

PATENT SPECIFICATION

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- (21) Application No 29636/77 (22) Filed 14 Jul 1977 (19)
(31) Convention Application No 51/094852U (32) Filed 16 Jul 1976 in
(33) Japan (JP)
(44) Complete Specification Published 6 Sep 1978
(51) INT.CL.² G06F 3/02 //
G04B 47/00
(52) Index at acceptance
B6F 6B8B1 6B8BY CA
G3T 301 303 407 QB



(54) IMPROVEMENTS RELATING TO KEY-OPERATED DEVICES

(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 key-operated devices and, although the invention is not so restricted, it is more particularly concerned with an electronic watch of the digital type, e.g. a chronograph, world time watch, or alarm watch, having a key-operated, multiple-function calculator portion, both the time display and the calculator display being effected by means of liquid crystal material or by light emitting diodes.

The mounting of the keys of such a calculator portion has previously involved the use of a large number of different parts, and this has been time-consuming and therefore expensive.

According to the present invention, there is provided an apparatus comprising a device operated by a plurality of keys, each key being operable from the exterior of said device and being mounted in a hole in a common support member, each key having an abutment portion which is engageable with an abutment portion of the support member adjacent the respective hole to prevent removal of the key therefrom in a predetermined direction, and a display plate which carries indicia indicating the purpose of the various keys and which is disposed adjacent to one surface of the support member, the display plate partially occluding said holes to prevent removal of the keys therefrom in the direction opposite to the said predetermined direction.

Preferably the support member is transparent.

The said holes could be constituted by blind holes.

However, the said holes preferably extend right through the support member, there being provided a resilient member which is disposed adjacent to a surface of the support member opposite to the first-mentioned surface thereof, a portion of the resilient member engaging each of the keys to urge the latter in the said opposite direction.

Each key preferably has a flange which constitutes its abutment portion, the respective abutment portion of the support member being constituted by a shoulder portion thereof.

The flange may be disposed either at one end of the key or mid-way of the length of the key.

The display plate preferably contacts the said one surface of the support member and is secured thereto by adhesive.

The display plate may have a peripheral portion which is clamped between the support member and a casing member of said apparatus.

Preferably the said apparatus is a watch, and the said device is a calculator portion of the watch, the support member being constituted by the watch glass.

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

Figure 1 is a broken-away cross-sectional view of a watch previously known to the Applicants, the said watch being outside the scope of the present invention, and

Figures 2 and 3 are broken-away cross-sectional views of two different embodiments of watches according to the present invention.

Terms such as "upper" and "lower" as used in the description below are to be understood to refer to direction as seen in the accompanying drawings.

In Figure 1 there is shown an electronic watch of the digital type which has been previously known to the Applicants, and which

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is provided with a key-operated, multiple-function calculator portion 5 by means of which calculations such as multiplication, division addition and subtraction can be performed. The watch is provided with a display portion (not shown) on which there is displayed both the time, the results of said calculation, and if desired an indication of the day and date. Such a display portion may comprise liquid crystal material or light emitting diodes.

The calculator portion 5 of the watch is provided with a plurality of keys or buttons 2 each of which is operable from the exterior of the watch and each of which is mounted in a hole 7 in a watch glass 1, the latter constituting a common support member for the keys 2.

Each of the keys 2 is provided with a flange 2c at its upper end. The flange 2c of each key is engageable with a shoulder portion 1c of the watch glass 1 adjacent the respective hole 7 to prevent removal of the key 2 from the hole 7 in the downward direction.

Each of the keys 2 is introduced into its respective hole 7 from above. Once it is so introduced, a recessed portion of a respective stop ring 3 is forced over a reduced diameter portion 2a of the key 2 so as to widen the stop ring. The stop ring 3, when it has been so mounted on its respective key 2, is disposed immediately below a bottom surface 1a of the watch glass 1.

Each of the keys 2 is provided at its lower end with an end portion 2b which engages a portion 6a of a resilient member 6. The resilient member 6 urges the various keys upwardly and thus urges each of the stop rings 3 into engagement with the surface 1a. As will be appreciated the engagement between each stop ring 3 and the surface 1a prevents removal of the respective key 2 from its hole 7 in the upward direction. Accordingly each of the keys 2 is retained in the watch glass 1.

Indicia (not shown), indicating the purpose of the various keys 2, is either provided on the respective keys themselves or on the surface 1a of the watch glass 1.

As will be appreciated, in the case of the construction shown in Figure 1, an individual stop ring 3 is required for each of the keys 2 and since, in practice, the calculator 5 may have twenty or more keys 2, this means that not only will a corresponding number of stop rings 3 be required by also each of these stop rings 3 needs to be individually assembled on its respective key 2. Consequently the work of assembling the construction shown in Figure 1, and hence its cost, is considerable.

In Figure 2 there is therefore shown one embodiment of a watch according to the present invention, the watch having a key-operated, multiple-function calculator portion 10, e.g. for calculating multiplications,

divisions, subtractions and additions. The results of the calculations performed by the calculator portion 10 are displayed on a display device (not shown) e.g. a display device comprising liquid crystal material or light emitting diodes, the display device also having a time display portion operated by the watch proper and, if desired, a calendar portion for showing the day and the date.

Each of the keys 12, which is operable from the exterior of the watch, is mounted in a hole 17 in a transparent watch glass 11 which constitutes a common support member for the various keys 12.

Each of the keys 12 is provided at its upper end 12a with a flange 12b which is engageable with a shoulder 11c of the watch glass 11 adjacent the respective hole 17 to prevent removal of the key 12 therefrom in the downward direction.

A display plate 14, which carries indicia (not shown) indicating the purpose of the various keys 12, is disposed in contact with an upper surface 11e of the watch glass 11 and is secured thereto by a layer (not shown) of adhesive. The display plate 14 has a peripheral portion 14b which is clamped between a peripheral portion 11b of the watch glass 11 and a flange or bezel portion 15a of a casing member 15 of the watch.

The display plate 14 partially occludes the holes 17 of the watch glass 11 but is itself provided with a plurality of holes 14f which are aligned with the holes 17 to permit operation of the keys 12.

The holes 17 extend right through the watch glass 11 from the upper surface 11e thereof to a lower surface 11f thereof which is disposed opposite to the upper surface 11e. Mounted immediately below the watch glass 11 and in contact with the lower surface 11f is a resilient member 16 a portion 16a of which extends into each of the holes 17 to engage each of the keys 12 and thus urge the latter upwardly. Such upward urging of the keys 12 urges them into contact with the lower surface of the display plate 14 which thus prevents the keys 12 from being removed from the holes 17 in the upward direction.

The assembly of the construction shown in Figure 2 is substantially simpler than that of Figure 1. Thus all that is necessary in order to assemble the construction shown in Figure 2 is to introduce the keys 12 into their respective holes 17 in the watch glass 11, mount the display plate 14 on the upper surface 11e of the watch glass 11 and secure it thereto by means of adhesive, mount the resilient member 16 on the timepiece portion of the watch and so that the portions 16a of the resilient member 16 engage the lower portions of the keys 12, and assemble the casing member 15 so that the peripheral portion 14b of the display plate 14 is clamped bet-



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ween the bezel portion 15a of the casing member 15 and the flange portion 11b of the watch glass 11. Each key 12 will then be operable from the exterior of the watch but will nevertheless be retained securely within its respective hole 17.

In Figure 3 there is shown a watch which is generally similar to that of Figure 2 and which for this reason will not be described in detail, the parts of Figure 3 which correspond to those of Figure 2 having reference numerals which are larger by 10 than the corresponding numerals used in the case of Figure 2.

In the case of the Figure 3 construction, however, each key 22 has a flange 22b which is disposed midway of the length of the respective key and which is engageable with a shoulder portion 21c of the transparent watch glass 21 to prevent removal of the key 22 from its respective hole 27 in the upward, as opposed to the downward, direction. In the Figure 3 construction, moreover, use is made of a display plate 24 which is disposed in contact with and is secured by means of adhesive to the lower surface 21f of the watch glass 21, the display plate 24 partially occluding the bottoms of the holes 27 to prevent removal of the keys 22 therefrom in the downward direction. the display plate 24 is provided with indicia, not shown, indicating the purpose of the various keys, and these indicia are visible through the transparent watch glass 21.

Accordingly both in the case of the Figure 2 and in the case of the Figure 3 construction, fewer parts are employed than in the Figure 1 construction, assembly is easier, and an easily visible indication is provided of the purpose of the various keys. The constructions of Figures 2 and 3, moreover, are suitable for use in a small watch.

WHAT WE CLAIM IS:-

1. Apparatus comprising a device operated by a plurality of keys, each being operable from the exterior of said device, and being mounted in a hole in a common support member, each key having an abutment portion which is engageable with an abutment portion of the support member adjacent the respective hole to prevent removal of the key therefrom in a predetermined direction, and a display plate which carries indicia indicat-

ing the purpose of the various keys and which is disposed adjacent to one surface of the support member, the display plate partially occluding said holes to prevent removal of the keys therefrom in the direction opposite to the said predetermined direction.

2. Apparatus as claimed in claim 1 in which the support member is transparent.

3. Apparatus as claimed in claim 1 or 2 in which the said holes extend right through the support member, there being provided a resilient member which is disposed adjacent to a surface of the support member opposite to the first-mentioned surface thereof, a portion of the resilient member engaging each of the keys to urge the latter in the said opposite direction.

4. Apparatus as claimed in any preceding claim in which each key has a flange which constitutes its abutment portion, the respective abutment portion of the support member being constituted by a shoulder portion thereof.

5. Apparatus as claimed in claim 4 in which the flange is disposed at one end of the key.

6. Apparatus as claimed in claim 4 in which the flange is disposed midway of the length of the key.

7. Apparatus as claimed in any preceding claim in which the display plate contacts the said one surface of the support member and is secured thereto by adhesive.

8. Apparatus as claimed in any preceding claim in which the display plate has a peripheral portion which is clamped between the support member and a casing member of said apparatus.

9. Apparatus as claimed in any preceding claim in which the said apparatus is a watch, and the said device is a calculator portion of the watch, the support member being constituted by the watch glass.

10. Apparatus substantially as hereinbefore described with reference to and as shown in Figure 2 or in Figure 3 of the accompanying drawings.

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