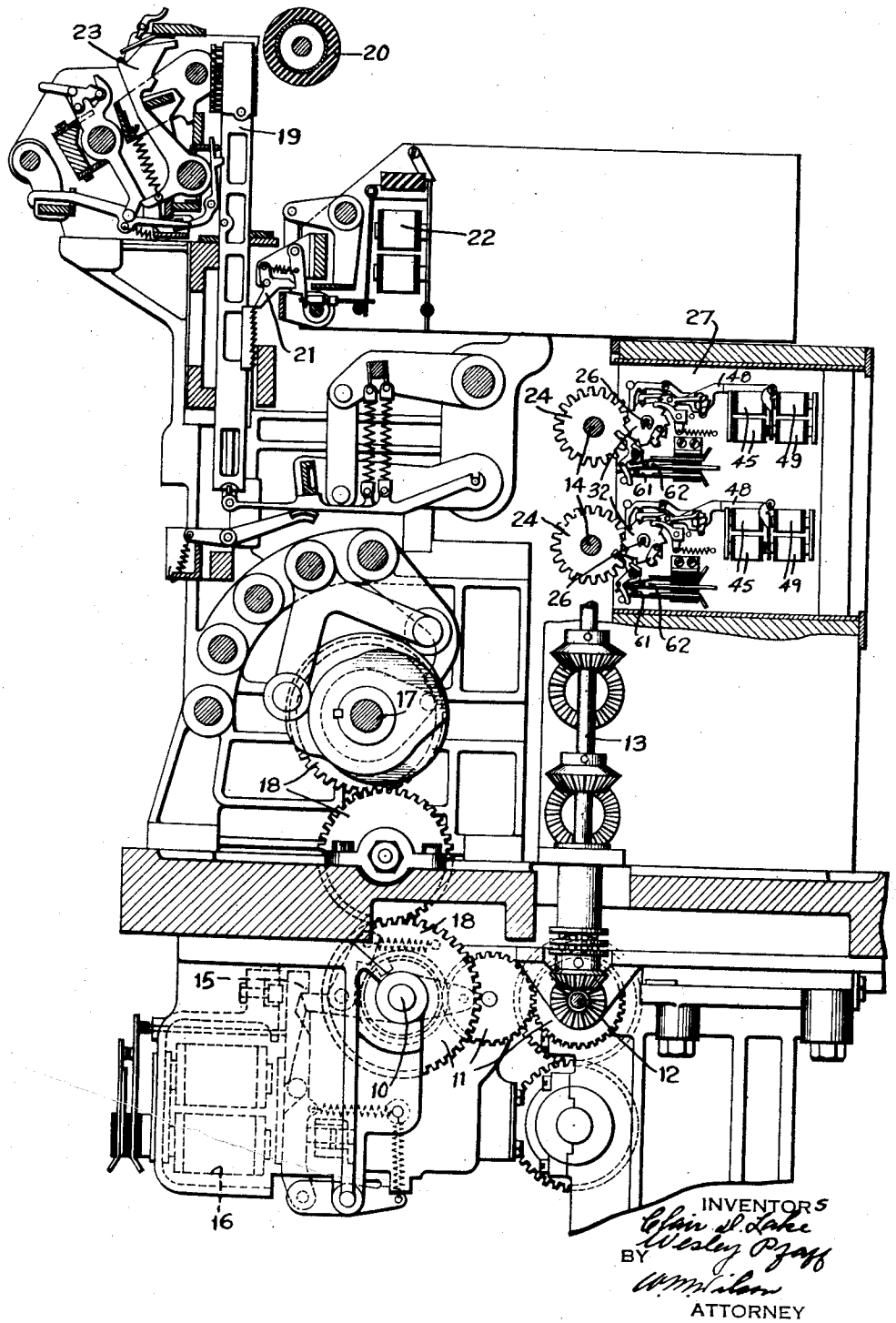
March 14, 1939. C. D. LAKE ET AL 2,150,227

TABULATING MACHINE

Filed Oct. 11, 1935 5 Sheets-Sheet 1

FIG.1.



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TABULATING MACHINE

Filed Oct. 11, 1935 5 Sheets-Sheet 2

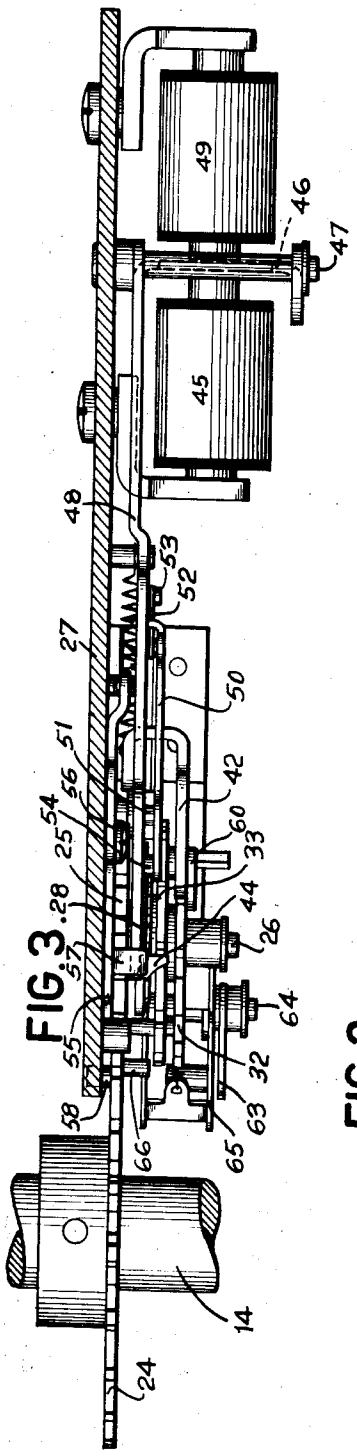

FIG. 3.

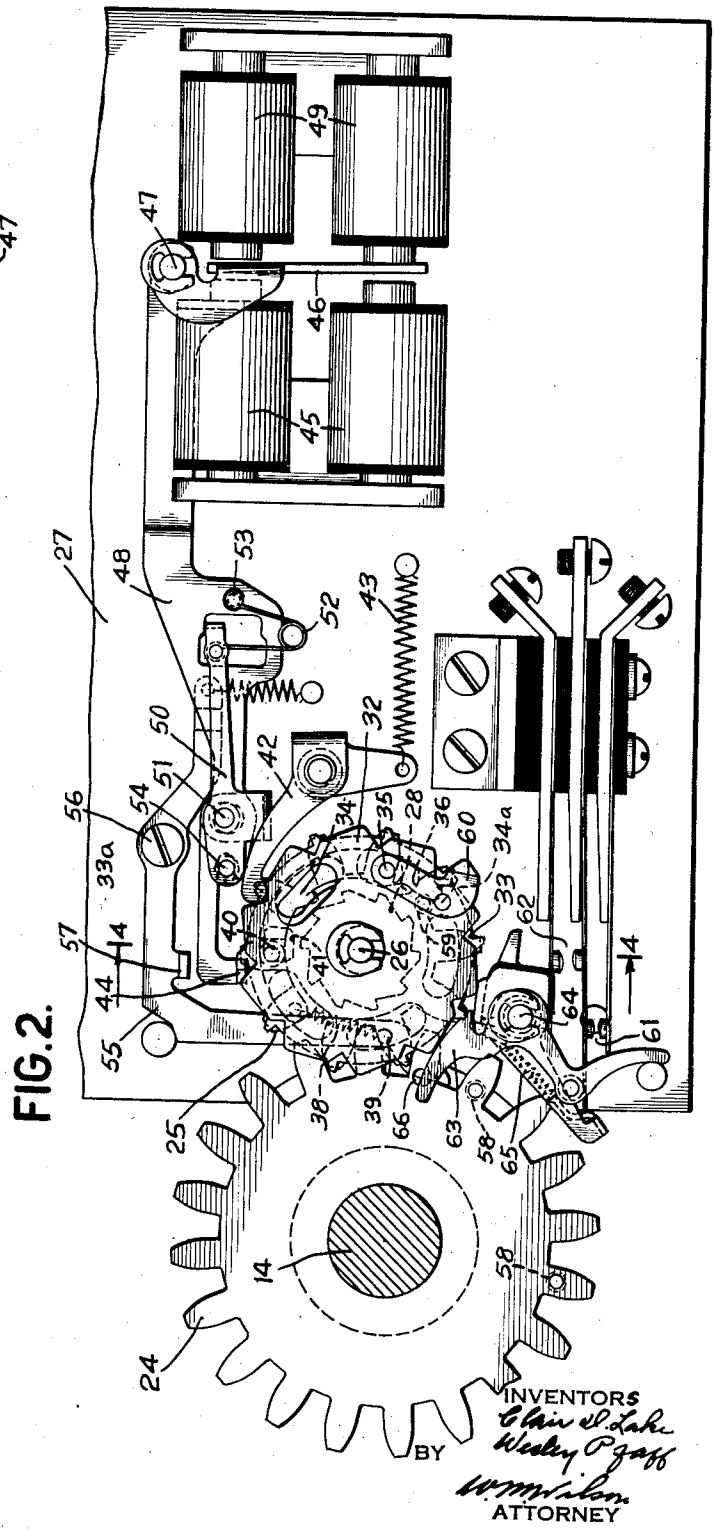

FIG. 2.

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TABULATING MACHINE

Filed Oct. 11, 1935 5 Sheets-Sheet 3

FIG.4.

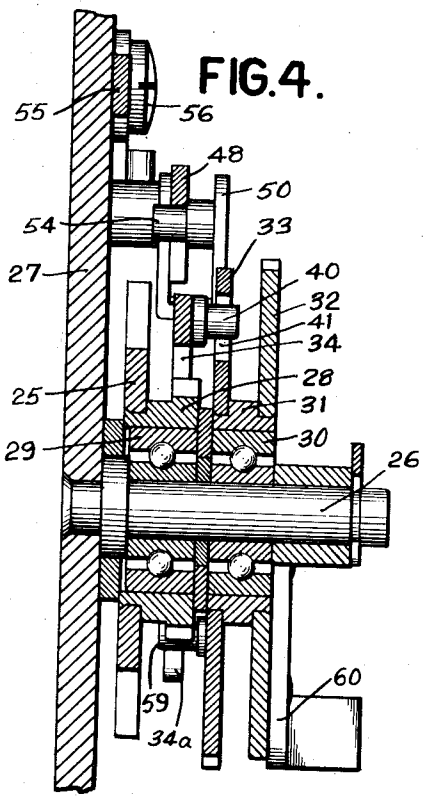


FIG.5.

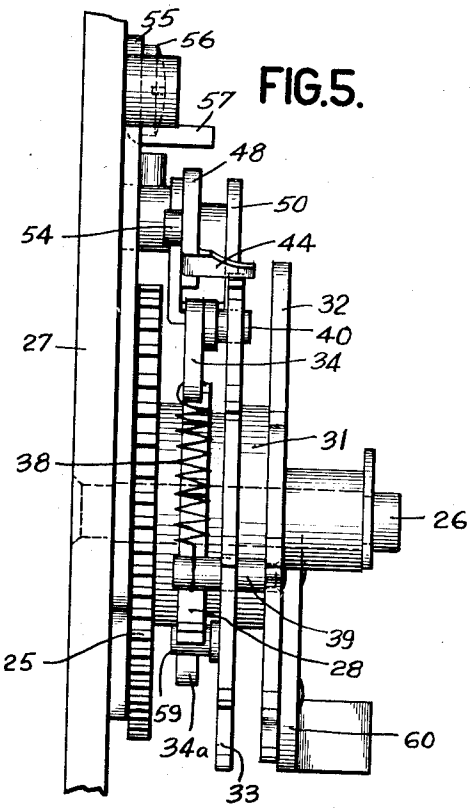


FIG.7.

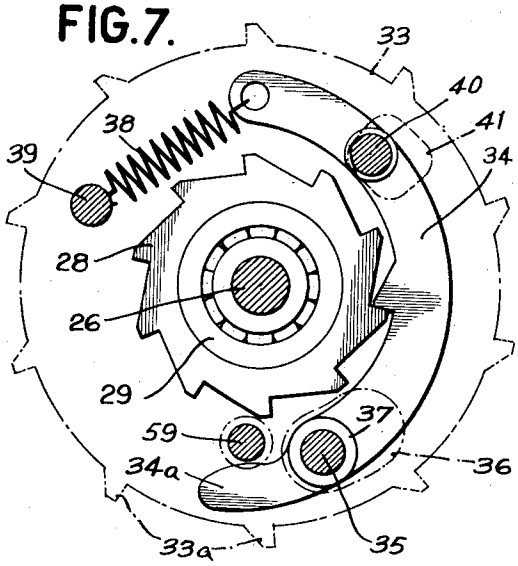
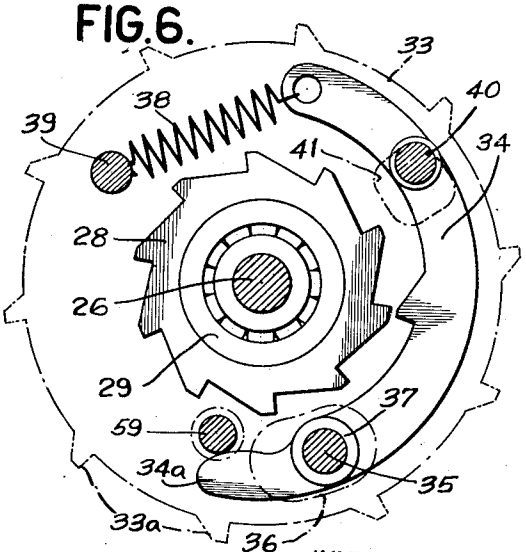


FIG.6.



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TABULATING MACHINE

Filed Oct. 11, 1935 5 Sheets-Sheet 4

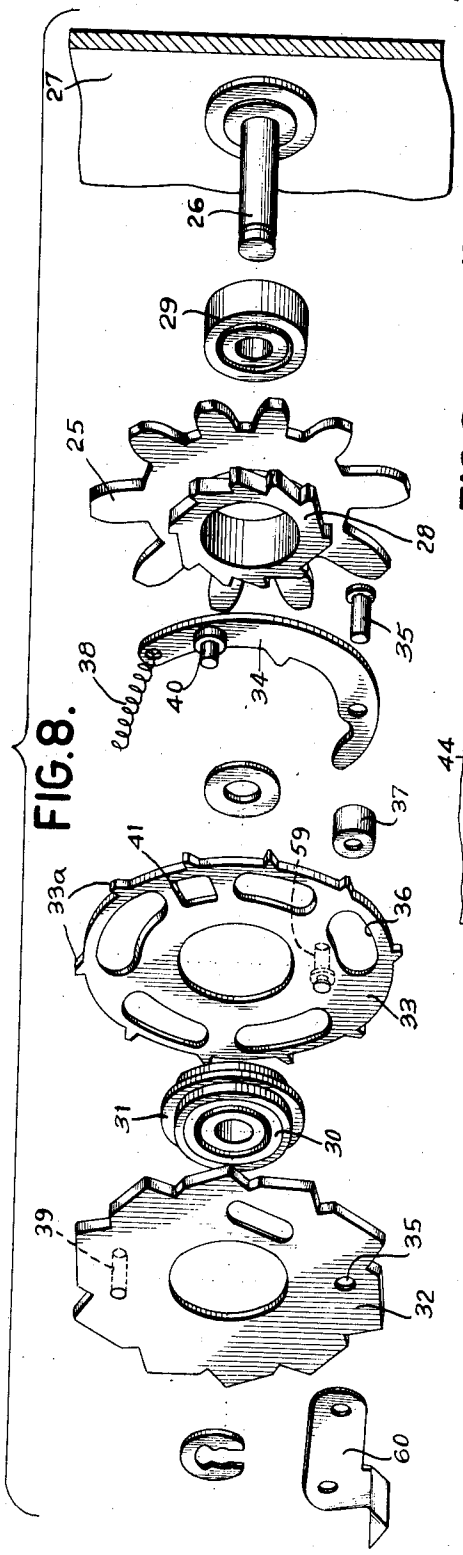

FIG. 8.

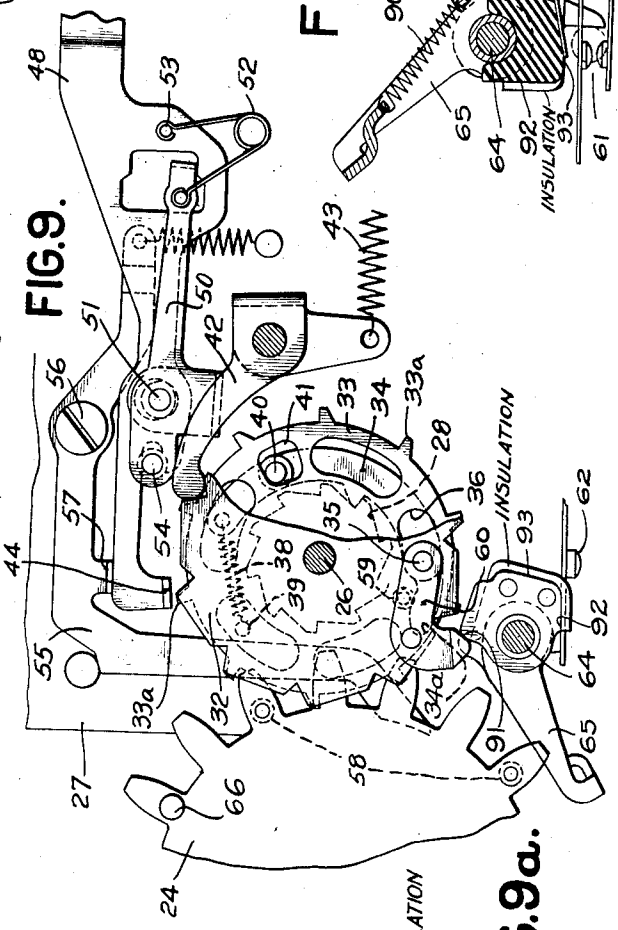

FIG. 9.

FIG. 9b.

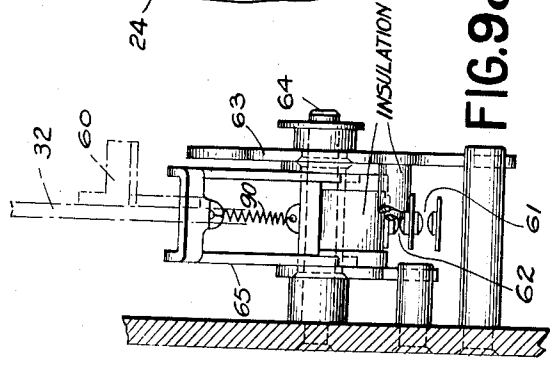

FIG. 9a.

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TABULATING MACHINE

Filed Oct. 11, 1935 5 Sheets-Sheet 5

FIG.10.

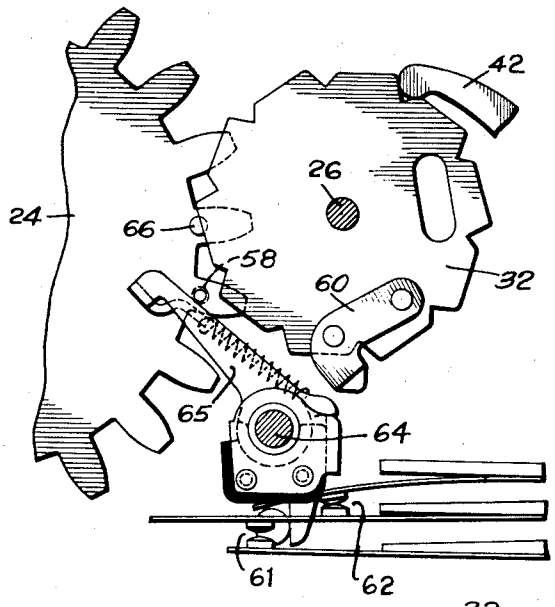
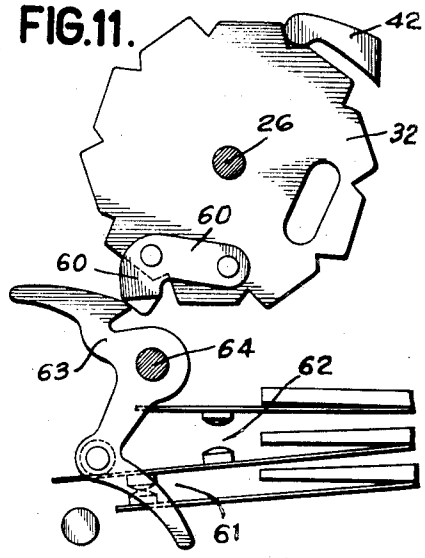


FIG.11.



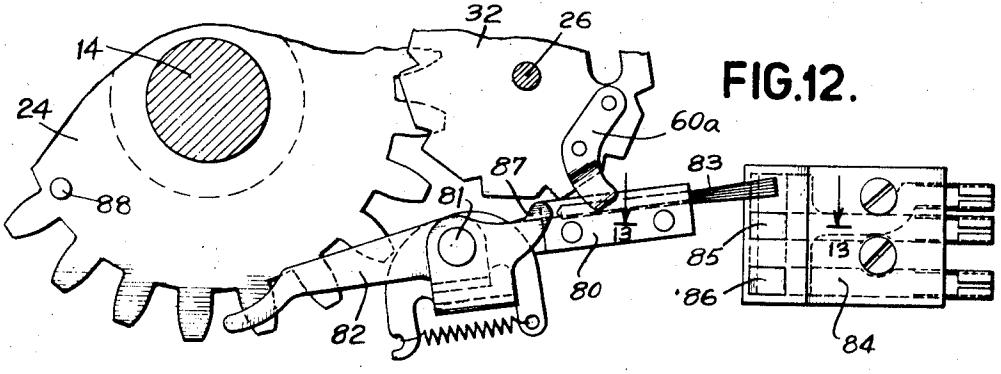


FIG.12.

FIG.13.

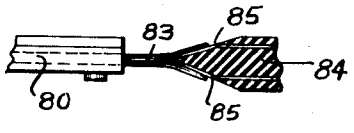
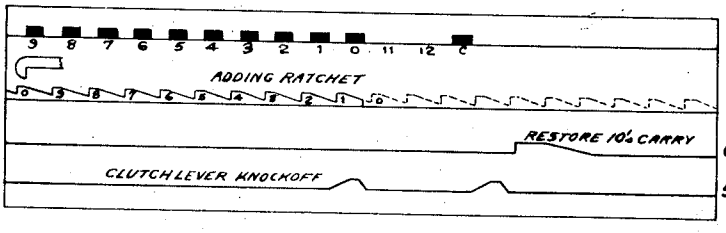


FIG.14.



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Patented Mar. 14, 1939 2,150,227

UNITED STATES PATENT OFFICE

2,150,227

TABULATING MACHINE

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Application October 11, 1935, Serial No. 44,554

8 Claims. (Cl. 235—61.6)

This invention relates to tabulating machines and more particularly to the accumulating mechanism of such machines.

The invention relates more particularly to the simplification of accumulating mechanisms in which the several denominational orders are separate and independent units which may be separately placed in the machine for separate operation. These units are generally built on plates arranged for slidable insertion and it is customary to place two denominational orders on a plate. Machines of this type are shown in Patents Nos. 1,909,549 and 1,914,285, granted May 16, 1933 and June 13, 1933, respectively, to J. R. Peirce.

The principal object of the invention is to provide a greatly simplified accumulator unit construction to the end that greater operating speed may be attained.

A further object of the invention is to provide an improved clutching mechanism for such type of unit.

A still further object of the invention is to provide improved locking devices for insuring the positive positioning of the driven elements throughout the operation of the machine.

Various other objects and advantages of the invention will be obvious from the following particular description of two forms of mechanism embodying the invention or from an inspection of the accompanying drawings; and the invention also constitutes certain new and useful features of construction and combination of parts hereinafter set forth and claimed.

In the drawings:

Fig. 1 is a cross section of a tabulating machine, showing the location of the improved accumulating unit.

Fig. 2 is a view of one order of the accumulator.

Fig. 3 is a plan view of Fig. 2.

Fig. 4 is a cross section taken substantially along lines 4—4 of Fig. 2.

Fig. 5 is an outside view of the mechanism, looking in the same direction as Fig. 4.

Fig. 6 is a detail view of certain parts in normal position.

Fig. 7 is a similar view, with the parts in operative position, showing the locking arrangement.

Fig. 8 is an "exploded" view of the separate elements.

Fig. 9 is a view showing parts in Fig. 2 in operative position.

Fig. 9a is an end view of the carry contact operating lever as viewed from the left in Fig. 10.

Fig. 9b is a sectional view of the carry contact operating lever in its operated position.

Fig. 10 is a view showing the operation of the tens carry mechanism.

Fig. 11 is a further view of the carry mechanism.

Fig. 12 is a detail showing a modified form of carry controlling mechanism.

Fig. 13 is a detail taken on liens 13—13 of Fig. 12.

Fig. 14 is a chart showing the timing of certain of the critical parts of the device.

The type of tabulating machine to which the invention is applied is shown generally in Fig. 1 and may be similar to the machine shown in the copending application of A. W. Mills, Serial No. 634,454, filed September 23, 1932, and the simplified and improved accumulating unit of the present invention may be readily substituted for that disclosed in said application.

Referring to Fig. 1, the main drive shaft 10 is suitably driven from a motor (not shown) and through gearing designated 11 drives shaft 12 which has bevel-gear connection with a vertical shaft 13. This shaft, in turn, has bevel-gear connection with horizontal shafts 14 which make one revolution per cycle of the machine. A clutch mechanism generally designated 15 controlled by a clutch magnet 16 causes connection of shaft 17 to the main shaft 10 through the gearing designated 18. This shaft carries the cams which operate the printing section of the tabulator in which type bars 19 are reciprocated past a platen 20 and may be interrupted at differential times during their upward movement by stop pawls 21 tripped under the control of print magnets 22. After all the type bars have been positioned, printing hammers 23 are tripped to take an impression.

The shafts 14 carry gears 24 which are in constant rotation. Meshing with each gear 24 is a gear 25 (see Figs. 2 and 3) which is freely mounted on a stud 26 secured in a plate 27. The plate 27 carries two gears 25 to provide for two denominational orders of an accumulating unit. As shown in Fig. 1, the plate 27 is horizontally slidable, with its gears 25, away from the gear 24 and in this manner the plate 27 with the mechanism mounted thereon may be removed from the machine for repair or replacement.

As viewed in Fig. 4, the gear 25 has integral therewith a driving ratchet 28 (see also Fig. 8). The gear and ratchet are supported on a ball bearing 29 carried by the stud 26. It is thus

seen that the gear 25 and ratchet 28 are in constant rotation.

Also mounted on stud 26 and supported on a ball bearing 30 is a collar 31 which has rigidly secured thereto an accumulating disk 32. The collar 31 also carries a ratchet 33 which is mounted for rotation upon the sleeve. The disk 32 carries a clutch pawl 34 which is pivoted to the disk at 35. As viewed in Figs. 4 and 5, the pawl 34 lies in the plane of driving ratchet 28 and the ratchet 33 lies between the pawl 34 and its supporting disk 32. The ratchet 33 is provided with an opening 36 through which the spacing sleeve 37 (see Fig. 8) and its supporting pin extend. A spring 38 connected to the upper end of the pawl 34 has connection with a pin 39 carried by the disk 32. This pin also extends through a suitable opening in the ratchet 33 (see Fig. 5). Secured on pawl 34 is a pin 40 which engages a camming surface 41 in the ratchet 33. The relationship of the parts is shown in Fig. 6 where the pawl 34 is normally held out of engagement with the ratchet 28 due to the action of camming surface 41 against the pin 40. If the ratchet 33 is permitted to move counterclockwise with respect to the pivot point of pawl 34, the camming surface 41 will move away from the pin 40 and will permit the spring 38 of the pawl to rock the latter into engagement with the ratchet 28 so that the parts assume the positions shown in Fig. 7.

The accumulating disk 32 is normally held by a detenting arm 42 which is normally urged in a counterclockwise direction by its spring 43. With the disk 32 thus restrained against movement, the tension of spring 38 (see Fig. 6) tends to cause the pin 40 to act against the camming surface and urge the ratchet 33 in a counterclockwise direction. The ratchet 33 is provided with teeth 33a which may be engaged by a latching extension 44 of a lever 48, as in Fig. 2.

If the extension 44 is raised out of engagement with the tooth 33a, the ratchet 33 may then rock counter-clockwise to permit the pawl 34 to move from the position of Fig. 6 to that of Fig. 7, thereby engaging the constantly rotating driving ratchet 28 and the accumulating disk 32 will accordingly be advanced until the pawl is again disengaged from the driving ratchet. This disengagement is brought about by lowering the extension 44 into the path of one of the teeth 33a, thus holding the ratchet 33 and causing its camming surface 41 to cam the pawl 34 out of engagement with the driving ratchet.

The initial elevation of the extension 44 to permit clutching of the accumulating disk is controlled by a pair of magnets 45, which upon energization attract armature 46 pivoted at 47 and rock lever 48 clockwise. A second pair of magnets 49 is provided which also act on the armature 46 to cause the rocking of lever 48 in a counterclockwise direction. The lever is provided with a toggle mechanism for maintaining the lever in either position. This toggle comprises a lever 50 pivoted at 51 to the plate 27 and a hairpin spring 52 whose one end is secured to the extremity of lever 50 and the other end of the spring is secured to a pin 53 on the lever 48. Lever 50 also has pin and slot connection with the lever 48 at 54. Thus as the arm 48 is rocked clockwise under control of the magnet 45, the pin and slot connection 54 will cause the lever 50 to rock clockwise, throwing the toggle 50, 52 across dead center to the position shown in Fig. 9, in which position the parts will be held by the spring 52 until the lever 48 is rocked back to its initial position.

This return rocking of the arm may be effected by the magnet 49 or it may be mechanically brought about through the counterclockwise rocking of the member 55 which is pivoted at 56 and has a lateral extension 57 extending above the end of lever 48. The member 55 has its depending arm lying in the path of pins 58 which are carried by the driving gear 24. As the pins pass the end of the member, the latter is rocked counterclockwise and through its extension 57 will depress the end of the arm 48 to cause disengagement of the clutching instrumentalities. It will thus be seen that the accumulating disk 32 may be clutched to the driving ratchet when the magnet 45 is energized and de-clutching will take place upon the energization of magnet 49 or under the mechanical action of either of the pins 58 of the gear 24.

Referring now to Figs. 6 and 7, the pawl 34 is provided with a tail 34a which lies in the path of a pin 59 which is carried by the ratchet 33 (see also Fig. 5). The cooperation of tail 34a and pin 59 provides for locking the elements in their various positions to prevent the effects of inertia when the device is operated at high speed. As seen in Fig. 6, the relative location of the pin and tail are as shown and, upon engagement of the pawl 34 with the driving ratchet 28, the pin 59 will have shifted to a position where the pawl 34 is locked in position and cannot move out of engagement with the ratchet until the pin 59 is rocked back to its initial position.

With the parts in normal position as in Fig. 6, it will be recalled that the ratchet 33 is latched against counterclockwise rotation so that any tendency for the pawl 34 and, of course, its supporting disk 32, to rotate in that direction will be prevented by the engagement of pin 40 with the camming surface 41. If the disk 32, however, tends to rotate clockwise, such movement will cause the pin 59 to act on tail 34a and cause the pawl 34 to engage the ratchet 28. If the machine is in operation with ratchet 28 rotating, the pawl 34 will be forced back to its normal position.

The disk 32 carries an arm 60 (see Figs. 10 and 11) which controls the positioning of the usual carry contacts 61 and 62. The arrangement is such that while the accumulator disk 32 registers "9", arm 60 will be in engagement with a lever 63 pivoted on a stud 64 and will hold the lever in the position shown in Fig. 11 to maintain contacts 61 closed as long as the disk registers "9". When the disk passes from "9" to "0", the arm 60 will engage a member 65 and will rock the latter from the position of Fig. 9 to that of Fig. 10. The member 65 is maintained in either of its positions by virtue of the engagement of one of its flat surfaces with the upper blade of the contacts 62. The member 65, when rocked to the position of Fig. 10, will cause closure of contact 62 and this position of the parts is maintained until a pin 66 carried by the gear 24 engages an arm of the member 65 and rocks it back to the position of Fig. 2.

The member 65 is pivoted on the stud 64, which, as explained, also carries the lever 63. Member 65 is formed of two parts held together through a spring 90 (Figs. 9a and 9b). This construction is merely for purposes of safety and is not essential to the operation of member 65 which moves as a unitary structure. Normally the member occupies the position as in Fig. 9 where-

in the corner 91 thereof lies in the path of the arm 60 and the uppermost contact blade of the carry contacts is in engagement with the surface 92 of the member to hold it in this position. As the arm 60 rotates counterclockwise to advance from the position it occupies in Fig. 9, it will bear against corner 91 and rock the member 65 from the position of Fig. 9 to that shown in Figs. 9b and 10. In this position the uppermost contact blade will bear against the surface 93 of member 65 and will serve to hold the member in this position until it is again rocked back to normal position by the pin 66 in gear 24. It will be observed that the surfaces 92 and 93 are at different distances from the center of rotation of the stud 64 and they will thus serve to move the uppermost contact blade from contact opening to contact closing position while the contact blade in turn acts on the two surfaces to serve as an impositive detent for the member.

The construction and operation of the accumulating unit has been described in detail and a brief explanation will now be given to indicate the manner in which the parts are timed in relation to the rest of the machine.

Referring to Fig. 14, the line indicated at 67 represents the time at which circuits are completed to the magnet 45 in response to the analysis of perforations in the index point positions of record cards as the latter pass through the machine. If a "9" is to be added, the circuit to the magnet 45 is completed at the "9" time and disk 32 is rotated through nine steps at which time the leading pin 58 will cause disengagement of the clutch. If the magnet 45 had been energized in response to a "3", the clutch engagement would have taken place at the "3" time and been disengaged by the leading pin 58 after three steps of movement. It is thus seen that the time of engagement is variable and the knock-out or disengaging time occurs at a fixed point in the cycle. In the interval between the two pins 58, carry operations take place under control of the contacts 61 and 62 to add a unit into appropriate orders. The time of completion of this carry circuit is indicated at C on line 67 which is one point before the second pin 58 effects clutch disengagement.

When the unit is employed for subtracting operations, the magnet 45 is energized at the beginning of the cycle through timing devices in the machine so that the disk commences rotation at the beginning of the cycle. When a perforation is sensed in a record card, the magnet 49 is energized to cause disengagement. Thus, if a "3" is sensed, disengagement will take place after six steps of movement, thus adding the nines complement to the accumulating unit.

For total printing purposes, the disk 38 is given a complete revolution by energizing magnet 45 at the beginning of the cycle and permitting the pin 58 to knock it out at the end of the cycle. Depending upon the initial location of arm 60, member 65 will be engaged thereby to close contacts 61 at some time during the cycle and a circuit to the printing magnets 22 of Fig. 1 will be completed at a time corresponding to the value of the amount standing on the disk. The various circuits and their operating devices do not form part of the present invention and may be the same as those shown and described in the application of Mills referred to above, and further explanation is not necessary.

In sliding the plates 27 into position, the engaging gear 25 may occupy any position and no definite setting of the unit is necessary before it is moved into engagement with the driving gear 24. This ease of assembly is brought about because of the fact that the knock-out pins 58 are carried by the gear 24 and their timing is accordingly fixed as is also the timing of the carry restoring pin 66. In previous accumulating units designed for use with this type of tabulating machine, the knock-out and carry mechanisms have been incorporated in the unit itself and it has been necessary to carefully adjust the elements mounted in the unit to obtain proper correlation of the parts. With the present arrangement no such setting up is necessary as the timing is a function of the drive gear 24.

In Fig. 12 is shown a modified form of the carry circuit controlling devices which comprises a lever 80 pivoted at 81 and spring connected to a lever 82. The lever 80 carries a brush 83 whose strands straddle a wedge-shaped block 84 of insulating material in which are embedded pairs of contact segments 85 and 86 (see also Fig. 13).

The brush normally occupies a neutral position as shown in Fig. 12. While the accumulating disk 32 registers "9", the arm 60a engages a finger 87 of the lever 80 and holds the brush 83 in position to engage both segments 85 and form an electrical connection therebetween. As the disk 32 passes from "9" to "0", the lever 80 is further depressed and brush 83 straddles the segments 86. The engagement and straddling of the block 84 by the brushes 83 provides sufficient frictional engagement to maintain the lever 80 in any of its three positions. At the end of the cycle, the pin 88 will engage arm 82 to restore the brush to its neutral or initial position.

While there has been shown and described and pointed out the fundamental novel features of the invention as applied to a single modification, it will be understood that various omissions and substitutions and changes in the form and details of the device illustrated and in its operation may be made by those skilled in the art without departing from the spirit of the invention. It is the intention therefore to be limited only as indicated by the scope of the following claims.

What is claimed is as follows:

1. An accumulating unit for a tabulating machine comprising a driving element, an accumulating element, clutching mechanism therebetween, a pivoted clutch controlling lever, a magnet for positively rocking said lever in one direction to cause clutching means for thereafter positively rocking said lever in the reverse direction to cause unclutching, and a toggle mechanism for holding said lever in either position.

2. In an accumulating unit for an accounting machine having an accumulating wheel which is to be advanced to any of a plurality of rotative positions to represent different amounts, including in combination, differential advancing mechanism for said wheel, said mechanism comprising a continuously driven driving ratchet, a pawl carried by said wheel, a disk coaxial with said wheel and engaging said pawl to hold the latter out of engagement with said driving ratchet, means called into action at differential times, and with the wheel in any of its rotative positions for causing said disk to release said pawl for engagement with said driving ratchet, and means for causing said disk to disengage the pawl from the ratchet at a fixed time in the operation of the machine whereby said wheel will be advanced from its initial rotative position an

amount determined by the differential time of engagement of the pawl and ratchet.

3. In an accumulating unit for an accounting machine having an accumulating wheel which is to be advanced to any of a plurality of rotative positions to represent different amounts, including in combination, differential advancing mechanism for said wheel, said mechanism comprising a continuously driven driving ratchet, a pawl carried by said wheel, a disk coaxial with said wheel and engaging said pawl to hold the latter out of engagement with said driving ratchet, means for normally holding the wheel and disk against rotation in any one of the rotative positions of the wheel, means called into action at differential times and with the wheel in any of its rotative positions for effecting relative rotation of said wheel and disk, whereupon said pawl will engage said ratchet to rotate the wheel, and means for causing said disk to disengage the pawl from the ratchet at a fixed time in the operation of the machine whereby said wheel will be advanced from its initial rotative position an amount determined by the differential time of engagement of the pawl and ratchet.

4. In an accumulating unit for an accounting machine having an accumulating wheel which is to be advanced to any of a plurality of rotative positions to represent different amounts, includnig in combination, differential advancing mechanism for said wheel, said mechanism comprising a continuously driven driving ratchet, a pawl carried by said wheel, a disk coaxial with said wheel and having a camming surface engaging said pawl to hold the latter out of engagement with said driving ratchet, means for normally holding the wheel and disk against rotation in any one of the rotative positions of the wheel, means called into action at differential times with the wheel in any of its rotative positions, and including said camming surface for effecting relative rotation of said wheel and disk whereupon said pawl will engage said ratchet to rotate the wheel, and means for causing said disk to disengage the pawl from the ratchet at a fixed time in the operation of the machine whereby said wheel will be advanced from its initial rotative position an amount determined by the differential time of engagement of the pawl and ratchet.

5. In an accumulating unit for an accounting machine having an accumulating wheel which is to be advanced to any of a plurality of rotative positions to represent different amounts, including in combination, differential advancing mechanism for said wheel, said mechanism comprising a continuously driven driving ratchet, a pawl carried by said wheel, a disk co-axial with said wheel and having a camming surface engaging said pawl to hold the latter out of engagement with said driving ratchet, means for normally holding the wheel and disk against rotation in any one of the rotative positions of the wheel, means for releasing said holding means at differential times with the wheel in any of its rotative positions, means effective upon said release for advancing said disk to permit the pawl to engage the ratchet, whereupon said pawl will drive the disk therewith, and means for interrupting the rotation of the disk at a fixed time in the operation of the machine whereupon said camming surface will cause disengagement of the pawl and ratchet and said wheel will be advanced an amount determined by the differential time of engagement of the pawl and ratchet.

6. In an accumulating unit for an accounting machine having an accumulating wheel which is to be advanced to any of a plurality of rotative positions to represent different amounts, including in combination, differential advancing mechanism for said wheel, said mechanism comprising a continuously driven driving ratchet, a pawl pivoted to said wheel for engagement with said ratchet, a spring connected between the pawl and wheel, a disk co-axial with said wheel having a camming surface, a pin in said pawl engaging said camming surface and controlled thereby, when the wheel is in any of its rotative positions for holding the pawl out of engagement with the ratchet, means called into action at differential times with the wheel in any of its rotative positions for enabling said spring to move the camming surface out of engagement with the pin so the pawl can engage said ratchet, and means for interrupting the rotation of the disk at a fixed time in the operation of the machine whereupon its camming surface will engage said pin to disengage the pawl from the ratchet and said wheel will be advanced an amount determined by the differential time of engagement of the pawl and ratchet.

7. The invention set forth in claim 2 in which locking means is provided and rendered operative when said pawl and ratchet are engaged, for locking the same in engagement during the rotation of the accumulating wheel.

8. The invention set forth in claim 2 in which locking means carried by the accumulating wheel is provided and rendered operative when said pawl and ratchet are engaged, for locking the same in engagement during the rotation of the accumulating wheel.

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