Dec. 9, 1924. 1,518,173

G. M. BACON

COMPUTING MACHINE

Filed Sept. 9, 1921 4 Sheets-Sheet 1

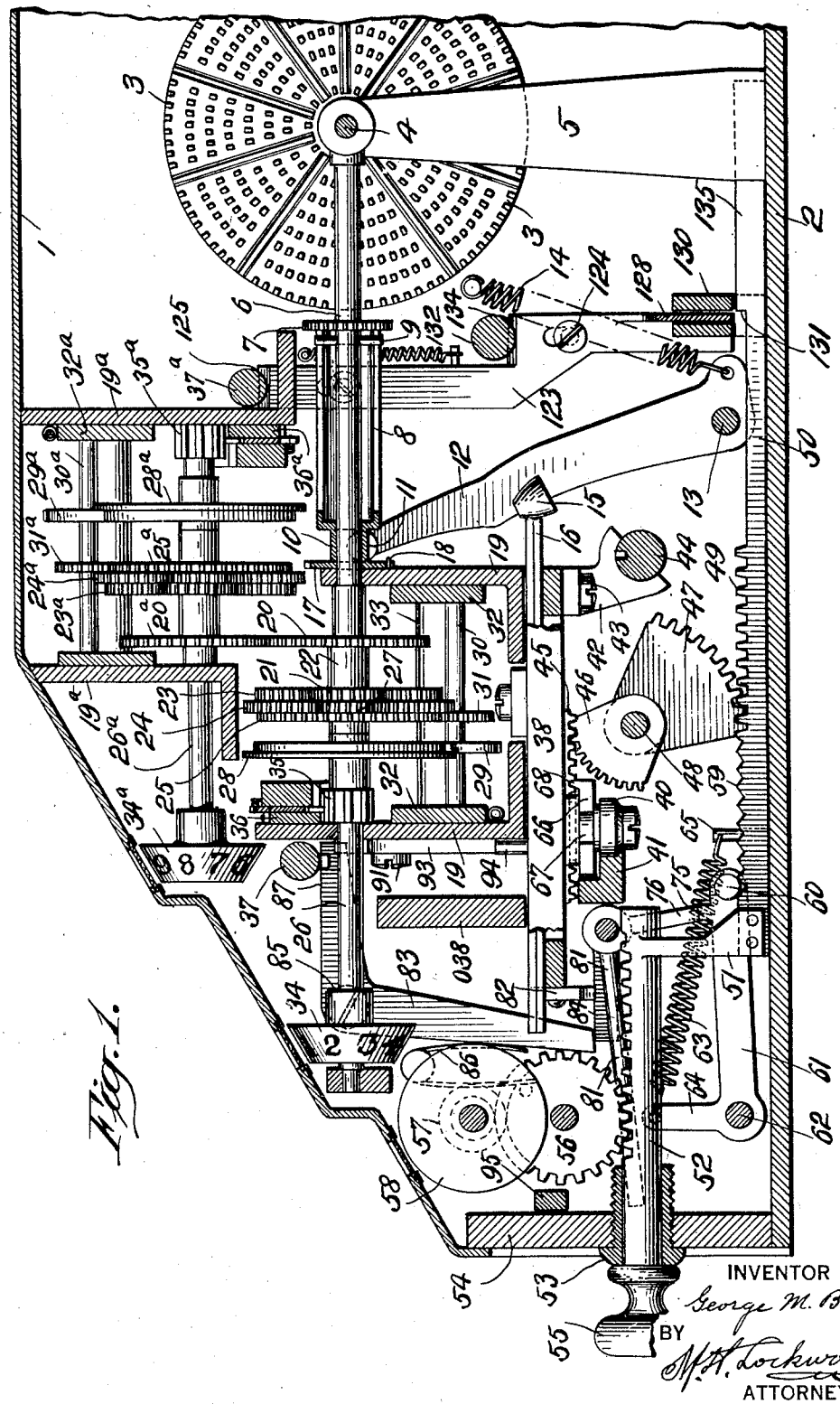


Fig. 1.

INVENTOR
George M. Bacon
BY
M. H. Lockwood
ATTORNEY

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G. M. BACON

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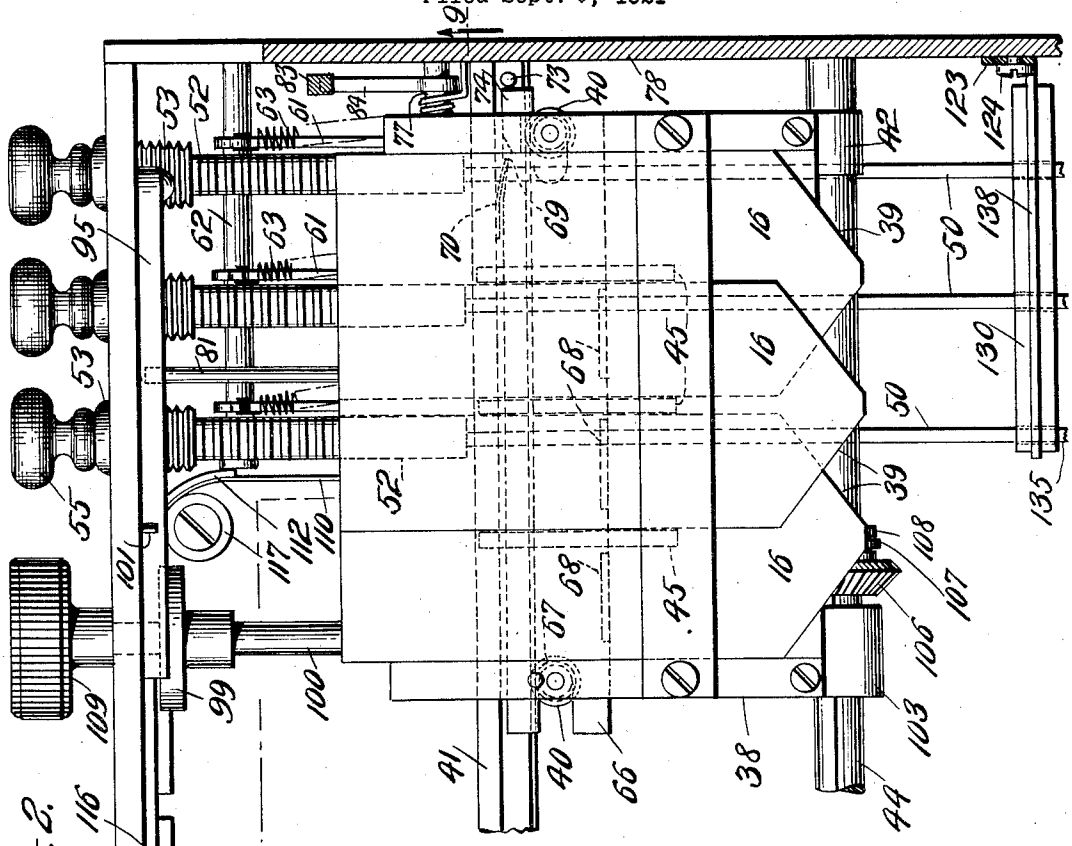


Fig. 2.

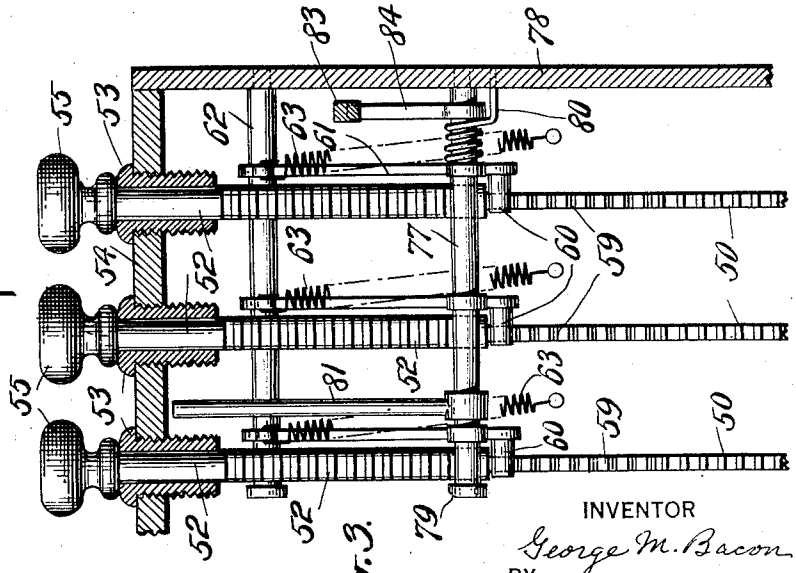


Fig. 3.

INVENTOR
George M. Bacon
BY
M. H. Lockwood
ATTORNEY

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G. M. BACON

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Fig. 4.

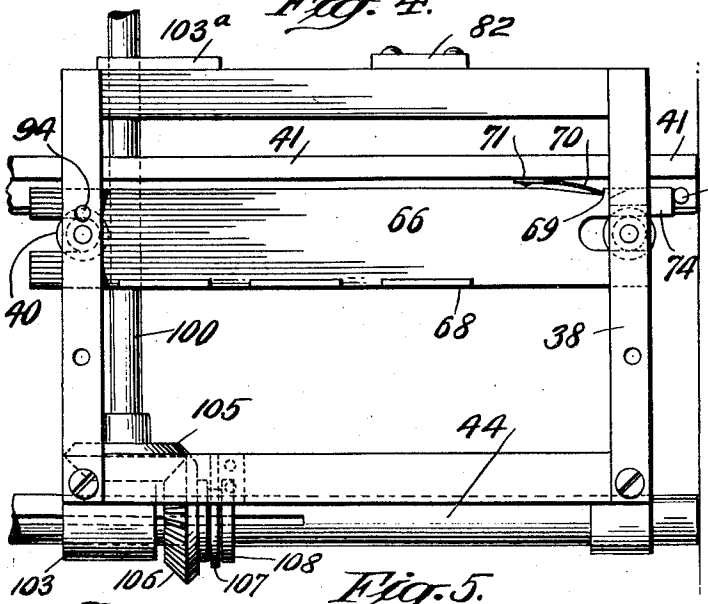


Fig. 6.

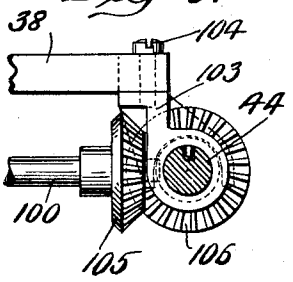


Fig. 5.

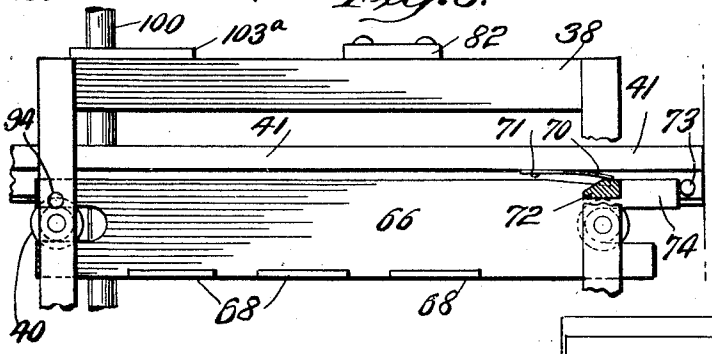


Fig. 7.

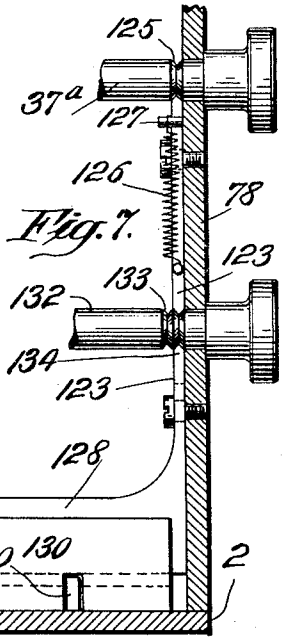
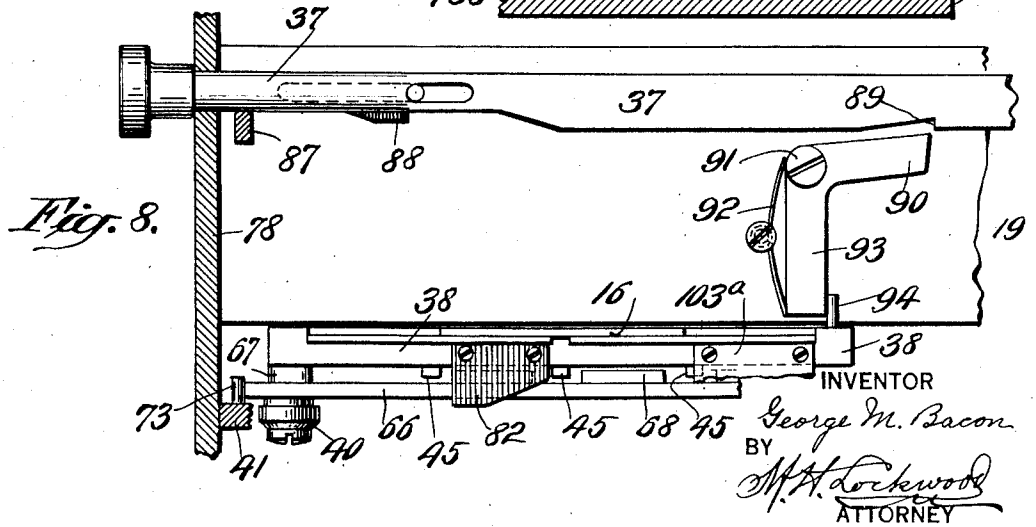


Fig. 8.



INVENTOR
George M. Bacon
BY
M. A. Lockwood
ATTORNEY

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G. M. BACON

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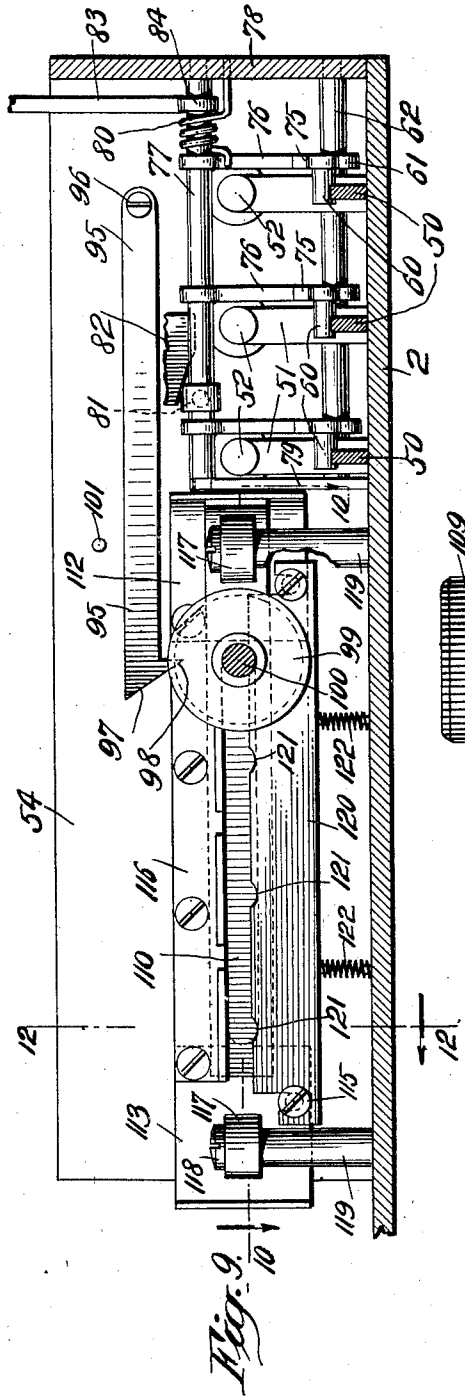


Fig. 9.

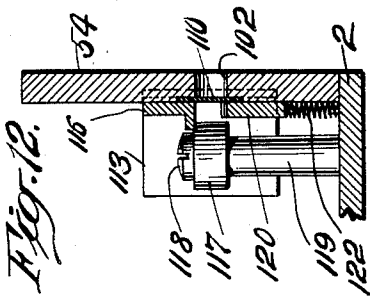


Fig. 12.

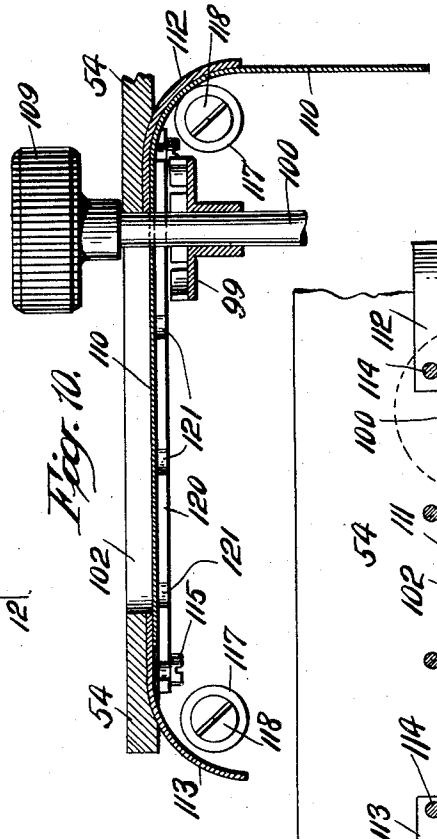


Fig. 10.

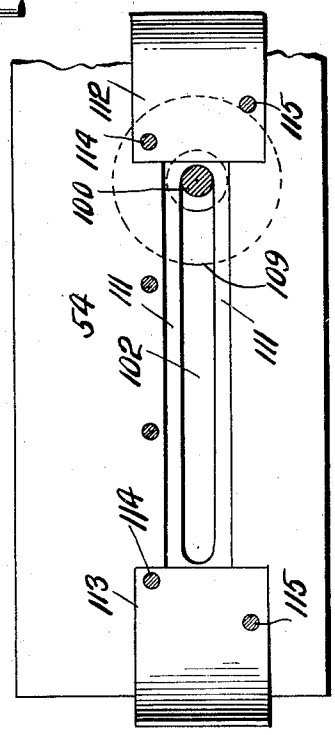


Fig. 11.

INVENTOR

George M. Bacon

BY

M. H. Lockwood

ATTORNEY

Patented Dec. 9, 1924. 1,518,173

UNITED STATES PATENT OFFICE.

GEORGE M. BACON, OF SALT LAKE CITY, UTAH, ASSIGNOR TO BACON MULTIPLIER, INCORPORATED, OF SALT LAKE CITY, UTAH, A CORPORATION OF UTAH.

COMPUTING MACHINE.

Application filed September 9, 1921. Serial No. 500,293.

To all whom it may concern:

Be it known that I, GEORGE M. BACON, a citizen of the United States, and resident of Salt Lake City, county of Salt Lake, and State of Utah, have invented certain new and useful Improvements in Computing Machines, of which the following is a specification.

My invention relates more particularly to improvements in the locking and safety features of a multiplying and dividing machine, such as shown and described in my pending application, Ser. No. 429,107, filed December 8, 1920.

In the physical embodiment of the machine shown and described in the above application, many of the locking features and safety devices embodied therein, while functioning satisfactorily, were found to be more or less difficult in assembling and adjusting, and in some cases more complex than necessary. With a view to making the machine more readily adaptable for manufacture and to simplify the construction where possible, many of the features have been redesigned and the construction and mode of operation of special features modified considerably, although the general plan of operation of the machine is substantially the same as that shown and described in the above application.

The register wheel construction and transfer mechanism of the products and total products dials have been materially improved and simplified and the mechanism for restoring the respective dials to zero has been simplified and rendered more efficient and effective. These improved features are more particularly described and claimed in my companion application, filed of even date with this application. In this application, therefore, while these improved features are shown, it is not necessary to describe them further than to indicate their relation to the rest of the mechanism for a more complete description thereof will be found in my companion application.

One object of my present improvement is to provide a simple means under the control of the multiplicand carriage for locking the products clearing pull when the multiplicand carriage is out of neutral position.

Another object is to improve the action and mechanism for setting up the multiplicand in the multiplicand carriage and for effectively locking the setting up members when the multiplicand carriage is moved out of neutral position to different denominational positions of the multiplier. In this connection, also improved means is provided for locking the multiplicand cams in the multiplicand carriage during the time the multiplicand is out of neutral position.

A further object is to provide means for holding the multiplicand setting up members in locked position after the multiplicand carriage has been returned to normal position and until the products clearing pull has been operated to clear the products dials. With the mechanism functioning in this manner, it will be seen that, after the multiplicand has been set up and the multiplicand carriage moved out of neutral position, it will be impossible to move the multiplicand setting up members and, since the products clearing pull cannot be operated when the multiplicand carriage is out of neutral position, the locking means for locking the multiplicand setting up members cannot be released, thereby insuring the proper manipulation of the machine and preventing the making of errors through inadvertence or incorrect operation thereof.

Another object of my improvement is to provide more simple and efficient means for locking the total products clearing pull and the division pull, when the multiplicand setting up members are operated. In my prior pending application, the locking bar for these pulls was normally out of engagement with the respective pulls and a more or less delicate and complicated mechanism was employed for effecting the locking when the multiplicand dials were operated. In the present improvement, however, the locking plate is resiliently held in engagement with the respective clearing and division pulls and a notch or stepped extension of the multiplicand setting up racks is designed to cooperate with a bar-like lateral extension of the locking member, so that the latter cannot be moved out of locking position, after the setting up members have been operated for setting up the multiplicand.

A further object of my present improvement resides in providing a dust shield for covering the slotted opening in the front of the case, through which the operating shaft of the multiplicand carriage ex-

tends. This improvement is associated with an improved detent plate for locating and resiliently holding the multiplicand carriage in proper denominational positions. In my prior pending application, detents were provided in connection with the forks for connecting the operating shaft to the respective multiplier dials and, while this mechanism may be retained, it is now supplemented by a notched plate resiliently mounted parallel to the direction of movement of the multiplicand carriage and provided with notches on the edge thereof for cooperation with the operating shaft to properly center it both in neutral and in the different denominational positions of the carriage.

In carrying out the present form of my improvement, it will be understood that various improvements have been made in the mechanical details of construction and these and other features are shown in the accompanying drawings, in which Fig. 1 represents a vertical longitudinal section through my improved machine, but with many of the mechanisms not related to the present improvement left out, in order to bring out the details of the improvement more clearly; Fig. 2 is a partial top plan view of the machine in section to show the multiplicand carriage and the associated multiplicand setting up members; Fig. 3 is a sectional detail view of the multiplicand setting up members; Fig. 4 is a fragmentary view, showing the frame and the multiplicand carriage and the locking plate for the multiplicand cams; Fig. 5 is a similar view of the locking plate with the multiplicand carriage broken away to show the cam for releasing locking plate; Fig. 6 is a detail of the bevel gear connection of the operating shaft mounted on the multiplicand carriage; Fig. 7 is a sectional detail view of the locking member for locking the total products clearing pull and the division pull; Fig. 8 is a view in elevation showing details of the products clearing pull and the lock therefor controlled by the multiplicand carriage; Fig. 9 is a transverse section in elevation showing the dust shield covering the slot through which the operating shaft extends, taken on the line 9—9 of Fig. 2 and also shows the pawl for locking the multiplicand carriage in neutral position; Fig. 10 is a horizontal section through the slot in the front plate of the case, on the line 10—10 of Fig. 9, through which the operating shaft extends and shows details of the dust shield strip; Fig. 11 is a broken away view of the front casing showing the recess and deflectors for the dust shield strip and Fig. 12 is a vertical sectional detail through the dust shield strip on the line 12—12 of Fig. 9.

Referring to the drawings and more particularly to Fig. 1, it will be seen that my improvement is embodied in a multiplying and dividing machine, substantially similar in construction and mode of operation to the machine shown and described in my pending application, Ser. No. 429,107, previously referred to. The various mechanisms in my improved machine are preferably, however, so designed as to be more readily assembled in units and then properly mounted in the frame of the machine. The machine is enclosed in a casing 1, some of the parts being supported on the base plate 2, and others on suitable brackets and angle plates secured to the side frame plates in any suitable manner, the latter being substantially as shown in my prior application and in the companion application. As in my prior application, the differential wheels 3 are mounted on a shaft 4, supported in bearing brackets 5, extending upward from the base 2 of the machine, as indicated in Fig. 1. The differential wheels 3 are adapted to drive the shafts 6 by means of spur pinions 7, which are slidably mounted upon the shafts 6. In order that this may be accomplished with the least amount of friction and lost motion, the pinions 7 are preferably secured to the ends of tubular barrels 8 which are provided with longitudinal slots, co-operating with pins 9, passing through the shafts 6. The forward end of each barrel 8 at 10 is provided with an annular groove in which a roller 11 operates, the roller being mounted upon the upper end of a lever arm 12 pivoted at 13 and held in the position shown in Fig. 1, by a spring 14. The lever arms 12 are provided with conical shaped rollers 15, adapted to cooperate with multiplicand cam plates 16, mounted on the multiplicand carriage as hereinafter described. The front end of each barrel 8, and forming one side of the annular groove 10, is preferably formed as a notched disc 17, the notches of which are adapted to cooperate with a fixed pin 18 mounted in one of the transversely extending angle plates 19 of the framing of the machine. The notched discs 17 and pins 18 serve to locate and hold the pinions 7 in proper position to mesh with the respective differential wheels 3 when the pinions 7 are slid rearward on the shafts 6. The shafts 6 which extend through the angle frame bracket 19 carry the gears 20 and driving gears 21, which are united by hubs 22 and are secured to the shaft 6 to rotate therewith. The driving gear 21 drives a pinion 23 secured to another gear 24 and rotatably mounted as planetary gears upon a large gear wheel 25, which in turn is rotatably mounted upon the shaft 26 of the register wheels of the products dials. The shafts 6 and 26 are in axial alignment and the gear mechanisms are the same as shown and described in my companion application. Secured to the shaft 26 for rotating it from the

shaft 6, is a pinion 27, meshing with the planetary gear 24, the arrangement being such that the shaft 26 will be rotated twice for each rotation of the shaft 6. The planetary pinions 23 and 24 are preferably duplicated on the opposite side of the gear 25 as shown in Fig. 1 of the drawings.

Mounted upon and secured to the product dial shafts 26, are single toothed Geneva drive members 28, which cooperate with Geneva wheels 29 for transferring the tens at each rotation of the product dial shaft 26. The Geneva wheels 29 are secured to the shafts 30 each of which carries a pinion 31 meshing with the large gear 25 of the next higher denomination, so that in transferring the tens, the large gear 25 together with the planetary pinions 23 and 24 are rotated a sufficient amount to rotate the adjacent register wheel of higher denomination one tenth of a complete rotation. As described in my companion application, the shafts 30 are mounted in a movable frame comprising side plates 32 secured together by suitable cross bars 33, so that the frame as a whole, may slide transversely of the machine to separate the Geneva wheels 29 from the corresponding Geneva members 28 and thereby permit independent rotation thereof while restoring the product dials 34 to zero.

For restoring the product dials 34 to zero, each of the product dial shafts 26 carries a mutilated pinion 35 which, as described in my companion application, is adapted to cooperate with a rack 36, which is properly mutilated to permit rotation of the shafts and dials during the normal operation of multiplication or division, but may be slid transversely to engage the pinions 35 and restore the respective dials 34 to zero. For operating the rack 36 and restoring the product dials 34 to zero a clearing pull 37 is provided. This mechanism is more particularly described in detail in my companion application and need not be repeated here.

The total products unit comprises substantially duplication of the planetary gears and Geneva transfer mechanism as used for the product dials with the exception that the arrangement on the total product dial shafts 26^a is reversed, hence the corresponding parts in the total products unit are similarly numbered with the exponent "a". The clearing mechanism of the total products dials is also a duplication of that used in connection with the product dials with the arrangement of the parts reversed, as shown in Fig. 1 of the drawings.

As in my prior application, Ser. No. 429,107, the multiplicand is adapted to be set up on a multiplicand cam carriage, which is mounted for movement transversely of the machine, below the product dials and associated mechanism. The multiplicand carriage 38 comprises a rectangular frame, as more particularly shown in Figs. 1, 2 and 4 of the drawings, in which a plurality of cam plates 16, previously referred to, are slidably mounted, the number of cam plates corresponding to the number of places in the multiplicand, according to the capacity of the machine. The cam faces 39, of the respective cam plates 16 are adapted to cooperate with the conical rollers 15 when the multiplicand carriage is moved to different denominational positions of the multiplier and thereby position the pinions 7 with respect to the corresponding differential wheels 3, as more particularly described in my prior pending application. In the present improvement, the multiplicand carriage 38 is provided with rollers 40 (see Fig. 1) cooperating with a track 41 extending transversely of the machine, the roller and track being preferably beveled at the lower edge to maintain the carriage in proper relation. The rear end of the carriage is provided with a depending bracket 42 secured to the carriage by suitable screws 43, the bracket 42 being Y-shaped or semi-circular at its lower end and adapted to fit over and slide upon the shaft 44, which is the driving shaft and geared through suitable intermediate gears to the shaft 4 of the differential wheels 3 for driving the latter. This intermediate gear mechanism is more particularly shown and described in my prior application, Ser. No. 429,107.

For slidably setting the respective multiplicand cam plates 16, to represent the multiplicand, each cam plate is provided with a rack 45 on its under side, cooperating with a gear segment 46 secured to a larger gear segment 47 and both rotatably mounted upon a suitable shaft or rod 48, as shown in Fig. 1 of the drawings. The larger segment 47 engages rack teeth 49 in a rack bar 50 extending along the base plate 2 of the machine, transversely of the direction of movement of the multiplicand carriage. Each rack bar 50 is connected by a bracket 51 with a rack 52, which may preferably be cut on a round rod extending through a bushing 53 in the front casing plate 54 of the machine and provided with a pull knob 55. Each of the racks 52 engages a gear 56, which in turn meshes with a pinion 57 secured to the hub of the dial 58 which carries numerals from zero to nine on its periphery and is adapted to indicate the digital values of the multiplicand. The value of the multiplicand as set up in the machine, depends upon the distance the respective rack bars 50 have been pulled out, the multiplicand being indicated on the multiplicand dials 58.

In my prior application, the multiplicand dials and setting up racks were positioned by a star wheel and detent cooperating with the respective dials, but this entailed a considerable amount of friction and lost motion,

Therefore, in the present instance, the rack bar 50 is provided with a plurality of V-notches or saw-teeth 59 with which a pin or roller 60 cooperates, the latter being mounted on the rear end of a bell crank lever 61 pivotally mounted on a rod 62 and held to resiliently engage the saw teeth by means of a spring 63 secured to an arm 64 of the bell crank and to a pin 65 extending upward from the base 2 of the machine, as shown in Fig. 1 of the drawings. The distance of the rod 62 from the bracket 51 of the setting up members is preferably just sufficient to allow the setting up members, including the rack bar 50 to be pulled out the necessary nine spaces and in this manner the rod 62 will act as a limiting stop.

It has previously been pointed out that the multiplicand carriage 38 is movable transversely of the machine in order to bring the multiplicand cams 16 into proper denominational relation to the lever arms 12 to position the gears or pinions 7 relative to the corresponding differential wheels 3. When the multiplicand carriage is thus moved from neutral position, where the racks 45 are in engagement with the segmental gears 46, it is necessary to provide means for locking and holding the cam plates 16 in their set positions to represent the multiplicand. In order that this may be accomplished in a simple manner, a slidable locking plate 66 is mounted on the underside of the carriage by U-slots engaging a collar or post 67, upon which the carriage rollers 40 are mounted. The locking plate 66 is provided with a flange formed as a single gear tooth 68 extending longitudinally thereof, along one edge, as indicated in Figs. 1, 2 and 5 of the drawings. The locking gear tooth 68 is interrupted at intervals to permit free longitudinal movement of the racks 45 with the corresponding cam plates 16 when the multiplicand carriage is in neutral position, as indicated in Fig. 2 of the drawings. For locking the multiplicand cams when the carriage 38 is moved out of neutral position, the locking tooth 68 is adapted to engage the teeth of the racks 45 and lock the cam plates. In order that this may be positively accomplished, the front edge of the locking plate 66 is provided with a notch 69, (see Fig. 4) which, when the carriage is in normal position and the locking plate out of locking position, is adapted to be engaged by a spring finger 70 secured at 71 to the angular carriage supporting rail 41, as more particularly shown in Figs. 4 and 5 of the drawings. It will thus be seen that when the multiplicand carriage 38 is moved out of neutral position, or the position shown in Figs. 2 and 4 of the drawings, the locking plate 67 will be temporarily held from movement, therewith by the spring finger 70, thereby forcing the locking teeth 68 into the racks 45 for locking the multiplicand cam plates 16, as previously explained. As soon as the locking is effected by the movement of the carriage 38, a cam lug 72 (see Fig. 5) engages the end of the spring finger 70 and lifts it out of the notch 69 thereby releasing the locking plate 67 and permitting it to travel with the carriage 38 and hold the multiplicand cams 16 locked in positions to represent the multiplicand. It will be understood that when the multiplicand carriage 38 is returned to neutral position the cam plates 16 should be again unlocked when the racks 45 engage the respective gear segments 46. For this purpose, a pin 73 is preferably inserted in the track 41, as shown in Figs. 4 and 5 of the drawings, and the end 74 of the locking plate 67 is adapted to engage the pin 73 and hold the locking plate until the carriage 38 reaches the position shown in Fig. 4 of the drawings, and the spring finger 70 again reengages the notch 69. The locking plate 67 is substantially similar to the corresponding locking plate shown and described in my prior application, but the mechanism for positively operating the locking plate as herein described, is novel.

When a multiplicand has been set up on the multiplicand carriage 38 by manipulating the multiplicand setting up racks 50—52, it is essential that the setting up members should be positively locked against movement while the multiplicand carriage 38 is out of neutral position. In the present instance, this is accomplished by providing the detent arms 61 with upwardly projecting lugs 75 adapted to cooperate with locking arms 76 secured to a rock shaft 77, which is pivotally mounted transversely of the setting up members, as indicated in Fig. 9 of the drawings. The rock shaft 77 is supported at its outer end in the frame side plate 78 and at its inner end in a bracket 79 extending from the base plate 2 of the machine. The locking arms 76, in Figs. 1 and 9 of the drawings, are shown in locking engagement with the lugs 75 of the detents 60, but normally when the machine is in position for setting up the multiplicand, the locking arms 76 are thrown forward out of the field of the lugs 75 by means of a spring 80, shown in Fig. 9 of the drawings. After a multiplicand has been set up on the multiplicand carriage 38 by manipulating the setting up racks 50, which is done by pulling out on the pulls 55, the multiplicand carriage 38 is moved out of neutral position to different denominational positions of the multiplier. In order to effect the locking of the setting up members when the multiplicand carriage is moved out of neutral, the rock shaft 77 is provided with a forwardly extending rod or arm 81 with which a cam 82, mounted on the front edge of the car-

riage 38, is adapted to cooperate as indicated in Fig. 9 of the drawings, where the cam is shown broken away from the carriage.

The cam 82 encounters the arm 81 as soon as the carriage 38 begins to move out of neutral position and, since it is desirable to keep the setting up members locked until the multiplicand carriage is returned to neutral position and also until the clearing pull 37 has been operated to restore the products dials to zero, a latch pawl 83 is adapted to engage the outer end of an arm 84 and hold the locking arms 76 in position to lock the setting up members until the latch pawl 83 is manipulated to release the arm 84 and permit the spring 80 to move the locking arms 76 out of locking position. From Fig. 1, it will be seen that the latch pawl 83 is bell crank shape and pivoted on a suitable screw at 85 and a spring 86 cooperates with the latch 83 to throw it toward the right, as shown in Fig. 1, to engage the arm 84 when the setting up members are locked, as shown and described. The rearwardly extended arm 87 of the bell crank shaped locking pawl 83 extends under the product clearing pull bar 37, as shown in Figs. 1 and 8 of the drawings, and the clearing pull 37 is provided with a cam lug 88 adapted to engage the arm 87 when the clearing pull reaches the outer end of its movement. It will thus be seen that the setting up pulls 55 cannot be operated for changing the multiplicand or setting up a new multiplicand until the clearing pull has been operated to release the locking latch 83 and unlock the detents 60 of the setting up members.

Obviously, it is essential, therefore, that the clearing pull 37, for restoring the products dials to zero, should not be operated while the multiplicand carriage 38 is out of neutral position. This may be accomplished in various ways, but preferably, as shown in Fig. 8 of the drawings, the clearing pull rod 37 is provided with a locking notch at 89 with which a bell crank shaped locking pawl 90 is adapted to cooperate for locking the pull against operation. The pawl 90 is pivoted on a screw 91 on the front angle plate 19 and is adapted to be thrown into locking position by a suitable spring 92, operating on the downwardly extending arm 93 of the locking pawl. The multiplicand carriage 38 is provided with a suitable pin 94 adapted to engage the arm 93 of the pawl 90 when the carriage is in neutral position, as indicated in Fig. 8 of the drawings, and hold the pawl 90 out of engagement with the notch 89, thereby permitting the clearing pull 37 to be operated. In this manner, it will be understood that as soon as the multiplicand carriage 38 is moved to the right, out of neutral position, the pin 94 will move away from the arm 93 and permit the spring 92 to effect the engagement of the locking pawl 90 with the notch 89 in the clearing pull 37, thus preventing operation of the clearing pull so long as the multiplicand carriage is out of neutral position.

Furthermore, it is desirable, in a machine of this character, to provide mechanism for locking the multiplicand carriage against movement out of neutral position after a multiplicand has been set up and multiplied and the multiplicand carriage returned to neutral position. For this purpose, in the present instance, I have provided a long pawl 95 pivoted at 96 to the front plate 54 of the casing, as indicated in Fig. 9 of the drawings, the pawl extending horizontally parallel to the direction of movement of the carriage. The hook-end 97 of the pawl is adapted to engage a notch 98 in the annular flange of the locking disc 99, which, as shown and described in my prior pending application, is secured to the forward end of the operating shaft 100, which is mounted upon the multiplicand carriage and movable therewith. A pin 101 may be inserted in the front plate 54 and project over the pawl 95 to limit its upward movement. Gravity ordinarily is sufficient to cause the engagement of the pawl 95 with the notch 99 although, obviously, a spring may be employed, if desired. As will be seen in Figs. 1 and 2 of the drawings, the rock arm 81, secured to the rock shaft 77, extends forward to a position under the pawl 95 so that when the rock shaft 77 is operated by the spring 80, after the latch pawl 83 has released the shaft, the forward end of the rock arm 81 will engage and lift the pawl 95 and thereby release the multiplicand carriage, so that it may be moved out of neutral position. It has been previously pointed out that the rock shaft 77 is not released until the products clearing pull 37 is operated for returning the product dials to zero. Hence, it will be seen that, after a product has been secured with one multiplicand, it becomes necessary to clear the product dials before the multiplicand carriage can be released from the pawl 95 to perform another multiplication. After the pull rod 37 has been operated to clear the products dials, the multiplicand setting up members will also be released as previously described, so that a new multiplicand may be represented thereon.

The operating shaft 100 extends forward through a slot 102 in the front plate 54, as shown in Figs. 2 and 10 of the drawings, and extends rearward to a bracket 103, secured to the underside of the carriage 38, by suitable screws 104, as shown in Figs. 4 and 6 of the drawings. The rear end of the operating shaft 100 is provided with a bevel or miter gear 105 meshing with a gear 106 keyed to the shaft 44 and slidably mounted thereon, so that the shaft 44 may be rotated in any

denominational position of the multiplier, as described in my prior application, now pending. A fork 107, somewhat similar to the fork 42 may extend downward from the underside of the carriage and engage an annular groove in the hub 108 of the miter gear 106, as shown in Fig. 2 of the drawings, so that the gear 106 may freely rotate and yet be moved as the multiplicand carriage 38 is moved. The front end of the shaft 100 is provided with a suitable operating knob or knurled head 109, which may be constructed substantially as shown in my prior application. The multiplicand carriage 38 is held in place by the bracket 103 sliding on the shaft 44 and the front end may be prevented from rising out of the track 41 by a transverse retaining bar 038, shown in Fig. 1 of the drawings. This construction enables ready removal or assembling of the carriage in the machine.

The slot 102 in the front plate 54 of the machine, through which the operating shaft 100 extends, is preferably protected in my present improvement by a dust shield comprising a flexible metal strip 110, provided with a hole through which the operating shaft 100 extends. The flexible shield strip 110 extends horizontally on each side of the shaft 100 a sufficient distance to at all times cover the slot 102. The front plate 54 is preferably recessed at 111 on each side of the slot 102, as shown in Fig. 11 of the drawings, to accommodate the thickness of the flexible shield strip 110. At the ends of the recess 111 curved deflecting plates 112 and 113 are preferably let into the front plate 54 and secured thereto under the screws 114 and 115, as shown in Figs. 9, 10 and 11 of the drawings. The shield strip 110 is preferably of steel or other suitable material and is held to slide in the recess 111 by the locking plate 116 which cooperates with the flange member 99, mounted on the shaft 100, for preventing rotation of the latter, except in denominational positions of the multiplier, as described in my prior pending application. The deflector plates 112 and 113, as will be seen in Fig. 10 of the drawings, are adapted to deflect the flexible strip 110, so that the ends thereof will project into the machine, substantially at right angles to the direction of movement of the multiplicand carriage. Suitable rollers 117 are mounted on screws 118, entering posts 119 in front of the respective curved deflector plates, in position to engage the flexible strip and hold it in proper relation to the deflector plates 112 and 113.

To assist in locating the multiplicand carriage 38 in proper denominational positions, it has been found desirable to provide a notched detent plate 120 which is mounted on the front plate 54 below the shaft 100, as will be seen in Fig. 9 of the drawings, the shoulder screws 115, which pass through vertical slots in the ends of the detent plates, being adapted to hold it in proper relation to the shaft 100. The detent plate 120 overlaps the dust shield strip 110 and its upper edge is provided with notches 121 adapted to cooperate with the shaft 100 or other suitable extension of the multiplicand carriage 38. Springs 122 are provided for resiliently holding the detent plate 120 in engagement with the operating shaft 100.

I have thus far described various improvements in connection with the multiplicand carriage and setting up members for controlling the operation thereof and have pointed out the necessity for operating the products clearing pull after each product has been registered. With the total product dials, it is not required to restore them to zero after each product is obtained for they serve for totalizing successive products. It is desirable, however, that the total products clearing pull 37ª should not be operated for restoring the total products dials to zero, while actually performing multiplication or division on the machine. In my present improvement, this is accomplished by providing a locking plate or member 123, held to slide vertically on suitable screws 124, as indicated in Figs. 1 and 7 of the drawings. The upper end of the locking plate 123 is wedge or inverted V-shaped and adapted to engage a V-notch 125 in the total products clearing pull 37ª, the locking bar 123 being normally held in such engagement by a spring 126, connected respectively to the locking plate and to a pin 127, secured in the side frame plate 78 of the machine, as shown in Fig. 7 of the drawings. The locking plate 123 is preferably provided with a laterally extending bar or arm 128, which, as indicated in Figs. 1 and 7 of the drawings, extends horizontally over the multiplicand setting up racks 50. The rack bars 50 extend through suitable slots 129 in a guide bar 130, which is slotted transversely of the rack bars 50, to guide the locking plate arm 128, as will be seen in Figs. 1 and 7 of the drawings. The rack bars 50 are notched at 131 or made narrower so as to permit downward movement of the locking plate 123 when the rack bars are in their normal positions, as indicated in Fig. 1 of the drawings. The rear ends 135 of the setting up rack bars 50 are of uniform width back of the notch 131 and wide enough to engage the lower edge of the arm 128 when the setting up racks are pulled out to set up a multiplicand.

It is desirable to also lock the division pull 132 when the machine is being operated, the division pull, as shown and described in my prior application Ser. No. 429,107, being adapted to shift the gears for reversing the

direction of rotation of the product and total product dials, as fully explained therein. The division pull 132 is provided with two V-notches at 133, adapted to cooperate with an inverted V-locking edge 134 on the locking plate 123, as indicated in Figs. 1 and 7 of the drawings. As with the clearing pull 37ª, the locking plate 123 normally holds the wedge-shaped locking edge 134 in one or the other of the notches 133 by the resilient action of the spring 126, so that when the setting up racks 50 are in normal position, as indicated in Fig. 1 of the drawings, the locking plate may be cammed out of the notches, thereby permitting the division pull to be shifted. If, however, the setting up pulls 55 have been operated, to set up a multiplicand, the wide portions 135 of the racks 50 will engage the cross bar 128 and prevent downward movement of the locking plate 123, thus locking both the division pull 132 and the clearing pull 37ª, until the setting up racks 50 are restored to normal position.

The operation of the various mechanisms of my improved machine have been pointed out in connection with the description of the mechanisms, so that it is believed that the operation should be clear and the improvement over the mechanisms of my prior application apparent, when a comparison is made therewith.

It will be obvious, however, that in developing a machine of this character for the market and to simplify the manufacture thereof, additional modifications in the specific details of the mechanisms may be made and, therefore, I do not wish to be limited to the particular details of construction shown and described, for it is believed that many of the features in connection with my improved machine are broadly novel and for this reason, various modifications may be made therein without departing from the spirit and scope of the invention.

I claim:—

1. In a computing machine of the character described, the combination with product dials of a clearing pull for restoring said dials to zero, a carriage provided with a plurality of multiplicand elements, means for mounting said carriage for movement transversely of the machine to different denominational positions of the multiplier and a pawl controlled by said carriage for locking said clearing pull against movement when said carriage is out of neutral position.

2. In a computing machine of the character described, the combination with product dials, of a clearing pull comprising a bar extending transversely of the machine, a multiplicand carriage mounted for movement transversely of the machine, from neutral position to positions denominationally of the multiplier, a pawl adapted to cooperate with a notch in said clearing pull bar for locking the bar against movement when said carriage is out of neutral position and means for holding said pawl in unlocking position, when said carriage is in neutral position.

3. In a computing machine of the character described, the combination with product dials, of a clearing pull bar for restoring said dials to zero, means for locking said bar against clearing movement, a multiplicand carriage movable transversely of the machine and means mounted on said carriage for unlocking said clearing pull when said carriage is in neutral position.

4. The mechanism as claimed in claim 3, in which the clearing pull bar is provided with a notch with which a pawl cooperates for locking the bar and a pin is mounted on said carriage for holding said pawl out of locking position when the carriage is in neutral position.

5. In a computing machine of the character described, the combination of, a multiplicand carriage mounted for movement transversely of the machine from neutral position to different denominational positions of the multiplier, stationary multiplicand setting elements adapted for cooperation with said multiplicand carriage for setting the multiplicand when the carriage is in neutral position, said setting elements being provided with rack bars, extending rearwardly, transversely of the direction of movement of said carriage, and spring actuated detents cooperating with said rack bars for positioning the same in different digital positions.

6. In a computing machine of the character described, the combination of, a multiplicand carriage mounted for movement transversely of the machine, from neutral position to different denominational positions of the multiplier, multiplicand cam plates slidably mounted on said carriage, multiplicand pull members for setting said cam plates when the carriage is in neutral position, a rack bar associated with each of said pull members, said rack bars being provided with detent teeth, a detent for cooperation with said teeth for locating and holding the pull members in digital positions, and means for locking said detents against movement.

7. The mechanism as claimed in claim 6, in which said locking means for the detents is under the control of said carriage, whereby when said carriage is out of neutral position the detents are locked against movement.

8. In a computing machine of the character described, the combination with a multiplicand carriage, mounted for movement transversely of the machine, of a plurality of movable racks adapted for setting up the multiplicand on the carriage when the latter is in neutral position, a corresponding plu-

rality of detents for the respective racks to hold them in digital positions of the multiplicand, a member movable into position to lock said detents and means carried by said carriage for operating said movable locking member when the carriage is moved out of neutral position.

9. In a computing machine of the character described, the combination with a reciprocating carriage provided with means for setting up the multiplicand thereon, multiplicand setting members in fixed relation to said carriage and adapted to be moved to set up the multiplicand when the carriage is in neutral position, detents for holding said multiplicand setting members in set positions, a locking member for simultaneously locking all of said detents, and means controlled by said carriage for effecting the locking of said detents by said locking member when said carriage is moved out of neutral position.

10. The mechanism as claimed in claim 9, in which a latch is provided for holding said locking member in locking position, after said carriage has been moved to effect the locking.

11. In a computing machine of the character described, the combination with product dials and a clearing pull rod for restoring said dials to zero, of a multiplicand carriage mounted for movement transversely of the machine, multiplicand setting racks in fixed relation to said carriage for setting the multiplicand thereon when the carriage is in neutral position, detents for holding said racks in positions representing the multiplicand, a locking member for holding said detents and thereby locking said racks against movement when said carriage is moved out of neutral position, means for holding said locking member in locking position after said member has been moved to effect the locking and means controlled by said clearing pull for releasing said locking member.

12. The mechanism as claimed in claim 11, in which said carriage is provided with means for moving said locking member to effect the locking when the carriage is moved out of neutral position, and means is provided for preventing the operation of said clearing pull to release said locking member until the carriage is returned to neutral position.

13. In a computing machine of the character described, the combination with a clearing pull, of a movable carriage, upon which the multiplicand may be set up, setting up members in fixed relation to said carriage, means for locking said setting members after the multiplicand has been set up, means controlled by said carriage for effecting said locking when said carriage is moved out of neutral position, means controlled by said clearing pull for releasing said locking means and means controlled by said carriage for preventing movement of said clearing pull except when the carriage is in neutral position.

14. The mechanism as claimed in claim 13, in which means is provided for locking said carriage against movement out of neutral position, after it has been returned thereto and until said clearing pull has been operated to release said locking means.

15. In a computing machine of the character described, the combination of a multiplicand carriage movable transversely of the machine from neutral position to different denominational positions of the multiplier and means for locking said carriage against movement out of neutral position, after it has been moved to a denominational position and then returned to neutral position.

16. In a computing machine of the character described, the combination with a multiplicand carriage upon which the multiplicand is adapted to be set up when the carriage is in neutral position, said carriage being movable to different denominational positions of the multiplier and then returned to neutral position, means for locking the carriage in neutral position when thus returned and manually operated means for unlocking said carriage, so that it may again be moved out of neutral position.

17. The mechanism as claimed in claim 16, in which said manually operated means comprises the clearing pull for restoring the product dials to zero.

18. In a computing machine of the character described, the combination with product dials and a clearing pull for restoring them to zero, of a multiplicand carriage movable from neutral position to different denominational positions of the multiplier, a locking member for locking said carriage against movement out of neutral position, means for holding said locking member out of locking position while the multiplicand is being set up on said carriage, and means controlled by said carriage for releasing said locking member when the carriage is moved out of neutral position, so that said locking member becomes effective to lock said carriage when it is again returned to neutral position.

19. The mechanism as claimed in claim 18, in which means is provided whereby said locking member may be moved out of locking position to release said carriage by operating said clearing pull to restore the product dials to zero.

20. In a computing machine of the character described, the combination of a multiplicand carriage, upon which the multiplicand may be set up, said carriage being movable from neutral position to different denominational positions of the multiplier.

setting up members located for cooperation with said carriage when the latter is in neutral position, means for locking said setting up members when the carriage is moved out of neutral position, and means controlled by said last named means for locking said carriage against movement out of neutral position while said means for locking said setting up members is effective.

21. In a computing machine of the character described, the combination of a multiplicand carriage, movable from neutral position to different denominational positions of the multiplier, setting up members for setting up the multiplicand on said carriage when in neutral position, means controlled by said carriage for locking said setting up members when the carriags is moved out of neutral position and means for locking said carriage against movement out of neutral position while said setting up members are locked.

22. The mechanism as claimed in claim 21, in which manually operated means is provided for releasing both of said locking means, as an incident to restoring the product dials to zero.

23. In a computing machine of the character described, the combination with a movable carriage, of a plurality of multiplicand cam plates mounted on said carriage, setting up members mounted for cooperation with said cam plates for moving the latter to set up the multiplicand when the carriage is in neutral position, a locking member mounted on said carriage for locking said cam plates when said carriage is moved out of neutral position, and a member for operating said locking means to effect the locking when said carriage is moved out of neutral position.

24. The mechanism as claimed in claim 23, in which said member is effective to hold the locking means while said carriage is being moved out of neutral position and means is mounted on said carriage for releasing said locking means from said member, after a predetermined amount of movement of the carriage.

25. In a computing machine of the character described the combination, of a multiplicand carriage, movable out of neutral position to different denominational positions of the multiplier, a plurality of multiplicand cams mounted on said carriage, a locking plate extending in the direction of movement of said carriage for locking said cams when the carriage is moved out of neutral position, said locking plate being provided with a notch, a stationary spring finger adapted to engage said notch in the locking plate when said carriage is in neutral position and the plate is out of locking position and a cam lug mounted on the carriage and adapted to engage said spring finger and release said locking plate in locking position when said carriage is moved out of neutral position.

26. The mechanism as claimed in claim 25, in which means is provided for engaging and holding said locking plate during the latter part of and prior to the completion of the return movement of said carriage to neutral position, whereby said cams are unlocked when the carriage reaches neutral position.

27. In a computing machine of the character described, the combination with total products dials, of a clearing pull for restoring said dials to zero, said clearing pull being provided with a locking notch, a spring pressed locking member normally in engagement with said notch but adapted to be released therefrom when said clearing pull is operated and a plurality of multiplicand setting up members mounted for individual movement according to the multiplicand digits and means operated by each multiplicand member for preventing the movement of said locking member and thereby locking said clearing pull against operation.

28. In a computing machine of the character described, the combination with total product dials, of a clearing pull for restoring said dials to zero, a locking plate normally in position to prevent operation of said clearing pull, members movable relative to said locking plate for setting up the multiplicand and means associated with said multiplicand setting up members for preventing movement of said locking plate when said members are operated to set up the multiplicand, thereby locking said clearing pull against operation.

29. In a computing machine of the character described, the combination with a plurality of total products dials, operatively connected to be actuated each time the product dials are rotated, of a clearing pull for restoring said total products dials to zero, a multiplicand carriage movable transversly of the machine from neutral position to different denominational positions of the multiplier, a plurality of rack members in fixed relation to said carriage, and movable when the carriage is in neutral position to set up the multiplicand thereon, a locking plate for locking said clearing pull against operation, and means connected with the respective racks members for holding said locking plate in locking positoin when said rack members are operated to set up the multiplicand.

30. The mechanism as claimed in claim 29, in which the machine is provided with a division pull and said locking plate is provided with means for locking said division pull rod simultaneously with locking said clearing pull.

31. In a computing machine of the char-

acter described, the combination with products and total products dials, of a clearing pull for restoring said total products dials to zero, a division pull for reversing the direction of rotation of said dials for division, a locking plate, resiliently engaging the clearing and division pulls, a plurality of movable racks for setting up the multiplicand, and extensions on said racks for engaging said locking plate when the racks are moved to set up the multiplicand thereby preventing movement of said locking plate and locking said clearing and division pulls against operation while a multiplicand is set up on the machine.

32. The mechanism as claimed in claim 31, in which said locking plate is provided with a lateral extension overlying said rack bars and said rack bars are provided with notches or off set portions for permitting movement of said locking plate when the rack bars are in normal position, the width of the bars back of said notches being sufficient to prevent movement of said locking plate when the rack bars are moved to set up the multiplicand.

33. In a computing machine of the character described, the combination with a multiplicand carriage movable transversely of the machine, from neutral position to different denominational position of the multiplier, of an operating shaft mounted on said carriage and extending through a slot in the frame of the machine, a flexible tape mounted on said shaft, and movable with said carriage to cover said slot as a dust shield and means for deflecting the ends of said tape away from the wall of the frame, in which the slot is located.

34. In a computing machine of the character described, the combination with a multiplicand carriage movable transversely of the machine, from neutral position to different denominational positions of the multiplier, of an operating shaft mounted on said carriage and extending through a slot in the casing of the machine, the casing on each side of said slot being recessed parallel thereto and a flexible dust shield slidably mounted in said recess and adapted to cover said slot in any position of said carriage, said operating shaft passing through a hole in said shield.

35. The mechanism as claimed in claim 34, in which the ends of said recess are provided with curved deflectors for deflecting the respective ends of said flexible shield, substantially at right angles to the direction of motion of said carriage.

36. In a machine of the character described, the combination with a multiplicand carriage, of an operating shaft mounted thereon and extending through a slot in the casing of the machine, a flexible dust shield mounted upon said shaft and extending laterally therefrom to cover said slot, a deflector at each end of said slot for deflecting the dust shield at right angles to the direction of motion of said carriage and rollers cooperating with said deflectors for holding said dust shield in proper relation thereto.

37. The mechanism as claimed in claim 36, in which said flexible dust shield is mounted in a recess extending on each side of said slot and means is provided for holding said shield in the recess and parallel to the direction of motion of said carriage.

GEORGE M. BACON.