-340B	1939	F-12	3	No	Vert. fin tube	Yes	Stainless steel	One above other	2-2 tray	Yes	No	No	No	2	Black	Black	—	R	Two phase	2
CE-340C	1940	F-12	3	No	Vert. fin tube	Yes	Stainless steel	One above other	2-2 tray	Yes	No	No	No	2	Black	Black	—	R	Small two ph	2

(A) On 1937 and 1938 CH-1, CJ-1 and CE-140 machines, the shallow evaporators are narrower than later ones and will not hold two standard Quick trays side by side.

(B) Compressors are rated as follows:
1—0.53 in. stroke with SO_2, ⅛ hp motor except 1/10 in most CJ-2B and CJ-2C machines.
2—0.66 in. stroke with SO_2, ⅛ hp motor.
0.53 in. stroke with F-12, ⅛ hp motor.
3—0.85 in. stroke with SO_2, ⅙ hp motor.
0.66 in. stroke with F-12, ⅙ hp motor.

(C) On 1938 CE-34A and CE-340A machines, the 5K61YA2 fan motor is used because of the capacitor in the starting winding circuit. On subsequent CE-34 and CE-340 models, the 5K61YA1 or 5K51AL1 fan motor is used because of the resistance split-phase compressor motor.

(D) The FBA-1A evaporator is assembled from the back of the cabinet.

(E) The larger control knob was introduced on most standard 1941 models.

(F) The control of the CF-22C machine is mounted in a vertical position above the top plate. The bellows tube bulb is located above the evaporator header. The cabinet air temperature is practically constant in all room temperatures.

(G) The control of the CF-22G machine is located in the cabinet top section and the escutcheon plate is on the front of the cabinet top cover.

PRODUCT DESCRIPTIVE TABLE

CK, LK, DK, and CG Machines

Model	Model Year	Refr.	Comp. Size (A)	EVAPORATOR (B)			ORIGINAL RELAY (C)		ORIGINAL CONTROL			Escutcheon Plate
				Material	Mount	Width	Type	Cat. No.	Cat. No.	Knob Color	Pointer Color (D)	
CK-1-B16	1935	SO_2	2	Stainless steel	Side	1 tray	E	M1A62	M1A61	Black	Black(E)	Round—chrome
CK-1-C16	1936	SO_2	2	Stainless steel	Center	1 tray	E	M1A62	M1A120	White	Red	Square
CK-1-C12	1936	SO_2	2	Stainless steel	Center	1 tray	E	M1A113	M1A120	White	Red	Square
CK-1-C1	1937	SO_2	2	Stainless steel	Center	1 tray	—	—	M1A151	White	Red	Square
CK-1-C2	1937	SO_2	2	Stainless steel	Center	1 tray	—	—	M1A152	White	Red	Square
CK-1-D16	1938	SO_2	2	Stainless steel	Center	1 tray	E or R	M1A62 or M1A168	M1A120	White	Blue	Square, rounded corners
CK-15-A16	1936	SO_2	2	Stainless steel	Center	1 tray	E	M1A62	M1A130	Black	White	Round—chrome
CK-2-B16	1935	SO_2	2	Stainless steel	Side	2 tray	E	M1A62	M1A61	Black	Black(E)	Round—chrome
CK-2-B12	1935	SO_2	2	Stainless steel	Side	2 tray	E	M1A113	M1A61	Black	Black(E)	Round—chrome
CK-2-C16	1936	SO_2	2	Stainless steel	Center	2 tray	E	M1A62	M1A121	White	Red	Square
CK-2-C12	1936	SO_2	2	Stainless steel	Center	2 tray	E	M1A113	M1A121	White	Red	Square
CK-2-C1	1937	SO_2	2	Stainless steel	Center	2 tray	—	—	M1A151	White	Red	Square
CK-2-C2	1937	SO_2	2	Stainless steel	Center	2 tray	—	—	M1A152	White	Red	Square
CK-2-D16	1938	SO_2	2	Stainless steel	Center	2 tray	E or R	M1A62 or M1A168	M1A121	White	Blue	Square, rounded corners
CK-2-E16	1942	SO_2	2	Blue enameled steel	Side	2 tray	R	M1A168	M1A258	White	Blue	Square, rounded corners
CK-26-A16	1937	SO_2	2	Stainless steel	Center	2 tray	E	M1A62	M1A121	White	Blue	Square, rounded corners
CK-26-B16	1938	SO_2	2	Stainless steel	Center	2 tray	E or R	M1A62 or M1A168	M1A121	White	Blue	Square, rounded corners
CK-28-A16	1937	SO_2	2	Stainless steel	Center	2 tray	E	M1A62	M1A121	White	Blue	Square, rounded corners
CK-28-A12	1937	SO_2	2	Stainless steel	Center	2 tray	E	M1A113	M1A121	White	Blue	Square, rounded corners
CK-28-B16	1938	SO_2	2	Stainless steel	Center	2 tray	E	M1A62	M1A121	White	Blue	Square, rounded corners
CK-30-B16	1934	SO_2	3	Stainless steel	Center	2 tray	E-3	M1A11	M1A10(F)	Black	Black(E) white dot	Round—chrome
CK-30-C16	1935	SO_2	3	Stainless steel	Center	2 tray	E	M1A64	M1A63	Black	Black(E)	Round—chrome
CK-30-D16	1936	SO_2	3	Stainless steel	Center	2 tray	E	M1A64	M1A122	White	Red	Square
CK-30-D12	1937	SO_2	3	Stainless steel	Center	2 tray	E	M1A154	M1A122	White	Red	Square, rounded corners
CK-30-D1	1937	SO_2	3	Stainless steel	Center	2 tray	—	—	M1A151	White	Red	Square, rounded corners
CK-30-D2	1937	SO_2	3	Stainless steel	Center	2 tray	—	—	M1A152	White	Red	Square, rounded corners
CK-30-E16	1938	SO_2	3	Stainless steel	Center	2 tray	E or R	M1A64 or M1A166	M1A122	White	Blue	Square, rounded corners
CK-30-E12	1942	SO_2	3	Stainless steel	Center	2 tray	R	M1A184	M1A122	White	Blue	Square, rounded corners
CK-30-G16	1938	F-12	3	Stainless steel	Center	2 tray	E	M1A64	M1A122	White	Blue	Square, rounded corners
CK-30-H16	1942	SO_2	3	Blue enameled steel	Center	2 tray	R	M1A166	M1A258	White	Blue	Square, rounded corners
CK-35-B16	1934	SO_2	3	Stainless steel	Side by side	1-1 tray or 1-2 tray	E-3	M1A11	M1A10(F)	Black	Black(E) white dot	Round—chrome

Model	Model Year	Refr.	Comp. Size (A)	EVAPORATOR (B)			ORIGINAL RELAY (C)		ORIGINAL CONTROL			Escutcheon Plate
				Material	Mount	Width	Type	Cat. No.	Cat. No.	Knob Color	Pointer Color (D)	
CK-35-C16	1935	SO_2	3	Stainless steel	Side by side	1-1 tray / 1-2 tray	E	M1A64	M1A63	Black	Black(E)	Round—chrome
CK-35-D16	1936	SO_2	3	Stainless steel	Side by side	1-1 tray / 1-2 tray	E	M1A64	M1A122	White	Red	Square
CK-35-D12	1937	SO_2	3	Stainless steel	Side by side	1-1 tray / 1-2 tray	E	M1A154	M1A122	White	Red	Square, rounded corners
CK-35-D1	1937	SO_2	3	Stainless steel	Side by side	1-1 tray / 1-2 tray	—	—	M1A151	White	Red	Square, rounded corners
CK-35-D2	1937	SO_2	3	Stainless steel	Side by side	1-1 tray / 1-2 tray	—	—	M1A152	White	Red	Square, rounded corners
CK-35-E16	1938	SO_2	3	Stainless steel	Side by side	1-1 tray / 1-2 tray	E / R	M1A64 / M1A166	M1A122	White	Blue	Square, rounded corners
CK-35-E12	1939	SO_2	3	Stainless steel	Side by side	1-1 tray / 1-2 tray	R	M1A184	M1A122	White	Blue	Square, rounded corners
CK-35-E1	1942	SO_2	3	Stainless steel	Side by side	1-1 tray / 1-2 tray	—	—	M1A151	White	Blue	Square, rounded corners
CK-35-E2	1942	SO_2	3	Stainless steel	Side by side	1-1 tray / 1-2 tray	—	—	M1A152	White	Blue	Square, rounded corners
CK-35-G16	1939	F-12	3	Stainless steel	Side by side	1-1 tray / 1-2 tray	R	M1A166	M1A122	White	Blue	Square, rounded corners
CK-35-H16	1941	F-12	3	Stainless steel	Side by side	1-1 tray / 1-2 tray	R	M1A166	M1A122	White	Blue	Square, rounded corners
LK-1-A16	1934	SO_2	2	Stainless steel L shaped	Center of back	(G)	E-3	58X121(J)	M1A56(K)	Black	Black	Rectangular, chrome plated brass
LK-1-B16	1934	SO_2	2	Stainless steel L shaped	Center of back	(G)	H	Combination	M1A65	Aluminum	—	—
LK-2-A16	1935	SO_2	2	Stainless steel L shaped	Center of back	(G)	H	Combination	M1A65	Aluminum	—	—
CG-1-A16	1935	SO_2	2	Stainless steel	Side	1 tray (H)	H	Combination	M1A80	White	—	Small rectangular
CG-1-B16	1936	SO_2	2	Stainless steel	Side	1 tray (H)	H	Combination	M1A80	White	—	Small rectangular
DK-1-A16	1935	SO_2	2	Stainless steel	Center	1 tray (I)	E	M1A62	M1A95	Black	Black	Rectangular, chrome plated brass

(A) Compressors are rated as follows:
2—0.66 in. stroke with SO_2, 1/8 hp motor.
3—0.85 in. stroke with SO_2, 1/6 hp motor.
0.66 in. stroke with F-12, 1/6 hp motor.

(B) All evaporators used on Monitor Top machines have a refrigerated shelf except the blue enameled one on the CK-2E (1942) machine.
An unrefrigerated aluminum shelf is included only in the CK-28B (1938) machine.
No Monitor Top evaporator has a liquid leg or a back cover.

(C) Type R relays were used in place of type E relays on machines manufactured after the third quarter of 1938.

(D) The teardrop pointer might be red or blue on some controls having the same Cat. No.

(E) The knob is arrow-shaped, and the point of the arrow serves as the pointer.

(F) The M1A10 control has a locking connector on the back. It also has the automatic return from defrost feature.

(G) The Liftop (LK) evaporator is different in shape from any other used on Scotch-yoke machines. It is L-shaped with a separate spherical header located back of the inner liner. It is mounted near the top o
the rear inner liner wall in an inverted position so that the base of the "L" forms the flat freezing surface.
The freezing surface extends across the back of the liner wall. The two special ice trays are placed end to end across the freezing surface.

(H) The CG-1A evaporator has no series part. There is no shelf and the right side is unrefrigerated. The CG-1B machine has a standard CK-1 evaporator with a refrigerated shelf and lower right side.

(I) The DK-1A evaporator has no shelf and the right side is unrefrigerated.

(J) The 58X121 relay has a locking connector.

(K) The M1A56 control has a locking connector. It has no defrosting mechanism.

Machine	Motor Data: Rated Voltage	Rated Cycles	Rated Horsepower	Speed, R.P.M. (Full Load)	Starting Current, Amperes (Locked Rotor)	Average Watts—100° F. Performance	Average Current, Amperes—100° F. Performance	Displacement, Cu. In.	Cylinder Bore, Inches	Piston Stroke, Inches	Compressor Data: Capacity, B.T.U./Hr. (100° F. Room, 20° F. Evaporator)	Refrigerant, Kind	Refrigerant Charge, Lbs.	Machine Data: Temperature Range of Evaporator Bottom— °F. (Control at Mid-position, Room Temp. 75-80° F.)	Average Machine Weight—Lbs. Uncrated	Crated
CF-22-A16	110	60	1/6	1740	17	200	3.1	0.81	1.25	0.66	740	F-12	2.13	21–10	115	155
CF-22-B16	110	60	1/6	1740	19	175	3.0	1.04	1.25	0.85	740	SO-2	1.88	20–6	120	155
CF-22-C16	110	60	1/6	1740	19	175	3.0	1.04	1.25	0.85	750	SO-2	1.81	21–2	120	160
CF-22-G16	110	60	1/6	1740	19	185	3.0	1.04	1.25	0.85	750	SO-2	1.81	20–10	135	175
CF-28-A16	110	60	1/8	1740	13	160	2.3	0.81	1.25	0.66	550	SO-2	2.00	20–6	115	155
CF-28-B16	110	60	1/8	1740	13	160	2.3	0.65	1.25	0.53	550	F-12	2.38	21–4	115	155
CF-28-C12	110	25	1/10	1440	13	135	2.1	0.81	1.25	0.66	460	SO-2	2.00	20–6	115	150
CF-28-C16	110	60	1/8	1740	13	160	2.3	0.81	1.25	0.66	550	SO-2	2.00	20–6	115	150
CF-28-D12	110	25	1/8	1440	13	190	3.1	1.04	1.25	0.85	600	SO-2	2.13	20–6	115	150
CF-28-D16	110	60	1/8	1740	13	160	2.3	0.81	1.25	0.66	550	SO-2	1.88	20–6	115	150
CF-28-E12	110	25	1/8	1440	13	190	3.1	1.04	1.25	0.85	600	SO-2	1.81	20–6	110	150
CF-28-E16	110	60	1/8	1740	13	145	2.2	0.81	1.25	0.66	550	SO-2	1.81	20–6	110	150
CF-28-H12	110	25	1/8	1440	13	200	3.1	1.04	1.25	0.85	600	SO-2	1.75	20–10	130	170
CFS-1-A16	110	60	1/8	1740	11	155	1.8	0.81	1.25	0.66	500	SO-2	1.63	20–4	115	145
CG-1-A16	110	60	1/8	1740	14.8	150	2.2	0.81	1.25	0.66	450	SO-2	1.88	20–6	110	135
CG-1-B16	110	60	1/8	1740	14.8	150	2.2	0.81	1.25	0.66	480	SO-2	1.88	20–6	110	140
CH-1-A16	110	60	1/8	1740	13	185	2.5	0.81	1.25	0.66	450	SO-2	1.75	22–8	95	130
CH-1-B16	110	60	1/8	1740	13	170	2.4	0.81	1.25	0.66	450	SO-2	1.75	22–8	95	125
CH-1-C16	110	60	1/8	1740	13	170	2.4	0.81	1.25	0.66	450	SO-2	1.75	22–8	95	125
CH-1-D16	110	60	1/8	1740	13	170	2.4	0.81	1.25	0.66	450	SO-2	1.63	22–8	95	125
CH-1-E16	110	60	1/8	1740	13	170	2.4	0.81	1.25	0.66	450	SO-2	1.50	22–8	95	125
CJ-1-A16	110	60	1/8	1740	13	160	2.3	0.81	1.25	0.66	450	SO-2	1.75	22–8	95	135
CJ-1-B16	110	60	1/8	1740	13	160	2.3	0.81	1.25	0.66	450	SO-2	1.75	22–8	95	135
CJ-1-C16	110	60	1/8	1740	13	145	2.2	0.81	1.25	0.66	450	SO-2	1.75	22–8	90	130
CJ-1-D16	110	60	1/8	1740	13	145	2.2	0.81	1.25	0.66	450	SO-2	1.63	22–8	90	125
CJ-1-E16	110	60	1/8	1740	13	145	2.2	0.81	1.25	0.66	450	SO-2	1.50	22–8	90	120
CJ-2-A16	110	60	1/8	1740	13	145	2.2	0.81	1.25	0.66	500	SO-2	1.88	20–6	110	145
CJ-2-B16	110	60	1/10 & 1/8	1740	13	125	2.0	0.65	1.25	0.53	400	SO-2	1.75	20–6	95	130
CJ-2-C16	110	60	1/10 & 1/8	1740	13	125	2.0	0.65	1.25	0.53	400	SO-2	1.75	20–6	95	130
CJ-2-D16	110	60	1/8	1740	13	125	2.0	0.65	1.25	0.53	400	SO-2	1.75	20–6	95	130
CJ-2-E16	110	60	1/8	1740	13	125	2.0	0.65	1.25	0.53	400	SO-2	1.75	20–6	95	130
CJ-2-H16	110	60	1/8	1740	13	135	2.1	0.65	1.25	0.53	400	SO-2	1.75	20–10	110	145
CK-1-B16	110	60	1/8	1740	14.8	170	2.4	0.81	1.25	0.66	480	SO-2	1.75	22–6	125	160
CK-1-C1	110	(d.c.)	1/6	1740	40	275	2.4	0.81	1.25	0.66	480	SO-2	1.88	20–4	125	160
CK-1-C2	220	(d.c.)	1/6	1740	40	275	2.4	0.81	1.25	0.66	480	SO-2	1.88	20–4	125	160
CK-1-C12	110	25	1/10	1440	14.8	140	2.2	0.81	1.25	0.66	400	SO-2	1.88	20–4	125	160
CK-1-C16	110	60	1/8	1740	14.8	170	2.4	0.81	1.25	0.66	480	SO-2	1.88	20–4	125	160
CK-1-D16	110	60	1/8	1740	13	160	2.3	0.81	1.25	0.66	480	SO-2	1.75	20–4	115	145

NOTE: In some instances, the refrigerant charge differs from that shown on the machine nameplate. Also, the nameplates of some 25-cycle machines show incorrect motor horsepower ratings, such as 1/8 instead of 1/10.

Machine	Motor Data: Rated Voltage	Rated Cycles	Rated Horsepower	Speed, R.P.M. (Full Load)	Starting Current, Amperes (Locked Rotor)	Average Watts—100° F. Performance	Average Current, Amperes—100° F. Performance	Displacement, Cu. In.	Cylinder Bore, Inches	Piston Stroke, Inches	Compressor Data: Capacity, B.T.U./Hr. (100° F. Room, 20° F. Evaporator)	Refrigerant, Kind	Refrigerant Charge, Lbs.	Machine Data: Temperature Range of Evaporator Bottom— °F. (Control at Mid-position, Room Temp. 75-80° F.)	Average Machine Weight—Lbs. Uncrated	Crated
CF-22-A16	110	60	1/6	1740	17	200	3.1	0.81	1.25	0.66	740	F-12	2.13	21–10	115	155
CF-22-B16	110	60	1/6	1740	19	175	3.0	1.04	1.25	0.85	740	SO-2	1.88	20–6	120	155
CF-22-C16	110	60	1/6	1740	19	175	3.0	1.04	1.25	0.85	750	SO-2	1.81	21–2	120	160
CF-22-G16	110	60	1/6	1740	19	185	3.0	1.04	1.25	0.85	750	SO-2	1.81	20–10	135	175
CF-28-A16	110	60	1/8	1740	13	160	2.3	0.81	1.25	0.66	550	SO-2	2.00	20–6	115	155
CF-28-B16	110	60	1/8	1740	13	160	2.3	0.65	1.25	0.53	550	F-12	2.38	21–4	115	155
CF-28-C12	110	25	1/10	1440	13	135	2.1	0.81	1.25	0.66	460	SO-2	2.00	20–6	115	150
CF-28-C16	110	60	1/8	1740	13	160	2.3	0.81	1.25	0.66	550	SO-2	2.00	20–6	115	150
CF-28-D12	110	25	1/8	1440	13	190	3.1	1.04	1.25	0.85	600	SO-2	2.13	20–6	115	150
CF-28-D16	110	60	1/8	1740	13	160	2.3	0.81	1.25	0.66	550	SO-2	1.88	20–6	115	150
CF-28-E12	110	25	1/8	1440	13	190	3.1	1.04	1.25	0.85	600	SO-2	1.81	20–6	110	150
CF-28-E16	110	60	1/8	1740	13	145	2.2	0.81	1.25	0.66	550	SO-2	1.81	20–6	110	150
CF-28-H12	110	25	1/8	1440	13	200	3.1	1.04	1.25	0.85	600	SO-2	1.75	20–10	130	170
CFS-1-A16	110	60	1/8	1740	11	155	1.8	0.81	1.25	0.66	500	SO-2	1.63	20–4	115	145
CG-1-A16	110	60	1/8	1740	14.8	150	2.2	0.81	1.25	0.66	450	SO-2	1.88	20–6	110	135
CG-1-B16	110	60	1/8	1740	14.8	150	2.2	0.81	1.25	0.66	480	SO-2	1.88	20–6	110	140
CH-1-A16	110	60	1/8	1740	13	185	2.5	0.81	1.25	0.66	450	SO-2	1.75	22–8	95	130
CH-1-B16	110	60	1/8	1740	13	170	2.4	0.81	1.25	0.66	450	SO-2	1.75	22–8	95	125
CH-1-C16	110	60	1/8	1740	13	170	2.4	0.81	1.25	0.66	450	SO-2	1.75	22–8	95	125
CH-1-D16	110	60	1/8	1740	13	170	2.4	0.81	1.25	0.66	450	SO-2	1.63	22–8	95	125
CH-1-E16	110	60	1/8	1740	13	170	2.4	0.81	1.25	0.66	450	SO-2	1.50	22–8	95	125
CJ-1-A16	110	60	1/8	1740	13	160	2.3	0.81	1.25	0.66	450	SO-2	1.75	22–8	95	135
CJ-1-B16	110	60	1/8	1740	13	160	2.3	0.81	1.25	0.66	450	SO-2	1.75	22–8	95	135
CJ-1-C16	110	60	1/8	1740	13	145	2.2	0.81	1.25	0.66	450	SO-2	1.75	22–8	90	130
CJ-1-D16	110	60	1/8	1740	13	145	2.2	0.81	1.25	0.66	450	SO-2	1.63	22–8	90	125
CJ-1-E16	110	60	1/8	1740	13	145	2.2	0.81	1.25	0.66	450	SO-2	1.50	22–8	90	120
CJ-2-A16	110	60	1/8	1740	13	145	2.2	0.81	1.25	0.66	500	SO-2	1.88	20–6	110	145
CJ-2-B16	110	60	1/10 & 1/8	1740	13	125	2.0	0.65	1.25	0.53	400	SO-2	1.75	20–6	95	130
CJ-2-C16	110	60	1/10 & 1/8	1740	13	125	2.0	0.65	1.25	0.53	400	SO-2	1.75	20–6	95	130
CJ-2-D16	110	60	1/8	1740	13	125	2.0	0.65	1.25	0.53	400	SO-2	1.75	20–6	95	130
CJ-2-E16	110	60	1/8	1740	13	125	2.0	0.65	1.25	0.53	400	SO-2	1.75	20–6	95	130
CJ-2-H16	110	60	1/8	1740	13	135	2.1	0.65	1.25	0.53	400	SO-2	1.75	20–10	110	145
CK-1-B16	110	60	1/8	1740	14.8	170	2.4	0.81	1.25	0.66	480	SO-2	1.75	22–6	125	160
CK-1-C1	110	(d.c.)	1/6	1740	40	275	2.4	0.81	1.25	0.66	480	SO-2	1.88	20–4	125	160
CK-1-C2	220	(d.c.)	1/6	1740	40	275	2.4	0.81	1.25	0.66	480	SO-2	1.88	20–4	125	160
CK-1-C12	110	25	1/10	1440	14.8	140	2.2	0.81	1.25	0.66	400	SO-2	1.88	20–4	125	160
CK-1-C16	110	60	1/8	1740	14.8	170	2.4	0.81	1.25	0.66	480	SO-2	1.88	20–4	125	160
CK-1-D16	110	60	1/8	1740	13	160	2.3	0.81	1.25	0.66	480	SO-2	1.75	20–4	115	145

NOTE: In some instances, the refrigerant charge differs from that shown on the machine nameplate. Also, the nameplates of some 25-cycle machines show incorrect motor horsepower ratings, such as ⅛ instead of 1/10.

Machine	Motor Data										Compressor Data			Machine Data		
	Rated Voltage	Rated Cycles	Rated Horsepower	Speed, R.P.M. (Full Load)	Starting Current, Amperes (Locked Rotor)	Average Watts—100° F. Performance	Average Current, Amperes—100° F. Performance	Displacement, Cu. In.	Cylinder Bore, Inches	Piston Stroke, Inches	Capacity, B.T.U./Hr. (100° F. Room, 20° F. Evaporator)	Refrigerant, Kind	Refrigerant Charge, Lbs.	Temperature Range of Evaporator Bottom—°F. (Control at Mid-position, Room Temp. 75–80° F.)	Average Machine Weight—Lbs.	
															Uncrated	Crated
CK-2-B12	110	25	1/10	1440	14.8	140	2.2	0.81	1.25	0.66	440	SO-2	2.19	22–8	135	175
CK-2-B16	110	60	1/8	1740	14.8	170	2.4	0.81	1.25	0.66	530	SO-2	2.19	22–8	135	175
CK-2-C1	110	(d.c.)	1/6	1740	40	275	2.4	0.81	1.25	0.66	530	SO-2	2.19	20–6	135	165
CK-2-C2	220	(d.c.)	1/6	1740	40	275	2.4	0.81	1.25	0.66	530	SO-2	2.19	20–6	135	165
CK-2-C12	110	25	1/10	1440	14.8	140	2.2	0.81	1.25	0.66	440	SO-2	2.19	20–6	135	165
CK-2-C16	110	60	1/8	1740	14.8	170	2.4	0.81	1.25	0.66	530	SO-2	2.19	20–6	135	165
CK-2-D16	110	60	1/8	1740	13	160	2.3	0.81	1.25	0.66	530	SO-2	2.19	20–6	135	165
CK-2-E16	110	60	1/8	1740	13	160	2.3	0.81	1.25	0.66	530	SO-2	2.06	20–10	125	155
CK-15-A16	110	60	1/8	1740	14.8	170	2.4	0.81	1.25	0.66	480	SO-2	1.88	20–6	135	175
CK-26-A16	110	60	1/8	1740	13	160	2.3	0.81	1.25	0.66	530	SO-2	2.19	20–6	130	170
CK-26-B16	110	60	1/8	1740	13	160	2.3	0.81	1.25	0.66	530	SO-2	2.19	20–6	120	145
CK-28-A12	110	25	1/10	1440	13	135	2.1	0.81	1.25	0.66	440	SO-2	2.19	20–6	120	145
CK-28-A16	110	60	1/8	1740	13	160	2.3	0.81	1.25	0.66	530	SO-2	2.19	20–6	120	155
CK-28-B16	110	60	1/8	1740	13	160	2.3	0.81	1.25	0.66	530	SO-2	2.19	20–6	120	155
CK-30-B16	110	60	1/6	1740	13	240	3.4	1.04	1.25	0.85	730	SO-2	3.75	25–15	180	245
CK-30-C16	110	60	1/6	1740	13	240	3.4	1.04	1.25	0.85	730	SO-2	2.81	22–8	180	245
CK-30-D1	110	(d.c.)	1/6	1740	40	345	3.0	1.04	1.25	0.85	730	SO-2	2.81	20–6	175	235
CK-30-D2	220	(d.c.)	1/6	1740	40	345	3.0	1.04	1.25	0.85	730	SO-2	2.81	20–6	175	235
CK-30-D12	110	25	1/8	1440	13	200	3.1	1.04	1.25	0.85	600	SO-2	2.81	20–6	175	235
CK-30-D16	110	60	1/6	1740	13	230	3.2	1.04	1.25	0.85	730	SO-2	2.81	20–6	175	235
CK-30-E12	110	25	1/8	1440	13	190	3.1	1.04	1.25	0.85	600	SO-2	2.56	20–6	175	215
CK-30-E16	110	60	1/6	1740	13–19	230	3.2	1.04	1.25	0.85	730	SO-2	2.56	20–6	175	215
CK-30-G16	110	60	1/6	1740	19	250	3.3	0.81	1.25	0.66	730	F-12	2.75	21–4	175	215
CK-30-H16	110	60	1/6	1740	19	240	3.3	1.04	1.25	0.85	730	SO-2	2.56	20–10	180	220
CK-35-B16	110	60	1/6	1740	13	250	3.4	1.04	1.25	0.85	780	SO-2	7.75	25–15	195	265
CK-35-C16	110	60	1/6	1740	13	250	3.4	1.04	1.25	0.85	780	SO-2	4.13	22–8	185	245
CK-35-D1	110	(d.c.)	1/6	1740	40	345	3.0	1.04	1.25	0.85	780	SO-2	4.13	20–6	185	245
CK-35-D2	220	(d.c.)	1/6	1740	40	345	3.0	1.04	1.25	0.85	780	SO-2	4.13	20–6	185	245
CK-35-D12	110	25	1/8	1440	13	190	3.1	1.04	1.25	0.85	650	SO-2	4.13	20–6	185	245
CK-35-D16	110	60	1/6	1740	13	230	3.2	1.04	1.25	0.85	780	SO-2	4.13	20–6	185	245
CK-35-E1	110	(d.c.)	1/6	1740	40	345	3.0	1.04	1.25	0.85	780	SO-2	3.88	20–6	175	220
CK-35-E2	220	(d.c.)	1/6	1740	40	345	3.0	1.04	1.25	0.85	780	SO-2	3.88	20–6	175	220
CK-35-E12	110	25	1/8	1440	13	190	3.1	1.04	1.25	0.85	650	SO-2	3.88	20–6	175	220
CK-35-E16	110	60	1/6	1740	13–19	230	3.2	1.04	1.25	0.85	780	SO-2	3.88	20–6	175	220
CK-35-G16	110	60	1/6	1740	19	275	3.4	0.81	1.25	0.66	780	F-12	4.75	21–4	185	235
CK-35-H16	110	60	1/6	1740	17	250	3.3	0.81	1.25	0.66	780	F-12	4.50	21–4	175	220
DK-1-A16	110	60	1/8	1740	14.8	150	2.2	0.81	1.25	0.66	450	SO-2	2.00	20–6	115	150
FBA-1-A16	110	60	1/8	1740	13	150	2.2	0.81	1.25	0.66	470	SO-2	1.50	20–4	85	125
LK-1-A16	110	60	1/8	1740	14.8	180	2.3	0.81	1.25	0.66	450	SO-2	1.25	22–5	160*	180*
LK-1-B16	110	60	1/8	1740	14.8	180	2.3	0.81	1.25	0.66	450	SO-2	1.38	22–5	145*	175*
LK-2-A16	110	60	1/8	1740	14.8	180	2.3	0.81	1.25	0.66	450	SO-2	1.38	22–5	160*	180*

* Weight of machine and cabinet combined.

NOTE: In some instances, the refrigerant charge differs from that shown on the machine nameplate. Also, the nameplates of some 25-cycle machines show incorrect motor horsepower ratings, such as 1/8 instead of 1/10.

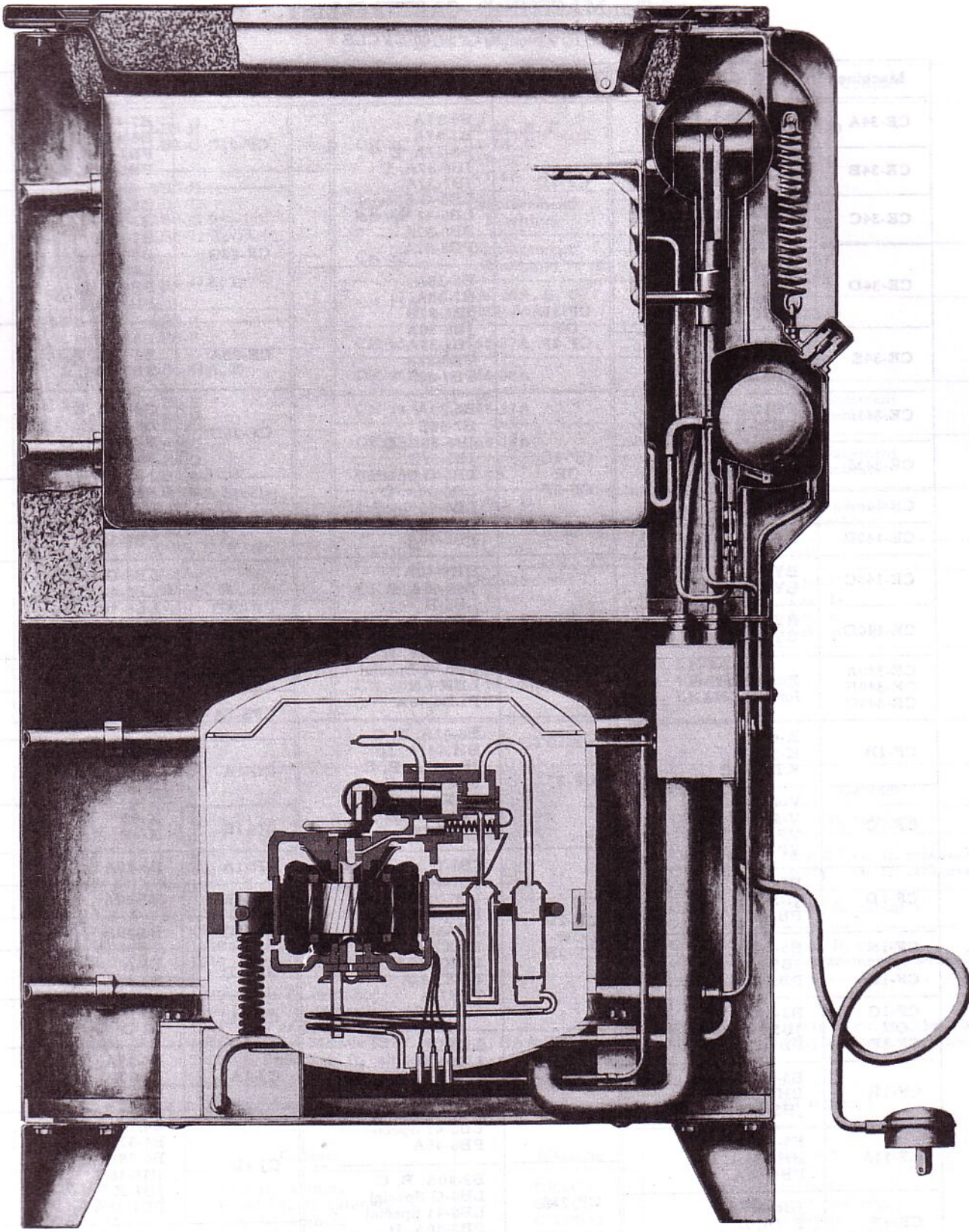


Fig. 97
Cross-sectional Chart
LK Refrigerator

MACHINE—CABINET LIST

110-VOLT, 50/60-CYCLE

Machine	Cabinet
CE-34A	PB12-38A, B PB16-38A, B
CE-34B	PB12-39A, B PB16-39A, B
CE-34C	PB12-39A, B, C PB16-39A, B
CE-34D	PB12-A PB16-A PB12-40A PB16-40A
CE-34E	PB12-B, C, D PB16-B, C, D PBS16-A
CE-34H	PB12-E PB16-E
CE-34M	K-12A, B K-15A, B
CE-140A	BY4-38A
CE-140B	BY4-39A
CE-140C	BY4-A BY4-40A
CE-140D	BY4-B BY4-C
CE-340A CE-340B CE-340C	Replacements for CE-34M
CF-1B	K-4A K-5A, B KT-5A, B
CF-1C	V-4A, C V-5A, C VP-4A, C VP-5A, C
CF-1D	B5-37A JB5-37A PB5-37A
CF-1E OR CF-1F	B5-38A JB5-38A PB5-38A
CF-1G OR CF-1F	B5-39A JB5-39A, B PB5-39A
CF-1H	B5-X BH5-41A, B JB5-40A
CF-11A	B5-40A BH5-41A, B PB5-40A
CF-2B	JB6-X K-7A, B KT-7A, B
CF-2C	JB6-X V-7A, C VP-7A, C
CF-2D	B6-37A B7-37A B8-37A, B JB6-37A, C JB7-37A LB6-G Special LB6-41 Special PB6-37A PB8-37A
CF-2E OR CF-2F	B6-38A B7-38A JB6-37B JB6-38A JB7-38A PB6-38A PB7-38A
CF-2G OR CF-2F	B6-39A B7-38B JB6-39A, B JB7-38B LB6-G Special LB6-39A, C LB6-41 Special LBC6-39A PB6-39A
CF-2H	BH6-40A JB6-40A, B LB6-B LB6-G Special LB6-39B LB6-40A, B LB6-41 Special LBH-6A PLB6-40A
CF-2J	B6-41A, B, C BH7-41A, B JB6-41A, B, C LB6-41B, C LBX6-41A, B PB6-41A, B, C PJB6-41B, D
CF-2M OR CF-2N	JB7-C JB7-42A LB7-A LB7-42A LBA6-G LBX7-A LBX7-42A LBXA6-A PJB7-A PJB7-42A
CF-2R	LBS6-B LBS8-A
CF-21A	B6-40A, B LB6-G Special LB6-41 Special PB6-40A
CF-22A	B8-40A, B, C LB6-G Special LB6-41 Special PB8-40A, B
CF-22B	B8-40B LB6-G Special LB6-41 Special PB8-40A
CF-22C	B7-41A, B B8-41A, B PB7-41A, B PB8-41A, B
CF-22G	B7-A B7-B B7-42A B8-A B8-42A PB8-A PB8-42A
CF-28A	B8-X B8-38A, B PB8-38A, B
CF-28B	B8-38A, B B8-39A PB8-38A, B PB8-39A
CF-28C	B8-39A LB6-G Special LB6-41 Special PB8-39A
CF-28D	LB6-G Special LB6-41 Special LB8-40A, B LBH-8A LBS6-A
CF-28E	JB8-41A, B
CFS-1A	JBS4-B JBS4-39A
CG-1A	M-4A, C X-3A X-4A
CG-1B	X-3A X-4B
CH-1A	B3-37A
CH-1B	B3-38A
CH-1C	B3-39A
CH-1D	B3-A B3-40A
CH-1E	B3-B B3-C
CJ-1A	B4-37A, B JB4-X PB4-37A
CJ-1B	B4-A B4-37B B4-38A, C JB3-38A JB4-X PB4-38A
CJ-1C	JB3-39A, B JB4-X JB4-39A
CJ-1D	LB3-A LB3-40A

MACHINE—CABINET LIST

110-VOLT, 50/60-CYCLE

Machine	Cabinet
CJ-1E	LB3-B LB3-C
CJ-2A	LB6-C LB6-D LB6-G Special LB6-41 Special
CJ-2B (60 cy. only)	LB6-41A, D
CJ-2C (60 cy. only)	LB6-E LB6-F
CJ-2D (60 cy. only)	LB6-41A, D
CJ-2E (60 cy. only)	LB6-E LB6-F
CJ-2H (60 cy. only)	LA6-A LB6-G LBX6-A LBX6-A Special
CK-1B	HT-47A, B T-5C X-5A, C, F, G
CK-1C	M-5A, C MP-5A, C
CK-1D	(Replacement Machine)
CK-2B	T-7B, C X-6A X-7B, C XT-6A
CK-2C	M-6A, B, C M-7A, C MP-6C XT-6A
CK-2D	(Replacement Machine)
CK-2E	(Replacement Machine)
CK-15A	SM-66A, B, C SMP-66A, G
CK-26A	M6-37A
CK-26B	M6-38A
CK-28A	M8-37A
CK-28B	M8-38A
CK-30B	T-9A
CK-30C	T-9C, D TM-9A
CK-30D	TM-9A
CK-30E	(Replacement Machine)
CK-30G	(Replacement Machine)
CK-30H	(Replacement Machine)
CK-35B	P4-180 P-110 P-134 P-170 S-107 S-146 S-182
CK-35C	S-107 S-146
CK-35D	P4-180 P-134 S-107 S-146
CK-35E	(Replacement Machine)
CK-35G	(Replacement Machine)
CK-35H	(Replacement Machine)
DK-1A	DK
FBA-1A	LB4-C LB4-D LB4-E LB4-40A, B, C
LK-1A LK-1B LK-2A	LK

110-VOLT, 25-CYCLE

Machine	Cabinet
CF1C12 CF1D12 CF1E12 CF1G12 CF1H12	1936 4 and 5 cu. ft. cabinets 1937 5 cu. ft. cabinets 1938 5 cu. ft. cabinets 1939 5 cu. ft. cabinets 1940 5 cu. ft. cabinets
CF2D12 CF2E12 CF2G12 CF2H12	1937 6, 7 and 8 cu. ft. cabinets 1938 6, 7 and 8 cu. ft. cabinets 1939 6 cu. ft. cabinets 1940 6 cu. ft. cabinets
CF28C12 CF28D12 CF28E12 CF28H12	1939 8 cu. ft. cabinets 1940 8 cu. ft. cabinets 1941 6, 7 and 8 cu. ft. cabinets 1941 Interim Models JB7-C, PJB7-A, B7-A, B8-A 1942 6, 7 and 8 cu. ft. cabinets

Machine	Cabinet
CK1C12	5 cu. ft. cabinets
CK2B12 CK2C12	6 and 7 cu. ft. cabinets 6 and 7 cu. ft. cabinets
CK28A12	8 cu. ft. cabinets
CK30D12 CK30E12	9 cu. ft. cabinets (Replacement machine)
CK35D12 CK35E12	10 to 18 cu. ft. cabinets (Replacement machine)

115-VOLT, DIRECT-CURRENT

Machine	Cabinet
CK1C1	5 cu. ft. cabinets
CK2C1	6 and 7 cu. ft. cabinets
CK30D1	9 cu. ft. cabinets
CK35D1	10 to 18 cu. ft. cabinets
CK35E1	(Replacement machine)

230-VOLT, DIRECT-CURRENT

Machine	Cabinet
CK1C2	5 cu. ft. cabinets
CK2C2	6 and 7 cu. ft. cabinets
CK30D2	9 cu. ft. cabinets
CK35D2	10 to 18 cu. ft. cabinets
CK35E2	(Replacement machine)

Note: Many CK machines have also been installed in older style cabinet as replacements for CA and DR machines.

TEMPERATURE CONTROLS

Controls used on Scotch-yoke machines are switches for turning the electric current on and off to regulate operation of the machines as follows:

1. Manual starting and stopping.
2. Automatic starting and stopping to maintain proper evaporator and cabinet temperatures.
3. Manual means of changing evaporator and cabinet temperatures within certain limits (not in control-relay combination).
4. Automatic starting and keeping the machine running when freezing water or desserts under most operating conditions.
5. Manual means of changing the evaporator cut-on temperature so that it will defrost but still maintain refrigeration of the cabinet (not in control-relay combination).
6. Overload protection of the motor (not in single-knob controls).

DESCRIPTION

TWO-KNOB CONTROLS

Two-knob controls contain a bellows-operated over-center bridle-spring-action temperature regulating device, "off" and "defrost" positions, a temperature adjustment, and a solder-pot overload. Cat. No. M1A258 is an exception, since this control does not have the solder-pot overload.

Two-knob controls are used on all Monitor Top CK machines, all Flatop CH, CJ, CF and CE models from 1935 through 1937, early Liftops LK-1A, and Under-the-Drainboard DK machines.

On CK and DK machines, the control is mounted on the rear of the front surface of the cylindrical plate condenser. It is covered with an escutcheon plate containing operating instructions.

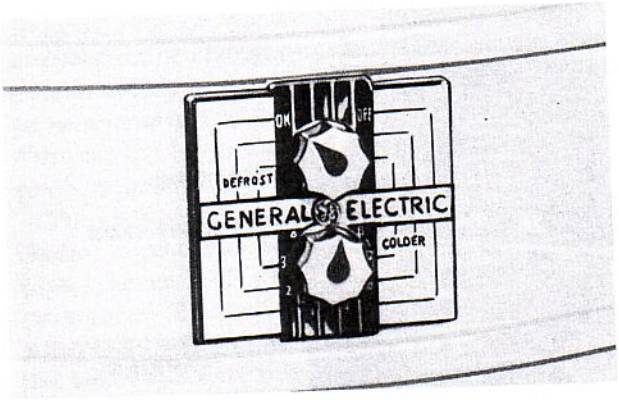


Fig. 98
Control on CK Machine

On Flatop machines, the control is mounted on the escutcheon plate across the upper part of the front opening of the evaporator.

Operating instructions are embossed on the escutcheon plate. On 1935 CF Form B and 1936 CF Form C machines, there is a window in which appears the red signal flag when the overload trips the machine off. The window, along with instructions for resetting the overload, is omitted from the escutcheon plate of all later models.

On LK-1A Liftop machines, the control is mounted on a plate located in the upper right corner of the unit compartment opening in the rear of the refrigerator.

The escutcheon plate contains the operating instructions but, since it is on the back of the refrigerator, it cannot be seen except by moving the refrigerator. There is a window within which appears the red signal flag when the overload trips the machine off.

The end of the bellows tube of controls on Liftop machines is not attached to the evaporator, as on all other Scotch-yoke machines, but is located within a tube connected to the evaporator

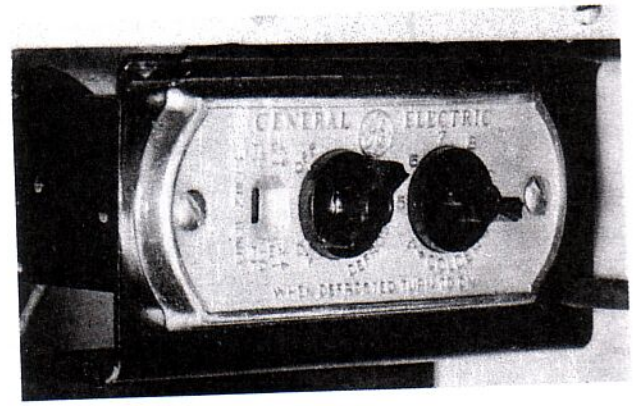


Fig. 99
Control on LK Machine

header on one end and to the outer shell of the cabinet on the other. The temperature of the bellows tube is, therefore, affected by the room as well as the evaporator. The warmer the room, the colder the evaporator must run in order to keep the same control temperature limits. The colder the room, the warmer the evaporator runs. If the end of the bellows tube is properly located in the tube, the compensation is such that the

cabinet air temperature is practically constant within reasonable room temperature limits of 60° to 100° F.

The functions performed by the two knobs are as follows:

Main Switch: Turns the machine on or off manually.
Resets the overload.
Defrosts the evaporator.

Temperature Knob: Raises or lowers the evaporator temperature limits.

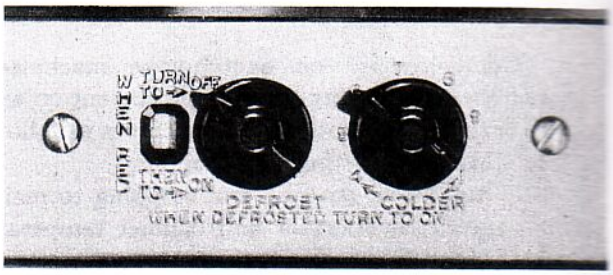


Fig. 100
Two-knob Control on Flatop Machine

MAIN SWITCH

Turns the machine on or off manually: When the main switch is turned to the "off" position, a cam on the knob moves an extension of the arm on which the movable main contact is mounted so that the contacts are opened.

When the main switch is turned to the "on" position, the cam releases the same arm so that the contacts may be opened or closed, depending on the position of the over-center bridle spring arrangement which is controlled by the evaporator temperature.

Resets the overload: In case of unusual load or power conditions on the motor which cause it to draw excessive current, an overload device trips the machine off. To turn the machine on again and to reset the overload, the main switch must be first turned to the "off" and then to the "on" position.

The overload is located in series with the main contacts in the common lead to the motor. All of the current to the motor passes through a small heater coil which is wound around a sleeve within which is a vertical shaft. On the lower end of the shaft is a ratchet wheel. A film of solder holds the shaft stationary within the sleeve.

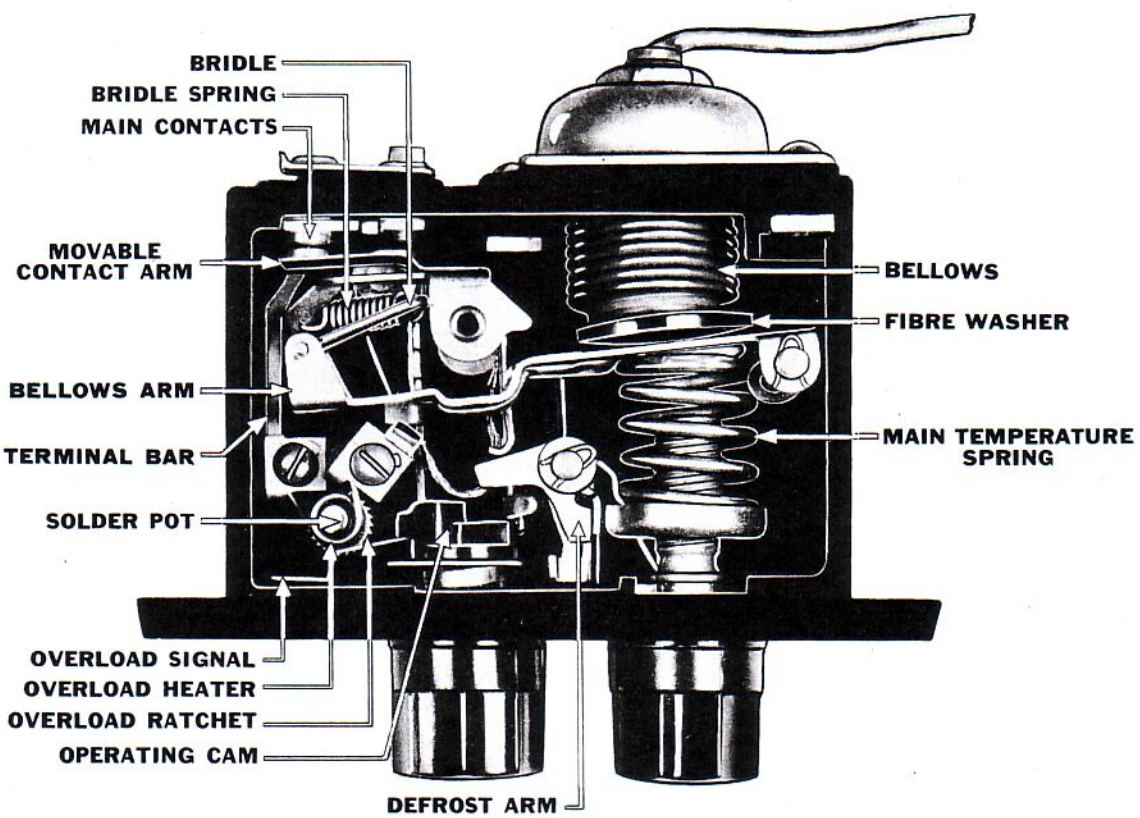


Fig. 101
Two-knob Control

When excessive current passes through the heater coil, the solder is melted and the ratchet wheel turns, releasing a dog. The dog springs out and strikes the extension of the arm on which is mounted the movable main contact, opening this contact as though the main switch were turned to the "off" position.

To reset the overload and start the machine, the main switch must first be turned to the "off" position. This movement resets the dog on the ratchet wheel. The knob is then turned to the "on" position and the main contacts are closed.

Defrosts the evaporator: Defrosting of the evaporator is obtained when the main switch is turned to the "defrost" position. Another cam on the knob releases a spring which acts in parallel with the main temperature spring against the bellows arm. The normal temperature range on the bottom of the evaporator is changed from approximately 6–20° F. to 6–50° F. It is evident that defrosting will take place since the evaporator warms up above 32° F.

The machine will continue to operate with the wide differential between the cut-off and cut-on temperatures until the main switch is returned to the "on" position.

TEMPERATURE KNOB

The temperature knob raises or lowers the evaporator temperature limits to allow changes in the freezing rate or the storage temperature in the evaporator, or changes in the cabinet air temperature to satisfy the particular desires of the user or to compensate for abnormal operating conditions. Turning the knob changes the compression of the temperature spring acting against the bellows arm.

The temperature regulating arrangement includes a metallic bellows soldered to a sealed tube, the end of which is clamped against the evaporator. The bellows and tube contain a small amount of refrigerant. The vapor pressure within the bellows is determined by the coldest section of the tube; that is, the end clamped to the evaporator.

The bellows bears against the lower end of the bellows arm, just above the pivot point. On the other side of the bellows arm, and acting in opposition to the bellows, is a compression spring whose pressure is determined by the position of the temperature knob.

The movement of the outer end of the bellows arm moves the ends of the bridle, which causes an over-center spring to open or close the movable main contact.

The evaporator temperature limits are made colder as the knob is turned clockwise through the various freezing positions. Position 1 is the warmest and position 9 is the coldest. As the knob is turned clockwise, the compression on the temperature spring is reduced and less pressure in the bellows (meaning colder evaporator temperatures) is required to operate the contacts.

The mid-position of the temperature knob is at position 5. The evaporator temperature differential, as measured with a standard serviceman's thermometer frozen to the inner bottom surface of the evaporator, is approximately 6–20° F. The cabinet air temperature in a room varying between 70° F. and 80° F., with a normal amount of food in the cabinet, will be maintained in the vicinity of 38° F. to 42° F.

The average range between positions 1 and 9 is approximately 12° F. The temperature variation of the evaporator bottom, for most machines, with different knob positions, is as follows:

Temp. Knob Position	Evaporator Bottom Temp., ° F.	
	On	Off
1 (warmest)	26	12
5 (mid)	20	6
9 (coldest)	14	0

Note: In this table, and elsewhere in this manual, the evaporator temperature is obtained by freezing or puttying a standard serviceman's thermometer to the center of the bare freezing surface. The cabinet door is left closed for several hours in a room where the temperature is relatively constant before a reading is taken. The serviceman can closely approximate these temperatures after several normal cycles.

The variation of cabinet air temperature in different room temperatures with changes in the temperature knob position is as follows:

Temperature Knob Position	Average Cabinet Air Temperature, ° F.		
	100° F. Room	80° F. Room	60° F. Room
1 (warmest)	51	45	38
5 (mid)	46	40	34
9 (coldest)	43	36	30

Note: Here, and in similar tables in this manual, the cabinet air temperature is obtained by suspending a standard serviceman's thermometer in about the geometric center of a cabinet in which there is no food. The cabinet door is left closed for several hours in a room where the temperature is relatively constant before a reading is taken.

For M1A56 controls on LK-1A machines, where the bellows tube is not attached to the evaporator as it is on other two knob controls, the cabinet air temperature changes less but the evaporator limits vary with the same temperature knob setting in different room temperatures. The knob is assumed to be at mid-position for the following:

Room Temperature, °F.	Cabinet Air Temperature, °F.	Evaporator Temperature, °F.	
		On	Off
100	40	20	2
80	38	22	5
60	36	24	8

In a room averaging 80° F., the temperature in the center of LK-1A cabinets is altered by moving the temperature knob as illustrated below:

Temperature Knob Position	Cabinet Air Temperature, °F.	Evaporator Temperature, °F.	
		On	Off
1 (warmest)	42	28	8
5 (mid)	38	22	5
9 (coldest)	33	15	0

On CK-2E and CK-30H machines, the bellows tube of the M1A258 control is clamped above the header. Evaporator and cabinet temperatures are similar to those of Flatop machines with enameled evaporators. See page 53.

TWO-KNOB CONTROLS

Cat. No.	Pointer Color	Universal Replacement Control	Solder-pot Overload Rating, Amps.	Control (F) Mid-position Temp. Limits, °F.	Bellows Tube Length, In.	Replacement Bellows Cat. No.	Machines Used On
M1A10 (A)	Black (B)	M1A182 (D)	5.1	28.5-18.5	22⅝	58X225	CK-30-B16, CK-35-B16
M1A56 (A)	Black (B)	None	3.4	34.5-24 5	19	M5A4	LK-1-A16 (G)
M1A61	Black (B)	M1A181	3.4	22.0-10.5	18½	M5A4	CK-1-B16, CK-2-B16, CK-2-B12 (25 cycle)
M1A63	Black (B)	M1A182	5.1	22.0-10.5	24	M5A4	CK-30-C16, CK-35-C16
M1A78	Black (B)	M1A181	3.4	22.0-10.5	19	58X250	CH-1-A16, CJ-1-A16, CF-1-B16, CF-1-C16, CF-1-D16, CF-2-B16, CF-2-C16, CF-2-D16, CF-1-C12 (25 cycle), CF-1-D12 (25 cycle), CF-2-D12 (25 cycle)
M1A95	Black (B)	M1A181 (E)	3.4	18.0-9.0	19	58X250	DK-1-A16
M1A120 (H)	Red or blue (C)	M1A181	3.4	22.0-10.5	21	M5A4	CK-1-C16, CK-1-C12 (25 cycle), CK-1-D16
M1A121 (H)	Red or blue (C)	M1A181	3.4	22.0-10.5	23¼	M5A4	CK-2-C16, CK-2-C12 (25 cycle), CK-2-D16, CK-26-A16, CK-26-B16, CK-28-A16, CK-28-A12 (25 cycle), CK-28-B16
M1A122 (H)	Red or blue (C)	M1A182	5.1	22.0-10.5	24	M5A4	CK-30-D16, CK-30-D12 (25 cycle), CK-30-E16, CK-30-E12 (25 cycle), CK-30-G16, CK-35-D16, CK-35-D12 (25 cycle), CK-35-E16, CK-35-E12 (25 cycle), CK-35-G16, CK-35-H16
M1A130	White (C)	M1A181	3.4	22.0-10.5	21	M5A4	CK-15-A16
M1A151 (H)	Red (C)	None	4.9	22.0-10.5	24	M5A4	CK-1-C1 (115 V DC), CK-2-C1 (115 V DC), CK-30-D1 (115 V DC), CK-35-D1 (115 V DC), CK-35-E1 (115 V DC)
M1A152 (H)	Red (C)	None	2.5	22.0-10.5	24	M5A4	CK-1-C2 (230 V DC), CK-2-C2 (230 V DC), CK-30-D2 (230 V DC), CK-35-D2 (230 V DC), CK-35-E2 (230 V DC)
M1A155	Black (B)	M1A182 (D)	5.1	26.5-15.0	20	M5A4	CE-34-M16, CE-340-A16, CE-340-B16, CE-340-C16
M1A181	White (C)	.....	3.4	22.0-10.0	36	M5A4 (I)	Universal replacement control
M1A181S	White (C)	.....	3.4	22.0-10.0	23	M5A4 (I)	Universal replacement control
M1A182	White (C)	.....	5.1	22.0-10.0	36	M5A4 (I)	Universal replacement control
M1A182S	White (C)	.....	5.1	22.0-10.0	23	M5A4 (I)	Universal replacement control
M1A258 (H)	Blue (C)	None	None	28.5-21.5	24	M5A4	CK-2-E16, CK-30-H16

NOTES:

(A) The terminal prongs on the rear of M1A10 and M1A56 controls are designed to go into a locking connector on the leads to the control. All other controls have the leads connected by screw terminals.
(B) The knob is arrow-shaped, and the point of the arrow serves as the pointer. The M1A10 knob has a white dot on the head of the arrow.
(C) The plastic teardrop pointer covers the screw that holds the knob on the shaft.
(D) Reset knob 3 or 4 positions warmer.
(E) Reset knob 2 positions colder.
(F) The control temperature limits are at the *bulb* of the control bellows and are listed for comparative purposes. They are not the temperature limits of the bottom of the evaporator.
(G) The M1A56 control is used on some remanufactured LK-1B and LK-2 machines.
(H) These controls have white knobs, the others have black knobs.
(I) The M5A4 bellows is satisfactory on both Monitor and Flatop machines. The 58X250 bellows can be used if the control is to be installed on a Flatop Machine. The M15A64 bellows recommended in the Parts Catalog has a length of 36 inches and is needed for certain open-type machines.

SINGLE-KNOB CONTROLS

Single-knob controls contain a bellows-operated, over-center bridle-spring-action temperature regulating device, "off" and "defrost" positions, and a temperature adjustment.

Single-knob controls are used on all Flatop models from 1938 through 1942, but are not used on any other Scotch-yoke machines.

The single-knob control is located directly behind and is attached to the escutcheon plate across the upper part of the evaporator front opening, except in the cases of 1941 M1A235 and 1942 M1A252 controls which are located in the cabinet top cover. Instructions for operating the control appear on the escutcheon plate and, in the case of the large knob and outer knob or dial controls, on the knob or dial.

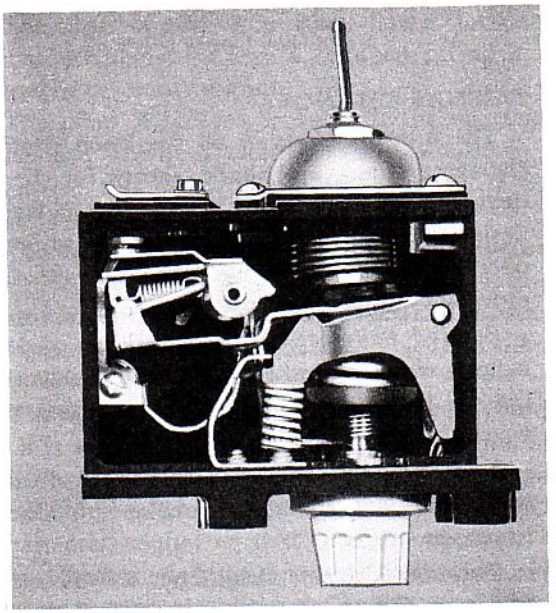


Fig. 102
Single-knob Control

The first single-knob controls had small sized knobs with plastic tear-drop shaped pointers. These were used on all standard models up through 1940. After that, large sized knobs with metal caps were used on all standard models. Deluxe models from 1940 through 1942 had recessed knobs into which fitted an outer knob or, in the case of the M1A235 control on CF-22-C-16 machines, a wheel dial.

Covers on single-knob controls manufactured before 1940 have a sealing slug over the cover screw. The recessed cover used from 1940 through 1942 is held on by wire clips.

Single-knob controls do not contain an overload device. The overload is located in the starting relay of machines using these controls.

The functions performed by the single knob are:

Turns the machine on or off manually.

Defrosts the evaporator.

Raises or lowers the evaporator temperature limits.

Turns the machine on or off manually: The machine is turned off when the knob is turned as far as possible in a counterclockwise direction. On all escutcheon plates, except the one with the wheel dial, the pointer will be a little to the right of straight downward. The machine is turned on when the pointer is at any other position.

When the knob is turned to "off," a small projection on the inner shoulder in the back of the knob comes in contact with and moves the extension of the movable main contact arm which projects through the front of the control case. The main contacts are opened.

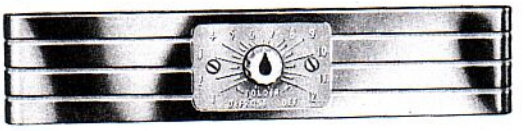


Fig. 103
Standard Single-knob Control

Defrosts the evaporator: The cut-on evaporator temperature is brought well above the melting point (to about 50° F.) when the pointer is turned to the "defrost" position. On all escutcheon plates, except the one with the wheel dial, the pointer will be a little to the left of straight downward.

When the knob is turned to "defrost", a second spring is allowed to come in contact with the bellows arm and act against the bellows. In all controls except the 1942 M1A252, a brass bell-crank pivots on the same bearing as the bellows arm. A small spiral wire spring pushes one end of the bell-crank toward about the middle of the bellows arm. The bell-crank end does not touch the bellows arm during normal cycling because the other end of the bell-crank rides on a shoulder around most of the circumference of the knob. There is a small indentation in the shoulder at the "defrost" position which allows the bell-crank to move so that it rides against the bellows arm.

The defrost device in the M1A252 control consists of an arrangement that changes the amount of movement allowed the end of the on and off lever where it comes through the case under the knob. When the knob is turned to the "defrost" position, a projection on it moves a spring wire

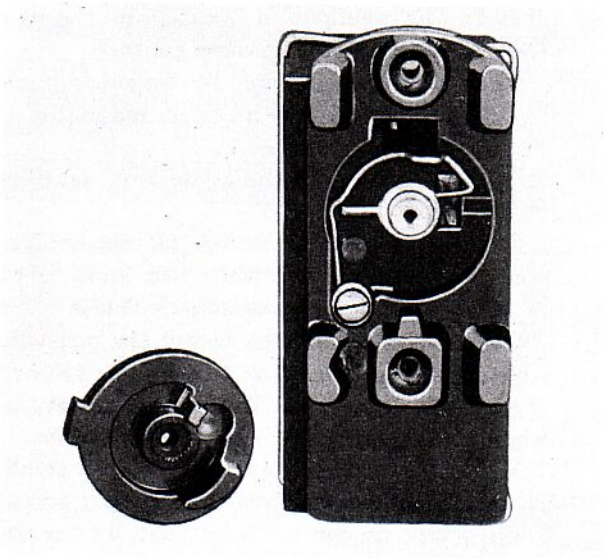


Fig. 104
Defrost Device of M1A252 Control

stop which normally restricts the movement of the on and off lever when the contacts are open. By allowing additional movement, the gap is increased and the contact end of the bridle spring is moved farther out. Consequently, the bellows arm must move farther out to snap the contacts closed. As the bellows arm moves out beyond its normal travel, it meets an additional spring which acts in parallel with the temperature spring. In order to overcome the effect of these two springs and close the contacts, the pressure in the bellows must increase to a control cut-on temperature corresponding to about 50° F.

The machine continues to operate on a defrosting cycle until the knob is turned to one of the freezing positions.

Raises or lowers the evaporator temperature limits: The temperature regulating mechanism is the same as described under "Two-Knob Controls". Like the temperature knob in two-knob controls, the single knob is connected onto the screw that regulates the pressure on the temperature spring.

For one-knob controls on standard machines charged with sulphur dioxide (SO_2) and having the bellows tube attached to the side of the stainless steel evaporator, the evaporator and cabinet air temperatures for different knob positions and for different room temperatures are the same as those previously given for two-knob controls. Regardless of the number of freezing positions on the escutcheon plate (12 on models previous to 1941, 10 on 1941 models), the range between the warmest and coldest positions are the same as on models with two-knob controls and 9 freezing positions.

For evaporator and cabinet air temperatures on 1940 CF-22A machines charged with Freon-12 (M1A204 control); 1940 CF-22B machines charged with SO_2 (M1A203 control); 1941 CF-22C machines charged with SO_2 (M1A235 Steady Cold Control), and 1942 machines with porcelain evaporators (M1A250 and M1A252 controls), refer to "Illuminated Controls" this page and "1942 Controls" page 52.

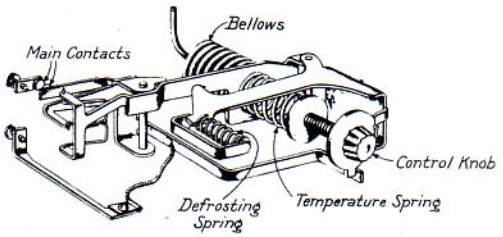


Fig. 105
Single-knob Control Mechanism

DESIGN CHANGES

The internal parts of all one-knob controls are the same in size and shape, except for the defrost device in M1A252 controls. However, a number of design changes have been made to improve the operation, reduce service and increase the life, especially in tropical climates.

Painted Bellows: After the middle of 1939, all bellows were painted with aluminum varnish. During the first part of 1941, a change was made to a gray paint.

Loop in Bridle Arm: Late in 1939, the form of the bridle arm was changed to make it fit deeper between its stops.

Recessed Covers: Originally, the movable contact arm and the defrost bell crank were held on their posts by sockets in the control cover. The cover was held on by a screw going into the movable contact arm post and the screw was covered with a sealing slug.

Early in 1940, the cover was recessed about $\frac{3}{16}$ in. from the moving parts. The movable contact arm and the defrost bell-crank are held on their posts by cotter pins. The cover is held onto the control by wire clips.

Projection on Bellows Arm: Late in 1940, a projection was added to about the middle of the bellows arm where the defrost arm hits it.

ILLUMINATED CONTROLS

Illuminated controls on 1940 and 1941 machines are the same as standard single-knob controls except for the knob which has a recess for taking

and holding the shaft of the outer knob or wheel dial. The control mechanism is as previously described and operation is similar. Hence, only the method of mounting and the temperature limits will be included here.

1940 Illuminated Controls (M1A203, M1A204)

The control is mounted to the lamp housing by two screws in the same way that standard controls are mounted to the escutcheon plate. The lamp housing attaches to the evaporator like a standard escutcheon plate.

The illuminated escutcheon plate contains an insert of polystyrene which has the property of diffusing the light thrown on it from the lamp in back of it. The outer knob is of the same material. The escutcheon plate is held to the lamp housing by two ears on the top of the housing and a snap joint at the bottom.

The shaft of the outer knob has a flat on the end which registers with a crimped spring in the recess in the control knob.

The lamp is located in back of the escutcheon plate and fits in a molded rubber socket in the enameled top plate. It is a G-E Mazda, 7 watt, clear, 110/125 volts.

The M1A203 control has standard temperature limits and is used on machines charged with sulphur dioxide (SO_2). The M1A204 control has special temperature limits and is used on machines charged with Freon-12.

The average refrigerated shelf temperature of an SO_2 machine is about 4° or 5° F. warmer than the evaporator bottom. The average refrigerated shelf temperature of a Freon-12 machine is approximately equal to that of the evaporator bottom. Consequently, the control limits are several degrees warmer than those of an SO_2 machine.

Approximate control, evaporator and cabinet air temperature limits in a room averaging about 75° F. are as follows:

	M1A203	M1A204
	SO_2 Machine	F-12 Machine
Control mid-position, ° F.	22–10.5	24–13
Evaporator, center of Bottom, ° F.	20–6	21–10
Cabinet air, ° F.	39	38

1941 Illuminated Steady-Cold Control (M1A235)

This control is mounted in the cabinet top above the enameled top plate. It is attached to a control plate with the knob shaft in a vertical plane. All other controls are mounted with the knob shaft in a horizontal plane.

Fig. 106
1940 Illuminated Control

The escutcheon plate and lamp housing form a single assembly which is held in place by spring tension of the ends of the control plate. A polystyrene insert forms the center of the escutcheon plate.

A wheel dial with freezing numbers around the circumference is used instead of a knob. The shaft is in a vertical plane and a flat on the end registers with a crimped spring in the control knob. The rim of the wheel projects through the escutcheon plate.

The lamp is located in back of the escutcheon plate in the lamp housing. It fits into a molded rubber socket in the enameled top plate. It is a G-E Mazda, 7 watt, clear, 110/125 volts.

The temperature limits of the M1A235 are considerably higher than those on any of the other controls.

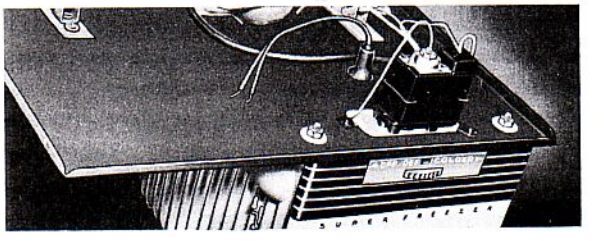


Fig. 107
1941 Illuminated Steady-Cold Control

The bellows tube bulb is attached above the middle of the left evaporator header. All other bellows tube bulbs are in contact with about the middle of the first or second channel on the left side of stainless steel evaporators.

The location of the bellows tube bulb above the center of the evaporator header was selected to give practically the same cabinet air temperature in all room temperatures between 60° and 100° F. The bulb is above the refrigerant level in the evaporator so its temperature is affected by the heat leakage into the top of the refrigerator as well as by the refrigerant temperature. The higher the room temperature, the greater the heat leakage and the lower the evaporator temperature is made in order to keep the same cabinet air temperature.

A comparison of cabinet temperatures in differ-

ent room temperatures with the M1A235 control and standard controls with the dial or knob in mid-position is as follows:

Room Temperature, ° F.	Cabinet Air Temperature, ° F.	
	M1A235	Standard Controls
100	39	46
80	38	40
60	37	34

The M1A235 control is designed to give the most satisfactory performance in regard to proper cabinet air temperature and the preservation of frozen foods with the dial in mid-position. However, a certain amount of variation can be obtained with the dial as follows:

Dial Position	Cabinet Air Temperature, ° F.
1 (warmest)	43
6 (mid)	38
12 (coldest)	33

Since the M1A235 control is used on both 7 and 8 cu. ft. models, it can be expected that the cabinet air temperature in the 7 cu. ft. size will run about a degree or so colder than these average figures, and the 8 cu. ft. about a degree warmer.

Since the evaporator temperature limits vary with room temperature as well as dial setting, it is difficult to get comparative figures.

The evaporator will frost satisfactorily with the dial in the normal mid-position in any room temperature between 65° and 100° F. However, in order to maintain the same cabinet air temperature in cooler room temperatures, the evaporator temperature limits must go up. If the dial is set at one of the warmer settings, the left header and even part of the left side of the evaporator may defrost during the latter part of the "off" cycle, especially in cool room temperatures.

Since the operation of refrigerators with the M1A235 Steady-Cold Control is somewhat different from that of other models, and in order to explain to the user the advantages to be derived, the following instruction sheet (GEJ-943) was attached to the evaporator with the Installation Record Card of later 1941 refrigerators:

OPERATING INSTRUCTIONS
FOR STEADY-COLD CONTROL

This GENERAL ELECTRIC refrigerator is equipped with a new type temperature control which is designed to give better performance over a wide range of load and usage conditions, with no attention required of the user.

The control is called the STEADY-COLD CONTROL because it maintains a constant cabinet temperature of about 40 degrees F. both in the warm summer months and in the cooler winter months, whereas most controls allow the refrigerator temperature to vary with wide changes in room temperature.

The normal operating position of the control is with the dial at position No. 6. This setting will maintain the cabinet temperature at about 40 degrees F.; will give fast freezing of ice cubes and desserts; and will preserve frozen foods and ice cream in the frozen storage section. Therefore, for all practical purposes, it should never be necessary to change the control from the normal No. 6 position except for defrosting or for exceptionally fast freezing.

Each point on the dial represents a different cabinet air temperature which will automatically be maintained by the control. The warmest position is No. 1 and the coldest No. 12. As pointed out above, position No. 6 should give the best all-around operation, but if colder or warmer cabinet air temperatures are desired, they can be obtained by selecting the proper number on the dial. However, with the control dial set at the warmer positions, a slight defrosting of the SUPER FREEZER may occur. This is perfectly normal and in no way affects the operation or efficiency of the refrigerator. This defrosting can be eliminated by setting the control dial to a higher number.

The STEADY-COLD CONTROL will better protect food from freezing in cool room temperatures. The SUPER FREEZER temperature limits are automatically raised as the room gets cooler. Some defrosting of the SUPER FREEZER will naturally occur under such conditions, even with the dial at position No. 6.

Complete defrosting of the SUPER FREEZER is obtained by setting the dial to the "Defrost" position. After defrosting is complete, the dial should be returned to the normal position No. 6, or whatever position has been found to be the most satisfactory.

An M1A235 Steady-Cold Control requires more care when being installed on a machine than is required for other controls. Each replacement control has special bends in the bellows tube and an instruction sheet (GEI-14361) is enclosed in the shipping carton. Refer to page 62.

1942 CONTROLS

These controls are similar to standard single-knob controls except the bellows tube has a twisted end instead of an enlarged bulb, the end of the bellows tube is clamped above the center of the header, and the temperature limits are warmer because of the bellows tube location.

M1A250 controls are attached to the enameled escutcheon plate across the upper part of the front opening of the evaporator on standard machines. M1A252 controls are in the cabinet top cover of deluxe models. The knob is in a recess in the front face of the top cover.

Fig. 108
1942 Standard Control

The escutcheon plates on 1942 models with enameled evaporators have the freezing positions marked differently from all previous ones. Mid-position is marked "N," standing for "normal." The four warmer positions toward the "defrost" setting are lettered "A," "B," "C," "D." The four colder positions are numbered "1," "2," "3," "4." With this arrangement, position "D" is the warmest and position "4" is the coldest setting. See Fig. 108.

Caution: Because of this change, care must be taken in recommending where to set the knob. For instance, position 3 on a standard machine with a stainless steel evaporator is a fairly common setting, but on a 1942 model with an enameled evaporator it is a very cold setting.

The defrost mechanism in the M1A252 control is different from that in all other single-knob controls and is described in the first part of this section on single-knob controls.

The bellows tube on these controls has a twisted end of small diameter tubing instead of an enlarged tubing section as on other single-knob controls. The end of the bellows tube is clamped to the top center of the enameled evaporator header.

Although the bellows tube of these controls is located above the header, there is some variation of the cabinet air temperature with changes in room temperature as illustrated by the following average figures with the knob at "N" mid-position:

Room Temperature, °F.	Cabinet Air Temperature, °F.	
	M1A250 Control	M1A252 Control
100	40	40
80	36	37
60	32	34

Note: Some machines are used in six and seven cubic feet cabinets while others are installed in seven and eight cubic feet models. The smaller cabinets may run a degree or two colder than the above average temperatures, and the larger ones, a degree or two warmer.

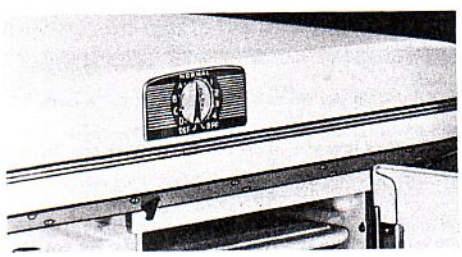


Fig. 109
1942 Deluxe Control

In the next table are given approximate evaporator temperatures with different knob positions as read with a standard thermometer frozen to the center of the bottom freezing surface of a machine operating in room averaging about 75° F.:

Knob Position	Evaporator Bottom Temp., °F.	
	On	Off
D* (warmest)	25	15
N (mid)	20	10
4 (coldest)	15	5

* Early M1A252 controls on CF-22G machines will operate on the defrost setting if turned warmer than position C.

The variation of cabinet air temperature with different knob positions for a machine operating in a 75° F. room is shown by the figures below:

Knob Position	Cabinet Air Temp., °F.
D* (warmest)	38
N (mid)	35
4 (coldest)	32

* Early M1A252 controls on CF-22G machines will operate on the defrost setting if turned warmer than position C.

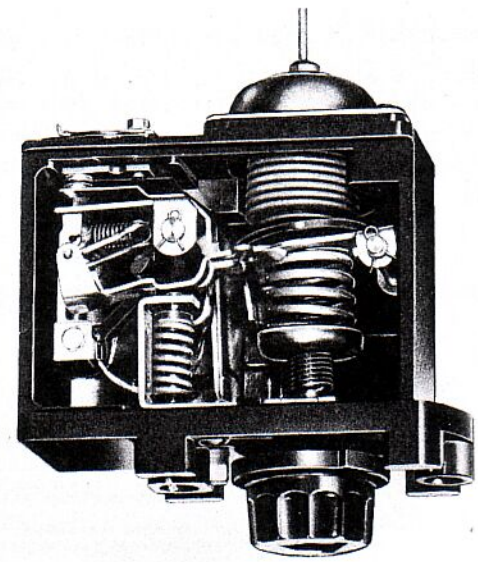


Fig. 110
M1A252 Control

SINGLE-KNOB CONTROLS

Cat. No.	Knob Size	Knob Color	Pointer Color	Universal Replacement Control	Control Mid-position Temp. Limits, °F. (H)	Bellows Tube Length, In. (I)	Machines Used On
M1A163	Small	White	Blue (A)	M1A199	22.0-10.5	19	CE-140-A16, B16 CF-1-E16, G16 CF-1-E12, G12 (25 cycle) CF-2-E16, G16 CF-2-E12, G12 (25 cycle) CF-28-A16, B16, C16 CF-28-C12, (25 cycle) CH-1-B16, C16 CJ-1-B16, C16
M1A165	Small	White	Blue (A)	M1A199 (F)	28.5-17.0	19	CE-34-A16, B16, C16 CF-1-F16 CF-2-F16
M1A180	Small	Black	White (A)	M1A199	22.0-10.5	19	CE-140-C16 CF-1-H16 CF-1-H12 (25 cycle) CF-2-H16 CF-2-H12 (25 cycle) CF-28-D16 CFS-1-A16 CH-1-D16 CJ-1-D16 CJ-2-A16, C16, E16 FBA-1-A16
M1A199	Small	Black	White (A)	.....	22.0-10.5	19	Universal Replacement Control
M1A203	Recessed	Black (Inner) White (Outer)	Blue (B) (Illuminated)	M1A199(G)	22.0-10.5	19	CF-11-A16 CF-21-A16 CF-22-B16
M1A204	Recessed	Black (Inner) White (Outer)	Blue (B) (Illuminated)	M1A199 (G)	24.0-13.0	19	CE-34-D16, E16 CF-22-A16
M1A232	Large	Blue	Blue (C)	M1A199	22.0-10.5	19	CE-140-D16 CF-2-J16, R16 CF-28-E16 CF-28-E12 (25 cycle) CH-1-E16 CJ-1-E16
M1A233	Large	Black	Black (C)	M1A199	22.0-10.5	19	CJ-2-B16, D16
M1A235	Recessed	Black (Inner) White (Dial)	Red Letters (D) (Illuminated)	None	38.5-30.0	18¾	CF-22-C16
M1A250	Large	Blue	Blue (C)	None	28.5-21.5	19 (Twisted end)	CE-34-H16 CF-2-M16, N16 CF-28-H12 (25 cycle) CJ-2-H16
M1A252	Recessed	Black (Inner) White (Outer)	Blue (E)	None	28.5-21.5	19 (Twisted end)	CF-22-G16

NOTES:

(A) The plastic teardrop pointer covers the screw that holds the knob on the shaft.

(B) A white external knob fits into the recess in the black internal knob. The pointer on the white knob is blue. A small bulb behind the translucent escutcheon plate illuminates it when the cabinet door is opened.

(C) The metal seal on the front of the knob covers the screw that holds the knob on the shaft. There is a white background.

(D) A large white dial with red letters and numbers rotates on a vertical shaft which goes into the recess in the black control knob. The edge of the dial projects through a slot in the illuminated translucent escutcheon plate.

(E) A white external knob fits into the recess in the black internal knob. The pointer on the white knob is blue. This control is located in the cabinet top cover and the knob projects through the front.

(F) Reset knob 4 positions warmer.

(G) Interchange knobs. Also reset knob two positions warmer when replacing M1A204.

(H) The control temperature limits are at the *bulb* of the control bellows and are listed for comparative purposes. They are not the temperature limits of the bottom of the evaporator.

(I) The 58X250 replacement bellows can be used on any of these controls.

CONTROL-RELAY COMBINATIONS

Control-relay combinations contain a bellows-operated, over-center bridle-spring action temperature regulating device, "on" and "off" positions, a bimetallic overload device, and a Type E starting relay.

They are used on LK-1B, LK-2A, CG-1A and CG-1B machines.

On LK machines, the combination is mounted behind a plate in the upper right corner (looking at the rear of the refrigerator) of the compressor opening in the rear of the cabinet. The single knob projects through the plate. There is no escutcheon plate.

On CG machines, the combination is located above the enameled bottom plate, in the box-top insulation. An extension on the knob projects through the front surface of the thick box top. A small escutcheon plate gives directions for operating it.

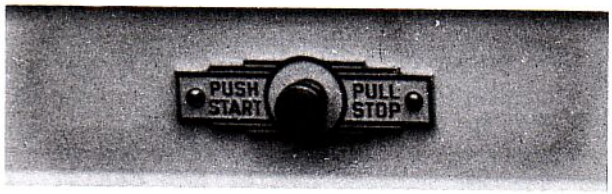


Fig. 111
Combination Control-relay on CG Machine

The control-relay combination includes a control unit and a Type E starting relay mounted side by side in a metal case. For information on the Type E relay, refer to "Starting Relays."

The internal parts of the two control-relay combinations are similar. However, the knobs differ as the Cat. No. M1A80 on CG machines has an extension. The temperature spring of the M1A65 on LK machines has much higher limits than the temperature spring of the M1A80. The M1A65 has a leaf spring on the bellows tube. This spring is to hold the bellows tube in place.

The single push-pull knob turns the machine on or off manually, and resets the overload. There is no defrost arrangement. There is an internal but no external temperature adjustment.

PUSH-PULL KNOB

Turns the machine on or off manually: When the knob is pushed inward to the "on" position, its arm moves an upright lever which pulls a stop on another lever away from the contact piece going between the two stationary main contacts. Whether the contact piece connects the contacts when released depends on the position of the bellows arm and bridle spring which, like in single- and two-knob controls, is controlled by a bellows whose pressure is determined by the coldest temperature of the bellows tube bulb. A projection on the upright lever moved by the knob arm locks in a slot in the end of the lever containing the stop.

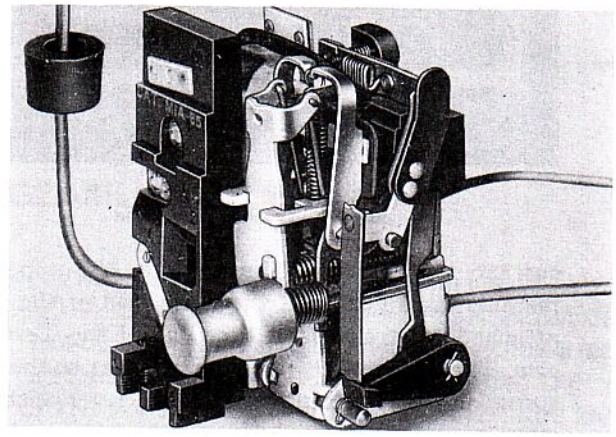


Fig. 112
Combination Control-relay

When the knob is pulled outward to the "off" position, the two levers are unlocked and the stop on one of them forces the contact piece away from the contacts. A coil spring under the knob gives the lever with a stop the proper snap action when opening the circuit.

Resets the overload: The overload device consists of a bimetallic strip (see note below) anchored at one end to the frame of the control. The other end is free to move and is connected to the upper end of a lever pivoted in its center. The lower end of this lever is an opposing bimetallic strip designed to compensate for changes in ambient temperature. The bottom end of the lever rests on the outer edge of a Textolite arm to which is pivoted the lower end of the upright lever that transfers the movement of the knob arm to the lever with the stop.

Note: A bimetallic strip consists of two thin pieces of dissimilar metals in intimate contact. When heated, the two metals expand at different rates and bend in an arc, the one with the greater coefficient of expansion forming the longer outer arc. If one end is anchored, the other end will move a certain amount.

One end of a coil heater is attached to the upper bimetallic strip. The heater is located parallel and close to the strip. The full current to the motor passes through it. In case of unusual load or power conditions which cause the motor to draw excessive

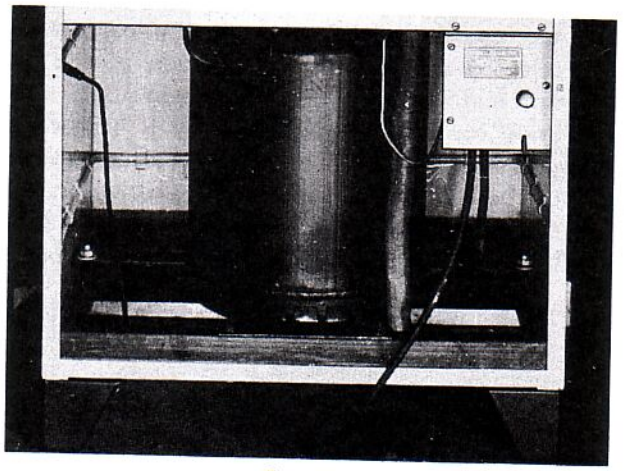


Fig. 113
Control-relay on LK Machine

current, the additional heat makes the upper bi-metallic strip flex until the lower end of the lever attached to it slides off the edge of the Textolite arm. This action frees the upright lever so that the spring under the knob pushes the lever with the stop against the contact piece to open the circuit as though the knob were pulled outward.

To reset the overload, the knob must be pushed inward.

TEMPERATURE REGULATION

The temperature regulating part is similar in action to that in single- and two-knob controls except that a tension instead of a compression spring is used. A screw, passing through the metal frame holding the stationary end of the bellows, threads into one end of the temperature spring and furnishes an internal means of altering the temperature limits. There is no external temperature adjustment.

M1A65: For this combination and also the control used on LK-1A machines, the end of the bellows tube is not attached to the evaporator but is located in a tube or well between the evaporator header and the cabinet outer shell so that the cabinet temperature is nearly constant within reasonable room temperature limits (60° to 100° F.). The bulb is held against the tube with a leaf spring, and a stop on the bellows tube locates it within close limits. Since the bulb is affected by both the evaporator and room temperature, it follows that, to keep constant control limits, the evaporator must run colder as the room temperature goes up.

Several different bulbs were used in production. As an average, the middle of the bulb is about 6½ in. from the stop.

Normal bulb temperature limits are 34.5°–24.5°F.

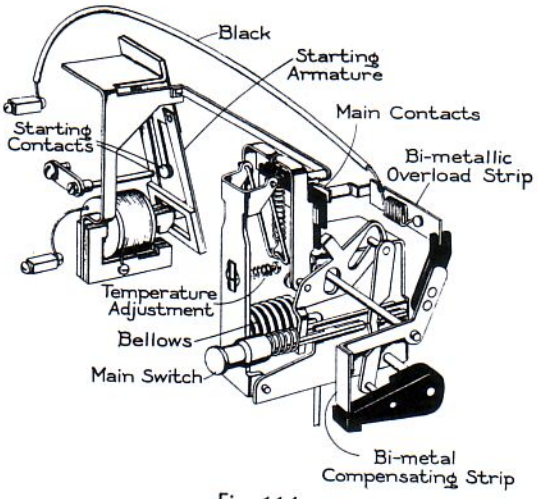


Fig. 114
Mechanism of Control-relay Combination

The variation of temperature in the center of the cabinet and the change of evaporator limits (with no external adjustment) in different room temperatures is indicated by the following average figures:

Room Temperature, °F.	Cabinet Air Temperature, °F.	Evaporator Temperature, °F.	
		On	Off
100	40	20	2
80	38	22	5
60	36	24	8

M1A80: The bellows tube end is clamped to one of the front channels on the left side of the CG evaporator as on Monitor Top machines with stainless steel evaporators. The temperature limits are about the same as for Monitor Tops; that is, 20°–10° F.

The variation of cabinet air and evaporator temperatures in different room temperatures is given below:

Room Temperature, °F.	Cabinet Air Temperature, °F.	Evaporator Bottom Temperature, °F.	
		On	Off
100	45	20	8
80	40	20	6
60	34	20	4

The cabinet air temperature for CG-1B machines may run a degree or two colder than these average figures due to the refrigerated shelf in the evaporator. The CG-1A machine may run a degree or two warmer because it does not have a shelf.

CONTROL-RELAY COMBINATIONS (See Note A)

Cat. No.	Knob Color	Bimetallic Overload Rating, Amps,	Control Mid-position Temp. Limits, °F.	Bellows Tube Length, In.	Replacement Bellows Cat. No.	Machines Used On
M1A65	Aluminum (B)	3.2	34.5-24.5 (C)	24	M5A13	LK-1-B16 LK-2-A16
M1A80	White (on extension) (B)	3.2	20.0-10.0 (C)	17½	M5A12	CG-1-A16, B16

NOTES:
(A) Refer to the chapter on "Starting Relays," page 70, for information on the type E relays used in these combinations.
(B) Knob must be pushed inward to start machine and must be pulled outward to stop it.
(C) The control temperature limits are at the *bulb* of the control bellows and are listed for comparative purposes. They are not the temperature limits of the freezing surface.

INTERCHANGEABILITY

TWO-KNOB CONTROLS

By substituting a two-knob escutcheon plate, many two-knob controls can be used in place of single-knob controls, except in the case of those with recessed knobs and those used with enameled evaporators. Since a machine originally having a single-knob control will be protected by the overload in the Type N or R relay on it, the solder-pot overload in the two-knob control will not be called upon to operate.

M1A10 and M1A56 controls are not interchangeable with any other control nor with each other. The terminal prongs of these two controls are designed to go into locking connectors. Different overload ratings and different temperature limits prevent their being used in place of each other.

Controls with 3.4 amp. overload ratings for CK-2 size compressors must not be interchanged with those with 5.1 amp. overloads for CK-3 compressors. A 5.1 amp. overload will not protect a CK-2 motor while a 3.4 amp. overload will cause tripping of a CK-3 motor.

Direct current controls (M1A151, 115 V.; M1A152, 230 V.) are not interchangeable with each other or any other control because of their overload ratings. Direct current controls have three terminals instead of two, the third one going to the top overload heater connection.

The M1A258 control is not interchangeable with any other control.

The M1A181 (36 in. bellows tube) and M1A181S (23 in. bellows tube) Universal Replacement controls are used to replace all two knob controls with 3.4 amp. overloads, except the M1A56. In the case of the M1A95 control, the temperature knob must be reset two positions warmer.

The M1A182 (36 in. bellows tube) and M1A182S (23 in. bellows tube) Universal Replacement controls are used to replace all two-knob controls with 5.1 amp. overloads. When substituted for an M1A10 or M1A155 control, the temperature knob must be reset three or four positions warmer.

There is no Universal Replacement control for M1A56, M1A151, M1A152 or M1A258 controls.

SINGLE-KNOB CONTROLS

A single-knob control must never be used in place of a two-knob control unless a Type R relay and an appropriate single-knob escutcheon plate are also substituted.

A single-knob control cannot be installed on a Monitor Top machine even though it has a Type R relay because no escutcheon plate is available and the bellows tube is not long enough.

Single-knob controls whose bellows tube is attached above the evaporator header (M1A235, M1A250, M1A252) are not interchangeable with each other nor with any other control, either single- or two-knob.

Except for the three controls just noted, all single-knob controls are interchangeable with each other. Controls for machines charged with Freon-12 are set 3° to 6° higher than those for machines charged with sulphur dioxide so, when interchanging a control, the knob should be reset to give the proper limits.

Note: Except for the knob on the M1A252 control with the different defrost arrangement, the knobs of all single-knob controls are interchangeable, including the smaller ones with the teardrop seal used previous to 1941, the larger ones with the metal cap seal used in 1941 and 1942, and those with the recessed end used on illuminated dial controls in 1940 and 1941.

When changing a knob, set it at the defrost position and be careful not to move the spindle until the knob has been replaced.

The M1A199 Universal Replacement control can be used to replace all single-knob controls except those whose bellows tube is attached above the evaporator header (M1A235, M1A250, M1A252). When being substituted for the M1A203 or M1A204 control, the knobs must be interchanged. The temperature knob must be reset four positions warmer when it is used in place of M1A165 and two warmer for M1A204.

CONTROL-RELAY COMBINATIONS

M1A65 and M1A80 control-relay combinations are not interchangeable, and no other control can be used in their place. The differences between the two combinations include unlike knobs (the M1A80 has an extension), much different temperature limits, and a special bulb on the M1A65.

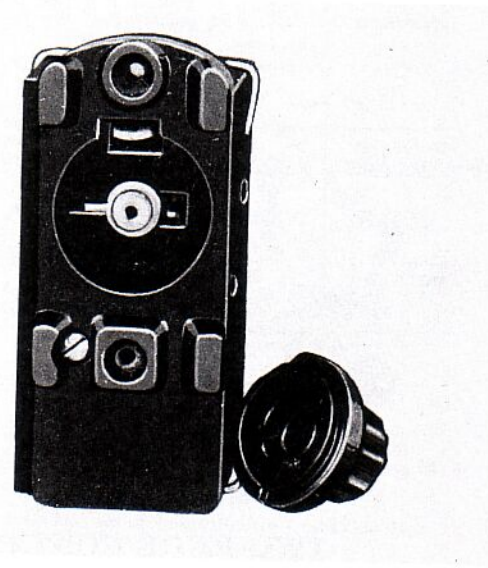


Fig. 115
Control with Knob Removed

ADJUSTMENTS

REMOVING COVER AND KNOB SEALS

COVER SEAL

On all two-knob controls and on early small single-knob controls, the control cover is held in place by a screw going into the post on which the movable contact arm pivots. A small round textolite seal covers the screw head.

The best way to remove one of these seals is to drive into it a sharp pointed instrument, like an awl. The seal can then be lifted out. When replacing the seal, it can be turned over.

TEMPERATURE KNOB SEAL ON EARLY TWO-KNOB CONTROLS

This small round textolite seal over the screw holding the knob on its shaft can best be removed by using a sharp instrument, as described above.

TEAR DROP SEAL

This small tear drop-shaped plastic seal over the screw holding the knob on its shaft can best be removed by prying around the edge with the point of a knife blade. Usually, it is better to pry around the point of the tear drop.

The ease of removal depends on the snugness of the fit and the amount of glue under the seal. Some come out easily; others may stick so hard that they can be taken out only by ruining them.

Generally, the fit is sufficiently tight so that a seal will stick in place after being put back in.

METAL DISK SEAL ON LARGE SINGLE-KNOB CONTROLS

The information about the tear drop seal applies also to the metal disc seal.

RESETTING TEMPERATURE LIMITS

TWO-KNOB AND SINGLE-KNOB CONTROLS

For the majority of installations, sufficient temperature variation can be obtained by turning the temperature knob. Within the normal range, between the coldest and warmest settings, should be adequate cooling capacity and ice freezing for room temperatures up to at least 100° F., and protection from freezing of food in cool room temperatures down to 60° F. or even below.

Occasionally some unusual operating condition may be present which will warrant resetting the knob. Among such conditions are:

(a) In high altitudes, the lower barometric pressure will lower the temperature limits roughly 1° F. for each 1000 feet rise. The knob may have to be reset warmer.

(b) In room temperatures below 60° F., it may be necessary to reset the knob warmer.

Before resetting the knob, make sure that the need for it is not caused by the user not understanding how to adjust it to get desired results, by some unusual or temporary operating condition, by too hasty or improper checking of the cabinet air or evaporator temperature, or by some defect in the control or machine.

Note: "Setting the knob colder" may be interpreted in two ways: If the knob is taken off and put back so that the pointer is at a colder setting (higher number), the temperature limits are actually made warmer for a given freezing position. If the knob is turned colder and then reset to its original position, the temperature limits are made colder.

It is to be understood that, in this manual, setting the knob or control colder means getting colder temperature limits for a given freezing position.

1. Pull the connecting cord plug out of the service outlet.
2. Set the knob with the pointer at the mid-position on the temperature dial.
3. Turn the pointer the number of divisions it is desired to set it warmer or colder. Between successive numbers, the evaporator temperature and the cabinet air temperature change roughly 1° F.
4. Remove the seal which covers the screw that holds the knob on its shaft.

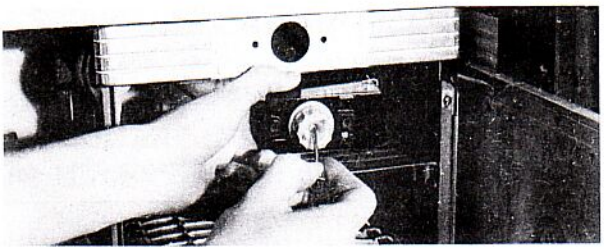


Fig. 116
Resetting Single-knob Control

5. A single-knob control must be disconnected from its mounting on the escutcheon plate or in the cabinet top in order to take off the knob. Refer to the next section on "Control Replacements," pages 61 to 64."
6. Without changing the new position of the knob, take out the screw in the center of the knob.

   Caution: Do not push inward on the shaft because a horseshoe-shaped bearing piece may get out of place.
7. Remove the knob from the shaft and, without turning the shaft, reset the knob at mid-position. With single-knob controls, mid-position is determined by the small mark on the shoulder of the knob lining up with the corresponding mark on the case directly *below* the knob.

   When the knob is being put on, the end of the brass defrost arm must ride on the shoulder of the knob and the inner projection on the underside of the knob must not bear down on the end of the on-off lever.
8. Put back the screw in the center, noting the Caution under step 6.
9. Replace the seal in the center of the knob.
10. Mount the control in place.
11. Turn the knob to the proper operating position and put in the connecting cord plug.

CONTROL-RELAY COMBINATIONS

There is no external temperature adjustment on control-relay combinations whereby the user can alter the evaporator and cabinet air temperatures. However, there is a screw adjustment available for the use of servicemen.

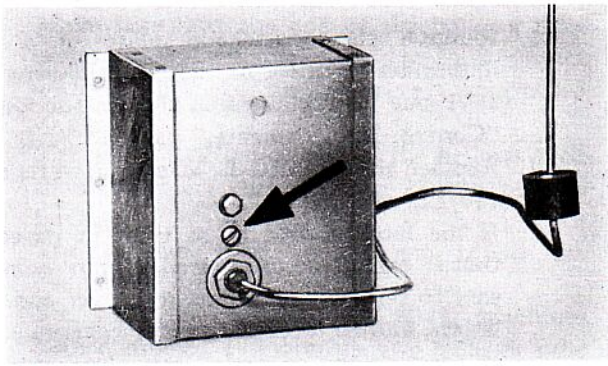


Fig. 117
Temperature Adjustment Screw

M1A65: There is a screw projecting through the metal box within which the control-relay combination is mounted. It is located just above where the bellows tube comes out on the side opposite the knob. To get at the screw, the combination should be removed from the mounting bracket.

To lower the evaporator and cabinet air temperatures, turn the screw counterclockwise (looking at the head of the screw). To raise the temperatures, turn it clockwise. The tension on the temperature spring is increased as the screw is turned clockwise. A single complete turn of the screw changes both the evaporator and cabinet air temperatures roughly 2° F.

The normal setting of the screw is about 4½ turns from the warmest possible position (when the end of the temperature spring is drawn up tight against the metal frame holding the stationary end of the bellows).

M1A80: There is a knurled head screw projecting through the plate which covers the opening in the enameled bottom plate. The control-relay combination is mounted above this plate. This screw oper-

ates one arm of a bellcrank, the other arm being under the head of the temperature spring screw.

To lower the evaporator and cabinet air temperatures, turn the screw counterclockwise (looking at the head of the screw). To raise the temperatures, turn it clockwise. A single complete turn of the screw changes both the evaporator and the cabinet air temperatures roughly 2° F.

The normal setting of the screw is about 7 complete turns from the warmest possible position (when one arm of the bellcrank is drawn tight against the enameled plate). The coldest setting is about 3 complete turns from the normal position (the other arm of the bellcrank will be against the metal box in which the combination is mounted).

REPLACING CONTROL LAMP

1. Remove the escutcheon plate of a 1940 illuminated control or the lamp housing of a 1941 one as explained in the instructions for "Control Replacements," page 62.
2. Replace the lamp (G-E MAZDA, 7 watt, clear, 110/125 volt).
   If the lamp should be so tight in its socket that it cannot be unscrewed, it may be necessary to remove the cabinet top cover and insulation, and to force the rubber covered socket in through the enameled top plate until the lamp can be taken out.

BELLOWS REPLACEMENTS

Most bellows in controls used on Scotch-yoke machines are charged with methyl chloride. It is essential that the end of the bellows tube be cooled to −10° F. (dry ice is the most practical cooling medium) before transferring the bellows from the shipping clamp to the control. The bellows must never be left free to expand except when making the transfer with the bellows tube properly cooled.

If these instructions are carefully followed, a bellows can be changed without affecting the original temperature limits very much. If a bellows is allowed to expand over ⅛ in., it will take a permanent set which will lower the temperature limits. In expanding, the bellows is apt to weaken or actually crack the thin metal so that failure may occur later on.

While handling or changing a bellows, great care must be taken not to scratch or dent the folds.

Bellows Cat. No.	Bellows Tube Length	Controls Used on
58X225	29½ in.	M1A10 two-knob
58X250	19 in.	All single-knob M1A78 two-knob on Flatops M1A95 two-knob on DK-1
M5A4	24 in.	All two-knob on CK except M1A10
M5A12	17½ in.	M1A80 combination
M5A13	24 in.	M1A65 combination

Notes: All of these replacement bellows are charged with methyl chloride except the 58X-225 which is charged with sulphur dioxide.
For Scotch-yoke machines, it is better to use one of the above bellows in Universal Replacement controls than one with a longer bellows tube.

1. Lay the control on a flat working surface with the cover uppermost. Remove the two screws which hold the bellows cover plate to the control and withdraw the bellows.

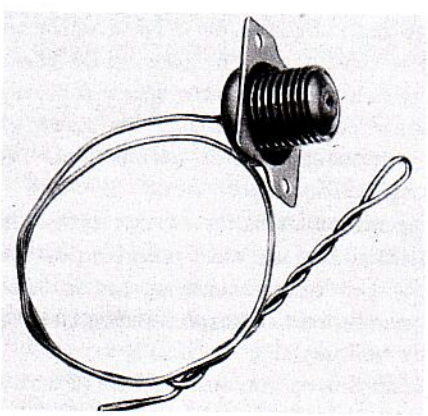


Fig. 118
Bellows Properly Cooled

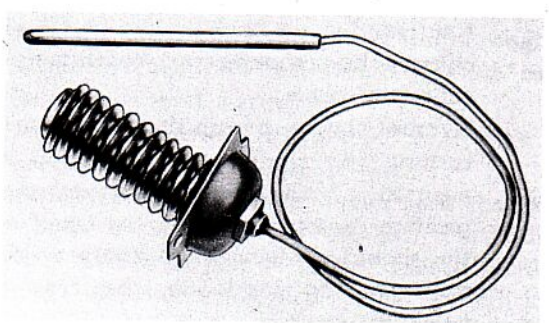


Fig. 119
Bellows not Properly Cooled

Caution: After these two screws are loosened and until the new bellows is tightened into plate, the control should not be moved violently or changed from the position specified; otherwise, one of the nuts which receive the attaching screws may slip out of its slot.

2. Place the end of the bellows tube in contact with a piece of dry ice. The bellows will contract rapidly so that it can be slipped out of the shipping clamp and into the control.
   Caution: The bellows must be kept contracted while making the transfer. If it expands over $\frac{1}{8}$ in., it will take a permanent set and will cause colder than normal temperature limits. Furthermore, the thin metal of the bellows may be strained or cracked.
   Do not dent or scratch the bellows folds.
   When straightening or bending the bellows tube, avoid bending near a soldered joint.
3. With the bellows properly contracted, slip it into the control. Be sure the cupped fiber washer is in place between the bellows and the bellows arm. As bellows arm is electrically alive, it must be insulated from the bellows.
4. Immediately, before the bellows can expand, put in and tighten the two screws holding the bellows cover plate to the control.

CONTROL REPLACEMENTS

TWO-KNOB CONTROLS ON CK MACHINES

1. Pull the connecting cord plug from the service outlet.
2. Loosen the clamp that holds the end of the bellows tube to the evaporator, pull the bellows tube out from under the clamp, and straighten the bellows tube.
3. Remove the escutcheon plate on the front of the condenser. It is held by two spring clips passing through holes in the condenser.
4. Take out the two screws that hold the control bracket to the condenser.
5. Pull the control upward until the connections on the back can be reached. Guide the bellows tube through the rubber bushings in the enameled bottom plate and the box top so as not to dislocate the bushings. Wetting the tube makes it go through easier.
6. On all except M1A10 controls, remove the cover over the terminals and disconnect the leads. On M1A10 controls, disconnect the locking connector by turning it slightly before pulling it off the terminal prongs.
7. Remove the control bracket by taking out the single screw.
8. Pull the control all the way out.
9. Install the replacement control by reversing the previous steps and keeping the following precautionary points in mind.
10. Assemble the bracket so that the main switch will be above the temperature knob. The lead terminals should be above the bellows tube.
11. Make sure the terminal screws are tight and that the insulation on the leads is in good condition so that the wires will not short together.
12. Straighten the bellows tube before installing the control.
13. Hold the rubber bushings while guiding the bellows tube through them.
    Caution: Replace a bushing if it comes out of its opening in order to prevent moisture and odors from entering the box top insulation.
14. Make sure that the end of the bellows tube under the clamp is straight and in good contact with the channel or header where it is supposed to go.
    The whole pinched-off end of the bellows tube should project beyond the clamp but no farther.
    The bellows tube should not touch the evaporator except under the clamp.
    For M1A258 controls on CK-2E machines with enameled evaporators, the bellows tube enters the clamp from the rear.
15. Tighten the clamp screw or screws.

TWO-KNOB AND STANDARD SINGLE-KNOB CONTROLS ON FLATOP AND DK MACHINES

Exception: The 1942 standard M1A250 Control is not included. See page 63.

1. Pull the connecting cord plug from the service outlet.
2. Loosen the clamp that holds the end of the bellows tube to the evaporator and pull the bellows tube out from under the clamp.
3. Take out the two screws holding the control to the escutcheon plate.
4. Pull the control forward out of the evaporator, while guiding the bellows tube through the hole in the top front corner of the evaporator. If necessary, pull out additional cable through the bushing in the enemeled top plate, while holding the bushing to prevent its pulling out of place.
5. Remove the terminal cover. Disconnect the leads.
6. Install the replacement control by reversing the previous steps and keeping the following precautionary points in mind.

7. Make sure that the terminal screws are tight, and that the insulation on the leads is in good condition so that the wires will not short together.
8. The end of the bellows tube under the clamp should be straight and in good contact with the channel or header against which it is supposed to be.

   The whole pinched-off section of the bellows tube should project beyond the clamp but the rest of the tube should not.

   The bellows tube should not touch the refrigerated part of the evaporator except under the clamp.
9. Tighten the clamp screw or screws.
10. Push excess cable up through the bushing in the enameled top plate, while holding the bushing to prevent its getting out of place.

1940 ILLUMINATED CONTROL

The method of removing and installing one of these controls on CF-11, CF-21, CF-22A and B machines is the same as a standard single-knob control, described above, except for the following steps:

1. Pull the outer control knob straight out until it is free from the escutcheon plate.
2. Pull the escutcheon plate out at the bottom, and lift it up and off the lugs on the top of the lamp housing.
3. The control can then be removed from the lamp housing.

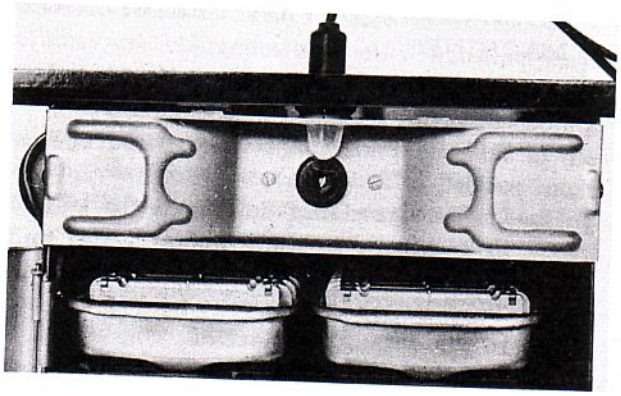


Fig. 120
Control on Lamp Housing

1941 ILLUMINATED STEADY-COLD CONTROL ON CF-22C MACHINES

Note: A copy of these instructions is included with each replacement M1A235 control.

The bellows tube of each replacement M1A235 control is bent as illustrated in the sketch.

1. Pull the connecting-cord plug out of the electric service outlet.
2. Remove the escutcheon plate and lamp housing by pulling down on the rear of the lamp housing and then outward to clear the dial.
3. Remove the dial by pulling downward on it.
4. Pull the bellows tube out from under the clamp above the left header after loosening (but not removing) the two clamp screws.
5. Loosen (but do not remove) the three screws that hold the control mounting plate to the cabinet top.

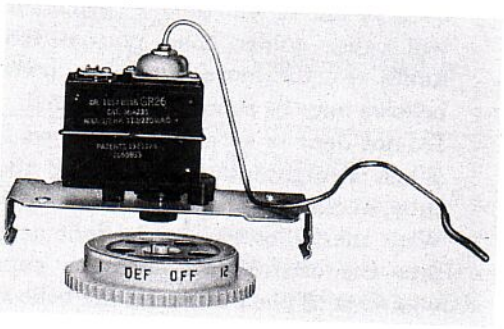


Fig. 121
Control, Mounting Plate, and Dial

6. Slide the control mounting plate out from under the screws, and pull it down and out.
7. Remove the two screws that hold the control to the control plate.
8. Take off the terminal cover and disconnect the electric leads.
9. The steps for installing a control are essentially the reverse of removing a control except for the following:
10. The bellows tube is bent ready for installation, except for one additional bend necessary for shipping. Straighten the extra bend in the bellows tube as indicated in Fig. 122.

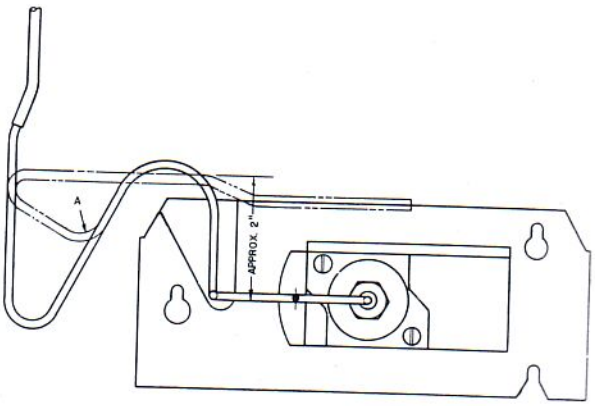


Fig. 122
Bellows Tube on M1A235 Control

The broken lines indicate the position of bellows tube as received.

The full lines show position of bellows tube ready for installation.

When straightening the bend at (A), be careful not to kink the tube.

11. Assemble the control to the control-mounting plate with the bellows to the top left.

    The bellows tube should make a short, smooth curve (not a sharp bend) as it leaves the bellows and goes down toward the control mounting plate.

    The bellows tube should be located in the channel in the left rear of the control mounting plate.
12. The enlarged end of the bellows tube should be pushed under the clamp above the header until it hits the stop at the back. Then tighten the clamp screws.
13. Form the section of the bellows tube from the enlarged section to the slot in the evaporator edge so that it has a gradual slant toward the enlarged section. Make sure there are no dips in the bellows tube and that it does not touch the evaporator.

    Note: If the bellows tube should have a dip in it or if it should touch the evaporator, the evaporator temperature limits will be altered.
14. Make sure that the bellows tube does not vibrate against the evaporator, enameled top plate, light housing, or control plate.

1942 STANDARD CONTROL

The mounting of the enameled escutcheon plate on the CF-2M enameled evaporator is different from that of stainless steel evaporators. On CF-2M, CF-2N, CF-28H, and CJ-2H machines, the escutcheon plate is attached to a separate lacquered plate by two screws. The control plate and the escutcheon plate are both held to the top plate by two screws which go into punched nuts. Two cardboard washers separate the two plates and two round cardboard washers go between the upper ledge of the escutcheon plate and the enameled top plate.

The procedure is the same as for standard single-knob controls, page 61, except for the following steps:

1. Loosen the bellows tube clamp screw. It has a rather thin $\frac{3}{8}$" hex-head which can best be turned with a socket wrench. Slip the twisted end of the bellows tube out from under the clamp.
2. Remove the escutcheon plate and the control plate from the top plate by loosening (but not removing) the two screws which go up into the punched nuts in the top plate just in back of the control plate. There are slots in the escutcheon and control plates so that they can slide forward.

    Note: It will be necessary to use a short (3") screwdriver with a $\frac{1}{8}$-inch wide bit to turn the Phillips head screws.
3. The cardboard spacers between the two plates must be in place before slipping the plates under the screw heads. The spacers wrap around the upper ledge of the inner plate with the shorter leg including the slot on the under side.
4. The round cardboard spacers go between the upper ledge of the outer plate and the enameled top plate of the machine.

1942 DELUXE CONTROL IN CABINET TOP

Only the 1942 CF-22-G16 machines have this control which is mounted in back of the front edge of the cabinet top cover. It is attached to an inner mounting plate with two screws. This inner mounting plate is attached to the inner side of the cabinet top cover with four screws. An outer plate is held by the same screws. The outer knob passes through a rubber bushing seal in the hole in the recessed portion of the outer plate. A ring gasket seals the joint between the outer plate and the cabinet top cover. The escutcheon plate snaps on over the edges of the outer plate.

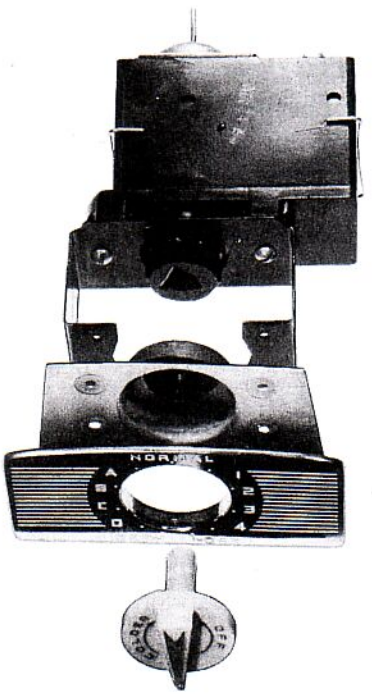


Fig. 123
Control, Mounting Plates and Knob

1. Pull the connecting cord plug out of the service outlet.
2. Loosen the bellows tube clamp screw. It has a rather thin 3/8" hex-head which can best be turned with a socket wrench. Slip the twisted end of the bellows tube out from under the clamp.
3. Remove the control escutcheon plate by prying outward on its lower edge.
4. Take out the four screws that hold the outer and inner mounting plates. The outer plate and outer knob can be pulled forward.
5. Take off the hand hole plate in the enameled top plate above the evaporator by loosening (but not removing) the two screws directly in back of the blank escutcheon plate, pulling the blank escutcheon plate forward, and pulling the hand hole plate forward until the front holes slip over the screws.
   Note: It will be necessary to use a short (3") screwdriver with an 1/8 inch wide bit to turn the Phillips head screws.
6. Pull out the loose insulation in the cabinet top cavity.
7. The control and inner mounting plate can be pulled down through the hand hole.
8. Take out the two screws that hold the control to the inner mounting plate.
9. Take off the terminal cover and disconnect the leads.
10. Install the replacement control by reversing the previous steps and keeping the following precautionary points in mind.
11. The control with the inner mounting plate assembled will have to be held in place in the cabinet top cover while the first two attaching screws are started.
    The curved edge of the outer plate is uppermost. The round rubber gasket should be in place around the recessed portion of the outer plate to seal around the opening in the cabinet top cover.
12. The loose insulation should be carefully packed back into the cavity in the cabinet top cover.
13. The twisted end of the bellows tube bulb should be located so that the center portion is directly under the clamp and in good contact with the evaporator where the top of the header begins.
    Caution: The bellows tube should touch the evaporator only under the clamp. The outer loop and the rest of the bellows tube should be bent away from the evaporator.

M1A56 CONTROL ON LK-1A MACHINES

This control is mounted on a plate located in the upper right corner (looking at the rear of the refrigerator) of the compressor opening in the rear of the cabinet.

1. Disconnect the locking connector on the back of the control, giving it a slight turn while pulling it off.
2. Pull the rubber plug from the lower end of the well opening and draw the bellows tube out of the well.
   Note: If there is no metal stop on the bellows tube to locate it in the well, make a mark on the tube to obtain the proper distance for inserting the bellows tube of this or another control.
3. Take out the two screws holding the escutcheon plate and control to the bracket.
4. The control can now be brought forward from behind the bracket.
5. Install the replacement control by reversing the previous steps and keeping the following precautionary points in mind.
6. To get proper evaporator and cabinet temperatures, the bellows tube must be inserted just the right amount in the well. Later controls have a metal stop on the bellows tube. Earlier ones must be marked. As an average, the middle of the bellows tube bulb should be about 6½ in. up from the bottom of the well.
   Note: Early instructions called for pushing the ***end*** of the bellows tube 9 in. up the well.

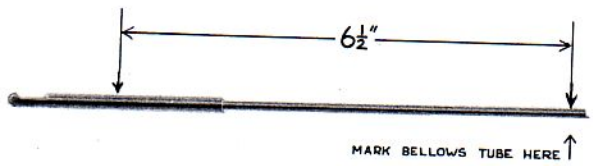


Fig. 124
Locating Bellows Tube in Well

7. Seal off the end of the well. On early controls, there is a split rubber plug. On later ones, there is a rubber bushing that fits over the metal stop and the end of the well.
   If there is no rubber plug or if it does not seal properly, use friction tape for covering the well opening.
   Caution: It is important to properly seal this opening to prevent condensation of moisture in the well.

M1A65 COMBINATION ON LK-1B & LK-2A

The location is the same and the procedure for

removing is the same, as for the M1A56 control, except for the following steps:

1. Pull the connecting cord out of the service outlet.
2. Remove the screws holding the control-relay combination to the back of the plate.
3. Disconnect the leads from the relay terminals.

M1A80 COMBINATION ON CG MACHINES

This control-relay combination is located in the box top insulation above the enameled bottom plate. It is mounted on a separate enameled plate which is attached to the bottom plate.

1. Pull the connecting cord out of the service outlet.
2. Remove the black knob projecting through the front of the condenser by turning it in a counterclockwise direction.
3. Take off the small escutcheon plate by removing the two screws.
4. Remove the control knob extension by turning it in a counterclockwise direction.
5. Loosen the bellows tube clamp and pull the end of the bellows tube out from under it.
6. Take out the four screws that hold the mounting plate to the enameled bottom plate.
7. Pull the combination out of the box top.
8. Disconnect the leads from the relay terminals.
9. Remove the combination from the mounting plate by taking out the four mounting screws and the knurled-head temperature adjusting screw.
10. Attach the combination to the mounting plate with four screws.
    The bellows tube goes through the rubber bushing in the base of the mounting plate.
11. Assemble the knurled-head temperature adjusting screw up through the base of the mounting plate into the tapped hole in the adjusting link. Tighten the screw until the upper inner edge of the bellcrank is 3/32 in. from the metal box within which the combination is mounted.
    Caution: Do not adjust the temperature spring screw which is moved by the bellcrank.
12. Connect the leads to the relay terminals:
    Terminal 4 black lead from connecting cord
    3 red (running) lead from motor
    1 white (starting) lead from motor
    Note: The black (common) motor lead is permanently connected to the white connecting cord lead within the box top.
    Caution: Never interchange leads. The starting winding will be injured if left continuously in the circuit.
13. Push the combination up into the box top. The control knob should point toward the front of the machine.
14. Attach the mounting plate to the enameled bottom plate with the four screws.
15. Assemble the end of the bellows tube under the clamp on the side of the evaporator. The tube should be straight and in good contact with the channel under the clamp. The whole pinched-off section of the tube should project below the clamp but no farther. The tube should not touch the refrigerated part of the evaporator except under the clamp.
16. Add the control knob extension by inserting it through the hole in the front of the condenser and screwing it into the control knob.
    Caution: Do not screw it in too far. After the black knob is screwed on tight and pushed inward to the "on" position, the distance between the inner surface of the knob and the escutcheon plate should be 3/64 in.
17. Put on the small escutcheon plate which is held to the condenser by two screws. Make sure that the rubber bushing on the extension fits tightly against the escutcheon to seal the hole through the condenser.
18. Screw on the black knob.

IMPROPER OPERATION

Improper operation of the control can stop the machine or can keep it from starting.

WEAK BELLOWS

A weak bellows, one that has lost all or nearly all of its gas charge, offers little resistance to the pressure of the temperature spring. Consequently, the contacts will be kept open, so the machine will not start.

During the time when a bellows is losing its charge, there will be a period when the amount remaining is right on the border line for operating the bellows arm; sometimes the control will trip on and start the machine, other times it will not. This is generally referred to as "erratic operation."

If, when in this condition, the knob is turned to a colder setting, the control will function all right for a while until more of the gas charge is lost and erratic operation occurs again.

A weak bellows can be checked by removing the control cover and, with the bellows tube warmed up to room temperature, pressing on the

bellows arm (near the center so as not to bend it) toward the bellows. If the bellows is weak, it will offer little resistance. The bellows should be replaced. Refer to page 60, "Bellows Replacements." In the home, it is generally more convenient to replace the control and then change the bellows in the shop.

In tropical countries and in hot, humid coastal areas, bellows failures on Flatop machines, where the control is mounted across the front of the evaporator, are somewhat more frequent than elsewhere. Certain design changes were made to reduce these failures: the bellows was painted and the cover was recessed. In such places, only controls with these improvements should be used for replacement purposes.

BROKEN TERMINAL BAR

A metal strip carries the current from the terminal not connected to the stationary contact to the post to which is joined the overload heater in two-knob controls and the movable contact arm pigtail in single-knob controls. Once in a while one of these bars will break and the machine will not start.

Although relatively rare, this breakage may occur where the control has been subjected to excessively high humidity. Most frequently it is found in installations where a Flatop refrigerator is run over week ends, and is left off during the week with trays of water remaining in the evaporator.

Early terminal bars were not plated and they are the ones which break. Later ones were plated.

The terminal bar can be replaced with one from an otherwise defective control, or a new one can be ordered.

ON AND OFF LEVER BINDS

In single-knob controls, the on and off lever is an extension of the movable contact arm. It passes through an opening in the control case close to the knob shaft. A projection on the under side of the knob moves the lever and keeps the contacts open when the knob is turned to "off".

Once in a while, a lever will rub against the knob shaft and will hold the main contacts open, especially when the knob is at one of the warmer positions. The control operation is apt to be erratic; at times the control functions all right, at other times it does not trip back on after cutting off at the end of a cycle. Touching the knob or jarring the machine, such as when closing the cabinet door, may cause it to operate normally again.

Turning the knob to one of the colder positions often eliminates the trouble.

The rubbing can be observed by removing the knob. There should be a clearance of at least $\frac{1}{32}$ in. with the movable contact arm as far out on its post as possible. The lever may rub on either the front bearing shoulder or the rear one within the case.

On controls with recessed covers, an examination can be made for rubbing without removing the knob. The movable contact arm can be lifted as far as possible on its post, and moved back and forth to check for interference.

By placing the end of a screwdriver under the lever just before it goes through the case and forcing the outer end of the lever down, the proper clearance can be obtained.

INOPERATIVE SOLDER-POT OVERLOAD

The shaft of the ratchet wheel is held stationary in its sleeve by a drop of solder. If there is insufficient solder, the shaft may rotate within the sleeve so that the overload will not reset, or it may allow the overload to trip on normal or only slightly more than normal current. The control must be replaced.

Caution: Do not attempt to resolder the parts with ordinary solder.

Do not short circuit the heater coil or install a larger heater coil. An exception can be made in the case of a machine having a Type R relay, where it is permissible to short circuit the overload in the control.

BRIDLE CAUGHT ON STOP

If there is excessive movement of the movable contact arm on its post, perhaps due to a warped cover or the cover screw not being drawn down tight enough, the bridle arm may get caught on top of one of its stops. If it is the stop toward the knob side of the control, the contacts will be held open and the machine will not start.

Slight jarring of the control—even a slight movement of the knob—may cause the bridle arm to jump back into place.

This condition can be checked by removing the control and rapping it with the cover down against the open hand. The bridle will jump up on one of its stops if this defect is present.

A bulge in the sides of later production bridles was made to eliminate this trouble.

MOVABLE CONTACT ARM BINDS

This condition is most likely to occur in controls whose cover is held on by a screw, especially where,

after the cover has been removed, the screw has been drawn down too tight. The movable contact arm may bind on the bearing surface on the cover so that the contacts are held open and the machine will not start.

The trouble can generally be corrected by loosening the screw a little.

Improper operation of the control can also cause unsatisfactory refrigeration.

PARTIALLY WEAK BELLOWS

After a bellows has lost part of its gas charge through a minute leak, a time is reached when the amount remaining in the bellows tube all vaporizes before the cut-on temperature is reached. The bellows will then expand at a much slower rate and the temperature at which the control trips on will be higher than normal. As more gas leaks out, the cut-on temperature will gradually go up.

The first evidence of a partially weak bellows is failure of a machine to cycle at all when the knob is turned to "defrost." This condition is rarely caught.

The first symptom for an M1A10 control, with the automatic return from defrost feature, is failure of the main switch to snap back to the "on" position when turned to "defrost" with the bellows tube at room temperature.

The most likely symptom to be observed is more and more defrosting of the header during the latter part of the off cycle. Both the on and the off periods will be longer than normal. This condition gets worse and worse until the whole evaporator may run on a defrosting cycle. During the time the trouble is developing, the ice freezing rate gets slower and slower, and the cabinet air temperature gradually goes up.

While in the early stages, the defrosting can be eliminated by turning the knob to one of the colder positions. For a time, the operation will be normal but, as more gas leaks out of the bellows, the defrosting will return.

Opening the control and pressing on the bellows arm will not show up a partially weak bellows because there is enough pressure to make the bellows appear reasonably strong.

The only way of taking care of a complaint of this nature is to replace the control, after first checking other conditions in the machine which might cause similar defrosting. Refer to "Unsatisfactory Refrigeration".

BELLOWS ARM HITS BELLCRANK

At the instant the movable contact trips closed, there should be clearance between the bellows arm and the defrost bellcrank. If the bellows arm hits the bellcrank before tripping on, the upper temperature will be raised several degrees. It is quite possible that the trip-on temperature may be 32° F. or above. Partial or complete defrosting of the evaporator will occur during the latter part of the off cycle. Both the on and the off parts of the cycle will be abnormally long.

If the bellows arm is bent only a relatively small amount (such as by pushing on the bridle spring end when the bellows is warm), it is apt to hit the defrost bellcrank before tripping off. The bridle spring end of the bellows arm should be parallel to the bellows end. If not parallel, the bridle spring end can be straightened with a pair of thin-nosed pliers.

In two-knob controls, check the movement of the defrost bellcrank and the cam on the main switch that moves the bellcrank. In single-knob controls, make sure that the brass bellcrank is on its post and that the post is solid in the case.

IMPROPER SPRING UNDER KNOB

The defrost arrangement in M1A252 controls on 1942 CF-22G machines consists of a spring wire stop under the knob which changes the movement allowed the end of the on-off lever when the knob is turned to "defrost." In early controls, the spring was not quite right in that it allowed the machine to operate on a defrosting cycle when the knob is turned warmer than the dot marking position C.

This situation rarely causes complaint because the knob on these machines is usually kept at Normal and all except the last of the four warmer positions give satisfactory operation.

A defrost spring (Cat. No. M15A87) can be ordered and the original one changed by following these instructions:

1. Pull the connecting cord from the service outlet.
2. Remove the control from the cabinet top cover. It is not necessary to remove the end of the bellows tube from its clamp or to disconnect the leads.
3. Set the knob at mid-position as indicated by the small mark on the rim of the knob lining up with a similar mark on the bottom of the face of the control case. The cover is on the bottom side of the control.
4. Remove the knob by taking out the screw in the center.

5. Replace the original defrost spring with a correct one. It is held by a single screw.
6. Put the knob back on, being careful to set it at mid-position without turning the knob shaft.
7. Replace the control in the cabinet top cover.

BELLOWS ARM HITS MOVABLE ARM

At the instant the movable contact trips open, there should be clearance between the bellows arm and the tail on the end of the movable contact arm which projects down toward the bellows. This tail is designed to allow the bellows arm to exert force on the movable contact arm to push the contacts open should they stick or weld together. Refer to Figs. 101 and 102 on pages 46 and 49. This tail was eliminated from controls used on 1942 machines with enameled evaporators.

Interference between the bellows arm and the tail on the movable contact arm just before tripping off will cause short cycling. The on period may be a minute or less, and the off period a matter of only two or three minutes. The running time will be much more than normal and the cabinet air temperature will be colder than it should be.

The control contacts will be pitted and burned quite badly. The complaint may originate from radio interference caused by the very frequent operating and arcing of the contacts.

A control with this fault should be replaced.

BELLOWS ARM STUCK UNDER BELLCRANK

Once in a while, a control may be found where the bellows arm gets caught under the brass defrost bellcrank when the knob is turned to "defrost." The contacts will remain closed, the machine will run all the time, and the cabinet air temperature will get too cold.

This condition can be caused by the bellcrank slipping off the end of its post due to a warped cover or missing locking clip, the post being loose in the control case, or improper forming or assembly of the parts.

Slight jarring of the control—even a slight movement of the knob or closing the cabinet door—may release the bellows arm.

At the end of 1940, a projection was added to the side of the bellows arm to eliminate this trouble.

Note: A warped cover is usually caused by excessive humidity and is infrequent except in tropical climates or in hot coastal areas. The early covers held on by a screw are the ones that warp. The ends of the cover bend outward so there is a gap between them and the control case. Sometimes the warping is sufficient to allow the outer bearing of the brass bellcrank to slip off its post.

If the internal parts of the control are corroded badly, the control should be replaced with a later one having a recessed cover held on with wire clips. Except for an unpainted bellows, corrosion should not affect the operation of the control parts since the moving parts are made of stainless steel.

MOVABLE CONTACT ARM BINDS

If a movable contact arm binds so the contacts are kept closed, the machine will run all the time and the cabinet air temperature will be too cold. Refer to the item on page 66, "Movable Contact Arm Binds," which describes the condition where the contacts are kept open.

BRIDLE CAUGHT ON STOP

If a bridle arm is caught on the stop toward the terminal side of the control, the contacts will be kept closed, the machine will run all the time and the cabinet air temperature will be too cold. Refer to the item on page 66, "Bridle Caught On Stop," where the condition of the contacts being kept open is described.

TOO LONG TERMINAL SCREW

The control terminal screws are supposed to be $\frac{7}{32}$ or $\frac{1}{4}$ in. long. If a longer screw, such as a $\frac{1}{2}$ in. screw used on Type R relays with clip terminals, is used in the stationary contact terminal, the contact may be forced inward far enough to close the gap and keep the machine running continuously. Replace the screw with a proper one.

SHORTED CONTROL LEADS

If the insulation is stripped off one of the control leads near the terminal, the bare wire may short to the other lead or its terminal, and cause the machine to run continuously. Properly insulate the lead.

CREEPING TEMPERATURE KNOB

If the temperature knob of a two-knob control creeps toward a colder setting from the position it is set, install a crimped spring washer (Cat. No. M15A3) under the knob.

STARTING RELAYS

DESCRIPTION

The starting relays used on Scotch-yoke machines serve the purpose of connecting the starting winding of the motor into the circuit for an instant while the motor starts and comes up to speed. The motors used in these machines run single-phase but must be started with the help of an auxiliary winding, known as the starting winding. The starting winding has either greater resistance than the running winding or has a capacitor in series with it in order to give the necessary phase displacement to develop the required starting torque.

Exception: The special high-efficiency motor in the CFS-1A machine is different from the other motors in that the starting winding, with a capacitor in series with it, is in the circuit all the time. The starting relay on this machine connects another capacitor in parallel with the first one during the momentary starting period.

The starting relay consists of a coil of insulated wire on a pole piece and an armature to which is attached the movable contact arm. The coil is in series with the running winding of the motor. When the current is first turned on, with the rotor stationary, the initial heavy current through the coil is sufficient to move an armature and close a pair of contacts which places the starting winding in parallel with the running winding.

With the two windings in the circuit, the motor rotor starts to turn and almost instantly comes up to full-load speed of about 1740 R.P.M. The current drops rapidly from the initial inrush value of 13–19 amperes to the normal running value of 2–3 amperes. The adjustment of the spring tension of the armature is such that the magnetic force from the coil is overcome when the current has dropped to about half of its initial value and the armature opens the starting winding contacts. From then on, the motor runs single-phase with only the running winding in the circuit.

The "pick-up" current is the minimum current that will cause the armature to close the starting contacts. The "drop-out" current is the maximum current which will cause the armature to open the contacts after they have been closed. The drop-out current must be at least 0.1 ampere less than the pick-up current.

Type N and R relays have bimetallic automatic-reset overload devices incorporated in them. Type E-3 and E relays have no overload device; machines on which they were used have the overload in the control. The overload is rated at the minimum current which will, in time, cause it to operate and break the circuit to the machine.

TYPE E-3 RELAY

The Type E-3 relay was used on LK-1A, CK-30B, and CK-35B machines. On LK-1A machines the relay is mounted on a plate in the upper right corner of the unit compartment opening in the rear of the cabinet—it is just below the control. On CK-30B and CK-35B machines, the relay is mounted on the outside of the condenser toward the rear.

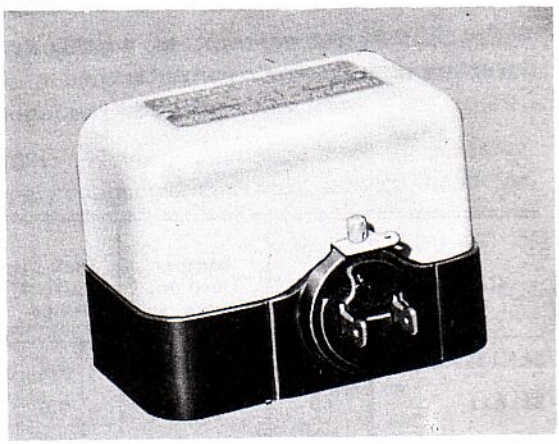


Fig. 125
Type E-3 Relay

The E-3 relay is mounted with the base in a vertical plane and the terminal prongs pointing downward. The armature must move in a horizontal plane.

Caution: Never mount a Type E-3 relay or run a machine with the relay dismounted in any position except as described above. With the relay in some other position, the motor starting winding may be damaged.

The connecting cord attaches to the terminal prongs with a locking connector. The connector can be removed only with a slight turning motion while being pulled off.

The compressor leads are connected to terminal screws in the relay base.

Caution: Never interchange leads in the relay base. Interchanging of the leads may damage the motor.

The E-3 relay consists of a coil on the middle

leg of a double horseshoe-shaped laminated pole piece. This coil is in series with the running winding of the motor. The armature is made of a rather heavy copper section attached to a spring steel leaf from the springing point. The end of the armature circles the upper part of the middle leg on which the coil is placed, and forms a single short-circuited turn above the coil.

Current passing through the coil induces current in the short-circuited turn, the action of which tends to repel the armature. If the current is greater than the pick-up current, the force is sufficient to move the armature outward to close the starting contacts. When the current decreases to the drop-out value, the spring tension of the armature overcomes the magnetic force and opens the contacts.

Caution: Never attempt to adjust, repair or replace an armature or a contact.

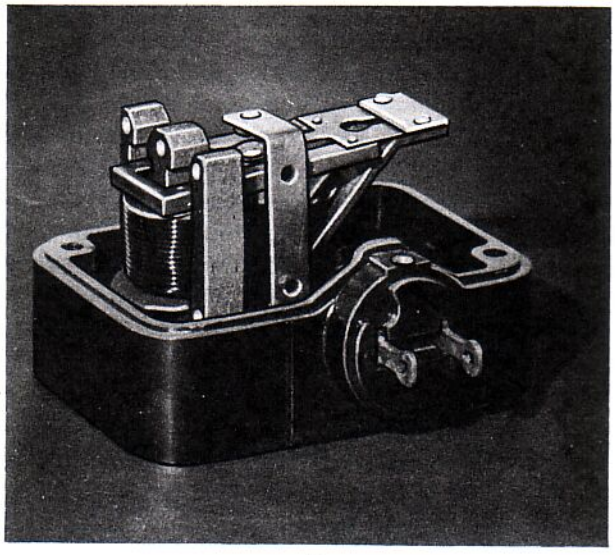


Fig. 126
E-3 Relay Mechanism

TYPE E-3 RELAYS

1934

Cat. No.	Cycles	Motors Used on, Horsepower	Pick-up Current, Amps.	Minimum Drop-out Current, Amps.	Replacement Type R Relay	Machines used on
58X121	60	1/8	6.0	5.0	M1A162*	LK-1-A16
M1A11	60	1/6	9.0	8.0	M1A166*	CK-30-B16 CK-35-B16

* See "Interchangeability," page 76, for Accessory Parts required and for installation instructions.

TYPE E RELAY

On CK and DK machines, the E relay is mounted on the inner surface of the condenser between two fins on the rear of the machine. On Flatop machines it is attached to a bracket on the side of the compressor case or the fins except on the CE-34M where it is on the fan housing.

Fig. 127
E Relay on CJ Machine

The relay is held in place by a screw going into a stud projecting from the upper rear of the base. On CK and DK machines, it has no other support because the fins prevent its getting very much out of perpendicular, but on Flatop machines, a second nut on the long cover screw anchors the screw to the bracket.

The Type E relay forms part of the control-relay combination used on LK-1B, LK-2A and CG machines.

On LK machines, the control-relay combination is mounted on a plate in the upper right corner of the unit compartment opening in the rear. On CG machines, the combination is located above the enameled bottom plate in the box top insulation. In the combination, the E relay (without a cover) is attached to the control part which is held in the box with a screw. The relay part cannot be changed.

The E relay must be mounted with the armature hanging downward and with the two cable openings

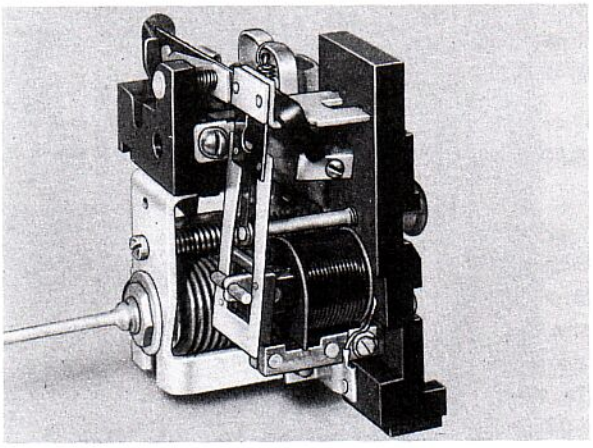


Fig. 128
Control-relay Combination

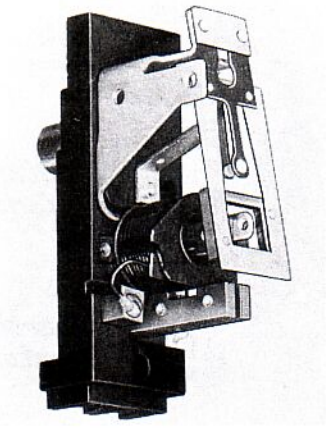


Fig. 129
E Relay—1936

in the base at the bottom. The base must be vertical so that the armature will operate in a vertical plane.

Caution: Never mount an E relay or run a machine with the relay dismounted in any position except as described above. Operating a machine with the relay in any other position may cause damage to the motor starting winding.

The connecting cord, compressor, and fan motor leads on machines with fan motors, are connected to terminal screws on the relay base.

Caution: Never interchange leads at the relay. Wrongly connected leads may damage the motor.

TYPE E RELAYS

1935, 1936, 1937

Cat. No.	Cycles	Motors Used on, Horsepower	Pick-up Current, Amps.	Minimum Drop-out Current, Amps.	Replacement Type R Relay	Machines used on
M1A62	60	1/8	6.0	5.5	M1A162*	CF-1-B16, CF-1-C16, CF-1-D16, CF-2-B16, CF-2-C16, CF-2-D16 CH-1-A16 CJ-1-A16 CK-1-B16, CK-1-C16, CK-1-D16 CK-2-B16, CK-2-C16, CK-2-D16 CK-15-A16 CK-26-A16, CK-26-B16 CK-28-A16, CK-28-B16 DK-1-A16
M1A64	60	1/6	9.0	8.0	M1A166*	CE-34-M16 CK-30-C16, D16, E16, G16 CK-35-C16, CK-35-D16, CK-35-E16
M1A65 (Control-relay Combination)	60	1/8	6.2	5.5	—	LK-1-B16 LK-2-A16
M1A80 (Control-relay Combination)	60	1/8	6.2	5.5	—	CG-1-A16 CG-1-B16
M1A113	25	1/10	5.5	5.0	M1A170*	CF-1-C12, CF-1-D12 CF-2-D12 CK-1-C12 CK-2-B12, CK-2-C12 CK-28-A12
M1A154	25	1/8	6.6	6.0	M1A184*	CK-30-D12 CK-35-D12

* See "Interchangeability," page 76, for Accessory parts required and for installation instructions.

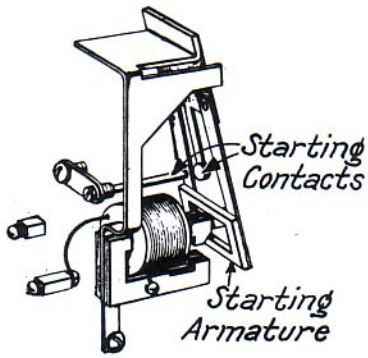


Fig. 130
E Relay Mechanism (1935)

The Type E relay consists of a coil on one pole of a laminated upturned horseshoe-shaped pole piece. The coil is in series with the running winding of the motor. The armature is made up of a single copper short-circuited turn which circles the outer end of the pole with the coil on it. Current passing through the coil induces current in the short-circuited turn, the action of which attracts the armature. If the current through the coil is greater than the pick-up current, the force is sufficient to overcome the spring tension of the armature so that it is drawn inward to close the starting contacts. When the current decreases to the drop-out value, spring tension of the armature overcomes the magnetic force and snaps the contacts open.

Caution: Never attempt to adjust an armature, or to repair or replace an armature or a contact.

E relays on 1935 machines have the stationary contact mounted on a post from the base, and have a fiber bumper through the top of the frame that sticks out beyond the pole to limit the rebound of the armature. In order to reduce relay starting noise, the stationary contact was mounted on a leaf spring from a support, and the bumper was omitted in relays used on 1936 and 1937 machines.

A solder-pot overload device in the control protects machines with Type E relays.

TYPE N RELAY

The Type N relay was used on early production 1938 Flatop machines.

The Type N relay is mounted on a bracket on the right side of the compressor case or fins, and is held to the bracket with a long U-bolt with nuts or wing nuts. On machines with fan motors, the relay should be in front of the bracket so that it will be in the air stream from the fan. In case the fan motor should fail, the overload will run warmer

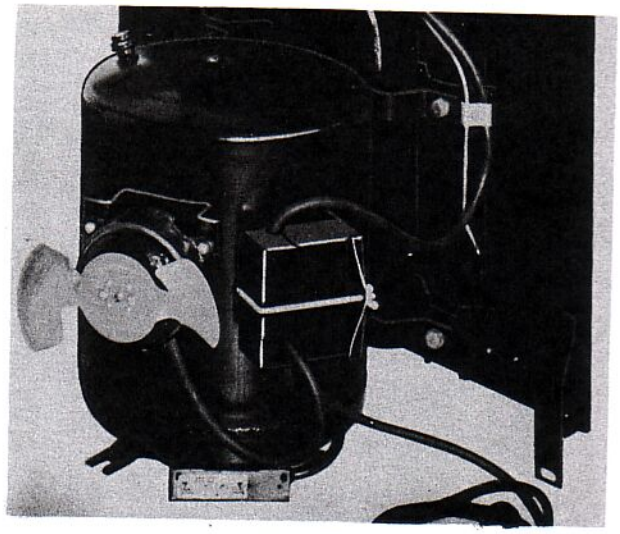


Fig. 131
N Relay on CH-1 Machine

than normal, and will tend to trip sooner to protect the motor under unusual power or load conditions.

The N relay must be mounted with the armature hanging downward, and with the two cable openings in the base at the bottom. The base must be vertical so that the armature will operate in a vertical plane.

Caution: Never mount a Type N relay or run a machine with the relay dismounted in any position except as described above. Operating a machine with the relay in any other position may damage the motor starting winding.

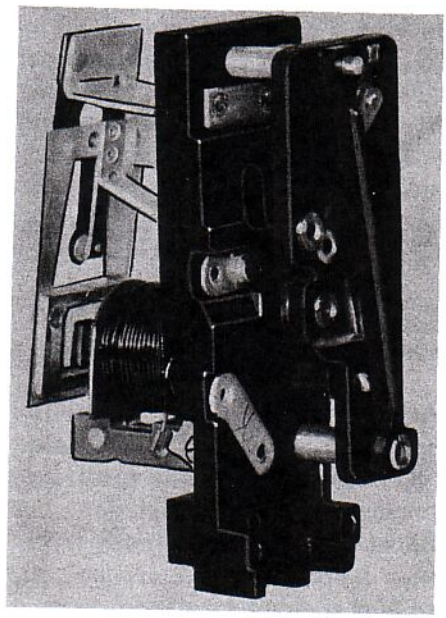


Fig. 132
Type N Relay

The connecting cord, compressor and fan motor leads (on machines with fan motors) are connected to terminal screws on the relay and overload bases.

Caution: Never interchange leads at the relay. An improperly connected relay may damage the motor.

The starting relay part of the N relay is the same as later E relays with the spring mounted stationary contact and no armature bumper. Refer to the E relay section, page 72 for a description and an explanation of its operation. However, a change was made in the blue spring steel part of the armature to improve the operation on 50-cycle service as indicated in the sketches below.

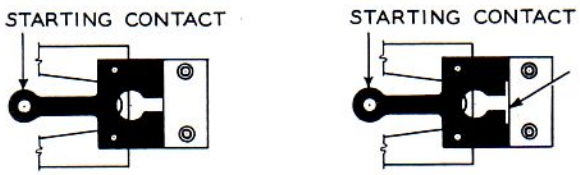


Fig. 133

To the relay base is attached an automatic-reset, bimetallic overload device. It consists of a bimetallic element next to a heater grid which is in series with the common lead to the motor. Any excess current to the motor passing through the heater causes additional flexing of the bimetallic strip until, at a predetermined temperature of the strip, an auxiliary pair of contacts is opened. The minimum current that will ultimately trip the overload on a one-eighth horsepower machine is 3.2 amps which is somewhat higher than the average full-load current of 2.2 amps.; for the overload on a one-sixth horsepower machine, it is 4.3 amps. compared to the average full-load current of 3.3 amps. A small Alnico permanent magnet holds the contacts open until the bimetallic element cools enough to pull away and close the overload contacts.

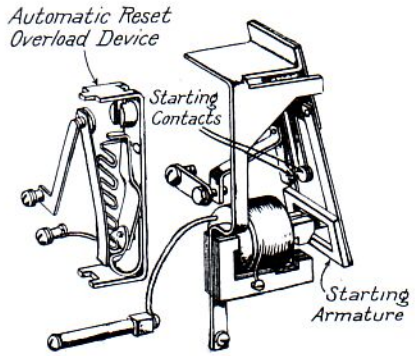


Fig. 134
N Relay Mechanism

Caution: Never block or attempt to adjust or repair the overload device.

TYPE N RELAYS

Early 1938

Cat. No.	Cycles	Motors Used on, Horsepower	Pick-up Current, Amps.	Minimum Drop-out Current, Amps.	Overload Rating, Amps.	Replacement Type R Relay	Machines Used on †
M1A162	60	1/8	6.0	5.5	3.2	M1A162*	CF-1-E16 CF-2-E16 CF-28-A16 CH-1-B16 CJ-1-B16
M1A166	60	1/6	9.0	8.0	4.3	M1A166 *	CE-34-A16 CE-340-A16
M1A168	60	1/8	6.0	5.5	3.0	M1A162 *	CE-140-A16
M1A170	25	1/10	5.5	5.0	3.0	M1A170 *	CF-1-E12 CF-2-E12

† Later production machines of these models have Type R relays.
* See "Interchangeability," page 76, for Accessory parts required and installation instructions.

TYPE R RELAY

The Type R relay was used on all Monitor Top and Flatop machines built after the first quarter of 1938. It has been used on all remanufactured CK and Flatop machines, regardless of their type and form, since the beginning of the fourth quarter of 1938. It is the only relay furnished for replacement purposes.

On Monitor Top machines, the R relay is mounted between two rear fins on the inner surface of the condenser, except when used on CK-30B and CK-35B machines where it is on the outside toward the rear. Special accessories, including a short U-bolt and bracket, are required when the R relay replaces an older type.

On Flatop machines with fins, it is clamped to the fins with a spring clip. On those without fins, it is mounted to a bracket on the compressor case with a spring clip or a short U-bolt. On machines with fan motors, the relay should be on the front of the bracket so it will be in the air stream from the fan.

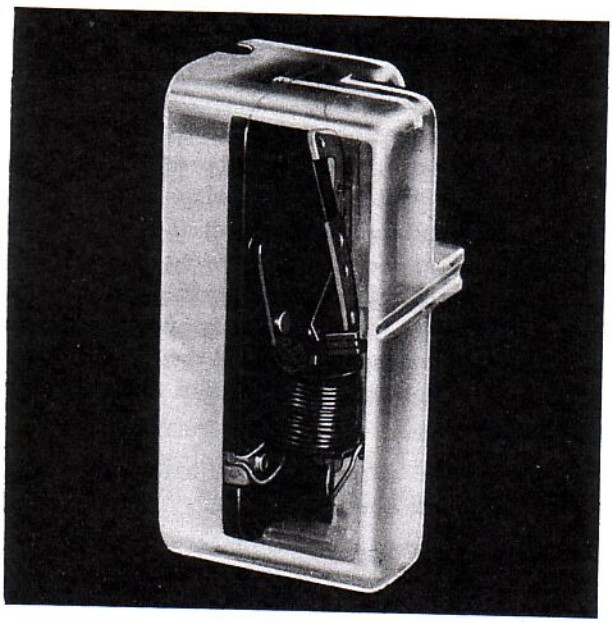


Fig. 135
R Relay

The R relay must be mounted with the armature hanging downward, and with the two cable openings in the cover at the bottom. The base must be vertical so that the armature will operate in a vertical plane.

Caution: Never mount a relay or run a machine with the relay dismounted in any position except as described above. Any other position may result in damage to the motor starting winding.

The connecting cord, compressor, and fan motor leads on machines with fan motors, are connected to terminal screws on the relay base.

Caution: Never interchange leads at the relay. An improperly connected relay may damage the motor.

The starting relay part is different from that in Type E and N relays. The series coil is in a different plane and is mounted on a thin solid core which forms the frame to which the armature is attached.

Caution: Never attempt to adjust an armature or to repair or replace an armature or a contact.

The original 60-cycle R relays introduced early in the second quarter of 1938 do not operate satisfactorily on 50-cycle power. Included in the information on the cover is the marking "60 cyc.". These include relays in groups 1, 2 and 3. (The group number is stamped in yellow ink on the terminal base along with the date of manufacture.) There are two copper short-circuited turns on the outer end of the armature and the steel arm to the movable contact is a continuation of the steel spring of the armature itself. Machines to which these relays were assembled usually had "60" stenciled on the compressor case dome. These relays have never been supplied for replacement purposes.

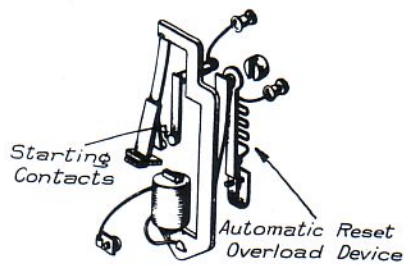


Fig. 136
R Relay Mechanism

Just before the beginning of the third quarter of 1938, a felt pad was riveted in the cover of 60-cycle relays to damp out possible occasional fluttering on 60-cycle power. The brass rivet can be seen on the outside of the cover. Otherwise the relays are the same as the original ones and have not been supplied for replacements.

At the beginning of the fourth quarter of 1938 along with the introduction of 1939 models, the armature design was changed so that 60-cycle relays operate satisfactorily on 50-cycle power. The information on the cover includes "50/60 cyc.". Relays with this improvement are in groups 5, 6, and 7. There are three copper short-circuited turns on the outer end of the armature and the movable contact is on a separate arm of beryllium copper welded to the steel part of the armature. This is the only R relay supplied for replacement purposes.

During the third quarter of 1940, a damping device was placed on the armature of 25-cycle relays to reduce the arcing noise from the starting contacts during the momentary setting period.

At the beginning of the second quarter of 1941, the No. 2 and 3 terminals were changed from tapped inserts to U-shaped clips which fit over the edge of the relay base. Only the inner part of the clip is tapped to receive the terminal screw. Longer terminal screws are supplied with relays having clip terminals.

During the last part of the fourth quarter of 1941, an armature adjusting screw was added to the frame for the factory setting of pick-up current.

Caution: Never alter the setting of this armature adjusting screw.

The M1A206 relay is different from other relays as it has a fifth terminal which is connected to the frame of the relay by a wire. As long as the control contacts are closed, current is supplied to the starting winding through a capacitor in series with the winding. During the momentary starting period, a second capacitor is in parallel with the one that is in the circuit all the time.

The automatic-reset, bimetallic overload device in R relays is about the same as the one in N relays except that it is mounted beside the starting part of the relay. Refer to the N relay section, page 73, for a description and explanation of its operation.

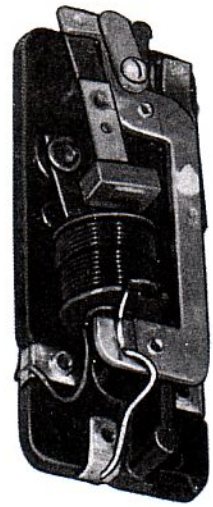


Fig. 137
M1A206 Relay for CFS-1A Machine

Caution: Never block or attempt to adjust or repair the overload device.

TYPE R RELAYS

Late 1938, 1939, 1940, 1941, 1942

Cat. No.	Cycles	Motors Used on, Horsepower	Pick-up Current, Amps.	Minimum Drop-out Current, Amps.	Overload Rating, Amps.	Machines used on †
M1A162	60	1/8	6.0	5.5	3.2	CF-1-E16, F16, G16, H16 CF-2-E16, F16, G16, H16, J16, M16, N16 CF-11-A16 CF-21-A16 CF-28-A16, B16, C16, D16, E16 CH-1-B16, C16, D16, E16 CJ-1-B16, C16, D16, E16 CJ-2-A16, B16*, C16*, D16, E16, H16 FBA-1-A16
M1A166	60	1/6	9.0	8.0	4.3	CF-2-R16 CF-22-A16, B16, C16, G16 CE-34-A16, B16, C16, D16, E16, H16 CE-340-A16, B16, C16 CK-30-E16, H16 CK-35-E16, G16, H16
M1A168§	60	1/8	6.0	5.5	3.0	CE-140-A16, B16, C16, D16 CK-1-D16 CK-2-D16, E16 CK-26-B16
M1A170	25	1/10	5.5	5.0	3.0	CF-1-E12, G12, H12 CF-2-E12, G12, H12 CF-28-C12
M1A184	25	1/8	6.5	6.0	4.3	CF-28-D12, E12, H12 CK-30-E12 CK-35-E12
M1A206	60	1/8	6.2	5.5	3.0	CFS-1-A16
M1A231	60	1/10	4.9	4.5	2.9	CJ-2-B16*, C16*

† Earlier production of some of these machines have Type N relays.
§ M1A162 can be used as a replacement for M1A168.
* Most CJ-2-B16 and CJ-2-C16 machines have 1/10 horsepower motors and M1A231 relays but some of the later production machines have 1/8 horsepower motors and M1A162 relays.

INTERCHANGEABILITY

GENERAL

The Type R relay supersedes Types E-3, E, and N, and is the only one supplied for replacement.

All replacement 60-cycle relays operate satisfactorily on 50-cycle power.

All replacement 25-cycle relays have damping devices to eliminate the arcing noise from the contacts.

All machines reconditioned after the beginning of the fourth quarter of 1938 have either Type R or N relays—regardless of the form on the rating plate.

The only difference between the M1A162 and M1A168 relays, either Type N or R, is that the overload setting of the latter is slightly more sensitive. In the field, they can be used interchangeably. Since the M1A162 relay is more apt to be available, it is approved for replacing an M1A168 relay.

Replacement relays with clip terminals have two ½-inch terminal screws furnished with them.

RELAY REPLACEMENTS

CATALOG NUMBERS

The catalog number of the proper R relay to be used in place of an older type relay is given in the following table:

Original Relay		Replacement Relay	
Type	Cat. No.	Type	Cat. No.
E-3	58X121	R	M1A162
E-3	M1A11	R	M1A166
E	M1A62	R	M1A162
E	M1A64	R	M1A166
E	M1A113	R	M1A170
E	M1A154	R	M1A184
N	M1A162	R	M1A162
N	M1A166	R	M1A166
N	M1A168	R	M1A168 or 162
N	M1A170	R	M1A170

As can be seen in the table, the catalog numbers for the corresponding N and R relays are the same.

ACCESSORIES FOR MOUNTING

The accessory sets of parts listed below are required when older type relays are replaced with R relays.

Accessory Parts Required
R Relay Replacing N or E Relay

Original Relay	Machines	Access. Set Cat. No.	Mount Replacement R Relay to
N	CE	M15A25 & M15A21	Original bracket with U-bolt. Assemble wing nuts in front
	CF	M15A27 or M15A25	Compressor fins with clip or Original bracket with U-bolt
	CH CJ	M15A25	Original bracket with U-bolt
E	CE-34M	M15A31 & spacer	Plate behind original bracket with clip
	CF	M15A27	Compressor fins with clip
	CH CJ	M15A31	Plate below original bracket with clip
	CK DK	M15A28	Bracket with U-bolt
E-3	CK-30B CK-35B	M15A32	Plate with U-bolt
	LK-1A	M15A28	Bracket with U-bolt

The accessory sets consist of the following:

M15A25 Set

M15A19 Back Plate
M15A20 Short U-bolt
66X712 Wing Nuts (2)

M15A27 Set

M15A23 Back Plate
M15A16 Spring Clip

M15A28 Set

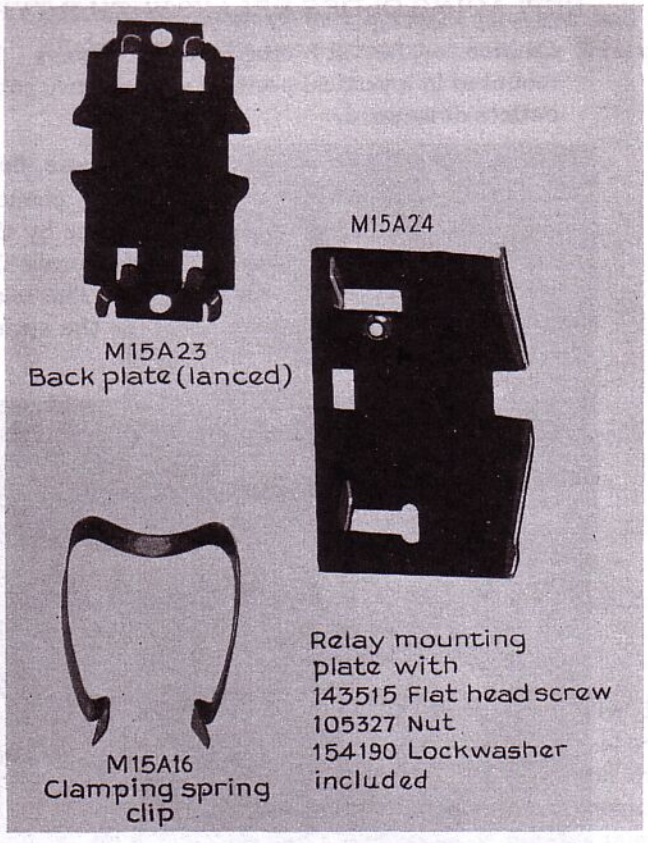
M15A19 Back Plate
M15A20 Short U-bolt
M15A29 Mounting Bracket
66X712 Wing Nuts (2)

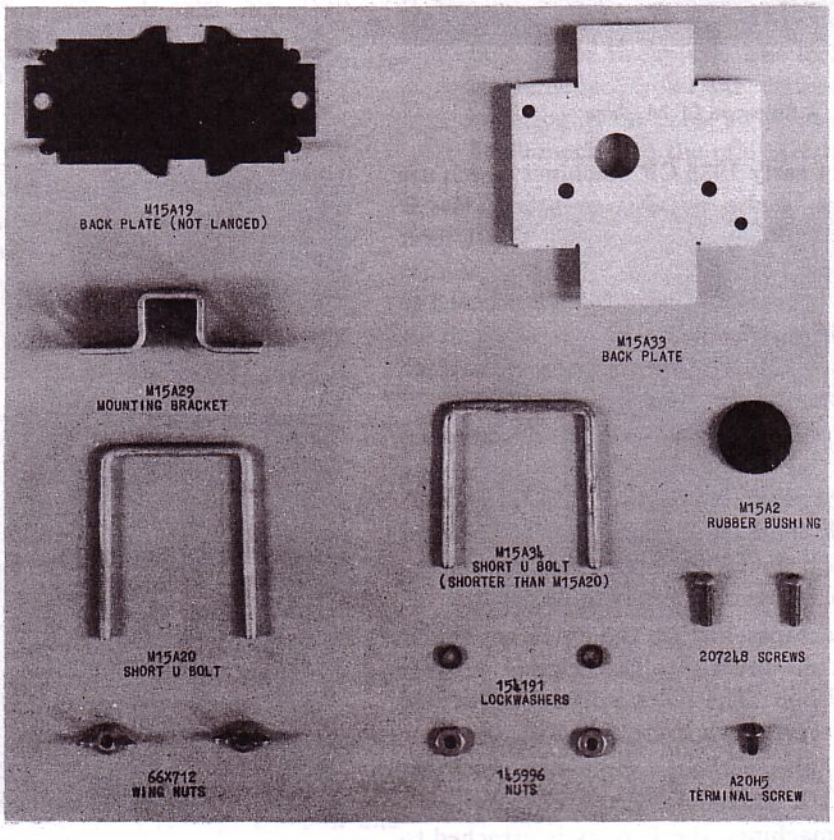
M15A31 Set

M15A16 Spring Clip
M15A19 Back Plate
M15A24 Mounting Plate

M15A32 Set

M15A2 Rubber Bushing
M15A33 Back Plate
M15A34 U-bolt
A20H5 Terminal Screw
145996 Hex Nuts (2)
154191 Lock Washers (2)
207248 Screws (2)





Figs. 138 and 139
Mounting Accessories

REPLACING OLDER RELAYS WITH R TYPE

Caution: The R relay must always be mounted in a vertical position with the two cable outlets downward.

On CF machines with compressor case fins: The lanced back plate covers the wiring connections in the relay base and is held in place by the outer four prongs. The other four prongs locate the relay between two compressor case fins. The relay and back plate are held to the fins by the spring clip. See Fig. 140.

Fig. 140
R Relay on CF Machine

In the case of early 1938 CF machines which use the N relay, it is also possible to attach the R relay to the original bracket with a short U-bolt and wing nuts. This short U-bolt is somewhat wider between prongs than the long U-bolt used to hold the N relay. It is, therefore, necessary to file out the holes in the bracket in order to attach the short U-bolt. This is similar to Fig. 142.

On CJ and CH machines without compressor case fins: For the machines of these types having E relays, it is necessary to employ a special mounting plate which is attached to the original bracket with a screw and nut. The R relay is then held to the special bracket with a clip. See Fig. 141.

On these machines having the N relay, the R relay is connected directly to the original bracket with a short U-bolt. The holes in the bracket will have to be enlarged with a file. See Fig. 142.

On CE machines without compressor case fins (except CE-34M): In replacing the N relay originally on these machines, the R relay is attached to the original bracket with a short U-bolt. The holes

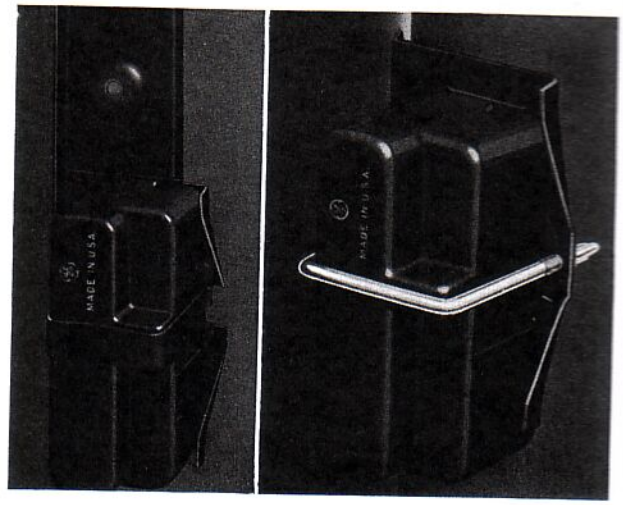


Fig. 141
R Relay with
M15A31 Accessories

Fig. 142
R Relay with
M15A25 Accessories

in the bracket must be enlarged with a file to accommodate the short U-bolt. Since the relay must be located in the air stream from the fan, it must be assembled to the front of the bracket. See Fig. 142.

On CE-34A and CE-340A machines, it is also necessary to use a Cat. No. M15A21 clamping strap so that the wing-nuts can be assembled to the forward side of the relay. Because of the fan housing, it is impossible to assemble the wing-nuts on the back side of the bracket.

On CE-34M machines: The same special plate as used to adapt the R relay to CJ and CH machines with E relays is necessary. Because of limited space, the special plate must be mounted in an up-side-down position. A ¼-inch spacer, such as a nut or block of wood, must be used between the plate and the bracket. The R relay is then mounted with a spring clip.

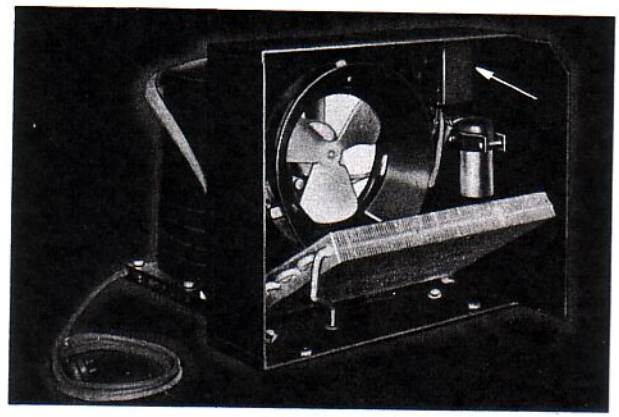


Fig. 143
E Relay on CE-34M Machine

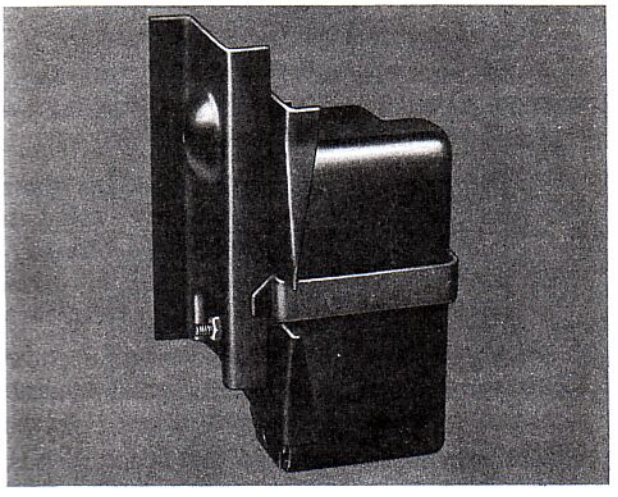


Fig. 144
R Relay on CE-34M Machine Bracket

On LK-1A machines: Drill a $\frac{3}{16}$-inch hole in the lower part of the relay mounting bracket on the machine. The relay is assembled to a special bracket with a short U-bolt. The special bracket is held to the relay mounting bracket on the machine with a screw. An alternate method is to drill two $\frac{3}{16}$-inch holes in the relay mounting bracket on the machine and use the M15A25 accessory set. The locking connector must be removed from the connecting cord and the covering of the cable stripped so that the leads can be connected to the relay terminals.

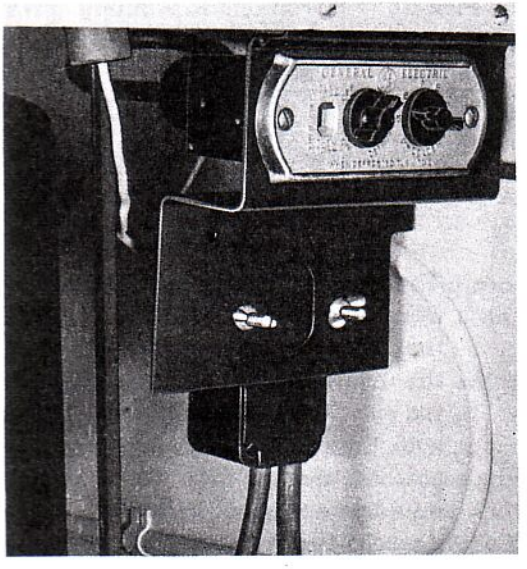


Fig. 145
R Relay on LK-1A Machine

On CK and DK machines (except CK-30B and 35B): The R relay is attached to a special bracket with a short U-bolt. The bracket fits against the condenser inner surface between two fins and is held to it by the same screw that held the E relay.

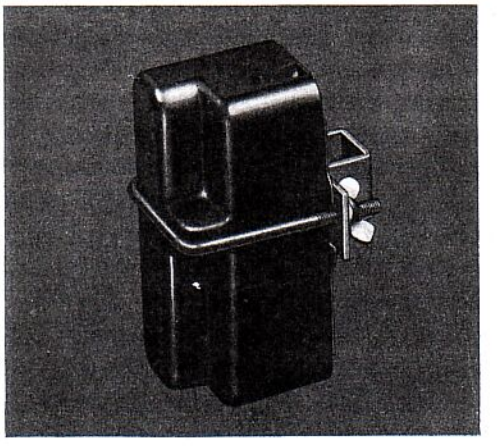


Fig. 146
R Relay with M15A28 Accessories

On CK-30B and CK-35B machines: The R relay is attached to a special back plate by a short U-bolt. The back plate is then fastened to the condenser outside surface by two screws which go into the same tapped holes where the E-3 relay was mounted. The three-wire cable should pass through the rubber bushing located in the center hole of the backplate. The locking connector must be removed from the connecting cord and the covering of the cable stripped so that the leads can be connected to the relay terminals.

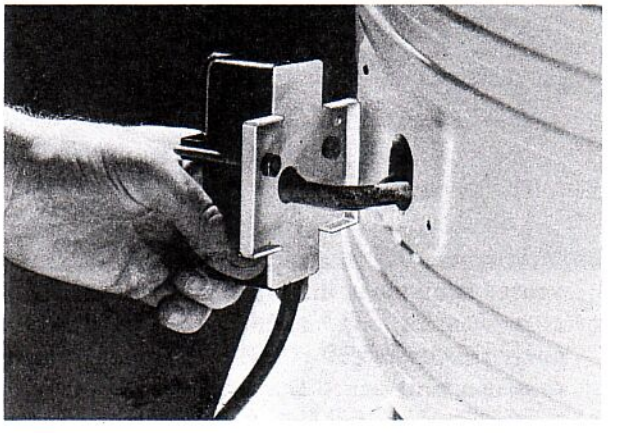


Fig. 147
R Relay on CK-30B Machine

WIRING CONNECTIONS

Refer to "Type R Relay Wiring Connections" on page 117.

If the replacement relay has clip terminals, use one-half inch screws in terminals 2 and 3.

Starting relays and overload devices are relatively simple in construction and represent only a small percentage of the total value of a machine. Yet, on them depend the proper operation and the life of the machine. They are designed, manufactured, adjusted and tested to perform their functions and to protect the machine for many years without attention or adjustment.

Since they require such careful adjustment to make them function properly, they must be handled with considerable care. The parts must never be adjusted or repaired.

Do not drop a relay or throw it around even though it is in its shipping carton. Starting relays and overload devices are as delicately adjusted as expensive electrical instruments and should be treated accordingly. Rough handling and dropping can alter the pick-up and drop-out characteristics of a relay.

Do not remove the cover from a relay unless absolutely necessary and do not leave the cover off. There is a possibility of altering the pick-up and drop-out adjustments if the armature or frame is hit against or caught on the cover when the cover is removed or put on. If left around without a cover, the parts may be damaged and, in the case of an R relay, chips may get on the Alnico magnet.

The cover of E-3 relays fits down onto the base, and is held with a nub on one side of the cover locking into a recess in the base, and a screw through a tab on the other side going into the terminal prong side of the base. As originally installed, a wire with a lead seal locked the screw to the cover.

Type E and N relays are held in their covers by a single long screw with a nut located in a recess in the relay base.

Type R relays are held in their covers by ribs molded in the base and cover. The base is prevented from going in too far by the inner rib of the cover bearing on the center rib of the base. The cover rib comes quite close to the end of the frame to which is attached the armature. Two small ribs on the inside surface of the cover hold the base in place.

To remove the cover of an R relay, spring the sides of the cover with the fingers until the base drops past the ribs. Then pull the base out, keeping it square with the sides of the cover. It is helpful to place a screw in terminal 4 and use it to guide the base out and in. When putting the relay back in the cover, make sure that it is properly started so that the series coil goes down in the deep part of the cover. Then push it in so that the base is square with the cover sides all the way.

> *Caution:* Do not tamper with the wax seals on the base of an R relay. The small screws under them are sometimes mistaken for holding screws. Actually, they are overload adjusting screws and must not be disturbed.

If an R relay is left around on a work bench, either with the cover on or off, there is a possibility that steel chips may get on the Alnico magnet.

Do not adjust an armature. Relay armatures can be adjusted only with the aid of meters because their pick-up and drop-out current values fall within narrow limits. For instance, the M1A162 pick-up current must be 6.0 amperes plus or minus only 0.2 ampere.

Even slight bending of the armature—so slight that the gap is not changed perceptibly—can change the characteristics of the relay enough to make it inoperative in normal service. It is apparent that bending which alters the gap so that the change can be detected by the eye will render the relay entirely unfit for use.

The following table illustrates the effect of very slight bending of the armature of an M1A162 R relay:

Pick-up current, amps.	Drop-out current, amps.	Minimum pick-up voltage	Maximum drop-out voltage
8.0 (high) (A)	6.9	100 (C)	over 200
6.0 (proper)	5.7	80	170
4.0 (low) (B)	3.9	50	110 (D)

Notes

A. The armature is bent a slight amount away from the stationary contact. The amount that the armature is bent is so slight that the difference cannot be distinguished with the eye. Assuming an average gap of $\frac{1}{8}$ in. with the relay held in its proper operating position, the gap after the armature is bent would probably not be increased as much as $\frac{1}{64}$ inch. It is evident that, if the armature is bent so far that the gap is as much as $\frac{1}{4}$ in., the minimum pickup voltage may be 110 or even higher.

B. The armature is bent a slight amount toward the stationary contact. The amount of bending (less than $\frac{1}{64}$ in.) cannot be

detected with the eye. If the armature or stationary contact arm is bent so that the contacts are still closer (less than $\frac{3}{32}$ in.), the maximum drop-out voltage may be greater than the normal service voltage of 115 to 120.

C. If the voltage at the machine is less than 100, the armature will not pick-up at all to close the starting contacts, and the overload will continue to trip.

D. If the voltage at the machine is greater than 110, the armature will not drop-out to open the starting contacts, and the overload will continue to trip.

Do not file the contacts. No matter how carefully the filing is done, the pick-up and drop-out values will be changed. Frequently, the change is sufficient to cause improper relay operation, especially under unusual power conditions.

Note: Never file the contacts of a Type R relay because of the relatively light construction of the parts. Although not recommended, the contacts of type E-3, E or N relays can be smoothed as described below.

If a replacement relay is not immediately available and it is necessary to smooth the contacts of a type E-3, E or N relay to keep the machine operating until the relay can be replaced, hold the contacts between the thumb and forefinger of the left hand so as to exert as little pressure as possible on the armature and contact arms. Gently press the contacts against the sides of a No. 1 or No. 2 cut steel file as it is moved back and forth a few times.

Caution: Do not use a coarse file (such as a nail file), or emery or sandpaper (particles may imbed in the silver). Do not attempt to file the contacts far enough to remove all the pits.

After connecting the relay, check its operation with the cover off. Do not use it if the contacts remain closed more than an instant or the machine seems to start hard or there is more than slight sparking when the contacts open.

Caution: Do not attempt to adjust the armature.

Do not replace a contact. Contact tips are made from fine silver (99.9% pure). To replace a burned-out contact with a steel or brass nut and screw (sometimes loose in the contact arm) or a riveted contact means that the contact resistance will be high, the tips may rust and corrode, the natural period of vibration of the armature is changed by the difference in weight, and the pick-up and drop-out characteristics are changed while the contact is being put in (no matter how skillfully or carefully the work is done)—and the motor in the machine is apt to burn out in time due to improper relay operation.

Do not repair or replace an armature. Relay armatures are designed and thoroughly tested to avoid natural periods of vibration that might cause fluttering and breakage. The pick-up and drop-out settings are obtained by delicate adjustments to the armature after assembly. To repair a broken armature or contact arm by bolting, riveting or soldering the same piece or another piece is certain to change the natural period of vibration, and the pick-up and drop-out characteristics (no matter how skillfully or carefully the work is done)—and the motor in the machine is apt to burn out in time due to improper relay operation.

Do not block or short-circuit an overload device. Overload devices are designed and tested to protect the motor under unusual power or load conditions, and yet leave sufficient margin to take care of normal pull-down and heavy load currents without tripping. If an overload trips, there is usually a reason somewhere in the machine, in the relay (the most frequent source of trouble, especially in machines with type E relays), in the wiring to the machine, in the house wiring or in the service lines.

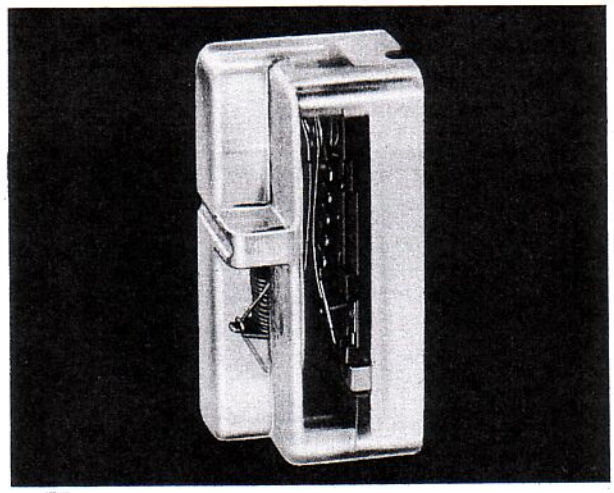


Fig. 148
Overload in R Relay

Defective overload devices are relatively rare although an occasional solder-pot will trip on less current than it should; refer to "Inoperative Solder-pot Overload", page 66. To substitute a higher rated heater grid or to short-circuit the grid in a two-knob control, or to block or short-circuit an overload in a type N or R relay removes the protection required by the motor—and, in time, the motor is apt to burn out.

Do not adjust or repair an overload device. Tripping time for solder-pot overloads in two-knob controls and bimetallic overloads in type N and R relays, and reset time for the latter must be within close limits to prevent motor windings reaching a dangerously high temperature under unusual power or load conditions. This maximum temperature is considerably below where actual charring takes place but only slightly below where moisture will be driven from the cotton insulation.

Any adjustment or repair to an overload device is bound to alter the operating limit, and to remove part or all of the protection required by the motor —and, in time, the motor is apt to burn out.

IMPROPER OPERATION

Relay and overload troubles are relatively infrequent but those that have been experienced will be listed and explained.

CONTACT DROPPED OR BURNED OUT

It is usually impossible to tell whether the contact was originally loose causing high resistance and resulting in burning of the arm about the contact, or whether excessive current through the contact caused the burning of the arm and loosening of the contact.

It is probable that some of this trouble is caused by the contact not being properly riveted to its arm. After the contact has dropped out, the starting winding circuit may be open-circuited, or the circuit may be completed through the arm of the stationary contact. In the latter case, burning of the arm may follow and sometimes the resulting poor contact may cause darkening or even burning of the series coil.

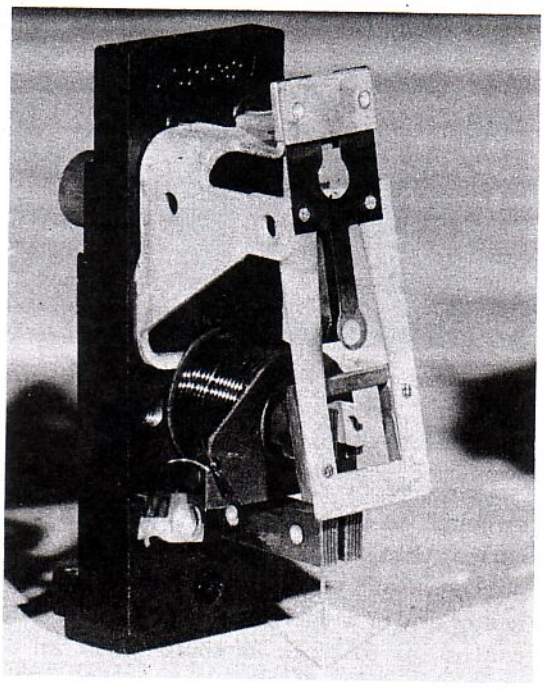


Fig. 149
Contact Missing

Excessive current through the starting contacts can also cause loosening of a contact. This may be a current of more than normal value brought about by grounding or a short circuit in the machine. It may be the normal starting current continued for a longer than usual period due to failure of the machine to start and failure of the overload to trip soon enough.

In either case, the relay should be replaced since it is impossible to replace a contact without disturbing the armature adjustment even if the arm is not burned. If it appears that the trouble was caused by excessive current, the machine and power supply should be checked.

TYPE E RELAY

STARTING NOISE

The normal slight noise caused by the closing of the contacts and the hitting of the armature against the rawhide bumper in early E relays is amplified by the motor-compressor assembly, and is sometimes objectionable. Replacement R relays, which are of lighter construction, should be quieter than the E relays.

Caution: Do not attempt to adjust the relay either by bending the armature or by changing the height of the post that supports the stationary contact in early E relays.

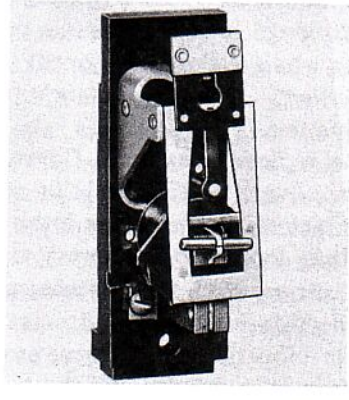


Fig. 150
E Relay—1935

CONTACTS WELDING MOMENTARILY

This condition may occasionally occur and cause tripping of the overload. It is practically impossible to catch the contacts welded because any jarring of the relay, even that caused by the machine shutting off, breaks the contacts open. However, the contacts appear rough and pitted.

> *Caution:* Do not attempt to adjust the relay. If the cause of the tripping cannot be discovered, and low voltage or other unusual power conditions are not responsible, an R relay with an automatic-reset overload should be substituted.

50-CYCLE OPERATION

All 60-cycle machines having E relays can be used directly on 50-cycle service. The relay starting noise is apt to be louder than on 60-cycle service due to increased current. This noise should be less on later relays with the spring mounted stationary contact and without the rawhide bumper. A late R relay should be still less noisy.

Because the current on 50 cycles is greater than on 60 cycles, it is likely that there will be somewhat more tripping out, particularly under high temperature and load conditions, and where the voltage is a little higher than the average.

Where the performance is not satisfactory, a late R relay should be substituted. The E relay should not be adjusted.

TYPE N RELAY

50-CYCLE OPERATION

The early N relay has a tendency to flutter on 50-cycle service, particularly if something external sets the armature vibrating. This fluttering usually causes a complaint of noise but, if bad, keeps the overload tripping.

The vibrating may be so bad on CE-34-A and on CE-340-A machines that the continual bringing of the starting winding into the circuit causes the compressor to bump against the case.

The vibrating can be damped out by inserting a rawhide bumper in the hole above the armature as used in the early E relays. With the bumper in place, the gap between the contacts must be at least $\frac{1}{16}$".

The armature was changed in later N relays so that they are satisfactory on 50-cycle service.

TYPE R RELAY

MOVABLE CONTACT ARM BROKEN OFF

This trouble is limited to late R relays where the movable contact is mounted on a beryllium copper arm which is welded to the armature. It is caused by a defective weld. The relay must be replaced.

MOVABLE CONTACT ARM BURNED OFF

The relay must be replaced.

ARMATURE BROKEN OFF

This is caused by improper welding. The relay must be replaced.

ARCING NOISE DURING STARTING

There may be an arcing or popping noise, during the momentary starting period, from early 25-cycle R relays. A damping device was added to later relays to reduce the arcing. When too objectionable the relay can be replaced as all replacement relays have the damping device.

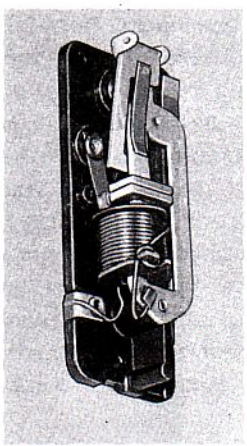


Fig. 151
Damping Device on a 25-cycle Relay

FLUTTERING OR ARCING

This trouble is limited to the early R relays. For an explanation of design changes made to correct this condition, refer to page 74.

The fluttering may be present throughout the running cycle or it may occur only occasionally. If very bad, it may cause the overload to keep tripping and eventually burn off the arm on which the movable contact is mounted.

Like any moving element, each relay armature has a natural period of vibration of its own. Generally this is not near that of the machine or the magnetic circuit through the armature. Once in a while a relay may be found with a natural period close to that of the machine or the magnetic circuit so that it vibrates after the machine starts up. If the vibrations are bad enough to keep closing the starting contacts, the overload may or may not trip. It is also possible that the jarring or vibrating of something external to the refrigerator might set

the armature to vibrating but this would not cause trouble unless it is something that happens frequently or continues for a prolonged period.

A fluttering armature may cause a repeating metallic click or ring with a definite rhythm which may be thought to come from the compressor.

A relay which is suspected of fluttering can be checked by examining the inside of a relay cover. If it is badly covered with a carbon deposit, it is probable that it should be replaced. There is a light covering of carbon deposit in most relay covers after a period of service.

The contacts of a fluttering relay will usually be badly pitted.

A relay that shows evidence of fluttering should be replaced. No attempt should be made to adjust it.

50-CYCLE OPERATION

Early R relays, even those with a felt pad in the cover, will not operate satisfactorily on 50 cycles. Machines to which they were assembled have the usual 50-cycle marking removed from the rating plate. Most of these machines have "60" stenciled on the compressor case dome. To use one of these machines on 50-cycle service it is necessary to substitute a late R relay.

The M1A231 relay will not operate satisfactorily on 50 cycles. CJ-2B and C machines with 1/10-horsepower motor which use this relay are not supposed to be used on 50-cycle service due to limited capacity.

FAN MOTORS

PURPOSE OF FAN

An external motor-driven fan is used on certain refrigerating machines to provide forced draft cooling.

Type CH-1 machines are equipped with a fan because of possible restricted ventilation. This type of machine is designed specifically for built-in kitchen installations. The machine has a flat-plate condenser and if the refrigerator is not built in, the fan motor may be disconnected.

Type CE-140 machines, because they are mounted beside the cabinet, use a finned-tube condenser, and require a fan.

Type CE-34 machines and Type CE-340 machines, because of their comparatively large refrigerating capacity, are equipped with a fan and finned-tube condenser. If these machines were equipped with a flat-plate condenser large enough for their larger refrigerating capacity, the condenser would be too bulky for handling and shipping.

FAN MOTOR DESCRIPTION

Four different fan motors have been used.

Cat. No. 5KY20B14 (C2H1) motor with Cat. No. C7H1 fan was assembled on 1937 CH-1A and CE-34M machines.

It is of the single-phase, shaded-pole type. Its cable contains only two leads; a black one and a white one. The connections are such that the fan motor operates only when the machine runs.

The two end-bells are made of cast aluminum. A bronze bearing with oil grooves is in each end-bell. An oil tube with a wick leads to each bearing. The cast-aluminum rotor is mounted on a steel shaft. There are two projections on the rear end-bell, one from the top and the other from the bottom, which serve as a two-point mounting.

The cast-aluminum fan has three blades. It is held on the motor shaft with an Allen setscrew.

Cat. Nos. 5K61YA1 and 5K61YA2 motors with the C7H2 fan were used on 1938 and 1939 machines. The 5K61YA2 motor is assembled only to 1938 CE-34A and CE-340A machines, which have a capacitor in series with the starting winding. The 5K61YA1 motor will be found on all other 1938 and 1939 machines having a fan.

These motors are of the two-phase type, the current for one phase coming from the line and, for the other, being generated in the starting winding of the refrigerating machine motor. The machine starting winding is connected to the line only during the momentary starting period. After the machine starts, the starting winding is disconnected from the line. Since the starting winding is con-

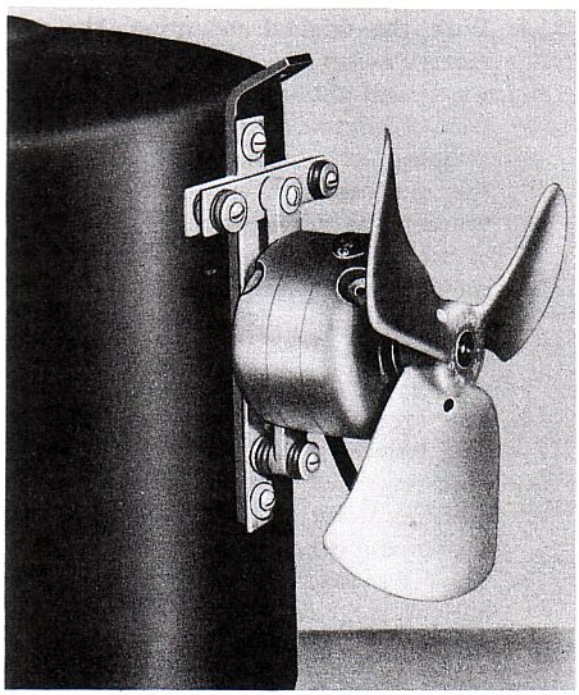


Fig. 152
Fan Motor 5KY20B14 with Fan

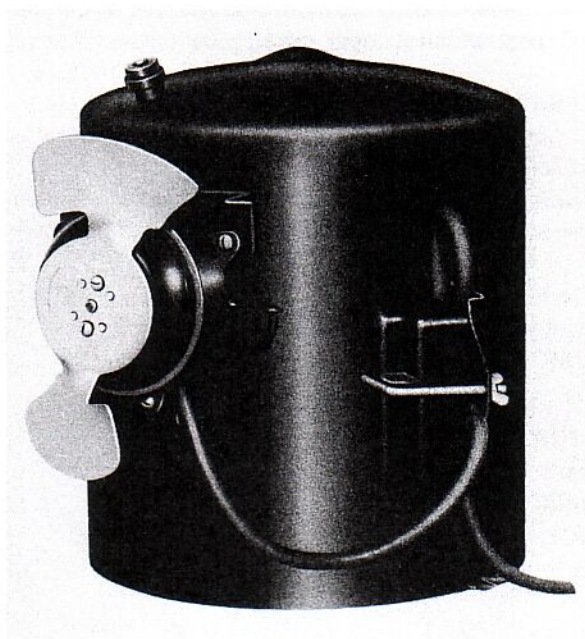


Fig. 153
Fan Motor 5K61YA1 with Fan
(5K61YA2 same in appearance)

nected directly to one winding of the fan motor, current generated in it due to rotation of the cast-aluminum rotor flows into that winding of the fan motor.

The cable contains three leads: the black one is common to the two windings, the red one goes between one phase and the line, and the white one connects the other phase with the starting winding of the compressor motor. The connections are made to the starting relay so that the fan motor operates only when the machine runs.

The cast-iron frame has two bearings formed by undercutting the mid-section. There are three ears on the frame which are drilled for the three-point mounting. A cast-aluminum rotor is pressed on the steel shaft.

An oil reservoir is formed by a steel cover which fits over and is cemented to a ledge on the rear of the motor frame. The reservoir is partially filled with a special oil with an oxidation inhibitor to prevent gumming and sludging. A large circular wick takes the oil from the reservoir to a recessed portion of the rear bearing. An oil groove in the shaft carries the oil to the front bearing, from where it drains back to the reservoir.

The first fan motors of this type had two Duprene rubber plugs in the side of the oil reservoir; one at the top and the other at the height of the maximum oil level. Later, an oil tube was extended out from the right side of the reservoir. It is capped with a Duprene rubber plug.

The two-blade steel fan has holes in the center part which fit over raised pins on the rotor to locate it, and it is held by two screws with lockwashers which go into tapped holes in the rotor.

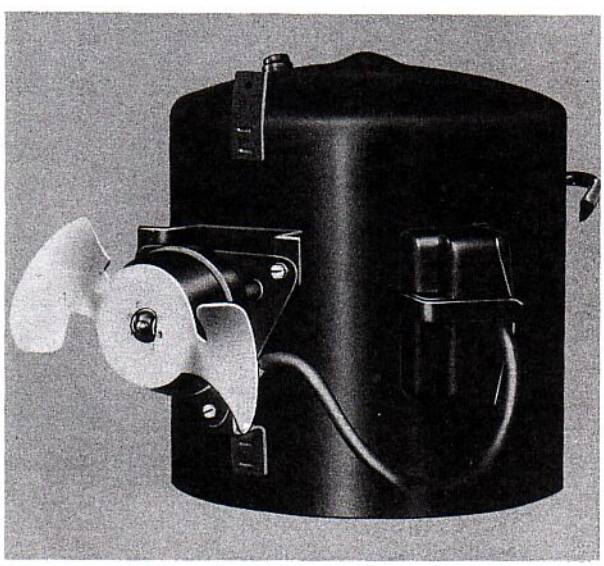


Fig. 154
Fan Motor 5K51AL1 with Fan

Cat. No. 5K51AL1 motor with Cat. No. C7H2 fan was first used on 1940 models, and has been used on all subsequent fan-cooled machines.

It is smaller, but similar in construction and operation to the 5K61YA1 motor previously described. These two motors are interchangeable, but the 5K51AL1 cannot be substituted for the 5K61YA2 motor.

Included with the 5K51AL1 motor is the triangular plate to which it is rubber mounted. This plate has holes in the three corners to make it interchangeable with the 5K61YA1 motor.

There is a single Duprene rubber plug in the side of the oil reservoir at the height of the maximum oil level.

Although the C7H2 steel fan is the same as on the 5K61YA1 motor, it is held on the threaded end of the fan motor shaft by a speed-nut instead of two screws going into the end of the rotor.

FAN MOTOR MOUNTINGS

5KY20B14 (C2H1)

On the early production CH-1A machines, there was no foot on the bottom of the compressor base to join it to the cross-bar in the cabinet base. Later a foot was added. Because of this change, the fan motor was mounted in five different ways as follows:

1. With the original mounting, the upper fan motor bracket was attached to a horizontal bar which was rubber mounted to the horizontal part of a cross-shaped piece. This piece was attached to a bracket welded to the front of the compressor case. The bottom fan motor bracket was rubber mounted to the lower part of the cross-shaped piece. This arrangement is shown in the picture of the 5KY20B14 motor. It was discontinued because the screws on which the rubber bushings were placed could not be positively locked.
2. The fan motor was then solidly attached to the case bracket with two screws. Under certain operating conditions, there was a slight noise resulting from the difference in speed between the fan and compressor motors.
3. The fan motor was next solidly mounted on an upright strip welded to the cross-bar of the cabinet base in front of the compressor case. Again, under certain installation conditions, a slight noise resulted from the difference in motor speeds.
4. The upright strip was then connected to the

strap on the front of the compressor case with an angle piece. This eliminated the slight noise which under certain conditions was observed with the two previous mountings.

5. Finally, after the foot was added to join the front of the compressor base to the cabinet cross-bar, the fan motor was again solidly attached to the bracket on the front of the compressor case. This mounting was entirely satisfactory.

On CE-34M machines, the fan motor is attached solidly to a bracket welded on the front of the compressor case.

5K61YA1, 5K61YA2 AND 5K51AL1

These fan motors have three-point mountings, and are attached solidly to brackets welded to the front of the compressor case. This mounting is shown in the pictures of these fan motors.

C20H74 MOUNTING ACCESSORIES

With this set of accessories, a 5KY20B14 (C2H1) fan motor on a CH-1A machine can be replaced with a 5K61YA1 or a 5K51AL1 motor. Also, a 5KY20B14 (C2H1) motor on a CE-34M machine can be replaced with a 5K61YA2 motor.

The set consists of an arc-shaped bracket, two spacers, and suitable screws, lockwashers, and nuts. The center of the curved piece is attached to the upper part of the case bracket with a spacer between them. Two of the fan motor corners are mounted on the ends of the bracket. The third corner is joined to the lower part of the case bracket with the other spacer between them.

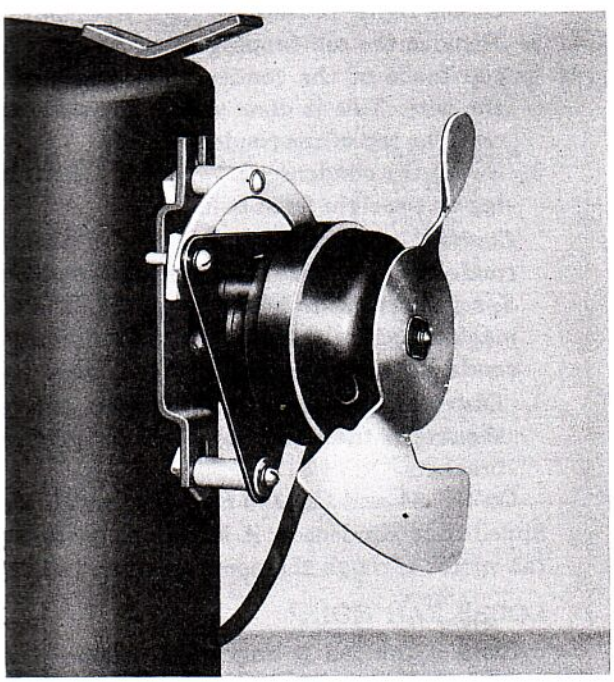


Fig. 155
Fan Motor with C20H74 Mounting Accessories

The first case brackets had a tapped hole in either end to take the mounting screws. The holes were later changed to slots and then rectangular nuts were used with the screws.

If the two-blade fan should come too close to the baffle on the fan housing of the CE-34M machine, the baffle can be bent out of the way.

FAN MOTOR ADJUSTMENTS

OILING—5KY20B14 (C2H1)

This fan motor was supposed to be oiled once a year and a label to that effect was pasted on many of the machines having it. Experience has proved that, with the intermittent service to which it is subjected, the motor will run several years without requiring additional oil. It has been found that, when oiling is required, the motor becomes somewhat noisy but runs all right. If the proper oil is added within a reasonable time, there will be no damage to the bearings.

Instructions

It is usually necessary to remove the fan motor from the machine. Refer to "Replacing a Fan Motor" which follows this section.

Use only an automobile oil, S.A.E. 10 or 20, preferably of the wax-free type.

Do not use an ordinary household oil because it may gum up and stall the fan motor.

Fill the two oil cups two or three times, allowing time for the oil to seep down and saturate the wick.

Do not spill oil on rubber bushings used with the first type of mounting on CH-1A machines.

If a fan motor gets gummed up because of the use of improper oil, it can usually be cleaned with carbon tetrachloride. Two longitudinal screws hold the two end-bells together.

Caution: Before pulling the front end-bell over the end of the shaft, smooth down any burrs made on the shaft by the fan setscrew. Otherwise, the bearing may be injured.

OILING—5K61YA1, 5K61YA2 AND 5K51AL1

These motors are designed to operate for many years, if not indefinitely, without requiring oiling. The large oil reservoir holds a cubic inch of oil. If, for some reason, oiling is required the motor will become somewhat noisy but will continue to run. If the proper oil is added within a reasonable time, there will be no damage to the bearings.

Instructions

It is generally necessary to remove the fan motor

from the machine. Refer to "Replacing a Fan Motor" below.

Use only an automobile oil, S.A.E. 10, preferably of the wax-free type.

Do not use an ordinary household oil because it may gum up and stall the motor.

To oil the early production 5K61YA1 and 5K61YA2 motors, remove the two plugs and, with the motor in its normal position, add oil through the top hole until it comes up to the level of the hole on the side.

To oil later ones with the oil tube, remove the plug and, with the motor in its normal position, fill the tube full.

To oil a 5K51AL1 motor, remove the single plug. With the motor in its normal position, add oil until it comes up to the level of the hole.

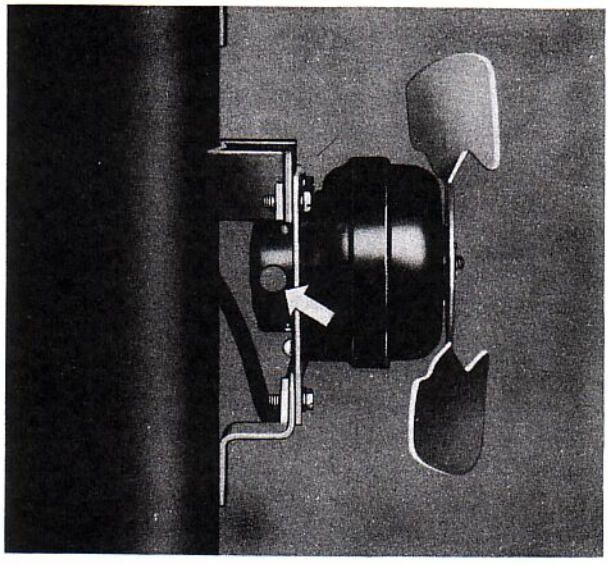


Fig. 156
Oil Plug on 5K51AL1 Fan Motor

Be careful not to spill oil on the rubber bushings used to mount the motor to the triangular plate of the 5K51AL1 model.

If a fan motor gets gummed up because of the use of improper oil, carbon tetrachloride can be tried to clean it out. If the machine will run, drain the oil, run it a few minutes with carbon tetrachloride, and drain it. Should the fan motor be stalled for this reason, try draining the oil and flushing the motor with the cleaning fluid.

REPLACING A FAN MOTOR

On CH-1 machines, it is relatively simple to disconnect the fan motor leads from the starting relay, and remove the screws that hold the motor to the mounting bracket.

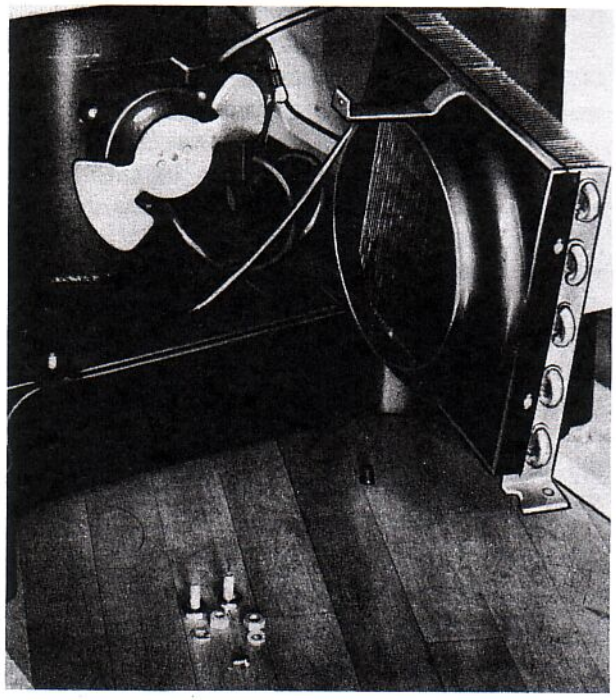


Fig. 157
Dismount Finned Tube Condenser to Remove Fan Motor

On all CE-140 machines and CE-34 and CE-340 machines with a vertical finned-tube condenser, it is necessary to swing the condenser to the right to get at the fan motor:

1. Remove the two nuts and bolts at the left of the condenser base, and the back nut and bolt on the right. Loosen the right front nut.
2. Remove the self-tapping screw which holds the top brace of the condenser to the bracket on the case. This is done with a screwdriver from over the top of the condenser.
3. Swing the condenser slowly to the right, pivoting on the right front bolt.

   Caution: Make sure that the tubes to the condenser do not bend excessively or kink. Special care has to be used on a CE-34 or CE-340 machine where the tube from the bottom of the condenser to the liquid receiver is quite short.
4. Disconnect the leads from the relay, and remove the screws that hold the motor to the mounting brackets.

On CE-34 and CE-340 machines with a slanting finned-tube condenser, it is possible to get at the fan motor through the opening in the fan housing.

LOOSE FAN NOISE

Even if the fan is only very slightly loose, an objectionable running noise may be present. This is the first check that should be made when inspecting a noisy fan motor.

On the three-blade fan, the setscrew should go down on the flat on the shaft. It can be tightened with a Cat. No. A18X7 wrench.

The two screws or the speed-nut which hold the two-blade fan must be tight. A noticeable noise can be created even though the speed-nut is less than a turn loose.

LOOSE MOUNTING

The fan motor mounting screws should be tight. On the 5K51AL1 motor, the three screws which rubber-mount the motor to the triangular plate must also be reasonably tight. The rubber bushings should be in good condition. Care must be taken not to spill oil on them when oiling a fan motor.

FAN OUT OF BALANCE

A fan must be in proper balance to run quietly. Do not attempt to bend blades of a three-blade fan.

END BUMP (5KY20B14 MOTOR)

This is a tinny scraping noise which occurs while the fan motor is slowing down, after the machine shuts off. Sometimes it is observed while the fan motor is coming up to speed. During normal running, the rotor floats between the end bearings by magnetic attraction but when the current is shut off, it may drift one way or the other. The shaft shoulder is supposed to ride against a special Prenite washer but occasionally instead, the end ring scrapes against the bearing housing cover. To correct end bump proceed as follows:

1. Observe which way the fan drifts after the power is shut off.
2. Remove the fan motor from the machine.
3. Remove the fan from the motor shaft, using Cat. No. A18X7 wrench.
4. File off any burrs on the shaft caused by the fan setscrew. This is important to prevent scoring of the motor bearing as it is drawn off the shaft.
5. Take off the two nuts on the screws which hold the two halves of the motor case together. If the screws are removed, make sure that the insulators are on them when they are replaced.
6. Remove the front half of the motor case.
7. Place one Cat. No. C20H66 Prenite washer on the shaft inside the bearing housing cover on the end toward which the fan drifted. It will be necessary to remove the rotor to put a washer on the back side.
8. Reassemble the motor and mount it again, carefully tightening all screws.
9. Check for noise. It is possible that in an extreme case two washers may be required.

SCRAPING NOISE (5K61YA1 AND 5K61YA2)

The first motors of these types had a small thrust spring keyed to the end of the shaft opposite the fan. Occasionally, a spring will work loose and cause a scraping noise as it rotates on the shaft. There is no field correction.

About the beginning of 1938, the spring was eliminated. For a while, a daub of red paint on the top of the motor frame marked motors without this spring.

FAN MOTOR DATA

Fan Motor Cat. No.	5KY20B14 (C2H1)	5K61YA1	5K61YA2	5K51AL1
Fan Cat. No.	C7H1	C7H2	C7H2	C7H2
Years Used	1937	1938–1939	1938	1940–1942
Machines Used on	CH1A CE-34M	CH-1B, C CE-140A, B CE-34B, C CE-340B	CE-34A CE-340A	CH-1D, E CE-140C, D CE-34D, E, H CE-340C
Mounting	2-point	3-point	3-point	3-point
Fan Blades	3	2	2	2
Phases	single (shaded pole)	two	two	two
Rotation	counter-clockwise	counter-clockwise	counter-clockwise	counter-clockwise
Speeds, R.P.M.	1500	1350	1450	1350
Watts Input	23	7.5–9.0	7.5–9.0	9.0–12.0

FAN MOTOR INTERCHANGEABILITY

Original Fan Motor Cat. No.	Machines Used on	Can Be Replaced by	Accessories Required
5KY20B14 (C2H1) (1937)	CH-1A	5K61YA1	C20H74 Set C7H2 Fan (2) 175541 Screws (2) 154190 Lockwashers
		5K51AL1	C20H74 Set C7H2 Fan C20H94 Nut
	CE-34M	5K61YA2	C20H74 Set C7H2 Fan (2) 175541 Screws (2) 154190 Lockwashers
5K61YA1 (1938–1939)	CH-1B, C CE-140A, B CE-34B, C CE-340B	5K51AL1*	C20H94 Nut
5K61YA2 (1938)	CE-34A CE-340A	—	—
5K51AL1 (1940–1942)	CH-1D, E CE-140C, D CE-34D, E, H CE-340C	5K61YA1	(2) 175541 Screws (2) 154190 Lockwashers (3) 145995 Screws**

* When transferring the fan from the old to the new motor, note that the early production two-blade fans are not marked to indicate the front. One side of each blade is wider and has a deeper cut-in section near the hub. This side should be outward, toward the front of the refrigerator. Since the rotation is counterclockwise, this wider side leads. Later fans have an arrow stamped on the front.

** The $\frac{5}{8}$-in. screws used with the 5K51AL1 motor are hardly long enough to hold the 5K61YA1 motor which takes $\frac{7}{8}$-in. screws.

WIRING DIAGRAMS

Although the electrical connections of the various types and forms of Scotch-yoke refrigerating machines are fundamentally the same, there are a number of modifications which are shown in the following diagrams.

It must be recognized that these diagrams indicate how the different machines were originally connected when they left the factory. The connections of some older machines in service have been changed due to the installation of the R type starting relay. When the R type relay is used as a replacement for an E or N relay, connections will be similar to the connections of later forms of machines originally equipped with the R relays; this is indicated by the wiring instructions for the R relay shown on Page 117. The majority of re-manufactured machines, regardless of type and form, are being equipped with the newer R type relay.

All diagrams are for alternating-current machines except one which indicates the connections of the direct-current CK machines.

Machines for operation on twenty-five cycle alternating current generally have the same connections as corresponding sixty-cycle machines. However, CF-28D12, CF-28E12, and CF-28H12, twenty-five cycle machines, have a capacitor in series with the starting winding of the motor.

The following index lists the different sizes and forms of the Scotch-yoke type of machine. Opposite the machine is the number of the page on which the wiring diagram is located.

WIRING DIAGRAM INDEX

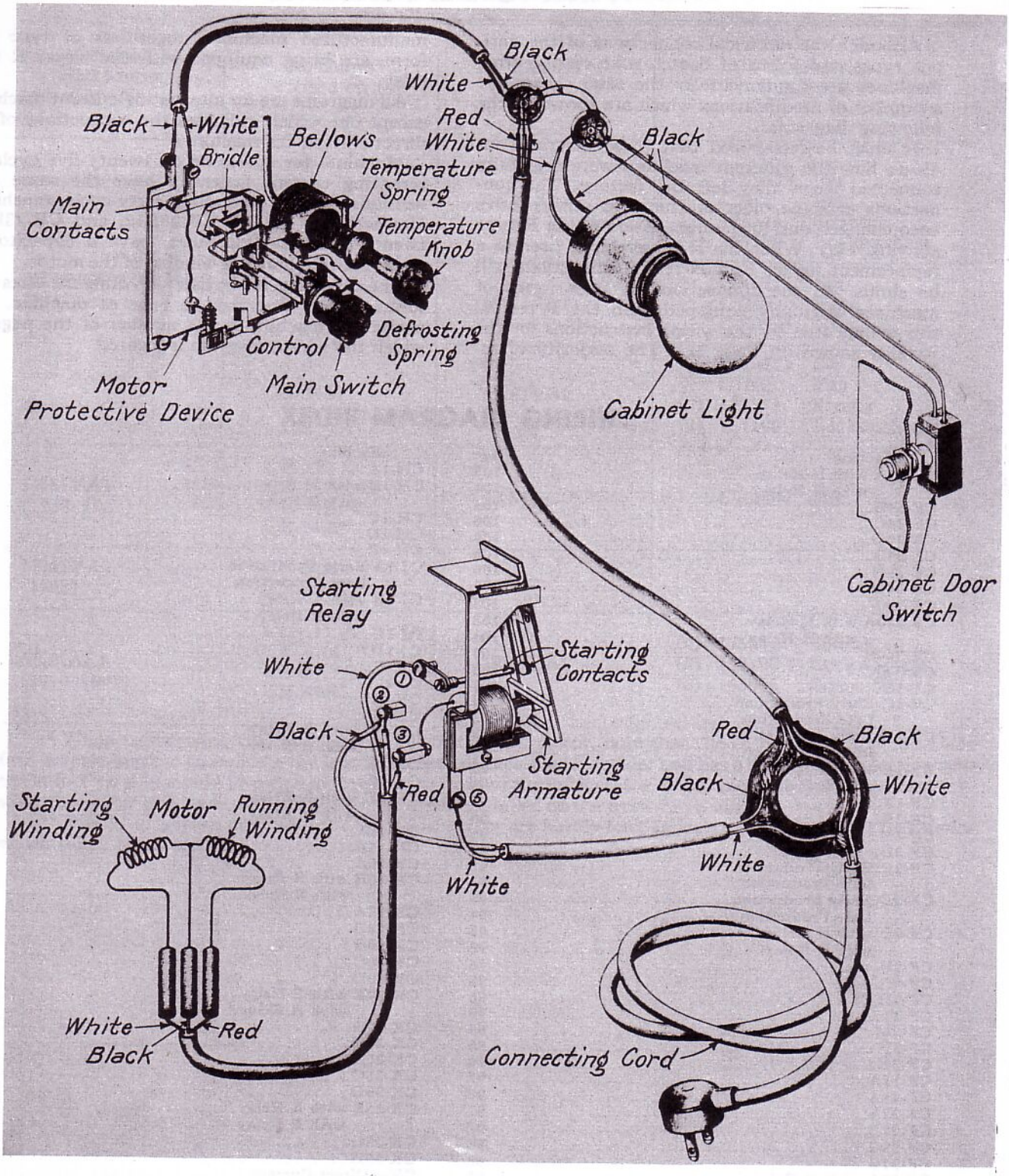


Fig. 158
Pictorial Connection Diagram
Machines: CF-1B and CF-2B
CF-1C Early Production and CF-2C Early Production

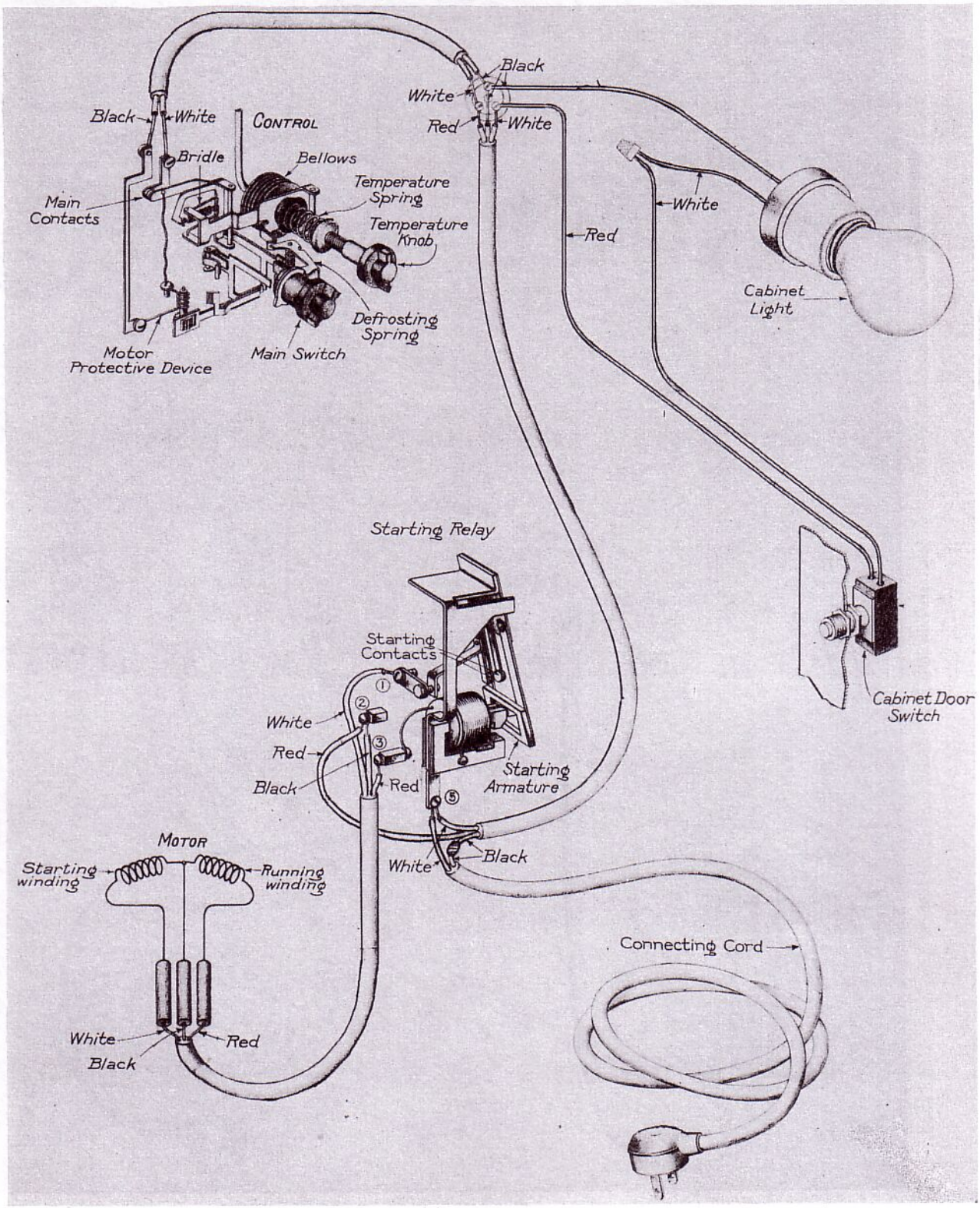


Fig. 159
Pictorial Connection Diagram
Machines: CF-1C Late Production and CF-2C Late Production
CF-1D Early Production and CF-2D Early Production
CJ-1A Early Production

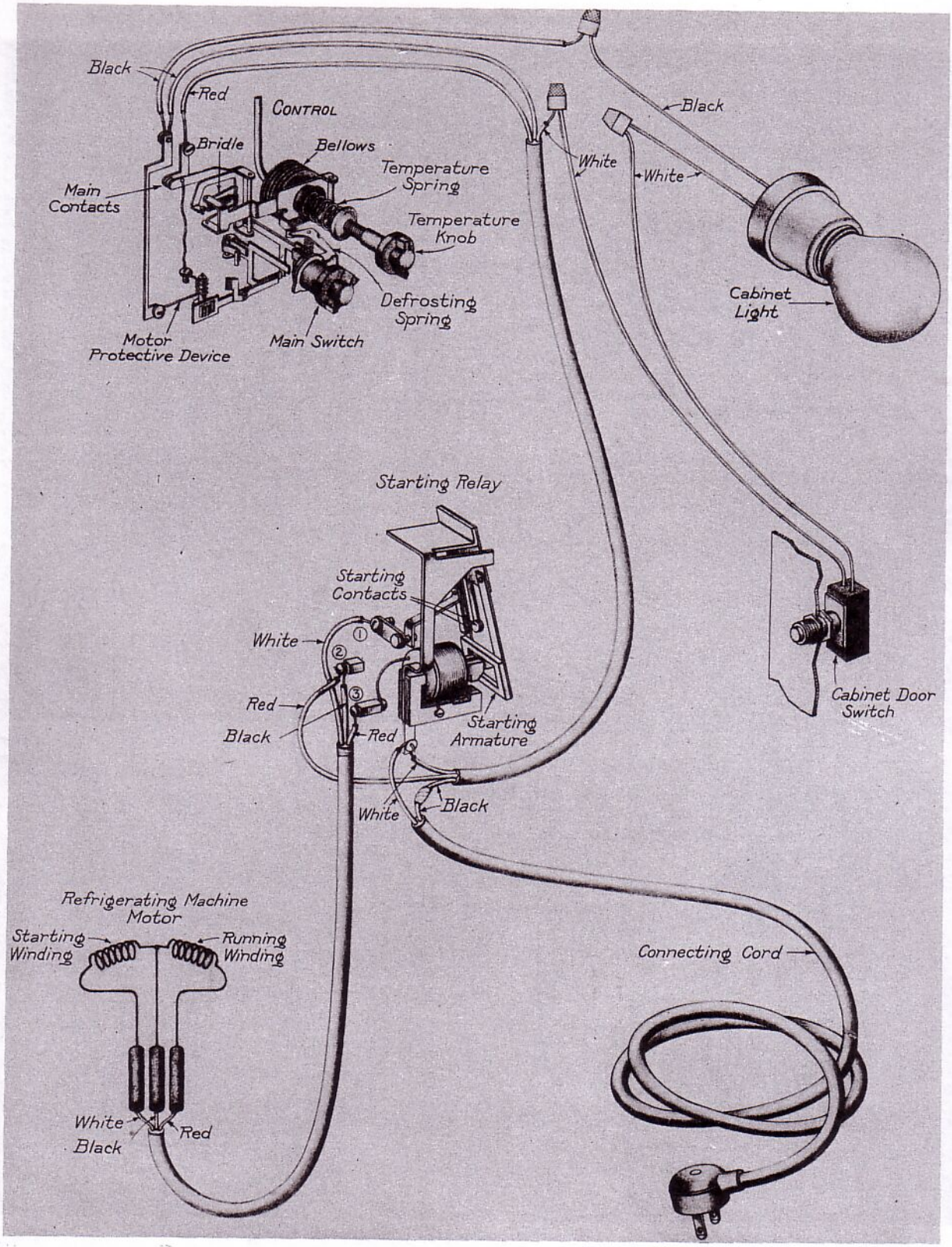


Fig. 160
Pictorial Connection Diagram
Machines: CF-1D Late Production and CF-2D Late Production
CJ-1A Late Production

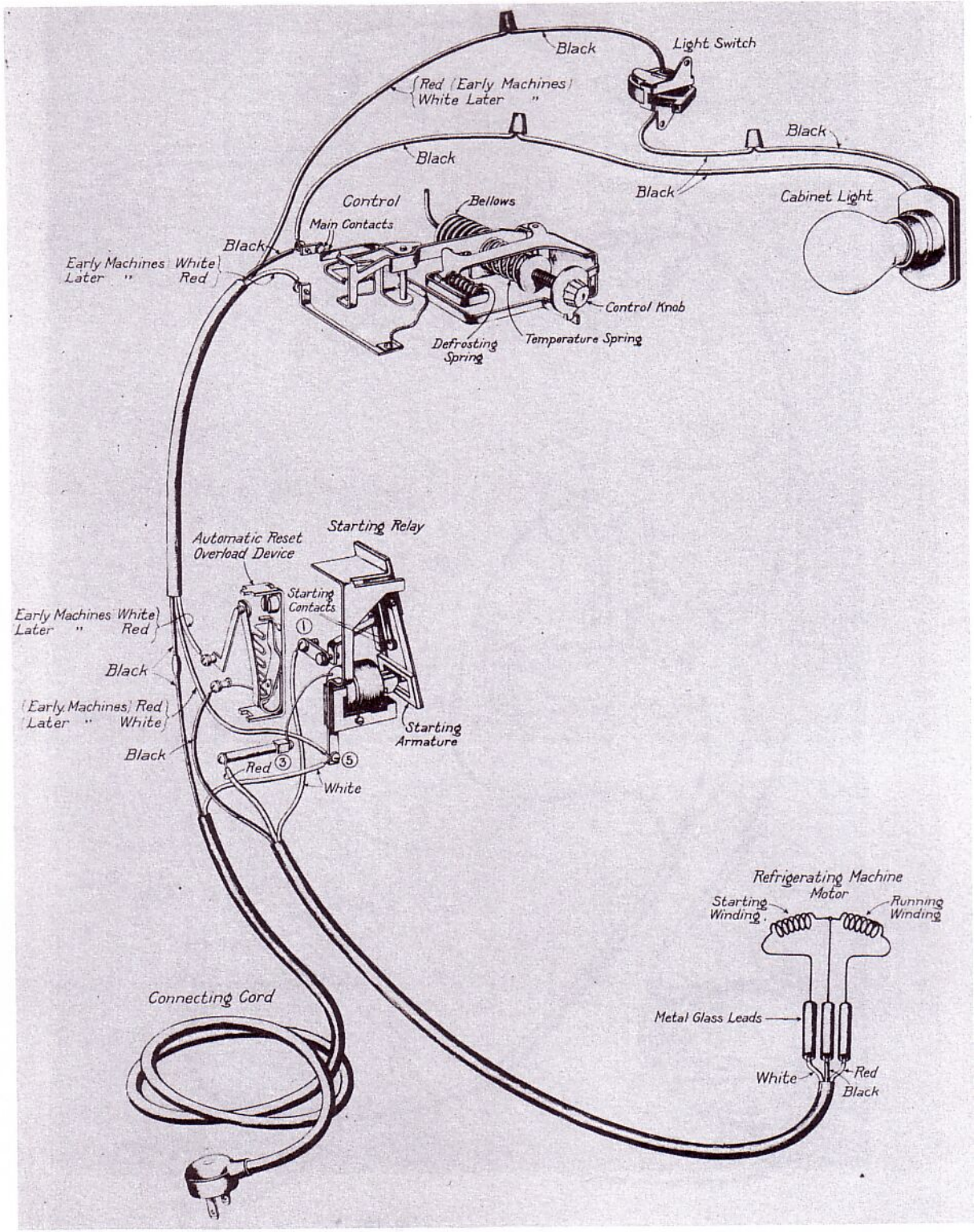


Fig. 161
Pictorial Connection Diagram
Machines: CF-1E with N Relay
CF-2E with N Relay
CF-28A with N Relay
CJ-1B with N Relay

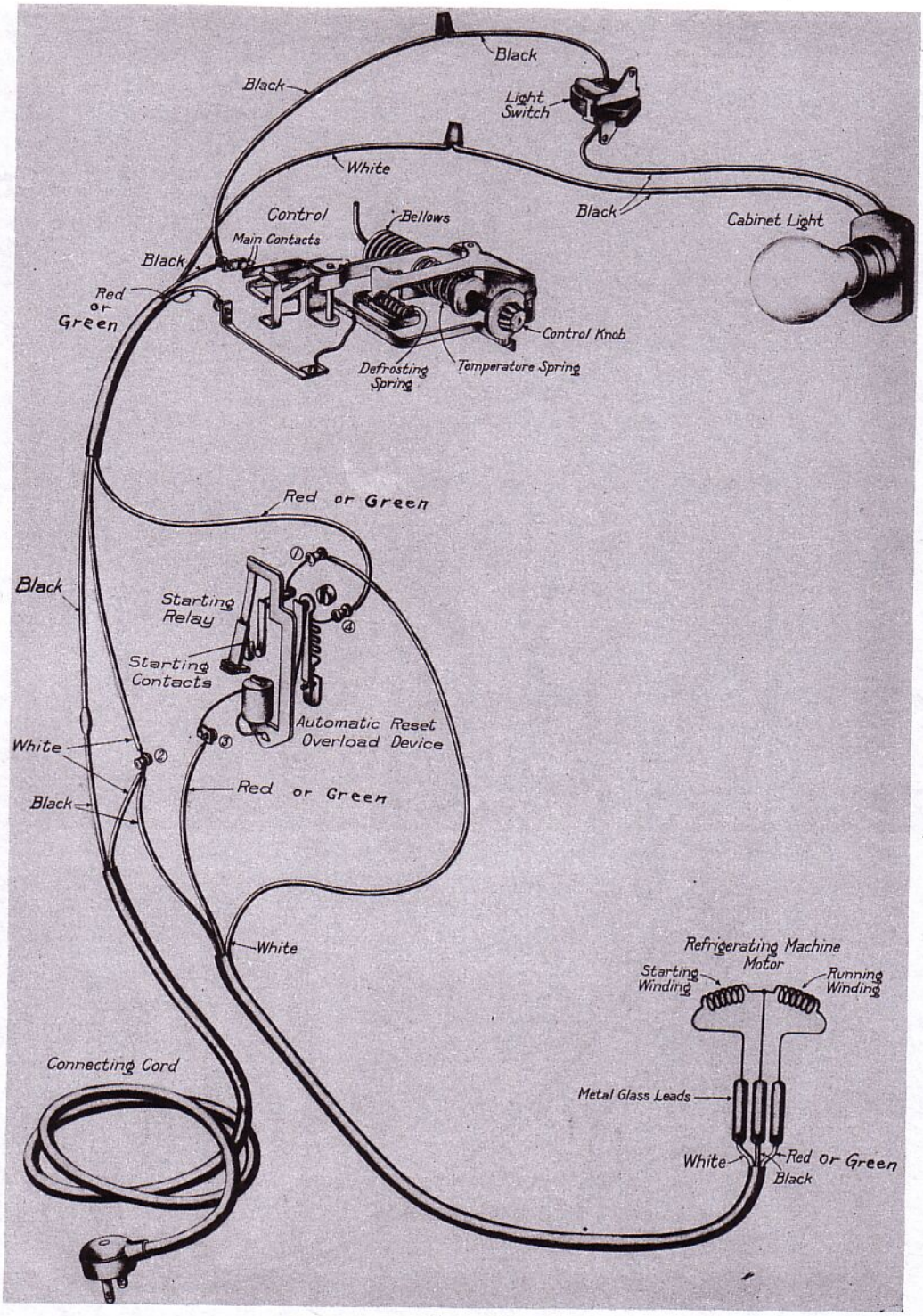


Fig. 162

Pictorial Connection Diagram

Machines: CF-1E with R Relay, CF-1F, G, and H
CF-2E with R Relay, CF-2F, G, H, J, M, N, and R
CF-28A with R Relay, CF-28B, C, D, E, and H
CJ-1B with R Relay, CJ-1C, D, and E
CJ-2A, B, C, D, E, and H
FBA-1A

Exception: CF-28-D12, E12, and H12 25-cycle machines have a capacitor in series with the starting winding of the motor; the white compressor lead is connected to the black capacitor lead and the white capacitor lead is connected to relay terminal 1.

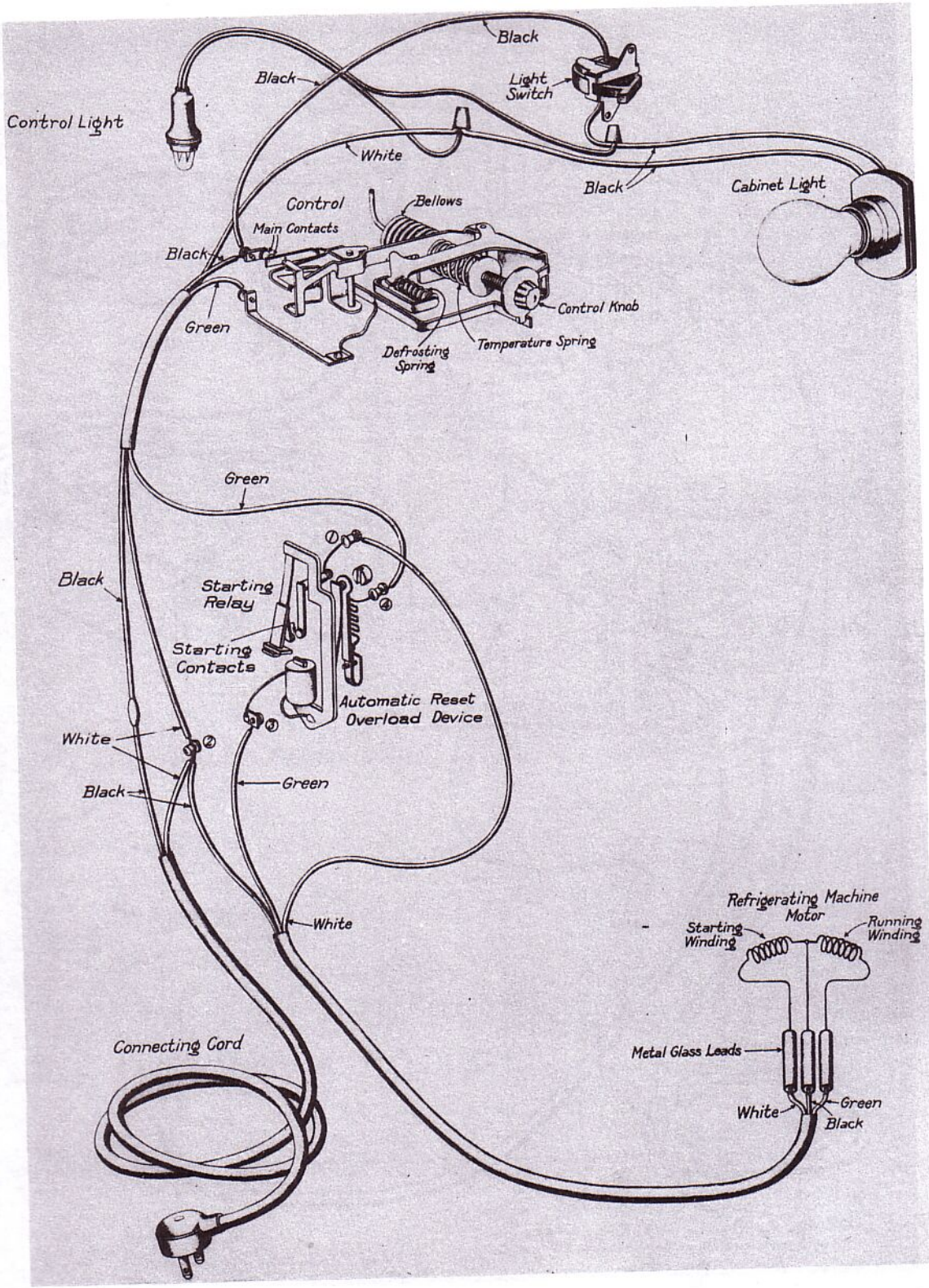


Fig. 163
Pictorial Connection Diagram
Machines: CF-11A
CF-21A
CF-22A and CF-22B

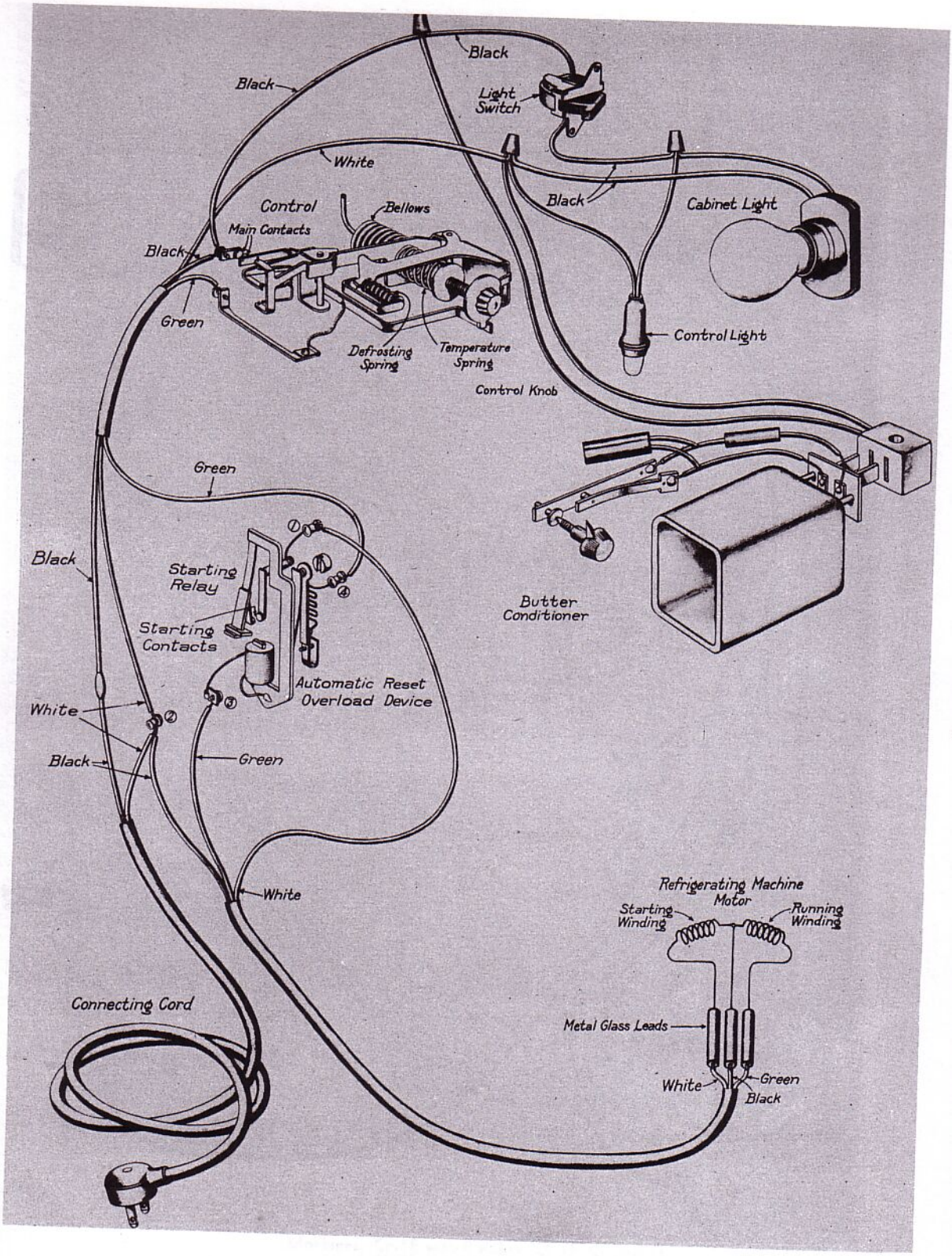


Fig. 164
Pictorial Connection Diagram
Machines: CF-22C and CF-22G

Exception: CF-22G machines have no control light. They have a different style butter conditioner which is directly connected instead of having a plug and socket.

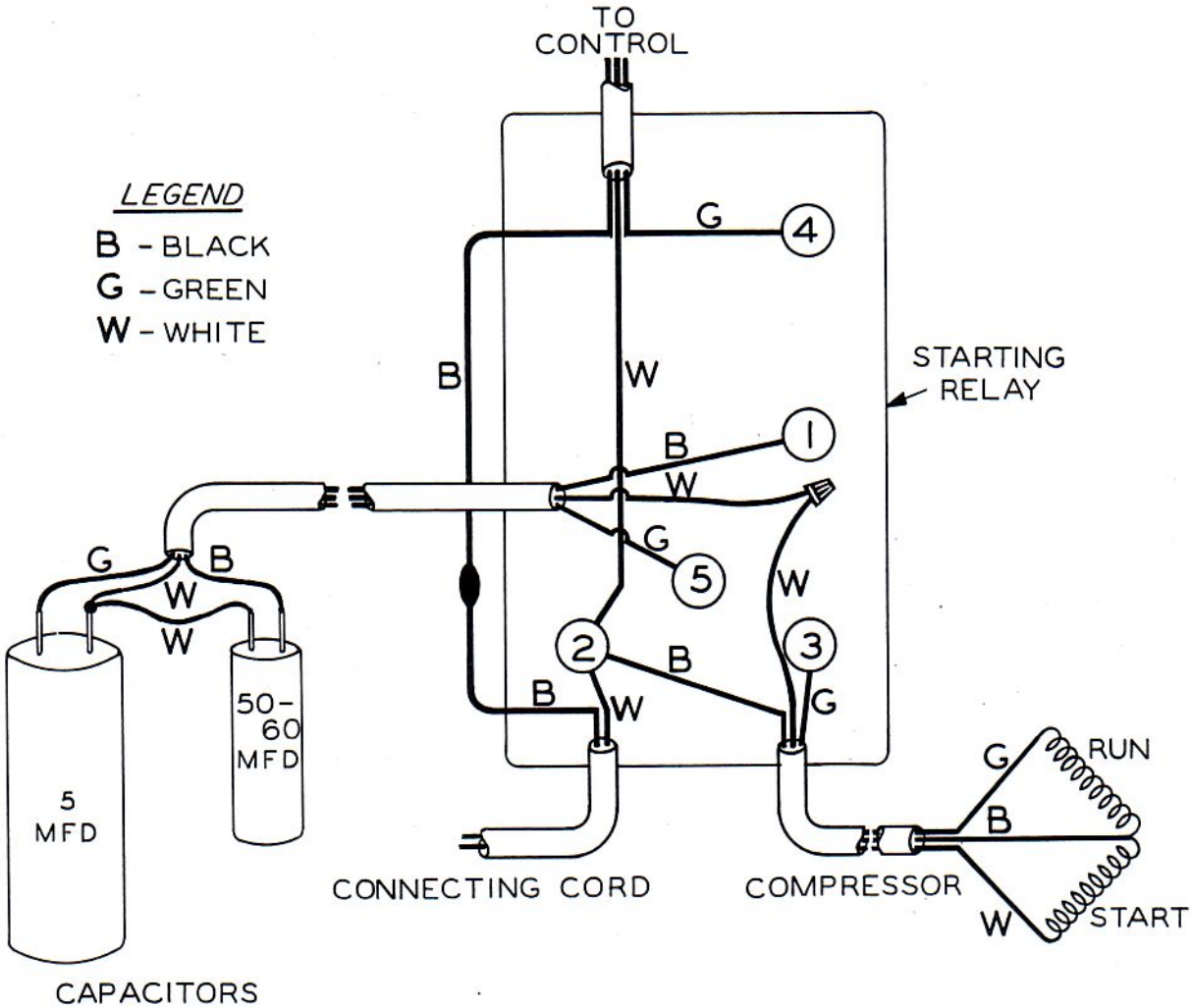


Fig. 165
Connection Diagram for CFS-1A Machines

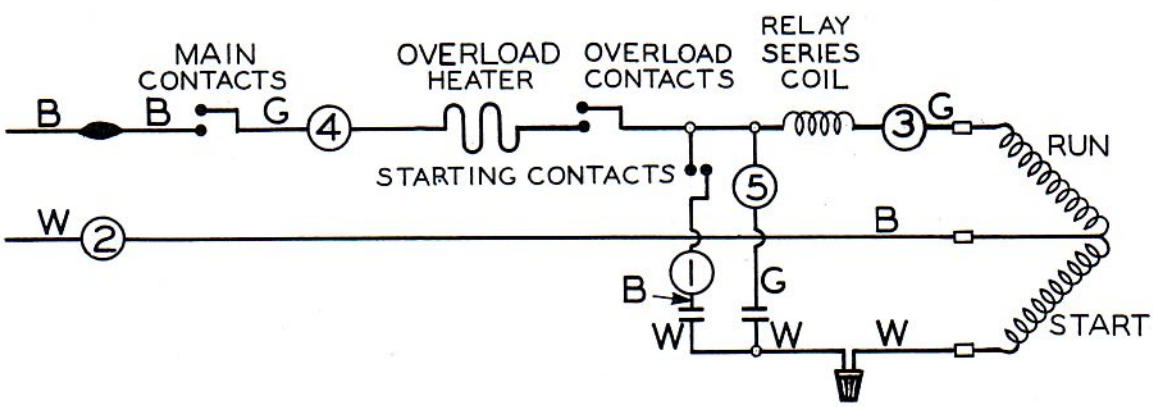


Fig. 165-A
Schematic Wiring Diagram for CFS-1A Machines

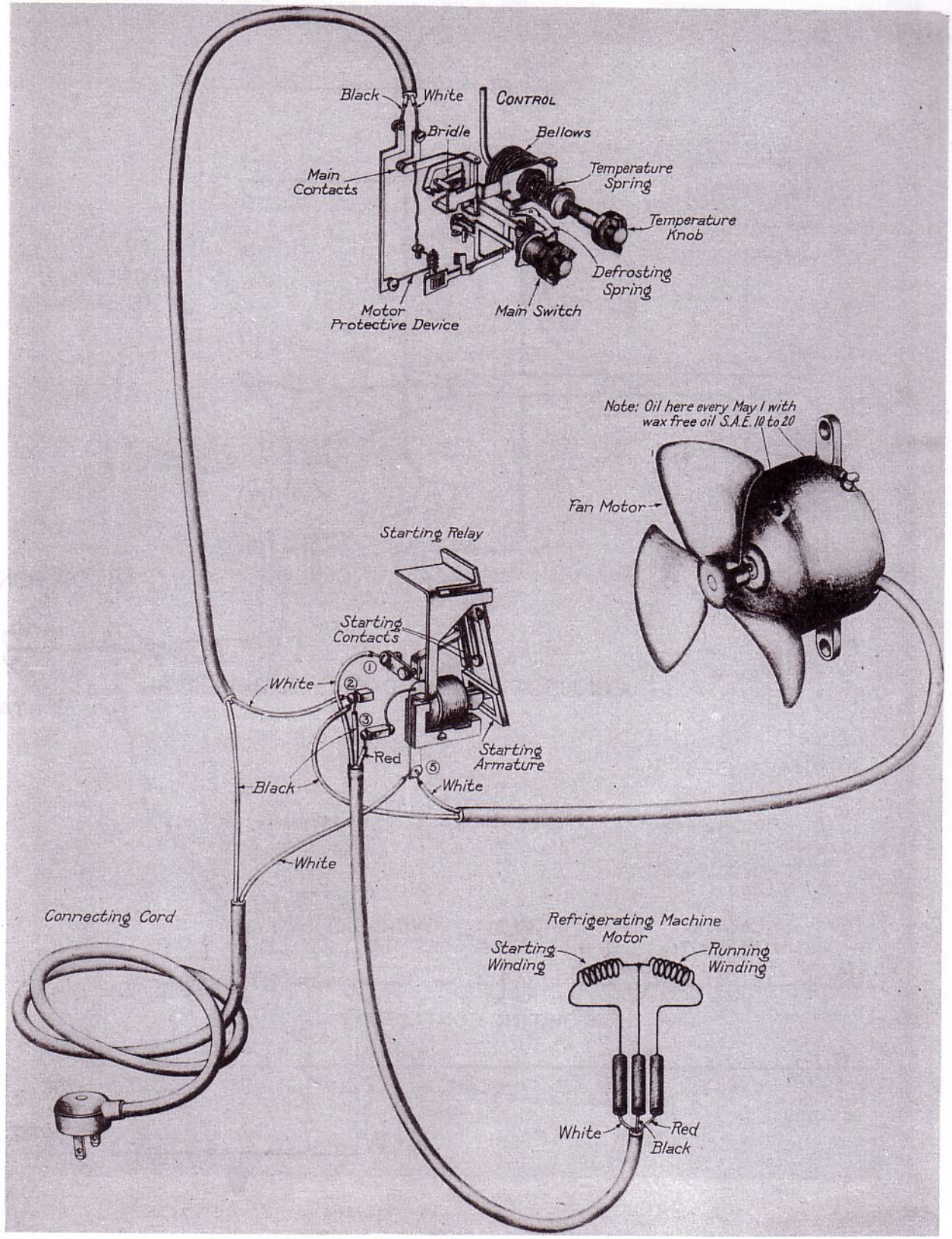


Fig. 166
Pictorial Connection Diagram for CH-1A Machine

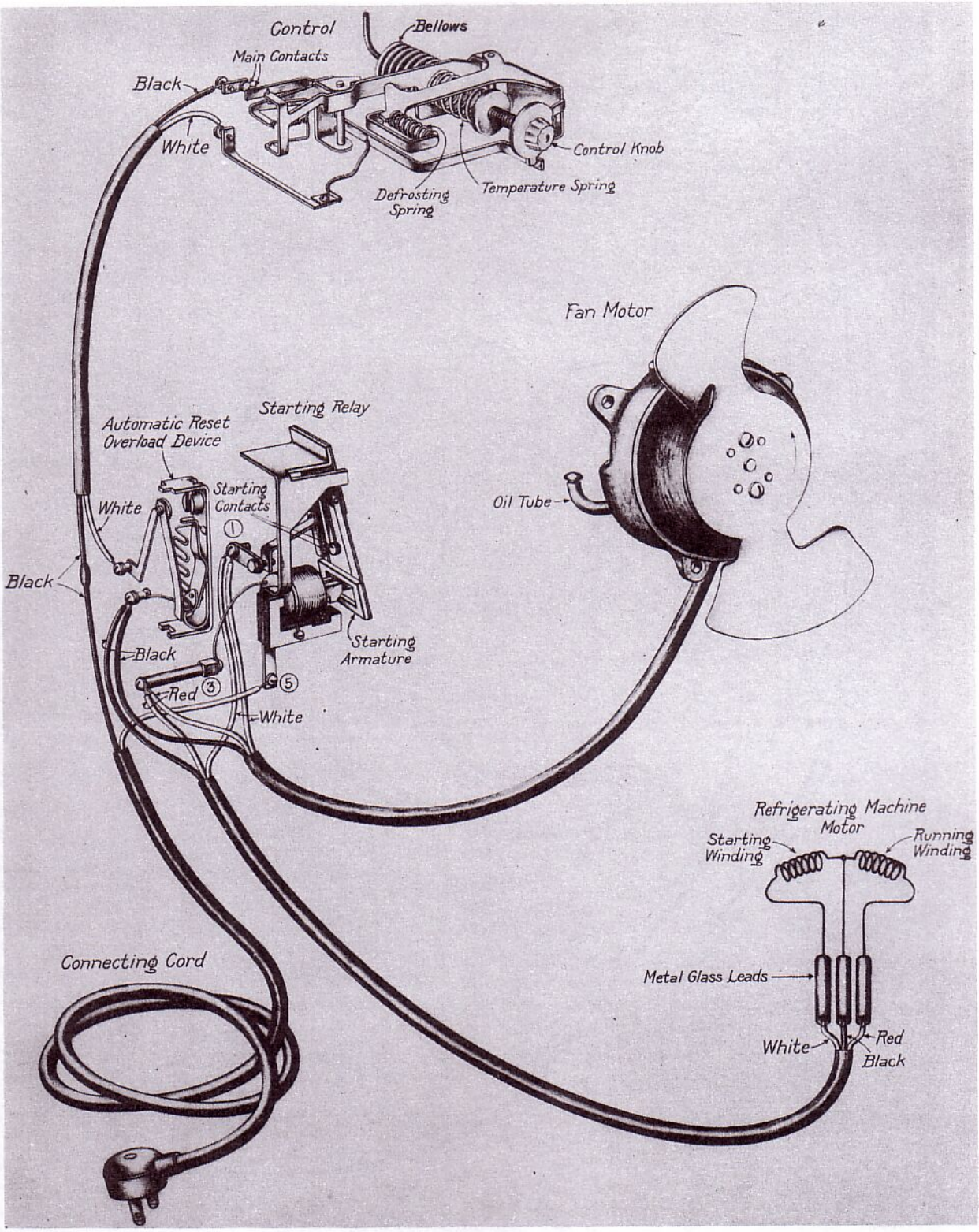


Fig. 167
Pictorial Connection Diagram for CH-1B Machines with N Relay

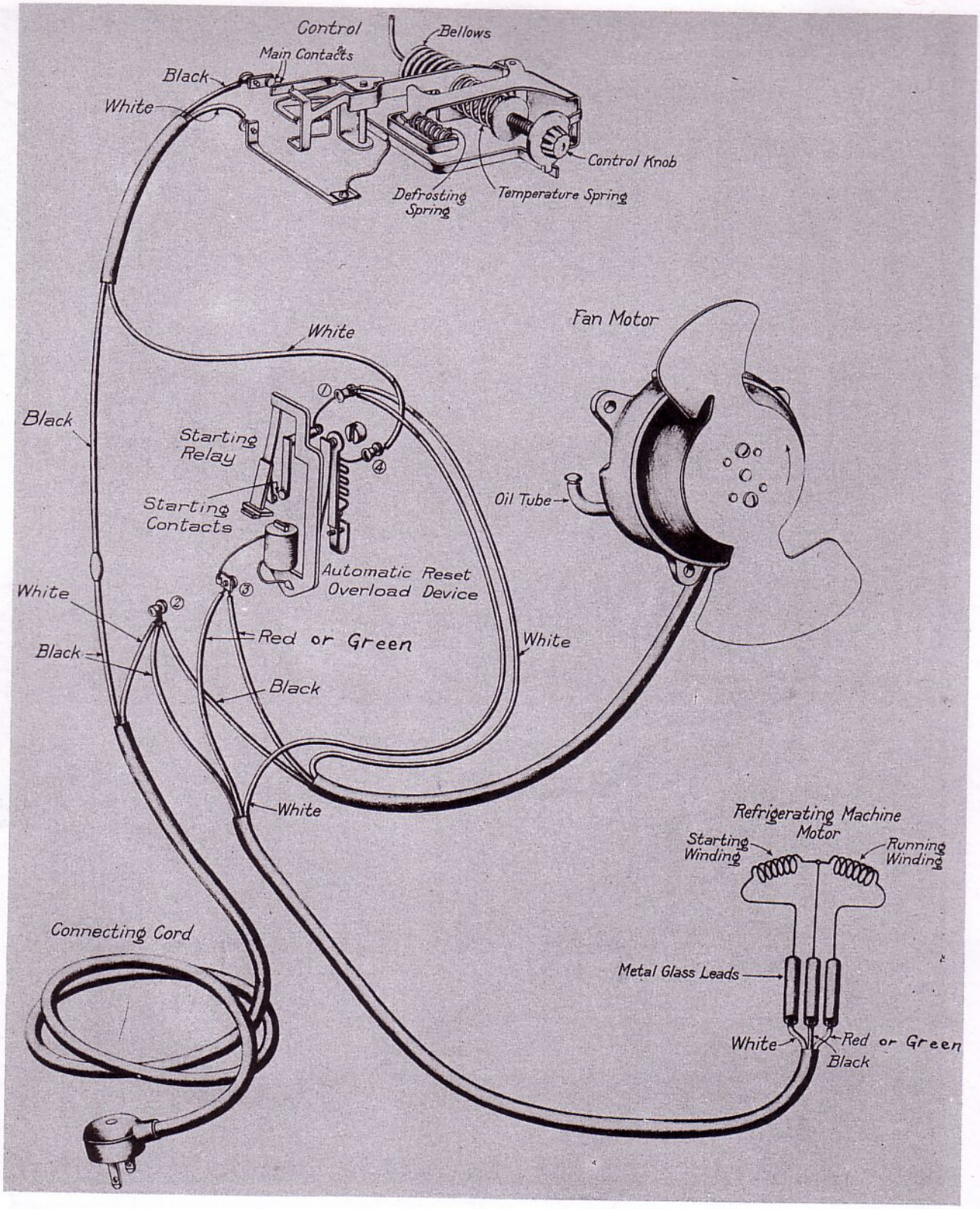


Fig. 168
Pictorial Connection Diagram
Machines: CH-1B with R Relay
CH-1C, CH-1D, and CH-1E

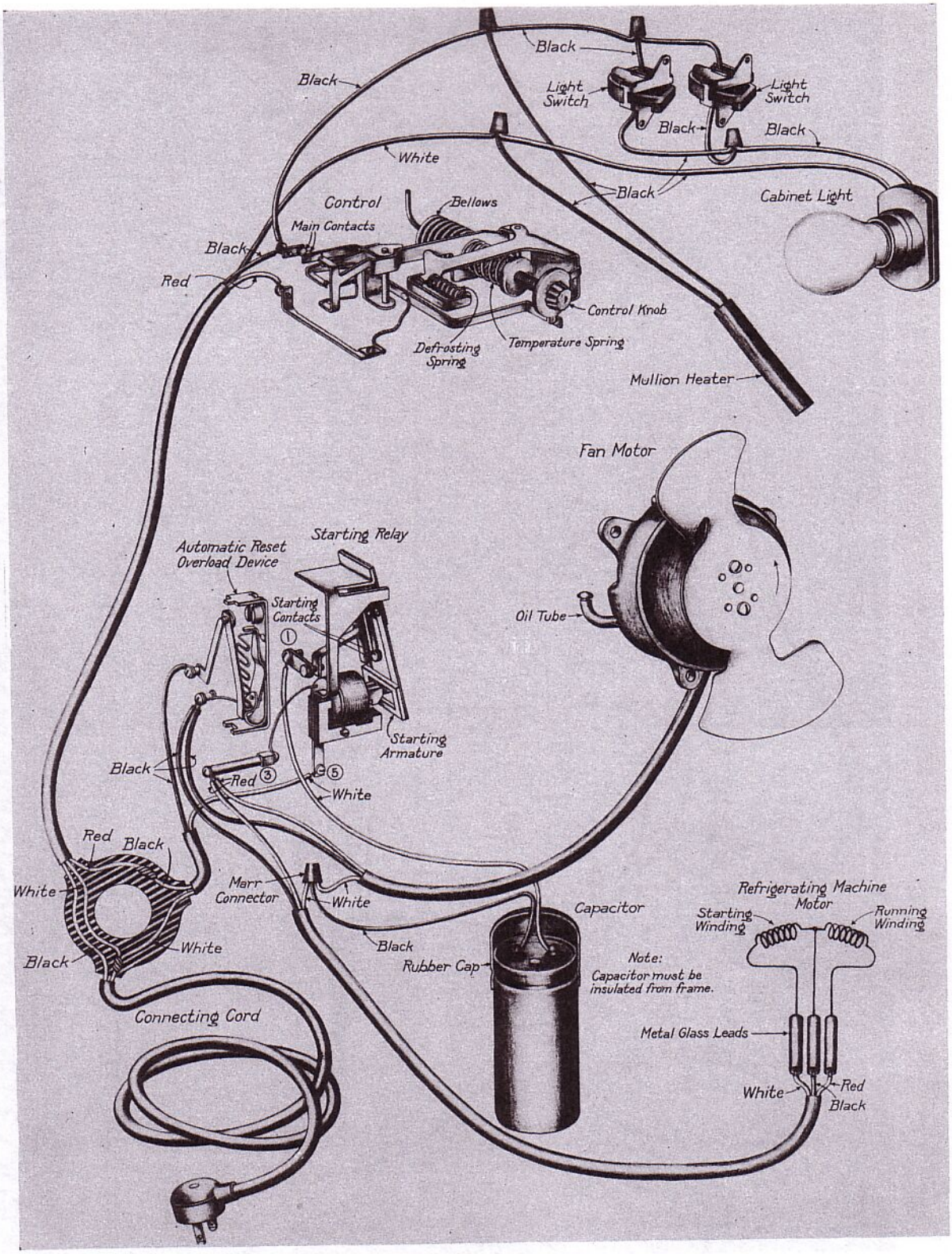


Fig. 169
Pictorial Connection Diagram
Machines: CE-34A with N Relay
CE-340A with N Relay
Exception: CE-340 Machines have Two-knob Controls

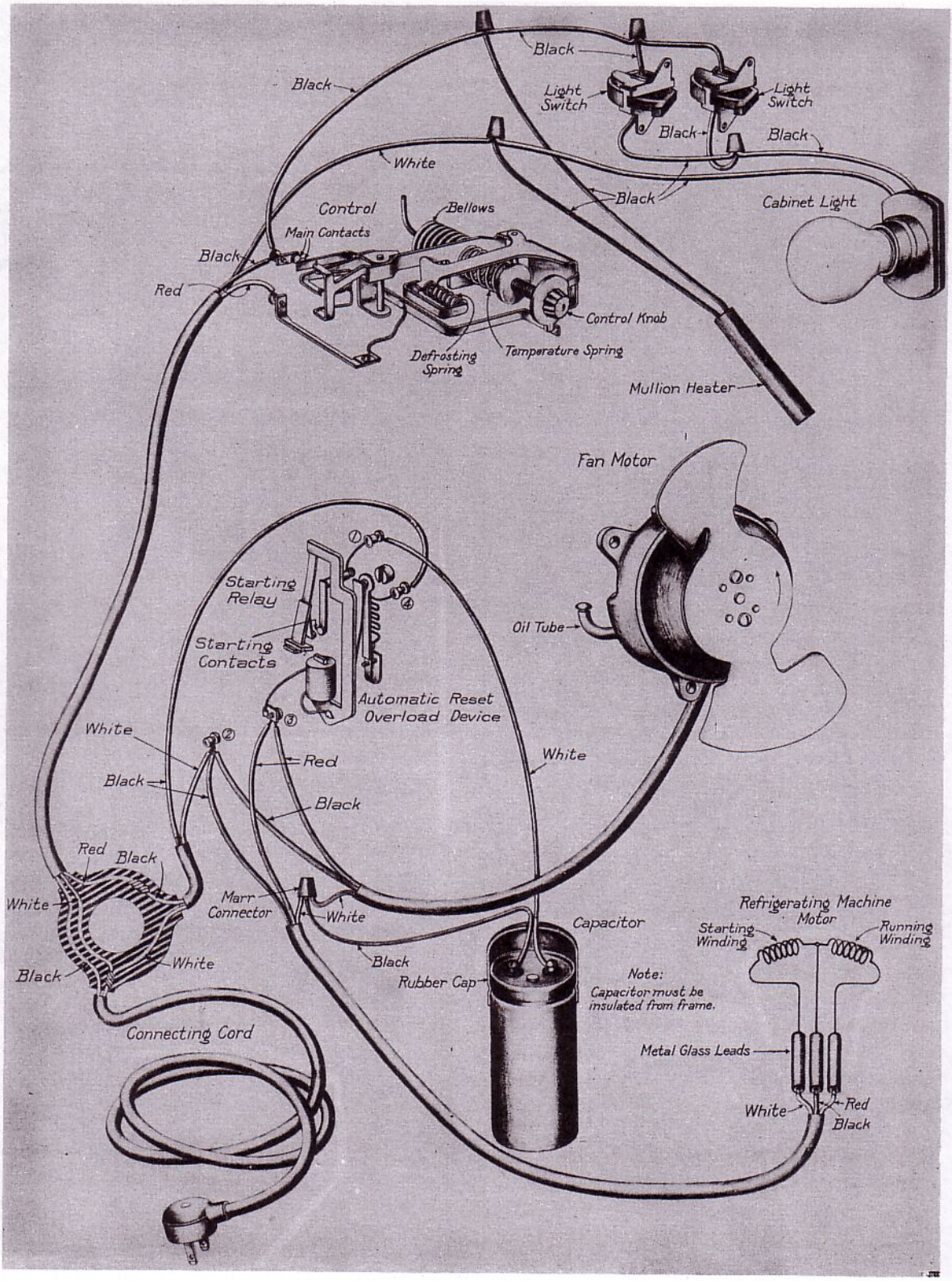


Fig. 170
Pictorial Connection Diagram
Machines: CE-34A with R Relay
CE-340A with R Relay
Exception: CE-340 Machines have Two-knob Controls

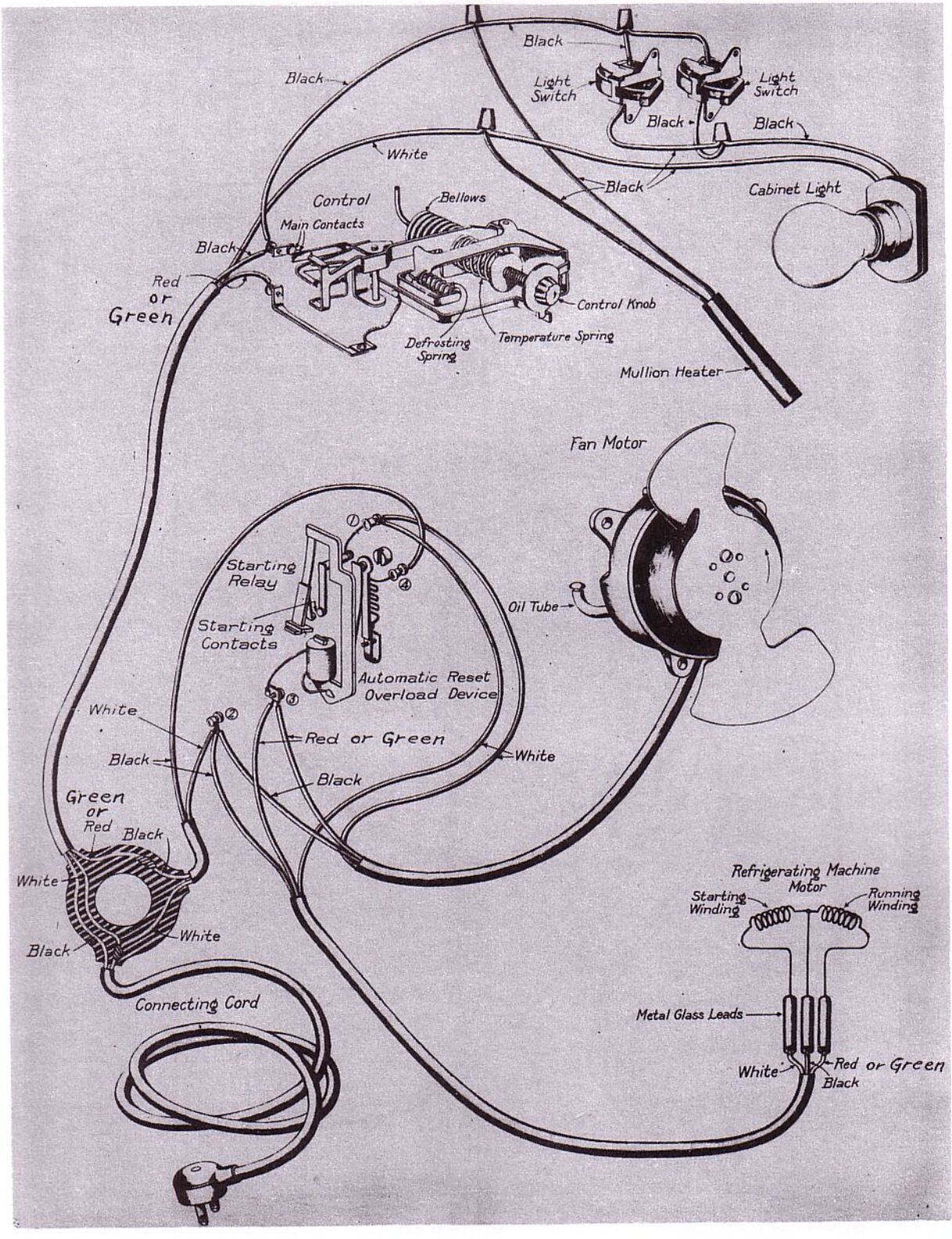


Fig. 171
Pictorial Connection Diagram
Machines: CE-34B
CE-340B and CE-340C
Exception: CE-340 Machines have Two-knob Controls

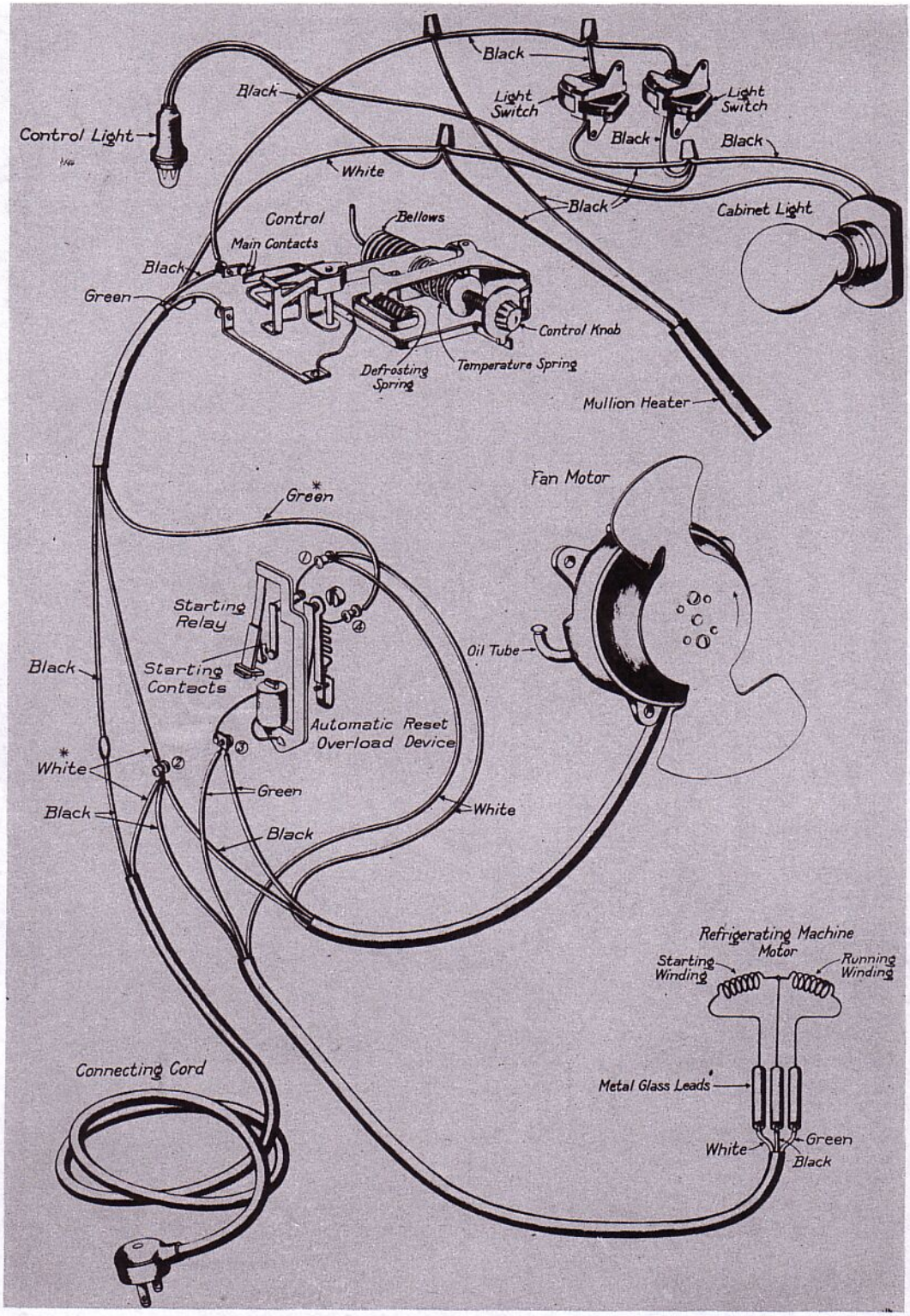


Fig. 172

Pictorial Connection Diagram for CE-34C, D, E and H Machines

Exceptions: 1. Early production CE-34C machines have these alternate connections—Green lead from cabinet top to relay terminal 2, white lead from cabinet top to relay terminal 4, and white lead from connecting cord to relay terminal 4.

2. CE-34C and CE-34H machines have no control light.

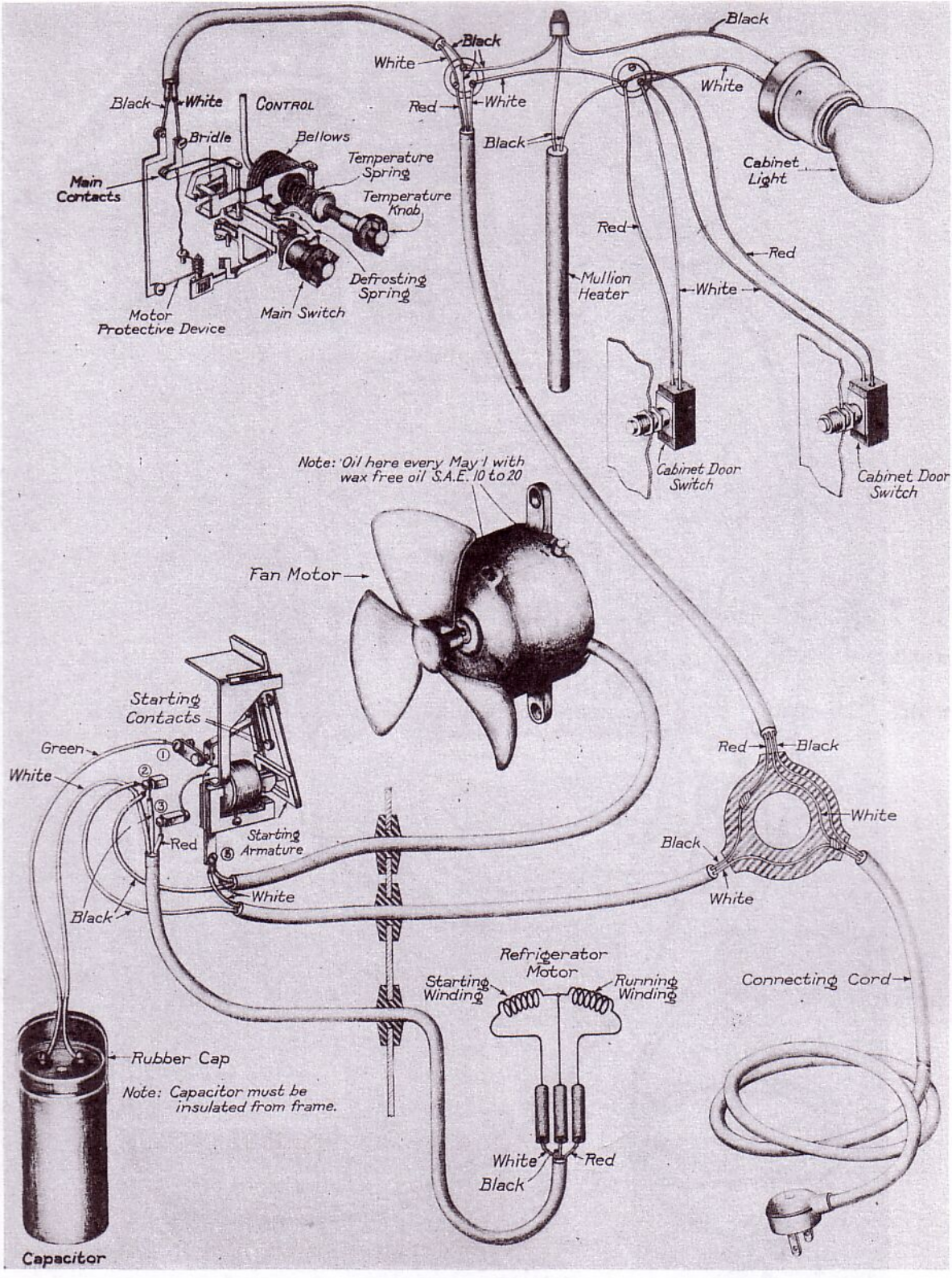


Fig. 173
Pictorial Connection Diagram for CE-34M Machines

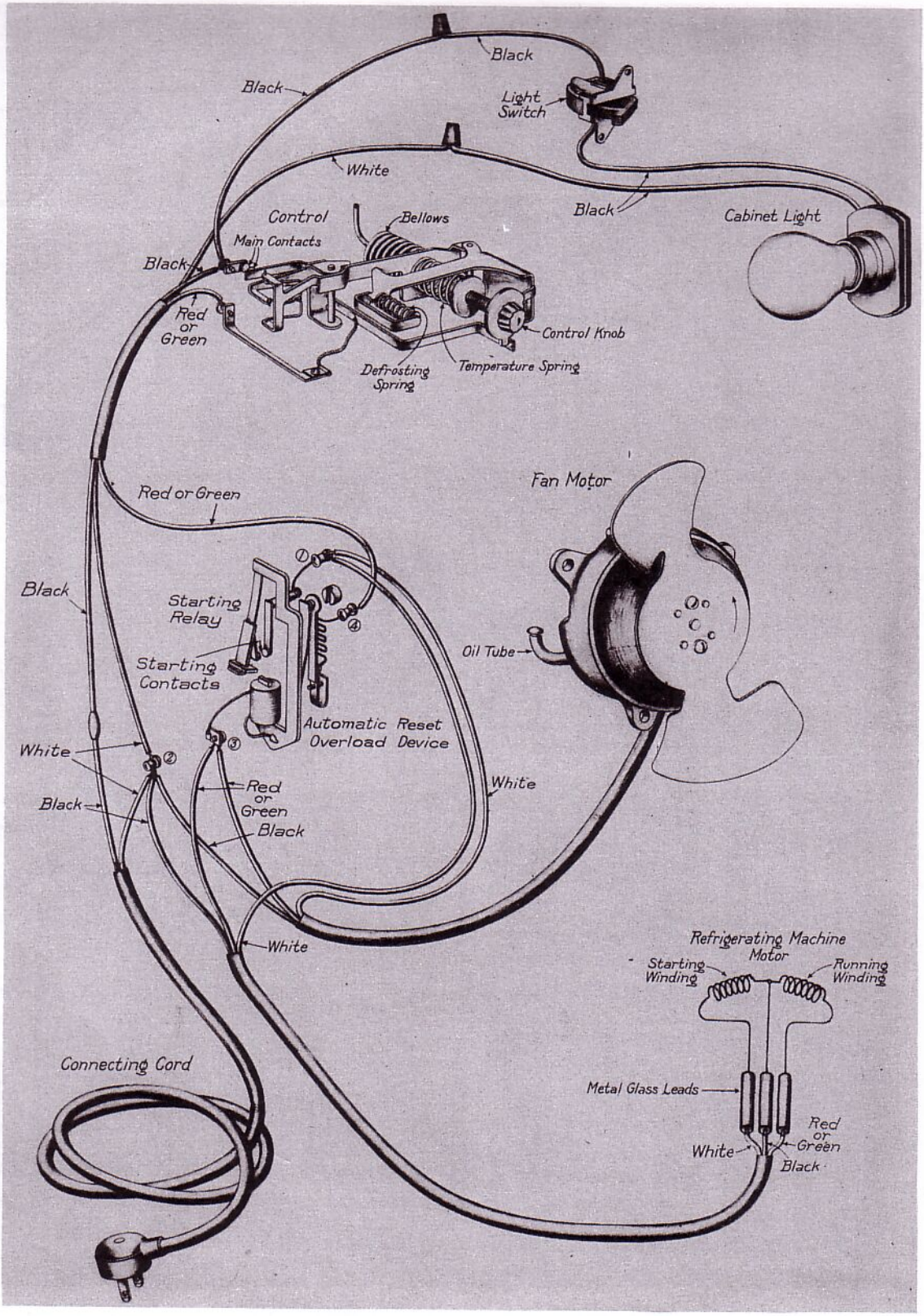


Fig. 174
Pictorial Connection Diagram for CE-140 Machines

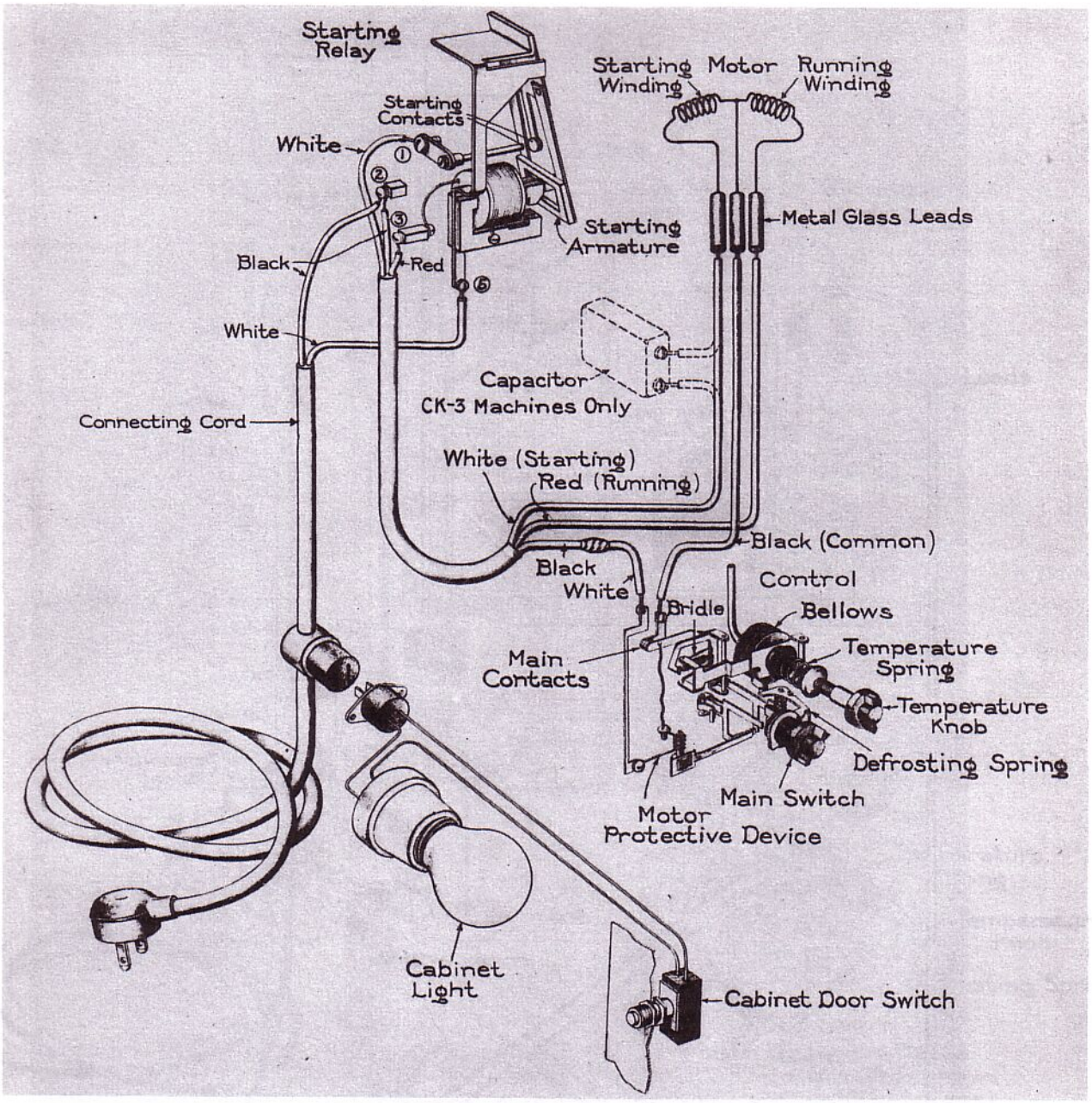


Fig. 175

Pictorial Connection Diagram

Machines: CK-1B, C, and D with E Relay
CK-2B, C, and D with E Relay
CK-15A
CK-26A and B with E Relay
CK-28A and B
CK-30C, D, E, and G with E Relay
CK-35C, D, and E with E Relay
DK-1A

Exception: DK-1A Machines have no cabinet light.

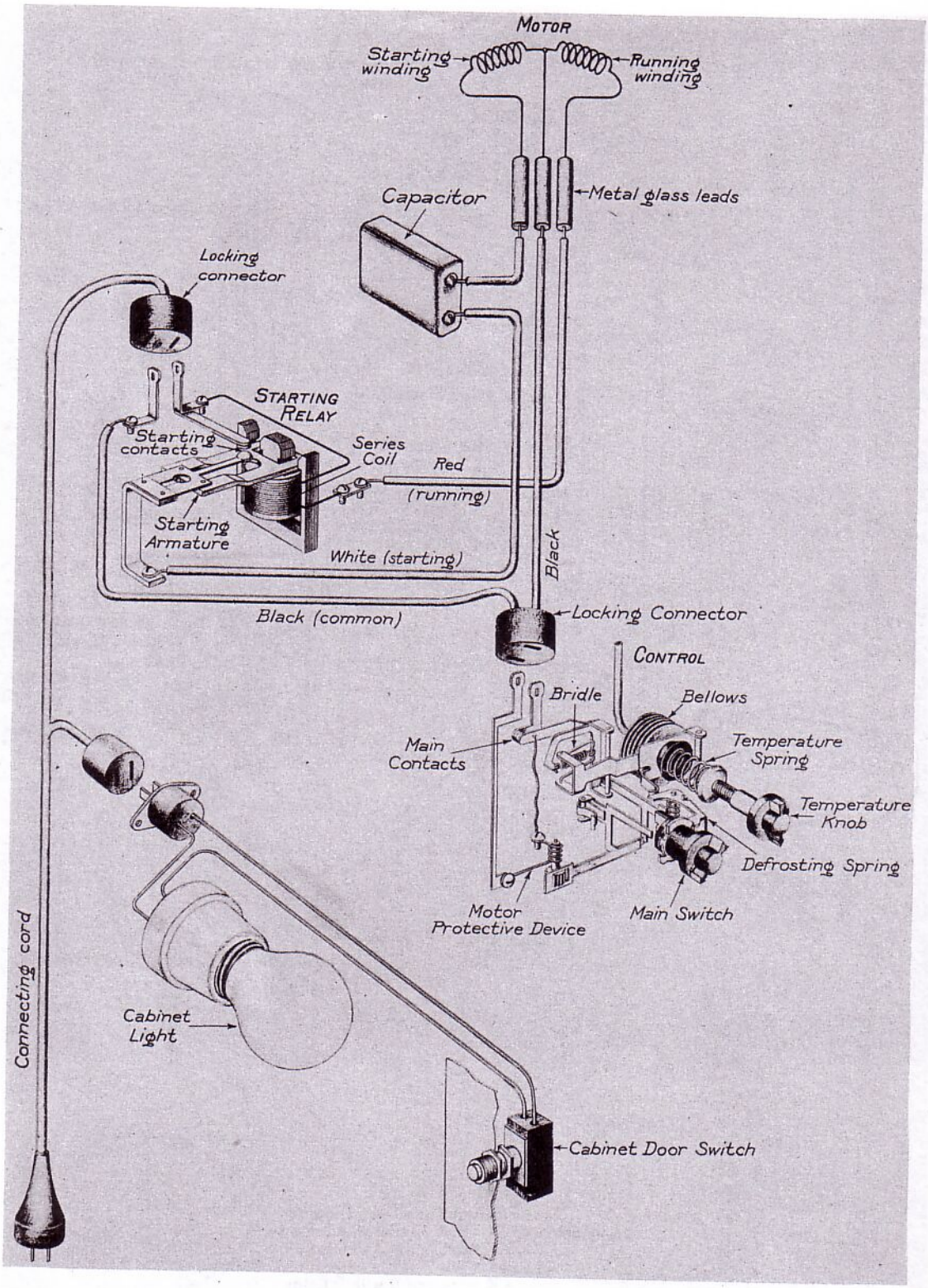


Fig. 176
Pictorial Connection Diagram for CK-30B and CK-35B Machines

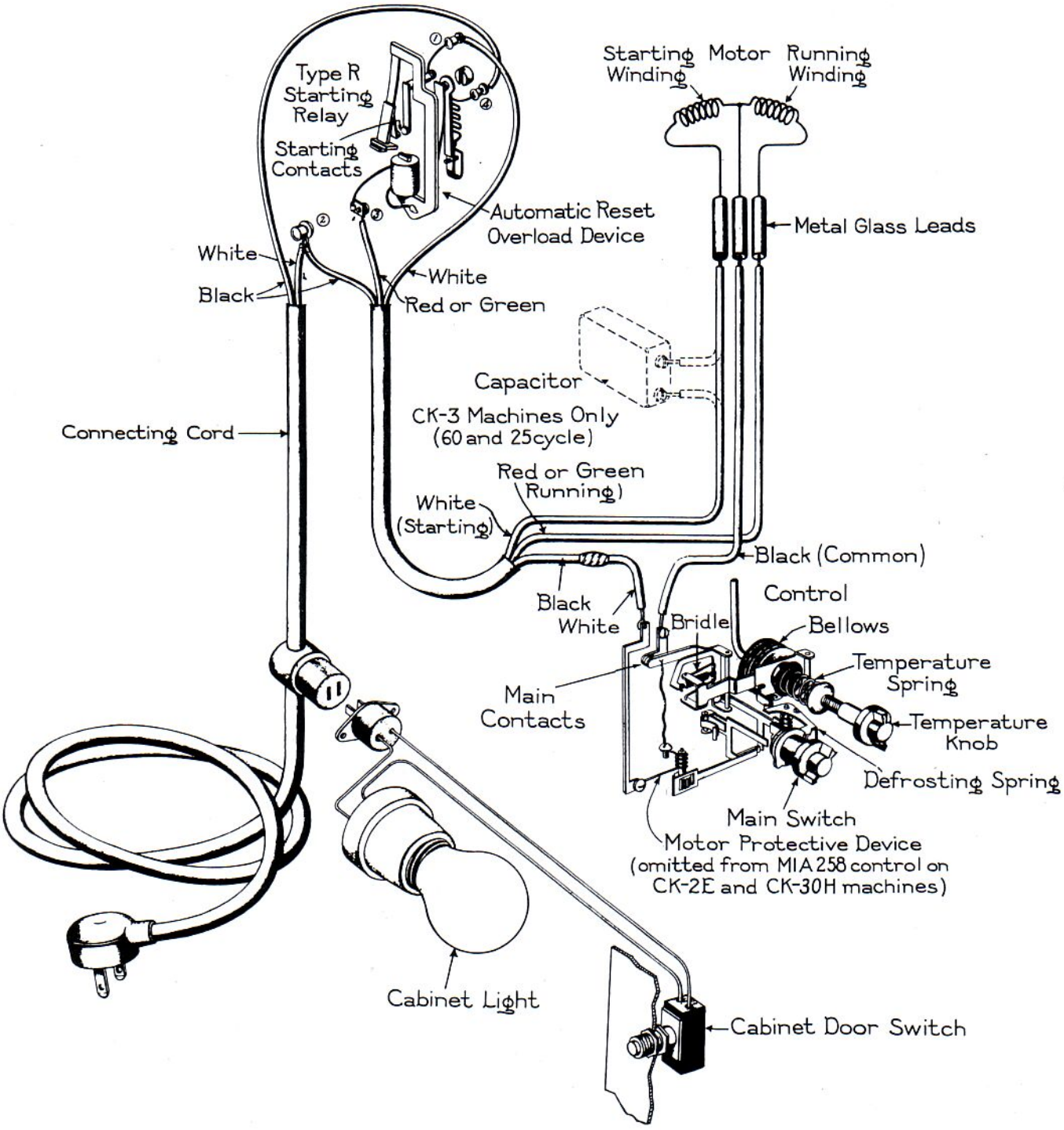


Fig. 177
Pictorial Connection Diagram
Machines: CK-1D with R Relay
CK-2D with R Relay and CK-2E
CK-26B with R Relay
CK-30E with R Relay and CK-30H
CK-35E with R Relay, CK-35G and H

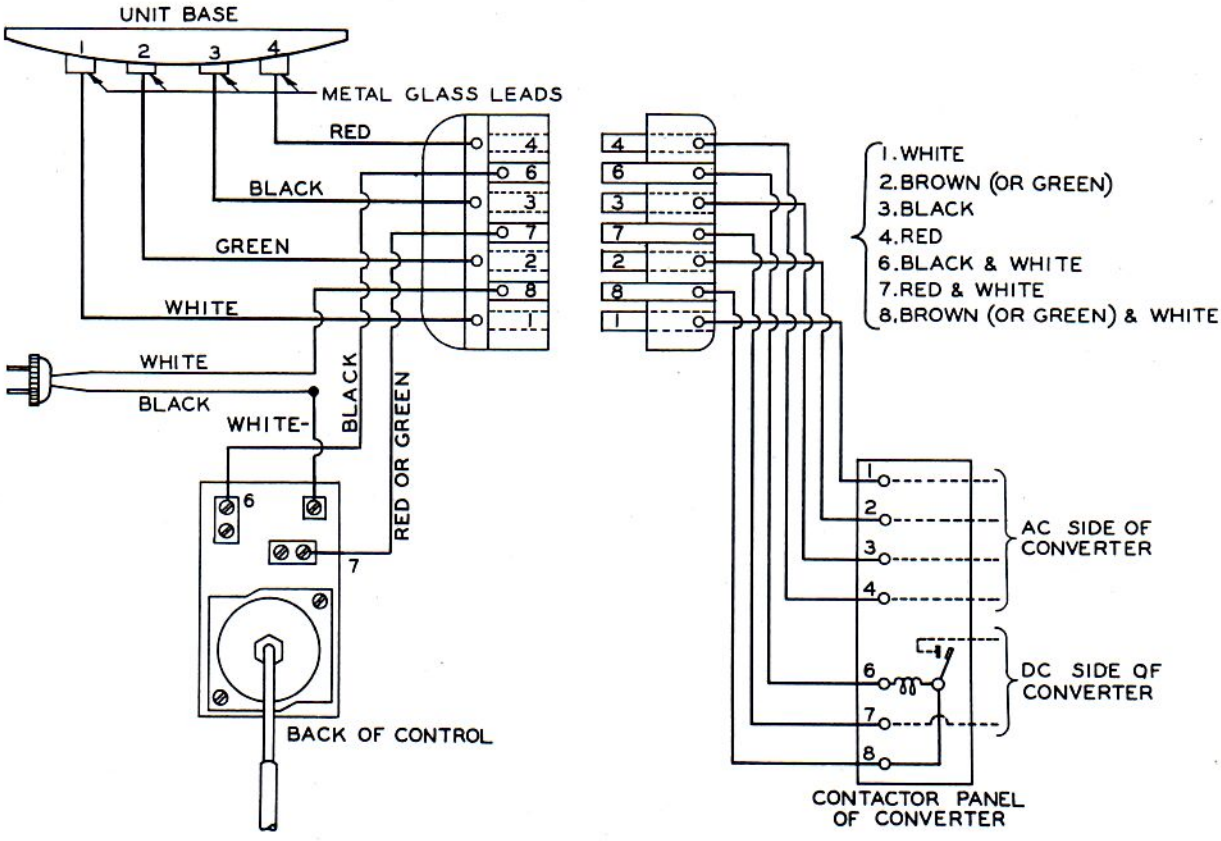


Fig. 178
Connection Diagram
Machines: CK-1C1 and CK-1C2 (Direct Current)
CK-2C1 and CK-2C2 (Direct Current)
CK-30D1 and CK-30D2 (Direct Current)
CK-35D1, DK-35E1, and CK-35E2 (Direct Current)

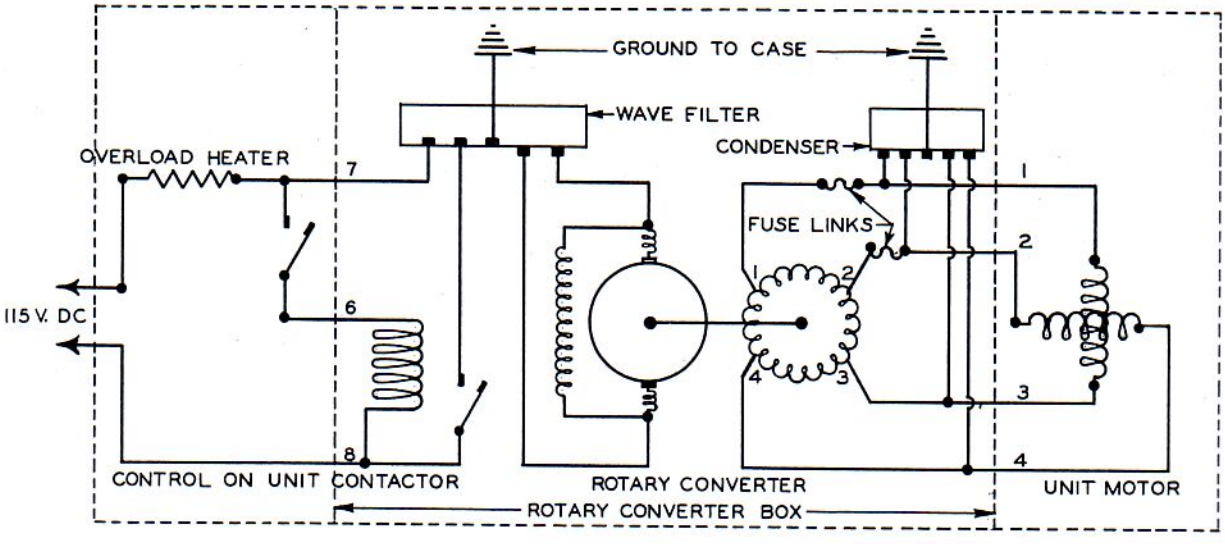


Fig. 179
Schematic Wiring Diagram
Machines: CK-1C1 and CK-1C2 (Direct Current)
CK-2C1 and CK-2C2 (Direct Current)
CK-30D1 and CK-30D2 (Direct Current)
CK-35D1, CK-35E1, and CK-35E2 (Direct Current)

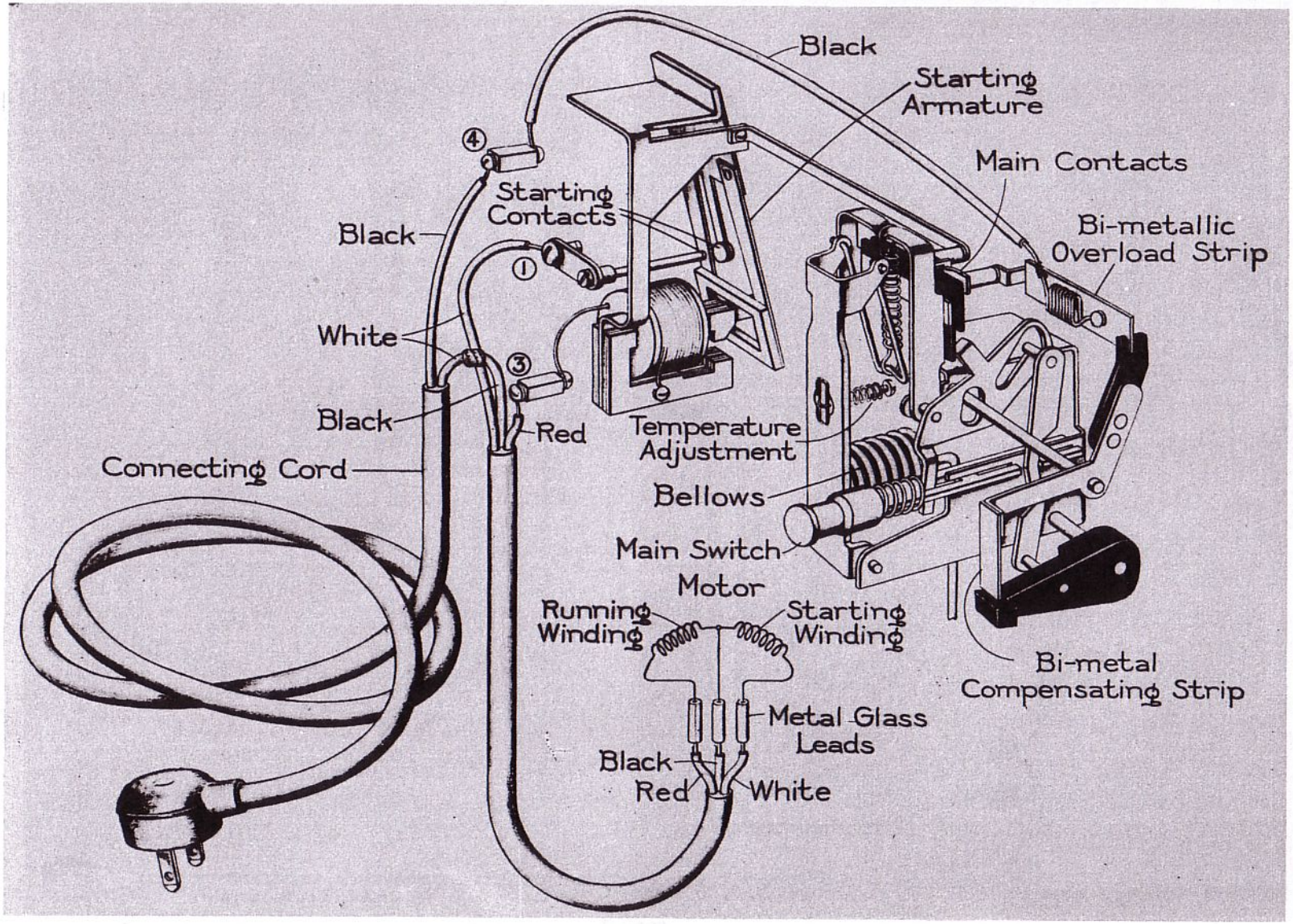


Fig. 180
Pictorial Connection Diagram for CG-1 Machines
Exception: Some CG-1B Machines Have a Cabinet Light Circuit

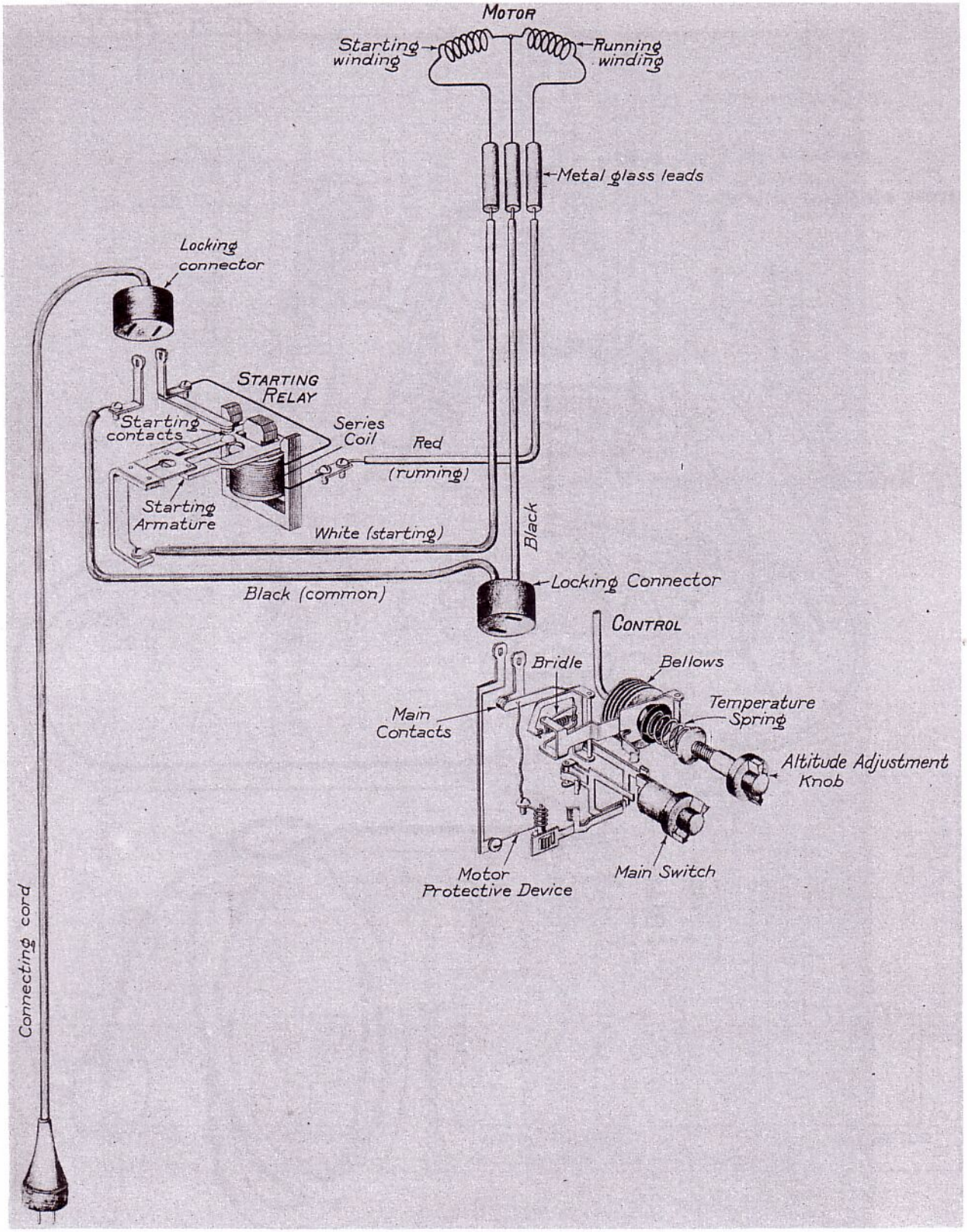


Fig. 181
Pictorial Connection Diagram for LK-1A Machines

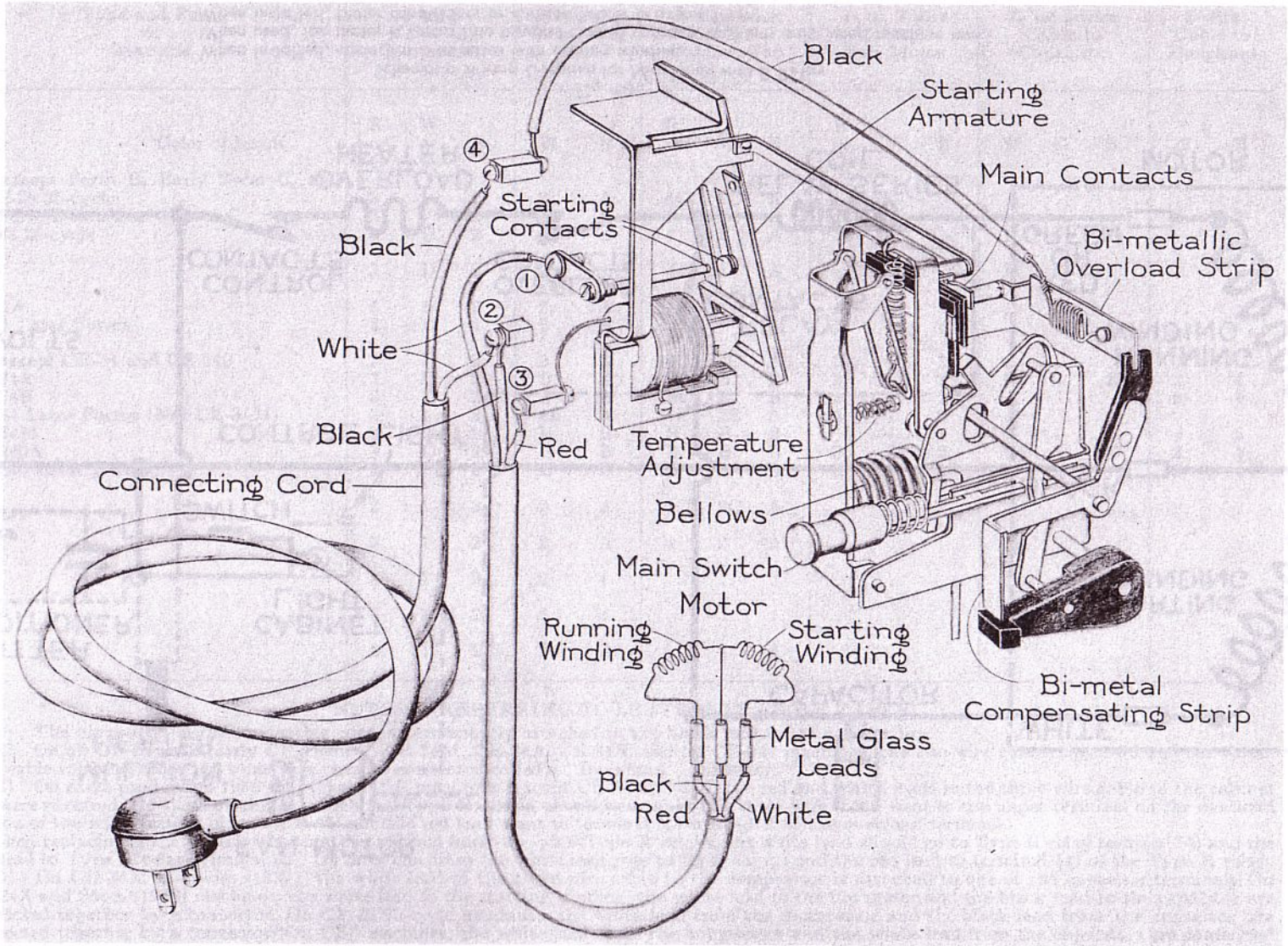


Fig. 182
Pictorial Connection Diagram for LK-1B and LK-2 Machines

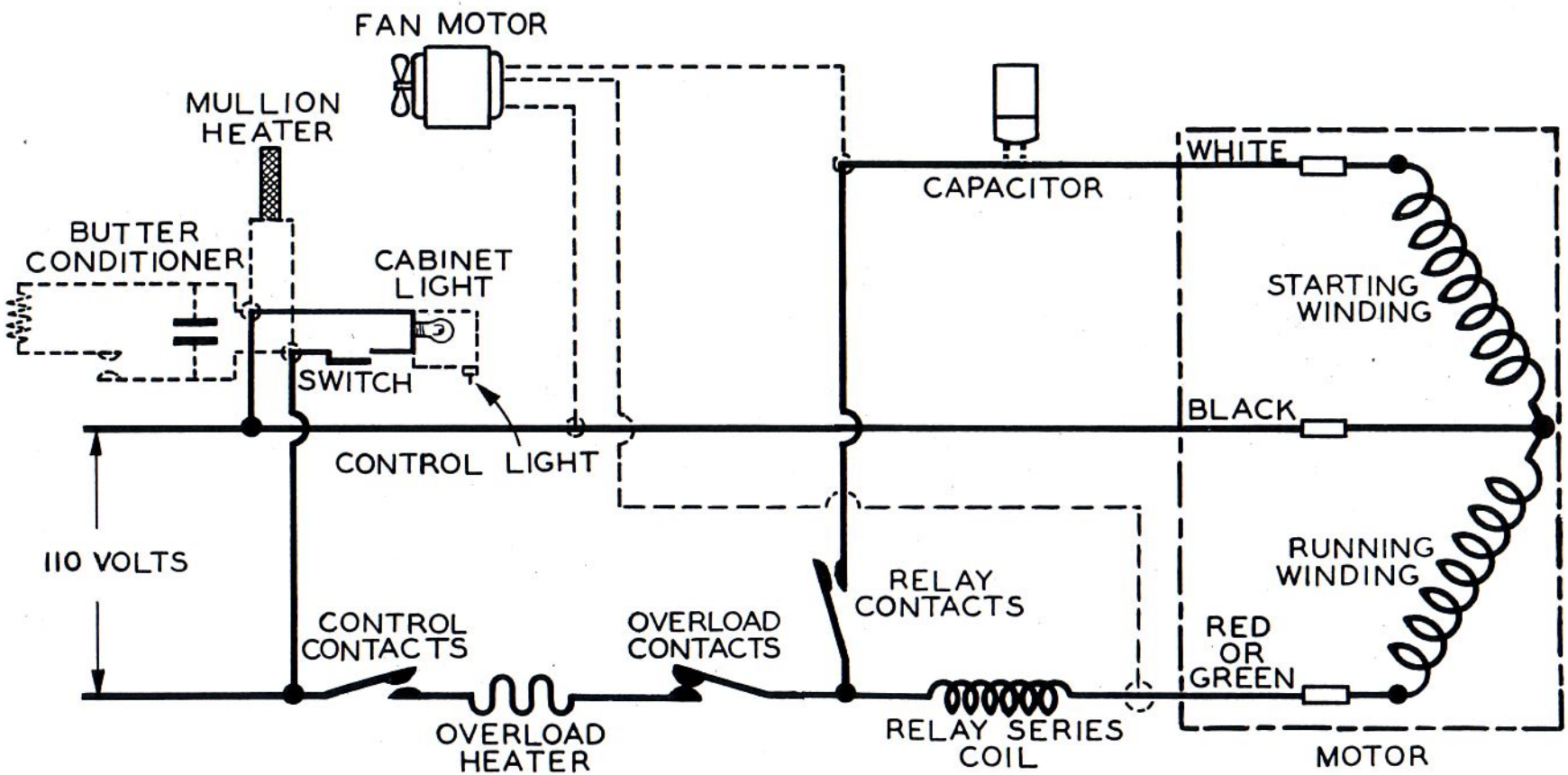


Fig. 183
Schematic Wiring Diagram for Machines with R Relay
When installed, capacitor is in series with starting winding.
When used, fan motor is across line beyond control contacts and runs only when machine runs.
When installed, butter conditioner or mullion heater is across line.

CR-1057 TYPE R STARTING RELAYS

WIRING CONNECTIONS—SCOTCH-YOKE REFRIGERATING MACHINES

Type and Form of Machine	3-wire Cable to Compressor			2-wire Connecting Cord		3- or 2-wire Cable to Cabinet Top			3- or 2-wire Cable to Fan Motor			3- or 2-wire Cable to Capacitor			2-wire Cable to Doughnut	
*Color of Leads	R or G	W or Y	B	W	B	R or G	W	B	R or G	W	B	W	G	B	W	B
CF **except** Form B, Early Form C, and CF-28 25-cycle	3	1	2	2	A	4C	2C	A	..	..	..	..	..	..	..	..
CF Form B and Early Form C	3	1	2	B	B	B	B	B	..	..	..	..	..	..	4	2
CF-28 25-cycle	3	D	2	2	A	4	2	A	..	..	..	1	..	D	..	..
CFS	3	D	2	2	A	4	2	A	..	..	..	D	5	1	..	..
CH-1A	3	1	2	2	A	..	4	A	..	4	2	..	..	..	..	..
CH-1 Later Forms	3	1	2	2	A	..	4	A	3	1	2	..	..	..	..	..
CE **except** CE-34 and CE-340	3	1	2	2	A	4C	2C	A	3	1	2	..	..	..	..	..
CE-34A	3	D	2	B	B	B	B	B	3	D	2	1	..	D	2	4
CE-34B	3	1	2	B	B	B	B	B	3	1	2	..	..	..	2	4
CE-34 Later Forms (Not CE-34M)	3	1	2	2E	A	4E	2E	A	3	1	2	..	..	..	..	..
CE-34M	3	D	2	B	B	B	B	B	..	4	2	..	1	..	4	2
CE-340A	3	D	2	B	B	B	B	B	3	D	2	1	..	D	2	4
CE-340 Later Forms	3	1	2	B	B	B	B	B	3	1	2	..	..	..	2	4
CJ	3	1	2	2	A	4C	2C	A	..	..	..	..	..	..	..	..
FBA	3	1	2	2	A	4	2	A	..	..	..	..	..	..	..	..
CK	3	1	2	2	4	..	..	..	..	..	..	..	..	..	..	..
DK	3	1	2	2	4	..	..	..	..	..	..	..	..	..	..	..
LK	3	1	2	2	A	..	4	A	..	..	..	..	..	..	..	..

NOTES: (REFERRING TO LETTERS IN ABOVE TABLE)

(A) The black lead of the connecting cord is permanently attached to the black lead to the cabinet top.

(B) On all CF Form B, early CF Form C, CE-34M, CE-34A, CE-34B, and all CE-340 machines, the two-wire connecting cord and the three-wire cable to the cabinet top come to a circular connector called a "Doughnut" connector.

(C) On early production 1938 CF, CJ and CE machines (except CE-34 and 340) the red and white leads in the three-wire cable to the cabinet top were reversed. On these machines, which had Type N relays, the white lead in this three-wire cable went to the upper terminal on the overload section of the relay instead of terminal (5) and the red lead went to terminal (5) instead of to the overload terminal.

When replacing Type N relays having this original hook-up, with Type R relays, the white lead should go to Type R relay terminal (4) and the red lead to Type R relay terminal (2). On later machines the white lead goes to terminal (2) and the red lead to terminal (4) of the Type R relay.

(D) On CE-34M machines (1937), the white lead of the three-wire cable to the compressor is attached to one of the capacitor terminals. On CE-34A and 340A (1938) machines, the white lead to the starting winding, the white lead to the fan motor and the black lead to the capacitor are connected together by a connector. On CF-28 25-cycle machines, the white lead from the compressor and the black lead from the capacitor are connected together by a connector. On CFS machines, the white lead from the compressor and the white lead from the capacitors are connected together by a connector.

(E) Early CE-34C machines were wired with the white lead of the cabinet top cable going to terminal (4), the green lead from the cable to terminal (2) and the white connecting cord lead to terminal (4). Later production machines were wired as indicated in the table and replacement relays can be wired either way.

*Color Code: R—Red Lead W—White Lead B—Black Lead G—Green Lead Y—Yellow Lead

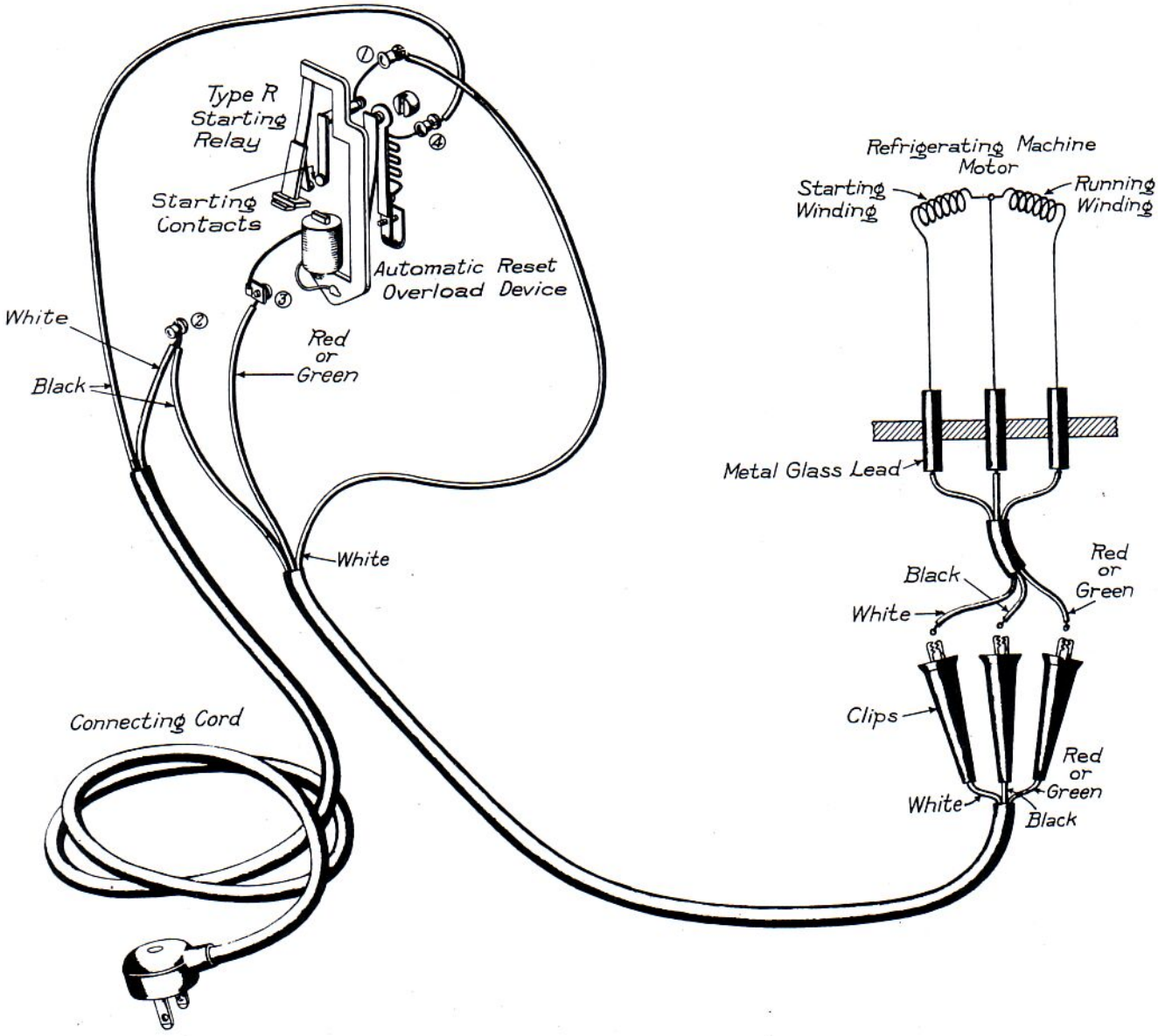


Fig. 184
Pictorial Connection Diagram
Test Set for Flatop Machines

COMPLAINTS AND MACHINE ADJUSTMENTS

NORMAL OPERATION

In order to determine whether a machine requires adjusting, it is essential that its operating characteristics under normal and abnormal conditions be understood and taken into account. There is some difference in the performance of the various models under the same normal conditions, and there is some change in the operation of any machine if the operating conditions are abnormal.

Since the great majority of refrigerators are installed in temperate climates where the average room temperature is generally between 70° and 80° F., these limits will be assumed to represent normal conditions. Much of the data will be given for such conditions. However, the capacity and adjustment of machines are such that their performance should be satisfactory in room temperatures as low as 60° F. and as high as 100° F.

For this manual, room temperatures which stay below 60° F. or above 100° F. for several hours at a time will be considered abnormal. Under such conditions, a machine may require some adjustment, such as turning the control knob warmer or colder to maintain the proper cabinet temperature.

CABINET AIR TEMPERATURE

For the proper preservation of food, the cabinet temperature should be maintained below 50° F. and above 32° F. The mid-position temperature limits of most machines are set to maintain the average cabinet air temperature around 38° to 42° F. in normal room temperatures. Some 1941 and all 1942 models hold the cabinet temperature between 35° and 37° F. under the same conditions.

Except under abnormal conditions, such as in room temperatures above 100° F., or under heavy load conditions, such as in high humidity weather, where the cabinet door is opened or left open excessively, or where an excessive amount of warm food is placed in the cabinet, the cabinet temperature should be maintained under 50° F.

Except for 1942 machines with enameled evaporators, the cabinet temperature should not get below 32° F. with the knob in mid-position until the room temperature goes below 60° F. for several hours. The 1942 machines are set colder than previous ones so that, with the knob in mid-position, the cabinet temperature may get down to or even below 32° F. in a 60° F. room.

On nearly all models, there is an external temperature adjustment whereby the user can change the cabinet air temperature within reasonable limits. On LK-1A machines, the temperature knob is on the back side of the cabinet where it is not accessible without moving the refrigerator. On other LK models, there is no external temperature adjustment. However, on LK machines, the method of controlling the evaporator and cabinet air temperatures is such that the latter varies relatively little within reasonable room temperature limits. On CG machines, there is no external temperature adjustment for the user but there is one that can be changed by a serviceman.

Except for 1941 CF-22C machines with the "Steady Cold" control and LK models, the cabinet air temperature tends to go up as the room temperature rises, and down as the room temperature drops. There is considerable lag in the change in the cabinet air temperature due to the cabinet insulation. The temperature within 1941 refrigerators with CF-22C machines changes very little within reasonable room temperatures because the method of control is such that the evaporator temperature limits are made to decrease as the room temperature goes up. A somewhat similar method of control is used on LK models but the cabinet air temperature is not held quite as constant.

Opening the cabinet door, especially when the weather is hot and humid, and placing warm foods or liquids in the refrigerator will raise the cabinet air temperature for a period of time. Frequent opening of the door during hot and humid periods will cause the temperature to remain several degrees warmer than normal.

Beginning with 1937 models, most standard and all deluxe refrigerators were equipped with "Thriftometers", a special thermometer with a safety zone band, 50° to 32° F., within which food would be properly preserved. These thermometers were attached to either a shelf or the cabinet door inner liner. Some small and some special models did not have this accessory. For refrigerators having them, these thermometers can be used as an indication of the cabinet air temperature, provided the cabinet door has not been opened much before the reading is made.

On a service call, the best and quickest way of determining the cabinet temperature is to place an accurate thermometer in some liquid that has been stored near the center of the cabinet for several hours. Let the thermometer stand in the liquid for at least five minutes with the cabinet door closed.

If the thermometer must be removed to read it, do so before the bulb is out of the liquid.

A thermometer can be hung in a refrigerator to get the air temperature. Before doing so, it should be ascertained that the door has not been opened much beforehand and that warm food has not been placed in the refrigerator. The thermometer should be placed so that its bulb is located in about the geometric center of the cabinet. The door should be opened only an instant while putting it in and should be left closed for at least fifteen minutes. Then the reading should be made as quickly as possible after the door is opened.

The variation in cabinet air temperature that can be obtained with the temperature knob is illustrated by the following average figures for an 80° F. room:

	Average cabinet air temperature in 80° F. room, °F.		
Knob position	Warmest	Mid	Coldest
CK and Flatop machines except 1941 CF-22C and 1942 machines	45	40	36
1941 CF-22C with "Steady Cold" control	43	38	33
1942 CK (A) and Flatop machines with enameled evaporators, except for CF-22G machines	39	36	32
1942 CF-22G machines	40 (B)	37	33
LK machines	42 (C)	38	33 (C)
CG machines	45 (D)	40	36 (D)
DK machines	47	42	38

(A) For CK-2E machines, these temperatures run about two degrees higher.
(B) Because of improper defrost springs in early M1A252 controls, some CF-22G machines will run on a defrosting cycle if the temperature knob is turned to "D".
(C) These temperatures refer to LK-1A machines which have an external temperature adjustment. Similar temperatures can be obtained for other LK models by removing the control and turning the temperature adjusting screw 2½ turns clockwise to get the warmer one, and 2½ turns counterclockwise to get the colder one. Refer to "Temperature Controls".
(D) A small knurled-head screw projects through the enameled top plate above the evaporator to give an external temperature adjustment for CG machines. To obtain these temperatures, it should be moved three turns in the clockwise direction to get the warmer one, and three turns counterclockwise to get the colder one. Refer to "Temperature Controls".

The following table gives average cabinet air temperatures in different room temperatures for mid-position knob settings:

	Average cabinet air temperature, °F. (A)		
Room temperature, °F.	100	80	60
CK and Flatop machines except 1941 CF-22C and 1942 machines	46	40	34
1941 CF-22C machines with "Steady Cold" control	39	38	37
1942 CK (B) and Flatop machines with enameled evaporators, except CF-22G	40	36	32
1942 CF-22G machines	40	37	34
LK machines	40	38	36
CG machines	45	40	34
DK machines	48	42	36

(A) These temperatures are without opening the door and with a fairly constant room temperature. In a home, a reasonable variation can be expected due to door openings and changes in room temperature.
(B) For CK-2E machines, which have no refrigerated shelf, temperatures run about two degrees higher.

EVAPORATOR TEMPERATURES

Measuring the evaporator temperature when a machine starts and stops usually will indicate if the machine is operating normally. See page 47 for general information or pages 38, 39 and 40 for evaporator temperatures of different machines.

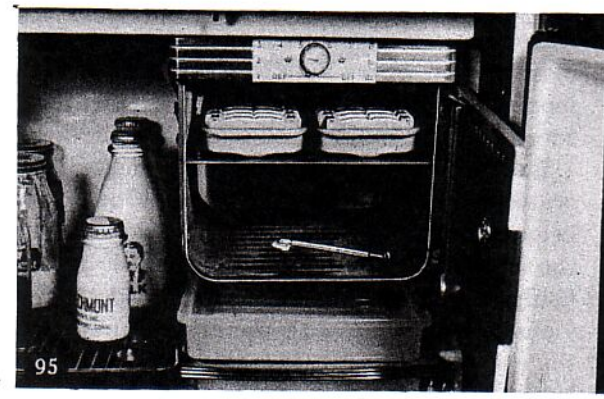


Fig. 185
Measuring Evaporator Temperature

EVAPORATOR FROST

The condition and location of the frost on the evaporator are the best indications of whether a machine is operating normally or not.

The condition of the frost means whether it is snow-white and crystalline in appearance, or whether it is icy and moist. The condition of the frost is determined by a number of factors such as ambient temperature and humidity, frequency and length of cabinet door openings, the degree to which moist foods and liquids are covered, the thickness of the frost, and the knob setting.

The frost is generally white and crystalline when the weather is cool and dry, the cabinet door openings are short and infrequent, the load in the cabinet is light, moist foods and liquids are well covered, the frost is not too thick (not over ¼ in.) and the temperature knob is at a normal setting (near mid-position). If the temperature knob is set at one of the colder positions or the room temperature is cool, frost crystals are apt to be long and fluffy.

The frost is usually somewhat icy and the surface is moist when the weather is hot and humid, the cabinet door is opened frequently and is left open more than a few seconds, the cabinet is heavily loaded, moist foods and liquids are left uncovered, or the frost is too thick (over ½ in.).

If the temperature knob is set at one of the warmer positions, the frost may be somewhat icy regardless of weather and operating conditions.

Except for the rear channel, the channels on left side and bottom should always be frosted.

The height of the frost line on the main header on the left side of the evaporator depends somewhat on the same factors that determine the condition of the frost. Usually the frost is at least half way up the header.

Note: In cool room temperatures (under 65° F.), the left header of 1941 CF-22C machines with the "Steady Cold" control may defrost partially or completely during the latter part of the off cycle, due to the normal characteristic of this particular control to automatically raise the evaporator temperature limits as the ambient temperature gets lower.

The frosting of the series part of the evaporator will vary with the same factors that determine the condition of the frost. When outside temperature is cool, humidity low, cabinet door openings short and infrequent, cabinet lightly loaded, moist foods and liquids well covered, and the temperature knob at a normal setting, the series part may frost only partially or not at all. This condition is brought about by the limited amount of frost migrating to the coldest part of the evaporator.

The series part of the evaporator will frost as heavily as the parallel part when the weather is hot and humid, the cabinet door is opened frequently and is left open more than a few seconds, the cabinet is heavily loaded, moist foods and liquids are left uncovered, and the temperature knob is at a normal setting.

If the temperature knob is kept at one of the warmer positions, there may be defrosting of some of the series part during the latter end of the off cycle. Some of the series part will run bare and the frost on the rest of it will be icy and moist.

RUNNING TIME

While there are a number of conditions that affect the length of the "on" and "off" periods, the average "on" period in a 75° F. room temperature is around 2 to 5 minutes and the "off" period around 10 to 20 minutes.

Conditions which affect the length of the "on" and "off" periods include size of the cabinet, capacity of the refrigerating machine, room temperature and humidity, temperature setting, door opening, food and ice freezing load.

While freezing is being done in the evaporator, the machine will run most of the time.

POWER CONSUMPTION

The electrical energy used by a refrigerator depends on all the factors that influence the cycles. In a temperate climate, such as prevails in most of the United States, the average for a CK-2 or CF-2 machine in a six cubic foot cabinet during the summer is 25 to 30 kilowatthours per month and 20 kilowatthours for other months. In southern states, consumption will be higher.

Meter tests in homes have proven that the majority of refrigerators average around 0.7 kw. hr. per day, but it must be kept in mind that, because of great reserve capacity, under heavy load conditions, in hot humid weather, a seven or eight cubic model can use 3.0 kw. hr. per day.

A CE-34 machine in a cabinet of 12, 15, or 16 cubic feet averages about 75% higher than smaller models.

NOISE

The normal running noise is hardly noticeable to most people. However, the running tone varies under different operating conditions and may be more noticeable at one time than at another.

The normal running tone of Freon-12 machines is usually louder than that of SO_2 machines.

SWEATING

In hot, humid weather, there will be some moisture precipitated on the cold surfaces within a refrigerator, when the cabinet door is opened. This is a natural condition like the sweating of a glass of cold water or a cold water pipe.

The extent of the sweating depends on the outside humidity, the size of the cabinet door, and the number and length of the door openings.

DEFINITIONS

In order to assist in the diagnosis of the trouble and selection of the proper adjustment in the field, and to insure a correct description of the complaint should it be necessary to return the refrigerating machine to the factory, the following fundamental definitions are given:

Stalled: The machine will not start.

Trips: The machine starts and runs until the overload trips and breaks the circuit.

Open Circuit: If one of the electrical circuits or connections from the service outlet to the motor windings is broken at some point other than at the main or starting contacts, there is an open circuit.

Grounded Circuit: If one of the electrical circuits or connections should come in direct or partial contact with a part of the refrigerating machine, cabinet or something external to the refrigerator, it is considered as a grounded circuit.

Short Circuit: If two electrical circuits or connections of different potential come in direct or partial contact with each other, there is a short circuit.

Unsatisfactory Refrigeration: The machine runs all right but does not perform its refrigeration functions in a satisfactory manner.

Noise: The machine runs all right and refrigerates satisfactorily but is considered too noisy.

Leak: Refrigerant or oil escapes from the refrigerating machine.

Damaged: Some part or parts of the refrigerating machine are damaged.

MACHINE WILL NOT RUN

The refrigerating machine will have one or the other of two symptoms:

Stalled—Will not start

Trips—Starts and runs until overload trips

The source of trouble may be external to the machine or it may be in the machine itself. It is recommended that the external factors be checked first. These include such things as the location of the machine, the current and voltage supplied, and the electrical circuit to the machine. In testing the machine, the parts should be checked in the following order: control, starting relay, capacitor on some models, and finally the machine itself.

Note: While the tripping of the overload usually is the indication of trouble elsewhere, there is the possibility that the overload itself is faulty. For machines with the overload device in the two-knob control, see page 48. For machines with the overload in the relay, see pages 73 and 75.

If a machine will not run, possible causes are:

Improper current or voltage
Restricted air circulation to condenser
Open circuit
Grounded circuit
Improper relay operation
Short circuit
Stalled compressor
Burned motor
Excessive load on compressor

IMPROPER CURRENT OR VOLTAGE

Refrigerating machines are designed for operation on only certain types of electric service. If a machine is connected to the wrong electric service even for an instant, the motor may be damaged.

Complete recommendations for various types of electric service appear on page 20.

RESTRICTED AIR CIRCULATION TO CONDENSER

Air circulation must be provided to remove heat from the condenser.

Restriction of the air circulation will result in inefficient operation and, if the restriction is bad, the compressor may stall and trip the overload.

Recommendations for minimum space limitations are given on page 201.

OPEN CIRCUIT

CIRCUIT TO THE REFRIGERATOR

If the cabinet has a light, observe whether the light comes on when the door is opened. If the cabinet light does not come on and the bulb tests all right in a socket on another electrical circuit

there is an open circuit in the supply line. If an open circuit is found, check the connecting cord plug in the electric service outlet, making sure that good electrical contact is obtained. Also, check the supply line fuses.

If the cabinet does not have a light, or as an additional check on those that do, the electrical circuit to the refrigerator can be checked as follows: Remove the connecting cord plug from the electric service outlet. Place a test lamp across the relay terminals indicated in the table below.

Relay Type	Place Test Lamp Across
E-3	Locking connector or terminals to locking connector
H (control-relay combination)	LK—terminals 2 and 4, CG—terminals 3 and 4. (This circuit includes the machine running winding since one connecting cord lead is permanently connected to the black lead to the motor.)
E	Terminals 2 and 5
N	Terminals 5 and upper overload terminal
R	Terminals 2 and 4

Replace the connecting cord plug in the electric service outlet. With the control main switch in the "on" position, the lamp should light. If it does not, check the connecting cord plug in the electric service outlet and also check the supply line fuses. Since the control is in some of these circuits, it will be necessary to test it as described below.

CONTROL

If the circuit to the refrigerator is all right, remove the connecting cord plug from the electric service outlet and remove the control so that the screw terminals on the rear for the leads can be inspected. Make sure these connections are properly made and are tight.

If these terminal connections prove to be satisfactory, remove the control. Replace it with a new control. If the machine starts and runs, it is evident that the original control may have had an open circuit. For "Control Replacements", see page 61.

A control can be tested for open circuit by placing a test lamp in series with the control in an electric circuit and observing whether the lamp lights when the main switch is turned to the "on" position. If the lamp does not light, there is an open circuit.

Another way to test the control is to eliminate it from the machine circuit. First, dismount the control. Then, place a jumper wire across the control terminals or connect the leads together. (When the control is connected to the machine circuit with a locking connector plug, insert the bare ends of a looped jumper wire into the plug from which the control was disconnected.) If the machine runs, the open circuit is located in the control.

An open circuit in a control may be caused by a weak bellows, open lead or connection, burned off contact, defective toggle device, or binding of or interference with some moving part. Refer to "Improper Operation", page 65.

RELAY

If the circuits to the refrigerator and the control prove to be all right but still the machine does not start, the starting relay should be inspected.

Caution: Do not disturb or adjust the starting armature as it is carefully adjusted and tested at the factory in order that its tension be just right to insure proper starting of the machine under all reasonable voltage conditions.

Never interchange any motor leads. The starting winding will be injured if left in the circuit for even a minute. In some instances the color of the leads to the relay may not be easily distinguishable. If such is the case, mark them carefully when disconnecting them.

Remove the connecting cord plug from the electric service outlet. Dismount the relay if necessary. Check the electrical connections to the relay. Be sure all are tight and that the proper lead comes to each terminal. See "Wiring Diagrams", page 91.

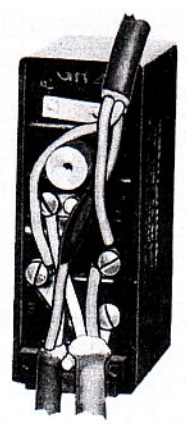


Fig. 186
Connections to E Relay

Remove the cover from the relay. With the connecting cord plug in the electric service outlet and the control main switch in the "on" position, move the armature carefully, using a piece of insulating material such as wood or cardboard. The armature should operate freely.

Caution: The armature is at line voltage so should not be handled. If a person's body is grounded, a serious shock might result.

Do not hold the starting contacts closed for more than a few seconds at a time.

Note: The main switch of the control should be in the "on" position when the following tests on the starting relay are made, and the connecting cord plugged into the service outlet.

If the starting contacts do not spark when opened and closed, there is an open circuit to the starting winding. This may be at the metal glass leads through the base or in the starting winding. In a machine having a capacitor, the open circuit is apt to be at the capacitor terminals or within the capacitor. Refer to "Capacitor" below.

Disconnect the machine running winding lead (red or green) from its relay terminal, and see if it sparks when touched to the terminal. If it does not, there is an open circuit to the running winding. The open circuit may be in the series coil in the relay, at the metal-glass leads through the base or in the running winding.

To test the series coil in the relay, short-circuit it with a short piece of insulated wire. Again see if the red lead sparks when touched to its terminal. If it does, but did not before the series coil was short-circuited, there is an open circuit in the series coil. The relay must be replaced; see page 76.

CAPACITOR

There is a capacitor in series with the starting winding lead of the following:

1. 60 cycle, 1/6 hp machines built before 1939 with serial numbers below 9,000,000, and some rebuilt after that. (CK-30B, C, D and some E's; CK-35B, C, D and some E's; CE-34M, A; CE-340A.)
2. 25 cycle, ⅛ hp machines. (CK-30-D12, E12; CK-35-D12, E12; CF-28-D12, E12, H12.)
3. 60 cycle CFS-1A machines which have a starting and also a running capacitor.

If an open circuit is found in the starting winding circuit when testing the relay, the capacitor should be checked. The open circuit may be at one of the connections to the capacitor, or within the capacitor.

In a CK-30 or CK-35 machine having a capacitor (60 cycle or 25 cycle), it is located in the box top

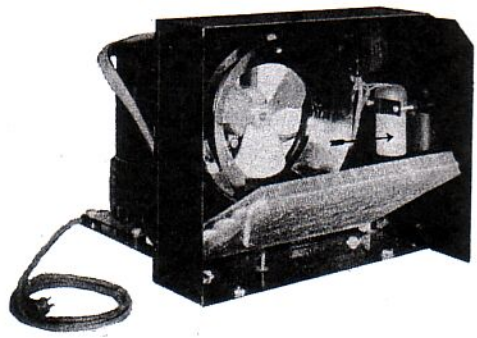


Fig. 187
Capacitor on CE-34 Machine

so that it is necessary to lift the machine out of the cabinet to get at it. Another method of testing for an open in the starting winding circuit is to use a series test lamp in a lead to the service outlet and touch its terminals to the white (starting) and black (common) leads from the compressor. The connecting cord must be disconnected from the service outlet and the control contacts must be closed. If the lamp does not light, there is an open in the starting winding circuit. If it burns with less than normal brilliancy, the capacitor is weak.

On a CE-34 or CE-340 machine having a capacitor (60 cycle), it is located on the front of the fan housing. Its terminals can be short-circuited when checking the starting winding circuit, or the capacitor can be tested by placing across it the terminals of a series lamp in a lead to service outlet. If the lamp does not light, the capacitor is open-circuited. If it burns with less than normal brilliancy, the capacitor is weak.

On a CFS-1A machine (60 cycle), the two capacitors are held by a bracket near the front of the compressor case fin assembly. If the smaller size capacitor (50–60 m.f.d.) is open-circuited, the

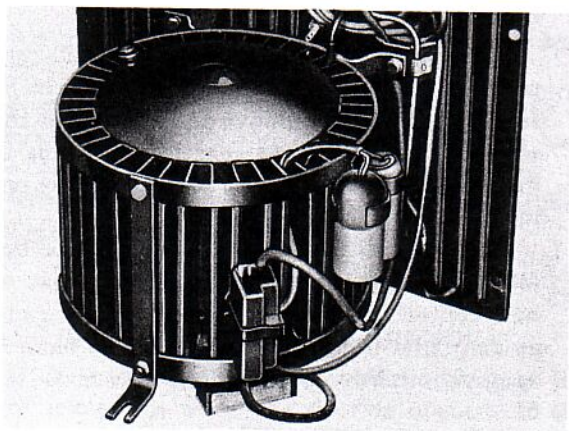


Fig. 188
Capacitors on CFS-1 Machine

machine will not start. If the larger size (5 m.f.d.) one is open-circuited, the machine will start and run all right but the motor will draw slightly more than normal power.

On a 25 cycle CF machine having a capacitor (CF-28-E12, D12 and H12), it is located in a bracket attached to the upper ring around the compressor case fins. It can be tested like one on a CE-34 machine.

MACHINE

If the open is not in the circuit to the refrigerator, control, relay or capacitor, it must be in the circuit to the compressor motor or in the motor windings.

If the open is in one of the external leads to a metal glass lead or at the soldered junction, it can be corrected by replacing the lead or resoldering the joint. If the open is within the compressor case, it cannot be eliminated.

GROUNDED CIRCUIT

All electrical circuits and connections are insulated from the refrigerating machine itself. If one of the electrical circuits or connections should come in direct or partial contact with a part of the refrigerating machine, it is considered grounded.

A ground in the circuit to the refrigerator or the cabinet light, or in the control, starting relay, or machine may cause blowing of the house fuses, tripping off of the overload, welding of the contacts or burning off of a lead.

A series test lamp will be found necessary to locate the ground.

Caution: The machine or cabinet must not be externally grounded while testing for a grounded circuit; otherwise, the line may be short-circuited to ground.

If the machine cannot be conveniently insulated from ground, a series test lamp must be used in each lead from the line to the machine.

CIRCUIT TO THE REFRIGERATOR

A ground in the circuit to the refrigerator will cause blowing of the house fuses.

Make sure that the ground is not in the connecting cord plug. Look for evidence of arcing. Also, watch for indications of moisture and dirt.

REFRIGERATOR

A preliminary test can be made to determine if there is a ground somewhere in the refrigerator. If a ground is found, the cabinet light circuit connectors, control, starting relay, capacitor (in some models), and machine can be tested separately.

Remove the connecting cord plug from the electric service outlet and dismount the relay.

Disconnect one of the connecting cord leads from its terminal. For a machine with a locking connector on the connecting cord, disconnect the red or black compressor lead at the relay. With the main switch of the control in the "on" position and the connecting cord plug in the electric service outlet, insert the test lamp in series between this lead and its terminal. The lamp should light, indicating a circuit through the motor.

Then insert the test lamp in series between this lead and a small spot on the compressor case where the finish has been scraped off. If the lamp lights, there is a ground somewhere in the refrigerator. Proceed to locate it with the following tests.

CONNECTORS IN FLATOP CABINETS

Remove the cabinet cover and take out the cabinet top insulation. Inspect the wires to the connectors in the cabinet top to make sure that there is no bare wire touching some metal part. Look for evidence of moisture and arcing.

If the cabinet top insulation is damp, dry it and replace it.

When putting on the cabinet top cover, make sure that the seal around the cover and around the refrigerant tubes is good.

CABINET LIGHT CIRCUIT

Disconnect the cabinet light circuit from the machine circuit. Using an electric lead, connect the cabinet light circuit directly to the service outlet. With the cabinet door open, the cabinet lamp should light.

After making sure that the cabinet or machine itself is not externally grounded, arrange the connections to the electric lead so that the cabinet light circuit forms one side of the circuit and the cabinet the other. Try various parts of the cabinet by touching the lead to bare metal spots on the inner liner as well as on the outside of the cabinet and the machine. If the cabinet lamp lights, there is a ground in the circuit.

CONTROL

Check the leads to the control to be certain that there is no bare section that might touch some other part of the machine. Tape any such bare spot.

Dismount the control. A ground in the control can be verified by making first one terminal, and then the other, one side of an electric circuit and

the bellows tube, with a test lamp in series, the other side of the circuit. If the lamp lights, there is a ground in the control.

Caution: The control or bellows tube must not be externally grounded while testing for a grounded circuit; otherwise, the line may be short-circuited to ground.

The most likely cause of grounding in a control on a Flatop machine is moisture collecting within the control under very humid conditions after frost has been allowed to build up very thick on the evaporator. This is infrequent except in tropical climates. The moisture forms a path between the electrical parts of the control and the bellows, or one of the bellows plate nuts on early controls. On later controls these plate nuts are completely enclosed from the inside by the control case. Other improvements include recessing the cover, increasing the number of drain holes in the cover, and protecting the bellows with an insulating paint.

When replacing a bellows, make sure that the cupped insulating washer is placed between it and the bellows arm. Otherwise, the control will be grounded.

RELAY

Remove connecting cord plug from the electric service outlet. Dismount the relay. Look for evidence of moisture and arcing. Eliminate any grounded place by taping or otherwise insulating it.

CAPACITOR

Refer to page 124 for a list of machines having a capacitor.

The first type of capacitor used in CK-30B and CK-35B machines is rectangular in cross section and the case forms one side of the capacitor circuit. Later capacitors are of the electrolytic type and are circular in cross section. The case of the round capacitor is fairly well insulated from the rest of it.

In CK-30 and CK-35 machines the capacitor is located in the box top insulation. Grounding can occur only if the insulation gets wet. The insulation can be removed and dried out. Make sure that the outer gasket between the edge of the box top and the cabinet seals all the way around. It is better that there be no inner gasket so that any moisture leaking through the outer gasket will be drawn to the evaporator.

The round capacitor on other machines is insulated from the mounting bracket by a rubber cap.

A series test lamp in a circuit to the service outlet will indicate whether a capacitor is grounded if one terminal is touched to the capacitor and the other to some part of the machine where the finish has been scraped off. If the lamp lights, there is a ground.

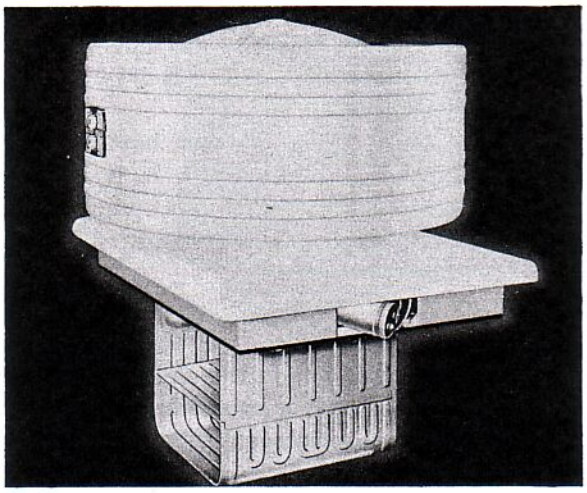


Fig. 189
Capacitor on CK-30 Machine

MACHINE

If the ground is not in any of the forementioned parts, it must be in the circuit to the compressor motor or in the motor windings.

If the ground is in one of the external leads to a metal glass lead or in the external end of a metal glass lead, it can be checked with a series lamp and usually it can be corrected.

A grounded circuit within the compressor case cannot be remedied.

A partial ground might be present to a degree that would, under certain conditions, cause electrical shock to a person touching the refrigerator, yet not appear as defective operation of the machine nor would it be indicated by any of the preceding tests. Such a slight ground would probably be experienced only under high humidity conditions. The usual cause is moisture in the box top insulation, metal glass leads cover, or control.

IMPROPER RELAY OPERATION

A faulty relay can cause an open circuit, a grounded circuit, or a short circuit, as described elsewhere in this section. In addition, a faulty relay may operate in such a manner that the overload will trip. This tripping may be caused by momentary welding of the contacts, by a contact dropping out, or by a contact burning out; see page 82.

SHORT CIRCUIT

All electrical circuits and connections are insulated from each other. If two of these circuits

or connections should come in contact with each other, a short circuit results.

A short circuit in the circuit to the refrigerator may cause blowing of the house fuses. A short circuit in the relay may cause blowing of the house fuses, tripping of the overloads, welding or burning of the starting contacts, or burning off of a lead. A short circuit in the control may cause the machine to run all the time. A short circuit in the cabinet light circuit may cause continuous burning of the cabinet light, or blowing of the house fuses. A short circuit in the machine may cause blowing of the house fuses, tripping off of the overload, welding or burning of the main or starting contacts, or burning off of a lead.

CIRCUIT TO THE REFRIGERATOR

Inspect the connecting cord plug and the service outlet. Look for evidence of moisture and arcing.

CABINET LIGHT AND CONNECTORS

Inspect the cabinet light circuit for evidence of moisture or arcing. Check the connectors in the cabinet top to determine that the wires are properly connected and not touching. Proceed as directed on page 125.

CONTROL

The machine will continue to run even when the main switch is turned to the "off" position if there is a short circuit in the control. Inspect the leads and terminals on the rear of the control to make sure that the trouble is not there.

RELAY

Remove the machine connecting cord plug from the service outlet. Dismount the relay. Make a visual inspection of all the leads and connections, noting that the leads are properly connected and not touching. Look for evidence of arcing.

CAPACITOR

A shorted capacitor may cause a machine to start so hard that the overload will trip. Refer to page 124 for a list of machines having a capacitor.

The capacitor can be tested with a series lamp on direct current (d-c). A shorted capacitor will continue to pass direct current but a good one will pass it for only an instant and then the lamp will dim and go out.

MACHINE

If there is still a short circuit present after the preceding tests have been completed, it must be in the circuit to the compressor motor or in the motor windings.

The external leads to the metal glass leads can be checked.

A short circuit within the compressor case cannot be remedied.

STALLED COMPRESSOR

The compressor may be stuck with corrosion or dirt or by mechanical failure of a part. Jarring of the machine may free the compressor if the cause is of minor extent.

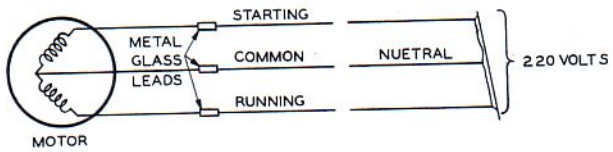


Fig. 190
Application of 220 Volts

Apply 220 volts AC momentarily to the machine. The compressor may be started with this treatment and then continue to run satisfactorily on normal voltage. In the home where 220 volt AC is not available, use a 110/220-volt autotransformer connected so that 220 volts is delivered to the connecting cord when the 110-volt side is plugged into the 110-volt service outlet.

Fig. 191
Using 110/220-volt Transformer

Caution: 220 volts AC should be applied only momentarily (not over a second) to a machine. This should not be repeated over three or four times and then only after allowing a minute or two between applications.

BURNED MOTOR

A burned motor usually results in a stalled compressor. In this case the machine will fail again even if it is broken loose with 220 volts.

While it is possible to get a burned motor because of a defective winding or badly restricted air circulation, the most frequent cause is im-

proper electric service. Before installing a replacement machine in place of one with a burned motor, carefully check the refrigerator location and electric service, see page 20. A machine should not be installed where the voltage goes below 90.

A burned motor can be detected by holding the hand or a piece of paper about an inch from the float valve purging screw, and opening it a little. After the sulphur dioxide odor has disappeared, there will be a strong burned odor from the oil remaining. When the motor of a CG, CK or DK machine is burned, the white dome of the compressor case usually becomes brown.

EXCESSIVE LOAD ON COMPRESSOR

The compressor may stall because of an excessive load on it, particularly in warm room temperatures, during the initial pull-down after the refrigerator is installed or after being shut off for a time. At such times, the evaporator temperature is high and a considerable amount of liquid refrigerant may be in the lubricating oil; both conditions tending to increase the compressor load.

It may be necessary to restart a machine with a solder pot overload more than once if it continues to trip off while pulling down. After it has reached normal operating temperatures, it will continue to run all right.

TEST SET

With Flatop CE, CF, CH, CJ, and FBA machines, about the most reliable way to determine the cause of a "Will Not Run" complaint is to use a simple test set. The test set will quickly indicate whether the difficulty is in the external electrical circuit of the machine or in the motor-compressor assembly. It can be made up with a Type R relay, a connecting cord, and a piece of three-wire cable fitted with test clips. The relay in the test set must be changed when different size motors on different power supplies are tested, but Cat. No. M1A162 will normally be used since most machines have 1/8 horsepower, 110-volt, 60-cycle motors.

MATERIAL

1—Two-wire cable with male plug (connecting cord)
1—Three-wire cable having different colored wires
3—Test clip
3—Test clip insulators
1—Type R relay
M1A162 for 60- and 50-cycle machines with 1/8-horsepower motor
M1A166 for 60- and 50-cycle machines with 1/6-horsepower motor
M1A231 for 60-cycle CJ-2B and C machines with 1/10-horsepower motor
M1A170 for 25-cycle machines with 1/10-horsepower motor
M1A184 for 25-cycle machines with 1/8-horsepower motor

The clips are attached to the leads of the three-wire cable and the insulators should be placed over the clips. The relay, connecting cord and three-wire cable are wired together in a manner similar to the external wiring of a refrigerating machine but with the control circuit eliminated. This is done by connecting the two-wire cable leads to the test relay terminals 2 and 4 while the three-wire cable leads are attached to terminals 1, 2, and 3.

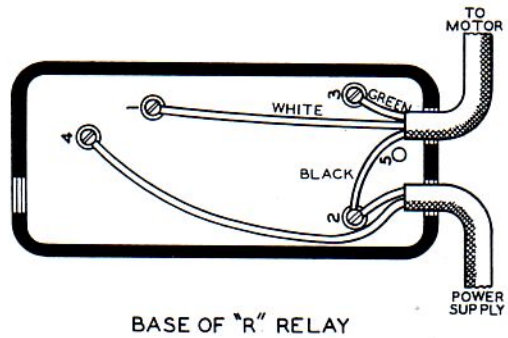


Fig. 192
Test Set Relay Connections
For Complete Wiring, See page 118

PROCEDURE

1. Dismount the relay from the machine to be tested and disconnect the three motor leads from the relay terminals.

Exception: With machines having capacitors, do not disconnect the white running winding lead from the connector where it is attached to a lead from the capacitor. Instead, disconnect the capacitor lead to relay terminal 1 and use it for the connection to terminal 1 of the test relay mentioned in step 2. This keeps the capacitor in series with the starting winding.

2. Clip the test set leads to the proper motor leads as follows:

Motor Lead	Leads from Test Relay Terminals
Red or Green (Running)	3
Black (Common)	2
White (Starting)	1

Caution: Make sure that the proper connections are made. Improper connections may cause damage to the motor. See page 118.

3. Hold the relay vertically (with the two lead openings in the cover downward) and plug the connecting cord into the service outlet.
   a. If the machine starts with the test set, the trouble is located in the external circuit of the machine. Test the control, relay and connecting cord by replacing each one until the difficulty is located.
   b. If the machine will not start with the test set, the difficulty is in the motor circuit. Steps 4 and 5 should then be followed.

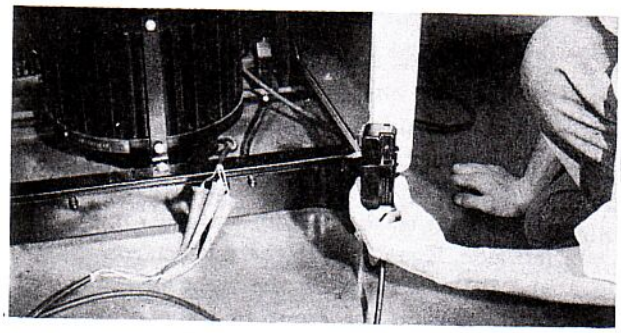


Fig. 193
Using Test Set

4. Make an independent test of the capacitor, if there is one in the circuit. When the machine does not start with the test set, the capacitor should be checked before assuming the difficulty is in the motor circuit. See page 124 for method of testing capacitor.
5. When the difficulty is apparently in the motor circuit, disconnect the connecting cord from the outlet and then remove the relay cover. Holding the relay base in a vertical position (with the armature downward), again plug the connecting cord into the outlet.
   a. If the starting contacts spark and remain closed until the overload trips, the compressor is probably stalled. A hum from the motor-compressor indicates that the electrical circuits are in a satisfactory condition but that the compressor is stalled. Jolt the compressor or apply 220 volts as indicated on page 127.
   b. If the overload heater gets red hot almost instantaneously before the contacts can open, check the motor circuit back to the metal glass leads for a ground or a short circuit. If neither is found, the motor is inoperative and the machine must be replaced.
   c. If the starting contacts close, then open without sparking, check back to the metal glass leads for an open circuit. If an open circuit is not found, the motor is inoperative and the machine must be replaced.
   d. If the starting contacts do not close, check back to the metal glass leads for an open circuit. If an open circuit is not found, the motor is inoperative and the machine must be replaced.

UNSATISFACTORY REFRIGERATION

Unsatisfactory refrigeration complaints can be divided into two general classes: (1) Evaporator does not frost properly and (2) Evaporator frosts properly but the user is not satisfied with some part of the refrigeration service that the machine is supposed to render.

The machine is assumed to run all right: otherwise, the complaint would be "Machine Will Not Run."

Many complaints of unsatisfactory refrigeration arise from a lack of understanding of variations in the frosting and in the performance of a machine due to changes in the weather or load conditions, and of differences in frosting and performance between various models.

EVAPORATOR DOES NOT FROST PROPERLY

Improper, incomplete or erratic frosting of an evaporator may be caused by certain ambient or operating conditions, by an inoperative control, or by some fault within the machine. The location of the frost, if any, in combination with the noise from the machine and temperatures of the various parts, gives an indication of the source of the trouble.

When checking a machine for unsatisfactory refrigeration, make sure that it has run for a period of time sufficient to bring normal conditions if it were operating properly.

EXAMPLES OF IMPROPER FROSTING

Examples of improper or incomplete frosting include the following:

No frost, evaporator does not cool at all: There may be no refrigerant circulating through the evaporator because of a restriction in the system, a stuck float valve, a very low refrigerant charge, or the compressor not pumping.

A restriction in the evaporator, brought about by slightly thickened oil, is the most common; see page 151 for adjustments.

No frost, evaporator cools some and may sweat: This condition indicates that there is refrigerant in the evaporator but for some reason such as a bad discharge valve leak, stuck open float or heavy overcharge the temperature cannot be brought down to freezing.

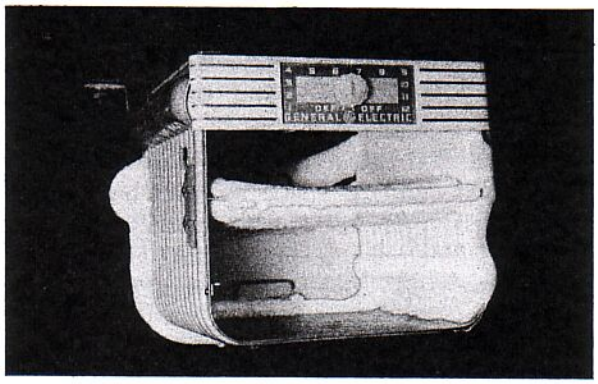


Fig. 194
Low Refrigerant

No frost on left side and bottom, normal on right side and shelf: The refrigerant charge is low. The small amount of refrigerant remaining in the machine evaporates in the series part of the evaporator before reaching the parallel tubes.

No frost on right side and shelf, normal on left side and bottom; frost well up on left header: There is a definite division between the frosted parallel part and the bare series part at the injector header in the lower right-hand corner of the evaporator. This is an evaporator restriction brought about by an accumulation of slightly thickened oil which impedes the flow of refrigerant through the injectors. In order to pass through the oil, the refrigerant pressure rises and the temperature of the series part gets above freezing.

This condition is often referred to as "shelf defrosting" and affects particularly some of the 1941 CF-2J, CF-22C, CF-28E, CJ-2B, CJ-2C, CJ-2D, and CJ-2E machines. See page 151 for adjustments.

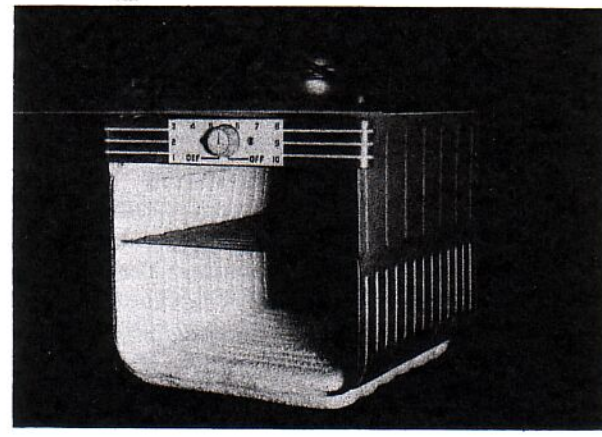


Fig. 195
Evaporator Restriction

No frost on shelf, little or none on right, normal on left side and bottom except sometimes low on header: Under low humidity and light load conditions, the small amount of frost that collects on the evaporator tends to migrate to the coldest parts; that is, the bottom and the lower part of the left side. Even though there is no frost on the shelf, and little or none on the right side (usually there is a trace on the front of some of the U-shaped channels), the shelf temperature limits will be normal (about 5° or 6° F. warmer than the bottom on stainless steel evaporators), drops of water will freeze on it, and the series part will frost if the cabinet door is left open. There is nothing wrong when this condition exists.

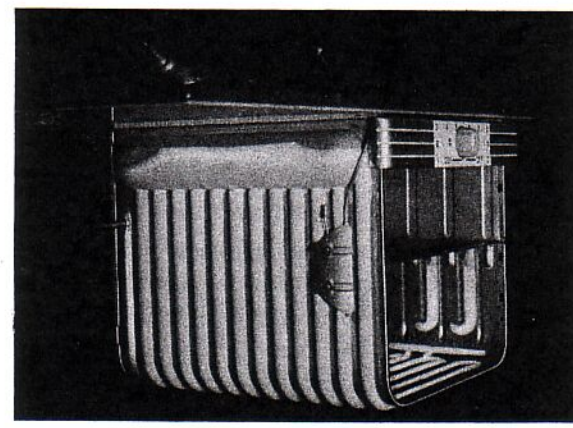


Fig. 196
Low Humidity

No frost on rear channels (except the last one on stainless steel evaporators) across bottom and part way up left side, low or no frost on header: The refrigerant charge is slightly low so that little refrigerant is fed into some of the rear parallel channels.

Normal frost while running; header defrosts rapidly when machine is shut off: There is a leak between the high pressure and low pressure sides, usually a slight or medium discharge valve leak. The discharge valve acts as a check valve when the machine is shut off.

Normal frost while running; header, upper part of left side and shelf defrost during latter part of "off" cycle: The cut-on temperature limit of the control is too high. Either the knob is at too warm a position or it has been reset too warm, or the bellows is partially weak. If the cycles are fairly normal, tending toward a shorter than normal "on" period and a longer than normal "off" period, the knob setting is probably too warm. If the cycles are unusually long with both the "on" and "off" periods abnormally long, the bellows is partially weak.

Normal while running, header and part of left side defrost during "off" cycle—CF-22C machines only: The Steady-Cold control is designed to maintain the cabinet air temperature practically constant in all reasonable room temperatures. To do so, the evaporator temperature limits are automatically lowered as the room temperature increases, and raised as the room temperature goes down.

In order to maintain proper frosting of the evaporator, the temperature knob should be kept at position 6. Some defrosting may occur with the knob at a warmer position especially if the room is cool.

If the room temperature goes below 65° F. for several hours at a time, some defrosting may take place even with the knob at position 6.

If the room temperature gets very cold, down around 40° F., the evaporator may entirely defrost. However, the food will not freeze until the room temperature goes below 32° F. for at least several hours.

Normal while running, completely defrosts during "off" cycle: The control knob may be at the "defrost" position. If the knob is at one of the freezing positions, the cut-on limit may be unusually high due to the knob having been reset too warm, or the bellows is partially weak.

Normal while running, completely defrosts during "off" cycle—CF-22G machines only: The control located in the cabinet top section has a different type of defrost mechanism than other controls. The defrost spring under the knob of early production controls allowed the evaporator to run on a defrosting cycle even though the knob pointed to position C or D.

Normal while running, shelf and right side defrost rapidly when machine is shut off: A leak around the float valve needle allows warm refrigerant to continue flowing into the evaporator.

Normal except that suction tube frosts: A slight or medium overcharge of refrigerant will cause the suction tube to frost. If the frost on the evaporator is very heavy, over ½ inch thick on a surface, frost may build up around the suction tube so that it frosts back and gives an indication of a high refrigerant charge.

NOISE WITH IMPROPER FROSTING

Certain characteristic noises accompany some of the conditions where the evaporator does not frost properly.

Light metallic clicking from compressor: This noise indicates a rather low vacuum within the compressor case so that the oil pump does not take in a full charge of oil at each turn and the oil blades tick against the cylinder as they move back and forth.

If a machine is made to run continuously by disconnecting the bellows tube from the evaporator and the evaporator is within a closed cabinet so that it can pull down to a low temperature, this noise will be produced.

Any condition which takes all of the refrigerant out of the evaporator will be accompanied by this noise. Such conditions include the float valve stuck closed either mechanically or by non-condensable gas; a plugged orifice or liquid line; a bad restriction in the series part of the evaporator; a very low or no refrigerant charge.

Loud sputtering noise from compressor: There are several possible causes for this sound which indicates faulty valving to or from the cylinder.

If the intake valve is held open by the unloader due to the oil passage to the unloader being blocked or the unloader being stuck, there will be no cooling of the evaporator. With either of these troubles, the compressor will coast to a stop without the usual unloading sound. With a blocked oil passage, there will be no oil flow against the compressor case dome.

If the discharge valve leaks badly or the release valve is operating due to much higher than normal pressure within the cylinder, the evaporator may cool some and possibly sweat. A leaky intake valve is further indicated by a peculiar "chug-chug" as

the compressor slows down and a hissing noise after the compressor stops, caused by compressed refrigerant vapor leaking back into the cylinder.

Loud liquid boiling noise in case: This noise, which occurs while the machine is running and usually continues after the machine is shut off, indicates that there is liquid refrigerant in the base.

A mild liquid boiling or dripping, particularly toward the end of the "on" part of the cycle, is normal in some of the older machines.

After a machine has been shut off for a period of time, especially in a cool place, the refrigerant may transfer from the evaporator to the case. For quite a while after the machine is started up and until the liquid is boiled out, this noise will be present.

If the liquid boiling is loud and persists after the machine has run several hours, the probable trouble is an overcharge of refrigerant.

Hiss from compressor while running and after shut off: A high pressure leak within the compressor case, either from the discharge muffler or a joint to the high pressure tube, causes this steady hissing noise which continues for a time after the machine is shut off.

Hiss from compressor after being shut off: A discharge valve leak allows high pressure refrigerant vapor to leak back into the cylinder when the machine is shut off. This leakage may be so bad that the accompanying hiss is quite loud or it may be so slight that it can be barely detected. A peculiar "chug-chug" noise will be noticed as the compressor slows down.

Loud flushing noise from evaporator: Due to the injector action, there is a normal flushing noise in the evaporator, which is noticeable when the cabinet door is open.

An unusually loud flushing noise, accompanied by a hiss from the float valve orifice, indicates a stuck open float valve or a restricted evaporator.

Hiss from float valve orifice: As mentioned in connection with the preceding noise, a stuck open float valve also causes a hiss as a refrigerant vapor passes through the orifice.

TEMPERATURES WITH IMPROPER FROSTING

Temperatures often indicate the cause of the improper frosting. The compressor case dome, condenser and float valve temperatures are usually abnormal when the evaporator does not frost properly. In a normal room temperature, 70° to 80° F., the dome is warm, and the condenser and float are slightly warm during the latter part of the "on" period.

Dome hot: Any condition which causes the machine to run a high percentage of the time or at a higher than normal evaporator temperature will make the dome run warmer than normal. Pulling the cabinet air temperature down when a machine is first started or freezing water will make the dome hot.

The dome will also run much warmer than normal with a discharge valve leak, internal high pressure leak or float valve stuck open.

Dome cool: This is an indication that no oil is being directed against the dome such as with a blocked oil passage or low oil, or refrigerant being evaporated within the case such as with a heavy overcharge.

Condenser and float valve hot: With the exception of a discharge valve leak and internal high pressure leak where the compressed refrigerant vapor leaks back into the low pressure side, the same conditions that make the dome run hot cause the condenser and float valve to be much warmer than normal.

Condenser and float valve cool: If little or no refrigerant is being pumped into the condenser, the condenser and float will feel cool to the hand. Any of the conditions which prevent the evaporator from cooling will cause the condenser and float to run cool. Among them are the float valve stuck closed either mechanically or with non-condensable gas, no or very low refrigerant charge, intake valve held open, low oil or blocked oil passage.

ADJUSTMENTS FOR IMPROPER FROSTING

There are certain general adjustments that can be made in an effort to correct the various troubles which prevent the evaporator from frosting properly. These service adjustments are:

Heating the evaporator to build up pressure in the system to eliminate a restriction or to correct a discharge valve leak; see page 145.

Lifting the float bulb to release a stuck float valve; see page 145.

Bleeding to remove non-condensable gas; see page 146.

Purging to remove overcharge of refrigerant; see page 147.

Monitor Testing to add refrigerant; see page 148.

EVAPORATOR FROSTS PROPERLY

Although the frost on the evaporator is all right, some part of the refrigeration service that the machine is supposed to render is not satisfactory to the user. Among these complaints are:

Cabinet temperature is too high.
Cabinet temperature is too low.
Unsatisfactory ice freezing.
Unsatisfactory dessert freezing or storing.
Sweating of evaporator door or interior of cabinet.
High per cent running time.
High power consumption.

CABINET TEMPERATURE TOO HIGH

The cabinet air temperature can vary a number of degrees from what is considered normal and still the preservation of food will be reasonably satisfactory. It is desirable to maintain the average temperature below 50 degrees F. Under heavy load conditions in a very warm room and after the cabinet door has been opened, the cabinet air temperature may rise above 50 degrees F for a short time.

The "Thriftometer" or safety zone indicator, a thermometer with the proper food preservation range of 50 degrees to 32 degrees F. indicated by a marked section, furnished with some later refrigerator models gives a fairly accurate indication of the cabinet temperature. However, excessive door openings should not be allowed just previous to the time the door is opened to read the temperature.

To check the cabinet temperature, a thermometer can be placed in a liquid that has been in the refrigerator for at least several hours. Since the cabinet air temperature will rise when the door is opened, a thermometer hung from one of the shelves must be left there with the door closed for over an hour in a warm room in order to register the true average temperature.

Among the things that can cause the cabinet air temperature to be too high, even though the evaporator frosts normally, are:

Improper control temperature knob setting.
Bent bellows arm in one-knob controls.
Partially weak bellows in control.
Restricted air circulation to condenser.
Restricted air circulation in cabinet.
Excessive door or cabinet top leakage.
Excessively high room temperature.
Excessive loading of cabinet.
Excessive cabinet door opening.
Cabinet light on.

Improper Control Temperature Knob Setting

The cabinet temperature depends to a certain extent on the control temperature knob setting. This setting is made adjustable in order to satisfy the individual desires of the user. If it is desired to make the cabinet air temperature colder, the knob is turned clockwise; if warmer, it is turned counterclockwise.

The temperature knob should never be reset just because a hasty check of the cabinet temperature shows it to be a few degrees lower or higher than it should be. The cabinet temperature depends on a number of factors, in addition to the setting of the temperature knob. These factors include the room temperature, food load in the cabinet, ice freezing load, air circulation in the cabinet, air circulation to the condenser, door gasket or cabinet top leakage, and the frequency of door opening. All of these factors should be carefully checked before the temperature knob is reset.

Bent Bellows Arm in One-knob Controls

If the bridle arm end of the bellows arm is bent slightly toward the contacts, the bellows arm may hit the defrost bellcrank before the contact trips closed. The cut-on temperature will be raised several degrees, and the average temperature of the evaporator and cabinet air will be higher than normal.

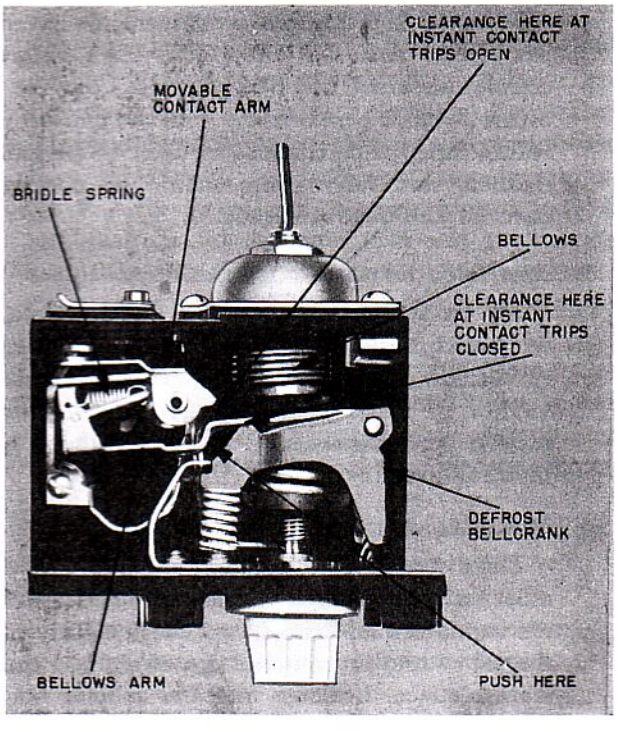


Fig. 197
Control Mechanism

The bridle spring end of the bellows arm should be parallel to the bellows end. If it is not parallel, the bridle spring end can be straightened with a pair of thin-nosed pliers.

Partially Weak Bellows in Control

A partially weak bellows in the control causes the evaporator upper temperature limit to be higher than normal. The average evaporator and cabinet air temperatures will be warmer than they should be for a given knob position.

In time, the bellows will lose more of its charge and the evaporator will start to defrost during the latter part of the "off" cycle. Eventually, all of the charge will leak out, and the contacts will stay open and prevent the machine from starting up.

With a partially weak bellows, both the "on" and the "off" periods will be abnormally long. The cut-off temperature will be normal but the cut-on temperature will be several degrees high.

Turning or resetting the knob colder will relieve the trouble only temporarily. The control must be replaced or a new bellows put in.

Restricted Air Circulation to Condenser

If the air circulation to the condenser is seriously restricted, the capacity of the machine will be reduced. If the machine is required to operate in a warm room temperature with a heavy load, the reduction of capacity may be noticeable.

Monitor Top condensers must not be covered or completely enclosed. On Flatop refrigerators, air circulation must not be restricted from the front of the cabinet base or the top of the cabinet in the rear. Finned tube condensers must be periodically cleaned, and fan motors should be occasionally checked and oiled if necessary.

Restricted Air Circulation in Cabinet

Air circulation is necessary to insure uniform temperature distribution in the cabinet. If the air circulation is restricted by excessive crowding of food or by placing coverings over the shelves, the cabinet air temperature in places will be higher than it should be.

Excessive Door or Cabinet Top Leakage

The outer shell and the top panel of the cabinet must be completely sealed so air is not drawn into the insulation and the door must fit tightly against the cabinet to prevent leakage of air into the food storage space. Leakage into the cabinet not only allows the entrance of relatively warm air but also introduces moisture which is condensed out of the air. This condensation of moisture either in the inner part of the cabinet or in the insulation space is more serious than the loss caused by the temperature difference of the air that leaks in.

First check the door seal by inserting a three mil feeler at a number of places under the door gasket. If the gasket does not fit reasonably tight at all points, adjust it.

In addition to raising the cabinet temperature, a bad door seal also shows up as excessive sweating of the cabinet interior and faster than normal building up of frost on the evaporator.

Monitor Top machines have a gasket seal between the box top and the outer shell of the cabinet. On CK-1 and CK-2 machines there is a sponge rubber gasket up under the outer edge of the box top. On CK-30 and CK-35 machines there is an extruded rubber gasket that fits around the edge of the box top.

Flatop cabinets have a rubber gasket seal under the cabinet top cover and another seal where the refrigerant tubes and the cable go into the top section of the cabinet.

To check the cover seal and the refrigerant tube seal on 1935 and 1936 cabinets remove the cover. The sponge rubber sealing pieces about the refrigerant tubes should not extend above the top rim of the cabinet. Observe the sponge rubber above the top rim of the cabinet. Observe the sponge rubber strips glued to the inside of the cabinet cover. If loose or out of place, replace them, using a good grade of rubber cement.

Examine the insulation in the cabinet top. If it is moist, there must be leakage. Make sure that the No-Ox-Id cloth properly seals off the insulation space in the sides of the cabinet.

Examine the seal between the top plate and the ledge formed by the inner liner of the cabinet. There is a layer of No-Ox-Id cloth between the ledge and the top plate. Make sure that this cloth is not wrinkled, particularly at the corners, so that there is an opening. Try the screws that hold the top plate to the ledge to make sure that they are reasonably tight.

The cover seal and the refrigerant tube seal are somewhat different on 1937 and subsequent models.

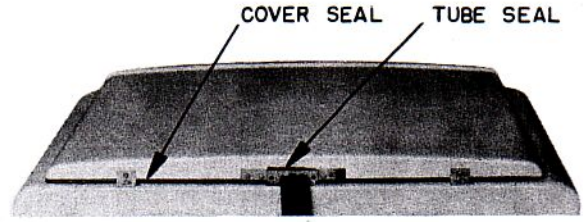


Fig. 198
Newer Cover and Tube Seals

An extruded gasket is attached under the outer edge of the cover and seals on the top ledge of the cabinet. This seal can be improved by tightening the two front corner screws in the upper Textolite strip and the adjustable strips that hold the cover to the back of the cabinet. A sponge rubber piece seals the refrigerant tubes and cable where they pass through the back of the cover. This sponge rubber piece must butt squarely against the ends of the cover gasket.

The cabinet that takes the FBA-1A machine has a gasket under the plate over the rear opening, and a sponge rubber seal around the refrigerant tubes.

Since the LK machine is built into its cabinet, there are no seals except the cover gasket.

The Balltop CG machine is similar to Monitor Top machines in that there is a sponge rubber gasket up under the lower edge of the box top section which seals around the top of the cabinet. There is also a small cover plate with a rubber gasket which seals off the float valve purging socket opening.

The top of the Under-the-drainboard DK refrigerator is sealed with a covering of No-Ox-Id cloth under the aluminum top cover. There is a rubber gasket seal where the refrigerant tubes and cable go through the opening in the cover.

Excessively High Room Temperature

The capacity of a refrigerating machine and the heat leakage into the cabinet depend on the room temperature where the refrigerator is located. With the same control temperature knob setting, the cabinet air temperature will increase with an increase in room temperature, except for CF-22C machines. The cabinet air temperature remains practically constant in these models in all reasonable room temperatures.

Excessive Loading of Cabinet

The cabinet air temperature will rise when a large amount of relatively warm food is placed in the cabinet. The temperature will continue to be higher than normal until the food is cooled. If warm food is constantly being placed in the cabinet, the temperature will average somewhat above normal. The cooling of large quantities of drinking water or beverages, or a watermelon, constitute a heavy load on the refrigerating machine which will result in an increase in the cabinet air temperature.

During ice freezing, particularly when all trays are being frozen at once, much of the cooling capacity of the evaporator is diverted to the freezing of the water. Under heavy load and high temperature conditions, the cabinet air temperature will be higher than normal, while the water is being frozen.

Excessive Cabinet Door Opening

Whenever the cabinet door is opened, warm air enters the cabinet and the temperature goes up a few degrees. If the door is left open or is opened excessively, the cabinet air temperature will stay above normal.

Under high humidity conditions, the load imposed on the refrigerating machine to condense the moisture out of the air is much more severe than that to cool the warm air that enters when the door is opened. Consequently, it is recommended that, particularly in high humidity weather, the cabinet door be left open as little as possible to insure satisfactory performance.

Cabinet Light On

Check the operation of the cabinet light switch to make sure that the light goes off just before the door is closed. If the cabinet light should be on all the time, the cabinet air temperature would be abnormally high. And it would be noted that the bulb would burn out relatively frequent.

CABINET TEMPERATURE TOO LOW

Since foods are preserved better and longer the colder they are kept, down to the freezing temperature, there has been a trend toward lower cabinet temperatures as refrigerators have been improved to maintain such temperatures without danger of freezing. When electric refrigerators were first introduced, the cabinet temperature was 50° F. A few years later this was reduced to 45° F., and then to 40° F. Some 1941 and 1942 models maintain an average cabinet air temperature of between 35° and 38° F. in normal room temperatures, 70°–80° F.

As long as food is not frozen, the cabinet temperature is not too cold to properly preserve food, but it may be too cold for the taste of some users.

Possible causes of too cold a cabinet air temperature include:

Improper control temperature knob setting.
Excessively low room temperature.
Creeping temperature knob.
Poor bellows tube contact to evaporator.
Improper control operation, see page 67.

Improper Control Temperature Knob Setting

The cabinet temperature depends on the temperature knob setting. It will be noted that, if

the temperature limits of a two-knob or an early standard single-knob control are normal, the cabinet air temperature will get down to 32° F. in a 68° F. room if the temperature knob is left at the coldest position. The room temperature will have to go below 60° F. for the cabinet temperature to reach 32° F. with the knob at mid-position.

Freezing of food should not take place in a 1941 refrigerator with a CF-22C machine having the "Steady-Cold" control unless the room temperature goes below 32° F.

Controls used on 1942 machines with enamel evaporators are set for a colder cabinet temperature than previous standard controls. With the knob at mid-position (N), the cabinet temperature gets down to 32° F. in a 60° F. room. If the knob is left at the coldest position for several hours in a normal room temperature, 70°-80° F., the cabinet temperature will come down to or below 32° F.

In high altitudes, the lower barometric pressure will lower the temperature limits of all controls around 1° F. for each 1000 feet rise. This may necessitate running or resetting the temperature knob at a warmer position.

Excessively Low Room Temperature

From the information given in the preceding item, it is evident that, if the control limits are proper, a freezing cabinet temperature should not be experienced in any room temperature above 60° F., provided the knob is set no colder than mid-position.

If the room temperature goes much below 60° F. for several hours at a time, the cabinet temperature may go below 32° F. if the knob is left at mid-position. To prevent freezing of food, it will be necessary to turn the knob to a warmer setting.

In a 1941 refrigerator with a CF-22C machine having the "Steady-Cold" control, the temperature should not get down to freezing until the room temperature gets below 32° F. However, the evaporator will start operating on a partial defrosting cycle when the room gets below 65° F. The amount of defrosting will increase as the room gets colder than that. Should the room go a little below 40° F. (the upper limit of the M1A235 control is 38.5° F.), the machine will not run at all.

It is evident that, for the most satisfactory performance, a refrigerator should be installed where the room temperature does not go much below 60° F. for more than a few hours at a time.

Creeping Temperature Knob (two-knob control)

An occasional temperature knob of a two-knob control may creep toward a colder setting than where it was set by the user. A crimped spring washer (Cat. No. M15A3) can be installed under the knob to eliminate this trouble.

The knob on a single-knob control will not creep due to the friction of the defrost arm rubbing on the rim.

Poor Bellows Tube Contact to Evaporator

If the bellows tube does not make good contact to the evaporator at the right place, the evaporator and cabinet temperatures will run colder than normal. Adjust the clamp and bellows tube, and tighten the holding screw or screws to improve the contact.

On all stainless steel evaporators, except the one on CF-22C machines, the end of the bellows tube should be tight against the first or second parallel channel. The pinched-off end of the bellows tube should project out below the clamp. The bellows tube should not touch the evaporator except under the clamp.

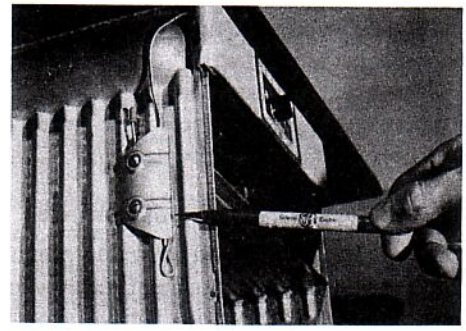


Fig. 199
Bellows Tube Clamp

On enameled and on CF-22C evaporators, the end of the bellows tube is held against the fillet at the top of the header. The bellows tube must not touch the header except under the clamp. On CF-22C evaporators, the end of the bellows tube should butt up against the stop on the clamp. On enameled evaporators, the loop on the twisted bellows tube goes just beyond the clamp.

UNSATISFACTORY ICE FREEZING

There are several factors that contribute to the freezing rate. Among the things that can cause slower than normal freezing are:

Improper control temperature knob setting.
Cool room temperature.
Poor contact of ice tray with evaporator.
Location of tray.
Rubber tray.

Improper Control Temperature Knob Setting

For most rapid freezing, the control temperature knob should be turned to the coldest position so that the machine will run continuously in normal and warm room temperatures until the freezing is practically completed.

The lower the evaporator temperature during the period of freezing, the faster the heat transfer will be and the quicker the water will be frozen. By turning the temperature knob to the coldest setting, the machine is kept running as long as possible and the average evaporator temperature is maintained several degrees colder than it would be if the machine were allowed to cycle.

When freezing a tray of water on the shelf alone, it is especially important to turn the temperature knob to the coldest position if it is desired to freeze it in as short a time as possible. As noted later in "Location of Tray", the freezing rate on the shelves is much slower than on the evaporator bottom.

> *Caution:* When the freezing is completed, the knob should be returned to the normal position. Otherwise, the cabinet air temperature may be reduced to a point where freezing of food will result.

Cool Room Temperature

As mentioned in the item above, the freezing rate depends on how much of the time the machine runs while the water is being frozen. If the room is cooler than normal, below 70° F., the machine will cycle even though the knob is in the coldest position. If the room is below 60° F., the freezing rate will be relatively slow due to the fact that the machine runs very little of the time.

To get satisfactory freezing in a room temperature below 60° F., it is essential that the dial of the "Steady-Cold" control used on CF-22C machines be turned to the coldest position. If the dial is left at the normal mid-position setting, the evaporator will operate on a partial defrosting cycle.

Poor Contact of Ice Tray with Evaporator Surface

The transfer of heat from the water to the evaporator is accomplished largely through the contact of the tray with the freezing surface. If the contact is poor, the freezing rate will be relatively slow.

If the tray is not frozen to the evaporator surface, the freezing rate will be reduced. It is recommended that a half-cup of water be spread over the evaporator surface at the time the tray is put in.

It may be more convenient to fill the tray with slightly warm water. Then the tray will melt its way through the frost and make good contact with the freezing surface without the need of flowing on water.

It is especially important to properly freeze the tray to the shelf in order to obtain the most satisfactory results. It will be observed that where the humidity is very low in the cabinet (that is, where the outside humidity is low, the door is not opened often, and dishes are kept well covered) there may be little or no frost on the shelf. Under low humidity conditions, the frost tends to collect on the coldest part of the evaporator. It is quite necessary that a little water be flowed on the shelf before attempting to freeze there. Tests show that a tray of water properly frozen to the shelf freezes in one-half the time taken by one just set on a dry shelf.

When examining a tray during the course of freezing, the tray should not be moved so as to break the frozen contact to the freezing surface. If the contact is broken, a slight amount of water should be flowed onto the freezing surface before the tray is put back. This procedure should be followed particularly when replacing a tray of dessert which has been removed for stirring during the course of freezing.

If the bottom surface of the tray is badly dented or warped, good contact cannot be obtained. The surface should be straightened or the tray replaced.

If the tray is separated from the evaporator by a thick coating of ice, the transfer of heat will be retarded because ice is a poor conductor of heat. If the coating of ice is irregular and rough, leaving air spaces under the tray, the contact is even worse. In such cases, it will be necessary to defrost the evaporator or, lacking time for that, the ice on the freezing surface can be melted by "ironing" it with a tray of hot water.

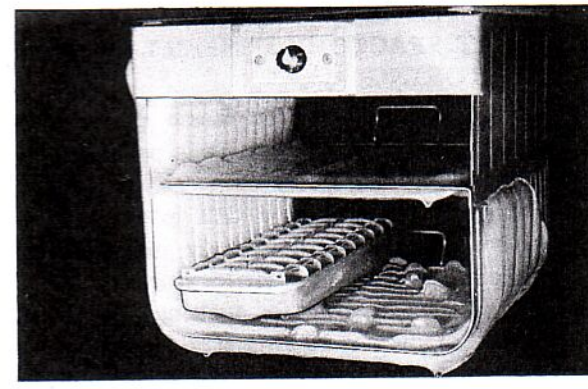


Fig. 200
Uneven Freezing Surface

Location of Tray

The freezing rate on the refrigerated shelf is slower than on the evaporator bottom. The shelf

temperature of a CK-2 stainless steel evaporator runs about 5° F. warmer than the bottom. In a normal room temperature, 70°–80° F., it takes twice as long to freeze a metal tray of water on the shelf with the temperature knob at the coldest position, and three times as long if the knob is left at mid-position. For the fastest freezing, the tray should always be placed on the bottom surface.

The freezing rate on the right side of the CK-2 evaporator shelf is slower than on the left side.

The removable aluminum shelf, which is inserted between the bottom and the refrigerated shelf of CK-2 evaporators in certain models from 1938 on, is not recommended as a freezing surface. It is useful as a storage place but, since it is not refrigerated, its freezing rate is relatively slow.

Rubber Ice Tray

A rubber tray was furnished with many early refrigerators before the Quick tray was introduced in 1938 models. The rubber tray had the advantage over solid-divider metal trays in that it was easier to remove the ice cubes.

Rubber is a poor conductor and retards the flow of heat from the water. When placed beside a metal tray on the bottom of the evaporator, the rubber tray has a freezing rate of about one-third that of the metal tray; that is, it takes three times as long to freeze the water in the rubber tray. On the shelf, particularly when used alone, the rubber tray shows up even worse. Therefore, it is suggested that the rubber tray always be placed on the evaporator bottom when it is being frozen and even then, rapid freezing cannot be expected.

Rubber grids have been used in metal trays in quite a number of refrigerator models. The freezing rate of such trays is slower than for all-metal trays.

UNSATISFACTORY DESSERT FREEZING OR STORING

The time required to freeze desserts depends on the constituents used. It is usually somewhat longer than the time to freeze water. Certain desserts which are very rich in sugar and other non-freezing constituents are very difficult to freeze in any domestic refrigerator.

Since the freezing (or melting) point of many desserts is lower than for water, it may be necessary to keep the temperature knob at a colder setting than usual after the dessert is once frozen.

The dessert should be stored on the bottom of the evaporator rather than on the shelf, and the tray should be kept frozen in good contact with the freezing surface.

Commercial ice cream is stored at temperatures between 0° and 10° F. It will therefore be found difficult to keep it for any extended period without turning the temperature knob to a colder than normal position. It should be placed in an aluminum tray properly frozen to the bottom of the evaporator.

SWEATING OF EVAPORATOR DOOR OR INTERIOR OF CABINET

Whenever the cabinet door is opened, some of the cold air within the cabinet is replaced by warm air from the room. In humid weather, the room air contains considerable moisture which is bound to condense out within the cabinet. Part of it collects as frost on the evaporator. The other cold surfaces including the cabinet walls, shelves, dishes and the evaporator door also collect beads of water.

The condensing of the water out of the air constitutes a heavy load on the refrigerating machine so the cabinet temperature will be higher than normal.

A poor door or cabinet top seal will increase the sweating.

During periods of high humidity, it is impossible to entirely eliminate sweating. However, it can be kept at a minimum by opening the door and leaving it open as little as possible and by keeping moist foods and liquids well covered.

HIGH PER CENT RUNNING TIME

If the frost on the evaporator is not normal, refer to "Evaporator does not frost properly" on page 129.

If the frost is normal, the trouble may be found in one of the previous parts of this section:

Cabinet temperature too high; see page 133.
Cabinet temperature too low; see page 135.
Sweating of evaporator door or interior of cabinet; see above.

HIGH POWER CONSUMPTION

If a machine draws abnormally high watts while running, the machine may have shorted stator turns, a discharge valve leak, or an overcharge of refrigerant.

The various troubles and operating conditions which cause a machine to have a high per cent running time as just previously described also result in high kilowatt hour consumption.

UNSATISFACTORY REFRIGERATION CHART

Evaporator Frost	Machine Operation	Noise	Temperatures (While Running)			Other Symptoms	Cause	Adjustment
			Dome	Condenser	Float			
1. None (Mainly CF-2J, CF-22C, CF-28E, CJ-2B, C, D, & E Machines)	Runs continuously	Metallic clicking from compressor	Slightly warm	Slightly cool	Cool	May purge liquid if float valve purging screw is opened ⅛ of a turn.	Restriction in refrigerant system	Shut off machine. Heat evaporator with heater below injector header (lower right corner) or add 4 oz. of Freon-12. Recommend hot water defrosting.
2. None (LK-1A Machines only)	Runs continuously	Light metallic clicking from compressor	Slightly warm	Slightly cool	Slightly cool	Purges frothy oil.	Oil logging of float valve. Opening near bottom of intake muffler. Oil in base foams under conditions where liquid refrigerant collects in base.	Keep lifting the float with magnetic lifter (do not leave current on lifter too long) until oil passes through to evaporator. The oil can also be purged out.
3. *None	Runs continuously	Light metallic clicking from compressor	Slightly warm	Slightly cool	Slightly cool	Purges dry gas. (Purging screw should not be opened over ⅛ turn.) Very little SO_2 odor if bled slowly through oil.	Non-condensable gas (air)	Bleed off the non-condensable gas slowly through oil. Check for evidence of a low side leak.
4. None	Runs continuously	Light metallic clicking from compressor	Slightly warm	Slightly cool	Cool	Purges liquid. (Purging screw should not be opened over ⅛ turn.) A Flatop machine may not purge liquid until the base of the condenser is warmed.	Float stuck closed.	Break loose with magnetic lifter or by tapping (not hammering) on the float valve shell. If it does not free itself, heat the float to drive out the liquid and try again. Flush by lifting the bulb several times.
5. None	Runs continuously	Light metallic clicking from compressor	Slightly warm	Slightly cool	Slightly cool	Purges dry gas. (Purging screw should not be opened over ⅛ turn.) If there is no refrigerant left in the machine, there will be little outward pressure when the purging screw is opened	No or very low refrigerant charge.	Lift the float with magnetic lifter. It will come up easily. If there is some refrigerant, the series part of the evaporator will start to cool and even frost, but it will soon warm up. Check for a leak.
6. *None	Runs continuously	Loud sputtering noise from compressor	Warm	Slightly cool	Slightly cool		Unloader stuck so that intake valve is held open.	Heavy jarring of the machine may break the unloader loose.
7. *None	Runs continuously	Slight sputtering liquid noise from compressor	Slightly cool	Slightly cool	Slightly cool	No oil flow can be detected against the compressor case dome. The compressor will coast to a stop without the usual unloading noise.	Oil passage to unloader is blocked.	Machine must be replaced.
8. *None	Runs continuously	Quiet. No oil flow can be detected against the compressor case dome	Slightly cool	Slightly cool	Slightly cool	The compressor will coast to a stop without the usual unloading noise. If machine is shut off for a while, or if evaporator is heated, the evaporator may frost at first when machine is started up.	Low oil.	Machine must be replaced.
9. None, but the evaporator may cool some and possibly sweat.	Runs continuously	Loud sputtering noise from compressor. Hiss from compressor directly after shut off	Very warm	Slightly cool or slightly warm	Slightly cool or slightly warm		Bad discharge valve leak.	Shut off machine. Heat evaporator until warm. Restart machine. The warm and higher density refrigerant may flush out whatever is under the discharge valve.
10. *None, but the evaporator may cool some and possibly sweat.	Runs continuously	Compressor quiet. (Normal). Loud flushing noise from evaporator. Hiss from float orifice while running and after shut off.	Very warm	Warm	Warm		Float stuck open.	Break loose with magnetic lifter or by tapping (not hammering) on float shell. Operate it several times with the lifter.

* Items with asterisks are extremely rare.

UNSATISFACTORY REFRIGERATION CHART (Continued)

Evaporator Frost	Machine Operation	Noise	Temperatures (While Running)			Other Symptoms	Cause	Adjustment
			Dome	Condenser	Float			
11. *None, but the evaporator may cool some and possibly sweat.	Runs continuously	Loud liquid boiling in compressor case.	Cool	Warm	Warm		Heavy overcharge of refrigerant.	Purge off the excess refrigerant, taking precautions so that it will do no harm.
12. *None, but the evaporator may cool some and possibly sweat.	Runs continuously	Hiss from compressor while running and after shut off.	Very warm	Slightly cool or slightly warm.	Slightly cool or slightly warm.		Internal high pressure leak.	Machine must be replaced.
13. None on left side and bottom; normal on right side and shelf.	Runs continuously	Quiet (Normal)	Warm	Slightly cool or slightly warm	Slightly cool or slightly warm		Low refrigerant charge	Check carefully for a leak. Add refrigerant.
14. None on right side or shelf, normal on left side and bottom (Mainly CF-2J, CF-22C, CF-28E, CJ-2B, C, D, & E Machines)	Cycles Normally	Quiet (Normal)	Warm (Normal)	Slightly warm (Normal)	Slightly warm (Normal)	The shelf temperature remains constant above 32°, the bottom limits are normal.	Accumulation of slightly thickened oil in injector header.	Shut off machine. Heat evaporator with heater below injector header (lower right corner) or add 4 oz. of Freon-12. Recommend hot water defrosting.
15. None on shelf, little or none on right side; normal on left side and bottom except low on header.	Cycles Normally	Quiet (Normal)	Warm (Normal)	Slightly warm (Normal)	Slightly warm (Normal)	The shelf temperature limits are normal, drops of water will freeze on it, and it will frost if the cabinet door is left open a while.	During periods of low outside humidity and under light load conditions, frost migrates to coldest part of evaporator.	The machine is all right.
16. Low or none on header; one or more of channels across bottom and part way up left side bare.	Cycles Normally	Quiet (Normal)	Warm (Normal)	Slightly warm (Normal)	Slightly warm (Normal)		Slightly low refrigerant charge.	The machine is all right unless running time is excessive, or more than two or three channels are bare. Check for a leak.
17. Normal while running; header defrosts rapidly when shut off.	Cycles with short "off" and long "on" period.	Quiet (Normal). Hiss from compressor after shut off.	Warmer than normal	Warmer than normal	Warmer than normal		Medium discharge valve leak.	Refer to Item 9, "bad discharge valve leak."
18. Normal while running; header defrosts slightly when shut off.	Cycles with higher than normal per cent running time; shorter than normal "off" period and longer than normal "on" period.	Quiet (Normal). Slight hiss from compressor directly after shut off.	Slightly warmer than normal	Slightly warmer than normal	Slightly warmer than normal		Slight discharge valve leak.	Refer to Item 9, "bad discharge valve leak."
19. Normal	Cycles normally	Quiet (Normal)	Warm (Normal)	Slightly warm (Normal)	Slightly warm (Normal)	Cabinet too warm.	Control set too warm.	Reset control colder.
20. Normal while running; header, upper part of left side and shelf defrosts during "off" cycle.	Cycles with long "on" period and long "off" period.	Quiet (Normal)	Warmer than normal	Warmer than normal	Warmer than normal		Partially weak bellows.	Change control or replace bellows. It is impossible to check a partially weak bellows except by turning the knob to "defrost" and noting that the control does not trip "on" even though the evaporator temperature goes above 60°F.
21. Normal while running, header and part of left side defrost during "off" cycle (CF-22C machines only)	Cycles normally	Quiet (Normal)	Warm (Normal)	Slightly warm (Normal)	Slightly warm (Normal)	Poor ice freezing in cold room temperature	Steady cold control holds constant cabinet temperature with varying room temperatures. Evaporator temperature rises as the room gets colder. Defrosting takes place if room gets cold.	Machine is all right. Operate control at position 6 or higher. Explain operation to user so he understands protection provided against a freezing cabinet in a cold room.

* Items with asterisks are extremely rare.

UNSATISFACTORY REFRIGERATION CHART (Continued)

Evaporator Frost	Machine Operation	Noise	Temperatures (While Running)			Other Symptoms	Cause	Adjustment
			Dome	Condenser	Float			
22. Normal while running; completely defrosts during "off" cycle. (CF-22G machines only	Cycles with long "on" period and long "off" period.	Quiet (Normal)	Warmer than normal	Warmer than normal	Warmer than normal		Control knob is at too warm a position (position C or D).	Turn knob to a colder position. For most installations, position N (normal) is satisfactory. Defrost spring (Cat. No. M15A87) under the knob can be replaced if it is necessary to run knob at positions C or D.
23. *Normal while running; shelf and right side defrost rapidly when shut off.	Cycles with short "off" period and long "on" period.	Compressor quiet. (Normal.) More than normal flushing noise from evaporator. Hiss from float orifice when running or after shut off.	Warmer than normal	Warmer than normal	Warmer than normal		Leak around float needle.	Refer to Item 10, "Float Stuck Open."
24. Normal except that suction tube frosts to enameled top plate. The suction tube may defrost during the "off" cycle.	Cycles with longer than normal "on" and "off" periods.	Quiet (normal) or slight liquid boiling in compressor case.	Warmer than normal	Warmer than normal	Warmer than normal		Medium overcharge of refrigerant.	Refer to Item 11, "Heavy overcharge of refrigerant."
25. *Normal	Runs continuously	Quiet (Normal)	Hot	Hot	Very warm	Cabinet too warm	Load excessive.	Reduce load. Provide more ventilation.
26. Normal	Cycles normally	Quiet (Normal)	Warm (Normal)	Slightly warm (Normal)	Slightly warm (Normal)	Cabinet too cold	Cold location.	Move refrigerator to warmer location or reset control warmer.
27. Normal	Long running periods	Quiet (Normal)	Warm (Normal)	Slightly warm (Normal)	Slightly warm (Normal)	Cabinet too cold.	Bellows clamp loose.	Tighten clamp.
28. Normal	Long running periods	Quiet (Normal)	Warm (Normal)	Slightly warm (Normal)	Slightly warm (Normal)	Cabinet too cold.	Control set too cold.	Reset control warmer.
29. Normal	Runs continuously	Metallic clicking from compressor	Warmer than normal	Warmer than normal	Warmer than normal	Cabinet too cold.	Control inoperative.	Replace control.

* Items with asterisks are extremely rare.

NOISE

The machine is assumed to run and refrigerate satisfactorily. Otherwise, refer to "Unsatisfactory Refrigeration" "Evaporator does not frost properly" on page 129.

The normal running tone of a machine may seem objectionable to an occasional user. The degree to which the sound of a machine is noticeable depends on the machine, the installation and the user.

A defective or improper starting relay may cause an objectionable noise; see pages 82 and 83.

LIQUID FLOWING NOISE

Close listening near the compressor case will reveal a mild liquid flowing noise coming from the circulation of oil for cooling purposes within the compressor case. This is quite normal and will seldom be objectionable.

An unusually loud liquid flowing noise against the dome of the compressor case may be caused by improper oil flow from the oil squirter. The level of the refrigerator may affect this noise. Try changing the level of the whole refrigerator or, in the case of a Flatop model, change the suspension of the machine in the cabinet.

LIQUID SPUTTERING NOISE

A slight liquid sputtering noise from the compressor case can occasionally be distinguished. This

is caused by liquid refrigerant boiling out of the oil supply in the base of the compressor case. Any condition which changes the equilibrium of the refrigerant in solution in the oil will produce this noise. At times, it will be found more pronounced toward the end of a normal "on" period when the temperature difference between the oil returning from the compressor and that in the base is the greatest. It may also be observed during ice freezing.

LIGHT METALLIC CLICKING NOISE

This noise from the compressor indicates that there is a rather low vacuum on the low pressure side of the system so that the oil pump does not take in a full charge of oil at each turn. This noise will be observed when a machine is made to run continuously by disconnecting the bellows tube from the evaporator, provided the evaporator is located in a closed cabinet so that it will pull down to a low temperature. A machine should not be allowed to operate under this condition.

METALLIC JARRING NOISE

This is a light vibrating noise coming from the compressor. It usually can be stopped for at least an instant and often for quite a long time by giving the compressor case a sharp blow with the hand. It comes from a very slight movement of a mounting spring on its seat at the normal frequency of vibration of the compressor unit. The performance or life of a machine is not affected by the presence of this noise.

It can frequently be eliminated by changing the level of the compressor. A Monitor Top machine should be tilted slightly forward, and a Flatop machine should be tilted backward. Sometimes the level of the refrigerator can be changed, especially in the case of a Flatop model which originally tilted slightly forward. A Flatop machine can be tilted backward by raising the front foot of the compressor case above the cross-bar in the cabinet.

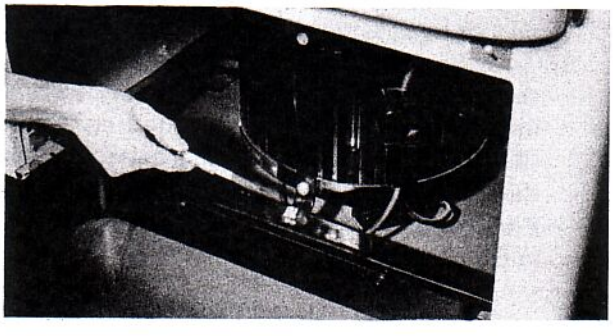


Fig. 201
Compressor Foot on Cross Bar

If necessary, the condenser mounting can be changed to accommodate the tilting of the compressor case.

METALLIC RATTLING NOISE

A noise of this type usually indicates something loose or two parts vibrating together. First inspect the position of the refrigerator to make sure that it is not touching a wall, pipe or something else.

Then check the dishes, bottles and shelves in the cabinet to see that they are not the source of the noise.

If it is a Flatop model, note the position of the refrigerant tubes going up between the back of the cabinet and the condenser that they do not vibrate together or against the cabinet or condenser. Check the mounting of the machine in the cabinet. The various screws, and nuts and bolts that hold the machine in the cabinet should be tight.

If the rattling noise seems to come from within the compressor case, try running the machine in different positions to see if the noise can be eliminated. The compressor bumper is designed to be quite close to the brackets in the case in order to protect the compressor unit during shipment. If the noise can be eliminated by changing the level of the machine, make the necessary change in the level of the refrigerator, or, if it is a Flatop model, alter the suspension of the machine in the cabinet.

If it is a 1934, 1935 or 1936 model, there is a possibility that the rattling noise may come from a loose oil cup. This cup catches the oil flowing over the end of the cylinder and returns it to the space around the upper stator windings. It is held to the upper bearing bracket by two cap screws with lock washers under their heads. In 1937 and subsequent models, the oil cup is cast integral with the upper bearing bracket. A loose oil cup can be easily detected by shaking the machine. In addition to the deep toned thumping of the compressor bumper against the case brackets, there is a light jingling rattle.

RUNNING TONE OF FREON-12 MACHINES

The normal running sound of a Freon-12 machine is somewhat louder than that of a sulphur dioxide machine. If necessary, the noise level can be reduced by installing noise absorbing material and baffles as follows:

1. Place rubber pads or bushing under the bolts and screws which mount the machine in the cabinet.
2. Line the unit compartment in the base of the cabinet with pieces of insulation, such as Insulite or Celotex.

3. Place a baffle in front of the compressor case, extending from the cross-bar about half way up the case and across the unit compartment.
4. Close up the side and bottom, but not the top, openings between the condenser and cabinet with strips of wood or cardboard.
5. Tape or place a split rubber tube on the high pressure tubes from the compressor base to the condenser.

RUNNING VIBRATION OF CH-1A AND CJ-1A MACHINES

Early production machines of these models were assembled in the cabinet so that there was no support for the front of the compressor case. In certain installations where the floor under the refrigerator either is not solid or has a period of vibration close to that of the compressor or fan motor, there may be an objectionable running vibration. It can be eliminated by supporting the front of the compressor base or case.

CJ-1A MACHINES

The most simple means of supporting the front of the compressor base is to force a block of wood between it and the floor. This has the disadvantage of having to be replaced every time the refrigerator is moved.

A permanent support can be obtained by assembling an angle iron support assembly.

The first production CJ-1A machines in B-4 cabinets had no compressor base support supplied although such an assembly can be obtained and put on. Later production B-4 cabinets had this angle iron assembly supplied as an accessory, with suitable instructions for installing it.

The design was then changed so that a foot was welded to the front of the compressor base and this was bolted to an angle iron brace across the cabinet base, as with CF machines.

CH-1A MACHINES

Several different fan motor mountings were used on CH-1A machines and the mounting determines the method of supporting the front of the compressor case or base.

The first mounting was a three-point, rubber one to the front of the compressor case. Since no available angle iron assembly can be used in B-3 cabinets, the adjustment is to force a wooden block between the compressor base and the floor, or between the compressor case and the front cabinet cross-bar.

A few machines were then sent out with the fan motor solidly mounted to the strap on the front of the compressor case. The same adjustment as for the first mounting applies.

Next, the fan motor was mounted solidly on an upright strip from the cabinet base in front of the compressor case. To correct a running vibrating noise with this mounting, it is only necessary to force a block of wood between the compressor case and the angle iron in front of it.

There should be no trouble with subsequent mountings because the fourth mounting involved the tying together of the upright strip used in the second mounting and the compressor case, and the fifth and final mounting had a foot welded to the compressor base which was bolted to an angle iron strip across the cabinet base.

RATTLE WHILE STOPPING

A slight rattle within the compressor case as the compressor slows down is usually caused by the turns of the high pressure coil being too close together, or the compressor bumper or lugs too close to the case brackets. Changing the level of the refrigerator or, where the noise is in a Flatop model, altering the position of the machine in the cabinet, may eliminate the noise.

COMPRESSOR HITS CASE WHILE STARTING OR STOPPING

This noise is usually an occasional relatively loud thump rather than a light rattle as described in the preceding item. It is an indication of fluttering or sticking of the relay contacts, or sticking of the unloader.

Fluttering or sticking of the relay contacts, which will keep bringing the starting winding into the circuit or hold it there, may cause the compressor to bump against the case. This condition is more likely to occur in machines with No. 3 size compressors, such as CF-22's, than in those with No. 2 size compressors, such as CF-2's, because the former compressors are closer to the case. Some of the early Type R relays had a tendency to flutter on 60-cycle service. Early Type N relays had a tendency to flutter and early Type R relays were not particularly satisfactory on 50-cycle service.

If the unloader sticks in the outward position, the machine starts and stops under load. The compressor may hit the case as it starts or stops. This trouble is also more apt to be found in machines with No. 3 size compressors.

VIBRATION WHILE STOPPING

The Scotch-yoke compressor is designed to unload above half speed so that most of the slowing down occurs without load on the compressor. A slight tremor can be detected in some installations but, if the refrigerator is reasonably well installed, the slight vibration should not be objectionable.

This trouble is more often found in Monitor Top than in Flatop machines due to the fact that the machine weight is on top of the cabinet in the former.

In case a refrigerator is believed to vibrate too much during stopping, the following factors may contribute to the trouble:

a. Refrigerator not sitting solidly on all four legs. If the refrigerator is installed so that it does not sit solidly on all four legs, any slight vibration will be magnified.

b. Refrigerator rests against something. If the refrigerator rests against the wall or something else, the slightest vibration will be transmitted and amplified.

c. Position of dishes in cabinet. Sometimes dishes or bottles are so located that they will rattle together, or against the inner liner of the cabinet or the evaporator with the slightest vibration from the machine.

d. Floor construction. If the floor on which the refrigerator sits is not solid or if it has a natural period of vibration close to that of the refrigerator, the slightest vibration during stopping may be transmitted and amplified. Rubber pads can be tried under the refrigerator legs. In an extreme case it may be necessary to brace the floor from the underside.

BOILING NOISE FROM EVAPORATOR

Due to the injector action in the evaporator, designed to provide the most efficient cooling and the most rapid freezing, the normal boiling noise from the evaporator when the machine is running is noticeable when the cabinet door is open. With the cabinet door closed, it should not be objectionable.

RADIO INTERFERENCE

There is no radio interference during the normal running of a machine. When the control trips on, there may be a click from the radio, depending on the house wiring. The same click would occur should a light switch or any other appliance be turned on. If radio interference is traced to the refrigerator, there may be a ground, short circuit, arcing relay or faulty butter conditioner.

LEAKS

SULPHUR DIOXIDE MACHINES

A leak in these machines is usually readily detected since the odor of sulphur dioxide makes itself apparent even when present in very small quantities.

To locate a leak, use an uncorked bottle of concentrated ammonia or a swab saturated with it. The reaction of sulphur dioxide gas and ammonia fumes produces a white vapor which is easily recognized.

Sometimes a very small leak can be detected by the presence of an oil spot at the place where the refrigerant is coming out.

An oil spot around the compressor case purging socket, found on 1938 and subsequent models, rarely comes from a leak. A heavy oil was put into the socket before the Duprene rubber plug was added.

Caution: Never tamper with the case purging screw unless there is definite evidence of sulphur dioxide leaking.

A very small leak on the high pressure side of the system can allow the gradual escape of the refrigerant charge without there being a noticeable odor. Refer to page 149 for an explanation of the evaporator frosting under various low refrigerant conditions.

If a machine has lost nearly all of its charge, it is difficult to locate the leak without adding refrigerant.

Always check the float valve purging screw by putting a few drops of light oil in the socket and, with the float valve warm, watch for bubbles coming up through the oil. Reseat the purging screw if there is a leak. If the leak cannot be stopped, place a Monitor Test bottle sealing cap with a lead gasket in it over the end of the purging screw socket.

If there should be a very small leak on the low pressure side of the machine, and the evaporator operates below 14° F., air will be drawn into the machine and will collect in the float valve. See page 146, "Bleeding non-condensable gas."

To locate a low side leak, defrost and warm the evaporator, using a Monitor Test heater or trays of warm water. Then bring the fumes of concentrated ammonia near to the evaporator and its tubes.

When using the Monitor Test heater to warm the evaporator, never allow the temperature of the evaporator to get above what the hand can stand.

Never place the coils of the Monitor Test heater in direct contact with the evaporator. Place it on an ice tray or on a pair of pliers.

Blue corrosion on the copper tubes to the evaporator may be mistaken for evidence of a leak.

Unless there is some other indication, such as the attack on the enamel of the top plate or the actual odor of sulphur dioxide in the cabinet and in food, the blue corrosion is probably caused by fumes from certain uncovered foods. Food containing vinegar will readily cause this blue corrosion on copper tubes which are not protected. It is recommended that, where this blue corrosion is objectionable, the tubes be cleaned and carefully covered with lacquer. The user should be instructed to cover foods, particularly those containing vinegar.

A white powder on the enameled top plate above the evaporator is not an indication of a leak if it can be wiped off with a damp cloth. If the enamel is etched so that it is rough and the white deposit cannot be rubbed off with a damp cloth, there is a possibility of a low side leak.

A brown, rust-like stain on the unrefrigerated leg of an evaporator may also be mistaken for evidence of a leak. This stain generally results from certain treatment of the metal during manufacture. It can usually be removed with a common scouring powder and should not appear again.

FREON-12 MACHINES

Freon-12 has no odor such as sulphur dioxide, nor is there a simple test like the use of ammonia vapor to indicate its presence. Consequently, leaks in these machines are difficult to locate.

The only evidence of loss of refrigerant in Freon-12 machines is improper frosting of the evaporator. At first, the left side and bottom will be bare while the right side and shelf will be frosted but finally there will be no frost at all. Refer to page 149.

One way to locate the leak without special equipment is to look for an oil spot where the refrigerant is probably escaping. Another method is to spread a mixture of soap and water over suspected surface; if a leak is present, bubbles will be blown in the solution.

GENERAL ADJUSTMENTS

HEATING EVAPORATOR

A 500-watt Calrod heater can be used to heat the evaporator. A headlight heater element can also be employed. If a heater is not available, ice trays can be filled with hot water and placed in the evaporator. As soon as the water cools down, trays should be emptied and more hot water used.

With the machine shut off, the heater is generally placed in the evaporator between the shelf and the bottom.

Caution: The coils of the heater must not touch the evaporator. Place it on an ice tray or on a pair of pliers.

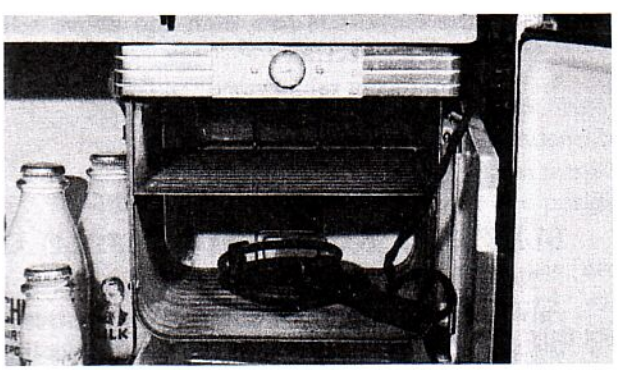


Fig. 202
Heating Evaporator

When heating the series part of the evaporator to relieve a restriction or shelf defrosting condition, the heater should be located under the injector header along the lower right corner of the evaporator.

The evaporator should be heated until it feels very warm to the hand.

Caution: Never allow the evaporator to get hotter than the hand can stand.

Prolonged heating will drive all the refrigerant from the evaporator to the compressor case.

LIFTING FLOAT BULB

A magnetic float valve lifter can be used to lift the float bulb to check its operation, flush the orifice, transfer the liquid refrigerant in the float valve to the evaporator, or release a binding or stuck float mechanism.

Early production lifters, originally designed for DR machines, must have the two legs cut off flush with the lower end of the coil to be used on Scotch-yoke machines.

If no lifter is available, tapping or jarring of a stuck float valve with a hammer may loosen it. Use a wood block to protect the valve. See Fig. 204.

INSTRUCTIONS FOR MAGNETIC LIFTER

If liquid refrigerant comes out of the float valve with the purging screw opened not over 1/8 turn, the valve should be heated with a Monitor Test heater before lifting the bulb. The bulb may not come up with the shell full of liquid but may break loose if the liquid is first driven out.

1. Place the lifter on the float valve. On Monitor Top CK and Liftop LK machines, the recessed

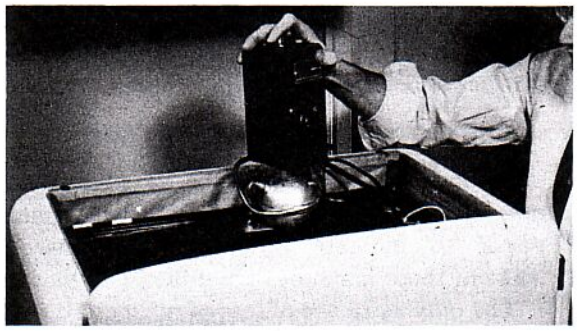


Fig. 203
Using Float Valve Lifter

portion of the core fits down over the purging screw socket. On Flatop and Under-the-drain board DK models, the core can sit on the top of the float valve shell. A lifter cannot be used on a Balltop CG machine because the float valve is beneath the box top so that the core will not go through the hole over the purging screw socket.

2. Plug the lifter connecting cord into a suitable electric service outlet, either 110-volt alternating current or 115-volt direct current.

   Caution: Never plug into a 220-volt circuit.

3. Depress the push button firmly for about one second. When the float bulb lifts, it can be distinctly heard.

   Caution: Never hold the push button down for over two seconds; otherwise, the copper oxide rectifier may be injured.

4. Repeat four or five times to try to loosen the mechanism, or to limber it up and allow the liquid refrigerant to flush through the orifice, if it has already been loosened.

The initial surge of current through the lifter is more effective in freeing the float valve mechanism than the steady current which follows.

Caution: Never depress the push button more than eight times in succession without leaving a couple of minutes for the rectifier to cool.

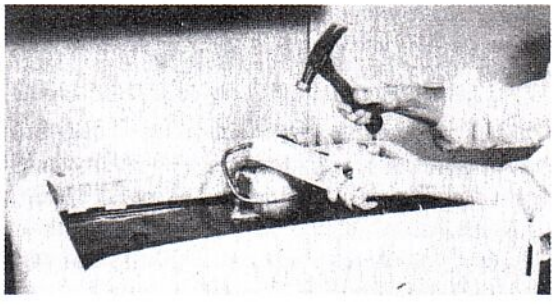


Fig. 204
Tapping Stuck Float Valve

MAINTENANCE OF MAGNETIC LIFTER

If the lifter is used beyond the limits previously mentioned (held on more than two seconds at a time or used more than eight times in rapid succession), there is a possibility that the copper oxide rectifier may be injured.

After checking all connections and the push button, the rectifier can be checked by connecting a direct-current ammeter in series with the operating coil:

1. Remove one side plate of the lifter by taking out the two small screws.
2. Remove one of the operating coil connecting leads from its terminal on the rectifier.
3. Attach this connecting lead to one terminal of a direct-current ammeter with 15-ampere or higher scale.
4. Attach an insulated wire lead from the other terminal of the ammeter to the rectifier terminal from which the operating coil connecting lead was removed.
5. Place a voltmeter across the two line (center) terminals of the rectifier.
6. Plug the lifter connecting cord into a 110-volt outlet.
7. With any given voltage across the rectifier, the current should be more than the following minimum values:

Voltage	Minimum Amperes
110	7.2
115	7.5
120	7.8
125	8.1

8. If the current is less than the above values, replace the rectifier.
9. The following replacement parts are available:
   Operating coil.
   Copper oxide rectifier unit.
   Push button.

BLEEDING NON-CONDENSABLE GAS

Non-condensable gas is indicated when the float valve is definitely cooler than the condenser with the machine running and the evaporator cooling. If there is so much non-condensable gas that no liquid passes through the float valve, the refrigerant will be pumped out of the evaporator into the condenser. Then the evaporator will not cool, and both the condenser and float valve will feel slightly cool.

Non-condensable gas in Scotch-yoke machines is

relatively rare and, when present, is generally air taken in through a very slight low side leak.

If a large amount of non-condensable gas is found in a machine, check for a low side leak.

INSTRUCTIONS FOR BLEEDING

1. Keep the machine running.
2. To get at the float valve purging screw:

   Monitor Top CK Machines: Remove the cap over the purging screw socket. In order to prevent injury to the finish on the top of the float valve, cut through the lacquer around the base of the cap before unscrewing it. Remove the auxiliary sealing screw above the purging screw in earlier models.

   Flatop CE, CF, CH, CJ Machines: Take off the cabinet top cover. Remove the loose insulation over the float valve.
   Remove the auxiliary sealing screw above the purging screw in earlier models. This sealing screw was eliminated from later production CF-1D, CF-2D, CJ-1A and CH-1A machines, and all subsequent models.
   It is necessary to take off the plate on the back of the cabinet to get at the float valve of an FBA-1A machine.

   Liftop LK Machines: Remove the cap over the purging screw socket projecting from the back of the cabinet.

   Balltop CG Machines: Take off the small cover-plate in the back of the box top.

   Under-the-drain Board DK Machines: Remove the cabinet top cover.

3. Partially fill the purging screw socket with a light oil.
4. Open the purging screw just a crack with a purging wrench and allow the non-condensable gas to bubble through the oil as fast as possible without blowing all the oil out of the purging screw socket.
   If the bleeding is done properly, the non-condensable gas should be removed with practically no loss of refrigerant and with very little odor in case it is an SO_2 machine.
5. Continue the bleeding until the float valve feels as warm as the center of the condenser.
6. Close the purging screw and check for a leak with oil in the purging screw socket.
7. Remove the oil as well as possible from the purging screw socket.

PURGING REFRIGERANT

Unless refrigerant has been added to a machine, there should be no occasion for removing it. The refrigerant charge can vary two or three ounces from the normal without noticeably affecting the machine's performance.

Caution: Refrigerant should not be removed or added to machines with the bellows tube clamped above the header (CF-22C with stainless steel evaporator and all models with enameled evaporators) since the height of the liquid in the header is an important factor in determining the evaporator temperature limits.

A slight overcharge, around 5 or 6 ounces, will cause frosting of the suction tube below the enameled top plate while the machine is running, and will slightly increase the power consumption and running time. The machine will be quiet except for an occasional liquid boiling noise in the compressor case caused by liquid refrigerant getting over.

A medium overcharge, around a half pound, will cause the suction tube to frost beyond the enameled top plate and it will be somewhat cool where it enters the compressor case. The dome may not be as warm as it should be. There will be quite a lot of liquid boiling noise in the compressor case.

A heavy overcharge, a pound or more, will allow the evaporator to cool and even sweat, but it will not frost. The machine will run continuously with a loud liquid boiling noise in the case. The dome will be cool, but the condenser and float valve will be warm.

PURGING INTO ATMOSPHERE

If the machine is located where the refrigerant gas will do no harm, the float valve purging screw can be opened and the gas allowed to escape into the atmosphere. The machine should not be in a cabinet because of the possibility of getting some of the gas into the insulation. Refer to Step 2 in the previous column for instructions for getting at the float valve purging screw.

Caution: Never open the compressor case purging screw.

PURGING SO_2 INTO LYE-WATER SOLUTION

About 10 feet of ¼-inch copper tubing can be connected to the adapter bottle opening by means of a ¼-inch flare nut to a ⅝-inch by ¼-inch flare-to-flare reduction union. The copper tubing can also be attached with a 1¼-inch flare nut, ¼-inch by ¼-inch male union, copper washer and

bottle adapter fitting. A rubber tube can be used with a short piece of ¼-inch copper tubing attached as above.

Lye-water solution in a wooden or enameled container in the proportion of 1¼-lb. of lye dissolved in 1 gallon of water will absorb 1 lb. of SO_2.

1. Keep the machine running.
2. Assemble the adapter to the float valve purging screw socket. To get at it, refer to Step 2 on page 147. For detailed instructions on assembling the adapter, refer to page 150.
3. Place the valve stem into the float valve purging screw and tighten the valve stem gland nut.
4. Assemble the purging connection to the adapter. This is screwed into the opening where the Monitor Test bottle goes in.
5. Put the open end of the tubing at the bottom of the wooden or porcelain container under the lye-water solution.
6. Open the float valve purging screw three complete turns and pull the valve stem up out of the purging screw.
7. Purge until the desired amount of refrigerant has been removed.

   Caution: Do not purge too much.
8. Close the float valve purging screw tightly. If the gas still continues to come out, open the float valve purging screw and reseat it.
9. Remove the tube from the lye-water solution immediately after the purging is completed, so that the solution will not be drawn up the tube.
10. Remove the adapter from the float valve.
11. Check the purging screw in the float valve for a leak, using light oil in the purging screw socket. Remove the oil as well as possible.

    A slight leak that cannot be stopped by tightening the purging screw can be sealed off with a Monitor Test bottle sealing cap.

PURGING SO_2 INTO SODAWATER SOLUTION

The equipment and procedure are essentially the same as described under "Purging SO_2 into Lye-water Solution," except for the solution used. The procedure outlined below allows the removal of exactly ½ lb. of sulphur dioxide. By varying the solution, other exact amounts can be taken out.

1. Dissolve 1 lb. of ordinary washing soda (sal soda) in 2 gallons of water, using an enameled pail.
2. Assemble the adapter and purging tube as described under "Purging Into Lye-water Solution."
3. Place the end of the purging tube at the bottom of the pail containing the washing soda solution.
4. Open the float valve purging screw just enough to allow as rapid flow of sulphur dioxide as possible without its escaping into the atmosphere from the washing soda solution. There will be some agitation of the solution at the surface above the end of the tubing, but there should be practically no odor of sulphur dioxide.
5. After about ten minutes, when the operation is half completed, the solution will become effervescent from the carbon dioxide being released. At this point ¼ lb. of refrigerant has been purged out.
6. Continue the purging at the same rate until there is a noticeable odor of sulphur dioxide with the nose held a foot above the surface of the solution.
7. Close the float valve purging screw.
8. Immediately remove the purging tube from the solution to prevent drawing up the solution.
9. Remove the adapter and check the purging screw for a leak as outlined in "Purging into Lye-water Solution."

MONITOR TESTING, TO ADD REFRIGERANT

In general, the adding of refrigerant to Scotch-yoke machines is not recommended for the following reasons:

The design of the evaporators on these machines is such that the refrigerant charge must be accurate within a few ounces to insure satisfactory performance under all operating conditions.

Sulphur dioxide is available in Monitor Test bottles charged with 1¾ pounds. The refrigerant charge in CK-2 and CF-2 size machines averages about 2 pounds. It is difficult to add part of a bottle in case less than the total amount is needed.

Refrigerant obtained from other sources may or may not be satisfactory, especially in regard to moisture content.

A machine which requires the addition of refrigerant must have a minute leak or it has been badly overpurged.

There are certain operating conditions, and there are other conditions within the machine that can cause unusual frosting of the evaporator. Sometimes these unusual frost conditions are mistaken for a low refrigerant charge.

SYMPTOMS OF LOW CHARGE

If the refrigerant charge is slightly low, a matter of 3 or 4 ounces, the frost line will be at the base of the header. The rest of the evaporator will be frosted normally. The performance of the machine will be almost normal.

Under low humidity and light load conditions, the frost will migrate to the coldest part of the evaporator. The header and upper shelf may have no frost but the temperature limits will be normal.

If the refrigerant charge is mediumly low, say ¼ to 1 pound low, the frost line will be down below the header on the left side but the series part of the evaporator, the right side and shelf, will be well frosted. Some of the rear channels across the bottom and part way up the left side (but not the rear channel on stainless steel evaporators which is part of the series section) will be bare. The machine will be quiet and will cycle but the running time will be high. Check the machine for a leak before adding refrigerant.

If the refrigerant charge is very low, only ¼ to ½ pound remaining in the machine, only the series part of the evaporator, the right side and shelf, will frost. The machine will be quiet but it will run continuously. Check the machine for a leak before adding refrigerant.

If there is very little, less than ¼ pound, or no refrigerant in the machine, the evaporator will not cool or frost. There will be a light metallic clicking noise from the compressor. Dry refrigerant gas will be purged if the float valve purging screw is opened not over ⅛ turn. The float bulb will lift easily with the magnetic lifter, and the series part of the evaporator will cool and even frost for a few minutes but will soon warm up.

INSTRUCTIONS TO ADD REFRIGERANT

These instructions apply specifically to the addition of sulphur dioxide since the great majority of the Scotch-yoke machines use that refrigerant. Freon-12 can be added to models designed to use it with the same equipment and with the same procedure, except for leak testing.

Caution: Only refrigerant from a reliable and approved source should be charged in a Monitor Test bottle or a machine. If possible, the bottle should be evacuated.

The maximum charge allowed in a standard bottle is 1¾ pounds of SO_2 or 1½ pounds of F-12.

If refrigerant is to be added, a standard Monitor Test Kit should be used. The parts in the kit include:

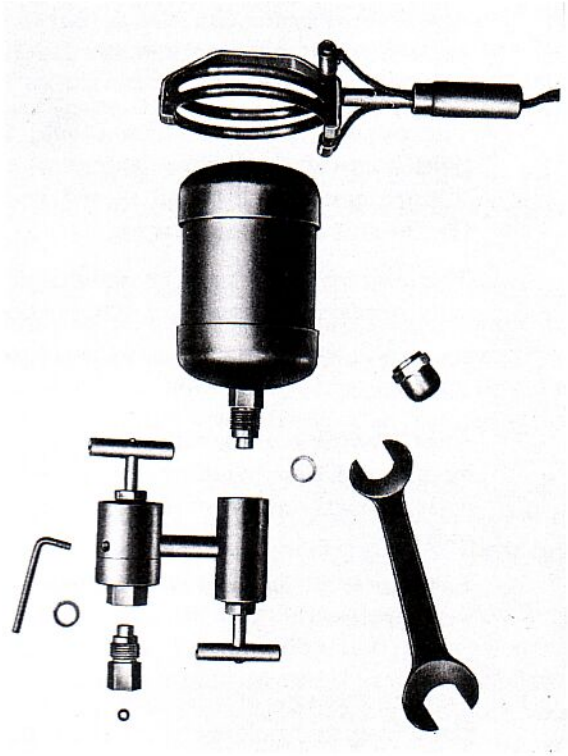


Fig. 205
Monitor Test Equipment

Adapter.
Heater (500 watts on 110 volts).
Wrench.
Purging wrench.
Lead gaskets.

In addition to the kit, the following equipment is necessary:

Monitor Test bottle (originally charged with 1¾ pounds of SO_2)
Concentrated ammonia (to check for an SO_2 leak)
Light oil (to check for a purging screw leak)

The Monitor Test equipment should be kept in good condition. When not in use, it should be stored where it will not become dirty, rusty or damaged. Some specific precautions to be observed are:

Only one lead gasket should be used in the seat on each side of the adapter.

A lead gasket can be used many times if the gland nut and bottle are not tightened too much. Small flakes from the gasket should be removed with a knife each time before using the adapter.

A mutilated lead gasket can be cut out with a knife. Care should be taken not to scratch the seat in the adapter.

The adapter purging screw should be kept tightly closed at all times except as noted in the procedure. A little oil should be kept on the threads to prevent rusting.

The adapter gland packing should be periodically checked and replaced when necessary.

Replace a stem when the splines get badly chewed up.

After a bottle is used, make sure that the purging screw is tightly sealed. Place a sealing cap with a lead washer over the purging screw socket.

The heater wiring and connections should be well insulated.

1. Prepare the adapter. Loosen the valve stem gland nuts and pull the valve stems out as far as possible.

   Make sure that the purging screw is tight.

   Check the lead gaskets. If a new one is to be used, put it on the end of the float valve or bottle purging screw socket, rather than into the adapter seat.

   A cold adapter should be warmed before using it in a warm humid place because of the possibility of moisture condensing in it.

2. Prepare the bottle. Remove the cap.

   No dirt or lead slivers should be left in the purging screw socket, on the seat, or on the threads.

   Loosen the purging screw with the purging wrench and reseat it immediately.

3. Prepare the machine. Shut off the machine.

   To get at the float valve purging screw, proceed as outlined in Step 2, page 147, "Bleeding, to remove non-condensable gas".

   Make sure that there is no dirt or insulation in the purging screw socket, on the seat, or on the threads.

   Loosen the purging screw slightly with the purging wrench and reseat it immediately.

4. Assemble the equipment. Assemble the adapter to the float valve.

   The spherical float valve used on later Flatop machines is mounted to the top plate with a relatively light bracket. Hold the float valve while tightening the nut.

   Enter the valve stem into the float valve purging screw and tighten the gland nut. The valve stem should go way down into the purging screw.

   Assemble the bottle to the other side of the adapter and tighten it.

   Enter the valve stem into the bottle purging screw and tighten the gland nut. Make sure that the stem goes way in.

5. Check for leaks and purge adapter. Open the purging screw in the float valve just a crack and check all joints with concentrated ammonia held close to them. A leak is indicated by the presence of a white vapor in the vicinity.

   Caution: Do not proceed until all leaks are eliminated.

   Loosen the adapter purging screw for an instant to purge out the air in the adapter and to check that the float valve purging screw is open. Reseat the adapter purging screw immediately.

6. Open the purging screws. Open the float valve purging screw and then the bottle purging screw three or four complete turns, and pull out the valve stems. It may be necessary to exert a force on the stems to keep them way down into the purging screws. If they are not way down, the splines may be stripped.

7. Apply heat to the bottle. Place the heater over the end of the bottle and place the plug into a 110 volts service outlet. If all the refrigerant in the bottle is to be put in the machine, leave the heat on until the bottle purging screw socket is very warm.

   There are two possible methods to add less than 1 ¾ pounds of SO_2. The heating can be stopped when the bottle is warm only part way down. The bottle purging screw is then closed. The adapter must be heated to drive the liquid into the machine and then the float valve purging screw can be closed.

An alternative method is to charge the desired amount into a clean empty bottle from a full Monitor Test bottle or from a larger drum obtained from a reliable and approved source.

In case it is desired to check the amount of refrigerant put in, the bottle can be weighed before and afterward. An empty bottle with its cap weighs about 3 pounds 12 ounces. The cap with the lead gasket weighs about 3 ounces.

8. Remove the equipment. Close the bottle purging screw and then the float valve purging screw.

Open the adapter purging screw just a crack.

There should be just a puff of escaping gas.

If liquid comes out, reseat the bottle purging screw, open the float valve purging screw, and heat the adapter. Then close the float valve purging screw and try again.

If gas continues to come out, reseat both the bottle and float valve purging screws.

Remove the bottle from the adapter and the adapter from the float valve.

Tighten the bottle purging screw and put on its sealing cap.

9. Check for leak. Place a few drops of light oil in the float valve purging screw socket and watch for bubbles as an indication of a slight leak. If there is a leak, reseat the purging screw.

A small leak, which cannot be stopped by reseating the purging screw, can be taken care of by assembling the bottle cap with a lead gasket in it to the purging screw socket.

ADJUSTMENTS FOR RESTRICTED EVAPORATOR

Partial refrigeration or "no refrigeration" complaints can be caused by a restriction or obstruction in the refrigerant system. This is particularly true with some of the 1941 CF-2J, CJ-2B, CJ-2C, CJ-2D, CJ-2E, CF-28E and CF-22C machines whose evaporators can become partially restricted or completely plugged up due to thickening of the oil. It is entirely possible that other earlier Scotch-yoke machines may be affected by such a condition but the machines listed are the ones most subject to such a complaint.

A restriction caused by thickening of the oil at times brings about partial frosting of the evaporator; that is, the left side and bottom have frost but the evaporator shelf and right side are bare. When the restriction has existed for some time, on some machines the evaporator is entirely without frost.

If a restriction is caused by thickened oil as described above, there are *three possible corrections.*

I. *Shut off the machine until the evaporator warms up to room temperature.* The cabinet door should be left open and trays of hot water can be placed in the evaporator. The warmer the evaporator gets, the more likely the trouble will be eliminated.

This procedure will correct some but not all of these complaints. If, after a machine is cured, hot water defrosting is performed regularly, the trouble may never occur again.

This adjustment has the advantage that it can be done by the user and does not require a service call. It has the disadvantages that it will not correct all machines and it is less likely to be permanent than the following methods.

II. *Shut off the machine and heat the evaporator until it feels hot to the hand.* The heat should be applied especially to the injector header along the lower right corner of the evaporator. An electric heater or a torch can be used.

The coils of the heater should not touch the chiller tray, the cabinet wall or the evaporator.

Recommend that hot water defrosting be done regularly.

The majority of machines will respond to this treatment but occasionally one will be found that either will not be corrected or will fail again within a short time.

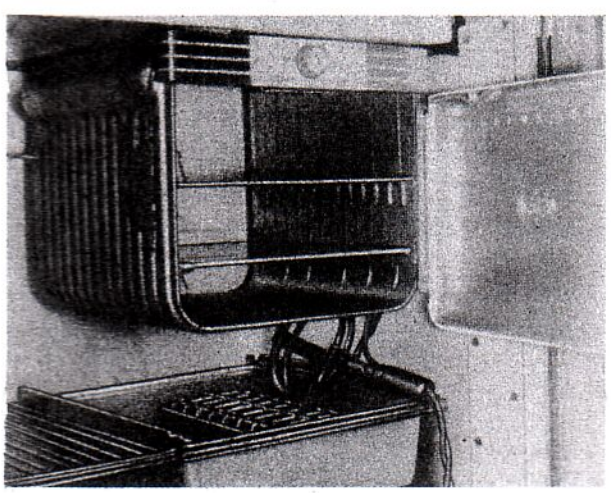


Fig. 206
Heating Evaporator

III. *Shut off the machine and add 4 ounces of Freon-12 to the SO_2 in the system.* This procedure should permanently correct the condition.

Heat the evaporator before the Freon-12 is added in order to thin the oil.

Before assembling the Monitor Test Equipment, the float valve purging screw should be opened a crack (not over ⅛ turn) to make sure that the float valve is not full of liquid. If it is, heat the float valve until the liquid is driven out.

The Freon-12 is added through the float valve purging connection with the help of a Monitor Test Kit. Black Monitor Test bottles are charged with 4 ounces of Freon-12 for this purpose.

Since it is so important that the right amount of Freon-12 be put in, it is a good idea to carefully weigh the bottle before and afterward. Otherwise, there is no way of telling for sure whether the proper quantity went in.

In order to make sure that all the Freon-12 goes into the machine, the heater should be placed under the lower end of the bottle. The heating should continue until the whole bottle is as hot as the hand can stand, and the valves should be left open for at least five minutes after the bottle is hot.

It may be a matter of ten minutes or so after

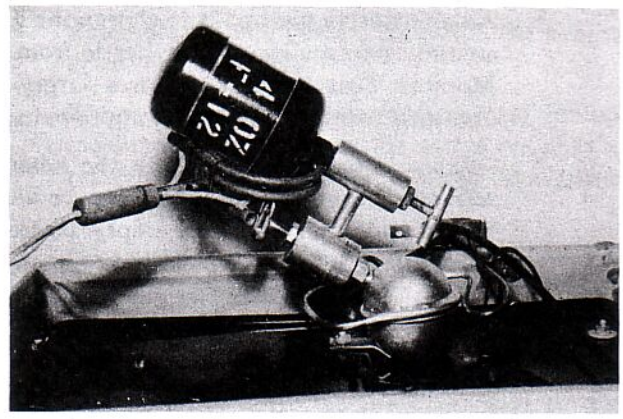


Fig. 207
Adding Freon-12

the Freon-12 is added before there is any apparent change. Then there is a loud flushing noise as the Freon-12 breaks through the thickened oil.

If the flushing noise does not occur or if shelf does not start to cool within ten minutes, try bleeding the float valve just a little. Put a little oil in the purging screw socket. Crack the purging screw just enough to let any air trapped in the float valve bleed out without blowing all the oil out of the socket. Also try heating the bottom of the condenser.

REPLACEMENT OF MACHINES

Two men are usually required to handle a machine replacement.

CF, CH AND CJ MACHINES

1. Remove the evaporator door if there is one installed on the machine.
2. Remove the cabinet top cover and insulation.
   a. On most models it is necessary to loosen the two outside corner screws of the top Textolite strip above the cabinet door opening. Loosening, but not removing the screws, releases clamps holding the front edge of the top panel.

Fig. 208
Loosening Front-clamp Screws

   b. Remove the screws from the clips holding the top cover to the rear of the cabinet and also from the clamp surrounding the refrigerant tubes of the newer models.
   c. With CF-22G machines having the control in the cabinet top, it is necessary to dismount the control. See page 63.
   d. With the door open, take off the top cover by raising it at the back and pushing it forward. Remove the top insulation.
3. Disconnect the leads to the cabinet light, the cabinet light switch, and the butter conditioner, if there is one installed.
4. Remove the screws holding the top plate to the cabinet liner walls.
   Note: Older models also have an inner strip or clamping plate around the refrigerant tubes from which the screws must be removed.
5. Assemble supporting brackets to the machine if they are available.

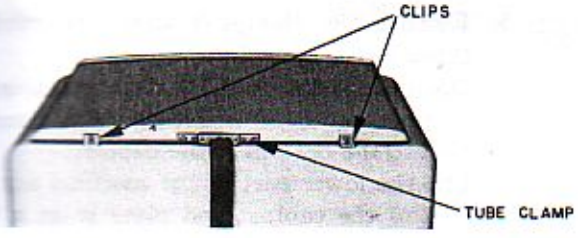


Fig. 209
Rear of Top Cover

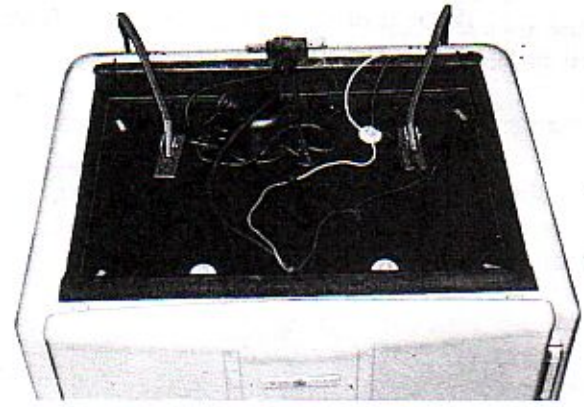


Fig. 210
Supporting Brackets—Front View

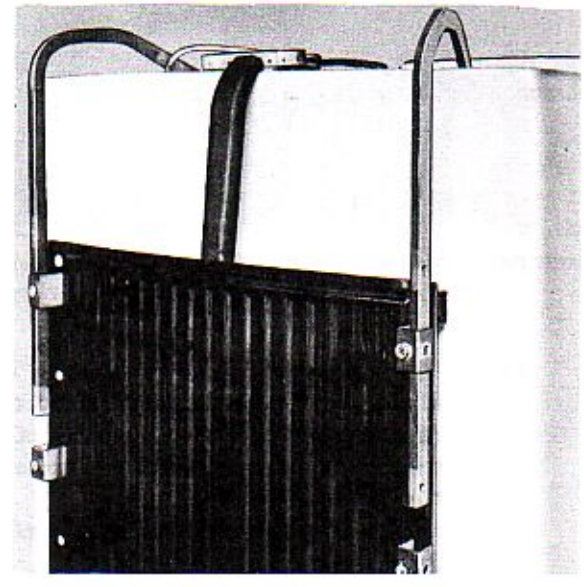


Fig. 211
Supporting Brackets—Rear View

6. Remove the screws and nuts holding the flat-plate condenser to the rear of the cabinet.
7. Remove the lower front panel of the cabinet or the dry storage compartment if one is installed.
   a. With K, KT, V and VP models, push down on the panel and pull it out at the top.
   b. With cabinets of the B line, the panel either can be pulled out at the top or at the bottom and then lifted off its supports.
8. Remove the bolt which holds the compressor case to the bottom of the cabinet.
9. Open the cabinet door and lift the evaporator and top plate assembly slightly to break it loose from the No-Ox-Id cloth on the liner flange. If the control and escutcheon strike the cabinet top, dismount them. See "Control Replacements", pages 61 to 63.
10. Swing the lower part of the machine out of the rear of the cabinet and then lift the evaporator and top plate assembly out of the top.

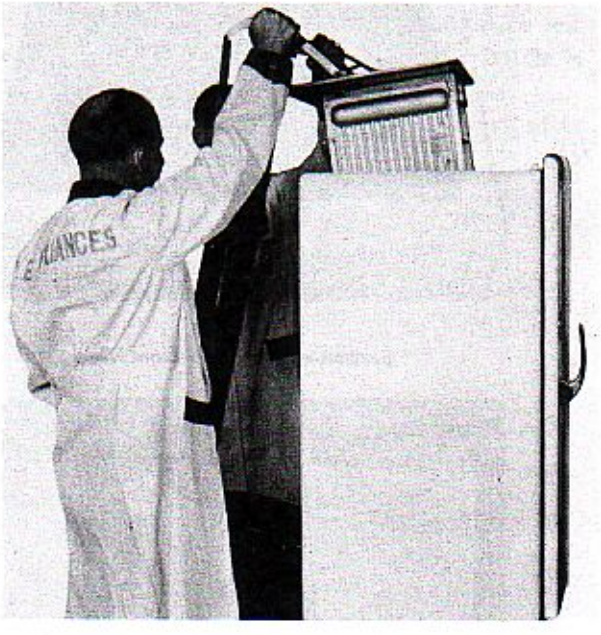


Fig. 212
Lifting Machine out of Cabinet

11. If evaporator supporting brackets are not available, one service man should lift the compressor case and condenser while the other man raises the evaporator and top plate assembly out of the cabinet.
    Caution: Be careful not to kink the refrigerant tubes.
12. Stand the machine on the floor if supporting brackets are installed. Otherwise, set the evaporator on a box or a table, or lay the entire machine on the floor on its side to prevent the tubes from kinking.
13. Lift the evaporator of the replacing machine into the cabinet top.
    Note: With the smaller cabinets, the supporting brackets need not be removed until the evaporator is in the cabinet. With some of the larger cabinets, the supporting brackets must be lengthened or removed before the machine will fit into the cabinet.
    Caution: Do not kink the refrigerant tubes.

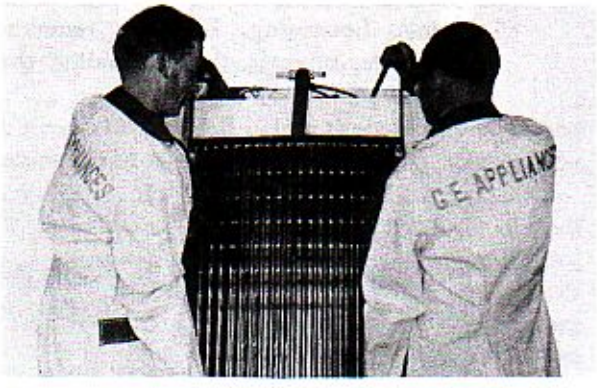


Fig. 213
Installing Replacement Machine

14. Swing the lower part of the machine into place.
15. Replace the mounting bolt, screws, and nuts.
16. Reassemble the cabinet top. Iron down all No-Ox-Id cloth with a block of wood. Make certain the cabinet top is well sealed from the air. The sponge rubber around the refrigerant tubes should completely fill the opening in the rear.

CE MACHINES

1. Remove the evaporator door or doors if installed on the machine.
2. Remove the cabinet top and insulation.
3. Disconnect the cabinet wiring.
4. Remove the screws holding the top plate to the cabinet liner walls.
5. Remove the clamps holding the refrigerant tubes to the rear of the cabinet.
6. Open the lower front panel of the cabinet.
7. Remove the bolts which hold the compressor case to the bottom of the cabinett
8. Lift the lower part of the machine out of the rear of the cabinet and place it on a box or chair.
   Caution: Do not kink the refrigerant tubes.
9. Lift the evaporator and top plate out of the

top of the cabinet. If the control and escutcheon strike the cabinet top, dismount them. See "Control Replacements", pages 61 to 63.

10. Place the compressor case of the replacing machine on a box or chair and then lift the evaporator and top plate assembly into the top of the cabinet.
    Caution: Be careful not to kink the refrigerant tubes.
11. Replace the mounting bolts, screws and nuts.
12. Reassemble the cabinet top. Iron down all No-Ox-Id cloth with a block of wood. Make certain that the cabinet top is well sealed from the air. The sponge rubber around the refrigerant tubes should completely fill the opening in the rear.

CG AND CK MACHINES

1. Remove the evaporator door if one is installed on the machine.
2. Lift the complete machine up and out of the cabinet.
3. Lower the replacement machine into place.
   Note: Be sure the machine box top seals well on the cabinet top.
4. Replace the evaporator door.

DK MACHINES

1. Remove the channel holding the refrigerant tubing and wiring to the side of the cabinet.
2. Remove the cabinet top cover and insulation.
3. Take out the blocks and the corner pieces holding the top plate in place.
4. Lay the refrigerator on its back.
5. Remove the bolts holding the machine to the base.
6. Lift the evaporator and top plate assembly out of the top of the cabinet.
   Caution: Be careful not to kink the tubing.
7. Install the replacement machine by reversing the previous steps.

FBA-1A MACHINES

1. Remove the evaporator door.
2. Loosen, but do not remove, the four Phillips-head screws holding the evaporator to the top of the cabinet.
3. Remove the porcelain plate behind the evaporator by taking out the four Phillips-head screws.
4. Turn the refrigerator around, remove the backplate from the upper part of the cabinet and take out the Kapok insulation under it.
5. Remove the screws and nuts holding the flat-plate condenser to the rear of the cabinet.
6. Lift up and pull open the lower front panel and then remove the bolt which holds the compressor case to the bottom of the cabinet.
   Some cabinets have a Clinton screw inside the bottom of the panel which must be removed before the panel can be opened.
7. Slide the evaporator toward the front of the cabinet until the slotted holes in the top of the evaporator slip over the holding screws.
8. Lift the evaporator out through the rear and then lift the lower part of the machine off its supports.
   Caution: Be careful not to kink the refrigerant tubes.
9. Support the evaporator on a box or table, or lay the entire machine on the floor on its side.
10. Lift the evaporator of the replacing machine into the cabinet.
    Keep the supporting brackets on the machine until the evaporator is part way into the opening, then rest the evaporator on the back of the cabinet while brackets are being removed.
11. Install the machine by reversing steps 1 through 7.
    Be sure that the gasket underneath the backplate seals the cabinet from the outside air.

LK MACHINES

LK Machines cannot be removed from the cabinet. When a replacement is necessary, the complete cabinet and machine must be replaced.

REFRIGERATOR CABINETS

CABINET MODELS AND NOMENCLATURE

The refrigerator cabinets used with the Scotch-Yoke Machines are of two main types—the Monitor Top and the Flatop models. Others are the Liftop, or chest type, and Under-the-Drainboard types where the unit is mounted at the side of the cabinet. Most of the cabinets are of the "All-Steel" construction. The exceptions are cabinets of previous manufacture which were used with some of the early CK machines.

While there are a number of different models in both the Monitor Top and Flatop types, the main differences are in exterior styling, finish, equipment, and accessories. Basically the "All-Steel" cabinets are all of similar construction.

In most cases the cabinet nomenclature identifies the type, model, finish, size (cubic foot capacity) and in many cases the year's model. In general, the first letters indicate the type of cabinet and the exterior finish; the numerals immediately following indicate the size; if there is a second set of numbers preceded by a dash (—) the year's model is indicated. The last letters indicate more or less minor variations of the model.

Examples:

M-7—Monitor Top; synthetic enamel exterior finish; 7 cu. ft. capacity.

PB6-39—Flatop; porcelain exterior finish; 6 cubic foot capacity; 1939 model.

MONITOR TOP CABINETS

The Monitor Top cabinets are those having the model number or nomenclature beginning with the following letters:

M	T	HT*
MP	TM	HX*
SM	X	P*
SMP	XT	S*

* These are earlier Monitor Top cabinets originally made for use with DR or CA machines, some of which were used with the early CK machines.

The letter P or T, where included, indicates a porcelain exterior finish. All the others have a synthetic enamel exterior finish. One exception is the XT models. On these the outer door panel has a porcelain finish with the rest of the cabinet having a synthetic enamel exterior finish. The table on page 197 lists the Monitor Top cabinets with their original machines.

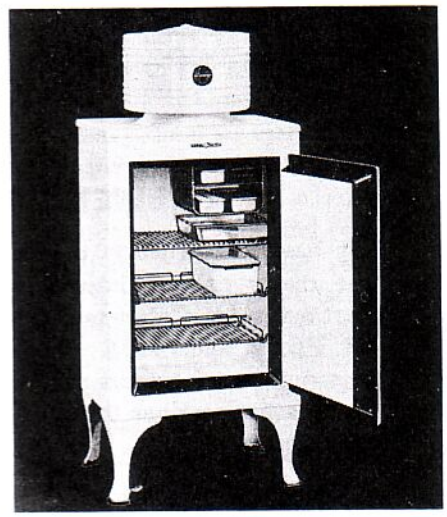


Fig. 214
Monitor Top Cabinet

FLATOP CABINETS

The Flatop cabinets have nomenclatures or model numbers beginning with the following letters:

B	KT	LBH	PLB
BH	LA	LBS	V
JB	LB	LBX	VP
JBS	LBA	PB	BY*
K	LBC	PJB	DK*
			LK*

* These cabinets, while classified with the Flatops, are special models.

The letter P, where included, indicates a porcelain exterior finish. All the others with two exceptions have a synthetic enamel finish. The exceptions are as follows:

KT—These cabinets have porcelain finished outer door panels, top panels and unit compartment panels. The rest of the exterior is finished with synthetic enamel.

K-12, K-15—These are large two-door cabinets and have the exterior finished in porcelain.

The first type letters of the Flatop cabinet nomenclature have a further general significance in identifying the cabinets:

K—1935 model—glyptal (synthetic enamel) exterior finish.

KT—Same as K except top, outer door panel and unit compartment panel have porcelain finish.

V—1936 model—glyptal finish.

VP—1936 model—same as V except porcelain exterior finish.

Starting with 1937, the following type letters were used:

B—Deluxe equipment model—glyptal exterior finish.

PB—Same as B except porcelain exterior finish.

BH—Standard equipment model—glyptal exterior finish.

JB—Minimum equipment model—glyptal exterior finish.

PJB—Same as JB except porcelain exterior finish.

JBS, LA, LB, LBA, LBC, LBS, LBX, LHB — Special models—some have no accessories or interior lights—others have a minimum amount of special accessories—all have glyptal (synthetic enamel) exterior finish.

PLB—Special model as above but porcelain exterior finish.

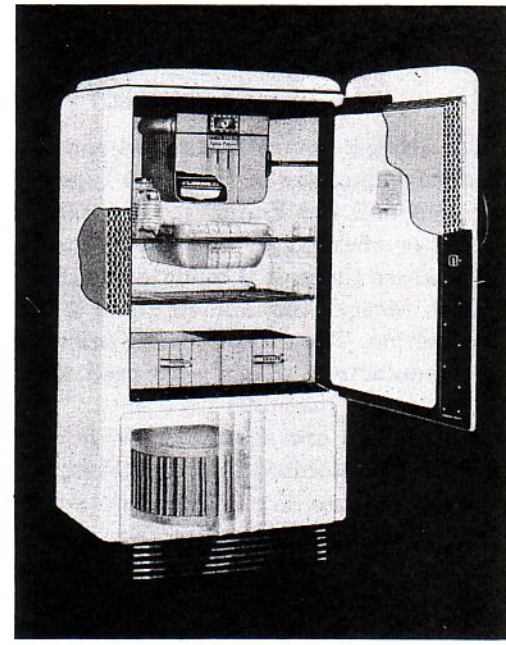


Fig. 215
Flatop Cabinet

CABINET COMPLAINTS AND ADJUSTMENTS

Since the basic construction of the cabinets is similar, the major cabinet adjustments are the same in most instances. Cabinets such as the LB-4, K-12, K-15, PB-12, and PB-16 are of more or less special construction. Adjustments on these are covered by separate sections under "Special Cabinet Models", page 178.

POOR DOOR SEAL

A poor door seal usually shows up as a machine operation complaint such as: high per cent running time, high power consumption, interior sweating, sweating around the door on the outside, higher than normal cabinet air temperatures or excessive frosting of the evaporator. Since the condition can cause or be a contributing factor to such complaints, it is obvious that a good door seal is important.

A poor door seal is the result of one or more of the following conditions:

1. Worn or flattened door gasket.
2. Worn hardware—usually the hinges, but sometimes the latch.
3. Broken latch—usually the latch bolt.
4. Improperly adjusted strike plate.
5. Door sprung out of line.
6. Front of cabinet uneven or out of line.

Imperfect door seals may be located by the use of a 0.003-inch metal feeler. Locate the point of poor seal by inserting the feeler at various points around the door between the gasket and the cabinet front, with the door closed.

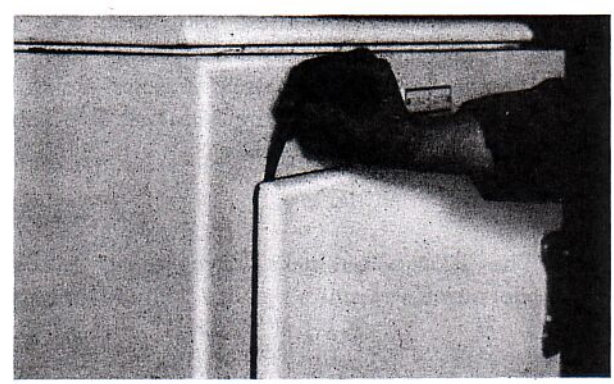


Fig. 216
Checking Door Seal with 0.003-inch Feeler

If a poor seal is located, first check the gasket to see that it is not excessively worn or flattened. Check the hardware to see that it is not sprung, worn, or out of adjustment, and that the screws are tight.

Check the strike plate, mounted on the cabinet

door jamb, to see that the screws are tight and that the plate is properly adjusted. The strike plate can be moved in or out by loosening the two screws holding it to the door jamb, a couple of turns. Then tap the strike plate to move it in or out. Usually only a slight amount is necessary. Be sure the screws are tight after the adjustment is made.

Often a poor door seal can be corrected by rehanging the door, as described later under "Replacement of Door", by replacing the gasket or by properly adjusting or replacing the hardware.

If, however, the poor door seal is caused by the door being sprung out of line, or by the front of the cabinet being out of line, it can be corrected as follows:

1. Check all four sides of the cabinet front where the door gasket seats. If it is possible to insert a 1/32-inch feeler between a straightedge and the face of the cabinet, such points should be corrected. If an unevenness does exist, it is very likely that the cabinet front will be bulged outwardly, generally at the center of the Textolite strip.
2. When the front is bulged outward, loosen the Textolite strip screws approximately 1½ turns on all four sides of the door opening—*front side only*—not on the liner side.
3. Pound the high points of the cabinet front with a rubber mallet and keep checking with a straightedge until a comparatively even, flat surface is obtained. Strike the cabinet only at the radius at the edge of the Textolite strip so as not to damage the finish. When the front is straight, tighten up all the screws.
4. If the cabinet front is found to be bulged inwardly, it will probably be necessary to remove the Textolite strip at that point and pull the front of the cabinet out so that it bulges forward. Replace the Textolite strip, thoroughly tightening the screws on the liner side but leaving the outer screws loosened 1½ turns. Proceed in the same manner as for high points on the cabinet front.
5. Check the seal with the 0.003-inch feeler. If the gasket is not properly seated at all points, loosen all Textolite strip screws around the outer door panel side of door about 1½ turns, just so the screw heads bind slightly. Slam the door once or twice rather severely to let it take the shape of the cabinet front. Check the seal again and if found satisfactory, tighten the strip screws thoroughly to hold the outer door panel in place. If the seal is not satisfactory, repeat the process and spring the door further with the hands.

   If the door is still out, straighten it by sharply striking the rolled edge, at the open places, with a rubber mallet. Care should be taken to strike the radius only. Never hit the flat face of the door, as it will dent.

ODORS

Very little trouble may be expected from odor complaints if proper care is taken of the refrigerator. There is nothing used in the construction of the cabinet that should cause an odor. All foods should be kept in covered containers, especially those which have strong odors and also those which readily absorb odors. Food odors are the greatest source of odor complaints. The interior of the cabinet should be thoroughly cleaned with warm water and baking soda periodically.

If the refrigerator is to be left standing for any length of time, with the machine shut off, remove all foods from the cabinet, thoroughly clean the interior and leave the door ajar. If this is not done, odor trouble may result.

When odor complaints do arise, locate, if possible, the source of the odor and remove it. Sometimes odors may penetrate the insulation and be absorbed by it to be given off later. The cabinet should be thoroughly cleaned and aired out. Where the insulation has absorbed odors, remove the insulation, after removing the liner, and air the insulation or bake it up to 130 degrees to 150 degrees F. If the odor cannot be removed from the insulation, replace it. Before the cabinet is reassembled, thoroughly clean and dry each part.

If the cabinet is equipped with an air filter, the charge of activated carbon may need to be reactivated or replaced. See "AIR FILTER", page 171.

MOISTURE IN THE INSULATION

While there is little possibility of excessive moisture being drawn into the insulation and condensing out, it can happen due to a poor top panel seal or some similar condition. It is also possible that water, collected in the bottom of the cabinet liner, may work its way under the bottom door jamb strip and into the insulation. To guard against this:

1. Caution the user against using a lot of water inside the cabinet, when cleaning it, and sloshing it over the door jamb.
2. When removing a refrigerator from a home, be sure it has been defrosted and the ice

cubes removed, or use some waterproof covering over the evaporator to catch the water as defrosting takes place. Otherwise, a large quantity of water will melt off the evaporator and be sloshed around in the bottom during moving.

If the insulation does become wet, its resistance to heat leakage will be reduced, resulting in high power consumption, high per cent running time and high cabinet air temperatures. It can also cause odor complaints. To correct, the insulation will have to be removed and dried out or replaced. In reassembling the cabinet, make sure there are no air leaks in the outer case, that the top panel is properly sealed and that there is a good gasket seal where the refrigerant lines enter the cabinet.

INTERIOR SWEATING

Considerable sweating in the interior of the cabinet when the humidity is high and usage is heavy may be a normal condition.

This is particularly true with later design cabinets where the door opening was increased in size and the depth of the cabinet decreased in accordance with the more recent trend, to improve the usability of the cabinet. As the door is opened and closed, a large volume of warm moist air is admitted. The moisture in the air condenses out on the cold surfaces before it can be frozen out on the evaporator in the form of frost.

A poor door seal may be the cause or a contributing factor. A poor top seal may also cause the same results as a poor door seal. All moist or liquid foods should be stored in covered containers.

An excessive accumulation of frost on the evaporator might also aggravate the condition as it tends to insulate the evaporator and prevents the moisture in the air from being frozen out on the evaporator as rapidly as when the evaporator is not heavily frosted.

SHAKING OF CABINET AND NOISE

Shaking of the cabinet when the door is opened or closed, or when the unit is running, is usually due to improper leveling of the cabinet base or feet or because the floor is not solid. The cabinet should be leveled and shims placed under the legs or base so the refrigerator sets solidly on the floor. For use with the Flatop models, shims Cat. No. H20A23 and shim supports Cat. No. H20A24 are available. The supports which hold the shims fit into holes in the bottom of the cabinet base at the corners. With a few exceptions these can be used with the Flatop cabinets up to and including the 1939 models. Some of the later cabinets have leveling devices that can be adjusted.

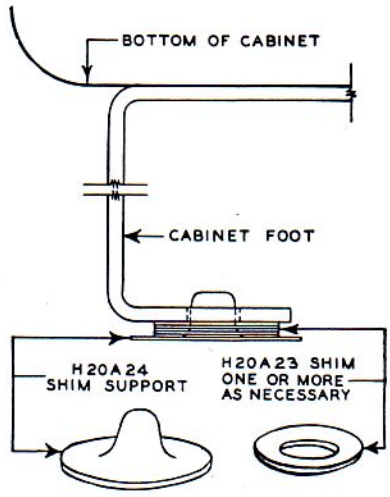


Fig. 217
Shims for Flatop Cabinet Base

Noises that may be attributed to the cabinet are usually caused by loose parts.

An occasional complaint of a whistle when the door is closed may be encountered. As the door is closed a slight air pressure is built up in the cabinet. Until the pressure is reduced, air tends to escape through the crack at the abutting of the ends of the door gasket, where the door gasket is of one piece. The rush of air through this crack sets up a whistle. If the crack is opened up slightly either by cutting off a slight amount from one end of the gasket or by pulling the ends apart slightly, the condition can be corrected.

Where vibration or running noise is transmitted from the refrigerator through the floor, pads of acoustic material such as rubber, felt, or Insulite, placed under the legs or corners of the cabinet base, may eliminate or improve the condition.

FINISH COMPLAINTS

GLYPTAL (SYNTHETIC ENAMEL)

Discoloration

Any white painted finish tends to discolor over a period of time through ageing. This is natural and is not extremely pronounced with the original finish used on General Electric cabinets. The finish tends to turn to a cream color through age, but not a pronounced yellow cast.

The use of cleaners or polishes not recommended may result in discoloration or yellowing. Many cleaners and polishes contain coloring matter or dyes. These may stain the finish. Some contain abrasives that are too harsh. These cut the gloss from the finish and roughen the surface so dirt and grease can become imbedded in the surface, causing discoloration.

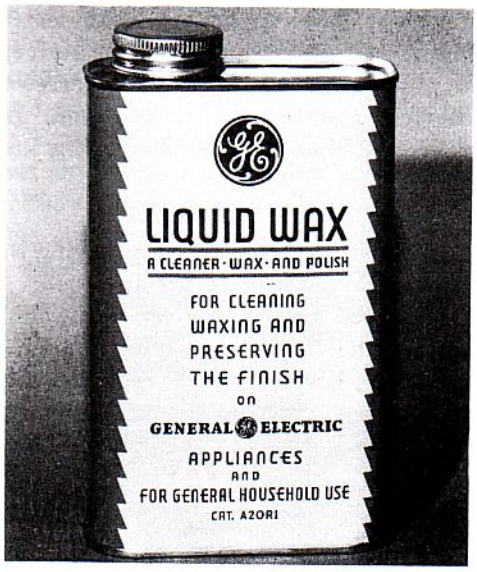


Fig. 218
G.E. Liquid Wax

It is recommended that only G.E. Liquid Wax be used to clean the exterior finish.

Improper or Infrequent Cleaning may cause discoloration. The use of G.E. Liquid Wax once a month to clean the exterior will prevent the accumulation of a dirty greasy film which will cause discoloration. The surface is cleaned and the wax seals the surface of the finish, maintaining the high gloss.

Tobacco Smoke, if present in appreciable quantity and over a period of time, will cause a definite yellowing of the finish.

Sulphur Dioxide (SO_2) fumes from a leaking machine, if present in quantity for an appreciable time, will cause yellowing.

Where the discoloration is only a surface condition, a good cleaning with G.E. Liquid Wax may help. Bad surface discoloration can be removed by the judicious use of a more abrasive material obtained by mixing some of a good kitchen cleanser with G.E. Liquid Wax. Follow this with an application of Liquid Wax alone.

Deep stains that extend through the finish can only be removed by sanding and refinishing or touching up. Complete instructions are given in the Refinishing Manual Form No. 8-496-7A.

Mars and Scratches

Any deep mar or scratch in the finish, particularly if it is through to the metal, should be refinished or touched up to prevent rusting. Small scratches, nicks, and mars can usually be successfully touched up. Fill in the spot, after cleaning with an oil free naphtha or lacquer thinner, with unthinned lacquer or an air drying synthetic lacquer. Use a pencil brush or a No. 4 Badger-hair, quill shanked brush and smooth over the spot with a quick motion of the thumb or forefinger. If necessary, the appearance may be improved by polishing after the spot has dried (at least 24 hours after application if a synthetic lacquer is used).

Large spots or mars usually require refinishing (refer to the Refinishing Manual).

PORCELAIN ENAMEL

Porcelain enamel is essentially a glass coating and therefore is affected very little by anything other than mechanical abuse. It does not discolor. It can be scratched by hard objects and will chip or crack if subjected to sharp or hard blows, strains or twists.

While this finish cannot be restored, small chips can be patched by using a porcelain patching material or cement. Follow the directions supplied with the patching material.

If bad chips or mars occur, the part will probably need to be replaced.

ADJUSTMENT AND REPLACEMENT OF PARTS

INNER LINER

The one piece inner liner is replaceable. The refrigerating machine must of course be removed. Remove the No-Ox-Id cloth seal around the top of the liner. Disconnect the light circuit leads. Either connector blocks, screw-on type connectors, or rivet type connectors are used in Flatop models. These are exposed when the top panel and insulation are removed. On some Monitor Top cabinets connectors were used. On others it may be necessary to cut the leads at the light socket or remove the light switch and the receptacle, which is mounted on the back of the cabinet, along with the liner. Remove the Textolite door jamb strips.

Pull the liner up and out of the cabinet. The liners of some of the later cabinets may be removed from the front.

Remove the light socket and attach it to the new liner. In some cases, due to changes in design, the old socket may not fit and a new one of the correct type will have to be used.

The liner is replaced by reversing the procedure. The use of large sheet metal slides (which can be removed after the liner is in place), at the sides

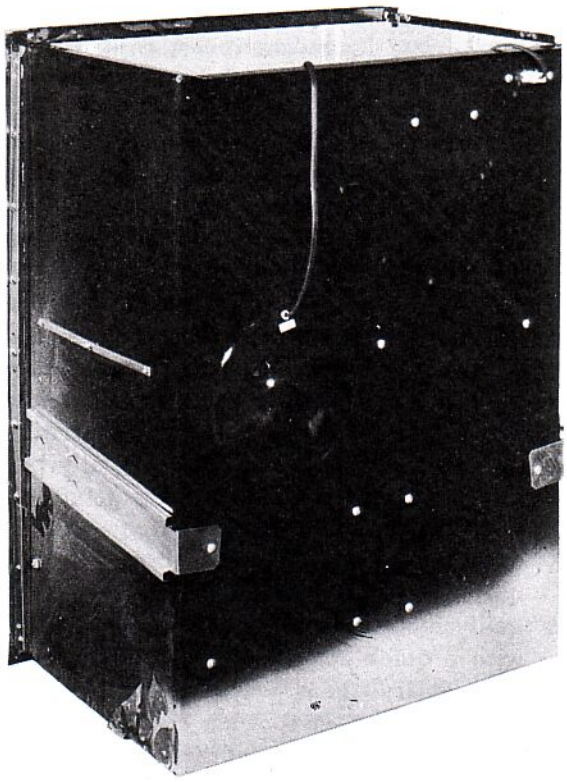


Fig. 219
Replacement Inner Liner—1941 Cabinet

and back of the liner space, will protect the insulation from being torn or displaced and will make it easier to insert the liner in the cabinet.

Be sure the No-Ox-Id cloth is securely ironed in place, using a smooth block of wood. On the earlier Flatops (K, KT, V, and VP) it is recommended that, after the refrigerating machine and cabinet top insulation are replaced, a full sheet of No-Ox-Id cloth be placed over the top of the cabinet and ironed down to the exterior of the top flange of the outer case. This will provide an additional top seal so as to prevent moisture being drawn into the insulation.

On the Monitor Top cabinets, be sure the No-Ox-Id cloth seal around the top opening is securely ironed in place to both the inner liner and the outer case. Be sure any seams and the cloth at the corners of the opening are sealed. Melted No-Ox-Id grease can be applied with a brush at these points to insure a seal.

Starting with 5 and 6 cu. ft. models in 1940, Prestole nut strips with self-tapping screws were used to secure the Textolite strips. If the replacing liner is equipped with Prestole strips, and the old liner with tapped strips for machine screws, or the reverse, it will be necessary to change the nut strips in order to use the original screws. These strips are loose riveted to the liner front flange. The proper nut strips should be reriveted in place to hold them while the strip screws are being inserted. Prestole nut strips, when used, are installed with the flat side next to the liner flange.

DOOR

Doors are replaceable by removing the hardware and reassembling it to the new door.

The best method for replacing the door is to work with the cabinet lying on its back. This procedure, however, is not recommended when the refrigerating machine is in the cabinet. Carefully center the door in the opening and draw the hinge screws tight in rotation so that unequal pressure of the screws will not throw the door out of line with resultant poor door seal.

OUTER DOOR PANEL

If it is necessary to replace the outer door panel, remove the door from the cabinet. Remove the Textolite strip screws from around the outer door panel only, and lift off the inner door panel with the Textolite strips attached to it.

Some replacement panels are furnished with Prestole nut strips. Where this type of strip was not originally used, the strips should be changed as outlined under replacement of inner liners.

For X-3 and X-4 Models, replace the outer door panel by removing the door and all hardware from the door. Remove the inner door panel and the strap steel hinge supports which are secured to the door frame. Lift the door frame out of the old panel and place it in the new one. Reassemble and rehang the door, checking the door seal.

INNER DOOR PANEL

Remove the door and take out all of the Textolite strip screws. Reassemble the Textolite strips to the new inner door panel. Place this assembly on the rest of the door and replace the Textolite strip screws around the outer door panel. Rehang the door and check and adjust the door seal.

Where a thermometer is mounted on the inner door, transfer it to the new inner panel.

For X-3 and X-4 models, remove the door from the cabinet. Remove the inner door panel by taking off the screws holding it in place. Either the old gasket or a new one will have to be placed on the new panel. Replace the panel, rehang the door and check the door seal.

TOP PANEL (FLATOP CABINETS)

On K, KT, V, VP, and LA-6 models, remove the top panel by taking out the screws at the two

brackets at the rear. Lift the panel up at the back and slide it forward to clear the front holding clips. Install the panel by reversing the procedure. Be sure the sponge rubber gasket inside the panel (not used on the LA-6) is cemented to the panel and that the ends of the gasket are cemented together. Use ordinary rubber cement. It is important that this gasket makes a seal all around. If not, a full sheet of No-Ox-Id cloth can be put over the top insulation and then tightly ironed down to the exterior of the top flange of the outer case, using a smooth wood block.

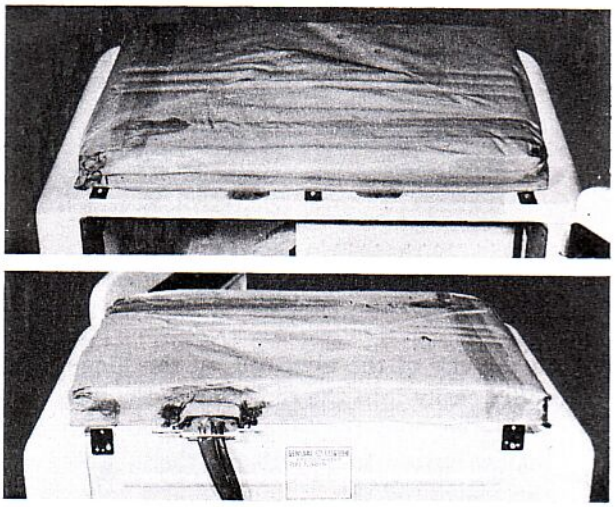


Fig. 220
LA-6 Cabinet with Top Panel Removed—
Front and Rear Views

On other Flatop models, to remove the top panel, take out the four self-tapping screws from the gasket clamp at the back center where the refrigerant lines enter the top of the cabinet. Remove the screws from the clips securing the panel to the cabinet at the back. Loosen the Textolite door jamb strip screw at each end of the outer row of screws at the top of the door opening. See Fig. 221. These two screws are screwed into clamps which hold the front edge of the top panel in place. With the cabinet door open, lift the back edge of the top panel, slide forward, and lift off.

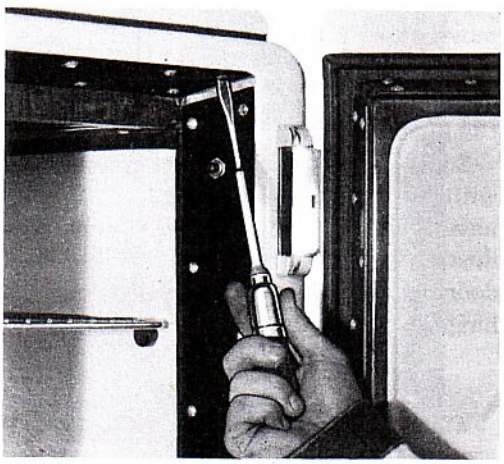


Fig. 221
Loosening Front Clamps for Top Panel

In replacing the panel, make sure the black rubber gasket is in place around the lower edge of the top panel. The gasket is designed so the skirt or flange of the gasket fits over the flange of the top panel. Both the front and rear clamps are adjustable so the top panel can be drawn down tight to insure a good seal.

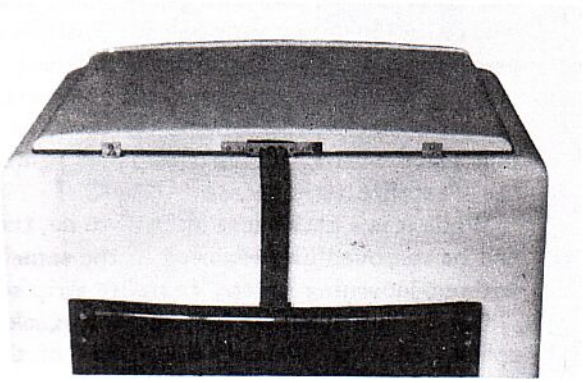


Fig. 222
Rear View of Top Panel Showing Seal Gasket,
Clamps, and Tube Seal

This gasket seal can be checked with a 0.003 inch metal feeler the same as a door gasket seal. It is of the utmost importance that this gasket seal be good and that the sponge gasket, where the refrigerant lines enter the cabinet, also makes a good seal. When the top panel is applied, the bottom corners of the sponge gasket may push out so they are under the ends of the black, extruded rubber top panel gasket. By taking a thin bladed screwdriver, the ends of the sponge gasket can be pushed or compressed toward the center of the cabinet. This will push the corners of the sponge gasket out from under the ends of the top panel gasket, so they can drop down and seal against the top of the cabinet.

The top panel can be adjusted by tightening or loosening the front clamps, so it can be aligned with the top edge of the cabinet door.

DOOR GASKET

Button type door gaskets, where used, are easily replaced. Pull off the old gasket. With a blunt pointed instrument, such as a small screwdriver, force the knobs or buttons, on the rear of the gasket, into the holes in the outer door panel.

The black rubber, extruded type of gasket, used

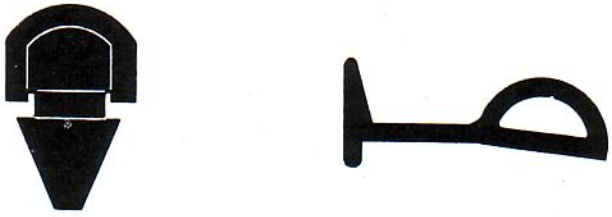


Fig. 223
Cross-sections of Door Gaskets
Left—Button Type Right—Extruded Type

on all of the latter models may be replaced by loosening the row of Textolite strip screws along the outer door panel and peeling the gasket off. The replacing gasket may be cut out at the corners, using the old gasket as a pattern. Insert the toe of the gasket skirt in the channel under the Textolite strip, and follow around the door, pressing it into place with a screwdriver. Then tighten down the Textolite strip screws.

While it is a little more difficult to do, the gasket can be removed and replaced in the same manner without loosening up the Textolite strip screws.

On X-3 and X-4 models, the door gasket has a split skirt that fits over the edges of the inner door panel. To replace, remove the door panel, install the new gasket, and replace the panel.

After replacing a gasket, check the door seal and make adjustment if necessary.

HINGES

Most of the hinges have a metal cover which conceals the screws. To remove these covers, insert a knife blade or small thin screwdriver in the slot at the inside and pry the cover out and off. This exposes the screws except on the V and VP, and some of the M-5, 6, and 7 models. The hinges on these models have springs in them which must be removed in order to take out the screws to remove the hinges. (Refer to "Spring Door Openers" page 166.)

Starting in 1939, semi-piano type, continuous hinges are used on B, BH, and PB models (except the B-3), and a few other later models. While there are two separate hinges, a filler rod or tube between the hinges gives the appearance of a continuous hinge. Separate metal covers, which are removable as on previous hinges, are used over the hinges proper. On the first of these, a solid rod with a tubular cover was secured to both the upper and lower hinges. When a hinge of this design is replaced, it will be necessary to remove the complete hinge assembly and drive the old hinge off of the filler rod. Either grind down the extension on the new hinge or ream out the hole

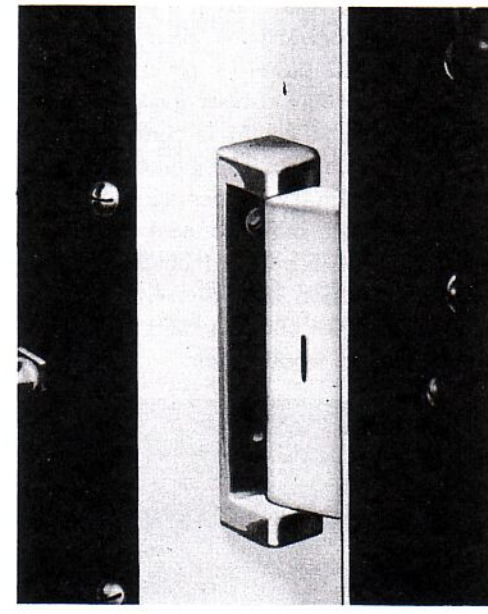


Fig. 224
Typical Hinge Showing Slot for Removal of Hinge Cover

in the end of the filler rod, so the hinge extension slides easily into the rod. The rod can be removed altogether and the hinges replaced with only the hollow spacer tube between them. Later in 1939 the spacer rod was eliminated and only the hollow spacer tube used from then on.

With the continuous type of hinge design, the hinge is secured to the inner flange of the outer door panel instead of to the edge of the panel. This same design hinge is used on a number of the 1940, 1941, and 1942 models, without a spacer, but with an end cap on the extension that normally fitted into the spacer.

On the 1940 models, due to the design of the outer door panel, it is necessary to remove the cabinet door before the hinge covers can be removed.

When replacing the metal hinge cover, pinch the cover together slightly before snapping it over the hinge to insure its being held in place.

Some of the Monitor Top cabinets have hinges with exposed screws. The hinges are solid and have no covers. Some of these have springs built into them, as they were used with foot pedal door openers. Because of this, the top and bottom hinges are not interchangeable.

LATCH

The latches used on the Monitor Top cabinets are constructed with the latch handle and base integral with the latch mechanism. The later ones have an escutcheon that fits over the handle and

snaps onto the base, concealing the mounting screws. There is a small slot cut in the edge of the escutcheon at the back or bottom. By inserting the blade of a small screwdriver in this slot and twisting, the escutcheon can be loosened and removed.

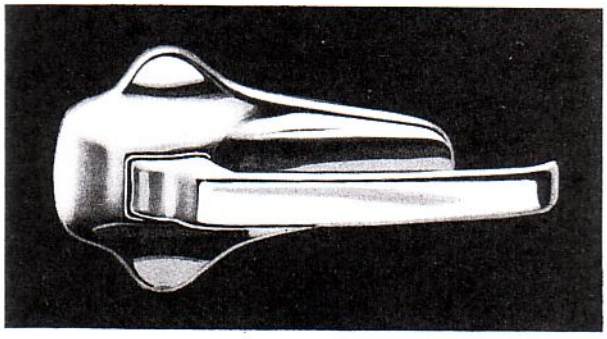


Fig. 225
Monitor Top Latch Handle with Escutcheon

To replace the Monitor Top latch, remove the screws which hold it to the outer door panel. Then tip the latch toward the edge of the door on the latch side and pull the latch out of the door. The latch is replaced by reversing the procedure. To replace the escutcheon, slide it over the latch handle, hook the front edge over the latch base and push the escutcheon down so it snaps onto the latch base plate.

The latches used on the Flatop cabinets are, with a few exceptions, of the concealed type and generally of the same basic construction.

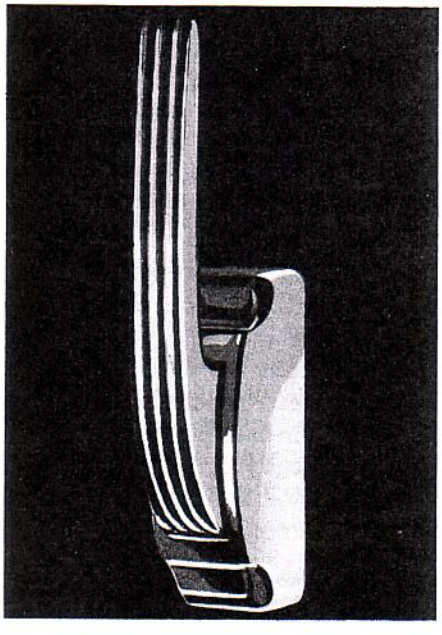


Fig. 226
Typical Flatop Latch Handle

To replace the concealed type of latch on the Flatop cabinets, first remove the escutcheon that encloses the base of the handle by inserting the blade of a small screwdriver in the slot under the handle at the bottom of the escutcheon, using a twisting motion to pry it off. With a thin open end wrench, unscrew the hex nut that clamps the latch body and the handle to the outer door panel. On later models, also remove the screw through the latch handle base above the hex nut. An oversize screw may sometimes be required at this point when the new latch is installed.

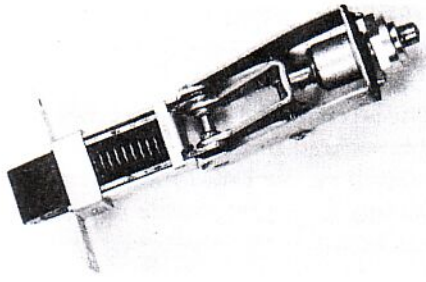


Fig. 227
Flatop Latch Mechanism

On the K, KT, V, and VP cabinet models, remove the three screws which hold the escutcheon plate around the latch bolt, on the Textolite door strip, and slide the latch mechanism out through the opening of the Textolite strip. On the 4 cu. ft. models it may be necessary to remove the Textolite strip before the latch can be removed.

On all later models, while the latch is still held to the Textolite strip with screws, it is necessary to remove the Textolite strip before removing the latch.

The latch used on the 1937 and 1938 line of 5, 6, 7, and 8 cu. ft. cabinets, some of the standard 1939 cabinets, and some of the later lower-priced models, was attached to the Textolite door strip by two screws that went through the door strip and threaded into two ears on the latch mechanism case. This latch was superseded by one with only a single ear at a different location. The hole in the single ear lines up with one of the holes through the Textolite strip and the outer door panel so one of the regular strip screws threads into the ear.

This single ear latch is used to replace the two-ear type. However, on the 1939 5 cu. ft. cabinets, it is necessary to drill a hole in the Textolite door strip and in the flange of the outer door panel. This hole is located on the horizontal center line of the door and in the same vertical center line as the outer row of Textolite strip screw holes. The size hole for the Textolite strip is .221 inch

diameter, and for the outer door panel flange, .170 inch diameter. A standard No. 8 self-tapping screw is used. In all cases, the two screws through the Textolite strip for the two-ear type of latch, should be replaced in the strip to plug the holes.

On the later models of cabinets, the latch handle is secured to its base bracket by a pin which is knurled on one end. This pin can be driven out if it is ever necessary to remove just the latch handle.

The latches used on the Ball Top cabinets, Models X-3 and X-4, are secured with screws to the face of the outer door panel and, on Model M-4, to the edge of the outer door panel. The M-4 latch has an escutcheon over the base or latch mechanism.

The latch on the BY-4 models is an external type and is secured to the edge of the door with screws. The latch on the DK-1 model is also of an external type, but is secured to the outer front of the door panel with screws.

STRIKE

On all of the cabinets with concealed type latches and the Monitor Top cabinets where the latch mechanism fits within the door, a flat strike plate and cupped strike case are used. The strike assembly is mounted on the door jamb with two screws. By loosening the screws, the strike plate and case can be moved in or out to adjust, so the door seals tighter, or closes easier. Be sure the screws are drawn tight to maintain the strike adjustment.

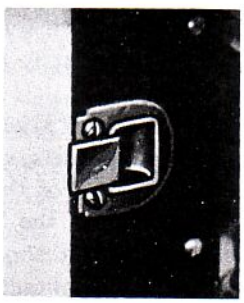


Fig. 228
Concealed Strike—Mounted in Door Jamb

The strikes used on the X-3, X-4, B-3, and DK-1 can be adjusted only by shimming under them or by bending them slightly as required. Those used on the M-4 can be adjusted by shimming only.

FOOT PEDAL DOOR OPENERS

Prior to the 1937 models both Monitor Top and Flatop cabinets, with a few exceptions, are equipped with foot pedal door openers. The strike case and

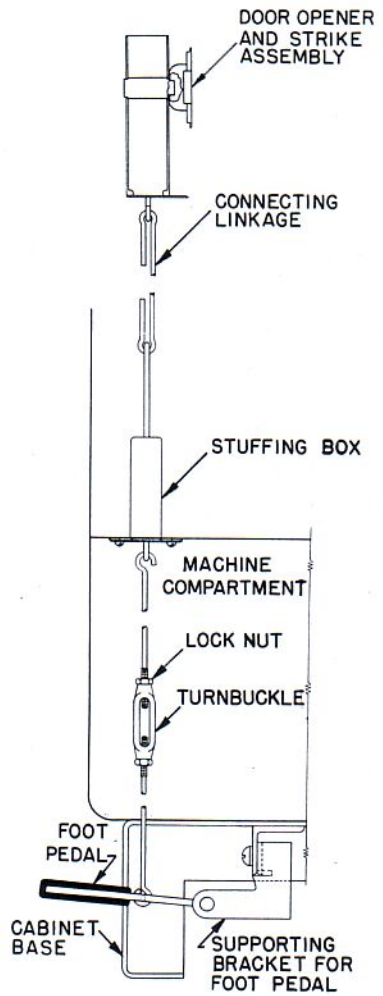


Fig. 229
Foot Pedal Door Opener Mechanism

door opener mechanism is assembled in the door jamb with two screws. Connecting linkages run from this through a stuffing box (to prevent air leakage) in the bottom of the cabinet to the foot pedal. When the pedal is depressed a tongue in the opener mechanism forces the latch bolt in, permitting the door to open.

The height of the foot pedal from the floor is adjustable on the Flatop models by means of a turn buckle in the linkage just inside the unit compartment. On the Monitor Top cabinets the linkage is connected to the foot pedal by a ball and socket joint. The ball portion is threaded on to the end of the linkage rod, for up or down adjustment. When adjustment is made on either type, be sure the lock nuts are tight.

SPRING DOOR OPENERS

Spring door openers are used in conjunction with the foot pedal openers to force the door open when the latch is released.

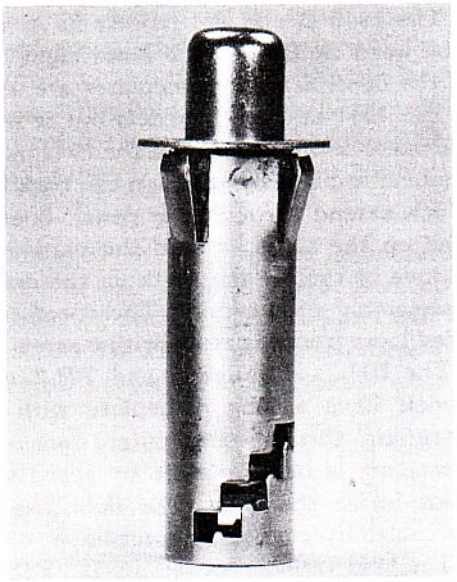


Fig. 230
Plunger Type Spring Door Opener

The K and KT models, some of the earlier V and VP models and some Monitor top models have a spring and plunger device mounted in the Textolite door jamb strip on the hinge side, which pushes the door open when the food-pedal mechanism has disengaged the latch. This device is held in place by screws or by pressure exerted on the edges of the hole through the Textolite strip by lugs or bayonet type springs which are part of the assembly of the device. To remove this door opener, merely pull it out of the Textolite jamb strip. By inserting the pointed end of a lead pencil in the spring support opposite the plunger end, and by pushing and turning the pencil, the spring tension can be increased or decreased by steps, as desired.

The later V and VP models and some of the Monitor Top cabinets are equipped with spring hinges which eliminate the door opener mounted in the door jamb. The spring in the upper hinge exerts pressure to open the door when the foot pedal is depressed. The spring in the lower hinge acts to retard the opening of the door so it will not swing back far enough to hit against the edge of the cabinet. The hinges themselves are standard for all the V and VP models, but on the four-foot models without the foot-pedal door openers, the springs are omitted. The hinges are interchangeable with the hinges on the K and KT models. The spring cartridge, consisting of the springs and spring guides, is removable and can be replaced if required. The opening spring cartridge has an "O" stamped on the spring guide and is used in the upper hinge, while the retarding spring cartridge, used in the lower hinge, has an "R" stamped on the spring guide.

The springs are removed from the hinges by pressing the spring guides together to depress the spring, and so the ends of the guides can be slipped out of the slots in the ends of the hinge pins. They are replaced in the reverse manner.

There are two springs to each cartridge. The ends of the springs extend out straight at the center, tangential to the circumference of the spring. The opening springs, in the upper hinge, marked "O" should be installed so the straight spring extensions ride inside the lugs at the center of the hinge leaf, and parallel to the outer door panel. Thus the closing of the door acts to wind this upper hinge spring, and when the latch is disengaged, it throws the door open.

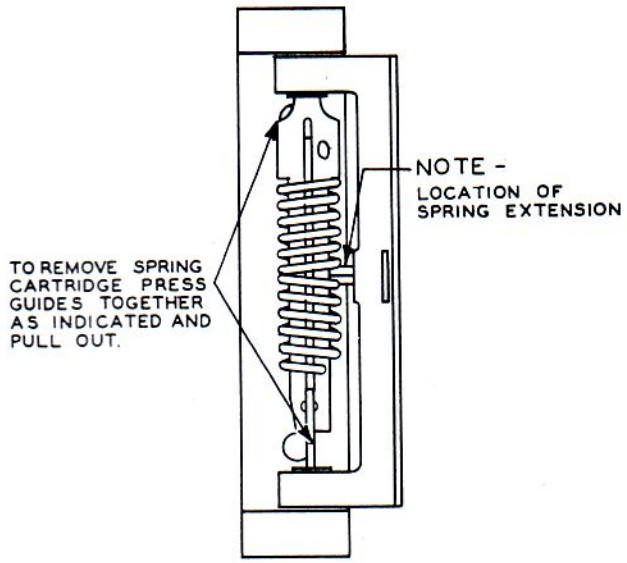


Fig. 231
Hinge with Spring Cartridge

The spring assembly in the lower hinge, marked "R" is installed with the spring extensions on the opposite side to those in the upper hinge, but still parallel to the door panels. Since these springs react opposite to those in the upper hinge, they will tend to wind up as the door is opened and retard the opening swing of the door as it passes beyond 90 degrees.

To remove or replace the upper springs, marked "O," the cabinet door should be open 180 degrees. To replace the lower springs marked "R" the cabinet door should be closed.

The earlier Monitor Top Cabinets have springs built into the door hinges. These springs are not replaceable and if they fail, the complete hinge is replaced.

SCUFF PLATE - NAMEPLATE THERMOMETER

Scuff Plates are used on the B and PB 1937, 1938 and 1939 models. These are attached to the outer door panel just under the latch handle. On the 1937 and 1938 models a threaded stud on the back of the plate extends through a hole in the outer door panel. A nut on the inside of the panel secures the plate in place. The plate is replaceable merely by unscrewing it. If the nut drops out of place, the Textolite door strip on the latch side will have to be removed and the nut held in place or a new one used. On later production, the nut is held in place by a strip of No-Ox-Id cloth.

Fig. 232
Scuff Plate and Latch Handle

The scuff plate on the 1939 models snaps onto a retainer plate which is screwed to the outer door panel. By inserting the blade of a small screw driver in the slot at the underneath edge, the plate can be pried off the retainer with a twisting motion.

Nameplates on all models, where used, except on some of the 1941 and 1942 models, snap onto a retainer plate which is screwed to the outer door panel or the exterior of the cabinet. By inserting the blade of a small screw driver in the slot at the underneath side and using a twisting motion, the plate can be pried off of the retainer.

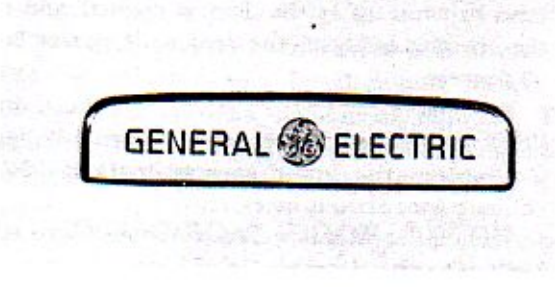


Fig. 233
Typical Nameplate

The 1940 B and PB models have a nameplate (the word Deluxe) at the lower right hand corner of the door. Similar nameplates are also on some of the 1941 and 1942 models but it is located on the panel below the door on the 1942 models. These are held in place by studs on the back of the plate which extend through the panel. Speed nuts are used on the studs to hold the plate in place. To remove or replace the plate on the doors requires disassembly of the door. The speed nuts can be pried loose from the studs with a screw driver.

The BH-7, B-7, and 8 and PB-7 and 8 1941 models have a long nameplate with four studs extending through the outer door panel. The nameplate is held in place by speed nuts on the studs inside the door. The door has to be disassembled to remove the nameplate.

The 1941 Interim models JB-7C, PJB-7A, B-7A, B-8A, PB-8A and 1942 models LB7-42, JB7-42, PJB7-42, B7-42, 138-42 and PB8-42 have, instead of a nameplate, individual letters forming the name General Electric across the door. On some models the letters are plastic—on others, metal. Individual letters are replaceable as is the monogram at the center. Studs on the back of each letter, extend through the door panel into a retaining strip inside the door. The first monograms are held on in the same manner except individual speed nuts are used. Later, the monogram was mounted on a base and ears on the base extend through the panel and are bent over to hold the monogram in place.

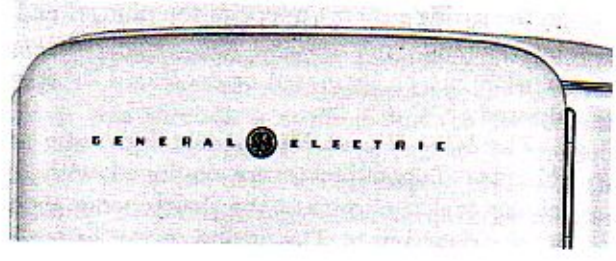


Fig. 234
Nameplate of Individual Letters

To replace one or more letters or the monogram, the door can be disassembled. An alternate method probably better suited for field service is to remove the top door strip. If the insulation is glass wool, press it down sufficiently with a screw driver or ice tray lifter to gain access to the retainer strip. If the insulation is Thermocraft, cut out a section with a sharp, long bladed knife. Pry the retainer strip from the letter to be replaced. If the old letter is broken off, insert the stud of the replacing letter in the panel to push out the old stud. With the

letter in place, hold a screw driver against the retainer strip and lightly tap the face of the letter to force the stud into the hole in the retainer strip. If the letter is not held satisfactorily, an individual speed nut can be used. Replace the insulation and add loose insulation, such as Kapok to fill any air spaces.

Thermometers to indicate the temperature of the interior of the cabinet were used in most cabinets starting with B, JB, PB, and M6 and 8 models in 1937. The first thermometers were mounted on the top shelf at the front.

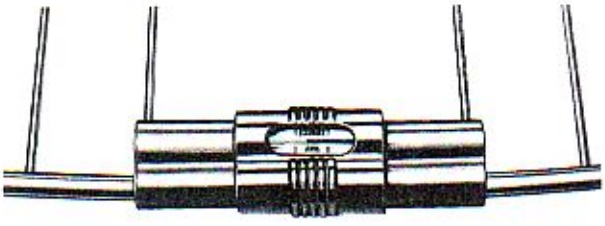


Fig. 235
Thermometer on Shelf—1938 Cabinet

The 1939 and 1940 P and PB-5, 6, and 8 and the B and PB-6, 1941 models have the thermometer mounted on the inner door panel. A retainer clip is screwed to the door. To remove the thermometer and case, push up from the bottom and unhook from the clip at the top.

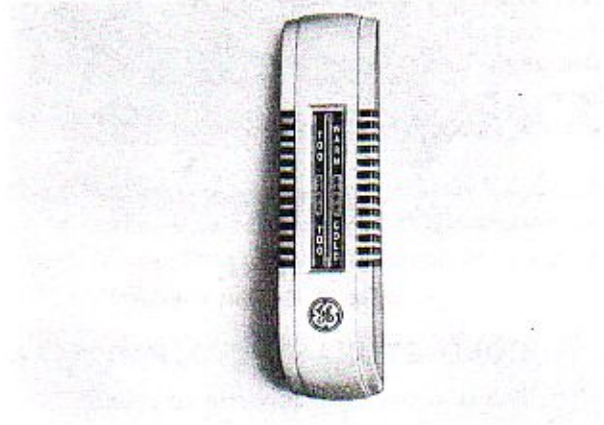


Fig. 236
Thermometer on Inner Door—1942 Cabinet

The 1941 B and PB-7 and 8 and the BH-7 models have the thermometer mounted on the inner door panel. A retainer is screwed to the door. The thermometer case hooks over the top edge of the retainer. A recess in the lower center of the case fits over an ear extending out from the retainer. A screw through the ear and the case holds the thermometer in place.

The only 1942 models that have a thermometer are the B-7, B-8 and PB-8. It is mounted vertically to the inner door panel by a spring clip on the back of the case which slips into small slots in the door panel. To remove, slide the thermometer upwards to disengage the clips.

SHELVES AND SHELF SUPPORTS

The first sliding shelves work in and out of a separate frame that fits in the liner. The supporting tangs on the frame can be bent so as to hold the frame snugly to the liner. Do not fit the frame too tight or the porcelain liner may be damaged. This type is found in the K, KT, V and VP Flatop cabinets, the 1937 B-5 and PB-5 models and all Monitor Top cabinets with sliding shelves except the 1937 and 1938 M6 and M8 models.

All other Flatop cabinets equipped with sliding shelves, except the 1941 BH-7, B-7, PB-7 and PB-8 models, plus the 1937 and 1938 M6 and M-8 cabinets, have full width shelves which slide in grooved plastic shelf supports. The supports are held to the inner liner by a screw through the center of each.

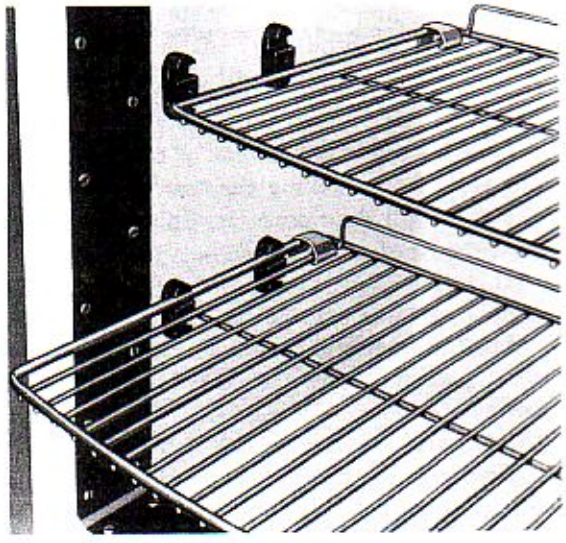


Fig. 237
Sliding Shelves with Grooved Plastic Supports

Caution: Do not remove more than one support at a time as the screws go into a channel piece on the back of the liner. If more than one screw is taken out at one time this channel may slip out of place, requiring removal of the inner liner in order to relocate the channel.

In some of the earlier models with this type of shelf support several different thicknesses of supports are available and in all cases shims are avail-

able so adjustment can be made to take care of variations of inner liners and shelves and so the shelves can be fitted properly. If the supports are too thick, causing a shelf to slide hard, file off the back of the support.

The 1941 BH-7, B-7, PB-8, B-8 and PB-8 models have entirely different sliding shelves and supports. The side frames of the stainless steel shelves are channels. The supports are elongated white plastic pieces one on each side, over which the channels fit and slide. Each support is held to the liner with two screws that pass through the liner into the liner brace. The screw heads are countersunk.

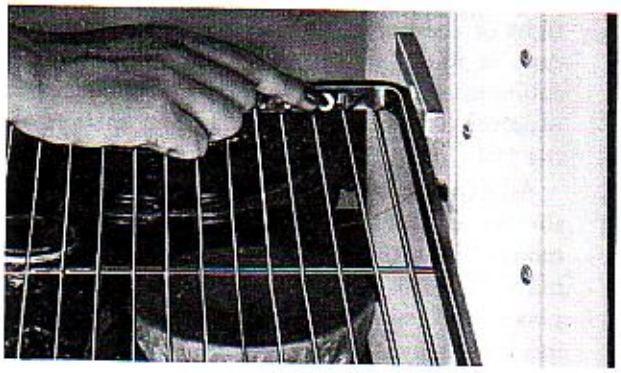


Fig. 238
Sliding Shelf and Supports—1941 Cabinet

It is essential that these supoprts be installed correctly. One end is rounded and this end should always be towards the rear of the liner to prevent the shelf from striking the rear of the liner and so the shelf will slide properly. Shims are available so that the fit of the shelf can be adjusted.

If sliding shelves tend to slide hard, lubricate the sliding surfaces with paraffin.

Shelf supports for most stationary shelves consist of aluminum or plastic knobs screwed onto bolts extending through the inner liner. To replace these merely unscrew the knob.

Caution: Before a knob is completely unscrewed, wrap a piece of string several times around the bolt or screw to keep it from being pushed back out of place and dropping down into the insulation. If this should happen a replacement support with a toggle type screw is available under Cat. No. H20H13. See Fig. 239.

The shelves in the X-3, X-4 and M-4 cabinets are stationary. The front and rear shelf frames extend straight out from the shelf and fit into rubber sockets fitted into the inner liner. To remove the shelf, force it sideways until the frame ends clear the rubber sockets on one side. Lift that side of the shelf up and pull the frame ends out of the sockets on the opposite side.

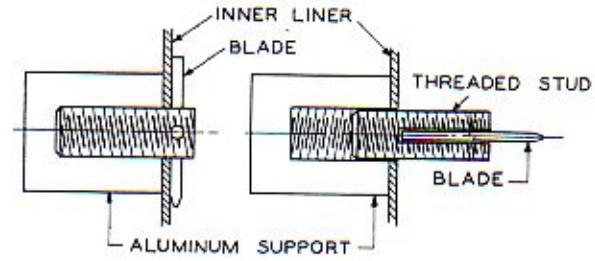


Fig. 239
H20H13 Replacement Shelf Support

Where cold storage compartments are used with center mounted evaporators, the glass trays are supported by slides in the cut out center portion of the top shelf.

In the 1941 and 1942 JB6 and 8, B and PB6, 7 and 8 and the BH-7 models with the side mounted evaporator, a different method of supporting the top shelf, including the cold storage tray, is used. The right cold storage tray support, mounted directly to the liner with long screws threaded into tapped plates on the outside of the liner, is held out from the liner by white tubular plastic spacers. The left cold storage tray support is part of the top shelf. Standard straight and mushroom headed supports are used at the two rear and at the front left corners of this shelf. The right front corner is supported by an adjustable strap attached to the evaporator.

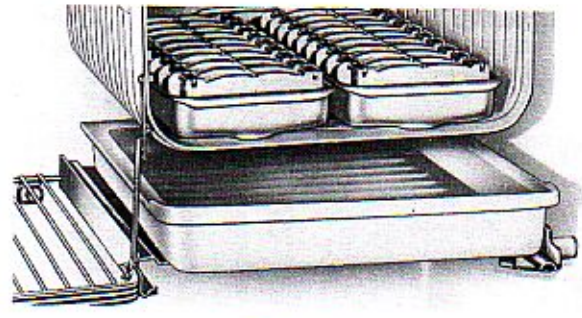


Fig. 240
Top Shelf—1941 Cabinet

COLD STORAGE COMPARTMENT

The cold storage compartment consists of a large deep glass dish that slides on supports, with a glass top cover that can be inverted to serve as a chiller tray. It is mounted directly beneath the evaporator. Flanges on the pan slide in channel supports built in the top full shelf.

In many models the channel guides have small leaf springs at the rear which hold the pan up at the back when empty and when full, the weight depresses the springs, increasing the gap between the dish and the cover. Thus, the greater the amount

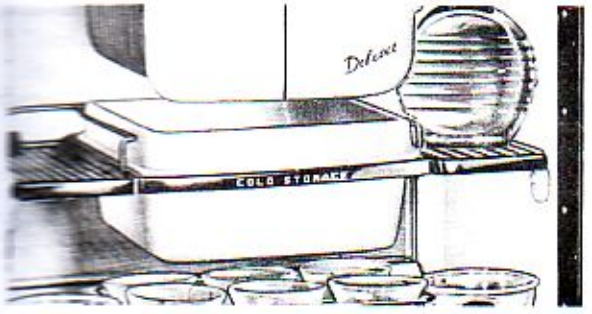


Fig. 241
Cold Storage Compartment—Center Mounted Evaporator

of food in the dish the greater the opening. This tends to maintain a uniform degree of humidity within the compartment.

Occasionally a pan may be found that tends to bind on the springs, due to the spring tension. This can be relieved by bending the springs down slightly.

The supports for the compartment should be adjusted so the pan cover fits snugly in the channel guides, yet slides easily. The cover is used as a gauge since it may be slightly wider than the dish.

Adjustment in cabinets with center mounted evaporators can be made by springing the shelf assembly apart or closer together at the front. After the shelf is adjusted, shims should be added to or removed from under the shelf supports to hold the shelf in the proper position.

For adjustment of the cold storage pan in 1941 and 1942 cabinets with side mounted evaporators, shims are available. These are used between the tubular spacers and the liner at the right side, so the fit of the cold storage tray can be adjusted. If a spacer is too long, it can be filed down. See Fig. 242.

The pan and cover should slide easily and should not be under any tension. The flanges of the pan and cover and the channel guides can be lubricated with paraffin.

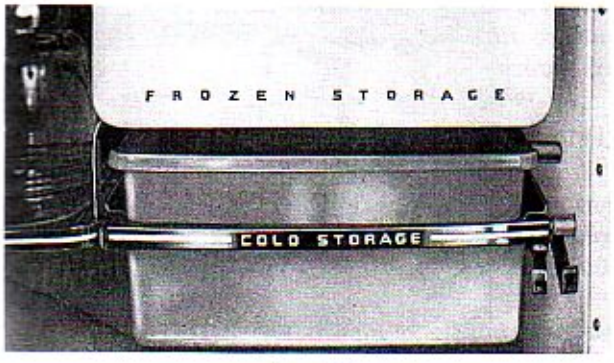


Fig. 242
Cold Storage Compartment—Side Mounted Evaporator

AIR FILTER

Starting in 1940, an air filter was included in the B and PB models. This consists of a perforated container filled with activated carbon granules. The carbon absorbs odors out of the cabinet air thus aiding materially in keeping food odors in the cabinet to a minimum.

In the 1940 models the container is aluminum. It is mounted on the rear of the liner by two shelf type supports. To remove, lift up and off of the supports.

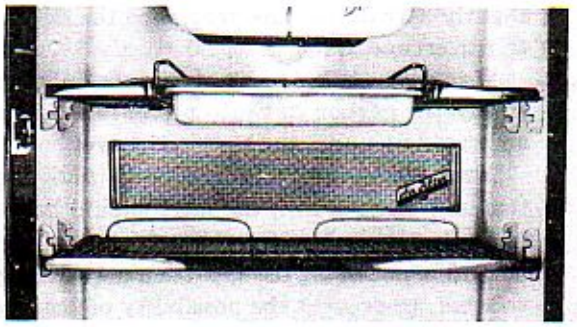


Fig. 243
Air Filter—1940 Cabinet

In 1941 models the aluminum container is located between the two sliding vegetable pans in the bottom of the liner and is designed to act as the center support for the pans. After the pans and their covers are removed, the filter can be lifted out.

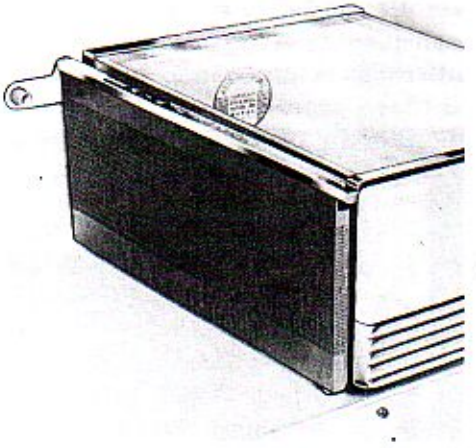


Fig. 244
Air Filter—1941 Cabinet

In the 1941 Interim and the 1942 models, the container is made of plastic and fits into the center supporting frame between the two sliding vegetable pans. A lug or projection on the front of the frame near the bottom supports the filter at the front. A spring clip on the back of the frame at the top

snaps into a slot in the plastic end cap of the container to hold it in place. To remove the container, release the spring clip and pull the container out of the frame.

The carbon should be reactivated every three or four months and should be replaced once a year.

To refill, remove the filter, pull off the end cap, empty out the old carbon and refill, making sure the filter is completely filled.

To reactivate the carbon, remove the filter and place it in a range oven for about one hour at 350 degrees to 375 degrees F. Leave the oven door slightly ajar during the process so the odors driven off can escape to the air.

Warning: Where the container is of plastic, empty the carbon out into a pan. The plastic will not stand up under the heat in the oven.

Since the carbon absorbs odors and may give them off when warm, the filter should be removed from the cabinet when the refrigerator is turned off and is not being used, particularly during warm weather, to prevent the possibility of accumulation of odor in the refrigerator.

BUTTER CONDITIONER

1941 B-7, PB-7 AND PB-8 CABINETS

These cabinets were the first models equipped with a butter conditioner. It consists of a small separate compartment mounted in the upper left hand rear corner of the liner. By means of a small thermostatically controlled heater, the inside temperature is maintained above normal cabinet temperatures and at a point proper for storage of a small quantity of butter for table use. A small glass butter dish is furnished to fit in the compartment.

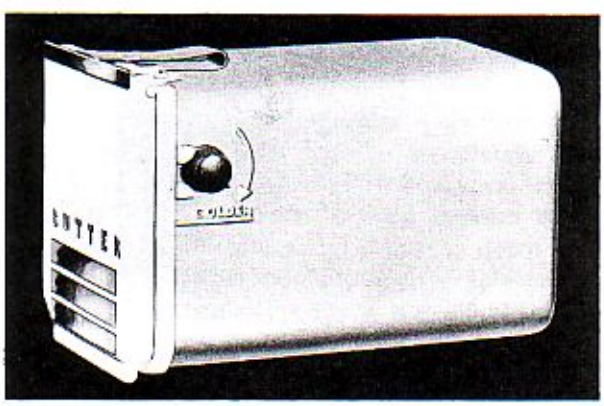


Fig. 245
Butter Conditioner—1941

This butter conditioner plugs into an outlet mounted in the rear wall of the inner liner. It is held in place by three supports. Two on the back

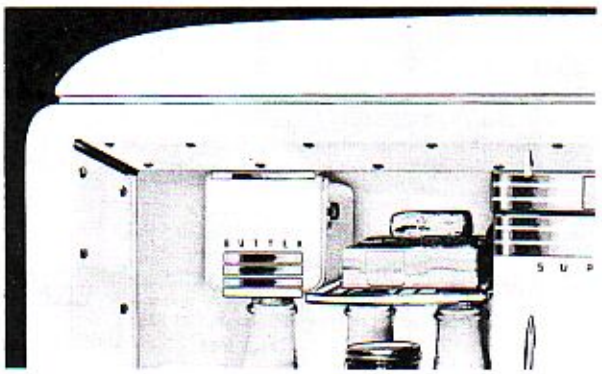


Fig. 246
Butter Conditioner in 1941 Cabinet

of the cabinet liner fit into holes in the back of the outer shell of the conditioner. Inside these holes are leaf springs that exert pressure against the supports. A headed support on the side of the liner fits into a hole in the side of the outer shell and the spring pressure forces the conditioner forward so it is held solidly in place under the head of the side support. A knob on the side of the conditioner, at the front, permits the customer to set the thermostat to the temperature desired (from approximately 50 degrees to 70 degrees).

To remove the butter conditioner, push back on it so as to clear the headed side support, move the conditioner toward the center of the cabinet off the side support and then pull it straight out.

1941 INTERIM AND 1942 CABINETS

The butter conditioner used in 1942 models and the 1941 Interim models is located in the left side wall at the top front corner of the cabinet liner. There is a hole in the liner and a cavity in the insulation for the shell of the conditioner. The electrical leads run up through the cabinet wall and are connected to the wiring in the top of the cabinet so the conditioner is across the line. The temperature is controlled by an adjustable thermostat.

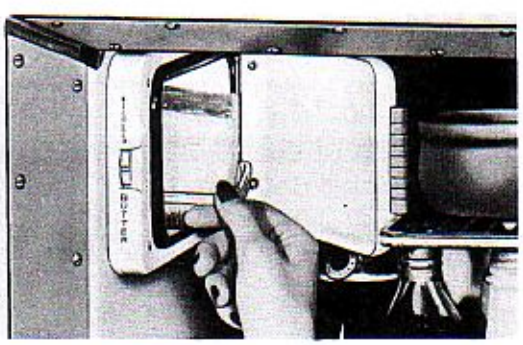


Fig. 247
Butter Conditioner in 1942 Cabinet

This design of butter conditioner is held to the liner by four screws. To remove it, loosen and back out about ¼ inch the two screws at the front corners. Remove the two screws at the rear which hold the door to the conditioner. Pull the rear end out from the liner and slide the conditioner back until the wire clamp on the inside of the butter conditioner frame clears the liner at the front. Pull the electrical leads out from the cabinet wall and if necessary because of replacement cut them off close to the conditioner.

ADJUSTMENTS

Since both types of butter conditioners are connected across the line, a short in their circuit would blow the house fuse. Where such a condition exists it is well to check the butter conditioner to be sure it is not at fault. By placing ice cubes in the conditioner the temperature can be lowered enough to assure that the thermostat contacts are closed.

The only operational complaints of the butter conditioners are radio interference, non-operation, or improper temperature.

If high enough temperature is not maintained first try recalibrating the thermostat.

To do this on the 1941 type remove the screw from the center of the control knob, pull off the knob and replace it on the shaft so the knob pointer is clockwise from its original position to raise the temperature or counter-clockwise to lower the temperature. The full range of the knob gives about a 20 degree F differential.

On the 1942 type it is necessary to remove the conditioner and to remove the thermostat from the shell. The center of the knob shaft is hollow though it may be filled with wax. Dig out the wax and with a small screw driver turn the screw inside the shaft clockwise to lower the temperature or counter-clockwise to raise the temperature. Turn the screw only a fraction of a turn as a small amount has considerable effect on the temperature adjustment.

If recalibration fails to remedy the trouble, or if the conditioner does not operate or causes radio interference, replace the electrical circuit or harness, complete. Instructions for replacing are included with the new harness.

To replace the electrical harness of the 1941 Butter Conditioner:

1. Loosen two rear holding screws on the Butter Conditioner, at the terminals. Remove two front door-hinge spring holding screws and remove the door assembly.
2. Place Butter Conditioner open end down on a table and remove the two rear screws.
3. Holding the plastic frame and blue knob down to the table, lift the outer shell off.
4. Pull the heater clamp out of its position and remove the electrical assembly.
5. Place the male plug of the new electrical assembly on the studs projecting from the end of the Butter Conditioner inner liner so that the studs project through the two large holes in the textolite plate. Remove washers from the screws and screw this textolite plate down temporarily.

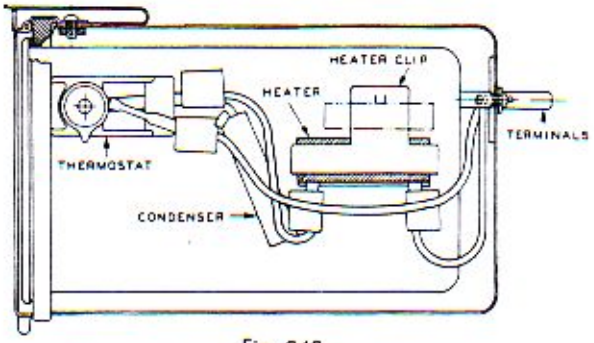


Fig. 248
Electrical Assembly—1941 Butter Conditioner

6. Place the clamp on the textolite heater as shown in Fig. 248. Force the tang end under the clip welded on the liner so the flat side of the heater is pressed tightly against the liner. Push the tang end in until the lanced-up holding tab snaps up behind the clip.
7. Place the thermostat against the plastic frame in the position shown gripping it by the blue knob. *Be careful not to touch the internal parts.*
8. Check over the wiring to catch any short circuits, open connections, etc. Be sure one of the wire leads passes over the aluminum condenser so the condenser and wire will be pinched between the outer shell and the liner when assembled, to prevent rattling. Be sure the condenser is located as shown—if placed closer to the heater, it may overheat.
9. Slip the outer shell down over the asembly, and fit its edges into the groove provided in the plastic frame. If the thermostat, heater, and male plug are correctly located, the screws holding the textolite male plug to the inner liner studs will project through the holes in the end of the outer shell.
10. Remove the screws one at a time, put two washers on each, and replace loosely. The textolite washer goes next to the outer shell.
11. Assemble the door in place.
12. Tighten the rear screws.

To replace the electrical harness of the 1942 style Butter Conditioner:

1. Remove the butter conditioner from the cabinet. Cut the lead wires.
2. With a screw driver pry out the spring clamps that hold the heaters to the shell.
3. Remove the spring clamp underneath the thermostat that holds the thermostat to the shell. Place a screw driver against the relatively flat end of the clamp that is directly under the thermostat case, and push it out so the clamp clears the bracket that extends up through the center of the thermostat base and remove the electrical harness assembly.
4. Pull the disk knob from the thermostat and place it on the new thermostat making sure it is the correct position.
5. Be sure the brass plate is properly located against the front end of the shell.
6. Place the thermostat assembly in position on the brass plate and with the disk knob located in the frame opening.
7. Install the spring clamp that holds the thermostat. The flat end of the clamp should be inserted underneath the thermostat case and under the bracket extending up through the thermostat base. After it is started under the bracket it can then be pushed into position with a screw driver.

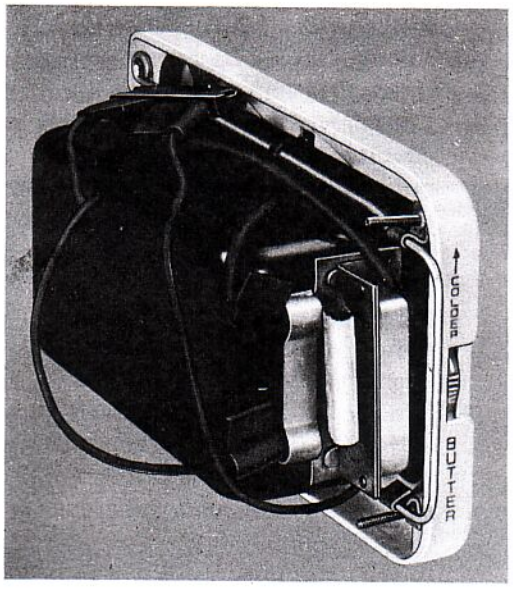


Fig. 249
Electrical Assembly—1942 Butter Conditioner

8. Make sure that the thermostat is located so that the knob disk does not bind on the plastic frame. Push the thermostat up against the shell flange and then locate so that the knob disk turns freely.
9. Bend the tabs at the ends of the brass sheet around the corners of the thermostat base to anchor the thermostat assembly.
10. Clamp the two heaters to the shell. Place the ends of a spring clamp under the brackets welded to the shell. Tip the heater so one edge goes under the clamp and push the heater into position under the clamp with the flat side of the heater next to the shell. Install the other heater in the same manner. *Caution:* When installing the electrical harness be careful of the electrical connections on the thermostat and heaters.
11. Connect the leads to those in the cabinet using the rivet type connectors supplied or by soldering. Tape the joints with rubber and friction tape.

CABINET LIGHTING CIRCUIT

The cabinet light equipment consists of a momentary contact switch, a light socket and the necessary leads. The leads are connected to the machine wiring in the top of Flatop cabinets. In Monitor Top cabinets, the leads are connected to a receptacle mounted in the cabinet back wall, into which a plug in the machine connecting cord fits.

Replacement parts are shipped with sufficient lead wire attached so it is only necessary to remove the old part, cutting the leads off close, and to splice the new leads to the old wiring. The spliced connections should be soldered together and wrapped with varnished cambric or rubber tape followed by friction tape.

Light switches are of two types. The first ones used were a push type and later ones, a cam type.

The first push type switches were mounted through a hole in the door jamb strip on the hinge side, with a nut on each side of the jamb strip.

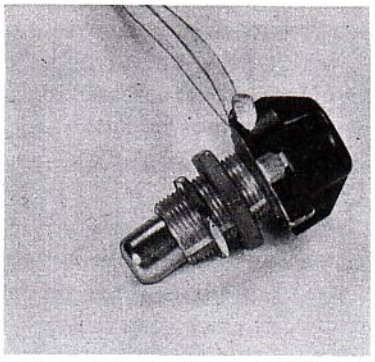


Fig. 250
Push Type Light Switch

To adjust, remove the jamb strip and change the position of the nuts. Just prior to 1937 production the inner nut was eliminated and a coil spring used in its place. To adjust, it is necessary only to tighten or loosen the nut on the outside of the jamb strip.

The push type light switch should be adjusted in or out on the jamb strip so the light is turned off when the cabinet door lacks not less than ½ inch from being closed, measured between the front of the cabinet and the door gasket.

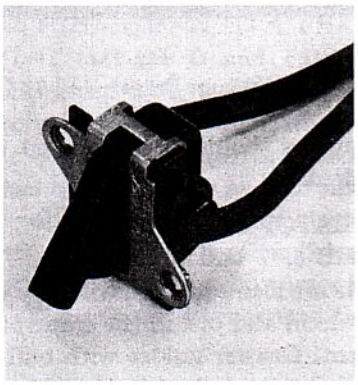


Fig. 251
Cam Type Light Switch

Beginning with the 1938 models, the light switch was changed from a push to a cam type and moved to the top jamb strip. It is mounted on the inside of the strip by two screws extending through the strip from the outside. The cam or operating lever extends out through a slot in the jamb strip. Starting with the 1941 models this switch is mounted to a fiber strip. This strip is clamped between the jamb strip and the cabinet. To replace, it is necessary to remove the top door jamb strip.

If the switch tends to stick in the off position it may be slightly out of position so the cam lever binds in the slot. Also it may be necessary to remove burrs from the edges of the slot or to enlarge the slot slightly, using a fine file.

Light Sockets are of several different types and different methods of mounting are involved. The first type is mounted directly to the inner liner by one screw, the head of which is exposed by lifting the center contact tab in the socket.

In later 1936 and all 1937 models the socket is mounted in a rubber bushing through a hole in the back of the inner liner. To replace, first remove the lamp guard and bulb. Unscrew the porcelain retaining ring and push the socket back through the rubber bushing and into the insulation. Push

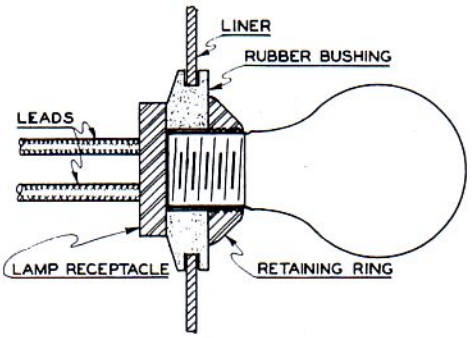


Fig. 252
Cross-section Light Socket—1937 Cabinet

the rubber bushing back out of place through the hole in the liner so the flanges of the bushing clear the edges of the hole and then pull the bushing forward edgewise and out. Pull out the socket. Reverse the procedure to replace. Work the rubber bushing into place, after pushing it back through the hole in the liner, and before the socket is pulled back through the bushing.

In 1938 and some 1939 models the socket snaps into a heavy rubber retainer or bushing. The edges of the hole in the liner fit into a groove around the bushing, thus holding the assembly in place. To replace, force the whole assembly back through the hole. Work the rubber bushing off of the socket and pull the bushing out ***edgewise*** and then pull out the socket. To replace push the socket back through the hole in the liner into the cabinet wall. Work the bushing into place around the edges of the hole in the liner. Pull the socket out through the bushing until it snaps in place.

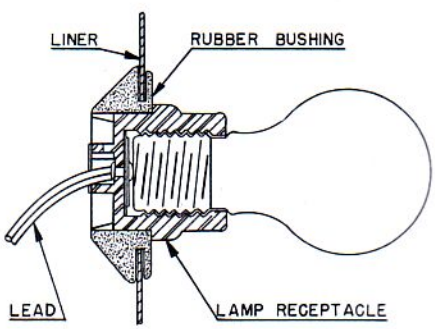


Fig. 253
Cross-section Light Socket—1938 Cabinets

In 1939 B, PB and LBC6 models and the 1940 and 1941 cabinets, the socket is mounted on a metal bracket. The bracket is held directly to the inner liner by a self-tapping screw. The light socket used with the 1941 Interim and the 1942 models is similar to the 1940 and 1941 construction. However, the bracket goes through a slot in the inner

liner and the mounting screw passes through the liner and screws into the bracket.

Wiring Connections in the top of the Flatop models up until 1940 were made by means of plastic connection blocks with screw terminals or by means of a connector that screwed onto the ends of the wires after they were twisted together. With the latter type, tape should be wound over and around the connector to hold it securely in place. In 1940 and subsequent models the ends of the wires are bared and twisted together. These are then inserted in a hollow rivet connector and the connector is crimped together and the joint taped. If this connection is to be broken, cut the wires. Reconnect them either by soldering, using the screw-on connector or the rivet type. In any case, tape the connection with rubber, then friction tape.

UNIT COMPARTMENT PANELS

Flatop cabinets except those later ones equipped with dry storage bins, have removable panels at the front of the unit compartment below the door. Several different styles of clips and supports have been used. They are secured to the cabinet or the panel by screws. To remove the panels, depending on the model—

1. Push down on the top of the panel, pull out at the top and lift off;
2. Pull up on the panel and out at the top and then lower the panel to disengage the lower clips;
3. Pull panel out at bottom and lift off the clips at the top, or;
4. Pull the panel out at the top and lift off of the brackets at the bottom.

DRY STORAGE DRAWER OR BIN

1937 AND 1938 M6 AND M8 CABINETS

The M6-37, M6-38, M8-37 and M8-38 Monitor Top cabinets have a dry storage drawer at the bottom. The drawer is equipped with roller slides.

The drawer stop consists of a large steel pin that is inserted through holes in the top and bottom flanges of the drawer at the rear and extends far enough below the drawer to hit against a cross rail at the front of the cabinet base. To remove the drawer pull the drawer out as far as possible, lift the pin and pull the drawer out.

Drawer guide supports are bolted to the cabinet at the sides through slotted holes that permit horizontal and vertical adjustment. The drawer guides are bolted to these supports through slotted holes permitting vertical adjustment. Each guide can be adjusted independently of the other. The

Fig. 254
Dry Storage Drawer—M6-38 Cabinet

roller guides should be lubricated with a light oil if required.

1941 FLATOP CABINETS

1941 B-6, 7 and 8 and PB-6, 7 and 8 Flatop cabinets are also equipped with dry storage drawers that slide in and out in the front of the unit compartment. Drawer guides with ball bearing rollers at the front are bolted to the sides of the cabinet at the bottom. Adaptor strips are screwed to the sides of a standard unit compartment panel and the drawer body is screwed to the adaptor strips. Drawer slides are mounted to the bottom of the drawer body.

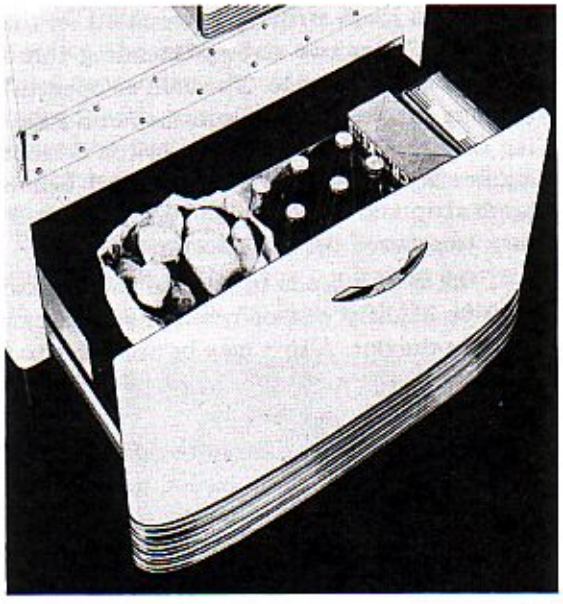


Fig. 255
Dry Storage Drawer—1941 Cabinet

The holes in the sides of the drawer are elongated. By loosening the screws, the front panel can be shifted up or down. The holes in the bottom of the

drawer are also elongated to allow horizontal adjustment of the drawer and panel. The elongation of the holes also permits adjusting the slides on the bottom of the drawer to fit the guides on the cabinet base.

While there are stops on the guides the drawer is easily removed by lifting it up as it is pulled out.

To remove the handle or tighten the handle screws it is necessary to dismantle the drawer from the front panel.

1942 FLATOP CABINETS (INCLUDING 1941 INTERIM MODELS)

The JB7-C, PJB7-A, B7-A, B8-A, PB8-A, JB and PJB7-42, B7-42 and the B and PB8-42 cabinet models are equipped with a tilt-type dry storage bin at the front of the unit compartment.

This bin is fabricated of one piece and is held to the front panel by two screws at each side. The bin rides on two supports, one at each side of the front of the cabinet base. Small lugs on these supports extend up into holes in the bottom edge of the front panel. These holes have metal bushing inserts.

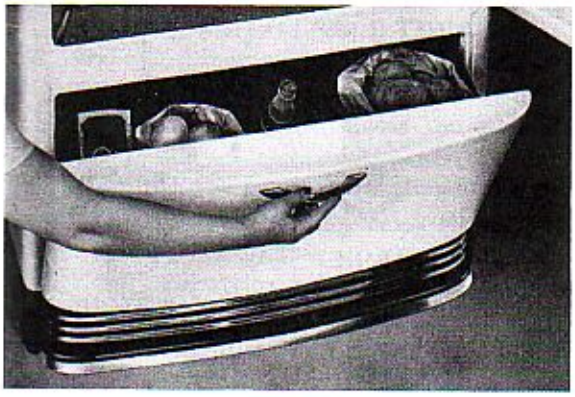


Fig. 256
Dry Storage Bin—1942 Cabinet

The supports are attached to the base by screws that go into tapped plates. The screw-holes in the base are elongated vertically, and in the supports horizontally, to permit adjustment of the supports and the position of the front panel.

Stops to prevent the bin from tilting too far forward are welded to the top rear corners of the bin. To remove the bin, lift it up off of the supports and tilt it sideways until the rear stops clear the sides of the unit compartment opening.

BASE SKIRTS AND GRILLES—FLATOP CABINETS

The K, KT, V and VP models have a black porcelain base skirt of one piece that covers the front and both sides of the cabinet base. It can be removed by pulling it off from the front as it is held in place by spring clips at the back of the base.

The 1937 and 1938 cabinets with base skirts have a different base construction than that of previous models. The skirt extends across the front of the base. Threaded studs are secured to the base frame. Knurled plastic nuts that screw onto these studs hold the skirt in place. This same construction is also used on later models equipped with base skirts.

Starting in 1939 all of the B and PB models have decorative base grilles instead of skirts. On the 1939 models the grille assembly is bolted to the cabinet base. On the 1940 models the grille is bolted to the bottom edge of the unit compartment panel. On the 1941 models, if equipped with a sliding dry storage bin, the grille is bolted to the bottom edge of the front panel of this bin; otherwise, it is bolted to the base or the unit compartment panel. On the 1941 interim B-7, PB-7 and PB-8 and 1942 models the grille is held to the base by spring clips.

Regardless of the cabinet model, the base skirt or grille should be removed whenever a cabinet is moved in order to prevent damage to the skirt or grille and to the floor.

ICE TRAYS

Until 1938 the ice trays supplied with the refrigerators were 2- and 3-pound aluminum trays with either solid aluminum dividers or with flexible rubber dividers. In most of the models one all-rubber tray was included.

In 1938 the Quick tray was introduced. This is a 2-lb aluminum tray with flexible aluminum dividers. The dividers are linked together in such a manner that 2 or more ice cubes may be removed as desired. The links and dividers are obtainable as

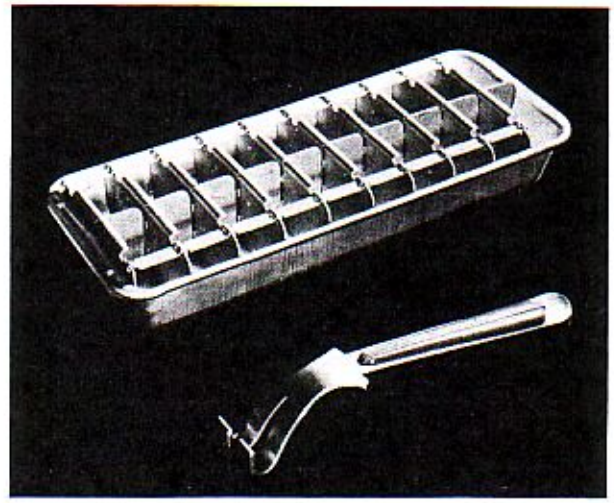


Fig. 257
Quick Tray

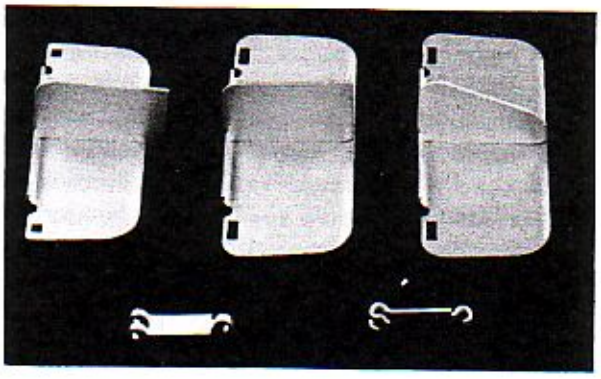


Fig. 258
Replacement Parts for Quick Tray

replacement parts so that the divider assembly can be repaired by replacing one or more of the links or the individual dividers. This tray was standard equipment in most of the refrigerators up until the middle of 1941.

After the middle of 1941, in addition to the aluminum Quick trays, ice trays of several different materials were supplied. These included trays and dividers of tin-plated copper, chrome steel, painted steel and rubber..

Inland trays were supplied with some of the LB6-D, E and F models. These trays are equipped with a linked divider so ice cubes can be released two at a time using a special lever supplied with the tray.

In some of the larger Deluxe models of cabinets, wide dessert trays were supplied. The first ones were made of aluminum, some of which were fitted with covers or with two flexible dividers. During 1941 and 1942 some of these trays were made of tin-plated copper or porcelain enameled steel.

SPECIAL CABINET MODELS

There are a few cabinet models where, because of design and construction, the adjustments or replacement of parts are different from the more common models. These cabinets are the K-12 and 15, the PB12 and 16, the LB4 and the LK-1 and 2. Where the procedures differ from other cabinets the following will apply.

MODEL LB4 CABINETS

LB4 cabinets are of the "wraparound" construction. There is no removable top panel and the machine evaporator is installed through the back instead of through the top of the cabinet.

DOOR AND JAMB STRIPS

The door and door jamb strips on the LB4 cabinets are parallel to the cabinet front instead of sloping inward at an angle. These strips are held in place by rubber bezels on the earlier models and by metal bezels on the later ones, rather than screws. The gasket is mounted on the cabinet instead of the door and also serves to hold the jamb strips in place at the outer edges. See Fig. 259.

To replace the door or jamb strips having rubber bezels:

1. Pry off the metal corner pieces at each corner of the door.
2. Insert the blade of a screw driver, on which the edges and corners have been rounded, under the lip of the inner bezel prying the lip back to release the edge of the strip. Run the screw driver along the edge of the strip to free the one edge.

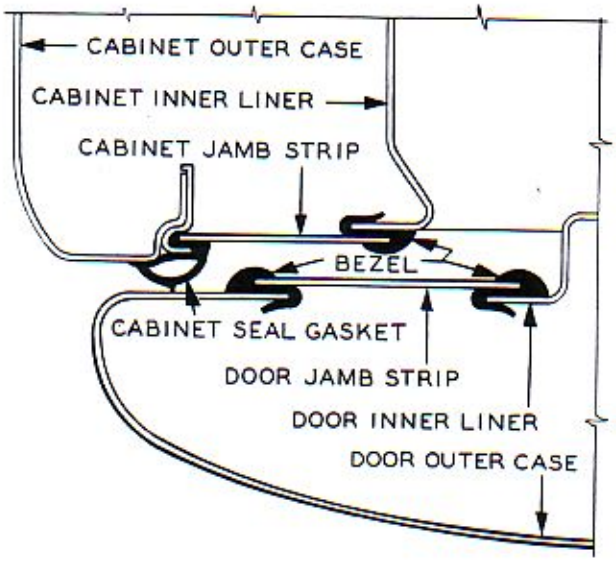


Fig. 259
Cross-section Showing Door and Door Jamb Construction—LB4-40 Cabinet

3. Pull the strip out from under the gasket or the other bezel. If a new gasket or bezels are used, place the new gasket in place, or in the case of the door, place the inner bezel on the flange of the inner door panel.
4. Place the other bezel on the strip with the rounded side out. Be sure the ends of the bezel are lined up with the ends of the strip.
5. Place the other side of the strip in the bezel or gasket already in place.
6. With a small round blunt tool push the tail of the bezel, on the strip, so it snaps down

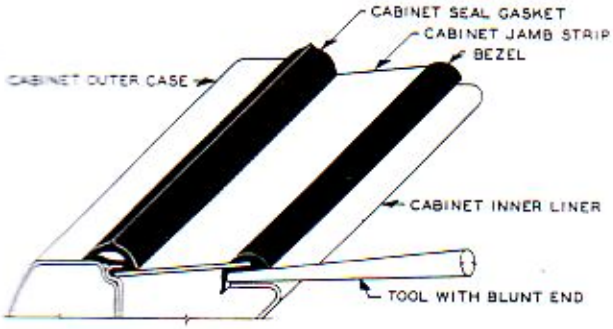


Fig. 260
Method for Installing Door and Door Jamb Strips—
LB4-40A and B Cabinet

behind the liner flange, or door flange. See Fig. 260.

7. Push on the bezel after removing the tool to be sure the tail of the bezel is worked into position.

To Replace Door or Jamb Strips having metal bezels:

1. Remove the three screws holding each corner piece.
2. The metal bezels have sufficient play so the inner bezel can be forced away from the edge of the strip to release the strip. See Fig. 261.
3. After the one edge of the strip is released, the strip can be worked out from under the other bezel or gasket.
4. When the strips are replaced, the metal bezels are placed on the flanges of the door panels and, in the case of the jamb, on the liner flange. The bezels should be pulled back to allow clearance for inserting the strip.
5. Place one edge of the strip under the gasket on the jamb or one of the bezels on the door.
6. Lay the strip down in place and push the bezel onto the other edge to hold the strip in place.
7. Replace the metal corner pieces.

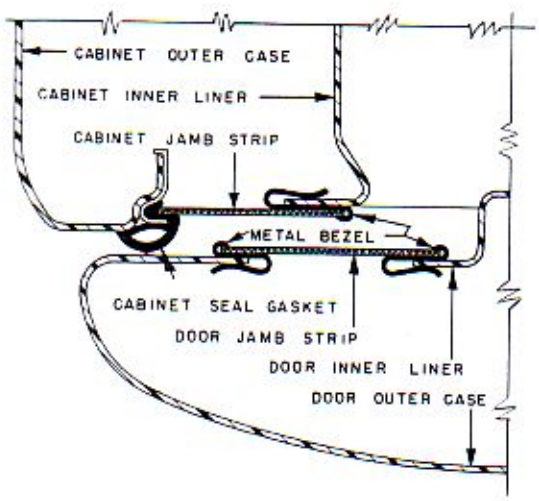


Fig. 261
Cross-section Showing Door and Door Jamb
Construction—LB4C, D and E

DOOR

To remove the door:

1. On the LB4-C, D and E models only, disconnect the door stop arm by removing the screw anchoring it to the lower edge of the door at the bottom hinge. There is no stop arm on the LB4-40 A and B models.
2. Remove the jamb strip on the hinge side of the cabinet.
3. The upper hinge is exposed. Remove the nuts and washers that hold the hinge to the cabinet.
4. Pull the door slightly forward to release the upper hinge from the mounting studs.
5. Lift the door up off of the lower hinge pin. On the LB4-C, D and E model, this pin is fastened to the door.
   Caution: On the LB4-40A and B models be careful not to lose the rubber washer on the lower hinge pin as it seals the hinge pin hole in the lower edge of the door.

INNER DOOR PANEL

To replace the inner door panel remove all of the Textolite door strips. The inner door panel is screwed to bridges, fastened to the outer door panel, or in later models to the X frame member in the outer door panel. By removing the screws through the flanges of the inner door panel, the panel can be removed and replaced.

OUTER DOOR PANEL

To replace the outer door panel, remove the door from the cabinet. Remove the door strips, inner door panel and insulation. Transfer the hinges, latch, bridges, inner frame member, etc., to the new panel. Reassemble and rehang the door.

UNIT COMPARTMENT PANEL

The lower panel for the unit compartment is hinged similar to the cabinet door. To remove the panel:

1. On the early models, remove the screw at the lower edge opposite the hinge side.
2. Remove the cabinet door.
3. Push in and lift up on the panel opposite the hinged side to release it from the catch.

4. On the LB4-40A and B models lift out the lower cabinet door hinge pin being careful not to lose the rubbber washer.
5. Lift the lower panel up off its lower hinge pin and away from the cabinet.

DOOR SEAL

The main adjustment for door seal is the adjustment of the strike. However, shims can be inserted or removed from between the lower door hinge bracket and the front of the cabinet or between the upper hinge and the inside of the outer door panel flange. Bending or replacement of the hinges may help to obtain a seal on the hinge side.

If the door is not sealing at certain spots the following procedure may correct the condition:

Open the door an even 90 degrees. Then tap the edge of the door with a rubber mallet. If done properly this may cause the flanges of the door panel to be forced out slightly resulting in a tighter gasket seal.

LATCH

The latch handle is removable as on other Flatop cabinets by removing the escutcheon around the base of the latch handle and the nut holding the handle assembly to the door. It is necessary to remove the Textolite door strip on the latch side in order to remove the latch from inside the door.

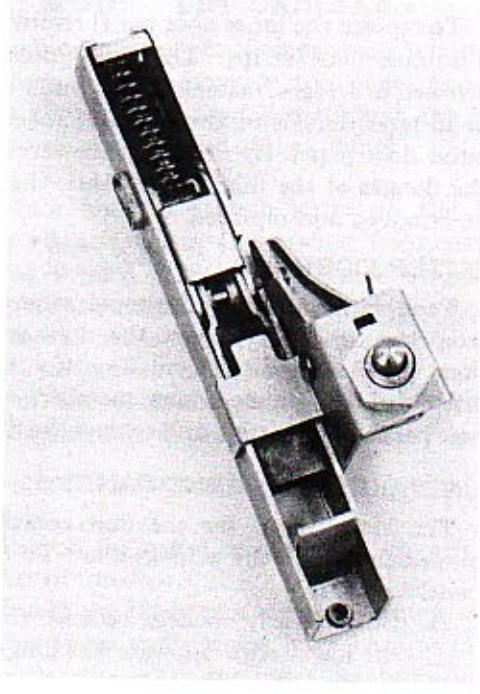


Fig. 262
LB4 Latch Mechanism

STRIKE

The strike, which extends out from the front of the cabinet, screws into a composition block which is fastened with screws inside the outer case of the cabinet. The strike is locked in position by a special retaining washer and nut. A twelve point end socket wrench that has been ground down on the outside to obtain a thin wall can be used to loosen the retaining nut. With this nut loose, the strike can be screwed in or out for adjustment. One complete turn moves it about 1/32 of an inch. Normal adjustment is usually found to be when the inside edge of the hook of the strike is about one inch out from the front of the cabinet.

Elongated holes in the strike mounting allow for vertical adjustment. Loosen the two screws and tap the strike to move it up or down. Normal vertical adjustment is when the center line of the strike is slightly above the center of the escutcheon around the strike hole in the door strip.

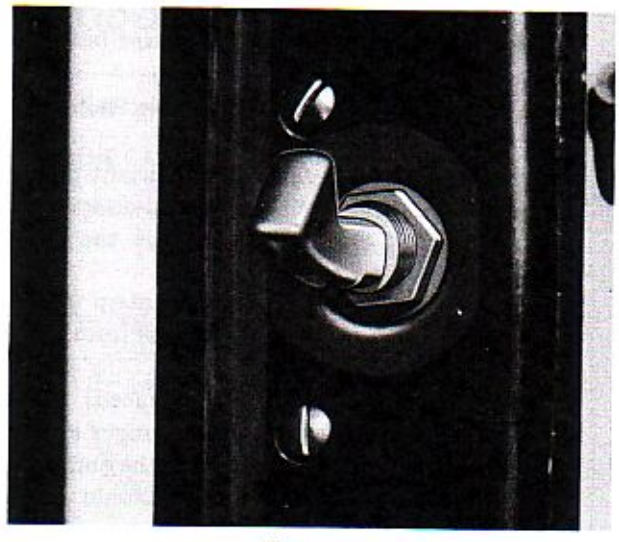


Fig. 263
Strike on LB4 Cabinet

DOOR STOP ARM

This door stop is used only on the later models. To remove it, take out the screw holding it to the lower edge of the cabinet door. The arm can then be pulled out of its slot in the cabinet outer shell. It is only held by a spring clip.

INNER LINER

To replace the inner liner:

1. Remove the door jamb strips.
2. The liner is held in place to the outer case by composition bridges at each front corner. Remove the screws holding the liner to these bridges.
3. Remove the cabinet back plate and Kapok

insulation so the cabinet light wiring can be disconnected.

4. Remove the inner liner back plate and light assembly. A Phillips head screw driver is necessary.
5. Remove the ice tray release bracket from the liner at the top left side.
6. Remove the evaporator door. Loosen the screws holding the evaporator to the top of the liner and back them out about ½ of an inch. Pull the evaporator forward to release it from the supporting screws.
7. Pull the liner out from the front.
8. It is not necessary to remove the cabinet door or the refrigerating machine. However, care must be exercised to avoid bending the refrigerant tubes and the evaporator must be supported in some manner during the process and while the liner is out.
9. Reverse the procedure to reinstall the liner.

CABINET LIGHT AND SWITCH

To remove or replace the light switch, remove the top door jamb strip. The light switch is either fastened to the strip from the inside or is mounted on a fibre piece which is clamped in place between the strip and the gasket retainer and metal strip bezel. Remove the cabinet back plate. Disconnect the switch leads and tie a long length of stout cord to them. Pull the light switch and leads out of the cabinet. Remove the cord and tie it securely to the leads of the new switch. Use the cord to pull the new leads back through the wall of the cabinet. Reconnect and remount the switch.

The light socket is secured to the inner liner back plate. To replace it, remove the cabinet back plate, disconnect the socket leads and tie a cord to them. Remove the inner liner back plate and pull it, the socket and its leads out of the cabinet. Remove the old socket and mount the new one on the liner back plate. Tie the cord to the new leads so the cord can be used to pull the leads back through the cabinet. Replace the liner back plate and reconnect the leads.

Caution: Be sure to carefully tape all electrical joints or splices so as to prevent short circuits or grounds.

MODEL LK CABINETS

LK refrigerators are commonly referred to as "Liftops." The machine cannot be removed from the cabinets. The inner liner is not replaceable.

LID GASKETS

All LK-1A and nearly all LK-1B Liftop refrigerators had a hollow gasket with a tongue cemented into the groove around the edge of the Duraform part of the top cover. Toward the end of the LK-1B production, a half-round gasket held in place by metal clips superseded the hollow one and became the standard replacement gasket because of its ease of installation. The gasket, complete with clips, is covered by Cat. No. H13H1 and the clips are cataloged as H20H12.

To install the H13H1 gasket, on all LK-1 refrigerators, proceed as follows:

a. Remove the original gasket.
b. Place the clips in the groove in the Duraform liner. The four small prongs on each clip rest on the bottom of the groove. The long prong is toward the inner edge of the groove, and points outward.
c. Lock the clip in place by pressing down on the humped section. This flattens the bottom section and pushes the four prongs out into the Duraform.
d. Space the clips out about two or three inches apart on the straight section of the groove and closer around the corners. Save two clips to hold the ends of the gasket where they butt together in the center of the rear groove.
e. Put the gasket in the groove with the half round part toward the outside edge. Cut off any surplus and butt the ends together in the rear groove.
f. Bend the long prong of the clips over the tongue of the gasket.

Where the original hollow gasket, that was cemented in place, pulls loose but complete replacement is not necessary, the metal clips, Cat. No. H20H12 can be used instead of cement to fasten it down. Install the clips in the groove of the Duraform liner as just described.

To hold the gasket make a small slit, just wide enough to allow the tongue of the clip to slip up into the hollow section of the gasket, at the base of the circular section of the gasket where it joins the part that fits into the goove. Cut another small slit in the top of the circular section, directly above where the tongue enters. Insert a screw driver in this latter slit and bend over the tongue of the clip inside of the gasket.

The metal clips may not always be available and in some instances they may not be supplied with the replacement gasket. If not, cement the gasket in place with rubber cement or some similar product. It may also be desirable to repair the original gasket by cementing it if it should pull loose at some point.

When using cement be sure the groove in the Duraform liner is reasonably clean. The old cement can be scraped out, but do not break through the surface of the Duraform, and do not use a solvent. Paint the groove with one thin coat of a standard rubber cement. Place the gasket in the groove, taking care not to stretch the gasket at the corners, as it will tend to pull out. Leave the cover open for at least six hours so that the solvent in the rubber cement will evaporate and not leave an odor in the cabinet.

The LK-2 lid gaskets are secured in place by the flange of the inner lid pan. To replace, lift up the outer skirt of the gasket to expose the screws holding the pan in place. Loosen these screws and pull off the old gasket. Place the new gasket over the flange of the pan and tighten the screws.

LID PANELS—LK-2

The lid panels are replaceable on the LK-2. Follow the procedure for replacing the lid gasket, removing the screws from the inner pan. Remove the insulation. Further disassembly and reassembly is obvious upon inspection.

LID COUNTERBALANCE—LK-2

The LK-2 lid counter balancing action is adjustable by means of a nut at the bottom of the counter balance assembly. Tightening or loosening the adjustment nut increases or decreases the counterbalance spring tension. The counter balance assembly and its parts are replaceable.

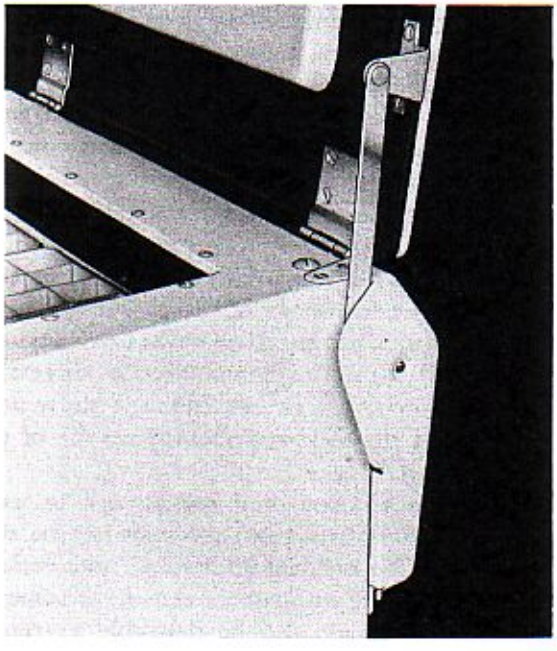


Fig. 264
LK-2 Lid Counterbalance

REPAIRING DURAFORM COLLARS

A Duraform plastic collar is used as a breaker strip between the inner liner and outer shell on all LK models. While these are not replaceable they can be repaired if cracked or broken.

Fig. 265
Duraform Collar—LK Refrigerator

Repairing Cracked Collars with Cat. No. H20H14 Accessories

If the Duraform collar is cracked or damaged in one of the corners, the repair can be made by merely assembling four Cat. No. H20H16 stainless steel corner pieces using two Cat. No. 58X272 self-tapping screws in each corner. The upper edge of each corner piece is slipped up under the flange of the outer shell where it is turned over the collar. To do this it may be necessary to loosen some of the aluminum screws which hold the collar to the outer shell. Holes are drilled in the collar for the self-tapping screws with a No. 25 (0.1495 in.) drill.

If the Duraform collar is cracked or damaged between the corners, it is possible to assemble special Textolite strips over the collar using the following parts:

	CAT. NO.
Complete set of parts	H20H14
Individual parts:	
Textolite strips (4 required)	H20H15
Stainless steel corner pieces (4 required.)	H20H16
Stainless steel self-tapping screws (20 required)	58X272

a. Using a round file, remove the radius or fillet at the bottom of each of the collar corners.
b. Take out the 20 aluminum screws which hold the collar to top of the outer shell.
c. Insert the Textolite strips up under the turned-over flange of the outer shell, in front of the collar. It may be necessary to split the corners of the collar in the up and down direction with a chisel.
d. Reassemble the aluminum screws which hold the collar to the top of the outer shell.
e. Before tightening the corner aluminum screws,

put the corner pieces in place, slipping their upper edge up under the outer shell flange.

f. After carefully locating the Textolite strips and corner pieces, and tightening the 20 aluminum screws, drill the holes in the collar for the self-tapping screws. Use a No. 25 (0.1495 in.) drill.

Caution: When locating and drilling these holes, it is important that they be carefully centered so that the screw heads will pull down properly onto the Textolite strips.

g. Assemble the self-tapping screws which hold the Textolite strips and corner pieces to the collar.

Repairing Cracked Collars with Putty:

a. Cut away the Duraform on either side of the crack to form a V-shaped groove.

b. Fill in the groove with black knifing putty leaving a little surplus in the center and rounding it off smooth. The surplus takes care of the slight shrinkage in the putty as it drys.

c. Let the putty dry until it is hard. This will probably take at least over night.

d. When dry, sand down the putty until there is a smooth, unbroken surface along the Duraform. Polish with a fine sandpaper.

e. Go over the whole Duraform surface with a black wax crayon and polish with a cloth.

MODEL K-12 AND K-15 CABINETS

These are large two door cabinets. For the most part their construction is such that many adjustments and replacement of parts is different than for any other cabinet. However, the foot pedal door opener, the door opening device, latches, strikes, hinges, nameplates, the cabinet light and circuit (except two switches are used) etc., are the same as used on K-4, 5 and 7 single door Flatop models.

The following procedures apply only to the K-12 and 15 models.

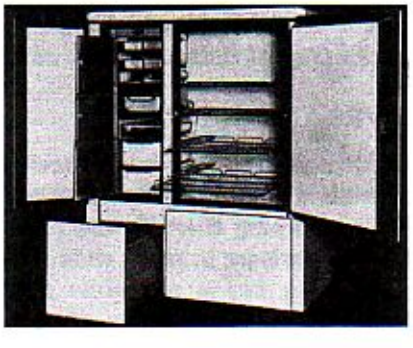


Fig. 266
K-15 Refrigerator

DOOR AND DOOR JAMB STRIPS

The door and door jamb strips are of a screwless type, being held in place by coil springs secured to the door panels and to the inner liner and outer shell or undercase. See Fig. 267. Special expanding pliers, Cat. No. H20A97, are used to remove these strips. Two are required.

To Remove or Replace the Door Strips

1. Remove the metal corner pieces at each end of the strip to be removed. This can best be done by inserting the end of a screw driver under the inside edge of the corner piece and prying it out; or it is possible to slip the corner pieces out from under the strip.
2. Insert one of the special pliers in the opening exposed by removing the corner piece. The edge of the flange of the outer door panel should catch in the groove on one side of these pliers and the edge of the flange of the inner door panel should catch in the groove on the other side of the pliers. Close the handles together so that the ends expand and pry the two panels apart about 3/8 of an inch. Apply the other pair of pliers at the other end of the strip in the same way. These tools are equipped with a latch to hold them in the expanded position. The strip can now be removed or replaced by lifting it out. With the strip in place again, remove the pliers and the spring tension will clamp the strip in place.
3. After the strips are in place, straighten and replace the metal corner pieces by slipping them into position.

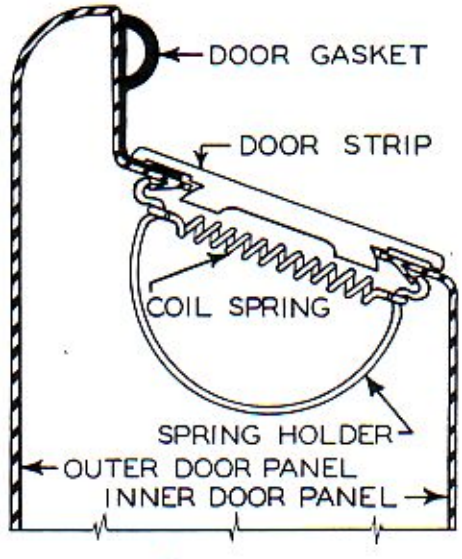


Fig. 267
Cross-section—K-12 and K-15 Door

To Remove or Replace the Mullion Door Jamb Strips

1. Remove all shelves and vegetable pans from the food compartment and cooling unit compartment.
2. Remove the screws from the inner mullion panel (3 screws from the center and 2 screws at top and bottom). It is not necessary to disturb the screws that hold the evaporator trim to the inner mullion panel.
3. With the screws removed, the inner mullion panel is free to come out. In some cases it may be necessary to use a little pressure to spring the mullion out of the rubber spacer at each end.
4. The strip can now be removed and replaced with another strip. Make sure the door opening mechanism and strike plate are located correctly in the new strip. The inner mullion panel can then be replaced by reversing the above procedure.

To Remove or Replace Jamb Strips Other Than the Mullion

1. Remove the three center screws from the inner mullion panel.
2. Remove the corner pieces adjacent to the strip to be replaced. This can best be done with a small pair of duck-bill or pointed-nose pliers.
3. Insert the special pliers in the openings exposed by removing the corner pieces in exactly the same manner as applied to the doors. Close the special tools so that the inner liner and outer case are spread apart about 3/8 of an inch. The strip can then be replaced and as the special tools are removed the spring tension will clamp the strip in place.
4. Straighten and replace the corner pieces and replace the screws in the mullion panel.

INNER LINER

Remove the top panel, the top sealing cover and the refrigerating machine, disconnecting the cabinet light and switch leads. Remove the door jamb strips. Unhook the coil springs, that hold the strips in place, from the lugs on the inner liner using a thin blade screw driver.

Remove the No-Ox-Id cloth top seal from around the top of the liner and pull the liner out.

The liner is replaced by reversing the procedure.

INNER AND OUTER DOOR PANELS

Remove the door strips. Unhook the springs for the door strips from the lugs on the door panels and remove and replace either panel. Reassemble and rehang the door. Check and adjust the door seal if necessary.

If the outer door panel is to be replaced, remove the door from the cabinet and all the hardware from the door.

DOOR GASKET

The skirt of the door gasket is clamped under the door strips—therefore, to replace the gasket, it is necessary to remove the door strips. See Fig. 267.

DOOR SEAL

Since screwless type door strips are used, the doors and cabinet front cannot be adjusted for door seal. However, the latch strike-plate is adjustable as in other models. Shims can also be used behind the door gasket and under the hinges to compensate for poor gasket seal.

TOP PANEL AND SEALING COVER

The outer top panel is removable by taking out the screws down through the top and lifting it off.

Underneath the top panel is a sealing cover that is held down against the top flange of the cabinet by a number of self tapping screws. A rubber gasket strip underneath the sealing cover, around its outer edges, provides an air tight seal.

END PANELS

To remove and replace the end panels remove the top cover and the bright metal trim immediately below the top cover, by removing the screws holding this trim. Remove the jamb strips and the coil springs under the strips where necessary. Then remove the screws holding the panel at the back and remove the panel. In replacing the panel, put the front edge of the panel in place first, and then bring the panel around the side. If necessary the panel can be sprung a slight amount to get it in place. When putting in the screws at the back, be sure the fiber spacing washers are in place between the back flange of the panel and the under-case.

SHELVES AND SUPPORTS

The shelves are of stainless steel. The supports for the sliding shelves can be replaced by removing the screws holding them to the liner. Be sure the spacing washers are in place when these screws are replaced.

The metal shelf supports for the non-sliding shelves can be removed and replaced by unscrewing them.

VEGETABLE DRAWER (Dry Storage Bin)

Immediately to the left of the unit compartment is a built-in vegetable drawer with a foot pedal drawer opener. The drawer is mounted on standard conventional type file cabinet slides. The drawer

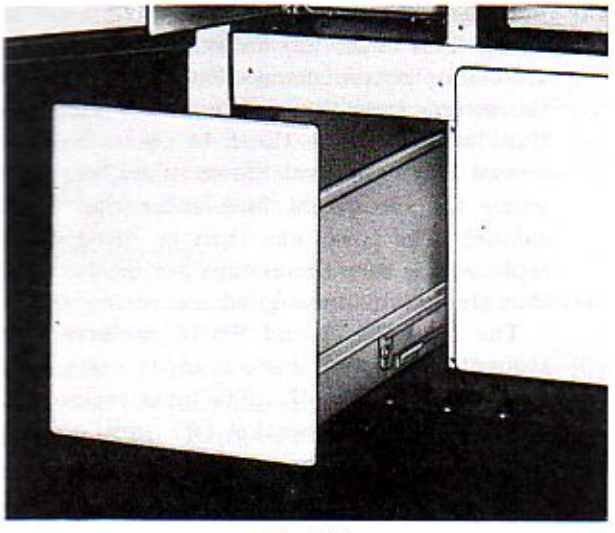


Fig. 268
Dry Storage Drawer—K12 and K15

can be removed by lifting up the catch at each side of the front of the slides and pulling the drawer out. See D, Fig. 269. The slides themselves can then be replaced by lifting and unhooking the rollers from the supports fastened to the cabinet frame.

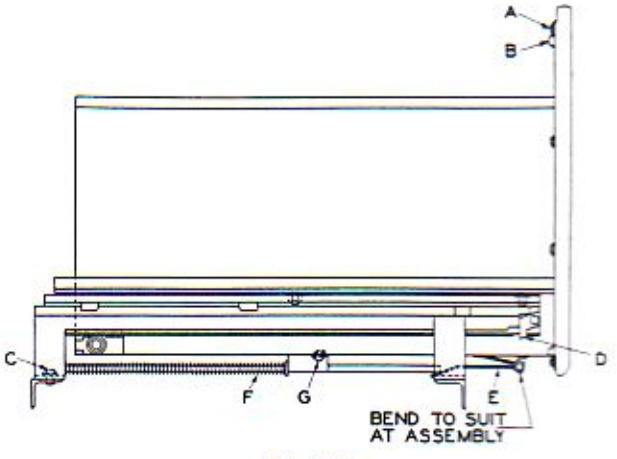


Fig. 269
Dry Storage Bin Assembly

The opening device is very simple. It consists of a trigger and a catch which is welded to the bottom of the drawer, and a compression coil spring that slides on a rod mounted under the drawer on the cabinet frame. The foot pedal is connected to the trigger assembly by a connecting link.

After the drawer is removed the trigger assembly and/or the rod and coil spring can be removed by removing the screws or bolts securing them to the frame. There is a catch G bolted to the bottom of the drawer which engages the washer mounted on the rod at the front end of the coil spring F so that the spring is compressed when the drawer is closed. Refer to Fig. 269.

An examination of the vegetable drawer and opening device will reveal the construction and how various parts can be removed and replaced.

The front of the drawer is held in place by screws, which can be removed.

If it is necessary to replace the trigger assembly or drawer release, the release arm can be bent when reassembled so as to properly engage with the latch on the bottom of the drawer.

The connecting link from the foot pedal merely hooks over the end of the release arm E.

REPLACEMENT OF TRIM AND DOORS—EVAPORATOR COMPARTMENT

Doors and trim, mounted to the cabinet, are used to close off the front of the evaporator space. The doors can be removed and replaced by removing the hinge pin and springs. The trim can be removed and replaced by removing the screws holding it in place.

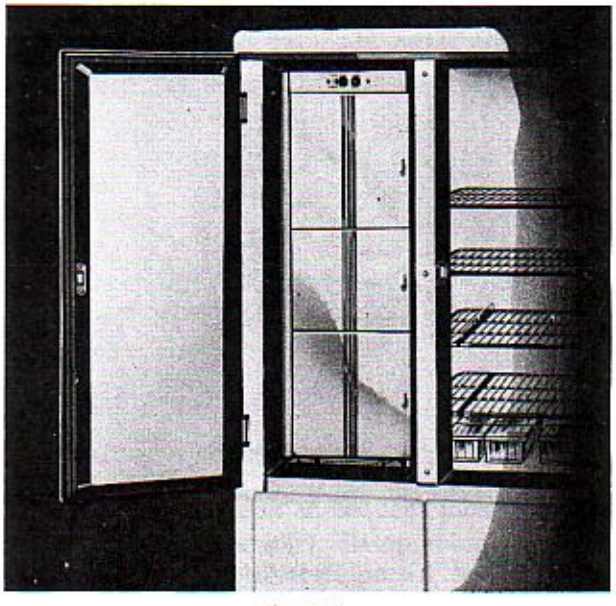


Fig. 270
Doors and Trim—Evaporator Compartment

MULLION HEATERS

Because of the relatively small cross section of the mullion between the cabinet door openings, a small heater is installed in the mullion to prevent exterior sweating. Two different heaters were used.

During the first production, a 28-watt heater was used, connected across the motor terminals so the heater draws current only when the unit is running. In later production, an 8-watt mullion heater was used, connected across the line so it draws current all of the time.

To check the mullion heaters, first remove the top panel, top cover, and insulation to expose the wiring. Disconnect one of the heater leads and place a test lamp in series with the heater. When the heater is the 28 watt type, the test must be made with the motor running. To determine if power is being supplied to the heater, check with the test lamp across the heater leads.

To replace a mullion heater, disconnect the leads and pull the heater out of its well. Only 8-watt heaters are supplied for replacement. Make sure they are connected across the line, so that they supply heat even when the machine is not running.

The leads on replacement heaters, which are also used in other cabinets, are short. Therefore it will be necessary to splice a 22-inch length to each lead.

MODEL PB-12 AND 16 CABINETS

These cabinets are also large two-door models. Their construction is different than that of the K-12 and K-15. A number of their construction

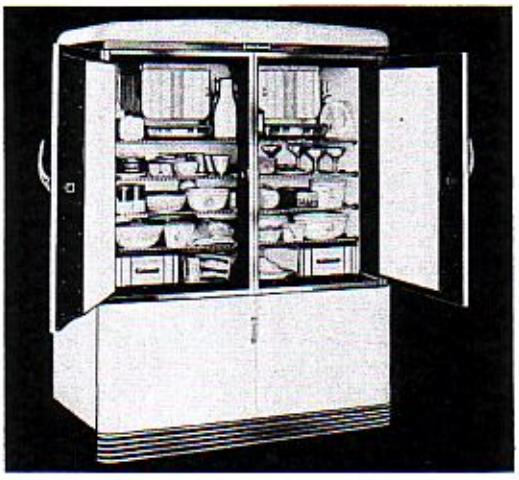


Fig. 271
PB-16 Refrigerator

and design features are similar to later single door P and PB models, and, therefore, adjustments and replacement for latches, strikes, door seal, liner, door gaskets, door panels, and the cabinet light circuit are the same.

Those features that differ and therefore require different procedures are discussed in the following:

TOP PANEL AND SEAL

The top panel on the 1938 PB-12 and PB-16 cabinets sets in place inside of the top trim, on a flat rubber gasket. Two clips on the top of the cabinet, at the back, hold the top in place.

Underneath the top panel is a separate sealing cover. This cover has an extruded rubber gasket around its bottom flange. To remove it, take out the screws from the eight or more metal clamps that hold the cover down in place. Remove the screws from the seal clamp plate at the point where the refrigerant lines enter the top of the cabinet. The cover can then be lifted off. When replaced, be sure the clamps are drawn tight and that the gasket has a good seal all around.

The 1939 PB-12 and PB-16 cabinets and subsequent production have a top construction like that shown in Fig. 272. The inner sealing cover is not used. A sponge gasket (A) under the edge of

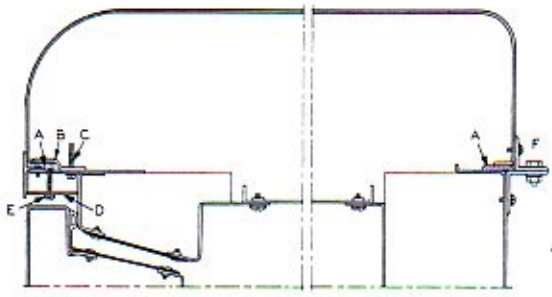


Fig. 272
Cross-section—Top Construction 1939 PB-12 and -16

the top panel provides the cabinet top seal. Three clamps (B) at the front, one at the center, and one at each end, and brackets secured to the back of the top panel, as at (F), hold the top down tight against the gasket. To remove the top panel, open both cabinet doors. Remove the black metal strip (D) just above the doors by removing screws (E). Remove the insulation under this strip. The clamping screws (C) will be exposed. Loosen these screws. Remove the screws at the rear brackets (F). Remove the screws securing the tube seal clamping plate to the top, where the refrigerant lines enter the top. Lift the top panel at the back, slide it forward from under the front clamps and lift it off. When replaced, be sure the gasket makes a good seal.

TOP TRIM

The polished metal trim around the top of the cabinet is secured to the cabinet with screws through a flange on the inside of the trim. These screws are exposed when the top panel and gasket are removed.

NAMEPLATE

The nameplate merely snaps onto the top trim at the front center. Remove it by prying it off.

END PANELS

To remove the cabinet end panels, remove the top panel and top trim. Take out the screws and washers securing the panel to the cabinet at the rear and on the side. Pull the panel away from the cabinet at the back to clear the rear flange and then pull the front edge of the panel from under the stainless steel front panel.

FRONT PANELS

The stainless steel front panels are removable as follows:

Mullion (between the doors): Take out the outer row of Textolite strip screws from each side of the million. Remove the screws from the panel at each side of the mullion between the bottom doors. Pull the panel down so the upper end comes out from under the top cross rail panel and lift off.

Top Cross Rails: Remove the Textolite strips from underneath the top ledge just over the doors by taking out the screws. Remove the outer row of Textolite strip screws from the top door jambs. By taking hold of the center of the panel and pulling out, there should be enough flex so the two ends can be pulled out from under the stiles at the sides.

Bottom Cross Rails: Remove the mullion panel. Take out the front row of Textolite strip screws from the bottom jambs. Lift the panel out from the center and pull the outer end from under the panels on the stiles.

Stiles (at outside of door openings): Remove the door, leaving the hinges attached to the door. Remove the outer row of Textolite strip screws from the outside door jamb. Remove the screws from the front of the panel and lift off.

BASE GRILLE

The base grille is held to the front of the base by spring clips. To remove, pull out at each end of the grille.

DRY STORAGE OR VEGETABLE BIN

The vegetable bin assembly is hinged to the left side of the cabinet and swings open in the same manner as the cabinet doors. The front panel of the bin is secured to the bin body by screws through the front flange of the bin into holes in the inner flange of the panel. The holes in the bin are large enough to allow adjustment

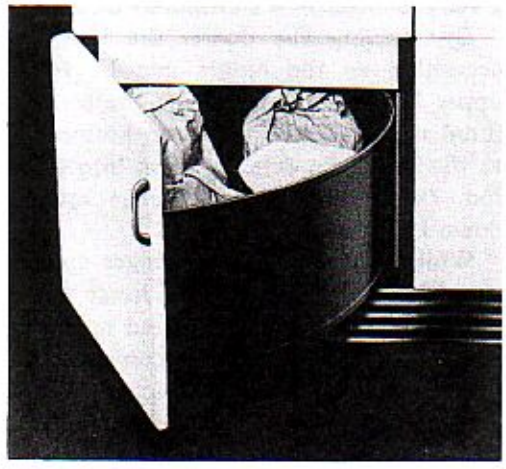


Fig. 273
Dry Storage Bin—PB-12 and PB-16

of the panel by shifting it when the screws are loosened. The handle is fastened to the front panel by screws from the inside.

The bin rides on a roller. In the 1938 models, the roller is screwed to the bottom of the bin near the back. The holes for the screws are slotted so the position of the roller can be adjusted to hold the bin closed. The roller, upon closing the bin, rides up over and behind a metal stop screwed to the cabinet base at the back left corner.

In 1939 and subsequent models, the roller is rigidly screwed to the cabinet base near the front. The roller can be adjusted if necessary by using shims underneath the roller bracket. With this type of roller support, a stop to prevent the bin from being pulled out is used. It consists of a bolt through the bottom of the bin near the back, placed so it strikes the front cross member of the cabinet base frame.

UNIT COMPARTMENT PANEL

The front unit compartment panel on the 1938 cabinets is hinged to the cabinet at the right. The panel used on 1939 and subsequent models is like those used on the smaller Flatop cabinets, being held to the cabinet and supported by clips. To remove, open the cabinet door, pull the panel out from the bottom and lift up off of the top clips.

HINGES

Semi-concealed piano type continuous hinges are used on the cabinet door, the dry storage bin, and the first unit compartment panels. There are two

separate hinges to each door and bin. A filler rod gives the effect of a continuous hinge.

By opening the doors, the hinge screws are accessible so the hinges can be removed. The upper hinge, after removing the screws, must be lifted up off of the filler rod between the hinges as the hinge pin extends down into the end of the rod. Likewise, the lower hinge must be pulled down from the rod.

While upper and lower hinges are supplied for the cabinet doors, only one hinge is supplied for the storage bin and the hinged unit compartment panel. This hinge is easily converted to a top or bottom hinge. The pin which extends out from one end can be driven back and out the other end. This will force out the end cap, which can then be inserted in the opposite end. See Fig. 274.

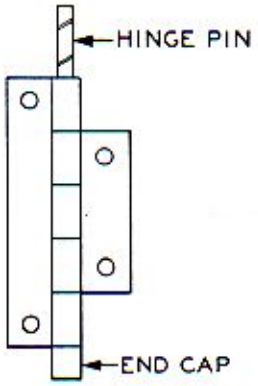


Fig. 274
Hinge for Dry Storage Bin

MULLION HEATER

A small 8-watt tubular heater is used to keep the mullion warm enough to prevent exterior sweating. It is held to the inside front of the mullion, between the doors, by screws and clamps or by spring steel clips (see Fig. 275), which snap under the tapped strips for the Textolite strip screws.

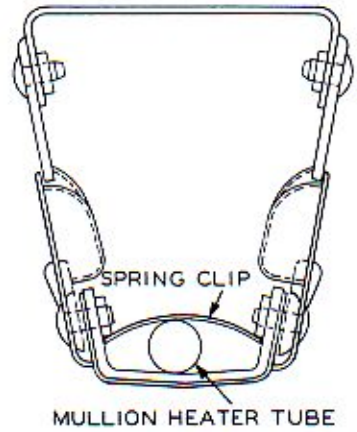


Fig. 275
PB12 and 16 Mullion Cross-section Showing Heater

To remove the heater, remove the Textolite door jamb strip on the right side of the mullion. This will expose the screws and clamps or spring clips, which are removed to release the heater. The heater is connected across the line with connections being made to the wiring in the top of the cabinet.

CABINET PICTURES

Representative pictures of cabinets are shown on the following pages. It will be noted that in many instances the nomenclature of the cabinet is the same as that of the complete refrigerator.

All cabinets, in which Scotch-yoke machines are likely to be installed, appear in the following list with the corresponding page on which a picture of the cabinet or of a similar one is shown.

INDEX OF CABINET PICTURES

INDEX OF CABINET PICTURES

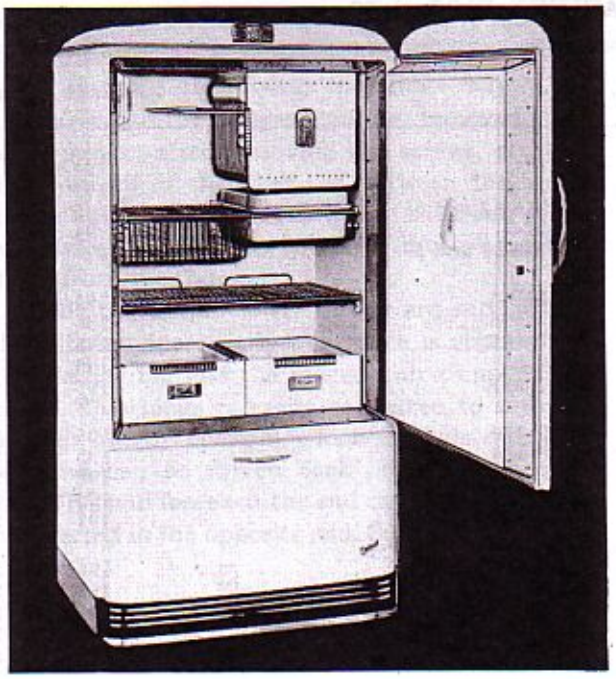


Fig. 276
B8-42 Refrigerator
Interior View

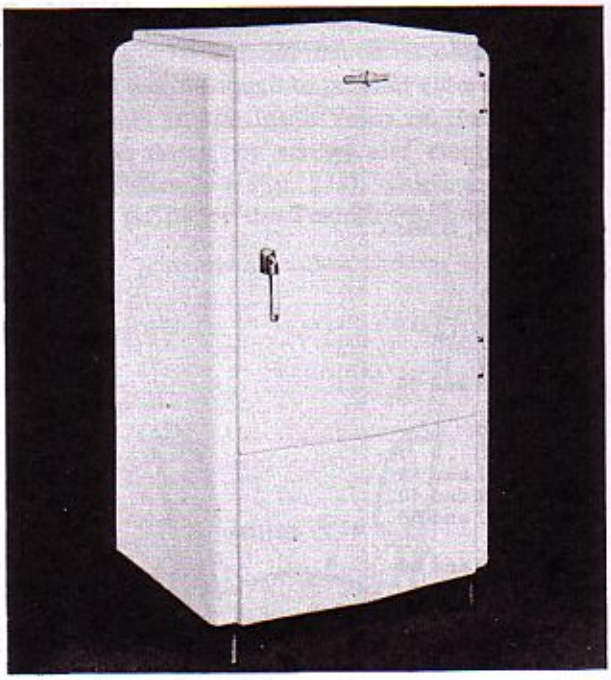


Fig. 278
V-7 Cabinet

Cabinets with similar appearance

V-4	VP-4
V-5	VP-5
	VP-7

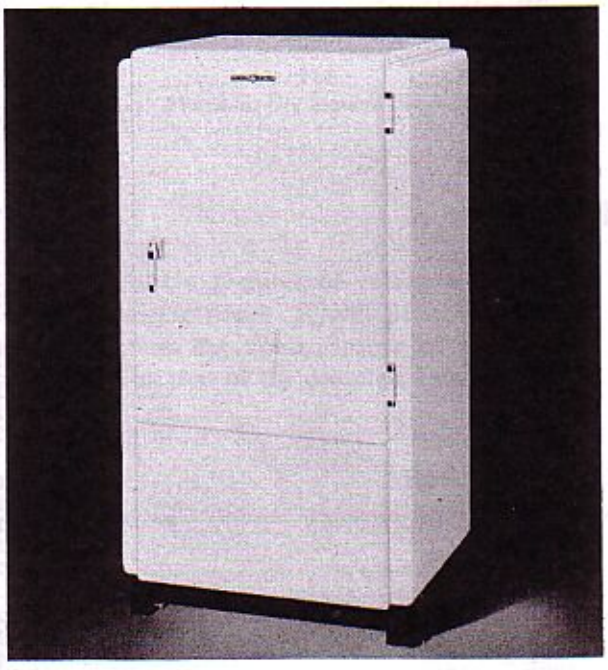


Fig. 277
K-7 Cabinet

Cabinets with similar appearance

K-4	KT-5
K-5	KT-7

Fig. 279
LB6-39 Cabinet

Cabinets with similar appearance

JB5-37 & 38	LB8-40	LBH8-A
JB6-37 & 38	LB6-B, C, D, E & F	LBS6-A
JB7-37 & 38	LBC6-39	PLB6-40
LB6-40	LBH6-A	

Fig. 280
PB6-40 Cabinet

Cabinets with similar appearance

B5-39 & 40	JB6-41	LBX6-41
B6-39, 40 & 41	JB8-41	LBX6-A
B8-39 & 40	LB6-41	LBX6-A "Special"
B5-X	LB6-41 "Special"	LBXA6-A
B8-X	LB6-G	PB5-39 & 40
BH5-41	LB6-G "Special"	PB6-39 & 41
BH6-40	LBA6-G	PB8-39 & 40
	LBS6-B	PJB6-41

Fig. 281
B7-41 Cabinet

Cabinets with similar appearance

B8-41	PB7-41
BH7-41	PB8-41
LBS8-A	

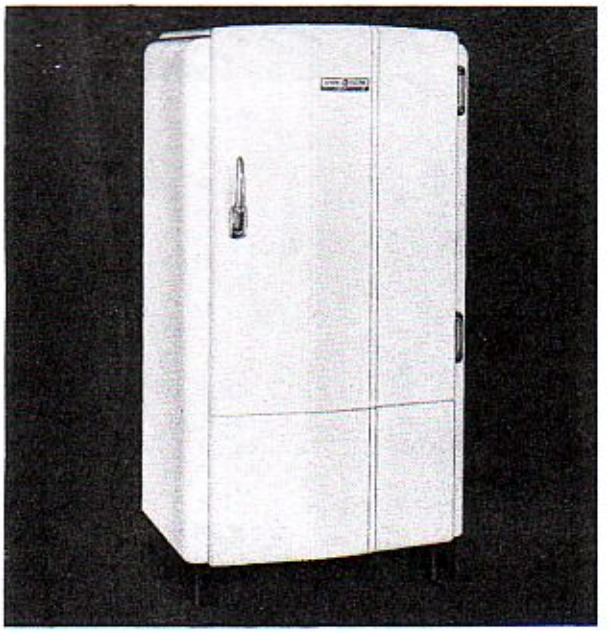


Fig. 282
JB6-40 Cabinet

Cabinets with similar appearance

B4-37 & 38	JB4-39	JBS4-B
B5-37 & 38	JB5-39 & 40	PB4-37 & 38
B6-37 & 38	JB6-39	PB5-37 & 38
B7-37 & 38	JB4-X	PB6-37 & 38
B8-37 & 38	JB6-X	PB7-38
B4-A	JBS4-39	PB8-37 & 38

Fig. 283
B8-42 Cabinet

Cabinets with similar appearance

B7-42	LB7-42	PB8-42
B7-A & B	LBX7-42	PB8-A
B8-A	LBX7-A	PJB7-42
JB7-42		PJB7-A
JB7-C		

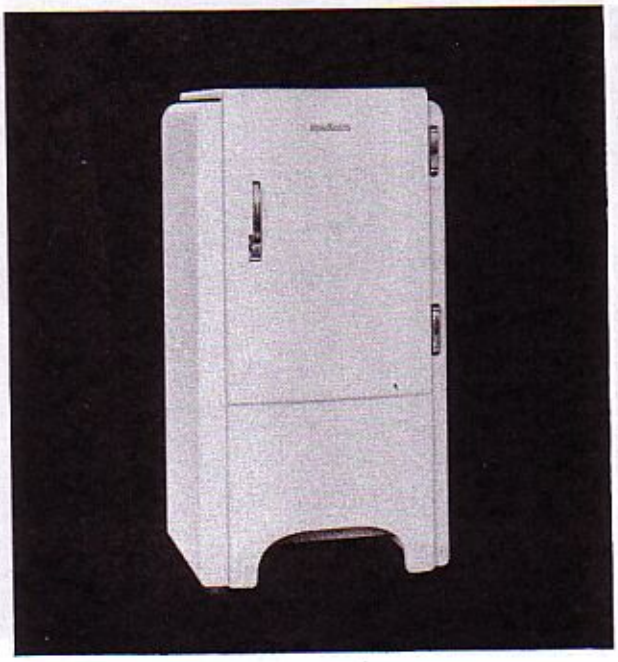


Fig. 284
LB3-40 Cabinet

Cabinets with similar appearance
JB3-38 & 39 LB3-A, B & C

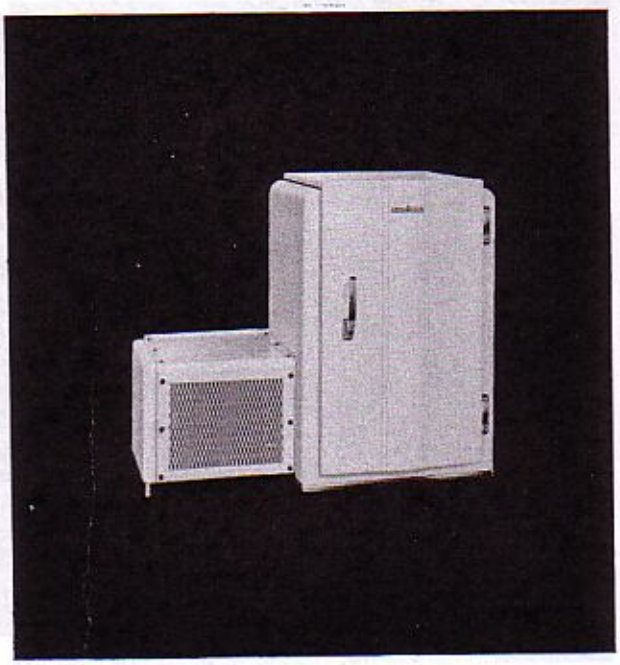


Fig. 286
BY4-40 Refrigerator—Left Hand

Refrigerators with similar appearance
BY4-38 & 39 BY4-A, B & C

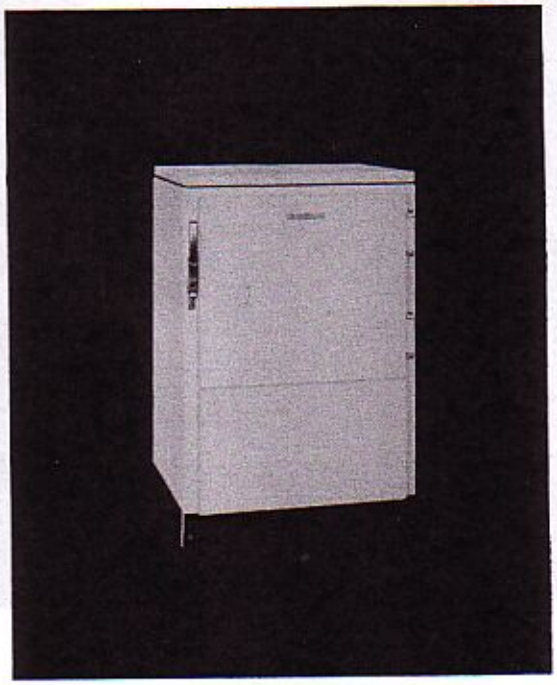


Fig. 285
B3-40 Cabinet

Cabinets with similar appearance
B3-37, 38 & 39 B3-A, B & C

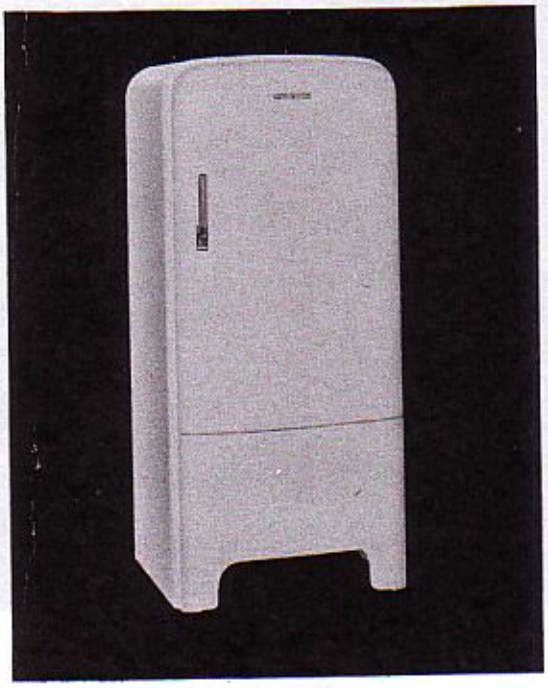


Fig. 287
LB4-40 Cabinet

Cabinets with similar appearance
LB4-C, D & E

Fig. 288
LA6-A Cabinet

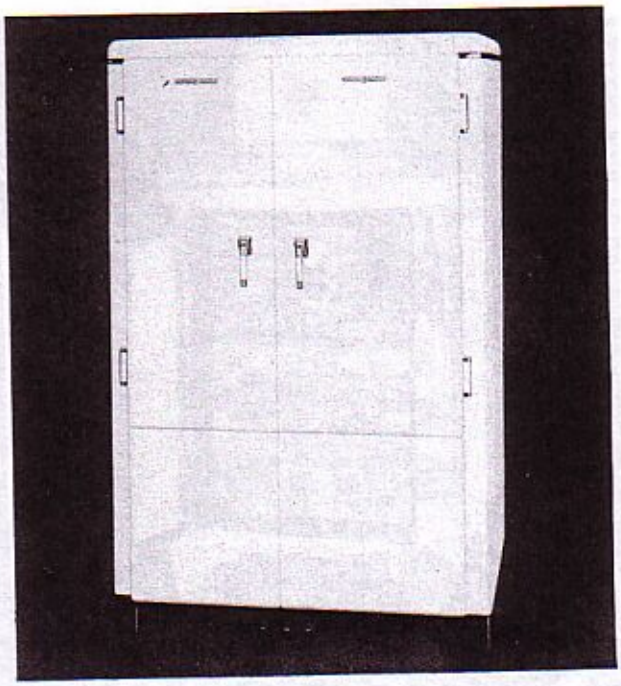


Fig. 290
K-12 Cabinet
K-15 Is Similar

Fig. 289
LK-2 Refrigerator
LK-1 Is Similar

Fig. 291
PB12-39 Cabinet

Cabinets with similar appearance

PB12-38 & 40
PB16-38, 39 & 40
PB12-A, B, C, D & E
PB16-A, B, C, D & E
PBS16-A

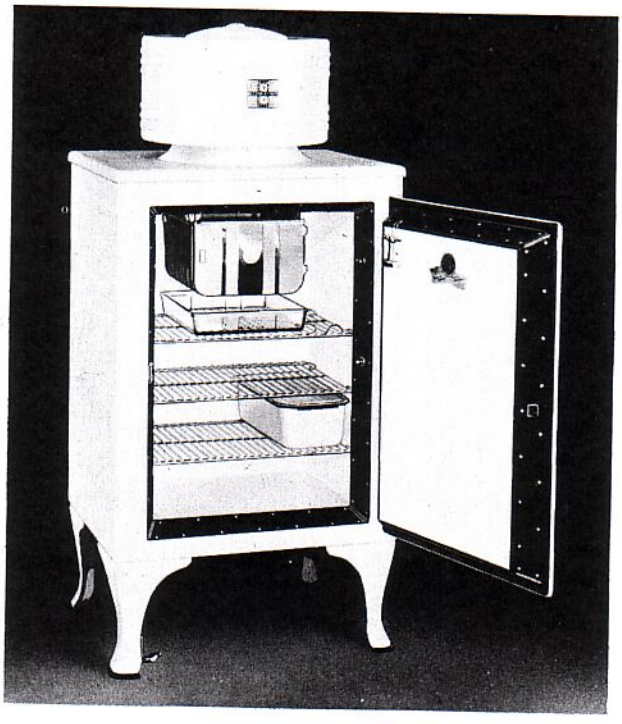


Fig. 292
Interior View
Monitor Top Refrigerator

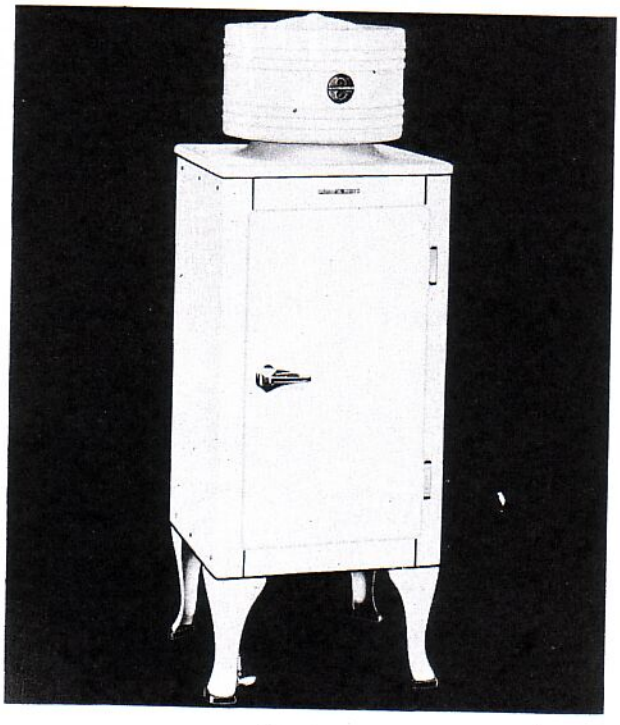


Fig. 294
T-5 Refrigerator
Models with similar appearance

HT-47	T-7	TM-9
HT-70	T-9	T-14 (Two T-7s combined)

Fig. 293
X-4 Refrigerator
Models with similar appearance

X-3	M-4

Fig. 295
M-6 Refrigerator
Models with similar appearance

HX-47	M-7	S-67	SMP-66	X-7
HX-70	MP-5	S-85	X-5	XT-6
M-5	MP-6	SM-66	X-6	

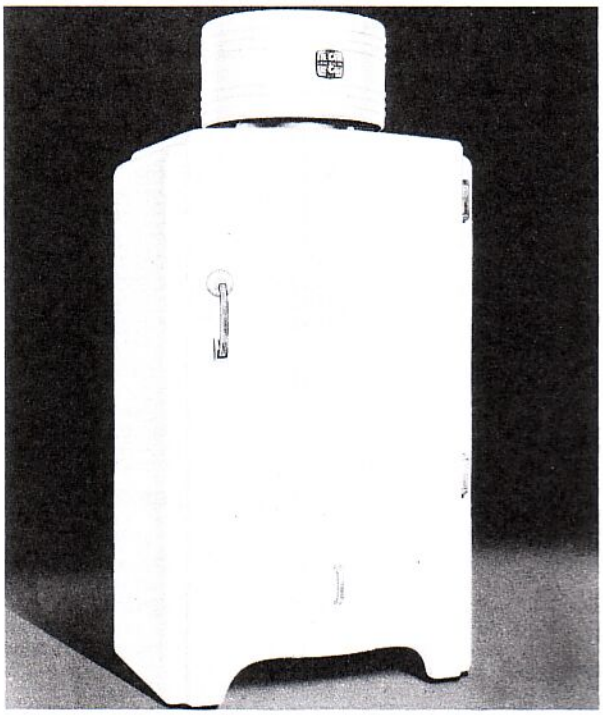


Fig. 296
M8-37 Refrigerator

Models with similar appearance
M6-37 & 38 M-8-38

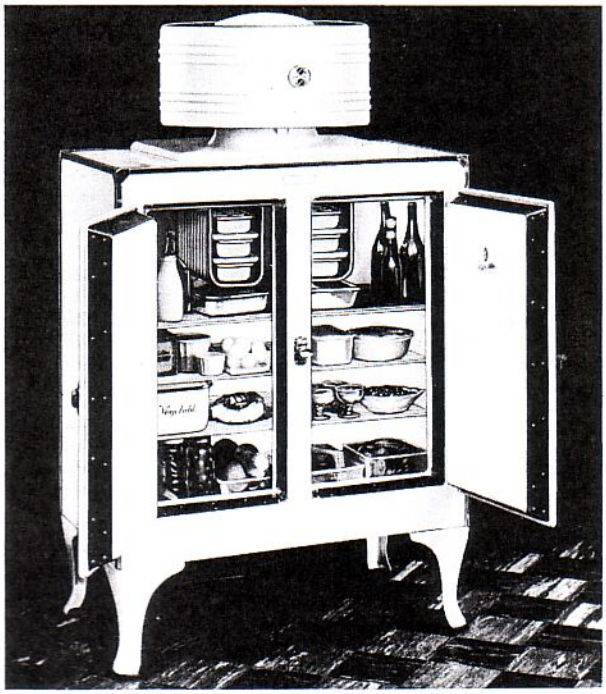


Fig. 298
P-110 Refrigerator

Models with similar appearance
P-44E (single door model) P-134
P-83 (single door model) P-170 (three door model)
P-85E (single door model) P4-180 (four door model)
PS-45 (single door model)

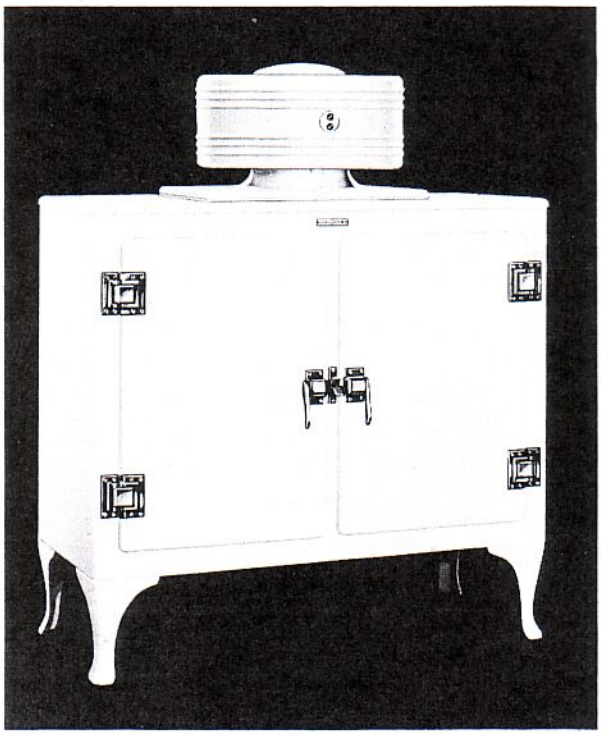


Fig. 297
S-146 Refrigerator

Models with similar appearance
S-107 S-182

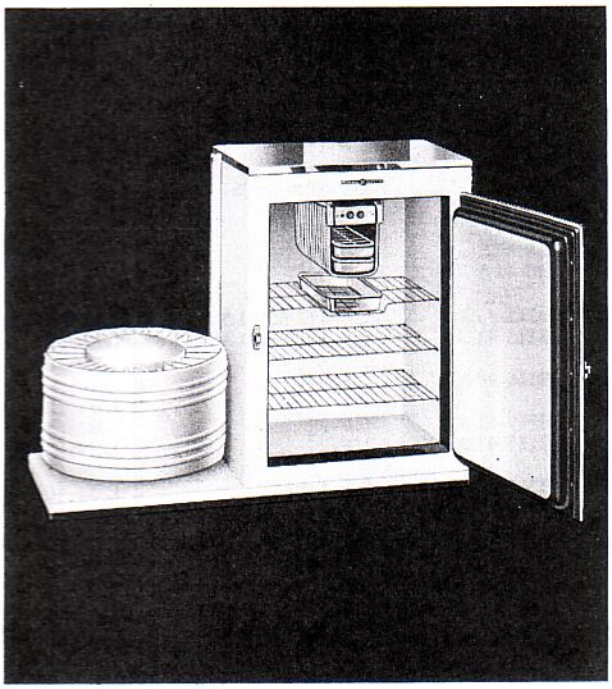


Fig. 299
DK Refrigerator—Left Hand

FLATOP CABINET—MACHINE LIST

Cabinet	Machine
B3-A	CH-1D
B3-B	CH-1E
B3-C	CH-1E
B3-37A	CH-1A
B3-38A	CH-1B
B3-39A	CH-1C
B3-40A	CH-1D
B4-A	CJ-1B
B4-37A	CJ-1A
B4-37B	CJ-1B
B4-38A	CJ-1B
B4-38C	CJ-1B
B5-X	CF-1H
B5-37A	CF-1D
B5-38A	CF-1E
B5-39A	CF-1G
B5-40A	CF-11A
B6-37A	CF-2D
B6-38A	CF-2E
B6-39A	CF-2G
B6-40A	CF-21A
B6-40B	CF-21A
B6-41A	CF-2J
B6-41B	CF-2J
B6-41C	CF-2J
B7-A	CF-22G
B7-B	CF-22G
B7-37A	CF-2D
B7-38A	CF-2D
B7-38B	CF-2F or 2G
B7-41A	CF-22C
B7-41B	CF-22C
B7-42A	CF-22G
B8-A	CF-22G
B8-X	CF-28A
B8-37A	CF-2D
B8-37B	CF-2D
B8-38A	CF-28A or 28B
B8-38B	CF-28A or 28B
B8-39A	CF-28C
B8-40A	CF-22A
B8-40B	CF-22A or B
B8-40C	CF-22A
B8-41A	CF-22C
B8-41B	CF-22C
B8-42A	CF-22G
BH5-41A	CF-1H or 11A
BH5-41B	CF-1H or 11A
BH6-40A	CF-2H
BH7-41A	CF-2J
BH7-41B	CF-2J
BY4 A*	CE-140C
BY4 B*	CE-140D
BY4 C*	CE-140D
BY4-38A*	CE-140A
BY4-39A*	CE-140B
BY4-40A*	CE-140C
DK-1A*	DK-1A
JB3-38A	CJ-1B
JB3-39A	CJ-1C
JB3-39B	CJ-1C
JB4-X	CJ-1B or 1C
JB4-39A	CJ-1C
JB5-37A	CF-1D
JB5-38A	CF-1E
JB5-39A	CF-1G
JB5-39B	CF-1G
JB5-40A	CF-1H
JB6-X	CF-2B or 2C
JB6-37A	CF-2D
JB6-37B	CF-2E
JB6-37C	CF-2D
JB6-38A	CF-2E
JB6-39A	CF-2G
JB6-39B	CF-2G
JB6-40A	CF-2H
JB6-40B	CF-2H
JB6-41A	CF-2J
JB6-41B	CF-2J
JB6-41C	CF-2J
JB7-C	CF-2M
JB7-37A	CF-2D
JB7-38A	CF-2E
JB7-38B	CF-2F or 2G
JB7-42A	CF-2M
JB8-41A	CF-28E
JB8-41B	CF-28E
JBS4-B	CFS-1A
JBS4-39A	CFS-1A
K-4A	CF-1B
K-5A	CF-1B
K-5B	CF-1B
K-7A	CF-2B
K-7B	CF-2B
K-12A***	CE-34M
K-12B***	CE-34M
K-15A***	CE-34M
K-15B***	CE-34M
KT-5A	CF-1B
KT-5B	CF-1B
KT-7A	CF-2B
KT-7B	CF-2B
LA6-A	CJ-2H
LB3-A	CJ-1D
LB3-B	CJ-1E
LB3-C	CJ-1D
LB3-40A	CJ-1D
LB4-C	FBA-1A
LB4-D	FBA-1A
LB4-E	FBA-1A
LB4-40A	FBA-1A
LB4-40B	FBA-1A
LB4-40C	FBA-1A
LB6-B	CF-2H
LB6-C	CJ-2A
LB6-D	CJ-2A
LB6-E	CJ-2C
LB6-F	CJ-2E
LB6-G	CJ-2H
LB6-G Special	CF-2D, 2G, or 2H CF-21A CF-22A or 22B CF-28C or 28B CJ-2A
LB6-39A	CF-2G
LB6-39B	CF-2H
LB6-39C	CF-2G
LB6-40A	CF-2H
LB6-40B	CF-2H
LB6-41A	CJ-2B or D
LB6-41B	CF-2J (50 cy.)
LB6-41C	CF-2J (50 cy.)
LB6-41D	CJ-2B or D
LB6-41 Special	CF-2D, 2G, or 2H CF-21A CF-22A or 22B CF-28C or 28D CJ-2A
LB7-42A	CF-2M
LB8-40A	CF-28D
LB8-40B	CF-28D
LBA6-G	CF-2M (50 cy.)
LBC6-39A	CF-2F or 2G
LBH6-A	CF-2H
LBH8-A	CF-28D
LBS6-A	CF-28D
LBS6-B	CF-2R
LBS8-A	CF-2R
LBX6-A	CF-2H
LBX6-ASpecial	CJ-2H
LBX6-41A	CF-2J
LBX6-41B	CF-2J
LBX7-42A	CF-2M
LBXA6-A	CF-2M (50 cy.)
LK-1A**	The Machine cannot be separated from the Cabinet
LK-1B**	
LK-2A**	
PB4-37A	CJ-1A
PB4-38A	CJ-1B
PB5-37A	CF-1D
PB5-38A	CF-1E
PB5-39A	CF-1G
PB5-40A	CF-11A
PB6-37A	CF-2D
PB6-38A	CF-2E
PB6-39A	CF-2G
PB6-40A	CF-21A
PB6-41A	CF-2J
PB6-41B	CF-2J
PB6-41C	CF-2J
PB7-38A	CF-2E
PB7-41A	CF-22C
PB7-41B	CF-22C
PB8-A	CF-22G
PB8-37A	CF-2D
PB8-38A	CF-28A or 28B
PB8-38B	CF-28A or 28B
PB8-39A	CF-28C
PB8-40A	CF-22A or 22B
PB8-40B	CF-22A
PB8-41A	CF-22C
PB8-41B	CF-22C
PB8-42A	CF-22G

FLATOP CABINET—MACHINE LIST (Con't)

Cabinet	Machine	Cabinet	Machine	Cabinet	Machine
PB12-A***	CE-34D	PB16-38A	CE-34A	V-4A	CF-1C
PB12-B***	CE-34E	PB16-38B	CE-34A	V-4C	CF-1C
PB12-C***	CE-34E	PB16-39A	CE-34B or 34C		
PB12-D***	CE-34E	PB16-39B	CE-34B or 34C	V-5A	CF-1C
PB12-E***	CE-34H	PB16-40A	CE-34D	V-5C	CF-1C
PB12-38A***	CE-34A				
PB12-38B***	CE-34A	PBS16-A	CE-34E	V-7A	CF-2C
PB12-39A***	CE-34B or 34C			V-7C	CF-2C
PB12-39B***	CE-34B or 34C				
PB12-39C***	CE-34C	PJB6-41B	CF-2J	VP-4A	CF-1C
PB12-40A***	CE-34D	PJB6-41D	CF-2J	VP-4C	CF-1C
PB16-A***	CE-34D			VP-5A	CF-1C
PB16-B***	CE-34E	PJB7-A	CF-2M	VP-5C	CF-1C
PB16-C***	CE-34E	PJB7-42A	CF-2M		
PB16-D***	CE-34E			VP-7A	CF-2C
PB16-E***	CE-34H	PLB6-40A	CF-2H	VP-7C	CF-2C

The single door cabinets are "right hand" when the door is hinged on the right side and "left hand" when the door is hinged on the left side.

* The DK-1 and BY-4 are special "Under-the-Drainboard" models for installation under a kitchen sink, particularly for apartment house use. The unit is mounted at the side of the cabinet on either the right or the left side. The term "right-" or "left-hand" on these models refers to the location of the unit. All DK-1 cabinets have right-hand doors. A left-hand BY-4 has a right-hand door and a right hand BY-4, a left hand door.

** The LK-1 and LK-2 are the Liftop or chest type models.

*** The K-12, K-15, PB12 and PB16 are large two-door models.

MONITOR TOP CABINET—MACHINE LIST

Cabinet	Machine	Cabinet	Machine
HT-47A, B*	CK-1B, C	P4-180**	CK-35B, D
HT-70A*	CK-2B, C	PS-45**	CK-1B, C
HX-47A, B*	CK-1B, C	S-67**	CK-2B, C
HX-70A*	CK-2B, C	S-85**	CK-30B, C
M-4A, C	CG-1A, B	S-107**	CK-35B, C, D
M-5A, C	CK-1B, C	S-146**	CK-35B, C, D
M-6A, B, C	CK-2B, C	S-182**	CK-35B, C, D
M6-37A	CK-26A	SM-66A, B, C	CK-15A, CK-2C
M6-38A	CK-26B	SMP-66A, C	CK-15A, CK-2C
M-7A, C	CK-2B, C	T-5C	CK-1B, C
M8-37A	CK-28A	T-7B, C	CK-2B, C
M8-38A	CK-28B	T-9A, C, D	CK-30B, C
MP-5A, C	CK-1B, C	T-14A	(2) CK-2B, C
MP-6C	CK-2B, C	TM-9A	CK-30C, D
P-44E**	CK-1B, C	X-3A	CG-1A, B
P-83**	CK-30B, C	X-4A, B	CG-1A, B
P-85E**	CK-30B, C	X-5C, F, G	CK-1B, C
P-110**	CK-35B, D	X-6A	CK-2B, C
P-134**	CK-35B, D	X-7B, C	CK-2B, C
P-170**	CK-35B, D	XT-6A	CK-2B, C

The single door cabinets are "right hand" when the door is hinged on the right side and "left hand" when the door is hinged on the left side.

Many of the above cabinets will be found in the field with other models of CK units installed on them due to machine replacements.

* The HT and HX-47s and 70s were originally made for use with the CA machines but some of the later production were originally used with CK machines. Cabinet adjustments on these are covered in the CA Machine Service Manual.

** These cabinets were originally made for use with DR machines but some were originally sold with CK machines. Cabinet adjustments on these are covered in the DR Machine Service Manual.

USE AND CARE OF THE REFRIGERATOR

The General Electric refrigerator is designed to satisfy all normal refrigeration requirements with a minimum amount of attention on the part of the user. A few instructions on the use and care of the refrigerator will assist the user in obtaining the most satisfactory service from it.

CLEANING THE INTERIOR

For cleaning the interior of the cabinet and the evaporator, a solution of baking soda in warm water should be used. Cleaning agents having an odor should be avoided. After cleaning, dry the interior by wiping with a clean dry cloth.

It is suggested that the interior be cleaned each time the evaporator is defrosted.

For cleaning deposits or stains on the evaporator, use a good kitchen cleaner.

For cleaning the freezing trays, use merely soap and water. Never use a metal sponge, abrasive cleaning powder or very hot water when cleaning trays.

When washing the cold storage compartment or chiller tray, do not use hot water. Hot water may cause breakage.

CLEANING THE EXTERIOR

A mild soap and warm water or General Electric Liquid Wax should be used in cleaning the exterior of the cabinet. Be sure to remove all soapy suds with clear water.

Caution: The use of any of the standard cleaning compounds which depend upon abrasive or alkaline action will remove the gloss from the finish on the cabinet.

STOPPING THE REFRIGERATOR

If the refrigerator is to be out of service for several days or longer, remove all foods from the cabinet and all water from the freezing and chiller trays. Clean the interior and leave the cabinet door slightly ajar to allow air circulation inside the cabinet. If there is any possibility of the cabinet becoming wet, it should be protected in the same way as a good piece of furniture. It may be desirable to cover the refrigerator with a sheet or a large paper bag to keep off the dust.

DISTRIBUTION OF FOOD

The coldest zone in the refrigerator is within the evaporator where the temperature is below freezing. The next warmer zone is in the chiller tray where the temperature may be just below or just above freezing.

Air circulation is necessary to insure uniform temperature distribution within the cabinet. Therefore, do not restrict the circulation by excessive crowding of food into the cabinet or by placing coverings over the shelves.

The circulation of cold air in the cabinet is from the evaporator, down around the chiller tray, and then up the sides of the cabinet. Whenever possible, space should be left between the dishes so that the cold air circulates freely. In view of this air circulation inside the cabinet, it is evident that foods with odors should be tightly covered.

For most satisfactory results, it is recommended that all liquids and the following foods be kept in covered containers:

I. Those with strong or objectionable odors such as cantaloupes and onions.
II. Those which absorb odors readily such as butter.
III. Moist foods such as mashed potatoes or creamed vegetables.
IV. Fresh vegetables such as lettuce and celery. (Should be kept in a vegetable pan.)

FREEZING ICE CUBES

To secure the most rapid freezing of ice cubes, be sure that the ice trays make good contact with the evaporator freezing surface. A half-cup of water spread over the freezing surface will result in faster freezing of the ice cubes because the tray bottom will freeze fast to the evaporator.

The ice freezing rate can be further increased by turning the temperature knob to the coldest setting. When the ice is frozen, the temperature knob should be returned to the normal position to avoid excessively cold cabinet air temperature.

It will be found that, particularly in warm room temperatures, ice cubes will freeze quicker on the bottom of the evaporator than on the shelf; the time required to freeze on the bottom being about two-thirds that on the shelf. Because of the evaporator construction, it may also be observed that the ice tray on the right side of the shelf on some machines freezes slower than the one on the left.

A rubber ice tray is useful for the ease with which ice cubes can be removed where only a few cubes are needed at a time. It is not a fast freezing tray. Generally, it will require from three to four times as long to freeze cubes in a rubber tray as in a metal tray.

To remove a metal ice tray when frozen, use the tray lifter, or loosen with an upward push directed against the upper rim of the tray. Do not use an

ice pick or other sharp instrument which might puncture the evaporator and cause a refrigerant leak. A rubber ice tray can be loosened by lifting on the handle.

QUICK TRAYS

Most of the models from 1938 to 1942 were equipped with "Quick Trays", so named for their fast ice freezing and the ease with which the cubes can be removed from them.

The front of the tray is marked and has the bottom recessed so that the handle end of the tray release can be inserted under it to break it loose after freezing.

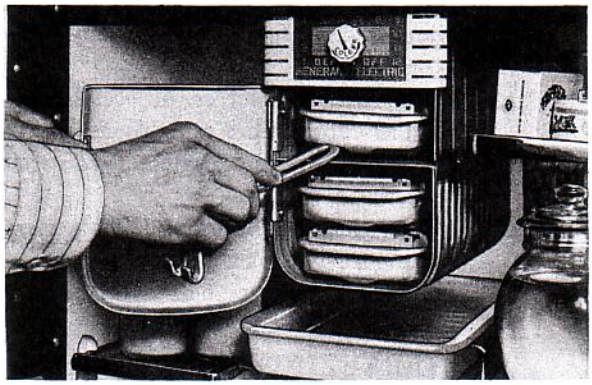


Fig. 300
Releasing Ice Tray

The cubes are removed by using the special hooked-shaped lever or tray release. The hooked part of the tray release is placed under the curved edge of the flexible dividers and pushes them upward when leverage is exerted on the handle. The trays must be completely *filled with water* before freezing so that the ice is sufficiently high to allow the use of the tray release.

The dividers will fit in the tray in only the correct position because one end of the tray has more slope than the other.

Fig. 301
Removing Ice Cubes

FREEZING DESSERTS

The time required to freeze desserts depends on the constituents used. It is usually somewhat longer than the time to freeze water.

It is recommended that frozen desserts be stored in the bottom section of the evaporator.

DEFROSTING

Frost will collect on the evaporator at a rate depending on the humidity of the air entering the cabinet at times when the door is opened and on the amount of uncovered liquid or moist foods in the cabinet. It is recommended that the evaporator be defrosted at a time when this accumulation is approximately one-fourth to one-half inch thick or when the accumulation interferes with the contact of ice trays. It is suggested that defrosting take place at least once a month, at which time the interior of the cabinet and the evaporator should be cleaned.

To defrost the refrigerator, the control should be turned counter-clockwise to the position marked "defrost". Ice trays, and food stored in the chiller tray should be removed previous to defrosting.

Note: CG and LK machines which are equipped with a control-relay do not have a "defrost" position and must be turned off

After the control has been turned to "defrost," the machine will automatically proceed to operate through defrosting cycles; that is, the evaporator temperature at which the machine cuts off will remain about the same but the cut-on temperature will be considerably above 32° F. The frost on the evaporator will melt off into the chiller tray. When the defrosting is completed, the evaporator should be cleaned before the control is turned to a running position. The water in the chiller tray should be immediately emptied.

HOT WATER DEFROSTING

In order to hasten the defrosting period, particularly in warm weather when it is desired to preserve the ice cubes and allow only a small rise in cabinet air temperature, pans of hot water can be placed in the evaporator after the control is turned off.

RESETTING THE OVERLOAD

A device is incorporated in two-knob controls to protect the motor of the machine in case of unusual load or power conditions. When this device operates, the motor is shut off. On some of the early models, a red signal appears in the window on the front of the control.

To restart the machine, the main switch must be turned first to the "off" position and then to the "on" poistion. If the overload trips immediately and will not remain set, wait a few minutes and try it again.

This procedure is not necessary on newer machines with single-knob controls. They have an automatic reset overload which is in the relay.

LUBRICATION AND MAINTENANCE

MACHINE

The sealed mechanism of all models is charged with the proper amount of oil at the factory and requires no attention in the home.

Fan Motor—A few models are equipped with an auxiliary fan motor which may require oiling once a year; see page 87.

Finned-tube Condenser—Most models with an external motor-driven fan also have a finned-tube condenser which should be cleaned occasionally with a small stiff brush or a vacuum cleaner.

CABINET

Occasional lubrication of various cabinet parts will keep them operating smoothly. In addition, it will undoubtedly minimize wear and prolong their life. The parts that would benefit from such attention and a method that can be used are described below.

Door Hinges—Remove the hinge covers, brush out dust and apply a small quantity of a good grade of cup grease or vaseline with a toothpick.

Latch—Pry off the latch escutcheon and, using a toothpick, brush a small amount of grease on the push pin and handle bearing. Rub paraffin on the nose of the latch bolt.

Foot Pedal—Brush the dust from the foot pedal mechanism and apply a small quantity of grease on the end of a toothpick to the bearings of the foot pedal. In some cases it may be necessary to loosen the lock nut in order to get grease on the ball joint. Operate the foot pedal and adjust it if necessary.

Evaporator Door Hinges—A small quantity of light machine oil can be worked into the Evaporator Door Hinges with a toothpick.

Storage Bin, Slides and Rollers—Bins, slides and rollers should be oiled with a light machine oil.

Butter Conditioner Hinges—Using a toothpick, apply a small amount of oil.

Door Stop of Late LB-4 Cabinets—Apply a *small* quantity of grease.

Switches—Light switches of the push type should be given *one* drop of oil. Work back and forward, and then wipe off the surplus oil.

Shelves—Sliding shelves, vegetable drawers, and cold storage compartments should be removed and the sliding surfaces rubbed with paraffin.

Important—As suggested above, the amount of oil or grease applied should be very small. If a good grade of cup grease is not available, the ordinary old-fashioned yellow vaseline from a corner drug store is readily available in small quantities, is acid-free, and is a good lubricant.

HANDLING

When moving a refrigerator across the floor of a customer's home, handle it so that there is no danger of the cabinet legs scratching the floor. If the refrigerator is dragged along, there is a possibility, considering the weight, that the slightest burr on one of the legs might scratch the floor surface. Do not move the refrigerator with the black base strip or grille in place.

The refrigerator should be reasonably level and should sit firmly on all four legs. The door, when open, should not tend to swing. This is caused by an unlevel floor.

Although rubber bumpers are placed on the condenser, it is recommended that the refrigerator be installed so that it does not touch a metal pipe or wall surface.

INSTALLATION LIMITATIONS

There are certain location limitations to be observed as unobstructed air circulation must be provided to and from the compressor and condenser to remove the heat from them.

Failure to observe these limitations will cause inefficient operation and possibly shortened life of the refrigerating machine, depending on the degree to which the air circulation is restricted.

Whenever the ventilation is limited and where there is a possibility of its being further limited, the purchaser and user should be warned that the space must be kept unobstructed at all times.

Failure to comply with these installation limitations or subsequent restricting of the ventilation beyond these prescribed limits, voids the manufacturer's warranty on the refrigerating machine.

There must be no obstruction in front of the cabinet base to restrict circulation of air into the opening under the lower front panel.

There should be an open space of at least six inches above the top of the cabinet.

If a refrigerator is built in so that there is no clearance above the top of the cabinet, air circulation must be provided for in another way.

I. A flue may be used from the top of the condenser if its area is equal to the width of the

cabinet times six. It must be so constructed and located that the air circulation will not be further restricted.

II. A free space along one or both sides of the refrigerator extending back to the wall against which the refrigerator is installed can be substituted as long as the height is equal to that of the cabinet and the width is about four inches on each side of the cabinet or six inches on one side.

POWER SUPPLY

Connect a machine only to the type of electric service for which the machine is designed. See page 20.

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