

March 16, 1954

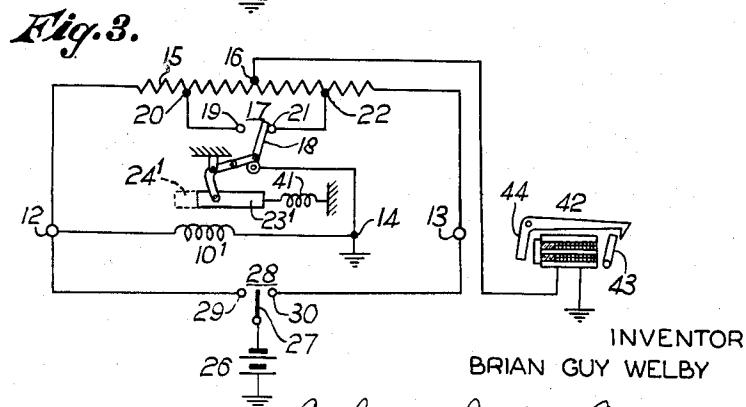
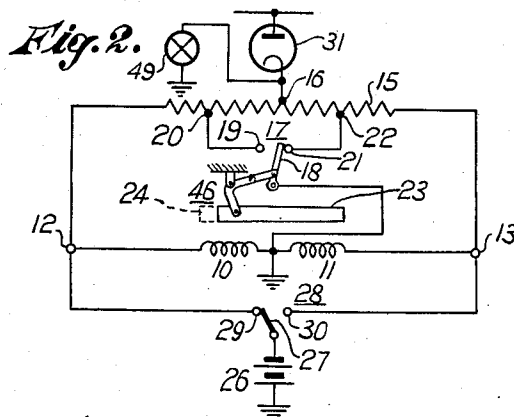
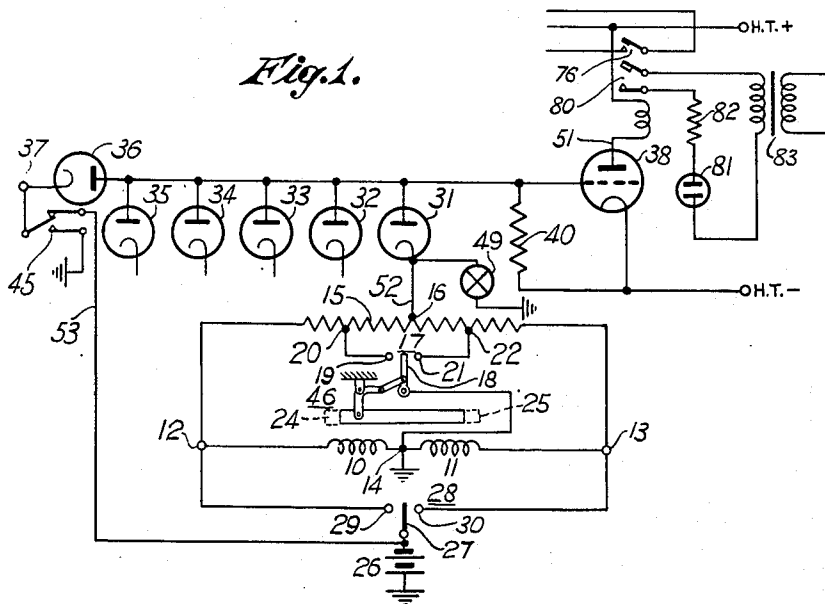
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2,672,601

FAULT INDICATING APPARATUS

Filed Feb. 27, 1952

2 Sheets-Sheet 1



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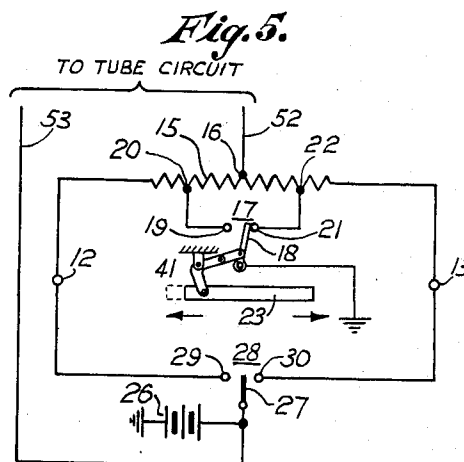
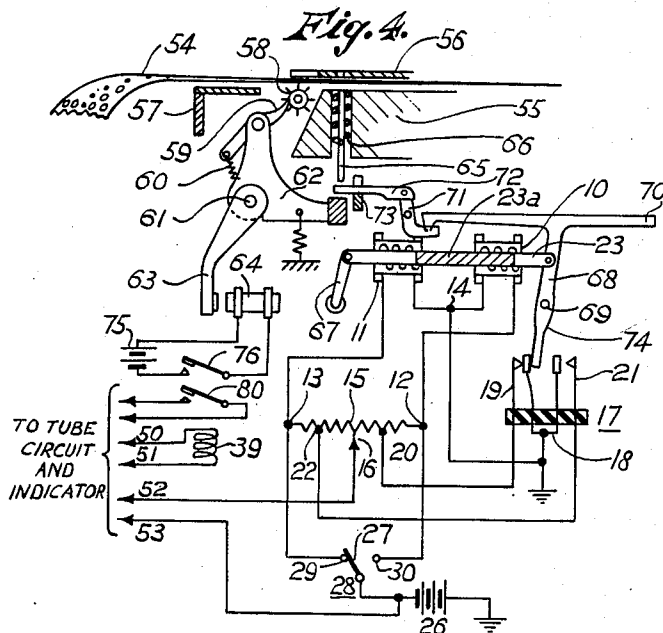
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2 Sheets-Sheet 2



UNITED STATES PATENT OFFICE

2,672,601

FAULT INDICATING APPARATUS

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16 Claims. (Cl. 340—226)

1

This invention relates generally to fault-indicating apparatus or testing systems for the purpose of indicating the position of a movable member or the failure of a movable member to reach a prescribed position, and more particularly to such apparatus or systems for indicating whether a movable member is in a first or second position to which it is adapted to be moved by actuating means in response to a first or second control operation, or any failure of first or second actuating means to effect the movement of a movable member to a first or a second position in response to a first or a second control operation respectively.

The invention is particularly applicable to tape perforators or other kinds of teleprinter apparatus where each of a group of movable members in the form of mechanical links is designated to be moved to a first or perforating position on the energisation by a first control operation of first actuating means in the form of an electromagnet individual to that link and to a second position on the energisation by a second control operation of second actuating means in the form of another electromagnet. It is usually of importance with such apparatus that whenever the energisation of one of the electromagnets fails to produce the appropriate movement of the link, the fault should be indicated in some way; for example a warning signal might be originated and/or the apparatus automatically stopped working for the fault to be cleared.

The invention also has application to relays of the kind in which a contact-operating armature is designed to be moved to one position on the energisation of a relay coil by a first control operation and restored to its original position by gravity or a spring when as the result of a second control operation the energisation has ceased. Again, it may be of importance to indicate whenever the energisation of the coil fails to produce the appropriate movement of the armature or whenever the armature fails to restore afterwards.

The invention has of course other applications of a character similar to those outlined in the preceding paragraphs.

An object of the present invention is to provide improved fault-indicating apparatus for the purpose stated.

A further object of the invention is to provide a simple form of rapid fault finding or testing system for a plurality of movable members or a plurality of operations which is responsive to the occurrence of a fault in any one of said movable members or operations.

In accordance with the present invention apparatus for indicating the position of a member movable under the influence of an actuating

2

means comprises an electrical circuit including an impedance, energising means for said impedance, switching means dependent on the position of said movable member to vary the potential difference between two points of said impedance, and indicating means responsive to the said variation of potential difference.

More specifically, in accordance with the present invention fault-indicating apparatus for the purpose of indicating any failure of first or second actuating means to effect the movement of a movable member to a first or a second position in response to a first or a second control operation respectively, comprises an electrical circuit including an impedance connected between a first and a second point and having an intermediate tapping, switching means including a movable contact adapted to engage first or second fixed contacts connected respectively to tappings on said impedance located between said intermediate tapping and said first point and between said intermediate tapping and said second point, a linkage for causing said movable contact to engage said first fixed contact or said second fixed contact according as said movable member is in said first or said second position as the case may be, energising means for causing each of said control operations to set up a potential difference between said movable contact and said first point or said second point as the case may be, and indicating means responsive to the potential difference set up between said movable contact and said intermediate tapping should said movable contact not be in engagement with said first fixed contact or said second fixed contact in response to said first operation or said second operation as the case may be.

Where either of said actuating means includes an electrical component arranged to be energised in response to the appropriate one of said control operations, said energising means in respect of this control operation may comprise electrical connections joining said movable contact and the appropriate one of said points to suitable points in the energising circuit of that component.

In the case where a number of movable members are required to be tested simultaneously, each of the said members has a testing circuit individual thereto, and the indicating means may comprise an electronic circuit common to all the said testing circuits and responsive to the occurrence of a "fault" potential at a given point in any one of said testing circuits.

The invention will now be described by way of example as applied to a five-unit code tape perforator of the teleprinter type, using double current operation. In such a perforator each code group of holes to be perforated is determined by

the movement, i. e. the setting, to a first or perforating position (from the position occupied at the previous setting or from some intermediate or neutral position) of the appropriate ones of five movable members or mechanical links controlling the operation of the perforating pins, the movement of each link being effected by the energisation in response to a first control operation of first actuating means in the form of a first electromagnet individual to that link; at the same time each of the remaining links i. e. those pertaining to the perforating pins which are non-operative for the particular signal being recorded, is moved to a second or non-perforating position by the energisation in response to a second control operation of second actuating means in the form of a second electromagnet individual to that link. After all the electromagnets appropriate to the required group of holes have been energised an additional electromagnet is energised to effect the actuation of the punching apparatus, for example to release a motor drive or to operate a punching solenoid, thereby causing the tape to be perforated in accordance with that group.

Such apparatus, however carefully designed, is liable to faulty operation of the setting electromagnets for the perforating pins, the energisation of a magnet in response to the appropriate control operation not being followed by the appropriate movement of the link individual to it when such a fault occurs during a setting operation—when any link required for the perforating operation does not move to its first position or when any of the non-perforating links does not move to its second position (to ensure its not making a perforation)—it is desirable to stop the apparatus or at least give some warning signal before the perforating operation is carried out. An example of a fault finding system according to the invention, and suitable for use in such an application, will now be described in more detail with reference to the accompanying drawings, wherein:

Fig. 1 is a schematic circuit diagram of one embodiment of the invention;

Fig. 2 shows part of the diagram of Fig. 1 with the switches operated under fault conditions;

Fig. 3 is a schematic diagram of another embodiment of the invention;

Fig. 4 represents a schematic circuit diagram of a modification of Fig. 3; and

Fig. 5 is a schematic diagram of a fault indicator system, slightly modified with respect to that in Fig. 1 in combination with one form of tape perforator mechanism.

Referring now to Fig. 1, which illustrates schematically the principle of the fault indicating system the two field windings 10 and 11 of a pair of electromagnets are connected in series between first and second points 12 and 13, the common point 14 of the two windings being earthed. Across points 12 and 13 is connected a resistor 15 having an intermediate tapping 16, which for conveniences is near the center of the resistor though this is not essential. A single pole changeover switch 17 has its movable contact 18 connected to common point 14, i. e. to earth. One of the two fixed contacts 19 of the switch is connected to a tapping 20 on the resistor between tapping 16 and the first point 12; the other fixed contact 21 is connected to a tapping 22 on the resistor between tapping 16 and second point 13, these fixed contacts 19 and 21

are therefore referred to as the first and the second fixed contacts respectively.

A link 23, which, in the case of a tape perforator testing system, may form part of the perforator pin selection mechanism, is associated with the field windings 10, 11 of the electromagnets, for example it may form part of a common armature of both electromagnets, such that it is moved to a first position 24 or a second position 25 according to which of the field windings 10 or 11 respectively is energised. The movable contact 18 of the switch 17 is associated with the link 23 in such a manner that when the link is in its first position 24, the movable contact 18 engages the first fixed contact 19 and when the link is in its second position 25, the contact 18 engages the second fixed contact 21. When the link is in an intermediate or neutral position (as illustrated by full lines in the figure) contact 18 engages neither of the fixed contacts 19 and 21. The connection between the link 23 and the movable contact 18 may take various forms and is shown diagrammatically in the drawing as a parallel linkage 48. The link may however be designed to carry movable contact 18 itself, the mechanical coupling between the link and the contact being then a direct one.

Windings 10 and 11 are energised by a suitable source, for example a battery 26 the positive pole of which is earthed and the negative pole connected to a movable contact 27 of another single pole changeover switch 28 the fixed contacts 29 and 30 of which are connected to first point 12 and second point 13 respectively. By causing contact 27 to engage contact 29 or 30, winding 10 or winding 11 is energised, as the case may be. These are the first and second control operations, respectively.

With the arrangement so far described, it will be seen that whenever the first control operation has been performed to energise winding 10, and movable contact 18 of switch 17 is in engagement with contact 19, that part of resistor 15 which contains tapping 16 is unenergised and so this tapping is at earth potential. The only part of resistor 15 that is energised is that between tapping 20 and first point 12, this part of the resistor being included in a circuit in parallel with the energised winding 10. The rest of the resistor has the earth potential of common point 14, to which it is connected by way of second point 13 and winding 11.

When however, while winding 10 is energised, movable contact 18 is in engagement with fixed contact 21, as shown in Fig. 2, owing to the link 23 being in its second position 25, that part of resistor 15 which contains tapping 16 is energised, since it is now included in the circuit in parallel with the energised winding 10. Similarly if contact 18 is in engagement with neither of the fixed contacts 19 and 21 when winding 10 is energised; the parallel circuit including tapping 16 is in this case completed by way of second point 13 and winding 11. In either case tapping 16 has a negative potential, the said potential being more negative in the second case than in the first.

Similarly whenever the second control operation is performed so that winding 11 of the second electromagnet is energised; if movable contact 18 is in engagement with fixed contact 21, tapping 16 is at earth potential; otherwise tapping 16 has a negative potential. A testing circuit as above described is individual to each of a plurality of links such as 23.

Tapping 16 is connected to the cathode of a diode valve 31. The anode of this valve is connected to the anodes of the corresponding diodes 32 to 35 associated with the testing circuits of the other links and to the anode of a sixth diode 36, the cathode of which is connected to a terminal point 37. The potential of this point 37 is normally negative but is raised to earth potential, for example by operation of normally open contacts 45, when the operation of the punch motor or other power source of the perforator, is required at the end of each link-setting process. The anodes of the diodes are also connected to the control grid of a triode valve 38, in the anode circuit of which is connected the field winding 39 of the electromagnet that controls the motor or other power source (not shown). The cathode of valve 38 is earthed and the control grid is connected to the cathode by way of a resistor 40.

In describing the operation, it is first assumed that the apparatus is functioning correctly, that each link is in an intermediate position midway between its first and second positions with movable contact 18 of each switch 17 similarly midway between the first and second fixed contacts 19 and 21, and that movable contact 27 of each switch 28 is midway between fixed contacts 29 and 30. The condition of each link and the associated apparatus is thus as shown in Fig. 1. As all the windings are unenergised all the intermediate tappings 16 are at earth potential. Terminal 37, and hence the cathode of diode 36, are however at a sufficiently negative potential to hold triode 38 cut off and so prevent the operation of the perforating mechanism.

Suppose now it is desired to perforate a group of holes in accordance with the code, and it is assumed that the first control operation, i. e. closing switch contact 27 to contact 29, represents the perforating condition of the link 23, and the second control operation, i. e., the reverse closure of the contact 27 represents the non-perforating condition of link 23. The first control operation—that is, operating each movable contact 27 to fixed contact 29—is accordingly performed in respect of the links 23 associated with those holes, and accordingly each winding 10 of the corresponding electromagnets is energised. As the apparatus is functioning correctly, each of those links is moved to its first position 24, thereby closing the corresponding contact 18 to its fixed contact 19, with the result that the corresponding intermediate tappings 16 remain at earth potential.

It will be appreciated that in each case there will be a brief interval between the time when winding 10 is energised and the time when the link has moved sufficiently to transfer contact 18 to contact 19 and that during this interval tapping 16 has the negative potential otherwise associated with incorrect functioning of the apparatus. This transitory effect can however be ignored.

Simultaneously the second control operation—that is, operating movable contact 27 to fixed contact 30—is performed in respect of the non-perforating links, and accordingly the corresponding windings 11 are energised. As, again, the apparatus is functioning correctly, each of these links moves to its second position 25, thereby operating the corresponding movable contact 18 to engage fixed contact 21, with the result that the corresponding intermediate contacts 16 remain at earth potential. The transitory effect

referred to in the preceding paragraph may again be ignored.

Consequently, after all five control operations have been performed, the cathodes of all five diodes 31 to 35 are at earth potential so that when the cathode of diode 36 is raised to earth potential by operation of contact set 45 triode 38 becomes conductive, winding 39 is energised, the motor perforating mechanism operates, and the tape is perforated in accordance with the code group.

Suppose now that the apparatus is functioning incorrectly and that when the control operations are performed one of the links required for the perforating operation, fails to move to its first position. The fault condition thus arises in which movable contact 18 controlled by this link is not in engagement with its fixed contact 19 in response to the first control operation. The corresponding intermediate tapping 16 is, thus given a negative potential, which potential, applied as it is to the cathode of one of the diodes 31 to 35, maintains triode 38 cut off even after the cathode of diode 36 has been raised to earth potential. The coil 39 remains unenergised, the punch mechanism therefore does not operate, and remains unoperated until the fault is cleared.

The punch mechanism is similarly prevented from operating if one of the links fails to move to the non-perforating position after the second control operation has been performed.

To summarize: Each "setting" operation causes one of the electromagnets of each link to be energized—the first electromagnet 10 in the case of each link required for the perforating operation, the second electromagnet 11 in the case of each of the other links—and unless each link moves to the appropriate position the punch mechanism does not operate.

After each required group has been perforated all five links are automatically returned to the neutral position by resetting mechanism (not shown) prior to the next setting operation. Alternatively, each link may remain in its first or second position, as the case may be, until the next setting operation; each link then moves direct from its previous first or second position to the new one, or remains where it is if it is required to be in the same position as before. The neutral position is thus never occupied by any link statically, except, of course, in error.

The existence of a negative potential on any of the intermediate tappings may be employed to operate some alarm device, such as a warning lamp instead of or in addition to preventing the operating of the punch mechanism. Also, coil 39 may be arranged to operate, through normally open contacts 30, a neon tube indicator circuit consisting of tube 31 and series resistor 32 supplied by the transformer 33.

Fig. 4 shows a fault finding or testing system similar in principle to that shown in Fig. 1, but slightly modified in minor respect applied to one form of tape punching mechanism of the teleprinter type.

In this diagram which is purely schematic, only those parts of the tape punching mechanism are shown which are necessary for illustrating the principle of the fault finding system. The tape 54 passes between an anvil 55 and a die-plate 56 and over a guide 57, and is fed at each punching operation by a sprocket 58 and spring pawl 59. The pawl 59 is secured to one

arm 60 of a three arm lever pivoted at 61, the other arms of which constitute a punch hammer 62 and the armature 63 of a punch solenoid 64 respectively. The anvil block 55 is bored to receive a row of five punch pins 65 having restoring springs 66. The parallel link mechanism referred to above with reference to Fig. 1 comprises a link 67 and the limb 68 of a T-lever pivoted at 69, and the link 23 pivotally connected at its ends to both of these members. A central ferromagnetic portion of link 23 forms a common armature passing through the solenoid windings 10 and 11. The head 70 of each T-lever engages a pivot link 71 carrying a pivoted distance piece 72 slidable within a horizontal guide 73, so that according to the positions of the respective T-levers, as set through the links 23 by the code in use, the distance pieces 72 are either inserted between punch hammer 62 and the respective punch pins 65 or are withdrawn therefrom. The lower part 74 of each T-lever is arranged to actuate the switch 17 which corresponds to that in Fig. 1. The test circuit and the circuit connections are practically the same as in Fig. 1. The tube circuit is not reproduced in full, but the connections thereof are indicated by the leads numbered 50, 51, 52 and 53 corresponding to those appearing in Fig. 1. Also the solenoid coils 10 and 11 are shown reversed in position as compared with Fig. 1. The switches 17 and 28 are shown in the first of the control positions namely with contact 27 closed to contact 29, and contact 18 of switch 17 closed to contact 19. In this embodiment the power for the punch operation is supplied by the punch solenoid 64 from the battery 75 through the additional switch contacts 76, which are closed by the relay coil 39 in the anode circuit of the triode 38 each time that a setting of the links 23 has been selected and has been found to be correct by testing as described above with reference to Fig. 1. Alternatively, in place of the punch solenoid 64 and the battery 75, motor operated mechanism may be employed for operating the punch, in which case the relay coil 39 and contacts 76 will be arranged to operate clutch engaging mechanism for the motor.

In the above described embodiments each actuating means includes an electrical component—the field winding of the electromagnet—arranged to be energized in response to the appropriate control operation, so that the energising means for causing each control operation to set up a potential difference between the movable contact and the first or second point as the case may be simply consists of the battery 26 and connections joining the movable contact and these points to suitable points in the energising circuits of these components. Where however a control operation—the second, say—does not cause any electrical component to be energised, arrangements must be made so that as part of this control operation some source of supply, which may for convenience be that used for the first control operation, is applied between the movable contact and the second point. To illustrate this a further embodiment of the invention will now be described with reference to Fig. 3, in which those components already described in connection with the embodiment of Fig. 1 are given the same references, and those components that differ somewhat from but correspond to components already described are given the same references modified by the addition of the index 1.

An electromagnetic relay includes a winding 10¹ which when energised displaces a contact-controlling armature 23¹ against the force of spring 41 to a first position 24¹ indicated by the arrow; this spring restores the armature (thereby restoring the contacts controlled by it) to a second position as soon as winding 10¹ ceases to be energised. This second position of the armature is that illustrated in Fig. 3. The winding 10¹ is connected between first point 12 and point 14 of a test circuit similar to that already described. It is assumed that the relay includes among its switching units a single pole change-over switch 17; movable contact 18 of this switch is shown in Fig. 3 as engaging second fixed contact 21 since the controlling armature 23¹ is shown in its second position. The arrangement is otherwise similar to that of Fig. 1 except that there is no winding or other electrical component connected directly between point 14 and second point 13, and that tapping 16 is connected to earth by way of a suitable electromagnetic indicating device 42—for example having a flag 43 adapted to be released by an armature 44.

The first control operation consists as before in causing movable contact 27 of switch 28 to engage fixed contact 29, thereby energising winding 10¹. The second control operation, however, consists not in causing the energisation of some component connected directly between points 13 and 14 but in disengaging contact 27 from fixed contact 29 and causing it to engage for a short period the other fixed contact 30 before returning to the neutral position shown in Fig. 3.

The operation of the equipment is similar to that of the embodiment first described as far as the first operation is concerned. When it is desired to energise the relay, contact 27 is caused to engage contact 29. If the apparatus is functioning correctly, armature 23¹ moves to its first position 24¹, thereby changing over contact 18 of switch 17 to fixed contact 19. Consequently intermediate point 16, lying in the unenergised portion of resistor 15 to the right of point 20, remains at earth potential and indicating device 42 does not operate. Should however the relay not be functioning correctly and the armature does not move sufficiently to cause contact 18 to engage fixed contact 19, intermediate tapping 16 acquires a negative potential and the indicator 42 operates to give warning.

It will be seen that, as with the first described embodiment, there will be a short period between the energisation of winding 10¹ and the engagement of contact 18 with contact 19, during which tapping 16 has a negative potential. But, as before, this transition effect can be ignored. If indicator 42 tends to respond to such a brief excitation it may be fitted with a slug or other delay device to prevent this.

After the relay has functioned correctly and it is desired to cause it to restore, the second control operation is performed by changing over contact 27 of switch 28 to fixed contact 30. If then the relay restores sufficiently for contact 18 to change over to contact 21, tapping 16 remains in an unenergised part of resistor 15 to the left of point 22 and so retains its earth potential (apart from another possible transitory fall to a negative potential during the time taken for contact 18 to move from 19 to 21). If on the other hand the relay does not restore sufficiently for contact 18 to engage contact 21, tapping 16 lies in an energised part of the resistor and ac-

quires a negative potential; the return circuit to earth from tapping 22 is completed by way of the rest of the resistor, first point 12 and winding 10¹ if contact 18 is not engaging either of the fixed contacts; or, if contact 18 has remained in engagement with contact 19, (for example owing to the armature sticking in the operated position) the return to earth from tapping 22 is completed by way of tapping 29 and contacts 19 and 18. In the former case of faulty operation the potential of 16 is more negative than in the latter case due to the additional voltage drop from point 14. In either case the indicator 42 operates.

It is desirable that moving contact 27 restores to neutral after each second operation, for otherwise there would be wasteful energisation of a part of resistor 15 even though the relay had restored correctly. In this example the closure of contact 27 to contact 30 may be a test operation to determine whether the link 23¹ has restored, as it should do, when contact is broken between 27 and 29.

The apparatus may also be used where neither actuating means includes an electrical component, and accordingly there are no windings or other components connected directly between points 12, 13 and 14. The movable member, whatever its form, is linked as before to the movable contact of the changeover switch and the apparatus acts in response to the control operations in a very similar manner to the action of the apparatus of Fig. 3 in response to the second control operation. Fig. 5 illustrates a fault finding or testing system operating in this manner. The circuit elements of the circuit system here illustrated corresponds to those in Figs. 1 and 2 except that the coils 10 and 11 are omitted and the link 23 is adapted to be shifted from the position 24 to 25 and vice versa by mechanical or other means not shown in the drawing, and is linked to the movable contact 18 of switch 17 and the movable contact 27 of switch 28. The contacts 18 and 27 are shown in the same positions as in Fig. 3, and the leads 52 and 53 are assumed to be connected to the tube circuit as shown in Fig. 1. In operation, the contact 27 of switch 28 is moved to its first position i. e. fixed contact 29 at the same time as link 23 is moved to its first position 24. If contact 18 engages fixed contact 19 the circuit is completed through that part of the resistor 15 lying between the point 12 and the tapping 20 so that the point 16 is at earth potential. If, due to faulty operation contact 18 does not close to contact 19, but makes contact with the fixed contact 21, or remains between the two end positions, a circuit is made through that part of the resistor containing the tapping 16, which thereby acquires a negative potential, which appears at the cathode of the respective diode of the respective test circuit and thereby gives a warning signal and prevents operation of the triode 38. Similarly, if either switch 23 or switch 17 fails to operate in the desired manner the tube circuit is rendered inoperative and the warning signal is given.

The above described embodiments are for illustrative purposes only and admit of wide variations within the scope of the invention. In particular the details of the circuitry may be considerably modified—for example other components may be included in series with the resistor between the first and second points—and the various polarities stated above may be reversed

if desired. Where it is desired to operate the apparatus by A. C. rather than D. C., suitable impedances may be substituted for the resistor connected between the first and second points.

I claim:

1. Fault indicating apparatus for indicating any failure of a movable member to reach a prescribed position in response to a control operation, comprising an electrical test circuit including an impedance connected between first and second points of said circuit, an energising source for said impedance, two tapping points on said impedance, switching means actuated by said movable member to close a circuit through one of said tapping points when the movable member is in the prescribed control position and thereby to establish a no-fault potential difference between said tapping points, and to close a circuit through another point of said impedance thereby establishing a fault potential difference between said first mentioned tapping points when the movable member is in any other position.

2. Fault indicating apparatus for indicating any failure of a movable member to reach a prescribed position in response to a control operation, comprising an electrical test circuit including an impedance connected between first and second points of said circuit, an energising source for said impedance, two tapping points on said impedance, switching means responsive to the position assumed by said movable member having one contact making position in which an energising circuit for a portion of said impedance is completed through one of said tapping points giving rise to a no-fault potential difference between said tapping points upon completion of the control operation, whilst any other position of said switching means gives rise to a fault potential difference between said tapping points, and indicating means responsive to said potential difference.

3. Fault indicating apparatus for indicating any failure of a movable member to reach a prescribed position in response to a control operation, comprising an electrical test circuit including an impedance connected between first and said second points of said circuit, an energising source for said impedance, two tapping points on said impedance, switching means actuated by said movable member to complete an energizing circuit through different portions of said impedance, according to whether the switching means reaches or does not reach a contact-closing position corresponding to the prescribed position of the movable member, so as to vary the potential difference between said tapping points, and indicating apparatus responsive to said change of potential difference.

4. Fault indicating apparatus according to claim 3 wherein the movable member is linked to said switching means having a first position corresponding to the prescribed position of the movable member and causing the establishment of a first potential difference between the said points, and the said switching means has at least one other position corresponding to failure of the movable member to reach the prescribed position, said other switch position causing the establishment of a second potential difference between the said points.

5. Fault indicating apparatus according to claim 3, wherein the switching means has a first contact making position corresponding to a first potential at an intermediate point of said impedance between said tapping points, a second

contact making position corresponding to a different potential at said point and a further non-contact making position corresponding to a further potential at said point.

6. Fault indicating apparatus according to claim 3, including a first switching means linked to the movable member and controlling the potential difference between said two tapping points of said impedance according to the position of the movable member, and a second switching means controlling the energisation of the impedance, said second switching means taking part in the control operation in response to which the movable member is actuated.

7. Fault indicating apparatus according to claim 6, including actuating means for the movable member comprising an electromagnetic component connected in said test circuit said component being energised by the energising source for the impedance by operation of said second switching means.

8. Fault indicating apparatus according to claim 7, wherein the movable member has two positions corresponding to two closed positions of the first switching means and is adapted to be moved to the first position by energisation of said electromagnetic component and to be restored to the second position by mechanical means.

9. Fault indicating means according to claim 7, wherein the movable member has two positions corresponding to two closed positions of the first switching means and is adapted to be moved to said positions by electromagnetic components individual thereto and energized alternately by operation of said second switching means into two respective positions.

10. Fault indicating apparatus according to claim 3, for indicating any fault in the movement of a plurality of movable members comprising a plurality of test circuits, one for each movable member, an electrical potential responsive means connected to a tapping point of each impedance of the individual test circuits, and a further electrical potential responsive means common to all of said individual electrical potential responsive means such that the existence of a fault potential at any one of said tapping points retains said common electrical potential responsive means in one condition, whilst the absence of a fault potential at all tapping points causes the said potential responsive means to assume a second condition.

11. Fault indicating apparatus according to claim 10 including a diode individual to each of said test circuits and connected to said tapping points, an electron tube circuit adapted to initiate a recording operation upon receipt of a given potential upon the grid of the tube and a common connection from each of said diodes to the grid of the electron tube.

12. Fault indicating apparatus according to claim 11 including a further diode connected to said common connection and normally retained at a potential preventing operation of said electron tube circuit irrespective of the potentials at the tapping points, and means for applying a second potential to said further diode to allow operation of said electron tube circuit after all of said test circuit diodes have received potentials from their respective tapping points in conformity with a no-fault condition in each test circuit.

13. Fault indicating apparatus according to claim 3 for a tape perforator of the teleprinter type comprising a plurality of movable members each having a test circuit, and a tape perforating

member individual to each of said movable members and wherein each movable member is adapted to be set according to a code into a first or second position corresponding to the "perforating" or "non-perforating" condition of each of said tape perforating members, a common operating means for said tape perforating members, and control means for said common operating means responsive to the existence of a no-fault condition in the impedance of all of said test circuits to initiate operation of the tape perforating members, and responsive to the existence of a fault condition in the impedance of any one of said test circuits to prevent operation of said tape perforating members.

14. Fault indicating apparatus according to claim 13, wherein the common control means comprises an electron tube circuit adapted to be energised to initiate the perforating operation upon receiving a given potential upon the grid thereof and a plurality of diodes, one for each test circuit connected between a common lead to said grid and a respective tapping on the impedance of their test circuits.

15. Fault-indicating apparatus for the purpose of indicating any failure of first or second actuating means to effect the movement of a movable member to a first or a second position in response to a first or a second control operation, as the case may be, comprising an electrical circuit including an impedance connected between a first and a second point and having an intermediate tapping, switching means including a movable contact adapted to engage first or second fixed contacts connected respectively to tappings on said impedance located between said intermediate tapping and said first point and between said intermediate tapping and said second point, a mechanical linkage for causing said movable contact to engage said first fixed contact or said second fixed contact according as said movable member is in said first or said second position as the case may be, energising means for causing each of said control operations to set up a potential difference between said movable contact and said first point or said second point as the case may be, and indicating means responsive to the potential difference set up between said movable contact and said intermediate tapping should said movable contact not be in engagement with said first fixed contact or said second fixed contact in response to said first operation or said second operation as the case may be.

16. Apparatus as claimed in claim 15 including a second switching means performing the said first and second control operations consisting in applying energising potentials to said impedance between the movable contact of the first switching means and the said first and second points respectively, and wherein an electrical actuating means for said movable member is energised by the appropriate one of said control operations.

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