Oct. 25, 1949. B. CARLSTROM ET AL 2,485,695

KEY INTERLOCK

Filed April 27, 1944 4 Sheets-Sheet 1

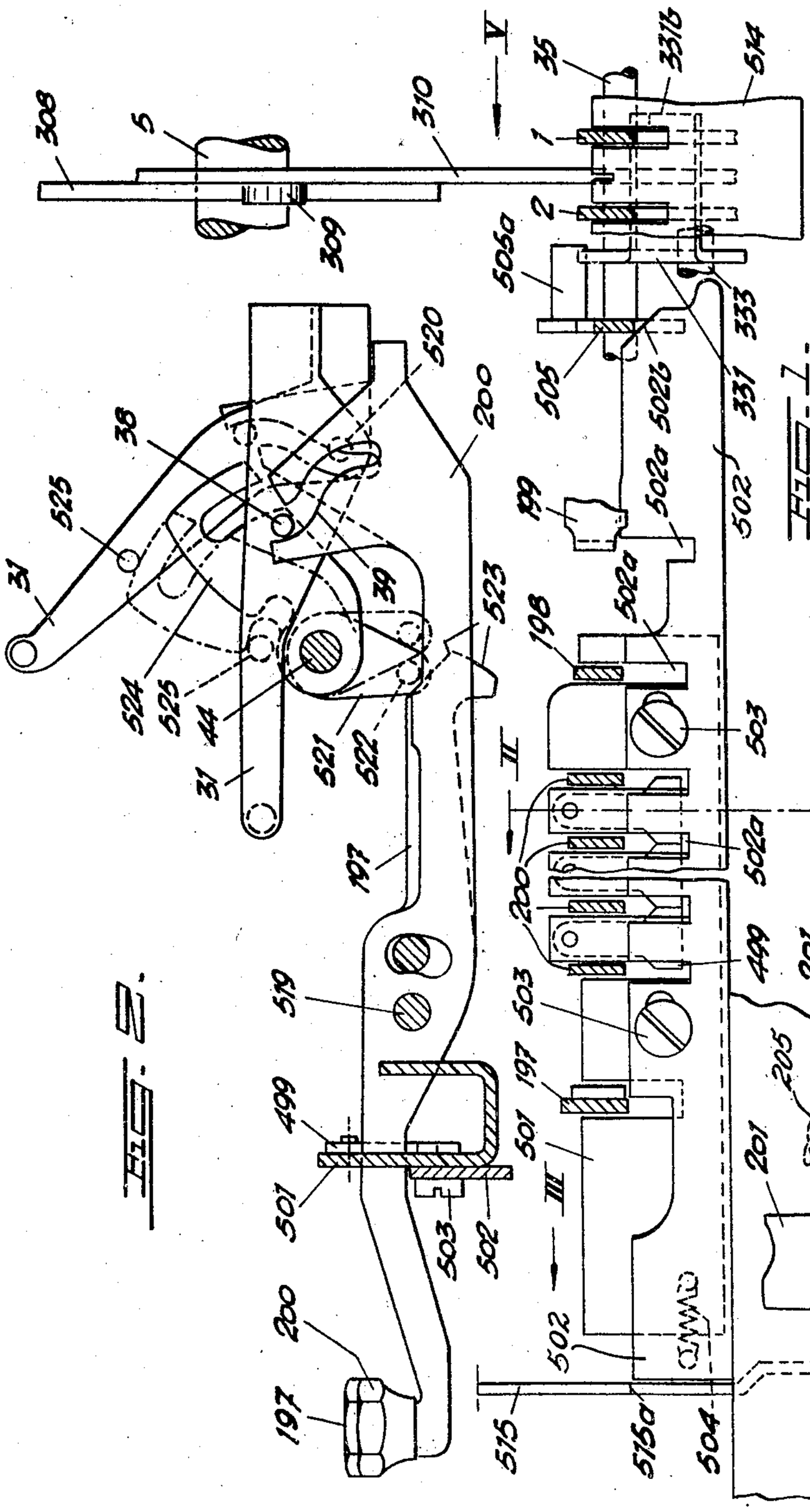

FIG. 2.

FIG. 1.

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KEY INTERLOCK

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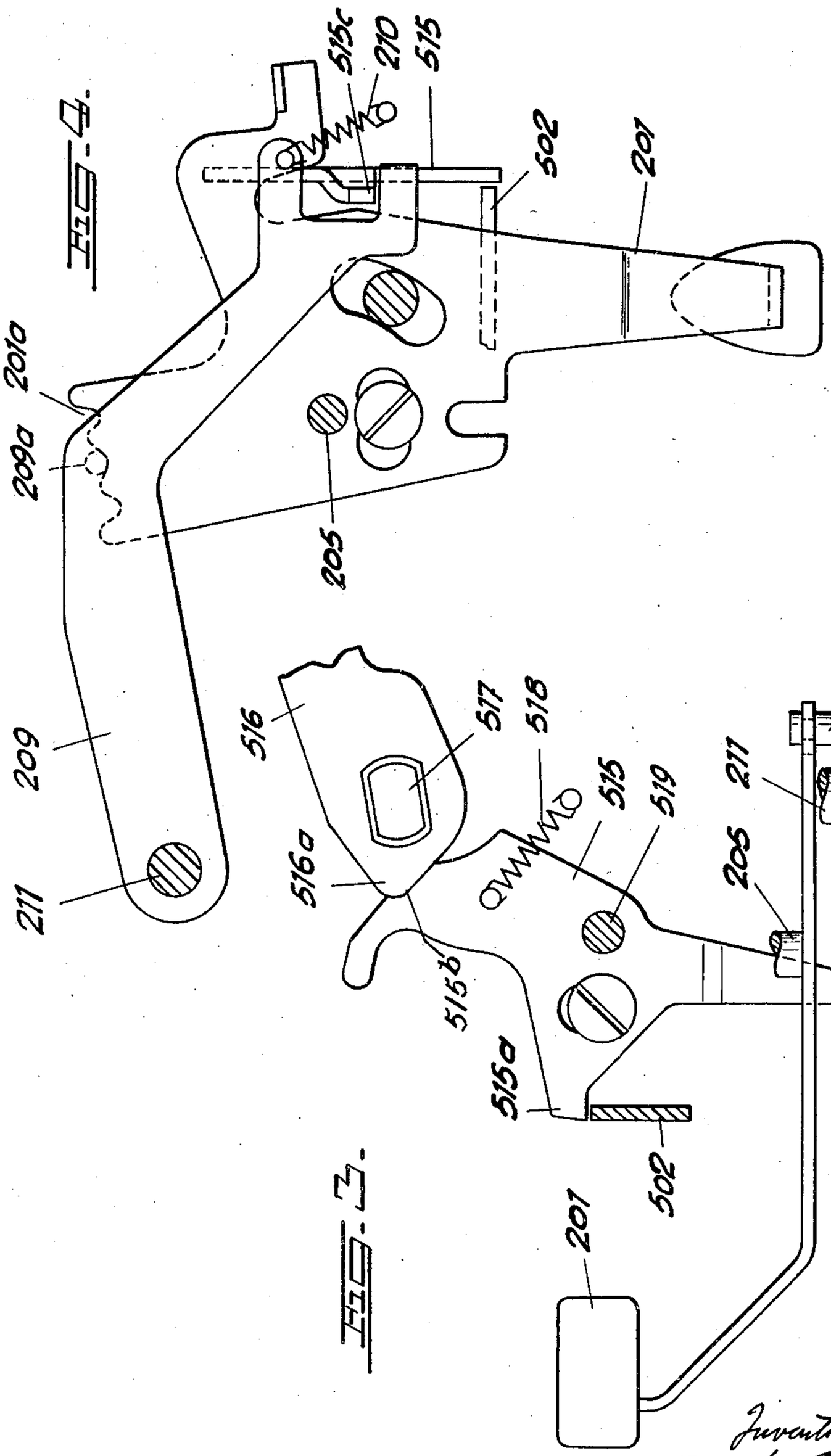

FIG. 4.

FIG. 3.

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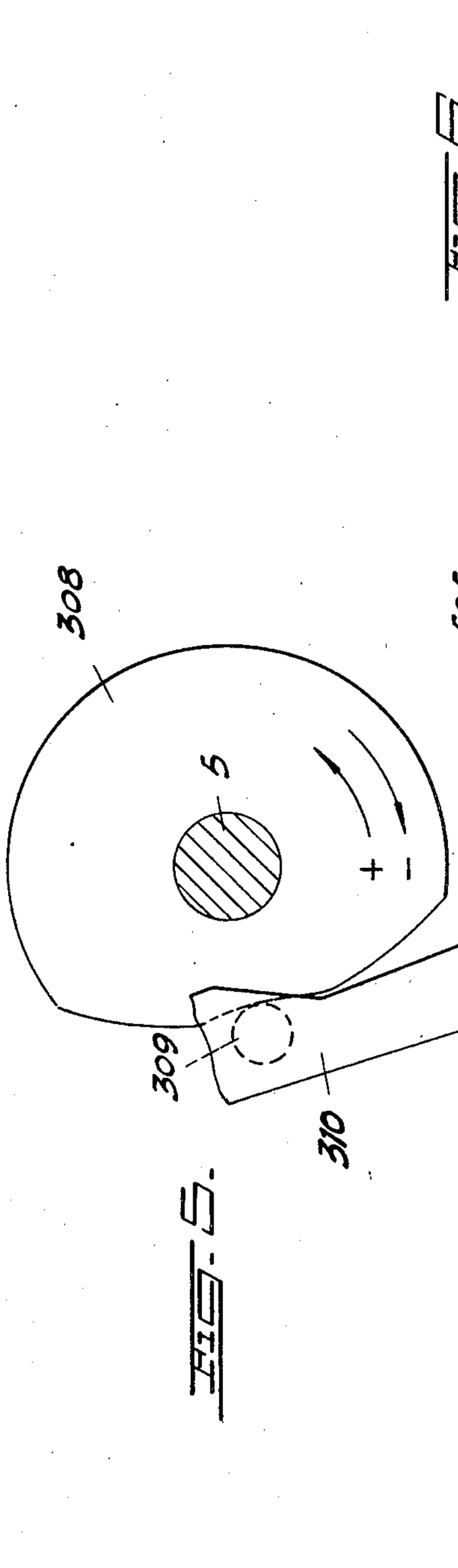

FIG. 5.

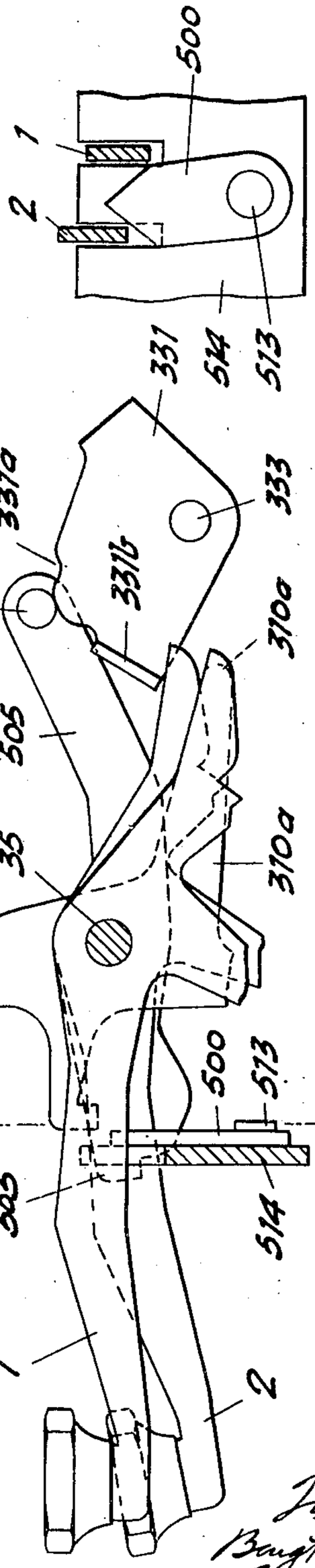

FIG. 6.

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KEY INTERLOCK

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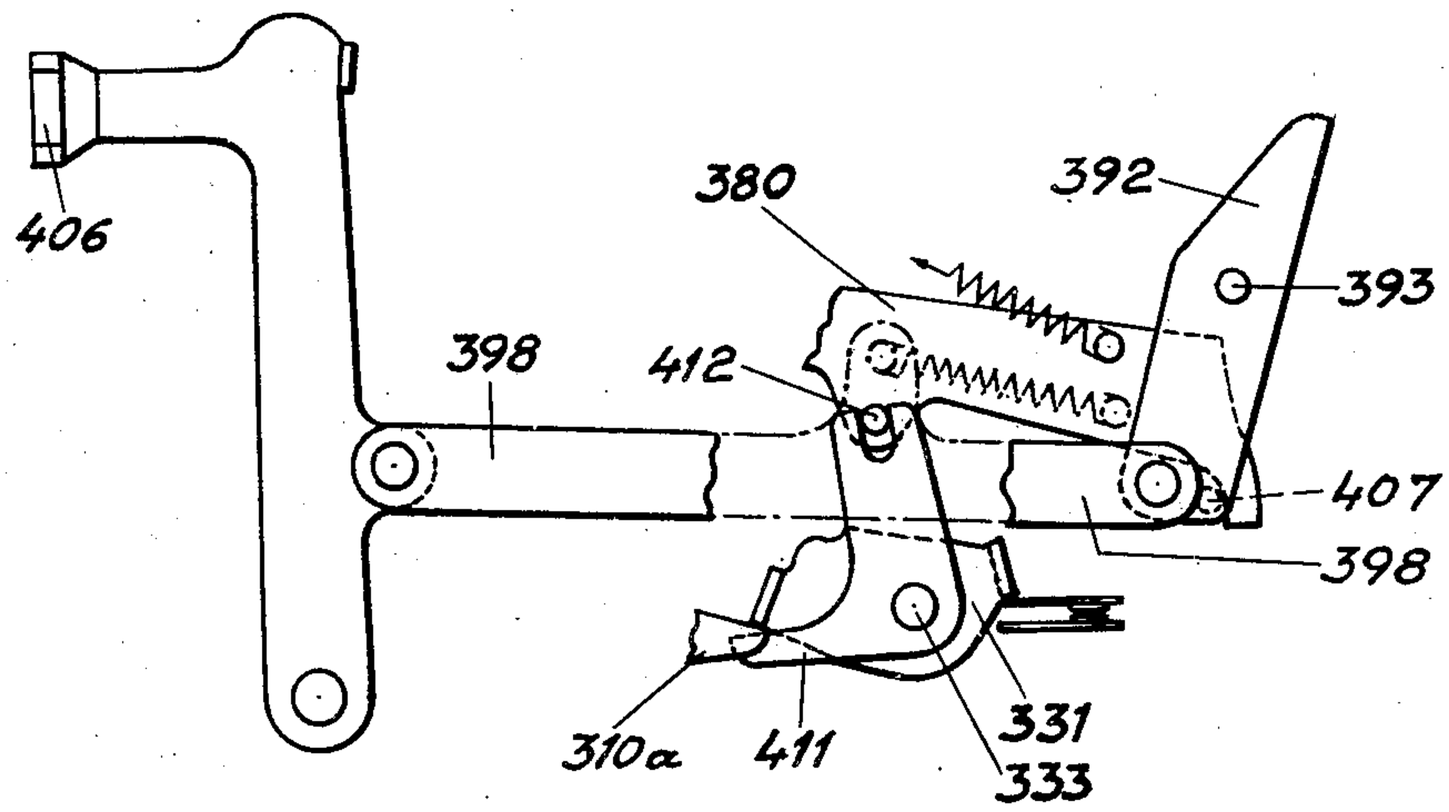
FIG. 7.



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Patented Oct. 25, 1949

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UNITED STATES PATENT OFFICE

2,485,695

KEY INTERLOCK

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Application April 27, 1944, Serial No. 532,961
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Section 1, Public Law 690, August 8, 1946
Patent expires November 30, 1962

9 Claims. (Cl. 235—130)

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In modern calculating machines for all the four fundamental arithmetic problems (addition, subtraction, multiplication and division), sometimes called multiplying machines, with ten amount or numeral keys for the numerals 0, 1, 2, 3 . . . 8, 9, locking devices are necessary to prevent an incorrect manipulation.

The chief purpose of this invention is to provide the machine with such locking devices that it is impossible simultaneously to manipulate two or more control members adapted to release incompatible functions, that is functions which will cause the machine to jam or will give rise to other faults in the machine when simultaneously released.

Another purpose of this invention is to provide for such locking devices that after the manipulation of a control member, such as a key, only that or those of the other control members may be manipulated which will effect the desired result, that is: whose function is compatible with the calculating operation initiated or prepared by the manipulation of said first-mentioned control member.

Another object of this invention is to provide a locking device for the motor keys of a power-operated multiplying machine having numeral and shifting keys and also one or more clearing mechanisms for the registers or counters, for the purpose of locking said clearing mechanisms in their inoperative position, when the motor key is depressed, or vice versa.

Another purpose of this invention is to effect such locking in a simple and reliable manner.

One embodiment of the invention is illustrated in the annexed drawings.

Fig. 1 shows a front view of the most important parts of the locking mechanism in accordance with this invention.

Fig. 2 shows a vertical section on the line II—II in Fig. 1.

Fig. 3 shows a vertical view substantially in the direction of the arrow marked III in Fig. 1.

Fig. 4 shows the parts illustrated in Fig. 3, seen from below.

Fig. 5 shows a partial view (end view) in the direction of the arrow marked V in Fig. 1; and

Fig. 6 shows a section on the line VI—VI in Fig. 5.

Fig. 7 shows the actuator clearing key and adjacent parts.

In the drawing only those parts are shown which are necessary for illustrating this invention. For attaining clearness, in some cases only those parts are shown which are nearest to the observer, that is nearest to the plane of drawing.

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In this specification—when not otherwise expressly stated—the expressions "right," "left," "upwards," "downwards," "forward," "backward" are used to indicate these directions as they appear to an operator sitting at the key-board of the machine.

The machine to which this invention is applied in accordance with the annexed drawings, is in its principal features constructed in accordance with U. S. Patents Nos. 2,108,596 and 2,243,075, though the invention is by no means limited to that type of machines. The results register and the revolutions counter may be cleared by hand (see U. S. Patent 2,188,748), while the actuator or setting mechanism may be cleared in accordance with U. S. Patents 1,927,771 and 2,068,899. The machine may have an electric driving mechanism in accordance with U. S. Patents Nos. 2,068,899 and 2,127,102, while the control mechanism may be constructed in accordance with British Patent No. 551,311 or U. S. Patents Nos. 2,398,286 and 2,243,075, issued, respectively, on April 9, 1946, and May 27, 1941. Certain parts in the specification below carry the same reference characters as the corresponding parts of the three last-mentioned patents.

The machine shown in the drawings has an actuator or pin-wheel rotor (not shown) which is journalled on the main shaft **5** and is settable by means of ten numeral keys **200**. In addition, the machine has shifting keys **197**, **198**, **199**. The right-step-shifting key **197** moves the carriage of the pin wheel rotor one step to the right, when said key is depressed. When depressed, the left-step-shifting key **199** moves said carriage one step to the left (via intermediary members), in well-known manner. When depressed, the tabulating key **198** causes said carriage to be moved directly to its extreme left position (for division). The machine also has a multiplication key **1** (positive multi-revolutions key) and a division key **2** (negative multi-revolutions key), by means of which the pin wheel rotor is started to perform one or more revolutions in its positive and negative direction of rotation, respectively, that is, counterclockwise and clockwise, respectively, in Fig. 5. Those directions are indicated by the arrows marked + and — in Fig. 5. In addition, the machine has a chief control lever **201** for setting the machine to automatic division and to multiplication with shifting to the right and to the left, respectively; see British Patent No. 551,311 or U. S. Patent No. 2,398,286. The

lever **201** is rockably journalled on the stationary pin **205** secured to the machine frame.

The numeral keys **200** cooperate with rockable locking pawls **499** journalled on the stationary rail **501** which forms a part of the frame of the machine. In that rail guiding slots are cut for the keys **200**, **197**, **198**. Due to the action of the pawls **499** only one of the numeral keys **200** can be depressed simultaneously.

On the rail **501** a locking bar **502** is slidably journalled on screws or studs **503** entering oblong slots in said bar. A tension spring **504** normally holds that bar in its extreme right position (position of rest). The bar **502** extends along the front side of the machine and it has channels or slots **502***a* for each of the keys **197–200** permitting said keys to swing freely upwards and downwards, when the bar is in its position of rest. On its right end the bar **502** has an oblique surface **502***b*, engaged by the forward end of a lever **505**, as shown in Figs. 1 and 5. This lever **505** is rotatably journalled on the pin **35** and carries at its rear end a pin or stud **505***a*, normally resting in a recess **331***a* of an angular member or contact lever **331**, which is rotatably journalled on the stationary pin **333**. When said lever is rocked due to the depression of either of the keys **1**, **2** it closes a contact for the electric current to the driving motor, in well-known manner.

The lever **331** has a bent portion **331***b* extending across the rear ends of the keys **1**, **2** and also across the locking arm **310**. Said arm is rotatably journalled on the pin (key shaft) **35** and carries a roller **309** engaging the periphery of the cam disc **308** rigidly secured to the main shaft **5**. In the drawings the reference character **310***a* indicates that part of the locking arm **310** which extends below the bent portion **331***b*.

The elements shown in Fig. 7 and numbered **380**, **392**, **398**, **407**, **411** and **412** are the same elements as those described under the same reference characters in United States Patent No. 2,398,286 wherein said elements are described in detail.

To prevent the simultaneous depression of the keys **1**, **2**, a pointed pawl **500** (Figs. 5 and 6) is rotatably journalled on the pin **513**, secured to a stationary guiding member **514** for these keys. The piece **514** forms a part of the frame of the machine.

At its left end the bar **502**, when displaced to the left, can just pass below the point **515***a* of a locking arm **515** which is rotatably journalled on the shaft **519**. At **515***b* this locking arm is recessed along a curve, and in this curved recess there normally rests the nose **516***a* of the clearing arm **516**, rotatably journalled on the shaft **517**. By preference, one clearing arm **516** is arranged on each of the clearing shafts of the results register and of the revolutions counter, said two clearing arms actuating the locking arm **515** either separately or in unison. (The clearing arm **516** may have the construction shown at **1** in U. S. Patent No. 2,188,748.) A tension spring **518** presses the locking arm **515** to engage the clearing arm **516**.

The locking arm **515** has a part **515***c* directed downwards which under the action of the spring **518** engages a projection of a locking arm **209** which is rotatably journalled on the fixed pin **211**. A tension spring **210** presses the pin **209***a* of the rocking arm **209** to engage either of three notches or recesses **201***a* of the chief control lever **201**. Said three recesses correspond to the setting of the lever **201** to automatic division, to multiplication with automatic step shifting to the left and to multiplication with automatic step shifting to the right.

The key-operated setting arms **31** (see U. S. Patent No. 2,108,596) for the pin wheels are rockable on a shaft **520** under the action of the numeral keys **200** which have curved slots **39** in their back ends to engage pins **38** on the setting arms **31**. A shaft **44** which is rotatably journalled in the machine frame and also has the same functions as the shaft **44** shown in U. S. Patent No. 2,243,075, carries arms **521** (Fig. 2), one in front of each of the three keys **197–199**. Each of said arms **521** is rigidly secured to the shaft **44** and has a stud **522** engaging a cam surface **523** on the respective keys **197–199** (only the key **197** is visible in Fig 2). To the shaft **44** a locking member **524** is secured just opposite the two setting arms **31** (said arms being common to all the numeral keys **200**), and said member **524** cooperates with pins **525** on said setting arms **31**. In the position of rest, that is when none of the keys **197–199** has been depressed, the locking member **524** is in its position shown in full lines in Fig. 2 and does not lock the setting arms **31**. Consequently, numerals (items) may be entered into the pin wheel rotor by means of the keys **200**. But when one of the shifting keys **197–199** is depressed, the locking member **524** is swung to its position shown in dash-and-dot lines in Fig. 2 so that the setting arms **31** and consequently also the numeral keys **200** are locked. As described in U. S. Patent No. 2,243,075 the shaft **44** then remains in its position as set, that is in its operative position, until the pin wheel rotor is cleared. At the clearing, the shaft **44** and the locking member **524** return to their positions of rest.

The device described acts as follows:

When one numeral key has been depressed, the other numeral keys are locked by the locking pawls **499** and cannot be depressed. Similarly, when one of the keys **1**, **2** (together with addition and subtraction keys possibly connected to them) has been depressed, the locking pawl **500** prevents the other from being depressed. But the shifting keys **197–199** may be simultaneously depressed, but this does not imply any risk or any particular inconvenience; if two of said keys are depressed simultaneously, they either counteract each other or will render the shift that one of them would effect separately; but this does not cause any risk of damage or jamming of the machine and it is consequently not necessary to prevent those keys from being depressed simultaneously. The chief control lever **201** may be manipulated, while simultaneously a numeral key **200** or shifting key **197–199** is depressed. This is desirable, because the functions originated by the manipulation of the lever **201** and of the keys **197–200** are compatible and independent of each other.

As soon as any of the keys **197–199** has been depressed, the setting arms **31** and consequently also the numeral keys **200** are locked by the locking member **524**. But if any of the numeral keys **200** is depressed, the pins **525** are rocked into the path of motion of the locking member **524** so that no shifting key **197–199** can be depressed, before the numeral key has returned to its position of rest.

As soon as a control key **1** or **2** is depressed, it swings the contact lever **331** clockwise in Fig. 5, so that the pin **505***a* is lifted out of the recess **331***a*. This causes the arm **505** to swing downwards to-

wards the oblique surface 502*b* in Fig. 1 so that the bar 502 is displaced to its extreme left position (locking position); this locks all the shifting and numeral keys 197–200 and also—via the locking arm 515—the arm 516 and consequently the whole clearing mechanism for the registers. Simultaneously also the chief control lever 201 is locked via the arm 515*c* which keeps the locking arm 209 with its pin 209*a* in the recess 201*a* into which it has been set, thus rendering it impossible to rock the arm 201. The bar 502 is kept in its locking position by the arm 505 as long as the pin wheel rotor rotates, because as soon as the pin wheel rotor is started due to the depression of either of the keys 1, 2, the cam disc 308 on the shaft 5 of that pin wheel rotor rocks the releasing arm 310. Consequently the part 310*a* of that arm engages the bent portion 331*b* of the contact lever 331 from below so that said lever cannot return to its position of rest, until the operator has taken off his finger from the depressed key 1, 2 and thereafter the pin wheel rotor has completed its current revolution just going on. Then the roller 309 enters the lower portion of the cam disc 308 and the rotor is stopped in well-known manner.

If one of the numeral or shifting keys 197–200 is depressed or if the clearing arm 516 is rocked, the bar 502 will be locked in its extreme right position and then itself via the arm 505 locks the contact lever 331 and thus also the two control keys 1, 2. If (incorrectly) the chief control lever 201 remains standing in such intermediate position that the pin 209*a* does not rest on the bottom of one of the recesses 201*a* but rests upon the top of one of the tongues between them, the locking arm 209 is rocked upwards in Fig. 4, that is backwards in the machine. This causes the lever 515 to be rocked counter-clockwise in Fig. 3 so that its part 515*a* enters the path of motion of the locking bar 502 and prevents it from being displaced to the left. This means that the control keys 1, 2 are locked when the chief control lever 201 is not correctly set into one of its three operative positions.

It is to be observed that when an addition key or a subtraction key or analogous member is coupled to the multiplication key 1 or to the division key 2, respectively, such addition or subtraction key or analogous member is locked and causes locking in just the same manner as the multiplication or division key, respectively, connected therewith and controlled thereby (see British Patent No. 551,311 or U. S. Patent No. 2,398,286).

If special clearing key 406, as shown in Fig. 7 (which corresponds to key 406 in the British Patent No. 551,311 or U. S. Patent No. 2,398,286 issued April 9, 1946), for the pin wheel rotor is provided, this clearing key when manipulated, rocks the contact lever 331 clockwise in Figs. 5 and 7, as described in detail in the patent just mentioned. In the manner indicated above the lever 331 then displaces the bar 502 to the left so that the keys 197–200 and the clearing member 516 are locked. Reversely, the particular clearing key 406 for the pin wheel rotor is locked, as soon as any of the members 197–200 and 516 has been manipulated and consequently the bar 502 has been locked in its right position.

What we claim is:

1. In a power operated multiplying machine rotatable in two directions under the control of two motor keys one for each direction of rotation and having a register, in combination, a locking member cooperating with said motor keys to prevent the simultaneous manipulation thereof, numeral keys for setting items, shifting keys, members kinematically connected with said numeral, motor and shifting keys, a slotted slidable locking bar movable into the paths of motion of said members kinematically connected with said numeral, motor and shifting keys and normally held out of said paths, said locking bar having an oblique edge in the path of motion of said members kinematically connected with said motor keys to cause slidable displacement of the locking bar by depression of either motor key and thereby prevent said numeral and shifting keys from being depressed when one of said motor keys is depressed, said slidable locking bar being held in normal position by said members kinematically connected to said numeral and shifting keys when one of said numeral keys or said shifting keys is operated to thereby prevent operation of the motor keys, and a register clearing initiating device, said locking bar cooperating with said clearing initiating device to prevent it from being manipulated when one of said motor keys is depressed, said clearing initiating device locking said slidable bar in normal position to thereby prevent depression of one of said motor keys when said clearing initiating device has been operated.

2. In a power operated multiplying machine rotatable in two directions under the control of motor keys one for each direction and having a register, in combination, a locking member for said motor keys to prevent the simultaneous manipulation thereof, numeral keys, shifting keys, a register clearing initiating device, members kinematically connected with said numeral, motor and shifting keys and with said register clearing initiating device, and a slotted slidable locking bar in the path of motion of said members kinematically connected with said numeral motor and shifting keys and with said clearing initiating device, said locking bar having an oblique edge in the path of motion of said members kinematically connected with said motor keys to cause slidable displacement of the locking bar by depression of either motor key to prevent said numeral and shifting keys and said clearing initiating device from being manipulated when one of said motor keys is depressed, said locking bar being held in its unoperated position by said members connected to said numeral and shifting keys to thereby prevent operation of said motor keys when said shifting or numeral keys have been operated.

3. In a power operated multiplying machine rotatable in two directions under the control of motor keys for either direction of rotation and having a locking member for said motor keys to prevent the simultaneous manipulation thereof, numeral keys for entering items, shifting keys for effecting denominational shifting, and a register clearing initiating device, in combination, members kinematically connected to the numeral, shifting and motor keys and a longitudinally slidable locking bar in the paths of motion of said members in kinematic connection with said numeral, shifting and motor keys and with the clearing initiating device, said locking bar having slots for all of said kinematically connected members, the slot for the member kinematically connected with said motor keys having an oblique edge whereby said locking bar is displaced and locks said numeral and shifting keys and said

clearing initiating device against manipulation when one of said motor keys is depressed and whereby displacement of said locking bar is prevented upon operation of either said numeral or shifting keys or said clearing initiating device to thereby prevent operation of either of said motor keys.

4. In a multiplying machine rotatable in either direction by an electric motor, the electric circuit of which is under the control of two motor keys one for each direction, the machine having numeral keys for entering items into said machine, shifting keys for effecting denominational shifting, register clearing initiating device, and a contact lever engaged by said motor keys to close the electric circuit, in combination, a second lever engaging said contact lever and a slotted locking bar in the paths of motion of said second lever and of the numeral and shifting keys and the clearing initiating device to prevent the numeral and shifting keys and the clearing initiating device from being manipulated when one of the motor keys is depressed, said locking bar being held against displacement when one of the numeral or shifting keys or the clearing initiating device is operated to thereby prevent operation of said second lever and of the motor keys.

5. In a multiplying machine having an actuator rotatable in either direction by an electric motor the electric circuit of which is under the control of motor keys, one for each direction, in combination, numeral keys for entering items, shifting keys for denominational shifting, a register initiating clearing device, a contact lever engaged by said motor keys to close the electric circuit, a second lever engaging said contact lever, a clearing key engaging said contact lever and adapted to control the clearing of said actuator, and a slotted locking bar in the paths of motion of said second lever and of said numeral and shifting keys and of said clearing initiating device, said locking bar having an oblique edge in the path of motion of said second lever to cause slidable displacement of the locking bar by depression of either motor key, to prevent said numeral and shifting keys and said register clearing device from being manipulated when said clearing key is depressed, said locking bar being held against displacement when one of said numeral or shifting keys or said register clearing initiating device is operated to thereby prevent operation of either of said motor keys.

6. In a power operated multiplying machine rotatable in two directions under the control of motor keys one for each direction, and having numeral keys for entering items into said machine, shifting keys for denominational shifting, a register clearing initiating device, a control lever for setting the machine to automatic division and to multiplication for automatic step shifting in either direction, in combination, members operatively connected with said numeral, shifting and motor keys, a member in operative connection with clearing initiating device and a slotted locking bar in the paths of motion of said members in operative connection with said numeral, shifting and motor keys and with said member in operative connection with said clearing initiating device and with the control lever to prevent the numeral and shifting keys, the clearing initiating device and the control lever from being manipulated when one of the motor keys is depressed.

7. In a power-operated multiplying machine rotatable in either direction under the control of motor keys, and having numeral keys, shifting keys for denominational shifting, a register clearing initiating device, a control lever for setting the machine to automatic division and to multiplication with automatic step shifting in either direction, in combination, members operatively connected with the numeral, shifting and motor keys and with the register clearing initiating device, a slidable slotted and cam ended locking bar in the paths of motion of said members in operative connection with said numeral, motor and shifting keys, a locking arm having three parts, said parts being in operative connection with said locking bar, said register clearing initiating device and said control lever to prevent said numeral and shifting keys and said clearing initiating device and said control lever from being manipulated when one of said motor keys is depressed, said parts of said locking arm preventing displacement of said locking bar to thereby prevent manipulation of said motor keys when either said numeral or shifting keys or said clearing initiating device has been operated.

8. In a power operated multiplying machine having two motor keys for setting the machine to rotation in either direction, setting arms for entering items into the machine, numeral keys acting on said setting arms, locking pawls cooperating with said numeral keys for preventing the simultaneous depression of more than one of them, shifting keys for effecting denominational shifting and a register clearing initiating device, in combination, members kinematically connected to the numeral, shifting and motor keys, a locking member for the setting arms, said locking member being under the action of said shifting keys to lock said setting arms, and a slotted cam ended locking bar in the paths of motion of said members in kinematic connection with said numeral, motor and shifting keys and with said clearing initiating device to prevent said numeral and shifting keys and said clearing initiating device from being manipulated when one of said motor keys is depressed due to movement of said locking bar resulting from cooperation of the cam end thereof with members connected with said motor keys, said locking bar being locked against displacement when said numeral or shifting keys or said clearing initiating device is manipuated to thereby prevent movement of either of said motor keys.

9. In a power operated multiplying machine having motor keys for setting the machine to rotation in either direction, setting arms for entering items into the machine, numeral keys acting on said setting arms, locking pawls cooperating with said numeral keys for preventing the simultaneous depression of more than one of them, shifting keys for effecting denominational shifting and a register clearing initiating device, in combination, members kinematically connected to the numeral shifting and motor keys, a shaft, a locking member on said shaft, arms on said shaft, said arms being engaged by oblique surfaces on said shifting keys to lock said arms when one of said shifting keys is depressed, and a slotted cam ended locking bar in the paths of motion of said members in kinematic connection with said numeral, motor and shifting keys and said clearing initiating device to prevent said numeral and shifting keys and said initiating device from being manipulated when one of said motor keys is depressed and to prevent said motor

keys from being manipulated when any of said numeral keys or said shifting keys or said clearing initiating device is operated.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,900,103	Gubelmann	Mar. 7, 1933
1,905,807	Coil	Apr. 25, 1933
1,906,063	Hilder	Apr. 25, 1933
1,968,898	Kurowski	Aug. 7, 1934
1,973,313	Hart	Sept. 11, 1934
2,269,644	Bratt	Jan. 13, 1944
2,330,689	Crosman	Sept. 28, 1944