This invention relates to electrical switch constructions and, more particularly, to an electrical switch assembly specially suited for use as a character read-out switch in keyboard operated typewriter machines.

The invention has for its general object to provide an improved switch construction for apparatus of the above character.

Another object is to provide an improved switch construction which eliminates bouncing to the switch contacts against each other and is unaffected by vibration of its surroundings.

A specific object is to provide a switch construction in which a movable switch contact is continuously urged against a fixed contact carrying board and is slidably moved with pressures imparted thereagainst to eliminate bouncing of the contacts against each other.

Another object is to provide an improved switch construction and organization with a typewriter key such that operation of the key is insensitve to actuation of the switch and which avoids discontinuous loading or sudden pickup of load as would interfere with the touch and typic characteristics of the typewriter during the depression of the key to actuate the switch.

Another object is to provide an improved switch construction of the above character, which is protected from the accumulation of dust and dirt on the switch elements and which further provides a slidable wiping engagement of the switch contacts under increasing contact pressure.

The invention is illustrated by way of example in the accompanying drawings in which:

Fig. 1 is a side elevation view with parts broken away of a part of the keyboard assembly of a commercially available typewriter embodying a typewriter key actuated readout switch construction in accordance with the present invention; and

Fig. 2 is a perspective view from below the typewriter keyboard illustrating the readout switch assembly of Fig. 1.

The typewriter keyboard assembly is similar to that shown in U.S. Patent 2,881,895 to L. J. Gavasso and comprises a box frame 12, which mounts a plurality of vertically depressible typewriter keys 14 in a conventional four horizontal row arrangement of a standard typewriter, the lowermost or fifth row of keys of Fig. 1 including a space bar 16. The frame includes an inclined top plate 18 and bottom plate 20 which are retained together in vertical spaced apart relation by a pair of laterally spaced, vertically extending side plates 22 and 24 suitably rigidly secured thereto. Each of the keys comprises a button or key top 26 received on a key stem 28, which passes through aligned slots in the top and bottom plates and includes an elongated slot 30 near the rounded lower end thereof.

The keys of the first and second upper rows of keys located rearwardly of the keyboard, are shown as having their upper portions oppositely bent or offset and as having their vertically disposed, slotted lower portions guided by a fixed rod 32, which extends transversely through the slot 30 in each of the key stems of the aforementioned Gavasso key tops and is suitably secured as to the underside of the bottom plate. A similar fixed rod 34, spaced forwardly from the rod 32, is provided for guiding the oppositely bent stems of the third and fourth rows of typewriter keys. Associated with the key stem of each key of the two upper rows of keys is a hook carrying lever, as 36, which operates a bail 37 and is pivotally mounted at its right or forwardly located end on a grooved rod 38 fixed in and extending transversely between the side plates. An oppositely extending bail actuating hooked lever 40 is provided for each of the keys of the third and fourth rows of keys and is pivotally mounted on a grooved rod 42 similar to and spaced rearwardly of the rod 38.

The levers are selectively indexed by selective actuation of the typewriter keys, the key stem of each of which carries a stud, as 44, for camming an associated lever 36 or 40 downwardly into the path of a plurality of transversely extending coded slides 46 that control the indexing of the type element carrying mechanism of the typewriter mechanism, as described more fully in the aforementioned Gavasso patent together with the manner of initiating a power actuated typing cycle of the cyclically operable machine from the typewriter keys.

Coil springs 48, 50 extending transversely between the frame side plates urge the levers 36, 40 and their associated key center toward their normal positions shown in which the guide rods 32 and 34 engage the lowermost end of the slots 30 in the respective key stems.

The typewriter character read-out switch section 60 is located below the bottom plate 20 of the typewriter keyboard assembly and comprises a rearwardly and forwardly spaced pair of horizontally positioned, transversely extending, flush printed circuit boards 66 and 67 that are fixedly mounted between a pair of laterally spaced brackets 68 depending from the bottom plate 20. Associated with the printed circuitry on the underside of the two boards 66 and 67 are two rearwardly and forwardly located groups of transversely spaced, bifurcated, leaf spring, switch blades 69 and 70 carried by a similarly located and like plurality of transversely spaced cam block levers 72 and 73. The blade carrying levers, which may be formed of nylon block material, include a rounded drum portion 74 and a forwardly extending arm portion 75 and are individually pivotably mounted centrally about their respective drum portion on a different one of a rearwardly and forwardly spaced pair of transversely extending fixed rods 76 and 77.

As viewed in Fig. 2, each printed circuit board includes a transversely extending common bus conductor 78 having a plurality of laterally spaced, rearwardly extending conductive arm portions 80 integral with and normal to the bus conductor. Located between adjacent arm portions 80 of a bus conductor are a short pad terminal 82 and an L-shaped terminal 84, which, together with the arm portion 80 to the right thereof and an aligned one of the resilient switch blades of the group of switch blades 69 or 70, constitutes an electrical S.P.D.T. switch, one of which is provided for each character key of the typewriter read-out section. The free or overhanging end of each bifurcated switch blade carries a laterally spaced pair of electrical contacts 88, 89 on the bifurcated arms 86, 87 thereof that engage a printed circuit board associated therewith.

The upper surface of the cam block levers are shown as engaging the rounded lower end of the key stems at a point displaced from the center of the rounded portion 74 of each cam lever, and the levers are so formed and spaced relative to the normal position of the key stems that the switch springs are under an initial preload or are tensioned so that their contacts at all times are urged against the bottom surface of the printed circuit board. In the illustrated configuration, this is accomplished by shaping and/or mounting the cam levers 72, 73 relative
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to their respective printed circuit boards and the lower end of the key stems of the key rows associated therewith so that the vertical distance between the key stem contacting surface of the extended arm portion 75 of the cam lever to the center of the rounded portion 74 thereof is slightly greater than the distance between the rounded end of the key stem to the center of the rounded portion of the cam block lever.

With the depression of a key, the rounded end of its associated key stem rocks a corresponding one of the switch levers 72 or 73 in the direction shown and wraps the resilient switch blade, secured to the upper flat surface of the switch lever, partially around the rounded arm portion 74 thereof. This action results in a slight foreshortening of the effective length and in additional flexing of the switch blade, placing it under additional tension, and urges the contacts upwardly with additional force against the board, thus avoiding the possibility of contact bounce against the board and contributing to the vibration dampening characteristics of the switch. The angular movement of the associated nylon block lever will cause the bifurcated ends of the resilient blade to move forwardly with a contact cleaning, wiping action, with arm 87 moving off of terminal 82 and onto terminal 84 to complete an electrical circuit between arm 89 of bus conductor 78 and the normally open terminal 84 through the forwardly actuated switch blade, acting as a bridging member.

The respective terminal pads 84 of each of the printed circuit boards may be wired through an encoder to one side of the interposer or punch magnets of a punching or recording machine, thereby to energize one or more of the magnets thereof and punch or record the appropriate code or symbol in the record medium wherein when a key activated one of the character read-out switches of the electronic reset section is pressed, and U.S. patent application S.N. 838,331 now Patent No. 3,052,336. It will be noted that electrical wiring connections are not made to any part of the blade carrying movable member or support thereof, but to the terminals of the stationary printed circuit boards, thereby assuring positive electrical connections. The printed circuit pads are located on the underside of the boards above the movable switch blade bridging contacts, the electrical contacts are protected from accumulation of dust, dirt and grease thereon, whereby a substantially dust proof construction is provided.

Since the key stems are in physical contact with the cam levers and the printed circuit pad portions 80, 82 and 84, constituting the switch circuit terminals, are contained in the same plane and are located in the direction of movement of the switch blade contacts, the depression of a key is insensitive to operation of the switch and does not give rise to a discontinuous or sudden application of load that would interfere with the touch and typing characteristics of the typewriter. And since the switch blades are pretensioned against the board and are slidable urging in increasing contact relation thereafter with movement of the blade carrying lever, erratic electrical operation due to bouncing of the blade contacts against the board, vibration of the surroundings or a snap depression of a key is virtually eliminated.

What is claimed is:

1. The combination with a vertically reciprocable key stem, an insulating board of broad flat surface expander and having an electrical switch contact fixed on a plane surface thereof, a lever pivotally mounted about a pivot axis through one end thereof, and a resilient electrically conducting switch blade member having one end secured to and overhanging the pivot end of the lever and a switch contact portion on the other end thereof, the other end of the lever continuously engaging the key stem at a point displaced from the pivot end of the lever and positioned relative to and normally against the key stem to pretension the switch blade contact portion against the said surface of the board for concomitant movement with the lever upon depression of the key stem in a direction to forestore the distance between the contact portion of the switch blade member and the pivot axis of the lever and slidesly move the end of the switch blade member carrying the contact portion toward the pivot axis of the lever and entirely in the plane of the surface of the board from an initial position out of electrical contact engagement to a position into slidable and wedge engagement contact relation with the fixed electrical switch contact on the board with resultant uniformly increasing contact pressure.

2. Electrical switching means comprising the combination of an insulating board of broad flat surface expander and having a spaced pair of electrical switch contacts fixed on a plane surface thereof, a lever having a rounded end about which it is rockable on a pivot axis extending normally therethrough and parallel to the contact surface of the board, a resilient, electrically conducting switch blade member extending from the aforesaid end of said lever and slidingly disposed in a contacting engagement with a fixed electrical switch contact portion at the other end thereof spaced from the aforesaid end of the lever, and a movable actuator normally positioned in engagement with and against the other end of said lever pretensioning the switch blade member with its contact portion against one of said fixed electrical switch contacts of said board, movement of said actuator comprising the mutually rocking said lever and wrapping said switch blade member about the rounded end thereof with consequent foreshortening of the distance between the contact portion of the spring blade member and the pivot axis of the lever and sliding movement of the contact portion end of the board member toward the aforesaid pivot axis of the lever under uniformly increasing contact pressure and entirely in the plane of the surface of the board from said one fixed electrical switch contact of the board to the other.

3. The combination with a vertically reciprocable key stem, an insulating board of broad flat surface expander and having an electrical switch contact fixed on a plane surface thereof, a lever pivotally mounted about a pivot axis through one end thereof, a resilient electrically conducting switch blade member having one end secured to and overhanging the pivot end of the lever and a switch contact portion on the other end thereof, stationary stop means limiting reciprocation of the key stem in one direction, and means biasing the key stem in said direction against said stop means, the other end of the lever engaging the key stem at a point displaced from the pivot end of the lever and positioned relative to and normally against the key stem to pretension the switch blade contact portion against the said surface of the board for simultaneous movement with the lever upon depression of the key stem in a direction opposite the aforementioned direction to forestore the distance between the contact portion of the switch blade member and the pivot axis of the lever and slidably move the end of the switch blade carrying the contact portion toward the pivot axis of the lever and entirely in the plane of the surface of the board from an initial position out of electrical contact engagement to a position into slidable and wiping electrical contact relation with the said fixed electrical switch contact on the board with resultant uniformly increasing contact pressure.

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