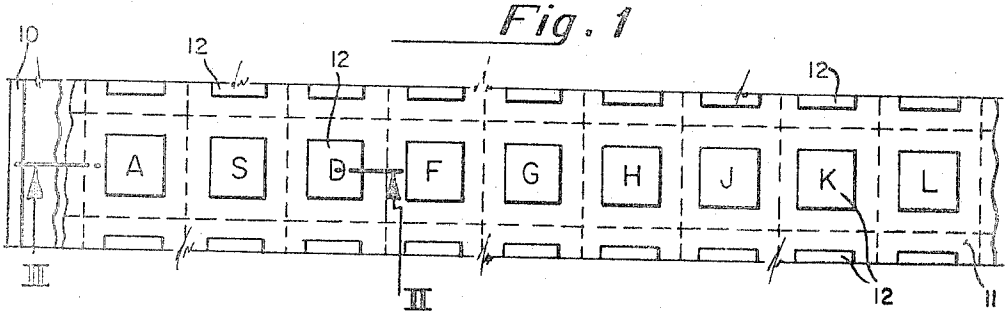
Jan. 6, 1970 R. J. MARCHETTI 3,488,613

MAGNETIC KEYBOARD SWITCH

Filed Oct. 30, 1968

Fig. 1



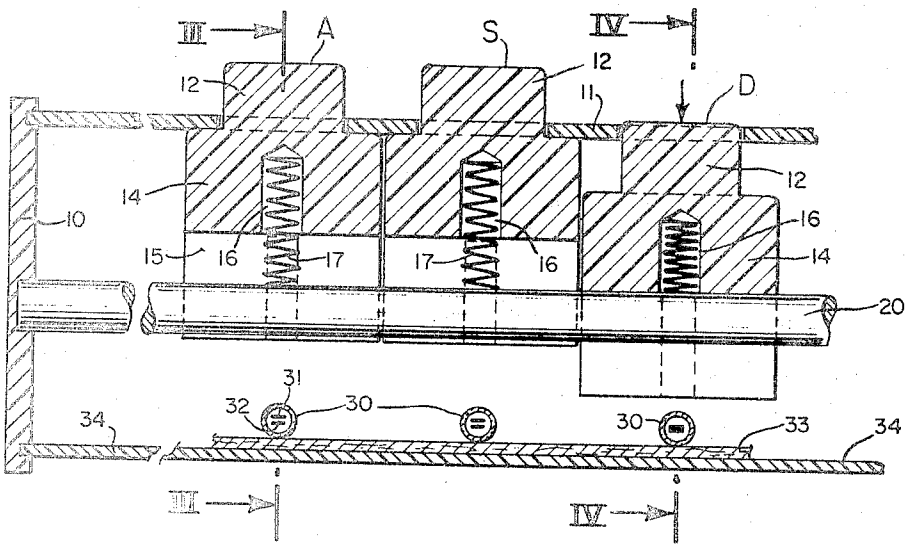


Fig. 2

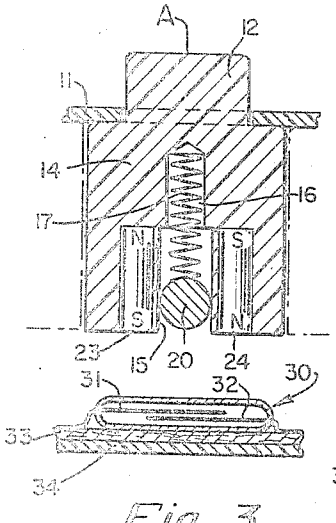


Fig. 3

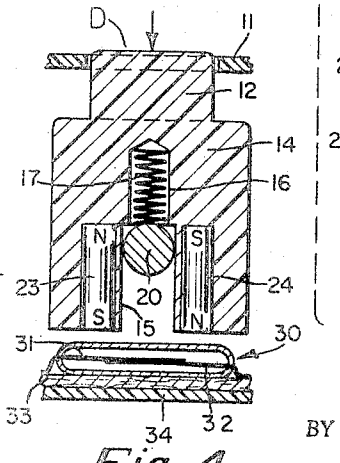


Fig. 4

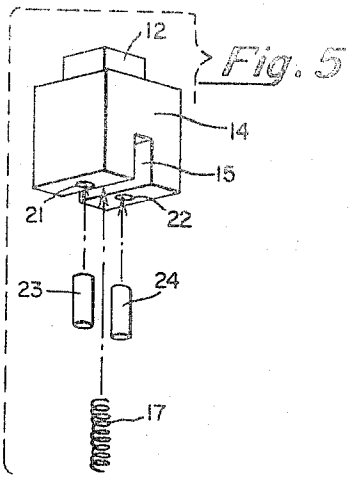


Fig. 5

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MAGNETIC KEYBOARD SWITCH

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U.S. Cl. 335—207 5 Claims

ABSTRACT OF THE DISCLOSURE

A switch key is disclosed for keyboards used for selective operation of switches, usually reed switches, in data input equipment for electronic computers. Each key includes a pair of permanent bar magnets disposed on parallel axes having their unlike poles in two common spaced-apart transverse planes orthogonal to the axes of the magnets. A shorting bar of good permeability is mounted in fixed position, in one of said planes. The shorting bar runs transversely relative to the keyboard, passing through slots in the keys between the pairs of magnets. When a key is in its normal raised position, the shorting bar is in the one common transverse plane of unlike poles which is nearer to the switch, and the bar shorts the magnetic field, thereby keeping it away from the switch. When the key is momentarily depressed, as by the finger of the keyboard operator, the set of unlike poles of the magnets nearer to the switch are moved close to the switch and away from the plane of the shorting bar, while the other set of unlike poles move into the plane of the shorting bar. As a result, the magnetic field of the one set of unlike poles passes through the switch, preferably a reed switch, to close momentarily the contacts.

Background of the invention

To put data information into an electronic computer usually involves the conversion of typed or printed information into electrical signals, and for this purpose the prior art has used a keyboard so constructed that the momentary depression of a key, as by the finger of the operator, operates a switch and closes an electrical circuit to energize an appropriate circuit or device to effect the desired storage or transmission of information.

Prior-art, keyboard-operated switch equipments of this type have employed permanent magnets in the keys to operate the switches, but such prior art equipments have experienced difficulty in that the switches have not opened quickly enough after the key has returned to its normal postion, or in that due to stray magnetic fields non-selected switches have at times operated in addition to the selected switch.

Summary of the invention

A principal object of the present invention is to provide a switch key for keyboard operated switch equipment which, in response to the momentary depression of the key, actuates only the switch associated with the selected key and releases the switch as soon as the key has been released and returned to its normal raised position.

The foregoing object is accomplished by providing a structural arrangement which includes a fixed shorting bar common to all keys of the same row and operative when the key is momentarily depressed to direct substantially the full magnetic field of the key magnets to the switch armature elements to cause operation of the switch, and operative when the key is returned to its normal raised position to short the magnetic field of the key magnets away from the switch elements.

Brief description of the drawing

FIG. 1 is a plan view depicting a portion of a keyboard of an information input machine;

FIG. 2 is an enlarged front elevational view, in section, showing three of the keys of the switchboard of FIG. 1, looking along the line II—II of FIG. 1;

FIG. 3 is an elevational end view, in section, looking along the line III—III of FIG. 2, showing one of the keys in its normal raised position;

FIG. 4 is an elevational end view, in section, looking along the line IV—IV of FIG. 2, showing one of the keys in depressed position;

FIG. 5 is an exploded perspective view of one of the keys.

Description of the preferred embodiment

FIG. 1 is a fragmented plan view illustrating a portion of a keyboard. Nine keys in a row are shown, the keys being identified as A, S, D, F, G, H, J, K, and L.

FIG. 2 is an elevational view, in section, along the line II—II of FIG. 1 showing three of the keys of FIG. 1, with two of the keys A and S in the biased raised or normal position and the third key D in the pushed down or depressed position. It may be assumed that the key D was depressed by the finger of the operator. The depression is but momentary. As soon as the finger touch is removed, the key returns (under the action of a biasing spring **17**) to its normal raised position.

FIG. 5 is a perspective view of one of the keys. Since all of the keys are similar, it will only be necessary to describe one. FIG. 5 shows the key to be of generally square configuration with an upper body portion **12** and a lower body portion **14**. The body portions **12** and **14** of the keys are of non-magnetizable material, preferably plastic. It is the upper body portion or cap **12** which is touched by the finger of the operator to depress the key.

The square lower body portion **14** has a central slot **15** extending therethrough in a transverse direction relative to the keyboard. The slot **15** of each key is aligned with slot **15** of all the other keys of the same row, and passing through these aligned slots **15** is a cylindrical shorting rod **20** of material of good permeability and low remanence, such as soft iron or steel. Shorting rod **20** is supported in fixed position by a connection at each end to the frame **10** of the machine. The cap portions **12** of the keys project upwardly through a key plate **11** which is also supported in fixed position in the frame **10** of the machine.

Referring now to FIGS. 3 and 4, these figures are elevational views in section of keys A and D as seen looking along lines III—III and IV—IV, respectively, of FIG. 2. The lower body portion **14** of each key includes a pair of vertically disposed elongated holes **21** and **22** on parallel axes for receiving, respectively, the permanent bar magnets **23** and **24**. The magnets are press fitted into the holes. While the holes **21, 22**, and the permanent bar magnets **23, 24**, could be rectangular, they are shown as cylindrical in shape. The holes **21, 22** are located on either side of the central slot **15**. The holes are close to the slot, leaving a wall therebetween of non-magnetizable body material which is as thin as is practical, being preferably just thick enough to avoid breaking out during use. The wall between the central slot **15** and the permanent magnet holes **21, 22** may, in a typical case, have a thickness of about .010".

As indicated above, the bar magnets **23** and **24** are permanent magnets, and may be of Alnico or a suitable ferrite. The magnets **23, 24** are so disposed in the holes **21, 22** that opposite poles of the two magnets lie in the same common lateral plane. That is, the north pole of

one magnet is laterally opposite the south pole of the other magnet.

Projecting above the central slot **15** is a blind hole **16** on the center vertical axis of the key for receiving the biasing spring **17**, the lower end of which bears against the shorting rod **20**.

It will be seen that in the normal or raised position of the key as illustrated by key A in FIGURE 3, the shorting rod **20** in slot **15** provides a material of high permeability and low remanence between the north and south poles at the lower ends of the two magnets, thereby effectively concentrating the magnetic flux of the lower-end poles in the lateral plane of the lower north and south poles of the permanent magnets. This prevents, or substantially prevents, the passage of flux into the air below the key. Mounted below each key is a switch **30**, preferably a reed switch. The orientation of the armatures or reeds **31**, **32** of the reed switch is transverse relative to the shorting rod **20**. The reed switches **30** may be mounted on a printed circuit board **33** of dielectric material, which may be self-supporting. If desired, the circuit board may be supported on a support plate **34** of non-magnetizable material. It will be seen that when the key is depressed, as illustrated in key D in FIG. 4, since the position of the shorting rod **20** remains fixed relative to the frame, the rod moves up in the slot **15** compressing the biasing spring **17**. The slot **15** is preferably just enough wider than the shorting bar **20** to provide clearance to allow for movement of the bar in the slot.

With the key D in depressed position, the lower north and south poles of the permanent magnets are now close to and immediately above the reed switch **30**, while the upper north and south poles of the permanent magnets are now laterally aligned with the shorting rod **20**. Thus, a major portion of the magnetic field of the lower north and south poles of the permanent magnets now extends into the switch **30** and through the reeds **31**, **32** thereof. As a result, the reeds of the switch **30** move toward and against each other, as illustrated in FIG. 4, thereby closing the electrical circuit controlled by the switch.

As soon as the key is released by removal of the finger of the keyboard operator, the key is returned by the spring **17** to its raised or normal position, illustrated by key A in FIG. 3. It will be seen that as soon as the depressed key is released and rises to its upper position, the magnetic field of the lower poles of the magnets is shorted by the shorting bar **20**, thereby removing substantially all magnetic lines of force from the region of the switch reeds and thereby causing the switch reeds to return to their normal open circuit condition.

It will now be apparent from what is illustrated in the drawing and described hereinabove, that the present invention provides, for use in a type of keyboard used in converting typed information into electrical signals, means whereby the momentary depression of a key by the keyboard operator is effective to close momentarily a particular reed switch (or other suitable form of magnetic switch) associated therewith. When the key is released and returns to its normal position, the magnetic field which had passed through the reeds of the switch is shorted and prevented from reaching the reed switch, thus allowing the switch to return instantly to its normally open condition. Also, since the magnetic field of a depressed key is concentrated at a particular switch, and since the magnetic fields of the non-depressed keys are shorted away from the switches, unwanted actuation of switches associated with non-depressed keys is avoided.

Given below are dimensions of an exemplary key. It is to be understood that these dimensions are given solely for the purpose of aiding in a comprehension of the invention and are not to be considered limiting.

The caps **12** of the keys are on ¾" centers. The lower body portions **14** of the keys are ¾" square. The shorting rod **20** has a 3/16" diameter. The slot **15** is 3/16" wide plus clearance to allow for movement of the rod in the slot. The slot **15** is ⅜" deep (or high). The permanent magnets **21**, **22** have a ⅛" diameter and are ⅜" long. The key is moved through a 3/16" stroke. In the depressed position of the key, the non-shorted poles (the lower poles) of the magnets are only 1/16" from the switches **30**. In the normal position of the key, the non-shorted poles (the upper poles) are ⅝" from the switch **30**. Thus, movement of the key through a 3/16" stroke has the effect of moving the non-shorted poles of the magnet through a ⅝" stroke. This results from the fact that what is in effect a U-shaped magnet with non-shorted poles facing upward when the key is in normal position, is transformed when the key is moved down into a U-shaped magnet with non-shorted poles facing downward. As indicated previously, the spacing between the magnets and the shorting rod is of the order of .010".

The height of slot **15**, in combination with bar **20**, establishes the limit of the downward movement of the key. The upward movement of the key, in response to the thrust of biasing spring **17**, is limited by plate **11** and the shoulders formed on the key by the cap **12** and the body portion **14**.

The fact that the body portion **14** of the keys is square in cross-section helps in maintaining the key aligned as it is depressed between the adjacent keys to allow for easy movement of the keys while maintaining alignment thereof.

The body of the keys has been indicated as plastic. The keys could, of course, be formed of other non-magnetizable material, such as aluminum or brass.

The switches have been shown as reed switches. While reed switches are preferable for the present purpose, other types of switches could be used so far as the basic invention is concerned.

No effort has been made to show a complete electrical circuit. It is sufficient for the purpose of the present invention to merely indicate that when the reed (or other) switch is closed magnetically by operation of a key, an electrical circuit is completed to achieve the wanted result.

While the preferred embodiment of this invention has been described in some detail, it will be obvious to one skilled in the art that various modifications may be made without departing from the invention as hereinafter claimed.

What is claimed is:

1. A switch key movable on its center axis between normal and depressed limit positions, said key comprising:

(a) a body of non-magnetizable material;

(b) a pair of permanent bar magnets in said body disposed on parallel axes, one magnet on either side of and parallel to the center axis of said key;

(c) unlike poles of the magnet pair being located in common planes transverse to the center axis of said key;

(d) a slot in said key body on the center axis thereof and between said magnets;

(e) a shorting bar of magnetizable material in said slot;

(f) said shorting bar having a dimension in the axial direction of said bar magnets to occupy, when the key is in its limit positions, one or the other but not both of said common transverse planes of said unlike poles;

(g) whereby when said key is moved on its axis, said shorting bar moves relative to said permanent magnets from the common plane of one pair of unlike poles to the common plane of the other pair of unlike poles.

2. A key according to claim **1** characterized in that there is but a thin wall of non-magnetizable body material between said shorting bar and said permanent magnets.

3. In combination:

(A) a switch key movable on its center axis, between normal and depressed limit positions, said key comprising:

(a) a body of non-magnetizable material;

(b) a pair of permanent bar magnets disposed on parallel axes, one magnet on either side of the center axis of said key;

(c) unlike poles of the magnet pair occupying common planes transverse to the center axis of the key;

(d) an elongated slot in said key body between said magnets;

(e) a shorting bar of magnetizable material in said slot;

(f) said shorting bar having a dimension in the axial direction of said bar magnets to occupy, when the key is in the limit positions, one or the other but not both of the common transverse planes of said unlike poles;

(g) whereby when said key is moved from one limit position to the other said shorting bar moves relative to the permanent bar magnets from a position in one common plane of one pair of unlike poles to the other common plane of the other pair of unlike poles;

(B) a switch having armature means disposed in a plane parallel to the common planes of the unlike poles of said bar magnet and located just beyond the common plane of said unlike poles which are not shorted by said shorting bar when said key is in its depressed limit position.

4. The combination according to claim 3 characterized in that:

(a) means are provided for supporting said shorting bar in fixed position, whereby when said key is moved to its depressed limit position said common plane of unlike poles nearer to said switch moves away from said shorting bar and towards said switch, and said common plane of unlike poles more remote from said switch moves toward said shorting bar.

5. A keyboard operated switch system comprising:

(A) a keyboard frame;

(B) a plurality of keys in row formation, each key comprising:

(a) an upper finger touch portion;

(b) a lower body portion;

(c) a slot through said body portion, said slot running in the direction of the row;

(d) a pair of permanent bar magnets vertically disposed in said lower body portion, one on either side of said slot and closely adjacent thereto;

(e) each magnet having a length substantially equal to the height of said slot;

(f) each magnet having each pole in a common lateral plane with an unlike pole of the magnet;

(g) a vertical hole in the center axis of said key, the lower end of said hole in communication with said slot;

(C) a shorting bar of magnetizible material supported in a fixed position in said frame and extending through said slots of the keys of the row;

(D) a biasing spring in the vertical center hole of said key the lower end of which bears on said shorting bar;

(E) a switch supported a spaced distance below the lower unlike poles of the pair of magnets of each key, whereby when a key is in its biased raised position the shorting bar in the key slot shorts the magnetic field of the unlike poles at the lower end of said permanent magnets to inhibit said magnetic field from reaching said switch; whereby when a key is depressed the shorting bar in said slot is shifted relative to said permanent magnet to short the unlike poles at the upper end of said permanent magnets, the unlike poles at the lower end of said magnets being then no longer shorted by said shorting bar and being in a position adjacent said switch to cause closing of the switch contacts.

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U.S. Cl. X.R.

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