

PATENT SPECIFICATION (11)

1587743

- (21) Application No. 44663/77 (22) Filed 27 Oct. 1977 (19)
(31) Convention Application No. 14144/76 (32) Filed 10 Nov. 1976 in
(33) Switzerland (CH)
(44) Complete Specification published 8 April 1981
(51) INT. CL.³ B23K 11/06
(52) Index at acceptance
B3R 10 14 2H2 2H3 60 63B



(54) IMPROVEMENTS IN OR RELATING TO ELECTRICAL RESISTANCE ROLL SEAM WELDING MACHINES SCIENCE REFERENCE LIBRARY

(71) We, FAEL S.A., a Swiss Body Corporate, of Musinière 17, CH-2072 Saint-Blaise, Switzerland, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to electrical resistance roll seam welding machines.

There have been proposed electrical resistance roll seam welding machines (which are also referred to as resistance roll welding machines) in which an electrode wire, which is in a continuously tensioned state, is pulled around the periphery of at least one of the roller electrodes by means of a traction device. Movement of the wire is effected solely by the traction device, and the wire also drives the roller electrodes and the workpiece passing between the electrodes during the welding operation. As a result, the electrode wire is exposed to a relatively high tensional stress over its length which can lead to appreciable elongation of the wire. This in turn can result in difficulties with respect to the synchronization of the wire drive, and the transport device for bringing the workpieces to be welded to the electrodes. Therefore special measures are required in order to eliminate the effects of lengthwise elongation of the electrode wire following termination of each welding operation by freely retightening the wire.

According to the invention, there is provided an electrical resistance roll seam welding machine comprising a pair of roller electrodes, a supply station for supplying an electrode wire to at least one of the electrodes to be pressed thereby against the workpiece, drive means for driving at least that one of the electrodes to which the wire is supplied, a collecting station for receiving used wire, a braking device for the electrode wire, said braking device being disposed between the supply station and the electrode, and a traction device for the electrode wire, said traction device being disposed between the electrode and the collecting station, and said traction device comprising an adjustable

torque electrical motor for adjusting the traction force exerted by the traction device on the wire, the braking device and traction device being such that, in use of the machine, the electrode wire can be continuously tensioned with any difference between the tractive force exerted on the wire by the traction device and the braking force exerted on the wire by the braking device being less than the entraining force exerted on the wire by the electrode.

An embodiment of the invention will now be described, by way of example only, with reference to the accompanying diagrammatic drawings, in which:

Figures 1A, 1B and 1C are respective side views illustrating different components of a resistance welding machine according to the present invention;

Figure 2 is a top plan view of certain of the components of the welding machine shown in Figure 1A; and

Figure 3 is a top plan view, analogous to the showing of Figure 2, of certain of the components of the welding machine shown in Figure 1C.

With reference to the drawings, it is to be appreciated that only enough of the structure of the resistance roll seam welding machine has been shown in order to enable one skilled in the art to readily understand the underlying principles and concepts and to simplify the illustration.

In Figure 1a, reference numerals 11 and 12 respectively designate a lower and an upper roller electrode. Between the lower electrode 11 and the upper electrode 12 there travel the workpiece parts which are to be welded to one another, for instance cylindrically rolled can shells of jackets. The lower electrode 11 is freely rotatably mounted by means of a stationary shaft 13 on an arm 10a of the machine frame 10. The upper electrode 12 on the other hand is fast for rotation with a shaft 14, which, as shown in Figure 2 is rotatably mounted in a bearing housing 15 disposed at an axial spacing laterally of the electrode 12.

The end of the shaft 14 remote from the electrode 12 is operatively connected by means of a flexible coupling 16 with an 100

intermediate shaft 17, which, in turn, is coupled by means of a flexible coupling 18 with the power take-off shaft 19 of a transmission or gearing 20. Flanged to the housing of the transmission or gearing 20 is an electrical drive motor 21 serving to drive the electrode 12. The rotational speed of the electrode 12 can be infinitely varied within wide limits.

The end of the shaft 14 carrying the electrode 12 is movably guided in vertical direction by means of a guide bearing 25. As shown in Figure 1A, a spring 26 or equivalent means downwardly biases the guide bearing 25, in order to bias resiliently the upper electrode 12 towards the lower electrode 11 and to produce the necessary welding pressure. This movement of the shaft 14 is possible for any random rotational position of the shaft 14 by virtue of the provision of the flexible couplings 16 and 18.

In conventional manner, a low-voltage winding of a welding transformer (not shown) is connected both with the machine frame 10 and with the bearing housing 15 which is electrically insulated from the machine frame 10. The flexible couplings 16 and 18 are electrically insulated, so that also the shaft 14 and the upper electrode 12 are electrically insulated from the machine frame 10. The rotary bearings between the shaft 13 and the lower electrode 11 and between the bearing housing 15 and the shaft 14 are constructed to transmit the welding current from the stationary to the rotatable part and vice versa.

In order to prevent a coating of molten tin from being formed on the electrodes 11 and 12 when welding workpiece blanks or parts formed of tin plate, an electrode wire 30 formed of a good electrically conducting material, such as for instance copper, is guided in conventional manner over a part of the periphery of each electrode 11 and 12, so that the tin on the surface of the tin plate and which melts during the welding operation does not adhere to the electrode, but instead adheres to the electrode wire 30 and is transported away therewith.

As best seen by referring to Figure 1B, the electrode wire 30 is withdrawn from a supply container 31 constituting a supply station for fresh or unconsumed electrode wire, and is then guided over a brake device 32 and guide and deflecting rolls 33 and 34, which are rotatably mounted on the machine frame 10 (Figure 1A), to the lower electrode 11. After looping around the lower electrode 11, the electrode wire 30 travels over further guide and deflecting rolls 35, 36 and 37, rotatably mounted on the machine frame 10, to the upper electrode 12 and is likewise looped around this electrode. Thereafter, the electrode wire 30 is fed via an inclined guide and deflecting roll 38 to a traction device 40,

illustrated in detail in Figure 1C, which delivers the wire to a chopper 41 or equivalent structure. The pieces of the electrode wire which are cut by the chopper 41 are collected in a collecting container 42 defining a collecting station for consumed wire. The course of travel of the electrode wire 30 has been indicated by the arrows in Figures 1A, 1B and 1C.

The already mentioned brake device 32 (Figure 1B) comprises a rotatably mounted drum 50 about which there is wrapped a number of times the electrode wire 30. Co-operating with the drum 50 is a brake shoe 51 mounted on a pivotable lever 52. This pivotable lever 52 is biased by a spring 53 or other suitable resilient means, which thereby serves to press the brake shoe 51 against the drum 50. Furthermore, there is rotatably mounted on the lever 52 a dancer roll 54 over which travels the electrode wire 30. The arrangement is carried out in such a fashion that due to the tension of the electrode wire upon the lever 52 there is exerted a rotational moment which is opposite to the action of the spring 53. With increasing tension in the electrode wire 30 the pressure of the brake shoe 51 upon the drum 50 diminishes.

As best seen by referring to Figure 1C, the traction device 40 comprises two drums 60 and 61 which are arranged adjacent one another such that their shafts 60a and 70 are generally parallel. The electrode wire 30 is wrapped a number of times alternatively about one half of the periphery of the drum 60 and about one-half of the periphery of the drum 61. By means of an endless band 63, which is guided over three deflecting rolls 64, 65 and 66, the wire windings are pressed against the periphery of the drum 61. The shaft 66a of at least the roll 66 is biased by a spring 67 which thereby tensions the endless band 63 and maintains a run thereof continuously in contact with the periphery of the drum 61. Whereas the one drum 60 is freely rotatable, the other drum 61 is fast for rotation with shaft 70 which, as shown in Figure 3, is in driving connection by means of a chain drive 71 with the shaft 72 of an electrical drive motor 73. The motor 73 is an asynchronous motor which is powered by an electrical control device 74 from an alternating-current power distribution network. The control device 74 possesses conventional circuitry for the phase control, and the ignition point can be adjusted within each alternating-current voltage half wave by means of an adjustment element 75, in order to be able to control the torque or rotational moment produced by the asynchronous motor 73. After the electrode wire 30 has moved past the traction device 40 the electrode wire is pushed into a guide tube 80 (Figure 1C), by means of which the wire is fed to the previously mentioned chopper.

By means of the device 32 (Figure 1B) there is a traction device 40 which is not so pull the electrode wire 30. The electrode wire 30 is transported off the collecting container 31. With the adjustment of the motor 73, the exerted force on the electrode wire 30 is varied. The speed of the electrode wire 30 is controlled by the device 74. The electrode wire 30 is transported off the collecting container 31. The electrode wire 30 is transported off the collecting container 31. The electrode wire 30 is transported off the collecting container 31.

With the adjustment of the motor 73, the exerted force on the electrode wire 30 is varied. The speed of the electrode wire 30 is controlled by the device 74. The electrode wire 30 is transported off the collecting container 31. The electrode wire 30 is transported off the collecting container 31. The electrode wire 30 is transported off the collecting container 31.

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By means of the traction device 40 (Figure 1C) there is exerted upon the electrode wire 30 a tractive force, whereas at the same time the brake device 32 (Figure 1B) exerts a braking force upon the wire. The sum of the tractive force and braking force must be sufficient to maintain the electrode wire 30 tensioned during its travel from the brake device 32 to the traction device 40. On the other hand, the tractive force exerted by the traction device 40 upon the electrode wire 30 is not so great that it would be adequate to pull the electrode wire 30 through the welding machine. It is possible to adjust the tractive force of the tension device 40 and the braking force of the brake device 32 to be either approximately of the same or exactly of the same magnitude. Any difference between the tractive force produced by the traction device 40 and the brake force exerted by the brake device 32 is smaller than the entrainment force exerted by friction by the driven electrode 21 upon the electrode wire 30. Consequently, the feed movement of the electrode wire 30 is exclusively determined by the rotational speed of the driven electrode 12. The traction device 40 merely transports the electrode wire which travels off the electrode 12 to the chopper 41 and to the collecting container 42 for the consumed wire.

With the aid of the control device 74 and the adjustment element 75 there can be varied and controlled the torque exerted by the motor 73 and thus also the traction force exerted by the traction device 40 upon the electrode wire 30 (Figure 3). The traction force therefore can be optimally adjusted to the specific operating conditions of the welding machine, such as for instance welding speed, quality of the electrode wire and so forth. Also the braking force of the brake device 32 can be adjusted by adjusting the spring 53 (Figure 1B). Furthermore, by means of the dancer roll 54 and the lever 52 there is achieved the beneficial result that during operation, the braking force exerted by the brake device upon the electrode wire is automatically maintained at least approximately constant.

The described manner of guiding the electrode wire and the wire drive affords the following advantages: the tensional forces which are present in the electrode wire 30 are in toto smaller than those prevailing for the equipment where the wire is driven through the entire welding machine exclusively by a traction device. The feed movement of the electrode wire 30 is exclusively determined by the driven roller electrode 12, the peripheral speed of which also governs the welding speed. The welding speed therefore cannot be influenced by the tension forces and brake forces exerted upon the electrode wire. Therefore, surge-like or intermittent tension

fluctuations possibly exerted by the dancer roll 54 upon the wire have practically no effect upon the welding speed. Finally, it is also advantageous that the means provided for the wire drive are exposed to only a relatively small influence of the mass.

In the welding machine described, the disadvantages of the previously proposed machines discussed earlier, are avoided and there is no need for any means for re-tightening of the wire following each welding operation. The machine described is relatively simple in construction extremely reliable in operation, not readily subject to breakdown or malfunction, and requires a minimum of maintenance and servicing.

The welding speed is fixed by directly driving one of the electrodes independently of any possible elongation of the electrode wire. The traction device at the end of the path of travel of the wire simply has the function of ensuring that there is present a sufficient tension in the wire, so that it does not become slack, and of positively drawing the wire from the electrodes and to convey the wire to the collecting station.

WHAT WE CLAIM IS:—

1. An electrical resistance roll seam welding machine comprising a pair of roller electrodes, a supply station for supplying an electrode wire to at least one of the electrodes to be pressed thereby against the workpiece, drive means for driving at least that one of the electrodes to which the wire is supplied, a collecting station for receiving used wire, a braking device for the electrode wire, said braking device being disposed between the supply station and the electrode, and a traction device for the electrode wire, said traction device being disposed between the electrode and the collecting station, and said traction device comprising an adjustable torque electric motor for adjusting the traction force exerted by the traction device on the wire, the braking device and traction device being such that, in use of the machine, the electrode wire can be continuously tensioned with any difference between the tractive force exerted on the wire by the traction device and the braking force exerted on the wire by the braking device being less than the entraining force exerted on the wire by the electrode.

2. A welding machine according to claim 1, wherein the traction device further comprises a drum about which the electrode wire is trained, said adjustable torque motor being operative to drive said drum.

3. A welding machine according to claim 2, wherein the traction device further comprises a second drum about which the electrode wire is trained, the two drums being arranged in parallel relationship.

4. A welding machine according to claim 130



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By means of the traction device 40 (Figure 1C) there is exerted upon the electrode wire 30 a tractive force, whereas at the same time the brake device 32 (Figure 1B) exerts a braking force upon the wire. The sum of the tractive force and braking force must be sufficient to maintain the electrode wire 30 tensioned during its travel from the brake device 32 to the traction device 40. On the other hand, the tractive force exerted by the traction device 40 upon the electrode wire 30 is not so great that it would be adequate to pull the electrode wire 30 through the welding machine. It is possible to adjust the tractive force of the tension device 40 and the braking force of the brake device 32 to be either approximately of the same or exactly of the same magnitude. Any difference between the tractive force produced by the traction device 40 and the brake force exerted by the brake device 32 is smaller than the entrainment force exerted by friction by the driven electrode 21 upon the electrode wire 30. Consequently, the feed movement of the electrode wire 30 is exclusively determined by the rotational speed of the driven electrode 12. The traction device 40 merely transports the electrode wire which travels off the electrode 12 to the chopper 41 and to the collecting container 42 for the consumed wire.

With the aid of the control device 74 and the adjustment element 75 there can be varied and controlled the torque exerted by the motor 73 and thus also the traction force exerted by the traction device 40 upon the electrode wire 30 (Figure 3). The traction force therefore can be optimally adjusted to the specific operating conditions of the welding machine, such as for instance welding speed, quality of the electrode wire and so forth. Also the braking force of the brake device 32 can be adjusted by adjusting the spring 53 (Figure 1B). Furthermore, by means of the dancer roll 54 and the lever 52 there is achieved the beneficial result that during operation, the braking force exerted by the brake device upon the electrode wire is automatically maintained at least approximately constant.

The described manner of guiding the electrode wire and the wire drive affords the following advantages: the tensional forces which are present in the electrode wire 30 are in toto smaller than those prevailing for the equipment where the wire is driven through the entire welding machine exclusively by a traction device. The feed movement of the electrode wire 30 is exclusively determined by the driven roller electrode 12, the peripheral speed of which also governs the welding speed. The welding speed therefore cannot be influenced by the tension forces and brake forces exerted upon the electrode wire. Therefore, surge-like or intermittent tension

fluctuations possibly exerted by the dancer roll 54 upon the wire have practically no effect upon the welding speed. Finally, it is also advantageous that the means provided for the wire drive are exposed to only a relatively small influence of the mass.

In the welding machine described, the disadvantages of the previously proposed machines discussed earlier, are avoided and there is no need for any means for retightening of the wire following each welding operation. The machine described is relatively simple in construction extremely reliable in operation, not readily subject to breakdown or malfunction, and requires a minimum of maintenance and servicing.

The welding speed is fixed by directly driving one of the electrodes independently of any possible elongation of the electrode wire. The traction device at the end of the path of travel of the wire simply has the function of ensuring that there is present a sufficient tension in the wire, so that it does not become slack, and of positively drawing the wire from the electrodes and to convey the wire to the collecting station.

WHAT WE CLAIM IS:—

1. An electrical resistance roll seam welding machine comprising a pair of roller electrodes, a supply station for supplying an electrode wire to at least one of the electrodes to be pressed thereby against the workpiece, drive means for driving at least that one of the electrodes to which the wire is supplied, a collecting station for receiving used wire, a braking device for the electrode wire, said braking device being disposed between the supply station and the electrode, and a traction device for the electrode wire, said traction device being disposed between the electrode and the collecting station, and said traction device comprising an adjustable torque electric motor for adjusting the traction force exerted by the traction device on the wire, the braking device and traction device being such that, in use of the machine, the electrode wire can be continuously tensioned with any difference between the tractive force exerted on the wire by the traction device and the braking force exerted on the wire by the braking device being less than the entraining force exerted on the wire by the electrode.

2. A welding machine according to claim 1, wherein the traction device further comprises a drum about which the electrode wire is trained, said adjustable torque motor being operative to drive said drum.

3. A welding machine according to claim 2, wherein the traction device further comprises a second drum about which the electrode wire is trained, the two drums being arranged in parallel relationship.

4. A welding machine according to claim 130

3. wherein the second drum is freely rotatable.

5. A welding machine according to any one of claims 2 to 4, wherein the traction device further comprises an endless band for pressing the electrode wire against the periphery of the driven drum, said endless band passing over a plurality of deflecting rollers, and spring means acting upon at least one of the deflecting rollers to exert a contact force between a run of the endless band and the periphery of the driven drum.

6. A welding machine according to any one of claims 1 to 5, wherein the braking device comprises a brake drum about which the electrode wire is trained, a brake for braking the brake drum, a dancer roll carried by a pivotable arm, the electrode wire being guided by the dancer roll after it leaves the brake drum, and the pivotable arm being operatively connected with the brake, and a spring acting upon said pivotable arm, the pivotable arm being pivotable under the influence of said spring and the tension force transmitted from the electrode wire by means of the dancer roll in such a manner that the braking force exerted by the brake device upon the electrode wire can remain at least approximately constant.

7. A welding machine according to any one of claims 1 to 6, comprising means for guiding the electrode wire to pass around both of the electrodes.

8. An electrical resistance roll seam welding machine substantially as hereinbefore described with reference to the accompanying drawings.

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Printed for Her Majesty's Stationery Office by Burgess & Son
(Abingdon) Ltd.—1981. Published at The Patent Office,
25 Southampton Buildings, London, WC2A 1AY,
from which copies may be obtained.



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