A mutual locking device establishing a mechanical interrelationship between the numerical keyboard and the operating keyboard of an electric calculating machine for preventing the commencement of an operating cycle initiated before the last of the numerical inputs has been completely entered, including means memorizing the operating input and entering the operating input immediately upon completion of the entry of the numerical input; and preventing the entry of a numerical input initiated while an operating cycle is in progress, including means for memorizing the numerical input and entering the numerical input immediately upon completion of the operating cycle.

12 Claims, 5 Drawing Figures
MUTUAL LOCKING DEVICE FOR THE KEYBOARD OF A CALCULATING MACHINE

BACKGROUND OF THE INVENTION

This invention relates to a locking device for the keyboard of an electric calculating machine and, more particularly, to a device of this kind which enables the actuation of an operating key before the numerical key with which the last digit has been set has returned to its position of rest, or the setting of a new digit before the machine has completed the processing of the numerical data previously set. With a calculating machine provided with the device in accordance with the invention, it is therefore possible to considerably increase the working speed on the keyboard of the machine.

2. Discussion of the Prior Art

As is well known the operations of an electric calculating machine are controlled by motor-actuated cams according to an automatic cycle which is started by depressing one of the operating keys of the machine. A locking device prevents the actuation of the operating keys during setting of a figure or digit on the machine, and the operation of the numerical keys during the period in which the machine is accomplishing any automatic cycle. This device normally comprises a sliding member having a projection which can be locked by the frame controlling the escapement of the setting slide or arrest holder, thereby preventing displacement of said sliding member when any numerical key is depressed. A sloping surface of the sliding member contacts with a projection of a crank handle integral with a shaft which is rotated during actuation of the operating keys and, when displacement of the sliding member is prevented by the action of the aforementioned projection, the crank and the shaft actuated by the operating keys is also prevented from rotating and, therefore, these keys cannot be depressed. Accordingly, the operating keys can be actuated only after the setting operation is completed, that is, to say after the finger which had depressed the last numerical key has released the latter, thereby allowing return of the universal frame to its position of rest.

The same locking device prevents further depression of the numerical key after an operating key has been depressed, for the whole duration of the cycle automatically accomplishing the desired calculations. In fact, upon depression of an operating key and, therefore, upon rotation of the aforementioned shaft, the projection of the crank cooperates with said sloping surface of the sliding member to displace the sliding member so as to bring it in the path of the universal frame, thereby preventing movement of the latter. Only upon completion of the cycle, can the crank be caused to rotate to thus displace the projection from the sloping surface of the sliding member and permit return of the sliding member to its position of rest, whereupon the universal frame is released. Therefore, this device permits a new setting to be effected only upon completion of the automatic cycle of the calculating machine.

The mutual locking devices for a keyboard of calculating machines of the prior art suffer, however, from some drawbacks. First of all, during setting of an amount on the keyboard, it is impossible to actuate an operating key until completion of said setting, which will take: place upon releasing of the last key of the amount set. Very skilled operators will tend to depress the operating keys, not only immediately after setting of the last digit, but even before the completion of such setting. With the locking device of the kind described, this high working speed of the operators does not result in any noticeable reduction of the overall working time of the machine, since the operating keys can be depressed only upon completion of the numerical setting operation on the keyboard.

Moreover, the duration of a cycle started by actuating an operating key, although very short, is still fairly long as compared to the setting time on the keyboard, and this duration imposes a further limitation on the attainment of high working speeds with the calculating machines. In fact, the operator will tend to carry out a new setting before completion of the machine cycle, which setting is rendered inoperable by the keyboard locking devices, which will allow depression of the numerical keys only upon completion of the automatic cycle.

SUMMARY OF THE INVENTION

In accordance with the present invention, there is provided a mutual locking device between the numerical or digit keyboard and the operating keyboard of an electric calculating or accounting machine, which obviates the disadvantages of conventional locking devices enumerated above.

The mutual locking device according to the present invention is intended for use in an electric calculating machine with reduced keyboard, wherein setting of each figure or digit is carried out by setting a stop on a slide by actuating a numerical key to displace a universal frame which controls the escapement device of the stop-holding slide of the calculating machine, and wherein actuation of the machine takes place by depressing an operating key. The mutual locking device is characterized by the fact that means are provided to prevent starting of the cycle before completion of the setting on the keyboard, and to memorize a locking signal for the numerical keys produced by depressing the operating keys.

DESCRIPTION OF THE DRAWINGS

For a better understanding of the present invention, one particular embodiment thereof will now be described, merely by way of nonlimiting example, with reference to the accompanying drawings, wherein:

FIG. 1 shows a side view of the locking device according to the present invention and its interrelationship to adjacent parts of the calculating machine;

FIG. 2 shows a detail of the device of FIG. 1, on enlarged scale;

FIG. 3 shows a plan view of a portion of the device according to the invention and, in particular, of a sliding member of said device intended for locking the universal frame which controls the escapement of the stop-holding slide, in the locking position;

FIG. 4 shows a section along the lines 4—4 of the part of the device shown in FIG. 3, and

FIG. 5 shows a section along the line 5—5 of the part of the device of FIG. 3.

DESCRIPTION OF A PREFERRED EMBODIMENT

The mutual locking device in accordance with the present invention, generally designates at 1 (FIG. 1) is shown in the drawings as applied to a calculating machine with reduced keyboard, comprising a setting or stop-holding slide, generally designated at 2, on which a number of suitable stops 3 can be set by depressing any of the numerical keys 4, by means of which a setting arm 5 is pushed to the left, as seen in the drawings. Arm 5 moves a universal frame 26, which controls the escapement device of the stop-holding slide 2, in the same direction. In other words, frame 26 moves to the left in response to the actuation of a numerical key 4. Setting slide 2 cooperates with toothed racks 6 to actuate the type wheel and the totalizer of the machine, not shown.

The locking device of the present invention essentially comprises a servomotor, which can better be seen in FIG. 2, substantially comprised of a servomotor shaft 7, a servomotor bridge 8 integral with the shaft 7, and a protruding arm 9, biased by a helical or coil spring 10 tending to cause the bridge 8 to rotate in the direction shown in the drawing when the servomotor is under load.

The upper end of an arm 11 of the bridge 8 is provided with a detent 12 adapted for cooperating with the end 13 of an actuating lever 14 pivotally mounted in 15. When the servomotor is loaded, it will take the arrangement shown in FIG. 1 and 2, that is to say the detent 12 of the arm 11 is biased, by the spring 10, against the end 13 of the operating lever 14. A coil spring 15 constantly biases upwards (i.e., toward the position
of rest) the operating lever 14, whose end 13, when the servomotor is loaded, is arrested by a projection 16 of the arm 11, adjacent to the dent 12 of said arm.

The end 17 of a second arm of the bridge 8, abuts against a cam 20, instead of the universal frame 26 in the direction of the crank 19 whose end 21 integrals with the shaft 20. Above the end 13 of the operating lever 14 a number of cooperating pins 21 is provided, each of which is integral with one of the operating or actuating keys 22 (FIG. 1). When one of the operating keys 22 is depressed, one of the pins 21 is displaced downwards against the end 13 of the operating lever 14 (FIG. 3), and the end is thus released from the dent 12. The bridge 8 will rotate by the action of the torque generated by the spring 10 and, therefore, by the projection 17 cooperating with the cam portion 18 of the crank 19, this crank also is caused to rotate in the direction of the arrow shown in the drawing. In other words, bridge 8 moves in response to the actuation of an operating key 22.

The crank 19 is integral through the crankshaft 20, with a stop lever 23 provided with an end detent 24 adapted for cooperating with a cam portion 25 formed on the inner side (i.e., the left-hand side, as seen in FIG. 2) of the universal frame 26 which controls the escapement device of the stopholding frame. The cam portion 25 essentially comprises a pair of straight sections 27, disposed perpendicularly to the direction of movement of said frame and connected to one another by a slope portion 28. Therefore, upon actuation of the servomotor and simultaneously with the depression of a numerical key, the crank 19 will cause the stop lever 23 to rotate, and this lever will bring the end stop 24 to abut, first, against the upper cam section 27, then against the slope section 28 and, finally, against the lower section 27, until the lever comes to rest at the bottom of the cam. In correspondence with this final position of the lever 23, means integral with the shaft 20 will start the cycle.

Further, a slider 29 (FIG. 3) cooperates with the universal frame 26. Slider 29 is movable in a direction essentially perpendicular to the direction of movement of the universal frame 26. The slider 29 is brought back to its position of rest, to the left as seen in FIG. 3, by a coil spring 30 and is pushed to the right by the action of a crank 31 integral with the crankshaft 20 described above, and provided with a projection 32 which is adapted to cooperate with a sloping surface 33 provided on an arm 34 of the slider 29. Since the shaft 20, as already stated, is integral with the crank 19 (FIG. 2), at the end of the stroke 24 of the crank 19, where the end stop 24 reaches the end of its stroke, the projection 32 of the crank 31, by cooperating with the sloping surface 33, will move the slider 29 to the right hand, or locked, position.

At the end of the slider 29, in the right-hand side of FIG. 3, a crank 36 is pivotally mounted on a pin 34 at one end thereof. At its opposite end, crank 36 is hinged to the machine casing by means of a pin 37. The crank 36 comprises a head 38, of essentially rectangular shape. A small plate 39, also of substantially rectangular shape and provided with an elongated aperture, is adapted to be displaced relative to the head 38. The plate 39 is resiliently restrained to the crank 36 by a coil spring 41 and is guided relative to the head 38 of said crank, besides by the pin 34, by means of a further pin 42 cooperating in a corresponding slot of the head 38.

With such an arrangement, the plate 39, upon striking against the face 43 of the universal frame 26, in a manner to be described below, will be resiliently displaced relative to the head 38, thereby allowing the frame 26 to occupy the position which, as shown in FIG. 3, is occupied by the end of plate 39. When, instead, the universal frame 26 is in its position of rest (shown in FIG. 3) and the slider 29 has reached the end of its stroke to the right, the plate 39 will act as a stop for the movement of the universal frame 26, which movement allows setting a figure or digit on the slide of the calculating machine under the action of one of the numerical keys.

With the portion 18 of the crank 19 which is pivotally mounted to the left, as seen in FIG. 3, to return to its position of rest, upon rotation of the crank 31 the crank 36 will be pivotally directed in the drawing, and the face of the plate 39 which in FIG. 3 is facing towards the cam portion 25 (FIG. 5) of the universal frame, will be also caused to rotate, thereby varying the angle it forms with the axis of said frame (which formerly was of 90°) and taking an essentially sloping position relative to the direction of movement of the universal frame. In these conditions, when by depressing one of the numerical keys an axial force is exerted tending to displace the universal frame 26 (upwards, as seen in FIG. 3), said frame will apply to the aforementioned face of the plate 39 a force which, on account of the new inclination taken by the plate, will have a component different from zero in the direction of movement of the slider 29, which component will therefore tend to displace said slider to the left, as seen in FIG. 3, as a result of the bias exerted by the coil spring 30.

The operation of the mutual locking device for the keyboard of a calculating machine described above is as follows.

The crankshaft 20 (FIG. 2), upon completion of the machine cycle, will have been rotated in the direction opposite to that indicated by the arrow shown on the crank 19, thereby loading the servomotor of FIG. 2. This rotation of the shaft 20 is normally accomplished by means of a slider 44 (FIG. 1), whose end, as seen at the bottom of FIG. 1, is coupled with a crank integral with the shaft 20. The opposite end of the crank is connected with levers cooperating with the cams provided on the main shaft of the machine and by which control the various operations of the machine, carried out during the aforementioned cycle.

Assume now to depress one of the numerical keys 4 (FIG. 1) and, simultaneously, one of the operating keys 22. Then, by the action of the small pins 21 the end 11 of the actuating lever 14 will be disengaged from the dent 12 of the arm 11 of bridge 8, thereby causing rotation of crank 19. Simultaneously, the universal frame 26 has been displaced to the left, as seen in FIG. 2, i.e., to the position shown in broken lines in said figure. The end detent 24 of the lever 23 will thus come into engagement with a point of the cam portion 25 of the frame 26. The shape of this cam portion and its relative position with respect to the end detent 24 are chosen in such a manner that detent 24 will come to rest at the intersection of the upper section 27 with the slope section 28. In this position of the frame 26, the figure or digit will already have been set on the slide of the calculating machine and, since the end detent 24 cannot lift the frame 26, the small pins 21 attached to said frame will engage in the dovetail slots of the frame 26. In this position, the cycle of the machine corresponding to the operating key previously depressed will not have been started. As soon as the numerical key which has determined the displacement of the frame 26 is released, frame 26 will be brought back to its position of rest, by the action of the end detent 24 cooperating with the slope section 28 of the cam portion 25, thereby allowing the lever 23 to reach its end-of-stroke position, in correspondence of which the machine cycle is started.

With the arrangement described, it is therefore possible to actuate the operating key even before the numerical key, with which the last digit has been set, has returned to its position of rest, with the result that the setting of this digit will always precede the starting of the machine cycle. In other words, the locking device, although allowing the machine to receive the two orders (i.e., the orders of setting and starting of the cycle), gives the priority to the first of these orders. In this manner, upon completion of the setting operation, the operator can immediately actuate the operating keys to set the machine for the subsequent stage, with the advantage of operating on the keyboard with a considerably high speed.

During rotation of the cam 31 (FIG. 3) which, by means of the crankshaft 20, is made integral with the cam 19, the slider 29 is also displaced to the right, as seen in FIG. 3. Since simultaneously with the actuation of the numerical keys, the universal frame 26 will also be displaced upwards, plate 39 will come into engagement with the face 43 of the frame 26 when the slider 29 has reached its end-of-stroke position to the right, as
seen in FIG. 3. In this configuration, the universal frame 26 will not be locked but will become locked upon reaching its position of rest (as shown in FIG. 3) by the action of the lever 23 (FIG. 1). In fact, the end of plate 39, during its displacement to reach the position of rest (which displacement takes place in a downward direction in FIG. 3), being released from the face 43 of the frame 26, will snap forward ahead of said frame, as shown in FIG. 3 and 5. From now on, it will be no longer possible to set another digit, in fact, upon attainment of the rest position of the frame 26, also the lever will reach the end of its stroke whereupon, as stated above, the cycle is started. By the end of the cycle, the shaft 20 will be caused to rotate in a direction such as to reload the servomotor 1, thereby starting a new cycle.

Before completion of any cycle, i.e., when the rotation of the crankshaft 20 in the direction opposite to that indicated by the arrow (FIG. 2) is approaching its end, the projection 32 of the crank 31 (FIG. 3), by coacting with the sloping surface 33, will allow a slight return movement of the slider 29 to the left, as seen in FIG. 3. This allows crank 36 to rotate slightly, establishing plate 39 at a slight angle. Thereby, depressing one of the numerical keys will produce a slight displacement of the universal frame 26 upwards (as seen in FIG. 3). This displacement can increase as the rotation of the crankshaft 20 proceeds and will be considerably assisted by the fact that, in these conditions, the force applied by the universal frame to the small plate 39 will admit a component whose direction corresponds to the direction of displacement of the slider 29, displacing plate 39 against the force of spring 41 with respect to crank 36.

In this manner, it will be possible to accomplish setting of a digit or figure before completion of a cycle proper with the advantage of attaining a more rapid actuation of the calculating machine.

It is apparent that many modifications and variations can be introduced in the embodiment of the present invention described above, concerning both the shape and the arrangement of the various parts and components, without departing from the scope of the invention.

I claim:
1. An electric calculating machine wherein a numerical entry is placed into said machine by actuating a numerical key that simultaneously displaces from a set position a universal frame which controls the escapement mechanism of a numerical slide and said numerical entry is completed upon receipt of said numerical entry by a stop on said numerical slide, and wherein an operating cycle entry is placed into said machine by actuating an operating key and said operating cycle enters are received upon receipt of said operating cycle entry by an operating mechanism, a mutual locking device establishing a mechanical interrelationship between the numerical keyboard and the operating keyboard comprising operating cycle locking and memorizing means for preventing said operating cycle entry from being received by said operating cycle mechanism if said operating key is actuated which said universal frame is displaced, and for memorizing said operating cycle entry if said operating cycle entry is so prevented from being received.
2. An electric calculating machine according to claim 1 wherein said mutual locking device further comprises numerical entry locking and memorizing means for preventing said numerical entry from being received by said numerical slide until a predetermined point is reached in said operating cycle has been achieved if said numerical key is actuated while said operating cycle is in progress, and for memorizing said numerical entry if said numerical entry is so prevented from being received.
3. An electric calculating machine according to claim 1, wherein said operating cycle locking and memorizing means comprises a stop lever moveable between a rest position and an operating position and biased toward said operating position, said stop lever being operatively connected to said operating mechanism to prevent receipt of said operating entry by said operating mechanism until said stop lever achieves said operating position, means holding said stop lever in said rest position until said operating key is actuated whereupon said stop lever is released to move toward said operating position, and said means holding said stop lever short of said operating position which said universal frame is displaced, whereby said operating entry is not received by said operating mechanism until said universal frame has returned to said set position after displacement.
4. An electric calculating machine according to claim 3, wherein said stop lever is fixedly mounted upon a shaft operatively connected to and controlling the commencement of said operating cycle and is pivotally moveable with said shaft between said rest position and said operating position, and wherein said cam has an upwardly inclined surface for engaging said stop lever at any point in said displacement of said universal frame, whereby said universal frame returns to said set position said cam surface is withdrawn to allow said stop lever to achieve said operating position.
5. An electric calculating machine according to claim 3 wherein said mutual locking device further comprises numerical entry locking and memorizing means for preventing said numerical entry from being received by said numerical slide until a predetermined point in said operating cycle has been achieved if said numerical key is actuated while said operating cycle is in progress, and for memorizing said numerical entry if said numerical entry is so prevented from being received.
6. An electric calculating machine according to claim 5 wherein said numerical entry locking and memorizing means comprises means for preventing displacement of said universal frame when said operating cycle is in progress until said predetermined point in said operating cycle is achieved, said means for preventing displacement being operated by said shaft.
7. An electric calculating machine according to claim 6 wherein said means for preventing displacement of said universal frame comprises an operating slide moveable between an unlocked position and a locking position and biased toward said unlocked position, said operating slide being moveable toward said locking position by said shaft, and a locking plate mounted on said operating slide and moveable therewith to engage said universal frame when said slide is in said locking position.
8. An electric calculating machine according to claim 7 wherein said locking plate is moveable with respect to said operating slide from said locking position and is biased toward said locking position, wherein said universal frame includes a slide surface for engagement by said locking plate, whereby if said universal frame is already displaced when said operating slide moves to said locking position, said plate will engage and slide upon said slide surface and by action of said bias will move to said locking position upon return of said universal frame to said set position.
9. An electric calculating machine according to claim 8 wherein said locking plate when in said locking position engages said cam surface, and said slide surface is upon the side of said cam adjacent said cam surface.
10. An electric calculating machine according to claim 9 wherein said operating slide is moveable from said locking position toward said unlocked position by action of said shaft and said bias at a predetermined point in said operating cycle, and wherein said plate is moveable longitudinally with respect to said operating slide and is further attached to and pivotable with a crank having a pivot axis fixed with respect to said operating slide whereby when said operating slide moves slightly toward said unlocked position said plate is pivoted slightly to allow a small displacement of said universal frame if said numerical key has already been depressed, thus allowing displacement of said universal frame prior to the completion of said operating cycle.
11. An electric calculating machine in accordance with claim 10 wherein said operating slide is operated by a projec-
tion carried by said shaft and cooperating with a sloping surface carried by said operating shaft, said projection being of such configuration as to allow said operating slide to move slightly from said locking position toward said unlocked position at a predetermined point near the end of said operating cycle.

12. An interlocking device for an electric calculating machine having a 10 key keyboard and a set of operating keys, wherein an amount is set up, order by order, on a stop pin carriage upon depressing a corresponding numerical key and a universal member is displaced by the depressed numerical key to operate an escapement device of said carriage, and wherein the actuation of the machine is effected by a cycle started by a spring-loaded motor released upon depressing an operating key, wherein the improvement comprises means conditioned by said universal member when so displaced to prevent said spring-loaded motor from starting a machine cycle until the member is released by the corresponding numerical key, said spring-loaded motor being reloaded by the machine near the end of each cycle, latching means being provided to prevent said member from being actuated by a corresponding numerical key until the spring-actuated motor is reloaded.

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