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T. C. DAWSON

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PROCESS OF LOCALLY HEAT TREATING HARDENED STEEL ARTICLES

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FIG. 1.

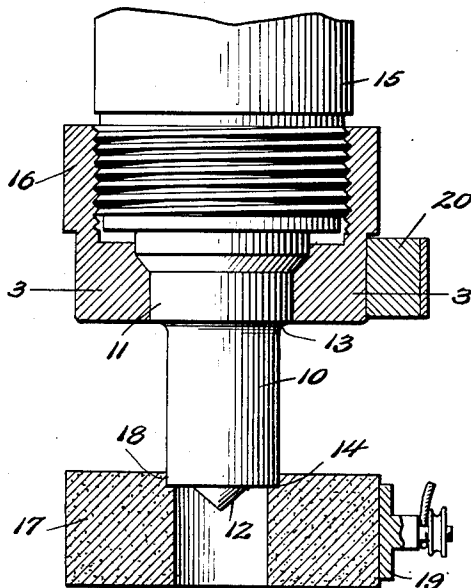


FIG. 2.

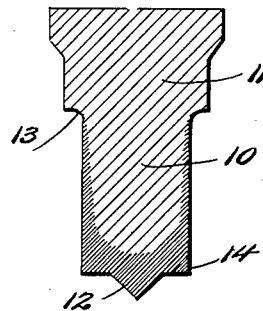


FIG. 3.

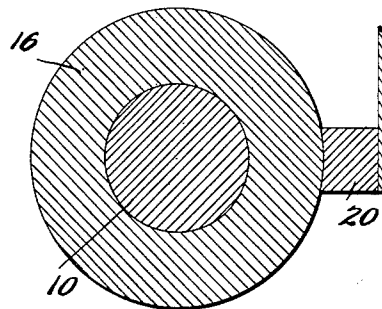
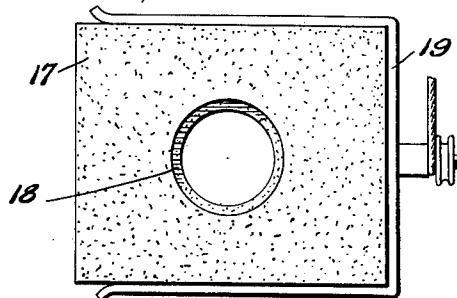


FIG. 4.



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## UNITED STATES PATENT OFFICE.

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## PROCESS OF LOCALLY HEAT-TREATING HARDENED-STEEL ARTICLES.

Application filed December 9, 1921. Serial No. 521,195.

*To all whom it may concern:*

Be it known that I, THOMAS C. DAWSON, a citizen of the United States, and residing at Bethlehem, Lehigh County, State of Pennsylvania, have invented certain new and useful Improvements in Processes of Locally Heat-Treating Hardened-Steel Articles, of which the following is a specification.

10 This invention relates to a steel heat treating process.

The object of the invention is to provide a process for locally heat treating hardened steel articles of various kinds and particularly for drawing the temper from or reducing the hardness of a desired portion of a hardened steel article by means of heat generated when passing an electric current through said article, the heat being so localized that adjacent portions of the article retain their original hardness. A further object is to provide a process in which a sliding contact is employed between the portion of the article to be heated and the terminal of the electric heating circuit, whereby it has been found that blistering and roughening of the surface of the article is avoided. While the process is obviously capable of use wherever it is desired to reduce the hardness of an article or portion of an article, it has been found particularly useful for drawing the temper from the cutting edge of metal punches whereby the hardness of the edge is reduced and rendered less liable to be broken or chipped in case the punch comes in contact with the die.

In the accompanying drawings forming a part of this specification there is illustrated an arrangement for carrying out the process as applied in drawing the temper from the edge of a metal punch. In said drawings:

Figure 1 is a vertical sectional view of an arrangement for carrying out the process and illustrating a punch in position to be heated by the passage of an electric current;

Figure 2 is a sectional view illustrating the structure of the punch to be treated;

Figure 3 is a transverse sectional view on line 3—3 of Figure 1; and

Figure 4 is a plan view of one of the

electrodes employed in the present process.

Referring to the drawings in detail, the numeral 10 represents a punch for piercing plates. The head 11 of the punch is formed for attachment to a punching machine and the cone point 12 is formed centrally at the bottom surface thereof to position the plate to be pierced. When made in the usual manner the punch is hardened throughout and the temper of the head portion is then drawn leaving the neck portion 13 more or less ductile. The hardened carbonized portion which remains after such treatment is illustrated by the shaded portion in Figure 2. With this class of tools it is of considerable advantage to temper the cutting edge 14, for the reason that when the tool is not exactly aligned with its die this cutting edge 14 strikes the die and causes chipping or spalling of the edge, whereas if drawn said edge will yield or give more or less and only slight wear of the same will result. Although it is advisable to draw the edge 14 the hardness at the point 12 should be retained. These results are accomplished in the following manner.

The punch 10 is clamped to the end of a rotatable spindle 15 which is operated from any suitable source of power not shown, the punch being connected to the spindle by means of a coupling nut 16. A carbon block or electrode 17 is supported in any suitable manner beneath the end of the spindle 15, this block being insulated from its support. The block 17 is bored centrally and a recess 18 is formed in the upper part thereof to receive the end of the punch so that when the spindle 15 is lowered the punch will enter said recess and the lower face thereof will come in contact with the bottom of the recess 18. A clamp 19 is secured to the carbon block 17 and such clamp is connected to one end of an electric circuit. The other end of such circuit is connected to the spindle 15 and punch 10 through the medium of a brush or electrode 20.

The circuit when closed causes the punch to heat very rapidly at and adjacent to its point of contact with the block 17, and during heating operation the spindle 15 is preferably rotated to insure a good contact be-

tween the cutting edge of the punch and the block. When the desired temperature is reached the punch is removed from the spindle and suitably cooled, preferably by being immersed or plunged in a cooling medium. It has been found in actual practice that to draw the edge of a carbon steel punch, the main line voltage of 220 volts should be transformed down to about 5 volts which produces a current through a punch of approximately 2,000 amperes, which heats the punch in proximity to the edge to approximately 600° F. which has been found to be a satisfactory temperature when the punch is immersed in the cooling medium.

While the invention has thus far been described as applied to drawing the temper from a punch, it is by no means limited to that particular use but may be employed in treating any hardened steel article where it is desired to draw the temper from any particular portion thereof and cause local toughness of the material. The process may also be employed to secure a decrementally hardened steel article by drawing the temper to a different degree from different parts of a previously hardened steel article so that the hardness may be caused to gradually decrease from one point toward another of the article.

As heretofore noted, one important feature of the invention lies in providing a sliding contact resistance as a means of heating the portion of the article treated and where feasible it will generally be found preferable to employ such sliding contact since blistering of the surface of the article is thus obviated or greatly reduced. Such sliding contact will be found valuable in any heat treating process where it is desired to obtain high temperatures locally and the same is not therefore to be understood as limited to obtaining high temperatures in the process of locally drawing the temper from a hardened steel article. Carbon, including graphite, has been found particularly adapted for use as a sliding contact electrode because of its softness and high fusing point.

In describing the process as applied to punches, cooling of the article is stated to be preferably effected by plunging it in a cooling medium. While such cooling is generally desirable, in many cases cooling in the air and absorption of heat by parts of the article adjacent the part locally heated will be found to suffice.

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

1. A process of drawing the temper from a part of a hardened steel article which consists in bringing such part of the article and an electrode into contact, causing relative movement between the article and electrode

while continuously in contact, passing a current through the electrode and article while the same are moved relative to each other, whereby said part of the article is heated to the desired temperature, and cooling the article.

2. A process of drawing the temper from a part of a hardened steel article which consists in bringing such part of the article and a carbon electrode into contact, causing relative movement between the article and electrode while continuously in contact, passing a current through the electrode and article while the same are moved relative to each other, whereby said part of the article is heated to the desired temperature, and cooling the article.

3. The process of drawing the temper locally from a hardened steel article which consists in bringing a carbon electrode and the portion of the article to be treated into sliding contact, in passing an electric current through the electrode and such portion of the article, whereby the article is locally heated to the required temperature, and in cooling the article.

4. The process of drawing the temper from the cutting edge of a hardened punch or the like, which consists in arranging the punch between the electrodes of an electric circuit in such a manner that the cutting edge only of the punch contacts with an electrode, passing a heating current through the electrodes and punch until said edge of the punch is heated to the desired temperature, and then cooling the punch.

5. The process of drawing the temper from the cutting edge of a hardened cylindrical punch or the like, which consists in arranging the punch between the electrodes of an electric circuit, one of the electrodes being made of carbon and the punch being arranged with respect thereto in such a manner that its cutting edge only contacts therewith, in passing an electric current through said electrodes and the punch, until said edge of the latter is heated to a desired temperature, and then in cooling the punch.

6. The process of drawing the temper from the cutting edge of a hardened punch or the like, which consists in arranging the punch between the electrodes of an electric circuit in such a manner that the cutting edge only of the punch contacts with an electrode, rotating said punch relative to said electrode and simultaneously passing a heating current through the electrodes and punch until the cutting edge of the punch is heated to the desired temperature and then cooling the punch.

7. The process of drawing the temper from the cutting edge of a hardened cylindrical punch or the like, which consists in embedding the cutting end of the punch in

a carbon electrode in such a manner that the cutting corner only of the punch contacts with the electrode, in passing an electric current through the punch and the electrode until the cutting corner of the punch is heated to a desired temperature, and then in cooling the punch.

8. The process of drawing the temper from the cutting edge of a hardened cylindrical punch or the like, which consists in embedding the cutting end of the punch in a carbon electrode in such a manner that the cutting corner only of the punch contacts with the electrode, in passing an electric current through the punch and the electrode until the cutting corner of the punch is heated to a desired temperature, and in causing relative movement between the punch

and the electrode while the electric current is passing therethrough.

9. The process of drawing the temper from the cutting edge of a hardened punch or the like, which consists in bringing the punch and an electrode into contact in such a manner that the cutting edge only of the punch contacts with the electrode, causing relative movement between the punch and electrode while the same are held in contact, passing an electric current through the electrode and cutting edge of the punch while such relative movement takes place, and immersing the punch in a cooling medium.

In testimony whereof I hereunto affix my signature.

THOMAS C. DAWSON.