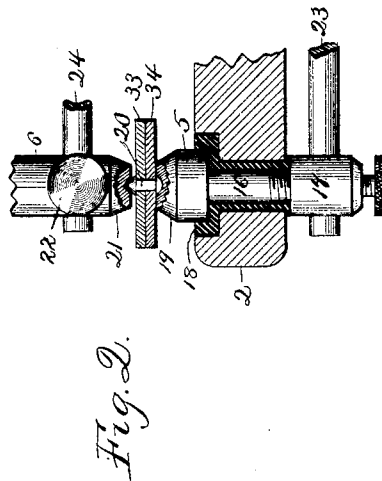
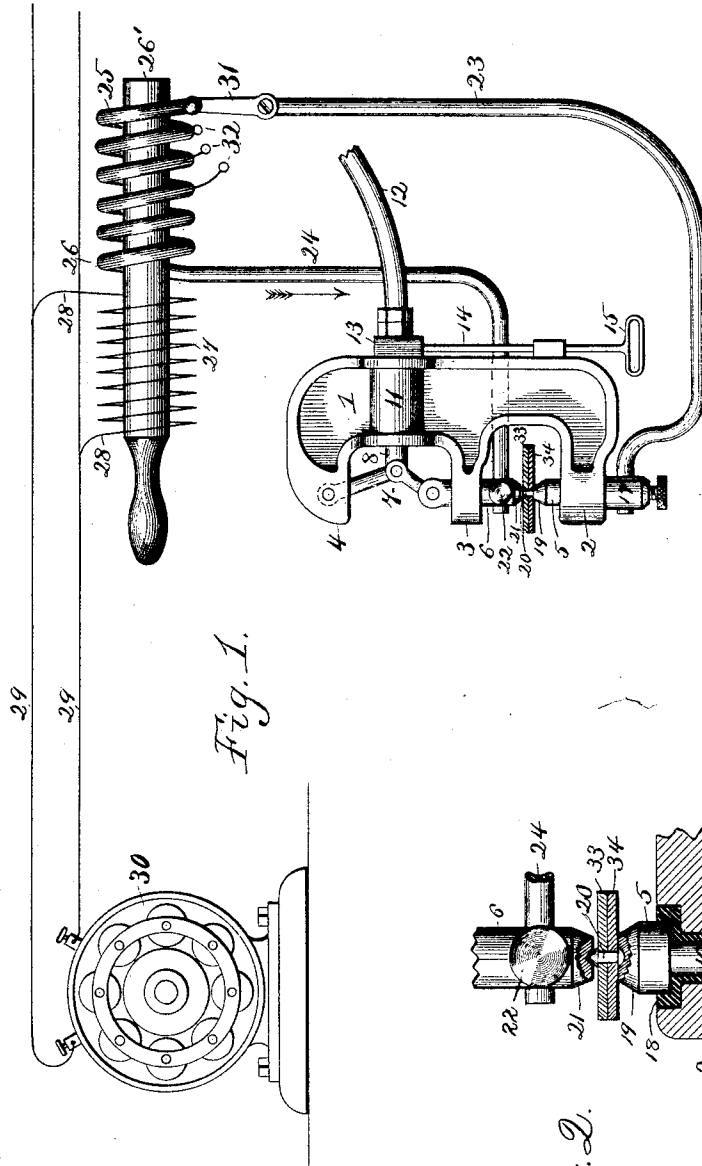


(No Model.)

E. E. RIES.
RIVETING BY ELECTRICITY.

No. 465,089.

Patented Dec. 15, 1891.



WITNESSES:

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UNITED STATES PATENT OFFICE.

ELIAS E. RIES, OF BALTIMORE, MARYLAND, ASSIGNOR TO RIES & HENDERSON,
OF SAME PLACE.

RIVETING BY ELECTRICITY.

SPECIFICATION forming part of Letters Patent No. 465,089, dated December 15, 1891.

Original application filed September 15, 1888, Serial No. 285,555. Divided and this application filed December 10, 1888. Serial No. 293,069. (No model.)

To all whom it may concern:

Be it known that I, ELIAS E. RIES, a citizen of the United States, residing at Baltimore, in the State of Maryland, have invented certain
5 new and useful Improvements in the Method or Process of Riveting by the Aid of Electricity, of which the following is a specification.

My invention has reference to a novel process of riveting in which the rivets are inserted into the holes in a cold state, are then heated to incandescence by the passage of an electric current through the same, and are maintained in that incandescent condition
15 during the operation of heading, whereby the riveting process is greatly facilitated and is accomplished with greater perfection than by the processes heretofore employed for this purpose, as set forth in my application, Serial
20 No. 285,555, filed September 15, 1888, of which this is a division.

It is common to heat rivets to incandescence before inserting the same into the hole of the plate or plates, more especially when these rivets are large, as in the manufacture of steam-boilers and other like heavy structures; but by reason of the contact of those heated rivets with the cold boiler or other plates they cool down very rapidly, and the
30 heading of the rivet is practically performed and more especially finished after the latter has cooled down to very nearly the normal temperature. This is due not only to the rapid cooling of the rivet when the same is in
35 place in the hole of the cold plate, but also to the cooling of the rivet during the transfer from the furnace where it has been heated and during the insertion into the hole. Such transfer and insertion occupies more or less
40 time, according to the distance of the furnace from the work and according to the position of the hole in the article under process. It frequently happens that the rivet-bolt, after the same has been heated to the desired degree of incandescence in the furnace, has to be grasped between the cold jaws of blacksmith's tongs, has to be carried some considerable distance to the work under process, passed from hand to hand unto the interior
50 of the boiler or other structure, and then by

a series of awkward, uncertain, and time-consuming manipulations it has to be inserted into the hole and a cold anvil placed against the head. Thus it happens that the facility of heading which is expected from the heating of the rivet becomes illusive, and, as before stated, the heading is practically done when the rivet has almost attained its normal temperature. By my improved process all this is avoided. The rivet is inserted into the hole while in a cold state with deliberation and comfort. It is then heated to any desired degree of incandescence and is maintained in that state of incandescence or at any other desired state of incandescence during the whole process of heading, so that the operation is performed upon the rivet while it is as soft as it can be made by heating.

This process may be practiced by means of a great variety of apparatus, and while I have shown one apparatus which is quite effective for the purpose of my invention it will be evident to those skilled in the art that other apparatus entirely different in form and construction may be employed. I am therefore not limited to any particular means in the practice of my invention, which is in the nature of an electro-mechanical process, pure and simple.

In the accompanying drawings, which form a part of this specification, I have illustrated in Figure 1 an elevation of one form of apparatus by means of which my improved process may be practiced, and in Fig. 2 a detail view, upon an enlarged scale, of the riveting-dies and the insulation of one of these dies.

Like numerals of reference indicate like parts in the two figures of the drawings.

The frame 1 of the riveting-machine has three parallel projecting brackets 2 3 4, the lowest one 2 supporting the anvil 5, the middle bracket 3 serving as a guide for the reciprocating die 6, and the upper bracket 4 having one of the links of a toggle 7 pivoted to it. The other link of this toggle is pivoted to the reciprocating die 6, and the toggle is actuated by a piston-rod 8 of a piston working in the cylinder 11, to which steam or compressed air is supplied by the pipe 12. The admission of steam to the cylinder is

controlled and regulated by the valve 13, actuated by the valve-rod 14, having a suitable handle 15 within convenient reach of the operator.

5 The riveting-machine so far as described is of ordinary construction, and its operation is well understood by those skilled in the art. The valve 13 is of a kind commonly used in such machines, which when turned to one
10 position admits steam behind the piston, which then actuates the toggle to raise the die 6, and when turned to another position admits steam in front of the piston, which then actuates the toggle to depress the die 6.

15 For the purposes of my invention the anvil 5 is preferably, although not necessarily, formed with a massive head, as shown in Fig. 2, and with a shank 16, which passes through the bracket 2. This shank is screw-threaded
20 at its lower end and the anvil is clamped to the bracket by a nut formed in the binding-post 17, which is screwed upon the projecting end of the shank 16. The whole anvil is insulated from the frame of the machine by an
25 insulating-bushing 18 of suitable material, as shown in Fig. 2. The upper part of the anvil is preferably formed into a truncated cone 19, and in the upper face is formed a cavity, as shown, for the reception of one end of the
30 rivet 20, which, when placed in position, may or may not have a head formed at this end.

The construction of the anvil so far described is by no means essential, since the same may be replaced by any ordinary anvil
35 of any desired size, so long as it has one or more rivet-receiving cavities formed on its upper face; but if such ordinary anvil be used it will be understood that the same must be insulated—as, for instance, by placing it upon
40 a block of wood, like any other stationary anvil—and it will be provided with suitable means for connection with an electrical conductor 23.

The die 6, as shown, is a cylindrical body
45 with a frusto-conical lower end 21, provided on its lower face with a cavity to receive the free end of the rivet. This cavity is preferably conical, but may be of any other shape to correspond to the desired form of rivet-head. The body of the die is formed into a
50 binding-post having the clamp-screw 22, and this binding-post receives a conductor 24, as shown. The two conductors 23 24 lead to the terminals of a suitable generator, which furnishes a current of great quantity and low
55 tension. It will now be understood that the current coming from the generator will pass by the conductor 24 through die and rivet, and then through the anvil back to the generator.
60 The rivet offers a resistance to the passage of the current, and becomes heated thereby, according to the current employed, to any degree of incandescence, and this heating may be continued so long as the heading-die remains in contact with the rivet, so that the
65 latter may be maintained in a soft plastic

condition until the riveting process is completed and the heading-die removed; but before the heading-die is removed and when the heading of the rivet is nearly completed it
70 will be found advisable to turn the current off gradually, so that the riveting process is practically completed when the rivet has lost all incandescence. This practice, however, may be changed, according to the material of
75 the rivet and according to the nature of the joint which it is intended to produce.

Any suitable source of electrical current, including the direct low-tension current of a dynamo or of a secondary battery, may be
80 used; but by preference I use the alternating currents of low tension and great quantity furnished by the thick-wire secondary coil 25 of a transformer 26, the fine-wire primary coil 27 of which is charged by alternating
85 currents of high tension and small quantity by the circuit 28 28, derived from a main circuit 29 29, which in turn is charged by an alternating-current dynamo 30.

The conductor 23 includes a switch-lever 31, 90 which may be moved by hand to make contact with any one of a series of contact-plates 32, connected, respectively, to different points of the secondary coil, and it will now be understood that all or a part of the secondary
95 coil may be placed in circuit with the conductors 23 24, leading to the anvil and heading-die, and thus the current regulated or entirely cut off, as desired; or in place of regulating the current by the switch this may be
100 done by moving the core 26' of the transformer within the coils, or I may use any other suitable means of controlling the current.

The whole process will now be readily understood. A rivet is placed with its head (if
105 there is a head) or with the head end upon the anvil in the cavity provided for this purpose, and the plates 33 34, to be joined by the rivet, are placed with the rivet-holes over the
110 shank of the rivet, one above the other. The operator now manipulates the valve-rod 14 to open the valve 13 (more or less) to admit steam to the cylinder in front of the piston to actuate the toggle and depress the die until
115 in contact with the rivet. The switch-lever is then operated to close the circuit and is moved until sufficient current is obtained to bring the rivet to the desired state of incandescence. More steam is then admitted to the
120 cylinder behind the piston, and the heading-die is forcibly moved downward upon the projecting end of the rivet-shank and the latter headed by a single stroke, or if it should be found necessary this operation may be repeated a number of times upon the same
125 rivet. During all this time the operator can regulate the incandescence of the rivet to a nicety by suitable manipulation of the switch-lever or of the movable core of the transformer. According to the nature of the work
130 the current may be cut off suddenly after the

rivet has been raised to the desired degree of incandescence and the heading of the rivet then proceeded with and completed, or the current may be cut off gradually while the heading is progressing, so that it is completed after the rivet has lost all incandescence.

It is not at all necessary that my process be practiced by means of the highly-organized machine shown in Fig. 1, since quite simple devices in the nature of hand-tools will be sufficient for this purpose. Thus the element of construction marked in Fig. 2 with the numeral 2 need not be a bracket forming part of the frame of a riveting-machine, but may be any suitable support for the anvil 5, or the latter may be used without a specially-constructed support. It may be held by an assistant against the head of the rivet after the latter has been inserted into the rivet-hole. Similarly the heading-die need not be actuated by a toggle which in turn is actuated by steam or compressed air or other machine-power, for it may be used like an ordinary blacksmith's heading-die, as a hand-tool, which is grasped by one hand and placed with the die-cavity over the end of the rivet-shank while the upper end of the die is struck with a hammer, as is well understood by those skilled in the art. In this case, however, the conductors 23 24 must be quite flexible, as will be readily understood; but owing to the very low tension of the currents which are employed in this process neither the anvil nor the heading-die need be insulated with special care. The most primitive insulating means will be sufficient.

In case of heavy work it is not absolutely necessary that the rivets should be inserted when in a cold state; but it may first be heated in the ordinary manner in the furnace, then inserted into the rivet-hole, and the heat lost by radiation or conduction may then be supplied electrically in the manner hereinbefore described.

Having now fully described my invention, I claim and desire to secure by Letters Patent—

1. The method or process of riveting which consists in heating the rivet when inserted in the rivet hole or holes by the passage of an electric current through the same and then heading the rivet, substantially as described.

2. The method or process of riveting which consists in first inserting the rivet into the rivet hole or holes, then heating the rivet by the passage through the same of an electric current of comparatively great quantity and

low tension, and then heading the rivet, substantially as described.

3. The method or process of riveting which consists in heating the rivet when inserted in the rivet hole or holes to the required degree of incandescence by the passage through the same of an electric current of suitable quantity and tension, then heading the rivet and maintaining the same in the desired state of incandescence by suitably regulating the current during the heading operation, substantially as described.

4. The method or process of riveting which consists in first inserting the rivet into the rivet hole or holes, then passing an electric current of comparatively great quantity and low tension through the rivet until the latter is heated to the desired degree of incandescence, then heading the rivet and at the same time maintaining the incandescence of the same by the continued flow of current, and finally gradually reducing and cutting off the current while the heading is completed, substantially as described.

5. The method or process of riveting metal structures together, which consists in first inserting a rivet into the rivet-hole, then making electrical contact between the ends of the rivet and an anvil and the heading-die, respectively, which constitute the terminals of an electric circuit, then charging said circuit with an electric current or currents until the rivet is heated to the desired degree of incandescence, and then forcing the heading-die upon the rivet until the heading operation is completed, substantially as described.

6. The method or process of riveting which consists in heating the rivet preparatory to subjecting the same to the action of suitable heading mechanism and in maintaining the same in the desired state of incandescence during the operation of heading by the passage therethrough of an electric current having the requisite heating effect, substantially as described.

7. The herein-described improved method of riveting, consisting in heating the rivet or rivet-blank electrically while in place and then heading either or both ends of the same. In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

ELIAS E. RIES.

Witnesses:

LEOPOLD RIES,
JNO. T. MADDOX.