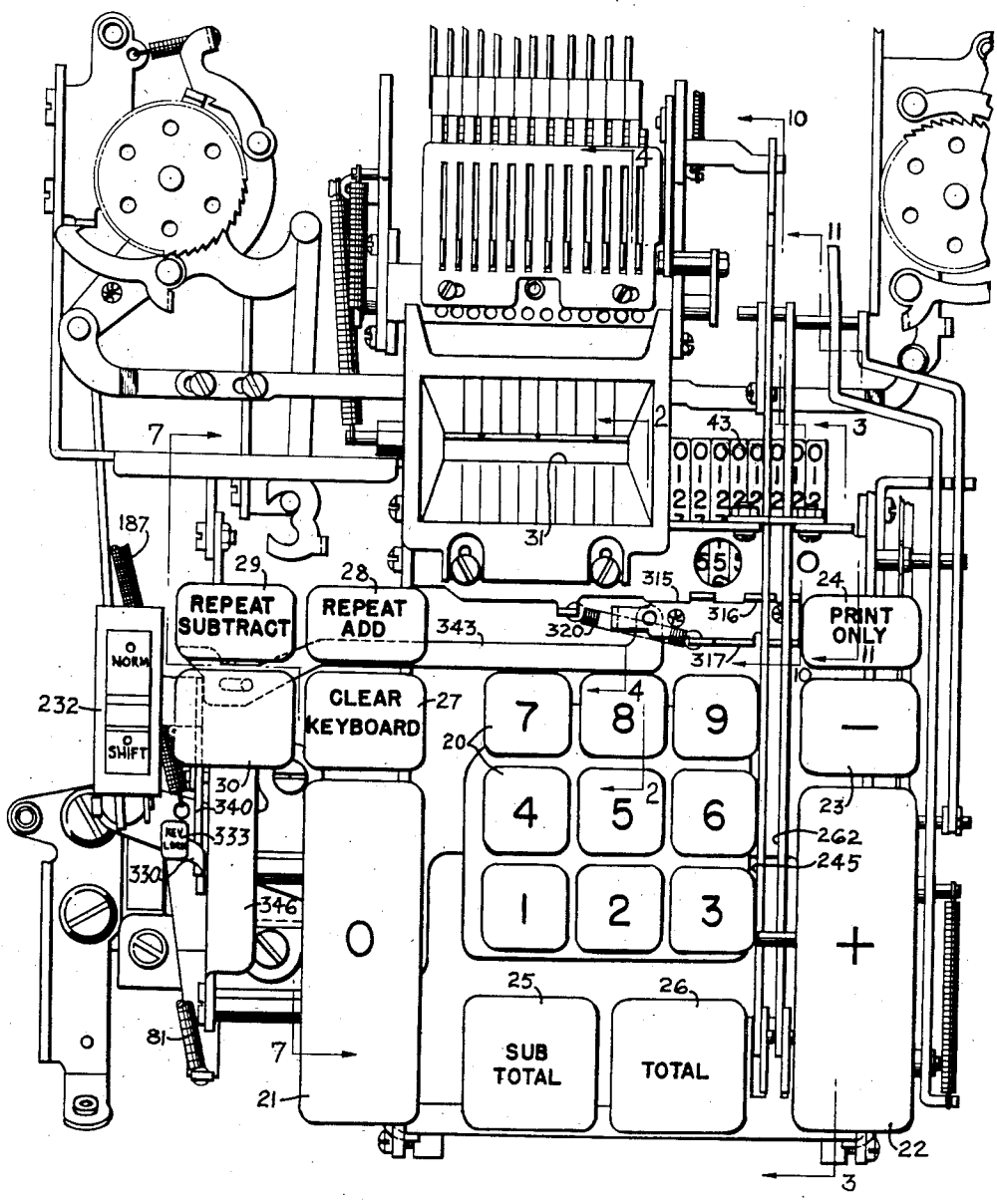
April 21, 1959 J. E. GROBL ET AL 2,883,105

TEN KEY ADDING MACHINE CLEARING MECHANISM

Filed Sept. 30, 1957

11 Sheets-Sheet 1

FIG_1



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TEN KEY ADDING MACHINE CLEARING MECHANISM

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11 Sheets-Sheet 2

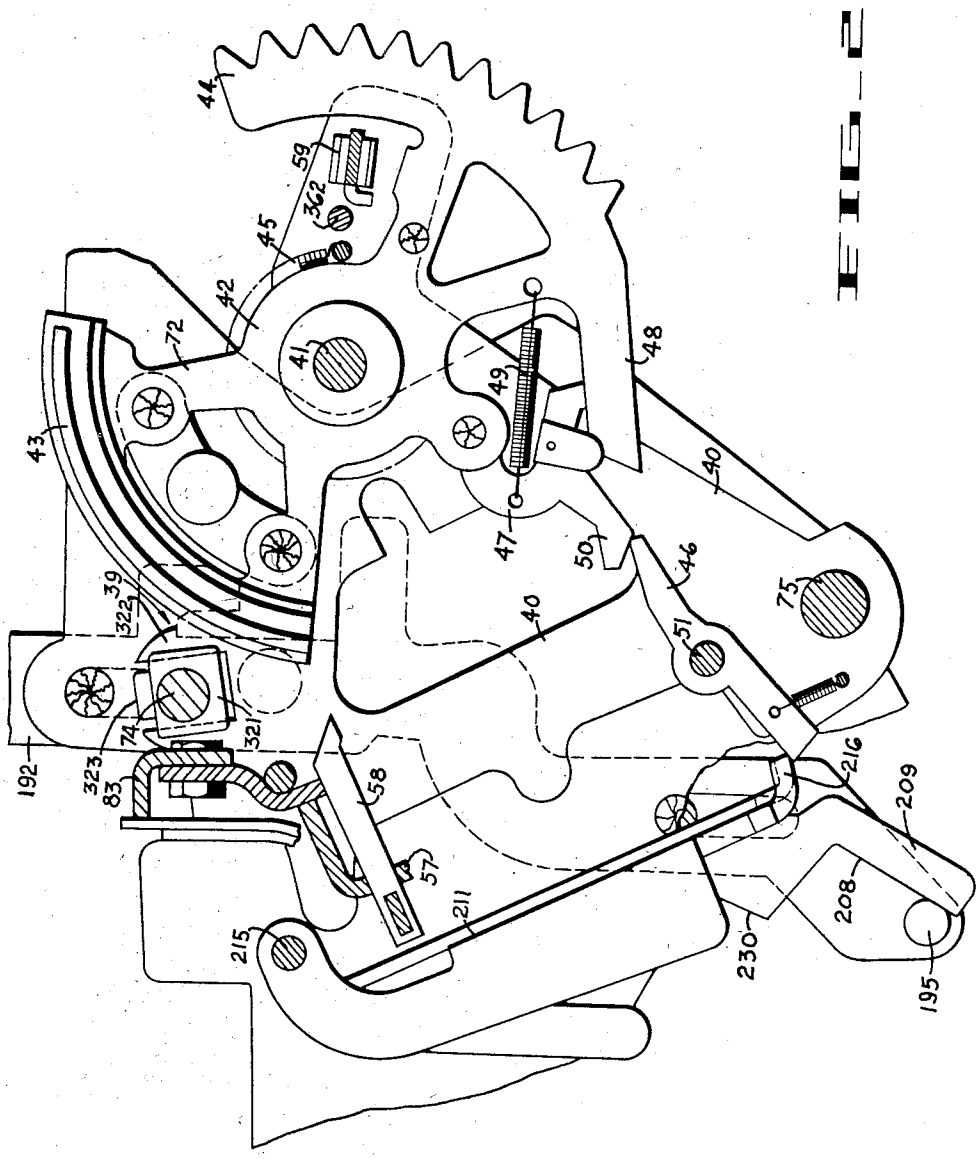

FIG. 2

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11 Sheets-Sheet 3

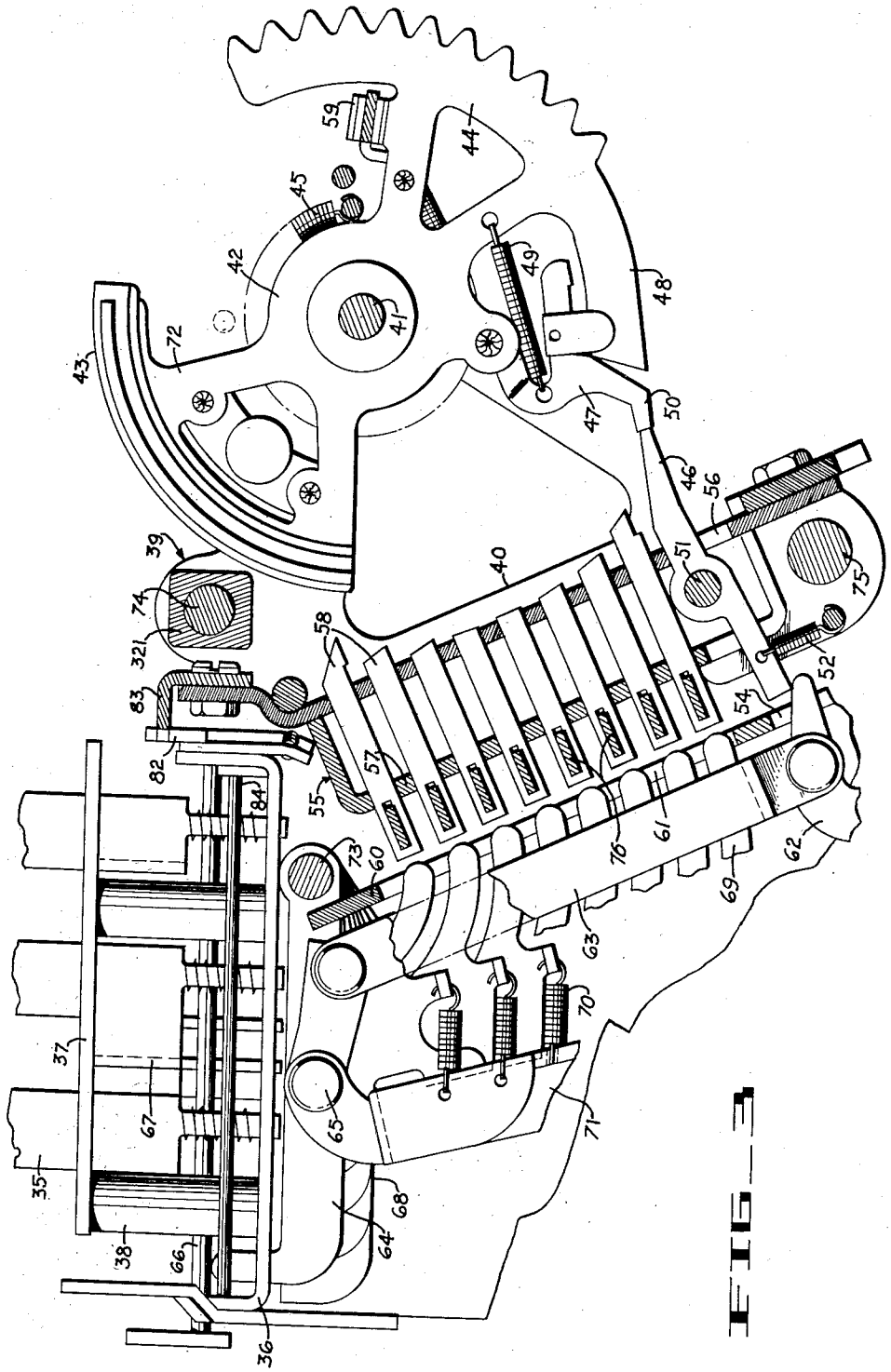

FIG. 3

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TEN KEY ADDING MACHINE CLEARING MECHANISM

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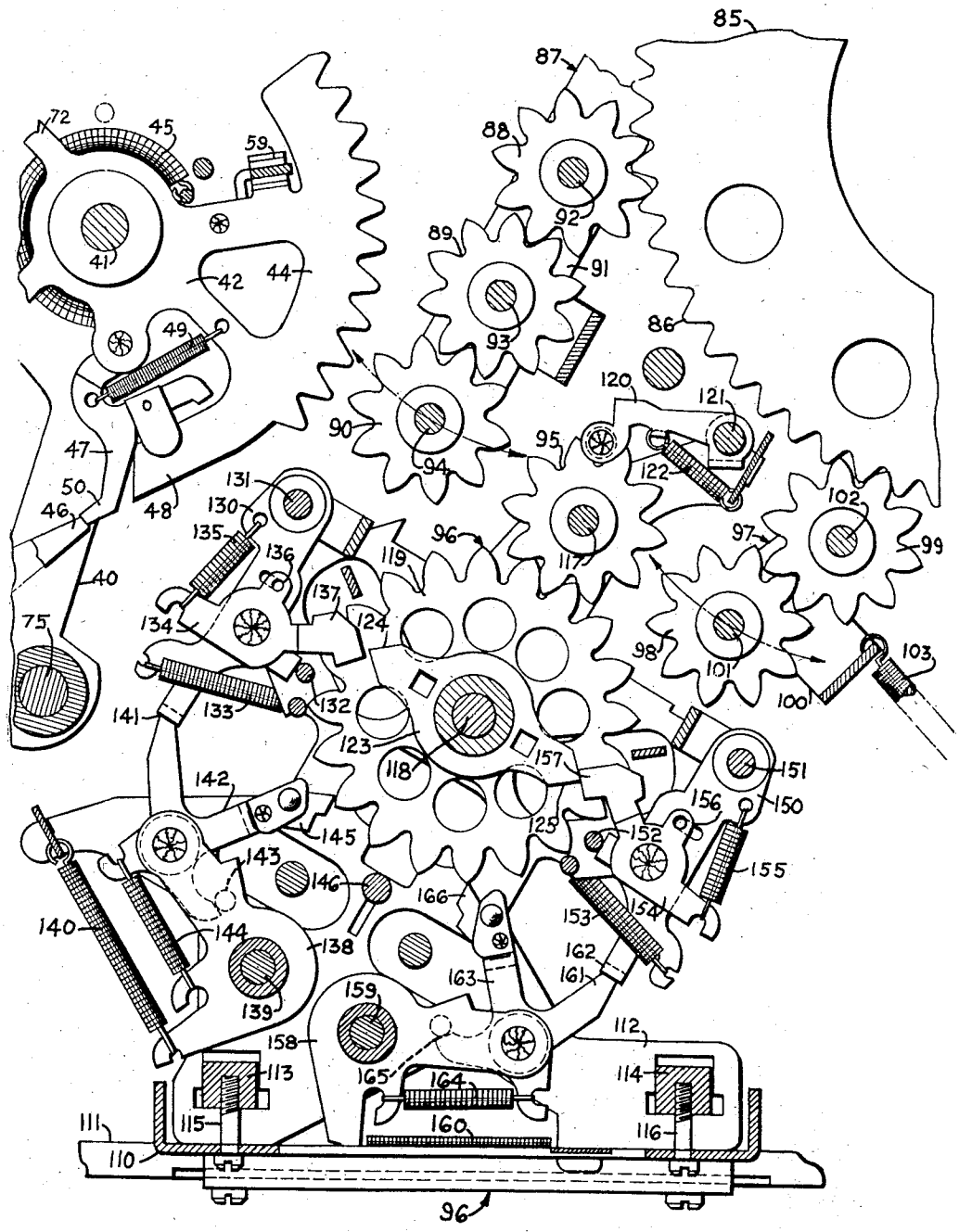
FIG. 4



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TEN KEY ADDING MACHINE CLEARING MECHANISM

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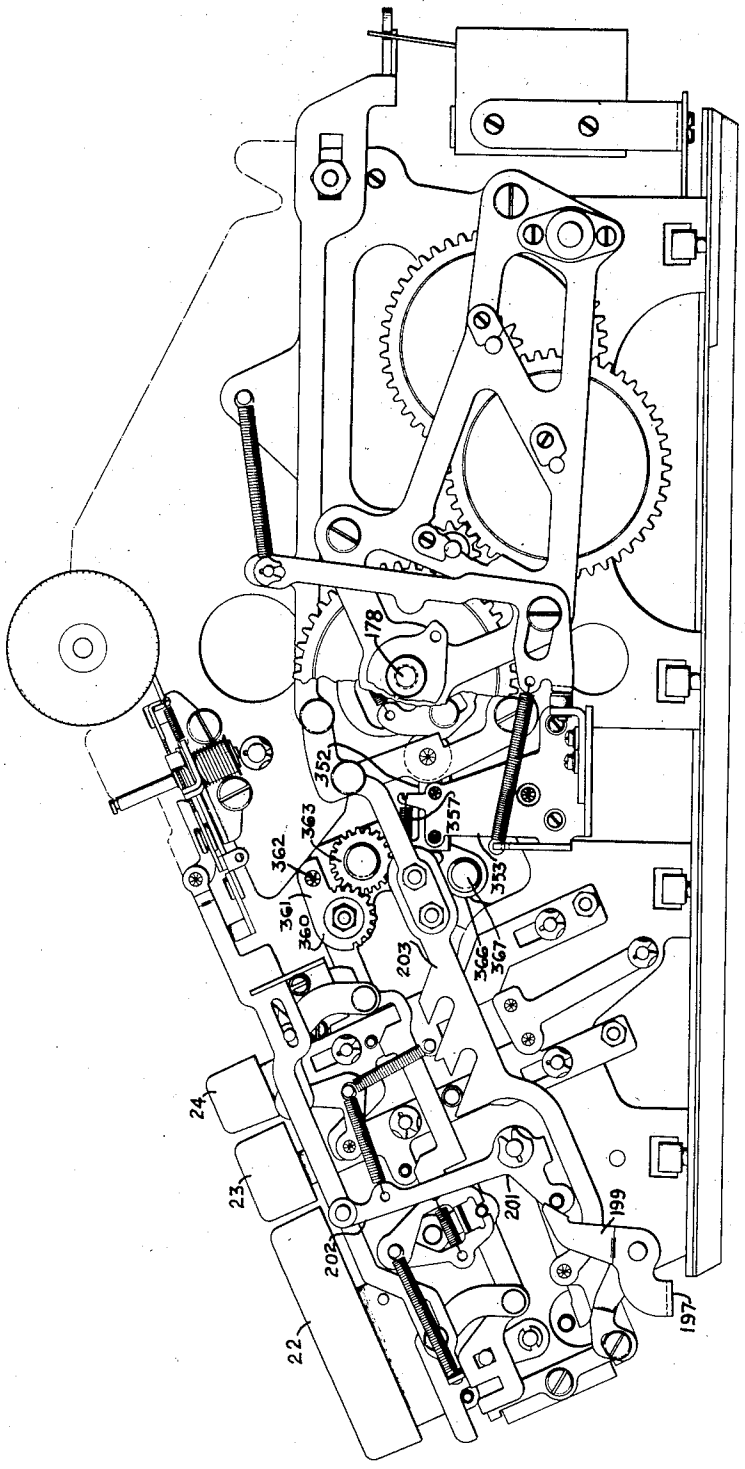

FIG. 5

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TEN KEY ADDING MACHINE CLEARING MECHANISM

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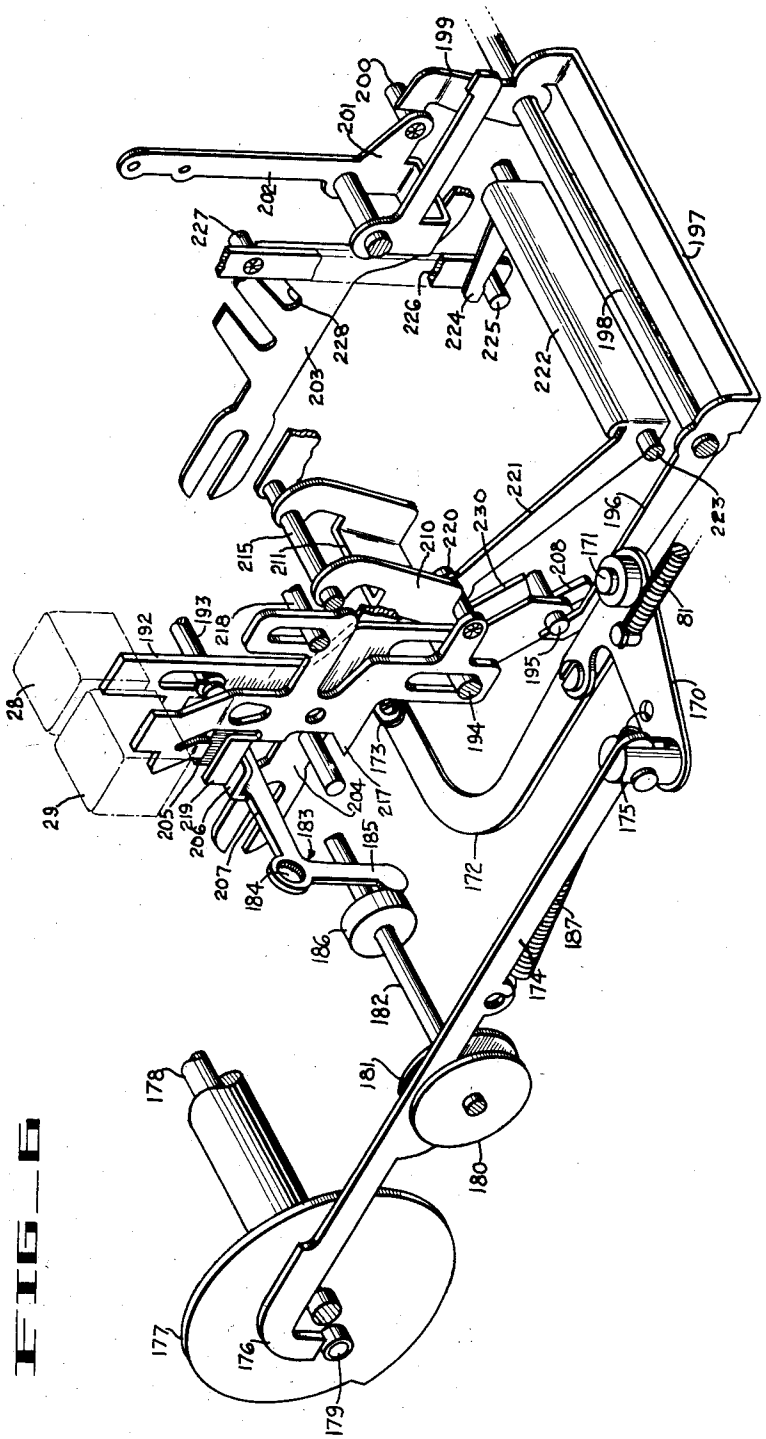

FIG. 6

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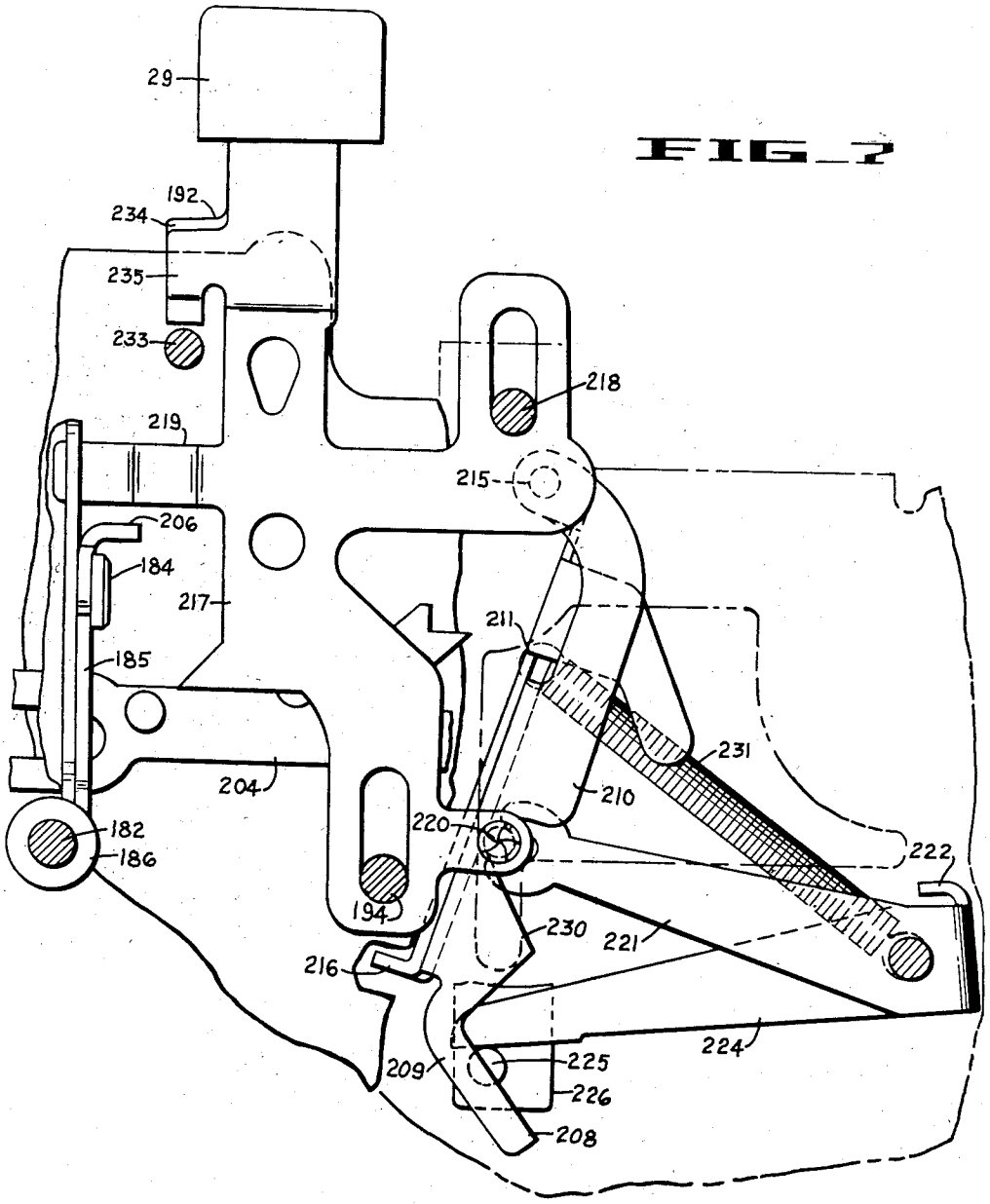
FIG_2



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TEN KEY ADDING MACHINE CLEARING MECHANISM

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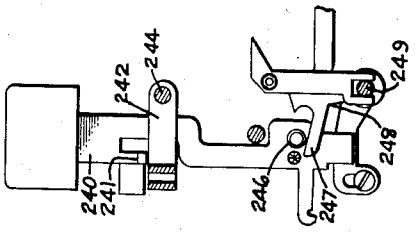

FIG. 9

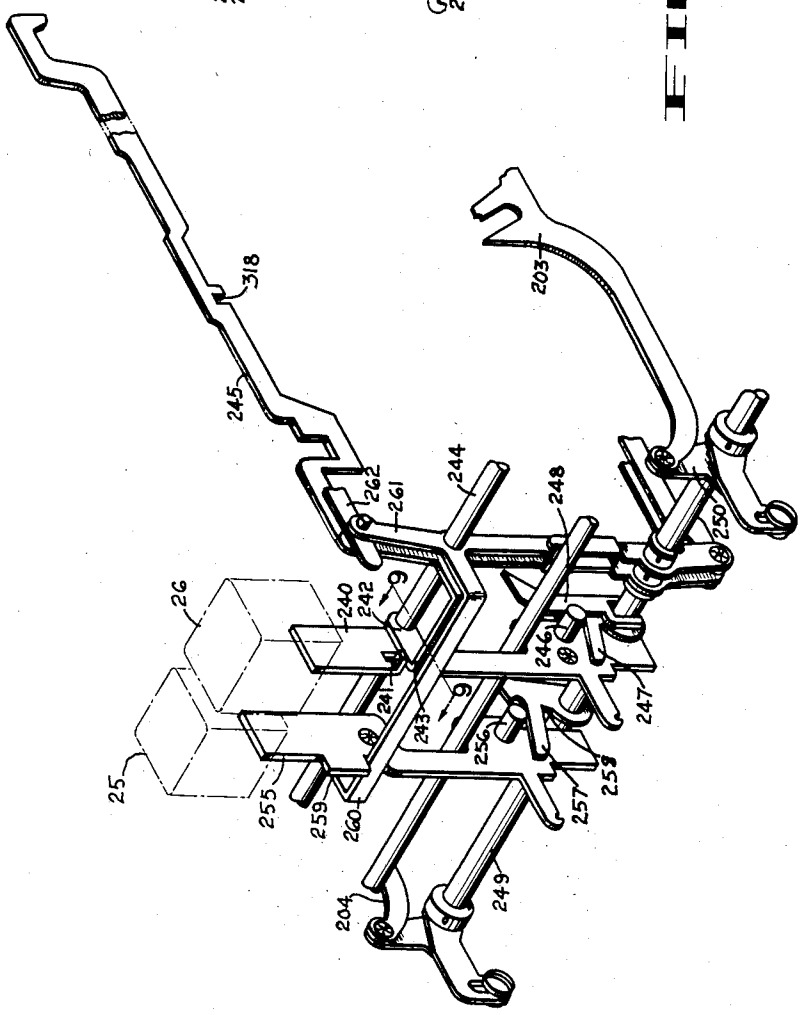

FIG. 8

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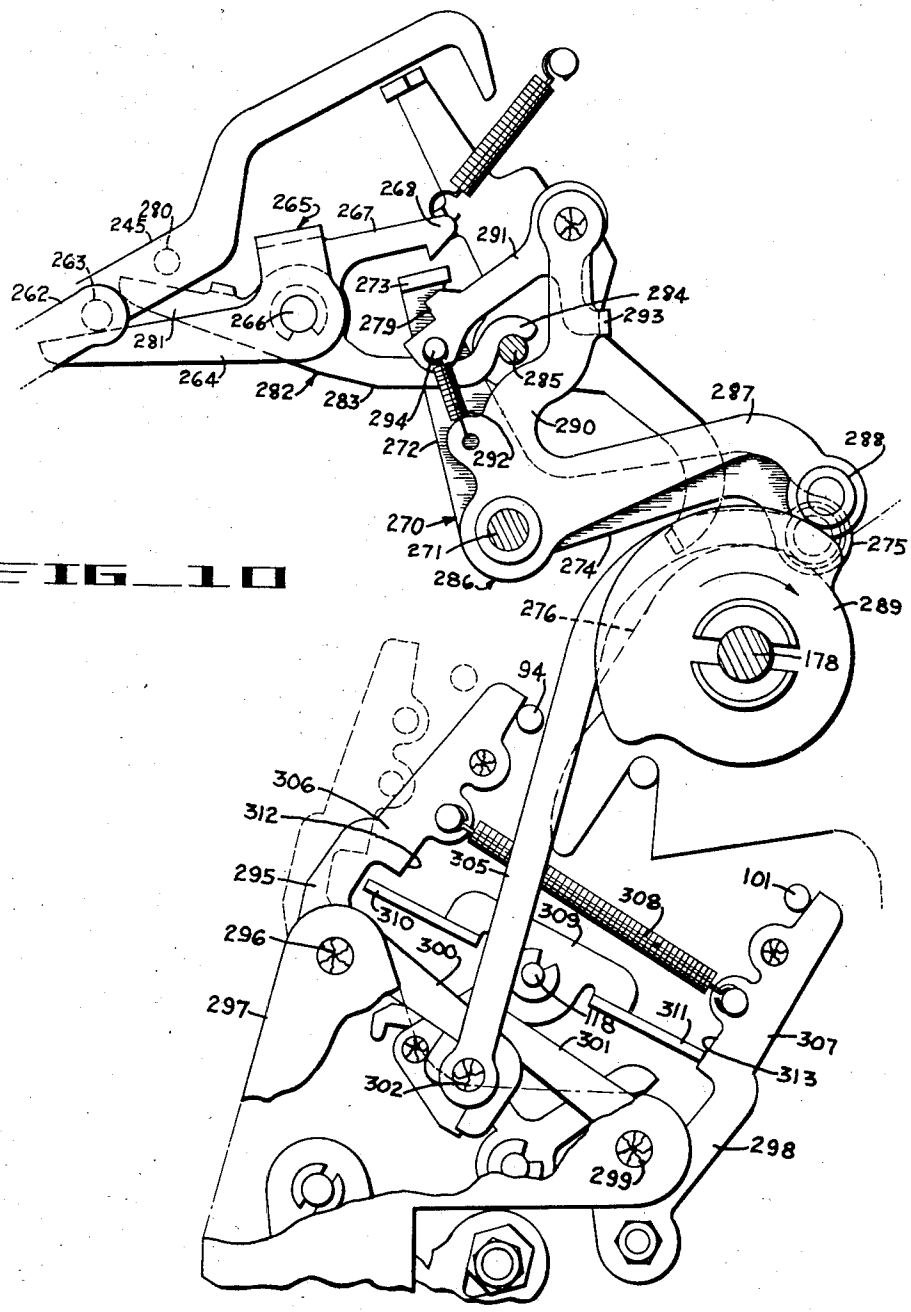

FIG_10

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TEN KEY ADDING MACHINE CLEARING MECHANISM

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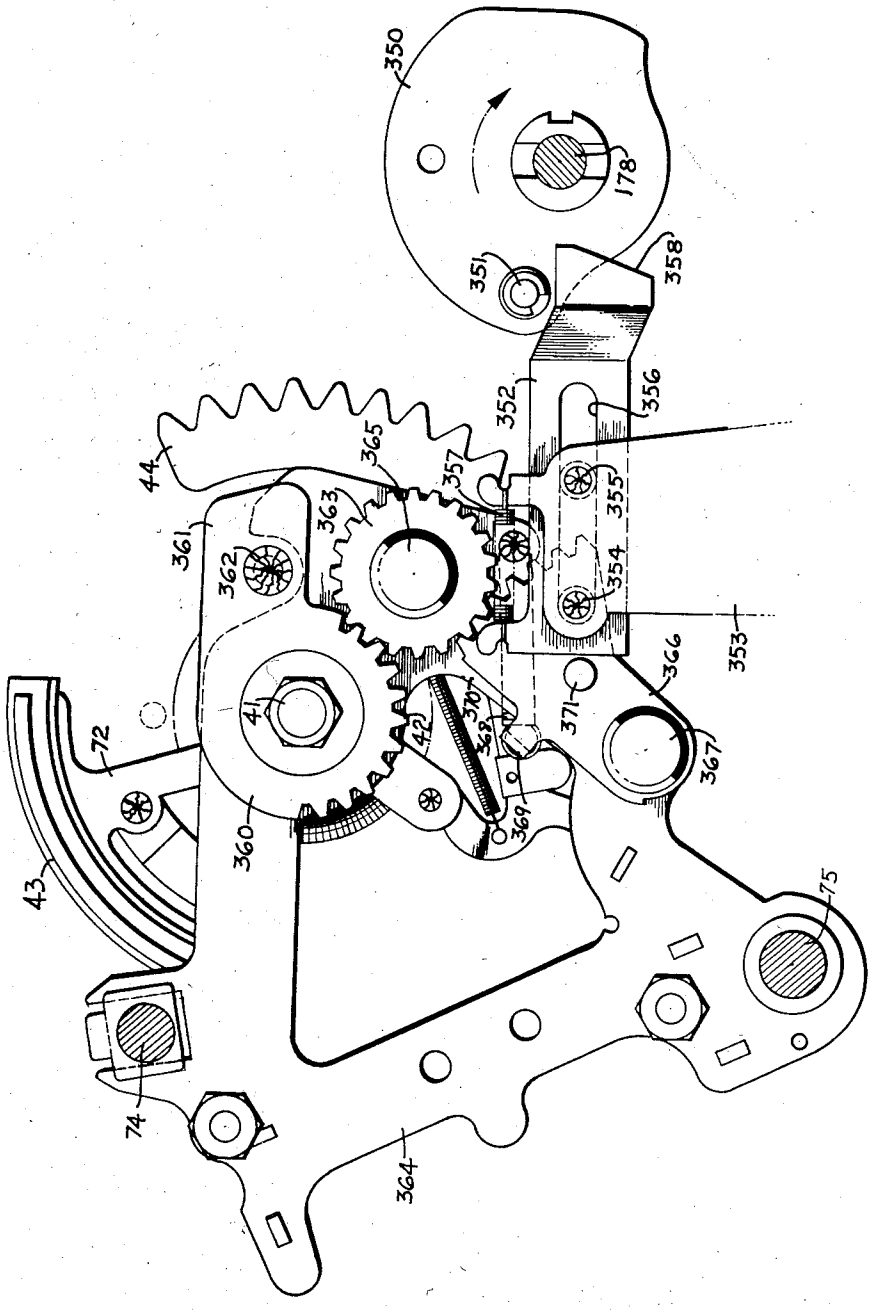

FIG. 11

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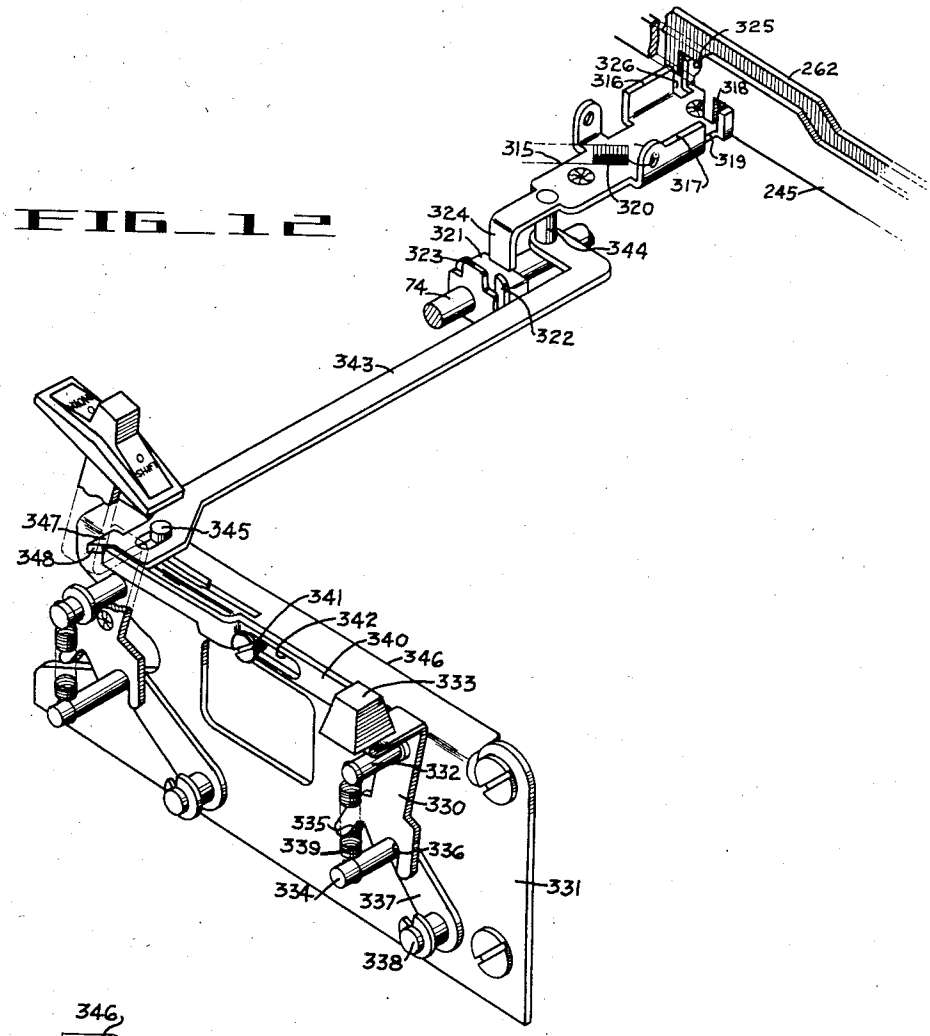

FIG_12

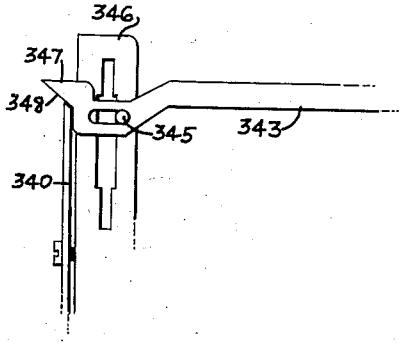

FIG_13

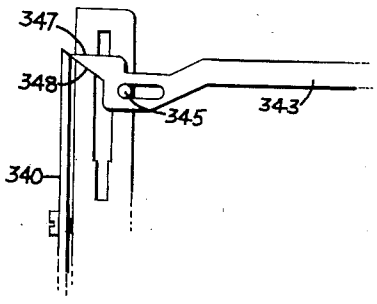

FIG_14

United States Patent Office 2,883,105 Patented Apr. 21, 1959

2,883,105

TEN KEY ADDING MACHINE CLEARING MECHANISM

Jon E. Grobl, Oakland, and Gottfried Zickler, Castro Valley, Calif., assignors to Friden, Inc., a corporation of California

Application September 30, 1957, Serial No. 686,972

3 Claims. (Cl. 235—60)

This invention relates to ten-key adding or calculating machines having repeat operation control means, such as a repeat addition key or both a repeat addition and a repeat subtraction key, a total-taking key and a control key for clearing the selection mechanism of the machine.

In machines of the character indicated above, an example of which is illustrated in the copending application, S.N. 528,154, by Harold J. Chall et al., filed August 15, 1955, for "Escapement Control Mechanism for Ten-Key Calculating Machine," it has been necessary, following a repeat operation, to clear out and restore the selection mechanism before a total could be taken. This method of operation requires an additional decision and an additional manipulation on the part of the operator and an additional machine operating cycle before a total can be taken.

In previous machines of the character indicated, it is conventional to block operation of the total control key whenever the selection mechanism is displaced from its home position and, presumably, contains a selected value, since the taking of a total under these conditions would fail to clear out and restore the selection mechanism, as is customary when a total is taken.

Since the necessity for clearing out and restoring the selection mechanism before a total is taken after repeat operation can be eliminated by removing the block for the total control key, it is a primary object of this invention to free the total control key for operation immediately following a repeat operation and before the selection mechanism has been cleared and restored to its home position.

Since merely freeing the total control key would leave the selection mechanism in an uncleared condition if a total were taken directly after a repeat operation, it is also an object of the invention to provide for the clearing and restoration of the selection mechanism before the end of a total-taking cycle established under the above-described conditions.

Since there may be machine operations under which it is desirable to retain the blocking of the total control key after a repeat operation, as previously provided, and other operating conditions under which it is desirable to free the total control key after a repeat operation, as described above, it is a further object of the invention to provide manipulatable means for selectively blocking or freeing the total control key under conditions in which the selection mechanism is displaced from its home position.

Other objects and advantages will become apparent from a consideration of the following description and the appended claims in conjunction with the accompanying drawings wherein:

Fig. 1 is a fragmentary top plan view of the forward portion of an adding machine to which the invention may be applied, the machine cover having been omitted;

Fig. 2 is a fragmentary cross-sectional view of a portion of the selection mechanism, on an enlarged scale, taken along the longitudinal vertical plane indicated by the line 2—2 of Fig. 1, with the selection mechanism of the machine displaced to the left from its home position;

Fig. 3 is a fragmentary cross-sectional view of additional parts of the selection mechanism, on an enlarged scale, taken along the longitudinal vertical plane indicated by the line 3—3 of Fig. 1;

Fig. 4 is a fragmentary cross-sectional view of the register and drive mechanism, on an enlarged scale, taken along the vertical plane indicated by the line 4—4 of Fig. 1;

Fig. 5 is an elevational view of the right-hand side of the machine with the machine cover removed;

Fig. 6 is a perspective view of the repeat operation control keys of the machine and the machine parts immediately associated with these keys;

Fig. 7 is a longitudinal cross-sectional view, on an enlarged scale, taken along the plane indicated by the lines 7—7 of Fig. 1;

Fig. 8 is a perspective view of the total and subtotal control keys of the machine and the machine parts direcly associated with these keys;

Fig. 9 is a side view of the "total key" and mechanism closely associated therewith, such as taken on a plane indicated by the line 9—9 of Fig. 8;

Fig. 10 is a fragmentary cross-sectional view of some of the operation controls, on an enlarged scale, such as taken substantially on a vertical plane indicated by the line 10—10 of Fig. 1;

Fig. 11 is a side view, on an enlarged scale, of additional operation controls lying to the right of those shown in Fig. 10, as along the vertical plane indicated by the lines 11—11 of Fig. 1;

Fig. 12 is a perspective view of the manipulatable mechanism for controlling the operation of the total control key when the selection mechanism of the machine is displaced from its home position;

Fig. 13 is a fragmentary top plan view of the mechanism shown in Fig. 12, with the parts in their home, or inoperative, positions; and

Fig. 14 is a view similar to Fig. 13 with the parts in their operative positions.

With continued reference to the drawings, the machine illustrated therein and to which the invention is applied, is the well-known Friden adding machine disclosed in the Patent No. 2,832,530, issued April 29, 1958, to Harold J. Chall, for "Value Selecting and Transmitting Mechanism for Listing Adding Machine," and in the application, S.N. 528,154 referred to above.

Referring particularly to Fig. 1, the machine has a ten-key keyboard including nine numeral keys **20** numbered from "1" to "9" and arranged in a 3 x 3 square formation, and a "0" key **21** disposed at the left-hand side of the group of digit keys. Control keys are arranged around the ten-key keyboard and include the add key **22**, the subtract key **23** and the print only "non-add" key **24** at the right-hand side of the keyboard. The subtotal key **25** and the total key **26** are disposed at the front of the keyboard while the keyboard clear, or error, key **27** and the repeat add key **28** are disposed directly rearwardly of the "0" key **21** and at the left-hand side of the group of digit keys **20**. A repeat subtract key **29** is disposed immediately to the left of the repeat add key **28** and a back-spacing key **30** is positioned immediately to the left of the clear keyboard key **27**.

The complete selection mechanism is somewhat diagrammatically illustrated in Figs. 2 and 3. It will be noted in Fig. 3 that the keys **20** have flat stems **35**, slidably mounted for vertical movement in a fixed keyboard frame having a bottom plate **36** and a top plate **37** held in spaced and parallel relationship to each other by suitable spacing elements **38**.

The selection mechanism also includes a shiftable unit,

generally indicated at 39, the carriage of which comprises a pair of end plates, the left one of which is indicated at 40 in Fig. 3 and the right one of which is shown at 364 in Fig. 11, secured in spaced and parallel relationship to each other by suitable tie rods and shafts supporting the selection mechanism. One of these shafts constitutes an axle 41 extending between, and mounted at its ends in, the carriage end plates. This axle carries a series of rockable selection sectors 42, each of which comprises two integral but substantially diametrically opposite sections. One section of each selection sector constitutes a numbered dial 43, which dials are visible through a window 31, Fig. 1, provided in the machine cover, when an entry is made into the selection mechanism, so that the operator can visually check the values entered. The other section of each selection sector comprises an arcuate rack 44, the purpose of which will be presently described. The selection sectors are resiliently urged in a clockwise direction, as illustrated in Figs. 2 and 3, by individual tension springs 45, and are releasably held against rotation from the bias of the springs 45 by individual "0" latch pawls 46. Each selection sector 42 carries a pivotally mounted live point 47 which is held in engagement with the front end of a forward extension 48 of the rack by a spring 49. Each live point has, at its outer end, a forwardly directed nose formation 50 which engages the rear end of the coordinal "0" latch 46 to releasably hold the sector against rotational movement. The "0" latches 46 are ordinally mounted on a shaft 51 which extends between, and is mounted in, the end plates of the carriage, each latch being resiliently urged to operative position in which it engages the coordinal live point 47 by a tension spring 52.

The shaft 51 is located in the lower portion of the carriage 39, in what is sometimes called the "pin box," generally indicated at 55. The pin box comprises a rear wall 56 and a front wall 57, and contains a plurality of settable pins 58 which are slidably mounted in registering apertures in the pin box walls 56 and 57. These pins are arranged in ordinal rows, each row being aligned with one of selection sectors 42 of the selection mechanism. There are eight pins in each row respectively settable by the digit keys from "1" to "8," each adapted to stop the related sector 42 in a differential position corresponding to the value of the key depressed. There is preferably no pin for a value of "9," the depression of that key releasing the sector for free rotation until stopped by a fixed bar 59 extending between the end frames of plates 40 and constituting the "9" stop. The bar 59 is of rectangular cross-sectional shape and also provides the "0" stop for the sectors when the sectors are returned to their "0" position, as will be later described.

A fixed guide plate 60 is disposed forwardly of the settable pins 58 and parallel to the front wall 57 of the pin box. This plate is provided with a vertical slot 61 located at the selection or pin setting station of the pin box. A "0" latch release lever 62 is pivotally mounted on the base of the machine and has its rearward end extending through a small slot aligned with the slot 61, and hence in position to engage under the front end of the "0" latch 46 located at the selection station. This release lever is connected by a link 63 to the rearward end of the lever 64 pivotally mounted intermediate its length on a pivotal support 65. The forward end of the lever 64 is turned upwardly through a slot in the keyboard base plate 36 to form a nose that is disposed beneath a bar 66 which extends longitudinally of the keyboard. The bar 66 is mounted in a pair of arms, not shown herein, which are pivoted at the side of the keyboard frame, so that the bar can be moved in a substantially vertical direction. Each of the key stems 35 of the value keys "1" to "9" is provided with an extension, as indicated at 67, overlying the bar 66, so that this bar is moved downwardly and rocks the lever 64 whenever a digit key of the keyboard is depressed. The rocking of the lever 64, by depression of a keyboard key, raises the link 63 and the rear end of the lever 62 to rock the "0" latch lever 46 in the selection station in a clockwise direction, as viewed in Fig. 3. Such rocking of the "0" latch moves it away from the nose formation 50 of the coordinal live point 47, and thereby frees the associated selection sector 42 for rotational movement by its corresponding spring 45.

Eight bellcrank levers 68 (one for each value key "1" to "8") are rockably mounted on a pivotal support 73 in side-by-side relationship. Each of these bellcrank levers 68 has an upwardly turned nose at its front end so positioned as to be engaged by the bottom ends of the stems 35 of the respective digit keys 20. At its lower end each of the levers 68 is provided with a rearwardly directed finger formation 69 movable through the slot 61 in the plate 60 to engage the front end of the corresponding settable pin 58 to move the pin rearwardly. The finger formations 69 of the levers 68 are arranged in vertical sequence and in a manner such that the lowermost finger is moved when the "1" key is depressed and the uppermost finger is moved when the "8" key is depressed. These levers are resiliently held in their retracted position by individual tension springs 70 connected between the levers and a spring supporting bracket 71 and are moved rearwardly only when the corresponding digit keys are depressed.

The mechanism thus briefly described provides an arrangement in which the depression of a digit key from "1" to "8" results in first moving the corresponding settable pin 58 rearwardly to its set position. Immediately thereafter, as a result of further depression of the key, the "0" latch 46 at the selection station is moved to release the coordinal selection sector 42. The spring 45 then turns the selection sector until the nose formation 50 of the associated live point 57 strikes the rear end portion of the set pin, thereby stopping the selection sector at an angular position corresponding to the value of the key which was depressed. When the "9" key is depressed, the "0" latch 46 at the selection station is released, but no pin 58 is set, the spring 55 rotating the sector until the rearwardly disposed edge of the sector spoke 72 engages the fixed stop 59 and stops the sector. When the "0" key is depressed, the "0" latch pawl 46 at the selection station is not released, nor is any pin 58 projected to an operative position, the selection sector being held in its "0," or latched, position, but the selection carriage is moved one ordinal step to the left, as will be described in the next few paragraphs. However, it can be mentioned here that following a machine operation, when the carriage is returned to its home, or right-hand, position, cam fingers 80 of a fixed comb extend through closed slots in the forward portions of the pins 58 and retract those pins which have been set during the selection operation to their normal, or retracted, position.

The frame of the shiftable selection carriage is slidably mounted on an upper rail 74 and a bottom rail 75. These rails extend transversely of the forward portion of the machine and are rigidly mounted on the machine frame, so that the carriage can move transversely of the machine. The shiftable selection carriage 39 is resiliently urged to the left by a strong spring 81, Figs. 1 and 6, and is restrained against such movement by an escapement mechanism 82, of well-known form, mounted on the rearward edge of the keyboard frame and cooperating with the teeth of an escapement rack 83 mounted on the carriage frame adjacent the upper carriage supporting rail 74. As this escapement mechanism is well-known to the art, a more detailed illustration and description thereof is considered unnecessary for the purposes of the present disclosure.

An escapement operating bar 84 extends longitudinally of the keyboard frame in a forward and rearward direction and is mounted for substantially vertical movement. The rearward end of this bar engages escapement pawls of conventional construction to operate suitable pawls to escape the carriage one ordinal space to the left. The

key stems of the digital value keys **20** and the "0" key **21** provide shoulders, or extensions, such as **67**, which engage the bar to move it downwardly and operate the escapement each time any value key is depressed. The shiftable selection carriage is thus shifted one order to the left each time a value is selected by depression of the appropriate keyboard key **20** or the "0" key **21**.

The mechanism for entering a value in the selection mechanism into the accumulator of the machine is illustrated in Fig. 4. Actuator sectors **85** are rockably mounted on an actuator shaft, not illustrated, and are rocked from their full-cycle, or "0," position to differentially set positions and back to their full-cycle position during each cycle of the machine by power-operated mechanism, not illustrated herein but well-known to the art. In the adding machine, partially illustrated in the accompanying drawings, these sectors are rocked by a rockable bail which extends through the sectors and which is connected to the several sectors by individual, pressure releasable connections. The group of actuator sectors includes one actuator sector **85** for each selection sector **42** with one additional actuator sector to operate the symbol printing mechanism of the machine.

The actuator sectors are provided with peripheral gear teeth **86** which are constantly in mesh with an add pendent gear train and a subtract pendent gear train, both of which are rockably mounted in the machine. The add pendent gear train **87** contains ordinally arranged sets of gears swingably mounted between the actuator sectors **85** and the selection sectors **42**, one gear **88** of each set being constantly in mesh with the coordinal actuator sector **85**. Each order of the add pendent gear train includes an idler gear **89** and a driven gear **90**, which is obviously driven by the coordinal actuator sector **85** through the gears **88** and **89**. The gear train **87**, which includes the ordinally arranged sets of gears **88**, **89** and **90**, are supported in a rockable pendent gear frame **91** by axles **92**, **93** and **94**, respectively.

In the first part of each machine operating cycle involving addition, subtraction, print only and keyboard clearing, the add pendent gear train **87** is swung in a manner to move the driven gears **90** forwardly to mesh the gears of this set with corresponding rack portions **44** of such selection sectors **42** as have been moved to the left of the selection station described above. For each addition operation of the machine, the add pendent gear train is swung, during the second part of the machine operating cycle, to mesh the gears of the gear set **90** with corresponding drive gears **95** of the accumulator, generally indicated at **96**. During each subtractive operation of the machine the add pendent gear train **87** is returned at the end of the first half of the operating cycle to the intermediate position shown in Fig. 4, and the subtract pendent gear train, generally indicated at **97**, is then moved to engage the accumulator drive gears **95** during the last half of the operating cycle. The subtract pendent gear train **97** comprises two ordinally arranged sets of gears **98** and **99** mounted in a rockable frame **100** by the respective axles **101** and **102**. The gears **99** of each ordinal set are constantly in mesh with the teeth of the corresponding actuator sectors **85** and the gears **98** of each set are adapted, when the train is rocked to a subtraction position, to engage the respective drive gears **95** of the accumulator. The subtract pendent gear train is normally biased away from engagement of the gears **98** with the accumulator drive gears **95** by suitable means, such as the spring **103**. It will be noted that since the add pendent gear train **87** contains three sets of gears while the subtract pendent gear train **97** contains only two sets of gears, the subtract pendent gear train will drive the accumulator drive gears **95** in the opposite direction from that in which they are driven by the add pendent gear train **87** with the same direction of movement of the actuator sectors **85**. The gears of the gear set **88** of the add pendent gear train also drive the printing mechanism of the machine. This printing mechanism is not illustrated herein, but is fully shown and described in Patent No. 2,779,267, patented January 29, 1957, by H. J. Chall, for "Printing Mechanism for a Calculating Machine."

The accumulator **96** is a unitary structure bodily mountable in, and removable from, the adding machine and is fully illustrated and described in the application, S.N. 416,301, now Patent No. 2,832,533, by Harold J. Chall, filed March 15, 1954, for "Calculating Machine Accumulator." As illustrated herein, the accumulator has a frame including a base member **110**, detachably secured to the machine base **111**, end plates **364**, such as seen in Fig. 11, and intermediate, or separator, plates **112** ordinally arranged in spaced and parallel relationship to each other and to the end plates. These frame plates are rigidly secured to the base **110** by suitable means, such as the notched clamp bars **113** and **114** and the screws **115** and **116**. Various shafts and tie rods extend through the accumulator frame plates to additionally secure these plates in their spaced and parallel relationship, and include the shaft **117** for the accumulator drive gears **95** and the shaft **118** for the accumulator gears **119**. The accumulator gears **119** and their drive gears **95** are ordinally arranged on their respective shafts, with the same spacing between orders as in the actuators **85** and their gear trains **87** or **97**, or the selection sectors **42**. Each drive gear **95** meshes constantly with its respective accumulator gear **119** and is detented in any angular position by an individual detent pawl **120**. These pawls are rockably mounted on a shaft **121** and are spring-urged by individual springs **122** to seat rollers carried at the distal, or free, ends of the pawls between the teeth of their respective accumulator drive gears **95**.

A tens-transfer cam **123** is disposed beside each accumulator gear **119**, coaxially of the gear, and is secured to the respective accumulator gear. As each accumulator gear has twenty teeth, each of the tens-transfer cams **123** is provided with a pair of diametrically extending arms, or lugs, **124** and **125** symmetrically beveled to points at their distal ends. A positive tens-transfer mechanism is disposed at the forward side and a negative tens-transfer mechanism is disposed at the rearward side of the accumulator. The ordinal units of these tens-transfer mechanisms are conditioned for operation by the coordinal tens-transfer cams and are placed in operation by power-operated actuating means near the end of any machine operating cycle in which a valve is transferred from the selection mechanism into the accumulator of the machine. Each ordinal unit of the positive transfer comprises a latch arm **130** rockably mounted at its upper end on a shaft **131** and resiliently urged to latching position against a stop **132** by a spring **133**. A live point **134** is rockably mounted on the lever **130** and urged by a spring **135** to a position limited by stop means **136**. The live point **134** has on its end adjacent the cam **123** an abutment formation **137** which is engaged by a cam point **124** or **125** of the transfer cam when the associated gear **119** passes through its "9" to "0" positions in either an additive or a subtractive direction. When the gear **119** and cam **124** rotate in a negative direction the live point **134** yields, when they rotate in an additive direction, the live point cannot yield, so the cam rocks the lever **130** outwardly, away from the stop **132**. A bellcrank lever **138** is disposed below the latch lever **130** and is rockably mounted on a shaft **139**. This bellcrank lever is resiliently urged toward the accumulator gear (in a clockwise direction as viewed in Fig. 4) by a spring **140**. The bellcrank is releasably held against rocking from the force of the spring **140** by engagement of the upper end of the lever with an ear **141** on the lower end of the latch lever **130** of the adjacent lower order. When the latch lever **130** is moved outwardly by engagement of the coordinal tens-transfer cam with the abutment formation **137** of the live point **134**, the bellcrank lever **138** in the next higher order

of the accumulator is released from control by latch lever 130. However, full rocking of the bellcrank is not permitted at this time, but is controlled by a conventional mechanism to limit operation until the digitation phase of that cycle is completed, whereupon a power-operated control means functions (at the very end of the cycle) to free the bellcrank levers for complete rocking movement. A gear rotating pawl 142 is pivotally mounted on, and projects inwardly from, the bellcrank lever 138. This pawl is resiliently held in operative position, limited by stop means 143, by a tension spring 144. At its inner end the pawl is provided with a gear tooth element 145 which is adapted to engage the adjacent tooth of the coordinal accumulator gear 119 and rotate the gear one unit space. Such operation of pawl 142, of course, occurs only if the bellcrank lever 138 has been released and is rocked inwardly by the spring 140 at the end of the operating cycle. Movement of the gear by the element 145 is limited to one unit space of rotation by engagement of the element 145 with a fixed stop bar 146 when the gear has been rotated the proper amount.

Each ordinal unit of the negative tens-transfer mechanism is exactly similar to each ordinal unit of the positive tens-transfer mechanism and includes a latch lever 150 swingably mounted on a shaft 151 and resiliently urged into engagement with a fixed stop bar 152 by a tension spring 153. A live point 154 is pivotally mounted on the latch lever 150 and resiliently held by a spring 155 in an operative position limited by the stop means 156. This live point is provided at its inner end with an abutment formation 157 engaged by an end of the coordinal cam 123 as the gear and cam pass through their "0" to "9" position. Whenever the cam point engages the abutment of live point 154, with the gear moving in an additive direction, the live point yields. However, if the gear is moving in a subtractive direction the stop means prevents yielding by the live point, so that the engagement of the cam causes the rocking of the latch lever 150 outwardly (counter-clockwise in Fig. 4). Each ordinal unit of the negative tens-transfer mechanism also includes a bellcrank lever 158 rockably mounted on a shaft 159 and urged by a spring 160 to turn in a counter-clockwise direction, as viewed in Fig. 4. An extension 161 on the bellcrank lever engages an ear 162 on the lower end of the adjacent lower order latch lever 150 to restrain the bellcrank lever against movement by the spring 160. A gear turning pawl 163 is pivotally mounted on the bellcrank lever 158 and is urged by a spring 164 to an operative position determined by a stop means 165. At its end remote from the lever 158, pawl 163 carries a gear tooth engaging element 166 which is adapted to turn its accumulator gear 119 (in the adjacent higher order with respect to latch lever 150) one unit space when the bellcrank lever 158 is rocked. As in the positive tens-transfer operation, when the latch lever 150 is rocked outwardly by the tens-transfer cam passing subtractively through its "0" to "9" position, the bellcrank lever 158 is released from this latch lever and, when freed by the power-operated control means near the end of the coincident operating cycle, is rocked by the spring 160 to make the tens-transfer. The element 166 engages the fixed stop bar 146 to limit the tens-transfer movement of the accumulator gear to one unit space.

Suitable mechanism, not herein illustrated but fully illustrated and described in the above-mentioned Patent No. 2,832,530, is provided to control the operation of the pendent gear trains 87 and 97 in response to operation of the add key and the subtract key. Also, the power-operated means for controlling the movements of the bellcrank levers 138 and 158 is fully illustrated and described in the patent, No. 2,832,533, issued April 29, 1958, to Harold J. Chall, above-mentioned, and Patent No. 2,832,544, issued April 29, 1958, to Harold J. Chall for "Calculating Machine." With the above-described mechanism, a value can be inserted into the selection mechanism of the machine and entered either additively or subtractively into the accumulator.

During the first portion of a machine operation the bail-operating the actuator sectors 85 is moved from its "0," or full-cycle, position to its extreme operative position; and during the latter portion of the same cycle this bail is returned from its extreme operative position to its full-cycle position. During the movement of the bail from its full-cycle to its extreme operative position, the gears 90 of the add pendent gear train 87 are in mesh with the rack portions 44 of those selection sectors 42 which have been moved to the left of the selection station of the shiftable selection mechanism (the gears 88 always meshing with their respective actuator sectors 85). Thus, during the first portion of the movement of the actuator bail, those selection sectors 42 which are to the left of the selection station and have been moved from their "0" positions, are returned to their "0" positions and latched in "0" position by the coordinal "0" latches 46. This differentially sets the associated actuator sectors 85 and, during the second, or return, movement of the actuator bail the value from the selection mechanism is read out of the actuator sectors which have been differentially set and into the accumulator through the add pendent gear train 87 or the subtract pendent and gear train 97, as has been described above.

After the selected value has been read out of the differentially set selection sectors 42 and into the actuator sectors 85 by the add pendent gear train, the shiftable selection mechanism is returned to its home, or right-hand, position during the second portion of the operating cycle; i.e., simultaneously with the "reading out," or transmitting, of the value from the differentially set actuator sectors into the accumulator mechanism. Further, the printing mechanism is set by the rotation of gears 88 during the first, or actuator setting, phase of the cycle; is operated to print the value during the dwell that occurs during the two phases, or portions; and is returned to its "0" setting during the second, or actuator return, phase of the cycle, as is fully explained in said Patent No. 2,832,530, referred to above.

The mechanism for returning the shiftable selection mechanism to its home position is particularly shown in Fig. 6 and includes a bellcrank lever 170 pivotally mounted at its angle on the machine base by a pivotal mounting 171. A longitudinally curved lever 172 extends rearwardly from one arm of the bellcrank 170 and has its distal end connected to the left-hand side plate of the shiftable carriage by a pivoted link 173. The spring 81 is connected between this bellcrank and a fixed spring seat, not shown, to resiliently urge the bellcrank lever to turn in a direction (counter-clockwise in Fig. 6) to move the shiftable selection mechanism to the left from its right-hand position, this movement being controlled by the escapement mechanism mentioned above. A link 174 is connected at its forward end by a universal type connection 175 to the distal end of the other arm of the bellcrank lever 170, the rearward end of which link is biased downwardly by a suitable spring 187 tensioned between the link and the bellcrank. The rearward end of the link 174 is provided with a hook 176, normally disposed beside a cam 177 mounted on the main drive shaft 178 of the machine. This cam carries a stud 179 which is engageable with the hook 176 of the link 174, during the latter portion of an operating cycle of the machine, to move the link rearwardly. This turns the bellcrank lever 170 in a direction to restore the shiftable selection mechanism to its home, or right-hand, position, in which position the mechanism is releasably latched by the escapement mechanism.

Intermediate its length the link 174 passes between a pair of spaced-apart guide disks 180 and 181 mounted on a slidable shaft 182 disposed forwardly of, and parallel to, the main drive shaft 178. The shaft 182 is urged by a spring, not illustrated, to maintain the hook forma-

tion 176 in the path of the stud 179, so that normally the selection carriage will be restored during the latter portion of each operating cycle of the machine. This restoring operation may, however, be disabled by means including a bellcrank lever 183 pivotally mounted, as at 184, on the machine frame. This bellcrank has an arm 185 depending from the pivotal mounting and bearing against a collar 186 fixed on the shaft 182 to slide the shaft in an axial direction (transversely of the machine) to move the hook 176 out of the path of the stud 179.

The repeat addition key 28 and the repeat subtract key 29 are effective to establish addition and subtraction operations, respectively, of the machine as established by the add key 22 and the subtract key 23, respectively, and are additionally effective to disable the selection "0" latch mechanism and the selection carriage restoring mechanism.

As shown in Fig. 6, the repeat addition key 28 has a flat stem 192 guided for vertical movement on the guide studs 193 and 194 and carries at its lower end a transverse stud 195 projecting from both sides of the key stem. One end of the stud 195 bears on the rearward end portion of an arm 196 of a bail 197 rockably mounted on a shaft 198, supported at the lower forward portion of the machine. The bail is provided at its other, or right-hand end, with an arm 199, the distal end of which bears against a stud 200 projecting from the distal end of one arm 201 of a bellcrank. A second arm 202 of the bellcrank is connected to the addition control mechanism of the machine, so that rocking of the bellcrank 201, 202 by depression of the repeat addition key 28 will condition the machine for addition operation. Depression of the key 28, by rocking bellcrank 201, 202 also operates a mechanism, a portion of which is indicated at 203, 204, which closes the motor switch and engages the main clutch of the machine to cause the machine to cycle.

An arm 205 extends rearwardly from an intermediate part of the key stem 192, which arm engages a shelf, or bracket, 206 provided on a second arm 207 of the bellcrank lever 183. Depression of the repeat addition key 28, among other things, rocks the bellcrank lever 183, moving the shaft 182 to the left to shift the hook 176 of the link 174 out of the path of the stud 179. Thus, the shiftable selection carriage will not be restored to its home, or right-hand, position during the latter part of the machine cycle established by depression of the repeat addition key.

The inner end of the stud 195, carried at the lower end of the repeat addition key stem 192, bears on an inclined edge 208 of a tail portion 209 (shown in Fig. 7) of an arm 210 forming the left end of bail 211. The bail 211 is swingably mounted at its upper end on a supporting rod 215 extending transversely of the machine and is provided at its lower end with a rearwardly directed flange 216. The flange has a length substantially equal to the width of the group of selection sectors 42 and, when the bail 211 is swung rearwardly, as it is when the repeat addition key is depressed, this flange engages the forward ends of the "0" latch levers 46 (see Fig. 2) and holds these levers in an inoperative position so that their rearward ends cannot engage the live points 47 on the coordinal selection sectors to latch the sectors in their "0" positions. The sectors will thus return to their differentially set positions in which the live points are stopped by the coordinal set pins 58.

The repeat subtract key 29 has a flat stem 217 (Figs. 6 and 7) guided for vertical movement on the guide rod 194 and a guide rod 218. This key stem is likewise provided with a rearwardly extending arm 219 which overlies on the flange 206 on bellcrank 183. Thus, when the repeat subtract key is depressed, the engagement of arm 219 with flange 206 rocks the bellcrank lever 183 to disable the selection carriage restoring mechanism. Obviously, the disablement of the carriage restoring mechanism results in the selection carriage, including sectors 42, being left in the position to which it was stepped by entry of the selected value therein. A stud 220 projects to the right from the lower portion of the key stem 217 and engages the rearward end portion of one arm 221 of a bail 222. The bail 222 is rockably mounted on a bail rod 223 extending transversely of the lower forward portion of the machine. The bail 222 carries at its right end (remote from the arm 221) a rearwardly directed arm 224 which bears on a stud 225 projecting from the lower end portion of the stem 226 of the subtract key 23. With this arrangement, the depression of the repeat subtract key not only disables the restore mechanism, it also operates the subtract key to condition the machine for subtraction operation. A stud 227 projecting from the stem 226 of the subtract key engages in an inclined notch 228 of the slide 203 to close the motor switch and engage the main clutch of the machine to establish a machine operating cycle.

The stud 220, projecting from the lower end portion of the repeat subtract key stem 217, also overlies a second inclined edge 230 on the tail portion 209 of the side arm 210 of the bail 211, so that the bail 211 will be rocked rearwardly to disable the "0" latches 46 when the repeat subtract key is depressed. Thus, when the repeat subtract key is depressed, the selection mechanism will be left, at the end of a repeat subtract operation, in the position and condition at which it was left at the end of the entry of the selected value. It will be noted in Fig. 7, that the bail 211 is rocked rearwardly by depression of the repeat add and repeat subtract keys against the force of a spring 231 which acts to return this bail to its original position and free the "0" latches for operation when the repeat addition or the repeat subtraction key is released.

A mechanism may be provided, as shown in application S.N. 439,544, to cause the shiftable selection mechanism to step one order to the left each time the repeat add key is depressed and released for semiautomatic multiplication operation of the machine. This multiplication mechanism is selectively rendered operative or inoperative by a selection lever 232 rockably mounted on the machine just to the left of the repeat subtract key, as shown in Fig. 1. When this lever is rocked to its shift position, it moves a bar 233, Fig. 7, under rearwardly projecting extensions 234 and 235 of the repeat addition and repeat subtraction key stems 192 and 217, respectively, so that the bar will be moved, upon depression and release of either of these keys, to cause an ordinal shift of the selection carriage to the left. As this mechanism constitutes no part of the present invention, a further illustration and description is considered unnecessary in the present disclosure.

Referring now to Figs. 8 and 9, the total key 26 has a flat stem 240 slidably supported for vertical movement in the front portion of the machine frame. This key stem is provided near its upper end with a laterally projecting ear 241 which bears on one arm 242 of bail 243. The bail 243 is rockably mounted on a transverse shaft 244, and its right-hand arm is pivotally connected at its upper end to the forward end of a link 245 which extends rearwardly from the bail 243 to condition the total-taking mechanism of the machine for operation when the total key 26 is depressed.

A stud 246 projects from the key stem 240, near the lower end thereof, which stud bears on one arm 247 of a yoke 248 mounted on a transverse shaft 249 to rock this shaft when the total key is depressed. An arm 250 projecting radially from the shaft 249 is connected to the front end of the member 203 to move this member and thereby close the motor switch and engage the main clutch of the machine to establish a cyclic operation of the machine by depression of the total key.

The subtotal key 25 has a flat stem 255 slidably mounted for vertical movement in the front part of

the machine frame, adjacent the total key 26. The key stem 255 is provided near its lower end with a laterally projecting stud 256 engageable with an arm 257 of a yoke 258 also mounted on the shaft 249 to rock the shaft 249 and cause the machine to cycle when the subtotal key is depressed. Near its upper end the key stem 255 is provided with a forwardly extending lug 259 which engages the upper edge of a bail 260 rockably mounted on the shaft 244 to rock this bail when the subtotal key is depressed. The bail 260 has, at its right-hand end, an upwardly extending arm 261 pivotally connected at its upper end to a link 262 which extends rearwardly of the machine from the arm 261. At its rearward end the link 262 (see Fig. 10) carries a laterally projecting stud 263 riding on the upper edge of the forward arm 264 of a bail 265 rockably mounted on a transversely disposed pin 266. The bail has a second arm 267 extending rearwardly from the pin 266, which arm is provided at its rearward end with a downwardly facing hook 268.

There is a bellcrank lever 270 associated with the hook 268. This bellcrank is rockably supported at its elbow on a transversely disposed shaft 271. It has an arm 272 extending upwardly from the shaft 271 and terminating at its upper end in an ear 273 adapted to engage hook 268. The bellcrank lever has a second arm 274 carrying at its distal end a cam following roller 275, the bellcrank 270 and roller 275 being operative to follow the peripheral contour of a subtotal cam 276 mounted on, and rotatable with, the main drive shaft 178. A spring, not illustrated, resiliently urges the bellcrank lever 270 in a direction (clockwise in Fig. 10) to maintain the roller 275 in engagement with the cam 276. Such rocking of bellcrank 270 is disabled at all times other than during a subtotal or total taking cycle by engagement of the hook formation 268 with the ear 273 of the bellcrank. When the subtotal key is depressed the link 262 is moved forwardly, rocking the bail 265 to release the ear 273 from the hook 268. This releases the bellcrank lever 270 for rocking movement by the associated spring and thus conditions the subtotal taking mechanism for operation.

Near its rearward end the link 245, associated with the total key 26, carries a laterally projecting stud 280 (see Fig. 10) which engages the upper edge of the forward arm 281 of a lever 282 which is pivotally mounted intermediate its length on the pin 266. A second arm 283 of this lever extends rearwardly from the pin 266 and is provided at its rear end with a curved rest formation 284 which normally rests on a fixed stud bar 285. When the link 245 is moved forwardly by depression of the total key 26, the stud 280 engages the lever arm 281 and rocks the lever 282 to raise the rear arm 283.

A second bellcrank lever 286 is also rockably mounted at its elbow on the shaft 271. This bellcrank has an arm 287 extending rearwardly from the shaft 271 which carries at its rearward end a cam following roller 288 engageable with the peripheral contour of the total cam 289 also mounted on, and rotatable with, the main drive shaft 178. The lever 286 also has a second arm 290 extending upwardly from the shaft 271, the dextral end of which carries a live pawl 291 pivotally mounted on the upper end of the arm 290 and is resiliently urged by a spring 292 to an inoperative position limited by an ear 293, as is particularly shown in Fig. 10.

When the link 245 is moved forwardly by depression of the total key, the stud 280 engages the lever arm 281 and rocks the lever 282 (counter-clockwise in Fig. 10) to raise the rear lever arm 283. When raised, the lever 283 engages a stud 294 extending through the free, or outer, end of the pawl 291 and lifts the pawl. Near its outer end the pawl 291 is provided with an upwardly opening notch, the back of which constitutes a shoulder 279. When the free end of the live pawl 291 is raised by the lever arm 283 it first engages the hook 268 and lifts the hook away from the ear 273 and, at almost the same time, the shoulder 279 is disposed in operation to the rearward edge of the ear 273 to lock the bellcrank levers 270 and 286 together for simultaneous and coextensive movement. With the two bellcrank levers thus locked together, the spring, which urges the subtotal bellcrank lever 270 toward its cam 276 when this lever is freed from the hook 268, is enabled to rock both levers 270 and 286 together. However, the rocking of the levers is now controlled by the total cam 289 rather than by the subtotal cam 276. The subtotal cam 276 is a short rise cam which actuates the total readout mechanism in a manner to read an accumulated value out of the accumulator during the first portion of the total-taking cycle and to then restore this value back to the accumulator during the latter portion of the cycle, thereby leaving the accumulator in its original condition. The total cam 289 is a long rise cam which actuates the readout mechanism to read the value out of the accumulator during the first portion of the total-taking cycle and then disables the readout mechanism, so that the accumulator is left in a zeroized, or cleared, condition after the accumulated value has been read out of it.

A sign character control bellcrank 295 is pivotally mounted at its elbow on a pivot pin 296 carried by a bracket 297 mounted on the base plate of the machine, to the right of the accumulator. A similar bellcrank 298, operating in opposition to bellcrank 295, is mounted at its elbow on a pivot pin 299 carried by the bracket 297 at the upper rear corner thereof. The bellcrank 295 has an arm 300 extending rearwardly from its pivot pin 296 and the bellcrank 298 has a similar arm 301 extending forwardly from its pivot pin 299. These bellcrank arms 300 and 301 overlap between the pivot pins 296 and 299 and are hooked at their extremities to enclose a stud 302, which is disposed below the overlapping hooked portions of these bellcrank arms. The stud 302 is carried at the lower end of a link 305, the upper end of which is connected to the pin which carries the cam follower roller 275 on the arm 274 of the bellcrank 270. The stud 302 is raised and lowered to rock bellcranks 295 or 298, as the cam 276 or the cam 289 rocks the bellcrank lever 270 or the bellcrank levers 270 and 286, respectively.

The bellcrank lever 295 has an upwardly extending arm 306 which engages at its upper end, the projecting right-hand end of the axle shaft 94 of the additive gear train 87. Similarly, the bellcrank 298 has an upwardly extending arm 307 which engages at its upper end, the extending right-hand end of the gear shaft 101 of the subtract gear train 97. The lever arms 306 and 307 are resiliently urged toward each other by a spring 308 having sufficient strength to move either the add pendent gear train or the subtract pendent gear train into mesh with the accumulator drive gears 95.

A sign indicating gate 309 is rockably mounted at the right-hand end of the accumulator, on the extended right-hand end of the accumulator gear shaft 118. It is provided with oppositely disposed brackets, or wings, 310 and 311, which are respectively adapted to block rocking of either bellcrank 295 or 298, as fully explained in the patent to Harold J. Chall, No. 2,832,530, issued April 29, 1958. The accumulator is provided with true credit balance, or "fugitive 1" mechanism, not herein illustrated but fully shown and described in that patent. The sign indicating gate 309 is rocked by this mechanism from one to the other of its two operative positions whenever the algebraic sign of the value in the accumulator changes from positive to negative or from negative to positive. The outer end of the wing 310 of the gate 309, in one position of the gate, is disposed in opposition to a stop shoulder 312 on the bellcrank arm 306 and in the other position of the gate, is disposed opposite a recess which enables the bellcrank to rock (clockwise in Fig. 10). The other end of the wing 311 of the gate, in the second position mentioned, is disposed in opposition to a stop

shoulder 313 on the bellcrank lever arm 307, thereby blocking rocking of that bellcrank; while in the first mentioned position, the wing is disposed opposite a recess in the arm so that the bellcrank 298 would be free to rock (counter-clockwise in Fig. 10). When the gate is in its positive sign indicating position, shown in Fig. 10, the wing 311 blocks the lever arm 307 while the wing 310 frees the lever arm 306 for rocking inwardly by the spring 308, thereby engaging the additive gear train 87 with the accumulator drive gears. When the gate is in its negative sign indicating position, it will block the lever arm 306 and free the lever arm 307, thereby engaging the subtract pendent gear train 97 with the accumulator drive gears.

The shape and timing of the total cam 289 is such that the value in the accumulator will be read out, positively or negatively depending on the character of the sign of such value, during the first portion of the total cycle of the machine and will be printed at the end of the first half of the cycle. As soon as the value has been printed, the pendent gear train is moved away from the accumulator drive gears and the accumulator is left in its cleared condition while the actuator sectors are returned during the latter portion of the operating cycle to their home, or full-cycle, position and the printing mechanism is zeroized.

Since, during a total or subtotal operation the value is read out of the accumulator during the first portion of the operating cycle and the add pendent gear train is not brought into mesh with the selection sectors, if a total or a subtotal were to be taken in the conventional machine immediately after a repeat operation, the selection carriage would be restored to its home or right-hand position but the selection sectors would not be returned to their "0" position. The total key does not operate the bell-crank lever 183 to disable the selection carriage restore mechanism, so that the restore mechanism is free to operate link 174, bellcrank 170 and link 172 (Fig. 6) to restore the carriage to its right-hand position. Moreover, the conventional subtotal and total mechanism provides no means to return the selection sectors to their "0" condition. Such an operation would thus leave the selection mechanism restored to the right-hand, or home, position of the carriage but with a value still standing in the selection sectors, and there would be no way to move this value from the selection sectors before a new entry was made into the selection mechanism. For this reason it has been necessary to completely clear the selection mechanism after a repeat operation before taking a total or a subtotal. This has conventionally been done by providing an interlock which blocked operation of both the total and subtotal keys until the shiftable selection mechanism is restored to its home position and the selection sectors zeroized, which had to be done by depressing the clear keyboard key 27 to clear the selection mechanism.

The blocking means for the total and subtotal keys is particularly shown in Figs. 1 and 12 and comprises a flat slide 315 mounted on a cross member of the machine frame, just forwardly of the selection sectors 43 for limited movement transversely of the machine. This slide extend under the intermediate portions of the links 245 and 262 and is provided with upstanding lateral flanges 316 and 317. The link 245, operated by the total key, is provided intermediate its length with a downwardly opening notch 318 through which the forwardly disposed flange 317 of the slide 315 is slidable. This flange is provided with an upwardly opening notch 319 through which the portions of the link 245 at the sides of the notch 318 may pass when the selection carriage is in its home, or right-hand, position. A tension spring 320 connected between a seat formed in the flange 317 and a fixed part of the machine frame resiliently urges the slide 315 to move to the left to a position in which the flange 317 to the right of the notch 319 is brought into the notch 318 of the link 245, to thereby block the link against forward movement and hence block operation of the total key 26. A bearing sleeve 321 (also shown in Fig. 2) is slidable along the upper rail 74 and is mounted in the upper forward portion 322 of the left-hand end plate 40 of the selection carriage to constitute one of the elements supporting the carriage on the rail 74. This sleeve carries an upwardly extending ear 323 which engages a downwardly extending ear 324 on the left-hand end of the slide 315, thereby enabling the slide 315 to move to the left under the force of its spring 320 to block operation of total key slide 245 as soon as a single value is entered into the selection mechanism, and to force the slide to the right against the pressure of the spring when the selection carriage is restored to its right-hand position, thereby bringing the notch 318 into registry with the total link 245 and free the total key for operation.

Similarly, the subtotal link 262 is provided with a downwardly opening notch 325 which receives the flange 316 of the slide 315 while the flange 316 is provided with an upwardly opening notch 326 which permits the link 262 to move forwardly when this notch is in alignment with the link. Normally, i.e., with the selection carriage in its inoperative, rightmost position, the notch 319 will be in alignment with the link 245 and the notch 326 will be in alignment with the link 262. In that event the slide 315 is forced to its limiting right-hand position by restoration of the shiftable selection carriage to its right-hand, or home position. Both the subtotal key 25 and the total key 26 are then free to operate as far as the blocking slide 315 is concerned, other means not herein described but well-known to the art, being provided to prevent simultaneous operation of the two control keys. Normally, when the selection carriage is stepped to the left the spring 320 moves the slide 315 to its limiting left-hand position in which a portion of the flange 317 is disposed in the notch 318 and a portion of the flange 316 is disposed in the notch 325, thereby blocking the slides 245 and 262 and rendering both the subtotal key and the total key inoperable.

In accordance with the present invention, several means are provided to free the subtotal key and the total key for operation when the selection carriage is to the left of its home, or right-hand, position. The preferred form of this mechanism comprises a manually operated lever 330 (Figs. 1 and 12) rockably mounted, as by pin 332, on an upright frame plate 331 disposed to the left of the left-hand control keys. A cap, or key top, 333 is mounted on the upper end of the lever 330 for manual operation of the lever. The lever is detented in either one of two operative positions by a detent pin 334 engaging in one or the other of two notches 335 and 336 in the lower end of the lever. The pin 334 is mounted on the free end of an arm 337, mounted at its other end on a fixed pivotal mounting 338. A spring 339 tensioned between the pin 334 and pivot stud 332 urges the pin into detenting engagement in the notches 335 and 336.

A slide 340 extends rearwardly from the upper end of the lever 330 to which it is connected by a pivotal mounting, not shown. The slide is supported in operative position by suitable means including a pin 341 secured to the plate 331 and extending through a longitudinally extending slot 342 provided in the slide 340. The rear end of the slide 340 is disposed adjacent the left-hand end of a link 343 which extends transversely of the machine immediately forwardly of the selection sectors 43. At its right-hand end the link 343 is pivotally connected to the slide 315 by a pivot pin 344. The left-hand end of this link is provided with a longitudinally extending slot which embraces a guide pin 345 extending from the top flange 346 of the frame plate 331. A cam nose 347 is formed on the left-hand end of the link 343 to provide an outwardly and rearwardly inclined cam edge 348 engaged by the rear end of the slide 340.

With this arrangement, the rearward rocking of the upper end of the lever 330 and the consequent rearward movement of slide 340 moves the link 343 to the right. The link then holds the slide 315 in its extreme right-hand, or unblocking, position, i.e., the position assumed when the selection carriage returns to its righthand, home position. With the lever 330 in the rearward position, the subtotal and total keys are maintained free to operate even though the selection carriage has been stepped to the left from its home position. Under these conditions, a subtotal or total can be taken directly after a repeat operation without first clearing and restoring the selection mechanism by operation of the clear keyboard key, or by other means.

When the lever 330 is rocked forwardly the link 343 is freed from control by link 340, so that it, and slide 315, are free to move to the left from the force of spring 320 whenever the selection carriage is stepped to the left from its home position. Under these conditions, the total and subtotal keys will both be blocked at the end of a repeat operation. The operator of the machine may thus select whether the machine will operate normally with the subtotal and total key blocked after a repeat operation or whether it will operate in accordance with the present invention in which a subtotal or total may be taken directly after a repeat operation without first restoring and zeroizing the selection mechanism.

When a subtotal or total is taken with the selection carriage displaced to the left from its right-hand, home position, the carriage will be restored to its home position by the conventional restore mechanism, as explained above, but additional means are required to remove the selection from the selection sectors and return these sectors to their "0" positions. Such means or mechanism is shown in Figs. 5 and 11, to which reference may now be had for a detailed explanation of this feature of the invention.

The conventional addition mechanism actuating cam 350 mounted on the main drive shaft 178 carries a stud 351 projecting laterally therefrom at a location spaced slightly above an operating slide 352, with the cam at its full-cycle position. The slide 352 is mounted for longitudinal movement on the right-hand frame plate 353 of the machine by suitable means, such as the pair of spaced guide pins 354 and 355 extending from the frame plate through a longitudinally extending slot 356 in the slide 352. The slide is resiliently urged to its extreme rearward, inoperative, position by a tension spring 357 and is provided at its rear end with an upwardly and rearwardly inclined cam edge 358. The extreme rearward position of the slide 352 is such that, when the machine cycles, the stud 351 engages the cam edge 358 of the slide near the end of the cycle and moves the slide forwardly against the force of spring 357. At the end of the cycle, the stud passes by the rear end of the slide, to the position shown in Fig. 11, and the spring 357 then returns the slide to its limiting rear position.

A mutilated gear, or sector, 360 is rotatably mounted on the extended right-hand end of the selection sector shaft 41. It is provided with a tangentially extending arm 361. A pin 362 extends to the left from the arm 361 a distance equal to the several selection sectors 42 and is so positioned that, when the sector 360 is rocked, this pin engages the rearward edges of the spoke members 72 and returns all of the differentially set selection sectors to their "0" positions (see Figs. 2 and 3). The returned sectors are latched in their "0" positions by the "0" latches 46, as described above. An idler gear 363 is rotatably mounted on the right-hand end plate 364 of the selection carriage by a suitable pin, or stud, 365 and has gear teeth meshing with the teeth of the gear sector 360. An arm 366 is rockably mounted at its lower end on the end plate 364 by a pivot stud, or axle, 367 disposed below the stud 365. The distal end of this arm is provided with a series of gear teeth which mesh with the teeth of the idler gear 363. The arm is normally urged to its rearward limiting position by a tension spring 368 and is stopped in this limiting rearward position by engagement of the ear 369 on the arm with an abutment formed on the adjacent inner edge 370 of the end plate 364. The ear 369 is also used to attach the front end of a return spring 368 to the arm 366, thereby biasing the arm rearwardly (clockwise in Fig. 11). A stud 371 projects to the right from the outer, or right-hand, side of the arm 366 above the pivot stud 367 and at the level of the intermediate portion of the front end of the slide 352.

The slide 352 will, of course, be moved forwardly by the stud 351 each time the machine cycles. However, when the selection carriage is away from its home position, the stud 371 will be out of position to be engaged by the front end of this slide. When the shiftable selection carriage is restored to its right-hand, or home, position during a subtotal or total cycle following a repeat operation, the stud 371 is brought into position to be engaged by the front end of the slide 352. Then, when the slide 352 is moved forwardly by the stud 351 near the end of the same cycle, the lever 366 is rocked forwardly, rotating the idler gear 363 and turning the gear 360 to swing the arm 361 in a forward direction. The pin 362 then engages all of the differentially set selection sectors 42 and returns these sectors to their "0" positions in which they are latched by the coordinal "0" latches 46. This mechanism will not zeroize the selection mechanism except when the selection mechanism is in its extreme right-hand, one ordinal step past, or to the right of, its home position, since in any other position of the selection mechanism the slide 352 will miss the stud 371 and the arm 366 will not be rocked.

With the above-described arrangement, the manually operable selection lever 333 may be set to enable the machine to take a subtotal or a total immediately after a repeat operation and without previously restoring and zeroizing the selection mechanism. When such a total or subtotal is taken, the selection mechanism will be automatically restored to its home position and zeroized before determination of the subtotal or total cycle.

We claim:

1. In a ten-key adding machine having selection mechanism shiftable from a home position as an entry is made in the selection mechanism, and repeat operation control means effective to operate the machine without restoring the shiftable selection mechanism to home position and zero condition, total control means operable to establish a total taking operating cycle of the machine while said shiftable selection mechanism is out of home position and zero condition, means operative during such a total taking cycle to restore said shiftable selection mechanism to its home position, and means operating after said selection mechanism has been restored to home position and before the end of the coincident operating cycle to restore said selection mechanism to zero condition.

2. In a ten-key adding machine having selection mechanism shiftable from a home position as an entry is made in the selection mechanism, and repeat operation control means effective to operate the machine without restoring the shiftable selection mechanism to home position and zero condition, total control means operable to establish a total taking operating cycle of the machine, a block for disabling said total control means while said selection mechanism is displaced from its home position, manipulatable means effective to selectively disable said block and enable said total taking means while said shiftable selection mechanism is out of home position and zero condition, means operative during such a total taking cycle to restore said shiftable selection mechanism to its home position, and means operating after said selection mechanism has been restored to home position and before the end of the coincident operating cycle to restore said selection mechanism to zero condition.

3. In a ten-key adding machine having selection mechanism shiftable from a home position as an entry is made

in the selection mechanism, and repeat operation control means effective to operate the machine without restoring the shiftable selection mechanism to home position and zero condition, total and subtotal control means operable to establish a total or subtotal taking operating cycle of the machine, a block for disabling said total and subtotal control means when said selection mechanism is out of home position, manipulatable means effective to disable said block and enable said total and subtotal control means while said shiftable selection mechanism is out of home position and zero condition, means operative during such a total taking cycle to restore said shiftable selection mechanism to its home position, and means operating after said selection mechanism has been restored to home position and before the end of the coincident operating cycle to restore said selection mechanism to zero condition.

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