

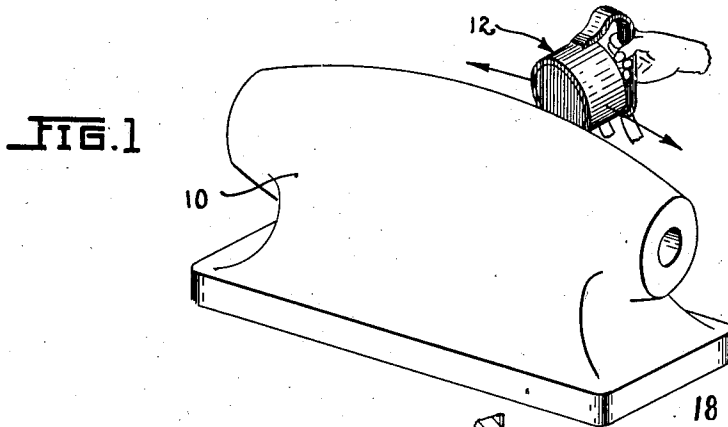
Dec. 23, 1941.

H. A. TOULMIN, JR

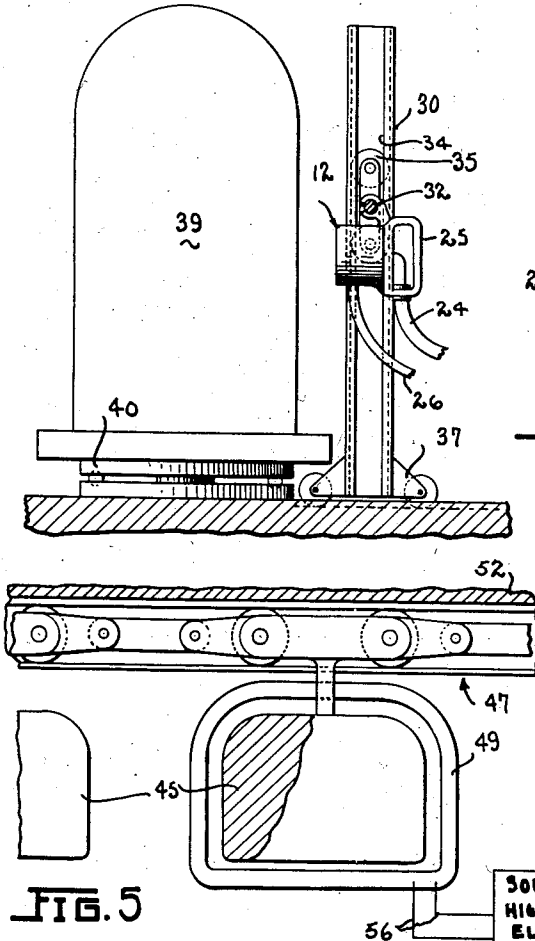
2,267,001

METHOD AND APPARATUS FOR DRYING PAINT

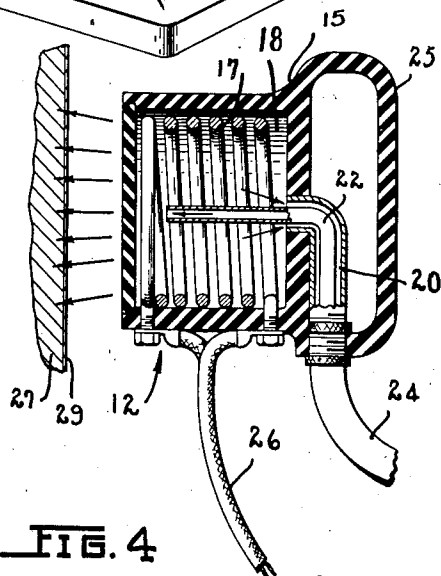
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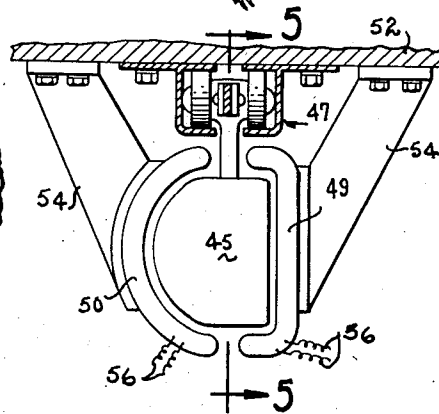
**FIG. 2**



**FIG. 3**



**FIG. 4**



SOURCE OF  
HIGH FREQUENCY  
ELECTRICAL  
ENERGY

INVENTOR  
HARRY A. TOULMIN JR.  
BY *[Signature]*  
ATTORNEYS

## UNITED STATES PATENT OFFICE

2,267,001

METHOD AND APPARATUS FOR DRYING  
PAINT

Harry A. Toulmin, Jr., Dayton, Ohio, assignor to  
The Commonwealth Engineering Company,  
Dayton, Ohio, a corporation of Ohio

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4 Claims. (Cl. 219—47)

My invention relates to a method of drying films, and more particularly to a novel apparatus and method of baking or drying enamel, lacquer and similar coatings in the finishing of articles.

It is a principal object of this invention to devise a method of induction heating of metal surfaces so as to rapidly dry a coating film applied thereover.

Another object of this invention is to provide a novel induction heating device which is applicable as a hand tool for applying to a painted surface so as to heat the base metal on which the coating has been applied to effect the drying of the coating.

Another object is to heat electrically conducting articles, such as castings, pressed steel, aluminum and like metal articles which have been coated with a liquid coating composition, by electrical induction from a high frequency current in order to bake or dry the coating.

Another object is to provide a portable induction heating apparatus which can be moved over the surface of an article to heat the metal base by induced electrical current with or without moving the article being treated.

Another object is to provide an apparatus and method for continuously finishing articles which have been coated and whereby the article is heated by electrical induction from a high frequency alternating electric current so as to bring about drying of the film to produce a finished article.

These and other objects and advantages will appear from the following description taken in connection with the drawing, wherein

Figure 1 is a perspective view illustrating the use of my induction heating apparatus for heating a freshly painted article, such as the tailstock of a lathe machine;

Figure 2 is an elevational view of a modified apparatus used as a supplement to my hand operated induction heating device as employed for drying large machine elements or frame parts wherein it is desired to utilize means for supporting the induction coil heating device a predetermined distance from the work;

Figure 3 is an enlarged vertical sectional view taken through my novel induction heating device and illustrating its application to a coated metal surface;

Figure 4 is an elevational view, partly in section, of a modified apparatus for continuous induction heat treating of the articles being fin-

ished which are suitably conveyed along on an endless conveyor;

Figure 5 is a view taken substantially on the line 5—5 of Figure 4 and looking in the direction of the arrows.

In general, it has been the practice heretofore to accelerate the drying of paint and lacquer coatings as applied to articles by placing the same in an oven or the like means whereby the coating can be subjected to heat treatment. This method necessitates the provision of various sized ovens and heat exchanging means in order to handle coated articles which are to be dried or upon which the finish is to be baked. My invention eliminates the need for this equipment and expensive apparatus and provides a novel means and method for drying the coating applied on an article by merely placing a device comprising a primary induction coil carrying high frequency current in close proximity to the coated metal surface whereby to induce sufficient amount of electric current to flow through the metal adjacent the coating to heat the metal drying the coating.

My invention is particularly useful in finishing large pieces of machinery, such as castings, machine frames and irregular shaped articles which require a very large capacity oven and are otherwise difficult to heat so as to dry or bake the coating to produce a finished product.

In one embodiment of my invention a manually manipulated induction heating device is provided comprising a primary coil which is fluid cooled and is arranged to be moved over the surface of the article to be heat treated. I prefer that the heating is effected through the use of high frequency alternating currents, as the heating is much more effective when high frequency currents are used. The heating effect will be better in a magnetizable article than in one which is merely conductive, but my method and apparatus are applicable for heating both types of articles.

Referring to the drawing in detail, in Figure 1 there is illustrated a tailstock casting piece 10, the surface of which is locally heated by moving the induction coil in the heating device, generally designated 12, back and forth in close proximity to the surface of the article, as indicated by the arrows. The primary induction heating coil device 12 is manually grasped and moved over the surface of the article similarly as in spraying the casting with a coating composition, the heating being effected by the induced eddy currents, and with an iron base both hysteresis and eddy

currents will be set up within the metal when high frequency electric current is flowing through the primary coil of the device 12.

The detailed construction of my manual induction tool device is illustrated in Figure 3 wherein an integral casing 15 encloses the primary coil 17 in the chamber 18 which is arranged to be cooled by the circulation of water or other cooling fluid through the conduit 20 into the chamber 18 in contact with the coil and outward through the concentric passageway 22 in the conduit member 24. The casing 15 is preferably made of electrical and heat insulating material and the handle 25 for grasping the induction device may be made integral with the casing, as illustrated in Figure 3. Electric current is supplied to the coil 17 by means of the electrical conduit means 26. As shown, the metal surface portion 27 of the article having the coating 29 is dried by the induced electrical current set up in the metal portion 27 when the induction coil device is held in close proximity to the coated surface, as illustrated in Figure 3.

Where the magnetism of the article is sufficient to make it impractical to manually hold the primary coil heating device 12 a proper distance from the work, a supplemental supporting frame means 30 may be provided for holding the induction coil device 12 a proper distance from the surface of the work to be heat treated. This supplemental supporting member 30 may comprise a rectangular frame having a cross bar 32 mounted for vertical reciprocation in the side channel members 34 by means of the rollers 35. The induction heating coil device 12 is slidably supported on the transverse rod 32 and is arranged whereby the operator can grasp the handle 25 and move the induction heating coil device 12 vertically and laterally, as required, to heat the surface of the article and effect drying of the coating. Preferably the supporting frame means 30 is mounted on a portable base means 37 so that the device can be moved from one article to another and suitably positioned adjacent the work.

The use of high frequency current, on the order of 10,000 to 50,000 cycles, is contemplated. Passage of high frequency current of low voltage and high amperage through the induction coil while the device is held close to but not actually touching the surface of the coated article induces a current in the surface of the metal which rapidly bakes the coating applied over the surface.

As illustrated in Figure 2, the article being treated, such as shown at 38, is mounted on a rotatable base 40. In this way, the application of the drying device to the surface of the coated article at a predetermined distance is readily effected.

In the arrangement shown in Figures 4 and 5 provision is made whereby the articles being finished can be supported on an endless conveyor and moved between inductors shaped to conform generally with the article being finished. This construction is adapted for production drying of coated articles. As illustrated, the article 45 is suitably supported on an overhead trackway means, generally designated 47, and the primary induction coil members 49 and 50 are positioned around the article so as to conform generally with its surface contour. The primary induction coil members are supported on the overhead structural member 52 by bracket means 54, and are connected to a source of high frequency

electric current by the wires 56. When current is supplied to the primary coils the metal surface of the coated article is heated by the induced eddy currents to bring about drying of the film. The movement of the coated articles between the induction coils 49 and 50 is preferably intermittent but with the use of multiple coils the processing of the articles may be continuous.

Where the coated article to be dried comprises a nonmetallic base, the induction heat drying may be effected by mounting or encasing the article within an electrically conducting material in which the induced electric current can be made to indirectly heat the coating and effect drying of the same to a hard tough film.

Further, as a modification of the fluid cooled primary coil means 17, there may be employed coils of pipe so as to form a water cooling system. The pipe, in this instance, forms the primary coil through which cooling water is flowed to maintain the coil at the proper temperature. In order to prevent leakage of current it is only necessary to insert a section of insulating pipe in the discharge line, since the conductivity of ordinary water to high frequency current is low enough to be substantially negligible. Variations in the shape of the device may be made in order that the maximum effect of the induced current for heating the article can be set up and the desired uniformity of heating secured.

Moreover, I do not limit my invention to the use of single-phase electric current, but where desired multiphase high frequency current obtained from any multiphase source may be utilized. Likewise, one or more coils may be used in place of one primary coil. It will be observed that my method and mechanism are capable of use generally to heat a localized surface of an article and that either the article may be moved or the primary induction coil device or both. Further, the induction heating of coated articles may be applied to special forms or objects by shaping the coils to conform to the contour of the article, as required, to subject the same to high frequency induced electric current.

It will be also understood that my apparatus and the application of my process may be greatly varied without departing from the spirit and scope of my invention and that such modifications will be readily understood by those skilled in the art and may be made to adapt this invention to various conditions and uses.

Having thus fully described my invention, what I claim as new and desire to secure by Letters Patent is:

1. A method of baking industrial finishes on electrical conducting surfaces of irregular contour including the steps of (a) focusing a source of inductive heat from a high frequency current on a limited area of the object to be treated, (b) adjusting the distance of heat source from the object, and (c) regulating the time of application of the heat to the area under baking treatment and the rate of movement of baking heat on the object, and (d) the relative angular position of the induction coil of the source of heat to the object, in accordance with the thickness of the industrial finish on the object.

2. A method of baking industrial finishes on electrical conducting surfaces of irregular contour including the steps of (a) focusing a source of inductive heat from a high frequency current on a limited area of the object to be treated, (b) adjusting the distance of heat source from the object, (c) regulating the time of application of

the heat to the area under baking treatment and the rate of movement of baking heat on the object, and (d) the relative angular position of the induction coil of the source of heat to the object, in accordance with the thickness of the industrial finish on the object, and (e) simultaneously cooling said source of heat.

3. As an article of manufacture, in combination a manually movable induction heating device for heat treating articles, and means comprising a portable supporting member including a vertical stand having a track for holding said device a predetermined distance from the article to be heated, said device having means engaging said track for vertical movement thereon, and handle means on said induction heating device whereby said heating device and stand may be moved around articles of different shapes and sizes, and whereby said heating device may be

moved on said track, or held in adjusted position thereon.

4. As an article of manufacture, a heating device for drying coated metal articles comprising a casing, an induction coil mounted in said casing, and means for conducting high frequency current of low voltage and high amperage through said induction coil, said device having a handle and means for movably mounting said device on a portable stand whereby said casing and its coil may be moved around irregularly shaped objects, and is adapted to be positioned in close proximity to said coated metal objects without touching the surface whereby an electric current is induced in the surface of the metal which rapidly dries the coating film thereon.

HARRY A. TOULMIN, JR