May 20, 1969 A. F. CARDENAS 3,445,609

REVERSING SWITCH ASSEMBLY

Filed Oct. 11, 1965 Sheet 1 of 2

Fig. 1.

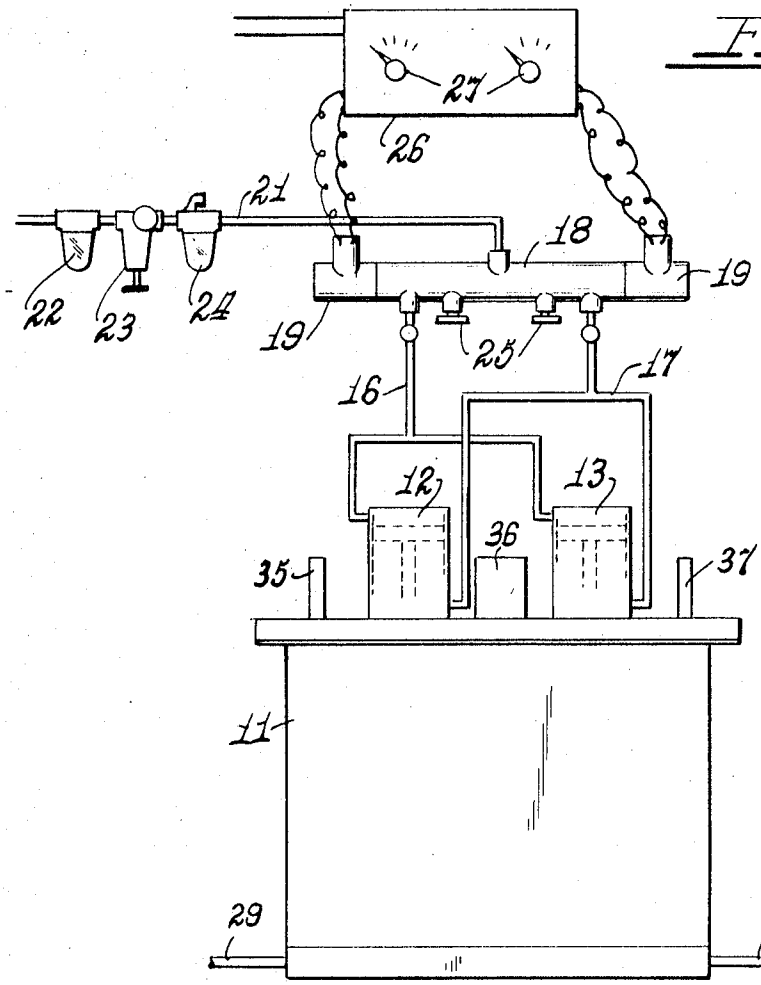

Fig. 4.

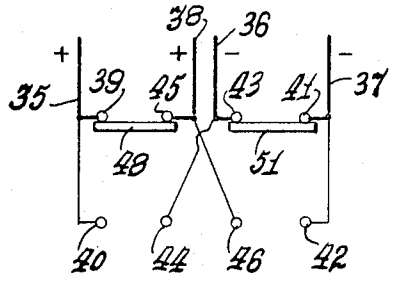

Fig. 5.

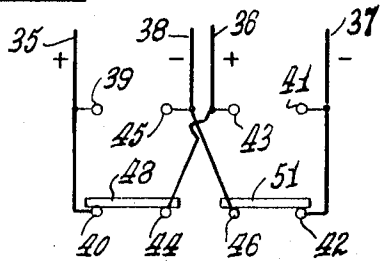

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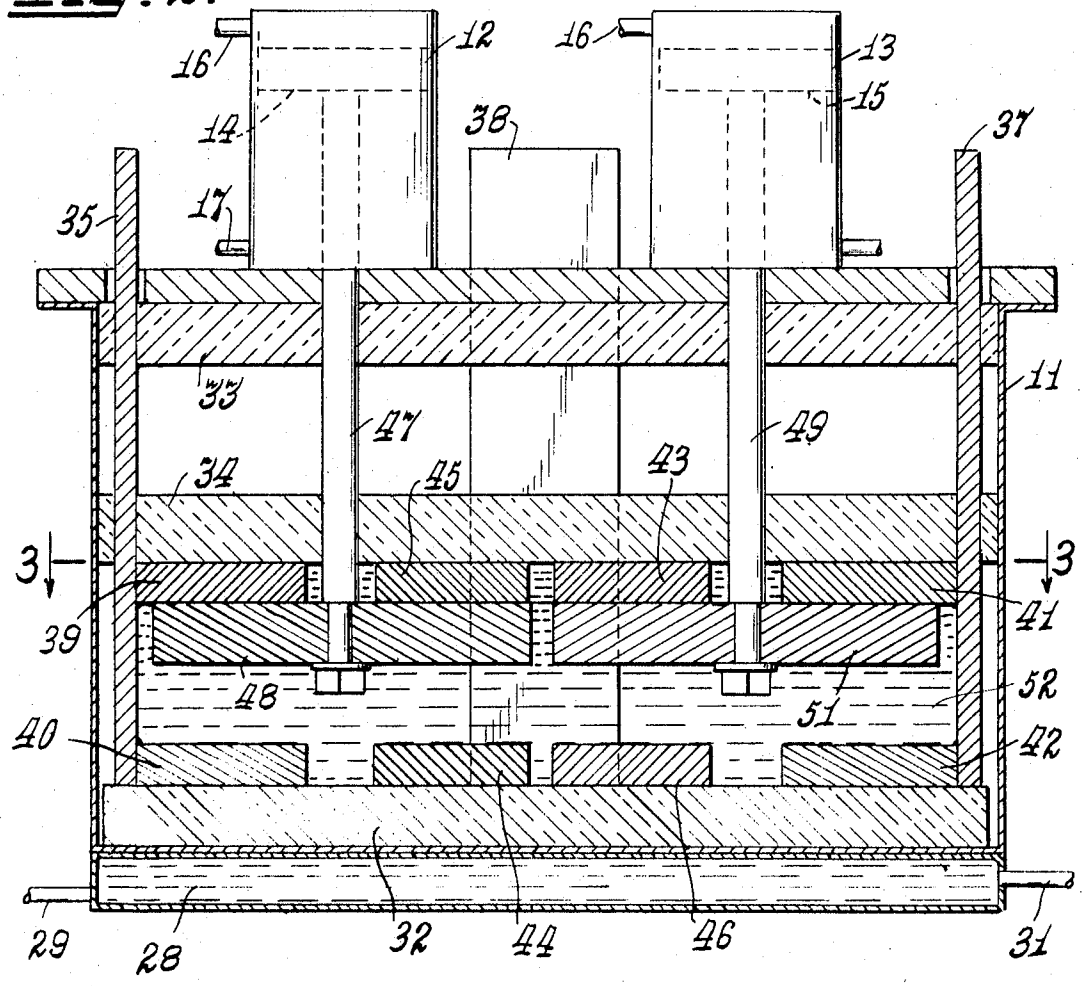
Fig. 2.



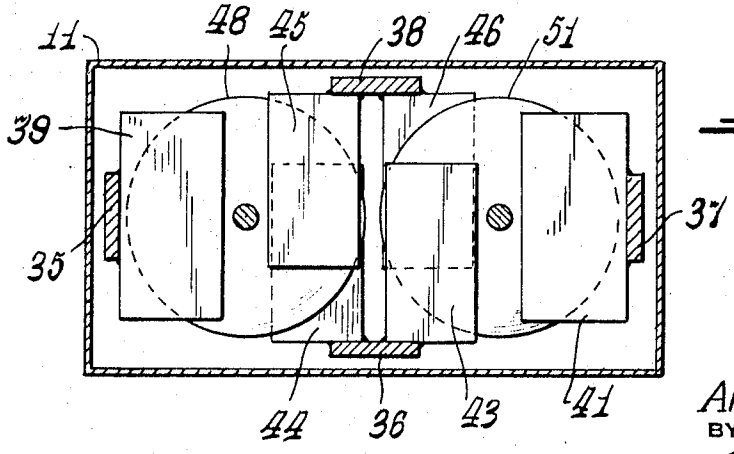


Fig. 3.

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REVERSING SWITCH ASSEMBLY

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U.S. Cl. 200—1 12 Claims

ABSTRACT OF THE DISCLOSURE

A reversing switch of the type having an insulated housing and contact plates in the housing, wherein terminal posts including contact plates thereon are selectively vertically movable between sets of horizontally disposed opposed fixed contact plates, and piston and control means for causing selected movement of the terminal posts, as to cause electric current flowing therethrough to flow in a predetermined direction when the movable contacts are placed in conductive relation to one set of fixed contacts and to cause the current to flow in a reverse direction when the movable contacts are placed in conductive relation to the opposed set of fixed contacts.

The invention relates to improvements in polarity reversing switches and more particularly deals with the novel construction and assembly of such a switch.

Polarity reversing switches have great utility in association with electroplating equipment requiring periodic reversal of the polarity of the current. Such reversal of current flow is necessary to periodically stop the plating process and through reverse current flow, deplate so as to remove unsound, hard and inferior metal deposited during the plating process and prevent marginal build-up. Periodic reversing of polarity makes the entire plating process less critical in operation, yields a smoother surface, cuts polishing time, and eliminates the tendency for the deposit to "treeing." Further, in prior known reversing switch structures, it is necessary to cut off the current supply each time the switch is reversed, to prevent arcing. This unnecessary shut-off of current supply increases the time required for each reversing cycle, and is made unnecessary by the present structure, whereby reversing of the polarity is accomplished without separate stoppage of the current flow.

It is therefore an object of the invention to provide a novelly constructed reversing switch.

Another object is to provide a reversing switch assembly which is entirely automatic in its operation.

It is the further object of its invention to provide a reversing switch of the character referred to which is ruggedly and relatively inexpensively constructed, positive in operation, and very inexpensive but very efficient in use.

An exemplary embodiment of the invention is shown in the accompanying drawings, in which:

FIGURE 1 is a schematic view of the reversing switch and associated control mechanism;

FIGURE 2 is a longitudinal vertical sectional view of the reversing switch;

FIGURE 3 is a sectional plan view of the reversing switch, on a reduced scale, and taken substantially along line 3—3 of FIGURE 2; and

FIGURES 4 and 5 are schematic representations of the current flow when the reversing switch is in plating and deplating positions.

Referring to the disclosure of an exemplary structure of the reversing switch assembly shown in the accompanying drawings, and particularly to FIGURE 1, said switch is enclosed in a substantially rectangular housing **11**

mounting on its top surface a pair of cylinder assemblies **12** and **13**, which are vertically arranged and of the pneumatic piston type. These assemblies are operable connected to the reversing mechanism that is enclosed in housing **11** and which will be described in detail hereinafter. As is well understood, pistons **14** and **15** in said piston-cylinder assemblies are adapted to be moved upwardly or downwardly in unison in response to the admittance of pressurized air to each end of the cylinders. For this purpose, the upper ends of said cylinders have a conduit **16** in flow communication therewith, and a conduit **17** in flow communication with their lower ends.

These conduits **16** and **17** are connected ,as shown, to a conventional type of reverse flow manifold valve **18** having a solenoid **19** at each end thereof, each operable when individually energized to shift the enclosed valve element from one position to the other for admitting air into either conduit **16** or **17**. A line **21** connects valve **18** to a source of pressurized air and this line preferably includes a filter **22**, a flow regulator **23** and a lubricator **24**, the latter affording means to convey a lubricant to pistons **14**, **15**, along with a supply of air to the cylinders. The usual exhaust ports of the manifold valve preferably have dust excluders **25** fitted thereover.

Operation of the manifold valve is controlled by a conventional timer **26** which includes dual controls **27** so as to enable the timer to be set to actuate the manifold valve at predetermined intervals. One example of timing is to have the manifold valve remain in a position holding the reversing switch in plating position for fifteen seconds and to then have the manifold valve reverse the switch to deplating position for three seconds. It is understood that these time intervals are suggestive only and that they may be varied depending upon the nature of the operating, i.e., whether plating, cleaning, descaling, etc., as well as the nature of the material being plated and the plating material.

Referring now specifically to FIGURES 2 and 3, the housing **11** is of sheet metal construction and it includes in its floor a tank **28** through which there is a steady flow of cooling fluid delivered thereto through a line **29**, and withdrawn through line **31**. Mounted on the floor of the housing is a layer **32** of electric insulation material. Similar layers of such material are provided, one beneath the top wall, as at **33**, and one substantially midway between them, as at **34**.

Four electric conductor posts **35**, **36**, **37**, and **38** are spaced around and arranged vertically within the housing, and held spaced away from the housing walls by insulation layers **32**, **33**, and **34**, as shown. These posts extend to the outside of the housing and constitute connectors for the various lines leading from the line current and to the electroplating equipment, all as is well understood in this art. Specifically, the post **35** may be connected to the plus line, whereas post **37** may be connected to the return line. The post **35** carries, within the housing and between spaced insulation layers **32**, **34**, two vertically spaced apart contact plates **39** and **40**. The post **37** likewise mounts two vertically spaced apart contact plates **41** and **42**.

The post **36**, as shown in FIGURE 3, mounts integrally with upper and lower contact plates **43** and **44**, which are offset longitudinally of the housing, so as to lie in different vertical planes. Post **38** also have two vertically spaced apart contact plates **45** and **46**, which are also offset longitudinally of the housing, as shown. Specifically, the plates **39**, **41**, **43**, **45**, are disposed in a common horizontal plane, whereas plates **40**, **42**, **44** and **46**, are in a second common horizontal plane spaced below the plane of plates **38**, **41**, **43** and **45**.

The piston **14** includes a piston rod **47** that extends into the housing and mounts on its end a contact plate **48**. The

piston **15** includes a piston rod **49** that also extends into the housing and mounts on its end a contact plate **51**. Upon referring to FIGURE 2, it will be observed that the plate **48** is shown in electrical contact with contact plates **39** and **45**, whereas plate **51** is shown in electrical contact with contact plates **41** and **43**. When in this position (see FIGURE 4), electric current, in this example positive, from contact post **35** is conducted through plates **39**, **45** and **48** to the post **38**. The return current path is from post **36** through plates **41** and **43** to post **37**. This can be termed the circuitry for the plating cycle.

When the timer calls for a reversal of the switch, the pistons **14** and **15** are thrust downwardly (see FIGURE 5) carrying the contact plates **48** and **51** into contact respectively with contact plates **40**, **44** and **42**, **46**. This reverses the current flow through the switch so that positive current is now delivered to post **36** and the return flow is through post **38**.

The action of the pistons is substantially instantaneous, hence the tendency to arc is reduced to a minimum, if not totally eliminated. However, such arcing, should it occur, is quenched by maintaining a supply of oil **52** which the housing at a level to maintain all of the contact plates submerged at all times.

Although pneumatic drive means for the switch has been illustrated and described, it should be understood that solenoids may replace the air cylinders, without impairing or altering the operation of the reversing switch assembly.

While I have described and illustrated a preferred embodiment of my invention, it should be understood that changes and modifications in the various details disclosed may be made without departing from the spirit of my invention, and nothing herein shall be construed as limitations upon the invention, its concept or structural embodiment as to the whole or any part thereof, except as defined in the appended claims.

I claim:

1. A reversing switch comprising, in combination, a housing, four electric conductors arranged in said housing and insulated one from the other and from the housing, a pair of spaced contact terminals integral with a first of said conductors arranged one above the other, a pair of spaced contact terminals integral with a second of said conductors arranged one above the other and offset out of vertical alignment, a pair of spaced contact terminals integral with a third of said conductors arranged one in vertical alignment with one of said offset contact terminals and the other in vertical alignment with the other of said offset contact terminals, a pair of contact terminals integral with a fourth of said conductors arranged one above the other, a first movable electric contact member arranged between and adapted to have selective contact with either of the contact terminals on the first conductor and either one of one set of vertically aligned contact terminals on the second and third conductor, a second movable electric contact member arranged between and adapted to have selective contact with either one of the contact terminals on the fourth conductor and either one of the other set of vertically aligned contacts on the second and third conductors, means to quench arcing, and means to cool said housing.

2. A reversing switch comprising, in combination, a housing, four electric conducting posts arranged in said housing and insulated from one another, a pair of spaced contact terminals on a first of said posts arranged one above the other, a pair of spaced contact terminals on a second of said posts arranged one above the other and offset out of vertical alignment, a pair of spaced contact terminals on a third of said posts arranged one in vertical alignment with one of said offset contact terminals and the other in vertical alignment with the other of said offset terminals, a pair of contact terminals on a fourth of said posts arranged one above the other, a first movable electric contact member arranged between the one

or the other contact terminal on the first post and one or the other of one set of vertically aligned contact terminals on the second and third posts and adapted to have selective contact with either terminal on said first, second and third posts, and a second movable electric contact member arranged between and adapted to have selective contact with one or the other contact terminals on the fourth post and one or the other of the other set of vertically aligned contacts on the second and third posts.

3. The reversing switch recited in claim **2**, in which means is provided to move said movable electric contacts in unison.

4. The reversing switch recited in claim **2**, in which all of the contact terminals are immersed in a body of oil.

5. The reversing switch recited in claim **2**, in which the reversing switch is water cooled.

6. A reversing switch comprising, a housing, a plurality of fixedly mounted spaced apart electric contact terminals in said housing, a plurality of movable electric contact terminals in said housing arranged between said fixed terminals, plunger elements in said housing operably connected to said movable terminals, power operated means operable to move said plunger elements in unison into electrical contact of said movable terminals with selected groups of said fixed electric contact terminals so as to cause electric current flowing therethrough to flow in a predetermined direction, said means being operable to move said movable terminals into electrical contact with a different selected group of fixed terminals as to cause electric current flowing therethrough to flow in a reverse direction.

7. The reversing switch recited in claim **6**, in which the fixedly mounted contacts are electrically connected in pairs.

8. The reversing switch recited in claim **6**, in which the fixedly mounted contacts are electrically connected in pairs and the movable contact elements are arranged to engage one or the other contact of each of said pairs of such contacts.

9. A reversing switch assembly comprising in combination, a reversing switch in an insulated housing having a pair of movable contact elements arranged between and movable in unison toward and away from sets of opposed fixed contact elements reversible power means operably connected to each movable element, selector means operable to actuate said power means, and timer means to control operation of the selector means, so as to cause electric contact for a predetermined timed interval between the movable contacts and one set of fixed contacts thereby allowing electric current to flow in one direction and to move the movable contacts away from the first set of fixed contacts into electric contact with the opposed set of fixed contacts thereby allowing electric current to flow in a reverse direction.

10. The reversing switch assembly recited in claim **9**, in which the reversible power means comprises piston-cylinder assemblies.

11. The reversing switch assembly recited in claim **10**, in which the selector means comprises a reciprocable manifold valve structure.

12. The reversing switch asembly recited in claim **9**, in which solenoids are provided to actuate the selector means.

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