

Nov. 14, 1933.

A. C. SELETZKY

1,935,487

AUTOMATIC RESISTANCE TESTING APPARATUS

Filed Aug. 28, 1931

4 Sheets-Sheet 1

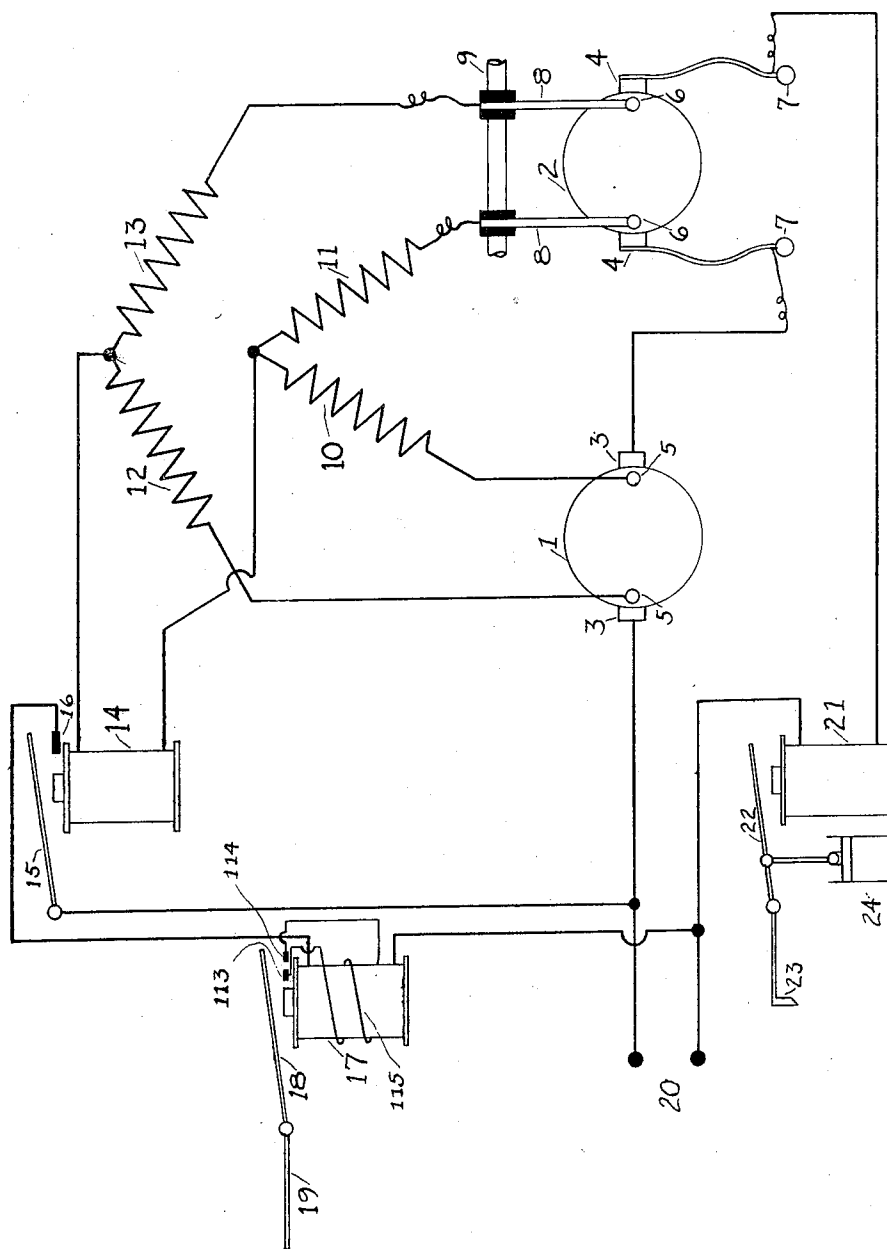


FIG. 1

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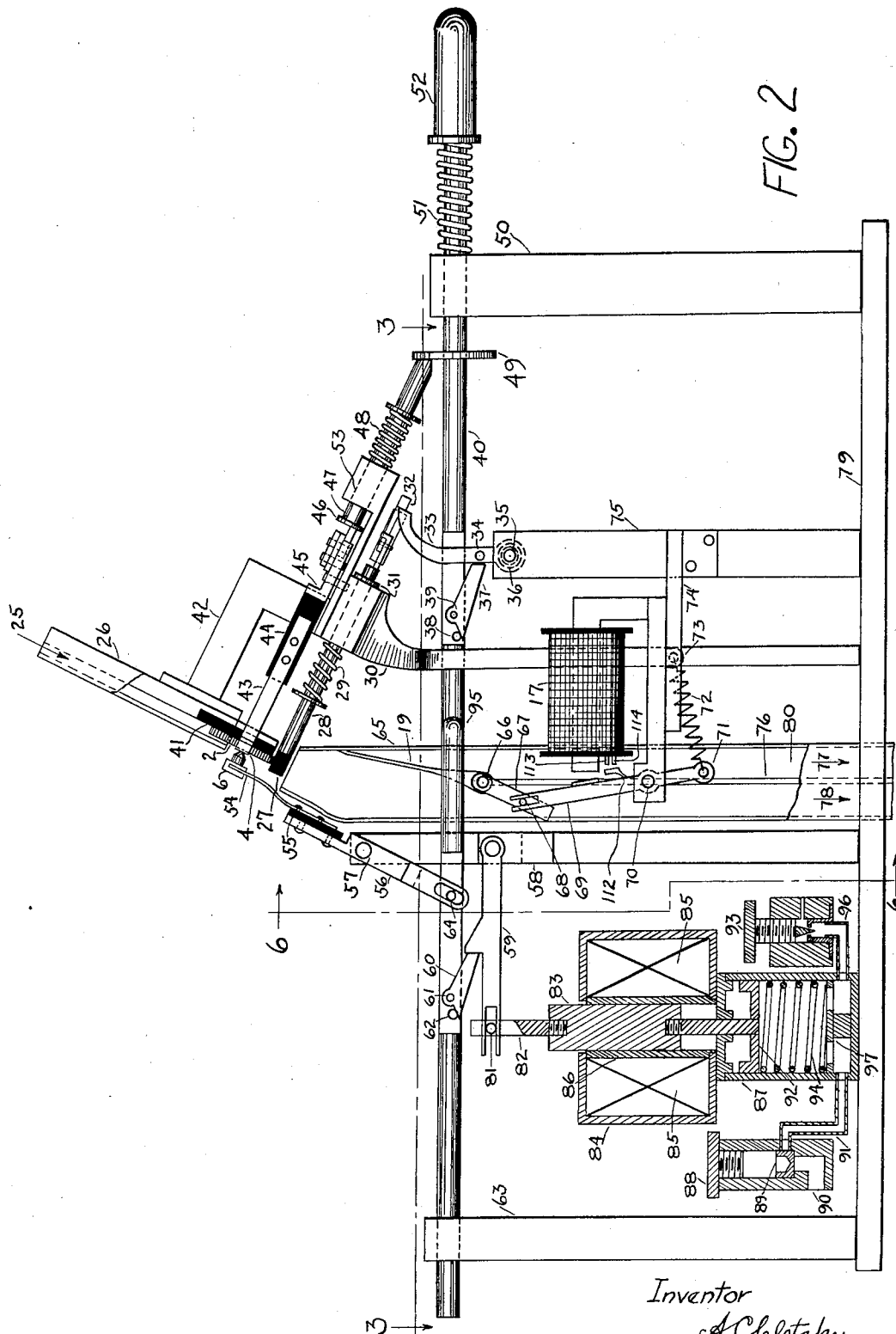
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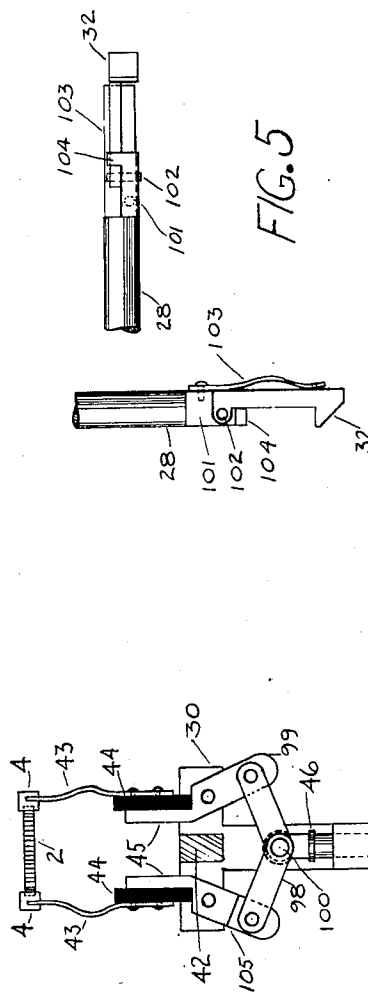
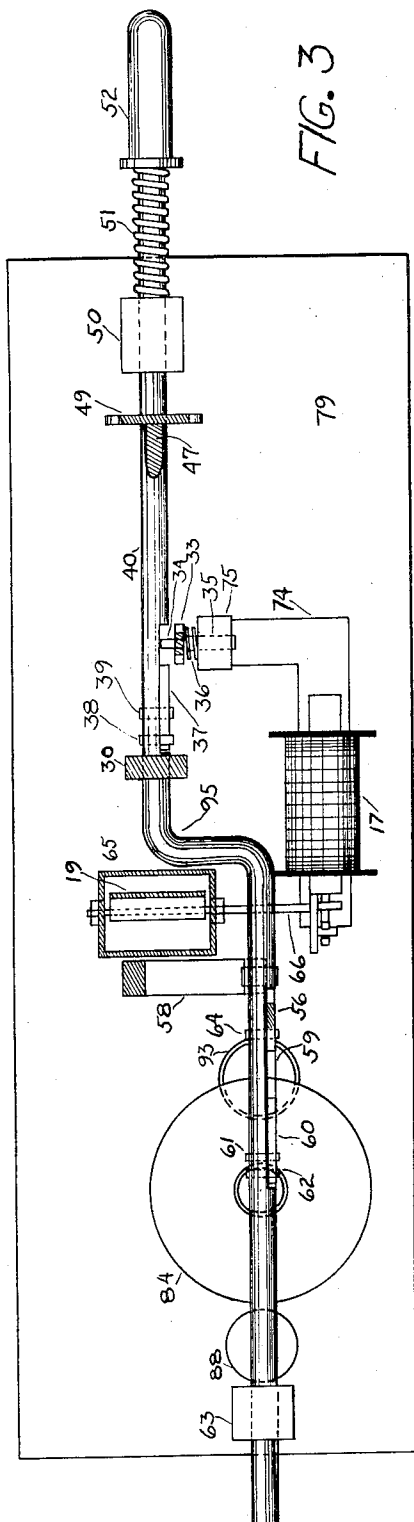
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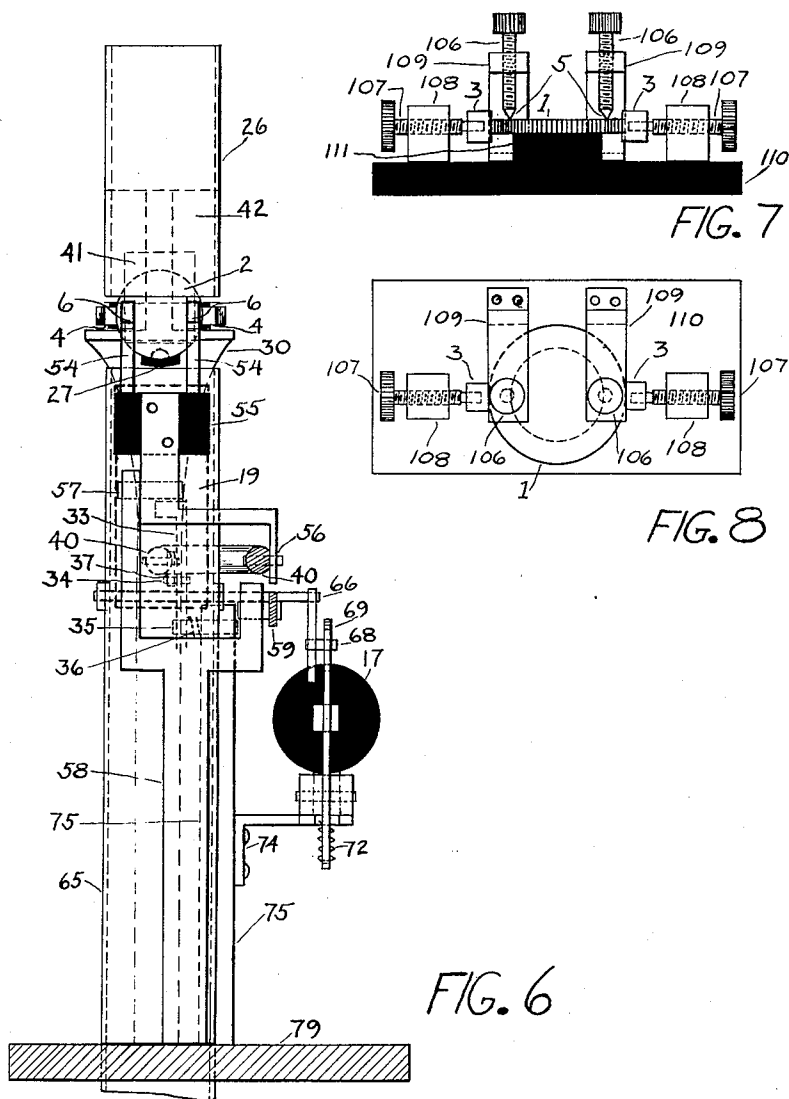
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UNITED STATES PATENT OFFICE

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AUTOMATIC RESISTANCE TESTING
APPARATUS

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Application August 28, 1931. Serial No. 560,047

2 Claims. (Cl. 194—100)

This invention relates to an automatic resistance testing apparatus for the testing of articles made of conducting materials and is particularly concerned with an automatic apparatus for the detection of spurious coins. A genuine coin has a certain electrical resistance as measured between two given points on the coin. The metals used in the manufacture of counterfeit coins cause the resistances of the counterfeit coins to be different from the resistances of genuine coins of the same denomination. The comparison of the resistance of an unknown coin with that of a genuine coin of the same denomination offers a method of detection which is independent of the weight, dimensions or magnetic properties of the coin and depends only upon the value of specific electrical resistance of the material from which the coin has been minted.

The apparatus about to be described compares the resistance of an unknown or test coin with that of a genuine coin and automatically diverts the test coin into one channel if the coin be genuine and into another channel if the coin be counterfeit. This coin detecting apparatus may be mounted in such a position on a coin vending machine, that the coin must first pass through the coin detecting apparatus, be removed from the coin entrance of the vending machine if the coin be counterfeit, and be allowed to fall into the coin entrance of the vending machine if the coin be genuine. The coin detecting apparatus may also be arranged to give any sort of audible, visual or other signal upon the introduction of a spurious coin.

Fig. 1 is a schematic diagram of connections of the apparatus. Fig. 2 is a side elevation of the actual apparatus omitting the coin holder and the electrical connections to the relays and contacts. Fig. 3 is a sectional plan view through the line 3—3 as indicated in Fig. 2. Fig. 4 is a plan view of the current contact assembly. Fig. 5 presents two views of the spring catch on the end of coin stop plunger. Fig. 6 is a sectional end elevation through the line 6—6 as indicated in Fig. 2. Fig. 7 is an elevation of the genuine or standard coin holder. Fig. 8 is a plan view of the genuine or standard coin holder.

Figure 1 presents a connection diagram of the coin detecting apparatus. Current, which may be either direct or alternating, is passed through the genuine or standard coin 1 and the unknown or test coin 2 by means of current contacts 3 and 4 respectively. Standard coin 1 is permanently mounted in an appropriate holder and test coin 2

is temporarily held in place by means which will be described later. Current contacts 4 for the test coin are mounted on spring arms pivoted at 7 which swing outward, thereby releasing the test coin and breaking the electrical circuit through it. The potential drops across the coins are measured by potential contacts 5 and 6 respectively. Current contacts 3 and the potential contacts 5 for the standard coin are permanently adjusted on the standard coin. Potential contacts 6 for the test coin are mounted on spring arms 8, which are attached to and insulated from shaft 9 in such a manner that they can swing upwards and release the test coin. Upon passing through the test coin the testing current goes through time delay trip magnet 21 and then returns to source 20.

The potential drops across both standard and test coins are measured by the Kelvin network of four resistances, 10, 11, 12 and 13, which are connected to the potential contacts of the coins as shown in Fig. 1. The values of the four resistances must be so adjusted that no difference of potential will exist across the junction of resistance arms 10 and 11 and the junction of resistance arms 12 and 13 when the testing current is flowing through the standard coin and a genuine test coin. In other words, the resistances are so proportioned that when the potential drop across the test coin is equal to the potential drop across the standard coin, there will be no potential difference between the junction of the resistance arms mentioned above. With the resistances of arms of the network so adjusted, when the test coin is counterfeit the potential drop across it, that is across potential contacts 6, will be different from the potential drop across the standard coin, that is across potential contacts 5; this difference in potential drops will set up a voltage across the junctions of the resistance arms and thereby will cause a current to flow through relay 14. Relay 14 is arranged to operate a mechanism which causes the apparatus to reject the spurious coin. At the same time it may be arranged to close other circuits to actuate any kind of signaling device desired. Furthermore, if it is so desired, the input terminals of any appropriate voltage detecting device may be connected across the junctions of the resistance arms in place of relay 14 and arranged to actuate a mechanism to discharge the coins selectively or to operate signaling devices.

As shown in Fig. 1 however, the energizing of relay 14 due to the presence of a counterfeit coin between current contacts 4, attracts its armature

15. The movement of armature 15 causes it to close on contact 16 thereby making an electrical circuit through selector magnet 17. The selector magnet then attracts its armature 18, which movement deflects selector vane 19 to such a position that upon release, the spurious test coin will be diverted into the spurious test coin channel. On the other hand if the test coin be genuine, relay 14 will remain deenergized; this will keep the circuit through selector magnet 17 open; its armature 18 will therefore remain in its normal or open position which is so arranged that selector vane 19 deflects the genuine coin, when it is released, to the genuine coin channel. The test coin is automatically released after a fixed and predetermined length of time by time delay trip magnet 21 which attracts armature 22. The travel of this armature is retarded by an appropriate retarding mechanism 24; at the end of its stroke armature 22 moves trigger 23 to such a position that it releases the discharging mechanism which ejects the test coin into one of two channels depending upon whether the test coin is genuine or counterfeit. The setting of time delay trip magnet 21 is adjusted by retarding mechanism 24 for a length of time requisite for the proper functioning of relay 14; this period is very short, being only a fraction of a second.

It will be noticed, that when relay 14 is actuated by the presence of a spurious coin between current contacts 4, the voltage across the junctions of the resistance arm disappears when the coin is released. In order to prevent selector vane 19 from returning to its normal position before the spurious coin has reached it, selector magnet 17 is provided with a retarding winding 115. The ends of retarding winding 115 terminate in contacts 113 and 114 which are closed and the winding thereby short circuited upon itself by armature 18 when the armature has reached the end of its stroke. Since retarding winding 115 is on open circuit when selector magnet 17 is deenergized, the retarding winding does not hinder the fast closing action of the selector magnet. Retarding winding 115 is wound with a sufficient number of turns to prevent selector vane 19 from returning to its normal position before it has diverted the released spurious coin into the spurious coin channel. In the apparatus to be described, selector vane 19 is mounted immediately beneath the test coin, as a result of which the minimum amount of time elapses between the instant the test coin is released from its current and potential contacts and the instant it strikes selector vane 19.

The apparatus about to be described in detail on the following pages performs the following operations: when a test coin has been dropped into the entrance shute of the apparatus and a plunger depressed, current and potential contacts 4 and 6 close upon the test coin thereby completing a circuit through it, the standard coin and time delay trip magnet 21. Relay 14 is or is not energized depending upon whether the test coin is counterfeit or genuine, which determines the position of selector vane 19. The testing current passing through time delay trip magnet 21 attracts armature 22 which deflects trigger 23 at a rate determined by the setting of the retarding mechanism 24. At the end of its stroke trigger 23 releases the discharging mechanism which removes the current and potential contacts from the test coin and ejects it into one of two channels depending upon the position of selector vane 19. In the actual apparatus de-

scribed, time delay trip magnet 21, the retarding mechanism 24 and the trigger 23 are incorporated in one unit. If so desired release trigger 23 could be actuated by a separate magnet which in turn would be energized by time delay trip magnet 21.

The use of separate current and potential contacts in this apparatus greatly increases its sensitivity and enables it to segregate counterfeit coins whose specific resistance might be very close to that of a genuine coin of the same denomination. At the cost of reduction of sensitivity the current and potential contacts on both standard and test coins could be combined into two pairs of contacts serving both purposes. However, since the object of this apparatus is to provide as sensitive a means of detection as is possible to incorporate in a practical mechanism, separate current and potential contacts have been provided.

Figure 2 shows the elevation of the test coin receiver and discharger. Resistance arms 10, 11, 12 and 13 in Fig. 1 as well as the standard coin in a suitable mounting as shown in Figs. 7 and 8, and relay 14 may be mounted in any convenient position near the test coin receiver and discharger and hence are not shown in Fig. 2. Preferably they should be mounted on base 79 of the receiver and discharger thereby keeping the connecting leads as short as possible. The various parts of the coin receiver and discharger are mounted on a suitable base 79. The test coins are discharged through discharge shute 65 which passes through the base of the apparatus. The lower part of the discharge shute is divided into two channels, one for the genuine coins and one for the spurious coins. These channels may be connected as is desired to suit the purpose at hand. For instance, in a coin vending apparatus, the discharge channel for good coins could be connected to the coin entrance of the coin vending mechanism; the discharge channel for spurious coins could be left open so that the counterfeit coins would simply be rejected by the coin testing mechanism. Test coin 2 is inserted into the top of coin entrance shute 26 as indicated by arrow 25. The test coin then falls to the bottom of the entrance shute where it is arrested by stop plunger 28 and rests on insulation stop piece 27 which is attached to the end of stop plunger 28. Insulation stop piece 27 is cut into such a shape that it centers the test coin at the bottom of entrance shute 26. The coin is insulated from the metal wall of the entrance shute by resting on a flat piece of insulation 41 which is fastened in a section of the back wall of the entrance shute, milled out so that the insulation lies flush with the back wall. Entrance shute 26 is supported by arm 42 which is an extension of bearing support member 30. The lower part of entrance shute 26 has been shown with the front side of the shute removed as indicated by the irregular transverse line. Flexible leads connect the spring arms of current and potential contacts 4 and 6 respectively as indicated in Fig. 1; to avoid confusing Fig. 2 these connecting leads have been omitted as well as the connecting leads to the trip and selector magnets.

When the test coin falls to the bottom of the entrance chute, in which position it is shown in Fig. 2, main plunger 40 is pushed in manually against compression spring 51 by depressing plunger handle 52. The inward travel of main plunger 40 causes release catch 60 to pass over release lever trip 59 and lock itself in place.

This is the position shown in Fig. 2. Release catch 60 is pivoted to a flat section of main plunger 40 with pin 61; its downward motion is limited by stop pin 62. The same forward motion of the main plunger closes the current and potential contacts upon the test coin. Potential contacts 6 are attached to spring arms 54 which in turn are mounted on a piece of insulation 55; insulation piece 55 is attached to one end of rocking lever 56 which is pivoted by pin 57 to support member 58. The lower end of rocking lever 56 has a rectangular slot which engages driving pin 64 which is attached to main plunger 40. The dimensions of the rocking lever and the position of pivot pin 57 are such that when main plunger 40 has been pressed in and is locked in position by release catch 60, potential contacts are pressed firmly against the face of the test coin.

Current contacts 4 are closed upon and released from the test coin by the motion of plunger 47 which rides in bearing 53 which is formed by an extension of support member 30. Current contacts 4 are also mounted on spring arms 43 which in turn are fastened to bell crank levers 45 and insulated therefrom by insulating members 44. The current contact assembly is shown separately in Fig. 4. Bell crank levers 45 are pivoted in the upper part of support member 30. The offsets 105 and 99 of bell crank levers 45 are pivoted to connecting links 98 which in turn are connected to the flat section of plunger 47 with pin 100. Offset 105 has a heavier section than offset 99 so that connecting link 98 attached to offset 105 can ride freely above the connecting link attached to offset 99. Plunger 47 is normally held out by compression spring 48 in which position spring arms 43 hold current contacts 4 away from the test coin. When main plunger 40 is pushed in, its bearing disc 49 (Fig. 2) presses against the tapered end of plunger 47 which acting on the toggle mechanism composed of the connecting links 98 and offsets 105 and 99 causes spring arms 43 to press current contacts 4 against the test coin. With the return stroke of main plunger 40 bearing disc 49 recedes, current contact plunger 47 is pushed back by its spring 48 and current contacts 4 swing away from the test coin. The outward motion of plunger 47 is arrested by limit stop flange 46.

The forward stroke of main plunger 40 has been seen to close current contacts 4 and potential contacts 6 upon the test coin, and to lock itself in position against the force of main compression spring 51 by means of release catch 60. Referring to Fig. 1 it is seen that the introduction of test coin closes the circuit through standard coin 1, test coin 2 and time delay trip magnet 21. Trip magnet 21 and its associated time delay mechanism are shown in section through their centers in Fig. 2. The testing current passing through windings 85 of the trip magnet attracts plunger 83 against the force of restoring spring 94; attached to the bottom of plunger 83 is piston 92 which moves in cylinder 87. Trip magnet winding 85 is encased in shell 84 which is made of magnetic material. Plunger 83 which is also constructed of magnetic material is guided in its travel by bushing 86, which is made of non-magnetic metal. Piston 92 being forced downwards by plunger 83 expels air from cylinder 87 through connection 96 and out through needle valve 93. The setting of the needle valve determines the downward rate of travel of piston 92. In order to provide a quick upward stroke

for piston 92, a quick acting air inlet valve 88 is attached to the bottom of cylinder 87 by connection 91. An inlet valve 88 has a smooth acting check valve 89 which permits air to enter rapidly into cylinder 87 through orifice 90 when piston 92 is rising, but seals orifice 90 on the downward stroke of the piston when the air seeks egress through connection 91. To prevent restoring spring 94 from possibly impeding the progress of the air in and out of the bottom of cylinder 87, the spring is arranged to rest on a small flanged pillar 97 provided with holes in the flange, so disposed that they fall within the radius of the restoring spring and thereby assure unobstructed passage of air into and from the cylinder.

The upper end of plunger 83 screws on an extension rod 82 which carries driving pin 81, which in turn rides in the yoke at the end of release trip 59. When plunger 83 is attracted downwards it draws release trip 59 down until the release trip releases catch 60, whereupon main plunger spring 51 drives main plunger 40 back to its normal position. With the return stroke of main plunger 40, driving pin 64 engaging rocking lever 56 removes potential contacts 6 from the test coin; likewise bearing disc 49 recedes, allowing compression spring 48 to push plunger 47 back and thereby remove current contacts 4 from the test coin, as has already been explained. When current contacts 4 are released from the test coin, the electrical circuit through trip magnet is broken which allows spring 94 to restore plunger 83 to its normal position. Needle valve 93 is set so that the interval of time, from the instant main plunger 40 has been pushed in and locked in position by release catch 60, and the instant the downward motion of plunger 83 causes release trip 59 to release main plunger 40, is sufficient to enable relay 14 (Fig. 1) to actuate selector magnet 17.

Upon the return stroke of main plunger 40, coin stop release lever 37, which is fastened to a flat section of the main plunger with pivot pin 39, strikes driving pin 34 which is screwed into pawl 33. Pawl 33 is pivoted to support member 75 with pin 35 and normally maintained in a vertical position by spring 36. The downward motion of coin stop release lever 37 is limited by stop pin 38. The extremity of pawl 33 engages spring catch 32, and as pawl 33 is rotated about pin 35 by the action of coin stop release lever 37 on pin 34, coin stop plunger 28 is drawn forward along its own axis until insulated coin stop 27 is withdrawn sufficiently from beneath the test coin to allow it to fall into lower or discharge chute 65. When coin stop plunger 28 has been withdrawn to this extent, spring catch 32 passes out of the limiting line of contact with the extremity of pawl 33, is thereby disengaged and restored to its normal position by compression spring 29. The travel of coin stop plunger 28 due to the action of compression spring 29 is arrested by stop flange 31. Since the downward travel of coin stop release lever 37 is limited by stop pin 38, the rotation of pawl 33 lowers driving pin 34 beyond the line of contact with lever 37, whereupon lever 37 releases driving pin 34 and rides over it. Pawl 33 then returns immediately to its vertical position by the action of spring 36. When main plunger 40 is again pushed in for the testing of another coin, coin release lever 37 is free to ride over pin 34 and drop into position in back of the pin. In order to prevent interference between the extremity of pawl 33, in re-

turning to its normal vertical position, and spring catch 32, the catch has been so arranged that it may be deflected sideways, yet normally held in line with coin stop plunger 28 by means of a small leaf spring.

The construction of the spring catch will be made clear by referring to Fig. 5 which presents two views of the spring catch on the end of coin stop plunger 28. Catch 32 is pivoted to the flat extremity 101 of plunger 28 with pin 102 and maintained in alignment with the axis of the plunger by means of leaf spring 103 which presses catch 32 against stop 104. Stop 104 is simply a projection of the flat extremity 101 of plunger 28. Pawl 33, returning to its vertical position strikes the tapered end of catch 32, deflects the catch to the side and locks itself in back of catch 32 ready for the next stroke.

From the foregoing paragraphs it is now evident that when main plunger 40 is pushed in, current contacts 4 and potential contacts 6 are closed upon the test coin; that when the main plunger is released by release trip 59, the return stroke of the main plunger releases the current and potential contacts from the test coin, and also withdraws insulated coin stop 27 from beneath the coin. The coin then falls into lower chute 65 which is divided into two channels by partition wall 76. The test coin in falling into the lower chute is diverted into one or the other of the two channels, indicated by arrows 77 and 78, by the position of selector vane 19.

Referring back to the diagram of connections in Fig. 1 it will be remembered that if test coin 2 be genuine, relay 14 will remain deenergized, which in turn means that selector magnet 17 will not be actuated. Selector magnet in Fig. 2 is mounted on bracket 74 which is attached to support member 75. The armature is in the form of a lever with a yoke at one end and a hole 71 for tension spring 72 at the other. It is pivoted in a yoke cut along the center of the base of the selector magnet by pin 70. Bracket 74 also has a yoke cut along its center line far enough in from its extremity to allow tension spring 72 to come up in the yoke and be attached to hole 73, drilled in a projection extending downwards from the base of selector magnet 17. The armature also carries contactor 112 which short circuits the retarding winding (No. 115 in Fig. 1) by closing upon terminal contacts 113 and 114 of the retarding winding when selector magnet 17 is energized and attracts its armature. The yoke in the upper end of the armature engages driving pin 63 which is fastened to the lower end of selector vane 19. Selector vane 19 is made of flat metal sheet and is fastened to pin 66, which serves as the axis of the vane. Shaft or pin 66 for the selector vane rotates in bearings made in the back and front walls of discharge chute 65. Pin 66 extends through the front wall of the chute where it is attached to a crank which carries driving pin 63. To give a clearer picture the front wall of lower chute 65 has been shown removed as indicated by the irregular line near the bottom of the chute. Since, as was assumed at the beginning of this paragraph, the test coin is genuine, selector magnet 17 will not be actuated and tension spring 72 will hold selector armature in the position as shown in Fig. 2. When the coin is released by the removal of current and potential contacts 4 and 6 and by the withdrawal of coin stop plunger 28, it will be deflected by selector vane 19 into the left hand channel as indicated by arrow 78. On the other

hand if the test coin be counterfeit, selector magnet 17 will be actuated thereby deflecting selector vane 19 to the opposite side wall of the chute; the counterfeit test coin upon release is then diverted into the right hand channel as indicated by arrow 77. Selector vane remains deflected to the left hand side of the channel long enough to divert test coin into the right hand channel indicated by arrow 77 by the action of the retarding winding on selector magnet 17, when the retarding winding is short circuited on itself by contactor 112.

Figure 3 gives a section of the coin receiving and discharging mechanism as seen on line 3—3 in Figure 2. It will be noticed in Fig. 3 that main plunger 40 is bent at point 95 to enable it to pass around discharge chute 65. Main plunger 40 is supported at its ends by bearing members 63 and 50 and also about midway between these members by bearing support member 30, which also carries coin stop plunger 28, the current contact toggle system and extension arm 42 which supports coin entrance chute 26 as may be seen in Fig. 2.

Figure 6 is a section of the coin receiving and discharging mechanism as seen on line 6—6 in Fig. 2. For the sake of clarity rocking lever 56, coin entrance chute 26 and the upper extension of bearing support member, 30 which supports the coin entrance chute, have been shown vertically instead of inclined as they really are in Fig. 2. Rocking lever 56 which carries potential contacts 6 is pivoted by pin 57 to the left side of the yoke forming the upper part of support member 58. The right hand side of this yoke forms a bearing for release trip 59.

Figures 7 and 8 show two views of the standard coin holder. Standard coin 1 rests on a cylindrical block of insulation 111. Standard coin current contacts 3 are mounted on studs 107 which screw into support blocks 108. Standard coin potential contacts 1 are formed of sharp points turned on the ends of studs 106 which screw into support arms 109. All of these parts are mounted on a suitable insulating base 110. Electrical connections are made by attaching leads to support blocks 108 and support arms 109 as shown in Fig. 1. It should be noted that for the proper functioning of the coin detecting apparatus the standard coin could be replaced by a resistance which would give a voltage drop equal to the voltage drop across a genuine coin when the testing current is passing through it. However, it is usually more practical to use a standard coin holder of the type just described with a genuine coin than to make up an equivalent resistance representing the genuine coin.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent of the United States is:

1. A resistance testing apparatus for spurious coins, consisting of a network of six resistances, one arm of which consists of the coin to be tested, a testing circuit, lever-mounted current contacts to pass a current through the coin to be tested, lever-mounted potential contacts to obtain the potential drop across the coin to be tested, a receiving chute provided with a movable stop to support the coin to be tested, a plunger having mechanical connections with the potential and current contact levers and with the movable stop so constructed, that, upon the depression of the plunger, the potential and current contacts are pressed against the coin thereby closing the testing circuit through the coin and upon release of

the plunger the current and potential contacts are released from the coin thereby opening the testing circuit and the movable stop is released from the coin, a time delay solenoid, a catch for engaging the depressed plunger, said catch being released from the plunger by said solenoid after a definite time interval, a relay connected to the resistance network, said relay being actuated when the resistance of the coin to be tested is not equal to the resistance of a genuine coin of the same denomination, a discharge chute for tested coins provided with two channels, one for the discharge of genuine coins and the other for the discharge of spurious coins, a deflecting vane in the discharge chute, a time delay selector magnet having an armature connected to the deflect-vane, said selector magnet being connected to the relay so as to operate the deflecting vane when the coin being tested is spurious and maintain the deflecting vane in its operated position until the spurious coin released from the movable stop has been diverted into the spurious coin channel, said deflecting vane remaining unmoved when the coin being tested is genuine thereby diverting the genuine coin into the genuine coin channel.

2. A resistance testing apparatus for spurious coins, consisting of a network of six resistances, one arm of which consists of the coin to be tested, another arm of which consists of a genuine coin of the same denomination as the coin to be tested, a testing circuit, lever-mounted current contacts to pass a current through the coin to be tested, lever-mounted potential contacts to obtain the potential drop across the coin to be tested, current contacts to pass a current through said genuine coin, potential contacts to obtain the potential drop across said genuine coin, a receiving chute provided with a movable stop to support the coin to be tested, a plunger having mechanical connections with the potential and current contact levers and with the movable stop so constructed that, upon the depression of the plunger, the lever-mounted potential and current contacts are pressed against the coin to be tested thereby closing the testing circuit through the coin and upon the release of the plunger the lever-mounted potential and current contacts are released from the coin being tested thereby opening the testing circuit and the movable stop is released from the coin being tested, a time delay solenoid, a catch for engaging the depressed plunger, said catch being released from the plunger by said solenoid after a definite time interval, a relay connected to the resistance network, said relay being actuated when the resistance of a coin to be tested is not equal to the resistance of a genuine coin of the same denomination, a discharge chute for tested coins provided with two channels, one for the discharge of genuine coins and the other for the discharge of spurious coins, a deflecting vane in the discharge chute, a time delay selector magnet having an armature connected to the deflecting vane, said selector magnet being connected to the relay so as to operate the deflecting vane when the coin being tested is spurious and maintain the deflecting vane in its operated position until the spurious coin released from the movable stop has been diverted into the spurious coin channel, said deflecting vane remaining unmoved when the coin being tested is genuine thereby diverting the tested genuine coin into the genuine coin channel.

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