July 7, 1942. J. MUELLER 2,288,828

TABULATING MACHINE

Filed March 9, 1940 5 Sheets-Sheet 1

FIG. 1

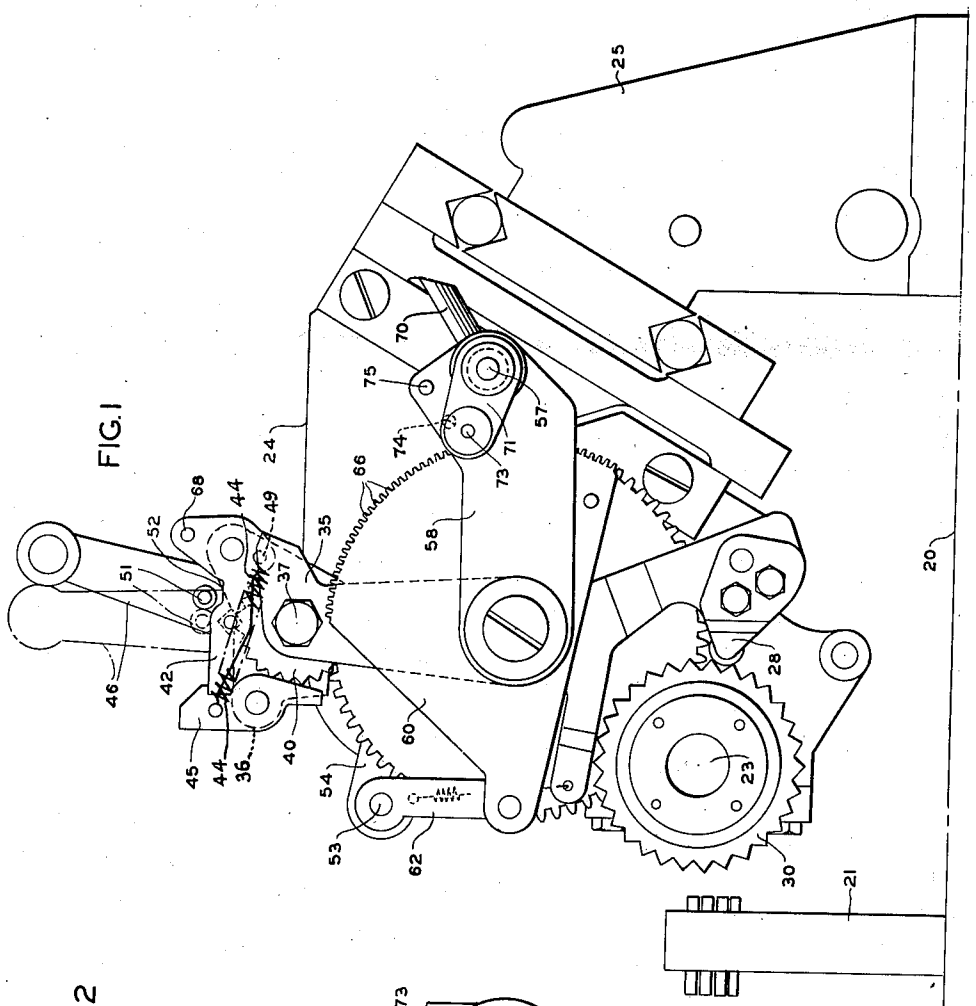
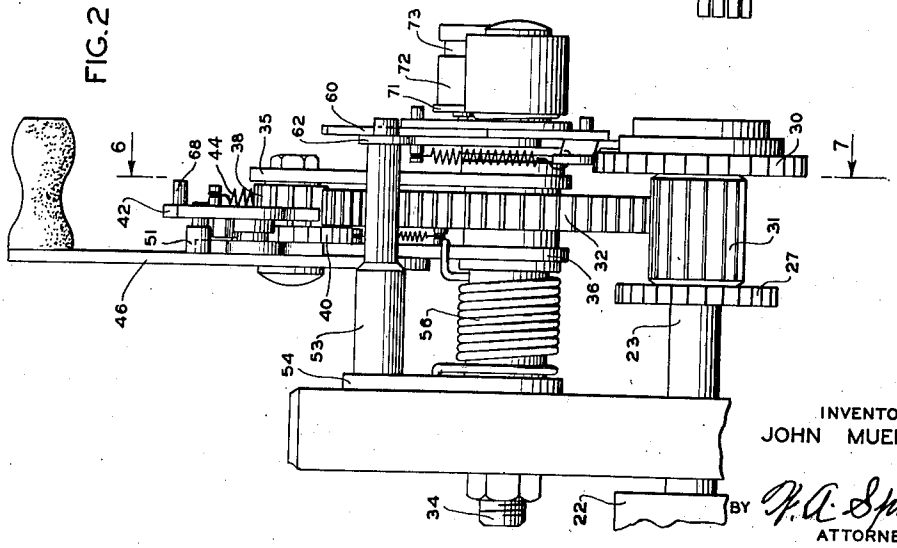


FIG. 2



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FIG. 5

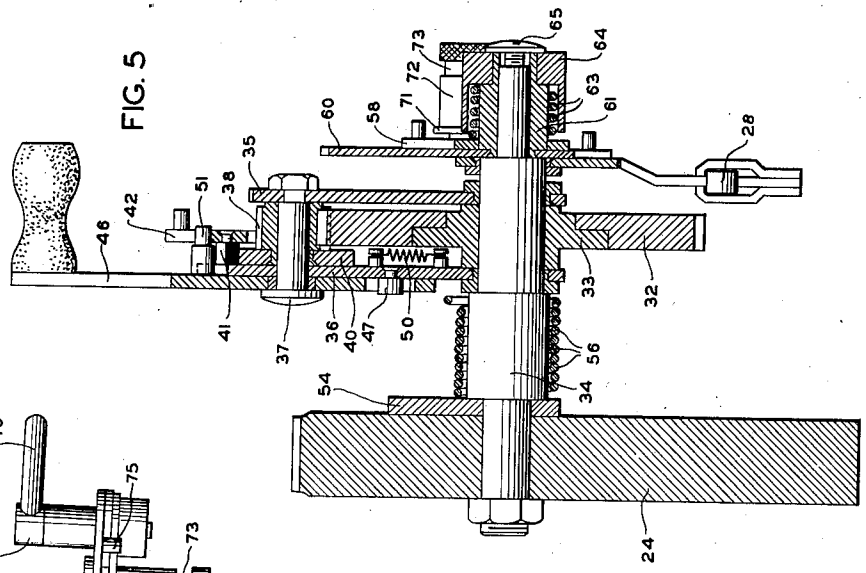


FIG. 3

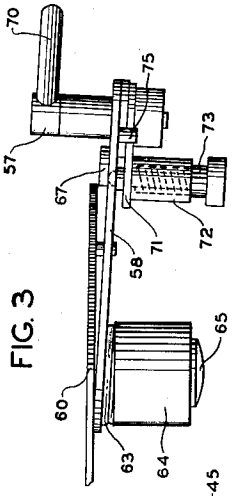
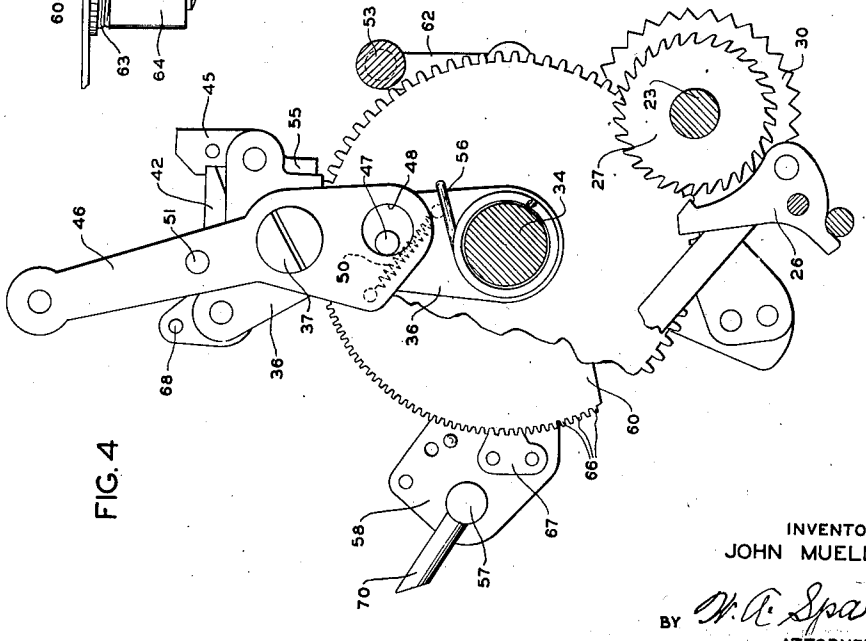


FIG. 4



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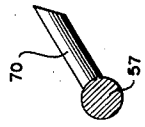


FIG. 7

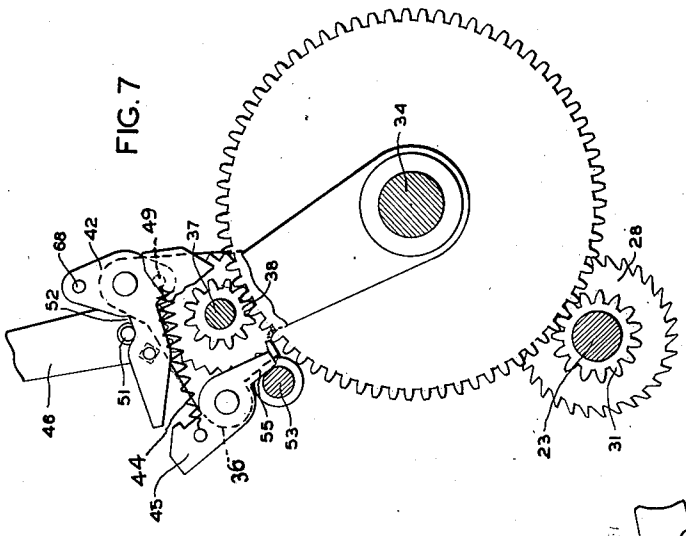


FIG. 8

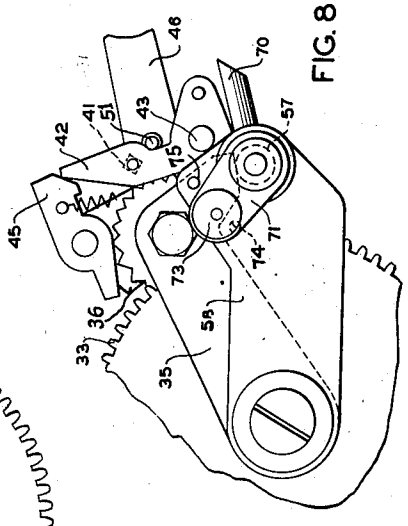
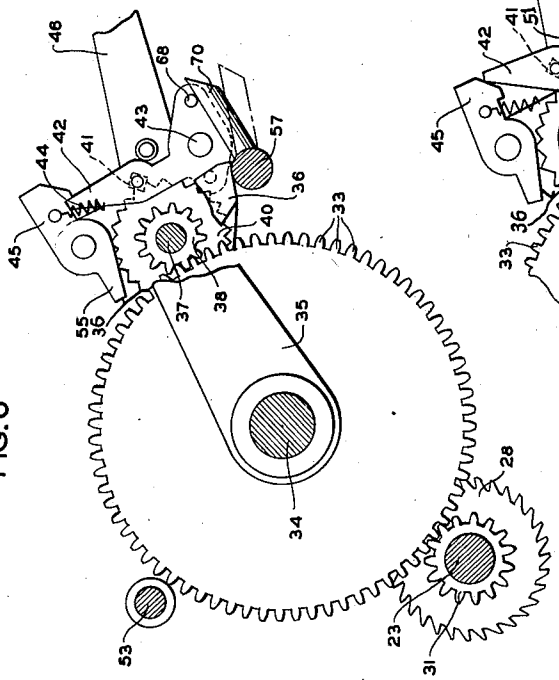


FIG. 6



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TABULATING MACHINE

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FIG. 9

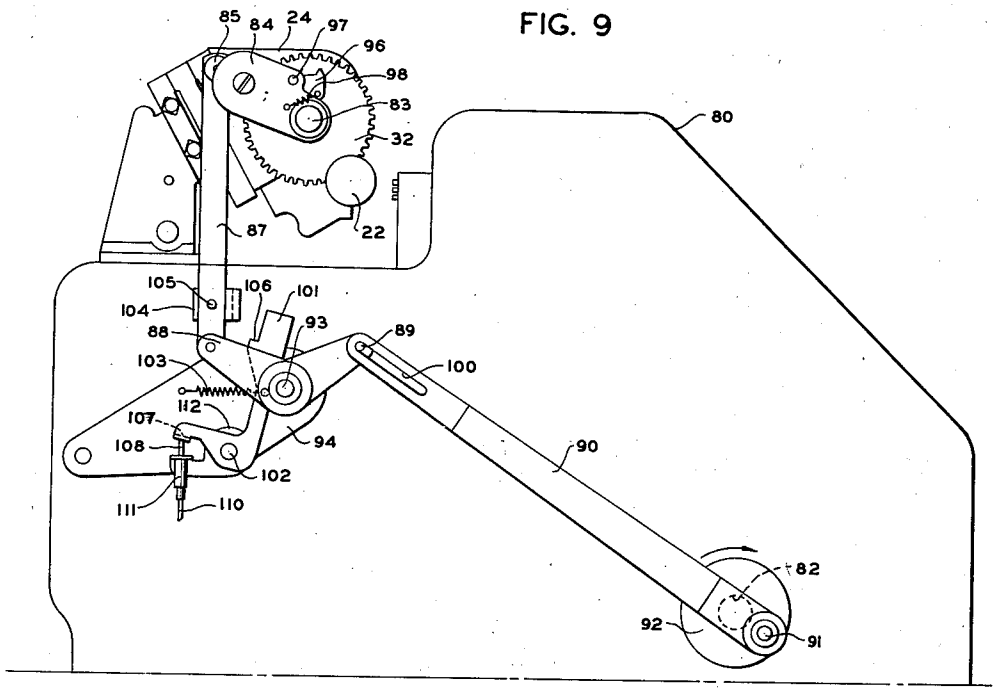
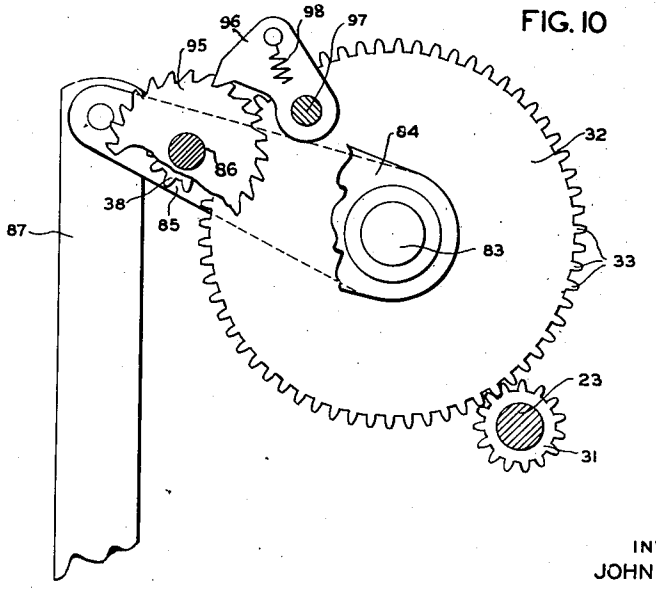


FIG. 10



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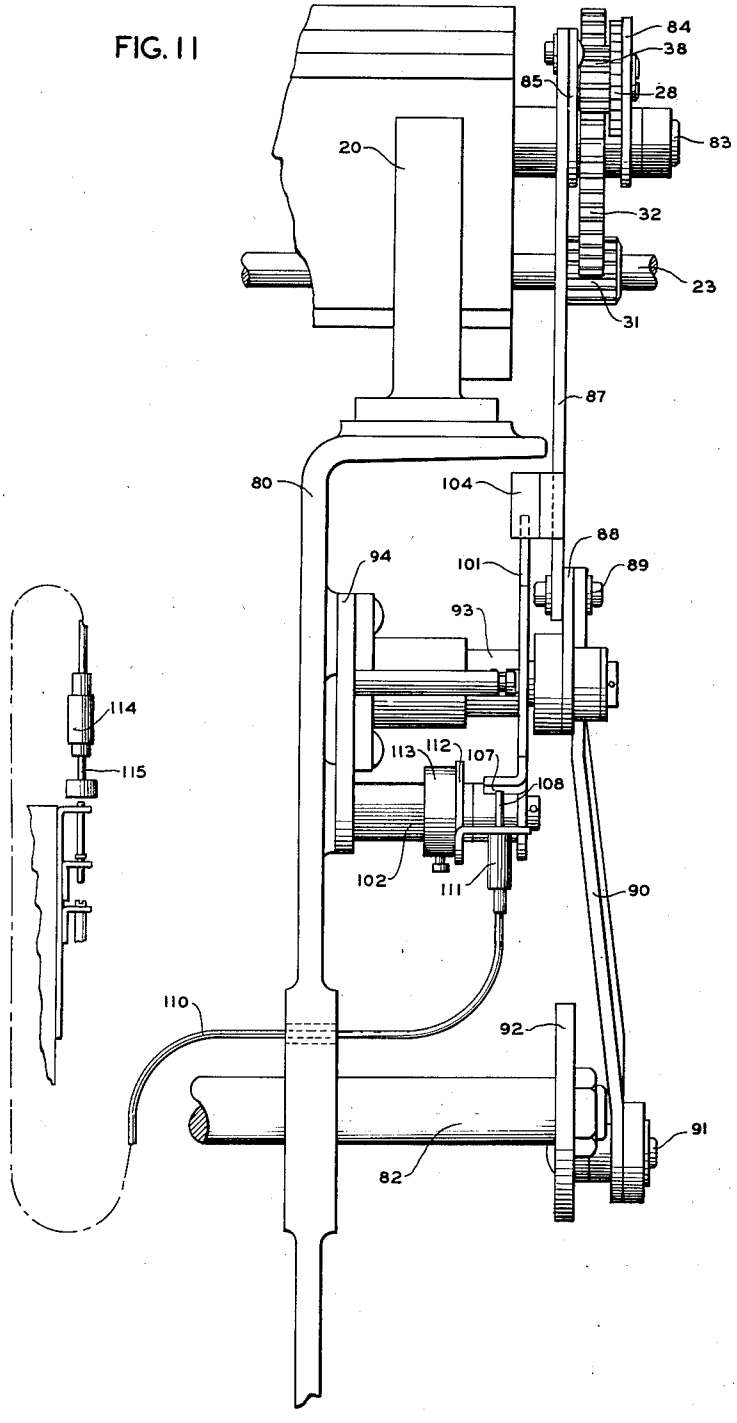
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TABULATING MACHINE

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FIG. 11



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Patented July 7, 1942 2,288,828

UNITED STATES PATENT OFFICE

2,288,828

TABULATING MACHINE

John Mueller, North Bergen, N. J., assignor to Remington Rand Inc., Buffalo, N. Y., a corporation of Delaware

Application March 9, 1940, Serial No. 323,137

8 Claims. (Cl. 197—114)

This invention relates to paper feed mechanisms and more especially to mechanism for imparting long feeds to a web of paper in recording accounting and statistical machines.

The invention has for its principal object to improve such mechanisms in respects which will be explained herein.

The invention resides in certain improvements and certain features of construction and combinations and arrangements of parts, all of which will be fully described herein and particularly pointed out in the claims.

Some accounting machines handle wide paper, and the paper cylinder, the feed rolls, etc., are long and heavy, and when long feeds are to be imparted to the paper, the parts are moved rapidly and arrested abruptly, and the mechanism is subjected to severe stresses. The invention has for one of its principal objects to construct the mechanism in such a way as to make it of ample strength and at the same time to be capable of exact regulation of the distance to which the paper is fed.

Two embodiments of the invention are illustrated in the accompanying drawings, in which:

Fig. 1 is a right hand side elevation of a hand-operated paper injector or long feed mechanism, with the handle partially operated;

Fig. 2 is a front view of the same;

Fig. 3 is a top view of a portion of Fig. 1 and illustrating the manner of setting the mechanism for different lengths of feed;

Fig. 4 is a left hand elevation of the mechanism with parts in section and parts broken away;

Fig. 5 is a vertical section of Fig. 1 through the axis of the main gear and looking toward the rear;

Figs. 6 and 7 are sections on the line 6—7 of Fig. 2 and looking in the direction of the arrows, the handle being in normal position in Fig. 6 and just beginning its return stroke in Fig. 7;

In Figs. 1–7 the mechanism is shown set for compensating feed;

Fig. 8 is a fragmentary view showing the mechanism set for uniform long feed;

Figs. 9, 10, and 11 illustrate a modification in which the long feed is imparted to the paper automatically by the drive mechanism of one form of Powers punched card tabulator;

Fig. 9 is a partial left hand side view on a reduced scale;

Fig. 10 is a left hand side view of a portion of the mechanism, partly broken away and partly in section on the line 10—10 of Fig. 11;

Fig. 11 is a rear elevation on a smaller scale than Fig. 10, with parts broken away.

Referring first to Figs. 1–8, 20 represents the right hand main side frame piece of one form of Powers tabulator head and 21 the type carriers settable differentially to print on a platen 22 (Fig. 2). The platen shaft 23 is journaled in the end brackets 24 of a carriage mounted by roller bearing rails on brackets 25 rising from the main frame pieces. The platen is line spaced by any suitable pawl 26 (Fig. 4) and ratchet 27, and yieldingly held by any suitable detent 28 acting on a toothed wheel 30.

The long feed mechanism comprises a pinion 31 fast on the platen shaft 23 and operated by a large gear 32, whose hub 33 (Fig. 5) is journaled on a shouldered stud 34 secured in the carriage bracket 24. The gear 32 is straddled by a sort of yoke comprising two arms 35 and 36 journaled on the stud 34 and rigidly connected together by a shouldered and headed bolt 37, on which is journaled a pinion 38 in constant mesh with the gear 32. A notched locking wheel 40, rigidly secured to the pinion 38, is adapted to be engaged by a positive lock, consisting of a square stud 41 projecting from a latch lever 42 pivoted at 43 to the arm 36 and lifted out of engagement by a spring 44 acting on a stud 49 on the lever 42. The latch lever 42 is adapted to be positively locked in engagement by a pawl 45 pivoted to arm 36 and drawn into engagement by the spring 44.

The yoke 35, 36 is drawn forward to feed the paper by a handle lever 46, pivoted to the left hand face of the arm 36, on the bolt 37, about which the handle has freedom to rock to an extent limited by a pin 47 (Fig. 4) projecting from the arm 36 through a hole 48 in the handle lever. A spring 50 anchored to pins on the arm 36 and handle lever 46, normally holds the handle in the relative position shown in the drawings; but when the handle is operated, it first swings about its pivot to the position shown in broken lines in Fig. 1, after which the handle and the yoke 35, 36 swing forward together. A pin 51 on the handle 46 normally projects into a notch 52 in the lock 42, but when the handle is swung about its pivot to its forward position, this pin moves out of the notch, over the upper surface of the lock 42, forcing said lock into engagement with the wheel 40 and positively aligning or centering the wheel and locking the dog 41, 42 in engagement. As the handle moves forward, therefore, the wheel 40 and pinion 38 are locked against rotation about the bolt 37, and the gear 32 is

forced to turn with the yoke 35, 36, turning the platen and advancing the paper.

The forward stroke of the handle is arrested by a post 53 mounted on a frame plate 54 secured to the carriage bracket 24, partly by the stud 34 and partly by other means. At the end of the forward stroke, said post is first struck by the tail 55 of the pawl 45, releasing said pawl as shown in Fig. 7; and the yoke is then arrested by one of its arms 35, 36 striking the post. At the moment of arrest, the handle 46 is pulled by the hand of the operator into its forward position with the pin 51 holding the lock pawl 42 locked into engagement with the wheel 40, thus positively preventing overthrow of the parts due to momentum, notwithstanding the pawl 45 is released. When the operator lets go of the handle, its spring swings it rearward about its pivot 37, bringing the pin 51 over the notch in pawl 42, permitting the latter to be moved out of engagement with the wheel 40, thus unlocking the pinion 38. Fig. 7 shows the position of the parts at this moment. The pinion being unlocked, the yoke 35, 36 and with it handle 46, are then swung rearward to normal position (Figs. 6 and 8) by a restoring spring 56 (Figs. 4 and 5) coiled about the stud 34, the gear 32 remaining stationary and the pinion 37 rolling freely over it. In Figs. 1, 2, 4 and 5, the parts are for convenience shown in the midst of the return stroke.

The yoke 35, 36 is arrested on its return stroke by a nose of the arm 35 striking a post or stub shaft 57 projecting from an arm or plate 58 pivoted on the stud 34, about which it is adjustable as will now be described, in order to regulate the extent of motion and the length of paper feed. A stationary toothed sector 60 has its hub 61 (Fig. 5) mounted on the reduced outer end of main stud 34, and it has a forwardly directed arm connected with the fixed post 53 by a link 62 to hold it firmly against turning about the stud 34. The arm 58 is loosely mounted on the hub 61 and it is pressed against the outer face of the sector 60 by a compression spring 63 coiled about hub 61 within a counterbored housing 64 secured on the reduced end of said hub by a screw 65 threaded into the end of the stud 34. Said housing does not quite reach to the arm or plate 58, so that the latter may be pulled by hand slightly away from the sector 60 as shown in Fig. 3. An arc of the periphery of said sector is made with teeth 66, and to the inner face of the plate 58 (Figs. 3 and 4) there is riveted a plate 67 having teeth interlocking with the teeth 66. The plate 58 is adjusted by pulling it away from the sector 60 as shown in Fig. 3, thus disengaging the plate 67 from the teeth 66, then swinging the plate arm 58 to the desired setting, and then permitting the spring 63 to press the plate 58 into its normal position against sector 60, in which the teeth of the plate 67 interlock with the teeth 66 and maintain the adjustment.

In order to provide for compensating paper feed, means are provided for throwing the locking dog 42, 41 into engagement with the wheel 40 at the end of the return stroke of the yoke 35, 36. To this end (Fig. 6) a pin 68 projecting from an arm of the dog 42, is adapted to strike an arm 70 projecting from the stop post 57, just before the yoke arm 35 is arrested by said post, and thus to force the dog into locking position, where it is retained by the pawl or latch 45. The mode of operation here called "compensating paper feed" is usually employed where a web of paper is designed to be printed on and afterwards severed into bill sheets of uniform lengths, say, for example, a length equal to 24 line spaces. In that event, the plate arm 58 is adjusted to give a throw of 24 spaces to the platen. If, with the parts in the position of Fig. 6, the handle be pulled, the paper would be fed from the first line of one form to the first line of the next form. Usually, however, a variable number of lines are to be printed on the first bill form, the platen being advanced step by step by the line space pawl 26 (Fig. 4). This turns the pinion 31 and gear 33, and, as the yoke 35, 36 is now locked to said gear, it and the handle will advance step by step in harmony therewith. After the last line has been printed, the operator pulls the handle for the balance of its excursion, and thus brings the first line of the next bill to printing position.

In order to provide for a uniform extent of long feed, the stop arm 70 is made rotatable to the position shown in broken lines in Fig. 6 and in full lines in Fig. 8, where it is not struck by the pin 68, and, therefore, the locking dog 42 is not moved to locking position on the return stroke, and the planetary pinion 38 is therefore left free to rotate on its arbor. In this setting therefore, the platen may be rotated by the line space pawl or otherwise, resulting only in the rotation of the pinion 33 without advancing the yoke 35, 36. At the end of a group of items, the handle may be pulled forward, advancing the paper to a uniform extent, determined by the setting of the plate arm 58. When the handle 46 is pulled, it first rocks about its pivot 37, causing the pin 51 to move the dog 42 into engagement as above described. In Fig. 8, the sector 60 is omitted for clearness.

In order to set the arm 70 as described, the stop post or shaft 57 is rotatably mounted in a suitable boss on the plate arm 58, and it has fixed on its outer end a sheet metal arm 71 carrying at its free end a barrel or counter-bored housing 72 having the usual spring pressed plunger bolt 73 mounted therein, its inner end adapted to be seated in either one of two holes 74 in the plate arm 58. The operator may pull the bolt 73 outward, and turn the arm 71, post 57 and arm 70 from one position to the other, and lock them there by permitting the bolt 73 to enter the appropriate hole 74. A stop pin 75 guards against too great turning of the arm 71.

In long feed mechanism of this general character, the drive pinion (31) on the platen shaft is usually made of considerably smaller diameter than the platen, in order to get a rotation of sufficient extent for the purpose without an excessive extent of rotation of the drive gear (32) or making that wheel of excessive diameter. If, for example, the line space ratchet 28 be made with 30 teeth, and the pinion 31 also of 30 teeth, the teeth of the latter and of the gear 32 would be so fine that they would not have the necessary strength. Paper feeds have been made that way and have given much trouble with broken gear teeth. Also, where the gearing is operated by a pawl, the teeth are so close together that it is hard to insure that the pawl engage the right tooth, which it must do in order to impart the correct extent of feed to the paper. These difficulties have been overcome in the described mechanism. If, for example, the line space ratchet 28 has 30 teeth, the pinion 31 is made with only 15 teeth, which, in the specific instance given as an example, gives gearing of 24 pitch for the pinions 31 and 38 and the gear 32. This is substantial gearing,

strong enough for the purpose. Each tooth of the ratchet 28 corresponds to half a tooth of the gearing. The locking wheel 40 is made of much larger diameter than the pinion 38, and has twice as many teeth as said pinion, so that one tooth of said wheel corresponds to one-half tooth of the gearing and to one tooth of the line space ratchet 28. In the drawing the pinion 38 has 12 teeth and the wheel 40 has 24; but as said wheel is of relatively large diameter, these 24 teeth have a spacing sufficient to make it easy to set the locking post 41 into the right notch.

With the construction as described, if the plate arm 58 were settable only to angles corresponding to tooth spaces of the gear 33, moving of said arm one tooth space would make a difference of two line spaces in the feed of the paper. In order to be able to set the mechanism for any desired number of line space distances within its capacity, the teeth 66 of the fixed sector 60 are made of one-half the pitch of the teeth of the gear 32, so that the plate arm 58 may be set to half spaces of said gear, which corresponds to single spaces of the platen. In order to secure this result without straining or breaking the fine teeth 66, the described mode of adjusting the plate arm 58 is provided. The toothed plate 67 (Fig. 4) is made with a concave edge provided with a number of teeth interlocking with the teeth 66 on the sector, so that the strain is divided between several teeth.

Another mechanism embodying some of the principles of the invention is illustrated in Figs. 9 et seq., this being operated automatically instead of by hand. 80 represents the left hand vertical frame piece of the Powers tabulator described in the application for patent of J. Mueller, filed February 1, 1940, Serial Number 316,739 and whose carriage is shown in Fig. 1. In this machine punched cards are fed one after another from a stack, and are analyzed, the data being printed on the platen 22. The machine includes a drive shaft 82, which makes one rotation for each card analyzed. In the present instance the long feed mechanism is mounted upon the left hand end of the carriage. The mechanism includes a number of parts substantially the same as in the first form and these are designated by the same reference numerals. A pinion 31 on the platen shaft is driven by a gear 32 mounted on a fixed stud 83 and is engaged by a planetary pinion 38 mounted on two arms 84 and 85, which are rigidly connected together by a bolt 86 which, like the bolt 37, serves as an axle for the pinion 38. Pivoted to the arm 85 is the upper end of a link 87 which at its lower end is pivoted to one arm of a bell crank 88, whose other arm has a pivot 89 to which is connected a pitman, 90, operated by a wrist 91 on a crank disc 92 fast on the left end of the drive shaft 82. The bell crank 88 is pivoted on a stud 93 of a fixed frame plate 94 suitably secured to the main frame piece 80 of the machine. The construction is such that the yoke 84, 85, 86 may be rocked through a definite angle at each cycle of the machine.

In this form of the invention the mechanism is not rocked by a handle and abruptly arrested by a stop as in the first form, but has a harmonic motion derived from the crank and pitman 91, 90. There is, therefore, not the same liability to overthrow, and the positive lock provided by the square pin 41 locked into engagement with the notched wheel 40 as in the first form of the invention is not required. Said notched wheel is therefore replaced by an ordinary ratchet wheel 95 engaged by a pawl 96, pivoted at 97 to the yoke arm 84, and influenced by a spring 98. This spring is so disposed that when the pawl is in engagement with the ratchet wheel, the spring is to the rear of the pivot 97; but the pawl can be swung forward as shown in Fig. 9 until the anchor-pin of the spring rests upon the upper edge of the arm 84, in which position the spring is forward of the pivot, and serves to hold the pawl disengaged from the ratchet wheel. As will presently appear this entirely disables the long feed mechanism.

The construction is such that on the up-stroke of the yoke 84, 85, 86 the pinion 38 tends to roll on the gear 32, but is prevented from so rolling by the pawl 96. The gear 32 is therefore forced to turn with the yoke, and to feed the paper. On the down stroke of the yoke the pinion 38 rolls on the gear 32, such motion not being resisted by the pawl 96, and the gear 32 does not turn. The paper is therefore fed a definite distance at each cycle of the machine. In the specific machine illustrated this distance amounts to seventeen line spaces, this being the number required in that particular instance. The machine may be used to feed a web of paper to be afterward severed into strips or cards of that up-and-down length, only one line being printed on each form.

In this construction as in the first one the pinion 31 has only one-half as many teeth as the line space wheel and the ratchet 95 has twice as many teeth as the pinion 38. The mechanism thus affords the same advantages as the other, namely, gearing coarse enough to stand the strain, and at the same time one tooth of the ratchet 95 corresponds to one tooth of the line space wheel so that a feed is possible of an odd number of spaces. It will be noted that for the use just described the means for adjusting the extent of throw, namely, the sector 60, and the plate-arm 58 etc. are not required.

For the use just described the pitman 90 may be connected to the bell crank 88 by a pivot, in which case the returning spring 56 (Fig. 5) is not required. In the instance illustrated in the drawing, however, provision is made for automatically varying the extent of the feed and the pivot 89 therefore plays in a slot 100 in the pitman 90 and said spring is employed to return the yoke 84, 85. In this instance the mechanism is used to write on a form two lines taken from two different cards; in other words, each form contains records from two consecutive cards. In this particular instance the total length of a form is equal to 21 line spaces as measured by the ordinary line space wheel 27, and the two lines on the sheet are four of such line spaces apart. Starting with the paper in position to write the first line on a form, the paper, after printing the line, is fed four spaces to print the second line, after which it is advanced 17 spaces to bring up the first line of the next form. This mode of operation is secured by the mechanism now to be described.

The parts are so proportioned that a full stroke of the yoke 84, 85 feeds the paper 17 spaces but on every alternate cycle the parts are arrested on the return stroke after returning to an extent of four spaces, the balance of the stroke of the pitman 90 being taken up by the slot 100 sliding idly over the pivot 89.

The means for arresting the parts on the return stroke consist essentially of a pawl 101 pivoted on a fixed post 102 which as here shown is the elongated head of one of the bolts by which the plate 94 is secured to the main frame plate 80, said pawl having a spring 103. The link 87 is provided with what amounts to a lug 104, consisting in the present instance of an ear formed from a piece of sheet metal secured to said link by a screw and slot 105 to provide for adjustment. This pawl has its tooth or shoulder 106 at such a point as to arrest the link after four spaces of return movement.

In the present instance this pawl is controlled by a special hole in one of the cards, the pawl being drawn into an active position by its spring 103 and swung forward to inactive position by a Bowden wire controlled by the card. To this end the pawl has a rearwardly directed arm, having an ear 107 adapted to be lifted by a pin 108 operated by a Bowden wire 110, the thimble 111 of the said pin being mounted on a bracket 112 whose hub 113 is secured by a set screw to the post 102. The Bowden wire 110 has its lower end inside of the frame 80 where it terminates in a second thimble 114 from which a pin 115 extends downward in position to be lifted by a Bowden wire fitted to the outside of the left-hand end of the translator. It has not been deemed necessary to indicate all this mechanism in detail as the Bowden wire may be arranged in any suitable way to be operated from the special hole in the card.

The mode of operation of the mechanism is as follows:

In the specific machine to which the invention is shown applied, the card is sensed in the second half of a cycle and such pins as find holes raise Bowden wires which reach the tops of their strokes at the end of the cycle, and are locked up. These wires remain in their elevated positions until near the end of the next cycle, when they are retracted and are free to drop down except in those instances where the next card contains a hole in the same position. The Bowden wire 110 rises in about the last 60° of a cycle and remains up until near the end of the next cycle. Printing occurs at about 160° of said next cycle. The crank 91, 92 is so set as to impart the feed stroke (up-stroke) to the yoke 84, 85, after printing, such stroke being completed at not far from the end of the cycle, say at 20° after the end of the cycle.

The special hole is in the second card of each pair of cards. At the beginning of the cycle in which the data from this card is being printed, therefore, the pawl 101 is out of engagement with the stop lug 104, and is held out until nearly the end of the cycle, when it returns to arresting position, because the first card of the next pair, which is being sensed at that time, does not have the special hole. When, therefore, the yoke 84 85 is returning to normal position, the pawl is inactive and the link 87 and the yoke are fully restored to their lowest position. After the data from the second card is printed, said yoke rises and imparts the long feed of 17 spaces to the paper, bringing the first line of the second form to printing position. When, early in the following cycle, the link 87 descends, it is arrested at 4 spaces by the pawl 101, the pitman 90 thereafter sliding idly by its slot 100 over the pivot pin 89. In the last part of this cycle, after the lost motion in the slot 100 has been taken up and the yoke 84, 85 is on its shorter up-stroke, the pawl 101 is again set inactive, so that the next feed will be a long one as above described.

Various changes, other than those described, may be made in the details of construction and arrangement, without departing from the invention.

What I claim as new, and desire to secure by Letters Patent, is:

1. In paper feed mechanism of the class described, the combination of a gear, a planetary pinion engaging said gear, means for oscillating said pinion about the axis of said gear, a lock for said pinion comprising a dog movable into locking position and a latch for positively holding said dog in such position, means for arresting the feed stroke of said pinion and releasing said latch to unlock the pinion, means for arresting said pinion and for concomitantly moving said dog to locking position at the end of the return stroke, and a paper feed cylinder driven by said gear.

2. In paper feed mechanism of the class described the combination of a gear, a planetary pinion engaging said gear, means for oscillating said pinion about the axis of said gear, a lock for said pinion comprising a dog movable into locking position and a latch for positively holding said dog in such position, means for arresting the feed stroke of said pinion and concomitantly releasing said latch to unlock the pinion, means for arresting said pinion and for concomitantly moving said dog to locking position at the end of the return stroke, and a paper feed cylinder driven by said gear, said means for moving said dog to locking position at the end of the return stroke being settable to active and inactive conditions.

3. In paper feed mechanism of the class described, the combination of a gear, a planetary pinion, a yoke mounted for oscillation about the axis of said gear and in which said pinion is journaled, means for locking said pinion comprising a dog movable into and out of locking position, a handle for oscillating said yoke and having a limited motion relative thereto, a lug moved by such relative motion into engagement with said dog so as positively to lock the dog in engagement, and a paper cylinder driven by said gear.

4. In paper feed mechanism of the class described, the combination of a gear, a planetary pinion engaging said gear, a yoke in which said pinion is journaled and which is mounted for oscillation about the axis of said gear, means settable to regulate the extent of such oscillation, a locking wheel fast with said pinion, a locking dog mounted on said yoke and movable into and out of engagement with said locking wheel, a handle mounted on said yoke for limited motion relative thereto, means set by such relative motion to positively lock said dog in engagement with said wheel, means for arresting said yoke, and a paper cylinder driven by said gear, said locking wheel having a number of teeth greater than the number of teeth in said pinion whereby said locking wheel affords gradations in the extent of paper feed materially less than the spacing afforded by the teeth of said gear.

5. In a card controlled tabulating machine in which data is printed at each machine cycle, the combination of a gear wheel, means whereby said gear wheel feeds the paper, a planetary pinion engaging said gear wheel, a carrier for said pinion, means for oscillating said carrier about the axis of said gear wheel at each machine

cycle, a locking wheel rotating with said pinion, a locking dog acting to prevent rotation of said pinion on the feed stroke of said carrier and permitting such rotation on the return stroke, and card controlled means for varying the extent of the return stroke of said carrier whereby the extent of paper feed may be varied under card control.

6. In the long paper feed mechanism of an accounting machine, the combination with the platen pinion and its driving gearing, of an oscillatory member, a handle for operating said member and having a limited motion relative thereto, a dog on said member for locking said member to said gearing, and means acting during such relative movement first to move said dog into connecting position and then to lock said dog positively in connecting position.

7. In the long paper feed mechanism of an accounting machine, the combination with the platen pinion and its driving gearing of an oscillatory member, a gearing-operating dog on said member spring pressed out of engagement, a device differentially settable to arrest said member on its return stroke, an abutment mounted on said device and settable to active and to inactive positions and serving when active to throw said dog into engagement with said gearing, a latch for retaining said dog in engagement, and means for releasing said latch at the end of the forward stroke of said member.

8. In the long paper feed mechanism of an accounting machine, the combination with the platen pinion and its driving gearing, of an oscillatory member, a gearing-operating dog on said member spring pressed out of engagement, a device differentially settable to arrest said member on its return stroke, an abutment mounted on said device and settable to active and to inactive positions and serving when active to throw said dog into engagement with said gearing, a latch for retaining said dog in engagement, means for releasing said latch at the end of the forward stroke of said member, and means for imparting a forward stroke to said member and for moving said dog into engagement at the beginning of each stroke when said abutment is inactive.

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