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J. LEDWINKA ET AL

METHOD OF AND MEANS FOR HEATING DISKS OR PLATES ELECTRICALLY

Filed Feb. 2, 1922 2 Sheets-Sheet 1

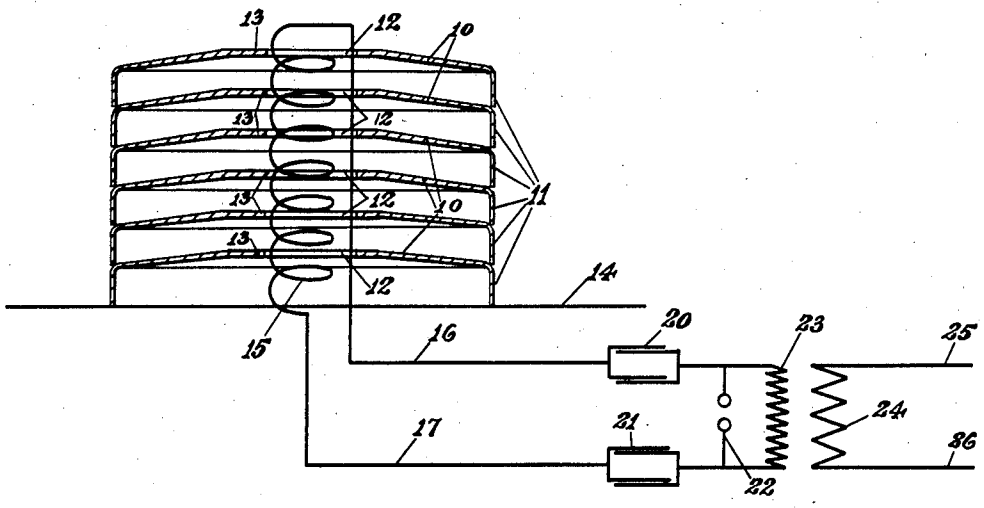


Fig 2

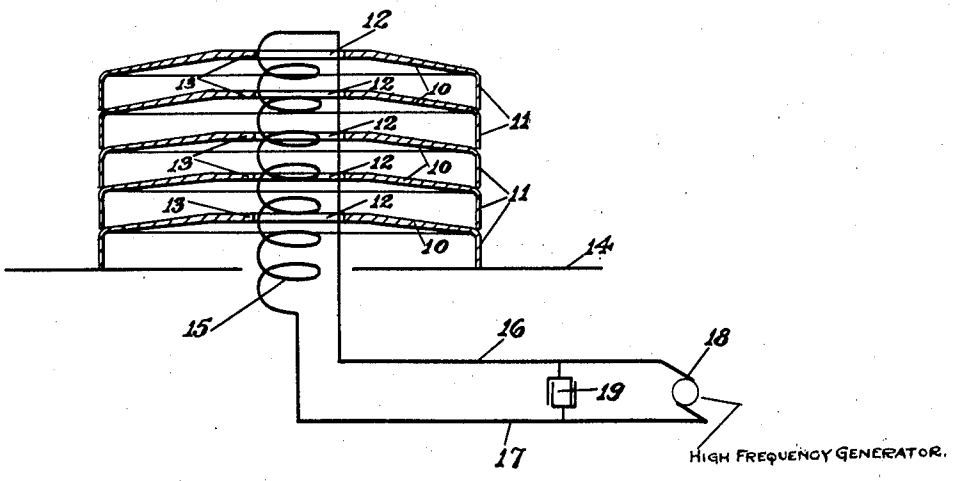


Fig 1

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FIG 4

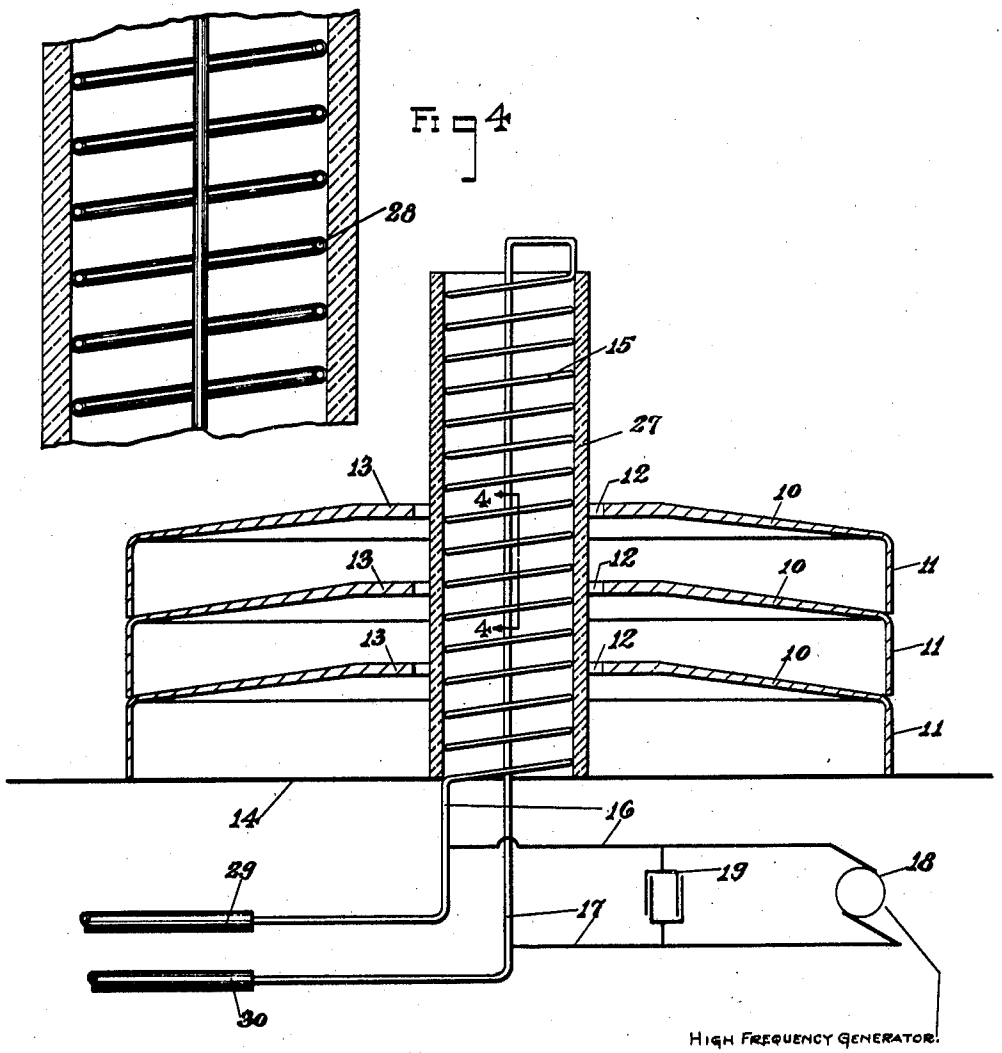


FIG 3

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UNITED STATES PATENT OFFICE.

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METHOD OF AND MEANS FOR HEATING DISKS OR PLATES ELECTRICALLY.

Application filed February 2, 1922. Serial No. 533,519.

Our invention relates to an improved method of and means for heating disks or plates electrically. This invention has to do, more particularly, with means for producing localized heating effects in disks or plates, for instance, wheel disks, for the purpose of annealing portions of such disks or plates, without materially affecting the remaining portions of such disks.

In the manufacture of some type of disk wheels, it is necessary to submit central portions of the steel disk to certain pressing operations which require the annealing of such portions of the disk. It is very desirable to confine the annealing to those portions of the disk which are subsequently to be formed or pressed, but the problem of localizing the heating has been a very difficult one. The principal object of our invention is to provide a method and means for heating disks by which the heating may be localized or confined to certain portions of the disk.

A further object of our invention is to provide electrical means for generating annealing heat in certain portions of a disk or plate.

Another object of our invention is to provide a simple, expeditious and efficient method of generating an annealing heat in certain predetermined portions of a disk or plate.

Another object of our invention is to provide a simple and effective apparatus for heating the central portions of disks, by means of which a number of disks may be heated at the same time so that the apparatus is particularly suited for quantity production of disks.

Further objects, and objects relating to economies and details of operation and construction, will definitely appear from the detailed description to follow. In one instance, we accomplish the objects of our invention by the devices and means described in the following specification. Our invention is clearly defined and pointed out in the appended claims. Preferred embodiments of the invention are illustrated in the accompanying drawings, forming a part of this specification, in which:

Fig. 1 is a wiring diagram of one embodiment of the invention.

Fig. 2 is a wiring diagram of a modified arrangement.

Fig. 3 is a vertical, sectional view through an apparatus embodying the invention, and

Fig. 4 is an enlarged, detail, sectional view, taken on line 4—4 of Fig. 3 and looking in the direction of the arrows at the ends of the section line.

In the drawings, the same reference numerals indicate the same parts throughout the several views.

In general, this invention consists in subjecting the portions of the disks to be heated to a field of force set up by a high frequency oscillating electric current, whereby high frequency currents are generated in such portions of the disk. A coil or helix connected in circuit with a source of high frequency current is brought into inductive relation to the portions of the disk or plate to be heated and high frequency currents are induced in such portions without any interlinkage of a transformer magnetic circuit with the electric circuit. In the case of disks having a central opening, when the portions immediately surrounding such openings are to be heated, the disks may be stacked one upon the other, with such central openings in alignment, and a coil or helix connected to a source of high frequency electric current inserted within said central openings, so that the portions or areas of the disks surrounding such central openings are brought into inductive relation to said coil to the substantial exclusion of the other portions or areas.

Referring to the numbered parts of the drawings, we have shown a plurality of wheel disks 10, each of which has a peripheral flange, 11, and a central opening, 12. The central portion or area, 13, surrounding the central opening is to be annealed, in order to press a rib and hemispherical sockets therein, and this invention provides a means for heating the portion, 13, to an annealing temperature without heating materially the remaining portions of the disk. The wheel disks, 10, are stacked one upon the other, as

shown, with the openings, 12, in alignment, upon the support, 14. A coil or helix, 15, (of less cross sectional area than the opening and therefore of less area than the central area to be heated) is positioned within the central openings of the several disks with the axis of the coil, 15, concentric with the axis of the cylindrical surface defined by the walls of the openings, 12. The coil, 15, is connected by the leads, 16 and 17, to any suitable source of high frequency electric current, such as the high frequency generator, 18. A condenser, 19, may be connected across the leads, 16 and 17. We are not to be restricted to a high frequency generator as the source of high frequency current, inasmuch as we may use any of the various circuits or systems known in the art for the purpose of producing high frequency currents. One such system is shown in Fig. 2, in which the leads, 16 and 17, from the coil, 15, are connected to opposite sides of the secondary coil, 23, of a transformer. Condensers, 20 and 21, are connected in the leads, 16 and 17, and the spark gap, 22, is connected across the leads, 16 and 17, between the condensers and the secondary coil, 23. The primary, 24, of the transformer is connected by leads, 25 and 26, to any suitable source of current.

An apparatus constituting one embodiment of the invention is shown in Fig. 3 and it will be observed that there is a shell or layer, 27, of heat insulating material interposed between the coil, 15, and the edges of the central openings in the disks, 10. This prevents the transfer of heat from the heated portions of the disks to the coil, 15, and helps to keep the coil cool. In order to prevent overheating of coil, 15, due to the heat generated by the resistance of the conductor forming the coil to the passage of electric currents therethrough, the conductor is in the form of a hollow tube, as shown at 28, see Fig. 4, and the ends of said hollow conductor are connected by the inlet and outlet tubes, 29 and 30, to a supply of cooling medium which is thus circulated through the coil, 15, to keep the same cool.

In operation, the wheel disks, 10, are stacked upon the support, 14, one upon the other, with the central openings, 12, in alignment. The coil, 15, with the shell, 27, of heat insulating material surrounding it, extends axially through these openings, as shown in Fig. 3. When the circuit in which the coil is connected is closed, the high frequency current in the coil sets up a field of force which induces substantial high frequency currents in the portions, 13, of the disks immediately surrounding the openings, 12. These induced currents substantially heat said portions, 13, but the substantial heating effect is confined to the parts of the disk in which the currents art induced. The induced currents are largely confined to the central part or area of the disk jointly by reason of the fact that these parts only lie in the region of the concentrated magnetic field immediately surrounding the coil, 15, and the fact that current path through this part is of least resistance, the disk here being thicker and the path being shorter than the annular current paths of the increasingly remote portions of the disk. The remaining portions of the disk are not heated except by the conduction of heat from the portions, 13, and by the extremely small currents straying from the central area, 13, or induced by possible stray fields. The portions, 13, are quickly raised to an annealing temperature while the remaining portions of the disk are not affected materially. The power of the small coil, 15, whose area lies wholly within the area to be heated is insufficient to carry the substantial heating effect beyond the bounds of the prescribed area. It is desired to concentrate the heat generated in the portions, 13, and hence the heat insulating shield or shell, 27, is provided between the coil, 15, and the portions, 13, to prevent transfer of heat from the parts, 13, to the coil. It will be apparent that the annealing may be localized in this way to the parts that are to be subjected, subsequently, to pressing operations.

We are aware that the embodiment illustrated may be altered and varied considerably without departing from the spirit of our invention and, therefore, we desire to claim our invention broadly as indicated by the appended claims.

Having thus described our invention, what we claim as new useful and desire to secure by Letters Patent is:—

1. The method of heat treating a prescribed portion of a body of conductive material substantially less than the whole, which consists in making an opening within the borders of the portion to be heated and in inducing from within the opening high frequency currents in the surrounding portion to be heated.

2. The method of heat treating a wheel disk or the like which consists in forming the disk with a central opening and then annealing a prescribed area of the disk substantially less than the whole and surrounding the opening therein by passing through a coil located within said opening a high frequency electric current.

3. The method of simultaneously heat treating a plurality of wheel disks or the like having central openings, which consists in stacking said disks with their central openings in alignment and surrounding a coil and passing a high frequency electric current through said coil to heat by induced currents prescribed areas of the disks surrounding their central openings.

4. An apparatus for simultaneously heating prescribed portions of a plurality of wheel disks or the like having central openings, comprising a support on which the disks may be stacked with their central openings in alignment, a coil arranged to be connected with a source of high frequency electric current disposed within said aligned openings, and a heat insulating shield surrounding the coil within said openings.

In testimony whereof, we affix our signatures.

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