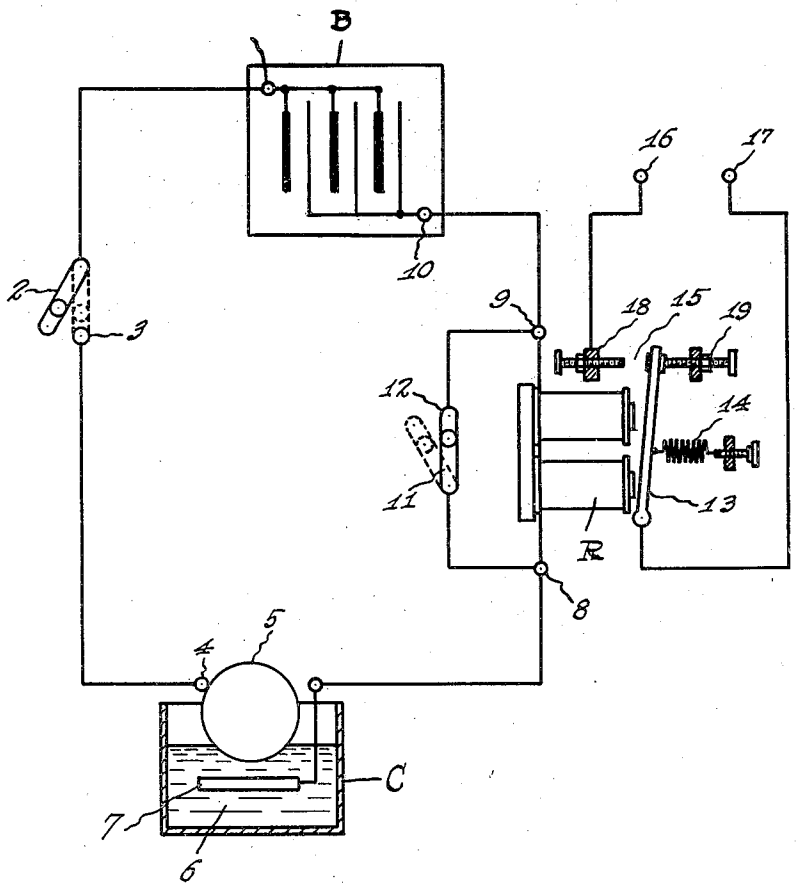
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PROCESS FOR TESTING METALS BY POLARIZATION

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PROCESS FOR TESTING METALS BY POLARIZATION

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This invention is a process whereby the stabilized polarization of a metal when subjected to electrolysis is utilized to control the amperage of the electrolyzing current. The object of this invention is to provide uniform initiative means for the detection and separation of one or more metals from other metals (or alloys), this invention being in part a continuation of my Patent No. 1,920,625, dated Aug. 1, 1933, Serial No. 530,898, Electrical detection and separation of coins from substitutes.

It is known that a metal subjected to electrolysis becomes polarized, the effect of such polarization acting like an electrical resistance to the flow of the electrolyzing current. It is also known that some metals become polarized to a greater extent than other metals when subjected to identical treatment, which leads to the possibility that the effect of polarization of a metal during electroly is may be available as a test for selecting one metal from other metals.

In attempts to employ electrolytic polarization for metal detecting, the usual procedure has been to provide means whereby the metal to be tested is made to act as an anode and placed in an electrolyte, then subjected to electrolysis by an electric current of the usual small or moderate amperage or current density per unit area of anode surface, which results in an instantaneous surge of polarization that acts like a variable resistance which instantly modifies the amperage irregularly to a greater or lesser extent, and this instantaneous amperage has been utilized to energize suitable electrical apparatus for indicating a difference in amperage that is produced when differing metals are used as an anode. But it has been found that the amount of polarization produced upon instantaneous electrolysis of a metal is variable, in one test the resulting amperage will have a certain value, and in other tests using the same kind of metal under reasonably identical conditions the amperage values will be so inconsistent and different from the original value that the detection of a metal from other metals by the method thus employed has proven futile and worthless.

The accompanying drawing is designed to illustrate this invention, B is a battery, C an electrolytic cell, and R an electromagnet or a relay. The armature 13 of the relay is made adjustable by means of the variable spring 14 and the screws 18 and 19. The positive pole 1 of the battery, connects with the switch lever 2 which is shown in the normal open position. 3 is a contact adapted to be connected by means of the switch 2 and leads to the contact 4. Contact 4 is adapted to electrically connect with the metal to be tested 5, which is made to function as the anode by dipping into the electrolyte 6 and in proximity to the cathode 7 contained within the electrolytic cell. The cathode 7 connects with the terminal 8 of the relay and the terminal 9 of the relay connects with the negative pole 10 of the battery. A short-circuit switch 12 connects with the terminals 8 and 9 of the relay and normally short-circuits the relay as shown in the drawing.

In initiating the test of a metal, the first step in the process for testing metals by polarization, is to place the metal to be tested in contact with 4 and 6 to make it function as the anode 5. The second step in the process is to move the switch 2 to make contact with 3, which will cause the electric current from the battery B to flow through the electrolytic cell and thence through the short-circuit 12 and return to the battery. As described in the specification following this description, a suitable battery will provide a current density of approximately 3000 amperes per square foot of electrolyzed anode surface and will result in a super-polarization of the anode and produce a stabilized increase or decrease in the normal amperage.

This stabilized change in amperage will take place within approximately one second. The third step in the process is to move the lever 12 to its open position 11 (within approximately one second after the lever 2 was connected to the contact 3) which will open the short-circuit across the relay and cause the stabilized increased or decreased polarizing amperage to flow through the magnet R and will result in immediately energizing or not energizing the armature 13, depending upon the kind of metal of which the anode 5 is made. If the anode is made of a metal causing an increase in the electrolyzing amperage then the armature 13 will become energized and will make contact at 15 with the screw 18, and this contact may be made to act as a circuit closing device to actuate suitable apparatus that may be connected to the terminals 16 and 17. The closing or not closing of the contact 15 becomes the initiative means and test for selecting one metal from other metals. By altering the adjustments of the armature 13, it is practical to effect the selection of a metal producing a definite stabilized increase in amperage from other metals that produce a lesser increase in amperage, and also to select a metal producing a definite stabilized decrease in am-

perage from other metals producing a lesser decrease in amperage.

In the present invention practical results have been made possible in the production of uniform stabilized differences in the amperage of an electric current during electrolytic polarization of different metals by the discovery that a metal placed in anodic contact with a suitable electrolyte containing a cathode to form an electrolytic cell, the anode of said cell being subjected to polarization by means of an electric current of sufficient voltage to produce a current density through said cell of approximately three thousand amperes per square foot of anode electrolytic contact surface, which current is continued for a definite limited interval of time approximating one second, during which time super-polarization of the anode ensues with the result of changing the normal electrical resistance between the anode and the cathode that existed before said super-polarization, and also results in practically stabilizing the changed electrical resistance within said cell within the limited time interval during said electrolytic polarization.

After said time limited super-polarization of the anode, the amount and kind of change in the electrical resistance within the electrolytic cell becomes of uniform value depending upon the kind of metal used as the anode when other conditions remain unchanged. Different metals used as the anode have the property of inducing a different amount of change in the normal electrical resistance within said cell, which resistance change may be indicated visually in terms of ohms by means of an ohmmeter, or the effect of the resistance change may be indicated in milli-amperes by passing the electrolyzing current through an ammeter. Since change in electrical resistance in a circuit causes a change in the amperage in such circuit, the electrolyzing current may be passed through a suitable electric relay, which relay has been adjusted to become energized when the normal amperage is passed through the relay, but not to become energized with a subnormal amperage.

Therefore, this invention essentially consists in stabilizing and in uniformly changing the normal amperage in the flow of a suitable electric current through an electrolytic cell, which current is maintained for a definite limited interval of time, then after said time interval said amperage becomes available as initiative means for energizing or not energizing suitable apparatus for the detection and separation of one metal from other metals.

In practice, a suitable electrolyte for detecting a nickel coin from other metals consists of water containing 20 per cent glycerine and into one gallon of which is dissolved four pounds of ammonium sulphate and four ounces of ammonium chloride. For the detection of a silver coin from other metals, to one gallon of water containing 20 per cent glycerine is dissolved two and one-half pounds of ammonium sulphate and one pound of ammonium chloride, the liquid being acidulated with the addition of two per cent of hydrochloric acid.

An ordinary three cell storage battery has been found to furnish a satisfactory amperage when the extent of the anode surface is approximately one-sixtieth of a square inch area.

The length of the time interval required during electrolysis is found by trial, it usually varies from approximately one-half a second to one and one-half seconds.

In carrying this process into effect the metal to be tested is placed in anodic contact with a suitable electrolyte, an area of approximately one-sixtieth of a square inch of anode in contact with the electrolyte being sufficient, a cathode is placed in contact with the electrolyte and in proximity to the anode, the distance between the electrodes may be approximately one-eighth of an inch, any comparatively non-oxidizable metal may be used for the cathode; the anode is then subjected to electrolytic super-polarization for a comparatively definite but limited interval of time by means of an electric current that produces a current density of approximately three thousand amperes per square foot of anode, this amount of amperage being usually sufficient to produce rapid stabilization of polarization and of the amperage, then upon expiration of said time interval, if a nickel coin has been used as anode, the amperage passing through the electrolytic cell will be greater than approximately 350 milliamperes, but if a substitute for a nickel coin that is made of some other metal is used as the anode under like conditions, the current flow or amperage through the electrolytic cell will be less than 350 milliamperes.

The above named ampere values may be obtained by placing a low resistance milliammeter in series circuit with the electric current source and the electrolytic cell. Or if an electrical relay is placed in series circuit with the electrical source and the electrolytic cell, and the armature of the relay is adjusted to become energized when the amperage through the electrolytic cell exceeds 350 milliamperes, and not to become energized when said amperage is less than 350 milliamperes, the relay will become the dynamic means either alone or in setting other apparatus into action to detect and to separate a nickel coin from substitutes for nickel coins, or for the detection and separation of one metal from other metals.

When making the initiative test for silver in an electrolytic cell as above described for nickel, it will be found that a reading taken by a milliammeter will indicate an electrolyzing current of less than 75 milliamperes if a silver coin is used as the anode, but if some other metal is used as the anode the milliammeter will indicate an electric current flowing through the electrolytic cell greater than approximately 75 milliamperes.

It is to be understood that the strength of current mentioned herein will vary considerably according to the kind and strength of electrolyte used as well as upon the internal resistance of the electrolytic cell due to area of and distance apart of the electrodes as well as the voltage of the electrical current supply, hence the amperages stated herein are relative, they have been cited as actual amperages that have been observed in apparatus that has been constructed to automatically test, detect, and to separate nickel coins from their substitutes and also to detect and separate silver coins from their substitutes when using a three cell storage battery as the electrical current source for producing super-polarization with a metal anode area of approximately one sixtieth of a square inch exposed to the electrolytic action in an electrolyte similar in composition and strength to the one mentioned herein.

I claim:

1. The process for initiating test of a metal, which consists in placing the metal to be tested in connection with a suitable electric current and

in contact with an electrolyte to function as the anode in an electrolytic cell; then in subjecting said anode to super-polarization by directing said electric current of sufficient amperage through said anode during a limited time interval of approximately one second to produce a definite stabilized increase or a lesser increase in said amperage; then in directing said changed amperage through electrical apparatus which becomes dynamically energized by the definite increased amperage and not energized by the lesser increased amperage, depending upon the kind of metal of which the anode is made, the energizing or not energizing of said electrical apparatus being the initiative means and test for selecting one metal from other metals, said definite increased amperage being uniformly produced when one kind of metal is used for the anode, said lesser increased amperage being uniformly produced when a different kind of metal is used for the anode, when said metals are subjected to identical treatment during an equal limited interval of time, substantially as herein described.

2. The process for initiating test of a metal, which consists in placing to metal to be tested in connection with a suitable electric current and in contact with an electrolyte to function as the anode in an electrolytic cell; then in subjecting said anode to super-polarization by directing said electric current of sufficient amperage through said anode during a limited time interval of approximately one second to produce a definite stabilized decrease or a lesser decrease in said amperage; then in directing said changed amperage through electrical apparatus which becomes dynamically energized by the lesser decreased amperage and not energized by the definite decreased amperage, depending upon the kind of metal of which the anode is made. The energizing or not energizing of said electrical apparatus being the initiative means and test for selecting one metal from other metals, said definite decreased amperage being uniformly produced when one kind of metal is used for the anode, said lesser decreased amperage being uniformly produced when a different kind of metal is used for the anode, when said metals are subjected to identical treatment during an equal limited interval of time, substantially as herein described.

3. The process for initiating test of a metal, which consists in placing the metal to be tested in connection with an electric current and in contact with a suitable electrolyte to function as the anode in an electrolytic cell containing said electrolyte and a cathode; then in subjecting said anode to super-polarization by means of said electric current with an amperage of approximately three thousand amperes per square foot of electrolyzed anode surface, said polarizing being continued for a limited time interval of approximately one second, more or less, during which time said super-polarization of anode produces a definite stabilized increase or a lesser increase in said amperage; then in directing said changed amperage through suitable electric apparatus which becomes energized by the definite increase in said amperage and does not become energized by the lesser increased amperage, depending upon the kind of metal of which the anode is made, the energizing or not energizing of said electric apparatus being the initiative means and test for selecting one metal from other metals, said definite increased amperage being uniformly produced when one kind of metal is used for the anode, said lesser increased amperage being uniformly produced when a different kind of metal is used for the anode, when said metals are subjected to identical treatment during an equal interval of time, substantially as herein described.

4. In the process defined in claim 3, the anode to be tested being made of nickel or a nickel coin, which when subjected to said super-polarization produces said definite increase in said polarizing amperage, and an anode made of other metal than nickel or a nickel coin when subjected to substantially identical treatment produces said lesser increase in said polarizing amperage.

5. The process for initiating test of a metal, which consists in placing the metal to be tested in connection with an electric current and in contact with a suitable electrolyte to function as the anode in an electrolytic cell containing said electrolyte and a cathode; then in subjecting said anode to super-polarization by means of said electric current with an amperage of approximately three thousand amperes per square foot of electrolyzed anode surface, said polarizing being continued for a limited time interval of approximately one second, more or less, during which time said super-polarization of anode produces a definite stabilized decrease or a lesser decrease in said amperage; then in directing said changed amperage through suitable electric apparatus which becomes energized by the lesser decreased amperage and does not become energized by the definite decreased amperage, depending upon the kind of metal of which the anode is made, the energizing or not energizing of said electric apparatus being the initiative means and test for selecting other metals from a particular metal, said definite decreased amperage being uniformly produced when one kind of metal is used for the anode, said lesser decreased amperage being uniformly produced when a different kind of metal is used for the anode, when said metals are subjected to identical treatment during an equal interval of time, substantially as herein described.

6. In the process defined in claim 5, the anode to be tested being made of silver or a silver coin, which when subjected to said super-polarization produces said definite decrease in said polarizing amperage, and an anode made of other metal than silver or a silver coin when subjected to substantially identical treatment produces said lesser decrease in said polarizing amperage.

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