No. 675,304. Patented May 28, 1901.

H. C. SPAULDING.

COIN COUNTER.

(Application filed June 22, 1897.)

(No Model.) 4 Sheets—Sheet 1.

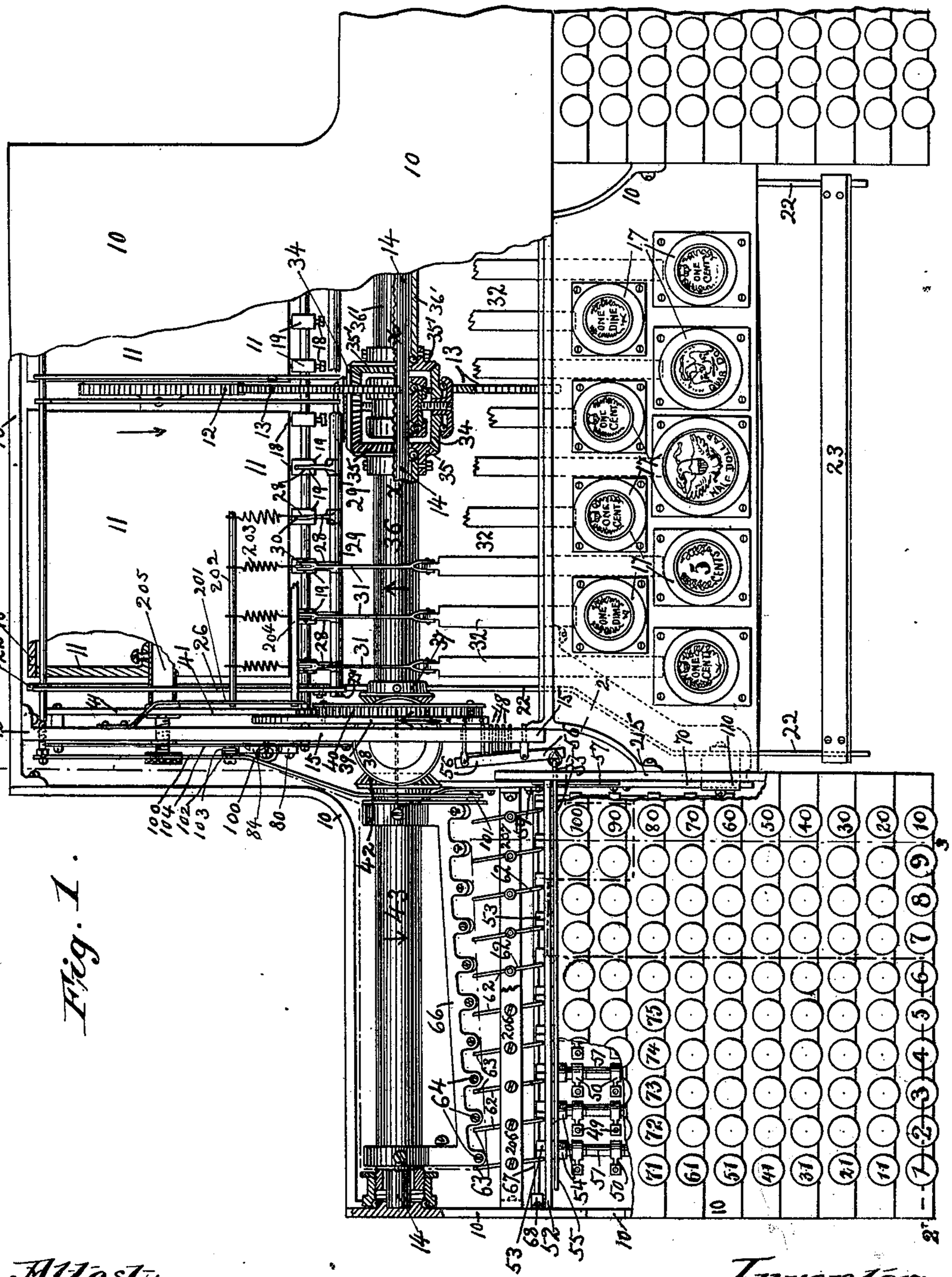

Fig. 1.

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(No Model.) 4 Sheets—Sheet 2.

Fig. 6.

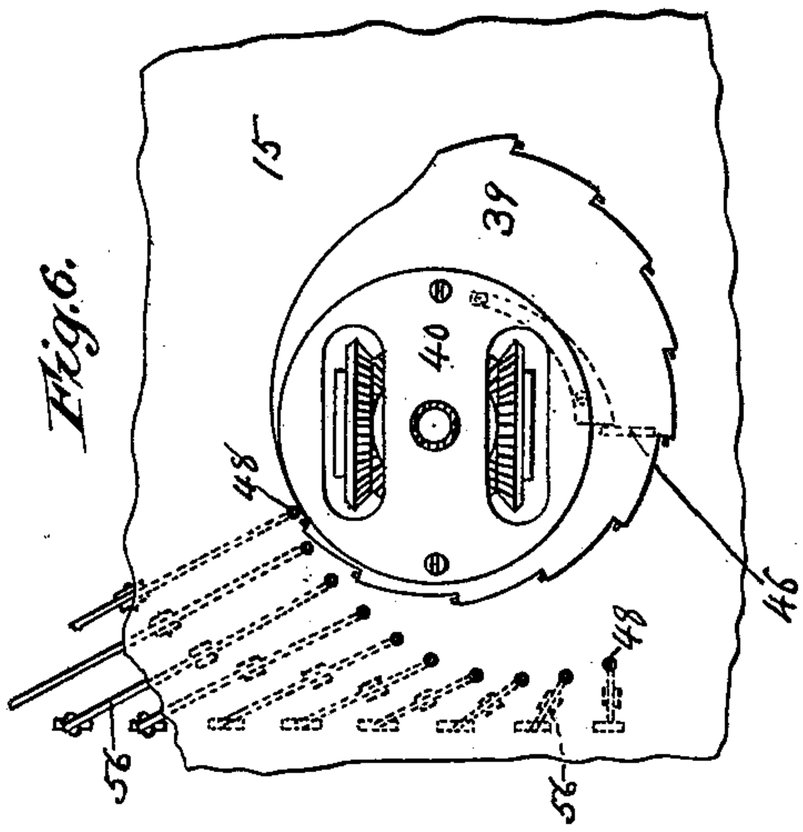

Fig. 5.

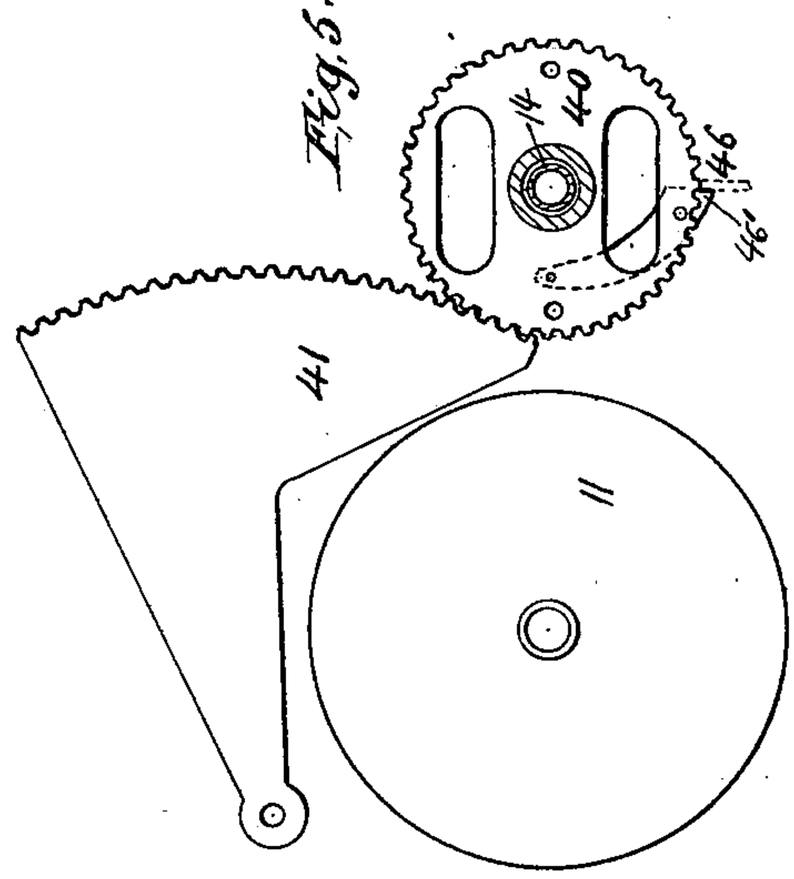

Fig. 2.

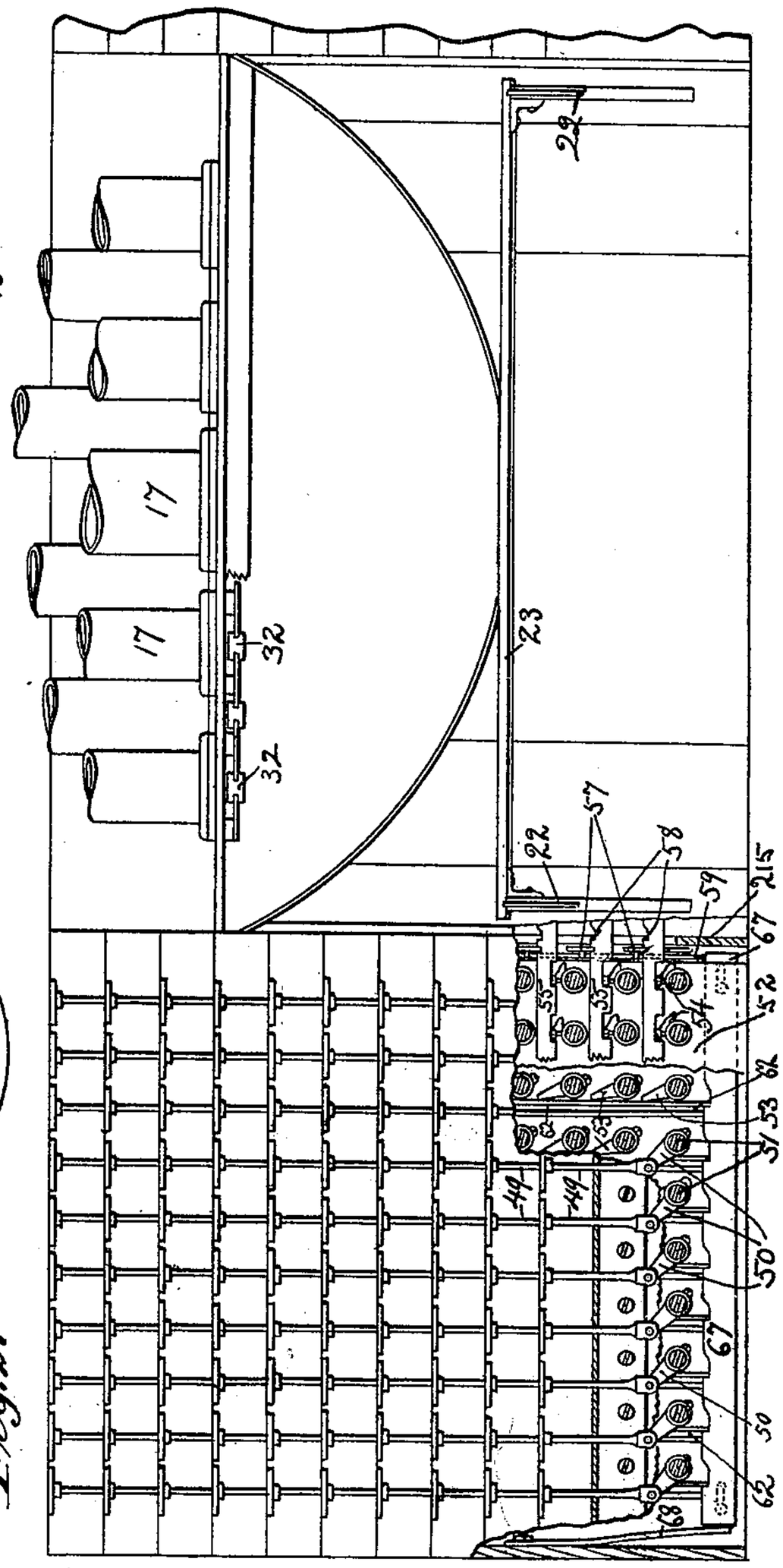

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Fig. 4.

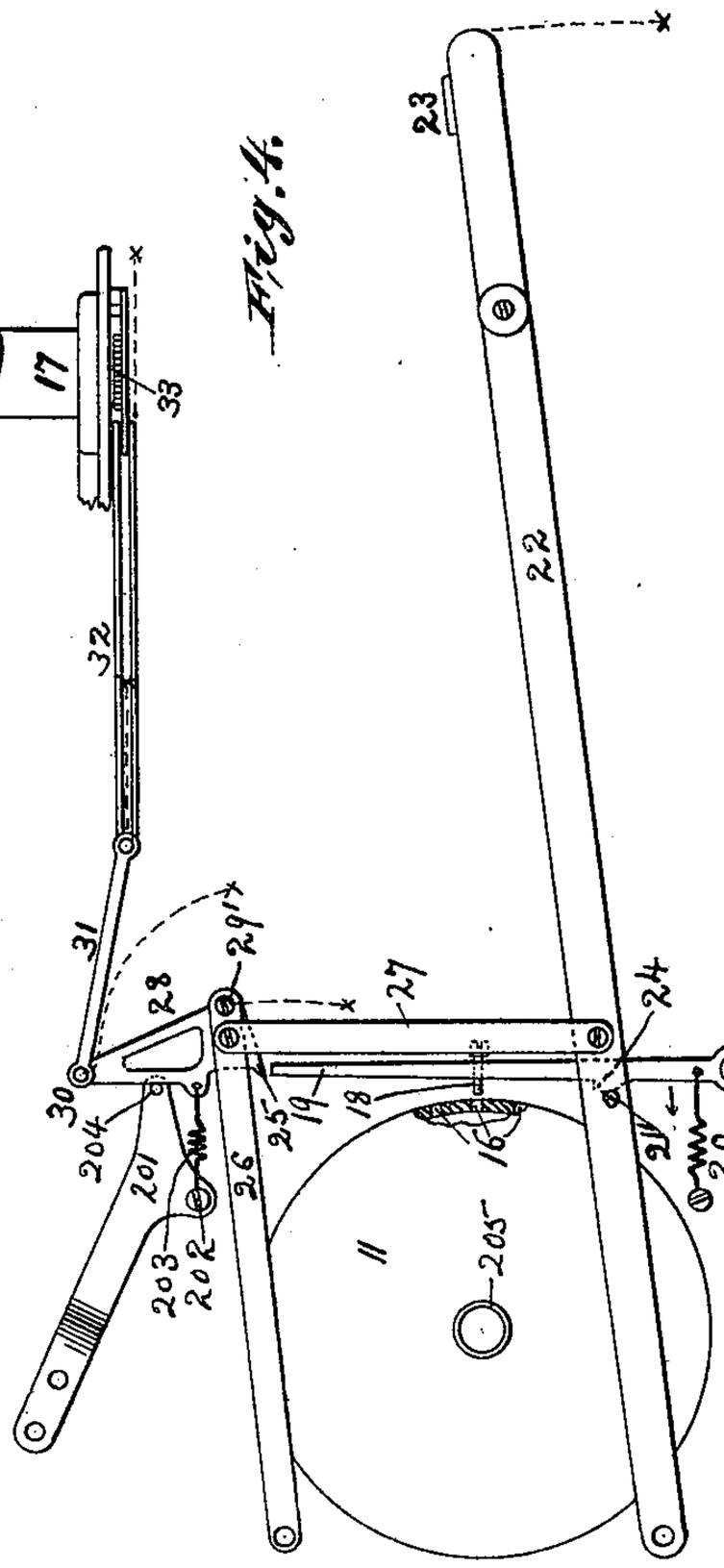
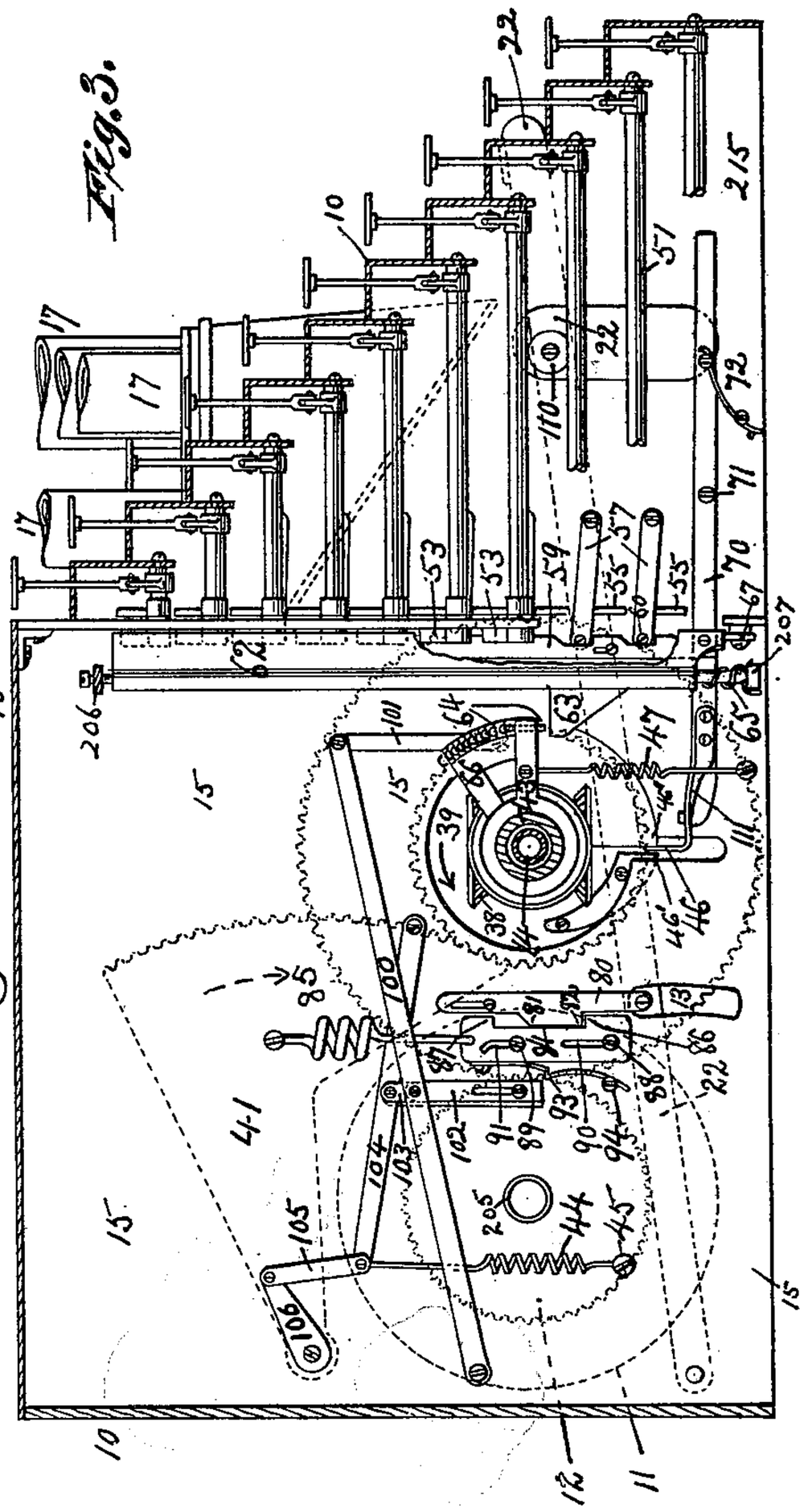


Fig. 3.



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COIN COUNTER.

(Application filed June 22, 1897.)

(No Model.)

4 Sheets—Sheet 4.

Fig. 7.

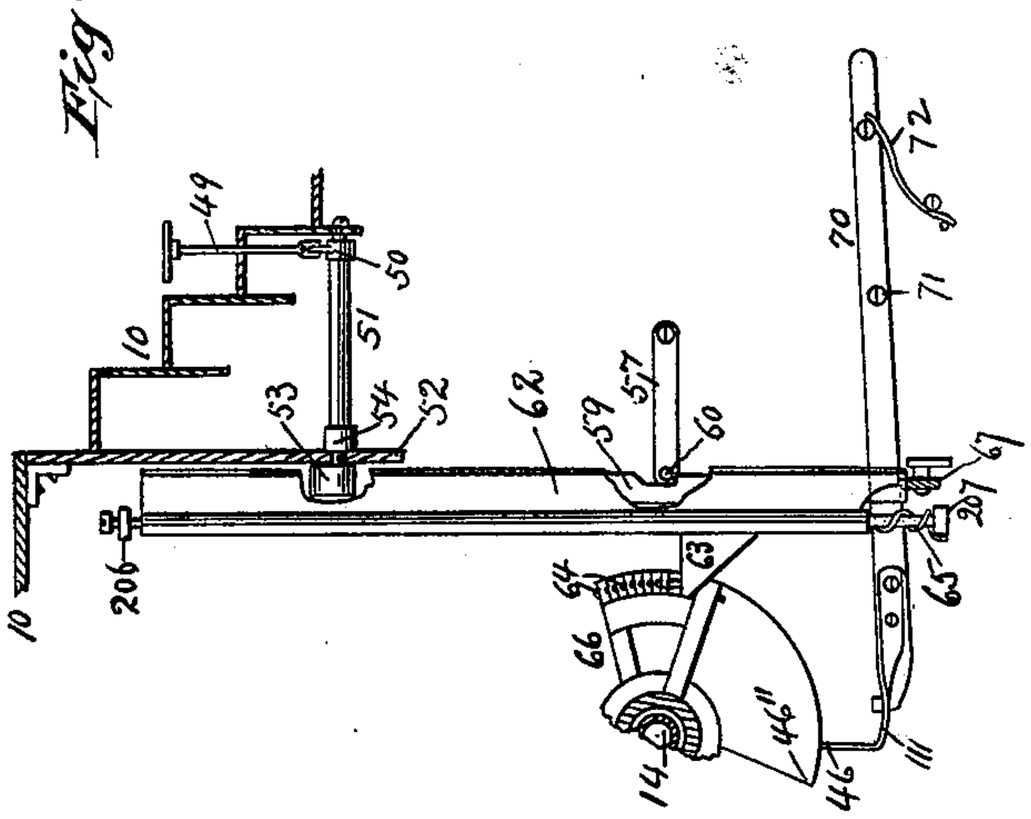


Fig. 9.

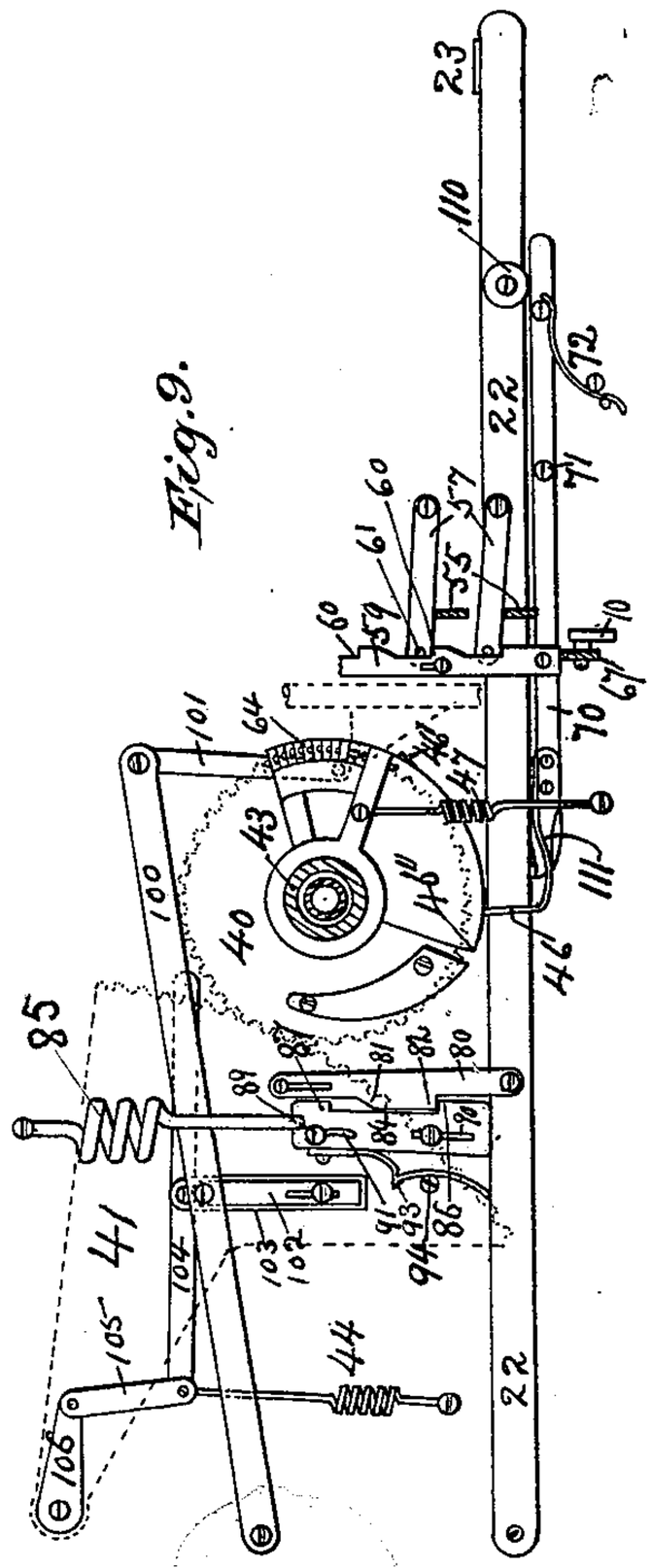
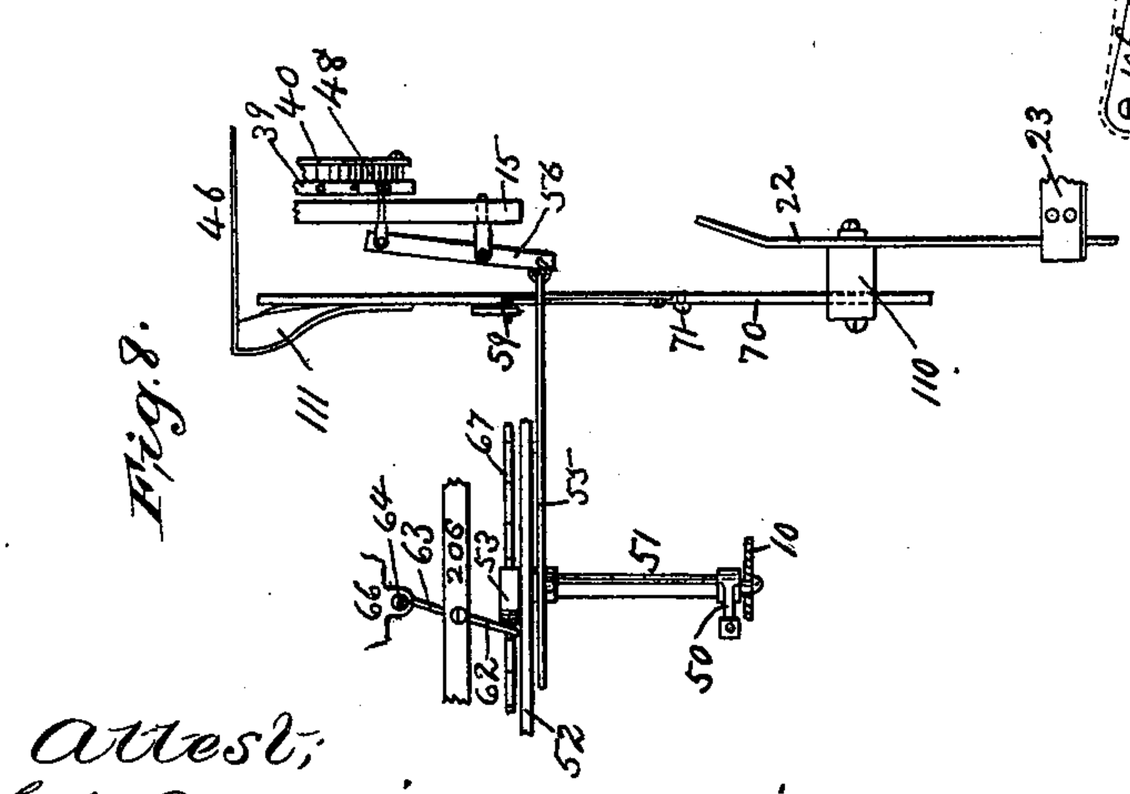


Fig. 8.



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UNITED STATES PATENT OFFICE.

HOLLON C. SPAULDING, OF BOSTON, MASSACHUSETTS.

COIN-COUNTER.

SPECIFICATION forming part of Letters Patent No. 675,304, dated May 28, 1901.

Application filed June 22, 1897. Serial No. 641,832. (No model.)

To all whom it may concern:

Be it known that I, HOLLON C. SPAULDING, mechanical engineer, of Boston, Massachusetts, have invented certain new and useful Improvements in or Relating to Apparatus for Cash and Sales Indicators and Registers and Automatic Change-Makers, of which the following is a description, referring to the accompanying drawings, which form a part of this specification.

My invention relates to cash-registers, to indicators, to change-calculators, and most particularly to mechanism for calculating and making change. Such latter mechanism may itself be connected with or provided with or part of indicating and registering apparatus.

In its preferred embodiment my apparatus as used for change-makers has two sets or banks of keys, one for the amount of money received and the other for the amount of the purchase. Each of these amounts may be indicated and registered or recorded by attachments common in cash-registers. The "Cash-received" keys and the "Amount-of-purchase" keys simultaneously, but quite separately, actuate coin-selecting mechanism. The joint effect of the operation of both sets of keys produces in the selector an effect which is the difference between the two individual effects, and which therefore corresponds to the amount of change desired. When the coin-ejecting mechanism is actuated, coins in amount equal to the change necessary are thrown out.

My invention also contemplates improvements in and relating to the following specific mechanisms, which are adapted to form part of cash-registering, of indicating, and of change-making apparatus—viz., key-operated stops or detents, lock mechanism for the stops and keys, coin-selector mechanism, mechanisms for units and for tens, stop mechanism for same, mechanism for transmitting motion from the units and tens mechanism to the coin-selector mechanism, differential gearing or connections by which the algebraic sum of several different simultaneous or successive movements may be transmitted as a resultant movement, coin-ejecting mechanism, mechanism for restoring parts to their normal condition, and releasing mechanism for the several lock mechanisms.

I will now proceed to describe my invention in one of its preferred embodiments as combined and used in a change-maker and will then point out in the claims the novel features which distinguish my invention and its several parts from other devices.

Before turning to the drawings it will be convenient to enumerate, briefly, the several mechanisms, with their functions and operation, and this will be most conveniently done by beginning with the ultimate object to be accomplished and working backward through the means and elements by which it is accomplished.

First, then, I have a set of coin-holders and levers and mechanism for ejecting from the coin-holders the amount of the change desired. The coin-ejector for each coin-holder is controlled by a coin-selector, which causes the operation of only those coin-ejectors which correspond to the amount of change needed. When the apparatus is constructed to make change from one dollar to one cent, there will be one hundred different adjustments or positions of the coin-selector, each position corresponding to one amount of change between one cent and one dollar, inclusive. The coin-selector is adjusted or set by means of the two banks of keys, one of which is the "Cash-received" bank of keys and the other the "Amount-of-purchase" bank of keys. Each of these banks of keys is connected with the selector, through mechanism which will be presently mentioned, so as to adjust or set the coin-selector to a position corresponding to the key struck by means of my differential mechanism. Each bank of keys has its separate effect upon the selector; but the "Amount-of-purchase" keys produce a reversed effect, so that when a key in each bank is operated the selector mechanism is adjusted or set to correspond to the difference between the cash received and amount of purchase, thereby corresponding to the change required. The way this differential effect is produced is as follows: By means of planetary bevel-gear mechanism a rotary movement corresponding to the amount of purchase and

another rotary movement corresponding to the cash received produces a resultant rotary effect on the coin-selector. Broadly the "selector" is merely any body to be adjusted by keys.

Speaking now only of the mechanism and connections of the bank of keys corresponding to cash received and understanding that these elements are precisely similar but reversed in effect in the case of the keys corresponding to the amount of purchase, I will describe the steps by which a depression of a key causes the rotary movement just mentioned, equivalent to the sum marked on the key. Let us suppose that twenty-five cents is received. The key "25" when struck operates two detents or stops, one of which corresponds to the units—that is to say, "5"—and the other to the tens—that is to say, "2"—in the number "25." These stops or detents limit the movement to two distinct mechanisms, one being the units mechanism and the other the tens mechanism. By depressing the key both these mechanisms are allowed to act under the impulse of springs or other driving means. The unit mechanism turns or moves against the detent corresponding to five units, (cents.) The tens mechanism rotates or moves in amount corresponding to the tens—that is to say, twenty cents. By planetary beveled gearing constituting simultaneous but independent means of transmission these two effects are transmitted to the coin-selector. The sum of these two effects is clearly $20 + 5 = 25$. If the purchase has been thirteen cents, the depression of the "Amount-of-purchase" key marked "13" will in a similar manner, but in an opposite direction, be transmitted to the selector mechanism corresponding, therefore, to minus thirteen. The joint effect of these two motions will be twelve, (twenty-five minus thirteen,) causing the coin-selector to be set at its twelfth position, which will provide for the ejection of coins amounting to twelve cents, preferably a dime and two one-cent pieces.

Having now briefly indicated the general nature of my apparatus, I will describe the several mechanisms as they are illustrated in the accompanying drawings, which show a preferred embodiment of my invention.

Figure 1 is a plan view showing the casing broken away to disclose the mechanism. Fig. 2 is a front elevation, partly broken away on the vertical section planes 2 2 of Fig. 1 to show key mechanisms and attachments. Fig. 3 is a vertical section on the section planes 3 3 of Fig. 1 looking to the right of that figure, showing some parts broken away to reveal details and elements behind them. Fig. 4 is a detail side view of one coin-ejecting mechanism and controlling mechanism therefor. Fig. 5 is a side elevation of the actuating segment and pinion which turn the tens mechanism looking to the right. Fig. 6 is a side elevation, looking to the left, of the stop mechanism and certain other details of the tens mechanism. Fig. 7 is a view showing selected parts only in side elevation in the position when the seventy-five-cent key is struck. Fig. 8 is a plan view of selected details for the seventy-five-cent key in same position. Fig. 9 is a side elevation of selected details of the actuating mechanism for the units and tens mechanisms and the restoring mechanism, which returns the parts to their normal position after the operation, the parts being shown in the position assumed when the seventy-five-cent key has been struck and the controlling-lever depressed to its lowest position.

Throughout the drawings like characters of reference indicate like parts.

The coin selecting and ejecting devices.—Inasmuch as the coin-selector is independently affected by the two sets of "Cash-received" keys and "Amount-of-purchase" keys and inasmuch as the operation of selecting and ejecting coins is common to both banks of keys, it will be convenient to first describe and make clear the coin selecting and ejecting mechanism. The casing is shown at 10, and the selector, which is in the form of a double barrel or drum, is shown at 11. The barrel is divided into two portions turning together in order to place the actuating-gear 12 near the center. The gear 12, meshes with the gear or segment 13, from which it receives motion. As the barrels 11 never make more than a complete revolution and as the gear 13 is larger than the gear 12 the gear 13 makes considerably less in one revolution. For the sake of simplicity, though it is not strictly accurate, we will assume that the gear 13 makes a half-revolution in setting the selector from zero-point to one hundred. This assumption will make the fractional rotation of the connected parts more easily understood. The gear 13 forms a plate which is mounted in ball-bearings upon the main shaft of the apparatus. The main shaft is shown at 14, and in Fig. 1 the ball-bearings which carry the gear 13 are shown in central sections in part and in plan in part, the dividing-line between these two illustrations being indicated at X X. All the planetary gearing and the units and tens mechanism are mounted on this shaft 14, as will be later described.

Returning to the selector barrels or drums 11, these are mounted, preferably, on ball-bearings upon the anterior-posterior supporting-plates 15. The right-hand portion of my apparatus is broken away in Fig. 1, so that only the left-hand and central parts are shown. The selector-barrel 11 has a series of perforations 16 (see Fig. 4, omitted for clearness from Fig. 1) extending in lines around the barrel, there being one line of perforations 16 for each coin-holding tube 17. In the drawings I have shown nine coin-tubes, corresponding to denominations from

fifty cents down to one cent, capable of making change of one dollar to one cent. The perforations in the selector-barrel 11 are also arranged in lines parallel with the axis, there being one hundred of these lines or rows, corresponding to change from one cent to one dollar. In each of these longitudinal rows the perforations 16 are omitted that correspond to the coins which must be thrown out to make the right amount of change. The functions of these perforations 16 will be clearly understood from Fig. 4. Oppositely placed to each circumferential row of perforations 16 is a pin 18, mounted on a lever or arm 19. A spring 20 tends to draw the pin 18 toward the selector-barrel; but the arm 19 is restrained by a movable stop 21, which is mounted on and moves with the main operating-levers 22, which support the finger plate or bar 23 at the front of the machine. The stop 21 is a bar extending all the way across the arms 19 in front of the selector-barrel 11 and mounted at each end in the levers 22, there being two of these levers. The rod 21 is hidden in Fig. 1; but the screw by which it is secured to the levers 22 may be seen in Figs. 3, 4, and 8 at 21′. The portion 24 of the lever 19 which engages the stop 21 is of such a form that as soon as the lever 22 is depressed the spring 20 acts to draw the pin 18 against the selector-barrel 11. If a perforation 16 is opposite the pin 18, the arm 19 is free to move toward the selector-barrel 11 until the upper end or tip is clear of the toe 25, and therefore does not engage the toe; but when the adjustment of the barrel 11 does not bring a perforation 16 opposite a pin 18 the pin striking against the face of the barrel prevents the displacement of the arm 19. Therefore when the downward movement of the operating-lever 22 draws down the arms 26 by means of the links 27 the toe 25 of the bell-crank 28 (which is pivoted on a rod 29, carried by arms 26) strikes the tip of the selector-arm 19, forcing the upper end 30 of the bell-crank 28 toward the front of the machine, and thereby through the connecting-link 31 actuating the coin-ejecting slide or plate 32 and throwing out the coin 33 from the coin-tube 17. The paths of motion of the pins 30 and 29 I have indicated by dotted lines. At various other places in the drawings I have shown the paths of motion of several parts, indicating the extreme position by a small "x" at the end of the dotted line. It being now clear that only the coin-slides 32 which correspond to those selector-pins 18 that are not opposite a perforation 16 in the selector-drum 11 will be actuated to throw out the coins, it is only necessary to arrange the rows of perforations in the selector 11 to correctly correspond to the necessary coins for each amount of change. The selection, therefore, is controlled and determined by the rotary adjustment of the selector barrel or drum 11 to any one of its one hundred positions.

The differential gearing.—This being clear, I will next explain the manner by which the proper movement of adjustment is given to selector-barrel 11. Its actuating-gear 13 is mounted to turn upon the fixed shaft 14 in ball-bearings, as already mentioned. This gear or disk 13 is mounted and turns with the planetary bevel-gears 34, the axes of which are radial to the shaft 14 and revolve about it, causing the turning of the gear-disk 13. The bevel-gears 34 mesh on either side with the bevel-gears 35 35′, mounted and turning with the sleeves 36 36′. These sleeves carry on their other ends similar bevel-gears 37, which mesh with the planetary bevel-gears 38, mounted and turning with the tens disk or stop mechanism 39. If the sleeve 36′ is held and 36 is turned, it is clear that the planetary bevels 34 roll on the bevel-gear 35′ and cause a rotation of the selector-actuating gear 13 through exactly one-half the angular movement of the sleeve 36. Similarly, if sleeve 36 is held and sleeve 36′ rotated the gear 13 will be given an angular movement of one-half that of the sleeve 36′. If both sleeves 36 36′ rotate together, the gear 13 will take one-half the sum of the two movements, and this is true in the algebraic sense when the sleeves 36 36′ are rotated in opposite direction. The sleeve 36 is adjusted by means of the "Cash-received" keys, and the sleeve 36′ is adjusted by means of the "Amount-of-purchase" keys, the only difference being that the connections to the sleeve 36′ are so arranged that the motion is reversed, so as to be subtractive in its effect in adjusting the selector-barrel 11.

The tens-disk 39 carries the gear-wheel 40, which meshes with and is turned by the gear-sector 41. This tens-disk 39 carries the planetary bevel-gears 38, which mesh with the bevel-gear 37 and also with bevel-gear 42, which is secured to and turns with the units-sleeve 43. It will now be seen that if the tens-disk 39 is held a rotation of the units-sleeve 43 transmits through the gears 38 an equal rotation, but in an opposite direction, to the sleeve 36. If units-sleeve 43 be held and the tens-disk 39 turned, it is clear that the bevel-gears 38 roll on the gear 42 and double and transmit the angular motion to the sleeve 36. Similarly, the tens-disk and the units-sleeve may simultaneously operate and transmit the sum of their effects to the sleeve 36. From the foregoing it is also clear that a movement of one one-hundredth of a revolution of the sleeve 43 in the direction indicated by the arrow in Fig. 1 will cause an equal rotation of the sleeve 36 in the direction indicated by the arrow and cause a movement of one-half as much or one two-hundredth of a revolution in the actuating-disk 13 and give one-hundredth of a revolution to the selector-barrel 11, so that one-hundredth of a revolution of the sleeve 43 adjusts the selector one unit. A movement of one-twentieth of a revolution of the tens-disk

39 in the direction indicated by the arrow upon it in Fig. 1 will rotate the sleeve 36 to double that angle or one-tenth of a revolution. This will turn the gear 13 one-twentieth and the selector-barrel 11 one-tenth of a revolution. Therefore an adjustment of one-twentieth of a revolution of the tens-disk 39 causes an adjustment of ten units at the selector-barrel 11.

The tens mechanism.—In Fig. 1 the parts are shown in their normal position before a key is struck. The tens-disk 39 through the gear 40 and sector 41 is acted upon by a spring 44, fixed to the frame at 45 as shown in Fig. 3. This spring tends to turn the sector 41 and the gear 40 and disk 39 in the direction indicated by the arrows. A stop 46 prevents movement and holds the disk at its zero position. This same stop 46 also holds the units-sleeve 43 at its zero position against the action of spring 47. (See particularly Figs. 1, 3, 7, 8, and 9. There are also ten separate movable stops 48 for the tens-disk 39, and these ten stops are actuated by and correspond to the ten rows of keys, each stop being actuated by one of the keys in the corresponding row—that is to say, keys 1 to 10 operate a stop 48′, which prevents the tens-disk turning to any extent, keys 11 to 20 allow it to turn one-twentieth of a revolution before stopping, keys 21 to 30 allow it to turn two-twentieths, keys 31 to 40 allow it to turn three-twentieths, and so on through the series of stops. When a key is struck, the stop or detent 46 releases the tens mechanism, allowing the disk 39 to turn until stopped by one of the key-operated stops 48. Thereby the selector-drum will be acted upon (disregarding the subtractive effect of the right-hand bank of keys and connections) by the disk 39 an amount corresponding to the row of the key struck, it making no difference which key in the row is struck. This tens-disk 39 and the tips of the stops 48 and their coöperative relation are clearly shown in Fig. 6. From Figs. 7, 8, and 9 the manner in which the depression of the key operates the tens mechanism will be clear, the figures showing the position of the parts when the seventy-five-cent key has been struck. The normal position of the parts is shown in the other figures. (See particularly Figs. 4, 5, and 6.) The pins 49, upon which the keys are mounted, extend downward and are pivoted to short crank-arms 50, which turn the key shafts or rods 51. The mounting of these various parts will be clear from the drawings, the transverse partition 52 forming one bearing for each key-shaft 51. Each key-shaft 51 carries at its rear end a finger 53, which forms part of the units mechanism, and a finger or cam 54, which acts upon the corresponding transverse bars 55. These bars 55 are ten in number and operate the ten levers 56, which control the tens-stops 48. Each bar 55 is in position to be acted upon by any key in the corresponding row. When the key 75, therefore, is struck it acts on the seventh bar 55 from the bottom and draws it to the left, throwing the stop 48 into position to engage and stop the tens-disk 39. The movement of the bar 55 to the left allows the corresponding pivoted stop 57 to fall into the notch 58 at the end of the bar, holding the bar in its displaced position, and thereby holding the stop 48 in position to engage the tens-disk. A vertical movable plate or bar 59 has a series of notches 60, which engage pins 61 in these drops or stops 57, so as to raise them when restoring the parts to normal position, and thereby to allow the bar 55 to return to its normal position; but the bar 59, as will presently be shown, is dropped out of the way of the pins 61 when a key is struck, so that the stops 57 are free to drop, as just described. It will be seen that these stops 57 lock the respective tens-mechanism stops 48, and these latter remain locked until the ejecting-lever 22 is struck and the coins thrown out, as will presently be described.

The units mechanism.—When a key—as, for instance, the seventy-five-cent key—is struck, its shaft 51 is turned, and the finger 53 acts upon a corresponding vertical pivoted plate 62, turning it to the left, and thereby moving the stop 63 to the right into position to engage with one of the screw-stops 64, which are carried by and turned with the units-sleeve 43. There are ten of these plates 62, mounted in suitable bearings above and below and preferably provided with springs 65, tending to return them to the normal position when displaced. Each of these plates 62 lies in position to be turned by any one of the ten fingers 53 in one vertical row of fingers 53, corresponding to the ten keys in a vertical column. Therefore when any key is struck it acts upon the plate 62 which corresponds to the units in the cents-mark upon the key. Thus if the key 75 is struck it acts on the fifth plate 62, turning the stop 63 into position to engage the fifth screw-stop 64 of the units mechanism. Accurate regulation of the action of these stops is obtained by adjusting each screw so that the selector-barrel 11 is properly set when the screw strikes against its stop 63. These ten screw-stops 64 form a spiral series, which may be mounted in a spiral or skewed support 66, carried on the sleeve 43. The first of these screw-stops 64 when engaged by the coöperative stop 63 checks the turning of the sleeve 43 at the one-cent position. The second screw-stop 64 cooperates with the second stop 63 to allow the sleeve 43 to turn to the two-cent position, and so on through the series. As soon as the key is struck the detent 46 releases both the units and the tens mechanism, so that the units mechanism turns under the action of its spring 47 until arrested by the stop 63 which has been thrown into position to arrest the motion. I have already explained that when a key is depressed it is automatically locked by the drops or stops 57. The extreme lower ends of the plates 62 lie in notches in a trans-

fifty cents down to one cent, capable of making change of one dollar to one cent. The perforations in the selector-barrel 11 are also arranged in lines parallel with the axis, there being one hundred of these lines or rows, corresponding to change from one cent to one dollar. In each of these longitudinal rows the perforations 16 are omitted that correspond to the coins which must be thrown out to make the right amount of change. The functions of these perforations 16 will be clearly understood from Fig. 4. Oppositely placed to each circumferential row of perforations 16 is a pin 18, mounted on a lever or arm 19. A spring 20 tends to draw the pin 18 toward the selector-barrel; but the arm 19 is restrained by a movable stop 21, which is mounted on and moves with the main operating-levers 22, which support the finger plate or bar 23 at the front of the machine. The stop 21 is a bar extending all the way across the arms 19 in front of the selector-barrel 11 and mounted at each end in the levers 22, there being two of these levers. The rod 21 is hidden in Fig. 1; but the screw by which it is secured to the levers 22 may be seen in Figs. 3, 4, and 8 at 21′. The portion 24 of the lever 19 which engages the stop 21 is of such a form that as soon as the lever 22 is depressed the spring 20 acts to draw the pin 18 against the selector-barrel 11. If a perforation 16 is opposite the pin 18, the arm 19 is free to move toward the selector-barrel 11 until the upper end or tip is clear of the toe 25, and therefore does not engage the toe; but when the adjustment of the barrel 11 does not bring a perforation 16 opposite a pin 18 the pin striking against the face of the barrel prevents the displacement of the arm 19. Therefore when the downward movement of the operating-lever 22 draws down the arms 26 by means of the links 27 the toe 25 of the bell-crank 28 (which is pivoted on a rod 29, carried by arms 26) strikes the tip of the selector-arm 19, forcing the upper end 30 of the bell-crank 28 toward the front of the machine, and thereby through the connecting-link 31 actuating the coin-ejecting slide or plate 32 and throwing out the coin 33 from the coin-tube 17. The paths of motion of the pins 30 and 29 I have indicated by dotted lines. At various other places in the drawings I have shown the paths of motion of several parts, indicating the extreme position by a small "x" at the end of the dotted line. It being now clear that only the coin-slides 32 which correspond to those selector-pins 18 that are not opposite a perforation 16 in the selector-drum 11 will be actuated to throw out the coins, it is only necessary to arrange the rows of perforations in the selector 11 to correctly correspond to the necessary coins for each amount of change. The selection, therefore, is controlled and determined by the rotary adjustment of the selector-barrel or drum 11 to any one of its one hundred positions.

The differential gearing.—This being clear, I will next explain the manner by which the proper movement of adjustment is given to selector-barrel 11. Its actuating-gear 13 is mounted to turn upon the fixed shaft 14 in ball-bearings, as already mentioned. This gear or disk 13 is mounted and turns with the planetary bevel-gears 34, the axes of which are radial to the shaft 14 and revolve about it, causing the turning of the gear-disk 13. The bevel-gears 34 mesh on either side with the bevel-gears 35 35′, mounted and turning with the sleeves 36 36′. These sleeves carry on their other ends similar bevel-gears 37, which mesh with the planetary bevel-gears 38, mounted and turning with the tens disk or stop mechanism 39. If the sleeve 36′ is held and 36 is turned, it is clear that the planetary bevels 34 roll on the bevel-gear 35′ and cause a rotation of the selector-actuating gear 13 through exactly one-half the angular movement of the sleeve 36. Similarly, if sleeve 36 is held and sleeve 36′ rotated the gear 13 will be given an angular movement of one-half that of the sleeve 36′. If both sleeves 36 36′ rotate together, the gear 13 will take one-half the sum of the two movements, and this is true in the algebraic sense when the sleeves 36 36′ are rotated in opposite direction. The sleeve 36 is adjusted by means of the "Cash-received" keys, and the sleeve 36′ is adjusted by means of the "Amount-of-purchase" keys, the only difference being that the connections to the sleeve 36′ are so arranged that the motion is reversed, so as to be subtractive in its effect in adjusting the selector-barrel 11.

The tens-disk 39 carries the gear-wheel 40, which meshes with and is turned by the gear-sector 41. This tens-disk 39 carries the planetary bevel-gears 38, which mesh with the bevel-gear 37 and also with bevel-gear 42, which is secured to and turns with the units-sleeve 43. It will now be seen that if the tens-disk 39 is held a rotation of the units-sleeve 43 transmits through the gears 38 an equal rotation, but in an opposite direction, to the sleeve 36. If units-sleeve 43 be held and the tens-disk 39 turned, it is clear that the bevel-gears 38 roll on the gear 42 and double and transmit the angular motion to the sleeve 36. Similarly, the tens-disk and the units-sleeve may simultaneously operate and transmit the sum of their effects to the sleeve 36. From the foregoing it is also clear that a movement of one one-hundredth of a revolution of the sleeve 43 in the direction indicated by the arrow in Fig. 1 will cause an equal rotation of the sleeve 36 in the direction indicated by the arrow and cause a movement of one-half as much or one two-hundredth of a revolution in the actuating-disk 13 and give one-hundredth of a revolution to the selector-barrel 11, so that one-hundredth of a revolution of the sleeve 43 adjusts the selector one unit. A movement of one-twentieth of a revolution of the tens-disk

39 in the direction indicated by the arrow upon it in Fig. 1 will rotate the sleeve 36 to double that angle or one-tenth of a revolution. This will turn the gear 13 one-twentieth and the selector-barrel 11 one-tenth of a revolution. Therefore an adjustment of one-twentieth of a revolution of the tens-disk 39 causes an adjustment of ten units at the selector-barrel 11.

The tens mechanism.—In Fig. 1 the parts are shown in their normal position before a key is struck. The tens-disk 39 through the gear 40 and sector 41 is acted upon by a spring 44, fixed to the frame at 45 as shown in Fig. 3. This spring tends to turn the sector 41 and the gear 40 and disk 39 in the direction indicated by the arrows. A stop 46 prevents movement and holds the disk at its zero position. This same stop 46 also holds the units-sleeve 43 at its zero position against the action of spring 47. (See particularly Figs. 1, 3, 7, 8, and 9. There are also ten separate movable stops 48 for the tens-disk 39, and these ten stops are actuated by and correspond to the ten rows of keys, each stop being actuated by one of the keys in the corresponding row—that is to say, keys 1 to 10 operate a stop 48′, which prevents the tens-disk turning to any extent, keys 11 to 20 allow it to turn one-twentieth of a revolution before stopping, keys 21 to 30 allow it to turn two-twentieths, keys 31 to 40 allow it to turn three-twentieths, and so on through the series of stops. When a key is struck, the stop or detent 46 releases the tens mechanism, allowing the disk 39 to turn until stopped by one of the key-operated stops 48. Thereby the selector-drum will be acted upon (disregarding the subtractive effect of the right-hand bank of keys and connections) by the disk 39 an amount corresponding to the row of the key struck, it making no difference which key in the row is struck. This tens-disk 39 and the tips of the stops 48 and their coöperative relation are clearly shown in Fig. 6. From Figs. 7, 8, and 9 the manner in which the depression of the key operates the tens mechanism will be clear, the figures showing the position of the parts when the seventy-five-cent key has been struck. The normal position of the parts is shown in the other figures. (See particularly Figs. 4, 5, and 6.) The pins 49, upon which the keys are mounted, extend downward and are pivoted to short crank-arms 50, which turn the key shafts or rods 51. The mounting of these various parts will be clear from the drawings, the transverse partition 52 forming one bearing for each key-shaft 51. Each key-shaft 51 carries at its rear end a finger 53, which forms part of the units mechanism, and a finger or cam 54, which acts upon the corresponding transverse bars 55. These bars 55 are ten in number and operate the ten levers 56, which control the tens-stops 48. Each bar 55 is in position to be acted upon by any key in the corresponding row. When the key 75, therefore, is struck it acts on the seventh bar 55 from the bottom and draws it to the left, throwing the stop 48 into position to engage and stop the tens-disk 39. The movement of the bar 55 to the left allows the corresponding pivoted stop 57 to fall into the notch 58 at the end of the bar, holding the bar in its displaced position, and thereby holding the stop 48 in position to engage the tens-disk. A vertical movable plate or bar 59 has a series of notches 60, which engage pins 61 in these drops or stops 57, so as to raise them when restoring the parts to normal position, and thereby to allow the bar 55 to return to its normal position; but the bar 59, as will presently be shown, is dropped out of the way of the pins 61 when a key is struck, so that the stops 57 are free to drop, as just described. It will be seen that these stops 57 lock the respective tens-mechanism stops 48, and these latter remain locked until the ejecting-lever 22 is struck and the coins thrown out, as will presently be described.

The units mechanism.—When a key—as, for instance, the seventy-five-cent key—is struck, its shaft 51 is turned, and the finger 53 acts upon a corresponding vertical pivoted plate 62, turning it to the left, and thereby moving the stop 63 to the right into position to engage with one of the screw-stops 64, which are carried by and turned with the units-sleeve 43. There are ten of these plates 62, mounted in suitable bearings above and below and preferably provided with springs 65, tending to return them to the normal position when displaced. Each of these plates 62 lies in position to be turned by any one of the ten fingers 53 in one vertical row of fingers 53, corresponding to the ten keys in a vertical column. Therefore when any key is struck it acts upon the plate 62 which corresponds to the units in the cents-mark upon the key. Thus if the key 75 is struck it acts on the fifth plate 62, turning the stop 63 into position to engage the fifth screw-stop 64 of the units mechanism. Accurate regulation of the action of these stops is obtained by adjusting each screw so that the selector-barrel 11 is properly set when the screw strikes against its stop 63. These ten screw-stops 64 form a spiral series, which may be mounted in a spiral or skewed support 66, carried on the sleeve 43. The first of these screw-stops 64 when engaged by the coöperative stop 63 checks the turning of the sleeve 43 at the one-cent position. The second screw-stop 64 cooperates with the second stop 63 to allow the sleeve 43 to turn to the two-cent position, and so on through the series. As soon as the key is struck the detent 46 releases both the units and the tens mechanism, so that the units mechanism turns under the action of its spring 47 until arrested by the stop 63 which has been thrown into position to arrest the motion. I have already explained that when a key is depressed it is automatically locked by the drops or stops 57. The extreme lower ends of the plates 62 lie in notches in a trans-

verse bar 67, which is pressed by a spring 68 to the right. This spring 68 and the bar 67 therefore aid the springs 65 in restoring the displaced plate 62 when the operation is completed. When a key is struck, one plate 62 turns, forcing the bar 67 to the left, and the vertical plate or bar 59, already mentioned, which normally rests upon the end of the bar 67, drops under the action of gravity and under the impulse of a lever 70, fulcrumed at 71 and provided with a spring 72. The dropping of the plate 59 and corresponding movement of the lever 70 withdraw the detents 46 of the tens mechanism and the units mechanism, and the dropping of the plate 59 serves an additional function in that its lower end interferes with the return movement of the bar 67 and so locks it in its left-hand position.

Restoration to normal position.—I have now described the mechanism by which on striking a key the units mechanism and the tens mechanism are released and set, so as to set the selector-barrel at a position corresponding to the key struck, (if the effect of the "Amount-of-purchase" bank of keys and connected mechanism be disregarded.) As already explained, these latter keys and mechanism are similar to the "Cash-received" keys and mechanism, save that the rotary effect on the sleeve 36′ is the reverse or subtractive. I have also described how after the selector-barrel is set by the joint action of both banks of keys the depression of the finger-bar 23 and levers 22 causes the selector-arms 19 to act on the ejecting apparatus to throw out the proper amount of change.

I will now describe the means and mechanism by which the several parts are restored to the normal position after change has been calculated and thrown out.

Moving with one of the levers 22 is a link 80, provided with two shoulders 81 and 82. These shoulders operate and control a spring-pressed "lifter-piece" 84, which performs a vertical but irregular movement under the action of a powerful spring 85. The shoulder 82 coacts with the shoulder 86 of this lifter 84 and the shoulder 81 coacts with the shoulder 87. The lifter-piece 84 is secured by the fixed screws 88 89, which extend through slots 90 and 91 in the piece. Slot 91 is turned or offset at its upper end, so that when the piece 84 is at its lowest position and the screw 89 is in the offset of the slot 91 it will hold the piece in its lowest position against the retractive action of the spring 85. This spring must be sufficiently strong to restore the units mechanism and tens mechanism to their normal positions, overcoming friction and the springs connected with them. When the lever 22 is depressed, the shoulder 82, engaging the shoulder 86, carries the lifter 84 down to its lowest positions and throws the upper end of the lifter to the right, so that the off-set in the slot engages the pin 89 and holds the lifter at its lowest position. The lifter-piece 84 carries the spring-shoulder 93, which is controlled by the fixed pin 94, so as to be withdrawn to the right when at its highest position, which is its position when the keys are being struck. This shoulder 93 engages and raises the connections by which the units and tens mechanisms are restored to their normal or zero positions. In the case of the units mechanism the connection consists of the slide-link 102, lever 100, and link 101, which turn the units-sleeve 43. The slide-link 102, which is connected to the lever 100, coacts with the spring-shoulder 93 of the lifter-piece 84. Fig. 9 shows the parts in position when a key has been struck and the various mechanisms set and the lever 22 depressed. The shoulder 93 appears in position beneath the link 102 ready to engage the link and force it upward by means of the spring 85 as soon as the lifter-piece 84 is released from the pin 89. This occurs on the raising of the lower lever to its highest point, when the shoulder 81 strikes the shoulder 87 of the lifter-piece 84, and thereupon the spring 85 and lifter 84 force the link 102 upward, turning the units mechanism back to the zero position and enabling the detent 46 to lock the mechanism in that position. The pin 94 withdraws the spring-shoulder 93 from the line of movement of the link 102 when the highest position of link 102 has been reached, the parts being then in position shown in Fig. 3. When, therefore, a key is struck and the units mechanism set, the link 102 is free to move downward without engaging the shoulder 93. In Fig. 9 the link 102 and its connected parts are shown in position when the seventy-five-cents key has been struck and the lever 22 depressed to its lowest position. When the lever 22 is released and rises, the selector-arms 19 are drawn back from the drum by means of the movable stop 21 on the lever 22 and the inclines 24 on the selector-arms 19, already described. When the lever nearly reaches its highest position, the shoulder 81 of link 80 strikes shoulder 87 of the lifter-piece 84, throwing it to the left, thereby moving the slot 91 to the left till the offset clears the pin 89 and the spring 85 is free to act. The spring thereupon draws up the lifter-piece and the shoulder 93 engages the link 102 and lifts it, as described, restoring the units mechanism to normal position.

The tens mechanism is provided with a slide-link 103 similar in form and action to the link 102 and coöperating with the spring-shoulder 93 of the lifter-piece 84 in exactly the same manner. The link 103 moves the lever 104 and by means of the link 105 and crank 106 turns the sector-gear 41, which meshes with the gear 40 of the tens-disk 39 and restores the tens-disk to its zero or normal position, allowing the stop or detent 46 to engage and hold it.

I have already explained that stop 46 is carried by the lever 70 and that the spring 72 tends to turn the lever and withdraw the

detent 46. When the lever 22 is depressed to its lowest point, the roller or projection 110 strikes the forward end of the lever 70 and forces it down against the action of the spring 72. This motion of the lever 70 raises the vertical plate 59 and raises the detent 46 in position to engage the units and tens mechanisms. The detent 46 is spring-mounted on the end of the lever 70, as shown at 111, so that as soon as the units and tens mechanisms are restored to their zero positions, as just described, the detent 46 springs into place.

The upward movement of the vertical plate 59 accomplishes several results: First, it raises the drop or stop 57, by which the key that has been struck is locked in its depressed position, for the raising of the drop 57 leaves the horizontal bar or plate 55 free to move to the right back to its normal position, and thereby permit the key-shaft 51 to be turned back to its normal position. The turning of the key-shaft is accomplished by the return of the displaced stop 63 and plate 64 of the units mechanism under the action of its spring 65 and also under the action of the spring 68 and bar 67, which is free to spring toward the right to its normal position as soon as the movement of the lever 70 raises the lower end of the bar 59 clear of its right-hand end. Thus the stop 63 and plate 64, the key-shaft 51 and finger 53, the cam or toe 54 and plate 55, and the tens-mechanism stop 48, connected with such plate 55, are all returned to their normal positions.

Having now explained the functions and operations of the several mechanisms, it will be clear that on striking a key in the bank of "Cash-received" keys and a key in the bank of "Amount-of-purchase" keys the units and the tens mechanisms for the two sets of keys will be actuated and will set the selector-barrel 11. The depression of the finger-bar 23, connected with levers 22, will cause the ejection of the proper amount of change, and the release of the finger-bar 23 and upward movement of the levers 22 will restore all the parts to their normal positions.

I will now mention, briefly, certain adjustments by which the wear may be taken up. It will be seen that all the units and tens mechanisms and the mechanism for simultaneously transmitting the effects of the units and tens mechanisms and producing their resultant effect on the selector-barrel are mounted on ball-bearings on the single shaft 14. A turnbuckle-sleeve 120 is interposed on the sleeve 36′ or elsewhere, by which the length of the sleeve may be lengthened or shortened at will, thereby simultaneously adjusting all the parts on the same shaft 14. The gears 12 and 13, and, indeed, all the gears, will preferably be involute-teeth gears. The tens mechanism will be adjusted by the set-screws of the tens-disk 39, which come in contact with the stops 48. The units mechanism will be adjusted by the set-screws 64, which come in contact with the stops 63.

For convenience in understanding the drawings I have marked various parts of the casing and stationary supports and pivots of the mechanism with reference characters beginning at 200, so that these parts may be identified in the several views; but it will not be necessary to describe these in detail.

I have now fully explained the operation of my invention in one of its preferred embodiments for change-makers. The mechanical embodiment of such an invention for each different requirement is much too complicated to make it either possible or expedient to enumerate all the obvious modifications and substitute elements which may replace the elements and details which I have shown without in any way departing from the principles of the invention.

In understanding the essentials of my device it will be seen that the simultaneous or successive transmission of the units and tens is based upon the principle that one element in a train of differential gears may be actuated by any of the other elements independently of the rest or by all the others simultaneously or successively, so that the resultant movement or position represents the algebraic sum of the effects of all the other elements.

The selector embodies the principle that a different adjustment of an arbitrarily-designed barrel or other moving body controls the ejecting mechanism for the desired amount of change. The several ejectors either operate or are idle according to the position of the selector mechanism. Attachments for recording or registering the operation of the different parts of my machine need not be mechanically different from other well-known registers and recording apparatus, and I will not therefore add to the present specification any description of the means by which they are attached to the two banks of keys for recording the amount of cash received and the amount of purchases made or to the selector-drum, or, broadly, rotary body 11 to record the amount of change or of money paid out. The banks of keys, which range from one cent to one hundred cents, may be used to range from one dollar to one hundred dollars, and when two such banks of keys, operating the selector-drum through differential gears, are employed the range may be increased to from one cent to one hundred dollars. In each bank of keys the one hundred separate keys act in such a manner that the units and the tens of each number are separately transmitted to the differential gearing, so that the number of the key struck is first mechanically analyzed into two components, and then these components are separately transmitted and again added together, while the components from the keys representing the amount of purchase are subtracted. This

principle distinguishes my apparatus widely from purely arbitrary or empirical methods of making change by mechanical means.

I claim, and desire to secure by Letters Patent, the following:

1. In combination in a change-making apparatus, the two banks of keys, the two units mechanism and the two tens mechanism controlled thereby, the differential gearing and the coin-selecting mechanism actuated by said gearing, and means for restoring the parts to normal position, substantially as set forth.

2. In combination, with the main or central shaft and the body to be actuated or controlled, the several sets of planetary or differential gearing mounted to revolve about the said shaft and connected together by intermediate rotary parts, key-controlled stops for said gearing, and means for actuating the said gearing against said stops, substantially as set forth.

3. In combination with coin-selecting mechanism, the units mechanism and tens mechanism, a second units mechanism and tens mechanism, and planetary or differential gearing connecting all four said units and tens mechanisms with the said selector mechanism, and means for adjusting the said units and tens mechanisms at will and thereby adjusting the said selector mechanism, substantially as set forth.

4. In combination with coin-ejecting mechanism, coin-selecting mechanism controlling the said ejecting mechanism, differential or planetary gearing controlling the said selecting mechanism, and means for adjusting the different elements of said gearing for "cash received" and for "amount of purchase" respectively, substantially as set forth.

5. In combination with coin-selecting mechanism and coin-ejecting mechanism, a set of controlling-keys therefor, and operating connections between said keys and said coin-selecting mechanism, there being two independent connections from each one of said keys to the said coin-selecting mechanism, substantially as set forth.

6. In ejecting mechanism and in combination with the holder, the ejecting slide or plate 32, the bell-crank 28, operating said slide or plate, the pivotal support 29 for the said bell-crank, means for giving motion to the said pivotal support 29, and an adjustable controlling arm or stop 19, either clearing the said bell-crank when the bell-crank is actuated, or striking and turning the said bell-crank, as determined by the adjustment of the said arm or stop 19, substantially as set forth.

7. In combination, a rotary support having a series of stops 64 mounted thereon, a series of coöperating stops 63 therefor, means for adjusting the said stops 63 at will, and means for turning the said rotary support and stops 64 till arrested by one of the said stops 63, substantially as set forth.

8. In combination, a rotary support having a series of stops 64 mounted thereon, a series of coöperating stops 63 therefor, a set of keys arranged in several groups, a set of key-operated connections for each of said groups, each of which connections adjusts one of the said stops 63, and means for turning the said rotary support with its series of stops 64 till arrested by one of the said stops 63, and means for restoring the several mechanisms to normal position, substantially as set forth.

9. In combination, a rotary disk or support 39 having a series of stops mounted thereon, a series of coöperating stops 48 therefor, a set of keys arranged in several groups, a set of key-operated connections for each of said groups, each of which connections adjusts one of said stops, and means for turning the said rotary support with its series of stops till arrested by one of the said stops, and means for restoring the said several mechanisms to normal position, substantially as set forth.

10. In combination with a set of operating-keys, and with the body to be actuated thereby, two sets of stops, 63 and 48, actuated by the said keys, and two sets of spring-actuated adjusting connections for said body controlled respectively by the said sets of stops 63 and 48, substantially as set forth.

11. In combination, a set of keys, arranged in lines or rows and in cross rows or columns, a set of stops each of which is operated by any of the keys in the corresponding one of the said cross rows or columns, a second set of stops, each of which is operated by any of the keys in the corresponding one of the said lines or rows, and adjusting mechanisms controlled by the two said sets of stops, substantially as set forth.

12. In combination, the set of keys and key-shafts, each of said key-shafts being provided with a cam or finger, 54, a series of bars 55 actuated by the said cams or fingers, and stops 48 connected with said bars, substantially as set forth.

13. In combination, the set of keys and key-shafts, each key-shaft being provided with a cam or finger 54, a series of bars 55 actuated by the said cams or fingers, stops 48 connected with said bars, mechanism controlled by the said stops, and means for locking the several bars 55 when displaced and thereby locking the depressed key, substantially as set forth.

14. In combination, the set of keys, a crank arm or finger 53 and a cam or finger 54 for each of the said keys, actuated thereby, mechanism controlled by said crank arms or fingers 53, and other mechanism controlled by said cams or fingers 54, each one of said keys controlling both said mechanisms through said crank arms or fingers 53 and cams or fingers 54, substantially as set forth.

15. In combination for cash-registers, change-makers and the like, a bank of keys, two sets of stops corresponding to the units and tens of the numerals of the keys, and actuated by said keys, units mechanism and

tens mechanism provided with detents 46, means for withdrawing said detents when a key is struck, actuating connections operating the said units mechanism and tens mechanism against the said stops, and means for restoring the parts to normal position, substantially as set forth.

In testimony of the foregoing I have hereunto set my hand.

HOLLON C. SPAULDING.

Witnesses:
EDWARD H. PIERCE,
WILTON L. CURRIER.