This invention relates to electric switching devices and has particular reference to electric switching devices operable by depressable keys.

It has been proposed heretofore to use a magnetic reed switch embodying a pair of overlapping reed elements hermetically sealed within a non-magnetic envelope and a depressible key carrying a permanent magnet, which, when the key is depressed a sufficient distance, causes its magnetic field to close the switch reeds.

Switching devices of the above type have definite advantages over more conventional key-operated switching devices in that the reed contacts are enclosed and are thus not subject to corrosion, oxidation, etc., they take up a minimum amount of space and result in an extremely light key stroke. However, such switching devices require a relatively long key stroke in order to provide reliable operation in both opening and closing the reed contacts. For example, it requires a certain magnetic flux strength to close the reed contacts but when once closed the flux must be weakened considerably in order to allow the contacts to open, and consequently, after the key has been depressed to a certain point to cause engagement of the contacts, it must be raised a considerable distance above such point to allow the contacts to again reopen.

Accordingly, a principal object of the present invention is to provide a magnetically operable key type switching device having a relatively short key stroke.

Another object is to provide a keyboard including switching devices of the above type which is simple and economical to manufacture and assemble.

Another object is to provide a switching device of the above type in which the magnet for controlling the reed contacts also holds the key in depressed position.

The manner in which the above and other objects of the invention are accomplished will be readily understood on reference to the following specification when read in conjunction with the accompanying drawings, wherein:

FIG. 1 is a transverse sectional view through a keyboard operated switching device embodying a preferred form of the present invention.

FIG. 2 is a sectional view taken substantially along the line 2--2 of FIG. 1.

FIG. 3 is a perspective view illustrating the key and guide bar construction.

FIG. 4 is a fragmentary view, partly in section, illustrating the manner of mounting a key top on a key stem.

FIG. 5 is a fragmentary plan view of the keyboard.

Referring to the drawings, the device comprises a U-shaped frame member 11 having forwardly extending sides 10. A series of guide bars 12 are secured to the forwardly extending sides of frame 11 by screws 13. The bars 12 are substantially Z-shaped, each comprising a vertical web section 14, a rearwardly extending upper flange 15 and a forwardly extending lower flange 16. Such bars are formed of soft iron or other magnetic material having a low magnetic remanence.

Groups of aligned notches 17 and 18 are formed in the upper and lower flanges to receive and guide a plurality of depressible keys 20.

Each key is formed of a key top 21 and a key stem 22. The latter is preferably formed of a flexible plastic material, such as is known in the art as "Delrin," and is split vertically to form two spaced legs which slideably embrace the web section 14 of the respective guide bar. Such legs are guided laterally by the side edges of the notches 17 and 18.

The upper ends of the legs of each key stem are formed to abut each other to permit forcing of the key top 21 thereover to form an integral key. The shoulders 19 thus formed by the upper ends of the legs limit depression of the key. The key top 21 may, if desired, be cemented to the top of the key stem after the latter has been assembled onto its guide bar.

A spring leg 23 is formed integral with each key stem and extends rearwardly into engagement with the flange 16 of the next adjacent guide bar to the rear, thereby normally aiding in holding the key in its raised position. The spring leg is also effective to return the key to its raised position.

Each key stem has a pair of spaced projections 25 extending laterally therefrom between which is mounted a permanent magnet 24. Such magnet is normally held against the bottom surface of the associated guide bar which thereby forms a keeper for the magnet.

A plate 26 of insulating material is secured to the frame 11 below the keys 20 by attaching devices 27 for the purpose of supporting a plurality of magnetic reed switches 28, there being one such switch directly below each of the key supported magnets 24.

Reed switches are well known in the art and are shown, for example, in the patent to W. E. Elwood, No. 2,289,830, issued on July 14, 1942. Briefly, such switch comprises a pair of magnetic reed contacts 30 which are enclosed in a glass envelope 31. At least one of the reed contacts is flexible and is normally spaced from the other. Upon application of a magnetic field of sufficient strength in the vicinity of the switch, the reeds are attracted together to form an electrical contact therebetween. When the magnetic field is removed, the reed contacts separate.

Preferably, the switches are oriented with their reed contacts extending parallel to the direction of polarization of the cooperating magnets 24.

A second plate 32 of insulating material is supported by the plate 26 through screws 33 and spacers 34. Diodes 35 and other electrical components may be secured to the plate 32 to form a diode matrix or the like connected in circuit with the reed switches 28.

The sides 10 of the frame member 11 are turned inwardly along their bottom edges at 36 and are mounted on supporting feet 37 of rubber or the like.

A bottom cover 38 having an upwardly extending front panel section 40 is removably secured to the frame member 11 by screws 41. Likewise, a U-shaped side cover member 42 surrounds the frame member 11 and is removably secured thereto by screws 43 which pass through spacers 44 and are threaded into the attaching devices 27 for the plate 26.

A top cover 45 is removably mounted over the upper edge of the frame member 11 and is yieldably held in place by spring detent fingers 46 which yieldably engage notches 47 formed in the frame member 11.

Normally, when a key 20 is in its raised position, the magnetic field of its magnet 24 is, to a large extent, concentrated in the adjacent portion of the overlying flange 16 of its guide bar 14. Therefore, even though the magnet is relatively close to the aligned switch 28, the magnetic field developed thereby and extending through the switch will be ineffective to close the reed contacts 30. However, upon depression of the key and removal of its magnet from a position directly adjacent the lower flange 16, the downwardly extending portion of its magnetic field will increase in magnitude, causing
the switch reeds to close to establish a circuit through the switch to certain of the electrical components carried by the plate 32.

Upon release of a key from depressed position, the reed contacts will continue to remain closed until the magnet 24 directly approaches the lower flange 16 whereupon the downwardly extending portion of its magnetic field will be materially weakened to permit the reed contacts to separate.

Due to engagement of the magnet 24 of each key with the flange 16 of its guide bar, a magnetic latching effect will occur, thus resulting in a desirable key characteristic wherein the first portion of the key stroke exerts a greater resistance to depression than the remainder of the stroke.

Such key characteristic also reduces the possibility of inadvertently depressing the key.

It should be noted that two or more switches could be arranged side-by-side to cooperate with the same key magnet. Also, by using polarized reeds, the switches could be made to operate as either normally open or normally closed switches. Further, switches having combinations of normally closed and normally open polarized contacts could be equally well employed.

Although the invention has been described in detail and certain specific terms and languages have been used, it is to be understood that the present disclosure is illustrative rather than restrictive and that changes and modifications may be made without departing from the spirit or scope of the invention as set forth in the claims appended hereto.

Having thus described the invention, what is desired to be secured by United States Letters Patent is:

1. A magnetically operable switching device comprising a frame,
an elongate guide member of magnetic material having a lower magnetic remanence carried by said frame,
said member having a plurality of aligned spaced flanges extending along the upper and lower edges thereof,
a depressible key member of non-magnetic material having an elongate vertical slit slideably embracing said member,
said slit being open at the upper end thereof,
a key top on said key member closing said upper end of said slit,
said key member being guided laterally by adjacent ones of said upper and lower flanges,
said magnet engaging one of said lower flanges when said key member is depressed whereby said flange substantially short-circuits the magnetic flux produced by said magnet and normally maintains said key member in undepressed position, and
a switch carried by said frame below said magnet,
said switch comprising a pair of magnetic reed elements, at least one of said reed elements being operable by magnetic flux produced by said magnet upon depression of said key member.

2. An electric switching device comprising a frame, an elongate guide member supported by said frame, said member having a plurality of aligned spaced flanges extending along the upper and lower edges thereof, a plurality of depressible key members having elongate vertical slits slideably embracing said member, said slits being open at the upper ends thereof, key tops on said key members closing said upper ends of said slits, said key members being guided laterally by adjacent ones of said upper and lower flanges, and electric switches supported by said frame below said key members, said switches being operable in response to depression of respective ones of said key members.

3. An electric switching device comprising a frame, an elongate guide member supported by said frame, said member having a plurality of aligned spaced flanges extending along the upper and lower edges thereof, a plurality of depressible key members, each of said key members having a pair of vertical legs slideable along opposed sides of said guide member, key tops bridging the upper ends of said legs, said legs being guided laterally by adjacent ones of said upper and lower flanges, and electric switches supported by said frame below said key members, said switches being operable in response to depression of respective ones of said key members.

4. An electric switching device according to claim 3 wherein the upper ones of said slits extend in one direction and the lower ones of said slits extend in substantially the opposite direction.

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