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POLARITY REVERSING SWITCH

Filed June 15, 1964

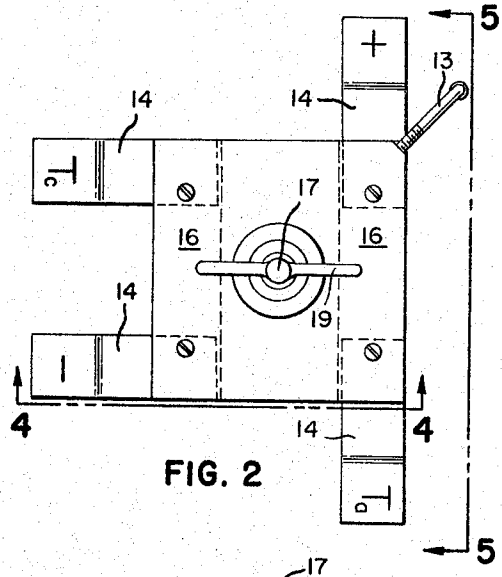


FIG. 2

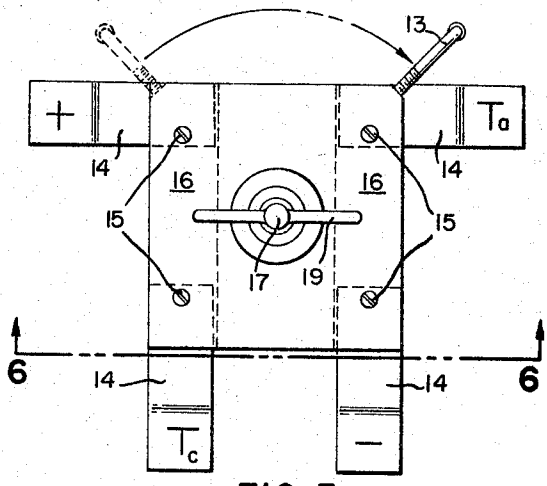


FIG. 3

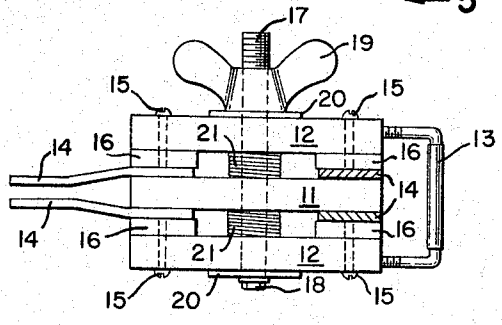


FIG. 4

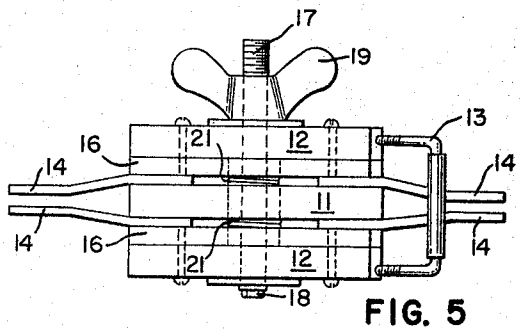


FIG. 5

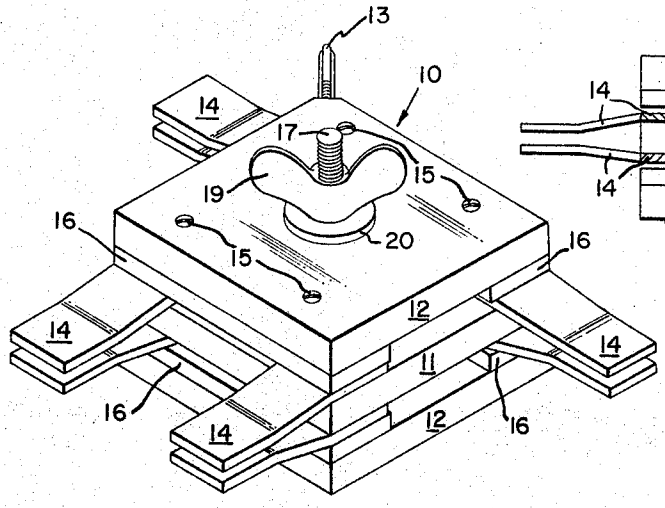


FIG. 1

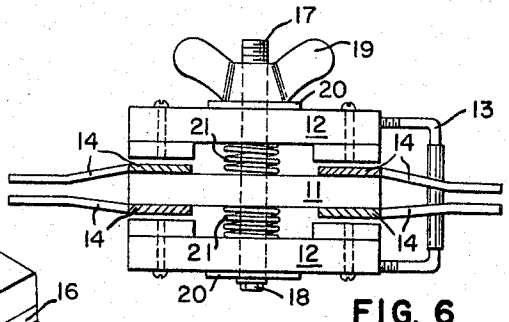


FIG. 6

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POLARITY REVERSING SWITCH

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8 Claims. (Cl. 200—158)

This invention relates to a reversing switch and in particular to a polarity reversing switch suitable for use in an electroplating operation.

Nearly all electroplating processes require direct current power. Since line current is usually alternating, electroplating installations require suitable power supplies to transform the alternating current into direct current. One type of equipment which can accomplish this purpose, and which has become exceedingly popular in the last few years, primarily because of its relatively inexpensive price and low maintenance cost, is the direct current rectifier.

It has been found desirable in certain electroplating operations to reverse the polarity of the current going to the electroplating tank. That is, instead of negatively charged current going to the cathode and thus to the piece or object to be plated in the aqueous solution, so that the positive ions in solution are thereby attracted to the cathode, the current is changed so that positively charged current goes to the cathode and negatively charged current reaches the anode. This reversing of the polarity, which lasts anywhere from a few seconds up to 20 or 30 minutes, depending upon the variables and circumstances of the particular electroplating situation, electrolytically cleans and microscopically etches the base metal. In this manner the surface to be electroplated, especially in hard chrome plating, can be easily and quickly cleaned and activated. In addition, the polarity may also be reversed to break down any oxide film which frequently forms on certain surfaces. This procedure has sometimes been called an "anionic treatment."

In order to reverse the polarity when a direct current rectifier is used in an electroplating operation, it is necessary to change the current on the output side of the rectifier. One manner of doing this is simply to switch the leads on the rectifier going to the plating bath, but this has proven to be impractical. It has heretofore been common practice to use a conventional knife switch located in the circuit between the rectifier and the electroplating tank to accomplish such a task. However, numerous problems and difficulties have been encountered with the above described knife switch usage, particularly when the electroplating operation requires an exceedingly high amperage and low voltage.

The capacity of an individual polarity reversing switch can be measured by the cross-sectional area of electrical conducting material incorporated therein. It can thus be seen that when 10,000 amperes or more is used, a large amount of cross-sectional area is necessitated. A knife switch of this magnitude is extremely bulky and cumbersome to operate and can only be handled efficiently when a commercial hydraulic operated device or the like is attached to the knife arm. This, of course, adds to the cost of operation. Furthermore, hot spots which cause faulty operation periodically occur in knife switches.

The invention in this application overcomes all of the above problems by providing a polarity reversing switch which can be hand operated at all amperages and especially at very high amperages in the order of 10,000 amperes and higher, is compact in size, economical to produce and efficient in operation.

The primary object of this invention is to provide a new and improved polarity reversing switch.

Another object of the invention is to provide a polarity reversing switch which is relatively simple in design and construction.

Another object is to provide structure of the character described having sufficient cross-sectional conducting area for usage under very high amperage conditions and still capable of being operated easily by hand.

A further object of the invention is to provide a polarity reversing switch which has contact cutoff means for automatically separating the contacting areas without having any sliding metal on metal contact as the polarity is being reversed.

Other features, objects and advantages of the present invention will be apparent from the following description of a preferred embodiment illustrated in the accompanying drawing in which:

FIGURE 1 is an isometric view of a polarity reversing switch embodying the invention therein;

FIGURE 2 is a top plan view partially in section illustrating the polarity reversing switch in one circuit forming position;

FIGURE 3 is a top plan view partially in section illustrating the polarity reversing switch in a different circuit forming position with the movement of the connecting member of the movable member shown in dotted outline;

FIGURE 4 is a sectional view taken substantially as indicated along line 4—4 of FIGURE 2 showing the terminals and terminal engaging conductors in contacting position;

FIGURE 5 is a sectional view taken substantially as indicated along line 5—5 of FIGURE 2; and

FIGURE 6 is a sectional view taken substantially as indicated along line 6—6 of FIGURE 3 showing the terminals and terminal engaging conductors in disengaging position.

In accordance with the present invention, a polarity reversing switch is provided with a stationary member having four external terminals and a movable member having internal terminal engaging conductors operable in a first position to form a circuit between pairs of terminals and when in a second position to form a circuit between different pairs of terminals. The terminals are connected to bus bars leading to an electroplating tank so that the flow of direct current through the switch is reversed when the position of the movable member is changed from the first position to the second position. Contact pressure forming means are provided for selectively engaging and disengaging the members in circuit forming positions and contact cutoff means are provided for automatically separating the members when the contact pressure forming means are in a disengaging position.

Referring particularly to FIGURES 1, 2 and 4, a polarity reversing switch, generally designated 10, is illustrated which is intended for use in many industrial operations, as, for example, in electrolytic processes and in particular in the electroplating industry. The polarity reversing switch 10 is provided with a stationary member 11 and a two-piece movable member 12 having one piece on each side of stationary member 11 and being joined together by connecting member 13. As seen in FIGURE 4, one piece of movable member 12 is superjacent stationary member 11 and the other piece of movable member 12 is subjacent stationary member 11. Both the stationary member 11 and the movable member 12 are constructed of a rigid, structurally secure non-conducting material such as wood or plastic or the like.

The stationary member 11 has connected to it by suitable means such as rivets or other appropriate hardware a plurality of external terminals 14. The terminals 14 are situated in diagonal pairs on each side of stationary member 11 with one pair of diagonal terminals 14 connected by means of bus bars (not shown) to a direct current power

source and labeled for convenience + and —, and the other pair of diagonal terminals **14** connected by means of bus bars (not shown) to an electroplating tank and labeled for convenience Tc for the cathode or negative portion of the tank and Ta for the anode or positive portion of the tank. The terminals **14** are preferably constructed of copper or its alloys or aluminum.

The movable member **12** has connected to it on the inner side of each piece of the movable member by bolts **15** or other appropriate hardware a plurality of internal terminal engaging conductors **16**. The terminal engaging conductors, as will be described in detail hereinafter, form a circuit between different diagonal terminals and are constructed of a highly conductive metal like copper or its alloys or aluminum. The internal terminal engaging conductors **16** do not have to be constructed of the same material as the external terminals **14** for satisfactory operation.

A shaft **17** passes through movable member **12** and stationary member **11** and is secured to one piece of the movable member **12** by locking member **18**. A wing-nut or similar pressure forming member **19** rotatably engages the threaded portion of shaft **17** and can be rotated to selectively engage and disengage the movable member **12** and the stationary member **11** in circuit forming positions. Washers **20** are provided on the shaft **17** at each outer side of movable member **12**.

Contact cutoff means are provided in the form of tension springs **21** which encircle the shaft **17** between each piece of the movable member **12** and the stationary member **11**. The tension springs **21** automatically separate the movable member from the stationary member and thus the external terminals from the internal terminal engaging conductors when the pressure forming member **19** is in a disengaging position, see FIGURE 6, by pushing the movable member **12** away from the stationary member **11**.

In actual operation, bus bars from a direct current rectifier are connected to terminals **14** labeled + and —. Bus bars connected to terminals **14** labeled Tc and Ta lead to an electroplating tank. The normal position for the polarity reversing switch during an electroplating operation is illustrated in FIGURE 2. Here, the negative current goes from — terminal through terminal engaging conductor **16** to the tank cathode and the positive current goes from + terminal through terminal engaging conductor **16** to the tank anode. Thus, the positive ions in solution are attracted to the negative tank cathode where they are electroplated on the desired object which is suspended in solution from the tank cathode. The pressure forming member **19** is rotated toward the locking member **18** until sufficient pressure is applied to the movable member **12** to ensure that the terminals **14** and terminal engaging conductors **16** are in pressed metal to metal contact. As seen in FIGURES 2 and 5, the terminal engaging conductors or electrical current conducting metallic strips are rectangular in shape and extend the entire length of one side of the movable member **12**.

To change the arrangement of the switch to the second position and thus reverse the polarity it is first necessary to shut off the power supply and then rotate the pressure forming member **19** to a place near the end of the shaft **17**. This allows the springs **21** to push the movable member **12** away from the stationary member **11** and thereby automatically separate the terminal engaging conductors **16** from the terminals **14**. In addition, there is no metal on metal grinding or scratching when the movable member **12** is rotated by hand by means of connecting member **13** to the position shown in FIGURE 3. The pressure forming member **19** is then again rotated back to its pressure position and the power supply is turned on. The terminal engaging conductors **16** are now arranged so that positive current flows to the tank cathode and negative current flows to the tank anode.

The polarity reversing switch of this invention can be positioned either vertical or horizontal relative to the tank base, although the usual operating position is vertical to the base and floor. In either position, the polarity reversing switch, whether of small design or large, depending upon the amperage, provides an easy, efficient and inexpensive way to reverse the polarity of direct current.

As a further advantage of the design and construction of the polarity reversing switch, it can be seen that by having metal to metal contact on both sides of stationary member **11**, reliability of the switch is greatly increased because damage to a terminal engaging conductor on one side will not render the switch inoperative.

The foregoing detailed description has been given for clearness of understanding only, and no unnecessary limitations should be understood therefrom, for some modifications will be obvious to those skilled in the art.

We claim as our invention:

1. A high amperage polarity reversing switch mounted on a base for reversing current to an electromechanical tank, comprising: a stationary member having two pairs of external terminals, a movable member having internal terminal engaging conductors operable in a first position to form a circuit between pairs of said terminals and when in a second position to form a circuit between different pairs of said terminals, and contact engaging means axially aligned relative to said base for selectively engaging and disengaging said members in circuit forming positions, whereby the flow of current through said switch is reversed when the position of said movable member is changed from said first position to said second position.

2. The polarity reversing switch of claim **1** wherein the contact engaging means are a threaded shaft and a corresponding member engaging said threaded shaft and capable of being rotated on said threaded shaft.

3. The polarity reversing switch as specified in claim **1** in which contact cutoff means are provided to automatically separate the movable member from the stationary member when the contact engaging means are in a disengaging position.

4. The polarity reversing switch as specified in claim **3** in which the contact cutoff means encircle portions of the contact engaging means.

5. A polarity reversing switch mounted on a base, comprising: a stationary member having two pairs of diagonally situated terminals with one pair of diagonal terminals connected to a direct current power source and the other pair of diagonal terminals connected to an electroplating tank, a movable member having terminal engaging conductors operable in a first position to form a circuit between each tank terminal and a power source terminal and when in a second position to form a circuit between each tank terminal and a different power source terminal, and contact engaging means axially aligned relative to said base for selectively engaging and disengaging said members in circuit forming positions, whereby the flow of direct current through said switch to said electroplating tank is reversed when the position of said movable member is changed from said first position to said second position.

6. A polarity reversing switch mounted on a base, comprising: a stationary member having two pairs of diagonally situated terminals with one pair of diagonal terminals connected to a direct current power source and the other pair of diagonal terminals connected to an electroplating tank, a movable member having terminal engaging conductors operable in a first position to form a circuit between each tank terminal and a power source terminal and when in a second position to form a circuit between each tank terminal and a different power source terminal, a shaft positioned in the center of said base and passing through said members connected to said movable member at one end and threaded at the other end, a pressure forming member rotatably engaging said threaded shaft end for selectively engaging and disengaging said members in circuit forming positions, and con-

tact cutoff means to automatically separate the terminal engaging conductors from the terminals when said pressure forming member is in a disengaging position, whereby the flow of direct current through said switch to said electroplating tank is reversed when the position of said movable member is changed from said first position to said second position.

7. The polarity reversing switch of claim 6 wherein the contact cutoff means are tension springs which push the movable member away from the stationary member.

8. A high amperage polarity reversing switch mounted on a base for reversing current to an electrochemical tank comprising: a stationary member having two pairs of terminals on each side thereof, a two-piece movable member having one piece on each side of said stationary member and terminal engaging conductors on the inner

side of each piece operable in a first position to form a circuit between pairs of said terminals and when in a second position to form a circuit between different pairs of said terminals, whereby said terminals and terminal engaging conductors contact each other on both sides of said stationary member and the flow of current through said switch is reversed when the position of said movable member is changed from said first position to said second position.

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ROBERT K. SCHAEFER, *Primary Examiner.*

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,265,846 August 9, 1966

Hans Brechtel et al.

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 4, line 19, for "electromechanical" read -- electrochemical --.

Signed and sealed this 22nd day of August 1967.

(SEAL)
Attest:

ERNEST W. SWIDER
Attesting Officer

EDWARD J. BRENNER
Commissioner of Patents