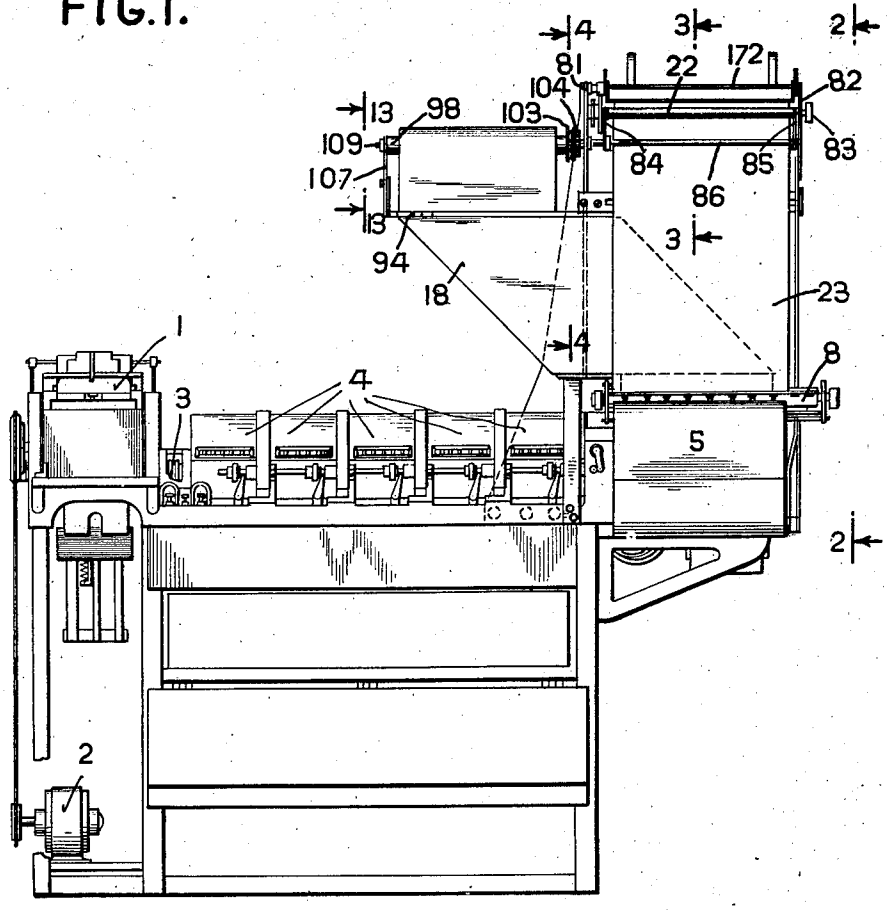
Oct. 4, 1932. F. M. CARROLL 1,880,416

PRINTING MECHANISM FOR ACCOUNTING MACHINES

Filed Feb. 17, 1928 12 Sheets-Sheet 1

FIG. 1.



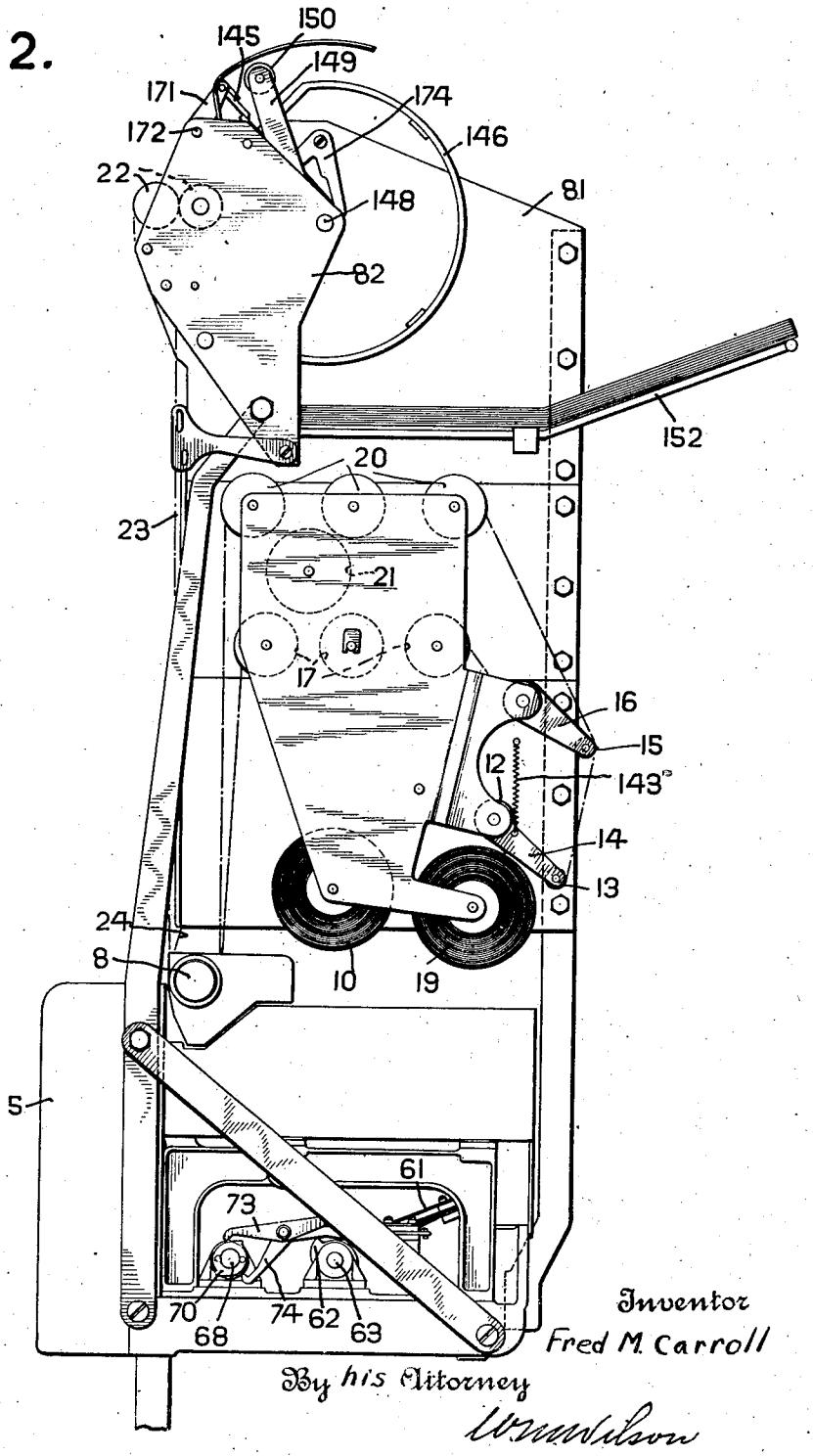
Inventor
Fred M. Carroll
By his Attorney
W. W. Wilson

Oct. 4, 1932. F. M. CARROLL 1,880,416

PRINTING MECHANISM FOR ACCOUNTING MACHINES

Filed Feb. 17, 1928 12 Sheets-Sheet 2

FIG. 2.



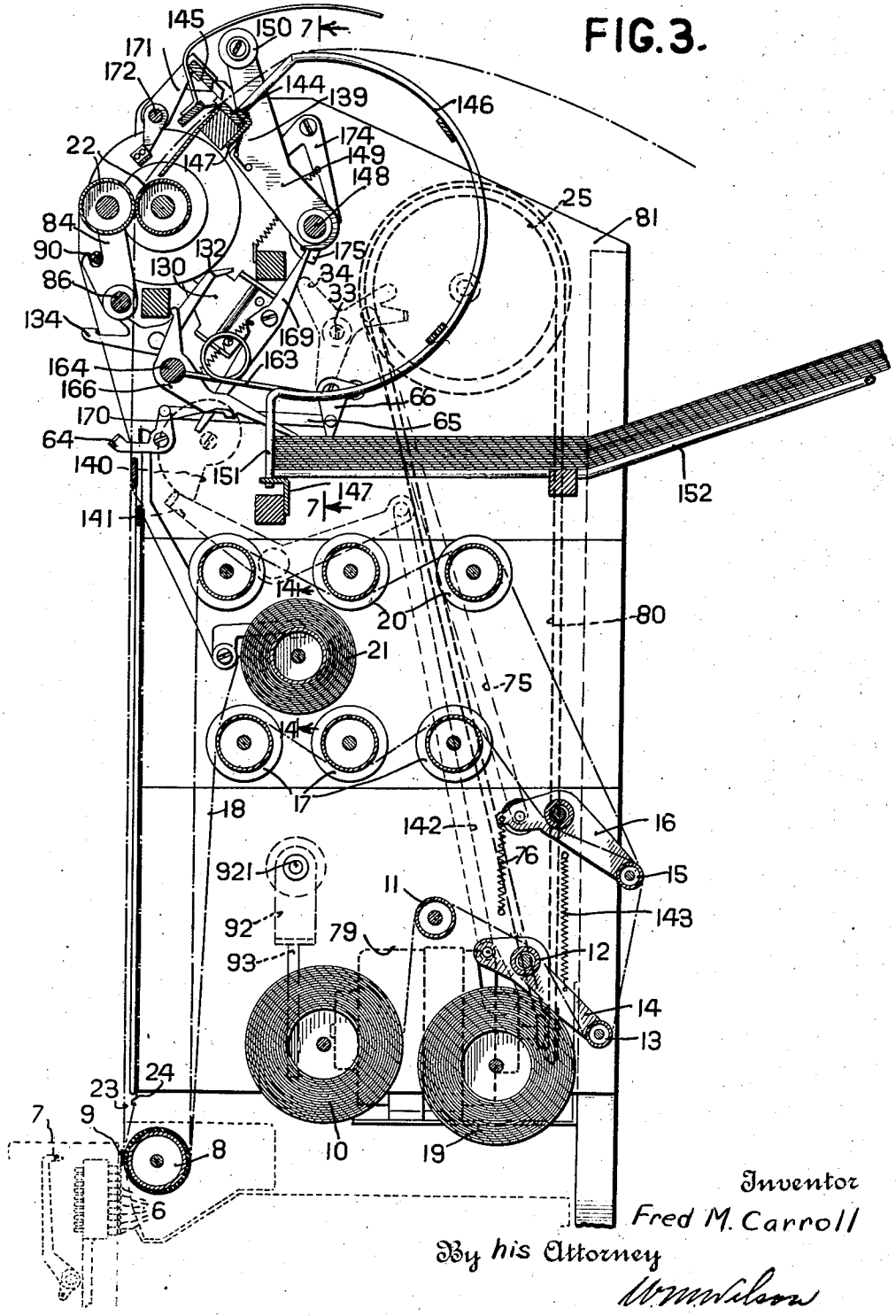
Inventor
Fred M. Carroll
By his Attorney
W. W. Wilson

Oct. 4, 1932. F. M. CARROLL 1,880,416

PRINTING MECHANISM FOR ACCOUNTING MACHINES

Filed Feb. 17, 1928 12 Sheets-Sheet 3

FIG. 3.



Inventor
Fred M. Carroll
By his Attorney
W. M. Wilson

Oct. 4, 1932. F. M. CARROLL 1,880,416

PRINTING MECHANISM FOR ACCOUNTING MACHINES

Filed Feb. 17, 1928 12 Sheets-Sheet 4

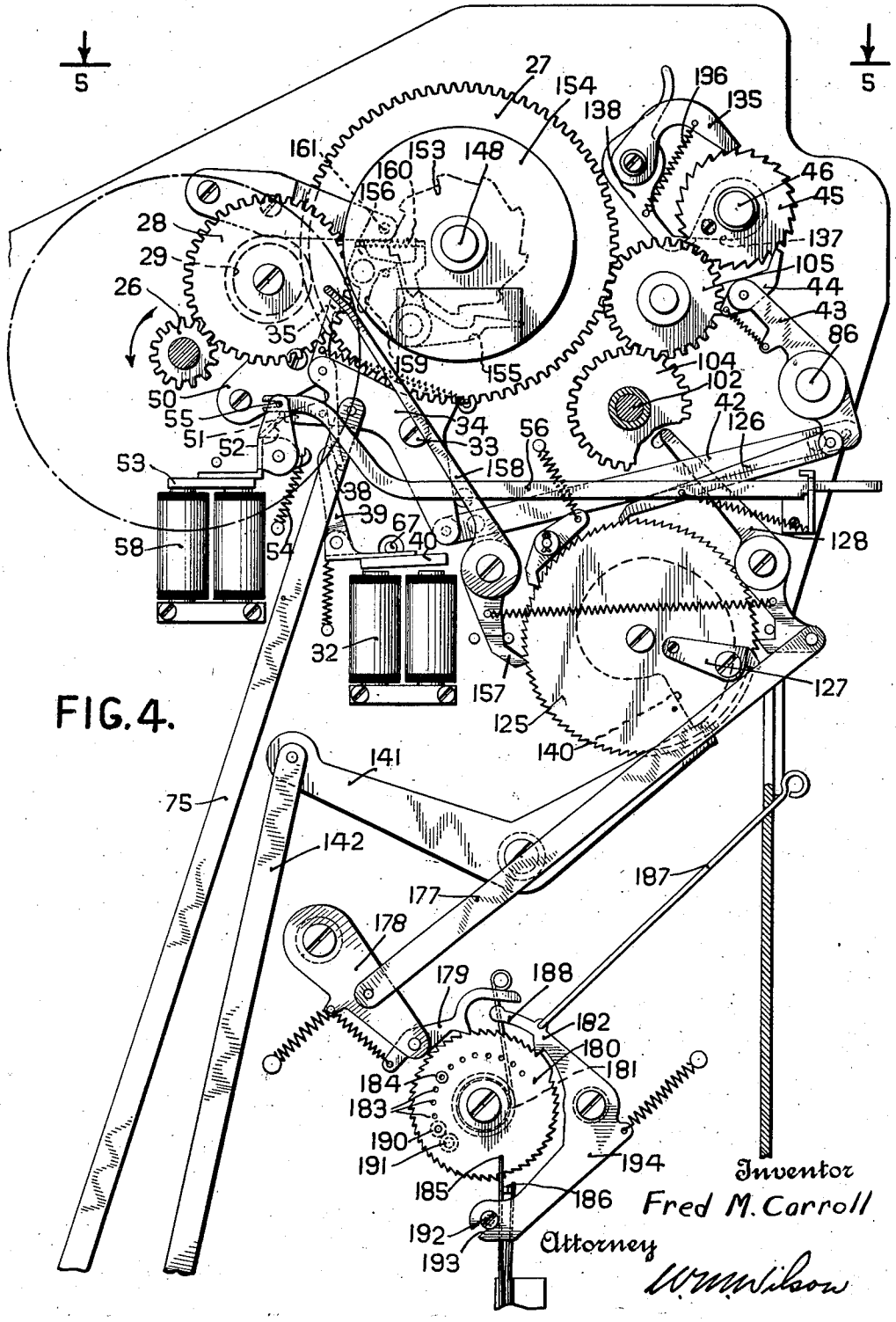


FIG. 4.

Inventor
Fred M. Carroll

Attorney
W. W. Wilson

Oct. 4, 1932. F. M. CARROLL 1,880,416

PRINTING MECHANISM FOR ACCOUNTING MACHINES

Filed Feb. 17, 1928 12 Sheets-Sheet 5

FIG.5.

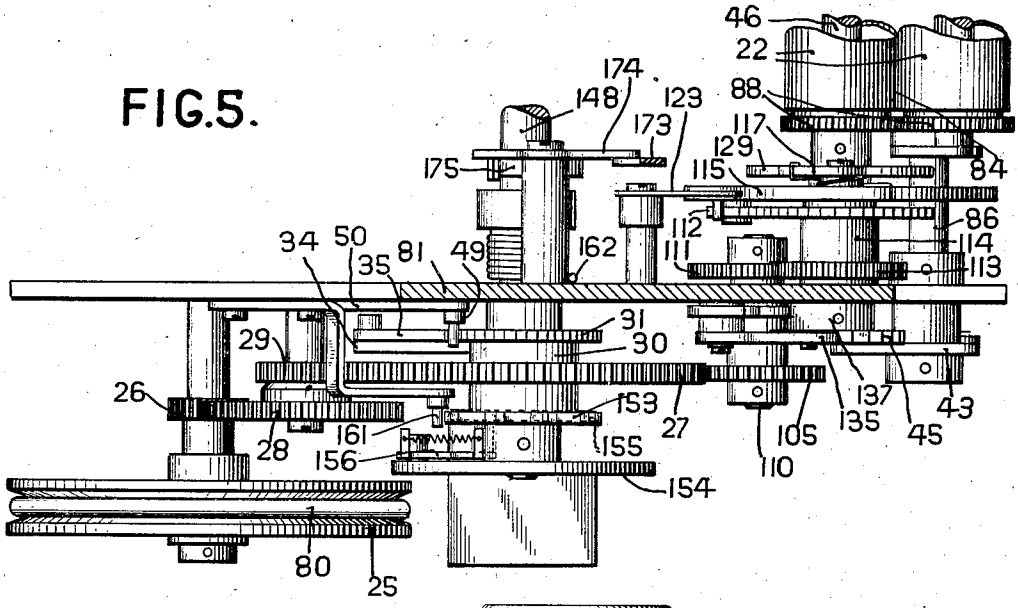
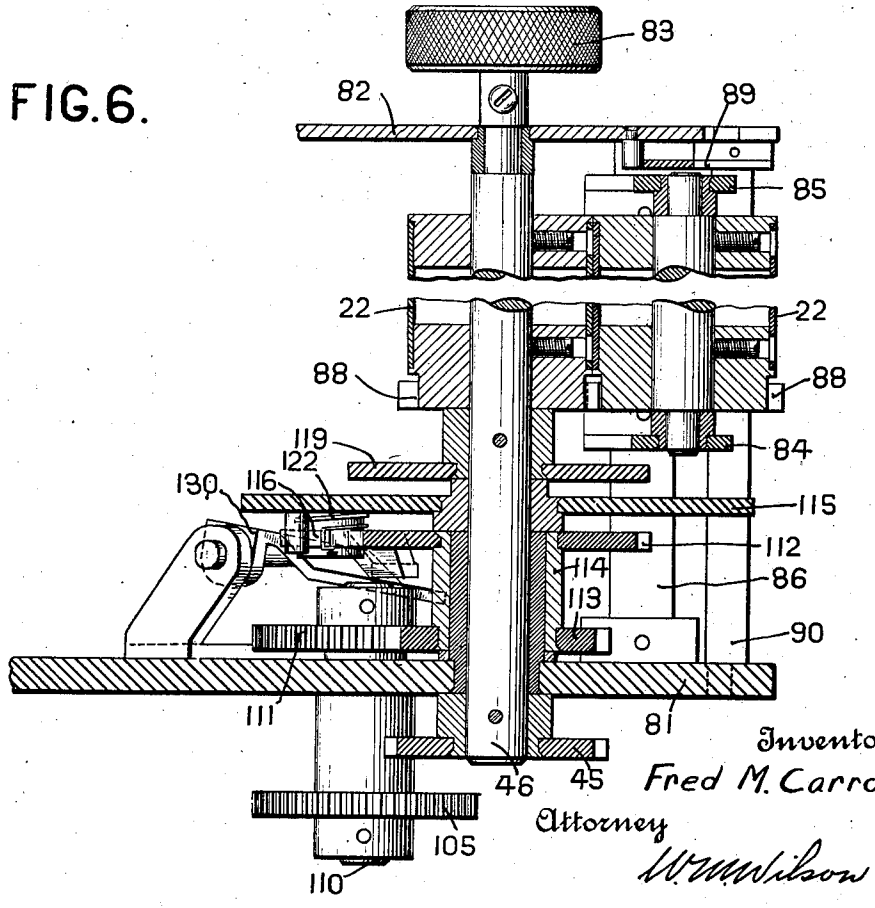


FIG.6.



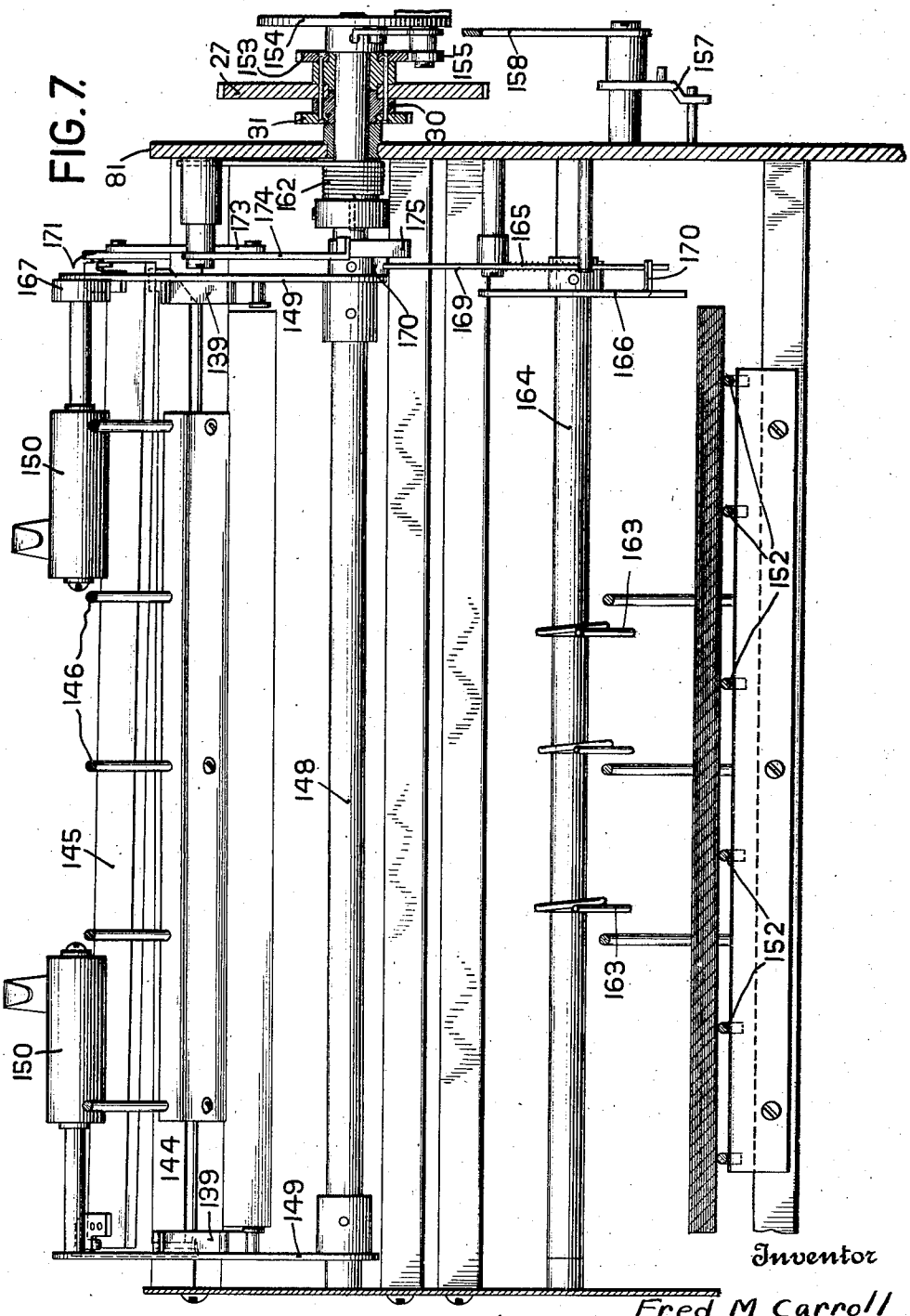
Inventor
Fred M. Carroll
Attorney
W. W. Wilson

Oct. 4, 1932. F. M. CARROLL 1,880,416

PRINTING MECHANISM FOR ACCOUNTING MACHINES

Filed Feb. 17, 1928 12 Sheets-Sheet 6

FIG. 7.



Oct. 4, 1932. F. M. CARROLL 1,880,416

PRINTING MECHANISM FOR ACCOUNTING MACHINES

Filed Feb. 17, 1928 12 Sheets-Sheet 7

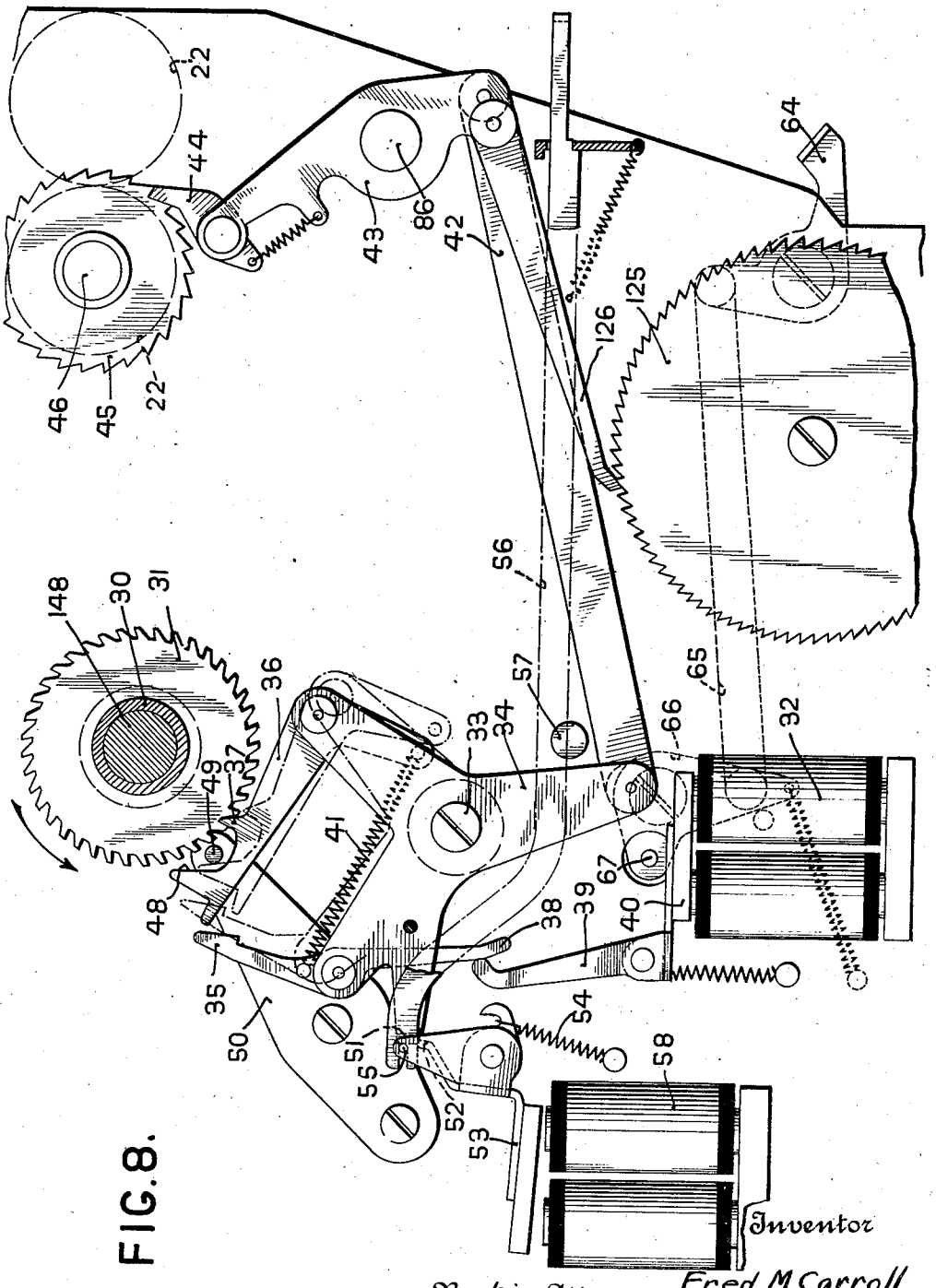


FIG. 8.

Inventor
Fred M. Carroll

By his Attorney
W. W. Wilson

Oct. 4, 1932. F. M. CARROLL 1,880,416

PRINTING MECHANISM FOR ACCOUNTING MACHINES

Filed Feb. 17, 1928 12 Sheets-Sheet 8

FIG. 9.

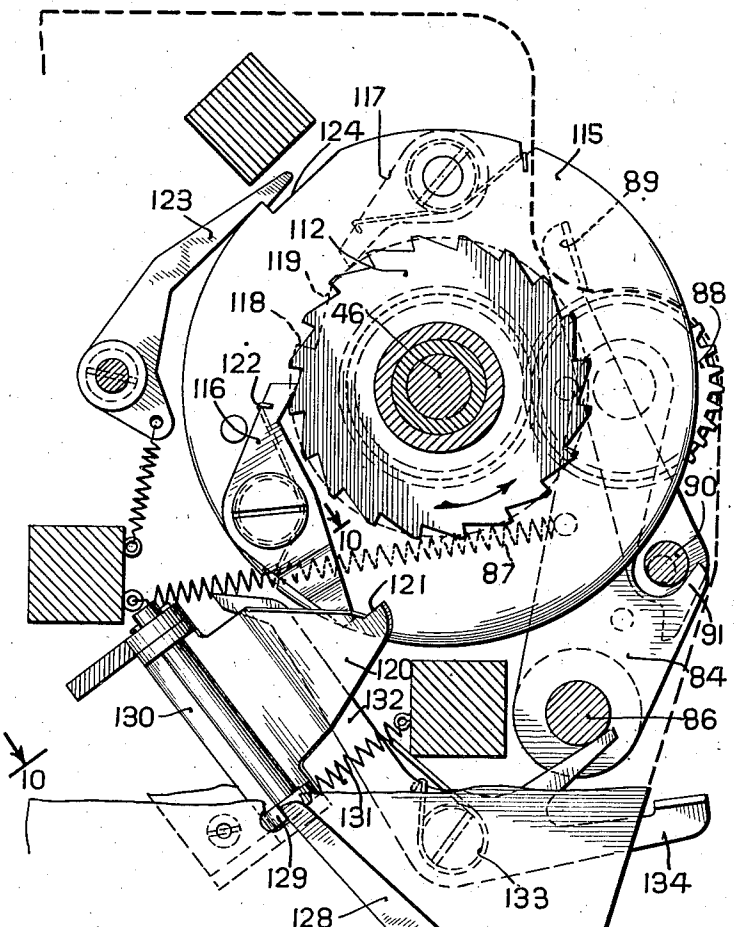
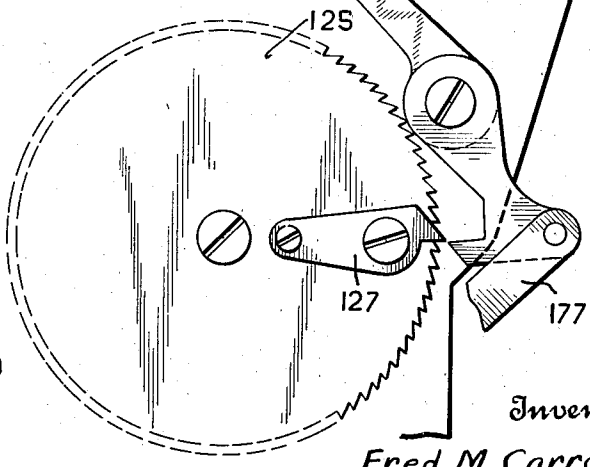
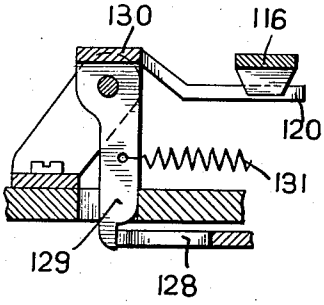


FIG. 10.





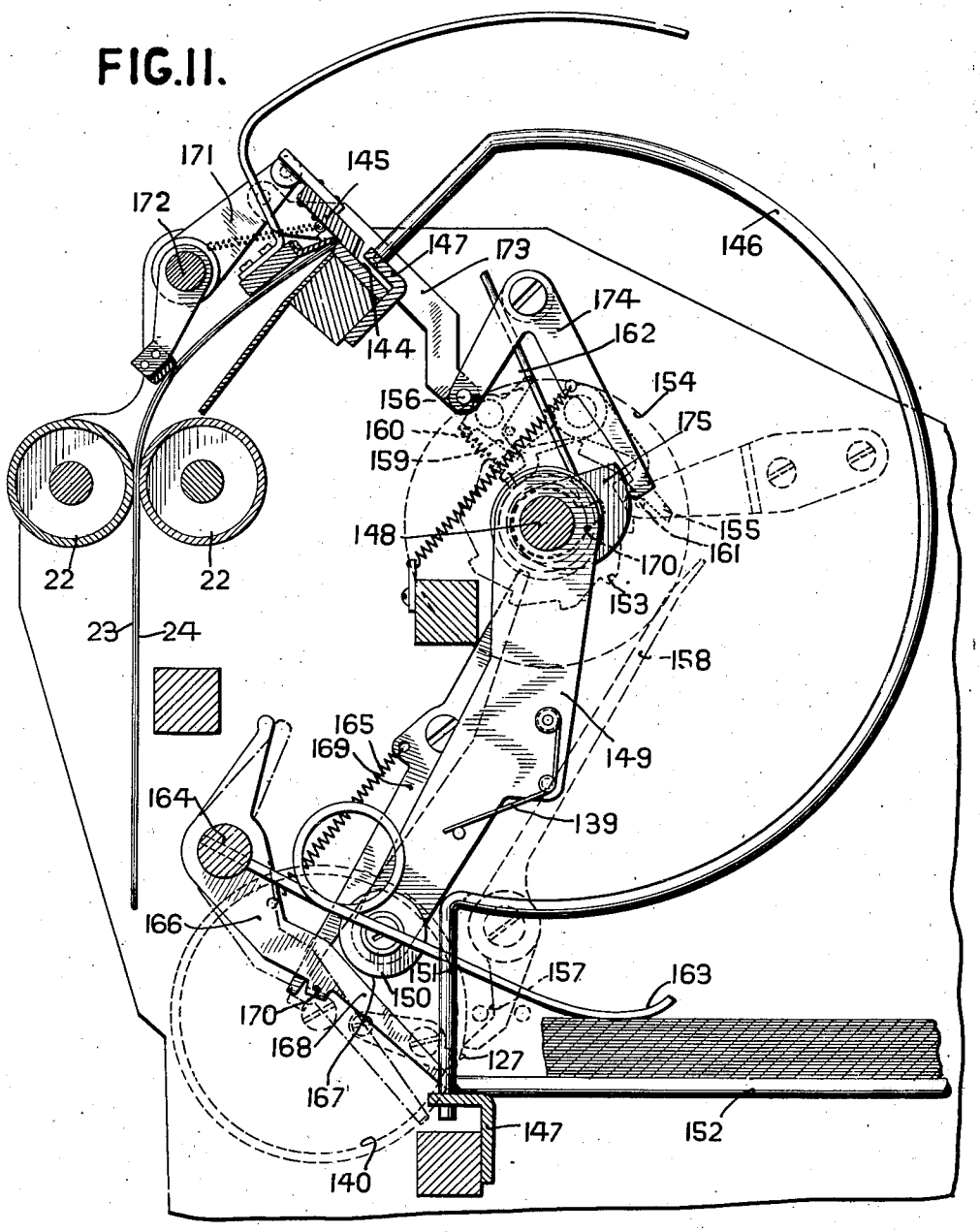
Inventor
Fred M. Carroll
By his Attorney
W. W. Wilson

Oct. 4, 1932. F. M. CARROLL 1,880,416

PRINTING MECHANISM FOR ACCOUNTING MACHINES

Filed Feb. 17, 1928 12 Sheets-Sheet 9

FIG.11.



Inventor
Fred M. Carroll
By his Attorney
W. W. Wilson

Oct. 4, 1932. F. M. CARROLL 1,880,416

PRINTING MECHANISM FOR ACCOUNTING MACHINES

Filed Feb. 17, 1928 12 Sheets-Sheet 10

FIG. 12.

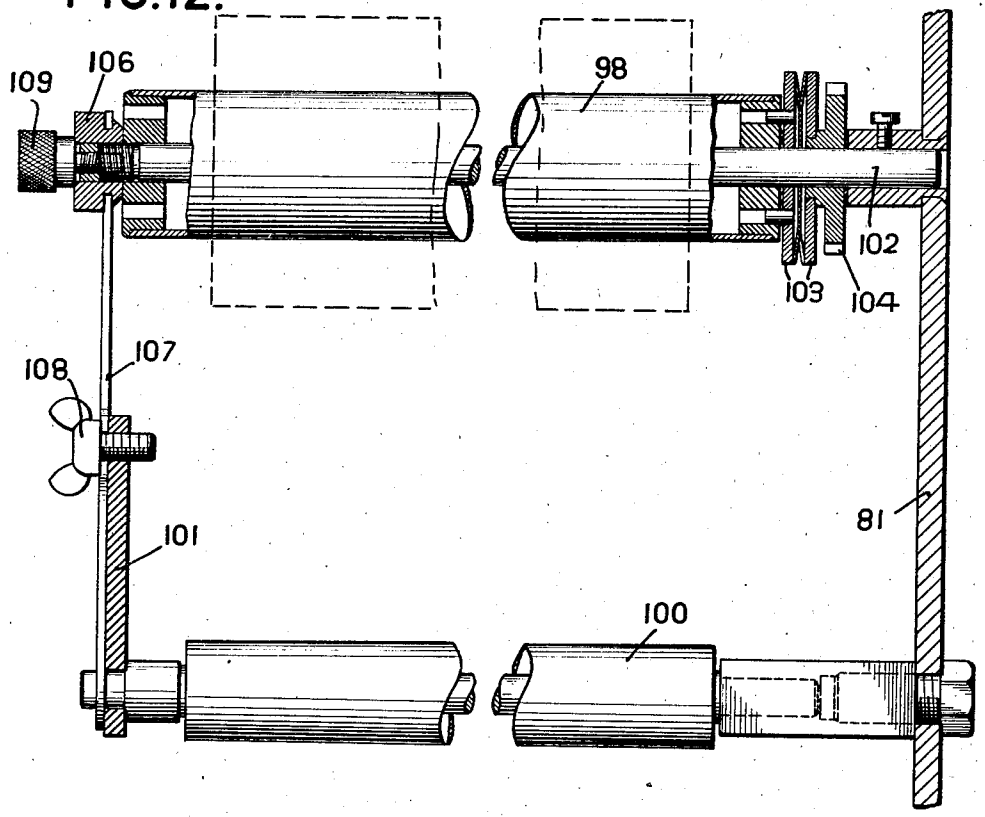
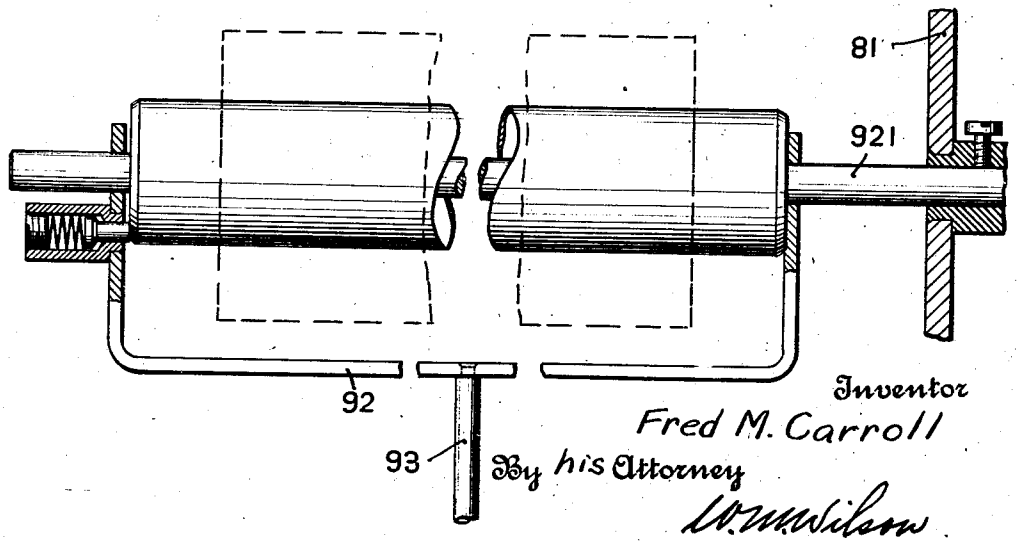


FIG. 20.



Inventor
Fred M. Carroll
By his Attorney

Oct. 4, 1932. F. M. CARROLL 1,880,416

PRINTING MECHANISM FOR ACCOUNTING MACHINES

Filed Feb. 17, 1928 12 Sheets-Sheet 11

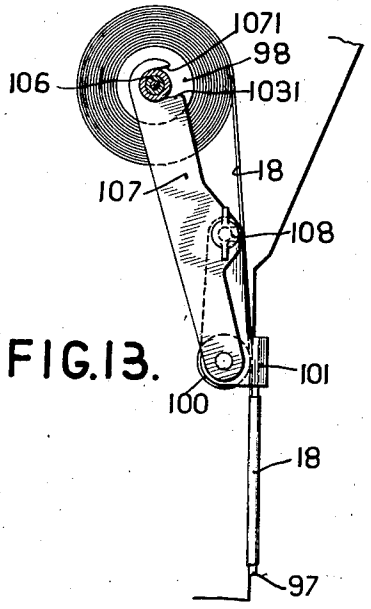
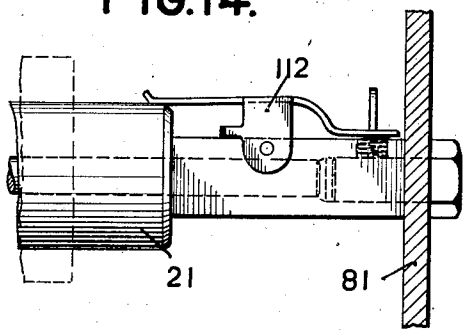


FIG.13.

FIG.14.



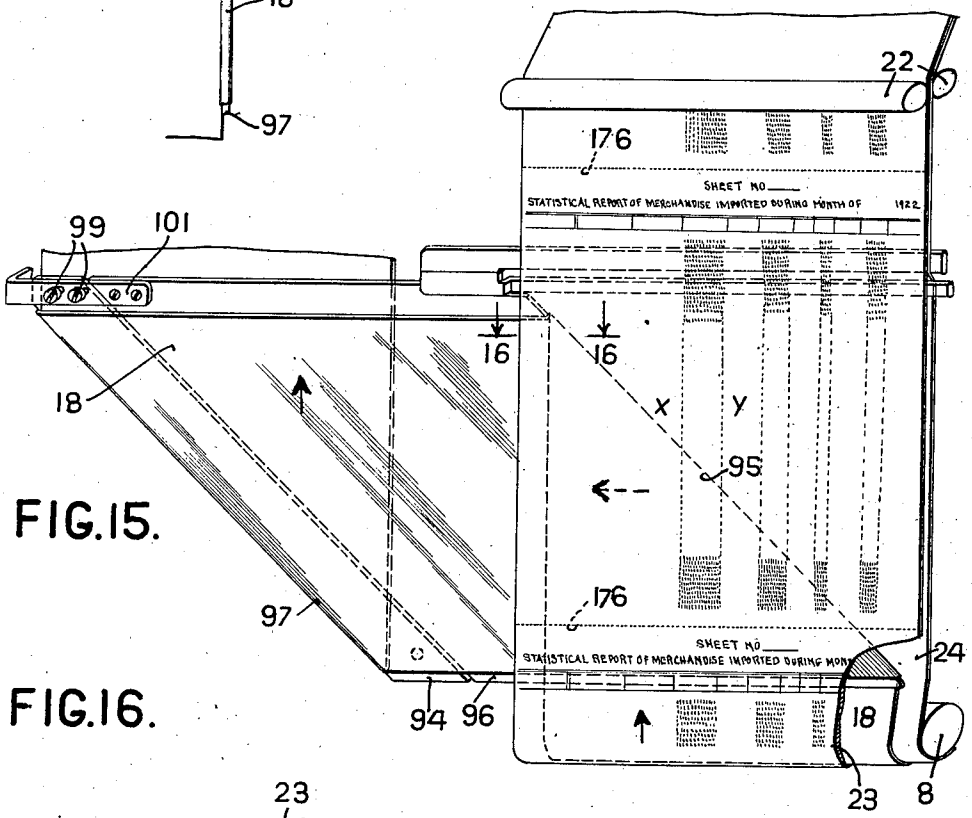
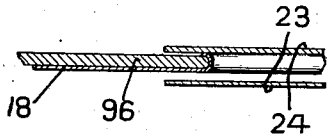


FIG.15.

FIG.16.



Inventor
Fred M. Carroll

By his Attorney
W. W. Wilson

Oct. 4, 1932. F. M. CARROLL 1,880,416

PRINTING MECHANISM FOR ACCOUNTING MACHINES

Filed Feb. 17, 1928 12 Sheets-Sheet 12

FIG. 17.

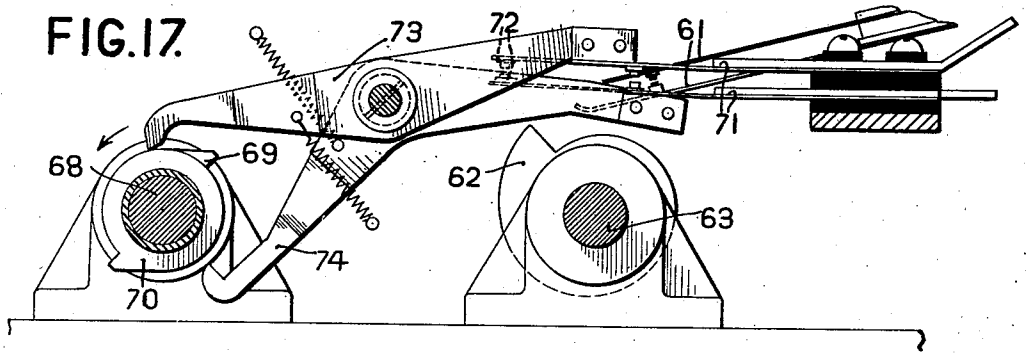


FIG. 18.

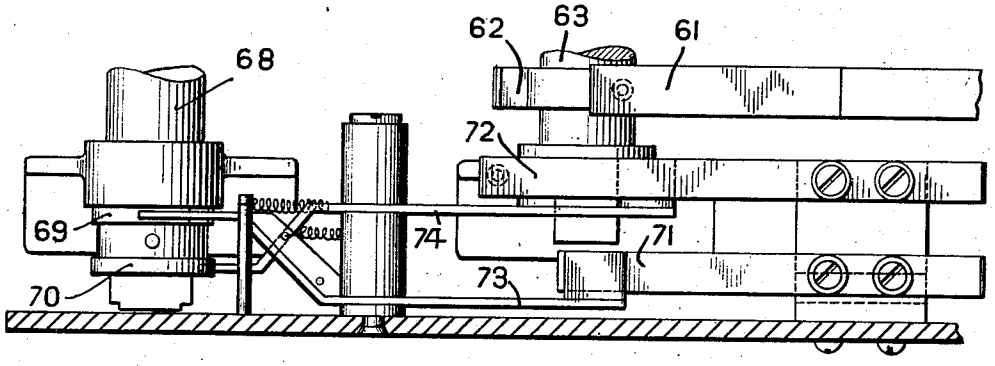
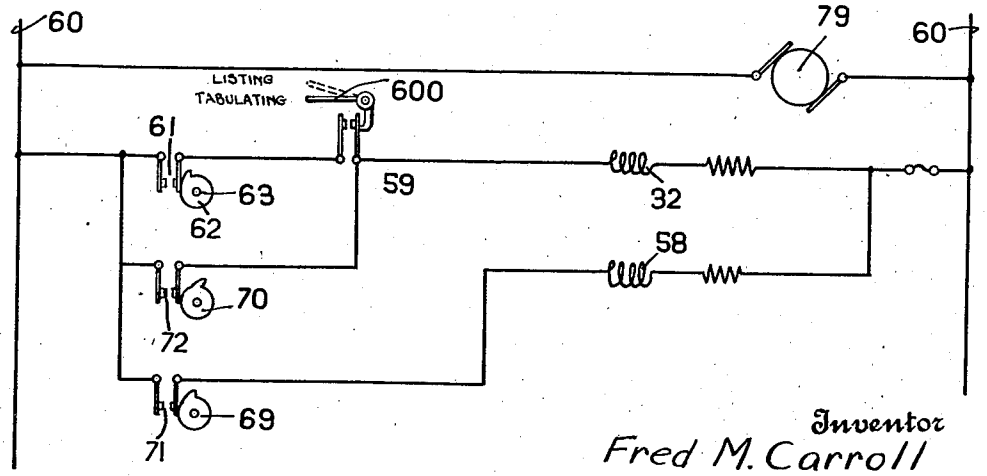


FIG. 19.



Inventor
Fred M. Carroll
By his Attorney
W. W. Wilson

Patented Oct. 4, 1932 1,880,416

UNITED STATES PATENT OFFICE

FRED M. CARROLL, OF YONKERS, NEW YORK, ASSIGNOR TO THE TABULATING MACHINE COMPANY, OF ENDICOTT, NEW YORK, A CORPORATION OF NEW JERSEY

PRINTING MECHANISM FOR ACCOUNTING MACHINES

Application filed February 17, 1928. Serial No. 254,936.

This invention relates to printing mechanisms in general 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. Where the data is printed upon separate manually inserted sheets usually no special problems are involved, however, when it is desired to print the data upon a continuous sheet drawn from a roll on which appears at intervals certain preprinted matter, automatic spacing of the sheet must be taken care to insure that listing will be effected only upon the blank portions of the sheet. It is, moreover, desirable that the strip be cut into sheets of predetermined length for convenience in handling and filing and that more than one copy of the data printed be provided.

It is, therefore the main object of the present invention to provide a mechanism whereby listing of items and totals may be effected upon a work sheet consisting of a number of blank forms connected in a continuous web or long sheet.

It is a further object of the present invention to provide a mechanism whereby the strips containing the data listed are severed into sections or sheets of required size and then stacked.

It is still a further object of the present invention to provide means whereby the duplicating medium for effecting duplicates of the copies listed may be drawn off for subsequent use while the printed strips may be severed into sheets and stacked.

In connection with listing operations, it is a further object to automatically space the paper after the last listing operation so that subsequent listings are made at the proper point on the following blank form.

In connection with paper feeding operations, it is a further object of the present invention to provide a mechanism whereby the additional load placed upon the machine due to the initiation of the paper feeding operations will be obviated.

In connection with the duplicating mechanism it is a further object to provide an auxiliary mechanism whereby the duplicating medium may be re-wound evenly upon a storage roller if this condition does not obtain during operations of the machine.

While it is a further object of the present invention to devise a mechanism for accomplishing the functions of continuous listing, severing and stacking which is automatic in its character and performance and which requires inattention on part of the operator, it is a still further object to provide means whereby operations will be suspended when a predetermined number have been effected.

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 front view in elevation of a conventional form of tabulator with the improved attachment associated therewith.

Fig. 2 is a view in side elevation of the tabulator shown in Fig. 1 taken on the line 2—2 of Fig. 1;

Fig. 3 is a section on line 3—3 of Fig. 1;

Fig. 4 is a section on line 4—4 of Fig. 1;

Fig. 5 is a plan view of the main operating mechanism taken on the line 5—5 of Fig. 4;

Fig. 6 is an enlarged longitudinal sectional view of some of the parts shown in Fig. 5;

Fig. 7 is a transverse sectional view taken on the line 7—7 of Fig. 3;

Fig. 8 is an enlarged view in side elevation of the mechanism provided for effecting single or double line spacing of the paper strips;

Fig. 9 is a sectional view in side elevation of the mechanism for controlling the spacing of the paper strips between listing operations;

Fig. 10 is a sectional view taken on the line 10—10 of Fig. 9;

Fig. 11 is an enlarged sectional view of the paper severing devices and the mechanism for stacking the printed sheets;

Fig. 12 is a view in side elevation of the duplicating strip rewinding mechanism;

Fig. 13 is a partial end view of some of the devices illustrated in Fig. 2 and is taken on the line 13—13 of Fig. 1;

Fig. 14 is a view in side elevation of the frictional retarding device associated with the duplicating strip supply roller and is taken on the line 14—14 of Fig. 3;

Fig. 15 is a front view in elevation of the mechanism provided for separating the duplicating medium from the printed strips;

Fig. 16 is a sectional view taken on the line 16—16 of Fig. 15;

Fig. 17 is a view in side elevation of the cam shafts for controlling the associated contacts;

Fig. 18 is a top plan view of the devices illustrated in Fig. 17;

Fig. 19 is a diagrammatic representation of the motor and relay control circuits;

Fig. 20 is a view in side elevation of an auxiliary device used for the purpose of rewinding the carbon strip on a roller.

Similar reference numerals in all of the above figures are employed to designate corresponding parts thereof.

For the purpose of illustration the present improvements are shown in connection with the Hollerith tabulating machine but it will be understood that with slight modifications they may be embodied in other forms of accounting machines and the present showing is to be considered as illustrative rather than restrictive.

The Hollerith tabulator is well known in the art and requires but little further description than will be given incidentally herein. In Fig. 1 the card controlling portion 1, the driving motor 2, the counter shaft 3 and the counters 4 are shown in their normal relationship. As is well known, as the perforated cards are passed through the machine, one or more of the counters are operated to show the figures or the totals of the figures represented by the perforations in said cards.

The improved printing attachment for such a tabulator is designated generally by numeral 5, a part of the interior mechanism of which will now be described by reference to Fig. 3. The printing devices whereby numerals corresponding to the perforations in particular card columns or the amount standing on any particular counter wheel are printed comprises a plurality of groups of type bars 6 any one of which may be impelled by hammers 7 against a platen 8 to perform the printing functions. Inasmuch as the printing devices and the controlling devices therefor are not involved in the present application they are not shown in detail herein. For further details of the above reference may be had to the Lake Patent, #1,379,268, dated May 24, 1921.

The paper strip on which are printed numerals by means of an inking ribbon 9 and the type carriers 6 is drawn from a storage roller 10 thence passes around fixed rollers 11 and 12, around a roller 13 carried by a pivoted arm 14, to a roller 15 also carried by an arm 16, thence over and under a series of rollers 17 and then passes around the platen roller 8. By means of the inking ribbon 9 impressions are effected directly upon the paper strip drawn from storage roller 10.

The paper strip upon which the impressions are made by a duplicating medium such as the carbon strip 18 herein shown, is drawn from a storage roller 19 and likewise passes around rollers 12, 13 and 15 to the series of fixed rollers 20 and thence downward around the platen roller 8. Carbon strip 18 is interposed between the paper strips 23 and 24 drawn from the rollers 10 and 19 respectively and is drawn from a supply roll 21 and while the printed strips 23 and 24 (see Fig. 15) extend upwardly to cooperate with a pair of feeding rollers 22 the carbon strip is separated out in a manner to be described hereinafter.

Driving mechanism

Power for driving the various mechanism comprising the present improvements is, in the present case, obtained by an auxiliary motor 79 (Fig. 3) the drive shaft of which transmits power by a belt 80 to a grooved

wheel 25 (Fig. 5). A pinion 26 rotatable with wheel 25 drives a gear 27 through idler gear 28 and pinion 29. Sleeved to gear 27 by a sleeve 30 is a ratchet wheel 31 (Fig. 8). Thus through the train of mechanism just described ratchet wheel 31 is constantly rotated for the purpose of line spacing the paper strips 23 and 24 to suitable space items and totals.

Line spacing mechanism

The mechanism for effecting single line spacing is under the combined control of ratchet wheel 31 and a magnet 32 (Fig. 8). Pivoted by a stud 33 is a triple armed member 34 one arm of which carries a pawl 35 adapted to normally latch a pawl 36 and hold a tooth 37 thereof out of engagement with the interdental spaces of the constantly rotating ratchet wheel 31. When the latching relationship is established an extension 38 of the latching pawl 35 is some distance away from an upward extension 39 of an armature 40 attracted by the magnet 32. When the magnet 32 is energized extension 39 will strike extension 38 rocking pawl 35 to permit a spring 41 to be effective to rock pawl 36 to engage the tooth 37 with the ratchet wheel 31. This will result in rocking triple armed member 34 and through a link 42 will rock a bell crank lever 43 and through the medium of a pawl 44 coacting with a ratchet wheel 45 attached to a shaft 46 (Fig. 6) to which the rearward feeding roller 22 is secured, the pair of feeding rollers 22 will be rotated. This will result in feeding the paper strips 23 and 24 upwardly to suitably space the last printed item from the succeeding one. Restoring action of the parts which drive the rollers 22 is afforded by a spring 76 (Fig. 3) to be referred to hereinafter and which is effective to accomplish this after the tooth 37 is disengaged from the ratchet 31. The latter function is effected by the coaction of a cam extension 48 (Fig. 8) with a stationary pin 49 attached to a fixed plate 50, pin 49 gradually camming pawl 36 downward until it is subsequently latched by pawl 35. The initial position of the parts just described is controlled by a lug 51 of an extension of triple armed member 34 coacting with a finger 52 of an armature 53 the relationship just described being normally maintained by the spring 76 which acts to force lug 51 against the top of finger 52. The position of pin 55 is determined by the position of a controlling slide 56 since the open ended slot thereof receives pin 55. As shown, slide 56 is adjusted for single spacing but when moved rearwardly to latched position it will rock armature 53 permitting spring 76 to be effective to rock member 34 against a stop pin 57 (see Fig. 8). When in this position tooth 37 will engage the ratchet wheel 31 at a point farther removed from the center of ratchet wheel 31 than otherwise and thus impart a greater movement to the parts to effect a double spacing of the paper. Ordinarily the parts are set for single spacing so that a double space will occur after a printed total in which case a magnet 58 will also come into play, as will be explained hereinafter.

Current for driving the auxiliary motor 79 (Fig. 19) is obtained from line wires 60. To control the energization of magnets 32 and 58 at the proper time cam contacts are provided. Reference numeral 59 designates a pair of contacts which are closed under the action of a setting lever 600 when the latter is adjusted to the "listing" position so as to complete the circuit through magnet 32 when cam contacts 61 are closed. The latter are controlled by a cam 62 rotatable with a shaft 63 which is driven during listing operations. Cam contacts 61 make shortly after the printing operation so that the printed paper strips may be fed immediately thereafter.

In total taking operations, it is desirable to double space the paper so as to readily identify the total printed. The double spacing occurs after a total print and is controlled by the combined action of magnets 32 and 58. Referring to Figs. 17, 18 and 19, reference numeral 68 designates a shaft operable during total printing operations and in the present machine during this operation shaft 63 is idle. Shaft 68 carries cams 69 and 70 which are adapted to close contacts 71 and 72 respectively. Cam 69 operates upon a lever arm 73 so as to close contacts 71 while cam 70 operates upon a lever arm 74 to close contacts 72. As shaft 68 rotates in the direction of the arrow in Fig. 17 cam 69 rocks lever 73 to close contacts 71 which closes the circuit through magnet 58. This will immediately adjust the parts for a double spacing (see Fig. 4) whereupon cam 70 will subsequently rock lever arm 74 to close contacts 72 energizing the magnet 32 to complete the paper feeding operation.

It is sometimes desirable to effect blank spacing of the paper and in the present machine this is accomplished by a manually operable lever 64 (Fig. 8). Lever 64 is of bell crank formation and is articulated to a link 65 which is connected to an arm 66. Arm 66 carries a pin 67 coacting with the armature 40. Depression of lever 64 will rock armature 40 to effect single or double paper spacing operations in exactly the same manner as premised hereinbefore.

In the present machine the paper feeding operations occur rapidly and in the event that the paper was drawn directly from the supply rollers a considerable amount of power would be required to start rotation of the supply rollers and if feeding rollers 22 slipped, inaccurate spacing of items would result. It is also desirable that the paper be relatively taut so that spacings may be regular. In the present instance in order to prevent tearing

of the paper during feeding operations and to reduce the load on the motor caused by the paper feeding operation the paper is slackened and the slack then taken up. To this end plate 34 has connected thereto a link 75 (Figs. 3 and 4) the lower end of which is connected to an extension of the arm 16. As plate 34 is rocked during a feeding operation link 75 will rock arm 16 clockwise (Fig. 3) producing a slack in the paper strips between roller 15 and rollers 17 and 20. This is gradually taken up and link 75 and triple armed member 34 are restored to normal by the spring 76 connected to an extension of arm 16. Restoration of arm 16 by spring 76 will also draw paper from the rollers 10 and 19 until the paper strips are again taut.

The rearward feeding roller 22 (Fig. 6) is carried by and attached to a shaft 46 journalled in the side frames 81 and 82 of the attachment and for the purposes of manual rotation the shaft 46 carries a knurled knob 83. The cooperating forward roller is carried by a plurality of arms 84 and 85 fixed to a rod 86 journalled in the frame members 81 and 82 (Figs. 1, 5 and 6). A spring 87 (Fig. 9) connected to arm 84 urges the rollers 22 into frictional relationship while the rearward roller 22 (Fig. 5) preferably drives the cooperating roller by intermeshing gears 88 attached to the respective feeding rollers. For the purpose of manually separating the feeding rollers 22 to insert the paper strips a lever 89 (Fig. 9) is provided and rocks an eccentrically mounted shaft 90 which cooperates with an extension 91 of arms 84 and 85. Rocking of the shaft 90 by lever 89 will draw the forward roller 22 out of cooperative relationship with the rearward roller 22 slightly but not sufficient to disengage the gears 88 (Fig. 5).

Means for rewinding duplicating strip

After the printed strips 23 and 24 pass between the feeding rollers 22 they are preferably severed into strips and stacked but the carbon duplicating strip is separated and rolled on a storage roller for subsequent use. Referring to Figs. 15 and 16 the carbon strip 18 is turned over the diagonal edge 95 of a fixed plate 96 after it leaves platen roller 8 thus changing the feed of the carbon strip transversely. The carbon strip 18 is again turned over the diagonal edge 97 to continue its direction of feed vertically parallel to the direction of feed of strips 23 and 24 whereupon it is wound on a storage roller 98 (Fig. 13). The diagonal edge 97 may be the edge of the plate 96 but in the present instance it comprises the edge of a plate 94 pivoted to plate 96 so that the angular adjustment thereof to provide for a proper vertical feed of the carbon strip may be regulated by adjusting screws 99.

The carbon strip passes over a roller 100 (Figs. 12 and 13) journalled between the side frame 81 and extension of a bracket 101 (Fig. 15) attached to plate 96. The storage roller 98 is loosely mounted on a shaft 102 (Fig. 12) supported at one end by the frame piece 81. Storage roller 98 is frictionally driven by the friction drive 103 one element of which is driven by a gear 104 (Fig. 4) which meshes with the constantly rotating gear 27 through idler gear 105.

Rotation of gear 104 and the friction clutch elements 103 will tend to turn storage roller 98 and thus wind the strip about the roller 98 but this is effectively prevented by regulating the friction drive. The preferred regulating means comprises an adjusting nut 106 which is screwed upon the shaft 102 and bears against the end of roller 98. The nut 106 fits in an open ended slot 1071 (Fig. 13) of a plate 107 pivoted on the supporting shaft of roller 100 and removably attached to bracket 101 by a wing nut 108. By screwing nut 106 the roller 98 may be adjusted along shaft 102 to regulate the amount of slipping between clutch elements 103. A screw 109 is provided to lock the nut 106 in its position of adjustment. When the platen roller 8 is turned synchronously with the feeding rollers 22 the carbon strip 18 will be drawn upwardly by the paper strips 23 and 24. The carbon strip will then be taken up by the storage roller 98 in a manner so that the same will be wound tightly thereon. A frictional retarding device comprising a spring urged plate 112 (Fig. 14) bears against the periphery of the supply roller 21 to prevent the latter from rotating freely and is also provided to keep the carbon strip taut.

The carbon storage roll 98 may be readily removed by unscrewing the wing nut 108 (Fig. 13) to permit plate 107 to be moved about its pivot thus releasing the roller 98.

For proper operation it is necessary that the carbon strip be wound tightly and evenly about the supply roll. If this condition does not obtain the strip may be rewound by the machine by transferring the improperly wound roll to a shaft 921 which carries a bail shaped holder 92 provided with a handle 93 which permits lateral adjustment of the roll along the fixed shaft 921. The end of the strip is attached by some suitable means to a roller carried by shaft 102. By suitably adjusting the holder 92 laterally the carbon strip may be re-wound evenly and tightly upon roller 98. This expedient is also of use in transferring a new carbon strip from a cardboard stock roller to one of the special designed rollers 21 or 98.

Supplemental paper feed

As will be observed in Fig. 15 the present machine lists items and totals upon strips of paper which are pre-printed to accommodate certain identifying matter. It is desir-

able of course that when the desired number of printings have been effected that the strips be automatically spaced so as to print subsequent items and totals upon the following forms. The present machine is intended to print 85 lines of single-spaced data upon each sheet but this number is not the essence of the present invention and it is considered within the purview of the present invention to alter this number to meet any particular requirement. The preferred means whereby the paper is automatically spaced to print on the next sheet when the desired number of listings have been effected is as follows. Pinion 105 (Figs. 5 and 6) is secured to a stub shaft 110 which carries a similar pinion 111 and which drives a ratchet wheel 112 through a gear 113 and connecting sleeve 114. The ratchet wheel 112 (Fig. 9) is one element of a clutch connection which is adapted to drive the feeding rollers 22 at a certain time. Loosely mounted on the shaft 46 is a disk 115 carrying a pawl 116 which is in the plane of the ratchet wheel 112 and adapted to engage the teeth of the ratchet wheel. Also pivoted to the disk 115 is a supplemental pawl 117 (Figs. 5 and 9) which is adapted to engage a shoulder 118 of a disk 119 securely fixed to the feeding roller shaft 46 (see Fig. 6). During machine operation ratchet wheel 112 rotates constantly and pawl 116 is normally held out of engagement therewith by a latch member 120 (Fig. 9) which is provided with a shoulder 121 normally engaging the tail of pawl 116. However, when latching member 120 is rocked as shown in Fig. 9 spring 122 is effective to rock pawl 116 into engagement with the teeth of the ratchet wheel to thereupon drive disk 115. As disk 115 rotates the pawl 117 will engage the shoulder 118 driving disk 119 to rotate the feeding rollers supplementally. Prior to the time that pawl 116 returns to its home position latching member 120 will be restored so that the tail of pawl 116 will subsequently engage the shoulder 121 permitting a free and independent rotation of ratchet wheel 112. As the pawl 116 strikes the shoulder 121 the possibility of rebound of disk 115 will be prevented by a pawl 123 engaging a shoulder 124 of disk 115.

The preferred means whereby the clutch is rendered effective at the proper time to automatically feed the paper comprises a ratchet wheel 125 (Figs. 4 and 8) which is given a step of movement for each single line space. Pivoted to a downward extension of lever 43 is a gravity pawl 126 engaging the teeth of the ratchet wheel 125. For each single or double movement of lever 43 a corresponding amount of movement is given to ratchet wheel 125. As ratchet wheel 125 completes a full revolution corresponding to 85 line spaces, an actuating plate 127 will engage and rock an extension of a pivoted lever 128 (Fig. 10) which in turn rocks an extension 129 of a pivoted bail member 130 of which latching member 120 is an integral bent part. When lever 128 and bail member 130 are rocked they are restored to normal by a spring 131 so that the tail of pawl 116 may subsequently engage the shoulder 121.

Manual control of the clutch just referred to for the purposes of feeding the paper strips as desired may be effected by a control lever 134 (Fig. 9) the upward extension 132 of which is adapted to engage a bent portion of the latching member 120 to rock the bail 130 in exactly the same manner that lever 128 does. The lever 134 is automatically returned to normal and ineffective position by a coil spring 133.

Attention is directed to the fact that after a step of movement is imparted to the feeding rollers 22 (Fig. 4) they are aligned and locked against overthrow by an aligning pawl 135 which is urged against the ratchet wheel teeth by a spring 136. During supplemental paper feeding operations the danger of overthrow, particularly towards the end, is greatly increased on account of the rapid paper feeding operation. The present improvements include an auxiliary device for gradually increasing the tension of the spring 136 at the end of a paper feeding operation and preferably comprises a cam 137 engaging a lever 138 to which one end of spring 136 is connected. It will be apparent that towards the end of a paper run cam 137 will rock lever 138 increasing the tension of spring 136 so that pawl 135 may be urged against the ratchet wheel 45 with greater force to prevent overthrow of the feeding rollers 22.

During the time the feeding rollers 22 are feeding the paper strips supplementally a certain amount of slack in the paper provided between roller 12 (Fig. 3) and roller 15 is taken up. This is performed by means of a spiral cam 140 rotatable with ratchet wheel 125 and which rocks a bell crank lever 141 one arm of which is connected to the extension of arm 14 by a link 142. While the data is being listed on the sheet cam 140 rocks bell crank lever 141 so as to force roller 13 downwardly in increments to the position shown, drawing a certain amount of paper from the rolls 10 and 19. When lever 141 drops off the high point of cam 140 a spring 143 connected to the arm 14 quickly raises roller 13 producing a certain amount of slack in the paper between rollers 15 and 12 and which is then taken up during the time the paper strips are being fed supplementally.

Paper severing and stacking mechanism

As the sheets are printed and fed they may be wound on a storage roller but are preferably cut into sheets of a desired size and

stacked. The preferred means whereby the above may be accomplished comprises the following mechanism.

As the printed strips are fed vertically by the feeding rollers 22 they pass between a stationary knife 144 (Figs. 3, 7 and 11) and a movable guillotine knife 145. The latter is actuated at the proper time to sever these paper strips as will be described hereinafter. As the strips are fed they assume substantially the over-hanging position indicated in Fig. 3 and drop over a grid comprising a series of wires 146 all of which except the outermost ones are anchored at their ends by plates 147 and all are bent concentric with respect to a rock shaft 148. Secured to the rock shaft 148 are arms 149 each carrying at its upper end a roller 150. These rollers pass over the ejected paper strips and roll them over the grid 146 so the free end of the strips abut the vertical sections 151 of the grid. When this position is assumed the strips are severed so that as they tumble over they will be stacked on a platform 152 also of grid formation.

Rocking of the shaft 148 to perform the necessary functions is preferably accomplished by clutching the shaft to one of the operating parts of the machine. Rotatable with the constantly rotating gear 27 is a ratchet wheel 153 (Figs. 4 and 5). Secured to shaft 148 is a disk 154 pivoted to which is a pawl 155 adapted to engage the teeth of the ratchet wheel but normally disengaged by a latching pawl 156 also pivoted to disk 154. At a certain point in the cycle of rotation of ratchet wheel 153 the actuating plate 127 will strike a finger 157 sleeved to a lever 158 (Fig. 7) rocking the latter so that the extreme end thereof will strike a tail 159 (Fig. 4) of latching pawl 156 and rock the latter. The released pawl 155 will now be urged by its connecting spring 160 to engage the ratchet wheel 153 and thus drive shaft 148 counterclockwise as viewed in Fig. 4. Prior to a complete revolution of disk 154 pawl 155 will strike a stationary pin 161 (Fig. 11) disengaging the pawl from the ratchet wheel 153 and while this relationship exists latching pawl 156 snaps under a portion of pawl 155. Automatic return of shaft 148 when released is effected by a coil spring 162 (Fig. 7) which is wound when shaft 148 is turned. This will bring the parts again to the position shown in Fig. 4.

Any shocks due to the quick return of arms 149 is taken up and eased by flat springs 139 (Figs. 7 and 11) the free ends of which pass frictionally under the cross-bar to which the plate 147 is attached as will be best seen in Figs. 3 and 7.

Reference character 163 (Figs. 7 and 11) designate a series of single coil spring wires carried by rod 164. Normally (Fig. 3) the free ends of these wires are above the stacked sheets permitting their free removal and are held in upward position by a spring 165 (Fig. 11) connected to a lever 166 attached to rod 164. As the right arm 149 (Fig. 7) reaches its lowermost position a roller 167 carried thereby will strike a camming edge 168 (Fig. 11) rocking lever 166 so that the spring wires 163 press against the uppermost sheet of the stack to firmly hold the stack in place. This position of wires 163 is temporarily held by a latching lever 169 the lower end of which rocks over a lug 170 when arms 149 are in their extreme downward rocked position. It will be apparent that the natural curve of the paper strips may bring the ends in interference with rollers 150 when the latter are returned and the spring wires 163 firmly hold the strips down during the return of rollers 150 but are released as the rollers return to normal starting position. As the arms 149 and shaft 148 return to their normal starting position a cam 170 (Fig. 7) will rock the upper end of lever 169 sufficiently to unlatch the lever 166 whereupon spring 165 will raise spring wires 163 upwardly.

Guillotine knife 145 is carried by a pair of arms 171 (Figs. 7 and 11) pivoted on a rod 172. A link 173 connects one of the arms 171 to one arm of a pivoted bell crank 174 the other arm of which coacts with a spiral cam 175 attached to rock shaft 148. As shaft 148 is rocked bell crank 174 will draw link 173 downward gradually, thereby bringing knife 145 against the stationary knife 144 producing a shearing action on the paper strips.

It will be observed that the severing and stacking operations occur at a different time than the supplemental paper feeding operation. This is due to the fact that when the paper sheets have been completely printed and are at a position where the line of demarcation (indicated by dotted lines 176 in Fig. 15) coincides with the knives printing is still being performed on one of the forms following:

Means for predetermining the number of sheets printed

The various operations just described such as listing, paper feeding, severing and stacking are automatic in their character and are performed without any attention on part of the operator. It is desirable that after the operations in connection with a certain number of sheets have been performed that the operations be discontinued. The preferred form which may be provided to accomplish the above is described as follows:

Connected to the extension of lever 128, which it will be remembered is rocked for each sheet printed, is a link 177 (Fig. 4) which is connected to a lever 178. Pivoted to the lever 178 is a pawl 179 engaging the teeth of a ratchet wheel 180. As ratchet

wheel 180 rotates a coil return spring 181 is wound and the various positions of the ratchet wheel 180 is held by a pawl 182. The wheel 180 may be provided with a series of holes 183 in which a removable pin 184 may be inserted the position of pin 184 determining the number of operations that are to be performed. As ratchet wheel 180 rotates the pin 184 will finally strike a contact member 185 of normally closed contacts 186. Contacts 186 may be connected in the line or motor circuits as desired. Automatic return of ratchet wheel 180 after the machine stops may be performed by disengaging pawl 182 from ratchet wheel 181 by a wire 187. Pawl 182 is preferably extended at 188 so as to rock pawl 179 and also disengage it from the ratchet wheel 180. When wire 187 is actuated ratchet wheel 180 will thereupon be turned reversely to normal by spring 181 and its return movement will be stopped by a pin 190 carried by the ratchet wheel 180 abutting a fixed pin 191. The control wire may be held in the ineffective position by frictional or other devices to permanently disable the automatic stopping mechanism just described.

In the event that the machine does not stop when pin 184 strikes the contact spring 185 by reason of the fact, for example, that some metallic substance has short circuited contacts 186, further movement of pin 184 may cause a disarrangement and injury to the control mechanism. In this case as pin 184 strikes contact piece 185 and continues its movement a pin 192 carried by the latter coacting with a diagonal slot 193 in an extension 194 of pawl 182 will cam pawl 182 to disengage it and pawl 179 from the ratchet wheel. Coil spring 181 will then act to quickly return ratchet wheel 180 to normal so that another set of operations will ensue.

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:

I claim:

1. In a machine of the class described comprising in combination, item entering means for listing data upon a work sheet comprising a series of connected blank forms, means for automatically spacing said work sheet when a predetermined number of listings have been effected upon a form, and means for predetermining the number of forms to be printed.

2. In a machine of the class described comprising in combination a printing mechanism including a duplicating medium for effecting duplicate impressions upon one of a pair of paper strips, a friction drive tending to feed said duplicating medium, and regulating means for said friction drive.

3. In a machine of the class described comprising in combination a printing mechanism including a pair of paper strips and a duplicating medium for effecting duplicate impressions upon one of the paper strips, means for feeding the paper strips, a friction drive tending to feed said duplicating medium, and means for regulating said friction drive whereby said duplicating medium is fed only simultaneously with said paper strips.

4. In a machine of the class described comprising in combination, a printing mechanism for listing items upon a normally taut paper strip, a storage roller, a pair of feeding rollers for feeding the paper strip, means for producing a slack in said paper strip between said feeding rollers and storage roller effective during the operation of said feeding rollers, and spring means effective to drive said storage roller and restore the paper strip to normally taut condition.

5. In a machine of the class described comprising in combination a printing mechanism for listing a predetermined number of items upon a paper strip, a paper storage roller means for supplementally feeding said paper strip when the predetermined number of items have been listed, and means for producing a slack in the paper strip between said platen and storage roller effective prior to supplemental paper feeding operations.

6. In a machine of the class described comprising in combination a printing mechanism for listing a predetermined number of items upon a paper strip, a storage roller for carrying said paper strip, means for supplementally feeding the paper strip when the predetermined number of items have been listed, and means for withdrawing the paper strip from said storage roller during listing operations, and devices for releasing said means to produce a slack in said paper strip prior to supplemental paper feeding operations.

7. In a machine of the class described comprising in combination, a printing mechanism for listing items on a paper strip, a paper feeding roller, means for rotating said roller a predetermined amount, means comprising a pawl and a connected spring for preventing overthrow of said roller, and means for increasing the tension of said spring at a definite point in the cycle of rotation of said roller and coincident with the completion of a number of listing operations.

8. In a machine of the class described comprising in combination a plurality of printing devices operable simultaneously to effect listings, a platen having a fixed position with respect to the printing devices, a control device stopped at a certain position when a predetermined number of listings has been effected upon one of a series of connected blank

forms comprising a work sheet, and means under control of the control device when it arrives and stops at a certain position for rotating said platen to space the work sheet when a predetermined number of listings have been effected upon a form.

9. In a machine of the class described comprising in combination, a plurality of rows of printing devices operable simultaneously to effect listings, a platen having a fixed position with respect to the printing devices, a control device for permitting a predetermined number of listings to be effected upon one of a series of connected blank forms comprising a work sheet, and means effective during machine operation and under control of the control device when it stops at a certain position during its rotation for rotating said platen to space the work sheet when a predetermined number of listings have been effected upon a form.

10. In a machine of the class described comprising in combination, a plurality of rows of printing devices operable simultaneously to effect listings, a platen having a fixed position with respect to the printing devices, devices for permitting a predetermined number of listings upon a work sheet comprising a series of connected blank forms, means effective during machine operation and under control of the last mentioned devices for rotating said platen to space the work sheet when a predetermined number of listings have been effected upon a form and means controlled by the predetermining devices for detaching a completely printed form from the work sheet.

11. In a machine of the class described comprising in combination, a plurality of printing devices operable simultaneously to effect listings, a platen having a fixed position with respect to the printing devices, devices for permitting a predetermined number of listings upon a work sheet comprising a series of connected blank forms, means under control of the last mentioned devices for rotating said platen to space the work sheet when a predetermined number of listings have been effected upon a form, means controlled by the predetermining devices whereby said printed sheet is severed into forms when a predetermined number of listings have been effected on each form, and means controlled by the predetermining devices for stacking the forms and operable as an incident to the severing operation.

12. In a machine of the class described in combination, a printing platen over which may be passed a plurality of work sheets interleaved by a carbon sheet, a carbon supply roll and work sheet supply rolls below said platen, means for feeding said work and carbon sheets together while in interleaved relationship from said supply rolls about said platen, and a guide means having a pair of parallel edges, one edge for feeding said carbon strip transversely out of interleaved relationship with said work sheet and the other edge for feeding the carbon strip parallel to the direction of feed of said work sheets.

13. In a machine of the class described, in combination, a platen over which a plurality of work sheets may be passed, a source of carbon supply arranged parallel to said platen whereby the work sheets and carbon sheet are fed to said platen together and in interleaved relationship, and a diamond-shaped plate, one edge of which guides the carbon sheet transversely out of interleaved relationship with the work sheet, and another edge parallel to the first mentioned edge for feeding the carbon strip parallel to the direction of feed of the work sheet.

14. In a machine of the class described in combination, a platen about which a plurality of work sheets and an interleaved carbon strip may be drawn from a source of supply parallel to said platen, and guide means comprising a plate having parallel edges capable of leading the carbon strip out of interleaved relation and thence in a direction parallel to but spaced apart from said work sheets.

15. In a machine of the class described in combination, a platen about which a plurality of work sheets and an interleaved carbon strip may be passed, a carbon strip supply roller arranged parallel to said platen, and a guide plate having an edge at an angle to the platen for feeding said carbon strip out of interleaved relation with the work sheets and having another edge parallel to the first named edge for feeding the carbon strip parallel to the work sheet.

16. In a machine of the class described in combination with a printing mechanism for printing data of distinct types upon a work sheet comprising a series of connected blank forms, means for automatically spacing said work sheet when data of one type is printed upon a form, means for operating said means when data of another type is printed to effect a greater spacing of the work sheet and additional means for automatically spacing said work sheet when a predetermined number of printings of data of one type have been effected.

17. In a machine of the class described in combination, a printing mechanism for listing data of separate and distinct types upon a work sheet comprising a series of forms, means for automatically spacing said work sheet when a predetermined number of listings of one type have been effected upon a work sheet, means within the machine for predetermining the number of listings of one type and means for spacing said work sheet prior to a predetermined number of listings whereby data of the other type may be printed upon the same form.

18. In a machine of the class described in

combination, a printing mechanism for listing data of two distinct types upon a work sheet, a spacing mechanism normally set for spacing the work sheet a predetermined extent when listing data of one type, and electrically controlled means for adjusting the spacing mechanism when listing data of the other type to effect a spacing greater than the predetermined extent.

19. In a machine of the class described, in combination, a printing mechanism for listing data of two distinct types upon a work sheet, a spacing mechanism normally set for spacing the work sheet when listing data of one type, a magnet for effecting the control of the operation of the line spacing mechanism and means comprising supplemental magnet effective when listing data of the other type for preliminarily adjusting the spacing mechanism for effecting a spacing of greater extent.

20. In a machine of the class described, in combination a printing mechanism controlled by successively fed individual record cards adapted to list certain of the data represented upon each card upon a work sheet comprising a series of work forms, devices for controlling listings that may be effected from a predetermined number of cards, and means for automatically spacing said work sheet as an incident to listings on one form the data from a predetermined number of cards whereby the remaining cards are employed to control listings upon the next form.

21. In a machine of the class described, in combination, a printing mechanism for listing data represented by records of different classification upon a work sheet comprising a series of forms, means for automatically spacing the work sheet when listings have been effected from a predetermined number of records to effect listings on another form, and means controlled by the change in classification and prior to a predetermined number of listings upon one form for printing other data on the same form and spacing the work sheet.

22. In a machine of the class described the combination with a printing mechanism for listing data of separate and distinct types upon a work sheet, of a paper feeding roller, operating means normally set for operating said roller a certain extent and automatically operated to space the listings of one type, means automatically operable as an incident to listing data of the other type for adjusting said operating means out of its initial set position to effect a greater operation of said feeding roller, and a single operating device for the operating means.

23. In a machine of the class described, in combination, a printing mechanism for listing data of separate and distinct types upon a work sheet, a paper feeding roller, an operating means normally adjusted for operating said roller a certain extent to space the listings of one type, a control device for said operating means, a supplemental control device for adjusting said means out of its normal adjustment to effect an operation of the roller a greater extent, means whereby both of said control devices are effective when listing data of the other type, and a single operating device for said operating means.

In testimony whereof I hereto affix my signature.

FRED M. CARROLL.