Dec. 5, 1967 J. WIRTH 3,356,296

KEYBOARD INTERLOCKING ARRANGEMENT

Filed Dec. 20, 1966

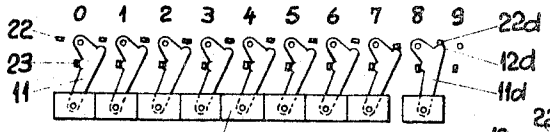
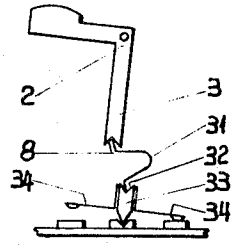


Fig 2

Fig 1

Fig 3



INVENTOR.
JOHANNES WIRTH

BY

ATTORNEYS

United States Patent Office 3,356,296
Patented Dec. 5, 1967

3,356,296

KEYBOARD INTERLOCKING ARRANGEMENT

Johannes Wirth, Zurich, Switzerland, assignor to Wirth, Gallo & Co., Zurich, Switzerland

Filed Dec. 20, 1966, Ser. No. 603,309
Claims priority, application Switzerland, Jan. 31, 1966, 1,406/66
5 Claims. (Cl. 235—27)

ABSTRACT OF THE DISCLOSURE

A keyboard interlocking arrangement wherein each key is mounted on an L-shaped key lever, a deflectably mounted locking lever means carried by each of said L-shaped levers is provided for restoring keys directly adjacent to a depressed key to their zero position, and a rotatably mounted transfer means supported by each of said deflectably mounted locking lever means applies the action of their respective reflectably mounted locking lever means to any of said successively numbered keys depressed.

The present invention relates to a keyboard, particularly for weighing machines.

The object of the invention is the provision of a keyboard which operates with minimum wear, minimum friction, minimum noise and minimum maintenance, which is not affected by corrosion and fouling, which has keys that need not be depressed a long way and that are operable with minimum effort.

Conventional keyboards usually comprise sideways and sliding contacts. Contact pressure cannot be reduced below given limits to obviate the effects of dirt and so forth, a necessity which also involves greater friction in the slideways. Keys that have been depressed are usually restored by a spring which is compressed when the key is depressed. The restoring force of these springs must be substantial. The springs must have sufficient power to definitely overcome the friction in slideways and sliding contacts for restoring the key, and allowance must be made for the fact that this friction may rise considerably in the course of time because the lubricant is gradually consumed, and parts may become worn and corroded. Thus eventually the effort needed for operating a key may be fairly high. Since the necessary deflection path of the key is considerable in most contact devices, this can likewise add to the effort required for operating a key. Consequently, when a key is released, a large amount of energy becomes free and, owing to the safety margin that has been allowed, this energy must be destroyed not only by friction but by the key striking its stop in zero position. Such keyboards are therefore rather noisy. The interlocking means between the keys (only one key is desired to remain in depressed position at any one time) are usually so constructed that the key which is to be restored is released through wedge-shaped elements. Since the mechanical efficiency of wedges is low, their operation further adds to the effort needed for moving the keys. Naturally all the described sources of friction result in excessive wear and other undesirable consequences such as those resulting from the fouling and gum-forming tendencies of lubricants.

The keyboard proposed by the present invention permits these drawbacks to be overcome in that each key is mounted on the shorter horizontal arm, which carries a lateral abutment, of a pivotably mounted L-shaped key lever whose longer arm, provided with an abutment face, cooperates at its bottom end with a spring and two stops in such a way that the key lever has two stable positions. Each key lever carrier deflectably mounted locking lever

supporting a rotatably mounted transfer member having an effective diameter equal to the spacing of the pivots of consecutive key levers. Each of said locking levers having a projection adapted to cooperate with the lateral abutment on the horizontal arm of the key lever of the next higher key, and the entire arrangement being such that when one key is depressed the abutment face of its key lever so deflects the associated locking lever that the latter will restore the next higher key, if this is depressed, to zero position by acting on the lateral abutment of its key lever, or transmit its deflection to the locking lever of the next key by cooperation of the transfer members of the two locking levers, while at the same time the lateral abutment of the key lever of the depressed key acts on the projection of the locking lever of the next lower key and causes this latter locking lever to deflect its own key lever by acting on its cooperating abutment and to restore the next lower key to zero position, if this key is depressed, or alternatively to transmit its deflection, by cooperation of its transfer member with that of the locking lever of the next key but one, to this latter locking lever.

Embodiments of the proposed keyboard are schematically and illustratively shown in the accompanying drawings in which:

FIG. 1 is a perspective view of part of decade

FIG. 2 is a schematic representation of a modification and

FIG. 3 is a detail of another modification.

In side panels of a conventional kind, not shown in the drawing, L-shaped levers 2 are pivotably mounted to swing on pins 1, 1*a*, each lever having a substantially vertical arm 3 and a substantially horizontal U-shaped arm 4. Each U-shaped arm 4 carries a key 5 displaying an indentifying character (e.g. a numeral). The deflection of the arm 3 is limited by stop members 6 formed by a crenellated member 7 which is secured in conventional manner to a framing. The bottom end of arm 3 is formed with a V-shaped notch 8. A corresponding V-shaped notch 9 is out into the member 7. A leaf spring 10 with four sharp bends constitutes a compression spring which engages each of the two notches 8 and 9. The springs thus operate to retain the levers 2 in either of two stable positions. The compression spring 10 has the effect of urging the arm 3 and hence the lever 2 into contact with either one of the two stop members 6 in the one or the other direction. The lever cannot in practice stop in any intermediate position because, on the one hand, the friction about the pins 1, 1*a* is very small and that generated in the notches 8 and 9 is negligible. The levers 2 including their pivot pins 1 and 1*a* as well as the member 7 may preferably be of plastics construction. The contacting materials in the notches 8 and 9 are therefore metal (spring) and plastics (lever 2 and member 7) so that the best possible conditions are created from the point of view of minimizing friction and wear. A locking lever 11 of substantially L-shaped form is likewise fulcrumed on the pivot pin 1 of each lever 2. Each locking lever 11 is provided roughly at the same level as the pivot pin 1 with a projection 12 and approximately vertically below the pin 1 with an abutment face 13. The extended bottom end 14 of each locking lever 11 carries a pivot pin 15 upon which a transfer disc 16 is rotatably mounted. The diameter of the transfer discs 16 is equal to the spacing of the pivot pins 1 of neighbouring keys. The abutment face 13 of each locking lever 11 cooperates with an abutment 23 on the lever 2 upon which the locking lever 11 is mounted, whereas the projection 12 of each locking lever 11 cooperates with a lateral abutment 22 on the lever 2 carrying the key for the next higher digit.

In FIG. 1 the key for numeral "5" has been depressed. Consequently, the abutment 23*a* on lever 2*a* cooperating

with the abutment face 13*a* on the locking lever 11*a* has deflected the latter anticlockwise. This deflection of the locking lever has in turn had the result of restoring the key for numeral "6" to raised position in virtue of the cooperation of the projection 12*a* with the lateral abutment 22*c* on the key lever 2*c*.

Now let is be assumed that the next key to be depressed is that for numeral "3." This results in abutment 23 striking the cooperating abutment face 13 on the locking lever 11 and deflecting the latter anticlockwise. The transfer disc 16 entrains the next transfer disc 16*b* and thus also deflects the locking lever 11*b* in the same direction. The projection 12*b* on locking lever 11*b* simultaneously raises the lateral abutment 22*a* on the lever 2*a* which is thereby restored to zero position. Assuming now that the position is as shown in FIG. 1, key "5" being in operate position, and that the key marked "6" is depressed, it will be readily understood that the lateral abutment 22*c* on the lever 2*c* will depress the projection 12*a* on the locking lever 11*a* and that the abutment face 13*a* of the locking lever 11*a* cooperating with the abutment 23*a* of the lever 2*a* will restore the latter to zero position.

The above explanations will have made clear that during normal keying operations the depression of any key will result in the previously depressed key returning to inoperate position so that only one key at a time can remain in depressed operated position. Response is quick and reliable. The resilience of the finger tip and of the plastics key lever ensure, even when the key is very slowly depressed, that the change over from inoperative to operative position and conversely is sudden, as in a snap-action tumbler switch, and that it is impossible to establish and maintain a midway dead position centre. When a deliberate attempt is made to prevent the mechanism from properly functioning the following possibilities arise.

If in the position of the keys shown in FIG. 1 the key marked "5" is raised (a possibility which can be eliminated by suitably shaping the head of the key, no value can be injected into the mechanism. If the general circuit lay-out is so devised that this position corresponds to the value "O" or that it inactivates the entire system, no faulty results can thus be produced. The depression of any key at once rectifies this position which in practice would never arise. Another possible deliberately faulty action would consist in depressing two keys simultaneously, say the two keys "0" and "9." The bistable manner in which the key levers are held and the practically complete absence of friction in the mountings should make it extremely unlikely that the two keys "0" and "9" could be simultaneously both pushed contrariwise into their dead centre position. Immediately the keys are released they would either both at once return to zero position without entraining undesirable consequences as already described, or one of the keys would snap into "0" or "9" operate position. If the dead centre position of two simultaneously depressed keys could nevertheless be successfully established and if it were desired to eliminate this possibility of deliberately faulting the mechanism, then suitable circuit arrangements could be provided which in such a dead centre position were designed to inactivate the entire system.

It is the object of these last explanations to show that, provided some precautionary arrangements are provided, even deliberate attempts to fault the apparatus can be completely guarded against. However, faulty keying, for instance by accidentally depressing two keys simultaneously, can never result in a transmission fault.

FIG. 2 represents the locking levers 11 of a complete row of keys in simplified form. The drawing reveals that the transfer disc 16 might have the form of prismatic members. Only the abutments 22 and 23 of the associated key levers 2 are shown. It will be understood that the last key for numeral "9" need not be associated with a

locking lever 11 and a transfer disc 16, since the lateral abutment 22*d* of the lever of key "9" directly operates the projection 12*d* of the lever 11*d* and operation of a digit above "9" is unnecessary.

FIG. 3 illustrates the possibility of replacing the compression spring 10 in FIG. 1 by a different type of compression spring 31 which, on the one hand, engages a notch 8 in arm 3 of lever 2, as in FIG. 1, and, on the other hand, a notch 32 in a switching member 33 made of plastics. The latter may carry one or more contacts 34 for operation with minimum friction in the manner of the switch blade of a tumbler switch.

The embodiment according to FIG. 3 further indicates one way of using the described keyboard for the generation of electrical signals by means of contacts. It will be understood that alternately low friction contact arrangements could be provided. Moreover, instead of operating electrical contacts, the keys might be arranged to control preferably light channels of capacitive or inductive pickoff devices or the like.

The described keyboard has the following advantages over keyboards known in the art:

(a) The motion transmitting members are pivoting parts, the pivoting motion being on knife-edge bearings or small diameter pivot pins;

(b) The locking, coupling or releasing members cooperate or with other parts preferably by thrust, so that substantially no sliding friction arises between the cooperating parts. The wedge-type arrangements usually adopted for these parts are avoided;

(c) The moving parts may be principally of plastic construction;

(d) If desired, the length of the switching motion can be substantially lengthened in relation to the distance the key head itself is depressed;

(e) With the aid of a spring the mounting of the L-shaped key levers is bistable.

(f) When a fresh key is depressed the return of the previously depressed key merely requires that work to be done which is needed for change-over into the other stable position ond substantially no friction or energy storage is involved.

(g) In all motion-transmitting movable parts only plastic cooperates with plastic or plastic with metal, so that the lubrication required for metal to metal can be eliminated.

(h) The small distance through which the keys must be moved during depression, the low mass of L-shaped levers and their low moments of inertia compared with keys depressed much greater distances in a linear path, and the much smaller operating effort result in an extremely noiseless action of the entire keyboard.

I claim:

1. A keyboard interlocking arrangement comprising, a plurality of successively numbered keys mounted on L-shaped key levers pivotally mounted on pins, each of said L-shaped key levers having a long arm provided with an abutment face and a shorter horizontal arm carrying a lateral abutment, spring means for engaging an end of each of said long arms operating to retain said L-shaped key lever in one of two stable positions, a deflectably mounted locking lever means carried by each of said L-shaped key levers for restoring keys directly adjacent to a depressed key to their zero position, and rotatably mounted transfer means supported by each of said deflectably mounted locking means for applying the action of their respective deflectably mounted locking means to any of said successively numbered keys depressed.

2. A keyboard interlocking arrangement as defined in claim 1, wherein each of said locking levers has a first projection adapted to cooperate with the lateral abutment on the horizontal arm of the key lever of the next higher key and a second projection adapted to cooperate with the abutment face on the long arm of the next lower key.

3. A keyboard interlocking arrangement as defined in

claim 2, wherein rotatably mounted transfer means include a member having an effective diameter equal to the spacing between the pivot pins of consecutive key levers.

4. A keyboard interlocking arrangement as defined in claim 1, including a notch in the end of said long arm, a crenellated member having a notch corresponding to said notch in said long arm, and wherein said spring means engages both of said notches in such a manner that deflection of said key lever causes said key lever to pass through a dead center position substantially mid-way between its two end positions.

5. A keyboard interlocking arrangement as defined in claim 1, wherein said spring means engages a notch in the key lever and a notch in a switch member in such a manner that the latter upon being deflected from one end position passes through a dead center position from which it snaps into another dead center position before the key lever reaches its final positions.

References Cited

UNITED STATES PATENTS

1,534,938	4/1925	Fournier et al.	235—145
2,142,862	1/1939	Skeen	235—27
2,451,090	10/1948	Johnson	235—27
3,024,988	3/1962	Wagemann	235—27

STEPHEN J. TOMSKY, *Primary Examiner.*

RICHARD B. WILKINSON, *Examiner.*

S. A. WAL, *Assistant Examiner.*