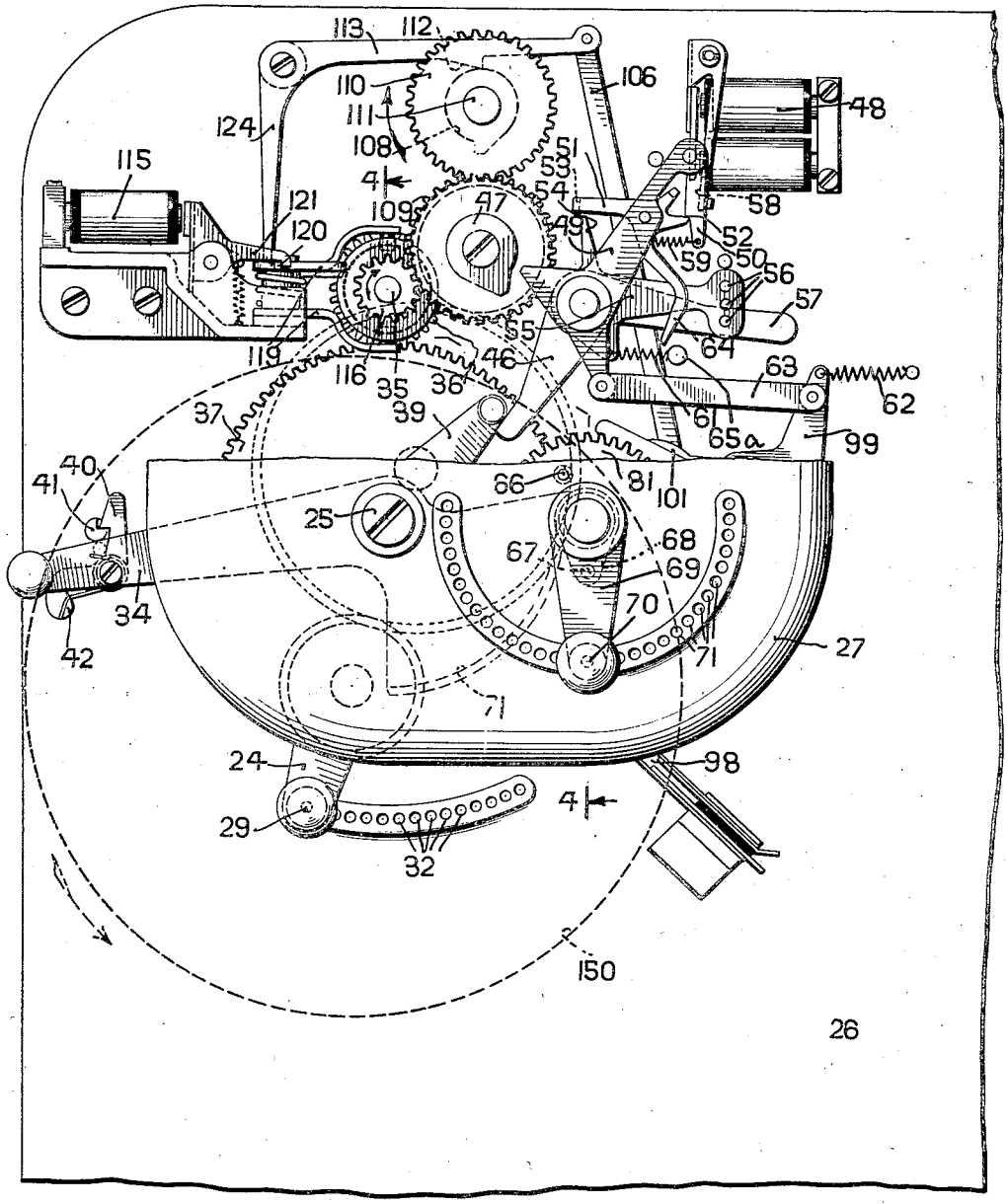
Aug. 8, 1933. F. M. CARROLL 1,921,453

PRINTING MECHANISM FOR ACCOUNTING MACHINES

Filed Jan. 19, 1928 7 Sheets-Sheet 1

Fig. 1.



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By his Attorney

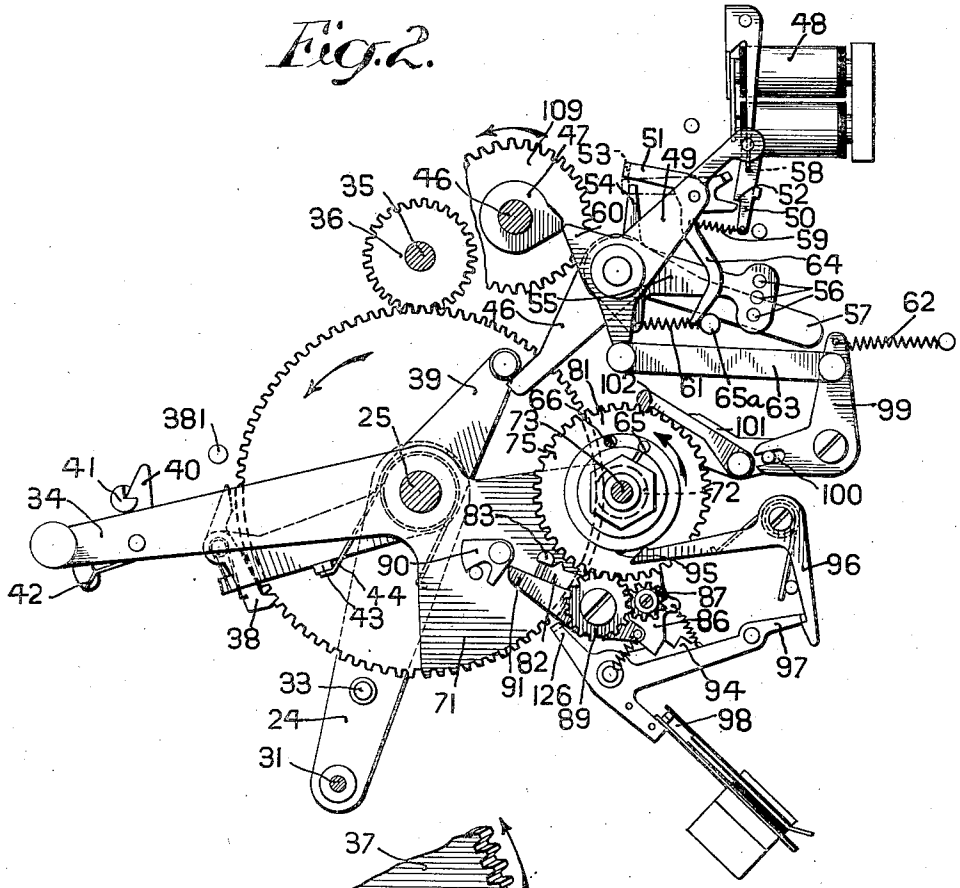
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Aug. 8, 193. F. M. CARROLL 1,921,453

PRINTING MECHANISM FOR ACCOUNTING MACHINES

Filed Jan. 19, 1928 7 Sheets-Sheet 2

Fig. 2.



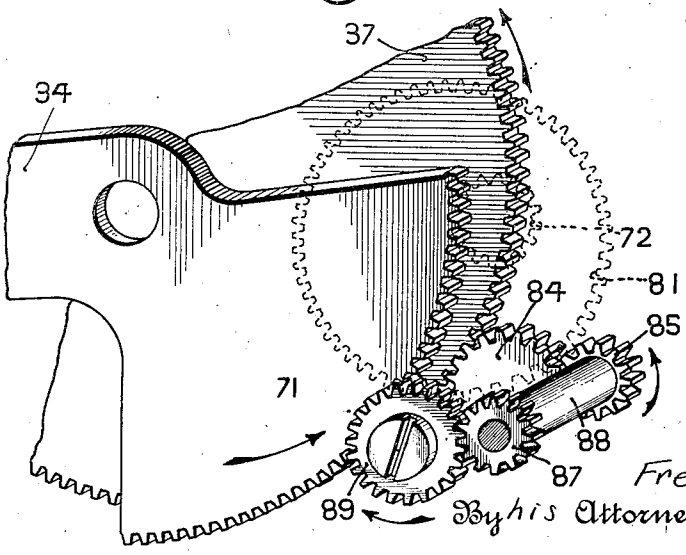


Fig. 3.

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PRINTING MECHANISM FOR ACCOUNTING MACHINES

Filed Jan. 19, 1928 7 Sheets-Sheet 3

Fig. 4.

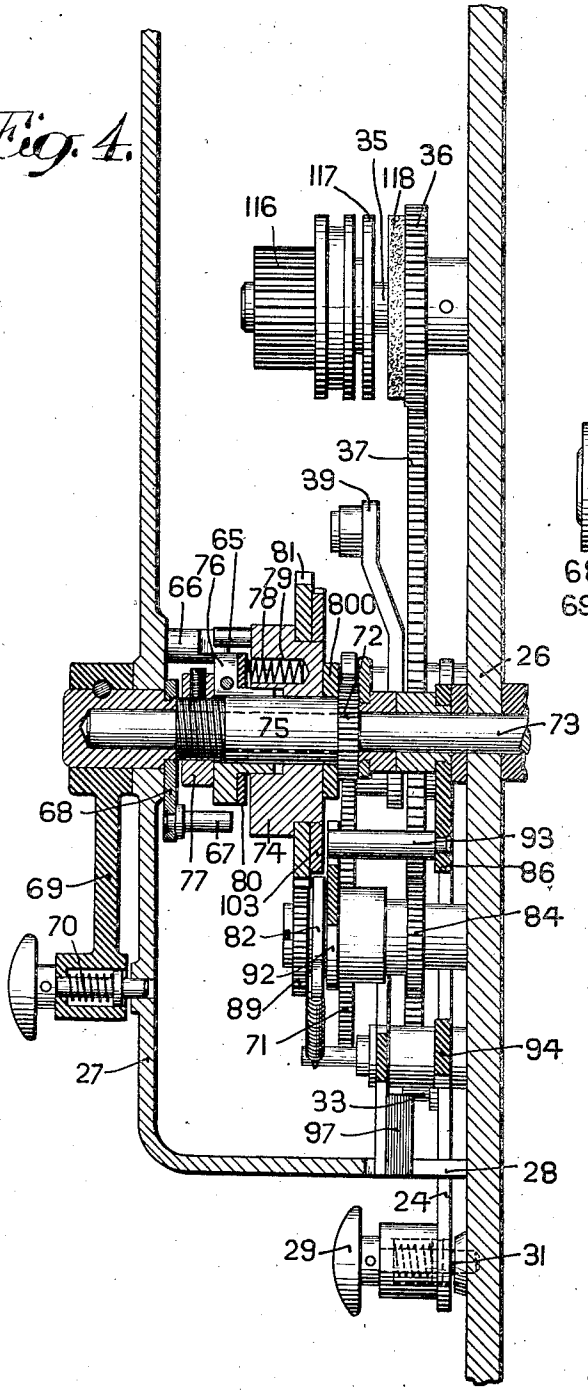
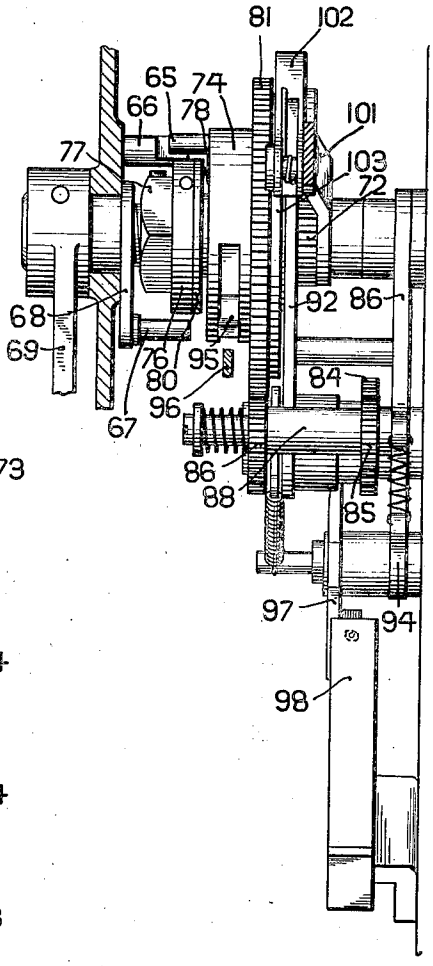


Fig. 5.



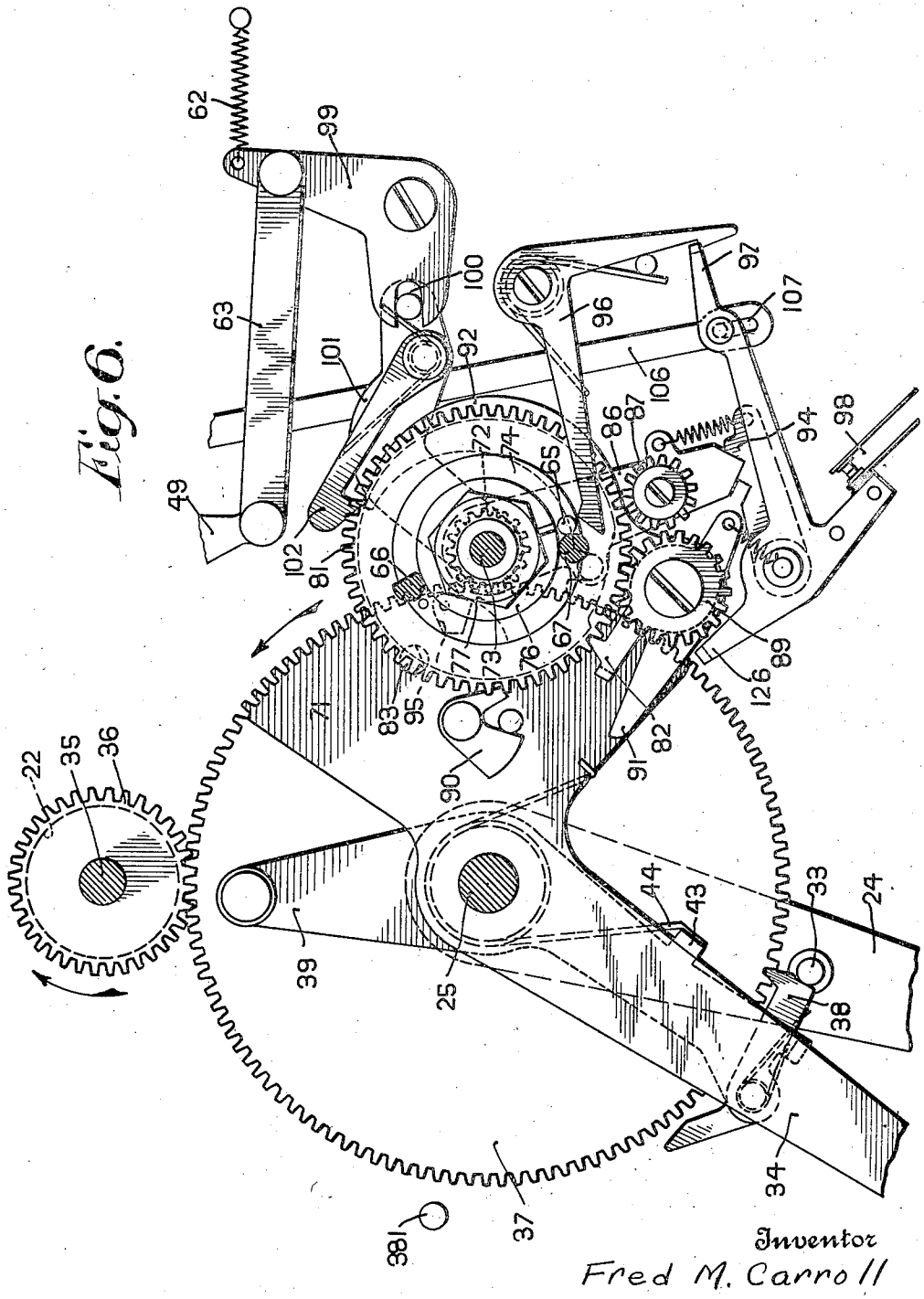
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PRINTING MECHANISM FOR ACCOUNTING MACHINES

Filed Jan. 19, 1928 7 Sheets-Sheet 4

Fig. 6.



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Aug. 8, 1933. F. M. CARROLL 1,921,453

PRINTING MECHANISM FOR ACCOUNTING MACHINES

Filed Jan. 19, 1928 7 Sheets-Sheet 5

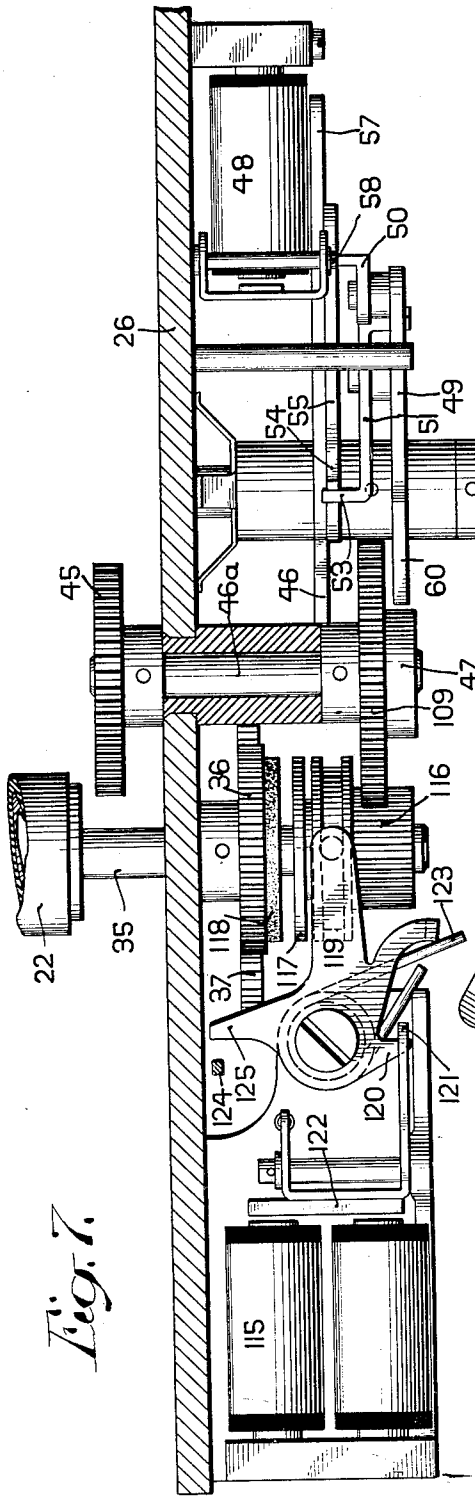


Fig. 7.

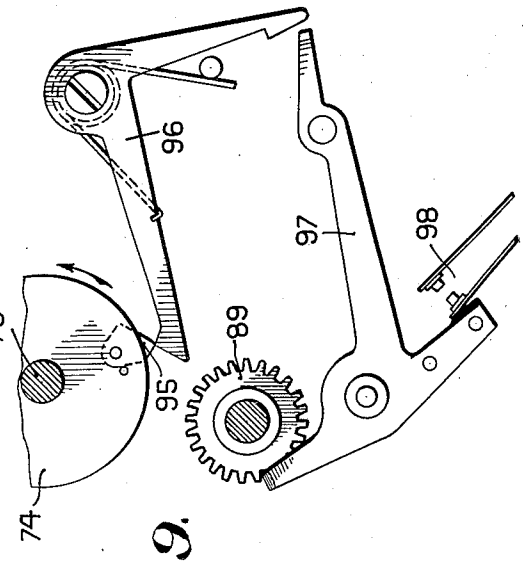


Fig. 9.

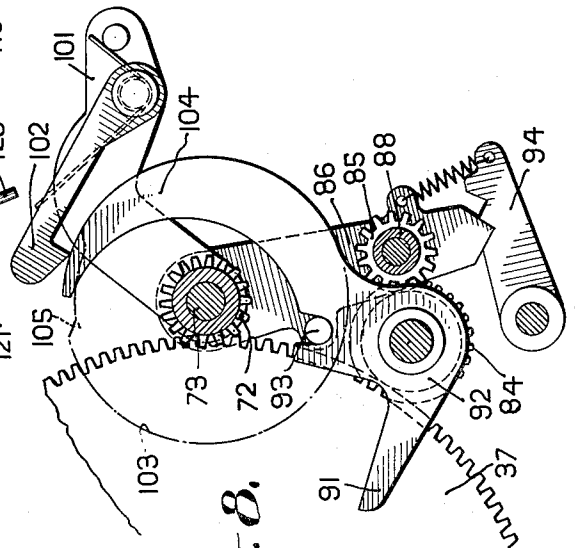


Fig. 8.

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Aug. 8, 1933. F. M. CARROLL 1,921,453

PRINTING MECHANISM FOR ACCOUNTING MACHINES

Filed Jan. 19, 1928 7 Sheets-Sheet 6

Fig. 10.

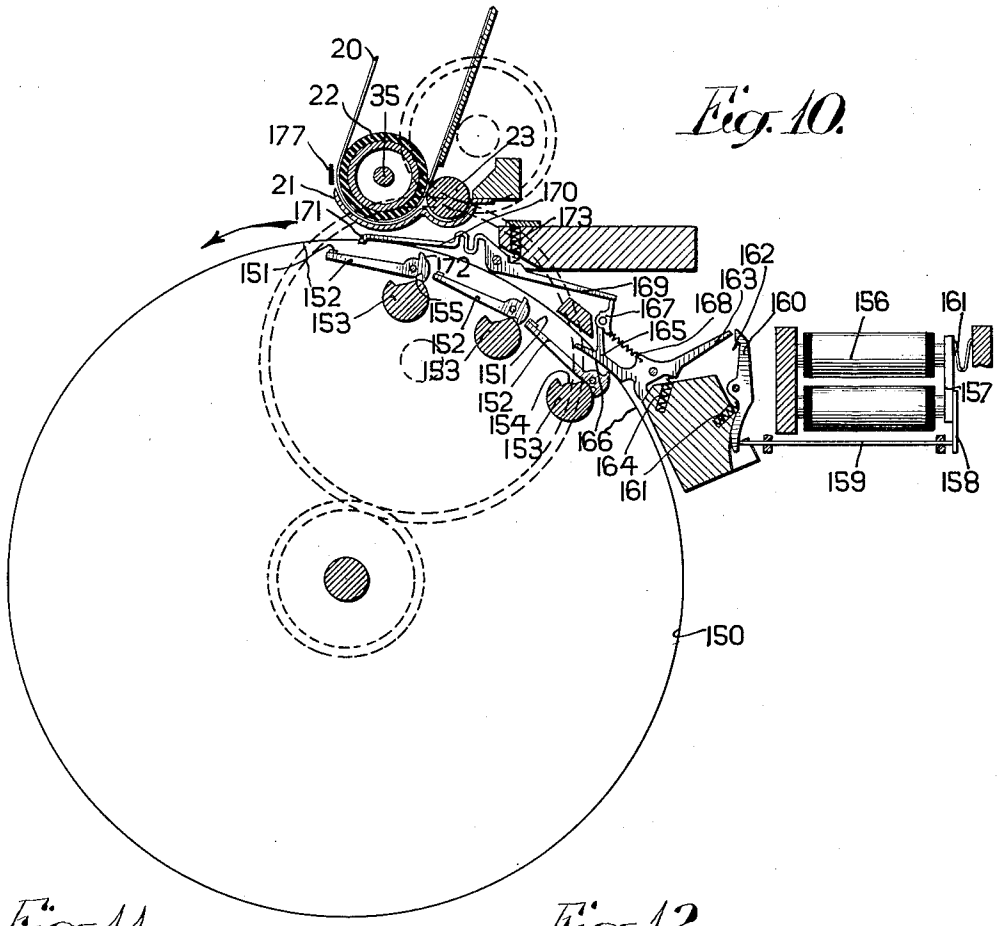


Fig. 11.

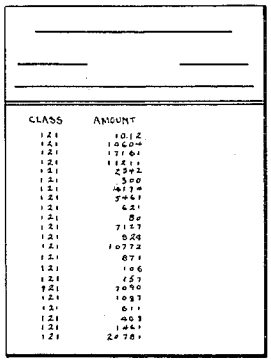
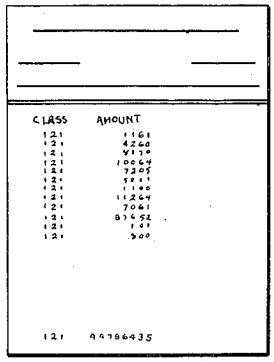


Fig. 12.



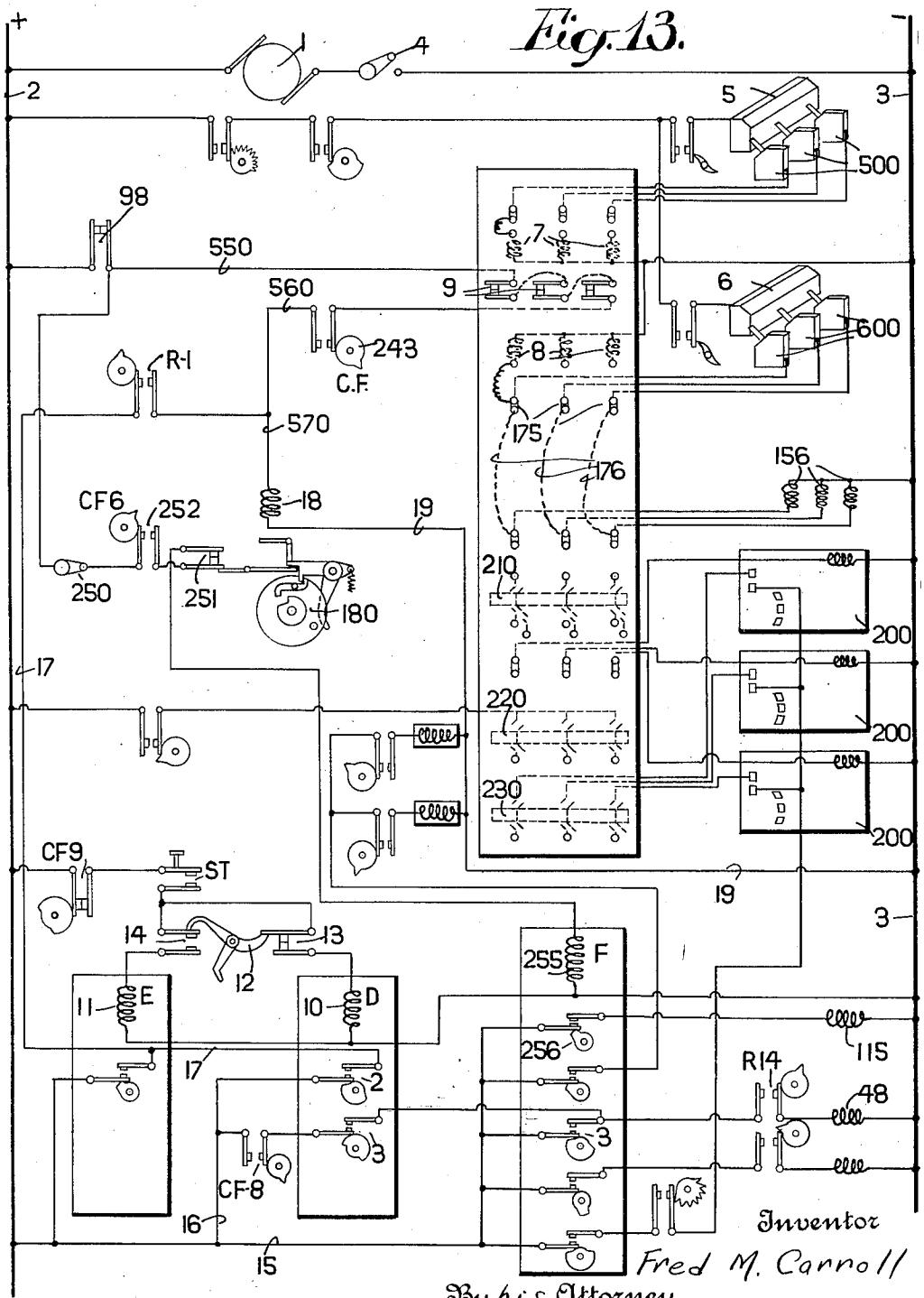
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PRINTING MECHANISM FOR ACCOUNTING MACHINES

Filed Jan. 19, 1928 7 Sheets-Sheet 7

Fig. 13.



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Patented Aug. 8, 1933 1,921,453

UNITED STATES PATENT OFFICE

1,921,453

PRINTING MECHANISM FOR ACCOUNTING MACHINES

Fred M. Carroll, Yonkers, N. Y., assignor to The Tabulating Machine Company, Endicott, N. Y., a Corporation of New Jersey

Application January 19, 1928. Serial No. 247,771

9 Claims. (Cl. 235—92)

This invention relates to printing mechanisms and more particularly to the paper feeding mechanisms therefor whereby the paper may be spaced in predetermined amounts.

In accounting practice it is usually desirable to list items relating to some particular classification upon a sheet together with the total of such items. When the number of listings is inordinate it is desirable that the listings be made upon separate sheets and the total thereof appear upon the last sheet, preferably at the bottom in order to facilitate ready reference to the sheets carrying printed totals for the purpose of checking, etc. The sheets referred to are ordinarily of a predetermined size and accommodate a limited number of listings. A part of the sheet may be required to allow for certain pre-printed matter or other identifying data which may be placed upon the sheet subsequent or prior to listing. Since the identifying matter is usually variable it is desirable that the amount of space set apart for the same be altered to meet the exigencies of different situations and thus obtain the maximum number of listings that may be placed on the sheet.

It is, therefore, the main object of the present invention to provide a mechanism for spacing the paper in zones, variably and in accordance with certain predetermined requirements.

More specifically it is an object of the present invention to provide a mechanism whereby a predetermined preliminary head spacing may be given to a sheet of paper to accommodate certain variable identifying data.

It is a further object of the present invention to space the paper in increments so as to suitably space the listings and to disable the item entering mechanism when a predetermined number of listings have been effected.

It is still a further object of the invention to automatically condition the machine for total taking when the listings in connection with a certain classification have been completed.

In connection with total taking operations it is a further object to automatically feed the paper from the point at which the last listing occurs to a total printing zone and thereafter disable the listing mechanism.

It is a further object to devise a mechanism for accomplishing the above objects which is automatic in its performance and which requires little attention on part of the operator to perform its different functions.

The particular type of entering mechanism whereby items may be listed and printed does not enter in the present invention but for the purpose of illustration and to more clearly comprehend the present improvements the type of entering mechanism controlled by punched cards is shown and described.

In general, record controlled tabulators are designed to add, list and print totals of items automatically entered in the machine from control records on which items are represented by index point perforations located in differential positions in the several card columns.

The cards are fed through the machine automatically and analyzed by suitable mechanism which in turn controls the accumulating and printing devices of the machine so that the data represented by the perforations in the card may be accumulated and printed. The controlling records are usually divided into groups representing different classifications, the group classification being represented in each card by similarly located perforations and it is desirable to continue the automatic feeding of the records to the analyzing mechanism as long as the group classification does not change but to interrupt the card feed for the purpose of taking totals when the groups change.

With a general understanding of the machine to which the present improvements are applied the present invention will be more clearly understood, but as the specification progresses, it will be readily apparent that other forms and types of entering mechanisms may be readily substituted for the one illustrated.

The invention will be clear from the following detailed description which should be read in connection with the accompanying drawings in which:

Fig. 1 is a view in side elevation of some of the devices comprising the present improvements, a portion of an enclosed case having been broken away to more clearly illustrate certain parts,

Fig. 2 is a view in side elevation of the present improvements with the casing removed to show more clearly the action when the paper feeding devices are operated,

Fig. 3 is a perspective view of a gear train constituting a part of the present invention,

Fig. 4 is a cross sectional view taken on the line 4—4 of Fig. 1,

Fig. 5 is a view in side elevation of some of the parts shown in Fig. 4,

Fig. 6 is an enlarged view, similar to Fig. 2, but showing the devices for effecting a preliminary spacing of the paper in operated position,

Fig. 7 is a top plan view of some of the mechanism illustrated in Fig. 1,

Fig. 8 is a view in side elevation of the gear controlling mechanism,

Fig. 9 is a view in side elevation of the contact controlling devices,

Fig. 10 is a view of the printing mechanism which may be used in conjunction with the present improvements,

Fig. 11 is a concrete example of a sheet printed by the illustrative machine and shows the provision of a head spacing followed by a predetermined number of listings,

Fig. 12 shows the manner in which a total is printed when the classification of items change prior to the completion of a predetermined number of listings,

Fig. 13 is a diagrammatic representation of the control system which may be used in connection with the improved paper feeding mechanism.

The present improvements may be applied to different types of accounting and tabulating machines but in order to more fully comprehend the present invention, it is shown in connection with the type of tabulating machine disclosed in the copending application, Serial Number 147,960 filed November 12, 1926 now Patent No. 1,750,459. The present explanation of this machine will be limited to what is necessary for an understanding of the present invention. The mechanical parts of the tabulating machine to which the present improvements are applied are driven by the motor 1 (see Fig. 13) to which power is furnished by the mains 2 and 3 and to which the motor may be connected by the switch 4. The upper or control brushes of the tabulator are indicated at 5 and the lower or adding brushes at 6, these brushes having coacting contact plates 500 and 600 respectively, with which the brushes engage through the perforations in the cards to close the proper controlling circuits. Each individual plate 500 and 600 is connected to a socket on the panel board so that plugging may be effected to the different devices of the machine as desired.

The automatic control system for the machine consists of magnets 7 and 8 one of each being provided for each group controlling column of the cards. A pair of these is adapted to actuate a balanced armature more fully shown in the Carroll Patent No. 1,821,088. The magnet 7 is plugged to one of the upper brushes and the magnet 8 to a corresponding lower brush. As long as the perforations in the cards under the upper and lower brushes agree both magnets 7 and 8 will be energized or deenergized. If the perforations in the given column of cards do not agree, either one of the magnets 7 or 8 will be energized while the other will be deenergized in which case the armature will cause opening of one of the series contacts 9. These contacts are included in the automatic control circuit and when they open in this manner will cause the machine to stop feeding of the cards and automatically institute total taking.

Assuming switch 4 to be closed causing motor 1 to operate, card feed may be instituted by depressing start key ST in which case one of the starting magnets 10 or 11 of the starting timers D or E will be energized depending upon whether or not there is a card under the upper brushes. If there is no card under the upper brushes 5, the upper card lever 12 will be in the position shown in the drawings closing the contacts 13 and opening the contacts 14 thereby closing a circuit for the starting magnet 10 of the D timer, this circuit extending from the line 2, through card feed contacts CF9, closed when the machine is at rest, to the start key ST, contacts 13 and D timer starting coil 10 to the negative side of the line. If there is a card under the upper brushes, the upper card lever 12 will be shifted to close the contacts 14 and open the contacts 13 in which case the E timer starting magnet 11 will be energized. The starting timers consist generally of cam controlled contacts which operate for several machine cycles to insure feeding the cards to the upper and lower brushes before the automatic control circuit becomes effective.

Under the conditions shown in the drawings the D timer is started and the card feed clutch magnet circuit is established from line 2 through wires 15 and 16, D timer contacts D2, wire 17, regular contacts R—1, closed at the proper time in the cycle, through card feed clutch magnet 18 and common return 19 to the negative side of line 3.

The energization of card feed clutch magnet 18 causes the card feed clutch to engage, and the cards in the magazine thereupon feed successively to the analyzing brushes 5 and 6. Certain data in the cards may be accumulated on the adding units 200 and totalized under control of the timer F and the switch bars 210, 220 and 230, as explained in the copending application above referred to but as these features do not specifically enter into the present invention they will not be further explained.

After the first card has reached the lower brushes 5, the control of the machine is removed from the starting timers and assumed by the automatic control circuit which as explained before includes the series connected contacts 9. This automatic control circuit extends from line 2 through contacts 98 which are opened when a predetermined number of listing operations have been completed, line 550, contacts 9, card feed contacts 243, wires 560 and 570 to the card feed clutch magnet 18 and thence through the common return 19 to the negative side of the line 3. This circuit will be established once each card cycle as long as the contacts 9 remain closed and it will be established at the proper time so that the card feed elements 180 engage and continue the card feed. When the group designations change contacts 9 as explained above will be opened. During this cycle the card feed clutch magnet 18 will fail to energize and card feed clutch 180 will disengage at the end of the cycle leaving the last card of the group just tabulated under the lower brushes and the first card of the next group under the upper brushes.

Preliminary paper feed

The paper strip 20 (Fig. 10) upon which the entries are made may be a separate sheet or a portion drawn from a supply roll and is passed over a guide plate 21 between the platen roller 22 and co-operating feeding roller 23. For predetermining the amount of head space for accommodating printed or other matter on the inserted sheet prior to listing, an adjustable lever 24 (Figs. 2 and 4) is provided. Lever 24 is loosely mounted upon a stub shaft 25 journaled in the side frame 26 of the machine and a casing 27 which conceals the operating and controlling mechanisms. Lever 24, however, plays in a slot 28 (Fig. 4) in the casing 27 and passes

outside so as to be exteriorally adjusted by means of a setting knob 29. Manipulation of knob 24 effects a withdrawal of a spring-urged plunger 31 which is adapted to coact with one of a series of concentrically arranged holes 32 (Fig. 1) to thereby lock lever 24 in its position of adjustment. Adjustment of lever 24 in the manner just described locates a stop pin 33 (Fig. 2), the position of which predetermines the extent of initial rotation given to the platen by a spacing lever 34.

For effecting rotation of the platen to initially space the paper, platen 22 is rigidly fixed to a shaft 35 (Fig. 2) which carries a pinion 36 meshing with a gear 37 loosely mounted on the shaft 25. The teeth of the gear 37 coact with a spring urged feeding pawl 38 pivotally mounted on one end of a bell crank lever 39 loose on shaft 25. Spacing lever 34 is normally latched by a pawl 40 (Fig. 2) engaging a stud 41, the disengagement of which may be effected by manipulation of the finger piece 42 permitting the lever to be drawn downwardly and by its coaction with a lug 43 integral with bell crank 39 will draw the latter downwardly and through the medium of feeding pawl 38 and the train of gears heretofore described will rotate platen 22 to give a preliminary spacing to the paper strip determined by coaction of pawl 38 with stud 33, as best shown in Fig. 6. The interdental spaces of gear 37 and the engaging end of pawl 38 are so shaped that when the pawl is moved downwardly it will drive gear 37 but when pawl 38 is restored the engaging end thereof slips or ratchets over the teeth of the gear permitting the platen to be retained in its adjusted position. Automatic return of spacing lever 34 to normal and latched position and bell crank 39 is effected by a coil spring 44.

Printing mechanism

The particular mechanism whereby the printing operation is effected to print the necessary information on the record sheet forms no part of the present invention and any of the prior art construction may be readily adopted. To more clearly comprehend the present invention the general form shown in the patent to F. M. Carroll, 1,516,079 dated November 8, 1924 and the above cited application, Serial No. 147,960, November 12, 1926 are herein shown and described.

In general a printing drum 150 (Fig. 10) driven by the motor 1 carries a plurality of rows of type 151 mounted on pivoted type carriers 152.

A locking cam 153 is provided for each type carrier to hold it positively against rotation about its pivot except when it is in printing position. These cams consist of cylindrical members or disks provided with a notch 154. They are rotated in synchronism with the drum by gear trains (not shown) so that each cam makes one revolution for each revolution of the drum and so that the notch will release the type carrier for possible printing operations whenever it reaches printing position. Each type carrier has a cam surface 155 concentric with the periphery of the cam disk 153 when the carrier is in normal inoperative position. During that portion of the cycle when the carrier is out of printing position the cylindrical surface of the disk 153 rides under the cam surface 155 and holds the carrier firmly against rotation as shown in connection with the right hand type carrier in Fig. 10. When a carrier reaches that position in which rocking about its pivot would cause its type to strike against the platen roller 22, the notch 154 in the locking disk releases the carrier so that it may be rocked about its pivot to cause its type to print.

The printing call mechanism for each row of type is controlled by a printer magnet 156 having an armature 157 provided with an extension 158 abutting a call rod 159 which in turn abuts one arm of a lever 160 and rocks it clockwise against the action of the compression spring 161 when the armature is attracted by the magnet. The lever 160 is provided at its oppositely extending arm with a notch 162 which in the absence of a printing operation engages and holds the end of an arm of lever 163 biased for clockwise rotation by a compression spring 164. An oppositely extending arm 165 of lever 163 is provided with a cam surface 166 and carries a dog 167 biased for rotation by a spring 168, the rotation being limited by suitable coacting lugs on the lever arms 165 and the dog. When the parts are in normal non-printing position the dog 167 rests against the tip of lever 169 which carries a finger 170 having a hook 171 at its end for engaging projections 172 on type carriers 152. The lever 169 has a coacting compression spring 173 which ordinarily holds the hook 171 out of the path of extensions 172.

The proper magnet 156 is energized instantaneously to effect printing. The magnet attracts its armature 157 which, through its extension, forces call rod 159 to the right rocking lever 160 about its pivot and releasing lever arm 163 from the notch 162. The lever 163 is rocked by its spring 164 and the biased dog 167 in descending snaps under the lever arm 169 as shown in Fig. 10. Shortly after this the tail projection of a type carrier behind that one which is to print engages the cam surface 166 and forces the lever arm 165 with its pivoted dog 167 upward, rocking lever 169 and forcing the hooked end 171 of finger 170 into the path of the tail projection 172 of the type carrier by which printing is to be effected. The drum in rotating forces the projection sharply against the hook 171 and the impact causes the carrier to turn about its pivot and force the type against an inking ribbon 177 and the paper wound around the platen roll 22. A slight additional movement is thereafter imparted to the arm 165 owing to the continuing coaction between the cam surface 166 and the tail piece 174 and the dog 167 slips off the end of arm 169 and, as the magnet 156 is now deenergized and its armature released, the end of the arm 163 is again latched in the notch 162. Incidentally the arm 170 having been released by the dog 167 is rocked by its spring 173 to inoperative position. The parts are thus restored in readiness for a subsequent printing operation.

Listing or printing of each item by the present machine is controlled directly from the lower analyzing brushes. Referring to Fig. 13 it will be noted that plugs 600 are wired to sockets 175 and by suitable jumper connections 176 any of the analyzing brushes may be connected to call magnets 156 to establish a circuit through which the printer magnets 156 get current impulses for listing. Drum 150 rotates in synchronism with the feed of the record cards past the lower analyzing brushes so that each type reaches printing position shortly after its

corresponding index point position on a record card reaches the lower analyzing brush. When a brush encounters a perforation a pulse of current flows in the circuit just traced energizing the printer control magnet 156 and setting the operating finger to engage the proper type carrier and cause printing immediately thereafter.

Spacing of paper for items and totals

After each printing operation as controlled by the successively fed cards the paper is spaced in increments to suitably space the entries on the sheet. This action is effected by a cam 47 (Fig. 1) rotating synchronously with machine operation and a magnet 48 energized at the proper time. A lever 49 carries a latching pawl 50 and a connecting pawl 51 a projection of the connecting pawl normally engaging a shoulder 52 of the latching pawl thereby holding a lug 53 of connecting pawl 51 out of engagement with a finger 54 of a member 55. Member 55 is provided with a series of holes 56 in which a pin may be inserted to enter a similar hole in one arm 57 of the bell crank 46. Energization of magnet 48 at the proper time will, through a depending finger 58 movable with the attracted armature rock connecting pawl 51 permitting a connected spring 59 to rock pawl 51 bringing lug 53 to pass in front of finger 54. As cam 47 is rotated its coaction with a projection 60 of member 49 will rock the latter clockwise and through the medium of the connecting pawl 51 rocks member 55 similarly. This results in rocking bell crank 46 by virtue of the pin connection referred to. A rocking movement is thus imparted to bell crank lever 39 effecting a paper feeding operation (see Fig. 2) in the manner previously described. Return movement of the parts operated by cam 47 is effected by a spring 61 connected to a downward extension of member 55 and a supplemental spring 62 which acts to return bell crank 49 to normal through a connecting link 63. Pawls 51 and 50 are restored to normal engaging position during the restoring part of the cycle by a curved finger 64 coacting with a stationary spring stud 65*a*.

It will be obvious that by properly positioning the removable pin in one of the series of holes 56 the angular relationship between member 57 and bell crank 46 may be changed thereby increasing or decreasing the lost motion between arm 46 and roller on arm 39 to effect, as in the present instance, single, double or triple space, of the paper, as desired.

Cam 47, as shown in Fig. 7, is carried by a shaft 46*a* to which a gear 45 is attached. Gear 45 is driven by the motor 1 so that in all operations in which magnet 48 is energized a paper feed will be effected. Magnet 48 is under control of contacts CF8 (Fig. 13) and timer D to provide for a paper feeding operation for each card analyzed.

The paper feed magnet circuit extends in series through card feed cam contacts CF8, timer contacts D3 and regular cam contacts R—14. The cam contacts CF8 and R14 are timed together so that if all three contacts, CF8, D3 and R14, are closed during the same cycle the magnet 48 will be energized. During the proper cycle of operation of timer D when cards are at the lower brushes contacts D3 close and remain closed until the timer D is again operated and the magnet 48 is energized during this and each subsequent cycle by the closure of contacts CF8 and R14 to space the paper after listing from each card.

In the above manner, paper spacing is effected after each listing operation and in order that a number of listings may come within a sheet of a predetermined size the present invention contemplates the provision of an adjustable device that predetermines the number of listings that may be effected upon a sheet and thereafter stops the card feed to permit subsequent listings from the remaining cards to be made on another sheet as shown in Fig. 11. However, as will be explained hereinafter, in the present machine, a change in the classification number of card groups will cause the machine to thereafter discontinue listing and automatically space the paper so that the total may be printed at the bottom of the sheet.

To this end the number of increments of feed given to the paper is made dependent upon the travel of an adjustable pin 65 arcuately until it reaches a fixed stop 66 (Figs. 4 and 6) carried by the casing 27. The initial location of pin 65 is dependent upon the positioning of a stop pin 67 carried by a plate 68 movable by a setting lever 69. The latter may be initially adjusted and locked in place by the usual spring plunger device 70 cooperating with a series of holes which may be suitably indexed so as to indicate to the operator the number of printings which may be effected on the sheet.

At the completion of the desired number of entries as controlled by the previous operation of the machine, pin 65 usually abuts 66 but under certain conditions to be hereinafter set forth pin 65 may be left in a position between pins 66 and 67 but in either case it is necessary to restore it to the desired position prior to the next operation of the machine. Lever 34 is part of a rack segment 71 which is in continuous mesh with a gear 72 loose on a stub shaft 73. Since pin 65 may be stopped in its restoring movement prior to the time that segment 71 is stopped by pin 33, gear 72 is adapted to restore pin 65 by a frictional drive. Pin 65 is carried by a cylindrical disk 74 loose on a sleeve 75 overlying shaft 73. A collar 76 is screwed upon sleeve 75 and held fixed by a lock nut 77. A spring 78 fitting in a socket 79 bears against a plate 80 carried by the collar 76 to thrust the cylindrical disk 74 along sleeve 75 to urge a disk 800 frictionally against gear 72. As gear 72 rotates the cylindrical disk 74 will be frictionally driven and pin 65 will be moved against pin 67 but when this condition obtains gear 72 may be further rotated.

Rotation of cylindrical sleeve 74 rotates a gear 81 carried thereby. Reverse rotation of gear 81 and cylindrical disk 74 when segment 71 is restored is prevented by engagement of a spring urged pawl 82 (Fig. 6) with the gear, the engaging end of the pawl and interdental spaces of the gear being so shaped that the pawl will permit rotation of the gear in the direction necessary to restore pin 65 but will prevent any movement in the reverse direction. Pin 65 will therefore be retained in its restored position. When rack segment 34 is returned to its starting position a pin 83 carried thereby coacting with a lug on the pawl 82 will disengage the latter from gear 81 as shown in Fig. 2.

As the gear 37 is given a step by step movement to feed the paper in increments, motion is transmitted through a gear train to the cylindrical disk 74 effecting the necessary travel of

pin 65 from its starting point. To this end gear 37 meshes with a pinion 84 (Fig. 3) which in turn meshes with a pinion 85. Pinion 85 is loosely pivoted on a stud carried by a rockable plate 86. Pinion 85 is directly sleeved to a similar pinion 87 by a sleeve connection 88. Pinion 87 meshes with a pinion 89 (Figs. 3 and 4) which is in the plane of and meshes with gear 81. Each increment of movement is transmitted to gear 37 will be communicated to gear 81 but prior to such movement it is necessary to rock plate 86 to bring the counter pinions 85 and 86 in mesh with their related pinions 84 and 89. This is effected by means of a pawl 90 (Fig. 2) carried by segment 71 which wipes idly by an extension 91 of a pivoted plate 92 (Fig. 8) when lever 34 is moved downwardly. Plate 92 has a pin and slot connection 93 to the rockable plate 86 and as pawl 90 strikes extension 91 on its return, plate 92 will be rocked to enmesh the associated pinions, 84, 85, and 87, 89 (Fig. 3). In this manner a direct gear connection between gear 37 and gear 81 is established. Plate 86 is held in either position of adjustment by a spring pressed pawl 94.

As disk 74 steps around the friction existing between disk 800 and gear 72 (Fig. 4) will tend to rotate gear 72 counterclockwise (Fig. 2), and rack segment 71 meshing therewith clockwise. It will be recalled, however, that lever 34 is normally latched and abuts a stop stud 41 which prevents any upward movement imparted to lever 34 and in this case, disk 800 will merely slip idly around sleeve 75 without disturbing gear 72.

As disk 74 is driven in increments, a pawl 95 (Figs. 5, 6, and 9) carried thereby will approach the wedge-shaped end of a bell crank lever latch 96 and at the time that pin 65 strikes pin 66 (coincident with the last listing operation) latch 96 will be operated disengaging it from a latching lever 97 which normally retains contacts 98 closed. Contacts 98 will thereby open under their own resiliency to deenergize card feed clutch magnet 18 (Fig. 13).

Link 63 (Fig. 2) previously mentioned rocks a bell crank lever 99 and through a pin and slot connection 100 rocks plate 101 (Fig. 8) during each machine operation. Plate 101 carries a gravity operated pawl 102 which is of a width sufficient to straddle a disk 103 secured to disk 74 and a curved extension 104 of plate 92. During the time pin 65 is approaching its extreme position where it serves to open contacts 98 to stop card feeding, the concentric periphery of disk 103 retains pawl 102 out of engagement with the point of extension 104. Substantially at the time pin 65 strikes pin 66, pawl 102 will register with a notch 105 in disk 103 thereby rocking plate 92 to de-mesh the associated gears 84, 85 and 87, 89, which, as premised hereinbefore, are held in their disengaged relationship by pawl 94. It will be recalled that after the D timer contacts D—2 open the circuit of the clutch magnet 18 is shifted to the automatic control contacts 9 and contacts 98, and the energizing circuit thus extends from line 2 (Fig. 13) contacts 98, auto control contacts 9, CF contacts 243, wires 560 and 570, magnet 18, wire 19 to the other side of the line 3. The card feed clutch magnet will thus be energized once each card cycle ensuring card feed as long as contacts 98 and 9 are made.

However, when contacts 98 open (coincident with the last listing operation on a sheet) card feed clutch magnet 18 will fail to energize and card feed clutch 180 will disengage at the end of the cycle and feeding of the cards will thereupon stop.

Opening of contacts 98 will prevent taking of a total if the classification of card groups does not change. The circuit through the total timer F extends from line 2, contacts 98, switch 250, CF contacts 252, contacts 251, F timer magnet 255 to line 3. Contacts 98 open up as the card associated with the last listing is fed, and as clutch 180 comes to rest CF contacts 252 will be closed and opened but since contacts 98 are already open no impulse will be transmitted to the F timer magnet 255.

During the last card feed cycle magnet 48 receives an impulse causing the paper feed devices to be operated and thereby feed the paper after the last listing operation. This suitably spaces the last printed line from the bottom of the sheet.

Cam contacts 98 are subsequently closed by a link 106 (Fig. 6) having an elongated slot 107 engaging a pin carried by bell crank 97. Link 106 is reciprocated by a cam 108 (Fig. 1) rotating synchronously with cam 47. Cam 108 is carried by a shaft 111 which also carries a gear 110 meshing with a gear 109 carried by the shaft on which cam 47 is mounted. Cam 108 coacts with a projection 112 of a bell crank lever 113 to rock link 106 to effect closing of contacts 98. Contacts 98 are closed after CF contacts 243 and R—1 are closed and opened, so as to complete the circuit through clutch magnet 18 to effect subsequent feeding of cards.

After the machine is carried through a predetermined number of listing operations the various operations in connection with a particular number of cards will have been completed and resumption of machine operation in connection with another group of cards may be performed by depressing the starting switch ST. Prior to this, the paper on which the entries have been made, may be withdrawn and a fresh sheet inserted, the desired blank heading being given by a subsequent operation of the spacing lever 34.

When the classification of card groups change it is desirable that the total of the items represented by cards of the first group be obtained prior to accumulation of items represented by the following group of cards. Since card classification may change prior to the time that the predetermined number of listings have been made on the sheet it is preferable to blank space the sheet after the last listing operation to bring the total at the bottom of the sheet as illustrated in Fig. 12.

To this end certain mechanism under control of magnet 115 (Figs. 1, 7 and 13) is rendered effective to feed the paper additionally after the last entry.

Intermeshing with the continuously driven gear 109 is a broad pinion 116 (Fig. 7) loose on an extension of the platen shaft 35. Integral with the pinion 116 is a friction disk 117 adapted to be brought into engagement with a corresponding friction disk 118 preferably made of leather, or similar material. This engagement is effected by a pair of pivoted clutch jaws 119 (Fig. 1). Disengagement of friction disks 117 and 118 against the action of a coil spring 123 is effected by the coaction of a projection 120 (Figs. 1 and 7) of one of the clutch jaws with the hooked portion 121 of an extension of the armature 122 of relay 115. When the magnet

115 is energized, clutch jaws 119 are released to allow spring 123 to be effective to slide friction disk 118, thereby rotating the platen 22 supplementally the desired amount. At the termination of this movement pin 65 strikes pin 66 to perform the functions previously described.

As more fully explained in the application Serial No. 185,718 filed April 22, 1927 now Patent No. 1,821,088 when the classification of card groups change, one or more of the series connected contacts 9 (Fig. 13) open and remain open until restored. Clutch magnet 18 then fails to energize due to opening of one of the contacts 9 interrupting the normal card feed. As the clutch elements come to rest contacts 251 close and remain closed. Since the desired number of listings have not yet been effected contacts 98 are still closed and as CF contacts 252 close and open an impulse will be sent through the F timer magnet 255.

The instantaneous closing of the contacts 252 energizes the starting coil 255 of timer F whereupon the contacts of the latter close in proper sequence and control the switch bars 220 and 230 to effect total printing from the accumulators as fully explained in the copending application Serial Number 147,960, filed November 12, 1926 now Patent No. 1,750,459.

As the F timer is operated contacts 256 are made during the first cycle to establish a circuit through magnet 115 traced as follows, from line 2, wire 15, F timer contacts 256, through magnet 115 to the opposite side of line 3.

The friction drive comprising members 117 and 118 will thereupon rotate platen roller 22 and through the train of mechanism comprising gears and pinions 36, 37, (Fig. 3) 84, 85, 87, 89, and 81, cylindrical disk 74 will be turned bringing pin 65 against pin 66 and opening contacts 98.

Clutch members 117 and 118 are returned to normal disengaged position by the depending arm 124 (Figs. 1 and 7) engaging an extension 125 of one of the clutch jaws 119. As the high part of cam 108 contacts extension 112, arm 124 will be rocked separating friction disks 117 and 118, and at the extreme rocked position of arm 124 clutch jaws 119 are restored to latched position.

Contacts 98 are restored to closed position at substantially the time the friction drive comprising members 117 and 118 is disabled, the closing of these contacts failing to subsequently re-energize timer F since CF contacts 252 are open.

Toward the end of the cycle any of the contacts 9 which might have been opened are restored to closed position. This restoring action is timed, of course, upon the opening of contacts 243 in the circuit of magnet 18 so that card feed stops at the end of a run although contacts 9 are closed for automatic control on a subsequent card group.

The paper feed during total printing may be taken care of by the F timer itself as there is no card feed at this time and the card feed contacts CF8 which normally control the spacing of the paper are open. The paper feed magnet 48 is controlled during total printing by the F timer contacts F3 which close during the first cycle and open during the fifth permitting the cam contacts R14 to energize the magnet 48 during the second, third and fourth cycles of timer operation. If found desirable this provides for suitable paper feed during the total printing operations to space the total from the first item of the next group which may be printed upon the following part of the same sheet, and such is especially useful when the preliminary paper feeding operation is not employed.

Attention is directed to the fact that in the normal position of pawl 38 (Fig. 2) a tail thereof coacts with a stationary pin 381 disengaging said pawl from gear 37 permitting a free movement of the latter when driven by the friction drive previously described.

The change in classification may occur early or late in a predetermined number of cards which control listings and it therefore is essential that feeding of the platen roller comes within the maximum number of listings which may be predetermined. For this reason a high gear ratio between gear 109 and pinion 116 is provided.

When the change in classification of cards occurs near the end of a predetermined number of listings it will require a short paper feed to cause the total to appear at the bottom. Since this is usually less than the maximum which may be imparted by the friction drive it is necessary to stop the rotation of platen roller at the desired point and permit the friction drive to slip.

When latching lever 97 is released to open contacts 98 a lug 126 (Fig. 6) will engage the teeth of the gear 84 and since gear 84 meshes with the larger gear 37 the platen roller 22 will thereby be locked in its rotated position. Since the friction drive comprising disks 117 and 118 is still enabled slipping will take place and disk 117 will be driven idly without effecting further movement of platen 22. Immediately after contacts 98 are again made gear 84 will be unlocked and the platen roller subsequently rotated for spacing the paper after the total is printed.

The invention has now been described in connection with a single operative embodiment thereof but it will be understood that many modifications will readily occur to 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 as new is as follows:—

1. In a machine of the class described, means for effecting the printing of items in one zone on a work sheet and a total of the items in another zone on said work sheet, but in alignment with the items, means for spacing the items that are printed in the item printed zone, means effective when a total is to be printed for automatically spacing the work sheet after printing the last item to an extent dependent upon the number of items that have been printed to cause the printing of the total in the total printing zone, and means for controlling the last named means for predetermining the total zone.

2. In a machine of the class described, the combination of mechanism adapted to list items of different classifications and print the total of items of the same classification, means for preventing the printing of a total and interrupting listing of items of a particular classification if a predetermined number of listings of such classification has been effected, and means under control of the interrupting means for effecting

a total printing operation when the classification of items change.

3. In a machine of the class described, the combination of mechanism adapted to list items of different classifications, and print the total of items of the same classification, contacts for preventing the printing of a total and interrupting the listing of items of a particular classification if a predetermined number of listings has been effected, and means including an electric circuit under control of the contacts for effecting of total printing operation when the classification of items change.

4. In a tabulating machine, in combination, means for analyzing records comprising successively fed cards and for listing data represented by perforations in the cards, said cards being characterized by different classifications, adjustable means for preventing the taking of a total and interrupting card feed if a predetermined number of cards has been analyzed, and means under control of the last mentioned means for effecting a total taking operation when the classification of cards change.

5. In a tabulating machine, in combination, means for analyzing records comprising successively fed cards and for listing data represented by perforations in the cards, said cards being characterized by different classifications, means for interrupting card feed and for preventing the taking of a total if a predetermined number has been fed, and means under control of the interrupting means for effecting a total printing operation when the classification of cards change and including devices for spacing a work sheet on which the data is listed for causing the total to be printed at a predetermined line of the sheet.

6. A machine of the class described comprising, a rotatable printing platen adapted to carry a sheet upon which is printed items and a total of the items, total taking mechanism, means for rotating the platen for each item printing operation, means settable by the operator of the machine, and means rendered effective by the total taking mechanism and under control of the settable means for variably rotating the platen extents dependent upon the number of items that have been printed to cause the total to be printed at a predetermined position.

7. A machine of the class described comprising, a rotatable printing platen adapted to carry a sheet for receiving classified items printed in a group of the same classification and for receiving a printed total of the group, total taking mechanism, means for rotating the platen for each item printing operation, means settable by the operator of the machine for predetermining the number of items of the group that may be printed on a sheet, and means under control of the settable means for effecting a variable operation of the platen if the classification of items change prior to printing a predetermined number.

8. A machine of the class described comprising in combination, a printing mechanism, a platen operated automatically to space a record sheet when the printing mechanism is effecting the printing of items and totals, a member for driving said platen and operable automatically an invariable extent during each operation of the printing mechanism when the latter effects item printing, and separate means, automatically operable during the operation of the printing mechanism to effect total printing operations, for controlling the operation of said member to an extent dependent upon the number of item printing operations that have occurred.

9. A machine of the class described comprising in combination, a printing mechanism, a platen automatically operable to space a record sheet when the printing mechanism is operated to print items and totals, a member for driving said platen automatically and operated an invariable extent each time that the printing mechanism is effecting an item printing operation, and means operable when the printing mechanism is effecting total printing operations for automatically operating said member whereby the sheet may be differentially spaced after the printing of a number of items less than a predetermined number.

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