Building a Two-Kilowatt Spot-Welding Set

A Practical Shop Utility Which Has Wide Usefulness and Can Be Made by Anyone

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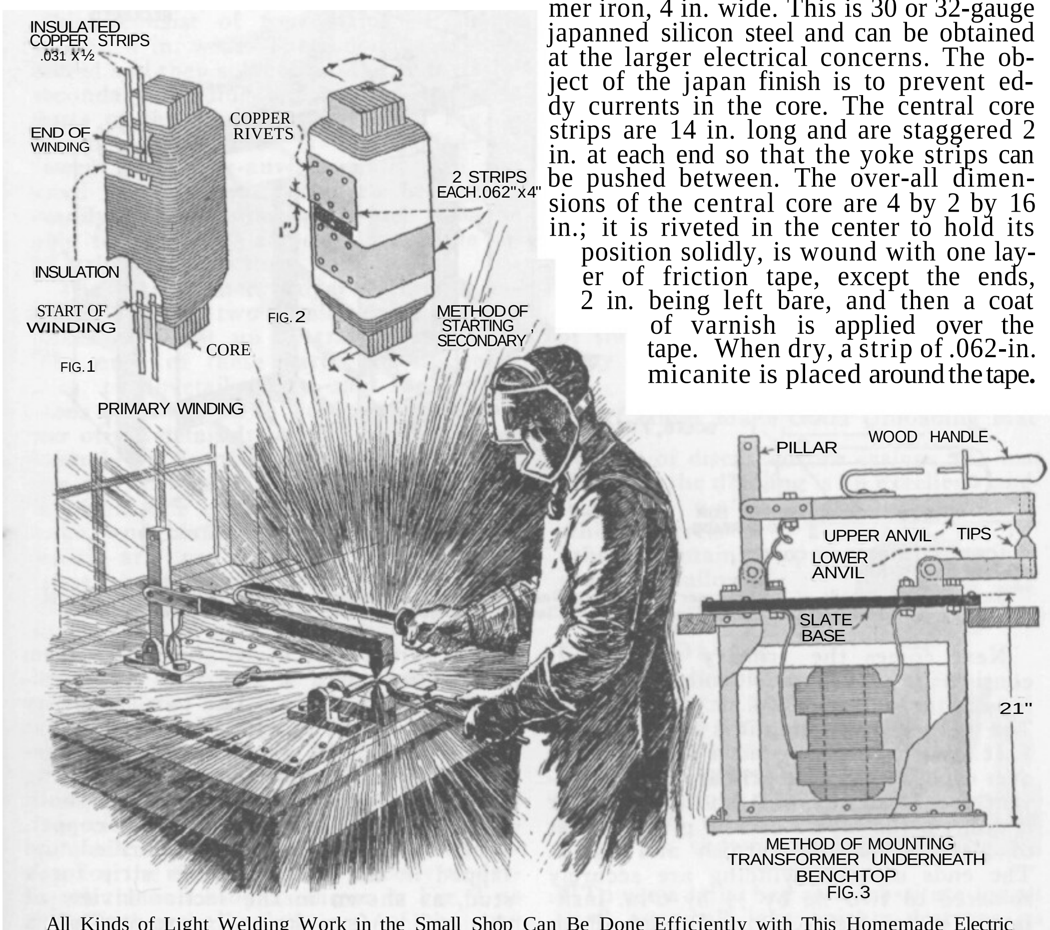
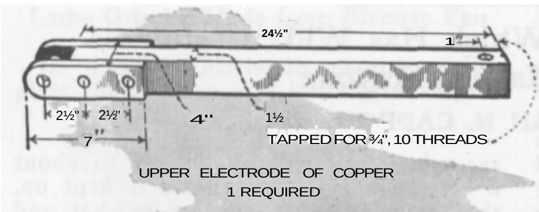
FOR welding light sheet iron, small rods, etc., a 2-kw. spot-welding outfit will be found very useful in the average small shop. The design is simple, no difficult castings are required, and when in operation, it does not cause any disturbance on the line by unbalancing the phases, owing to the special construction of the core.

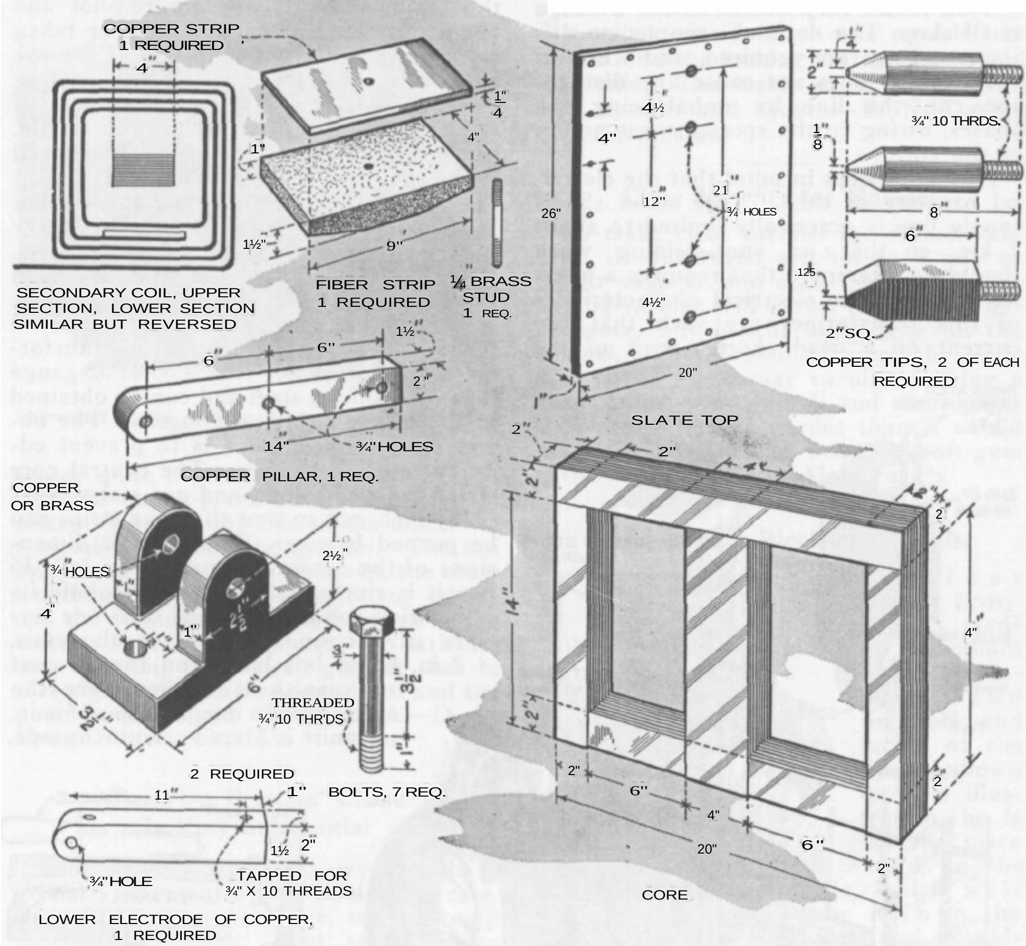
It is to be kept in mind that the electrical capacity of the average small shop's supply line is practically limited to about 2 kw., so that no spot-welding work should be attempted that requires a heavier current. The electrical characteristics of this transformer are such that the current on a dead short circuit of the secondary coil will be limited to about 2 kw., and if this condition is kept up, the secondary coil will get red-hot and begin to melt. Hence care must be taken not to overheat it. The design is for use only with 110-volt. 60-cycle, alternating current. The maximum contact area of the tips is equivalent to a ¼-in. circle, and the maximum thickness of material to be welded is ¼ in- The potential at the copper tips is 3 volts and the current approximately 600 amperes. On heavy stock, say of ½-in. thickness, a ¼-in. iron rivet is used, and this rivet is welded to the material, resulting in strong joints.

The central core on which the coils are wound is built up from strips of transformer iron, 4 in. wide. This is 30 or 32-gauge japanned silicon steel and can be obtained at the larger electrical concerns. The object of the japan finish is to prevent eddy currents in the core. The central core strips are 14 in. long and are staggered 2 in. at each end so that the yoke strips can be pushed between. The over-all dimensions of the central core are 4 by 2 by 16 in.; it is riveted in the center to hold its position solidly, is wound with one layer of friction tape, except the ends, 2 in. being left bare, and then a coat of varnish is applied over the tape. When dry, a strip of .062-in. micanite is placed around the tape.



All Kinds of Light Welding Work in the Small Shop Can Be Done Efficiently with This Homemade Electric Spot-Welding Outfit of Two-Kilowatt Capacity, Designed to Operate only on 110-Volt. 60-Cycle A.C.





Constructional Details of Transformer Core, Slate Base, Method of Winding Secondary Coils, Dimensions of Anvils, Anvil Supports, Welding Tips and Fiber Clamp for Holding Ends of Secondary Winding in Place

Next conies the primary winding. It consists of two parallel coils each having 220 turns of No. 12 d.c.c. magnet wire. The method of winding it is shown in Fig. 1. It is advisable to wind a layer of tape over each layer of the primary coil to prevent the possibility of a short circuit, or if desired, the layers can be given a coat of black asphaltum varnish and baked. The ends of each winding are securely soldered to two .031 by ½ by 6-in. insulated copper strips, as indicated. Both the primary coils are wound at the same time, being placed side by side. The primary winding is protected by an insulating tube of .125-in. micanite which is built up from thin sheets.

The method of starting the secondary winding is shown in Fig. 2. It consists of two coils made up from .062-in. copper strips, 4 in. wide, each having three turns, which are insulated from each other with a layer of .062-in. micanite, 4¼ in- wide. The two secondary coils are wound in opposite directions, as indicated by the arrows, and are connected in series, which is done by riveting and sweating the inside ends of both coils to a 9-in. strip of ¼-in. flat copper, 4 in. wide. A ¼-in. hole is drilled and tapped in the center of this strip for a stud, as shown in the sectional view of this coil. After the coils are wound, a fiber strip, 1½ by 4 by 9 in., with a hole

MATERIAL LIST

100 lb. 30 to 32-gauge transformer iron.
660 ft. No. 12 d.c.c. magnet wire.
240 sq. in. .125-in. micanite made up of thin sheets.
216 sq. in. 1.062 micanite made up of thin sheets.
4 copper strips, 1-32 by ½ by 8 in.
1 copper strip, ¼ by 4 by 9 in.
24 ft. copper strips, .062 by 4 in.
50 in. hard-drawn copper bar, 2 by ½ in.
7 ¾ by 6-in. bolts, 10 threads, with nuts.
32-in. length of hard-drawn copper bar, 2 in. square.
16-in. length round hard-drawn copper bar, 2 in. in diameter
1 piece fiber, 1½ by 4 by 9 in.
1 ¼ by 5-in. brass stud and nut.
40-in. length 2 by 2 by ½-in. angle iron.
40-in. length 2 by 1 by ¼-in. channel iron.
8 ¼ by 3½-in. bolts and nuts.
4 ¼ by 1½-in. bolts and nuts.
1 piece 1-in. slate, 20 by 26 in.
1 piece 1-in. asbestos slate for base (size to suit).
24 ¼ by 2-in. round-head bolts and nuts.
1 pt. asphaltum varnish.
1 roll ½ -in. friction tape.
3 by .125-in. copper strip for conductors.
16 ¼ by 2-in. Copper washers with ¾-in hole.
1 double-pole, single-throw, fused knife switch, 25 amp.

drilled through the center, is slipped over the projecting stud and a nut driven on; the purpose of this is to hold the finishing ends of the secondary down securely and also to make a neat-appearing job. The assembled view of this holder is not shown in the drawing. The outer ends of the secondary winding are connected to the two anvils by means of conductors, which consist of four strips of .062-in. copper, 4 in. wide. These conductors are bolted and then soldered to the ends of the secondary winding and also to the supports of the anvils, as shown in Fig. 3. A similar conductor is later coiled between the upper-anvil support and the anvil itself, permitting it to be moved readily. These conductors, which must be able to carry 600 amperes, are made up of strips to make them flexible.

The transformer proper is now completed, and the two outside cores and the yokes are built up of transformer iron. The ends of these parts are staggered 2 in. to dovetail nicely, and the dimensions are all given in the lower-right corner of the detail drawing. The whole core assembly is fastened together securely at the top with two 20-in. lengths of channel iron, one on each side of the upper yoke, and clamped together with bolts, which are run through both channel irons and the yoke, three or four holes having been drilled for this purpose. The lower yoke is similarly clamped between two 20-in. lengths of angle iron, which are also bolted to a slate base. The channel iron and angle-iron clamps are not shown. Although it is not necessary, the transformer may be inclosed in a sheet-metal case, which the builder can design. It should be perforated to allow free circulation of air to keep the transformer cool. The most convenient mounting for the transformer is directly underneath the benchtop, as shown in Fig. 3, as it will then be entirely out of the way and will not be damaged easily.

It is necessary to provide a 1-in. slate top on the bench to prevent burning the bench when welding. This piece, with all the dimensions, size of holes and their spacing, is shown in the upper-right detail. The anvil clamps and pillar are made of hard-drawn copper-bar stock,1½ in. thick and 2 in. wide, and their exact construction, length and location of holes to be drilled and tapped, etc.. are clearly indicated in the details, as well as the construction of the anvil-pivot supports and the welding tips. A steel handle with a wooden handgrip projecting well out and away from the upper electrode is provided so that the worker can manipulate the upper anvil easily. As will be noted, the upper anvil can be pivoted on the pillar at two points, spaced 6 in. apart. 10 accommodate various sizes of work. A double-pole, single-throw knife switch, of 25-ampere capacity, with fuses of this capacity, is provided in the primary circuits.