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D. SCIAKY

METHOD AND APPARATUS FOR ELECTRIC RESISTANCE WELDING OF TUBES

Filed July 6, 1940

Serial No. 344,220

2 Sheets-Sheet 1

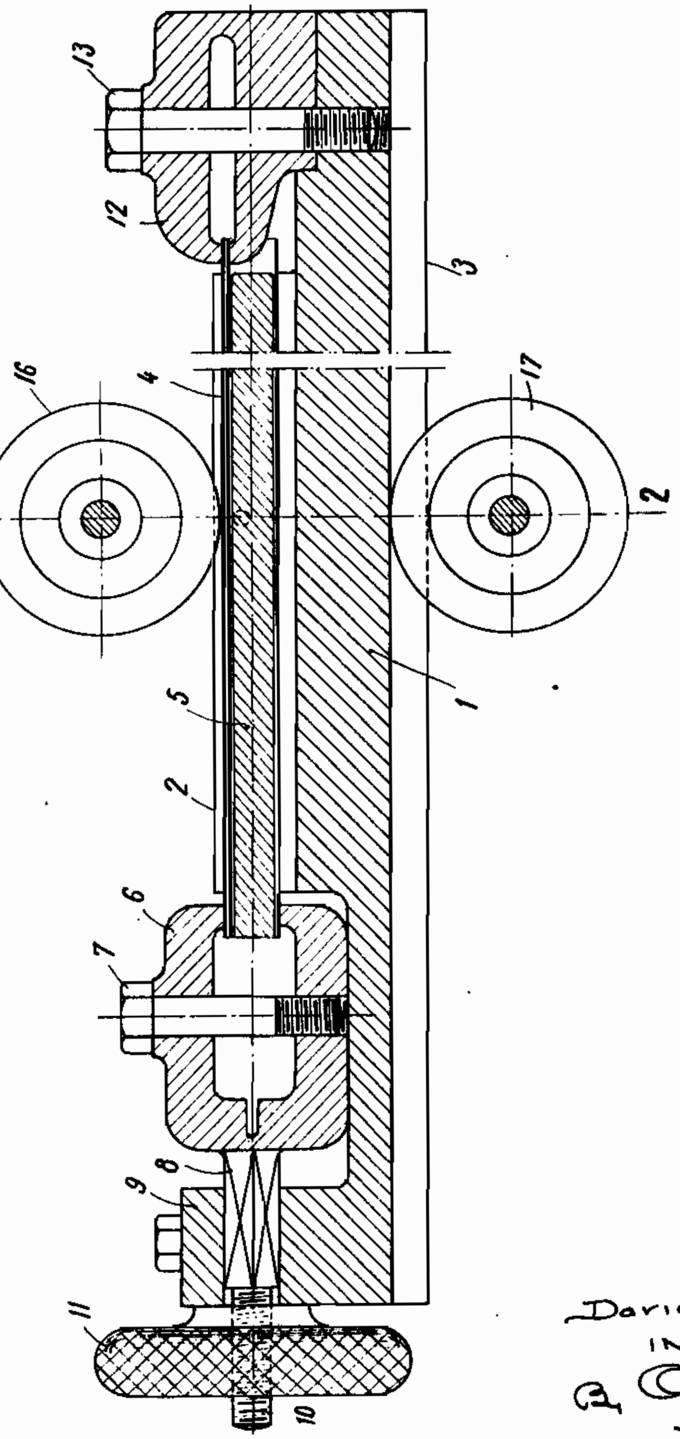

Fig. 1

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Fig.3

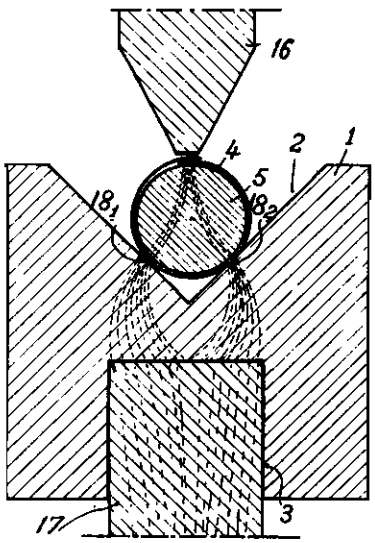


Fig.4

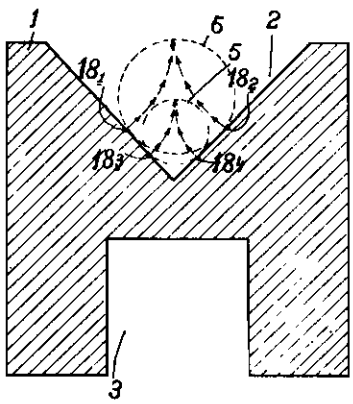


Fig.2

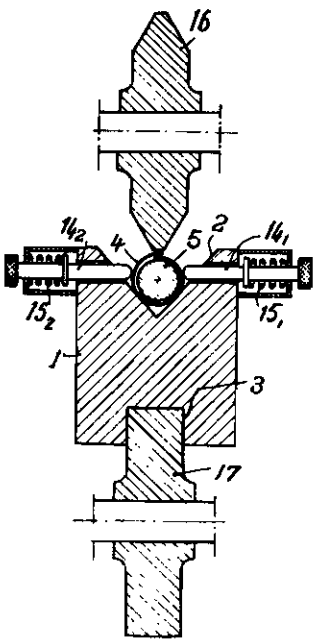
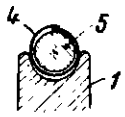


Fig.5



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ALIEN PROPERTY CUSTODIAN

METHOD AND APPARATUS FOR ELECTRIC RESISTANCE WELDING OF TUBES

David Sciaky, Paris, France; vested in the Alien Property Custodian

Application filed July 6, 1940

In the electric welding of tubes by overlapping of the margins of the tube, the work may be formed under its final shape prior to bring the same to the welding machine and, in such a case, the edges of the work are not to be brought together prior to welding the same.

However the known methods of electrical welding by overlapping of the margins of the work have the drawback to unduly overheat the work piece in the part which is adjacent to the weld. Therefore, the tube is out of shape when it is delivered from the machine and it is often necessary to subject the same to a heat treatment, follower by a reforming operation.

When using tubes of stainless austenitic steel with 18% of chrome and 8% of nickel, the heat treatment is needful and must be followed by a cold drawing operation, in view to give back to the metal the cold-hammering grade lost during the heat treatment.

This invention has for its object to avoid this drawback and to perform the electric welding of tubes by overlapping of their margins without material heating of the work and mainly of the parts of the same which are adjacent to the weld. Furthermore, the invention aims to eliminate the deformation of the tubes during the welding.

The invention relates to a method for electric welding of tubes by overlapping of the margins, characterised by the feature that the work is brought on a conducting mandrel, said work is held along two of its generative lines, the overlapped margins of the tube are longitudinally tensioned, a welding current is caused to pass between the generatrix along which the work is maintained and said overlapped margins of the tube, which enables to decrease the needless heating of the work and to cause a material part of the heat generated during the welding to escape through the way of the mandrel.

The invention relates also to an apparatus to carry out the above described method, characterised by a guiding support, which serves also as electrode, which is tangent to the work along two generatrix, and an upper welding electrode bearing on the overlapped margins of the work, which arrangement enables to guide this work along a substantial length under the welding electrode and reduces to the minimum the cross area of the flow which passes from the guiding support serving as electrode to the upper welding electrode.

According to an embodiment of the invention, the support serving as guiding electrode is V-shaped in cross section, which enables to use this support for the welding of tubes of different diameters.

Other features of the invention will appear in the following specification.

A welding apparatus according to the invention is shown by way of example in the accompanying drawings, in which:

Fig. 1 is a longitudinal sectional view of this apparatus.

Fig. 2 is a cross sectional view of said apparatus, along the line 2—2 of Fig. 1.

Fig. 3 is a diagrammatic view illustrating the flow of welding current.

Fig. 4 is a diagrammatic view illustrating the manufacture of tubes having different diameters in the same apparatus.

Fig. 5 is a cross-sectional view illustrating another embodiment.

The apparatus shown in Figs. 1 and 2 is provided with a horizontal support 1, on which the tube is supported and which serves also as electrode. This tube support may slide longitudinally. It is provided with a V-shaped cavity in its upper part along a length which is substantially equal to that of the work to be welded and, in its under part, it is provided with a groove 3 extending along its full length to serve as a track for a roller acting as electrode.

The work 4, whose margins are overlapped, is placed on a mandrel 5 and the whole is laid down in the cavity 2, so as to have the overlapped margins of the work on the upper part of the mandrel 5. The left part of the work and also of the mandrel is clasped in the pinching device 6 provided with flexible arms 6, the screw 7 serving to this purpose. This pinching device is extended rearwards to a squared rod 8, which slides longitudinally in the part 9 integral with the support 1. The squared part 8 is extended by a screw-threaded rod 10 upon which is screwed a nut 11 which rests on the support 1. By screwing the nut 11, the pinching device 6 is caused to draw the work 4 in the longitudinal direction, together with the mandrel 5.

The right end of the work has its overlapped part clasped by the pinching device 12 provided with flexible arms by means of the screw 13. This pinching device is also secured to the support 1.

The whole of the work and of the mandrel is also secured crosswise by any suitable means, such as spring-pressed bolts 14^1, 14^2. These bolts are pressed by springs 15^1, 15^2, which slide in the support 1 and push the work on the mandrel, whilst a free movement is permitted to the upper roller 16.

A stationary roller 17 serving as electrode constitutes a pole of the source of current; this roller is placed under the support 1 and bears against the latter in depth part of the under groove 3. A roller 16 serving as electrode constitutes the other pole of the source of current and is vertically movable by any suitable means; this roller bears on the overlapped margins of the work 4

and is arranged in the same vertical plane as the under roller 17.

The source of current is generally constituted by a static transformer, whose primary winding is connected to the supply main and whose secondary winding, connected at its ends to the rollers 16 and 17, delivers a current of low voltage and of very high amperage.

The support 1, the mandrel 5 and the rollers 6 and 7 serving as electrodes are of a metal which is a good conductor, e. g. of red copper.

The operation of the welding apparatus is as follows:

The work 4, provided with its mandrel, is placed in the cavity 2 of the support, with the part to be welded turned upwards; the two overlapped margins of one end are clasped in the gripping device 12 by tightening the screw 13. The pinching device 6 is then slidably moved towards the other end of the work; this end is clasped together with the mandrel through the screw 7. When the nut 11 is rotated, the pinching device is drawn, so as to tension the work in the longitudinal direction, particularly the upper part of the same.

The upper roller 7 is pressed on the overlapped margins of the work and the whole of the support 1, the work 4 and the mandrel 5 are moved longitudinally between the stationary rollers 16 and 17 serving as electrodes.

The electric flow follows the track shown in Fig. 3. It comes to the upper roller 16, concentrating itself in the overlapped margins of the work 4, whence it divides itself into two symmetrical derivations, each passing through the lateral line of contact of the work 4 with the support 1. This line passes substantially at the points 18^1 and 18^2 shown in the cross-sectional view of Fig. 3. Both derivations of the flow are united together at the line of contact of the lower roller 17 with the support 1. The longitudinal displacement of the whole of the support 1 may be performed by any known mechanical or electrical means. In the embodiment shown by way of example in the drawings, both rollers 16 and 17 serving as electrodes may be driving rollers; however it is easy to imagine that both rollers will be loose on their respective shafts and that the whole of the support 1 shall be displaced by a toothed rod or any other suitable means.

By way of example, the speed of displacement of the support may be of the order of 7 to 70 feet per minute. The gripping pressure of the electrodes may be of the order of 300 to 1500 pounds per square inch according to the diameter of the work, the sort of the metal and its thickness. The electric current may be passed step by step between the rollers 6 and 7 so as to make very close welding points; by way of example, with a current of 50 cycles per second, it is possible to cause this current to pass during two cycles in each series of eight.

The above described device has the following advantages:

1. The work is tensioned in the longitudinal direction so as to prevent its deformation under the welding heat. It is to be observed from the Fig. 1 that at one end, the work and the mandrel are held together by the pinching device 6, whilst at the other end only the upper end of the work is clasped by the pinching device 12. This enables to tension easily the work at its upper part without this tension may be counteracted by the mandrel 5.

2. The guiding support 1, which is tangent to the work along its generatrix 18^1 and 18^2, secures the contact and the guidance of this work along a considerable length under the welding roller.

3. The electrical flow pass through the work 4 at the point of contact of the roller 16 with the overlapped margins of this work on the one hand and at the lateral points of rest 18^1 and 18^2 of the work on the V-shaped support 1 on the other hand. This arrangement eliminates the undue heating of the cross area of the work between the two lateral points of rest 18^1 and 18^2 and the weld. The power amount which is necessary for the welding operation is thus reduced to the minimum.

4. The mandrel 5, inserted in the work and extending in the whole length thereof, performs all operations comprising the transmission of the pressure power on the weld, the conduction of the welding current and the evacuation of a considerable part of the heat evolved by the welding operation. It is thus possible to weld tubes having very small diameters, because no access is necessary in the interior of the work in view to perform any mechanical or electrical operation.

5. The tube of austenitic steel (e. g. of stainless steel having 18% of chrome and 8% of nickel) are subject to lose their corrosion resisting properties under an undue heating. When the method according to this invention is used for such tubes, an injury of the metal is avoided by the suppression of the heating of the tube in the cross area of the tube between the lateral points of rest 18^1 and 18^2 and the weld, and also by the quick evacuation of the heat in the mandrel 5, which is a good conductor.

It is also possible to use for the production of the work a band of metal which is hard-hammered by cold rolling without the risk to lose the high mechanical strength of the metal.

With the above-described method, it is now possible to weld in securing a very accurate diameter and the above-mentioned advantages very thin tubes, e. g. of steel alloys, special chrome-nickel steel, light alloys, etc.

This method enables also to obtain a very quick manufacture, because the suppression of the prejudicial heating make possible the use of welding currents having a considerable amperage.

The shape of the support 1 was shown only by way of example.

In fact, other shapes are possible for this support. Particularly, instead to have a V-shaped support, it is possible to use a half-circular support (Fig. 5), the work being also in contact with said support by two generatrix.

In addition to the above-mentioned advantages, the V-shape enables to weld, on a single support, works having different diameters. These works may also have an oval, rectangular or other suitable cross-sectional shape, the shape of the support being always such as to ensure the contact with the work along two opposite generatrix of the latter.

The mandrel 5 may be provided with a longitudinal bore to enable an intense cooling by a current of water or other suitable fluid.

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