Dec. 29, 1942. T. ZUSCHLAG 2,306,584

DEMAGNETIZATION OF MAGNETIC BODIES

Filed July 13, 1940

Fig. 1,

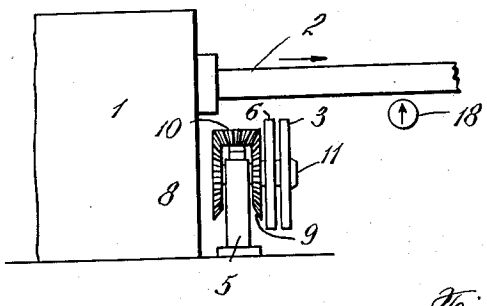


Fig. 2,

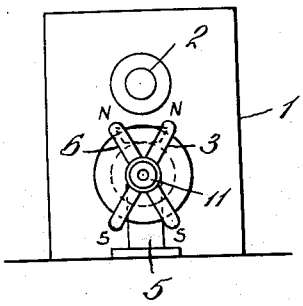


Fig. 3

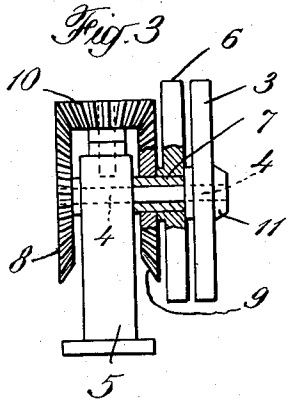


Fig. 4,

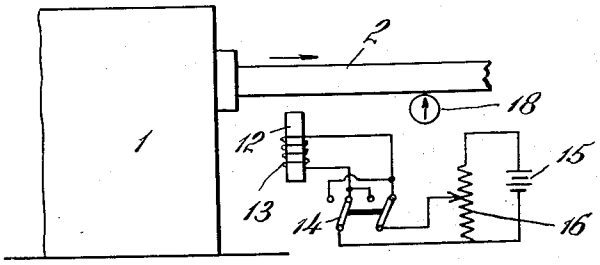


Fig. 5,

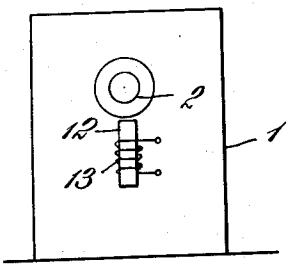
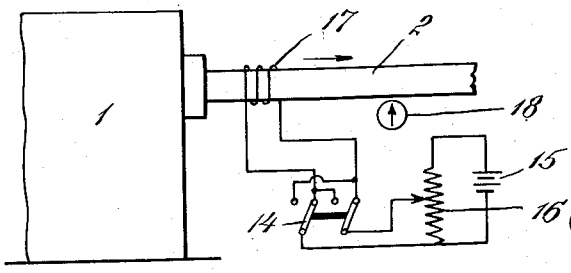


Fig. 6,



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DEMAGNETIZATION OF MAGNETIC BODIES

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Application July 13, 1940, Serial No. 345,338

2 Claims. (Cl. 205—4)

This invention relates to the manufacture of metallic rods, bars, tubes, and the like, and particularly to a method and apparatus for treating them at the time of their manufacture so that upon their completion they are substantially free from magnetism.

I have found that metallic articles, such as steel rods, bars and tubes which are fabricated by drawing, bending, straightening, and similar operations, frequently possess a substantial amount of magnetism upon their completion which, in many cases, interferes with their use. This is believed to be due to the fact that the operations performed upon the article during its fabrication so affect the state of its molecules that while they are in such state they are easily influenced by any magnetic force which happens to be acting upon the article, such as the earth's magnetism. If the article happens to be in the proper position with respect to the magnetic force, the molecules that have thus been made more susceptible to it are oriented or aligned by it so as to establish a state of magnetism in the finished article.

Just how the molecules are affected by the fabricating operations so as to make them more susceptible to small magnetic forces is not certain, but it is believed that one or more of the mechanical operations place them in such a disturbed state of agitation, vibration, or mobility that their resistance to alignment or orientation by the magnetic forces is materially decreased.

I have discovered that the agitation or other changed state of the molecules brought about by the mechanical forming operations can be utilized and taken advantage of in the application of a controlled magnetic force to counteract or eliminate any magnetism which might occur in the completed article as a result of the action of the first mentioned magnetic forces, i. e., the uncontrolled ones. I have found that by subjecting the article to a relatively small magnetic force adjusted to the proper sign or direction and intensity, before the molecules have set and while they are still in the above-mentioned disturbed or susceptible state, any magnetism which has been produced in the article being formed, or which might occur in the finished article as a result of the uncontrolled magnetic forces may be counteracted or eliminated.

My invention thus contemplates treating the article at the time of its manufacture by subjecting it, immediately after all of the fabricating operations have been performed upon it, and while the disturbed molecules are still readily responsive to the orienting influence of a relatively small magnetic force, to a controlled magnetic force which is so adjusted as to direction and intensity that any magnetism which would normally occur in the finished article by reason of the action of the uncontrolled forces will be eliminated or counteracted.

The controlled magnetic force may be applied in various ways. I prefer to use one or more adjustable permanent magnets, or an electro-magnet the current through whose coil may be reversed and varied in intensity, or a magnetic coil through which the article passes and the current through which may likewise be reversed and varied in intensity.

Several forms of apparatus embodying the invention and which are capable of carrying out the improved method are diagrammatically illustrated in the accompanying drawing, in which—

Figure 1 represents in side elevation an apparatus in which the controlled magnetic force is applied by two adjustable permanent magnets;

Fig. 2 is an end view of the apparatus shown in Fig. 1;

Fig. 3 is an enlarged view of a portion of Fig. 1 showing more clearly the details of the mounting and adjusting mechanism for the permanent magnets;

Fig. 4 is a side elevation of another form of apparatus in which the controlled magnetic force is applied by an electro-magnet;

Fig. 5 is an end view of the apparatus shown in Fig. 4; and

Fig. 6 is a side elevation of still another form of apparatus in which the controlled magnetic force is applied by a coil through which the article passes.

Referring first to Figs. 1, 2 and 3, the apparatus for drawing and straightening the metallic article or performing other fabricating operations upon it is diagrammatically represented at 1. The metallic article may be a steel bar, rod or the like represented at 2 and shown emerging from the forming apparatus 1. The controlled magnetic force should be applied to the bar 2 immediately after the mechanical operations upon it have been completed, and therefore the means for applying this force is represented in the drawing positioned close to the forming apparatus 1 where it can produce its effect on the bar 2 as it emerges from it. It comprises at least one adjustable permanent bar magnet positioned so that one pole points towards the bar 2. Preferably two bar magnets are employed mounted as follows: One of the magnets 3 is fixed at its

mid-point to a shaft 4 journalled in a suitable support 5 (Fig. 3). The other magnet 6 is fixed to a sleeve 7 which is rotatably mounted on the shaft 4. The shaft 4 carries a bevel gear 8 and the sleeve 7 carries a similar gear 9. A bevel pinion 10, rotatably mounted on the support 5, meshes with the two gears in such a way that when the magnet 3 is turned in either direction by means of a knob 11, the other magnet 6 will turn an equal amount in the opposite direction. It will be understood that the two magnets 3 and 6 turn in closely adjacent planes.

By turning the knob 11 the two magnets may be brought to a horizontal position in which unlike poles lie adjacent to each other thereby causing the field of one magnet to cancel that of the other and thereby minimize the effect of the magnets on the bar 2, or they may be brought to a vertical position in which the two "north" poles lie adjacent the bar 2, or the two "south" poles lie adjacent to it. When the two magnets are in the vertical position they will exert the maximum magnetic force on the bar 2, the sign or direction depending upon whether the two "north" poles or the two "south" poles are pointing towards the bar. By varying the angular relation between the magnets, as indicated in Fig. 2, the intensity of the magnetic force exerted on the bar 2 may be varied.

In Figs. 4 and 5 the controlled magnetic force is exerted by an electro-magnet 12 having an energizing coil 13. This coil is connected to a reversing switch 14 and is supplied with current from a battery or other direct current source 15 through a potentiometer 16. The direction and intensity of the magnetic force exerted on the bar 2 may be varied by means of the reversing switch and the potentiometer.

In Fig. 6 the electro-magnet shown in Fig. 4 is replaced by a coil 17 through which the article 2 passes when it emerges from the forming apparatus 1. The coil 17 exerts a magnetic influence on the article 2 to oppose and counteract any magnetism that has been set up in it during its formation. The direction and intensity of the magnetic field produced by the coil 17 may be varied in the same way as the magnetic field produced by the electro-magnet of Fig. 4, namely, by a reversing switch 14 and potentiometer 16.

In all forms of the apparatus the article being fabricated is subjected to a controlled magnetic force immediately after the forming operations are completed, and this is represented in the various figures by the juxtaposition of the controlled magnetic means to the casing 1 in which the forming operations are assumed to take place. When the metallic article 2 emerges from the apparatus 1 it may be tested to ascertain the direction and strength of magnetization if any. This may be done by any suitable instrument, such as that represented at 18 in Figs. 1, 4 and 6. This instrument may be a simple compass, but it is desirable to use an instrument that has a pointer moving over a graduated scale having a zero position at the center of the scale. A microammeter, or a magnetic vane type meter, well answers the purpose. The instrument 18 may be permanently positioned near the path of movement of the article 2, or it may simply be held adjacent to the article when it is desired to take a reading. If the instrument 18 indicates that the article possesses magnetism the controlled magnetic force is adjusted both as to direction and intensity, either by adjusting the position of the bar magnets (Figs. 1 to 3), or adjusting the direction and intensity of the current through the coil (Figs. 4 to 6) until the instrument 18 shows a zero reading and thus indicates that the magnetism in the article is being counteracted or eliminated. Perhaps several formed articles will have been discharged by the forming apparatus 1 before the proper adjustment can be made, but after the adjustment is once made it should suffice for a large number of articles formed at the same location and under the same conditions. Periodically a reading may be taken by the use of the instrument 18 to make sure that the discharged articles are being properly demagnetized and if not, appropriate further adjustment of the applied magnetic force may be made. The few articles which may be discharged by the forming apparatus 1 while the proper adjustments are being made may not, of course, be completely demagnetized but if desired these may be passed through an apparatus such as that disclosed in my prior Patent No. 2,207,392, issued July 9, 1940, which is intended to demagnetize steel, bars, tubes and the like some time after their completion. In accordance with that patent the agitation of the molecules in the completed article necessary to effect demagnetization is produced by an alternating current coil through which, or by which, the article is passed. A direct current coil superimposes a direct magnetic field upon the alternating magnetic field to neutralize extraneous magnetic forces, such as earth magnetism, which might affect the molecules while they are in their agitated and easily influenced state and thereby cause unwanted magnetism to remain in the article. In the present method and apparatus no alternating current coil is necessary because the molecules are agitated by the mechanical forming operations. While this agitation of the molecules which occurs during the mechanical forming operations is objectionable from the standpoint that it normally brings about unwanted magnetism in the finished article by permitting the extraneous magnetic forces to get in their work as above described, nevertheless it is taken advantage of and utilized in the application of the controlled unidirectional magnetic force which accomplishes the demagnetizing in the present invention. The alternating current coil forming part of the apparatus disclosed in the above mentioned patent is rather bulky and its elimination saves considerable space and expense. The apparatus required to carry out the method of this application may take a very simple and inexpensive form and to serve its purpose need only be used in proper relation to the usual forming operations.

I claim:

1. In the manufacture of metallic articles such as bars, rods, tubes, and the like, by mechanical forming operations, the method of preventing magnetism in the finished articles due to the action thereon of the earth's magnetism or other uncontrolled magnetic forces while the molecules are in a disturbed state to which they have been brought by said forming operations, which comprises obtaining an indication immediately after the forming operations upon the article are completed of the amount and direction of magnetism produced in it by said uncontrolled magnetic forces, subjecting each article immediately after the forming operations are completed to the action of a controlled direct magnetic field, and adjusting the direction and intensity of such direct magnetic field until said indication shows

that the action of said field on the molecules while they are still in said disturbed state has counteracted or eliminated any magnetism which has been produced in the article being formed or which might have occurred in the finished article as the result of said uncontrolled magnetic forces.

2. Apparatus for manufacturing and treating metallic articles comprising means for subjecting the articles during their manufacture to a mechanical operation, means located close to said first named means for indicating the amount and direction of magnetism produced in the articles due to the action thereon of the earth's magnetism or other uncontrolled magnetic forces while the molecules are in a disturbed state to which they have been brought by said mechanical operation, means also located close to said first named means for producing a direct magnetic field to the action of which the articles are subjected immediately after the mechanical operation is performed, and means for varying the intenisity of said direct magnetic field and for changing its direction whereby the effect thereof on the molecules while they are still in said disturbed state may be altered until said indicating means shows that the direct magnetic field has counteracted or eliminated any magnetism which has been produced in the article being formed or which might have occurred in the finished article as the result of said uncontrolled magnetic forces.

THEODOR ZUSCHLAG.