

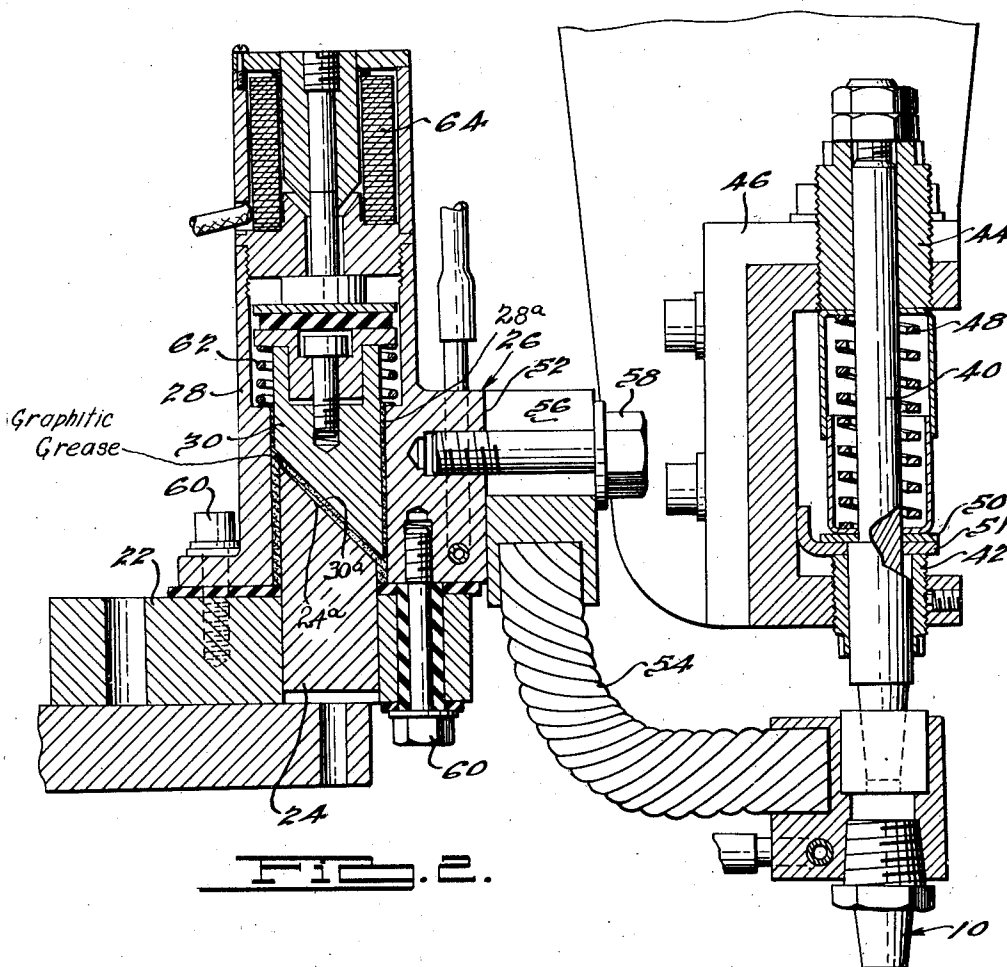
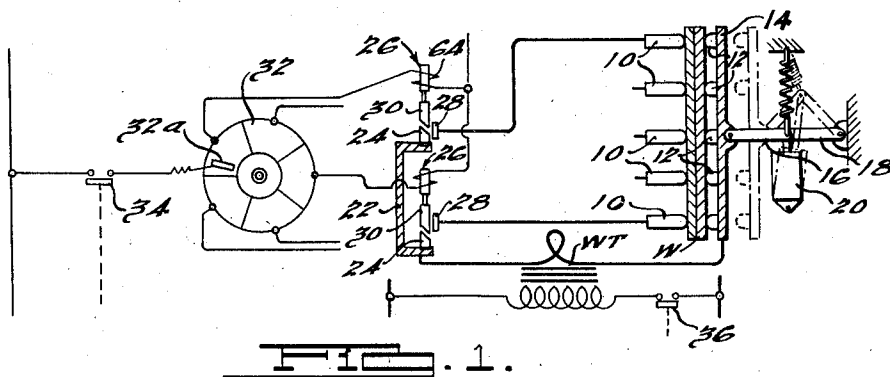
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ELECTRIC CONTROL APPARATUS

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ELECTRICAL CONTROL APPARATUS

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2 Claims. (Cl. 200-144)

The present invention relates generally to electric control apparatus, and in particular is directed to the provision of an improved method of and means for improving the operation of certain classes of switching equipment used in electric welding systems.

The copending application of Hugo Purat, Serial No. 349,653, filed August 2, 1940, and assigned to the same assignee as the present application, describes and claims certain features of an electric welding system in which the improvements of the present invention, while not being limited thereto, are of particular advantage. Generally stated, the above Purat system employs a plurality of pairs of welding points, all of which are arranged for connection, in parallel relation, to the secondary winding of a supply transformer. A switch individual to each pair of points is interposed in the secondary circuit of the transformer, and in addition, a master switch is interposed in the primary circuit of the transformer. In operation, all of the pairs of electrodes are simultaneously brought into engagement with the work, the secondary switch corresponding to one pair is closed, and thereafter the master switch is closed to energize the transformer. At the conclusion of the welding interval, the master switch is opened, and thereafter the secondary switch is opened. After a series of such operations, during which the secondary switches are successively operated, the electrodes are released from the work.

It will be noted from the above that the primary winding of the transformer is de-energized prior to the opening of the secondary circuit in question. Nevertheless, it has been found in practice that the opening of the secondary switch is accompanied by a surge or impulse of electric energy, which appears to be of a relatively high frequency compared to the frequency of the source. This high frequency surge or impulse is severe enough to draw one or more arcs between the separating contact surfaces of the secondary switch, and is seriously detrimental to the switch, as well as to the operation of the system as a whole.

Again, Patent No. 2,126,490, granted to William H. Martin on August 9, 1938, discloses and claims a hydraulically operated welding gun, having a cylinder, a piston movable in the cylinder under the influence of fluid pressure, and a pair of electrodes carried by the gun, which are moved relatively to each other by the movement of the piston. In this structure, the welding circuit extends through the piston, the wall of the cyl-

inder and thence through the electrodes. The piston and cylinder wall thus correspond to the contacts of a switch, and, in certain instances, the improvements of the present invention may be utilized to advantages in guns embodying the invention of the Martin patent.

With the foregoing general consideration in view, the principal objects of the present invention are to provide for preventing the above discussed surges or impulses from adversely affecting the system; and to provide for absorbing the energy of such surges or impulses so that the same do not produce arcing upon the opening of the switching apparatus in question.

Further objects of the present invention are to utilize means directly associated with the switching apparatus in question for absorbing such surges or impulses; and to utilize means which function not only to lubricate the moving parts of the switch in question, but also function to afford a conducting path through which the energy of such surges or impulses may be dissipated.

With the above, as well as other and more detailed objects in view, which appear in the following description and in the appended claims, a preferred embodiment of the invention is illustrated by the accompanying drawing, throughout the several views of which corresponding reference characters are used to designate corresponding parts and in which:

Figure 1 is a diagrammatic view illustrative of the welder system disclosed in the aforesaid Purat application; and,

Fig. 2 is a detail view in section, showing the adaptation of the present invention to one of the secondary switches employed in the system of Fig. 1.

Referring first to Fig. 1, the illustrative workpieces W are illustrated as clamped between a plurality of pairs of electrodes 10 and 12. The electrodes 10 are illustrated as being stationary, and the movable electrodes 12 are carried upon a bus bar 14, which may be actuated between the clamped position, shown in Fig. 1 in full lines, and the retracted position, shown in dotted lines, by any suitable means. Such means are diagrammatically shown as comprising the toggle links 16 and 18, which are arranged for operation by a suitable ram 20.

The bus bar 14 is permanently connected to one terminal of the secondary winding of the welding transformer WT. The other secondary terminal of the transformer WT is connected to a bus bar 22, which in turn is permanently

connected to one contact member 24 of each of a plurality of secondary switches 26. It will be understood that one secondary switch 26 is provided for each stationary electrode 10 and that each such switch is provided with an additional stationary contact member 28. Each switch 26 is also provided with a bridging member 30, which, upon energization of the associated switch winding, is adapted to bridge the corresponding stationary contacts 24 and 28, thereby completing the secondary circuit of the transformer through the corresponding pair of electrodes.

The windings of the several switches 26 are arranged to be successively energized by means of a commutator 32, which may be rotatably advanced by any suitable means, not shown. The circuit for the commutator is controlled by means of a movable switch member 34, and the circuit for the primary winding of the transformer WT is controlled by a second switch member 36.

Referring now to Fig. 2, in which one of the switches 26 and its cooperating electrode 10 are shown in greater detail, it will be noticed that each electrode 10 is rigidly secured at the lower end of a push rod 40, which passes through bushings 42 and 44, which in turn are carried by a supporting frame member 46. A caged compression spring 48 is seated between the lower end of the bushing 44 and a washer 50, which is seated against a shoulder formed on the push rod 40. The spring 48 normally maintains the washer in engagement with a spacer member 51, which in turn abuts the lower stationary bushing 42. If, however, the bus bar 14 is actuated to move the corresponding stationary electrode 12 into clamping engagement with the workpiece inserted between the electrodes 10 and 12, the pressure transmitted to the electrode 10 is sufficient to cause the spring 48 to yield somewhat, thus affording a resilient electrode pressure against the work.

The previously-mentioned fixed contact 28 of the cooperating electrode switch 26 is shown in Fig. 2 as being of cylindrical form and as having a flat outer contact face 52, to which the cooperating flexible lead 54 is connected by means of a block 56 and a stud 58.

The cylindrical contact 28 is rigidly secured to the cooperating bus bar 22 by studs 60, but is insulated therefrom by means of the indicated insulating elements.

The cooperating stationary contact 24, also of cylindrical form, has a drive fit within an opening provided therefor in the bus bar 22, and the upper end 24a of this contact projects into the cylindrical bore of the contact 28. It will be noted, however, that the outer surface of the contact 24 lies in spaced relation to the inner surface 28a of the just-mentioned bore.

The movable contact member 30 is of cylindrical form and has a free fit within the bore of the contact 28, the looseness of the fit between these members being exaggerated in the present drawing for purposes of clarity. The movable contact member 30 is normally maintained in the illustrated upper position by means of a compression spring 62, in which upper position the lower tapered face 30a thereof lies in spaced relation to the upper tapered face 24a of the contact 24. Upon energization of the solenoid winding 64, however, the contact member 30 is actuated downwardly, in opposition to the force of the spring 62, bringing the tapered faces of

the contacts 30 and 24 into firm engagement with each other. By virtue of the tapered relation of these interengaging faces, their engagement tends to force the movable contact member to the right, as viewed in Fig. 2, bringing the outer surface thereof into solid bearing engagement with the inner surface 28a of the bore in the contact 28. In the closed position of the switch, therefore, the movable contact 30 is forced into good electrical contact with both of the contacts 24 and 28. Upon the de-energization of the solenoid 64, however, the spring 62 is enabled to force the contact 30 upwardly to the position shown in Fig. 2.

Considering now the operation of the system, it will be appreciated that to initiate a welding cycle, the ram 20 may be actuated to clamp the work between the several pairs of electrodes 10 and 12. Assuming that the commutator has been indexed to a position in which the brush 32a thereof is in engagement with the segment corresponding to the pair of electrodes through which the welding impulse is to be passed, the switch 34 may be closed, thereby energizing the solenoid 64 of the corresponding secondary switch 26. In response to this action, the corresponding movable contact 30 is moved into solid engagement with the corresponding stationary contacts 24 and 28, as above described, thereby completing the circuit through the secondary of the transformer to the corresponding pair of electrodes 10 and 12. Thereafter, the switch 36 may be closed, completing the primary circuit of the transformer and initiating the flow of welding current. As described in the above-identified Purat application, suitable means may be provided to determine the length of time that the welding current flows, and, at the expiration of this period, the switch 36 may be opened, thereby initiating a decay of the energy in the transformer. Promptly after the opening of the switch 36, it is desirable to open the secondary switch 26 so as to enable the commutator 32 to be promptly indexed to the next position. Thus, it may be expected that the opening of the switch 26 will occur before the energy in the secondary transformer circuit has been completely dissipated, and in the absence of the improvements afforded by the present invention, such opening of the switch 26 draws one or more fine arcs between the engaging surfaces of the contacts 24, 28 and 30, which arcs are extremely detrimental, as will be understood.

In accordance with the present invention, any such tendency to draw a destructive arc is entirely overcome by filling the spaces between the contacts 24, 28 and 30 with graphitic material, commercial grades of so-called graphite grease having been found entirely satisfactory for this purpose. The minute particles of graphite in a substance of this character provide conducting paths of lower resistance than would be afforded by air gaps between the contacts 24, 28 and 30, and the energy which would otherwise be dissipated in these arcs is transmitted through the graphite without injury of any kind to the engaging surfaces of the contacts. The conducting paths thus provided by the graphite particles in the grease, however, while being adequate to carry the previously mentioned impulse or surge without permitting the formation of arcs, nevertheless present such high resistance to the flow of the normal alternating welding current as to substantially prevent the flow of any such current. Accordingly, even though all of the pairs

of electrodes 10 and 12 simultaneously engage the work during the period that one of the switches 26 is energized, and also during the period that the primary of the transformer is energized, no appreciable amount of current flows in any of the secondary circuits except the one corresponding to the then energized secondary switch.

It will be appreciated that welding systems of the above generally described type are operated at relatively high rates of speed of the order of 200 to 300 welding cycles per minute. The secondary switches 26 are, therefore, subjected to a relatively large number of operations, even though only one or a relatively few of such switches for a particular machine are closed during each individual welding cycle. This high duty makes it desirable to lubricate the secondary switches and it will be appreciated that the previously mentioned graphitic grease thus performs not only the function of eliminating the undesirable arcing at the contact surfaces, but also serves the purpose of efficiently lubricating the movable parts of the corresponding switch.

It will be appreciated that although the present invention has been described as being practiced in connection with a particular construction of electric switch, utilized in a particular type of system, the present improvements are,

nevertheless, applicable in a generic sense to other types of switches and to other types of systems. The present embodiment of the invention is, therefore, to be considered in an illustrative and not in a limiting sense.

What is claimed is:

1. In a switch, the combination of means defining first and second relatively movable contact surfaces and an enclosing housing for said contact surfaces, and a lubricant containing conducting elements filling the space in said housing between said contact surfaces to such an extent as to bridge the space between the contacts and form a conducting path therebetween when the same are fully separated, and means operatively associated with the contacts for effecting relative movement therebetween.

2. In a switch, the combination of means defining first and second relatively movable contact surfaces and an enclosing housing for said contact surfaces, and a graphitic grease in said housing and filling the space between said contact surfaces to such an extent as to bridge the space between the contacts and form a conducting path therebetween when the contact surfaces are fully separated, and means operatively associated with the contacts for effecting relative movement therebetween.

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