

W. C. SLAUSON

ELECTROMAGNETIC SWITCHING DEVICE

FIG. 1

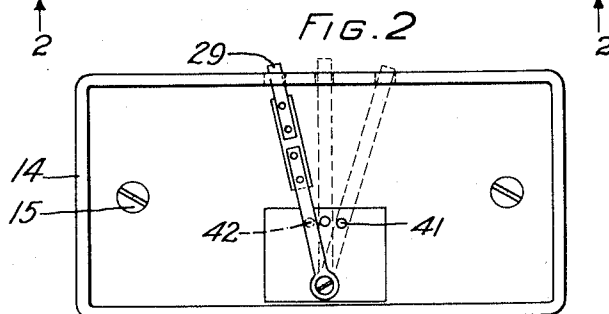
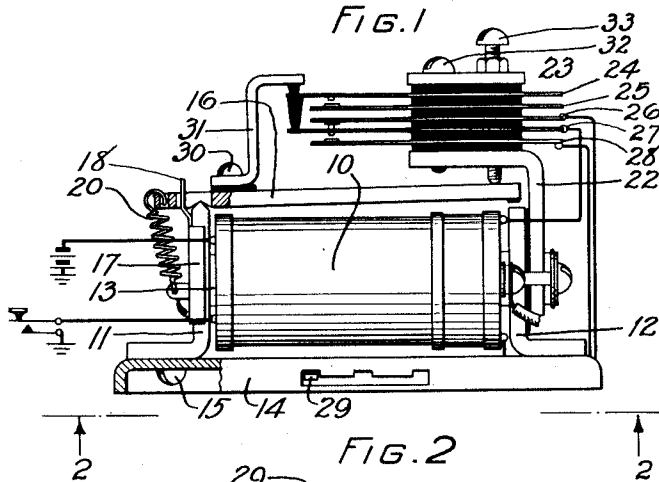


FIG. 3

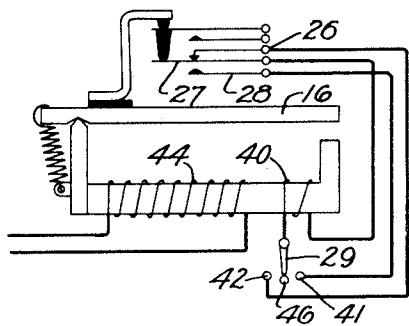


FIG. 4

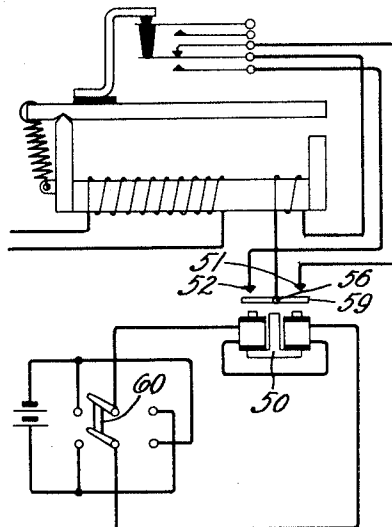
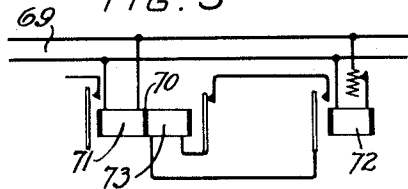


FIG. 5



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ELECTROMAGNETIC SWITCHING DEVICE

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This invention relates to electromagnetic switching devices and more particularly to means for varying the operating characteristics of such devices.

It is the object of this invention to provide means for automatically adjusting the time operating characteristics of relays while in service.

In electrical systems generally and telephone systems particularly the relay plays an important part. Owing to the numerous and varied conditions met with in such systems and the switching operations to be performed, it is necessary that an individual type of relay be furnished to satisfy each condition and perform the necessary switching functions. Heretofore, each condition met with was satisfied by a predesigned individual type of relay. For example, a condition which required a slow pick up quick releasing relay was satisfied by a relay predesigned to embody such operating characteristics, and in like manner, a condition that demanded a fast pick up slow releasing switching device was met by a relay so designed. There are numerous instances in telephone systems wherein circuit changes are made which necessitate different operating characteristics of the switching mechanism; for example, a change may be made in a circuit which calls for a quick pick up slow releasing relay where previous to the change a slow pick up quick releasing relay performed the required function. To satisfy this change it was necessary that the original relay be removed from the circuit and a new relay having the required operating characteristics substituted. Such replacements obviously consumed considerable time and rendered the circuit so affected inoperative until such changes were made.

Applicant obviates the necessity for such undue circuit disturbance when a change is to be effected, by incorporating in a switching device the essentials requisite for a plurality of different operating characteristics and providing means for applying these essentials in various combinations to render the relay readily adjustable to meet such changes in circuit requirements.

In one aspect of applicant's invention a three-position manual switch is provided and so associated with the contacts of a relay and a normally open secondary coil on the relay core that by the mere manipulation of the switch through its various positions the relay may be made quick to pick up quick releasing, quick operating slow releasing or slow to pick up quick releasing.

Another embodiment of the invention utilizes an electromagnetic switching device controlled from a local battery to perform the same functions

carried out by the manual switch hereinbefore referred to.

A further feature of applicant's invention embodying the normally open secondary coil resides in the provision of a quick to pick up high voltage relay as a controlling means for closing the short-circuited secondary on the core of a low voltage relay to render the latter slow operating upon the application of a high voltage to its terminals. This feature insures a constant time of operation of a low voltage relay when subjected to higher voltages.

These and other features of the invention will be readily understood from the following detailed description made with reference to the accompanying drawing in which Fig. 1 is a side elevation of an electromagnetic structure embodying the features of this invention;

Fig. 2 is a bottom view of the device shown in Fig. 1 and discloses the switching mechanism applicant has elected to employ to render the relay substantially universal in its operating characteristics;

Fig. 3 is a schematic diagram showing the electrical connections incorporated in the structure of Fig. 1;

Fig. 4 is a circuit and structural schematic diagram disclosing the use of a polarized relay as the means for imparting various time operating characteristics to the relay;

Fig. 5 is a circuit schematic diagram disclosing the method employed for rendering a low voltage relay constant in its time of operation when subjected to high voltages.

Referring now to Figs. 1 and 2 a double coil magnet 10 is shown provided with the pole pieces 11 and 12 secured to the relay core 13. The pole pieces 11 and 12 are provided with right angle extensions or flanges which are secured to the mounting plate 14 by means of screws such as 15. The pole piece 11 at its upper end, is provided with a knife edge which serves as a pivot for the armature 16. An adjustable sliding member 17 embraces the pole piece 11 and is furnished with an extension 18 which passes through a slot in the armature and prevents lateral displacement thereof. A coil spring 20 is secured at one end to the adjusting member 17 and has its other end in engagement with the armature. By moving the member 17 on the pole piece 11 the tension on the restoring spring 20 may be regulated.

Secured to and insulatively mounted on the pole piece 12 is an angular mounting piece 22 which serves as a seat for the spring pile-up 23

comprising the springs 24 and 25 which control an external circuit and springs 26, 27 and 28 which cooperate with the switching element 29 as a means for varying the operating characteristics of the relay.

Insulatively mounted on the armature by means of the screw 30 is a rigid operating arm 31 which actuates the contact springs 24 to 28 inclusive upon the actuation of the armature 16. Screws 32 and 33 serve to secure the spring pile-up 23 to the element 22, the screw 33 also serving as an adjustable back stop for the armature.

Reference is now made to Fig. 3, the same reference numerals being employed in this figure as in Fig. 1 to designate corresponding parts.

Assuming the switch-arm 29 to be in the mid-position as shown in Fig. 3 the relay will function as a quick pick up quick release device. This is due to the fact that the secondary coil 40 is opened when the switch-arm is in this position. Consequently, coil 40 is rendered ineffective in opposing any change of current in the operating winding 44 and the time characteristics of the relay are not altered.

Should it be desired to render the relay quick to pick up slow releasing, the switch-arm 29 is moved to the right and into engagement with contact 41. With the relay in its unoperated position the secondary coil is opened at the front contact of spring 28, so that when current is applied to the operating winding 44 of the relay, the relay operates independently of the coil 40 and at a speed determined by the characteristics of the operating coil 44 only. The relay functions accordingly, as a quick to pick up relay. When in its operated position the spring contacts 27 and 28 are closed causing the secondary coil 40 to be closed upon itself. The contact spring 27 is generally known as a transfer spring. When the current through winding 44 is discontinued and varies from its maximum value to zero, the change of current induces an E. M. F. in the short-circuited coil 40 which sets up a magnetomotive force opposing that produced by the decaying current in the winding 44. The result is that the armature 16 is momentarily maintained in its operated position. This electrical phenomenon is the well known effect of the short-circuited secondary or copper slug commonly employed in producing slow acting relays and it is believed that any further elaboration of the theory involved is unnecessary.

The reverse result is effected when the switch-arm 29 is moved to the left and into engagement with contact 42. Under this condition the winding 40 is closed at the back contact of spring 26 and spring 27 so that when current is applied to the winding 44 and during the build-up thereof from zero to its maximum value, the magnetomotive force set up by the closed winding 40 opposes that effected by winding 44 so that the armature is delayed in its actuation. When the relay is fully operated, the coil 40 is opened by the separation of spring contacts 26 and 27 so that when the current through the winding 44 is discontinued the coil 40 will play no part in delaying the release of the armature. Under this condition, that is with switch-arm 29 in engagement with contact 42, the relay becomes slow to pick up quick releasing.

From the foregoing description it is evident that with switch-arm 29 in mid-position the relay becomes quick to pick up quick releasing, when in engagement with contact 41 the relay becomes quick to pick up slow releasing and when in en-

gagement with contact 42 the relay becomes slow to pick up quick releasing, and that by the mere manipulation of the switch-arm a single relay may serve a plurality of purposes. Such a type of relay, when employed in telephone or similar circuits, will obviate the necessity for replacements and minimize the "out of service" periods frequently experienced by circuits wherein varying requirements necessitate relays of different operating characteristics.

Fig. 4 differs from Fig. 3 in the substitution of a locally controlled polarized relay for the three-position switch of Fig. 3. The contacts 51 and 52 of the polarized relay 50 correspond to the contacts 41 and 42 respectively of the manual switch shown in Figs. 1 and 2, while the contact 56 corresponds to contact 46 and the armature 59 is the equivalent of the switch-arm 29. A reversing switch 60 is employed as a means for changing the direction of the current in the windings of polarized relay 50. With switch 60 in its neutral position as shown in Fig. 4 the double coil relay is a quick operating quick releasing relay; when the switch 60 is moved to the left or right the time characteristics of the relay are changed in the same manner as hereinbefore described in connection with the operation of the manually operated switch-arm 29 of Figs 1 and 2. It is believed unnecessary to describe in detail the operation of the system disclosed in Fig. 4 as it is readily understandable from the description of Fig. 3. However, it may be well to say that for a certain actuation of switch 60 contact 51 will be closed rendering the double coil relay slow to pick up quick releasing, whereas when switch 60 is actuated to the other position contact 52 will be closed and the relay becomes quick to pick up slow releasing. By means of an electromagnetic device such as polarized relay 50 the characteristics of the double coil relay may be controlled from a point remote from the system in which the relay is located.

In Fig. 5 there is disclosed another application of the normally open secondary coil controlled by a relay associated with the same circuit in which the double coil relay is located. This arrangement is desirable in circuits wherein the operating voltage of the main circuit is variable and wherein it is essential that the double coil relay maintain a constant time of operation. It will be assumed that relay 70 is predesigned to operate at a certain speed upon the application of a 24 volt supply to its main winding 71 which is bridged across the line 69. Relay 72 is inherently a quick pick up relay and designed to function at a voltage higher than 24 volts, say 48 volts. Upon the application of a 24 volt source to line 69 relay 70 operates at a normal speed whereas relay 72, designed to function on 48 volts, will not respond, so that the secondary coil 73 remains open at both the armature contacts of relays 70 and 72. However, should a 48 volt supply be associated with the line 69, relay 72 operates immediately to close the secondary coil 73 of relay 70. In this manner the coil 73 serves as a short-circuited secondary and tends to delay the actuation of the armatures of relay 70. Relay 70 will operate accordingly, at substantially the same speed on either 24 volts or 48 volts.

What is claimed is:

1. In combination, a relay having an operating winding and a normally open secondary coil mounted on the core thereof, a plurality of contact springs mounted on said relay, one of said

- contact springs being permanently associated with a terminal of said secondary coil and switching means embodied in the structure of said relay as an integral part thereof adapted to selectively connect the other terminal of said secondary coil with any of the remaining contact springs to render said secondary coil effective to vary the operating characteristics of said relay.
2. In combination, a relay having an operating winding and a normally open secondary coil mounted on the core thereof, a contact spring on said relay permanently associated with one terminal of said secondary coil, a second contact spring and switching means embodied in the structure of said relay as an integral part thereof for connecting the other terminal of said secondary coil with said second contact spring to close said secondary coil prior to the energization of said operating winding and means for energizing said operating winding.
3. In combination, a relay having an operating winding and a normally open secondary coil mounted on the core thereof, a contact spring on said relay permanently associated with one terminal of said secondary coil, another contact spring, and switching means embodied in the structure of said relay as an integral part thereof for connecting the other terminal of said secondary coil with said other spring to effect the closure of said secondary coil upon the operation of said relay and means for energizing said operating winding to effect the operation of said relay.
4. In combination, a relay having an operating winding and a normally open secondary coil mounted on the core thereof, contact springs for said relay and a multi-position switch embodied in the structure of said relay as an integral part thereof cooperating with said contact springs and adapted in one position, to maintain said secondary coil open until said relay is fully actuated and in another position to close said secondary coil during the actuation period of said relay.
5. In combination, a relay having an operating winding and a normally open secondary coil mounted on the core thereof, said secondary coil having one terminal thereof connected to a transfer spring of said relay, a multi-position switching mechanism embodied in the structure of said relay as an integral part thereof adapted to associate the other terminal of said secondary coil with other springs of said relay to cause said relay to assume a different operating characteristic for each position of said switching mechanism upon the energization of said operating winding, and means for energizing said operating winding.
6. In combination, a relay, means for imparting to said relay a plurality of different time functioning characteristics, said means including a three position switch integrally associated with said relay and adapted when in one position, to render said relay quick-to-pick up, slow-releasing, when in a second position to render said relay quick-to-pick up, quick-releasing, and when in a third position to render said relay slow-to-pick up, quick-releasing.
- WILLIAM C. SLAUSON.