

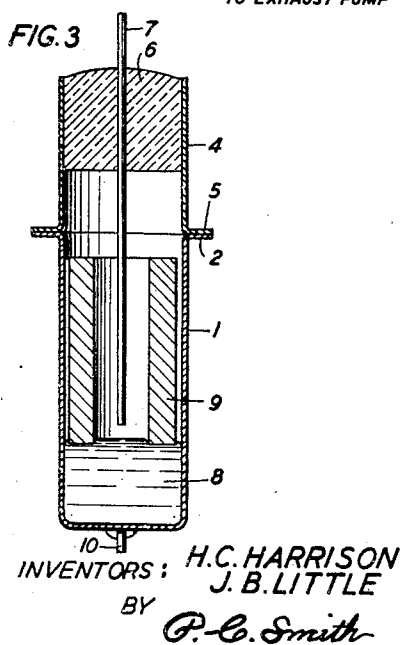
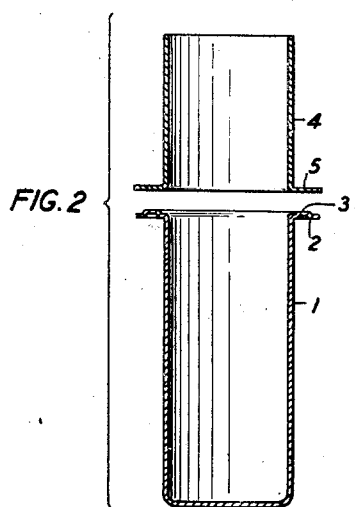
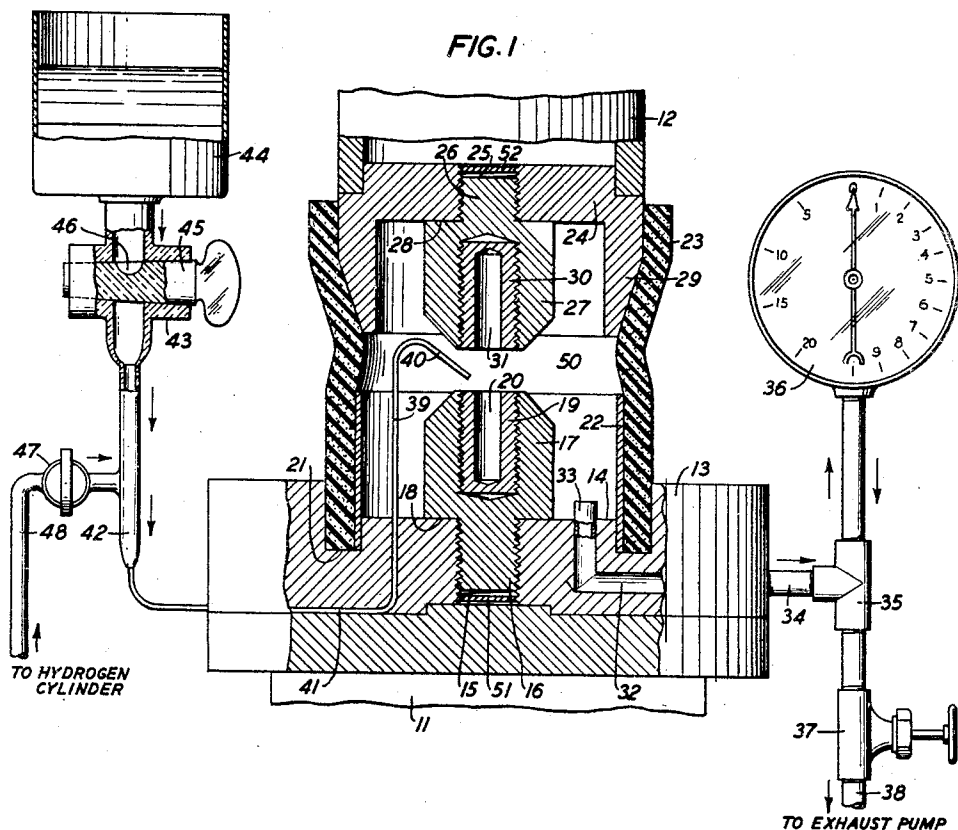
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MACHINE FOR SEALING RECEPTACLES

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2,326,296

MACHINE FOR SEALING RECEPTACLES

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6 Claims. (Cl. 226—19)

This invention relates to the art of sealing hollow metallic receptacles and more particularly to an improved machine for use in this art.

Although not limited thereto, the invention has special utility in the manufacture of electric switches of the liquid contact type. A switch of this type, which the machine according to the invention has been particularly adapted to seal, comprises a bottom can member having the upper rim of its side wall turned outwardly to form a flange, an upper eyelet portion having its upper end sealed by a glass insulator through which one switch terminal extends and having its lower rim turned outwardly to form a flange which may be welded to the flange of the can member, a body of mercury in the bottom of the can member and a hollow cylindrical armature floated upon the surface of the mercury through which the switch terminal extends. A second terminal may be soldered to the bottom can member. If the armature is subjected to an electric field, and pulled downwardly toward the mercury pool, the mercury becomes displaced upwardly through the hollow armature into engagement with the terminal depending from the upper eyelet portion whereby contact is established between the terminals through the mercury pool. It is generally found desirable to provide an operating atmosphere of a reducing gas, such as hydrogen, which may be introduced into the switch before it is sealed.

It is an object of the present invention to provide an improved welding assembly whereby the two portions of a switch receptacle may be enclosed in a chamber thereof which can be evacuated, through which a measured amount of mercury can be deposited in one portion of the switch receptacle, which can then be filled to a desired pressure with a gas and in which the portions of the switch receptacle can be welded together.

It is a further object of the invention to provide an apparatus for sealing metallic receptacles in an efficient and simple manner.

In accordance with the present invention these objects are attained by the provision of a welding assembly insertable into a welding press. The assembly has a base member from the center of which a lower welding electrode extends upwardly, which electrode is provided with an axial socket in which the lower can portion of a switch receptacle of the type hereinbefore described may be supported with its flanged rim resting upon the upper end of the electrode. Attachable to the piston or pressure member of the press is an

upper welding electrode support from the center of which a second electrode depends which electrode has a socket therein for receiving the upper or eyelet portion of a receptacle with its flanged rim engaged against the lower end of the electrode. Secured to the base member and surrounding both electrodes is a piece of thick walled rubber tubing which with the base member and upper electrode supporting member form a chamber within which the electrodes are enclosed. This chamber may be connected by a valved pipe with a suitable exhaust pump. Also supported within the chamber is a flexible tube having its upper end bent over and normally positioned above the socket in the lower electrode. This tube is connected to a mercury supply and to a flask of gas, for example, hydrogen, under pressure.

In using the assembly, the eyelet portion of the receptacle is placed in the socket of the upper electrode, the can portion with the armature placed therein is positioned in the socket of the lower electrode and the upper electrode is then lowered into the upper end of the rubber tubing, but not low enough to deflect the flexible tube. The valve to the hydrogen flask and the measuring valve to the mercury supply are then closed and the valve to the exhaust pump is opened to exhaust the chamber in which the portions of the receptacle are enclosed. When the exhaustion has been completed, the measuring valve to the mercury supply is turned to deposit a measured quantity of mercury in the lower portion of the flexible tube. The measuring valve is then closed and the valve to the hydrogen flask is opened thereby forcing the measured quantity of mercury through the flexible tube into the can portion of the receptacle. The exhaust pump pulls the hydrogen into the chamber thereby purging it. The valve to the exhaust pump is then closed and hydrogen is permitted to flow into the chamber until the requisite hydrogen pressure is established after which the valve to the hydrogen supply is closed. The upper electrode is then lowered to force the flanges of the portions of the receptacle together, the lowering of the electrode pressing the flexible tube to one side. The welding current is then applied to the electrodes whereby the flanges of the portions of the receptacle are welded together.

Having briefly described the welding assembly and the manner in which it is to be used, reference may now be had for a more comprehensive understanding of the invention to the following

detailed description read in connection with the accompanying drawing in which:

Fig. 1 shows partially in cross-section, the welding assembly in accordance with the present invention;

Fig. 2 is an enlarged cross-sectional view of the upper and lower portions of a switch element of the type which the assembly of Fig. 1 is particularly adapted to manufacture; and

Fig. 3 is an enlarged cross-sectional view of a completely assembled switch element.

Referring first to Figs. 2 and 3, the switch element disclosed therein is of the general type disclosed in Patent No. 2,259,661, granted October 21, 1941 to C. E. Pollard. It comprises a bottom can portion 1 having its upper edge turned outwardly to form a flange 2 which is provided with a circular ridge 3 for affording a better welding surface. The can portion is preferably pressed from non-magnetic stainless steel stock. The upper portion 4 is produced in the form of an eyelet having a lower outturned flange 5 which may be welded as hereinafter described to the flange 2 of the can portion 1. The eyelet portion is pressed from metal alloy stock which may be readily sealed to glass. When completely assembled as disclosed in Fig. 3, the upper eyelet portion 4 has its upper end sealed by a glass bead 6 through the center of which an upper electrode or terminal 7 extends, a small pool of mercury 8 is deposited in the bottom of the lower can portion 1 upon which a hollow cylindrical iron armature 9 floats, and the depending end of the terminal 7 extends through the hollow armature to a point just above the upper surface of the mercury pool. Before the portions of the switch receptacle are welded together, they are evacuated and refilled with hydrogen under pressure as will be hereinafter described. After the welding operation has been completed, the lower terminal 10 is soldered to the bottom of the can portion 1.

A switch element of the type just described is assembled in aligned holes in the polar extensions of a relay core in such a position that when flux is generated in the magnetic circuit including the polar extensions and the armature 9, the armature will tend to center itself between the polar extensions and will therefore be drawn downwardly into the bottom portion 1 of the switch element, thereby displacing mercury upwardly into engagement with the end of terminal 7 whereby a conducting path is established between the terminals 7 and 10 through the mercury. The can portion 1 being of non-magnetic stainless steel does not become magnetized to impede the movement of the armature 9. When flux ceases to flow through the armature, the surface tension of the mercury pool restores the armature to its normal position and the mercury breaks contact with the terminal 7.

To weld the bottom can portion 1 and the upper eyelet portion 4 of a switch element together and to insure that before the portions are welded they are evacuated and refilled with hydrogen, the welding press assembly disclosed in Fig. 1 has been devised. The assembly is arranged for insertion in the usual type of welding press which has a lower fixed electrode support 11 and an upper movable electrode support 12 which may be secured to the pressure member of the press.

The assembly is provided with a circular base member 13 which may be secured to the flange of the support 11 in any desired manner as by lag screws (not shown). The upper face of the member 13 is provided with a central depressed por-

tion 14 for the purpose to be later described and with an axial threaded hole 15 into which is threaded the shank 16 of a lower electrode 17. To seat the electrode firmly on the base member so that the pressure applied thereto in the operation of the press will not be borne by the threads of the member 13 and of the shank 16, the shank 16 is screwed into the axial hole 15 until the shoulder 18 of the electrode is seated firmly on the surface 14 of the base member 13. The electrode 17 is provided with an axial hole into which a cylindrical adapter 19 is threaded. The adapter is provided with an axial socket 20 of sufficient depth and diameter to receive the lower can portion 1 of the switch element such as is disclosed in Fig. 2, the diameter of the socket 20 being such that the lower can portion 1 will fit quite snugly therein. The base member 13 is also provided with a concentric groove 21 in which are secured a short section of metal tubing 22 and a longer section of thick walled rubber tubing 23.

Positioned in the lower end of the upper electrode support 12 is a cylindrical member 24 having an axial threaded hole 25 into which is threaded the shank 26 of an upper electrode 27. To seat the electrode firmly on the base of the member 24 so that the pressure applied thereto in the operation of the press will not be borne by the threads of the member 24 and of the shank 26, the shank 26 is screwed into the hole 25 until the shoulder 28 of the electrode is seated firmly on the lower surface of the member 24. The outer cylindrical wall of the member 24 is tapered as indicated at 29 for guiding the member 24 into the upper end of the rubber tubing 23 and for expanding the upper end of the tubing for securing a tighter fit therein. The electrode 27 is provided with an axial hole into which a cylindrical adapter 30 is threaded. The adapter is provided with an axial socket 31 of sufficient depth and diameter to receive the upper eyelet portion 4 of the switch element such as is disclosed in Fig. 2, the diameter of the socket 31 being such that the eyelet portion 4 will fit quite snugly therein.

To more effectively seal the chamber 50 against the leakage which might result due to imperfect seals between the threaded shanks 16 and 26 of the electrodes 17 and 27 and the threaded holes 15 and 25 in the members 13 and 24, the holes 15 and 25 are sealed after threading by plugs 51 and 52 brazed therein.

Extending through the base member 13 is a duct 32 in the inner end of which is secured a short section of tubing 33, the upper end of which extends above the surface of the depressed portion 14 so that any mercury which may become split in the depressed portion 14 during the use of the assembly cannot flow into the duct 32. Secured in the outer end of the duct 32 is a pipe 34 which is connected by a T 35 with a suitable pressure gauge 36 and through a valve 37 with a pipe 38 extending to any suitable exhaust pump (not shown).

Extending upwardly through the base member 13 is a small flexible tube 39, the upper end of which is bent as indicated at 40 so that its end portion or orifice overlies the socket 20 in the lower electrode adapter 19. The lower end 41 of the tube 39 lies in a groove in the lower face of the base member 13 and is sealed to the lower end of a glass tube 42. The upper end of the tube 42 is connected to the outlet of a glass stop cock 43 the inlet of which is connected to a mercury reservoir 44. The stock cock spindle

45 of the stop cock 43 is provided with a pocket 46 of a size to hold just the correct quantity of mercury for deposit in a single switch element. The tube 42 is also connected by a glass stop cock 47 to a pipe 48 connected with a flask or cylinder of hydrogen (not shown).

The utility of the welding assembly above described may be best understood by considering its application to the manufacture of a switch element of the type disclosed in Fig. 3. To start the welding of the parts of the switch element together, the plunger of the welding press is raised until the member 24 is entirely removed from the upper end of the rubber tubing 23, thus giving free access to both of the welding electrodes. An assembled eyelet portion of a switch element including the eyelet 4, glass bead 6 and terminal 7 is then inserted into the socket 31 of the upper electrode adapter 30 until the flange 5 thereof rests against the lower end of such adapter and a can portion 1 with an armature 9 therein is then inserted into the socket 20 in the lower electrode adapter 19 until its flange 2 rests against the upper end of such adapter. The upper electrode supporting member 24 is then lowered into the upper end of the rubber tubing 23 to the position illustrated in Fig. 1, thus closing the upper end of the tubing and forming a closed chamber 50, the electrode supports 13 and 24 forming the ends of such chamber and the rubber tubing 23 forming the cylindrical wall of such chamber. The electrodes 17 and 27 and the switch element portion carried thereby are thus enclosed in the chamber 50.

The stop cocks 45 and 47 are now closed and the valve 37 is opened, whereby the chamber is connected to the exhaust pump. Suction from such pump now applied to the chamber 50 reduces the air pressure in the chamber whereby atmospheric pressure on the outside of the rubber tubing 23 effectively seals the chamber. When the chamber and consequently the portions of the switch element disposed therein have been exhausted, the stop cock spindle 45 is turned through 180 degrees thereby depositing the globule of mercury which fills the pocket 46 thereof into the lower portion of the tube 42. With the spindle 45 of the stop cock in this position, the upper end of the tube 42 is effectively closed. The stop cock 47 is now turned to connect the hydrogen cylinder with the tube 42 whereupon the pressure of the hydrogen forces the measured quantity of mercury from the lower end of the tube 42 through the tube 39 and the mercury is directed from the orifice thereof into the can portion 1 of the switch element which was placed in the socket of the lower electrode adapter 19.

After the mercury has been cleared from the tube 39, the hydrogen continues to flow into the chamber and is exhausted by the exhaust pump until the chamber has become sufficiently purged. Valve 37 is then closed and the chamber then becomes filled with hydrogen until a desired pressure is reached when the stop cock 47 is closed.

The upper electrode 27 is now lowered until the flange 5 of the eyelet portion 4 engages the flange 2 of the can portion 1 with the requisite welding pressure. The downward movement of the upper electrode 27 pushes the upper bent end 40 of the flexible tube 39 to one side so that it will not interfere with the proper engagement of the flanges of the switch element portions. With the proper pressure applied, the welding circuit connected to the electrodes is closed and a weld

is effected which seals the portions of the switch element together with a measured quantity of mercury and an atmosphere of hydrogen therein. The welding circuit is then opened and the upper electrode 27 is raised so that the switch element may be removed from the welding assembly. The switch element may then be completed by soldering the lower terminal 10 to the bottom thereof.

While the invention has been disclosed as particularly adapted to the manufacture of switch elements of the type disclosed, it is to be understood that by changing the adapters 19 and 30 other types and sizes of switch elements could be similarly manufactured. It is to be further understood that the step of filling the switch element with gas could be omitted and the welding accomplished at the time the switch element is in an evacuated condition. Under this condition the mercury could be first forced through the tube 39 by air pressure or gas pressure and deposited in the can portion of the switch element as previously described and the chamber 50 then evacuated by closing both stop cocks 43 and 47 and by opening the valve 37.

It is also to be understood that the sealing means comprising the rubber tube and conical plunger could be replaced by other elastic closures, such as flexible metallic flanges with gasket edges.

What is claimed is:

1. A machine for sealing a two-part metallic receptacle comprising a fixed electrode support, a first electrode secured thereto, a movable electrode support, a second electrode secured thereto, said electrodes having axial sockets in which the parts of the receptacle to be sealed are insertable, a flexible tubular wall secured at one end to said fixed support surrounding said first electrode and having its other end normally open, said wall forming with said supports a closed chamber surrounding said electrodes when said movable support is moved into the open end of said wall toward said fixed support, an air pressure reducing pump, means for connecting said pump with said chamber whereby said chamber may be evacuated and means for moving said movable support and said second electrode to engage the parts of said receptacle whereby they may be welded together.

2. A machine for sealing a two-part metallic receptacle comprising a fixed electrode support, a first electrode secured thereto, a movable electrode support, a second electrode secured thereto, said electrodes having axial sockets in which the parts of the receptacle to be sealed are insertable, a tubular wall of thick rubber secured at one end to said fixed support surrounding said first electrode and having its other end normally open, said wall forming with said supports a closed chamber surrounding said electrodes when said movable support is moved into the open end of said wall toward said fixed support, an air pressure reducing pump, means for connecting said pump with said chamber whereby said chamber may be evacuated and said wall of rubber tubing sealed to said movable support, and means for moving said movable support and said second electrode to engage the parts of said receptacle whereby they may be welded together.

3. A machine for sealing a two-part metallic receptacle comprising a fixed electrode support, a first electrode secured thereto, a movable electrode support, a second electrode secured thereto,

said electrodes having removable adapters therein having axial sockets in which the parts of the receptacle to be sealed are insertable, a flexible tubular wall secured at one end to said fixed support surrounding said first electrode and having its other end normally open, said wall forming with said supports a closed chamber surrounding said electrodes when said movable support is moved into the open end of said wall towards said fixed support, an air pressure reducing pump, means for connecting said pump with said chamber whereby said chamber may be evacuated and said flexible wall sealed to said movable support, and means for moving said movable support and said second electrode to engage the parts of said receptacle whereby they may be welded together.

4. A machine for sealing a two-part metallic receptacle for a mercury switch comprising a fixed support, a movable support, said supports having axial sockets in which the parts of the receptacle to be sealed are insertable, a flexible tubular wall secured at one end to said fixed support and having its other end normally open, said wall forming with said supports a closed chamber when said movable support is moved into the open end of said wall toward said fixed support, an air pressure reducing pump, means for connecting said pump with said chamber whereby said chamber may be evacuated, a flexible tube extending into said chamber having its inner end downturned over the socket in said first support through which tube a measured quantity of mercury may be deposited in the part of said receptacle positioned in the socket of the first support and through which the chamber is filled with gas at a desired pressure and means for moving said movable support to engage the parts of said receptacle for sealing, the movement of said second support laterally deflecting said tube whereby the parts of said receptacle are sealed together.

5. A machine for sealing a two-part metallic receptacle for a mercury switch comprising a fixed support, a movable support, said supports having axial sockets in which the parts of the receptacle to be sealed are insertable, a flexible tubular wall secured at one end to said fixed support and having its other end normally open, said wall forming with said supports a closed chamber when said movable support is moved

into the open end of said wall towards said fixed support, an air pressure reducing pump, means for connecting said pump with said chamber whereby said chamber may be evacuated, a flexible tube extending into said chamber and having its inner end downturned over the socket in said first support, means including a supply of gas under pressure for forcing a measured quantity of mercury through said tube for deposit in the part of said receptacle positioned in the socket of said first support and for filling said chamber with gas at a desired pressure, and means for moving said movable support to engage the parts of said receptacle, the movement of said second support laterally deflecting said tube whereby the parts of said receptacle are sealed together enclosing said gas.

6. A machine for sealing a two-part metallic receptacle for a mercury switch comprising a fixed support, a movable support, said supports having axial sockets in which the parts of the receptacle to be sealed are insertable, a flexible tubular wall secured at one end to said fixed support and having its other end normally open, said wall forming with said supports a closed chamber when said movable support is moved into the open end of said wall towards said fixed support, an air pressure reducing pump, means for connecting said pump with said chamber whereby said chamber may be evacuated, a flexible tube extending into said chamber and having its inner end downturned over the socket in said fixed support, a mercury reservoir, a measuring valve for connecting said reservoir with said tube whereby a measured quantity of mercury may be deposited in said tube, a supply of gas under pressure, means for connecting said gas supply to said tube whereby said measured quantity of mercury may be forced through said tube for deposit in the part of said receptacle positioned in the socket of said first support and said chamber filled with said gas at the desired pressure, and means for moving said movable support to engage the parts of said receptacle, the movement of said second support laterally deflecting said tube whereby the parts of said receptacle may be sealed together enclosing said mercury and said gas.

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