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3,243,544

CONVERTIBLE RELAY CONTROL STATION

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Fig. 1

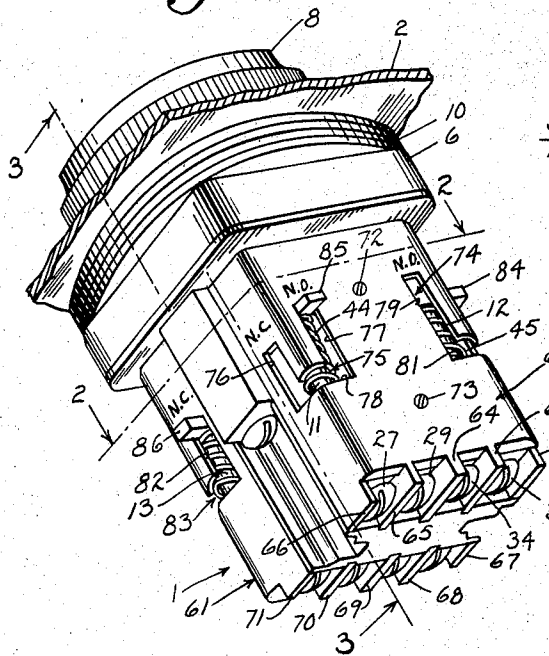


Fig. 2

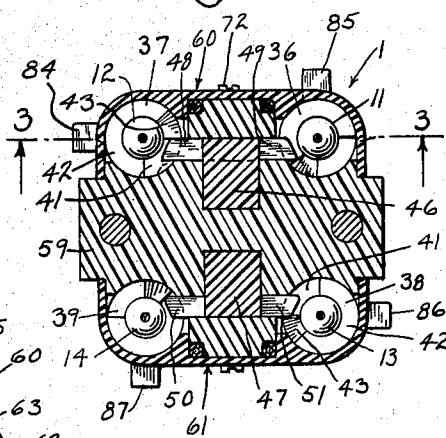


Fig. 4

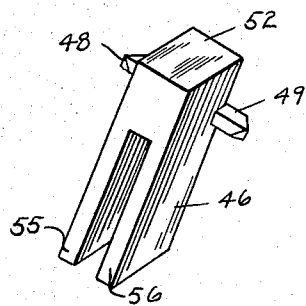


Fig. 3

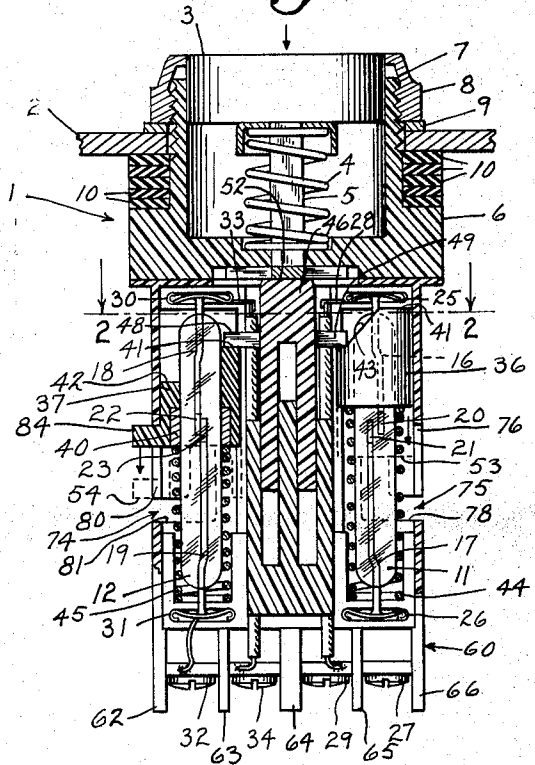
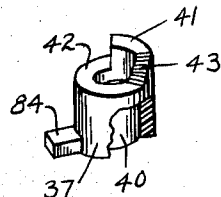


Fig. 5



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3,243,544

CONVERTIBLE RELAY CONTROL STATION

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This invention relates generally to an electrical control station for controlling electrical apparatus. More particularly the invention relates to a convertible control station comprising at least one magnetically-operable switch with accompanying magnetic means for actuating the contacts of the switches in a normally-open or normally-closed position according to the proximity of the magnetic means in relationship to the contacts of the switches. An embodiment of the control station comprises means for presetting the position of the magnetic actuating means so that each switch may be actuated in either a normally-open or normally-closed position independent of the operation of the other switches, thereby making the control station convertible between various manners of operation. The control station further includes means whereby upon operation of an operator mechanism in the control station the position of the magnetic actuating means changes such that the contact relationship of each switch changes.

A control station will be herein understood to be a device containing a mechanism interlinked mechanically, electrically or electro-mechanically to the electrical contacts of a single switch or a plurality of switches within the station. The relationship of the switch contacts responds to operation of an operator mechanism. The electrical contact response to the operator mechanism, in turn, controls the electrical energization of various electrical devices connected to the switches. Depending on the specific application of the control station the normal position of the switch contacts may be closed or open. If the normal position of the contacts are closed, electrical energy is permitted to pass through the switch until a response signal is received from the operator mechanism at which time the contacts open, thereby preventing further passage of electrical current through the switch. If the normal position of the switch contacts is open, electrical energy is blocked from passage through the switch until a response signal is received from the operator mechanism at which time the contacts close thereby permitting passage of electrical current.

In the electronic control field, there is need for a compact, highly reliable, precision electrical control station unit having a single electrical switch or a plurality of switches and which is convertible in the sense that the contact relationship of each switch may be alternatively preset to either a normally-open or normally-closed relationship. It may also be desirable that the control station include means wherein the preset normal contact relationship of each switch can be converted independent of the contact relationship of the other switches. To further increase the versatility of the control station it may be desirable that the change be made while the terminals of the control station are connected in the circuit without requiring disconnection of the wiring leads connected to the switch terminals. Applications for this type control center include use in connection with shift registers, numerical controls and control centers within the laboratory and industry. It is an object of this invention to provide a control station which meets these needs.

Also, frequently a control center is called upon for operation in a contaminated atmosphere containing dirt, dust, explosive and/or corrosive vapors. During recent years, hermetically-sealed, magnetically-operable switches, for example the dry reed switch, have been prominently

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used in switching applications requiring long mechanical life, and freedom of contact failure whether applied in the laboratory where the atmosphere is relatively free of foreign particles, or in foundries where the atmosphere contains foreign particles which would otherwise interfere with proper contact operation. The present invention provides a control station which may incorporate a single or plurality of such hermetically-sealed, magnetically-operable switches in a control station.

The magnetic means as called for by this invention to operate the switches is positioned about the switches and is interlinked with the operator mechanism within the control station. The magnetic means has sufficient flux such that when it is placed about the external surface of the switch and proximate to the switch contacts the switch contacts are biased in a closed relationship. At the same time, when the magnetic means is effectively removed from the proximity of the contacts to an inactive position, the magnetic flux does not create sufficient force on the contacts to hold them closed and the contacts assume an open relationship.

The control station of this invention includes means for alternatively presetting the position of the magnetic means in either position such that the switches may be operated from either a normally-open or normally-closed relationship. The position of the magnetic means may be externally converted from the preset position to the other position. This invention further provides a control station wherein the relationship of the magnetic means and each switch is independent such that if a plurality of switches are incorporated, each switch may be preset in a normally-open or a normally-closed operating position independent of the operation of the contacts of the other switches. For example, if four switches are used all four may be preset and operated from either the normally-open or normally-closed position, two preset and operated from one normal position and two from the other normal position, or three preset and operated from one position and the fourth from the other position. Assuming that the operator mechanism is of the push-button type, the relationship of the magnetic means and the contacts of each switch concurrently respond to manual operation of the push-button, thereby effecting actuation of each switch. The switches preset normally-open assume a closed position by changing the relationship of the magnetic means and contacts from the inactive to the biased position. The switches preset normally-closed assume an open position by changing the relationship of the magnetic means and contacts from the biased to the inactive position. Upon release of the push-button, the relationship of the magnetic means and switch contacts returns to the original position.

The foregoing principles and objects of the present invention will appear in the description to follow. In the description, reference is made to the accompanying drawings which form a part hereof and in which there is shown by way of illustration a specific embodiment in which this invention may be practiced. This embodiment will be described in sufficient detail to enable those skilled in the art to practice this invention, but it is to be understood that other embodiments of the invention may be used and that changes may be made in the body of the invention without deviation from the scope of the invention. Consequently, the following detailed description is not to be taken in a limiting sense; instead, the scope of the present invention is best defined by the appended claims.

In the drawings:

FIG. 1 is a perspective view of a push-button control station incorporating the principles of this invention and shown mounted on a panel segment. FIG. 1 shows the external features of the control station and illustrates the

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means for presetting each switch in either a normally-open or normally-closed position.

FIG. 2 is a sectional view of the control station of FIG. 1 taken along the plane 2—2 of FIG. 1 and illustrating the engagement of the push-rod interlink and the carriers carrying the magnetic means for actuating the contacts of the switches of the control station.

FIG. 3 is a sectional view of the control station of FIG. 1 taken along the plane 3—3 of FIG. 1 and illustrating the relationship between the push-button operator, the pushrod interlink, the magnetic actuating means, and two switches of the control station one switch being preset normally-open and the other switch normally-closed.

FIG. 4 illustrates in perspective a push-rod interlink mechanism for engaging the push-button operator and the carrier carrying the magnetic biasing means of the control station shown in FIG. 1.

FIG. 5 illustrates in perspective and in section a torroidal-shaped carrier for engaging the push-rod interlink of FIG. 4 and carrying a permanent magnet for actuating the switch contacts.

The control station shown in the drawings and illustrating the principles of the present invention is referred to by the general reference character 1. The control station 1 is shown mounted on a panel segment 2. The control station which, may include any one of numerous actuator mechanisms, is shown herein as incorporating a push-button operator mechanism. As best illustrated in FIG. 3, the push-button mechanism includes a push-button 3 supported by a biasing spring member 4 mounted about a button shank 5. The push-button 3, the spring 4, and the shank 5 are supported by a mounting block 6. The mounting block 6 supports a ferrule 7 which in turn carries a locking ring 8. Between the panel segment 2 and the locking ring 8 is a spacer 9. On the other side of the enclosure segment 2 is a plurality of washers designated by the numeral 10, which may be utilized to insure proper engagement between the control station 1 and the panel 2.

The control station 1 may include a single or a plurality of hermetically-sealed, magnetically-operable switches. In the illustration herein the control station 1 is shown as incorporating four glass-enclosed, hermetically-sealed, magnetically-operable switches in the form of dry reed switches 11, 12, 13 and 14. FIG. 3 is a cross-sectional view of the control station of FIG. 1 taken along the line 3—3 illustrating in detail the dry reed switches 11 and 12. The reed switch 11 has a pair of reeds 16 and 17, and the reed switch 12 has a pair of reeds 18 and 19. The reeds 16 and 17 each have a contact 20 and 21 respectively, at its terminus and overlapped relative to one another. Likewise, the reeds 18 and 19 each carry overlapped contacts 22 and 23 respectively. The reeds 16 and 17 each have a terminal portion 25 and 26 respectively extending exteriorly of the switch 11. The terminal 26 is electrically connected to a screw type terminal 27, and the terminal 25 is connected through a jumper wire 28 to a screw terminal 29 adjacent to the screw terminal 27. The reeds 18 and 19 each terminate in a terminal 30 and 31 respectively. The terminal 31 is connected to a screw terminal 32, and the terminal 30 is connected to jumper wire 33, to a screw-type terminal 34, adjacent to and in between the terminals 29 and 32.

Circumjacent to each of the reed switches 11, 12, 13 and 14 is a slidable and rotatable operating magnetic carrier 36, 37, 38 and 39 respectively, as shown in FIGS. 2 and 3. In FIG. 3 the carrier 36 is shown in whole and the carrier 37 in sectional. The carriers 36, 37, 38 and 39 are identical in structure and, as shown herein, each is molded from a plastic material. There are numerous commercially available plastic materials which are suitable. For a clearer understanding of the structure of the carriers 36, 37, 38 and 39, the carrier 37 is shown in detail in FIG. 5 with a section of the external surface

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broken away. The carriers 36, 37, 38 and 39 each carry a torroidal permanent magnet which is illustrated by the magnet 40 of the carrier 37. The torroidal magnets are secured in place to the carriers by cementing or other means to insure permanency of the attachment. The magnets within the carriers must have sufficient magnetic flux such that when each carrier is placed circumjacent to a reed switch and proximate to the contacts of the reed switch the magnetomotive force will be sufficient to overcome the restoring force of the cantilever supported reeds, thereby biasing the switch contacts in a closed relationship. At the same time, the magnet flux must be such that when the magnet is effectively moved away from the switch contacts, the restoring force of the reeds will overcome the force produced by the magnet flux, thereby permitting the contacts to assume an open relationship. This will be hereinafter referred to as the inactive position. In FIG. 3 the carrier 37 is shown in sectional and carrying the magnet 40. The carrier 37 is positioned such that the magnet 40 biases the contacts 22 and 23 in closed relationship so that there is a complete circuit between the screw terminals 32 and 34. At the same time, FIG. 3 illustrates the carrier 36 in whole and in an inactive position away from the contacts 20 and 21 of the reeds 16 and 17 of the reed switch 11. The magnet carried within the carrier 36 is effectively removed from the switch contacts 20 and 21 such that the flux force is not sufficient to hold the contacts 20 and 21 in a closed position and there exists an open circuit between the screw terminals 27 and 29.

From the illustration in FIG. 5 of the carrier 37 it shall be noted that the top surface of carrier 37 has two levels. One level of the carrier 37 is designated by the numeral 41 and the second level is designated by the numeral 42, both being joined by means of an intermediate incline cam surface 43. Each of the carriers 36, 37, 38 and 39 are constructed in a similar manner, and have two levels at the top ends thereof. It should also be noted in FIG. 3 that each of the carriers 36 and 37 are supported by a helical biasing return spring 44 and 45 respectively, circumjacent to the reed switches 11 and 12. Though not shown in detail herein, the carriers 38 and 39 are supported by similar biasing springs. An added feature of the return springs is that they have a shielding effect thereby making the switches less susceptible to the influence of stray magnetic fields.

Also engaging each of the carriers 36, 37, 38 and 39 is a push-rod interlink. The carriers 36 and 37 are engaged by a push-rod interlink 46 and the carriers 38 and 39 by a push-rod interlink 47 (see FIGS. 2 and 3). The structure of the interlinks 46 and 47 is identical, and for a detailed illustration the interlink 46 is shown in perspective in FIG. 4. Each interlink 46 and 47 carries a pair of ears 48, 49 and 50, 51 respectively, which engage the upper surfaces of the biasing magnet carriers 36, 37, 38 and 39. The interlink 46 has a top surface 52 which as shown in FIG. 3 engages the button shank 5. The ears 48 and 49 of push-rod interlink 46 engage the magnet carriers 36 and 37 and are formed to ride upon respective cam surface 43. The ear 48 is shown engaging the upper level surface 41 of the carrier 37. At the same time the ear 49 is shown engaging the lower level surface of the carrier 36. It shall be noted that the illustrated position of the carrier 37 permits the magnet 40 to be in the biasing position proximate to the contacts 22 and 23 of the reed switch 12. Also, by engaging the push-rod interlink 46 at its lower level surface, the carrier 36 carries its magnetic material effectively away from the contacts 20 and 21 of the reed switch 11 to an inactive position such that the contacts 20 and 21 assume an open position. Thus, as shown in FIG. 3, there exists a closed electrical circuit between the terminal contacts 32 and 34, and an open electrical circuit between the terminal contacts 27 and 29.

The engagement between the push-button shank 5 and the push-rod interlinks 46 and 47 sets the maximum distance the interlinks 46 and 47 can travel away from the switch contacts toward the push-button 3. Thus, as shown in FIG. 3, the push-rod interlink 46 is shown in its uppermost position. At the same time, the engagement of the ears 48 and 49 with the carriers 36 and 37, respectively, determines the uppermost position of the travel of the carriers 36 and 37 which are biased towards the interlink 46 by the springs 44 and 45. As shown in FIG. 3, by engaging its lower surface with ear 49 of the interlink 46, the carrier 36 is permitted to travel in a more uppermost position than the carrier 37 which engages the ear 48 of the interlink 46 at the upper surface 41. It shall be noted that the difference in height between the upper and lower levels of the carriers is such that when the interlink engages the lower level of a respective carrier, the magnet within the carrier is in an inactive position effectively removed from the contacts of the adjacent switch. However, when the interlink engages the upper level of a carrier 36 or 37, the magnet within the carrier is in a biasing position proximate to the contacts of the adjacent switch.

Now assuming that it is desirable to switch the contact relationship of the switches within the control station 1 from their preset normal position, pressure is applied to the push-button 3 causing the shank 5 to move against the push-rod interlinks 46 and 47. Viewing FIG. 3, the push-rod interlink 46 in turn moves against the carriers 36 and 37. The carrier 36, in turn, moves toward the contacts 20 and 21 of the reed switch 11, and the carrier 37 moves past and away from the contacts 22 and 23 of the reed switch 12. When the push-button 3 is moved in its farthest downward direction, the carriers 36 and 37 each assume a new position shown by the broken lines 53 and 54 respectively. At the positions 53 and 54 the magnets within the carriers 36 and 37 cause the contacts of the reed switches 11 and 12 to assume a new relationship. The carrier 36 is in a biasing position causing the contacts 20 and 21 to close, and the carrier 37 is effectively removed from the contacts 22 and 23 and in an inactive position causing the contacts 22 and 23 to open. Upon releasing the pressure applied to the push-button 3, the bias return springs 44 and 45 exert a force on the carriers 36 and 37 causing the carriers to assume their normal position thereby permitting the contacts 20 and 21 of the reed switch 11 to open and the contacts 22 and 23 of the reed switch to close.

It may be noted that in the embodiment illustrated herein the push-rod interlinks 46 and 47 must slide between the lowermost position when the push-button 3 is depressed, and the uppermost position when the push-button 3 is released. The sliding action of the push-rod interlink 46 is assured by the action of a pair of legs 55 and 56 of the interlink 46 acting within a pair of slots 57 and 58 of an insulated mounting block 59 which slots are slightly larger in cross-sectional area than the legs to readily accommodate the legs 55 and 56. The material making up the mounting base 59 is not critical. However for ease in production, a molding insulating material is recommended. Also, though not shown by the drawings herein the push-rod interlink 47, which as previously mentioned is identical to the push-rod interlink 46, acts within a pair of slots within the block 59. Thus, when the push-button 3 is depressed, both interlinks 46 and 47 respond which in turn results in simultaneous response of the magnet carriers 36, 37, 38 and 39.

The reed switches 11, 12, 13 and 14 with their respective associated terminals and magnet carriers are mounted in pairs within an insulated mounting structure. The reed switches 11 and 12 are mounted within a mounting structure designated by the general reference character 60 and the switches 13 and 14 within a mount-

ing structure designated by the general reference character 61. The composition of the structures 60 and 61 is not critical and may be of the same material as the supporting structure 59. The mounting structures 60 and 61 are identical in structure, attachable to the block 59 and provide an outer shell for the control station 1. In FIG. 3 the reed switch 11 is shown attached to the mounting structure 60 by means of the terminals 25 and 26 which are embedded within the structure. Likewise the terminals 30 and 31 are embedded within the structure 60 thereby supporting the reed switch 12. The mounting structures 60 and 61, are attached to either side of the mounting board 59. The mounting structures 60 and 61 carry a plurality of insulating barriers between the screw terminals to assure insulation between the screw terminals. In FIGS. 1 and 3 the mounting structure 60 is provided with barriers 62, 63, 64, 65 and 66 between the screw terminals 27, 29, 32 and 34, and the structure 61 provides barriers 67, 68, 69, 70 and 71 between its associated screw terminals. In FIG. 1, the mounting structure 60 is shown attached to the mounting board 59 by means of a pair of screws 72 and 73.

As illustrated in FIGS. 1 and 3, each of the mounting structures 60 and 61 possess a keyway adjacent to a reed switch. In FIG. 1 the mounting structure 60 is shown carrying a pair of U-shaped keyways 74 and 75 located at opposite corners thereof. Each of the U-shaped keyways 74 and 75 has a pair of legs of unequal length. The keyway 75 has a short leg 76 and a longer leg 77, with the short leg 76 designated NC (Normally-Closed) and the long leg 77 designated NO (Normally-Open). Joining the legs 76 and 77 is a bail portion 78 of the U-shaped keyway 75. Also, it may be noted that the keyway 74 has a long leg 79 designated NO and a short leg 80 (shown in sectional in FIG. 3, and hidden from view in FIG. 1). Joining the legs 79 and 80 is a bail portion 81 of the U-shaped keyway 74. FIG. 1 shows a short leg 82 of a keyway 83 accompanying the reed switch 13. The leg 82 is designated NC. The keyway 83 also has a long leg which is hidden from view. The mounting structure 61 also has a keyway accommodating the reed switch 14 so that each reed switch within the control station 1 has an associated keyway.

Referring back to FIG. 5 it shall be noted that the magnet carrier 37 as shown herein has a key 84 in the form of a laterally-extending projection. In FIGS. 1, 2, and 3 the key 84 is shown positioned within the short leg 80 of U-shaped keyway 74, thereby receiving the carrier 37 in a biasing position and biasing the contacts 22 and 23 of the reed switch 12 in the normally-closed condition, as heretofore described.

At the same time, the carrier 36 is shown carrying a key 85 in the form of a laterally extending projection similar to the key 84. The key 85 is shown positioned within the long leg 77 of the U-shaped keyway 75 thereby placing the carrier 36 in an inactive position permitting the contacts 20 and 21 of the reed switch 11 to assume a normally-open relationship.

It shall be further noticed in FIG. 2 that each of the carriers 38 and 39 carry keys 86 and 87 respectively, similar to the key 84. The keys 86 and 87 engage keyways in a manner similar to the U-shaped keyways 74 and 75. The combination of the keys of the magnet carriers associated with the U-shaped keyways as described, provides means whereby each switch may be alternatively preset in either a normally-open or normally-closed position merely by manually changing the keys and positioning them within the properly designated leg of the associated keyway. The U-shaped keyways are constructed such that when the key of a magnet carrier engaged the short leg, the associated switch is biased in a normally-closed relationship and when the key engages the longest leg the magnet is inactive and the associated switch assumes a normally-open relationship. The bail

portion of each keyway provides a connecting means between the two legs which may be transversed by a key. For example, as shown in FIG. 1, the key 75 may be manually set in either the key leg 76 or 77, depending upon whether the specific application calls for a normally-open or a normally-closed contact relationship between the contacts 22 and 23 of the reed switch 11. At the same time, regardless of the initial setting of the key 85, the position of the key 85 can be converted from one position to the other merely by sliding the key 85 within the keyway 75 from one leg to the other. This change may be made while external apparatus remains connected across the screw terminals of the control station 1 and without interfering with any of the other switches within the control assembly. Furthermore, each of the keys 84, 85, 86 and 87 are independently operated, so that the normal bias position of each of the switches 11, 12, 13 and 14 can be made and interchanged at any time regardless of the bias on the remainder of the switches within the control station.

From the foregoing, though it is not intended that the present invention be limited to hermetically-sealed switches, it will be apparent to those skilled in the art that by utilizing hermetically-sealed switches, the present invention provides a control station which may be utilized in highly contaminated areas without fear of the switches failing to make electrical contact due to dust, dirt, oxidation, or corrosion. Nor is there danger of hydrocarbons condensing on the contacts and causing a high resistance or contact failure. The control station may be used in hazardous atmospheres containing either explosive gases or inflammable dust without fear that the arcs formed upon contact opening will ignite the surrounding atmosphere.

I claim:

1. An electrical control station comprising
 - a supporting structure;
 - a magnetically-operable electrical switch supported by said structure, said switch having contacts movable relative to one another responsive to the proximity of a magnet;
 - a magnet establishing a flux acting on said switch, said magnet movable within said structure between a biasing position where the magnet actuates the contacts to closed circuit relationship and an inactive position effectively removed from the contacts where the magnet permits the contacts to be actuated to open circuit relationship;
 - convertible means for alternatively presetting said magnet in either the biasing or inactive position; and
 - push-button operating means engaging said magnet for moving said magnet from a preset position to the other of said positions.
2. An electrical control station comprising
 - a supporting structure;
 - a magnetically-operable electrical switch supported by said structure, said switch having contacts movable relative to one another responsive to the proximity of a magnet;
 - a magnet establishing a flux acting on said switch, said magnet movable within said structure between a first inactive position, a biasing position and a second inactive position, said biasing position placing the magnet proximate to the switch contacts actuating the contacts to closed circuit relationship, said first and second inactive positions placing the magnet in a position effectively removed from the switch contacts where the magnet permits the contacts to be actuated to open circuit relationship, said first and second inactive positions being on opposite sides of said biasing position;
 - convertible means for alternatively presetting said magnet in either the first inactive or the biasing position;

and push-button operating means engaging said magnet for moving said magnet from a preset position to another of said positions.

3. An electrical control station comprising
 - a supporting structure;
 - a plurality of magnetically-operable electrical switches supported by said supporting structure, each switch having contacts movable relative to one another responsive to the proximity of a magnetic field;
 - magnetic means movable with relationship to said switches and having a magnetic strength sufficient to close the contacts of said switches when said magnetic means is positioned about the external surface of said switches and in operating proximity of the contacts, the relationship of said switches and said magnetic means being movable within said structure between a biasing position where the magnet actuates the contacts to a closed circuit relationship and an inactive position effectively removed from the contacts where the magnet permits the contacts to be actuated to open circuit relationship;
 - means to independently preset the relationship of each of said switches and said magnetic means in either the biasing or inactive position; and
 - operating means engaging said magnetic means for changing the relationship of said magnetic means and said switches from the preset position to the other of said positions; whereby upon operation of the operating means the switches having contacts biased in a closed circuit relationship may assume an open circuit relationship and the contacts actuated to open relationship are biased in a closed circuit relationship.
4. An electrical control station comprising
 - a supporting structure;
 - a plurality of hermetically sealed, magnetically-operable electrical switches supported by the structure;
 - an associated magnet for each of said switches, said magnets separated so that each magnet is operative only with respect to its associated switch, said magnets movable within said structure between a biasing position where the magnet actuates the contacts of the associated switch to a closed circuit relationship and an inactive position effectively removed from the contacts of the associated switch where the magnet permits the contacts to be actuated to open circuit relationship;
 - means for alternatively presetting each of said magnets in either a biasing or inactive position; and
 - operating means engaging said magnets for moving each of said magnets from a preset position to the other of said positions.
5. An electrical control station in accordance with claim 4 in which the means for presetting said magnets comprises a keyed carrier for each of said magnets and an associated keyway defined by said supporting structure for each of said carriers, said keyways guiding the movement of said carriers and having stops to alternatively preset said carriers in the biasing or inactive positions.
6. An electrical control station comprising
 - a supporting structure;
 - a plurality of hermetically-sealed, magnetically-operable electrical switches supported by said structure, said switches having contacts movable relative to one another and responsive to the proximity of a magnet;
 - an associated magnet adjacent each of said switches, said magnets separated so that each magnet is operative only with respect to its associated switch, said magnets slidable coaxially with its associated switch between a first inactive position, a biasing position and a second inactive position, said biasing position positioning the magnet proximate to the switch contacts actuating the contacts to closed circuit relationship, said first and second inactive positions placing the magnet in a position effectively removed

from the switch contacts where the magnet permits the contacts to be actuated to open circuit relationship, said first and second inactive positions being on opposite sides of said biasing position;

a keyed carrier for each of said magnets each carrier carrying its associated magnet between the first inactive position, the biasing position and the second inactive position;

a keyway for each of said carriers receiving and guiding the movement of each carrier along its associated switch between the first inactive position, the biasing position and the second inactive position, each of said keyways defined by said supporting structure and having a first stop to receive and preset the associated carrier in the first inactive position and a second stop to receive and preset the associated carrier in the biasing position; whereby the contact relationship of each magnet may be preset in the closed or open relationship independently of the preset contact relationship of the other switches; and

an operator mechanism engaging said carriers, said

operator having movement parallel of said switches and moving said carriers from the preset position to another of said positions; whereby the operator mechanism upon receiving an external signal moves the keyed carriers within the keyways such that the carriers preset in the first inactive position assume the biasing position and the carriers preset in the biasing position assume the second inactive position.

7. In the electrical control station of claim 6

a helical biasing return spring circumjacent each of said switches, each of said springs engaging the carrier associated with the switch and mechanically biasing the carrier towards its preset position.

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J. J. BAKER, *Assistant Examiner*.