

Jan. 24, 1950

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2,495,513

ELECTRIC (INFRARED) HEATING APPLIANCE

Filed Feb. 15, 1945

2 Sheets-Sheet 1

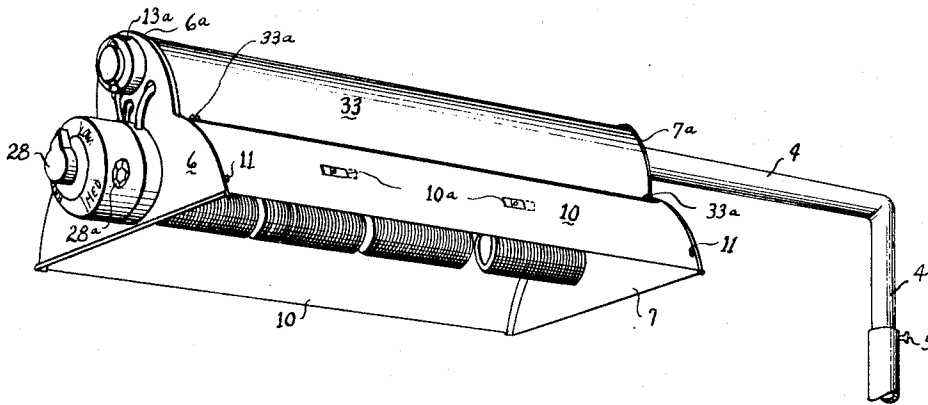


Fig. 1

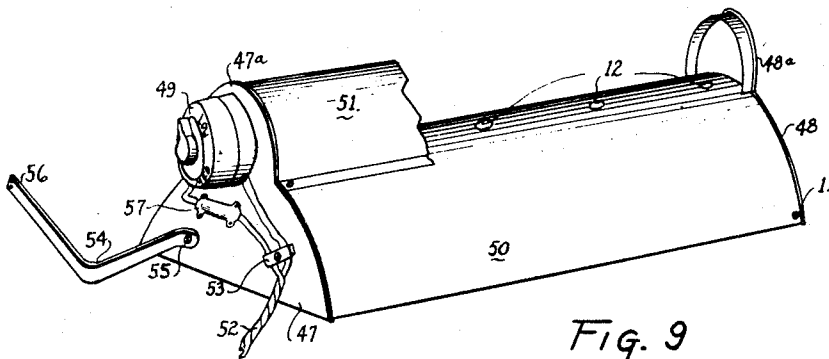
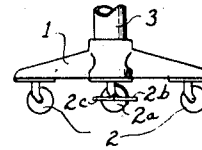


Fig. 9

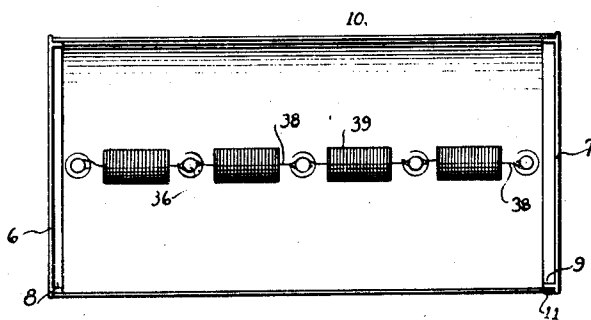


Fig. 3

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2 Sheets-Sheet 2

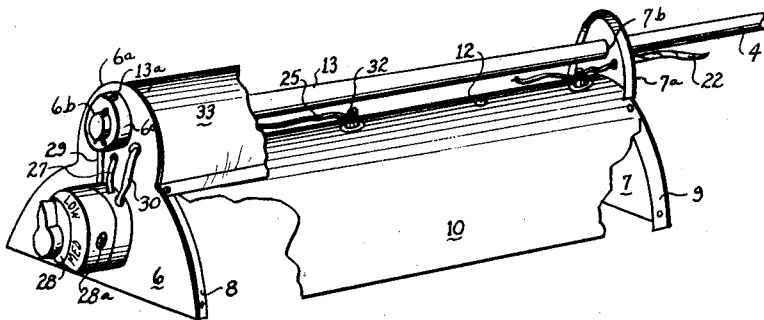


FIG. 2

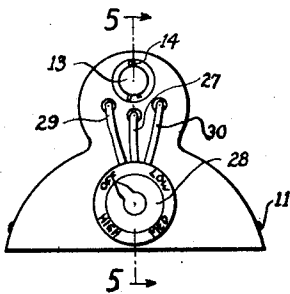


Fig. 4

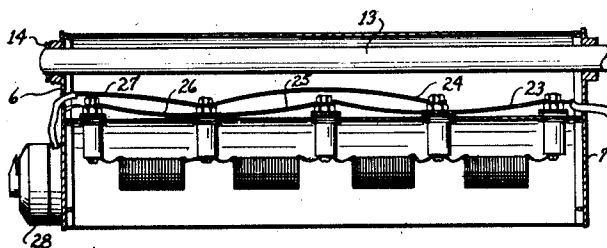


Fig. 5

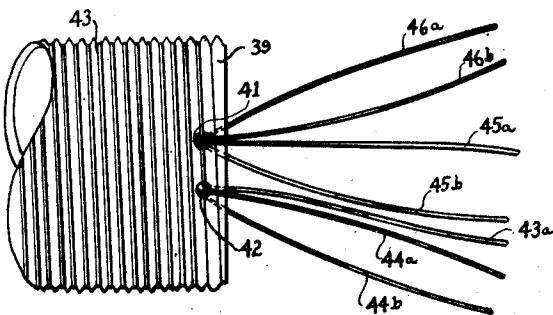


FIG. 7

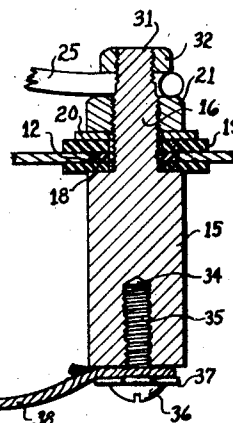


FIG. 6

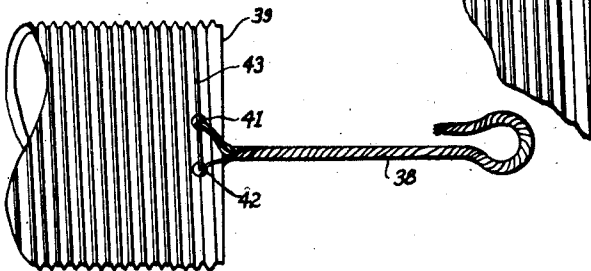


FIG. 8

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ELECTRIC (INFRARED) HEATING APPLIANCE

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Application February 15, 1945, Serial No. 578,102

4 Claims. (201—63)

1

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My invention pertains to an electric (infrared) heating appliance and more particularly to the adjustable support of, selectable control of, functioning of and improving assembly of essential parts of a glowing type of resistance unit or units for drying as well as heating for miscellaneous industrial application and for domestic uses.

During the past few years I discovered and developed, for post-war production, certain improving adaptations of patented and marketed inventions of my father, James E. Doyle, which were primarily applicable to his printing-press-accessory business. My modifications in design and of construction have contemplated an extended field of application of a conditioning performance by utilization of a heating and/or drying effect to which a wide range of material, other than printing paper, are to be exposed. Originally, our processing, by the application of an open-glow or infrared-ray heat, became a universally accepted requirement for the printing industry. The general objects of my inventions have been to increase efficiency with an appliance (preparatory to demonstration of it as an accepted production help in many other industries) suitable, with no or negligible change, for use in differing arts and which will be more durable.

Specific objects have been:

- 1. Provision of a reflector-structure possessing advantages of efficiency, sturdiness, mounting and facility of assemblage.
- 2. Plural adjustability of the reflector and resistance-unit assembly.
- 3. Gang arrangement of resistance units (coils) together with a control whereby varying combinations thereof may be energized.
- 4. Lengthening the life of each coil, both by a binding of wound ends to the core or spool and by reinforcing its terminals to lessen electrical resistance therein and to strengthen the terminals as coil-suspension connectors.
- 5. Accomplishment of the object set forth in the preceding paragraph by the employment of extra wire lengths, interlooped with near extremities of the wound wire and with both ends of such extra wire lengths intertwined with the wound-wire ends.
- 6. Composite studs intersecting the reflector housing of selected curvature, insulated thereagainst and with added insulation arranged to insure against radial displacement.
- 7. Association in such electrical-terminal studs of brass and steel, for example, as an alloy and iron-compound combination which will not cause

a corrosive adherence when subjected to electrical heat.

8. Dual-function flanging in the reflector assembly.

9. Interpositioning between a control switch and the studs of a dielectric post which is connected operatively with the switch by wiring adapted to enter the latter and also connected, in lieu of wiring, by bars suitable for high voltage and leading to the studs.

10. A support, as exemplified, comprising two angularly related, telescopic connections and alternatively resting on a roller carriage or with gravitational friction upon a floor while carrying, for turnable adjustment thereon, my heating appliance.

11. Heating unit of infrared glow zone, not enclosed like an oven, to achieve an oxidizing depth of heat penetration without hazard of charring or burning.

In considering the drawings together with the following specification, it is to be realized that the scope of my inventions comprehends many equivalent constructions and that the graphical showing and the particular description are merely specific exemplifications of a plurality of feasible mechanical embodiments and arrangements within the scope of the granted claims.

Figure 1 is a perspective view of an appliance embodying my inventions and comprising a triply adjustable form in combination with a portable standard.

Figure 2 is a perspective view, from above, with certain parts of the heating unit omitted and one part partially cut away.

Figure 3 is a bottom plan view of the open side of a reflector showing a gang arrangement therein of electrical resistance elements.

Figure 4 is an elevation of the left end of Figure 1.

Figure 5 is a vertical, longitudinal section through the pair of end walls and connecting reflector and surmounted hood to reveal enclosed parts in elevation.

Figure 6 is a greatly enlarged detail, partly in section, of a terminal assembly.

Figure 7 is a correspondingly enlarged view of a portion of one end of one of the wire-wound cores or spools with extra locking and reinforcing wires in place preparatory to intertwisting with an end of the wound resistance wiring.

Figure 8 is a view similar to Figure 7 after the connector wires have been intertwined, looped to form an eye for enveloping a terminal stud (as appears in Figure 6) and optionally soldered.

Figure 9 is a view generally similar to Figure 2, of a modification adapted for bracket-attachment to a machine carrying material to be heated instead of being adjustably supported by a portable standard.

For convertible adaptation to employment with differing kinds of machines so that there may be adjustably accomplished the most effective positioning of the source of infrared heat with respect thereto, the complete combination shown in Figure 1 is advantageously employed.

A carriage 1 is mounted on quadrantly spaced casters, one diametrically-opposite pair 2 being of the ordinary type whereas the other pair 2a are of the wheel-brake type comprising one lever 2b for setting the brake and a diametrically opposite lever 2c for effecting the brake release action. No claim is made for any wheel-brake caster by itself, wherefore further description is unnecessary. Having rolled the carriage approximately to a position on the floor permitting other adjustments (next described) to locate the source of heat where desired, with consideration of the kind of material (printing paper, textiles, wall or wrapping paper) to be exposed and/or its rate of travel, the two brake levers 2b may be "set," frictionally to insure against displacement along the floor. Extending upwardly from the carriage 1 is a tube 3 with which a duly smaller diametered tube 4 is in telescopic connection to provide a vertical adjustment. A set-screw 5 serves to fix the tube 3 and 4 in any chosen position. As shown, the tube 4 is L-shaped to comprise a horizontally extending arm.

A housing comprises end walls 6 and 7 including upper, smaller and likewise arcuate-edge-defined portions 6a and 7a respectively. Opposed sides of the walls 6 and 7 are provided with correspondingly arcuate flanges 8 and 9 respectively which serve not only as stiffening ribs, but as ledges to support the arcuate end edges of a concavo-convex reflector 10 which may be provided with a "pilot light" window or windows 10a, as clearly shown in Figure 3. Screws 11 serve to secure the reflector to the flanges 8 and 9. As exemplified, the median, longitudinal section line of the reflector is provided with five equispaced holes 12. The portions 6a and 7a are provided with holes 6b and 7b in which is journaled a tube 13 which is in telescopic connection with the horizontal arm of the tube 4 and which has its outer end intersected by a cottor pin 14 to prevent its withdrawal through the hole 6b. The connection just described permits of two additional adjustments of the heating unit; a horizontally slidable adjustment of the tube 13 and a swingable or turnable adjustment about the tube 13. A set-screw 13a passing through a lug 6c to engage the tube 13 fixes the heater in any desired tilted position.

As illustrated, an aligned gang of four electrical resistance units are to be suspension-carried within the metallic reflector 10 and, for effecting a reflector-insulated connection therebetween, five terminal posts of peculiarly-composite construction are shown in Figure 5. Because duplicates, the singular number will be employed in describing their assembled elements which most clearly appear in Figure 6. A stud 15 has a diametrically reduced and threaded intermediate section 16 inserted upwardly through its hole 12 in the reflector, the hole 12 being considerably larger in diameter than the section 16. Interposed between the stud's shoulder and the lower surface of the reflector is a dielectric (mica) washer 17 and

snugly fitted between the section 16 and the annular margin of the hole 12 is a dielectric (mica) washer 18 of substantially the same thickness as the thickness of the reflector at its hole margin. The dual purpose of the washer 18 is insulation of the section 16 from the reflector while holding the stud against radial displacement after a clamping action has been effected together with an upper dielectric (mica) washer 19, a superimposed metal washer 20 and a nut 21. It is to be understood that my infrared heating units are sometimes employed in an inverted position or with the concave side of the reflector facing upwardly instead of downwardly. Connection with a source of electric current is had through a cord 22 (see Fig. 2) which entering through the wall 7 becomes attached to the nearest post, other connecting wires 23, 24, 25, 26 and 27 progressively leading to the other four posts and to a three-heat switch 28 carrying a pilot lamp 28a and appropriately carried by the outer side of the wall 6 and additional wires 29 and 30 (also passed through suitably located holes in the walls 6) connecting the switch with a pair of the posts in a manner dependent upon which grouping of simultaneous or stage energization of resistance units, carried one between each pair of adjacent ones of the posts, has been selectively determined.

When applied to printing presses on which paper stock of varying width is conveyed, the switch control is perhaps preferably such that three grades of heat, "low," "high" and "medium" may be delivered by the two end pairs. More often is it preferred to effect the "medium" or even the "low" stage of heat by energization to an infrared glow, but by restriction of any energization to a number of resistance units less than the total number in the gang arrangement which is, of course, not necessarily along a straight line as exemplified in the drawings and as is more commonly adopted. Since no claim is confined to any of the specific wiring diagrams which are feasible within the experience of any electrician and which are applicable to the switch and multi-post connection on the convex side of the reflector, the description of that part of my appliance may approvably be terminated by adding that one of the wires, say the middle-post-connected one 25 loops around a further reduced threaded section 31 of the stud to be clamped against the nut 21 by a smaller nut 32.

A hood 33, conforming to the arcuate edging of the wall portions 6a and 7a, has longitudinal edge flanging resting on, and secured by screws 33a to, the reflector 10, the screws passing through the latter and into tapped holes in the flanging 8 and 9.

The lower end of each steel stud 15 has a tapped hole 34 for occupancy by a brass screw 35 having a head 36 adapted to engage a copper washer 37 whereby to bind the looped end of one of the connectors for one of the resistance-wiring units to be next described. The resistance-wiring connectors 38 are of a peculiarly suited, composite construction, between pairs of which as suspension means each resistance unit in its entirety is hung from an adjacent pair of reflector-carried posts, as shown in Figure 3.

Each resistance unit being like the others, only one need be described and consequently the singular number will be again employed. A cylindrical core or spool 39 is exteriorly or peripherally fashioned with a helical groove 40 sharply V-shaped in cross section and near each of its

ends the core is provided with a pair of radially directed perforations 41 and 42. The pairs of perforations are about equispaced from a diametrical plane of the core and on the same side of the latter. A thin resistance wire, of established alloy-merit for efficient and protracted exercise of its function, is wound in the groove 40 and each of its ends 43a passes over the perforation 41, first reached, and is then inserted inwardly through the other perforation 42 preparatory to being held temporarily taut and the wire 43 tight throughout the extent of the groove 40, by any means convenient to the individual manufacturer. A separate length of wire, having half-ends 44a and 44b of about the same length as the end 43a, is looped through the same hole 42 and temporarily so left. A similar, separate length of wire having halves 45a and 45b of substantially the same length as the ends 43a, 44a and 44b is then not only inserted through the perforation 41, but looped about that part of the wire 43 which straddles the perforation 41 whereby to effect an interlocking and prevent the wound wire 43, if expanding when heated, from slipping out of its groove, when an ultimate tightening has finally been accomplished. A third, separate length of wire, having halves 46a and 46b of about the same length as the five other ends, is then looped through the perforation 41. Then all seven wire ends at both ends of the core are intertwined so as collectively to achieve the composite connector 38, the terminal loop of which may not inexpediently be soldered, and so as tightly to draw the end 43a through the hole 42 while securely locking the three loops of the other separate, reinforcing wires and resisting any tendency of the wire 43, especially its wound end section to loosen in or to escape from its convolution of the groove 40.

The modification of Figure 9 is a somewhat simpler form suited to employment by attachment to any machine of longer continuity of operation and/or where the application of an open-glow, infrared heating zone location is foreknown to be spatially uniform. End frames 47 and 48 include the smaller upper sections 47a and 48a. In the absence of any journal bearing, the outer side of the frame 47 carries the switch 49. The reflector 50 is similarly secured as is also the superimposed hood 51 for concealing the lead wiring. A cable 52 connects with the switch 49 and may pass through a dielectric guide or clamp 53 on the frame 47 to relieve the switch-interior connections of any undue strain. A bracket 54, of variable shape depending upon accessibility of a place of attachment of either of its two ends, is shown to have one end 55 secured to the frame 47. Its other end 56 is intended to be secured to any conveniently located part of the machine on which this design of my appliance is to be mounted.

Consequent to the penetrating property of infrared heat as delivered by my resistance units, it is preferable to have any energized coil glowing at full or maximum temperature, any resultant high, low or medium heat zone being accomplished by selectively varying the number of coils which are energized subject to the chosen wiring diagram and the switch control.

The reinforcement of the suspension ends at both ends of each porcelain spool 39 provides a yielding, shock-proof means for hanging the spools from pairs of studs 15 and realize the added advantage of reducing the electrical resistance and therefore the heat in each com-

posite connector 38 and the dissipation of heat by conduction to the studs 15. Moreover, the selection of brass as the material for the screws 35 in the steel studs and of copper as the material for the washers 37 has been discovered to prevent corrosion therebetween which greatly inconveniences when coil replacement is required.

While a gang of four alined resistance-coil units are illustrated, large printing presses of the web or unwinding and rewinding-roll type would require a multiple of that number of unit coils. Besides its ornamenting dome function, the hood 33 supplies a stiffening function to the reflector and has the second utilitarian function of lessening heat loss in a direction from the concave toward the convex side of the reflector. On high-voltage installations, it is desirable at times to use bus bars (heavy copper or conducting-alloy) as connectors between those ends of the studs 15 which are within the confines of the hood 33. However, because such bars are not directly connectable with standard switches, in those instances we interpose a heat-resisting, dielectric block (lava, for example) with which both the bars and the flexible wiring from the switch are connected. In other cases it has been found desirable to insert a heat-resistant (asbestos) between the switch and that end wall to which it is attached. The means for fixing the heating unit in any chosen position of swinging adjustment about the tube 13 as an axis, may, instead of the set screw 13a, consist of projecting stops on the end wall for alternate engagement, for instance, with an edge of the bracket 54. Such a substitute manner of fixing that swinging movement, not at the telescopic connection 3-4, not being claimed, requires no further mention. The helical grooving in the cores to the cross-sectional form of a sharp V instead of to U-form provides an air space at the bottom thereof through which an air circulation eventuates, measurably to promote dissemination of heat and to prolong the life of the resistance wiring.

For accomplishing an automatic "throw off" or deenergization of the heater, a mercury switch 57 of any approved design may be connected in one of the lines of the switch 28, as appears in Figure 9, and be adapted to functionate on the known principle of permitting current flow through the mercury until a bodily displacement (here a manual swinging of the suspended heater in its entirety) so shifts the level of the mercury as to disrupt the electrical connection through that fluid metal.

To particularize or more specifically to describe the simultaneous energization of all of the row of resistance units or selectively differing groups thereof, it is added that whether the wiring diagram is for 110 volts, A. C. or 220 volts, A. C. or D. C., the lead wires to the switch 28 from suitable combinations of the ends of the studs 15 which are on the convex side of the reflector 10 effect a "hook-up" whereby when the switch is set at "Low" the pair of wire-wound spools at one end are energized, when the switch is set at "Med." only the other end pair of resistance units becomes energized and when the switch is turned to "High" all four of the resistance units are simultaneously energized. As will be readily perceivable to any skilled electrician, differing pairs of the infrared glowing coils may be energized by the "Low" and "Medium" stages of the switch; or only a single coil become energized when the switch is set at "Low" and either a pair of other coils or a single additional coil

become energized when the switch is turned to "Medium."

I claim:

1. In an electric-heating appliance, a helically grooved cylindrical core provided with a pair of radially directed holes at one end, a resistance wire wound in said groove and passed through one of said holes, a separate length of wire looped through the same one of said holes and having its ends twisted together with a free end of said wound resistance wire and another wire looped through the other one of said core holes and having its two ends also twisted together with the three first mentioned twisted ends.

2. In an electric heating appliance, a support having a pair of terminals, an externally-grooved insulating core provided with a pair of radially directed holes at each of its ends, a resistance wire occupying said core groove and having its two ends passed through two of said holes at opposite ends respectively of said core, separate lengths of wire looped one through each of the same pair of holes and each having its ends twisted together with one of the free ends of said resistance wire whereby to provide reinforced terminal connectors and means for attaching said connectors to said terminals.

3. In an electric heating appliance, a hollow, externally grooved insulating core provided at each end with a pair of closely adjacent holes, a resistance wire occupying said groove and having one of its two ends passed through one of the holes at one end of said core and having its other end passed through one of the holes at the opposite end of said core, a separate length of wire passed through the same hole at each end of the core respectively, a plurality of separate binding wires, each looped about an end section of said resistance wire at both ends of said

core respectively, both ends of the looping wires at each end of the core being passed through the other of the there located core holes, the two ends of each of the looping wires at both ends of the core being twisted together with the two ends of the separate wire and with an end of the resistance wire whereby to provide a seven-strand connector at each end of the core.

4. In an electric-heating unit, a carrier, a resistance wire wound on said carrier, the latter being provided with adjacent holes, said wire passing across one of said holes and through the other one thereof, a separate length of wire passed through that one of said holes which the wound wire crosses and being also looped around the latter there, another separate length of wire passed through the other one of said holes, the ends of all of said wires being twisted together whereby to prevent displacement of the wound wire and also to reinforce the combined terminal.

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