Dec. 20, 1938. L. D. DONBECK 2,140,670

METHOD OF PRODUCING STEEL STAMPS

Filed Feb. 14, 1936

Fig. 1.

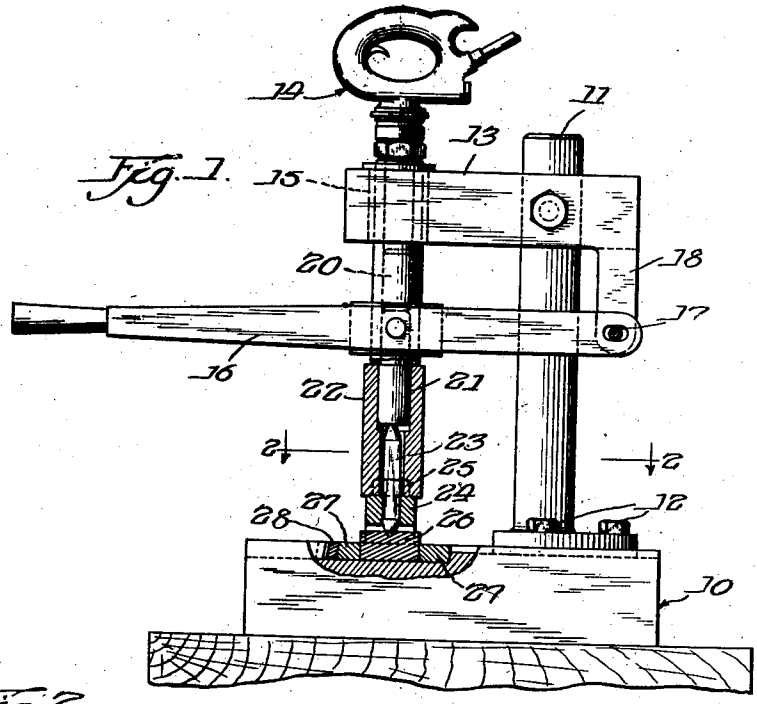



Fig. 2.

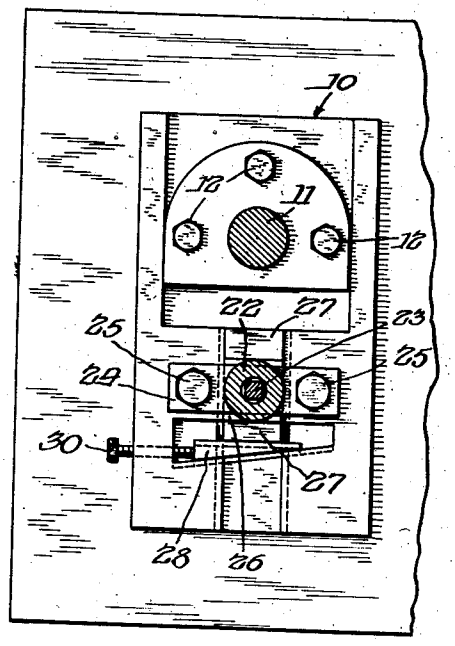



Fig. 3.

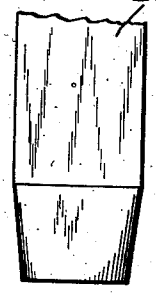



Fig. 5.

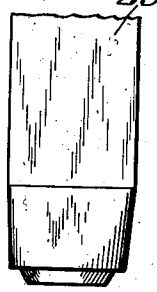



Fig. 7.

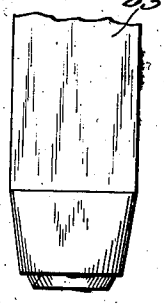



Fig. 4.

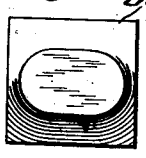



Fig. 6.

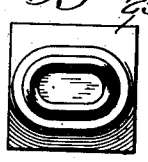
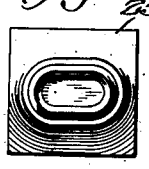



Fig. 8.




Inventor:
Larry D. Donbeck.
By Mania & Rambler
Attys

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# UNITED STATES PATENT OFFICE

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## METHOD OF PRODUCING STEEL STAMPS

Larry D. Donbeck, Gary, Ind.

Application February 14, 1936, Serial No. 63,953

1 Claim. (Cl. 148—12)

The invention relates to a method of producing steel stamps.

It is an object of the invention to produce steel stamps by a cold forming operation, which is made possible by special annealing and heat treatments of the stamp blanks. As a result of the treatments of the blanks the stamp end thereof is relatively soft and ductile, a condition which is essential to its being worked in the die. However, the shank of the stamp blank gradually increases in hardness in a direction away from the stamp end and thus the complete blank has definite physical characteristics for effectively withstanding the blow of the driving force and the column bending action to which the shank of the blank is subjected while at the same time the end can be formed to produce the stamp.

Another object of the invention resides in an improved heat treating method for high carbon steel to produce certain necessary characteristics which render it possible to cold form the stamp by apparatus of the type above described.

With these and various other objects in view, the invention may consist of certain novel features of construction and operation as will be more fully described and particularly pointed out in the specification, drawing and claim appended hereto.

In the drawing which illustrates an embodiment of the invention and wherein like reference characters are used to designate like parts—

Figure 1 is an elevational view of the apparatus of the invention, the stamp holder and guide block being shown in section to illustrate the manner of holding the stamp blank;

Figure 2 is a horizontal transverse sectional view taken substantially along line 2—2 of Figure 1;

Figures 3 and 4 are fragmentary elevational and bottom plan views, respectively, of the blank prior to forming;

Figures 5 and 6 are fragmentary elevational and bottom plan views, respectively, of the blank after forming; and

Figures 7 and 8 are views similar to Figures 5 and 6 showing the completed stamp.

Referring to Figure 1 of the drawing, the apparatus for forming a specially heat treated length of high carbon steel of the proper size and shape into a stamp consists essentially of a base member 10 suitably supporting an upright 11 secured to the base by the bolts 12. The upright has secured thereto a horizontal supporting member 13 which carries at its outer end the pneumatic hammer indicated in its entirety by numeral 14, said hammer extending vertically through an opening formed in the member 13, which opening is provided with the bushing or sleeve 15. Said pneumatic hammer is designed to be raised and lowered and for the purpose an actuating lever 16 is provided, suitably journalled by the pin 17 carried by the depending lug 18 integral with the member 13.

The pneumatic hammer 14 is equipped with a metal plunger 20 which is adapted to engage an intermediate plunger 21 having an upper portion fitting within the end of the hammer and a lower portion received by the stamp holder 22. Said stamp holder is provided with a circular bore of a size to suit the particular size of blank 23 being formed, and which, therefore, supports the stamp blank in the vertical position so that its upper end is in contact with the intermediate hammer 21. The stamp holder rests upon a guide block 24 of inverted U-shape and which is fixedly secured to the base 10 by bolts 25.

The forming die 26 is detachable with respect to the base 10, being fixedly secured to the base by the adjusting blocks 27, one of which has association with the securing wedge 28. Said wedge blocks and forming die are removable from the base when the threaded bolt 30 is withdrawn from out of contact with the wedge. However, when said bolt is in firm contact with the wedge, the parts are securely held in position in the base 10, with the forming die 26 located directly under the stamp blank 23.

The material of the present stamps is preferably hypereutectoid steel, consisting of about 1.03% carbon, .50% manganese, a minimum of phosphorus and sulphur, and the remaining principally iron. Inasmuch as the metal is worked cold, the forming operation is a rather drastic one and therefore special consideration must be given to the high carbon content of the steel blanks used in producing the present stamps. According to the invention the blanks are first annealed at a temperature ranging between 1490 degrees Fahr. to 1500 degrees Fahr., the temperature being held for a period of time sufficient to insure uniformity of the annealing temperature throughout the mass of the charge in the furnace, after which the charge is cooled to a point within the $AR^{1,2,3}$ range on the cooling curve. When this point is reached further cooling is retarded, whereupon the steel passes through the transformation range at a relatively low rate. The results of this treatment are the production of a metal having a uniform grain structure of desirable size, a metal which is free of strains and wherein spheroidizing of the excess cementite has taken place.

Following the annealing treatment the blanks are heat treated in order to strengthen the blank so as to overcome the column bending action to which they are subjected during the forming operation of the stamp. This treatment consists in heating the blanks to a temperature within the transformation range which may approximate 1450 degrees Fahr.

It is to be understood that the temperatures mentioned in connection with the present heat treating method may vary in accordance with the analysis of the steel used in making the stamps and therefore they are to be considered as illustrating the invention with reference to the particular analysis of steel given above.

After the stamped blanks have been treated to a temperature of 1450 degrees Fahr. they are quenched in cold running water in such a manner as to leave one end extending above the level of the quenching bath and which may approximate three-eighths of an inch in extent. This is the end to be formed in the die and for larger sections having a cross sectional area one inch square the length of the end extending above the level of the bath may be increased to approximately one-half inch. The shank of the stamped blank has been hardened by this quenching operation, whereas, the end extending above the quenching bath is left soft and ductile. After the blanks are withdrawn from the quenching bath they are stacked in a dry place on the floor in a compact pile and are there permitted to cool further, since there is still considerable heat remaining in the end which has not been quenched. The object of this cooling is to permit the heat from the unquenched end to be conducted back through the hardened shank of the blank, thereby establishing a degree of graduation in hardness, and inasmuch as previous heats on the steel have not been high enough to produce exaggerated or damaging grain size, the danger of an abrupt line of demarcation is avoided.

After the blanks have cooled sufficiently they are tempered by heating the blanks to a temperature ranging from 500 degrees Fahr. to 510 degrees Fahr., which is maintained for a period of time not less than one hour, and where shop conditions permit, this may be extended to two hours, in which case the lower temperature is preferred. This tempering treatment has for its object the elimination of quenching strains, and the establishment of definite physical characteristics to meet the various conditions of mechanically working the blank in the forming operation. Thus, the shank affords sufficient strength to overcome column bending action and also the head of the stamped blank is able to withstand the shock and tendency to upset, resulting from the repeated blows of the driving force. The soft ductile condition of the end of the shank is essential for properly forming the end to produce the stamp. In addition to establishing a physical condition in the metal at the end of the stamp, which facilitates its being worked in the die, this comparatively small section thus softened also makes it possible to confine the driving force of the hammer to that small section of metal necessary to form the stamp and insures complete filling out of the die. When the blank is driven into the die there is a tendency toward lateral movement of the metal above the die. Therefore, only a small section of metal sufficient to form the stamp is left soft. Otherwise the driving force of the hammer would be dissipated in a lateral movement attendant to the upsetting action and the blank would stick in the guide which supports it, and, further, the metal would not flow satisfactorily in the die.

In larger sections the tendency to upset and stick in the guide is not so great, due to the inherent strength of the larger section, and thus advantage can be taken of this by extending the length of the unquenched section. The advantage of increasing the length of the unquenched section is that larger sections cool more slowly and this gives more time for the constituents of the steel to precipitate out of solid solution, thereby insuring a more complete establishment of the soft ductile condition desired.

After formation of the stamps by use of the apparatus shown in the drawing, the stamps are ready for the final heat treatment. This first consists in a normalizing treatment designed to eliminate the severe strains in the stamp and to establish a fine uniform grain structure throughout the mass of metal. The stamps are heated to a temperature of about 1475 degrees Fahr. and are held at this temperature long enough to insure uniformity throughout the entire mass, whereupon they are permitted to cool to a point somewhat below the transformation range. By taking advantage of the residual heat still remaining in the stamps they are brought back from this temperature to a temperature of 1410 degrees Fahr., whereupon they are quenched in cold salt brine. The entire stamp is submerged for a brief period in the cold salt brine and then the shank of the stamp is lifted above the level of the quenching bath in such a way as to leave about one inch of the stamp end under the level of the quenching bath. The internal heat emanates out from the center, tempering the shank, and as this takes place the stamp is moved up and down in the quenching bath, thereby minimizing the possibility of producing dangerous lines of demarcation. Finally, the stamp is quenched cold, which produces a stamp at this period in its final treatment having a hard stamp end which gradually gets softer and tougher back through the shank. After being quenched the stamps are given a tempering treatment designed to eliminate the quenching strains and to establish a definite desirable physical condition essential to their efficiency and service. The tempering temperature is preferably 480 degrees Fahr. and the stamps are subjected to this treatment for not less than one and one-half hours and more, if time and shop routine permits.

What is claimed is:

The method of producing a steel stamp from a blank of high carbon hypereutectoid steel, which consists in annealing the blank from a temperature approximately 1495 degrees Fahr., reheating the blank to a temperature approximately 1450 degrees Fahr., quenching one end of the heated blanks and slowly cooling the unquenched end to produce a blank having a tough shank with a soft, ductile end portion, tempering the blank to eliminate the quenching strains, forming the stamp on the end portion by supporting the blank with said end portion in contact with a die and imparting successive driving blows to the other end, and finally subjecting the stamp to a normalizing treatment which consists in heating the stamp to approximately 1475 degrees Fahr. followed by quenching the stamped end cold and the shank to a temperature below the critical to produce a stamp having a hard stamp end and a soft, tough shank.

LARRY D. DONBECK.