F. L. DYER.

ELECTRIC RIVETING.

APPLICATION FILED AUG. 16, 1918.

1,305,078.

Patented May 27, 1919

Fig. 2.

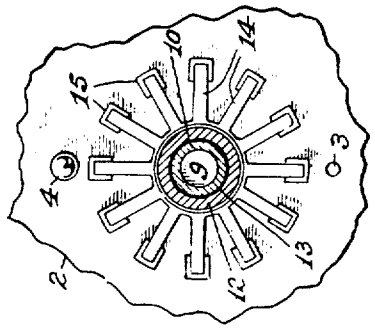


Fig. 4.

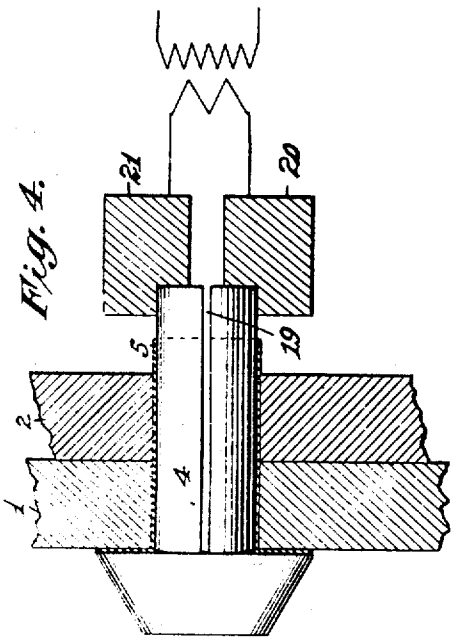
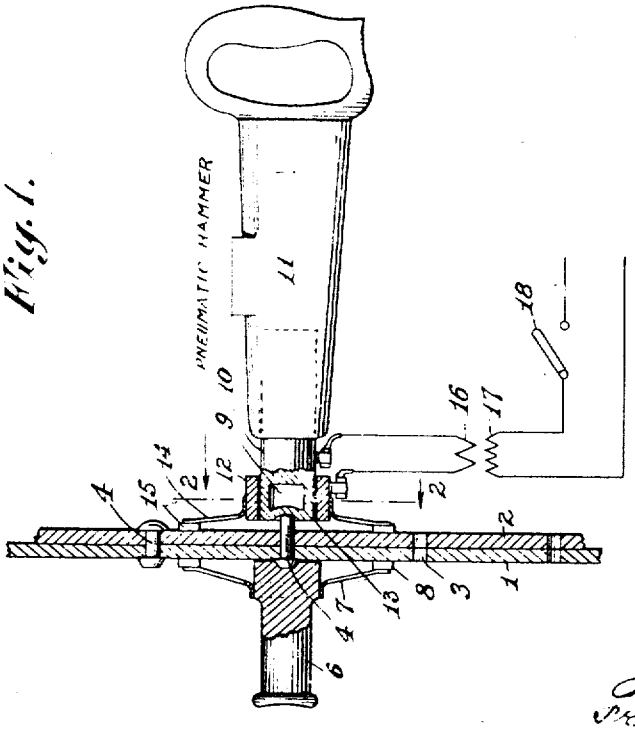


Fig. 1.



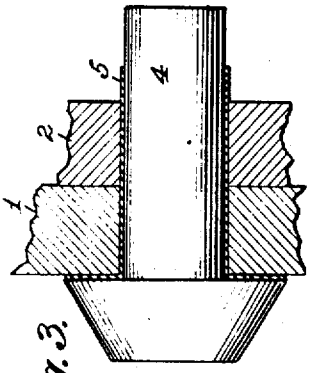


Fig. 3.

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UNITED STATES PATENT OFFICE.

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ELECTRIC RIVETING.

1,305,078. Specification of Letters Patent. Patented May 27, 1919.

Application filed August 16, 1918. Serial No. 250,117.

To all whom it may concern:

Be it known that I, FRANK L. DYER, a citizen of the United States, residing at Montclair, in the county of Essex and the State of New Jersey, and having a post-office address at #55 Liberty street, New York city, have invented certain new and useful Improvements in Electric Riveting, of which the following is a full, clear, and exact specification.

My invention relates to various new and useful improvements in electric riveting, the method being particularly adapted for use for riveting in connection with shipbuilding, and my object is to provide for such improvements in the art as will permit a riveting operation to be performed more quickly than by present methods and which will result in a more uniform and regular product.

In riveting operations as now carried out in shipbuilding or analogous fields, it is the practice to heat the rivets to the desired temperature in a small blacksmith's forge, to then pass them successively to the holder-on, who inserts each of them in the desired rivet hole, and the riveter thereupon by means of a pneumatic tool heads over or upsets the end of the rivet. If the rivet blank in this way is heated to too high a temperature the metal melts and the blank has to be discarded. Furthermore, during the time that the blank is exposed to the air after heating its temperature drops so that often the riveting becomes a difficult operation and frequently bad jobs are made, necessitating the tedious burning out of the rivet by an oxy-acetylene flame and the substitution of a good rivet.

Electric riveting is desirable because it permits the rivet blank to be brought to the desired high temperature, whereupon the riveting operation can be immediately performed before the blank has a chance to cool and in fact the heating current can be maintained during the riveting operation. But effective electric riveting as heretofore proposed can be carried out only in connection with relatively small plates and relatively small rivets since the plates must be small enough to be received within the throat of the riveting machine, the heating current passing directly from one electrode to the other through the rivet blank and a single powerful pressure being applied to upset the rivet by causing the electrodes to approach each other and the rivets must be small enough to permit them to be headed in this way.

In shipbuilding the plates are very large and it would be impracticable to apply a riveting machine with a throat big enough to straddle the plates and frames of a ship under construction since such a device will be too heavy and unwieldy to be effectively operated in competition with the present methods.

With my improved method instead of applying direct pressure to the heated blank as heretofore proposed with electric riveting, I upset the head of the rivet by a succession of blows from a pneumatic tool without in any way interfering with the passage of the heating current through the rivet blank which may thus be kept at the maximum temperature for effective riveting during the heading operation.

Furthermore, with my improved method, I so arrange the riveting tool or gun that in addition to heading the rivet, it also acts as an electrode to apply the heating current to the rivet, whereby the operator by one and the same tool effects the heating of the rivet and by a succeeding operation effects the usual riveting operation. In this way time is not lost between the heating and riveting operations and in fact, if desired, the heating current may be kept on during the riveting operation. With my improved method, moreover, preferably the gun and the "holding on" tool are equipped with electrodes by which the current will be diffused through the plates, thus permitting, as I will explain, the conductors to be carried on one side of the plates. In this way, by the very act of engaging these tools with the rivet, the electrodes will automatically close the circuit through the plates in the neighborhood of the rivet, whereby a minimum resistance will be included in the exterior heating circuit and that resistance at all times will be constant, thus permitting more certain and uniform work. Furthermore, this arrangement permits the riveter and holder on to move from rivet to rivet, and to commence work immediately on the rivet, without having to bother with the making of special contacts,

the only thing needed being that the transformer shall be movable conveniently from place to place.

In order that the invention may be better understood attention is directed to the accompanying drawing forming a part of this specification and in which—

Figure 1 is a diagrammatic cross sectional view showing two ship plates riveted together, illustrating the carrying out of my method by means of a simple form of apparatus.

Fig. 2. a cross sectional view on the line 2—2 of Fig. 1.

Fig. 3. an enlarged sectional view showing one of the rivets in place and illustrating particularly the insulating of the rivets from the plates, and

Fig. 4. a corresponding view of a modification in which the rivet is split longitudinally so as to provide a continuous passage for the current through the two legs of the rivet.

In all of the above views corresponding parts are represented by the same reference numerals.

1, and 2, represent two plates which are to be riveted together or a plate which is to be riveted to a suitable frame.

Rivet holes 3, are formed in these plates the holes being usually countersunk to receive the headed end of the rivet blank.

These blanks 4, are of the usual construction except that before being used they may be coated with a suitable insulating material 5, by which the head and shank of the rivet will be insulated from the metal plates or parts. The voltage of the heating current being very low the insulating thus secured need not be especially effective.

If desired, instead of applying insulating material to the blanks, an extremely thin insulating sheath of insulation like mica or asbestos may be applied to the shank of the rivet blank and to the under side of the head thereof so as to insulate the same. This insulation also reduces heat conduction from the blank and facilitates raising the temperature thereof to the desired point.

6, represents the tool used by the holder-on who presses said tool against the rivet blank to hold the same in position while it is being heated and headed. This tool is made preferably of copper at its inner end and for its main part is composed preferably of some material which is a poor conductor of heat, such as wood. If desired the copper end may be water cooled as is common with electric heating operations.

Extending radially outward from the tool 6, near its end are copper arms 7, carrying shoes 8, which come in contact with plate or frame. A suitable number of these copper arms are preferably used, giving as much of a cross section as possible to the heating current, thus reducing waste due to unnecessary resistance.

Engaging the other end of the rivet blank where the head is to be formed is a copper block 9, made hollow as shown and suitably water cooled and which is carried by the plunger 10, of a pneumatic riveting tool 11, said plunger being acted upon in the usual way by the piston of said tool to impose upon the rivet a series of rapidly recurring blows when the throttle of said tool is opened.

Surrounding the block 9, is a copper ring 12, insulated from the block by insulation 13, and said ring carries a number of copper arms 14, corresponding to the arms 7, each provided with a shoe 15, making connection with the plate or frame 2.

A number of these arms 14, are used to prevent undue heating in the secondary circuit exterior to the rivet blank.

The secondary 16, of the transformer is connected to the ring 12, and plunger 9, so that the heating current will be concentrated in the rivet blank 4, to heat the same, while this current will be diffused in the balance of the secondary circuit which is of relatively low resistance.

The primary 17, of the transformer is supplied with current of the desired voltage, and in the primary circuit is a switch 18, which the operator may open or close preferably by means of his foot so as to cut the heating current off or on as may be desired.

In operation, heating current of the desired voltage is applied to heat up the rivet blank as quickly as possible while the blank is being pressed by the two workmen between the tools 6 and 11, and when the blank has reached the proper temperature the riveter may then cut off the current or he may reduce the current, or he may keep the full strength of the current maintained in the blank. He then operates the throttle of the pneumatic tool, which strikes a succession of rapid blows on the heated blank and thus forms the head of the rivet, this operation being performed very rapidly because the rivet blank can be maintained at a higher temperature than is now possible and the metal will thus be more plastic and more easily worked.

With the modification shown in Fig. 4 I provide the rivet blank with insulation 5, and also with the longitudinal slot 19, extending in the shank almost through to the head thereof. With this modification all that the holder-on has to do is to press on the head of the rivet so as to hold it in place. Instead of a single block 9, I make use of two water cooled blocks 20 and 21, engaging the two legs of the blank so that the heating current will traverse said legs and bring the blank to the desired temperature, whereupon the same operation is per

formed for heading the blank as I have already described.

It will be understood, in carrying out my improved method, that the insulating of the rivet blanks from the plates or frames through which they pass need not be effected. In fact, provision may be made to cause the rivet blank to engage the surrounding metal with a good contact, either by fitting the blank accurately in the hole or by filling in around the blank with a conducting material. When this is done, the heating current will be concentrated at the end of the blank, instead of along its entire shank, since where the blank makes contact with the metal of the plates or frames, the current has an opportunity to diffuse and there will be less heating effect. But the end of the blank will be brought to the desired temperature, which manifestly is all that is necessary since the upsetting of the metal is limited to the end where the head is to be formed. When the method is carried out in this way, it is obvious that there will be diffusion of current between the blank and the surrounding metal in proportion to the degree or extent of such contact. If the contact is poor, there may be very little diffusion and most of the current will traverse the blank and be concentrated therein, but when the contact is good and sufficiently extensive there may be relatively little heating of the blank except for its exposed portion and for a short distance within the rivet hole. In the latter case, *i. e.*, where diffusion between the blank and surrounding metal can be counted on, or where such diffusion is especially provided for, there will be no need of special conductors to carry the current from the holding-on tool to the plate, since the current passes directly to the plates from the rivet blank.

Furthermore, it will be understood that instead of making connection for the secondary circuit to the plate by means of conductors carried with the riveting tool as I have described, there may be a direct connection made with the plate by temporarily bolting a contact plate to the same, said contact plate being shifted from place to place as the riveting progresses. In other words, instead of making a connection between one of the secondary leads to the ring 12, arms 14, and shoes 15 to the plate 2, a contact plate may be temporarily bolted to the plate 2 and the secondary lead connected directly to that plate. This connection may be relied upon for any number of riveting operations, so long as the place of riveting is not so far removed as to interpose undesirable resistance.

I prefer however to use separate electrodes carried by the tool 11 and (when the heating current is to traverse the entire length of the rivet) by the tool 6, because in this way the exterior heating circuit is always the same and includes a minimum of iron or steel, namely, only the thickness of the two plates. If a separate contact plate is used, as above proposed, and as suggested, for example, in patent to Thomson, No. 555,131, dated February 25, 1896 (see plate C^2), the exterior heating circuit, will be of varying resistance according to the distance between the contact plate and the rivet being worked on. Therefore, the amount of heat lost in the exterior heating circuit will be a variable factor, and the riveting operation is less likely to be uniform than when the resistance of the exterior heating circuit is constant, as will be the case where the electrodes are carried by the tool or tools. By "exterior heating circuit" I mean the secondary circuit of the transformer, except the short portion at the rivet where a useful heating effect is secured.

Having now described my invention, what I claim as new therein and desire to secure by Letters Patent is:

1. The method of electric riveting which consists in applying an electrode to the unheaded end of the rivet blank, passing the heating current therefrom through the rivet blank to heat the same and in applying after heating a succession of rapidly recurring blows to said electrode to form the head on the rivet blank, substantially as set forth.

2. The method of electric riveting, which consists in applying an electrode to the unheaded end of the rivet blank, applying a second electrode to the other end of the blank, passing the current between said electrodes to heat the blank, and in completing the circuit between said electrodes through the plates which are being riveted, substantially as set forth.

3. The method of electric riveting, which consists in applying an electrode to the unheaded end of the rivet blank, applying a second electrode to the other end of the blank, passing the current between said electrodes to heat the blank and in completing the circuit between said electrodes through the plates which are being riveted by electrodes which diffuse the current, substantially as set forth.

4. The method of electric riveting, which consists in applying an electrode to the unheaded end of the rivet blank, applying a second electrode to the other end of the blank, passing the current between said electrodes to heat the blank, in completing the circuit between said electrodes through the plates which are being riveted, and in applying a succession of rapidly recurring blows to the first electrode to form the head on the rivet blank, substantially as set forth.

5. The method of electric riveting, which consists in applying a pneumatic tool or gun to the rivet blank, passing a heating

current from the said tool to the rivet blank to heat the same, and in operating said tool to apply a series of rapidly recurring blows to the heated blank, substantially as set forth.

6. The method of electric riveting, which consists in applying a pneumatic tool or gun to the rivet blank, passing a heating current from the said tool to the rivet blank to heat the same, closing the circuit through the plates being riveted, and operating said tool to apply a series of rapidly recurring blows to the heated blank, substantially as set forth.

This specification signed and witnessed this fifteenth day of August, 1918.

FRANK L. DYER.

Witnesses:

ABRAHAM FASTOVE,

CORA B. WRIGHT.