

July 12, 1927.

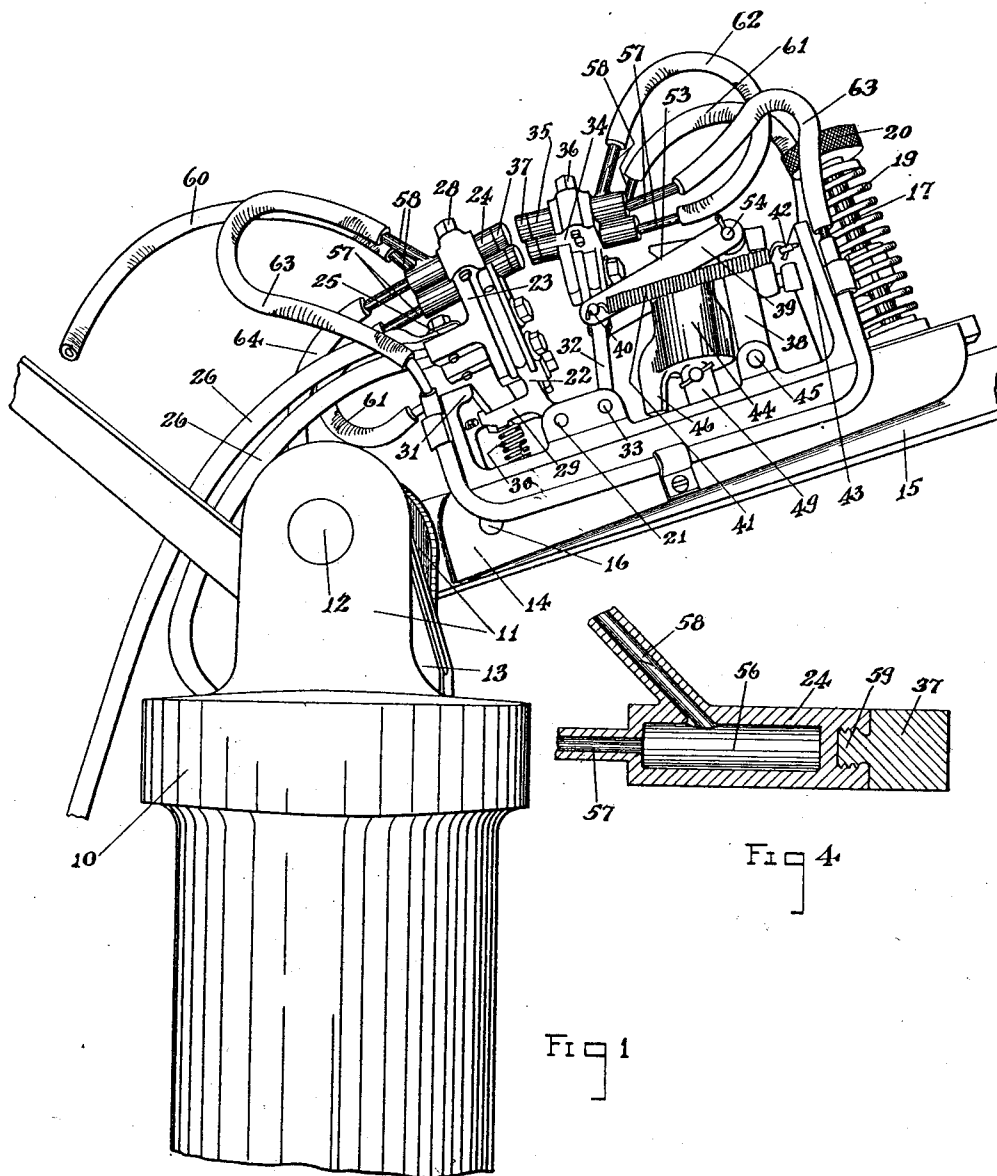
J. W. MEADOWCROFT

1,635,581

ELECTRIC SWITCH

Filed Jan. 18, 1922

2 Sheets-Sheet 1



Witness
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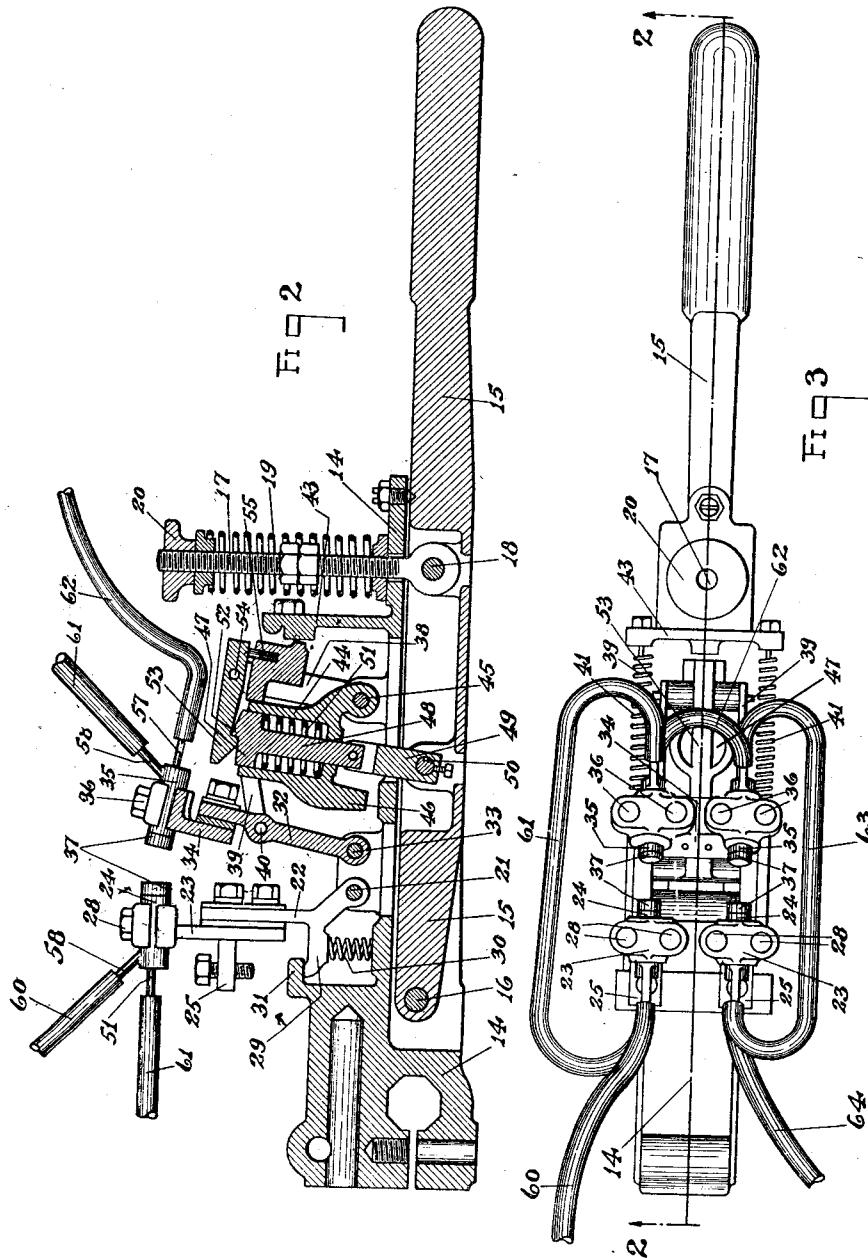
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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE.

JOSEPH W. MEADOWCROFT, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR TO EDWARD G. BUDD MANUFACTURING COMPANY, OF PHILADELPHIA, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA.

ELECTRIC SWITCH.

Application filed January 18, 1922. Serial No. 530,070.

My invention relates to improvements in electric switches and concerns, more particularly, switches of that class adapted for use in connection with electric welding machines, but is not restricted to such use as it may be used in any connection for which it may be adapted or appropriated.

One of the objects of my invention is to provide an electric switch mechanism which is very durable and efficient, even when the switch is used in situations which require that it be operated very rapidly and substantially continuously, and which has a long life so that the need for replacement or repair of the switch parts is greatly lessened.

A further object of my invention is to provide a switch construction which will withstand very successfully the destructive or deteriorating effects of rapid and continuous operation.

Another object of my invention is to provide means for carrying off the heat generated in the switch contacts by the passage of the current so as to prevent undue heating of the working parts of the switch.

Another object of my invention is to provide simple and effective means by which the contacts of an electric switch may be renewed very quickly and easily.

A further object of my invention is to provide an electric switch having means for cooling the switch contacts.

Further objects, and objects relating to details and economies of production and operation, will definitely appear from the detailed description to follow. In one instance, I accomplish the objects of my invention by the devices and means described in the following specification. My invention is clearly defined and pointed out in the appended claims. A structure constituting a preferred embodiment of my invention is illustrated in the accompanying drawings, forming a part of this specification, in which:

Fig. 1 is a perspective view of the head and a portion of the operating lever of an electric welding machine, showing a switch embodying my invention applied thereto.

Figure 2 is a longitudinal sectional view through the switch,

Figure 3 is a plan view of said switch, and

Fig. 4 is a longitudinal, sectional view through one of the switch contacts.

In the drawings, the same reference numerals refer to identical parts throughout the several views.

In the pending application of Joseph Ledwinka for Letters Patent for automatic electric welding machines, Serial No. 430,320, filed December 13th, 1920, there is illustrated an electric welding machine which is used to produce, automatically, a series of spot welds in the work placed or fed between the electrodes of the machine. This machine comprises a standard having a lower arm, carrying a fixed electrode, and an upper arm in which a plunger, carrying a movable electrode, is slidably mounted. This plunger is reciprocated, to cause the movable electrode to approach the fixed one, by a two-part operating lever. The inner part of the operating lever is fixed to a shaft, which is connected to the plunger by a toggle link, and the outer part of the lever is pivoted to the inner part. The two parts of the lever are held yieldingly in line with each other by suitable spring means. The welding circuit is controlled by an automatic switch in which the closing and opening of the circuit is determined by the relative positions of the two parts of the operating lever so that, when the movable electrode exerts a predetermined pressure on the work, the contacts of the switch move into engagement with each other and the welding circuit is closed, and, when this pressure is increased a predetermined amount, the contacts automatically move away from each other and the circuit is opened. The outer part of the operating lever is connected by a system of links and levers with a reciprocating pitman which is driven by an electric motor. The operating lever is, consequently, actuated or oscillated rapidly, for instance, in actual practice, at a rate of about 120 strokes per minute.

I have found that the automatic switch, in a machine such as described, has a very short life and needs much repairing and replacement of parts in order to keep it in operating condition. The copper contacts wear down very quickly and have to be renewed and the insulating fibre burns out and lets the parts of the switch work loose, resulting, frequently, in broken parts. The renewal of

switch parts is very often difficult due to the fact that the screws and bolts have expanded in use and set so tight that they have to be drilled out to release the parts. These conditions are very objectionable not only because of the direct expense entailed by the necessity for repairs to the switch, but also because of the time during which the machine stands idle while repairs and replacements are being made.

It is among the special purposes of my invention to provide a switch which is devoid of these objections and which will require very little repairing or replacement of parts, in other words, a switch which has a long life, even when operated under such trying conditions as described above.

My invention consists in providing means for cooling the switch contacts so as to carry off the heat generated by the passage of the current and by arcing and prevent the transmission of such heat to the working parts of the switch. I may accomplish this by using hollow switch contacts connected in a cooling system so that a cooling fluid may be circulated therethrough. The body of the switch contact may have a cooling chamber therein provided with an inlet and an outlet, the inlets and outlets of the various contacts being connected by suitable conduits so that a cooling medium may be circulated through them. The contacts may be provided with removable contact points detachably connected to the body of the contact, so that they may be removed without disturbing the latter.

In order to explain my invention, I have illustrated an automatic switch suitable for use in electric welding machines and constituting one embodiment of my invention. My invention, however, is not to be limited or restricted to a switch of this type as it will find use and application in switches of many other types.

In the drawings accompanying this specification, I have illustrated an automatic switch construction applied to an electric welding machine, which switch embodies my invention. Referring to the numbered parts of the drawing, I have shown the head, 10, of an electric welding machine, which head has the parallel upstanding ears, 11, in which is journaled a shaft, 12, connected by the toggle link, 13, with the plunger of the machine carrying the movable electrode. This shaft, 12, is oscillated by means of a two-part operating lever comprising the inner part, 14, which is fixed on the shaft, 12, and the outer part, 15, which is pivoted, at 16, to the inner part, 14. The lever may be actuated or oscillated either by hand or automatically by suitable link and lever connections, such as described in the Ledwinka pending application to which I have previously referred, or by other suitable mechanism.

The inner part, 14, of the lever is channel-shaped so that a portion of the outer part, 15, lies within this channel. The two parts, 14 and 15, of the operating lever, are yieldingly held in alignment with each other by means of a spring, 19, interposed between the outer end of the part, 14, and a thumb-nut, 20, screwed on the end of a rod, 17, which extends through the inner part, 14, and is pivotally connected to the outer part, 15, of the lever, 18.

A contact-carrying arm, 22, is pivoted at 21, to the inner part, 14, of the operating lever and carries a pair of contact-clamping members, 23, which are insulated from each other and from the operating parts of the switch. Each of these contact-clamping members, 23, carries a switch contact, 24, detachably secured therein by means of the set screws, 28, and electrically connected at 25, with a lead, 26, connected in the welding circuit. The pivoted arm, 22, is provided with the rearwardly extending portion, 29, which engages beneath a lug or shoulder, 31, formed on an overhanging portion of the inner part, 14, of the lever. A spring, 30, engaging this portion, 29, holds it against the stop shoulder, 31, so as to determine the forward position of the contacts, 24. It will be seen that this arrangement permits the contacts, 24, and the arm which carries them to move rearwardly, against the pressure of spring, 30, when engaged by the opposing contacts of the switch.

An arm, 32, is also pivoted to the inner part, 14, of the operating lever, at 33, and carries a contact-clamping member, 34, in which a pair of contacts, 35, are detachably secured by the set screws, 36. The contacts of this pair are electrically connected to each other and, when they are in engagement with the contacts, 24, previously described, the circuit will be closed. A link, 38, is pivoted to the part, 14, of the operating lever, by the pin, 45, and the upper end of said link is pivotally connected by a pin, 54, to the rear ends of a pair of parallel links, 39, the forward ends of which are pivotally connected by the pin, 40, to the swinging arm, 32. A pair of tension springs, 41, have their forward ends connected to the pin, 40, and their rear ends connected, at 42, to the fixed standard, 43. A housing, 44, has a downwardly-extending leg which is pivoted on the pin, 45, and another downwardly-extending leg, 46, at the forward end thereof, which is adapted to engage the part, 14, of the operating lever in order to limit the rocking movement of the housing, 44, around its pivot, 45. A plunger, 47, works within the housing, 44, and has a stem, 48, which extends through the bottom of the housing and is connected to the part, 15, of the operating lever, by a link, 49, extending through the part, 14, and pivotally connected to the

part, 15, at 50. A coil spring, 51, is placed within the housing, 44, between the base thereof and the plunger, 47, as shown in Fig. 2. The upper face of said plunger has a tooth, 52, formed therein which coacts with a pawl, 53, pivoted on the pin, 54, and yieldingly pressed into engagement with the plunger by a spring, 55. When a downward pull is exerted on the outer end of the outer part, 15, of the operating lever, the two parts of the lever move as one until the upper electrode of the welding machine engages the work. The resistance offered by the work to the further movement of the movable electrode causes the outer part, 15, of the lever to swing on the pivot, 16, relative to the inner part, 14, against the pressure of the spring, 19. This swinging movement of the outer part of the operating lever, causes the housing, 44, to swing on its pivot, 45, since it is connected with the outer part, 15, of the operating lever through link, 49, stem, 48, plunger, 47, and coil spring, 51. During this stage of the movement, the link, 38, is compelled to swing on the pivot, 45, with the housing, 44, since the pawl, 53, hooks into the tooth, 52, of the plunger, 47. The forward swinging movement of the link, 38, swings the arm, 32, forward, due to the links, 39, connecting the link, 38, and the arm, 32, and the contacts, 35, are brought into engagement with the contacts, 24. This swinging movement of arm, 32, puts the springs, 41, under tension. A further swinging movement of housing, 44, is prevented by the contact of the foot, 46, with the part, 14, of the operating lever and a further movement of the outer part, 15, of the operating lever around its pivot, 16, compresses the spring 51, and depresses the plunger, 47, withdrawing the tooth, 52, thereof from engagement with the pawl, 53, and breaking the connection between the housing, 44, and the link, 38, so that the arm, 32, is free to fly backward, influenced by the tension of springs, 41, carrying the contacts, 35, out of engagement with the contacts, 24, and opening the welding circuit.

Each of the contacts, 24 and 35, in this switch, has a chamber, 56, in the body portion thereof, and an inlet and outlet, 57 and 58, communicating with said chamber. These inlets and outlets are connected by suitable conduits or tubes, 60, 61, 62, 63 and 64, so that a suitable cooling medium may be circulated through the various chambers, 56, of the several contacts. The tubing is preferably arranged so that these chambers are connected in series and the cooling medium, for instance, cooling water, may flow in through the tube, 64, and the inlet, 57, to the chamber, 56, of one of the contacts, 24, out through the outlet, 58, and tube, 63, to the inlet, 57, of the chamber, 56, of one of the contacts, 35, from thence through the

tube, 62, to the chamber, 56, of the other contact, 35, from thence through the tube, 61, to the chamber, 56, of the remaining contact, 24, and from thence through the tube, 60, to the discharge. The contacts are all provided with removable contact points or ends, 37, each of which has a screw-threaded stem, 59, screwed into the body portion of the contact, as shown in Fig. 4. As these contact points or ends become worn down in use, they may be removed very quickly and easily by unscrewing them from the body portion of the contact and they may be replaced by new points or ends.

I have found that, by the use of a cooling system for the switch contacts, as described above, the objectionable features heretofore noted in the operation of the switch, particularly at high speed, are eliminated. The switch does not break down in use and it is practically unnecessary to repair or replace the operating parts, with the exception of the contacts, which, of course, wear down in use. I find, however, that the life of these contacts is about twice as long as the life of the contacts formerly used and I believe this to be due to the fact that a large part of the heat generated in the contacts is carried away by the cooling system. Not only is the life of the contacts prolonged due to the carrying away of the generated heat, but also to a large extent to the resistance and capacity shunt circuits which actually cut down the arcing at the contact points themselves. These circuits are those formed, respectively, by the series water circuit from one contact of the gap to the other through the bridging contact points, and by the water supply connection connecting with one terminal and the water discharge connection leading from the other terminal connecting with the sewer. I also find that my improved switch is so efficient and so superior to the switch heretofore used, that I may increase the speed of the automatic welding machine very greatly, so as to get, approximately, 30% more welds per minute with it. This results in increased production at lower cost and, of course, is very desirable. As I have stated, the contact points necessarily wear down in use and, in order to avoid the necessity for disconnecting the contacts and the connections for the cooling system, I have provided the removable contact points or ends which are detachably secured to the body portions of the contacts and may be removed very quickly and easily and replaced by new points or ends.

My invention has proven of considerable value in electric welding machines, especially those that are operated automatically and consequently at high speed. However, this invention is applicable to other electric switches and, therefore, I am not to be restricted to the details of the particular

switch mechanism illustrated or to a switch used in connection with an electric welder. I am aware that the embodiment of my invention, illustrated in the accompanying drawings, may be varied considerably without departing from the spirit thereof and, therefore, I claim my invention broadly, as indicated by the appended claims.

Having thus described my invention, what I claim as new and useful and desire to secure by Letters Patent is:

1. An electric switch comprising a plurality of pairs of contact members movable into and out of contact with each other, means for moving said members, and means for continuously circulating a cooling fluid in heat transferring relation to and through said contact members in series.

2. In an electric switch of the class described, a pair of contact members electrically and mechanically connected together, a second pair of contact members mechanically connected together but insulated from each other, said pairs of contact members being movable into and out of contact with each other, and means for continuously and uninterruptedly circulating a cooling fluid successively through each of said contact members.

3. In an electric welding machine including a primary circuit therefor, a pair of spaced apart contact members in one side of said circuit, a second pair of contact members electrically connected together and adapted to bridge said first pair of contact members, and means for circulating a cooling fluid through said contact members in succession beginning with one of said electrically spaced apart contact members and ending with the other of said electrically spaced apart contact members.

4. In an electric switch of the class described, a pair of contact members rigidly connected together but insulated from each other, a second pair of contact members rigidly and electrically connected together, said second mentioned pair of contact members being adapted to bridge said first mentioned pair of contact members, and a circulating cooling system having its source connected to one of said electrically insulated contact members and its outlet connected to the other of said electrically insulated contact members.

5. In an electric switch of the class described, a plurality of contact members, a pair of ports in each of said contact members, certain of said contact members being electrically connected together and the remaining of said contact members being insulated from each other, means connecting a port in one of said electrically connected contact members to a port in the other of said electrically connected contact members, and additional means connecting the other

ports of said electrically connected contact members to corresponding ports in said electrically insulated contact members, respectively, whereby to effect a complete circulating system for a cooling medium.

6. A power control system comprising a circuit of high voltage, a power consuming device, a circuit breaker controlling the supply of power thereto, and a column of conducting fluid of relatively high resistance circulating through the terminals of said breaker in series whereby the arc between the terminals is moderated by the resistance shunt so maintained and the heat of the arc is conducted away by the fluid column.

7. A power control system comprising a circuit of high voltage, a power consuming device, a circuit breaker controlling the supply of power thereto, and a column of water supplied through the grounded mains and discharged to grounded sewers circulating through the terminals of said breaker whereby parallel paths of resistance and capacity are introduced therebetween.

8. A power control system comprising a source of high voltage, a power consuming device comprising the primary of an electric welding transformer, a circuit breaker controlling the supply of voltage to said primary, and a column of conducting fluid of relatively high resistance circulating through the terminals of said breaker in series whereby the arc between the terminals is moderated by the resistance shunt so maintained and the heat of the arc is conducted away by the fluid column.

9. A power control system for electric welding machines comprising a welding transformer having primary and secondary circuits, welding electrodes permanently connected in said secondary circuit, and a circuit breaker automatically operated in the functioning of the machine to make and break the primary circuit for each weld made, together with a circulating column of electrically and heat conductive fluid flowing through the terminals of the circuit breaker in series.

10. A power control system for electric welding machines comprising a welding transformer having a primary circuit of relatively high voltage and a secondary circuit of relatively low voltage, welding electrodes permanently connected in said secondary circuit of low voltage, a circuit breaker operating continuously during the operation of the machine to connect and disconnect the primary circuit from the source of power, and a column of water circulating through the terminals of said breaker in series.

In testimony whereof, I affix my signature.

JOSEPH W. MEADOWCROFT.