United States Patent

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[33] **Japan**
[31] **43/29886, 43/30983 and 43/31689**

[54] **SWITCHING DEVICE WITH IMPROVED TABLET ACTUATOR MEANS**
9 Claims, 4 Drawing Figs.

[52] **U.S. Cl.** **200/1,** 200/6, 200/172, 84/1.01
[51] **Int. Cl.** **H01h 9/00**
[50] **Field of Search** ..... 200/1, 1 (A), 5, 5 (A), 5 (E), 6, 169, 172, 172 (A); 84/1.01

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ABSTRACT: The switching device of a tablet type comprises a plurality of tablets each having bosses formed integrally on the surfaces of its sidewalls coaxially with bores formed in the tablets to receive an axis. The tablets are arranged on a base by passing the axis through said bores in such a manner that the bosses formed on two adjacent tablets face each other.

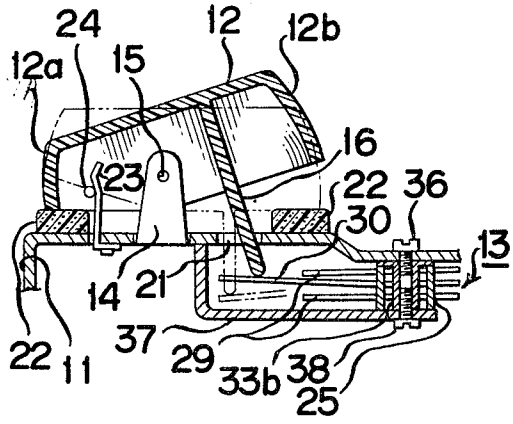


FIG. 1

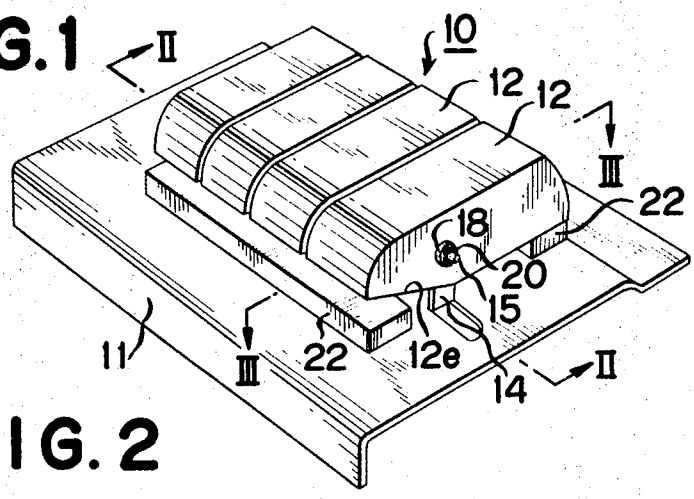


FIG. 2

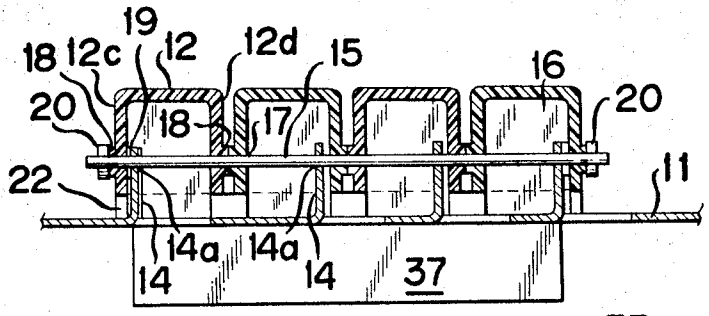


FIG. 3

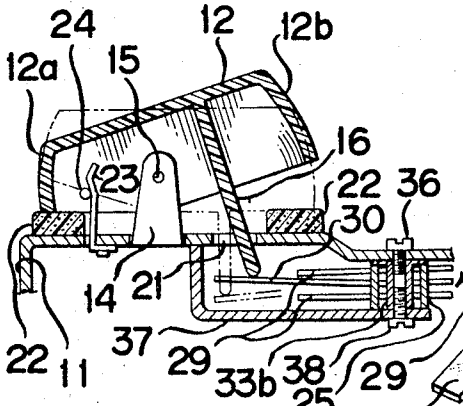
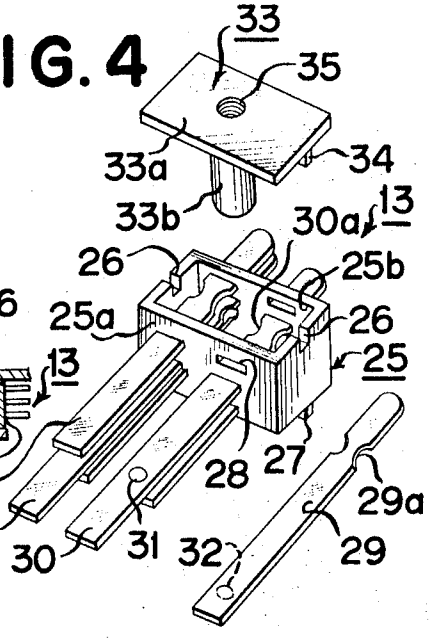


FIG. 4



SWITCHING DEVICE WITH IMPROVED TABLET ACTUATOR MEANS

This invention relates to a switching device of a tablet type placed on the operation board, for example, of an electronic organ.

An electronic organ generally employs a number of switches, particularly those of a tablet type, which are provided sideward of the keyboard surface to effect switching of a tone and sound effects. The provision of a number of independent switches in side-by-side relationship requires a number of parts for mounting of the switches, which is not economical.

An object of this invention is to provide a switching device having such an arrangement that a plurality of tablet-type switches are disposed in parallel.

Another object of this invention is to provide a switching device in which a contract means is arranged such that spring plate members are penetrated through sidewalls of a supporting frame, whereby assembling of the device is simple and easy.

The invention is now described in conjunction with a preferred embodiment with reference to the accompanying drawing, in which:

FIG. 1 is a perspective view embodying the switching device of this invention;

FIG. 2 is a cross section taken along the line II–II in FIG. 1;

FIG. 3 is a cross section taken along the line III–III in FIG. 1 showing a tablet in its operative position; and

FIG. 4 is an exploded perspective view, on an enlarged scale, of a contact means of FIG. 3.

In FIG. 1, the reference numeral **10** generally designates a switching device comprising, as main component elements, a substantially horizontal base **11**, a plurality of tablets **12** pivotally mounted on the base **11**, and a contact means **13** (in FIG. 3) having a plurality of contacts which engage and disengage each other by the operation of each of the tablets **12**.

A plurality of projections **14** which correspond in number and in position to the tablet **12** are serially formed on one surface of the base **11**. As best shown in FIG. 2, each projection **14** may be formed in such a manner that the base **11** is cut and that such a cut portion is raised and positioned substantially at right angles with the plane of the base so that each projection has substantially an inverted letter U-shaped configuration. A bore **14***a* is formed in the upper portion of each of the projections in alignment with each other so that a rod-shaped axis **15** is received by the bores **14***a* in parallel with the surface of the base **11**.

Each tablet **12** has a substantially rectangular box shape and an opening in the bottom portion. End walls **12***a* and **12***b* of the tablet have slightly curved surfaces. As shown in FIG. 3, an actuator plate **16** projects downwardly from the inner surface of each tablet **12** at a portion closer to the contact means **13** and is formed integrally therewith. Bores **17** are formed in sidewalls **12***c* and **12***d* of said tablet in alignment with each other, and bosses **18** are formed integrally on the outer surface of said sidewalls **12***c* and **12***d* in such a manner that said bores **17** are open therethrough. The sidewalls **12***c* and **12***d* of each tablet **12** are cut slopewise as at **12***e* at the bottom front end of the tablet so that the width of each sidewall is increased toward the rear end of the tablet. When the tablets **12** are supported by the axis **15** passing through the bores **17**, each tablet is rotatable around the axis **15** from its normal horizontal position with respect to the base **11** to a position where said cut portion **12***e* is horizontal. This will be described later in detail.

As shown in FIG. 2, the tablets **12** (four tablets are shown only for the purpose of illustration) are so arranged that when the axis **15** is passed through the bores **17** via the bores formed in the projections **14** the outer surfaces of the bosses between two adjacent tablets engage each other, and that the tablets **12** angularly rotatable around the axis independently each from the other. The bosses **18** thus provide spacings between two adjacent sidewalls of the tablets. Between the inner wall surfaces of two tablets positioned at both ends of a series of the tablet arrangement and corresponding two projections are

respectively inserted spacers **19** made, for example, of felt. The ends of the axis **15** are secured by stopper rings **20** so that the movement of the tablets **12** in the longitudinal direction of the axis can be avoided.

As shown in FIG. 3, rectangular openings **21** corresponding in number to the tablets **12** are formed in the base **11** at positions closer to the rear ends of the tablets than said projections **14**. The lower ends of the operation plates **16** formed integrally with the respective tablets extend through said rectangular openings **21**. Cushion pieces **22** are mounted on the base **11** at positions respectively corresponding to the bottoms of the front and rear end walls of the tablets in parallel relationship with the axis **15**, as depicted in FIG. 1. This cushion can prevent foreign matter incoming from a spacing between the base and the front or rear end (as the case may be) of the tablet **12** from being introduced through said spacing into the chamber of tablet.

The reference numeral **23** represents sheet springs for keeping the respective tablets in either of the operative positions, each said sheet spring having a letter S-shaped forward end and a lower end secured to the base **11**. Each tablet has a laterally extending pin **24** on its inner sidewalls. When the tablet **12** is pushed downwardly at its front end, said pin **24** slides downwardly along the surface of the sheet spring **23** against its spring action and stays at the dent portion of the S-shaped part of the sheet spring **23**, thus permitting the tablet **12** to stay at its operative rotated position.

On the bottom surface of the base **11** is mounted the contact means **13** operated by the actuator plates **16** of the tablets **12** as already mentioned. The arrangement of the contact means **13** will be described with particular reference to FIG. 4. The reference **25** indicates a frame of a rectangular hollow columnar configuration, or of a tubular spacer and mounting member, having open ends, and which is made of an insulating material. A pair of recesses **26** are formed in the edges of the upper open end of the frame **25** at intermediate points of the opposing shorter sides thereof, and a pair of registering projections **27** are extended from the corresponding edges of the lower open end. In the sidewalls **25***a* and **25***b* which define the longer sides of the frame **25** are formed a plurality of groups of slits **28**. In the FIG., each group consists of three rectangular slits formed vertically spacedly in the sidewalls **25***a* and **25***b*.

In practice, however, these slits **28** forming a group may be interconnected to form a single opening having notches. A long movable spring or resilient plate or switching blade **30** is securedly inserted through the intermediate slits in such a manner as to bridge the frame **25**, while a pair of short stationary spring plates **29** are similarly inserted through the upper slits and the lower slits, respectively, and facing to the movable spring plate **30** with spacings therebetween. On the upper surface and the corresponding lower surface of the movable spring plate **30** are mounted contacts **31**. Contacts **32** are respectively formed on each surface of the stationary spring plates **29** so as to correspond with said contacts **31**. Although only two groups of slits and associated spring plates are illustrated in FIG. 4, it should be understood that two groups or slits corresponding to one tablet.

The width of each of the spring plates **29** and **30** is reduced within the frame **25**. Namely, each spring plate is provided with opposite acute recesses in its edges or semicircularly cut from both sides to form narrow portions **29***a* and **30***a*, so that a circular opening is formed between two adjacent groups of spring plates. The reference numeral **33** indicates a cover for closing the upper open end of the frame **25**, said cover comprising a cover plate **33***a*, a detachable locator or stop member in the form of a hollow cylindrical member **33***b* disposed on the bottom central surface of said cover plate **33***a*, and a pair of registering projections **34** integrally formed on the bottom surface of the cover plate **33***a*. The stop member **33***b* engages the arcuate edges of the spring plates which edges function as abutments so as to hold the plates against movement lengthwise. A female screw **35** is threaded in the inner surface of the hollow cylindrical member **33***b* at the upper and lower

portions thereof. The cover 33 is placed on the frame 25 in such a manner that the registering projections 34 engage the corresponding recesses 26 formed in the frame 25 and that the cylindrical member 33*a* is inserted through the opening defined by the narrow portions of two adjacent groups of spring plates, whereby the spring plates are rigidly secured in position. The contact means 13 thus formed is secured to the base 11 by means of a bolt 36 which threadably engages the partly threaded hollow cylindrical member 33*b*, as shown in FIG. 3. Under this condition, the forward end of the movable spring plates 30 are in face-to-face contact with the bottom end of the corresponding operation plate 16 of the tablet 12. A cover plate 37 of substantially a boxlike configuration is provided to cover the entire contact means 13. The cover plate 37 has recesses (not shown) which register with the registering projections mounted on the frame 25 as is secured to the contact means 13 by a bolt 38 which also threadably engages the inner threaded surface of the hollow cylindrical member 33*b*.

The switching operation of the device will now be described. As shown in FIG. 3, when the forward end of the tablet 12 is pushed down, the tablet rotates around the axis 15 causing the operation plate 16 to elevate upwardly, whereby the movable spring plates 30 urge or flex upwardly to engage the upper stationary spring plates 29 at the contacts formed on the respective surfaces. For this purpose, it should be understood that the movable spring plates 30 is biased tending to move upwardly at their forward portions. When the tablet 12 is returned to its original nonoperative position as indicated by broken lines, the operation plate 16 presses the movable spring plates 30 downwardly causing said movable spring plates to engage the lower stationary spring plates 29 via the contacts formed on the respective surfaces. The flow of an electrical current is thus switched between one movable spring plate 30 and a pair of corresponding stationary spring plates 29. Since the operation plate 16 of the tablet 12 contacts either the forward end or the rear end of the rectangular opening 21 formed in the base 11, it is possible to prevent foreign matter incoming from a spacing between the base and the front or rear end (as the case may be) of the tablet 12 from being introduced through said rectangular opening 21 into the contact means 13 housed in the cover plate 37. For this purpose, the width of the actuator plate should be such that the width of the rectangular opening 21 formed in the base 11 is covered substantially.

In the embodiment shown, each tablet 12 is provided with a pair of bosses on its sidewalls to provide a spacing between two adjacent tablets. It is understood that bosses may be formed only on one side of the respective tablets to provide an equivalent effect.

I claim:

1. A switching device of a tablet type comprising a base (11) having a plurality of projections (14), an axis (15) penetrating through said projections (14) and secured thereby, a plurality of tablets mounted on said base (11) in parallel relationship with each other and each having bores (17) formed in opposing sidewalls thereof and at least one boss (18) formed on the outer surface thereof in coaxial relation with said bores to provide a spacing between two adjacent tablets, operation plates each projecting integrally from the lower surface of each said tablet, and a contract means (13) including spring plates having contacts formed thereon, said contacts being switched by each of said operation plates.

2. A switching device of a tablet type comprising a base, a tablet pivotally mounted on said base, an actuator projecting from said tablet, a frame of electrically insulating material having a rectangular hollow columnar configuration with open ends and opposite sidewalls, said sidewalls having, respectively, pairs of groups of slits perforated therein which slits are formed into elongated shapes each extending horizontally and are arranged vertically with respect to each group, a cover having a plate member closing one of said open ends and an internally-threaded hollow cylindrical member disposed substantially on the central part of said plate member, a pair of groups of spring contact plate members operated by said actuator and inserted in said groups of slits in a manner to bridge said opposite sidewalls, the portions of said spring contact plate members which are positioned in said hollow frame being cut off at both side edges thereof to form narrow portions so that a substantially circular opening is formed between said pair of groups of spring contact plate members, the hollow cylindrical member being inserted in said substantially circular opening, a cover plate covering said frame, and two bolts threadably engaged with said internally-threaded hollow cylindrical member, one of said bolts securing the frame to the base and the other of said bolts securing the cover plate to the frame.

3. A switch device as claimed in claim 2, wherein said open end closed by said plate member has recesses formed therein, and said plate member has projections formed integrally thereof, said projections engaging said recesses.

4. The switching device as claimed in claim 2, in which said contact means comprises a supporting frame (25) having a closed cross section and including a plurality of pairs of slits (28) formed in two opposing sidewalls thereof, a plurality of groups of spring plates corresponding in number to said tablets, each group including a pair of stationary spring plates (29) and a movable spring plate (30), which respectively penetrate through corresponding pairs of slits in a manner to bridge said opposing sidewalls of said supporting frame.

5. The switching device as claimed in claim 4, in which both of said stationary spring plates and said movable spring plates are disposed in parallel with said supporting frame and have narrow portions (29*a*), (30*a*) formed at side edges thereof within said supporting frame, said narrow portions defining openings between two adjacent groups of slits, and further comprising cylindrical members each inserted into each of said openings, whereby the spring plates are prevented from slipping out of position from said supporting frame.

6. A switching device comprising a horizontal base (11), a tubular mounting member (25) having one end disposed toward the underside of said base, two pairs of elongate laterally positioned contact carrying spring blades (29) extending along and beneath said base, said spring blades of each pair being in broadside overlying spaced relation to each other and extending through and mounted on said tubular mounting member, a pair of elongate resilient contact carrying switch blades (30) respectively interposed between said pairs of spring blades in broadside elongate relationship thereto and extending through and mounted on said mounting member, said switching blades biased into engagement respectively with the contacts carried by corresponding ones of said pairs of spring blades and flexible to overcome the bias and engage contacts carried respectively by corresponding other ones of said pair of spring blades, and a stop member (33*b*) extending between and in abutment with said two pairs of spring blades and said switching blades to hold said blades against longitudinal movement.

7. A switching device as defined by claim 6, wherein said stop member (33*b*) is disposed within said tubular mounting member (25).

8. A switching device as defined by claim 7, wherein said stop member (33*b*) is a pin extending axially transverse to the broadsides of said blades in engagement with recesses in the edges of said blades.

9. A switching device as defined by claim 6 with the addition of a cover member (37) overlying the lower end of said stop member (33*b*) and cooperable therewith and with said base (11) to enclose contact carrying portions of said blades, and means (36, 38) cooperable with said stop member (33*b*) to affix said stop member and said cover member to said base.