

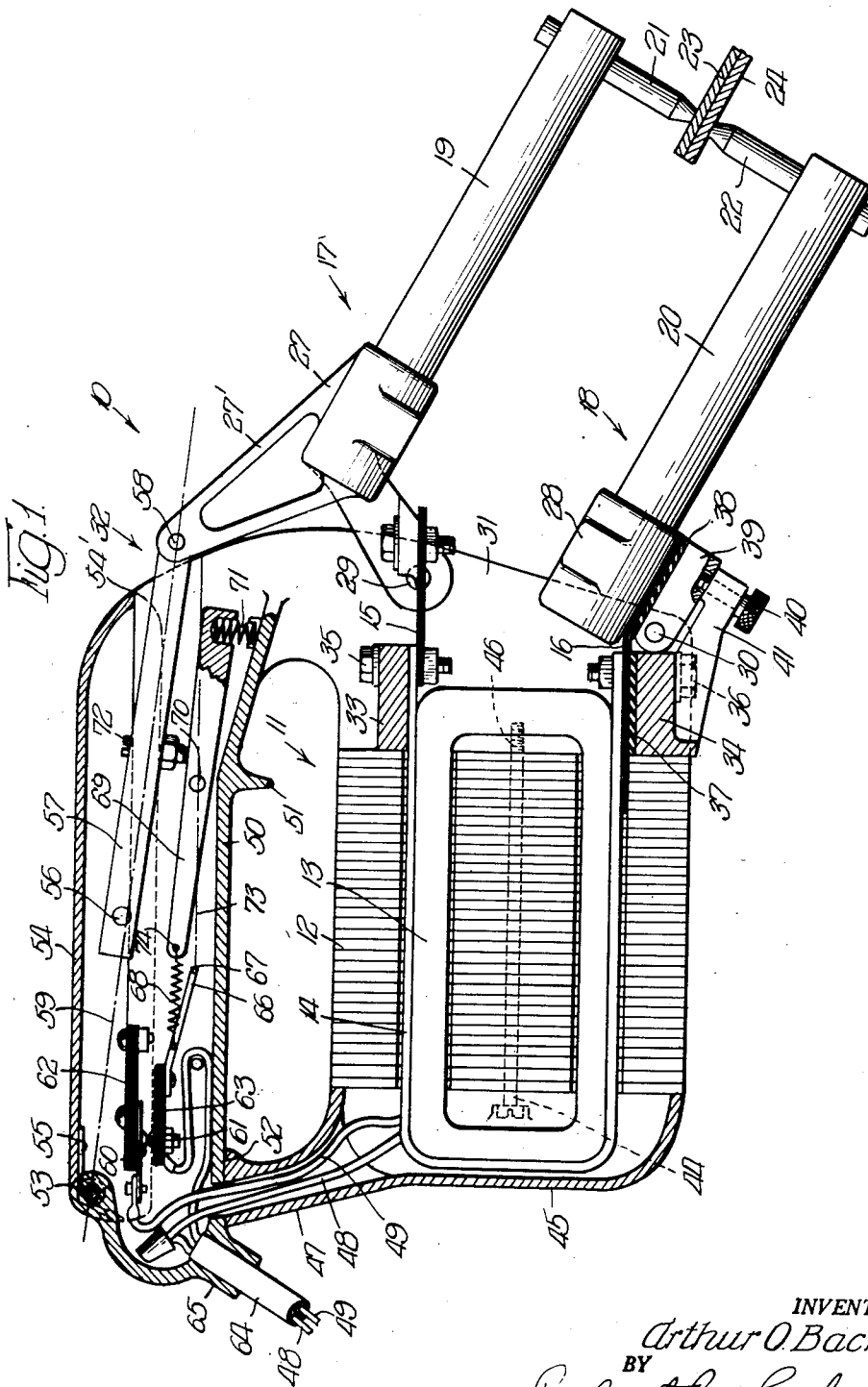
Sept. 8, 1953

A. O. BACKEN
PORTABLE SPOT WELDER

2,651,701

Filed April 17, 1951

4 Sheets-Sheet 1



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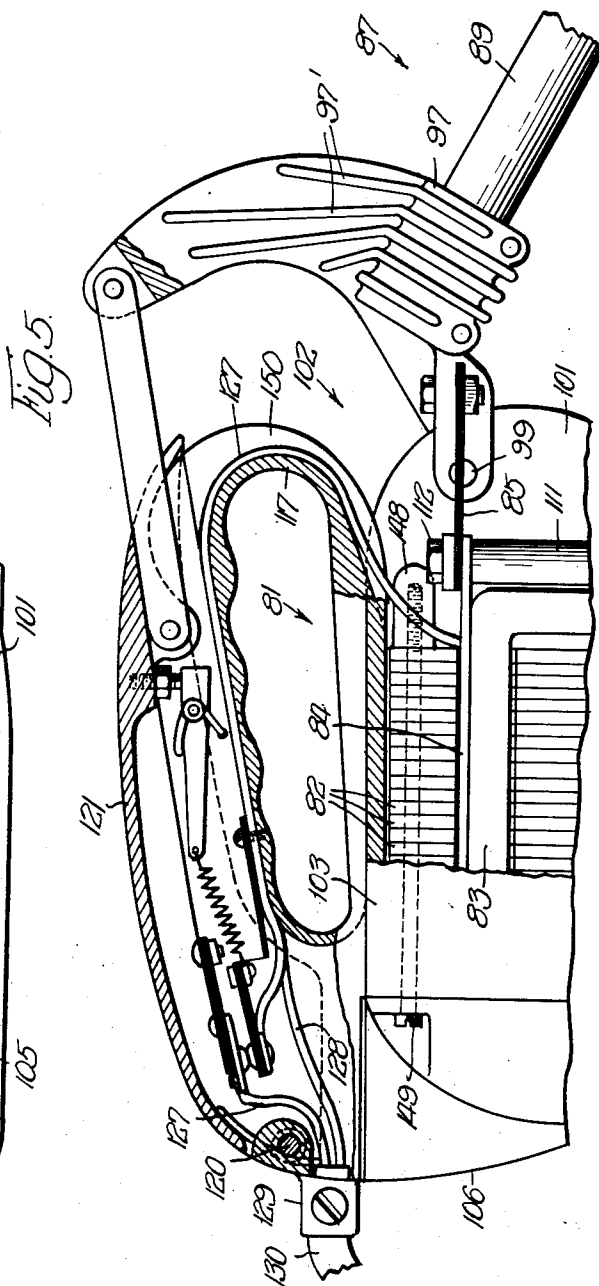
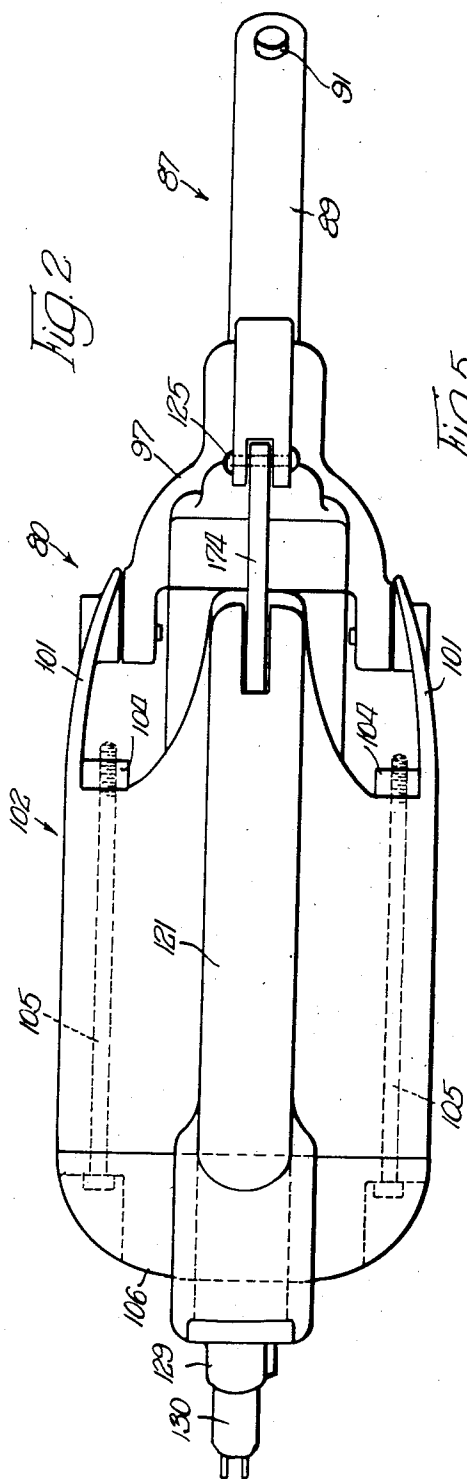
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4 Sheets-Sheet 2



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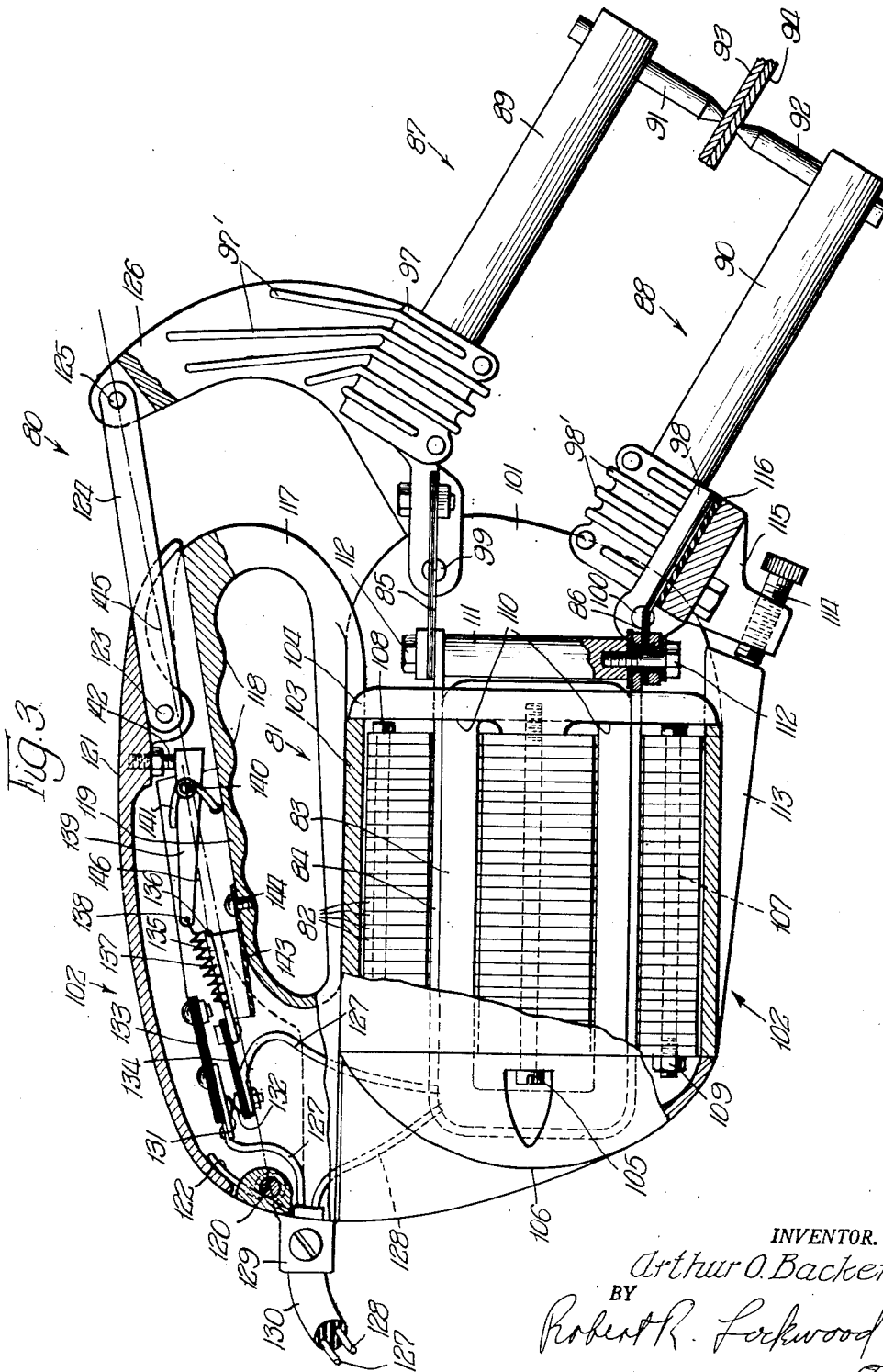
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4 Sheets-Sheet 3



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PORTABLE SPOT WELDER

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Application April 17, 1951, Serial No. 221,393

3 Claims. (Cl. 219-4)

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This invention relates generally to electric welders and it has particular relation to relatively small spot welders that are readily portable and can be lifted bodily and be manipulated by one hand of an operator.

Among the objects of this invention are: To provide a portable spot welder that will be simple and efficient in operation and which can be readily and economically manufactured; to apply operating pressure to the work between the electrodes or jaws by relatively slight movement between the welder and an operating lever pivoted thereon; to energize the transformer of the welder by continued movement of the operating lever after predetermined pressure is applied to the work and for deenergizing it by reverse movement of the operating lever while pressure is still being applied to the work; to effect the energization by means of a switch operated by an over center toggle mechanism that, in turn is controlled by another toggle mechanism made up in part by the operating lever; to bring the energizing conductors into the rear end of the handle provided for carrying the welder; to bring the energizing conductors for the primary winding out of the forward end of the carrying handle; to provide a frame around the core of the transformer with the carrying handle integral therewith and with forwardly projecting ears on which the welding electrodes or jaws are mounted; to pivotally mount both of the electrodes or jaws and to provide for adjusting one of them to compensate for wear or erosion of the electrode tips; and to increase the heat radiating surfaces of the electrodes or jaws and the parts associated therewith.

Other objects of this invention will, in part, be obvious and in part appear hereinafter.

This invention is disclosed in the embodiments thereof shown in the accompanying drawings and it comprises the features of construction, combination of elements and arrangement of parts which will be exemplified in the constructions hereinafter set forth and the scope of the application of which will be indicated in the appended claims.

For a more complete understanding of the nature and scope of this invention, reference may be had to the following detailed description, taken together with the accompanying drawings, in which:

Figure 1 is a view, partly in side elevation and partly in longitudinal section, of one embodiment of the invention;

Figure 2 is a top plan view of another embodi-

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ment of the invention, the view here being a top plan view of the welder shown in Figure 3;

Figure 3 is a view, partly in side elevation and partly in section, illustrating another embodiment of the invention;

Figure 4 is a view, in side elevation, of the embodiment of the invention shown in Figures 2 and 3, the operating lever being illustrated in the retracted position with the electrodes or jaws separated for receiving work therebetween;

Figure 5 is a view, similar to the upper portion of Figure 3, and illustrating a modification of the manner in which the frame is secured to the core;

Figure 6 is a view, in side elevation, of the embodiment of the invention shown in Figure 5; and

Figure 7 is a view, partly in side elevation and partly in section, showing a modified form of electrode tip construction.

Referring now particularly to Figure 1 of the drawings, it will be observed that the reference character 10 designates, generally, a portable spot welder which includes a transformer that is indicated, generally, at 11. The transformer 11 includes a laminated core 12 which is made up of a stack of laminations suitably shaped as well understood by those skilled in the art. The laminated core 12 surrounds a primary winding 13 which has a relatively large number of turns and is arranged to be energized from an alternating current source having a voltage of the order of from 200 to 230 volts. The transformer 11 also includes a secondary winding 14. In the particular embodiment of the invention shown the secondary winding 14 comprises a single turn of relatively large cross section conductor, such as a copper strap. The secondary winding 14 is arranged to operate at low voltage and to supply relatively high current through flexible conductor straps 15 and 16 to welding electrodes or jaws that are shown generally at 17 and 18. Each of the welding electrodes or jaws 17 and 18 is made up of a jaw member 19 and 20, respectively, which have welding tips 21 and 22 at their outer ends extending at right angles toward each other. Preferably the jaw members 19 and 20 are formed of good conducting material such as round copper rods. As shown in the drawing the welding tips 21 and 22 are arranged to engage the opposite sides of sheet metal strips 23 and 24, which constitute the work, for welding them together by passage of relatively heavy current therethrough. It will be understood that other shapes and forms

of work can be welded, the strips 23 and 24 being shown for illustrative purposes only.

Each of the jaw members 19 and 20 is carried by a support bracket 27 and 28, respectively, which are pivoted at 29 and 30 between ears, one of which is shown at 31, which form a part of a frame, shown generally at 32, for carrying the transformer 11. Between the ears 31 there are provided cross members 33 and 34 which are integral therewith and which bear against the adjacent end of the stack of laminations forming the core 12. Bolts 35 and 36 extend through the cross members 33 and 34 and are provided for the purpose of interconnecting the flexible conductor straps 15 and 16 to the respective ends of the U-shaped single turn secondary winding 13. Strips of insulation 37 and 38 underlie the flexible conductor strap 16 and bracket 28 for the purpose of insulating them and the associated parts from the frame 32. It will be observed that the support bracket 28 is carried by a support member 39 which is pivoted at 30 between the ears 31 of the frame 32. In order to compensate for wear of the welding tips 21 and 22 it is desirable to provide for adjusting the position of one of the welding jaws 17 or 18. For this purpose provision is made for adjusting the position of the welding electrode or jaw 18. This is accomplished by an adjusting screw 40 which is threaded through a bracket 41 that is integral with the cross member 34 forming a part of the frame 32. The end of the adjusting screw 40 bears against the underside of the support member 39, and on rotation of the adjusting screw 40, it is understood that the position of the welding electrode or jaw 18 is changed with respect to the position of the welding electrode or jaw 17.

With a view to securely mounting the transformer 11 on the frame 32 and for holding the laminations of the core 12 together as a single unit, through bolts 44 are provided. It will be observed that the bolts 44 extend through an end cap 45 which is located at the left hand end of the laminated core 12. As shown they extend through the laminated core 12 and are threaded at 46 into the adjacent portion of the ears 31.

It will be observed that the end cap 45 has a neck 47 formed integrally therewith and that it extends upwardly. Conductors 48 and 49 are located in the neck 47 and they are provided for energizing the primary winding 13. The manner in which the current flow through the conductors 48 and 49 is controlled will be described presently.

The portable spot welder 10 is carried by a handle 50 which is formed integrally with the frame 32 and has a generally U-shaped cross section. There is a depending projection 51 from the underside of the handle 50. This is for the purpose of facilitating the grasping of the handle 50 with the projection 51 located between the first and second fingers. It will be noted that the handle 50 extends along the entire length of the core 12 and that it overlies at 52 the upper end of the neck 47. If desired the upper end of the neck 47 can be joined integrally with the rear end of the handle 50.

Pivoted at 53 near the rear end of the handle 50 is an operating lever 54. It will be noted that the operating lever 54 is generally U-shaped in cross section and is inverted so that it generally overlies the upwardly opening U-shaped handle 50 and encloses a cavity therebetween. A coil

spring 55 extends around the pivot 53 and acts to bias the operating lever 54 in a counterclockwise direction.

The operating lever 54 is employed for effecting relative movement between the welding electrodes or jaws 17 and 18. This is accomplished by pivoting at 56 on the operating lever 54 a connecting link 57 which is pivoted at its other end at 58 on an arm 27' which is formed integrally with and extends from the support bracket 27. The lever 54, link 57 and the pivot 56 associated therewith constitute a toggle which is arranged so as to approach the center position that is indicated by the broken line 59 which extends through the pivots 53 and 58. However, the arrangement is such that the forward end of the operating lever 54 engages the frame 32 at 54' so as to prevent the toggle thus formed from going past the position represented by the broken line 59. As a matter of fact it approaches this position but is prevented from reaching it. It will be noted that the pressure for moving the welding electrode or jaw 17 to engage the work represented by the strips 23 and 24 is applied to the operating lever 54 generally at a position above the pivot 56. With this arrangement it is possible to apply a tremendous force to move the welding electrodes or jaws 17 and 18 relatively toward each other merely by the grasping of the handle 50 and the operating lever 54 about the pivot 56 and moving them toward each other to the position shown in Figure 1.

The current flow to the primary winding 13 through the conductors 48 and 49 is controlled by contacts 60 and 61. It will be observed that these contacts are carried by a stationary insulating support 62 and a movable insulating support 63, respectively, which are located near the rear end of the U-shaped handle 50. The contacts 60 and 61 are connected in the conductor 49 so that, when they are in engagement, the circuit is completed for energizing the primary winding 13 of the transformer 11, assuming of course that the conductors 48 and 49 are connected suitably to a source of alternating current of the required voltage and current supply capacity.

In accordance with conventional practice the conductors 48 and 49 are enclosed in a sleeve of insulation to form a cable that is indicated at 64 and this cable extends through a sleeve 65 that is formed integrally with the handle 50 at its rear end.

The contacts 60 and 61 are arranged to be operated with a snap action for closing and opening. For this purpose the movable insulating support 63 is carried by an arm 66 which is pivoted at 67 on the U-shaped handle 50. A coil tension spring 68 interconnects the arm 66 and a lever 69 which also is pivoted on the handle 50 at 70. The lever 69 is biased in a counterclockwise direction by a coil compression spring 71. The lever 69 is operated on movement of the link 57 through the agency of an adjusting screw 72 which projects through the link 57 as shown and engages the lever 69 at a position slightly at the right of its pivot 70.

When the operating lever 54 is released to relieve the pressure on the welding electrodes or jaws 17 and 18, the movement of the link 57 is extremely slight so that in effect the pressure is maintained on the work being welded such as the strips 23 and 24. However, a slight movement of the link 57 in the releasing direction permits the spring 71 to swing the lever 69 in a counter-

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clockwise direction so that the point 74 where the coil tension spring 68 is connected to the lever 69 swings past the line joining the pivots 67 and 70 as represented by the broken line 73. As soon as the point 74 moves past the broken line 73, the coil tension spring 68 is effective to snap the arm 65, movable insulating support 63 and the contact 61 carried thereby to the open position. As a result, the contact 61 separates from the stationary contact 60 with a snap action and the primary winding 13 is immediately de-energized.

The continued movement of the operating lever 54 in a counterclockwise direction, as urged by the spring 55, then is effective to release the pressure applied to the work between the welding electrodes or jaws 17 and 18.

When the operating lever 54 is moved to cause the welding electrodes or jaws 17 and 18 to engage the work between the welding tips 21 and 22, initially no movement of the movable contact 61 takes place. Rather the movement of the operating lever 54 continues until substantial pressure is applied to the work between the welding tips 21 and 22. Then during the final movement of the operating lever 54, the adjusting screw 72 engages the lever 69 and swings it in a clockwise direction so that the point 74 at the connection of the spring 68 thereto moves above the broken line 73. At this time the contact 61 moves into engagement with the stationary contact 60 with a snap action and, as a result, the primary winding 13 of the transformer 11 is energized. In this manner the welding pressure first is applied to the work and then the circuit for energizing the welding transformer is automatically completed. Likewise, on release of operating pressure from the operating lever 54, welding current first is cut off and operating pressure can be maintained on the work as long as is desired. Subsequently on release of the operating lever 54, the spring 55 serves to swing it in a counterclockwise direction in a position where welding tips 21 and 22 no longer engage the work. The work then can be removed or the welding tips 21 and 22 can be moved to another position for making another weld on the work.

Referring now particularly to Figures 2, 3, and 4 of the drawings, it will be observed that the reference character 80 designates, generally, another embodiment constructed in accordance with this invention. The portable spot welder 80 includes a transformer, shown generally at 81, which is generally the same as the transformer 11 referred to hereinbefore. The transformer 81 includes a laminated core 82 enclosing a primary winding 83 and a single turn secondary winding 84. Flexible conductor straps 85 and 86 are employed for interconnecting the terminals of the secondary winding 84 to welding electrodes or jaws 87 and 88 respectively. As before, each of the welding electrodes or jaws 87 and 88 includes a jaw member 89 and 90 that preferably is formed of good conducting material such as round copper rod. Also they include welding tips 91 and 92 extending at right angles to the jaw members 89 and 90, respectively, engaging sheet metal strips 93 and 94, constituting the work, for welding them together. It will be understood as indicated before, that other shapes and sizes of work can be employed in using the portable spot welder 80.

Each of the welding electrodes or jaws 87 and 88 includes a support bracket 97 and 98, respectively, and they are provided with radiating fins 97' and 98' for increasing the surface area there-

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of and promoting cooling of the associated parts. This cooling action is important when it is appreciated that on continuous use of the portable spot welder 80, considerable heat is generated by current flowing through the welding electrodes or jaws 87 and 88 which must be dissipated in some manner. By providing the radiating fins 97' and 98' the cooling effect of the atmosphere is increased. The support brackets 97 and 98 are pivoted at 99 and 100, respectively, between ears 101 which, as shown more clearly in Figure 2, are formed integrally with a frame that is designated generally by the reference character 102. The frame 102 has a central section 103 which is generally rectangular in cross section and has a rectangular opening for receiving the laminated core 82 of the transformer 81. The frame 102 is provided for carrying the transformer 81 and the central section 103 is arranged to be slipped over the laminated core 82.

The frame 102 is held in position on the laminated core 82 at the forward end by means of transversely extending bars 104 into which bolts 105 are threaded. It will be observed that the bolts 105 extend from and through an end cap 106 at the rear end of the laminated core 82. The laminations of the core 82 are themselves clamped by means of bolts 107 which extend through the corners thereof with the heads 108 at the forward end and nuts 109 at the rear end underneath the cap 106. As shown more clearly in Figure 3 of the drawings the bars 104 are offset as indicated at 110 for the purpose of clearing the heads 108 of the bolts 107. The central section 103 of the frame 102 is clamped between the ends of the transverse bars 104 and the end cap 106. In this manner the frame 102 is securely fastened relative to the transformer 81.

It will be observed in Figure 3 of the drawings that a spacer 111 is interposed between the ends of the single turn secondary winding 84. Bolts 112 extend through the flexible conductor straps 85 and 86 and the respective ends of the single turn secondary winding 84 into the spacer 111. As shown, the lower bolt 112 is suitably insulated from the spacer 111.

With a view to adjusting the position of the welding electrode or jaw 88 with respect to the other welding electrode or jaw 87, there is provided an adjusting screw 114 which is threaded in a bracket 115, spaced by a layer of insulation 116, from the support bracket 98. It will be observed that the adjusting screw 114 at its forward end bears against a boss 113 which is formed integrally with the frame 102 on the underside of its central section 103.

Formed integrally with the frame 102 and extending above the central section 103 thereof is a handle 117. It will be noted that the handle 117 has depending projections 118 on the underside. They are for the purpose of facilitating the gripping of the handle 117 by the hand of the operator. The handle 117 has a U-shaped cross section 119 and at its rear end there is pivoted at 120 an operating lever 121. The operating lever 121 is generally U-shaped in construction and it fits over the U-shaped cross section 119 of the handle 117 and generally encloses the mechanism therein. A coil spring 122 acts around the pivot 120 for biasing the operating lever 121 in a counterclockwise direction.

The operating lever 121 constitutes a part of a toggle mechanism that is employed for moving the welding electrodes or jaws 87 and 88 relative

to each other. Pivoted at 123 intermediate the ends of the operating lever 121 and near the forward end thereof is a link 124. At its other end the link 124 is pivoted at 125 to an arm 126 which is formed integrally with the support bracket 97 that carries the jaw member 83.

The primary winding 83 of the transformer 81 is energized through conductors 127 and 128. It will be noted that these conductors extend through a sleeve 129 that is formed integrally with the handle 117 at its rear end. In accordance with conventional practice the conductors 127 and 128 are formed in a cable 130 and it is arranged to be connected to a suitable source of alternating current such as a source operating at a voltage ranging from 200 to 230 volts as will be understood.

With a view to energizing the primary winding 83 of the transformer 81 at will, contacts are interposed in the conductor 127. For this purpose a stationary contact 131 and a movable contact 132 are provided. As shown in Figure 3 the contact 131 is carried by a stationary insulating support 133 while the contact 132 is carried by a movable insulating support 134. The movable insulating support 134 in turn is carried by an arm 135 which is pivoted at 136 on the U-shaped cross section 119 of the handle 117. In order to operate the contact 132 with a snap action into and out of engagement with the stationary contact 131, a coil tension spring 137 is employed. As shown the coil tension spring 137 is connected at one end to the arm 135 and is connected at the other end at 138 at one end of a lever 139. The lever 139 is pivoted at 140 on the U-shaped cross section 119 of the handle 117 and a spring 141 is employed for urging the lever 139 in a counterclockwise direction. The lever 139 is arranged to be operated by means of an adjusting screw 142 that is carried by the operating lever 121.

An insulating barrier 143 is secured by a screw 144 to the bottom of the U-shaped cross section of the handle 117 for the purpose of insulating more fully the parts associated with the movable contact 132.

In the construction shown in Figures 3 and 5 of the drawings, the end cap 106 is separate from the handle 117. It will be understood that, if desired, the end cap 106 can be secured to the handle 117.

In operation, the work represented by the strips 93 and 94 is positioned between the welding tips 91 and 92. Ordinarily this will be accomplished by bringing the portable spot welder 23 into the welding position. Then the operating lever 121 is moved from its position shown in Figure 4 of the drawings in a clockwise direction to actuate the welding electrode or jaw 87 downwardly for engaging the work. This is accomplished through the link 124 which forms a part of the toggle linkage that also includes the operating lever 121. The arrangement of the operating lever 121 with respect to the handle 117 is such that the toggle cannot go past the center position represented by the broken line 145 in Figure 3 extending through the pivots 120 and 125. However, the construction is such that this position is closely approached. Under these circumstances it is possible to apply a relatively great force to the work between the welding electrodes or jaws 87 and 88 on application of pressure to the operating lever 121 by the operator. It will be observed that this pressure is applied generally along a line through the pivot 123.

After the work has been engaged by the welding tips 91 and 92 and sufficient pressure has been applied thereto, the adjusting screw 142 engages the right end of the lever 139 and swings it in a clockwise direction. As the left end of the lever 139 passes beyond the broken line 146 which interconnects the pivot 136 and the pivot 140, the contact 132 is moved with a snap action into engagement with the stationary contact 131. The circuit is then completed for energizing the primary winding 83 of the transformer 81 and current flows through the secondary winding 84 and between the welding tips 91 and 92 for performing the welding operation.

After sufficient current has flowed to perform the welding operation in the judgment of the operator, he releases the pressure slightly on the operating lever 121. This slight movement of the operating lever 121 which results is insufficient to remove pressure from the work but is sufficient to permit the spring 141 to shift the lever 139 downwardly past the broken line 146. Thereupon the spring 137 is effective to move the contact 132 with a snap action out of engagement with the stationary contact 131. Thereupon the flow of current to the transformer 81 ceases and current no longer flows between the welding tips 91 and 92. However the pressure can be applied to the work as long as is desired. Thereafter the operating pressure is removed from the operating lever 121 and it is swung in a counterclockwise direction to the open position shown in Figure 4 by the spring 122.

The construction shown in Figures 5 and 6 of the drawings is generally similar to that illustrated in Figures 2, 3 and 4 and just described. However, the manner in which the laminated core 82 is secured in position on the frame 102 is somewhat different. It will be observed in Figure 5 that bosses 148 are formed integrally with the ears 101 which project forwardly from the transformer 81. Through bolts 149 extend from the cap 103 through the corners of the laminations of the core 82 into these threaded bosses 148. With this construction then it is unnecessary to employ the transverse bars 104 and the centrally located bolts 105 as shown in Figure 3.

Also it will be noted in Figure 5 that the conductors 127 and 128 are located in a groove 150 in the forward end of the handle 117 and therefore are connected to the primary winding 83 of the transformer 81 at the forward rather than at the rear end as in Figure 3.

In Figure 6 of the drawings radiating fins 151 and 152 are illustrated as extending from the jaw members 89 and 90. They assist further in cooling the associated parts and together with the fins 97' and 98' provide an increased radiating surface for the welding electrodes or jaws 87 and 88.

In Figure 7 of the drawings a modified welding tip construction is illustrated. A relatively small diameter shank 160 extends transversely through the jaw member 89 and is threaded and tapered at its lower end 161 for interfitting with a relatively large diameter welding tip 162. This construction makes it possible to use a relatively short length of copper rod of large diameter, for example 1½ inch long by ½ inch diameter, for the welding tip and a relatively longer shank 160 of copper rod of small diameter, for example 1½ inches long by ⅜ inch diameter. A set screw 163 threaded into the end of the jaw mem-

ber 89 acts to hold the shank 160 and the welding tip 162 carried thereby in position.

Since certain further changes can be made in the foregoing constructions and different embodiments of the invention can be made without departing from the spirit and scope thereof, it is intended that all matter shown in the accompanying drawings and described hereinbefore shall be interpreted as illustrative and not in a limiting sense.

What is claimed as new is:

1. A portable manually operable spot welder comprising, in combination, a transformer having a core formed by a stack of laminations of magnetic material with primary and secondary windings extending therethrough, frame means secured to said core, a pair of welding jaws connected for energization to said secondary winding and carried by said frame means and mounted for movement toward and away from each other to engage work therebetween, an operating lever pivoted on said frame means, a link interconnecting said lever and one of said jaws and therewith forming a toggle joint arranged to be substantially extended when said jaws engage the work, switch means carried by said frame means for connecting said primary winding to a source of alternating current and including a pivotally mounted contact member and a cooperating contact member, a control lever pivoted intermediate its ends on said frame means with one end arranged to swing past the pivot axis of said pivotally mounted contact member and the other end operatively connected to said operating lever, a coil tension spring interconnecting said one end of said control lever and said pivotally mounted contact member for shifting the same with a snap action into and out of engagement with said cooperating contact member on swinging movement of said control lever, and a spring cooperating with said control lever to bias the same to swing in a direction opposite to that in which it is swung by said operating lever.

2. A portable manually operable spot welder comprising, in combination, a transformer having a core formed by a stack of laminations of magnetic material with primary and secondary windings extending therethrough, frame means secured to said core including a carrying handle extending therealong, a pair of welding jaws connected for energization to said secondary winding and carried by said frame means and mounted for movement toward and away from each other to engage work therebetween, an operating lever pivoted on said handle, a link interconnecting said lever and one of said jaws and therewith forming a toggle joint arranged to be substantially extended when said jaws engage the work, switch means carried by said handle for connecting said primary winding to a source of alternating current and including a pivotally mounted contact member and a cooperating con-

tact member, a control lever pivoted intermediate its ends on said handle with one end arranged to swing past the pivot axis of said pivotally mounted contact member and the other end operatively connected to said operating lever, a coil tension spring interconnecting said one end of said control lever and said pivotally mounted contact member for shifting the same with a snap action into and out of engagement with said cooperating contact member on swinging movement of said control lever, and a spring cooperating with said control lever to bias the same to swing in a direction opposite to that in which it is swung by said operating lever.

3. A portable manually operable spot welder comprising, in combination, a transformer having a core formed by a stack of laminations of magnetic material with primary and secondary windings extending therethrough, frame means secured to said core, a pair of welding jaws connected for energization to said secondary winding and carried by said frame means and mounted for movement toward and away from each other to engage work therebetween, an operating lever pivoted on said frame means, a link interconnecting said lever and one of said jaws and therewith forming a toggle joint arranged to be substantially extended when said jaws engage the work, switch means carried by said frame means for connecting said primary winding to a source of alternating current and including a pivotally mounted contact member and a cooperating contact member, a control lever pivoted on said frame and arranged to be operated by said operating lever when the same is swung to move said welding jaws into and out of engagement with the work, and spring means operatively interconnecting said control lever and said pivotally mounted contact member for shifting the same with a snap action into and out of engagement with said cooperating contact member on swinging movement of said control lever, and a spring cooperating with said control lever to bias the same to swing in a direction opposite to that in which it is swung by said operating lever.

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