

PATENT SPECIFICATION

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(54) ELECTRIC SWITCH KEYBOARD

(71) We, KABUSHIKI KAISHA SUWA SEIKOSHA, a Japanese Company of 3-4, 4-chome, Ginza, Chuo-ku, Tokyo, Japan, do hereby declare the invention for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:-

This invention concerns an electric switch keyboard, e.g. of a calculator.

According to the present invention, there is provided an electric switch keyboard comprising a plurality of keys, a plurality of electrical contacts which are arranged to be respectively operated by said keys, and an electrically conductive intermediate member which extends between the plurality of keys and the plurality of contacts and which resiliently urges the keys and the contacts apart, the intermediate member contact the plurality of keys and being contactable with said plurality of contacts.

The intermediate member is preferably a sheet member and is preferably made of plastics material. Moreover, the intermediate member may act as a sealing member between members which are respectively provided with said keys and with said contacts.

The intermediate member may have a generally planar main part and a plurality of spaced apart T-shaped parts, each T-shaped part having a head portion which is parallel to and projects from the said main part and which engages a corresponding key, and each T-shaped part having a shank portion which is substantially normal to the said main part and is engageable with a corresponding contact.

The contacts are preferably disposed in respective recesses in a block, the parts of the intermediate member between said T-shaped parts being supported on a surface of the block.

The purpose of the respective keys may be

indicated by indicia disposed adjacent to but not on the respective keys.

The indicia are preferably provided on a common sheet and differ in colour from the latter.

The keyboard preferably forms part of an electronic calculator, while the calculator itself may form part of an electronic timepiece. In this case the intermediate member may be clamped between portions of a glass and a back cover of the timepiece so as to seal these portions together.

The keys are preferably mounted in the said glass, while the said common sheet is preferably mounted on the said glass.

Thus a peripheral part of the said common sheet may be engaged by a casing member of the timepiece, the casing member being interconnected to the said back cover by a spring which clamps the common sheet onto the glass.

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

Figure 1 is a plan view of a first embodiment of an electronic wrist watch provided with a keyboard in accordance with the present invention;

Figure 2 is a plan view of an intermediate member which forms part of the keyboard of Figure 1;

Figure 3 is a sectional view of the wrist watch of Figure 1 taken on the line 3-3 thereof;

Figure 4 is a plan view of a second embodiment of an electronic wrist watch provided with a keyboard according to the present invention;

Figure 5 is a sectional view of the wrist watch of Figure 4 taken on the line 5-5 thereof, and

Figure 6 is a broken-away cross-sectional view similar to Figure 5 but illustrating a modification.

In Figures 1 and 3 there is shown an

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electronic wrist watch of the digital type having a casing which comprises a casing member 10 and a back cover 11, the casing member 10 and back cover 11 being interconnected by a spring 12.

The wrist watch is provided with a watch glass 13, which may be made of natural or synthetic glass, the watch glass 13 having a peripheral flange 14 which underlies and is engaged by an inwardly extending flange 15 of the casing member 10.

Mounted in the watch glass 13 are a plurality of keys 16 of a calculator keyboard which is generally indicated at 17. Mounted within the said casing is a circuit block 20 which is provided with a plurality of electrical contacts 21, the contacts 21 being arranged to be respectively operated by the corresponding keys 16 when the latter are depressed.

An electrically conductive intermediate member 22 of resilient plastics sheet material extends between opposite sides of the back cover 11 and thus extends between all the keys 16 and the electrical contacts 21. The intermediate member 22 has a thickened peripheral part 23 which is clamped by the spring 12 between the peripheral flange 14 of the watch glass 13 and a part 24 of the back cover 11, the intermediate member 22 sealing the peripheral flange 14 to the part 24.

The timepiece is provided with a display portion 25, visible through the watch glass 13, the display portion being provided with indicia 26 which indicate the time and indicia 27 which indicate the result of a mathematical calculation performed by operating the keys 16. The indicia 26, 27 may be constituted by light emitting diodes or liquid crystal material controlled by circuits (not shown) in the circuit block 20.

The intermediate member is electrically connected (by means not shown) to a battery 28 housed within the back cover 11. The intermediate member 22 has a generally planar main part 30 and a plurality of spaced apart T-shaped parts 31. Each T-shaped part 31 has a head portion 32 which is parallel to and projects from the main part 30 and is connected thereto by sloping portions 30a, each head portion 32 engaging a corresponding key 16. Each T-shaped part 31 also has a shank portion 33 which is substantially normal to the main part 30 and is engageable with a corresponding contact 21. The contacts 21 are respectively disposed in recesses 34 of the circuit block 20, and the parts of the intermediate member 22 which are disposed between the T-shaped parts 31 are supported on a surface 35 of the block 20.

The intermediate member is provided with a projection 36 which is engaged by an internally projecting part 37 of the watch glass 13, the projection 36 being located in a

groove 38 of the circuit block 20.

The intermediate member is provided with a projection 36 which is engaged by an internally projecting part 37 of the watch glass 13, the projection 36 being located in a groove 38 of the circuit block 20.

As clearly shown in Figure 3, the intermediate member 22 resiliently urges the keys 16 and the contacts 21 apart and thus normally holds the keys 16 in their inoperative positions. However, if a specific key 16 is depressed contact is made between the shank portion 33 of the respective T-shaped part 31 and the respective contact 21 so as to effect energisation of the respective circuit of the circuit block 20. When, however, the key 16 is released, it is restored to its position shown in Figure 3 by the natural resilience of the intermediate member 22.

The intermediate member 22, which is of one-piece integral construction thus serves (a) as a sealing gasket between the watch glass 13 and back cover 11, and between the keys 16 and the circuit block 20, so as to prevent the ingress into the watch of dust, water and sweat, (b) as the equivalent of a plurality of springs urging the keys to their inoperative positions, and (c) for the transmission of electricity to the appropriate circuits of the circuit block 20.

The construction shown in Figure 3 enables the calculator to be made small and thin and thus permits it to be incorporated in a small wrist watch.

In Figures 4 and 5 there is shown a second embodiment of a wrist watch according to the present invention which is generally similar to that of Figures 1 to 3 and which for this reason will not be described in detail, like reference numerals indicating like parts.

In the case of the wrist watch shown in Figures 4 and 5, however, the purpose of the respective keys 16 of the keyboard 17, instead of being indicated by indicia disposed on the keys themselves, which is the arrangement in the Figure 1 construction, is indicated by indicia 40 disposed adjacent to but not on the respective keys 16. The indicia 40 are constituted by the numbers 0 to 9 and by indicia representative of the decimal point, multiplication, division, addition, subtraction, memory, and so on.

The indicia 40 could be printed or painted on either the top surface or the under-surface of the watch glass 13 but it is preferred to provide these indicia on a common sheet 41 which is mounted on the top surface of the watch glass 13 and is fixed to the latter by bonding and/or by a mechanical connection. The common sheet 41 is provided with a plurality of orthogonal lines 42 (Figure 4) which define a plurality of rectangular areas each of which is provided with a key 16 and with an indicium 40. Thus

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the lines 42 serve to make it clear which indicium relates to which key.

The indicia 40 preferably differ in colour from the common sheet 41. For example, the common sheet 41 may be made of a thin sheet of aluminium or other metal having recesses for the reception of a differently coloured paint so as to provide the indicia. Alternatively, the common sheet 41 could be constituted by a moulded plastics sheet containing plastics of two different colours.

As will be appreciated, since the indicia are not provided on the keys 16 themselves but at the sides thereof, the keys 16 may be made very small and may be designed for operation by a ball pen or other pointed object. Thus the keys 16 can for example have a width of the order of as little as 1mm. This permits the calculator part of the watch to be miniaturised.

One method of securing the sheet 41 to the top of the watch glass 13 is illustrated in Figure 6 in which it will be noted that the sheet 41 is provided with a peripheral part 43 which is disposed between the flange 15 of the casing member 10 and the peripheral flange 14 of the watch glass 13. Since the casing member 10 is interconnected to the back cover 11 by the spring 12, the peripheral part 43 of the sheet 41 is thus clamped onto the watch glass 13.

Since the indicia 40 are not provided on the keys 16, all the keys 16 may be made of the same kind and do not need to be of different sizes or shapes, thus reducing not only manufacturing costs, but also assembly costs.

The sheet 41 may cover the whole of the glass 13 except for the portion of the latter disposed above the display portion 25. The finish and colouring of the sheet 41 may moreover be such as to enable the watch to be provided with a variety of attractive designs.

The advantages of providing the keys with indicia which are disposed adjacent to rather than on the keys themselves are not limited to use on the specific watches shown in the drawings, but may for example be used on electronic watches such as chronographs, alarm watches and world time watches which are provided with keyboards.

Having regard to the provisions of Section 9 of the Patents Act 1949, we draw attention to our British Patent Specification No. 1,491,826.

WHAT WE CLAIM IS:-

1. An electric switch keyboard comprising a plurality of keys, a plurality of electrical contacts which are arranged to be respectively operated by said keys, and an electrically conductive intermediate member which extends between the plurality of keys

and the plurality of contacts and which resiliently urges the keys and the contacts apart, the intermediate member contacting the plurality of keys and being contactable with said plurality of contacts.

2. A keyboard as claimed in claim 1 in which the intermediate member is a sheet member.

3. A keyboard as claimed in claim 1 or 2 in which the intermediate member is made of plastics material.

4. A keyboard as claimed in claim 3 in which the intermediate member acts as a sealing member between members which are respectively provided with said keys and with said contacts.

5. A keyboard as claimed in any preceding claim in which the intermediate member has a generally planar main part and a plurality of spaced apart T-shaped parts, each T-shaped part having a head portion which is parallel to and projects from the said main part and which engages a corresponding key, and each T-shaped part having a shank portion which is substantially normal to the said main part and is engageable with a corresponding contact.

6. A keyboard as claimed in claim 5 in which the contacts are disposed in respective recesses in a block, the parts of the intermediate member between said T-shaped parts being supported on a surface of the block.

7. A keyboard as claimed in any preceding claim in which the purpose of the respective keys is indicated by indicia disposed adjacent to but not on the respective keys.

8. A keyboard as claimed in claim 7 in which the indicia are provided on a common sheet and differ in colour from the latter.

9. A keyboard as claimed in any preceding claim in which the keyboard forms part of an electronic calculator.

10. A keyboard as claimed in claim 9 in which the calculator forms part of an electronic timepiece.

11. A keyboard as claimed in claim 10 in which the intermediate member is clamped between portions of a glass and a back cover of the timepiece and seals these portions together.

12. A keyboard as claimed in claim 11 in which the keys are mounted in the said glass.

13. A keyboard as claimed in claim 8 and in claim 12 in which the said common sheet is mounted on the said glass.

14. A keyboard as claimed in claim 13 in which a peripheral part of the said common sheet is engaged by a casing member of the timepiece, the casing member being interconnected to the said back cover by a spring which clamps the common sheet onto the glass.

15. A keyboard substantially as herein-

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One method of securing the sheet 41 to the top of the watch glass 13 is illustrated in Figure 6 in which it will be noted that the sheet 41 is provided with a peripheral part 43 which is disposed between the flange 15 of the casing member 10 and the peripheral flange 14 of the water glass 13. Since the casing member 10 is interconnected to the back cover 11 by the spring 12, the peripheral part 43 of the sheet 41 is thus clamped onto the watch glass 13.

Since the indicia 40 are not provided on the keys 16, all the keys 16 may be made of the same kind and do not need to be of different sizes or shapes, thus reducing not only manufacturing costs, but also assembly costs.

The sheet 41 may cover the whole of the glass 13 except for the portion of the latter disposed above the display portion 25. The finish and colouring of the sheet 41 may moreover be such as to enable the watch to be provided with a variety of attractive designs.

The advantages of providing the keys with indicia which are disposed adjacent to rather than on the keys themselves are not limited to use on the specific watches shown in the drawings, but may for example be used on electronic watches such as chronographs, alarm watches and world time watches which are provided with keyboards.

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and the plurality of contacts and which resiliently urges the keys and the contacts apart, the intermediate member contacting the plurality of keys and being contactable with said plurality of contacts.

2. A keyboard as claimed in claim 1 in which the intermediate member is a sheet member.

3. A keyboard as claimed in claim 1 or 2 in which the intermediate member is made of plastics material.

4. A keyboard as claimed in claim 3 in which the intermediate member acts as a sealing member between members which are respectively provided with said keys and with said contacts.

5. A keyboard as claimed in any preceding claim in which the intermediate member has a generally planar main part and a plurality of spaced apart T-shaped parts, each T-shaped part having a head portion which is parallel to and projects from the said main part and which engages a corresponding key, and each T-shaped part having a shank portion which is substantially normal to the said main part and is engageable with a corresponding contact.

6. A keyboard as claimed in claim 5 in which the contacts are disposed in respective recesses in a block, the parts of the intermediate member between said T-shaped parts being supported on a surface of the block.

7. A keyboard as claimed in any preceding claim in which the purpose of the respective keys is indicated by indicia disposed adjacent to but not on the respective keys.

8. A keyboard as claimed in claim 7 in which the indicia are provided on a common sheet and differ in colour from the latter.

9. A keyboard as claimed in any preceding claim in which the keyboard forms part of an electronic calculator.

10. A keyboard as claimed in claim 9 in which the calculator forms part of an electronic timepiece.

11. A keyboard as claimed in claim 10 in which the intermediate member is clamped between portions of a glass and a back cover of the timepiece and seals these portions together.

12. A keyboard as claimed in claim 11 in which the keys are mounted in the said glass.

13. A keyboard as claimed in claim 8 and in claim 12 in which the said common sheet is mounted on the said glass.

14. A keyboard as claimed in claim 13 in which a peripheral part of the said common sheet is engaged by a casing member of the timepiece, the casing member being interconnected to the said back cover by a spring which clamps the common sheet onto the glass.

15. A keyboard substantially as herein-

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before described with reference to and as
shown in any of Figures 3, 5, or 6.

5 Agents for the Applicants,
J. MILLER & CO.,
Chartered Patent Agents
Lincoln House,
296-302 High Holborn,
LONDON, WC1V 7JH.

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