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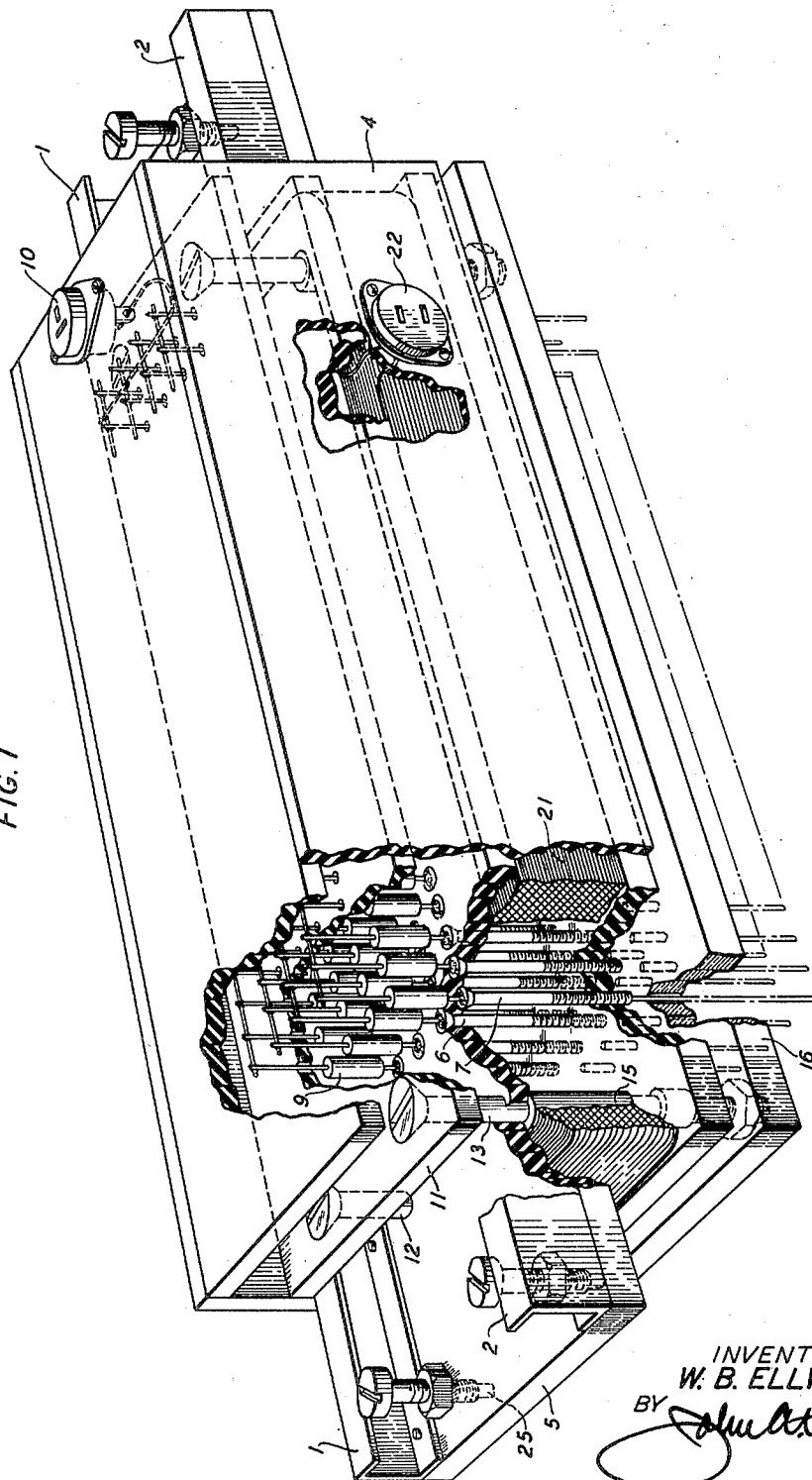
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MAGNETIC JIG FOR ELECTROPLATING

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2 Sheets-Sheet 1

FIG. 1



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FIG. 2

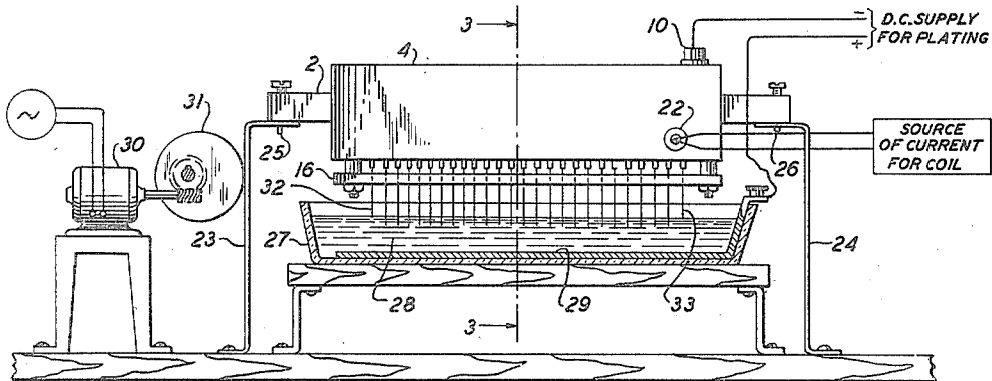


FIG. 3

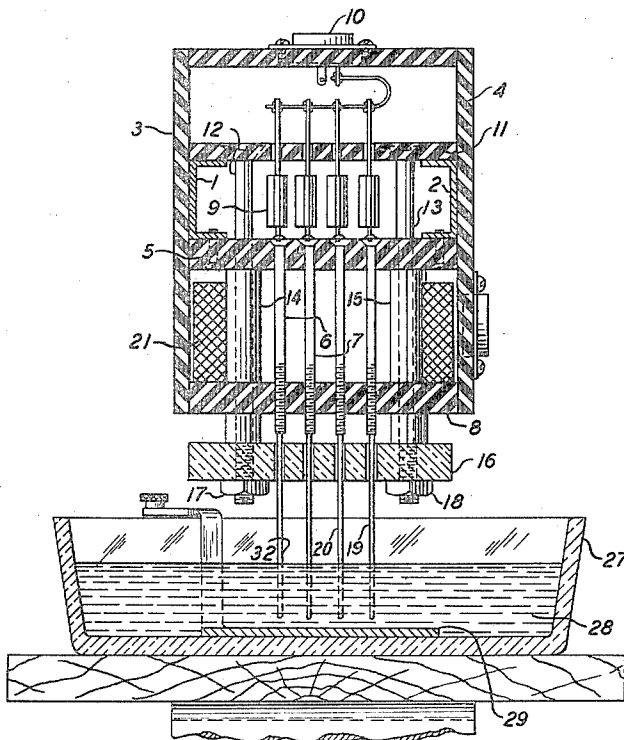
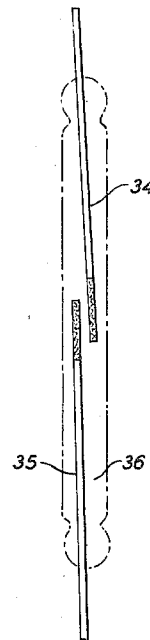


FIG. 4



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MAGNETIC JIG FOR ELECTROPLATING

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2 Claims. (Cl. 204—297)

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This invention relates to electromagnetically operated switches and particularly to sealed wire type of switch in which the magnetically movable members also act at the contact device. Switches of this kind consist generally of a tiny glass tube with the magnetic wires sealed in at the ends of the tube and immersed in an inert gas. These contact units are then inserted into solenoids so that the air-gap of the completed relay comes substantially at the point in the center of the coil where the greatest efficiency is obtained.

The object of the invention is to provide a method whereby contact units of great uniformity may be produced economically. Due to the small size of the contact units the extremely small movement of the wires and the fact that no adjustments can be made after the reeds have been sealed into the tubes, great accuracy, skill and care must be exercised in producing such units. One of the factors in the uniformity of the product and the economy with which the wires are formed is the electroplating process.

In accordance with this object a jig is provided by which a large plurality of wires are magnetically held in position each in its own electrical circuit as a cathode in the electroplating process and by which they may all be simultaneously dropped into a washing bath at the end of the electroplating process without being handled by an operator.

By way of example, a jig for this purpose consists of a solenoid to energize approximately one hundred separate magnetic cores or pole-pieces. These pole-pieces are all of the same length so that their surfaces are in the same plane. The other end of each magnetic pole-piece is connected through an individual 100-ohm resistance to a common cathode circuit. Spaced below these pole-pieces is a piece of insulation with one hundred holes drilled therethrough to guide the wires to be electroplated to the pole-pieces. When the magnet is energized, one hundred of the wires may be placed through these holes and will be firmly held against the pole-pieces so that the jig as an entirety may be turned about and the wires suspended as separate cathodes in an electroplating bath.

The magnet may be energized by direct current in which case the wires will be held immobile. As an alternative having certain advantages the coil may be energized by alternating current in which case there is some vibration of the wires so that when suspended in the electrolyte, gas bubbles will be shaken away from the immersed ends.

When the electroplating process is completed,

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the jig as a whole is moved away from the electroplating bath, held over a washing bath and the current through the magnetizing coil is broken whereupon the one hundred wires will fall by gravity simultaneously into the washing bath.

As a specific embodiment of the invention the wires formed of an alloy of iron and nickel are electroplated with rhodium. The use of rhodium as a contact metal has certain advantages. The peculiar properties of this metal which render it valuable for this use are its extreme hardness and its high melting point combined with its low specific resistance and high covering power as a plating material. The hardness is of value because it acts as a retaining sheath for the very malleable nickel and iron alloy and thereby prevents more than a slight deformation of the tips of the wires under the magnetic impact of such wires on operation of the device. Its high melting point prevents destruction of the contact tips under the rapid magnetic hammering in the formation of the contact surfaces and its low specific resistance makes it especially useful as a contact metal. The high covering power makes an extremely thin coat without pinholes and gives excellent protection against oxidation of the base material.

The drawings consist of two sheets having four figures as follows:

Fig. 1 is an enlarged perspective view partly broken away of the jig for holding the wires during the electroplating process;

Fig. 2 is a side view of the jig in its relation to the other parts of the apparatus during the electroplating process;

Fig. 3 is a cross-sectional view taken on the line 3—3 of Fig. 2; and

Fig. 4 is a view partly in outline of the contact device which employs these electroplated wires.

The jig is made on a framework of two metallic channel pieces 1 and 2. To these are secured two side pieces 3 and 4. A cross-piece 5 is secured to the channels 1 and 2 and forms a basis for inserting a plurality of iron pieces such as the flat-headed screws 6, 7, etc. At their threaded ends these screws thread into a piece of insulating material 8 so that the screws are held securely in place. At their head ends each screw has soldered to it a separate 100-ohm resistor, such as the resistor 9, all of which are connected in multiple and lead to a socket 10. A cross-piece 11 is provided by means of which the various elements of the jig may be securely attached and held together by the screws 12 and 13. Between the insulating pieces 5 and 8, insulating bushings 14 and

15 are placed and at the bottom of the device another piece of insulating material 16 is secured in the assembly and held by the nuts 17 and 18. This piece is drilled with a number of holes corresponding to the number of the iron pieces 6 and 7 so that the wires 19, 20, etc. inserted in these drilled holes will each come to rest on the end of an iron piece. The drilled holes are only slightly larger than the wires to be inserted therethrough so that such wires may be held in position without binding. When the device has been assembled, the lower ends of the iron pieces are ground to an even level and are preferably gold-plated to prevent rusting during the life and use of the apparatus.

A coil 21 is wound about the iron pieces so that when energized, preferably by direct current, each one of the iron rods will be magnetized so as to hold the alloy wires in position magnetically. The terminals of the coil 21 are brought out to a socket 22 so as to provide a flexible connection between the source of current and the jig. Usually the jig is placed in such a position that the wires may be dropped from above through the holes in the piece 16. After this operation has been completed the source of current is connected to the coil 21 and the jig placed in the position for the electroplating process.

Fig. 2 shows the position in which the jig is placed during the electroplating process. A pair of spring supports 23 and 24 is provided which is engaged by centering pins 25 and 26. A container 27 suitably supported contains the electroplating solution 28 and an anode 29. The anode 29 and the multiple connection through the socket 19 to the plurality of resistance coils and thence to the wires to be electroplated are connected to a suitable source of direct current so that as these wires dip into the solution they will become electroplated. In order to provide a certain amount of agitation, an electric motor 30 will operate an eccentric cam 31 to give the jig a back and forth motion. In order to adjust the level of the solution 28 so that the wires will all be plated for a uniform distance, a pair of shortened wires 32 and 33 is placed in the end positions and then the container 27 is raised or lowered by any suitable means until the surface of the solution just reaches these shortened wires.

In the electroplating process the jig with its wires held magnetically in place is generally first placed over another tray of acid and the wires connected as anodes so as to thoroughly clean the surfaces that are to be electroplated. When this process has been carried on for a very few minutes the jig is lifted from the acid solution and placed momentarily in a tray of distilled water and then placed in the electroplating solution as shown in Figs. 2 and 3. When the electroplating process has been completed the jig is lifted bodily from its supports 23 and 24 and held over a tray of distilled water. The source of current to the magnetizing coil 21 is then broken so that the wires now electroplated may be dropped into this tray of distilled water to be cleaned free from electrolyte.

The wires thus electroplated may be used as the elements of a glass-sealed contact device shown in outline in Fig. 4. Here, two of the wires 34 and 35 are shown sealed into either end of a glass tube 36 which is filled with a non-corrosive gas such as helium. The overlapping ends of these two wires are electroplated and held normally at a short distance from each other. When such a unit is placed within a helix

it forms an efficient and very fast acting contact device for which the helix is energized by the flow of current therethrough the magnetic effect will bring the two overlapping ends of the wires together so that an electrical circuit may be completed therethrough.

These wires as shown are parallel to each other and hence the contact made between them when they are drawn together is at least theoretically along a geometrically straight line or even at a geometrical point. In order to render this device an efficient contactor, contact surfaces are formed by placing the device in a magnetic circuit and hammering these overlapping ends together rapidly by connecting the helix to a source of alternating current. Since the wires are of a malleable nature this soon forms two conforming surfaces on the wires. The use of rhodium as a plating material is of special value since it is extremely hard and its high melting point renders it valuable as a sheath so as to prevent more than a slight deformation of the tips of the wires in this operation. Its high melting point prevents destruction of the contact tips under the rapid magnetic hammering in the formation of these contact surfaces and its low specific resistance makes it especially useful as a contact material.

What is claimed is:

1. A jig for positioning magnetic material wires in an electroplating bath consisting of a solenoid encompassing a plurality of magnetic cores co-ordinately arranged, each having an end face in the same plane and each being electrically insulated from the others, a guide for guiding each separate wire to be electroplated consisting of a slab of insulating material mounted in a plane parallel to the said plane of said core end faces and having a hole only slightly larger than and conforming in shape to the wire to be guided thereby for each of said magnetic cores constructed along the axis of each said core, a separate resistance element connected to the other end of each said core, said resistance elements having their other terminals multiplied to a common wire whereby a plurality of wires to be electroplated may be magnetically suspended through energization of said solenoid while each is connected in an individual electrical circuit by electrical connection to the face of the said core to which it is attracted and restrained from lateral movement away from its own axis and the axis of said core from which it is suspended.

2. A jig for positioning magnetic material wires in an electroplating bath consisting of a solenoid encompassing a plurality of magnetic cores co-ordinately arranged, each having an end face in the same plane and each being electrically insulated from the others, a guide for guiding each separate wire to be electroplated consisting of a slab of insulating material mounted in a plane parallel to the said plane of said core end faces and having a hole only slightly larger than and conforming in shape to the wire to be guided thereby for each of said magnetic cores constructed along the axis of each said core, a separate resistance element connected to the other end of each said core, said resistance elements having their other terminals multiplied to a common wire whereby a plurality of wires to be electroplated may be magnetically suspended through energization of said solenoid while each is connected in an individual electrical circuit by electrical connection to the face

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of the said core to which it is attracted and restrained from lateral movement away from its own axis and the axis of the said core-from which it is suspended, and means to control the energization and deenergization of said solenoid whereby the said jig may be unloaded over a cleaning bath by deenergization of said solenoid.

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