Dec. 20, 1955 H. HEINDORFF 2,727,689

TEN DIGIT KEYBOARD FOR CALCULATING MACHINE

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Fig. 1

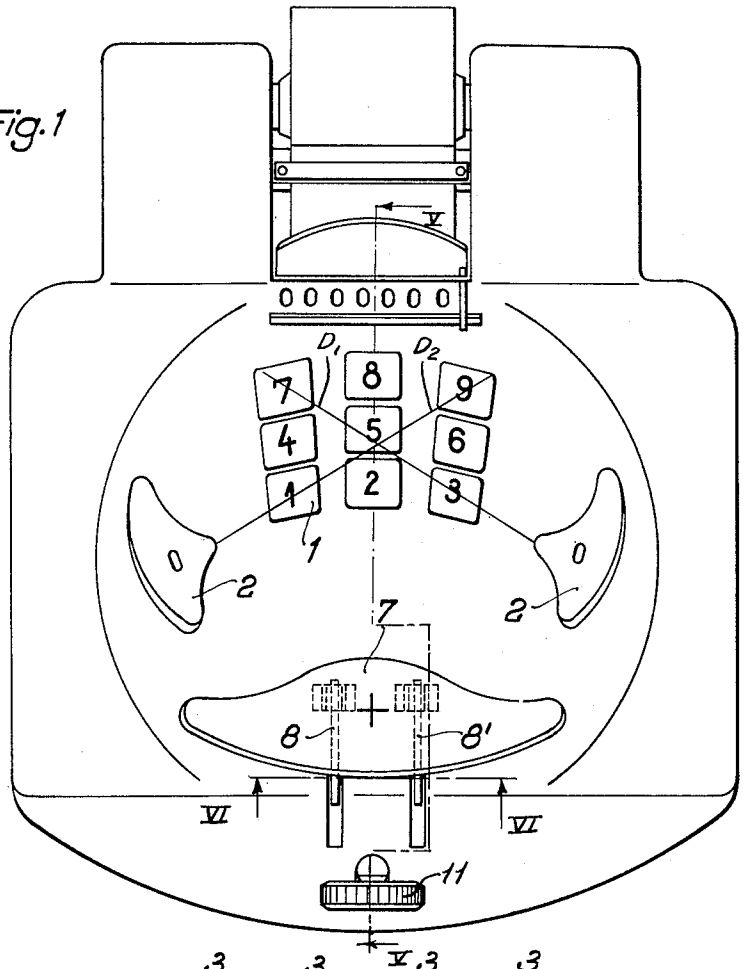

Fig. 3

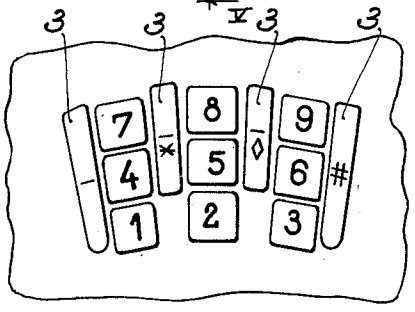

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Fig. 2

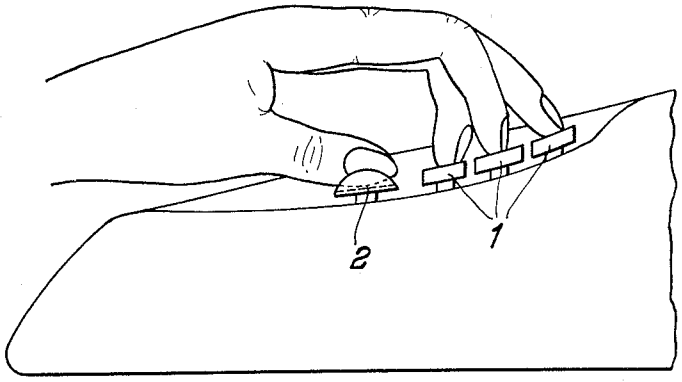
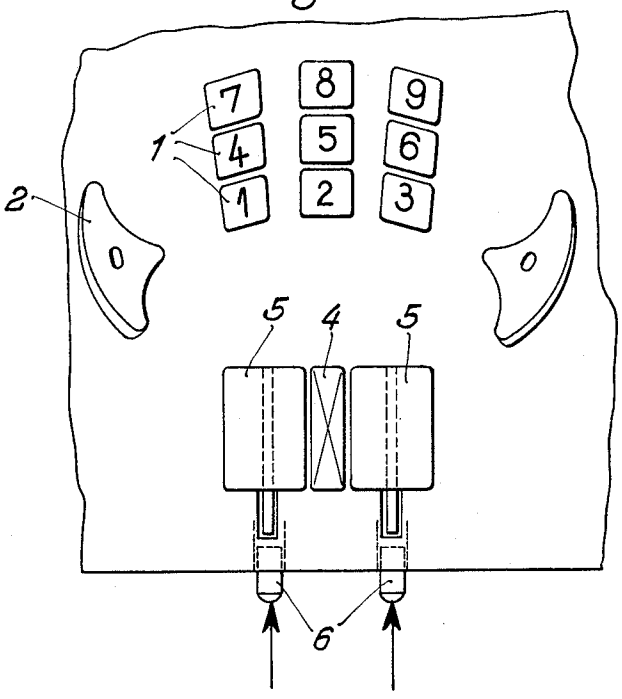


Fig. 4



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TEN DIGIT KEYBOARD FOR CALCULATING MACHINE

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Fig. 5

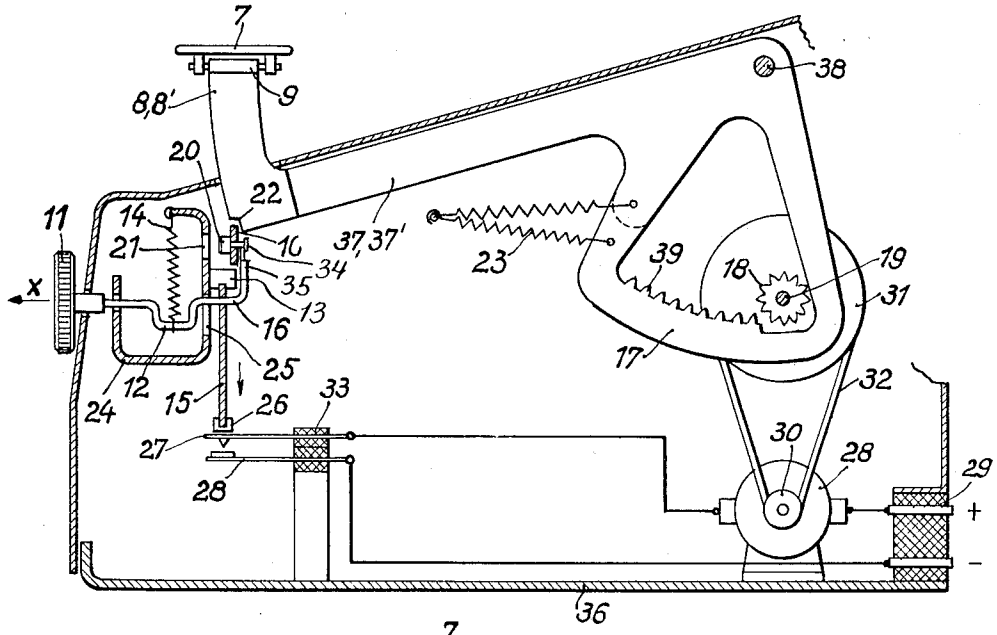
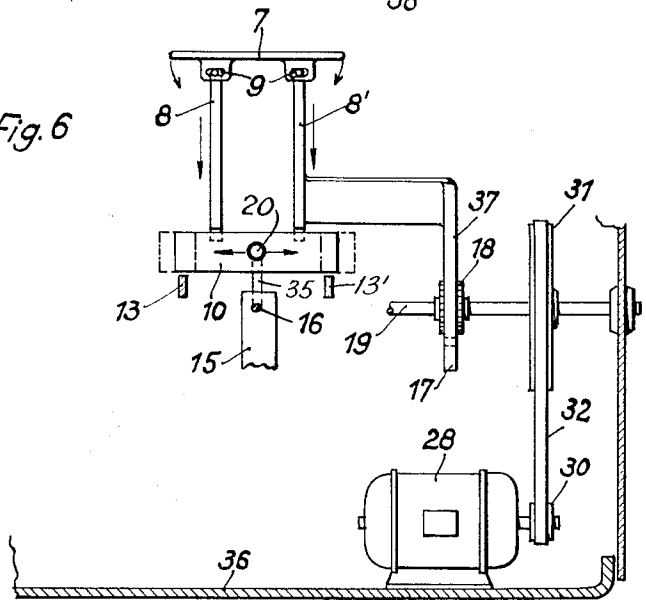


Fig. 6



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TEN DIGIT KEYBOARD FOR CALCULATING MACHINE

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Application January 21, 1953, Serial No. 332,159

Claims priority, application Germany January 18, 1952

10 Claims. (Cl. 235—145)

This invention relates to certain improvements in calculating machines and has special reference to the arrangement of the keys in the key board or bank of keys of a ten-digit keyboard for adding or calculating machines.

It is an object of the present invention to arrange the keys in such a manner that free and unconstrained selective operation is possible by the right or left hand from the same initial position of the hand corresponding to the natural movements of the fingers with a high degree of safety and with a minimum of effort.

Another object of the invention is to facilitate the change from motor to manual drive and vice versa.

With these and further objects in view, according to the present invention the value setting keys and advantageously also the function or mode of operation keys are arranged in a symmetrical order on both sides of the bisecting line of the bank of keys or of the key board, using the double number of the keys or key to be operated by the thumb, said keys to be provided symmetrically to the bisecting line on both sides of the bank of keys.

In this arrangement the columnar or vertical rows of the value setting keys of the bank of keys lying behind each other, except for a columnar row possibly disposed in the bisecting line of the bank of keys, form angles with this bisecting line which correspond to the spreading angles of the fingers of the human hand.

Since in spreading the fingers the finger ends diverge or go outwards and are simultaneously lifted while they converge and are simultaneously lowered when being bent, the horizontal rows of the value setting keys are arranged in steps from the front to the rear corresponding to the different level of the finger ends when reaching the horizontal rows, so as to permit free unconstrained working when setting the keys.

In order to facilitate the finding of the due position of the hand and of the fingers in the so-called "blind keying," upwardly projecting studs may be arranged between the columnar rows, or also at the sides of the bank of value setting keys, which studs may also form the heads of function keys.

The remaining numeral key or keys (0 or 0 and 9) may be arranged in the bank of keys on both sides of the value setting keys arranged in three rows or in two rows, and of the function keys, if any, in such a manner that said remaining key or keys is or are provided in duplicate and displaced to the front so that either of each pair of duplicate keys is always disposed below the thumb when actuating the bank of keys by the hand.

Other and further objects, features and advantages of the invention will be pointed out hereinafter and appear in the appended claims forming part of the application.

In the accompanying drawings several now preferred embodiments of the invention are shown by way of illustration and not by way of limitation.

Fig. 1 is a top plan view of a key board of a ten-digit-key adding and calculating machine, having the invention applied thereto,

Fig. 2 is a side view thereof, indicating the position of the fingers,

Fig. 3 is a fragmentary plan view similar to Fig. 1, with additional upwardly projecting studs,

Fig. 4 is a fragmentary plan view similar to Fig. 1, with an additional hand rest,

Fig. 5 is a fragmentary vertical section, taken along the line V—V of Fig. 1, on a larger scale, and

Fig. 6 is a fragmentary vertical section along line VI—VI of Fig. 1.

Similar reference numerals denote similar parts in the different views.

Referring now to the drawings in greater detail, and first to Fig. 1, it will be seen that nine value setting keys are arranged in three rows and columns lying behind one another on the key board of a ten-digit-key adding and calculating machine. The central column of the value setting keys bearing the marks **2, 5, 8** respectively is arranged in the bisecting line of the key board. The lateral columns with the marks **1, 4, 7** or **3, 6, 9**, respectively, are disposed symmetrically to the bisecting line of the key board. The value setting keys **1—9** are arranged substantially in a rectangular configuration having two diagonals D_1 and D_2. The zero key is provided in duplicate and constituted by a pair of keys **2, 2**, one of which is arranged on the right and the other on the left hand side of, and symmetrically to, the bisecting line of the bank of value setting keys **1**, so that the keys **2** can be selectively operated by the thumb of either the right or the left hand, as the case may be. The lateral vertical or columnar rows of the bank of value setting keys **1** form angles with the bisecting line of the bank of keys, which angles correspond to the spreading angles of the fingers. As will be seen from Fig. 1 the productions of the diagonals D_1 and D_2 are directed toward the thumb operated zero keys **2**.

Moreover, the horizontal triple rows, as indicated in Fig. 2, are arranged in steps from the front to the rear, i. e. corresponding to the various positions taken up by the finger ends when spreading the fingers. The figure also shows the operation of the zero key **2** by the thumb of the left hand.

As shown in Fig. 3, upwardly projecting studs **3** are provided between the vertical or columnar rows of keys and laterally beside the same; said studs may either form stationary guide strips or they may constitute the heads of function keys.

Said studs **3** are disposed symmetrically to the bisecting line of the key board, the angles formed between the studs and the bisecting line also corresponding to the spreading angles of the human hand.

Instead of being arranged in three rows of three keys each, as shown in Fig. 1, the keys by way of alternative may be arranged in two rows of four keys each. In the latter case the remaining keys, for instance for the 0 and 9, must be arranged on both sides of the bank of keys in duplicate, so that either of the duplicate keys is within reach of the thumb of the operating hand.

It is advantageous to arrange in the bisecting line of the bank of keys, in front of the same, a rest **4** for the operating hand which rest is spaced from the bank of keys in a forward and upward direction in such a way that it is disposed in an unconstrained operating position for supporting the wrist of either of the hands to be used alternatively.

In addition to said wrist support **4** for the operating hand there may be provided, according to Fig. 4, two motor actuating keys **5** which are to be operated by the outer ball of the hand. Consequently, always the motor actuating key **5** located below the thick part of the thumb has to be locked against depression so as to prevent inadvertent depression of a "0" when depressing the motor

actuating key or vice versa. This locking can be effected by inward pressing of a push button 6.

It is preferred to substitute the two motor actuating keys 5 and the wrist support by a touch plate 7, Fig. 1, which is carried by two key shanks 8, 8', Fig. 5, and connected thereto by joints 9, Figs. 5 and 6, whereby it is possible to tilt the touch plate 7. The key shanks constitute extensions of levers 37, 37' pivoted at 38, Fig. 5.

The lock for the touch plate 7 can be formed by a parallelly shiftable locking bar 10 which can be selectively shifted to the left or to the right by a hand wheel 11 through a shaft 16 having a crank 12. Arranged below said locking bar 10 are two stationary stops 13, 13' forming abutments for the two ends of the locking bar 10. The crank 12 is acted upon by a spring 14 by which the end positions of the shaft 16 and so of the locking bar 10 are determined. The shaft 16 passes through a bore in a slide or switch bar 15 by which the motor circuit can be closed or opened as will be hereinafter described. The left hand part of shaft 16, Fig. 5, is mounted for rotation in a stationary part 24 of the machine, while the right hand part is vertically shiftable and rotatable in a vertical longitudinal slot 25 of part 24.

By turning the hand wheel 11 to the right the locking bar 10 is also shifted to the right, through engagement of a pin 34 of bar 10 in the bifurcated end of an arm 35 of shaft 16, into the position shown in Fig. 6 in dotted lines. In this position the right hand key shaft 8 of the touch plate 7 is locked against depression by engagement of the lower edge of locking bar 10 with the stationary abutment or stop 13'. In this position the touch plate 7 can be depressed only by the outer ball of the left hand, since the locking bar 10 is able to pass by the left hand stop 13 and to take the slide 15 with it. As a result, the closed lower end of slide 15 which is provided with an insulating cap 26, will depress a contact spring 27 whereby contact is made between contact spring 27 and contact spring 28 mounted in an insulating holder 33 on the base plate 36 of the machine, and a driving motor 28 also mounted on the base plate 36 will be connected to its source of current 29, whereby the main shaft 19 of the machine is driven through a pair of pulleys 30, 31, and a conical or V-belt 32.

If the hand wheel 11 is turned to the left, the left hand shank 8 will be locked and the right hand shank 8' will be released. The locking bar 10 in this case is moved into the position marked in Fig. 6 by dot and dash lines.

As shown in Fig. 5, the key shanks 8, 8' of the tiltable touch plate 7 or their levers 37, 37' may be connected to a segment 17 having an inner series of teeth 39 adapted to mesh with a pinion 18 fixedly mounted on the main shaft 19 of the calculating machine, whereby the latter can be operated also by hand, against action of a return spring 23 and/or during the return stroke caused by said spring. To this end, it is merely necessary to move the shaft 16 in the direction of arrow x, Fig. 5, by drawing out the hand wheel 11, to such an extent that a locking pin 20 provided on the locking bar 10 is permitted to engage in an opening 21 of the stationary part 24 of the machine, whereby the locking bar 10 is moved out of the reach of recesses 22 on the key shanks 8. By engagement of the locking pin 20 in the opening 21 of part 24 the crank shaft 16 is locked in position. Moreover, both of the key shafts 8, 8' can now be depressed simultaneously by depression of the touch plate 7 through the wrist of the hand, whereby the main shaft 19 of the machine is rotated through the driving segment 17, as hereinbefore described. By pushing the hand wheel 11 back into the casing of the machine, this manual drive of the calculating machine can be locked and simultaneously the motor can be switched in again by tilting the touch plate 7, as hereinbefore described.

While the invention has been described in detail with respect to certain now preferred examples and embodiments of the invention it will be understood by those skilled in the art after understanding the invention that various changes and modifications may be made without departing from the spirit and scope of the invention and it is intended, therefore, to cover all such changes and modifications in the appended claims.

I claim:

1. In a ten-digit-key adding and calculating machine a key board comprising value setting key means arranged in a columnar order symmetrically to the bisecting line of the bank of keys, the thumb-operated key means being provided in duplicate on both sides of the bank of keys, symmetrically to said bisecting line, a support for the wrist of the operating hand arranged in the line of symmetry of the bank of keys, in front of the same, said support being spaced from the bank of keys by such an amount, in a forward and upward direction, that it permits support of the hand in an unconstrained operational position thereof, a driving motor, and a pair of motor actuating keys symmetrically provided on both sides of the support for operation of either motor actuating key through the outer ball of the hand, by tilting of the hand.

2. In a ten-digit-key adding and calculating machine a key board comprising value setting key means arranged in a columnar order symmetrically to the bisecting line of the bank of keys, the thumb-operated key means being provided in duplicate on both sides of the bank of keys, symmetrically to said bisecting line, a support for the wrist of the operating hand arranged in the line of symmetry of the bank of keys, in front of the same, said support being spaced from the bank of keys by such an amount, in a forward and upward direction, that it permits support of the hand in an unconstrained operational position thereof, a driving motor, and a pair of motor actuating keys symmetrically provided on both sides of the support in such a way that either of said actuating keys in case of the natural position of the right or left hand is disposed under the outer ball of the hand, for operation of the respective key by tilting of the hand, and means for selectively locking the other of said motor actuating keys against depression.

3. In a ten-digit-key adding and calculating machine a key board comprising value setting key means arranged in a columnar order symmetrically to the bisecting line of the bank of keys, the thumb-operated key means being provided in duplicate on both sides of the bank of keys, symmetrically to said bisecting line, a touch plate spaced from the bank of keys by such an amount, in a forward and upward direction, that it is adapted to form a support for the hand in an unconstrained operational position thereof, and a pair of motor circuit closing members symmetrically provided on both sides of the bisecting line of the bank of keys and jointed to the underside of said touch plate, for operation of either of said members by tilting of the touch plate.

4. In a ten-digit-key adding and calculating machine a main shaft, a key board comprising value setting key means arranged in a columnar order symmetrically to the bisecting line of the bank of keys, the thumb-operated key means being provided in duplicate on both sides of the bank of keys, symmetrically to said bisecting line, a driving motor, a touch plate spaced from the bank of keys by such an amount, in a forward and upward direction, that it is adapted to form a support for the hand in an unconstrained operational position thereof, a pair of motor circuit closing members symmetrically provided on both sides of the bisecting line of the bank of keys and jointed to the underside of said touch plate, for operation of either of said members by tilting of the touch plate, means for manual driving of the main shaft, means for operating said manual driving means by a deep depression of the touch plate, and adjustable coupling means adapted to be selectively moved into one position for transmitting depression movement of the touch plate to the motor circuit closing members and into a second position for transmitting such depression movement to the manual driving

means, for selective motor or manual drive of the machine.

5. In a ten-digit-key adding and calculating machine, a key-board comprising a bank of value setting keys arranged symmetrically to the bisecting line of the key-board, said value setting keys being arranged substantially in a rectangular configuration having two diagonals, and thumb-operated zero keys in duplicate at opposite sides of the bank of keys, symmetrically to said bisecting line, the productions of said diagonals being directed toward said thumb-operated zero keys.

6. In a ten-digit-key adding and calculating machine, a key-board comprising a set of value setting keys arranged symmetrically to the bisecting line of said key-board, said value setting keys being arranged substantially in a rectangular configuration having two diagonals, a set of function keys each set being arranged symmetrically to the bisecting line of the bank of keys and at least partly so as to separate the columns of said value setting keys from one another, and thumb-operated duplicate zero keys arranged in duplicate at opposite sides of the bank of value setting keys, symmetrically to said bisecting line so that the extended diagonals of the numeral keyboard point to the zero keys.

7. In a ten-digit-key adding and calculating machine, a keyboard comprising value setting key means arranged in a columnar order symmetrically to the bisecting line of the bank of keys, said value setting key means being arranged substantially in a rectangular configuration having two diagonals, and thumb-operated key means arranged in duplicate at opposite sides of the bank of value setting key means symmetrically to said bisecting line and to the columnar rows of the bank of keys, except for a columnar row disposed in the bisecting line, forming with said bisecting line angles corresponding to the spreading angles of the fingers of the human hand, the productions of said diagonals being directed toward said thumb-operated key means.

8. In a ten-digit-key adding and calculating machine, a keyboard comprising a bank of value setting keys, arranged in columnar and horizontal rows symmetrically to the bisecting line of said bank, the horizontal rows being arranged in steps from front to rear, corresponding to the different heights taken up by the finger ends when the fingers are spread, said value setting keys being arranged substantially in a rectangular configuration having two diagonals, and thumb-operated keys in duplicate at opposite sides of the bank of keys, symmetrically to said bisecting line, the productions of said diagonals being directed toward said thumb-operated keys.

9. In a ten-digit-key adding and calculating machine, a keyboard comprising a bank of value setting keys arranged in a columnar order symmetrically to the bisecting line of the bank of keys, said value setting keys being arranged substantially in a rectangular configuration having two diagonals, thumb-operated keys in duplicate at opposite sides of the bank of keys, symmetrically to said bisecting line, the productions of said diagonals being directed toward said thumb-operated keys, and upwardly projecting studs adjacent to at least a part of the lateral faces of the value setting keys.

10. In a ten-digit-key adding and calculating machine, a keyboard comprising a bank of value setting keys arranged substantially in a rectangular configuration having two diagonals, a plurality of function keys arranged in a columnar order symmetrically to the bisecting line of the bank of keys, thumb-operated keys provided in duplicate at opposite sides of the bank of keys, symmetrically to said bisecting line, the productions of said diagonals being directed toward said thumb-operated keys, and upwardly projecting studs adjacent to at least a part of the lateral faces of the value setting keys, said studs forming the heads of said function keys.

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