G. C. NIXON AND F. C. RAAB.

PROCESS OF CASE HARDENING ARTICLES.

APPLICATION FILED JAN. 17, 1921.

1,415,261. Patented May 9, 1922.

2 SHEETS—SHEET 1.

FIG. 1

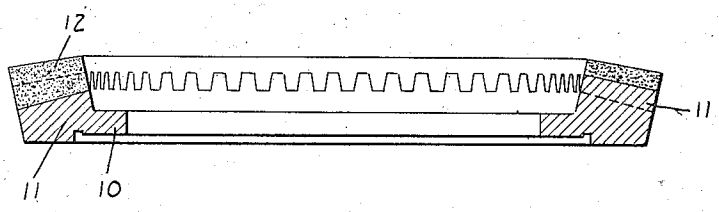
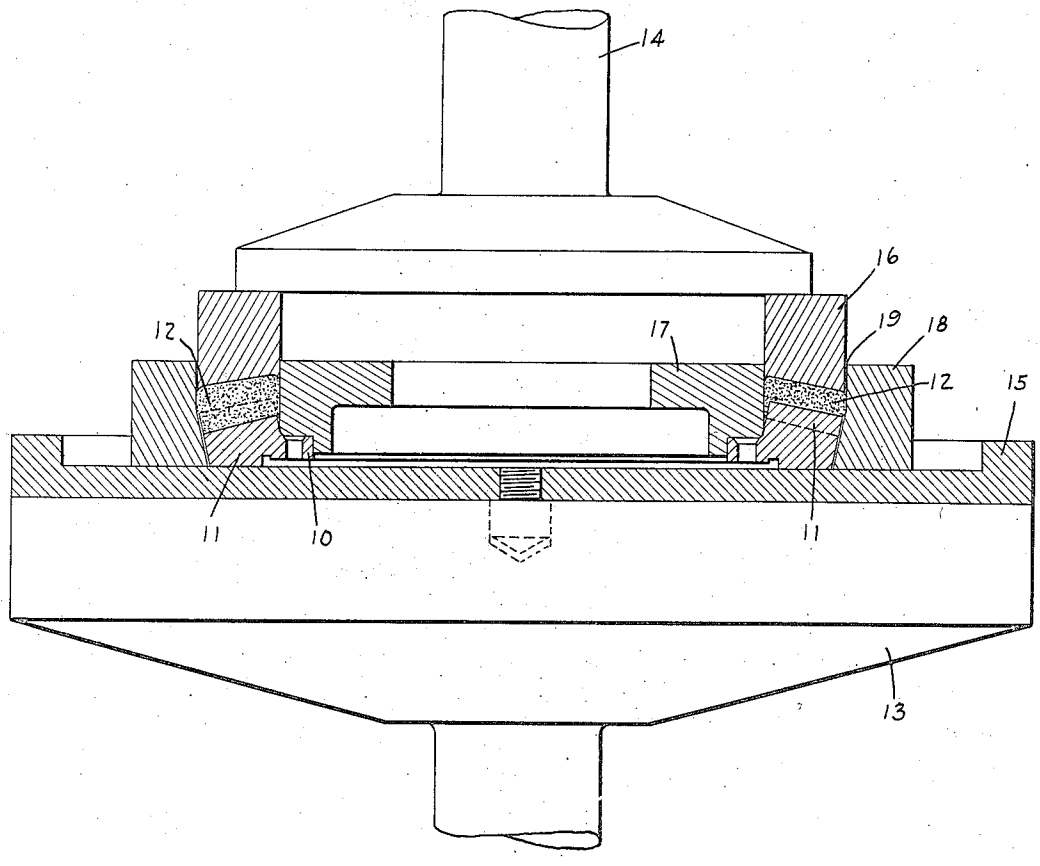


FIG. 2



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2 SHEETS—SHEET 2.

FIG. 4

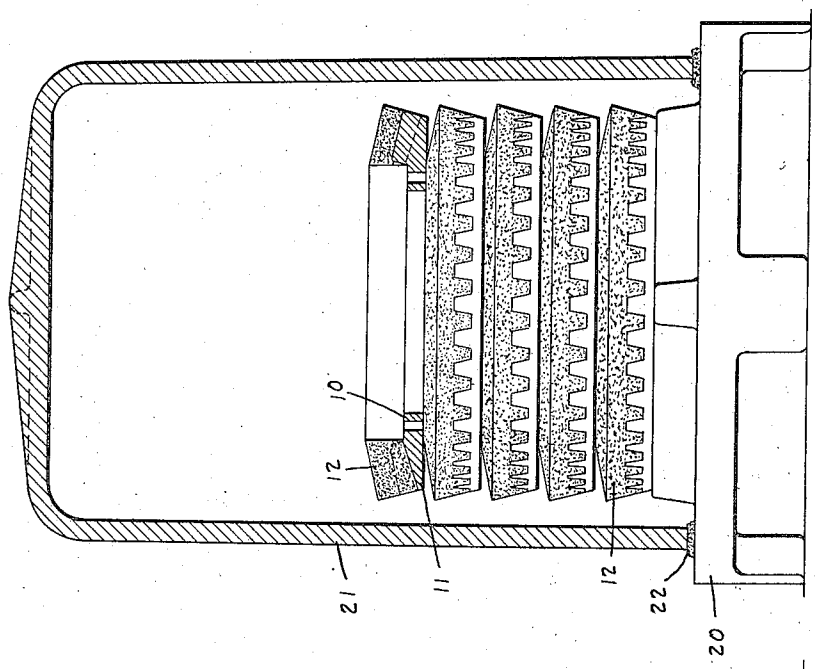
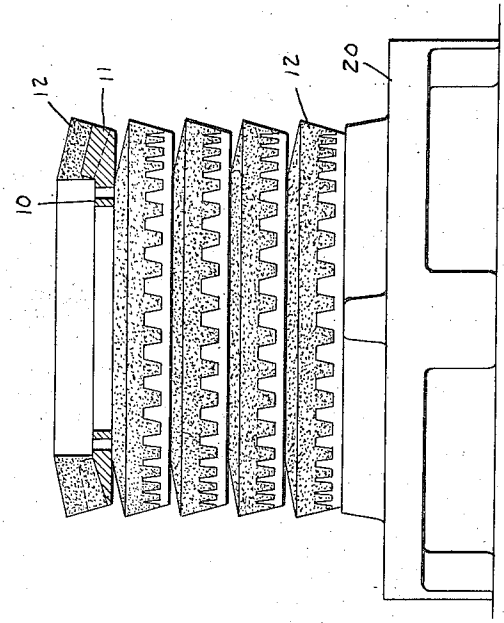


FIG. 3



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PROCESS OF CASE HARDENING ARTICLES.

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To all whom it may concern:

Be it known that we, GEORGE C. NIXON and FREDERICK CHARLES RAAB, citizens of the United States, and residents of Syracuse, county of Onondaga and State of New York, have invented a certain new and useful Process of Case Hardening Articles; and we do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, in which like numerals refer to like parts.

This invention relates to the art of carburizing or case hardening iron or steel. The usual method of preparing articles of steel and the like for carburization consists in placing the several articles or article in a receptacle or pot which contains the carburizing materials in dry and powdered or granulated form. The pot or receptacle is sealed to prevent the access of air to the same and said pot and contents thereof are then placed in a furnace and heated to a temperature sufficient to carburize and harden the surface of the article or articles. The foregoing process has been termed the dry case hardening process.

The chief object of the present invention is to improve the process of carburizing or case hardening metal by applying the carburizing material to the article in such a manner that the carburizing material is secured to the article and associates itself in all the superficial interstices thereof; and said carburizing material is applied to said surface in a relatively thick layer and under pressure. This causes the carburizing material on the article to be hardened so that said articles with the carburizing material thereon can be prepared in quantities before the same are placed in the pots and can be handled and stacked without difficulty and without cracking or causing the separation of the case hardening material from the articles to be carburized.

In the drawings Fig. 1 is a central sectional view illustrating a bevel gear which has been provided with carburizing material preparatory to being subjected to the heat treatment. Fig. 2 is a central sectional view of one form of mechanism for applying the case hardening material to the bevel gear shown in Fig. 1 under pressures which are greater than that obtained by hand pressure. Fig. 3 is an elevational view of a plurality of coated articles, one of the same being shown in section, and said view illustrates the compactness and durability of the carburizing coating applied to the article to be coated such that the same may be roughly handled or stacked, as shown. Fig. 4 is a central vertical section through a pot or receptacle containing a plurality of beveled gears which have been provided with case hardening material, said gears and receptacle being in condition and in position for the heat treatment.

This invention consists in combining with any suitable carburizing material, but preferably in dust or finely divided form, a material adapted for converting it into a plastic mass like putty or dough. This carburizing material is then applied to the surface of the metal article in a relatively thick layer so that the carburizing material will be attached directly to the surface of the article to be carburized and in immediate contact therewith.

The plastic or putty-like mass of carburizing material is placed upon the surface of the article to be carburized and pressed upon said surface so as to fill any and all interstices or irregularities therein, so that it will continue to adhere to said surface throughout the handling of the article in the case hardening process. A pressure of about fifty pounds per square inch may be used when the same is applied by hand, since said pressure is well within the power of individed manipulation, but if a greater pressure is desirable, mechanical means may be employed, as illustrated in Fig. 2.

In the drawings 10 indicates the body portion of a bevel gear provided with teeth 11 and to which is applied the carburizing material such that the teeth are covered with a relatively thick layer of the same. In Fig. 2 the mechanical means for applying the case hardening material 12 to the bevel gear 10 under pressures greater than that within the ordinary range of manual manipulation, such as 1500 to 2000 pounds and the like, consists in a table 13 associated with which is a plunger 14 and adjacent the plunger and suitably supported upon said table 13, is a centering plate 15. The plunger 14 carries a pressing ring 16, said pressing ring being associated with a core ring 17 and an enclosing ring 18. Thus an annular channel 19 is formed between the core ring 17 and the enclosing ring 18, which channel exposes the teeth and other surfaces of the

gear positioned upon the centering plate such that the case hardening material 12 may be secured thereto. It will be understood that the case hardening material 12 is supplied to the annular channel 19, and preferably is supplied by hand such that said channel is substantially filled. The plunger 14 is then moved towards the table 13, or vice versa, such that the pressing ring 16 seats itself in the annular channel 19 and forces the case hardening compound upon the exposed portion of the bevel gear and causes the compound to adhere to said bevel gear such that the coated gear is adapted to receive handling without danger of cracking, chipping or removing any of the case hardening compound from the surface desired to be case hardened.

This invention, therefore, permits articles to be coated at a point remote from the furnace where said articles are heated. The dry method first described in the specification requires an excessive length of time for treatment, since the articles to be carburized are surrounded with a mass of carburizing material which is difficult for the heat to penetrate and the carburizing or case hardening in this process is not uniform since there is a lack of intimacy or contact between the articles to be carburized and the dry carburizing compound. Also after the charge, including the carburizing compound and the articles to be carburized, is removed from the furnace, the contents thereof, other than the carburized articles, contains considerable heat and the pot also contains considerable heat and this heat, therefore, is lost when the pot and contents are allowed to cool.

This invention, however, is not limited to either the manner or means shown herein for securing the case hardening material in direct contact with the surface of the metal and in semi-plastic form, as that result may be accomplished in any other way or by any other means so long as the surface of the metal article, which it is desired to be case hardened, is covered with a relatively thick layer of carburizing material in such manner that said material adheres to the surface of the metal, and which carburizing layer is adapted to receive and withstand rough handling without danger of separation from the surface of the article to be carburized.

After the carburizing material has been applied to the surface to be carburized, substantially in the manner described, the articles are then placed within the pot or receptacle and the latter placed in a furnace and heated to a sufficient temperature for a sufficient length of time to furnish the depth of case hardening desired. In Figs. 3 and 4 a plurality of articles supplied with case hardening material are illustrated, and the same are shown in stacked relation indicating the rough handling which said carburizing coated articles are able to withstand without removal of the carburizing coating from the articles. In said figure a stand or support is indicated by the numeral 20 and associated with the stand is a lid 21 which cooperates with the stand 20 to form a pot or receptacle adapted to be placed in a furnace. The base is sealed to the lid by any suitable means such as that indicated by the numeral 22, and within the pot thus formed is positioned the several articles such as the stacked bevel gears, the teeth of which are covered with a relatively thick layer of carburizing material which was in a plastic form when it was applied to the gear or metal article, but which when placed in said pot is of sufficient hardness to adhere to articles without danger of chipping or cracking of the coating.

The carburizing material may be formed into plastic condition in various ways and by various means, as desired. For instance, a twenty per cent mixture of heavy tar or equivalent material with the carburizing material in powder or granular form, will cause the carburizing material to adhere directly to the surface of the article in a relatively thick layer and it will remain in position on the article. The method of applying the foregoing or other suitable carburizing material to the surface of the article in a relatively thick layer and under the desired pressure provides that the case hardening material will remain in position on the article while the same is being transported to and prepared for the receptacle and while being placed therein and during the heatng process. After the heating process has continued for a sufficient length of time, the plastic material will be hardened or baked hard on the article and will remain in such condition until the article has been case hardened and removed from the pot, whereupon the hardened material may be removed from the case hardened article in any convenient or suitable manner.

The invention claimed is:

1. The process of carburizing metal, which process includes covering the portion of the article to be carburized with adhering carbonaceous material under pressure sufficient to cause the same to rigidly adhere to the article and form a relatively thick layer thereon, and then heating the article with the carburizing material thus secured thereon.

2. The process of carburizing metal, which process includes combining carburizing material in any suitable form with a substance that renders it plastic and adherent, covering the portion of the metal article to be carburized with a layer of said compound, and pressing the same tightly on the surface of said metal article until

the same adheres to said article and assumes a rigid form to permit handling, and then heating the article with the carburizing material thus secured thereon.

3. The process of carburizing metal, which process includes combining carburizing material in any suitable form with a substance that renders it plastic and adherent, covering the portion of the surface to be carburized with a relatively thick layer of the compound and causing the same to adhere to the portion of the article to be covered by applying pressure thereto, and then heating the article with the carburizing material thus secured thereon.

In witness whereof, we have hereunto affixed our signatures.

GEORGE C. NIXON.
FREDERICK CHARLES RAAB.