

1940 EQUIPMENT PROGRESS

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INCREASED demands for production during 1940 placed special emphasis on new developments in plant equipment. Obviously, requirements of national defense have been important in this respect, calling as they do for the erection of many totally new plants. Beyond that is the generally quickened pace of industry in all lines and the need for enlarged capacity to produce new products. Since these forces are still active in industry, possibilities in new and improved equipment to meet problems ahead require investigation.

In examining a year's progress, the important fact is that evolution, and not revolution, has been at work. Thus one finds minor changes in familiar items dominant. Yet small improvements in equipment which reduce energy required or increase yields even slightly become significant in continuous day-after-day production. The old saw of the "many mickles which make a muckle" is nowhere more appropriately applied than to industrial equipment in large-scale production.

Important building projects under way in chemical process industries are placing heavy demands on equipment builders. Simultaneous enlarged requirements for material for national defense have seriously affected supplies to equipment builders, particularly of special alloys. This has tended to promote the use of clad metals to conserve scarce metals and has led to the redesign of many types of reaction vessels to obtain the greatest possible service from the minimum quantities of special alloys. At the same time, other corrosion-resistant materials—stoneware, glass enameled ware, synthetic resins as materials of construction and as coatings on carbon steel, fused silica, glass and chemical porcelain—receive increased attention for applications in which they can replace alloys. No shortages have so far made themselves felt in this respect, and the effects of any that might be anticipated in the future are likely to be nullified by cooperation between users and builders of special equipment.

Reaction Equipment

Corrosion resistance looms large in the design of reaction equipment. This depends not only on the material of construction but to an equal extent on the method of fabrication employed. In both of these respects improve-

ments of 1940 have been important. Limitations, previously imposed by inherent qualities of the materials available, gradually become less rigid as skill in handling them develops new methods.

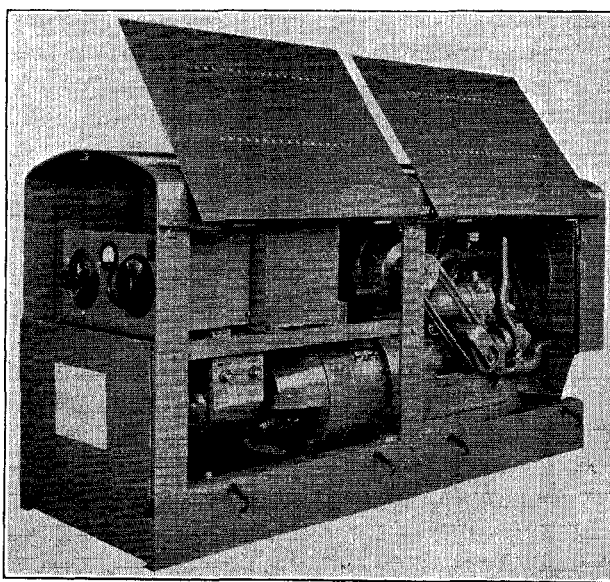
The problems of fabricating clad metals have, for example, been solved one by one. Carbon steel plates with practicable integral layers of stainless steel, nickel, or other corrosion-resistant metals are now formed, shaped, and even welded with comparative ease. This technique gives equipment the operating characteristic of the protective metal but saves in the quantity required for a particular purpose and thus materially reduces cost.

In the welding field, a new engine driven arc welder, built by Lincoln Electric Company, has a 200-ampere capacity but is light enough to be wheeled by one man or handled on moderate capacity lifting equipment. Another Lincoln development is a Diesel-powered 300-ampere unit with a gasoline engine for starting rather than the conventional motor-storage battery combination. A new small motor-generator type arc welder for portable use is also available.

Additions to the list of Lincoln electrodes available are five new items. "Faceweld" coated electrodes are used for building up hard surfaces on worn parts of carbon and manganese steels. "Hardweld 50" gives a machinable deposit of 0.50 per cent carbon steel. "Manganweld B" is used on 11 to 14 per cent manganese steel parts. "Nickelchrome-weld" is a shielded arc electrode for welding Inconel, Nichrome, and other alloys high in nickel and chromium. "Stainweld D" welds 25 per cent chromium-20 per cent nickel and is used to join various stainless steels to mild steel.

Rubber for linings and equipment is being substantially supplemented by the synthetic rubbers (neoprene, Thiokol, Koroseal, and Tygon, among others) which possess greater resistance to attack by chemicals and solvents. High adhesion of these materials to a steel base gives them important places in the chemical equipment picture. Tanks, pipes, fittings, pumps, valves, and a growing list of other essential items of this construction are available.

Glass-lined steel equipment is also produced in an increasing variety of useful forms. The chemical resistance of the glass enamels used



DIESEL-DRIVEN LINCOLN ELECTRIC WELDER WHICH HAS AN AUXILIARY GASOLINE MOTOR FOR STARTING

in equipment of this type has been continuously improved through recent years. At the same time, limitations on the size of individual pieces have been raised and pressure limits have been increased. Present advanced types of glass-lined steel vessels are recommended for working pressures as great as 100 pounds per square inch, a substantial increase over older types. Glass-lined pipe, fittings, and valves are now available, in addition to plain and jacketed vessels.

Among the special metals for equipment, tantalum attracts continuing attention by its complete freedom from corrosion, the high operating efficiency of units made of it, and their minimum cost of upkeep. Combinations of tantalum heat transfer units for heating, cooling, or condensing highly corrosive substances with glass-lined steel reaction vessels have recently proved highly efficient.

A new type of phenolic resin for chemical use has been developed within the past few years and is now available as "Haveg 50". The new resin is resistant to alkaline solutions (even hot sodium or potassium hydroxide) as well as acids. It is generally similar to the previous type, "Haveg 41", but possesses greater resilience and resistance to shock. In fabrication, external supporting members are used to reinforce the resinous walls and in this way cylindrical tanks as large as 6 feet in diameter and rectangular tanks as long as 10 feet are made in one piece. Tests extending over a period of three years in actual use have proved the value of the new material.

Several new lining materials based on developments in the field of synthetic resins have appeared as an answer to many problems of corrosion. The thermoplastic vinyl and vinylidene resins take prominent part in these on account of their high chemical resistance and the ease of their application.

New and Improved Equipment

Designs of reaction equipment are usually modified to meet specific requirements and are consequently less easily standardized than units performing mechanical operations in the industry. Mechanical equipment, on the other hand, reaches a considerable degree of standardization on forms serving a variety of purposes well. Thus, designs are modified in detail in preference to sweeping changes. This leads naturally to similarity between old and new models which often makes distinction between them difficult and quite as frequently more real than apparent.

The Lummus Company is offering this year a new homogenizer for the accurate blending of lubricating oils and additives, and a new emulsion de-oiling unit. Both are in successful operation in the petroleum industry. Also offered by Lummus is the Gulf Polyform process which differs from normal thermal cracking in processing oil in admixture with normally gaseous hydrocarbons (propanes and butanes) at

higher temperatures. The product is greater yield of higher octane gasoline than by conventional thermal cracking.

In the Dorr line of continuous processing equipment, five new developments employ familiar principles with new efficiency. A new Dorr classifier makes separations in the ultracoarse range (from 4 to 14 mesh). A new single-compartment thickener is guarded against overload by an automatic lifting device. The new Dorco V-type pump for sludges has a stroke variable, while in operation, to change capacity. A new slaker for lime removes grit while it yields a smooth hydrate paste. A new unit provides for flocculation and clarification in a single tank.

The liquid screen unit of the Link-Belt Company is finding wider applications in the process and chemical industries. This vibrating liquid screen removes solids from liquid wastes and is used in reducing stream pollution by discharges of this kind. Typical of products efficiently handled are fish oil, vegetable refuse, and phosphate rock.

Improvements have also been made in the Combs gyratory screens of Great Western Manufacturing Company. These screens attain high capacity for dry, liquid, and semiliquid materials through their gyratory vibrating motion.

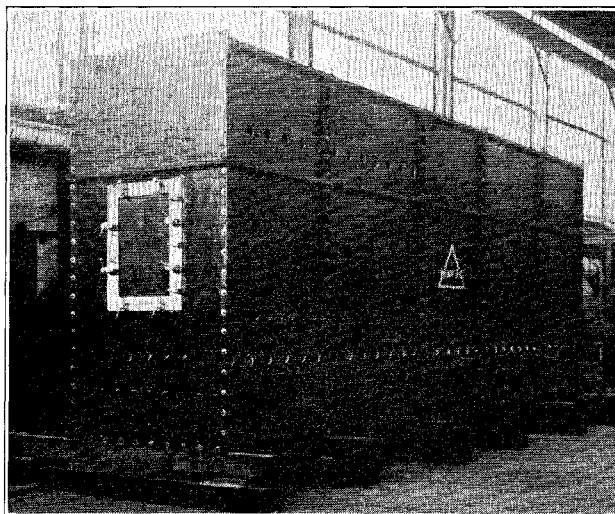
Continuous weighing is valuable in numerous modern chemical operations. The Richardson automatic coal scale has been improved in detail while still employing the same basic operating principle. Notable are welded dust-proof construction to protect operating parts from damage, inclusion of stainless steel where needed for corrosion resistance, a by-pass for emergency use which permits service to be quickly restored when trouble is remedied, right- or left-hand controls as desired, and optional magnetic pulleys to remove tramp iron.

An automatic batch weighing unit, designed by Toledo Scale Company, allows any number of batch weighing scales to be controlled electrically from a central panel. The equipment eliminates human error by ensuring against the omission of any ingredient from a batch as these are automatically handled. In addition to weighing, this automatic control equipment governs timing, valves, agitators, pumps, or other parts of the cycle.

A new check-weighing Toledo scale is designed for dusty or corrosive conditions. It is completely housed in a corrosion-protected outer shell, and essential working parts are made of stainless steel.

A new electric hoist, made by Electro Lift, Inc., is fabricated of aluminum alloy castings to give light weight with high strength for heavy duty. The lifting mechanism is of the high-speed cable type. Capacities of several models cover the range from $\frac{1}{8}$ to 3 tons.

A new joint for supplying steam, gas, or other fluids from a fixed pipe to revolving equipment has been developed by Barco Manufacturing Company. A rotating sleeve revolves or slides in and out to care for the motion involved, and the



HAVEG ACETIC ACID AGER BOX FOR TEXTILE MILL



(Above) AUTOMATIC SCALE, OF RICHARDSON SCALE MANUFACTURING COMPANY, WHICH FEATURES STAINLESS STEEL CONSTRUCTION FOR ALL CONTACT PARTS, EMERGENCY BY-PASSING, AND MAGNETIC HEAD PULLEYS; (left) CENTRAL CONTROL PANEL FOR TOLEDO SCALE COMPANY'S AUTOMATIC BATCH WEIGHING PROCESS

double ball design compensates for any slight misalignment or eccentricity. The same company has enlarged and improved its line of streamlined flexible ball joints.

A kneading unit for handling stiff pastes has been materially improved by Patterson Foundry & Machine Company. The new machine possesses, among other advantages, a totally enclosed mechanism for safety and cleanliness, new type kneading and mixing blades, and a built-in piping system which gives positive circulation in mixing chamber jackets.

Announced by Farrel-Birmingham Company, Inc., in 1940 were a new heavy-duty plastics mill for milling plastics at temperatures up to 300° F., a new streamlined, 20 × 20 inch, hydraulic molding press for small rubber and plastic articles, a laboratory Banbury mixer built in several sizes by simplifying the design of customary production units, and a new large size sheeting mill using 600 horsepower to drive its 28-inch rolls.

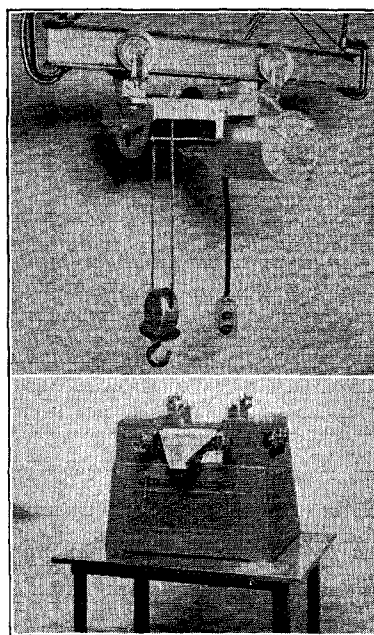
Additions to the line of the Kent Machine Works, Inc., include a new laboratory roller mill embodying the latest advances in their production mills and especially designed for easy cleaning. A new streamlined, 20-gallon, totally enclosed pony mixer has double-action mixing blades which cut mixing time to half.

A new high-efficiency cyclone dust collector, made by American Foundry Equipment Company, gives a separation of dust within a small percentage of that reached by filter type collectors but with the low back pressures characteristic of cyclones. Variations in air flow from rated capacity have

relatively low effect on efficiencies as compared with other cyclones, and a wide choice of sizes is available.

To complete the handling of dusts, the same company builds a wet disposal unit for efficiently handling the dust discharge of collector systems. Mixing of dust and water is accomplished on high-speed mixing disk in a self-contained unit of low power consumption.

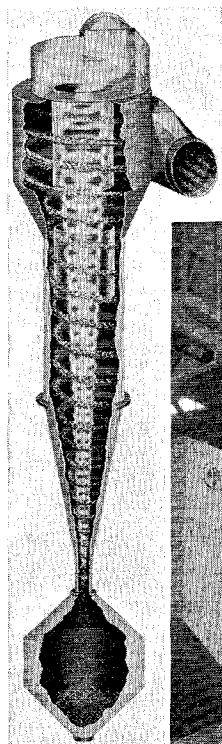
Wet-type collectors employing the multi-wash principle for recovering dust were improved during 1940 by Claude B. Schneible Company. This system recirculates liquid through a unit having no internal moving parts to build up concentration of dissolved or suspended solids to the desired point. Absence of nozzles to clog and extremely low maintenance characterize the system.



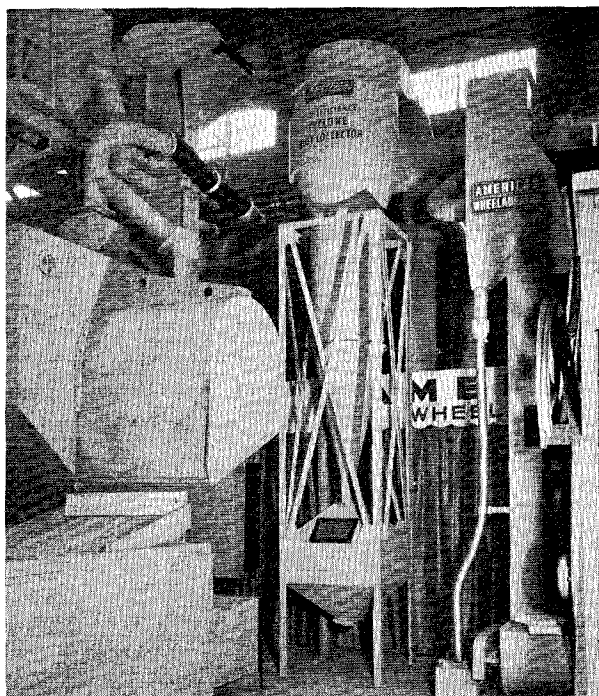
ABOVE IS A LIGHT-WEIGHT, NON-CORROSIVE, ALUMINUM-ALLOY CABLE HOIST MADE BY ELECTRO LIFT, INC.; THE LOWER PHOTOGRAPH SHOWS A LABORATORY ROLLER MILL OF THE KENT MACHINE WORKS, INC.

Pumping of sulfuric acid and similar corrosives require special design to protect stuffing boxes in addition to surface corrosion problems. The pumps built for this purpose by Chas. S. Lewis & Company now include units with capacities up to 1000 gallons per minute. All operate without pump pressure on stuffing boxes which are so arranged that the liquid pumped never touches the shaft packing. Also incorporated are semiopen impellers with external adjustment to compensate for wear. A new assembly has an extra deep, externally sealed stuffing box for use with submerged pumps mounted in process tanks under pressure or vacuum.

Added to the Lewis line of centrifugal refrigerant pumps are new units extending capacity beyond 300 gallons per minute



TWO VIEWS OF A HIGH-EFFICIENCY CYCLONE DUST COLLECTOR DESIGNED BY AMERICAN FOUNDRY EQUIPMENT COMPANY



operating temperatures can be closely controlled since temperature differences are not used to produce circulation.

For producing power in process plants, General Electric Company now builds a complete line of new type polyphase motors in integral horsepower units. These new motors, known as Tri-Clad, embody major advances in insulating current-carrying parts, improved bearings and lubrication, a cast aluminum rotor, and a pressure relief system of greasing ball bearings. The cast-iron frame gives more complete protection than has heretofore been available except in completely enclosed machines.

A new copper-spun rotor for polyphase squirrel-cage motors, developed by Fairbanks, Morse & Company, has current-carrying copper parts centrifugally cast in the laminated core. Its outstanding characteristics are high conductivity, low thermal expansion, high mechanical strength, and the dense uniform structure of the cast winding.

A new line of pumps of large capacity for low-pressure head have also been developed by Fairbanks, Morse & Company. The line of flow is at an angle to the axis of rotation; as the stream leaves the impeller, it enters a volute where its velocity is converted to pressure head. This avoids the need of diffusers commonly employed with propeller pumps.

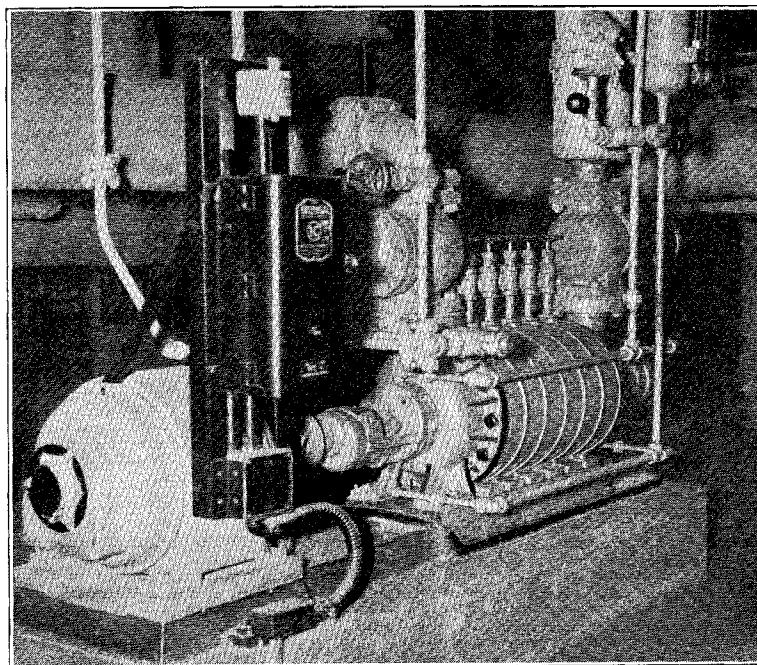
Built by the same company is a new line of mixed-flow pumps with vertical

for low-pressure circulation or medium-pressure booster service.

The new axial flow fans, built by Buffalo Forge Company, embody a set of stationary blades in the fan inlet which direct flow against the direction of rotation and give the outlet stream an axial direction. This feature, combined with a proportioned rotor and streamlined air passages, is responsible for the increased efficiency, pressure, and capacity of these fans. Also important is the limit-load horsepower characteristic which gives a level, instead of an ascending, power curve from open to shut.

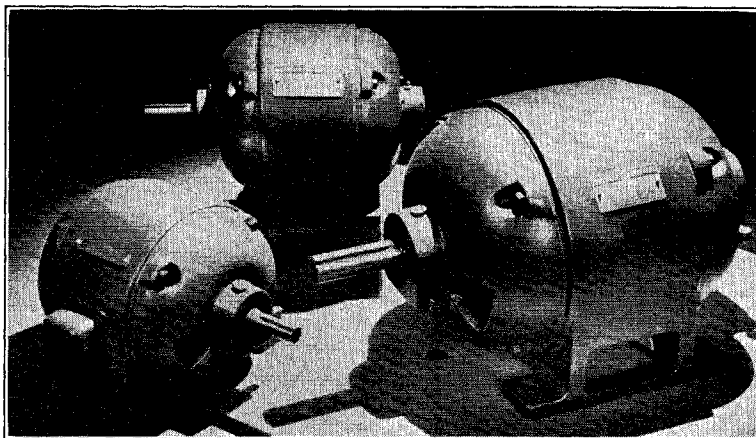
Increased capacity and higher heat transfer rates are achieved in the improved steam unit heaters of Autovent Fan & Blower Company by streamlining these units and redesigning them throughout. These units, used in heating industrial buildings, are now available with acid- and moistureproof fans and vapor-proof motors.

A new and improved double-drum vacuum dryer is built by Buffalo Foundry & Machine Company; and continued improvement is shown by this company's forced-circulation evaporators, in which



Courtesy, Chas. S. Lewis, Inc.

HIGH-CAPACITY HORIZONTAL CENTRIFUGAL BOOSTER PUMP FOR LIQUID REFRIGERANTS, FEATURING SPECIAL OIL-SEALED STUFFING BOXES



THREE MODELS OF GENERAL ELECTRIC TRI-CLAD MOTORS WITH NEW HOUSING, SLEEVE BEARINGS, CAST-ALUMINUM ROTORS, AND A SPECIAL RESISTANT MAGNET WIRE

propellers designed to meet the demand for efficient, large-capacity, moderate-head units. They operate with the propeller submerged and hence are ready for instant service without priming.

The power unit, called Unipower, built by Patterson Foundry & Machine Company, has been redesigned to require lower head room, and at the same time provide efficient, quiet, self-contained power for process equipment. Lightweight ground gears and efficient lubrication are provided by the new unit which can be mounted directly on reaction vessels.

New and improved designs of Aero-Form dryers have been developed by Proctor & Schwartz, Inc. In each of the several types the material is first formed into the best shape for continuous drying and is then carried through the drying cycle loaded to a uniform depth on a continuous conveyor. The shapes are formed by a rolling extruder feed which presses the material through a perforated plate, by a fin drum feed which forms wet material into small sticks in the grooves of a heated drum, or by a granulator feed for handling drier materials. Recirculation of air over heater coils with part of the moist air exhausted at each pass gives a large volume in motion at all times and prevents case drying of pieces. These dryers handle the widest range of feeds successfully.

For drying insecticides particularly, Western Precipitation Corporation has developed an efficient new type of dispersion dryer which takes wet filter cake from the vacuum filters and produces a high-grade superfine product. The new unit replaces a battery of rotary drum dryers and saves some 50 per cent in production cost for this operation.

The spray drying of heat-sensitive, hygroscopic food products has been greatly improved by a unique new unit also built by Western Precipitation Corporation. One of its unique features is a lining of Lastiglass.

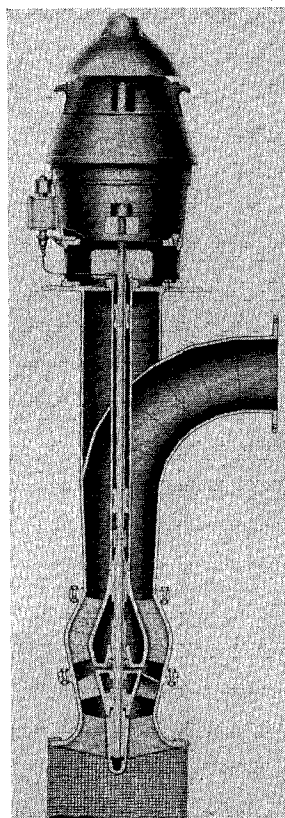
A new fine pulverizer for laboratory or pilot-plant service has been added to the line of the Pulverizing Machinery Company. The Bantam Mikro-Pulverizer is specially designed to duplicate on a small scale the performance of production machines. It is entirely self-contained, is readily cleaned, and has a capacity on semi-hard crystalline materials of 75 pounds per hour with 90 per cent passing 200 mesh.

Dry blending of powders is improved by the new triplex dry blender of Patterson Foundry & Machine Company. It consists essentially of two concentric cylinders divided into six individual compartments through which the feed moves under definite control as the whole revolves about its axis. Each of the several compartments does part of the

blending. Helical screws in the compartments move the feed along, and scoops transfer the charge from one compartment to the next. Complete blending is continuously effected by a process of successive divisions and recombinations of the charge.

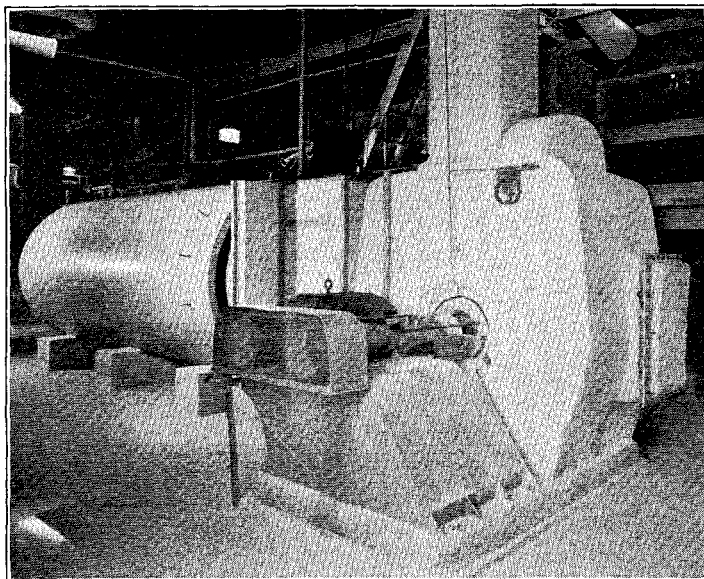
Filter Media Corporation now supplies newly designed filter plates which give free flow of liquid without reducing mechanical support of the filtering medium. Each drainage canal connects directly to an internal manifold and thus gives maximum freedom of flow. Plates are made from a variety of materials.

New models of the edge-principle filters of Cuno Engineering Corporation improve these useful devices. They are constructed entirely of metal and secure separation of solid from liquid through the thin spaces between laminations. One model, "Auto-Klean", gives positive mechanical cleaning of the filter element, which in the "Flo-Klean" model is accomplished hydraulically. The filters are continuously cleanable while in operation and require low pressure drop. Any machinable metal can be used in their construction to meet varying corrosion requirements.



MIXED-FLOW PROPELLER PUMP WHICH NEEDS NO PRIMING SINCE IT OPERATES WITH PROPELLER SUBMERGED

Courtesy, Fairbanks-Morse & Company



Courtesy, Western Precipitation Company

DISPERSION DRYER WHICH PRODUCES A SUPERFINE POWDER DIRECTLY FROM THE DISCHARGE OF A VACUUM FILTER

A new "Ferro Filter", built by S. G. Frantz Company, is equipped with permanent magnets to remove all iron particles from lubricating oil circulating systems at no operating or maintenance cost. The oil is passed through a stack of magnetized grids which pick up iron particles. Previous models required an electric current supply to magnetize the grids.

Ice in pieces of controlled size is produced for process use in a new automatic ice machine built by Henry Vogt Machine Company. Water is pumped through the vertical tubes of a tube-and-shell heat exchanger and frozen by refrigerant vapors in the shell. As the cylinders of ice are frozen, a second part of the cycle thaws them free from the tubes by automatically admitting warm refrigerant gas from the compressor to the shell. As the ice cylinders drop from the tubes, they are cut to length in a cutter and conveyed to the desired point.

A new method of controlling the distribution and flow of water in zeolite softeners has been announced by Elgin Softener Corporation. The new principle prevents the loss of zeolite, gives better distribution of water and hence better cleaning of the bed, increases the capacity of the unit, and allows the use of a larger quantity of zeolite.

A new clarifier, built by Graver Tank & Manufacturing Company, Inc., acts as a combined settler and filter and employs upward flow. The unit bridges the gap between the usual filters and clarifiers. Large particles are settled out, and fine slow-settling materials are entrapped in a naturally formed sludge bed. Low flow velocities provide ideal settling conditions.

The Permutit Company places increasing emphasis on the Spaulding precipitator method of softening water by the cold lime process. The precipitator possesses many advantages among which are short detention time, low chemical requirements, reduced recarbonation, low effluent hardness, selective calcium removal, and absence of settling.

Magnesium oxide or hydroxide is used to remove silica from water in the "Mag-de-Sil" process of the Permutit

Company. This is particularly important in feed waters for modern ultrahigh pressure steam boilers.

A new dry chemical feeder announced by the same company operates on the volumetric principles. A curved feed plate oscillates over the outlet of the storage hopper, releasing a definite adjustable volume of material, with each oscillation, directly into the mixing tank.

Instruments

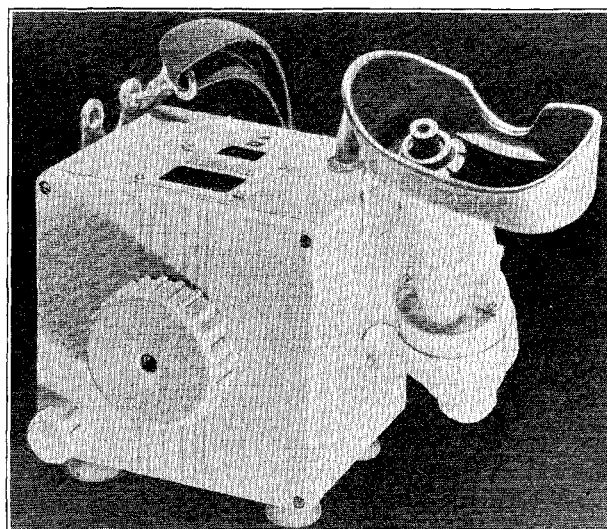
A direct-acting potentiometer recorder for applications requiring a recording potentiometer of highest speed has been developed by Leeds & Northrup Company. To attain its high speed, this new "Speedomax" recorder employs a thyatron relay, instead of a galvanometer, to control the balancing motor.

An entirely new temperature-measuring instrument is the Leeds & Northrup optical pyrometer employing the potentiometer method. It measures the high temperatures inside kilns, furnaces, etc., directly since the potentiometer is calibrated in degrees and not in milliamperes.

A new remote bulb thermostat for proportioning control was developed by Barber-Colman Company for situations where a motor-operated valve or damper must be positioned quickly and accurately in accordance with load variations. The remote bulb and bellows assembly

are hydraulically formed for maximum uniformity and strength.

A new portable self-contained recorder for simultaneously recording temperature and relative humidity has been developed by the Bristol Company. The instrument embodies a fan to circulate air over the sensitive elements and makes records of both variables on an 8-inch chart.



Courtesy, Leeds & Northrup Company

POTENTIOMETER-TYPE OPTICAL PYROMETER

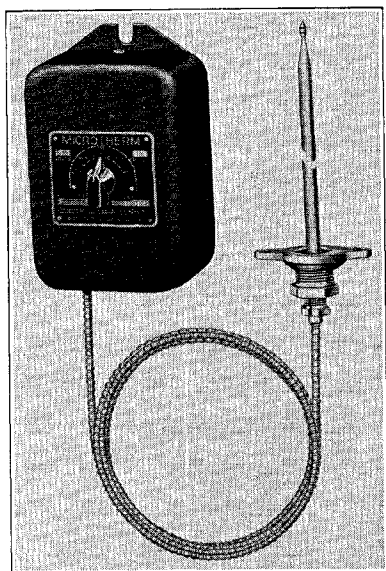
A new Bristol electronic pyrometer controller eliminates all moving parts in the control circuit and employs instead a new electronic circuit using a single high-output, all-metal

vacuum tube. This makes the instrument extremely sensitive to changes of temperature at the hot end of the pyrometer and avoids any hazard from electric sparks, since the operating elements of the relay are enclosed in vacuum.

The recording "Therm-otrol" of Wheelco Instruments Company also utilizes an electronic relay. In this instrument, which controls as well as records, the frequency of an oscillating current flowing between pickup coils, mounted on the control setting index, is altered when a change of temperature moves a control flag mounted on the pen arm between them. This change of frequency operates proper relays to actuate controls.

Electronic relays are employed in a new series of level controls made by Photoswitch, Inc. A probe fitting in the tank contains a high-resistance contact whose conductivity is changed by contact with liquid or solid contents to an extent great enough to operate the electronic relay. Current flowing through the circuit is far too small to cause trouble even with flammable liquids. Combinations of high and low level controls are available for the common conducting liquids as well as for alcohols, gasoline, etc.

New types of glass announced by Corning Glass Works include an alkali-resistant glass, substantially free from boron, and "Vycon" 96 per cent silica glass, with an extremely low coefficient of expansion. Both of these glasses are available in laboratory apparatus. Plant equipment made of them may come later.



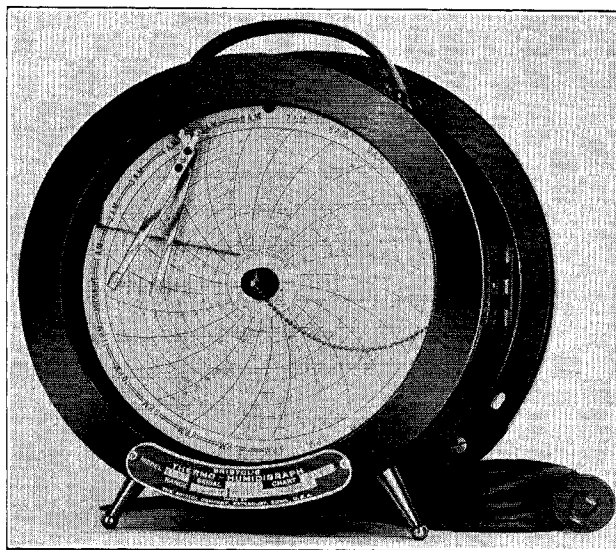
REMOTE-BULB THERMOSTAT MADE BY
THE BARBER-COLMAN COMPANY

Two new types of glass pH electrodes are made by National Technical Laboratories. The Beckman type E electrode is the first glass electrode available for measuring pH in the alkaline range from pH 9.5 to 13.5, a substantial advance in this field. Beckman No. 8990-T glass electrode can be used for pH measurements at temperatures from 50° to 100° C.; it is the first glass electrode which is accurate in this range. These units are primarily used for precise measurement but may be adapted for control purposes.

Added to the line of the same company are a new sleeveless calomel electrode, constructed with a unique liquid junction contact which minimizes maintenance attention, and a

newly developed helical type potentiometer giving fine adjustment over a wide range.

Coleman Electric Company makes a new practicable dropping mercury electrode, which greatly simplifies measurements of this kind, and a simplified electrometric titration unit for many applications, which is both rugged in construction and much less expensive than the usual elaborate instruments.



Courtesy, Bristol Company

PORTABLE DIRECT-READING HUMIDITY AND TEMPERATURE
RECORDER, EQUIPPED WITH A FAN TO CIRCULATE THE SUR-
ROUNDING AIR

A new pH measuring instrument is provided by York Ice Machinery Corporation particularly for use in controlling corrosion in air conditioning and refrigeration systems.

Scientific Glass Apparatus Company is featuring "Glas-Col" units for the controlled electrical heating of round glass vessels. The units, which form two-piece glass-fiber-insulated jackets for flasks, have built-in electrical heating elements and avoid any hazard from fire or overheating.

Protection against dusts is provided by new light-weight masks (less than a half ounce each) made by Martindale Electric Company and consisting of a soft rolled aluminum frame for holding a replaceable cotton filter over the wearer's nose and mouth.

The Martindale Metal-Marker, made by the same company, utilizes the pulsations of alternating electric current to impart rapid vibration (120 strokes per second) to a hardened steel (or diamond) point for marking on metals, glass, porcelain, or other materials. The device can be used in many places where stamping is impracticable.

This brief survey is intended to be suggestive of developments in the equipment field interesting particularly to plant engineers. It is, of course, incomplete, as all such surveys must be. However, it is presented here to help those responsible for building industry in the important tasks which lie ahead for them. None of these is more vital than increased productivity of our process industries. This must be built upon enhanced efficiency secured through improved design and construction of plants, which in turn depends largely upon cooperation of operators with builders of equipment.