Nov. 4, 1947. W. S. REYNOLDS 2,430,080

MACHINE FOR TESTING AND ASSORTING ARTICLES ACCORDING TO ELECTRICAL CHARACTERISTICS

Filed Sept. 23, 1944 4 Sheets-Sheet 1

Fig. 1

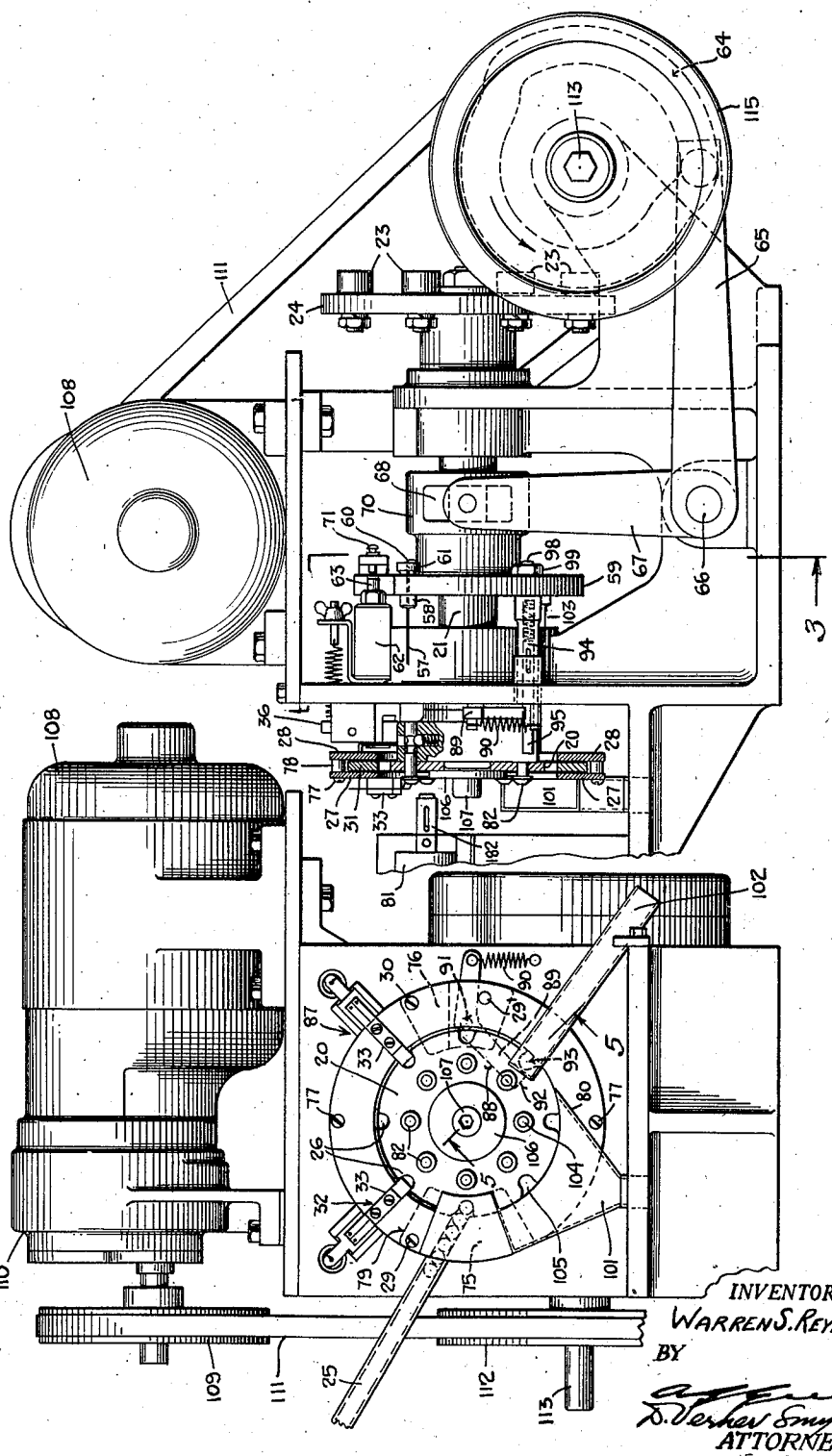


Fig. 2

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Fig. 3

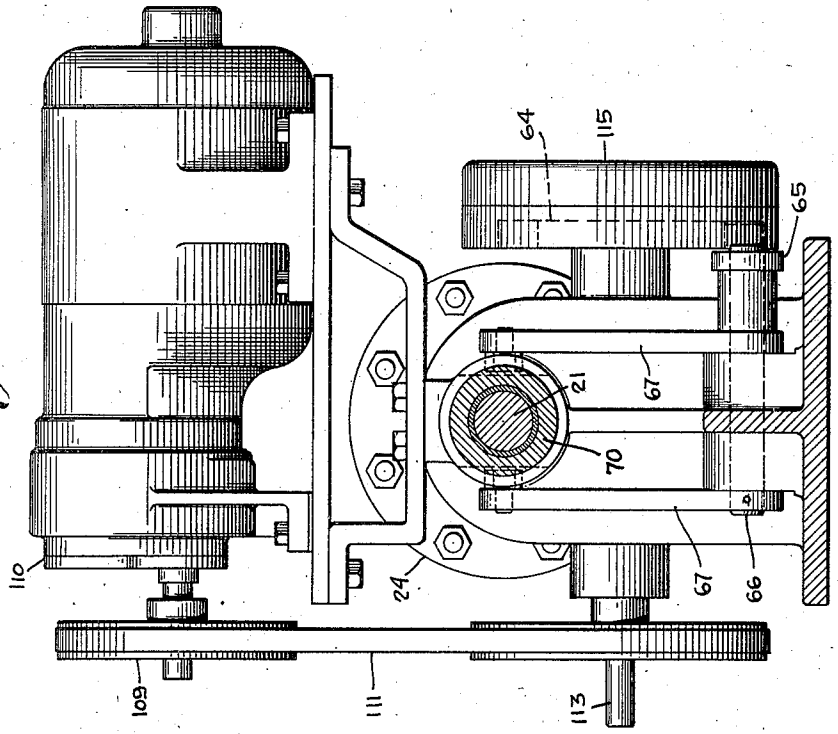
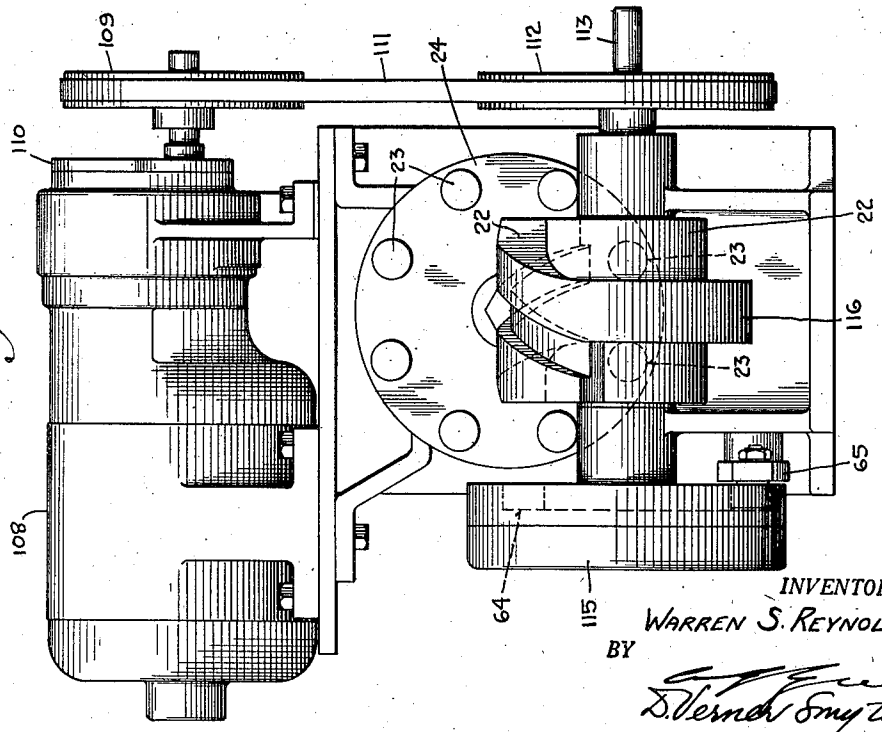


Fig. 4



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Fig. 6

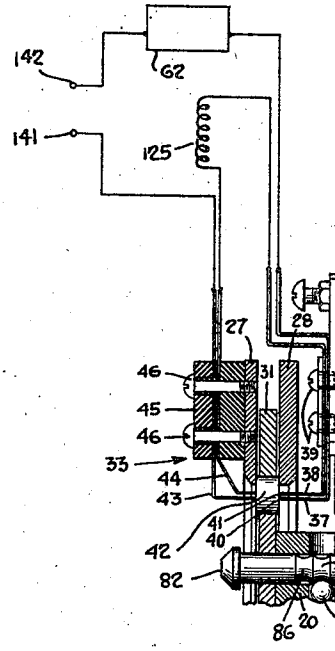


Fig. 12

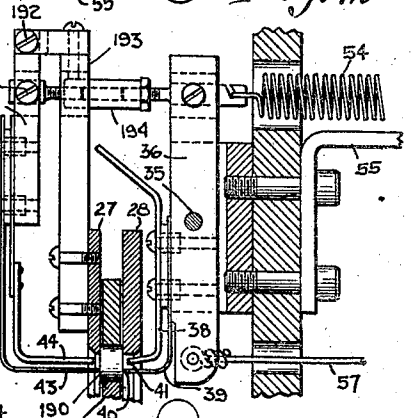


Fig. 7

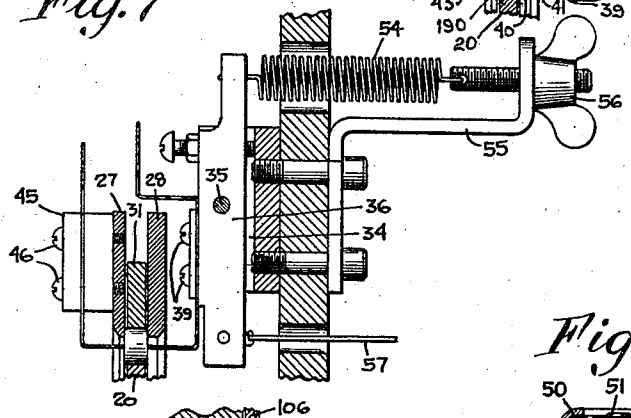


Fig. 8



Fig. 9

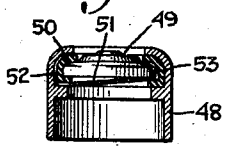
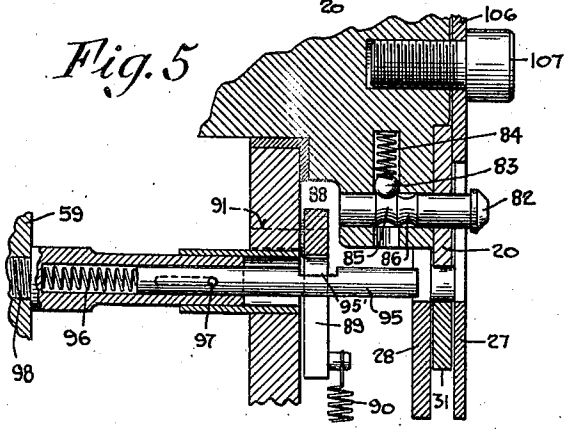


Fig. 5



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Fig. 10

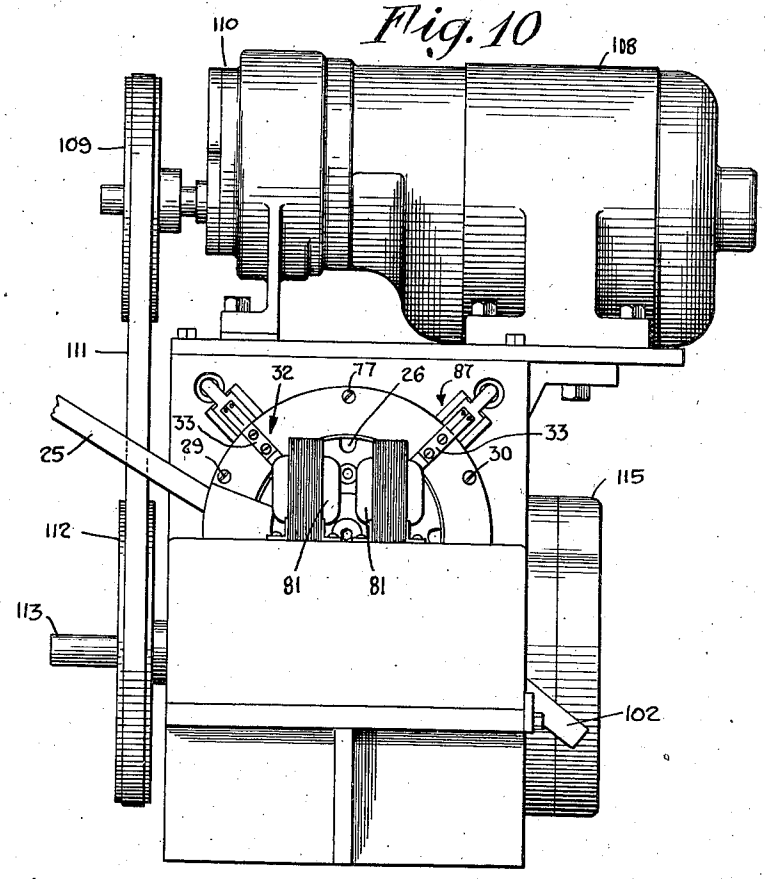
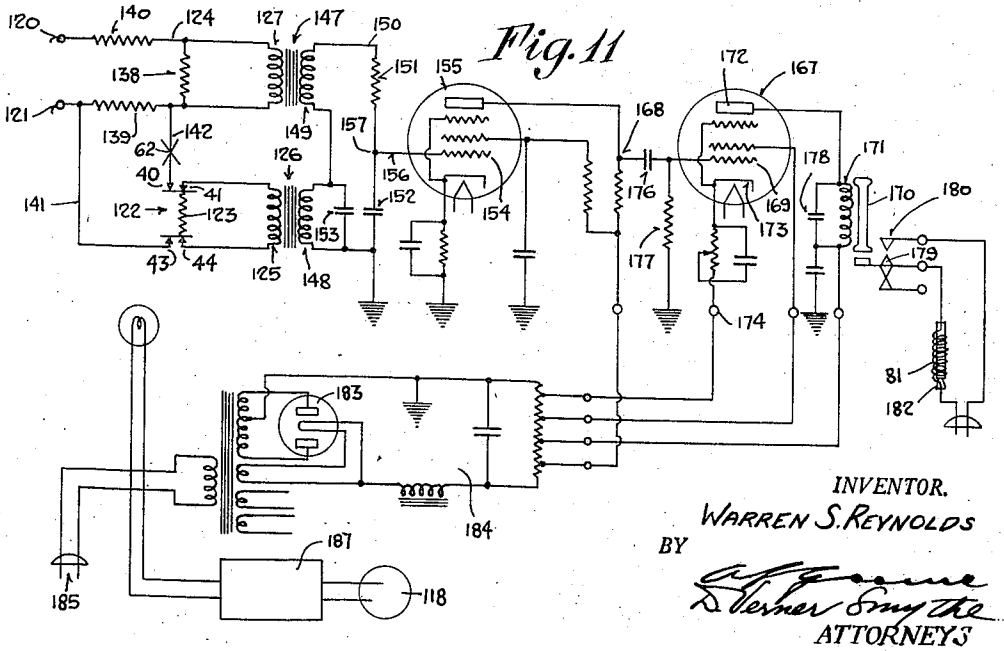


Fig. 11



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2,430,080

MACHINE FOR TESTING AND ASSORTING ARTICLES ACCORDING TO ELECTRICAL CHARACTERISTICS

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Application September 23, 1944, Serial No. 555,446

8 Claims. (Cl. 209—81)

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This invention relates to a machine for testing the electrical resistance or conductivity of articles being manufactured and is particularly adapted for use in assorting defective electric primers, such as used in ammunition, from acceptable electric primers. An electrical primer must have a resistance coming within a certain predetermined value in order to operate properly without fail in the ammunition or the purpose for which designed. The primer must not be open-circuited, have too low a resistance, or have too high a resistance.

One of the objects of the present machine is to efficiently and rapidly separate primers having the correct range of resistance from those which are defective. The details of the circuit per se are described in copending application Serial No. 547,736, filed August 2, 1944. These and other objects of the invention will become apparent from the following description and drawings.

In the drawings—

Fig. 1 is a side elevational view of the machine, certain parts being shown in partial section and certain other parts having been removed for clarity in illustration.

Fig. 2 is a front view of the machine with the solenoid removed.

Fig. 3 is a vertical sectional view taken in the direction 3—3 of Fig. 1.

Fig. 4 is a rear view of the machine showing the driving cam.

Fig. 5 is a fragmentary sectional view taken along the line 5—5 of Fig. 2, showing the construction at the acceptance punch station.

Fig. 6 is an enlarged detail showing the contact arrangement of the dial.

Fig. 7 is generally similar to Fig. 6, except a single contact arrangement is shown.

Fig. 8 is a detail view showing the shape of one of the contacts.

Fig. 9 is a detail view of one form of primer which may be tested with the present invention.

Fig. 10 is similar to Fig. 2, with the exception that the solenoids are shown in position.

Fig. 11 is a circuit diagram of one form of circuit which may be used with the present machine.

Fig. 12 is an enlarged detail of a modified form of the contact arrangement.

The machine comprises an indexable dial 20 carried by shaft 21 which is indexed by means of cam 22 acting upon cam rollers 23, said cam rollers being carried on disk 24 which is fastened to shaft 21. The dial 20 is mounted on shaft 21 by means of washer 106 (Fig. 5) and cap screw

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107. The primers are fed from a hopper (not shown) to the chute 25, the primers being arranged so that their axes are parallel to the main operating shaft 21. The primers roll down the chute and into apertures 26 contained in the edge of the dial 20, said apertures opening radially. Guide plates 27 and 28 are held by screws 29 and 30 to the frame of the machine in any suitable manner, such as by passing through spacer blocks 75 and 76. Other screws 77 and spacers 78 serve to hold the guide plate assembly. Located between guide plates 27 and 28 is an apertured guide disk 31 which may be of fibre or other non-conducting material. The guide disk 31 extends from a point 79 adjacent the feed station to a point 80 after the acceptance station for the purpose which will be described hereafter.

A drive motor 108 may drive pulley 109 through a gear box 110 or by any desired means. Belt 111, in turn, drives pulley 112. Pulley 112 is mounted on shaft 113, on which are mounted indexing cam 22 and handwheel 115, handwheel 115 having cam 64 cut therein. Indexing cam 22 is arranged to hold two of the rollers 23 by rib 116 so as to lock the dial 20 during the inspection operation. The portion of the cam shown at the top of Fig. 4 then indexes shaft 21 in a conventional manner.

The plates 27, 28, and 31 serve as a means to guide and hold the primers in their apertures 26 in the work transfer dial 20 as they are indexably rotated in the machine. A primer is indexed from the feed point to the first inspection station 32, at which point the conductivity of the primer is determined. This determination is made by means of contact 33 (Figs. 1 and 6) engaging the primer on one side and the pivoted contact element 34 engaging the primer element on the other side. Contact element 34 is pivoted to swing to engage the primer after it arrives at the station and is stationary, pivoted contact element 34 comprising the switch carrying block 36 pivoted at 35, the contact blades being indicated at 37 and 38, fastened to said block by screws 39.

Ends 40 and 41 serve to contact the primer body 42 as shown in Fig. 6, the ends 40 and 41 contacting either end of the primer body, depending on its arrangement in the dial. The other side of the primer body has been moved into contact with contact blades 43 and 44 of the stationary contact 33, said contact blades being mounted on block 45 by screws 46. The blades 43—44, 40—41, are separated and insulated from each other in any suitable manner. It is to be understood, of course, that a single contact arrangement may be

used, such as shown in Fig. 7, the contactors being selected in accordance with the desired results.

The ends of the switch contacts may take the shape shown in Fig. 8 at 47 so as to facilitate engagement with the ends of the primers.

As stated previously, the machine has been designed particularly to test an electrically operated primer suitable for use in ammunition of the small arms variety, although it is to be distinctly understood that articles other than primers may be tested, such as fuse elements, and other articles required to carry definite quantities of current or to have certain electrical properties. In Fig. 9 is found a cross-section of one type of primer which may be tested by the present machine, wherein the body is indicated at 48, said body being made of a metal such as brass. Located in the upper part of the body is a button 49 of brass or stainless steel which is separated from the body 48 by suitable dielectric cup 50. The resistance wire is shown at 51 located in contact with the body at 52 and in contact with the button at 53 so as to form an electrical connection between button 49 and body 48. The primer composition may be placed in the primer in contact or adjacent the resistance wire, so that upon heating thereof, ignition of the primer composition will result. One form of specific circuit which may be employed will be described hereafter.

Switch 34 is urged in a clockwise or contacting direction (Fig. 6) by means of spring 54 adjustably mounted on bracket 55 by screw 56. At the lower end of the pivoted switch, a rod or wire 57 is carried rearwardly in the machine through a bushing 58 (Fig. 1) located in an axially reciprocable disk or plate 59, said plate being slidably mounted on shaft 21. Rod 57 has an enlarged head 60 cooperating with the end 61 of bushing 58. When the disk 59 is moved to the right, enlarged head 60 will be grasped and moved to the right with the disk so as to move wire 57 to the right and rotate switch 53 about its pivot 35, carrying blades 40 and 41 away from the dial.

The contacts 41 and 44 may be connected to the primary 125 of a transformer system, such as will be described hereafter. The micro-switch 62 may be placed in the lead from the source of power to current contacts 40 and 43. The micro-switch 62 is located on the frame of the machine and has an operating button 63 (Fig. 1) arranged in a conventional manner.

After the dial has indexed so as to carry a primer to the first inspection station 32, axially slidable disk 59 will be moved to the left by cam 64 operating on bell crank lever 65, shaft 66, and arm 67. Arm 67 is engageable in a slot 68 located on the hub 70 of the axially reciprocable disk 59. Disk 59 moves to the left so that the rod 57 is allowed to move to the left under the urgence of spring 54 until contacts 40 and 41 meet the primer located in a pocket in the dial at this station. Thereafter, disk 59 continues its movement, rod 57 stopping at this point. Continued movement of disk 59 will cause adjustable abutment 71 to contact micro-switch button 63 and close the micro-switch, thereby completing the power circuit to the primer. Thus, current does not flow through the primer to be tested until the contacts are touching the same. In the event the primer conductivity does not fall within certain predetermined limits, the solenoid 81 will be operated to press inwardly the plunger 82 located at this station and corresponding to the defective primer. Plunger 82 and the other plungers are carried by the dial 20 in suitable apertures and held in the location to which they have been moved by means of ball 83 (Figs. 5 and 6) urged by the spring 84 into the suitable notch 85 or 86 in a plunger. Further indexing of the dial carries the primer to the second inspection station at 87, where another switch arrangement contacts the primer to make a second inspection thereof. This second circuit is similar to the first one and, if desired, may be set to closer limits. It is, of course, to be understood that only one testing station is absolutely necessary but that the second one may be desirable for some purposes in order to serve as a check on the first station and also to be set within slightly smaller limits. Assuming that a primer has been determined to be defective and its corresponding plunger pressed inwardly, as the primer and plunger is indexed to the acceptance station, a plunger 82 will contact the inner end 88 (Figs. 2 and 5) of the pivoted lever 89, said lever being urged by spring 90 in a clockwise direction about the pivot 91, rotation of the bell crank lever being limited by striking the shank of screw 29'. As shown in Fig. 2, a spacer block 76 is provided as a mounting for the guide plates 27 and 28. For clarity in illustration of parts therebehind, the spacer 76 is not shown in Fig. 1. However, as shown by the dotted lines on Fig. 2, the spacer 76 is recessed to provide clearance for the operation of the lever 89. The plunger which has been pressed inwardly will contact, and rotate, bell crank lever 89 so that the end 92 will be in engagement with a notch 95' in the shank of punch 95 to prevent engagement thereof with a primer located at 93 when the dial comes to rest at this station.

After the dial comes to rest, plate 59 will be moved to the left (Fig. 1), carrying therewith the spring loaded punch arrangement 94, said punch 95 (Fig. 5) being pressed outwardly by means of spring 96 and limited in its outward movement by some suitable stop mechanism such as pin and slot 97. Shank 98 is fastened by means of bolt 99 to the dial 59. If the bell crank lever 89 has not been rotated by a plunger 82, acceptance punch 95 will move an acceptable primer out of the dial into chute 102. If the bell crank 89 has blocked movement of the punch 95, and on continued movement of the dial, the primer will be carried to the point 100, where it will be free to roll down the reject chute 101. In the event it sticks in one of the dial pockets for any reason, it will be carried to the reject station 105, where a punch located on disk 59 and similar to 94 will positively eject the primer from the dial into the ejection chute 101.

A plunger 103 is fastened to disk 59 at station 104 and serves to reset the plungers 82 if they have been moved. The rejection plunger at 105 will, in addition to its rejection function, serve as a check on the positioning means for the dial, since on each movement of the disk 59 to the left, the reject plunger passes through the dial pocket stopped in opposition thereto.

In Fig. 12 is shown a modified form of the contact arrangement, the parts similar to that shown in Figs. 6 and 7 being given identical numbers. In this modified form both sets of contacts are pivoted toward and away from the primer. Pivoted member 36 carries contact blades 38 and 39 having ends 41 and 40 which contact a primer in the dial 20 at 100. The spring 54 carried in bracket 55 urges pivoted arm 36 about pivot 35.

Operating rod 57 is operable in the manner previously described for Figs. 6 and 7 to withdraw contact ends 40 and 41 from a primer in the dial. The blades 43 and 44 are carried by the pivoted member 191 which is pivoted at 192 to the fixed member 193. The upper end of pivoted member 36 is connected pivotally at 195 by means of the adjustable connection 194 to the pivoted member 191. When the operating rod 57 is allowed to move to the left so as to permit rotation of member 36 about pivot 35 in a clockwise direction, moving the pivoted blades 40 and 41 toward the primer, the adjustable connection 194 will be moved to the right so as to draw the pivoted contact arm 191 in a counterclockwise direction and thus move the contact blades 43 and 44 against the primer substantially simultaneously with the right hand set of blades. The contact blades can be connected to the circuit in the same manner as described for Figs. 6 and 7.

The circuit shown in Fig. 11 is described in copending application Serial No. 547,736, filed August 2, 1944, and, therefore, a brief description only will be given, details and equivalent circuits being described in said copending application. An alternating current source may be impressed across terminals 120 and 121. The primer is indicated at 122 with the resistance element thereof at 123. Contacts 40, 41, 43, and 44 are provided between which the primer is moved, as previously discussed. If desired, single contacts may be used in place of the double contacts. A standard resistance or impedance 138 is provided and a leakage impedance 139 may be used. Resistance or impedance 140 can be used in order to limit the current or to balance the circuit as required. The path of alternating current is terminal 121, wire 141, contact 43, resistance 123, contact 40, wire 142, resistance 138, wire 124, and terminal 120. The flow of current through resistance 123 will result in a potential being developed across contacts 44 and 41 and said potential is impressed on primary 125 of transformer 126. The potential developed across the fixed resistance 138 is impressed on primary 127 of transformer 147. Transformers 126 and 147 preferably should be magnetically and electrostatically shielded. Secondaries 148 and 149 are connected oppositely through wire 150, resistance 151, and condenser 152. Resistance 151 and condenser 152 are placed in the secondary circuit of the transformers to serve as a high frequency filter. Condenser 153 can be used to correct and insure that the two opposed alternating currents in said transformer secondaries are in phase with each other. Control grid 154 of screen grid tube 155 is connected by wire 156 to the secondary circuit at 157. Tubes shown are of the screen grid type with suppressor and screen grids, but it is obvious that they may be of any well-known electronic tube variety. The resultant alternating voltage produced in the oppositely connected secondary circuit of the transformers is arranged to give a resultant zero voltage therein if the resistance 123 is of the correct volume. In the event that the resistance 123 changes beyond predetermined limits, a voltage will be developed in the secondary circuit which will be other than zero.

Tube 155 is employed as an amplifier to amplify an alternating current signal impressed on the control grid 154 to give an amplified alternating current at point 168. The alternating potential at point 168 is impressed on the control grid 169 of tube 167. Tube 167 is operated as a detector tube in a well-known and conventional manner.

Condenser 176 serves as a blocking condenser in the grid circuit and resistance 177 serves as a bias resistance for the control grid 169 of tube 167. The plate circuit of tube 167 includes plate 172, cathode 173, power supply connection 174, and relay coil 171, relay 170 being unenergized normally and operated to closed position by tube 167. Condenser 178 is provided as a shunt across solenoid coil 171 so as to smooth out the direct current pulses at this point and keep the relay from chattering. Operation of relay 170 will cause switch 179 to contact blade 180 and complete the circuit through operating solenoid coil 81, the coil 81 being that shown in Fig. 10, for example. The plunger 182 of the solenoid may be used to operate one of the plungers 82 on the dial of the inspection machine. An interlock switch 62, as previously described, is provided to operate in synchronism with the dial so as to energize the circuit only after the contacts have engaged a primer following dial indexing.

It is obvious that various other arrangements may be used for employing the impulses or potential delivered to the solenoid to operate other control devices. It is also obvious that other amplifying means may be used, the amplifier eliminated, or the amplifier and detector transposed.

Power for operation of the amplifier is supplied by means of a conventional full wave rectifier tube 183 and filter circuit 194, the power supply being fed from any suitable source of alternating current at 185. The operating motor 118 for the testing machine may be connected through a time delay switch 187 to be sure the electrical circuit is operative before the testing machine motor is started.

What is claimed is:

1. In a testing machine, a dial having article receiving recesses therein; movable rejection plungers carried by said dial corresponding to each of said recesses; pivoted electrical contact means urged toward said dial at an inspection station; means operable to withdraw said contact means away from said dial until an article has been indexed to the inspection station; electrical testing means connected to said contact means to move a rejection plunger in said dial if an article tested thereby is beyond predetermined electrical characteristics; reciprocable plunger means for removing articles at an acceptance station following said inspection station; and an arm movable into the path of reciprocation of said reciprocable plunger by a rejection plunger which has been actuated by said electrical testing means.

2. In a testing machine, a dial having article receiving recesses therein; movable rejection plungers carried by said dial corresponding to each of said recesses; pivoted electrical contact means urged toward said dial at an inspection station; means operable to withdraw said contact means away from said dial including an operator, a reciprocable member, and an enlarged head on said operator held by said reciprocable member until after an article has been indexed to the testing station; electrical testing means connected to said contact means to move a rejection plunger in said dial if an article tested thereby is beyond predetermined electrical characteristics; reciprocable plunger means for removing articles at an acceptance station following said inspection station; and an arm movable into the path of reciprocation of said reciprocable plunger by a rejection plunger which has been actuated by said testing means.

3. In a testing machine, a dial having article receiving recesses therein; movable rejection plungers carried by said dial corresponding to each of said recesses; pivoted electrical contact means spring urged toward one side of said dial at an inspection station; contact means on the opposite side of said inspection station; an operating means with an enlarged head connected to said pivoted electrical contact means; a reciprocable disc having an aperture therein through which said operating means passes; means to move said reciprocable disc toward said dial after an article has been indexed to the testing station to allow the pivoted electrical contact means to contact an article in the dial; electrical testing means connected to said contact means; a solenoid connected to said electrical testing means for operating a rejection plunger in said dial if an article tested is beyond predetermined electrical characteristics; reciprocable plunger means for removing articles at an acceptance station following said inspection station; and an arm movable into the path of reciprocation of said reciprocable plunger by a rejection plunger which has been actuated by said testing means.

4. In a testing machine, a dial having article receiving recesses therein; movable rejection plungers carried by said dial corresponding to each of said recesses; pivoted electrical contact means spring urged toward said dial at an inspection station; an operating rod with an enlarged head; a reciprocating disc having an aperture smaller than said enlarged head; electrical contact means on the other side of said dial at said inspection station; means to reciprocate said disc toward said dial to allow said pivoted electrical contact means to move against an article in said dial at said inspection station; electrical testing means connected to said contacts; normally open switch means connected in said electrical testing circuit movable to closed position by said disc after said pivoted contact means have contacted an article, said electrical testing means being connected to a solenoid which is operable to move a rejection plunger in said dial if an article tested is beyond predetermined electrical characteristics; reciprocable plunger means for removing articles at an acceptance station following said inspection station; and an arm movable into the path of reciprocation of said reciprocable plunger by a rejection plunger which has been actuated by said testing means.

5. In a testing machine, an indexable dial having article receiving recesses therein; movable rejection plungers carried by said dial corresponding to each of said recesses, said plungers being movable into a position extending from a face of said dial; pivoted electrical contact means spring urged toward said dial at an inspection station; an operating rod with an enlarged head; a reciprocating disc having an aperture smaller than said enlarged head; electrical contact means at said inspection station on the other side of said dial; means to reciprocate said disc toward said dial to allow said pivoted electrical contact means to move against an article in said dial at said inspection station; electrical testing means connected to said contacts; normally open switch means connected in said electrical testing circuit movable to closed position by said disc after said pivoted contact means have contacted an article, said electrical testing means being connected to a solenoid which is operable to move a reject plunger to an extended position from said dial if an article tested is beyond predetermined electrical characteristics; reciprocable plunger means for removing articles at an acceptance station following said inspection station; and a pivoted arm at said acceptance station urged out of the path of said reciprocable plunger by yielding means, said arm being moved into the path of reciprocation of said reciprocable plunger by an extended reject plunger which has been actuated by said testing means.

6. In a testing machine, an indexable dial having article receiving recesses therein; movable rejection plungers carried by said dial corresponding to each of said recesses, said plungers being movable into a position extending from a face of said dial; pivoted electrical contact means spring urged toward said dial at an inspection station; an operating rod with an enlarged head; a reciprocating disc having an aperture smaller than said enlarged head; electrical contact means at said inspection station on the other side of said dial; means to reciprocate said disc toward said dial to allow said pivoted electrical contact means to move against an article in said dial at said inspection station; electrical testing means connected to said contacts; normally open switch means connected in said electrical testing circuit movable to closed position by said disc after said pivoted contact means have contacted an article, said electrical testing means being connected to a solenoid which is operable to move a reject plunger to an extended position from said dial if an article tested is beyond predetermined electrical characteristics; reciprocable plunger means for removing articles at an acceptance station following said inspection station; a pivoted arm at said acceptance station urged out of the path of said reciprocable plunger by yielding means, said arm being moved into the path of reciprocation of said reciprocable plunger by an extended reject plunger which has been actuated by said testing means; a reset plunger for resetting extended rejection plungers; and a second reciprocable plunger for insuring removal of articles from said dial at a reject station and at the same time assisting in positioning of the dial after indexing.

7. In a testing machine, a dial having article receiving recesses therein; movable rejection plungers carried by said dial corresponding to each of said recesses; pivoted electrical contact means urged toward said dial at an inspection station; an operating means with an enlarged head connected to said pivoted electrical contact means; a reciprocable disc having an aperture therein through which said operating means passes; means to move said reciprocable disc toward said dial after an article has been indexed to the testing station to allow the pivoted electrical contact means to contact an article in the dial; electrical testing means connected to said contact means; a solenoid connected to said electrical testing means for operating a reject plunger in said dial if an article tested is beyond predetermined electrical characteristics; yieldable plunger means mounted on said disc for removing articles at an acceptance station following said inspection station; and an arm movable into the path of said yieldable plunger by a rejection plunger which has been actuated by said testing means.

8. In a testing machine, a dial having article receiving recesses therein; movable rejection plungers carried by said dial corresponding to each of said recesses; pivoted electrical contact means urged toward said dial at an inspection station; an operating means with an enlarged head connected to said pivoted electrical contact

means; a reciprocable disc having an aperture therein through which said operating means passes; means to move said reciprocable disc toward said dial after an article has been indexed to the testing station to allow the pivoted electrical contact means to contact an article in the dial; electrical testing means connected to said contact means; a solenoid connected to said electrical testing means for operating a reject plunger in said dial if an article tested is beyond predetermined electrical characteristics; yieldable plunger means mounted on said disc for removing articles at an acceptance station following said inspection station; an arm movable into the path of said yieldable plunger by a rejection plunger which has been actuated by said testing means; yieldable plunger means mounted on said disc for removing articles at an acceptance station following said inspection station; a pivoted arm at said acceptance station urged out of the path of said yieldable plunger by a yielding means,

said arm being moved into the path of said yieldable plunger by a rejection plunger which has been actuated by said testing means; a reset plunger carried by said disc for resetting actuated rejection plungers; and a rejection station where the unacceptable articles are removed.

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