

Dec. 19, 1961

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3,014,102

ELECTROMAGNETIC SWITCH APPARATUS

Filed April 10, 1958

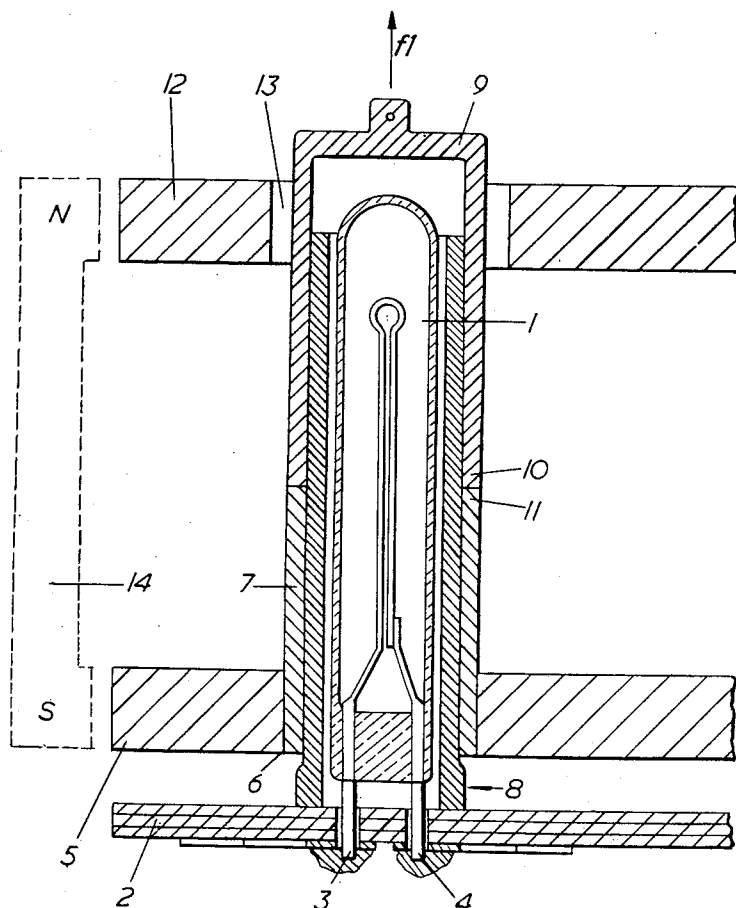


FIG. 1

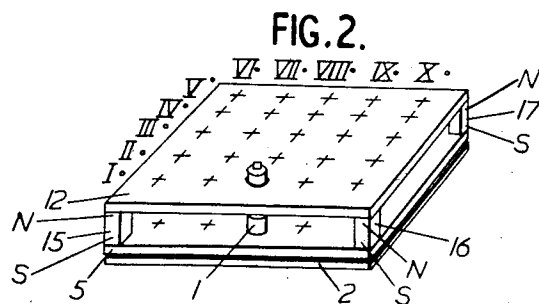


FIG. 2.

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ELECTROMAGNETIC SWITCH APPARATUS

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Filed Apr. 10, 1958, Ser. No. 727,599

Claims priority, application Italy May 9, 1957
9 Claims. (Cl. 200-87)

This invention relates to relays and particularly to contact relay armatures sealed in air-evacuated vessels and the object thereof is to provide a means to operate said contacts exploiting the magnetic reluctance of a magnetic circuit in which the devices operating the electric contacts are placed.

Several devices have been designed to close and open electric contacts placed within sealed vessels air-evacuated or filled with an inert gas, such contacts of relays having the energizing coil axially placed in respect to the contact members performing a rapid, reliable and more sensitive operation.

One of such devices has been claimed in our copending patent application, entitled, "Electrical Switching Device and Method for Making Same," filed March 18, 1958, Serial No. 722,194, and this device has been used for several applications and combinations. Such relays however due to currents flowing through the energizing coil, when placed very near each other to form group of switches, using the coordinate principle, have the drawback that they require complex means in order to prevent mutual effects due to the magnetic flux dispersion.

This invention concerns magneto-mechanical means for operating electric contacts of said devices and its application for the operation in sequence, in multiple or in alternate of one or more of a plurality of such contact devices.

In another of these embodiments, the invention relates to the simultaneous operation of a plurality of contacts by using the combination of magnetic and mechanical means, driven by electromagnets and using the coordinate principle.

One of the essential features of this invention is to eliminate the use of energizing coils directly mounted on the contact device, and to operate said contact devices by varying or making null the magnetic reluctance of the path of the stationary magnetic flux flowing around the magnetic members which operated the electric contact.

A further feature of this invention is shown by a practical example of an embodiment of a plurality of groups of contacts each one being provided with a movable magnetic member which controls, from outside, each sealed contact armature, to obtain the operation thereof; said movable magnetic members being mechanically coupled to operate simultaneously or alternatively, separately or associated in groups, to perform any combination of external electric circuits connected to said contacts.

The invention will be more clearly understood from the following detailed description of practical examples with reference to the figures of the accompanying drawing, in which:

FIG. 1 is a greatly enlarged cross-sectional view of a contact device of a clip relay forming part of a plurality of such devices or ordered in couples or groups to control a plurality of electric circuits; and

FIG. 2 shows a perspective view of a plurality of devices of FIG. 1 placed between two plates of magnetic material biased by suitable permanent magnets.

Referring to FIG. 1 there is shown a sealed contact device 1 of a clip relay having its lower end secured to a plate 2 of insulating material (Bakelite or plastic material) on a surface of which runs the printed circuit or an equivalent electric circuit to be controlled; terminals 3, 4 of the contact device 1 fastened to said printed cir-

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cuit by soldering or by any other suitable means. Mounted over the insulating plate 2, either joined thereto or slightly separated therefrom, there is a first plate 5 of magnetic material of high permeability, provided with a hole 6 into which fits a small tube 7 of magnetic material, also of high permeability, extending upwards half the height of the contact device 1. Tube 7 has its lower end in close contact with the internal surface of the hole 6. A tube 8, of plastic, coats the inside surface of the tube 7 and extends upwards to receive a cap 9 of magnetic material slidably mounted on tube 8, so that its lower rim comes in contact with the upper rim 11 of the magnetic tube 7.

Parallel to plate 5 and spaced suitably therefrom, in accordance with the position of the contact-carrier members (not shown), enclosed in the vessel, there is a second plate 12, of magnetic material of high permeability. Plate 12 is provided with hole 13 of suitable diameter, surrounding the cap 9 as cap 9 must move axially in this hole.

It is understood that, when opposite magnetic polarities are applied to the two plates 5 and 12, respectively, and which polarities may be obtained by placing one or more straight magnets 14 between said plates and arranged to show homonymous polarities on the same side, the magnetic circuit for said permanent magnets will run along the paths of the highest permeability encountered in said plates.

Let us suppose the polarity N is applied to plate 12. The magnetic flux lines will pass through the gap of hole 13, reach cap 9, pass through tube 7, to plate 5, completing the magnetic circuit. Plate 5 will carry polarity S as a result of being in contact with the other end of magnet 14. The magnetic contact carrier members of device 1, are magnetically shielded by cap 9, placed in contact with tube 7 and by tube 7 itself, and will not operate while cap 9 is in such shielding relation therewith. If cap 9 is slightly raised, however, the magnetic flux will flow now through the magnetic members of device 1 and the electric contacts thereof will be operated (making or breaking).

Mechanical drive of said cap 9 can be performed by known methods, i.e. pulling, rotation, pushing, falling, etc.; said mechanical members being operated by hand or by electromagnets provided with suitable levers. The drive is indicated by the arrow f1. This method to control indirectly magnetic contact carrier members enclosed in protective vessels, using a permanent magnetic field, renders it possible to control a plurality of contact units, combining them in series or parallel groups etc., and can be used to form selector switches, line finders etc., employed in switching circuits, i.e., telephone switching systems.

As an illustrative example, FIG. 2 is a greatly reduced schematic perspective view of an arrangement of a plurality of switching devices 1, only one of which is shown, using the coordinate principle. Such devices indicated by small crosses and designated by I, II, III, IV and V can be separately or simultaneously controlled by means of a single mechanical member driven by one or more electromagnets placed outside the plates, or rows of such devices, indicated by VI, VII, VIII, IX and X can be controlled in groups or simultaneously by the same mechanical means.

The plates 5, 12 will have a number of holes like the holes 6, 13 of FIG. 1 and will be provided with a sufficient number of permanent magnets such as 15, 16, 17, etc., so that plates 5, 12 which work as pole pieces, are able to provide the wanted magnetic effects on each of the contact carrier devices.

While the use of permanent magnets has been shown for the magnetic energization of the device, the invention

is not to be considered limited thereby as electromagnetic means may be substituted in lieu thereof.

While the principle of the invention has been described above in connection with a specific embodiment and particular detailed examples thereof, it is to be clearly understood that several embodiments suggested by this method could be realized by those skilled in the art, without departing from the spirit of this invention confirmed by the accompanying claims.

What is claimed is:

1. An electric switch comprising an elongated envelope having electrical contact means therein operable in response to a magnetic flux exerted thereon externally of said envelope, a pair of apertured, spaced plates of magnetic material, said plates extending in parallel planes, said planes normal to the axis of said envelope, opposite ends of said envelope extending into corresponding apertures in said plates, movable magnetic shielding means extending through the corresponding aperture in a first one of said plates and coaxially with a first portion of said envelope, means for rendering said plates magnetically polarized in opposite sense, the said shielding means being movable out of shielding relation with said envelope to include the said contact means in the flux path from said polarizing means to cause the contact means to operate, and being movable into shielding relation with said envelope to exclude the said contact means from the flux path from said polarizing means to cause the said contact means to restore.

2. An electric switch as claimed in claim 1, further comprising a fixed magnetic shielding member extending through the corresponding aperture in the other of said plates and coaxially with a second portion of said envelope.

3. An electric switch as claimed in claim 2, further comprising a fixed mounting base for said envelope, said base extending in a plane normal to the axis of said envelope.

4. An electric switch as claimed in claim 2, further comprising a sheath of non-magnetic material coaxial with said envelope, said sheath intermediate the outer surface of said envelope and the inner surface of both of said shielding means.

5. An electric switch as claimed in claim 1, wherein said means for rendering said plates magnetically polarized in opposite sense comprises permanent magnet means whose respective poles are in flux transfer relation with said plate, respectively.

6. An electric switch as claimed in claim 1, wherein the said movable shielding means are adapted for reciprocating movement in a direction parallel to the axis of said envelope.

7. An electric switch as claimed in claim 2, wherein said movable magnetic shielding means comprises an inverted vessel extending over an end of said envelope and having its open rim normally in contact with said fixed magnetic shielding means.

8. An electric switch comprising a plurality of elongated envelopes, each having electrical contact means therein operable in response to a magnetic flux exerted thereon externally of said envelopes, a pair of spaced plates of magnetic material extending in parallel planes, said planes normal to the axes of said envelopes, said plates having a plurality of spaced apertures arranged in a coordinate array, corresponding apertures in said plates being in register, one end of each of said envelopes extending into different apertures of one of said plates and the other ends of each of said envelopes extending into different corresponding apertures of the other of said plates, a plurality of movable magnetic shielding elements, each extending through a different aperture of a first one of said plates and coaxially with first portions of a different one of said envelopes, means for rendering said plates magnetically polarized in opposite sense, the said shielding means being selectively movable out of shielding relation with their associated envelopes to include the said contact means in the flux path from said polarizing means to cause the contact means of the selected envelopes to operate and being movable into shielding relation with said envelopes to exclude the said contact means of the selected envelopes from the flux path of said polarizing means to cause last said contact means to restore.

9. An electric switch as claimed in claim 8, wherein said means for magnetically polarizing said plates comprises a plurality of permanent magnets disposed between said plates adjacent the corners thereof, each of said magnets poled in like direction.

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