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MONITORING DEVICE FOR COUNTING PARTS PASSING
THROUGH AN ELECTROLYTIC BATH
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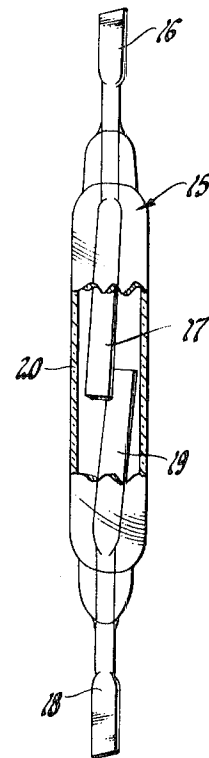
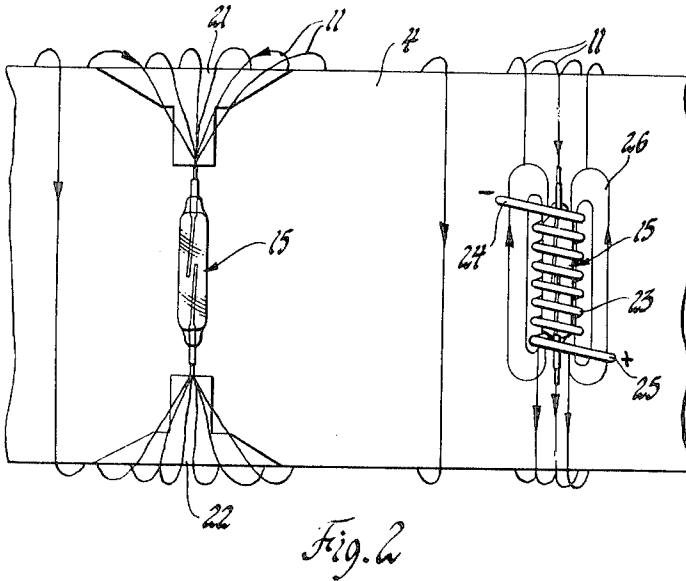
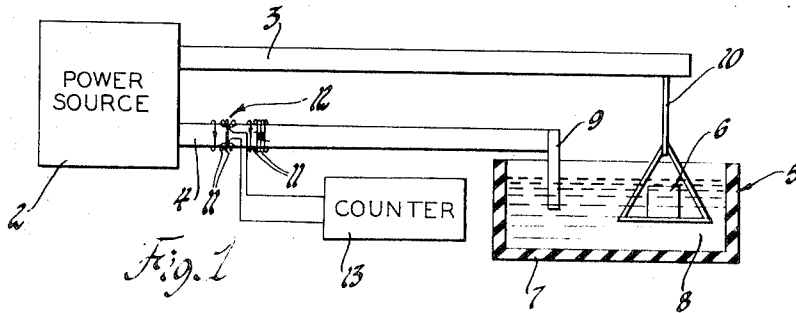


Fig. 3

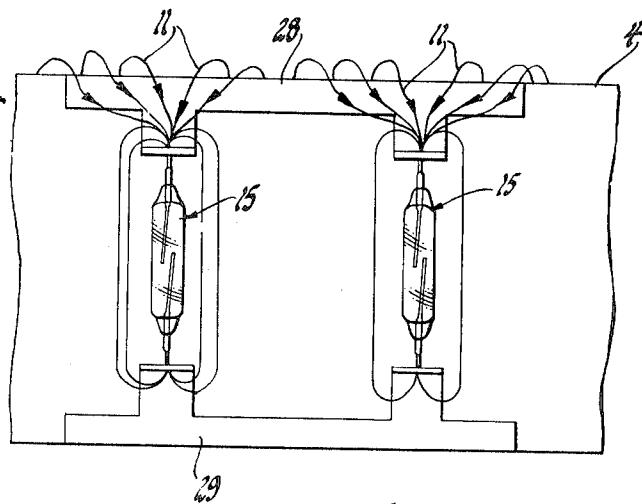


Fig. 4

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3 Claims

ABSTRACT OF THE DISCLOSURE

A reed switch, responsive to an electromagnetic field, is attached to a conductor and is closed when the electric current through the conductor reaches a predetermined value. Since the current through a bus bar (conductor) that supplies energy to an electroplating bath varies as the total surface area of the parts being plated varies, closure of the reed switch is indicative of the fact that a part or given number of parts has passed through the plating bath.

The present invention relates generally to apparatus for determining the number of parts passing through an electro-coating bath, and more specifically relates to means for measuring the current supplied to the bath in order to indicate the number of parts treated.

Most of the trim on a production automobile is chrome plated, i.e., light bezels, bumpers, molding, ornaments, etc. This is a complicated, expensive process. To chrome plate on a production basis requires a massive plating conveyor installation which is expensive to install, run and maintain. It is economically desirable to obtain efficient usage of these conveyors, and one method of doing this is to maintain an accurate count of the parts being plated to avoid overproduction.

One method of counting production of commercial plating equipment has employed means for monitoring the output current of one of the plating rectifiers. Since the current required to electroplate a part is relatively high (200 to 2000 amperes) it is necessary to employ a shunt in series with the power supply. These shunts generally produce a 50 millivolt (m.v.) drop at a particular rated current, i.e. 50 m.v. at 200 amperes. Thus, the measuring instrumentation has a maximum input signal range of 50 m.v. It is necessary to convert a change in this low input signal from the shunt into a digital or contact closure output. Means to accomplish this conversion include ultra-sensitive relays or amplifiers. These in turn add to the expense of the operation.

It is therefore a primary object of the present invention to provide a new system for monitoring the current flowing through an electroplating bath by providing switching means on one of the conductors leading to said bath, which switching means is directly responsive to current flow through the conductor;

A further object of the present invention is to provide a current monitoring system for electroplating baths wherein a relatively accurate count of the parts being plated may be made regardless of the fact that a single part or a plurality of parts are immersed in the bath at a given time;

A further object of the present invention is to provide a switching means that is directly responsive to current flowing to a plating bath and including means to vary the sensitivity of said means.

These and other objects of the present invention will become apparent from the following description when read in conjunction with the accompanying drawing, wherein:

FIG. 1 is a diagrammatic view of an electroplating system employing the present invention;

FIG. 2 is an enlargement of a portion of FIG. 1 showing an embodiment of the present invention.

FIG. 3 is a perspective view, partly in section, of the switch means incorporated in the present invention; and FIG. 4 is an enlarged plan view similar to FIG. 2 and showing a further modification of the present invention.

Referring now to FIG. 1, a power source 2 supplies current to a pair of conductors or bus bars 3 and 4 which in turn supply current to a plating bath 5. The bath may be employed to chrome plate metallic objects 6 which may be relatively large objects such as automobile bumpers, or a plurality of smaller objects such as door handles or radio knobs.

An electrolyte bath container 7 contains a fluid electrolyte 8 into which a first electrode 9 and a second electrode 10 are submerged. It is understood that the electrode 9 may be continuously immersed in the bath while the electrode 10, normally known as a moveable hanger or rack, is periodically immersed in the bath and carries the part or parts to be plated.

It is known that the electric current flowing through conductors 3 and 4 varies as the total surface area of the part 6, which may be a single part or several parts, varies. In other words, more current is required to coat a larger area than is required to coat a smaller area. If the part 6 comprises small objects such as door handles, for example, the total area coated may equal that of a car bumper.

Since the conductors 3 and 4 carry current to the bath 5 an electromagnetic flux 11 surrounds the conductors and the magnitude of the flux is proportional to the current passing through the conductors which current in turn is proportional to the area of the object being coated.

In order to determine the number of parts passing through bath 5, the present invention incorporates a switch means or transducer 12 that is responsive to the electromagnetic flux 11. The transducer 12 is connected to a computer or counter 13 that functions to record or otherwise indicate the number of times the transducer is activated.

Referring now to FIGS. 2 and 3, a reed type switch 15, shown in FIG. 3, includes a first terminal 16 connected to a first reed or contact 17 and a second terminal 18 connected to a second reed or contact 19. The contacts 17 and 19 are enclosed in a sealed envelope 20. The switch of FIG. 3 is well known in the art. The inner ends of the reeds 17, 19 overlap slightly and are generally strips of magnetic metal. By applying a magnetic force or field to the reed switch of FIG. 3, the reeds or contacts 17, 19 are forced together to complete a circuit.

As shown in FIG. 2 the reed switch 15 of FIG. 3 is attached by any suitable means to the bus bar or conductor 4 and is responsive to the electromagnetic field 11 that surrounds the conductor 4 as current passes through the conductor. A pair of flux concentrators 21, 22 are also attached to the conductor 4 and direct the flux lines 11 into the area occupied by the switch 15. The flux concentrators 21, 22 may comprise a single C-shaped piece of ferromagnetic material adapted to be wrapped around conductor 4 or may be comprised of two separate pieces of material that are substantially triangular in shape. Since these pieces have a lower reluctance to magnetic flux, they concentrate the flux in the area occupied by the switch.

Referring again to FIG. 2, a second embodiment of the present invention includes the switch 15 attached to the conductor 4. In this embodiment the switch 15 is provided with an outer coil 23 having ends 24 and 25 that are electrically connected to a suitable direct current source to provide a flux field 26. The field 26 is additive

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to the flux 11 to make the switch 15 more sensitive to changes in the field 11 and therefore more sensitive to the variation in current flow through the conductor 4. For ease in construction the coil 23 may first be wrapped around a bobbin of nylon or other plastic material which in turn houses the reed switch.

The embodiments shown in FIG. 2 may be used separately or in combination. For example, the switch 15 and flux concentrators 21, 22 may be adjusted to detect currents of high amplitude, whereas the current in the bias coil 23 can be controlled to, in turn, control the switch 15 depicted on the right hand of FIG. 2 to detect currents of a lower amplitude.

Referring now to FIG. 4, a pair of switches 15 are positioned on conductor 4 between single flux concentrators 28 and 29. The switches 15 are again responsive to flux density but may be initially adjusted so that one switch will close at a given value of current passing through conductor 4, and the other switch will close at a given higher or lower value of current.

In the embodiments shown in FIGS. 2 and 4 it is understood that the switches 15 are electrically connected to a counter that registers or otherwise indicates the number of times switch 15 closes. Assuming that one large object 6 passes through bath 5, switch 15 will close one time. As objects 6 proceed through the bath, switch 15 will periodically close and each closure of the switch will be indicated by counter 13 thereby indicating the number of parts plated.

In order to improve the sensitivity and control the value of current at which the reed switch 15 will close (thus giving an output), the leads on the switch can be shortened or the angle of the reed switch on the conductor 4 can be changed to increase the level at which the reed will pull in. In addition the concentrators 21, 22, for example, may be varied in shape.

If the biasing coil 23 is employed, the number of turns of wire forming the coil may be varied or the amount of current flowing through the coil may be varied.

The sensitivity of the system may be adjusted to measure bus bar currents as low as 50 amperes and in excess of 900 amperes.

It should be understood that although FIGS. 2 and 4 show two reed switches mounted on conductor 4, a single switch is all that is required in a plating system wherein a single rack 10 passes through the bath 5 at a given time.

Two reed switches of different sensitivity may be employed in the system when it is desirable to know if one or two racks are in the bath at a given time. Since the

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current through conductor 4 is proportional to the number of racks in the bath, one reed switch will close if one rack is in the bath and the second reed switch will close if a second rack is placed in the bath.

Although preferred embodiments of the subject invention have been described, it is understood that the invention is not intended to be limited by the disclosure.

What is claimed is:

1. In apparatus for counting the number of parts passing through an electrolytic bath, the combination comprising an electric power source, an electrolytic bath, electric conductors connected between said power source and said bath, switching means mounted on one of said conductors, said switching means being responsive to and actuated by the magnetic flux field that surrounds said one of said conductors upon the passage of current there-through, means mounted adjacent said switching means and adapted to increase the magnitude of said flux field in the area in which said switching means is mounted, counter means for indicating the number of times said switching means is actuated, and means electrically connecting said switching means to said counter means.

2. In apparatus for counting parts as defined by claim 1, said switching means comprising at least one reed type switch, and said means adapted to increase the magnitude of said flux field comprising soft ferrous magnetic strips mounted on said one of said conductors, said strips being substantially triangular in shape and mounted adjacent said switch means.

3. In apparatus for counting parts as defined by claim 1, said switching means comprising at least one reed type switch, and said means adapted to increase the magnitude of said flux field in the area in which said switch is mounted includes a coil of wire that houses said switch and further includes biasing means electrically connected to said coil to provide a flux field that is additive to the field provided by the conductor upon which said switch is mounted.

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