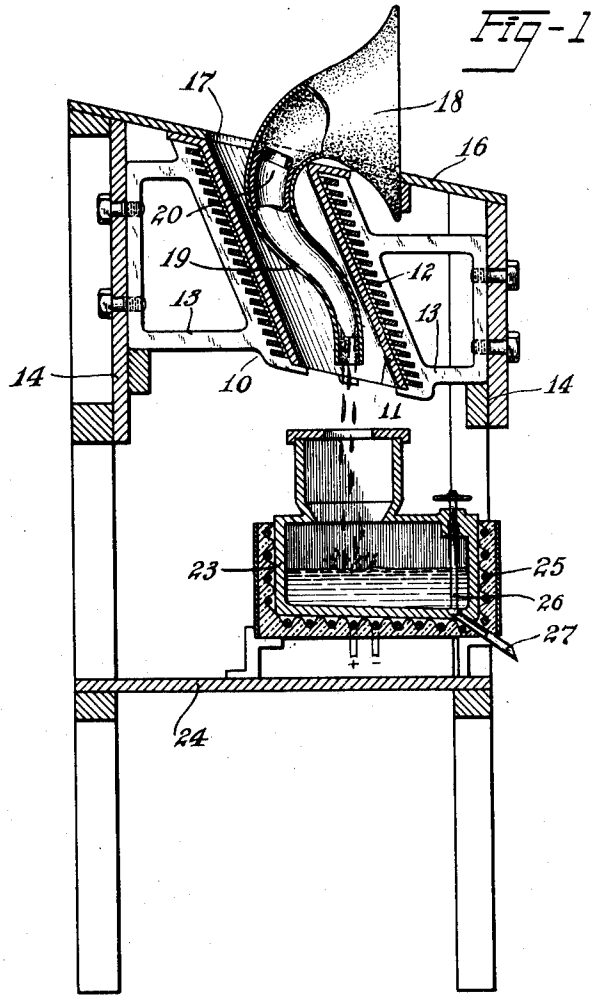
Jan. 17, 1928. 1,656,312

C. D. BLACK

METHOD OF REMOVING METAL CORES

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Fig-1



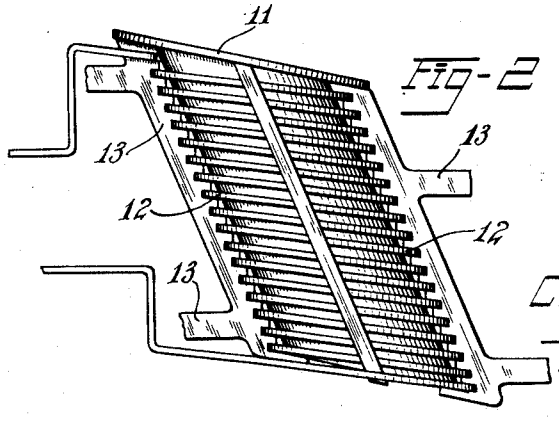


Fig-2

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Fig-3

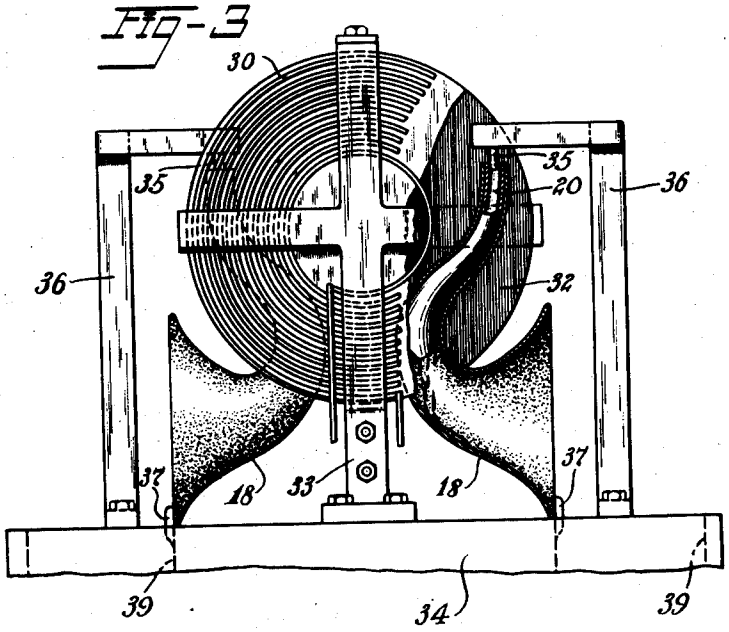
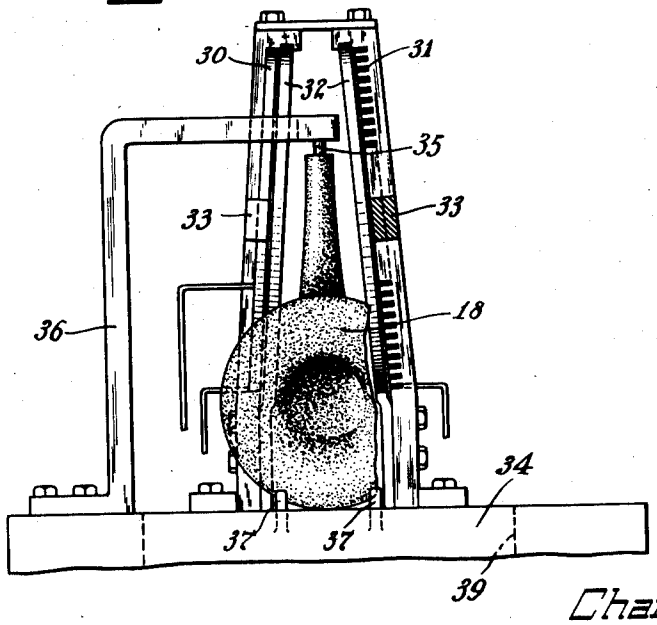


Fig- 4



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UNITED STATES PATENT OFFICE.

CHARLES D. BLACK, OF AKRON, OHIO, ASSIGNOR TO THE B. F. GOODRICH COMPANY, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

METHOD OF REMOVING METAL CORES.

Application filed September 24, 1924. Serial No. 739,573.

This invention relates to molding and forming operations and more particularly to a means for molding under heat and pressure, or under pressure alone, hollow bodies irrespective of their configuration and removing from the hollow bodies the cores employed in the molding process.

A principal object of my invention is to provide an improved method for removing the metal cores employed in the formation of hollow bodies by the fusion of the metal of the cores without detriment to the formed bodies. A further object of my invention is to provide an improved method for the production of sound projectors from hard rubber and for removing the cores employed in the molding operation.

In the manufacture of hard-rubber sound projectors, and similar hollow articles which normally have relatively thin walls, it is desirable to employ forming cores and to apply pressure to the walls of the article during the molding process. In some cases, the cores, by reason of the shape of the neck of the projectors, cannot be removed therefrom as a unit after the vulcanization process.

It has been heretofore proposed to make such a neck forming core hollow and a fusible metal, and to melt out the fusible core after vulcanization by passing therethrough a heated medium. In accordance with the present invention, a fusible core of this character is removed from a sound projector by placing the core containing portion of the projector in a high frequency induction furnace and melting out the core.

In the accompanying drawings, Fig. 1 is a view in vertical section of a sound projector disposed in a high frequency induction furnace and illustrating an embodiment of my invention; Fig. 2 is a view in elevation of the inductor unit of Fig. 1; Fig. 3 is a view partially in side elevation and partially in vertical section of a modified embodiment of the construction of Fig. 1; Fig. 4 is a view partially in elevation and partially in section of the structure illustrated in Fig. 3.

Referring more particularly to the drawings, I show in Figs. 1 and 2 a high frequency induction furnace 10, consisting of a thin-walled hollow cylinder 11 of electrical insulating material, such as quartz, micanite or asbestos, an inductor 12 in the form of a helically coiled bar surrounding the cylinder 11, and brackets 13 of electrical insulating material for supporting the cylinder 11 and the inductor 12 in fixed relation to a frame or table 14 upon which the furnace is mounted.

As shown, the axis of the cylinder 11 is oblique to its bases and the coils of the inductor are in general parallelism to the bases, the arrangement of the furnace being particularly adapted for receiving the gooseneck of the projector and causing the induced electric currents to be set up in the core of a projector of the special shape illustrated.

The table 14 is provided with a top 16 having an opening 17 therein to receive and support the sound projector 18, the construction being such that the neck of the projector 19 containing the metallic core 20 is entirely within the inductor coil 12. It is to be understood that the core section within the bell or flaring mouth portion of the projector during the molding operation is withdrawn before placing the projector in the furnace, as hereinafter described.

A catch basin 23 is supported on the shelf 24 of the frame 14 in such position as to receive the fused metal of the core 20. If desired, an electric resistance 25 may be disposed around the basin 23 to maintain the metal in a molten condition and permit it to be withdrawn through the valve 26 and spout 27.

Unvulcanized rubber in the form of sheets of suitable thickness is fitted about a core, which is preferably made in two sections, a bell section for the large flaring end, which core section may be of any suitable material, and a neck section 20 of low temperature fusing metal. The rubber covered core sections are then encased in a suitable mold,

for example of the two-section type, and the rubber subjected to pressure. The molded projector is then vulcanized by the application of heat, either in the mold or, the mold being removed, in open dry heat on the core. Upon cooling, the bell section of the core is removed from the vulcanized article and the core 20, which is held in the sinuous passage of the sound projector, is removed by placing the projector in the induction furnace in the manner shown in Fig. 1. A high frequency current is then passed through the inductor coil 12 and the core being within the field of the inductor is heated to a melting temperature by direct induction, the eddy currents which cause the heating being developed directly in the core. The metal upon melting is drained into the catch basin 23. With electric currents having frequencies of the order of from 10,000 to 20,000 cycles per second and potentials of the order of from 6,000 to 10,000 volts, a few minutes suffices entirely to fuse a hollow core of low melting point metal.

In the modification illustrated in Figs. 3 and 4, two inductors 30 and 31, each of annular conformation and comprising spirally wound bars, are spaced sufficiently apart to receive between them one or more sound projectors, two sound projectors being illustrated, preferably supported with the large end or bell downwardly to permit partially fused portions of the core to fall bodily out of the sound projector, should they become loosened sufficiently therein.

The furnace units of the apparatus of Figs. 3 and 4 are similar to that already described in connection with Fig. 1. Electrical insulating disks 32 lie contiguous to the induction coils 30 and 31 and internally thereof. Brackets 33 of electrical insulating material are secured to a table 34 and serve to support both the inductors 30 and 31 and the disks 32 in proper position. Pins 35 projecting from arms 36, also secured to the table, and lugs 37 on the table 34 are provided to hold the sound projectors in inverted upright position during the fusing of the cores 20. The fusing metal of the cores is caught in suitable receptacles disposed beneath the openings 39 in the table 34. The apparatus of this embodiment operates in all respects similar to that of Fig. 1 described above and further exposition thereof is here deemed to be unnecessary.

While this invention has been disclosed in connection with the manufacture of hard rubber sound projectors, it is obvious that it may be employed for the production of a wide variety of molded or formed articles. The present invention also contemplates the separation of metals having different fusing temperatures which have been cast one to the other or plated one upon the other, as for example, the removal of Babbitt metal from a bearing, or the production of hollow metal articles of irregular shape by metal plating a core of low fusing temperature, and then removing said core by fusing in an induction furnace.

This invention has many advantages when applied to the arts as above suggested, chief of which are the simplicity of the method, its low cost of operation and maintenance, and the comparative freedom of hazard to the operator carrying out the process.

I claim:

1. The method of producing hollow, vulcanized rubber articles which comprises forming unvulcanized rubber about a core of low fusing point, vulcanizing the rubber on the core, and thereafter placing the article with its core disposed in the space between the windings of an induction heater, and passing through the windings of such heater an alternating electric current having a frequency of the order of from 10,000 to 20,000 cycles per second.

2. The method of producing hollow, molded articles which comprises forming plastic material about a core of metal having a relatively low fusing point, hardening the plastic material about the core to form a self-sustaining construction, thereafter melting out the metal of the core by setting up therein eddy currents induced from an induction coil carrying a high frequency alternating current.

3. The method of producing hollow vulcanized hard-rubber articles which comprise forming an unvulcanized hard-rubber composition about a core of relatively low fusing point, vulcanizing the rubber on the core to form a self-sustaining construction, and thereafter melting out the material of the core by setting up therein eddy currents induced from a coil traversed by a high frequency alternating electric current.

4. The method of producing hollow, vulcanized rubber articles which comprises forming a vulcanizable rubber composition about a core of low fusing point, vulcanizing the rubber on the core at a temperature lower than the fusing point of said core, and thereafter melting out the material of the core by setting up therein eddy currents induced from a coil traversed by a high-frequency alternating electric current.

5. The method of producing hollow, vulcanized rubber articles which comprises forming a vulcanizable rubber composition about a relatively thin hollow core having a fusing point somewhat in excess of the temperature of vulcanization of the rubber composition, vulcanizing the rubber on the core, and thereafter melting out the core by setting up therein eddy currents induced by an induction heater traversed by high-frequency alternating electric currents.

6. The method of producing hollow, vulcanized rubber articles which comprises forming a vulcanizable rubber composition about a metal core having a higher fusing point than the vulcanizing temperature of said composition, vulcanizing the rubber on the core at a lower temperature than that of the fusing point of the core, cooling the vulcanized rubber article, and thereafter melting out the metal of the core by setting up therein eddy currents induced from a coil traversed by high-frequency alternating electric currents.

In witness whereof I have hereunto set my hand this 17th day of September, 1924.

CHARLES D. BLACK.