

Oct. 24, 1939.

G. FREDRICKSON

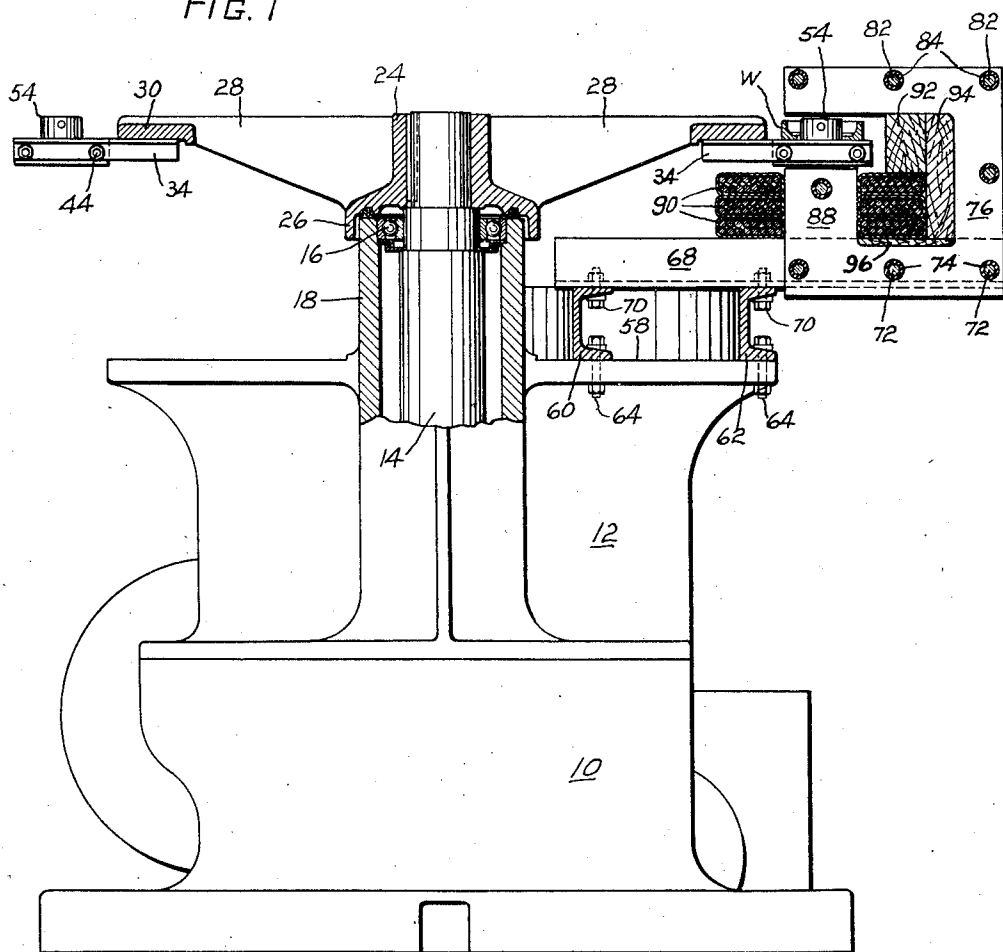
2,177,299

ELECTRIC HEATER

Filed Jan. 18, 1934

3 Sheets-Sheet 1

FIG. 1



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3 Sheets-Sheet 2

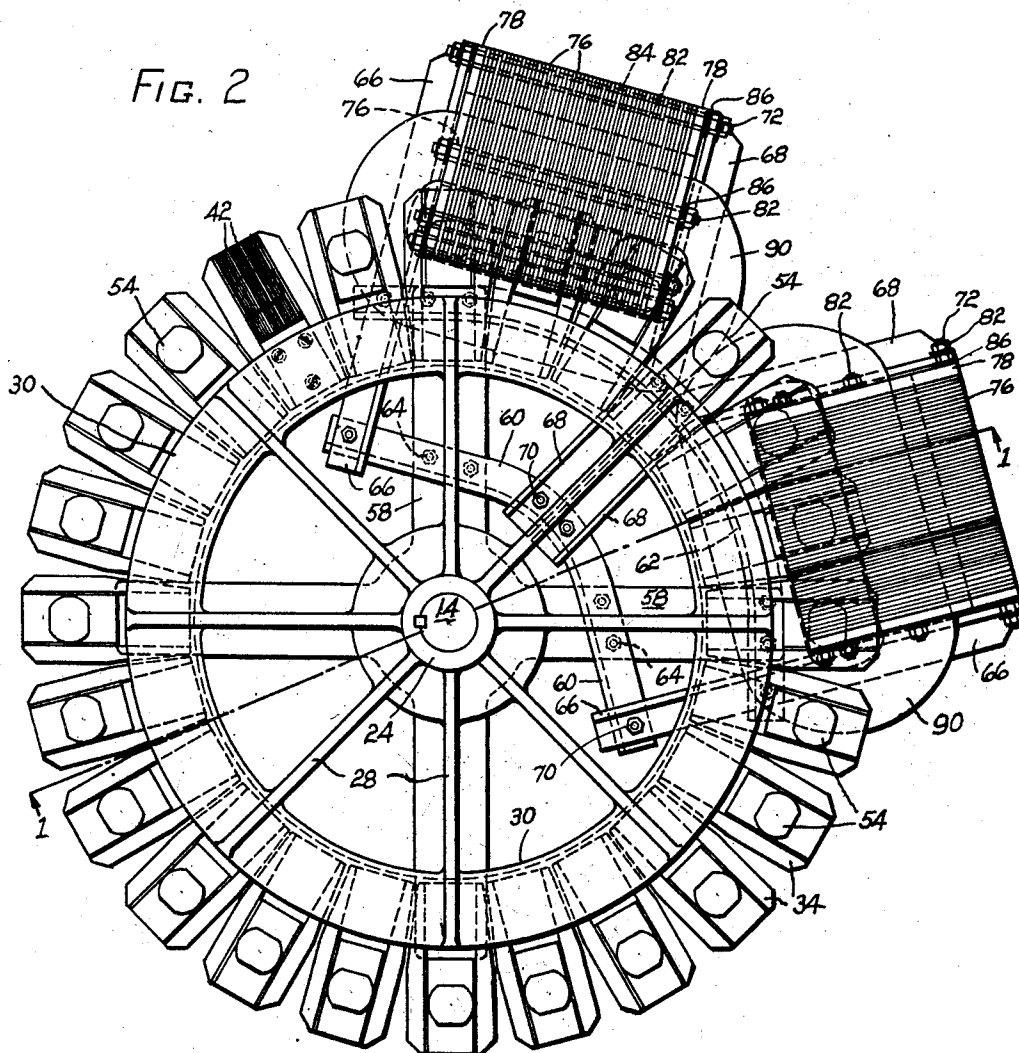
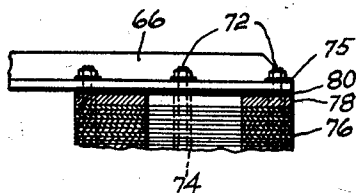


FIG. 3



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3 Sheets-Sheet 3

FIG. 4

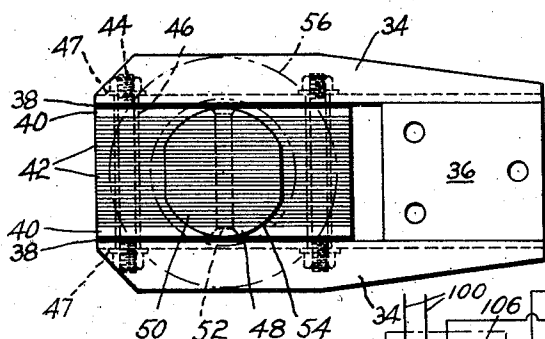


FIG. 8

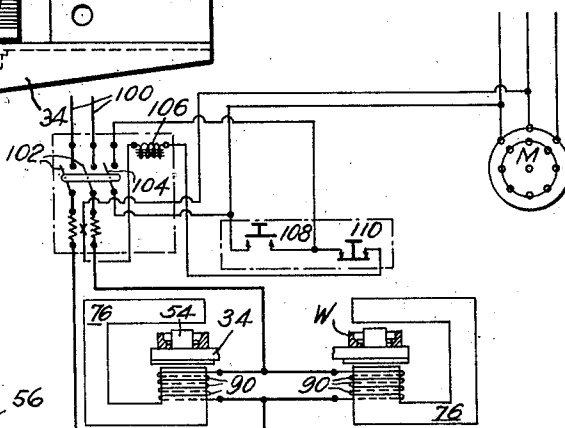


FIG. 5

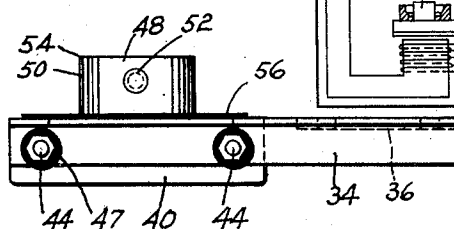


FIG. 7

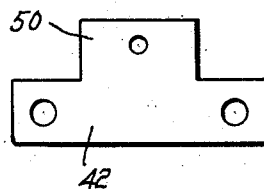
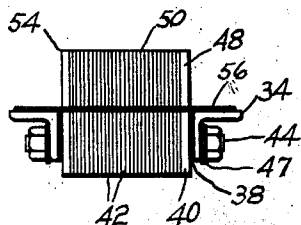


FIG. 6



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UNITED STATES PATENT OFFICE

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ELECTRIC HEATER

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a corporation of Delaware

Application January 18, 1934, Serial No. 707,126

5 Claims. (Cl. 219—13)

This invention relates to electric heaters and comprises all of the features of novelty herein disclosed. An object of the invention is to provide an improved heater adapted especially for heating rings. Another object is to provide an induction heater wherein the core and heating coils are easy to assemble. Another object is to provide a heater and work carrier combination to facilitate the rapid heating and handling of a series of articles. To these ends and also to improve generally upon devices of this character, the invention comprises the various matters hereinafter described and claimed.

In its broader aspects, the invention is not necessarily limited to the specific construction selected for illustrative purposes in the accompanying drawings in which—

Fig. 1 is a front elevation with some parts in section on the line I—I of Fig. 2.

Fig. 2 is a plan view.

Fig. 3 is a horizontal sectional view of a portion of the heater laminations and their supports.

Fig. 4 is a plan view of a work-support with an insulating washer indicated by broken lines.

Fig. 5 is a side elevation of the work-support.

Fig. 6 is an end elevation of the work-support.

Fig. 7 is a front view of one of the laminations of the work support.

Fig. 8 is a diagram of electrical connections.

The frame of the machine is conveniently made in two parts, a lower part 10 secured to an upper part 12. A vertical shaft 14 is journaled in ball bearings 16 carried by a tubular upright part 18 of the frame. The shaft is driven slowly in any desired way, as by an electric motor M and suitable speed reducing gearing (not shown). At the upper end of the shaft is keyed a hub 24 having a skirt 26 covering the bearing 16. The hub is part of a rotary table or carrier having spokes 28 and a rim 30 which has its under side faced off flat. Bolted to the rim of the carrier is a series of individual work supports, each constructed as shown in detail in Figs. 4, 5, 6 and 7 and each also forming a laminated filler or supplementary pole piece for the magnetic core of an induction heater hereinafter referred to.

Each work support is mounted on a pair of angle irons 34 welded to a perforated connecting plate 36 which is secured to the rim 30. The angle irons are insulated by strips of insulation 38 from end plates 40 which embrace laminations 42. Clamping bolts 44 pass laterally through the foregoing structure, being insulated therefrom by insulating bushings 46 and by insu-

lating washers 47 engaging the clamping nuts. The end plates 40 have upright extensions 48 embracing similar but wider extensions 50 on the laminations 42. All of the extensions are clamped together by a rivet 52 countersunk in the end extensions 48. Thus there is provided a laminated filler and work support comprising a base portion and an upright plug or core 54 which is adapted to enter the hole in a ring-shaped work-piece W. To insulate the piece from the angle irons 34, it may conveniently rest on extensions of the strips 38 or on a separate insulating washer 56 which is sleeved over the plug 54. For a work-piece which has a hole much larger than the plug 54, it is proposed to enlarge the plug by slipping a work-centering insulating ring over it, such ring internally fitting the plug and being keyed from turning by the slabbled off sides of the plug.

Across two radially projecting, horizontal faces 58 of the frame part 12 curved channel irons 60 and 62 are secured by bolts 64. Two pairs of angle irons 66 and 68 extend out beyond the carrier from the channel irons to which they are secured by bolts 70, and each pair supports an induction heater, the two heaters being alike and elongated circumferentially of the carrier. The two outermost channel irons 66 are straight and the two adjacent angle irons 68 have their inner ends bent laterally to extend directly towards the axis of the carrier as shown in Fig. 2 so that the heaters can be placed close together. Each heater is secured to the angle irons by bolts 72 as indicated in Figs. 1 and 3, each bolt being insulated by an insulating bushing 74 and insulating washers 75 from a series of laminations 76 held between thick end plates 78. Insulating plates 80 are interposed between the angle irons and the end plates 78. Above the angle irons, bolts 82, similar to bolts 72 but shorter, clamp the upper portions of the laminations together. The bolts have insulating bushings 84 similar to the bushings 74 with insulating washers 86 interposed between the end plates 78 and the clamping nuts. The laminations are generally U-shaped with an additional pole piece or extension 88 which is surrounded by a series of coils 90. The laminated core and the coils are elongated circumferentially of the carrier and are longer than the work-supporting filler which requires an interval of time to traverse the gap as the carrier slowly rotates. The coils are laid one on the other in series and insulated from one another by suitable casings. In each casing, two insulated wires are preferably grouped in parallel. By making

the coils in units that are thinner than the vertical extent of the gap, the laminations can be first assembled and bolted together, and the coils afterwards individually slipped over the pole

5 piece or extension 88 where they are clamped by suitable wooden blocks 92 and 94 and a wedge 96.

The wires in all of the casings are spirally coiled in the same direction and, for convenience of connecting them and to avoid cross connections, the lead-in wires may enter anywhere at

10 the outside of the first coil, come out at the inside of that coil at the exposed end of the core 88 and there enter the inside of the next coil. The wires go from the outside of that next coil

15 to the outside of the third coil and finally come from the inside of the third coil at the other exposed end of the core 88. The other heater is conveniently wired in the same way.

As shown in the diagram, the coils 90 are

20 adapted to be connected to a heating circuit having line wires 100 by a magnetic switch having blades 102. Another blade 104 of the switch is operated by a magnet coil 106. The motor for slowly driving the table is indicated at M and its

25 leads are wired to the magnet coil through a switch control circuit having push button switches 108 and 110, one to start the heating and one to stop it. The stopping switch 110 is normally held closed so that upon the temporary closing of the

30 starting switch 108, a circuit is completed through the coil 106 to close the switch blades 102 and 104. Thus the blade 104 will keep closed the magnetic switch and the heating circuit when the starting switch 108 is released and opens. If for any reason

35 the motor is shut off, the magnet coil 106 is de-energized, and the magnetic switch opens as usual, by spring pressure. Thus the heating circuit will not stay on and overheat the work when the motor and the rotary carrier stop. Nor can the heating

40 circuit be put on until the rotary carrier is in motion. The heating circuit may be a 110 volt, 60 cycle circuit and the motor circuit, which also serves as heater control service, may be a 440 volt, 60 cycle, 3 phase circuit.

45 In operation, the table is slowly rotated by the motor while the operator slips ring-like work-pieces over the plugs or cores 54 of the laminated work support and filler. The work is carried successively through the gaps of the two induction

50 heaters which heat the piece to the desired temperature. For ball bearing cups this temperature would usually be from 250° to 325° F. The laminated work support and its core or plug 54 fit the gap in the laminated core of the heater and, while

55 moving through the gap at right angles to the path of magnetic flux, have a close running clearance with the heater laminations. This filler structure supports the work and, being itself supported on the rotary carrier, cannot be drawn

60 magnetically into contact with the heater laminations. Thus there is no frictional rubbing or wear

on the heater. Since each piece passes gradually out of the second heater with the revolution of the table, it is thereby demagnetized as well as heated and can be picked off the stud with any suitable instrument and replaced by a new piece. In the 5 illustrated construction, the work is in the heating zone for about a quarter of a table revolution, or say about twelve seconds, but the heaters are elongated so that several work pieces are being heated at once. By omitting the plug 54, solid pieces may 10 be heated. Articles of non-magnetic material can be heated also.

I claim:

1. In a device of the character described, a core having a gap formed between opposing walls, 15 means for creating an alternating magnetic field in the core, and a filler fitting between the opposed walls but out of contact therewith, said filler comprising a work supporting base portion for supporting a ring-shaped work-piece and a plug 20 of smaller size projecting from the base portion into the work-piece; substantially as described.

2. In a device of the character described, a laminated core having a gap, a coil associated with the core, a movable carrier, and a plurality of lami- 25 nated work-supports mounted on the carrier, each being adapted to substantially fill the gap and movable successively and bodily through the gap without contact with the core; substantially as described. 30

3. In a device of the character described, a laminated core interrupted to form a gap, a coil associated with the core, a laminated work-supporting filler for the gap, a rotary carrier outside of the gap and supporting the filler in projecting rela- 35 tion, and means for turning the carrier to traverse the filler bodily through the gap without contact with the core; substantially as described.

4. In a device of the character described, a laminated core interrupted to form a gap, a coil associated with the core, a rotary carrier, the core and gap being elongated circumferentially of the carrier, and a work support projecting from the carrier into the gap and movable bodily through the gap upon the rotation of the carrier; substan- 45 tially as described.

5. In a device of the character described, a core having a gap formed between opposing walls, means for creating an alternating magnetic field in the core, a work-carrying filler in the gap and 50 comprising a work-supporting base portion to support a ring-shaped work-piece and a plug of smaller size projecting from the base portion into the work-piece, the work-piece and the filler being insertable as a unit into the gap with the base 55 portion lying close to one of said opposing walls without contact therewith and the plug projecting from the base portion into close proximity to the other wall of the gap; substantially as described. 60

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