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OPERATING DEVICE FOR IMPULSE-CONTROLLED INSTRUMENTS

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2 Sheets-Sheet 2

Fig. 6.

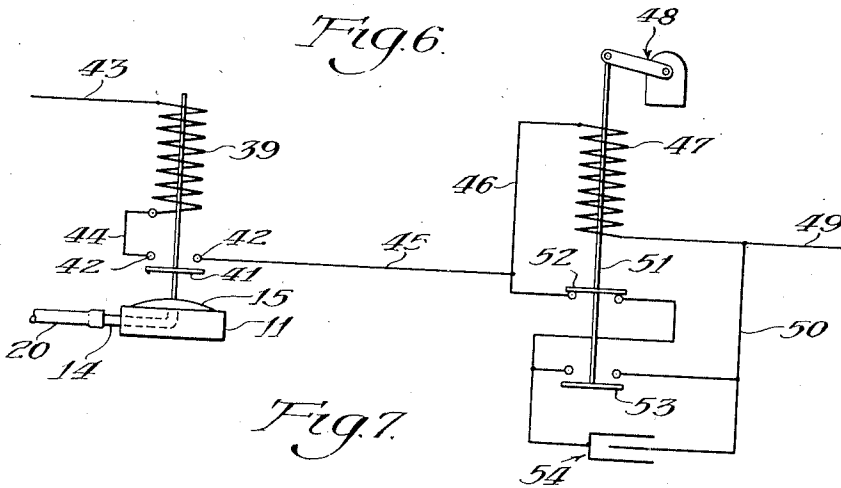


Fig. 7.

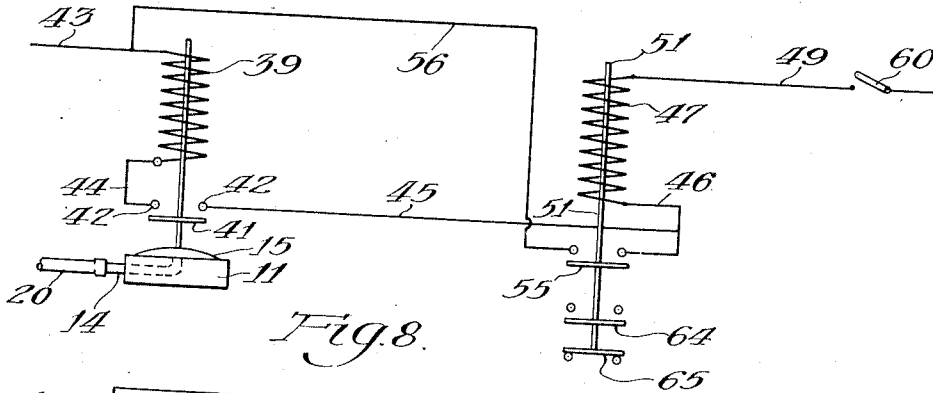
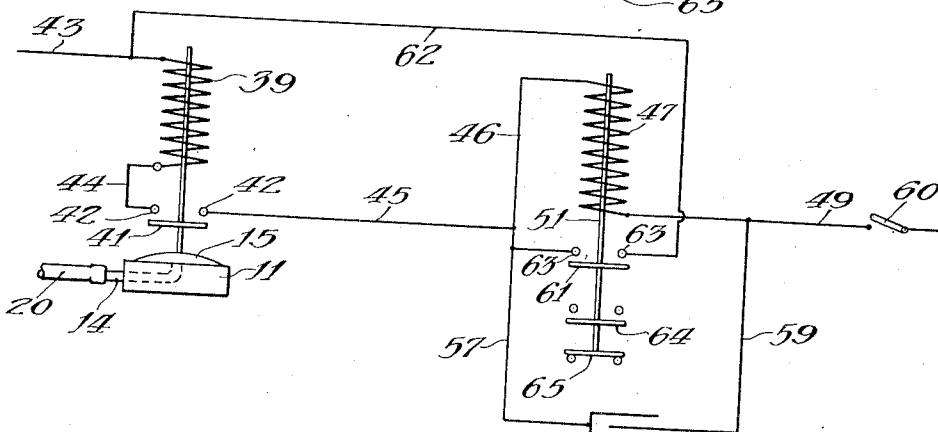


Fig. 8.



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OPERATING DEVICE FOR IMPULSE-
CONTROLLED INSTRUMENTS

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9 Claims. (Cl. 175—320)

This invention relates to operating devices for counters or the like wherein an air-operated switch or other momentary impulse device is employed to initiate the operation.

Such operating devices may be used, for example, with a traffic analyzer of the type shown in an application filed by Harold L. McCleery and Carlyle B. Stair on January 9, 1942, Serial No. 426,146, in which counting and signalling devices are operated by means of impulses caused by the wheels of automobiles passing over tubing laid in the street and connected with air-operated switches which serve to close electrical circuits and to thereby cause operation of said counting and signalling devices.

A common fault of operating devices of this general type heretofore devised has been that they do not under all conditions maintain contact of the switch elements long enough to insure that the counter or other controlled instrument will be operated upon each impulse. In the present device I employ an electromagnetic device in series with the switch contacts so that at the moment of contact current passes through the coil of an electromagnet which thereupon attracts an armature on the movable element of the switch and holds the switch closed for a predetermined time no matter how quickly the switch-closing impulse passes.

It is therefore the principal object of this invention to provide an operating device for the purpose stated in which provision is made for keeping the operating circuit closed long enough to cause operation of the counter or other controlled device regardless of the nature or speed of the impulse so long as it causes the switch elements to make any contact at all.

A more specific object is to accomplish this result through the use of an electromagnet and associated electrical elements in conjunction with an air-operated switch of the general type shown in the prior application above mentioned.

Other objects and advantages will be apparent from the following description of a preferred form of the invention, taken in connection with accompanying drawings, in which:

Fig. 1 is an elevational view of the switch portion of the operating device of my invention;

Fig. 2 is a transverse sectional view of the parts shown in Fig. 1;

Fig. 3 is a sectional view taken at right angles to the section of Fig. 2, being taken substantially on the section line 3—3 of Figs. 1 and 2;

Fig. 4 is a plan view of certain parts of the

switch, being taken substantially on the plane 4—4 in Fig. 2;

Fig. 5 is a transverse sectional view of the switch taken substantially on the section line

5—5 of Fig. 4;

Fig. 6 is a diagrammatic view showing the magnetic air switch in combination with the counter operating relay and the electrical circuits connecting said elements in operative relationship; and

Figs. 7 and 8 are views similar to Fig. 6 showing alternative arrangements, which, for certain uses of the device, may be preferable.

In said drawings, the switch is shown only in such detail as is necessary to an understanding of the present invention, and the showing is therefore to be regarded as somewhat diagrammatic. A switch base or block is indicated by the numeral 11 and has therein a horizontal air passage 12 and a vertical passage 13, the former having a coupling 14 of brass or other suitable material therein for receiving a piece of flexible tubing 20 which may be laid in the street if the device is to be operated by impulses caused by the passing of the wheels of automobiles over the tubing, as in the case of the prior application above identified.

Above the vertical passage 13 there is positioned a thin diaphragm 15 of rubber or other suitable material, which is held in place on the block 11 by means of a holding ring 16 which is clamped down by screws 17. A spacer ring 18 may be used if desired to hold the diaphragm somewhat above the top of the block 11, but this may be regarded as an optional element of the construction, since it is not in all cases essential.

The movable contact member of the switch comprises a leaf spring 19 which is supported in a block 21 on the switch base 11 and has its forward end 22 disposed above the central portion of the diaphragm 15, as shown particularly in Fig. 5 of the drawings. On said diaphragm immediately beneath said forward portion 22 of the contact spring 19 is a metal disc 23 which provides a wearing surface for said portion 22 of the contact spring to prevent the latter from wearing through the diaphragm. Said forward portion 22 of the spring is offset from the plane of the major part of the spring, as shown most clearly in Fig. 5.

On said portion 22 of the member 19 there is provided a contact member 24 of silver or like material, which is disposed directly beneath a fixed contact member 25, which is in the form of a screw extending downwardly from a sup-

porting bar 26, said screw and supporting bar both being made of conductive material such as brass. Said bar 26 in turn is supported upon a block 27 which rests upon the block 21, said blocks being held in place by means of screws 28, which also may serve as terminals or current-carrying connections to the bar 26 and the upper contact 25. It will be evident that said contact 25 is adjustable to provide the desired air gap between said contact 25 and the contact element 24. The movable contact spring 19 is connected to a binding post or terminal 29 by means of a pigtail connection 31 and is thereby connected into the circuit in manner which will be readily understood.

A magnet 32 is supported from the supporting bar 26 by means of an iron screw 33 having a flat head 34 at the lower end thereof disposed above a small piece 35 of sheet iron or other magnetic material carried by the movable contact spring 19. Said magnet is connected into the circuit by means of pigtail connections 36 and 37 reading, respectively, to the conducting bar 26 and to a binding post 38 in the base.

It will now be apparent that when the impulse is transmitted to the diaphragm 15 by air pressure in the passages 12 and 13 in the switch block 11, said diaphragm will be moved upwardly, flexing the leaf spring member 19 and causing the contact element 24 on the forward end 22 of said member to engage the fixed contact 25. Current will thereupon pass through the magnet 32 causing the same to attract the armature piece 35 into engagement with the flat head 34 of the screw 33, and so long as said magnet remains energized, the contact member 24 will thus be held in engagement with the contact member 25 no matter how quickly the impulse may pass. Therefore the length of the contact period is not dependent upon the length of time that the diaphragm 15 remains in its raised position, the contact being maintained even though the diaphragm may quickly return to the "off" position. If any contact at all is made between the contact elements 24 and 25, the magnet 32 will be energized and will maintain the positive contact between said elements 24 and 25 for a predetermined time controlled by the electrical elements diagrammatically illustrated in Figs. 6 to 8, inclusive, which will now be described.

In said last-mentioned views the air-operated switch is indicated generally by the reference numeral 11 and the tube, coupling and diaphragm by the numerals 20, 14 and 15, respectively, as in the other views. The magnet coil is indicated by the numeral 39 and the movable and fixed contacts by the numerals 41 and 42, respectively, the showing being purely diagrammatic and there being no effort to maintain exact correspondence with the other figures of the drawings. The connection of the magnetic coil 39 to the line current is indicated at 43 and a connection 44 is provided between said coil and the fixed contacts 42. A connection 45, 46 between the switch and a coil 47 of an actuating relay for the counter or other controlled device, identified by the numeral 48, is provided, and said coil is connected to the other side of the line by a lead 49.

In the form of the device shown in Fig. 6 the relay armature, which is identified by the numeral 51, carries a normally closed contact 52 and a normally open contact 53, and a condenser 54 is shunted across the coil through the normally closed contact 52. When the switch con-

tacts 41, 42 are closed, current passes from the lead 43 through the coil 39, the connection 44, the switch contacts 41, 42, the connection 45, 46 and the coil 47 to the line lead 49. The resistance of the coil 47 is sufficiently high so that the current passing through this path alone will not be sufficient to hold the switch contacts closed. However, current simultaneously passes through the closed contact 52 to the condenser 54, which is connected to the line 49 by a connection 50, and since the condenser, until charged by this current, offers no appreciable resistance, a rather high current impulse will pass through the magnet coil of the air switch so long as the condenser 54 is charging and the contact 52 is closed. The capacity of the condenser is such that the time required for it to become charged will be enough to insure that the relay coil 47 receives enough energy to operate the counter through the armature 51. During the operation of the relay, the contact 52 opens, and thereafter the contact 53 closes, which short-circuits and discharges the condenser. The capacity of the condenser is determined by the charging current and the time required to operate the relay 47, 51, since the magnet 32, 39 will hold the switch contacts closed for the length of time necessary to completely charge the condenser.

If the relay should not have fully operated before the condenser becomes charged and starts discharging, the energy from the condenser will be fed to the relay coil and will keep it energized even after the contact 41 has opened until the contact 52, which may have a delayed action, has fully opened, thus further assuring complete operation of the relay. However, the time required for charging the condenser is ordinarily sufficient for this purpose.

This arrangement insures a fast and positive operation of the relay armature which may be connected directly to a counter to record the impulses, as shown, or may be arranged to operate contacts for auxiliary apparatus (not shown) in manner which will be evident to those skilled in the electrical arts.

In the form of the device illustrated in Fig. 7, the resistance of the relay coil 47 is sufficiently low so that on the first momentary make of the contacts of the air switch, sufficient current will flow through said coil 47 to hold the switch contacts closed, as well as to cause the relay 47, 51 to operate. Operation of the relay causes a normally open contact 55 to close, thus establishing a holding circuit through a connection 56 from the line 43 through said contact 55 and the coil 47 to the other side 49 of the line. The relay will then remain closed until it is de-energized, either by opening a switch 60 in one of the line leads or by opening the holding circuit by some suitable means (not shown). This circuit insures the positive closing of the relay upon the first momentary contact of the air switch, and provides a holding circuit for the relay so that subsequent impulses will have no effect until the relay is deenergized in some such manner as that above described.

In the form of the device shown in Fig. 8, the resistance of the relay coil 47, as in the form shown in Fig. 6, is sufficiently high so that not enough current would pass therethrough to hold the switch contacts 42 closed if no other path for the current were provided. However, a second path for the current is provided through a lead 57 and a condenser 58 connected by a lead 59 to the other side 49 of the line. So long as

the condenser is charging, the switch contacts will be held closed, and the time will be so regulated by the capacity of the condenser selected as to make sure that the relay 47, 51 will be operated. There is a normally open contact 61 carried by the armature 51 of the relay, and upon operation of the relay, said contact will be closed, thereby establishing a holding circuit through a lead 62 from the line connection 43 to one of the fixed contacts 63 which are engaged by the contact 61 when the latter is closed, the circuit continuing through the relay coil 47 to the other side 49 of the line. The relay will then remain closed until it is deenergized in some such manner as described above in connection with the arrangement shown in Fig. 7.

In Figs. 6 and 8 I have shown additional contacts 64 and 65 which may be utilized for operating auxiliary devices such as signals or other electrically-controlled mechanism if this should be desired.

The foregoing detailed description has been given for clearness of understanding only, and no unnecessary limitations should be understood therefrom, but the appended claims should be construed as broadly as permissible in view of the prior art.

I claim:

1. An operating device for an impulse-controlled instrument, comprising: an impulse-operated switch having fixed and movable contacts and means whereby an impulse may be transmitted to the movable contact to close the switch, a switch arm carrying said movable contact an instrument-actuating relay connected in series with said switch, and an electromagnetic device arranged to be energized by the momentary closing of said contacts and to hold said switch arm in contact-closing position so as to maintain a closed circuit to said relay for a predetermined time sufficient to insure operation of the relay irrespective of the duration of the closing impulse.

2. An operating device for an impulse-controlled instrument, comprising: an air-operated switch having fixed and movable contacts and a diaphragm arranged to be actuated by air impulses to close said contacts, an instrument-actuating relay connected in series with said switch, and an electro-magnetic device arranged to be energized by the momentary closing of said contacts and to maintain a closed circuit to said relay for a predetermined time sufficient to insure operation of the relay irrespective of the duration of the closing impulse.

3. An operating device for an impulse-controlled instrument, comprising: an air-operated switch having fixed and movable contacts and a diaphragm arranged to be actuated by air impulses to close said contacts, an instrument-actuating relay connected in series with said switch, and an electromagnetic device arranged to be energized by the momentary closing of said contacts and to hold the same closed for a predetermined time sufficient to insure operation of said relay irrespective of the duration of the closing impulse.

4. An operating device for an impulse-controlled instrument, comprising: an impulse-operated switch having fixed and movable contacts and means whereby an impulse may be transmitted to the movable contact to close the switch, an instrument-actuating relay connected in series with said switch, an electromagnetic device arranged to be energized by the momentary closing of said contacts and to maintain a closed circuit to said relay for a predetermined time sufficient to insure operation of the relay irrespective of the duration of the closing impulse, said relay including a coil adapted to receive energy from current passing through said switch, and means for causing said coil to remain energized for such predetermined time.

5. An operating device for an impulse-controlled instrument, comprising: an impulse-operated switch having fixed and movable contacts and means whereby an impulse may be transmitted to the movable contact to close the switch, an instrument-actuating relay connected in series with said switch, an electromagnetic device arranged to be energized by the momentary closing of said contacts and to maintain a closed circuit to said relay for a predetermined time sufficient to insure operation of the relay irrespective of the duration of the closing impulse, said relay including a coil of such resistance that the current passing therethrough will not be sufficient to hold said switch closed, and a condenser in parallel with said coil and designed to receive charging current which is sufficient to hold said switch closed for a long enough time to insure complete operation of said relay.

6. An operating device for an impulse-controlled instrument, comprising: an impulse-operated switch having fixed and movable contacts and means whereby an impulse may be transmitted to the movable contact to close the switch, an instrument-actuating relay connected in series with said switch, an electromagnetic device arranged to be energized by the momentary closing of said contacts and to maintain a closed circuit to said relay for a predetermined time sufficient to insure operation of the relay irrespective of the duration of the closing impulse, said relay including a coil of such resistance that the current passing therethrough will not be sufficient to hold said switch closed, and a condenser in parallel with said coil, said condenser being of such capacity and so arranged as to insure that sufficient energy will be supplied to said relay coil to cause complete operation of the relay.

7. An operating device for an impulse-controlled instrument, comprising: an impulse-operated switch having fixed and movable contacts and means whereby an impulse may be transmitted to the movable contact to close the switch, an instrument-actuating relay connected in series with said switch, an electromagnetic device arranged to be energized by the momentary closing of said contacts and to maintain a closed circuit to said relay for a predetermined time sufficient to insure operation of the relay irrespective of the duration of the closing impulse, said relay including a coil of such resistance that the current passing therethrough will not be sufficient to hold said switch closed, and a condenser in parallel with said coil, said condenser being of such capacity and so arranged as to insure that sufficient energy will be supplied to said relay coil to cause complete operation of the relay.

8. An operating device for an impulse-controlled instrument, comprising: an impulse-operated switch having fixed and movable contacts and means whereby an impulse may be transmitted to the movable contact to close the switch, an instrument-actuating relay connected in series with said switch, an electromagnetic device arranged to be energized by the momentary closing of said contacts and to maintain a closed circuit to said relay for a predetermined time sufficient to insure operation of the relay irrespective of the duration of the closing impulse, said relay including a coil of such resistance that the current passing therethrough will not be sufficient to hold said switch closed, a condenser in parallel with said coil and designed to receive charging current which is sufficient to hold said switch closed for a long enough time to insure complete operation of said relay, and means operable by said relay to short-circuit said condenser upon completion of the operation of the relay.

9. An operating device for an impulse-controlled instrument, comprising: an impulse-operated switch having fixed and movable contacts and means whereby an impulse may be transmitted to the movable contact to close the switch, an instrument-actuating relay con-

nected in series with said switch, an electromagnetic device arranged to be energized by the momentary closing of said contacts and to maintain a closed circuit to said relay for a predetermined time sufficient to insure operation of the relay irrespective of the duration of the closing impulse, said relay including a coil of sufficiently low resistance that the current passing there-through will be sufficient to hold said switch closed, and means controlled by said relay for short-circuiting said switch upon operation of the relay.

9. An operating device for an impulse-controlled instrument, comprising: an impulse-operated switch having fixed and movable contacts and means whereby an impulse may be transmitted to the movable contact to close the switch, an instrument-actuating relay connected

in series with said switch, an electromagnetic device arranged to be energized by the momentary closing of said contacts and to maintain a closed circuit to said relay for a predetermined time sufficient to insure operation of the relay irrespective of the duration of the closing impulse, said relay including a coil of such resistance that the current passing therethrough will not be sufficient to hold said switch closed, a condenser in parallel with said coil, said condenser being of such capacity and so arranged as to insure that sufficient energy will be supplied to said relay coil to cause complete operation of the relay, and means controlled by said relay for short-circuiting said switch upon operation of the relay.

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