No. 644,287. Patented Feb. 27, 1900.

# D. E. FELT.

## TABULATING MACHINE.

(Application filed July 13, 1899.)

(No Model.) 8 Sheets—Sheet 1.

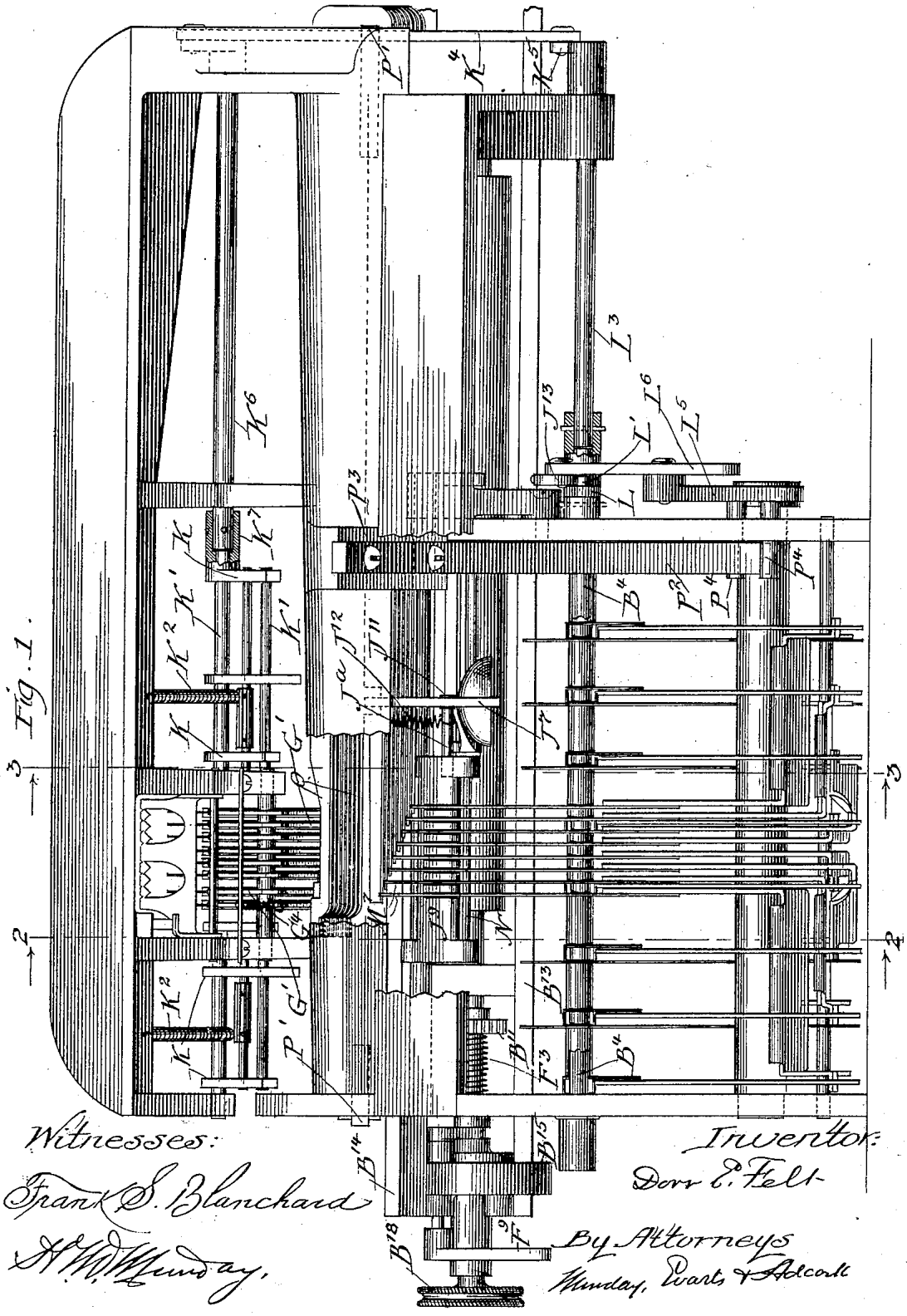

Fig. 1.

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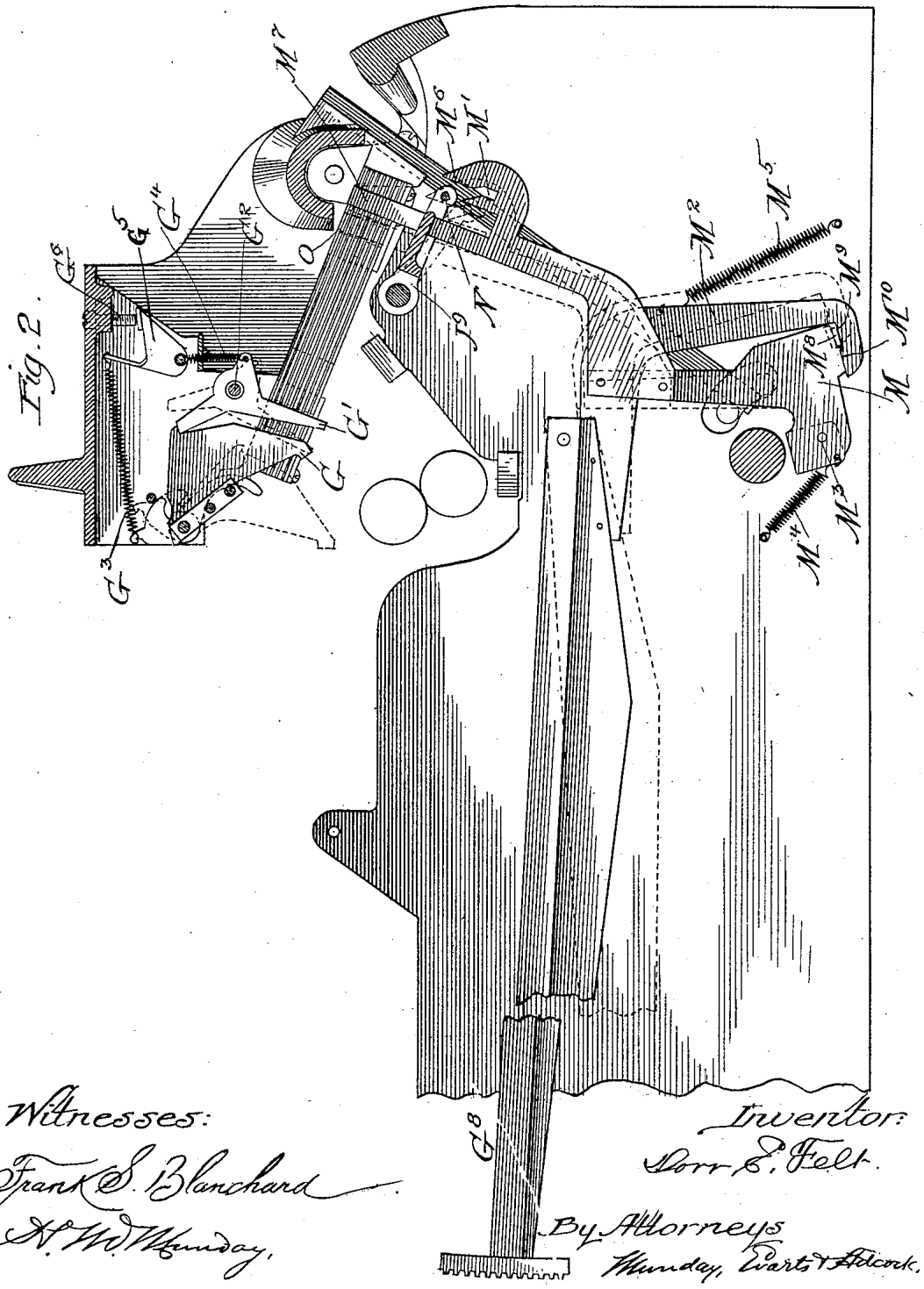
(No Model.) 8 Sheets—Sheet 2.

Fig. 2.

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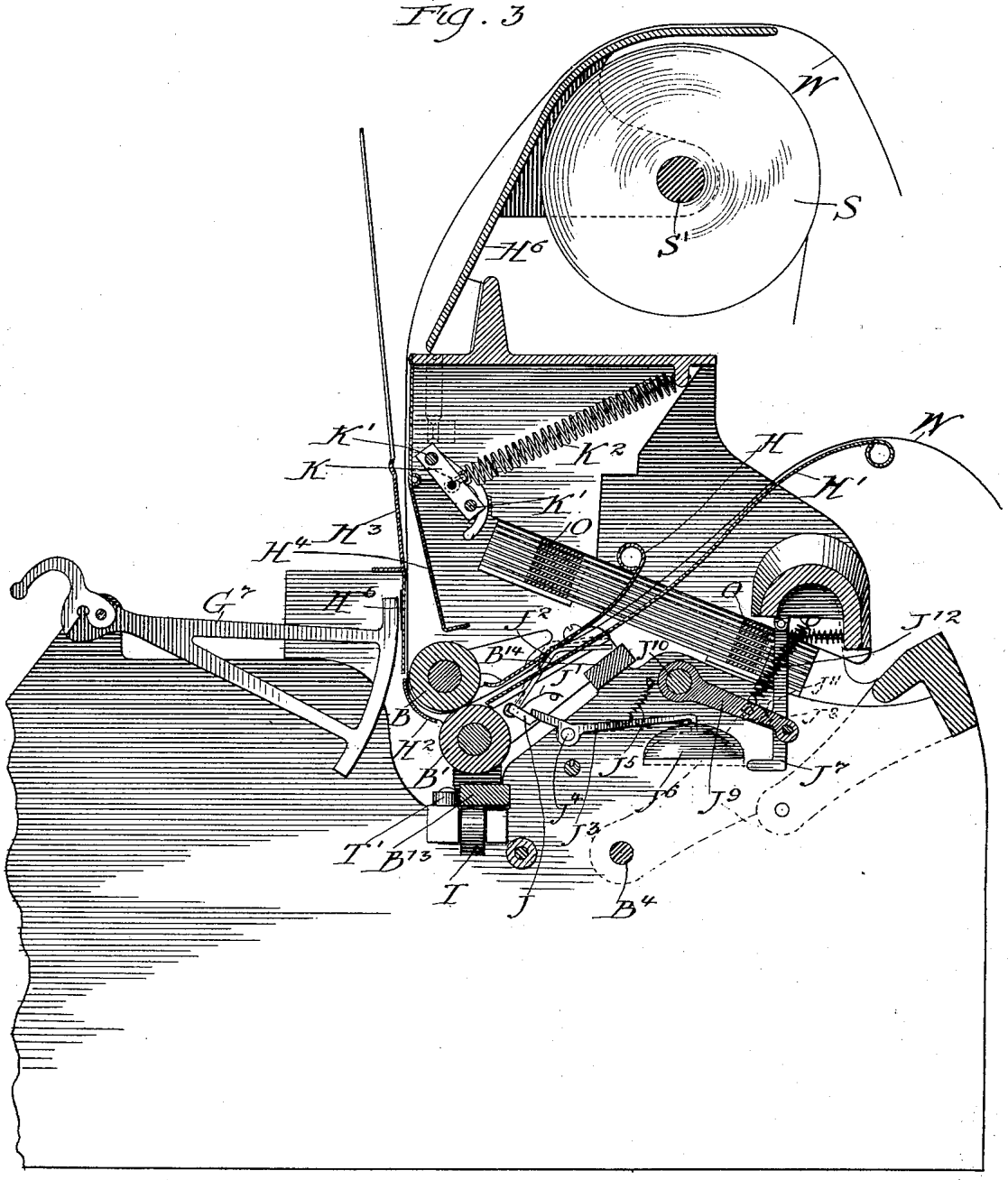
(No Model.) 8 Sheets—Sheet 3.

Fig. 3

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## TABULATING MACHINE.

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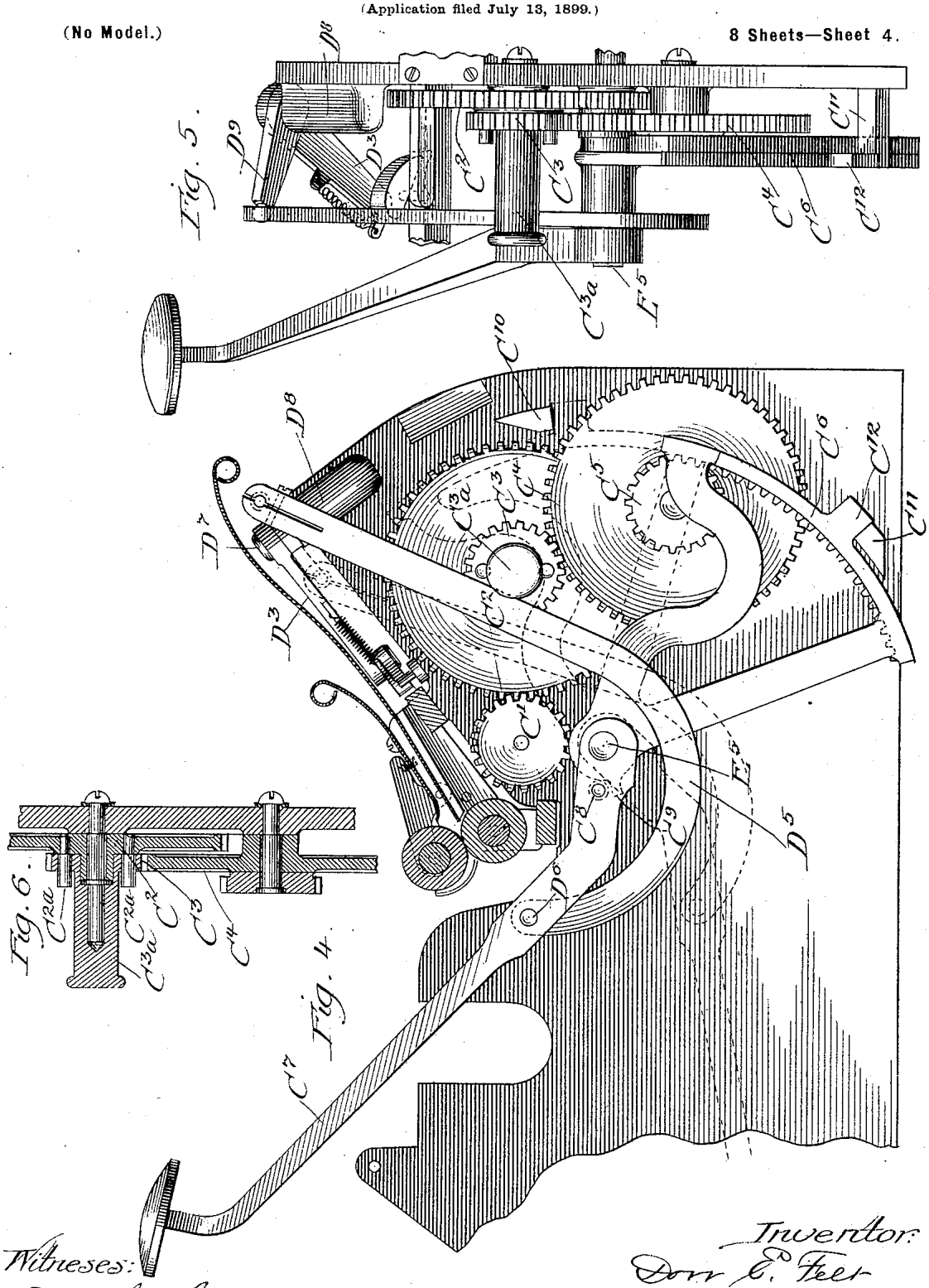
(No Model.) 8 Sheets—Sheet 4.

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# D. E. FELT.

## TABULATING MACHINE.

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(No Model.) 8 Sheets—Sheet 5.

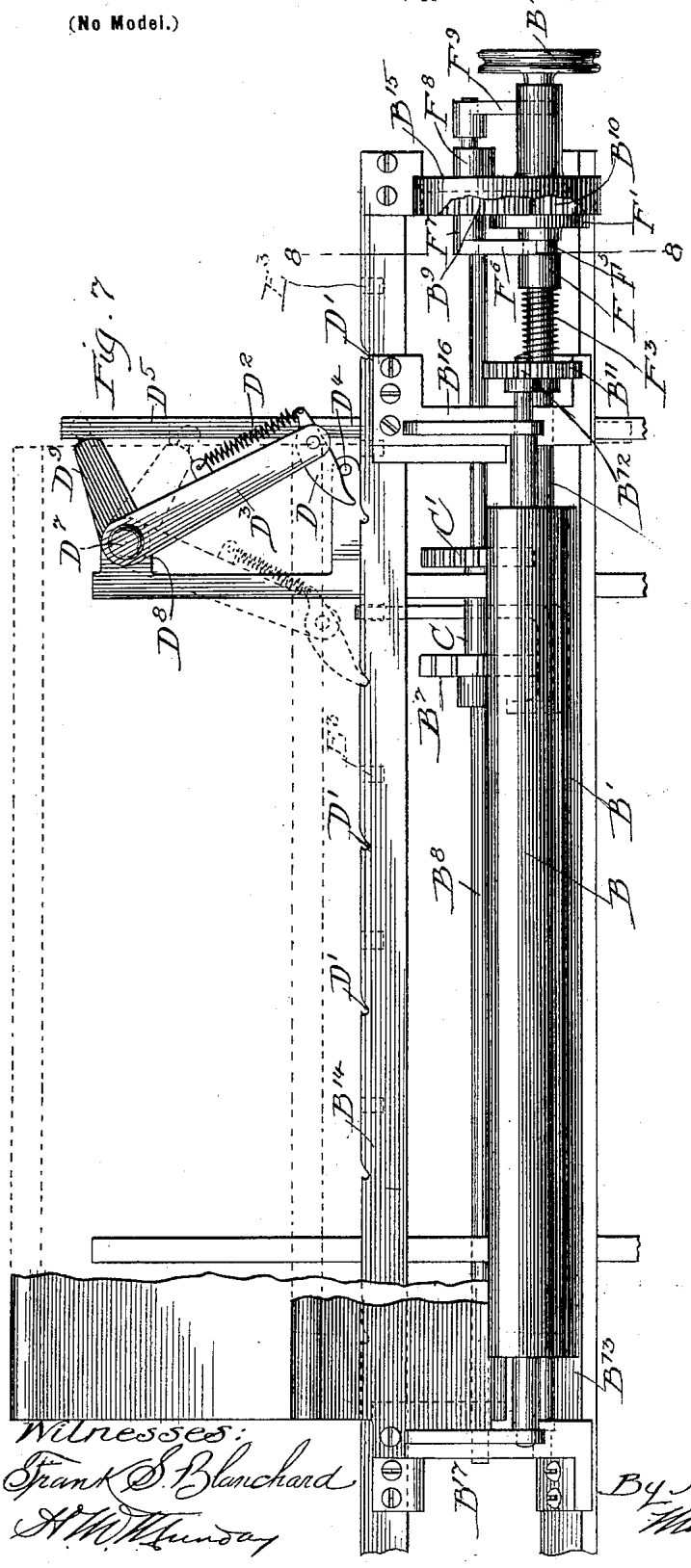

Fig. 7.

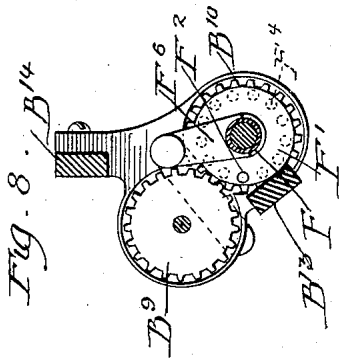

Fig. 8.

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## TABULATING MACHINE.

(Application filed July 13, 1899.)

(No Model.) 8 Sheets—Sheet 6.

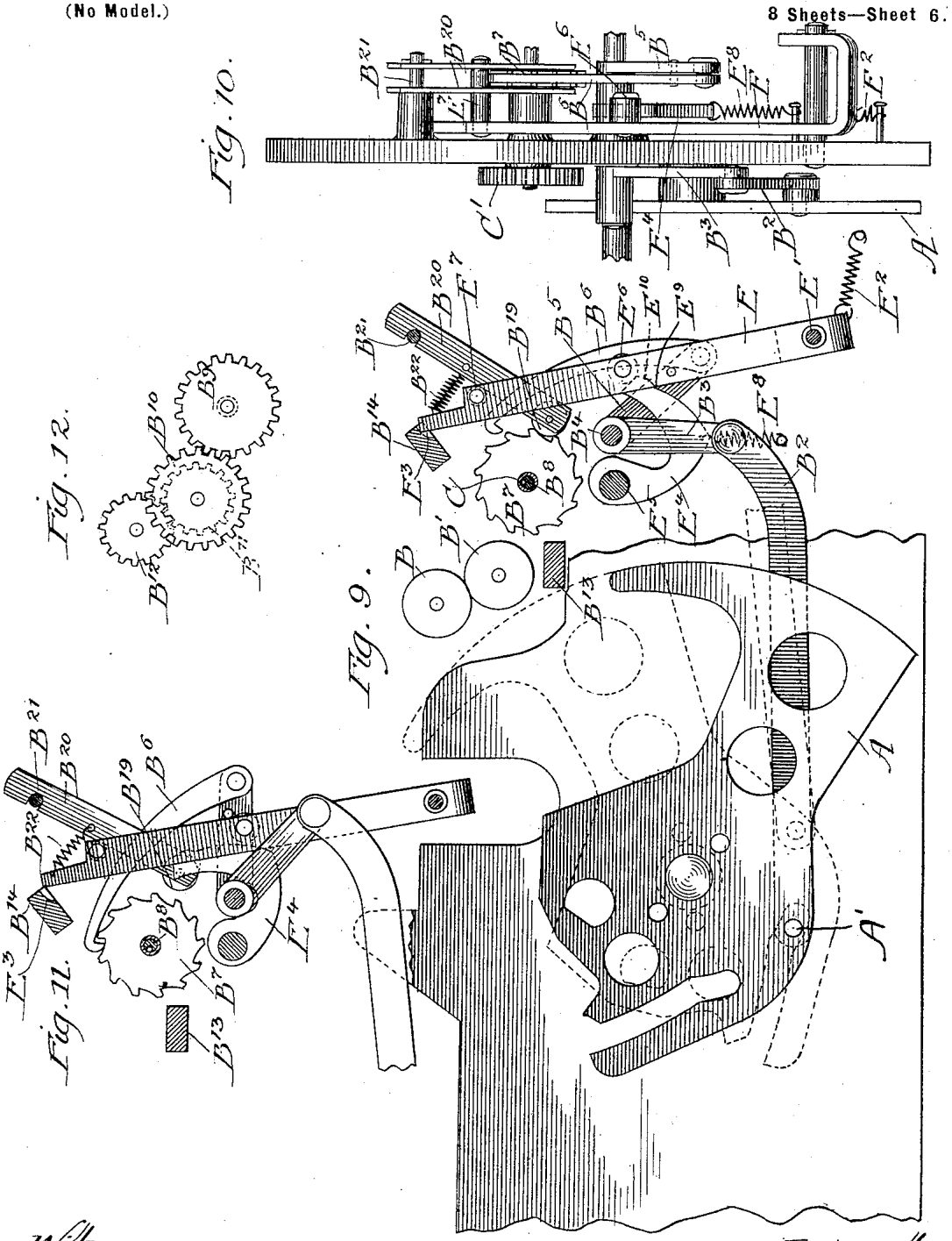

Fig. 10.

Fig. 12.

Fig. 9.

Fig. 11.

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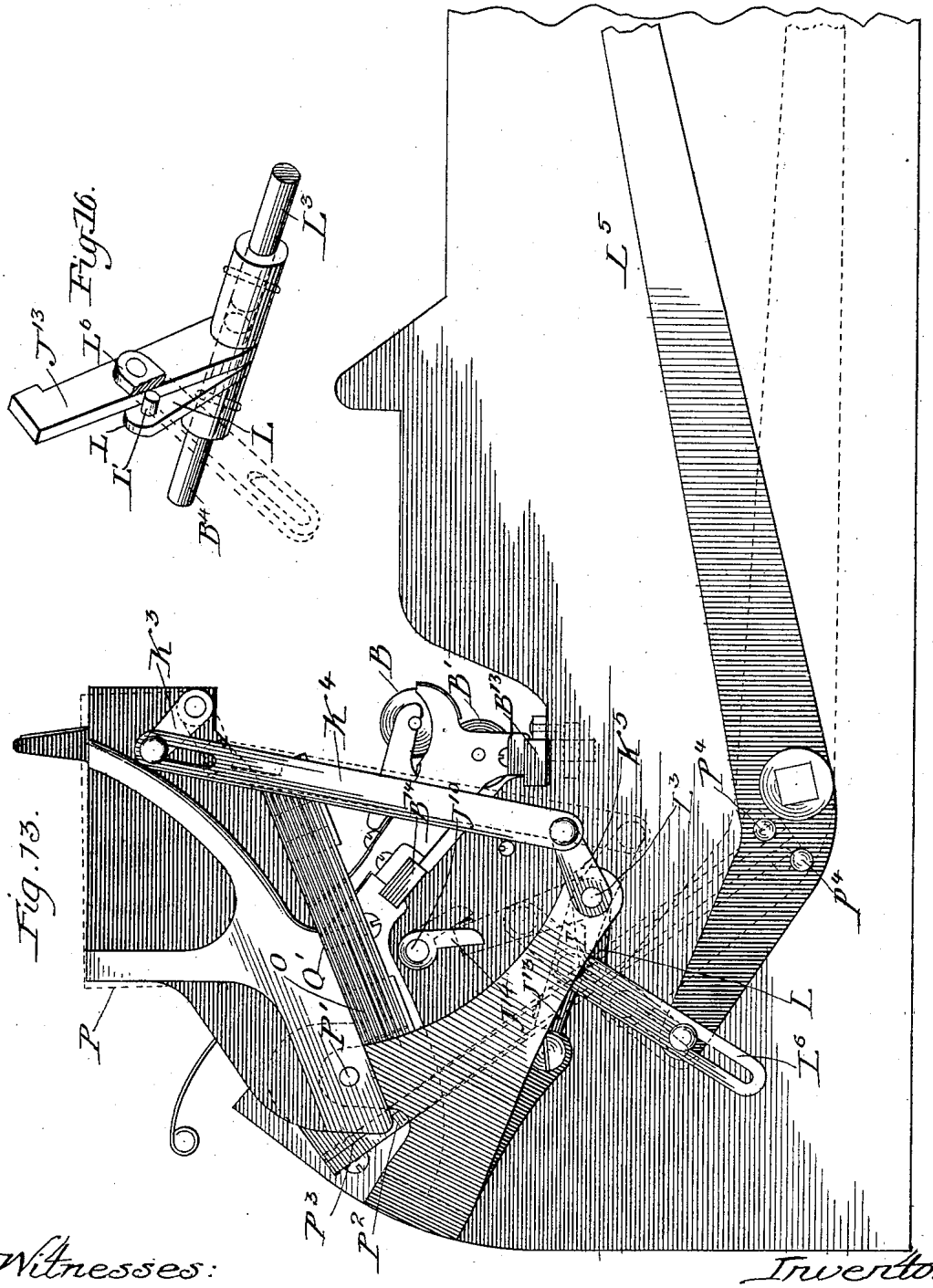
## TABULATING MACHINE.

(Application filed July 13, 1899.)

(No Model.) 8 Sheets—Sheet 7.

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D. E. FELT.

TABULATING MACHINE.

(Application filed July 13, 1899.)

(No Model.) 8 Sheets—Sheet 8.

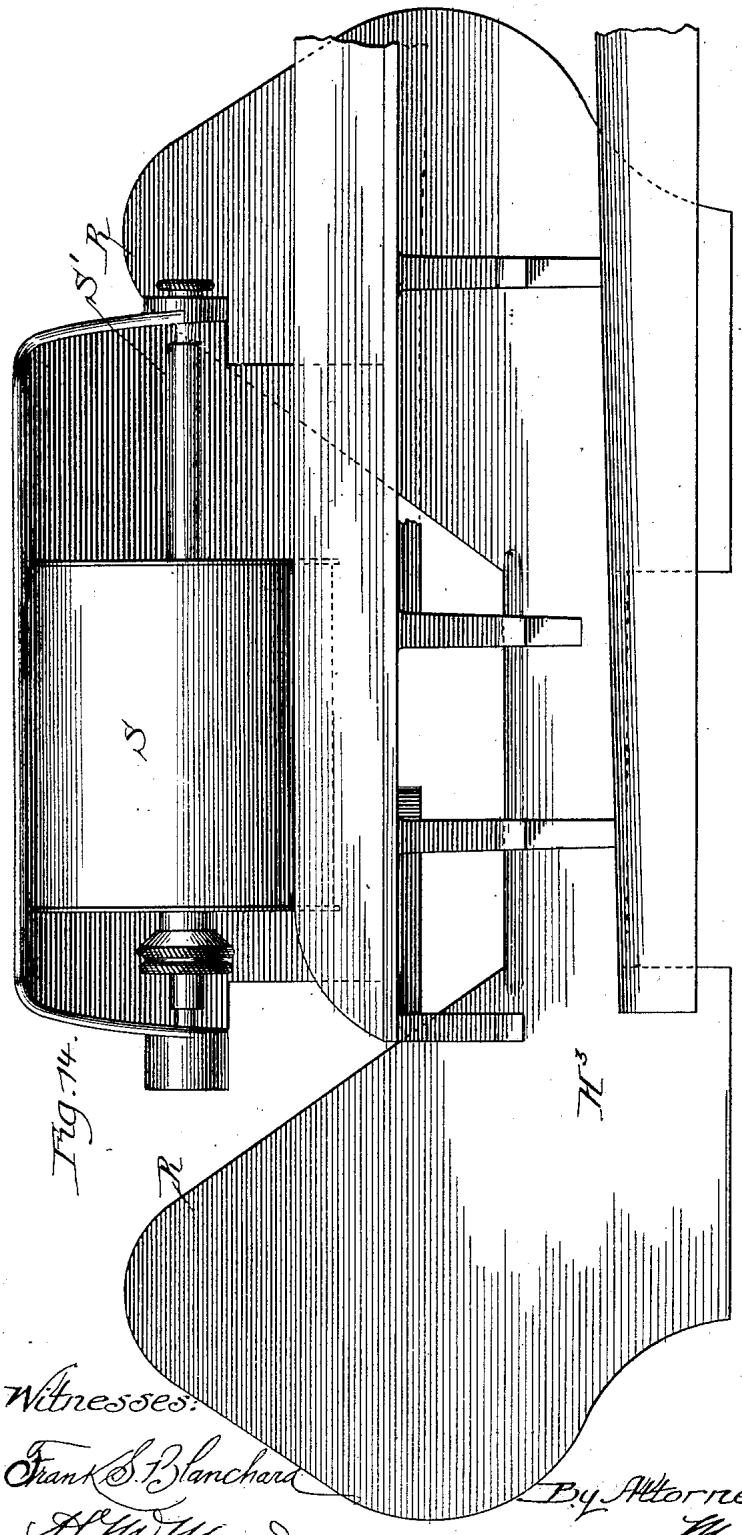


Fig. 14.

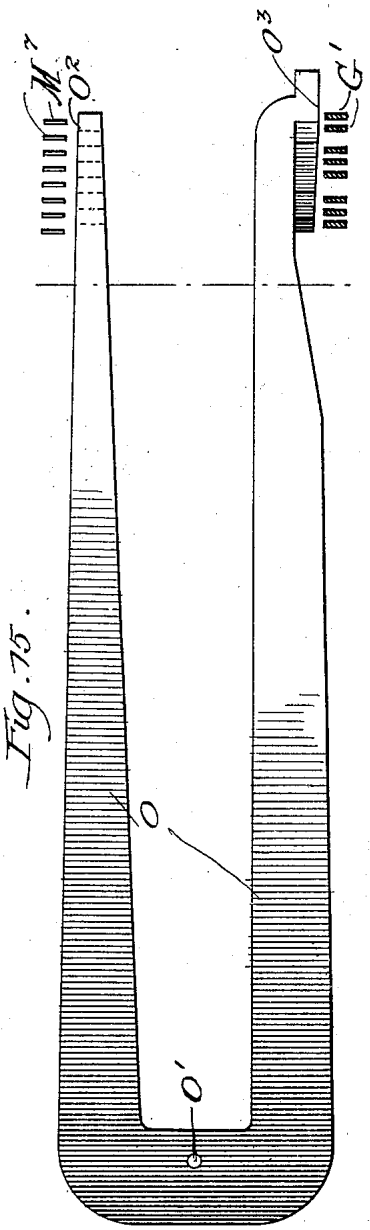


Fig. 15.

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# UNITED STATES PATENT OFFICE.

DORR E. FELT, OF CHICAGO, ILLINOIS.

## TABULATING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 644,287, dated February 27, 1900.

Application filed July 13, 1899. Serial No. 723,678. (No model.)

*To all whom it may concern:*

Be it known that I, DORR E. FELT, a citizen of the United States, residing in Chicago, in the county of Cook and State of Illinois, have invented a new and useful Improvement in Tabulating-Machines, of which the following is a specification.

This invention relates to that class of calculating-machines known as "tabulators" and which are adapted to print numbers in columns and to add the numbers printed. It is an improvement upon the tabulator shown in my Patent No. 628,176, dated July 4, 1899. The main changes in the machine from the construction shown in my said patent have been such as adapt the machine to admit the paper in a different manner from that previously used by me and so as to adapt the machine more perfectly to do all the work usually or commonly devolved upon such machines. The improvement also embraces improved means for returning the paper vertically after the printing thereon of a column of numbers to proper position for the starting of the next column. The machine is also adapted to be used with continuous or roll paper having width sufficient for a single column or with sheet-paper having width sufficient for a plurality of columns. For an understanding of these and other features of improvement embodied in the invention I refer to the accompanying drawings and subjoined description.

In said drawings, Figure 1 is a rear elevation of my improved machine, partly broken away. Figs. 2 and 3 are partial longitudinal vertical sections on the lines 2 2 and 3 3, respectively, of Fig. 1. Fig. 4 is a partial side elevation, partly in section, showing more particularly the sheet-returning mechanism; and Fig. 5 is a rear view of the same mechanism. Fig. 6 is a detail of said mechanism. Fig. 7 is a plan view of the paper-carriage. Fig. 8 is a section on the line 8 8 of Fig. 7. Fig. 9 is a partial vertical section showing the mechanism for controlling the lateral movement of the carriage. Fig. 10 is an edge view of said mechanism. Fig. 11 shows a portion of the same mechanism in another position. Fig. 12 is a detail of the gearing for actuating the paper-rolls. Fig. 13 is a partial side elevation of the side of the machine opposite to that shown at Fig. 4. Fig. 14 is a rear elevation of some of the parts shown at Fig. 3. Fig. 15 is a longitudinal section of the mechanism for releasing the hammers. Fig. 16 is a detail perspective of the arm $J^{13}$ and adjacent parts, showing the same in a different position from that indicated by the full lines at Fig. 13.

In the practice of the invention set forth in my said patent the paper as it is fed into the machine passes betweeen the type-segments and the hammers by which the paper is impressed upon the type, the downwardly-moving incoming part of the paper being closely behind and parallel to the upwardly-moving outbound or printed portion and both portions passing the printing-center and receiving the impact of the hammers. The paper was also passed around a driven feed-roll and was guided at each side of such roll by guide-rolls. This construction works perfectly where no carbon copies of the work are desired, but is not adapted to be used in producing carbon duplicates, because the increased number of thicknesses of paper necessary to be passed between the type and hammers in making an original and duplicate at one operation would prevent clear and distinct impressions. To remove this obstacle to the printing of duplicates, I have so reconstructed the printing mechanism as to provide a passage or entrance way for the paper behind and below the hammers, so that the paper is compelled to move past the printing-center but once instead of twice, as in the prior construction, and thereby obviating the presence between the hammers and type of all thicknesses except the paper being printed upon, the carbon for producing the duplicate, and the ink-ribbon. The changes made in the construction will now be described.

Referring to the drawings, A represents the main cam, through which many of the operations of the machine are caused, as will be understood from my said Patent No. 628,176 and also from my Patent No. 568,021, of September 22, 1896. It is pivoted at A′ and oscillated thereon by the main hand-lever. (Not shown.) I now connect it to the paper-feed rolls B and B′ by means of a lever $B^2$, pivoted at one end to the cam and at the other end to a crank-arm $B^3$, fast upon a shaft

$B^4$. The shaft $B^4$ carries a second crank-arm $B^5$, to the outer end of which a pawl $B^6$ is pivoted. This pawl engages a ratchet-wheel $B^7$ upon a shaft $B^8$, carrying a pinion $B^9$, meshing with a pinion $B^{10}$ upon the shaft of roll B'. The roll B is driven from roll B' by the pinions $B^{11}$ and $B^{12}$. This mechanism is adapted to actuate the feed-rolls in the line-spacing or vertical feeding movements.

The paper-feed rolls and also the shaft $B^8$ are supported in a laterally-movable carriage or frame consisting of longitudinal bars $B^{13}$ and $B^{14}$ and cross-heads $B^{15}$, $B^{16}$, and $B^{17}$, and in order to permit the lateral changes in position of the carriage without destroying the connection between the feed-rolls and their actuating devices the ratchet-wheel $B^7$ is loosely mounted upon the shaft $B^8$, so that it remains stationary as to location, notwithstanding the longitudinal movements of the shaft; but it is splined on the shaft so as to cause rotation by the latter. The pinion $B^9$ is located at the end of shaft $B^8$, and the journal of roll B' is extended so that its pinion $B^{10}$ may mesh with pinion $B^9$. The journal of roll B is shorter than that of roll B', and the pinion $B^{12}$ is mounted on its end, and of course pinion $B^{11}$ is correspondingly located. A thumb-wheel $B^{18}$ is attached to the journal of roll B', whereby both rolls may be turned by hand in either direction at will. The ratchet-wheel is, in fact, secured to a sleeve C, attached to or in one piece with a gear C', whose function will be understood later on, and said sleeve is splined to the shaft, as seen at Fig. 9. A dolly-roll $B^{19}$ in a frame $B^{20}$, swinging on the center $B^{21}$, is employed to insure the stoppage of said wheel at the proper positions to insure uniformity in its movements by it. A spring $B^{22}$ acts on the frame $B^{20}$ to keep the roll in bearing against the wheel.

The lateral movements of the feed-roll carriage are caused by the pawl D engaging the notches D' in the carriage-bar $B^{14}$, the notches being spaced to correspond with the width of the column-spaces. A spring $D^2$ tends to force the pawl into the notches as soon as the pawl is moved by its supporting crank-arm $D^3$ off from the stationary stud $D^4$. The actuating of arm $D^3$ will be explained hereinafter.

To prevent overthrow in the lateral movements of the carriage and also to lock it normally in its adjusted positions, I employ the following devices: At E is a swinging catch-lever pivoted at E' and provided with a spring $E^2$, tending to force its upper end over against the carriage-bar $B^{14}$, which is provided with notches or recesses $E^3$, corresponding in number and spacing to the notches D' and which are adapted to receive said lever. Said lever is controlled and caused to release the carriage by a cam-arm $E^4$, fast upon a rock-shaft $E^5$ and coming in contact with a stud-roller $E^6$, secured in and projecting from the lever. When said shaft is actuated, the catch-lever is forced by arm $E^4$ from the position of Fig. 9, which is the normal position and in which it locks the carriage, to the position of Fig. 11, in which the carriage is released, and the catch-lever is held from reëngagement by the cam-arm. The cam-arm is made elbow-shaped for the double purpose of prolonging its control of the catch-lever and to enable it to move around the shaft $B^4$.

It will be noticed that the can-arm $E^4$ has a depression $E^9$ on its acting edge and that the raised portion of such edge, extending from the end of the arm to the depression and indicated at $E^{10}$, is short. This portion is only long enough to lift lever E out of the notch $E^3$ in carriage-bar $B^{14}$ and prevent its falling back until after the notch has moved so far away as to prevent the lever from re-entering; but when the notch has passed beyond the lever the latter will be allowed to fall back and rest against the carriage, and thus be in position to quickly engage the next notch. In other words, the operation of said cam-arm is first to lift lever E entirely out of the notch and then hold it until the notch has moved beyond the lever. As soon as the movement of the cam-arm brings said depression opposite to the roller $E^6$ the lever drops back and rests against the carriage, and when the carriage has passed far enough to present another notch to the lever the latter will drop into it and prevent further lateral movement by the carriage due to momentum or other force. The bar E thus aids to overcome the momentum of the carriage, as well as to lock it between operations. Of course on the return movement of the cam-arm the lever will again be lifted out of the notch; but at that time the carriage will have been moved to and be at rest in its new position. Said catch-lever also acts, when moved as described, to carry the dolly-roll $B^{19}$ away from the ratchet-wheel, and thus relieve the latter of the resistance to its motion caused by the roll, and it also holds the dolly-roll until cam-arm $E^4$ returns to normal position. The lever is enabled to do this by means of the stud-roller $E^7$, carried by it and engaging the frame of the dolly-roll. A spring $E^8$, attached to the cam-lever, returns said lever and its carrying rock-shaft back to their normal positions after each operation.

The mechanism for returning the paper vertically to its starting position—that is, for repositioning it after the completion of one column preparatory to the starting of a fresh column—is best shown at Figs. 4 to 6, and consists of the pinion C', already mentioned and which moves with the ratchet-wheel in the line-feeding actuations, a train of gears $C^2$, $C^3$, $C^4$, and $C^5$, receiving motion from the pinion C' and communicating the same to a toothed segment $C^6$, loose upon a suitable shaft, preferably the shaft $E^5$, and a hand-lever $C^7$, fast on the same shaft and carrying a stud $C^8$, engaging a projection $C^9$ on the hub of the segment $C^6$. The regular feeding movements

through the mechanism described will carry the segment gradually and step by step to its lower position, (seen at Fig. 4,) and when this has been done the operator in order to return the paper vertically has only to depress the hand-lever $C^7$. He thereby, through the engagement of the stud $C^8$ with projection $C^9$, raises the segment to its upper or starting position and in so doing imparts a backward rotation to the gears and through them to the feed-rolls exactly equal in extent to the aggregate of the step-by-step forward rotations received in the regular feeding movements received while the tabulating is being done, and consequently the top of the sheet will be returned by this backward rotation to the plane in which the printing was started. If the sheet is now also shifted laterally a distance equaling the width of a column-space, it will be seen that the sheet will be properly positioned for the commencement of a fresh column. The hand-lever after it has thus returned the segment to its starting position is itself returned, together with cam-arm $E^4$, by spring $E^8$. (See Figs. 9 and 10.)

It is desirable that the vertical return of the sheet and the lateral movement of the carriage should take place simultaneously and be caused by the same motor device in order that the operator may by a single motion bring about both movements, and hence I connect the lateral shifting mechanism to the hand-lever $C^7$ as follows: A link $D^5$ is pivoted to lever $C^7$ at $D^6$ and extends upward to the proximate neighborhood of the rock-shaft $D^7$, supported in a housing $D^8$ and carrying the crank-arm $D^3$, already mentioned. Another crank-arm $D^9$, also fast upon said shaft, is connected to the upper end of link $D^5$ by a universal joint. With this construction the depressing of the hand-lever will carry the link down to the position indicated in broken lines in Fig. 4, and such change of position by the link causes a rocking of shaft $D^7$ and a movement by the arm $D^3$ and pawl D to the position given in broken lines at Fig. 7. The hand-lever always receives a full stroke, so that the carriage is sure to be shifted a full column-space, regardless of the extent to which the sheet has been fed in the line-spacing movements, and the sheet will be returned to its starting position whether the column last tabulated extends to the bottom of the sheet or only part way down the page. The carriage is also released from the locking action of catch-lever E when the shifting takes place, as the shaft $E^5$ will necessarily be rocked far enough in that operation to cause the cam-lever $E^4$ to force the lever E out of engagement with the carriage.

Stops $C^8$ and $C^9$ serve, in connection with the projection $C^{10}$, to limit the stroke of segment $C^6$ in both directions.

To permit vertical adjustments of the paper without disturbing the position of the paper-returning mechanism, I provide a clutch mechanism between the feed-rolls and their automatic actuating mechanism, which is desirably constructed as follows: On the shaft of the lower feed-roll B′ is a sleeve F, adapted to slide on the shaft, but splined thereon, so that it must turn with the shaft, and this sleeve carries a disk F′, provided with a pin $F^2$, projecting from its side face. A spring $F^3$, encircling the shaft, presses the sleeve and disk up against the pinion $B^{10}$, and the latter is provided upon its side face with a series of openings $F^4$, each of which is adapted to receive said pin. The sleeve is grooved at $F^5$ to receive an arm $F^6$, projecting from a sliding shaft $F^7$, supported in a bearing $F^8$ and carrying at its farther end an arm $F^9$. With this construction, the pinion $B^{10}$ being loose upon the shaft, it will be seen that any desired rotation may be imparted to the feed-rolls by the knob $B^{18}$ without giving any motion to the mechanism by which they are automatically actuated in the line-feeding operations or to said returning mechanism by simply applying pressure with the finger to the arm $F^9$ and sliding said arm and its shaft, so as to disengage the disk F′ from the pinion $B^{10}$. While the rolls are thus disconnected also, the returning mechanism may be adjusted by turning the projecting hub $C^{3a}$ of pinion $C^3$ by hand. I also, by preference, make the pinions $C^2$ and $C^3$ separable at will, so as to facilitate the making of adjustments, and for this purpose the pinion $C^2$ is provided with two laterally-projecting pins $C^{2a}$ and pinion $C^3$ with openings adapted to receive said pins, as will be understood from Fig. 6. The pins compel the rotation in unison of the two pinions; but pinion $C^3$ may be drawn off the pins by an axial movement, so as to destroy the connection between pinions $C^2$ and $C^4$. The hub $C^{3a}$ is preferably made to extend to the outside of the machine-case, so that it may be manipulated in the ways above set forth.

While one object of the making of the pinions separable is to facilitate adjustments, my main purpose therein has been to enable the operator to cut out the segment $C^6$ when using continuous paper. This is necessary, as the line-spacing feed would otherwise be brought to a standstill when the segment reached its arresting-stop or when the projection $C^9$ encountered the pin $C^8$ on the hand-lever $C^7$.

The hammers are shown in Fig. 2 at G, there being one hammer for each series of type. They are held normally out of action by the latches G′, pivoted at $G^2$, and each hammer is provided with a spring $G^3$, by which it is impelled in making the impression when released from the control of its latch G′ and the lifting-frame hereinafter described. When thus released, it swings to the position given in dotted lines in said figure. The latches are held in their locking positions by springs $G^4$, and the hammer-springs $G^3$ are regulated as to tension by attaching them to a rocking plate $G^5$, adjusted by a screw or screws $G^6$. One of the type-carrying seg-

ments is shown in its normal position at $G^7$ in Fig. 3 and is adapted to be swung upward to position the type to be printed in front of the hammer. One of the segment-levers used by me for operating the register-wheels by which the numbers tabulated are added is shown at $G^8$; but I do not show the wheels themselves, nor do I show the means for positioning the type-segments $G^7$, as my present invention is independent of those parts of the complete tabulating-machine.

I have shown the course of the paper through the machine clearly in Fig. 3, where a sheet W is shown as presenting its center portion at the printing-center. The paper is inserted from behind the hammers and passes under them to the feed-rolls and is guided to the rolls by an upper guide H and a lower guide H′, the latter being extended backward a considerable distance, as shown. After moving between the rolls the paper is deflected upward by a guide $H^2$ into the space between guide $H^3$ on one side and guide $H^4$ on the other side and from thence falls over backward onto the housing $H^6$. The ink-ribbon is shown at $H^5$ and indicates the printing-level. It will be noticed that in this construction there is no obstacle to the making of duplicates of the tabulating done in the machine, as it permits the insertion and manipulation, in unison with the original sheet, of the extra sheet or sheets and the accompanying carbon sheet or sheets necessary for that purpose, the operation being very similar to that of producing carbon duplicates in the ordinary type-writer.

For the purpose of giving an alarm when the bottom of the sheet of paper is about being reached I provide the following devices: At J is a flat bar pivoted at its ends to the cross-pieces of the paper-carriage, the pivots being located near the forward corners of the bar, so that the rear edge of the bar may be swung upward by the spring J′. A wire $J^2$, bent as seen at Fig. 3, projects backward and upward from the bar through an opening in guide H′ and in close proximity to guide H. The latter is provided with an opening, (not shown, but which will be understood from said figure,) allowing the wire to move to the position given in broken lines when no paper is present under the opening to prevent. The bar will therefore swing upward when the bottom of the paper has moved beyond the wire, and this movement rocks a lever $J^3$, pivoted stationarily at $J^4$ and having one end resting on the swinging edge of the bar. A spring $J^5$ maintains contact with the lever and bar at all times. The lever is bent laterally and carries at its other end a bell $J^6$ in near proximity to an L-shaped hammer $J^7$, freely pivoted to a stationary part of the machine at its upper end and vibrated toward the bell at each printing operation by means to be described later on. In its normal position the bell is held just above the level of the striking-point of the hammer, as seen at Fig. 3, so that the hammer does not ordinarily strike it; but when the paper has moved beyond the wire $J^2$ and permits the rocking of bar J by its spring a rocking of lever $J^3$ ensues, which lowers the bell sufficiently to bring it opposite the hammer-point, so that the hammer necessarily strikes the bell at each vibration received during the time the bell remains in its lower position.

The vibration of the hammer $J^7$ is due to the following means: On the front of the stem of the hammer is a projection $J^8$, and an H-shaped swinging plate $J^9$ on the rock-shaft $J^{10}$ carries on a laterally-projecting pivot $J^a$ a two-faced dog $J^{11}$, which encounters the projection $J^8$ at each actuation of said shaft, and thereby imparts to the hammer the vibrating movements necessary to cause the ringing of the bell. The dog and projection engage both when the plate $J^9$ descends and when it returns, so that repeated blows are caused by the hammer. The rock-shaft $J^{10}$ receives its actuation from a spring $J^{12}$ and from shaft $B^4$ through the medium of an arm $J^{13}$ on the latter and another arm $J^{14}$ on the former, the arms being arranged so as to engage and cause the movement by arm $J^{14}$ (indicated in broken lines at Fig. 13,) and consequently the bell-hammer will be vibrated at each printing operation.

After each printing operation such of the series of printing-hammers as may have been used are returned to their normal positions by a swinging frame composed of vertical heads or end pieces K and horizontal wires K′, acting in obedience to operating-springs $K^2$. The upper wire K′ is supported at one end in a stationary part of the machine and at the other end is coupled to a shaft $K^6$ by the boss $K^7$, formed on one of said vertical pieces, the shaft and said upper wire thus forming a rocking shaft whereby said frame may be actuated. This function is performed by the crank-arm $K^3$, a slotted link $K^4$, and a second crank-arm $K^5$, fast in the end of a shaft $L^3$, which is in reality an extension of shaft $B^4$, being arranged in line with the latter and coupled thereto in such manner as to insure movement with it, but having an independent turning movement of its own. This coupling is secured by providing an arm L, fast on the end of shaft $B^4$ and furnished with a pin L′, projecting laterally from the arm, and a second arm $J^{13}$, fast on shaft $L^3$ and located in the path of said pin. It will be seen from this that shaft $L^3$ necessarily turns with shaft $B^4$ when the latter is actuated at the time of each printing operation and that it will be returned to its normal position by springs $K^2$ as soon as shaft $B^4$ rocks back and allows the link $K^4$ to rise from the position given in broken lines to that given in full lines in Fig. 13. The shaft $L^3$ is operated independently of shaft $B^4$ whenever the answer-printing lever $L^5$ is operated, being connected to said lever by a slotted link $L^6$, pivoted to said arm $J^{13}$, and in these in-

dependent actuations it operates the swinging frame and causes the return of the printing-hammers in the same way as when actuations are received from shaft $B^4$. The end of shaft $B^4$ projects into the hub of arm $J^{13}$, as seen at Fig. 16, so that shaft $L^3$ will be held strictly in line with shaft $B^4$.

The paper-carriage is adapted to receive paper of ordinary letter-sheet width or even wider, and to allow this, as well as to connect the hammer-controlling devices with the selecting mechanism of the machine, I have adopted the following construction:

M is a device which I term a "tailpiece," whose function is similar to that of the elbow-lever $H^5$ of my Patent No. 568,021, as its upper end is provided with a backward projection having an inclined slot M′, corresponding to the slot $H^{12}$ of the patent. The tailpieces in my present construction instead of being operated in the manner set forth in the patent are now operated by their corresponding segment-levers $G^8$ through the medium of foot-pieces $M^2$, attached directly to the segment-levers and having the shape clearly shown at Fig. 2. The tailpieces are pivoted at $M^3$, and each is provided with a retracting-spring $M^4$ and with a projection $M^8$, extending laterally over the horizontal forwardly-extending part of what may be termed the "foot" proper of the corresponding and adjacent foot-piece. The foot-pieces are likewise provided with retracting-springs $M^5$, and the forwardly-extending foot portion of the several foot-pieces is recessed on top, as shown at $M^9$, to receive the projections $M^8$. The forward edge of this recess is inclined, as shown, so that when the foot-piece is actuated by its carrying segment-lever and assumes the position given in broken lines in Fig. 2 the tailpiece will be thereby moved to the position similarly indicated in said figure. In this change of position the projection $M^8$ draws out of recess $M^9$ and rides on the part $M^{10}$ in front of the recess and in so doing holds the tailpiece in its changed position until the foot-piece and segment-lever return to their normal positions. In the position to which the tailpieces are moved, as above described, they engage a cross-bar N, supported in the back limbs of plate $J^9$, already mentioned—that is to say, the top points $M^6$ of the tailpieces are brought against or opposite said bar and the open mouths of the inclined slots M′ are positioned immediately below the bar—so that when shaft $J^{10}$ is rocked by the contact of arms $J^{13}$ and $J^{14}$ said frame will be lowered, so as to carry the bar into the slots. This, by reason of the inclination of the slots, causes a further movement of the upper ends of the tailpieces, which have been actuated, as above set forth, toward the front of the machine and brings their extreme upper ends $M^7$ against the corresponding U-shaped frames O, one of which is clearly shown full size at Fig. 15, and through such frames causes the release of the hammers. These frames O, which I call the "hammer-releasing" frames, which are levers in reality, although not so denominated in my description, are made U-shaped in order that the paper may be passed through them without interfering with their operation in any way, and the paper-guides H and H′ are both positioned between the limbs of the frames, as shown at Fig. 3. One frame is provided for each denomination embraced in the machine, and the series of frames are arranged one above another and transversely of the machine. All are pivoted at their closed end by a common pivot O′, so that at the other end they are adapted to move in lateral directions independently of each other. Each is adapted when thus moved to release one of the hammers by the contact of one of its limbs with the depending leg of the latch, which normally holds the hammer out of action, so that said hammer will be free to print as soon as the hammer-lifting frame K K′ is moved out of the way. In this latch-releasing operation the frames O are operated by the tailpieces, the upper ends $M^7$ of which strike one of the limbs of the frames, as will be understood from Fig. 15, coming against the same at $O^2$. The limbs carrying these surfaces are successively shortened, Fig. 1, so as to insure contact by each frame with its corresponding tailpiece and no others; but each frame is adapted to release not only the latch controlling the hammer of its corresponding denomination, but in addition thereto the latches of all the denominations lower than its own, and to this end the contact-surfaces $O^8$, upon which the duty of throwing the latches out from under the hammers falls, are made of graduated lengths, as will be understood from Fig. 15. Thus the frame shown at said figure operates only a single latch. The one under it operates two latches, the next one three latches, and so on through the series. By thus adapting each of the frames O to release the hammers of all denominations below its own denomination I do not interfere in any way with the printing at the same time of digits in the columns of lower denominations, but I insure the printing of all the zeros which may occur in the numbers tabulated, it being understood that the type-segments are normally positioned with the zero-type at the printing-line, so that all will print a zero if the hammers are allowed to fall against them by the frame K K′. The frames O are returned to their normal positions by the latches G′ acting under the power of their returning-springs $G^4$. The frames are open at one end, and thus the machine is adapted to take in paper of any desired width.

The upper part P of the frame or box of the machine in which many of the parts above described are supported is pivoted at the ends on pivots P′ P′, Figs. 1 and 13, and is swung on said pivots at each operation by the answer-printing lever $L^5$ through the medium of a bar $P^2$, rigidly attached to the part P at $P^3$

and held to lever $L^5$ by the pins $P^4$ $P^4$, located upon opposite sides of the bar. This construction causes a slight lifting of the forward part of the box P at each actuation of said answer-lever.

A roll of continuous or ribbon paper is shown at S, supported on the shaft S', and the machine can be used with it as well as with the wide sheets. When tabulating on the narrow paper, no change is made in the machine, but as the paper-carriage does not then require to be shifted nor the paper to be returned to its starting position the operator does not actuate the mechanisms for performing these operations.

In order to adapt the machine to use with the narrow or ribbon paper, the guide $H^3$ is cut out at the center, as seen at Fig. 14, leaving upstanding wings R R at each side of the center. The bottom or lowest edge of the cut portion is adapted to serve as a tearing edge in severing the narrow paper, while the wings serve to support the wide paper. The proximate edges of the wings recede from each other, as shown, each being cut at an angle of about fifty degrees, which angle I find to be desirable, because when the edge of the wide paper comes against the angling edge of the guide the latter acts to deflect the paper upward to its proper position.

The lower bar of the paper-carriage is preferably supported upon horizontal rollers T and guided by vertical rollers T'.

I claim—

1. The tabulating-machine, having its hammers and hammer-controlling mechanism located as shown, and the latter being constructed to allow the paper to enter through it, and also having its paper-feed rolls below the printing-center and means for directing the paper thereto, substantially as specified.

2. In a tabulating-machine, a printing mechanism embracing a series of open frames for transmitting motion from one part to another of said mechanism, in combination with paper-guides positioned in the openings in said frames and forming the path whereby the paper enters the machine, substantially as specified.

3. In a tabulating-machine, the combination of the series of open-ended frames O, with paper-guides directing the entering paper through the frames, feed-rolls for actuating the paper, and a laterally-movable carriage in which said rolls are supported, substantially as specified.

4. In a tabulating-machine, a printing mechanism embracing a series of U-shaped movable frames for transmitting motion from one part to another of said mechanism arranged to permit the passage of the paper through them without interfering with their operation, substantially as specified.

5. In a tabulating-machine, a printing mechanism embracing a series of spring-actuated hammers and their holding devices, selecting mechanism for selecting the hammers to be operated, and a series of open frames connecting said holding devices and said selecting mechanism, substantially as and for the purpose set forth.

6. In a tabulating-machine, the combination with the devices for making the impressions, of means for selecting the devices to be operated, and a series of graduated motion-transmitting levers O whereby said selecting means may cause the operation of the desired impressing devices, substantially as specified.

7. In a tabulating-machine, the combination with the devices for making the impressions, of means for selecting the devices to be operated, and a series of graduated motion-transmitting levers O, pivoted at one end and movable at the other end, whereby the selecting means may cause the operation of the desired impressing devices, substantially as specified.

8. In a tabulating-machine, the combination with the devices for making the impressions, of means for selecting the devices to be operated, and a series of graduated independent motion-transmitting levers O arranged in a pile, as set forth, whereby said selecting means may cause the operation of the desired impressing devices, substantially as specified.

9. The combination in a tabulating-machine with the feed-rolls for moving the paper vertically in line-spacing, and means for actuating said rolls in such movements, of a hand device geared to and adapted to impart a backward rotation to the rolls and thereby to return the paper to its starting position, substantially as specified.

10. The combination in a tabulating-machine with the laterally-movable paper-carriage, and feed-rolls for moving the paper vertically in line-spacing, and means for actuating said rolls in such movements, of a hand device geared to and adapted to impart a backward rotation to the rolls and thereby to return the paper to its starting position, substantially as specified.

11. The combination in a tabulating-machine with the feed-rolls for moving the paper vertically in line-spacing, and means for actuating the rolls in such movements, of gearing actuated in unison with the rolls and adapted to impart a backward rotation thereto, and a hand-lever for actuating said gearing and causing it to give such backward rotation to the rolls, substantially as specified.

12. The combination in a tabulating-machine with the feed-rolls for moving the paper vertically in line-spacing, and means for actuating the rolls in such movements, of a train of gears actuated in unison with the feed-rolls and adapted to impart reverse rotation thereto, a toothed segment actuated by said gears, and a hand-lever adapted to actuate said segment and gears in rotating the rolls reversely, substantially as specified.

13. The combination in a tabulating-machine with feed-rolls for moving the paper

vertically in line-spacing, and means for actuating the rolls in such movements, of gearing including a segment $C^6$ moving in unison with the rolls and loose on its shaft, and a lever fast on the shaft of the segment and provided with means whereby it may lock with and actuate the segment and thereby cause a backward rotation of the rolls, substantially as specified.

14. The combination with a laterally-movable paper-carriage and the feed-rolls for moving the paper vertically in line-spacing, of a stationarily-located ratchet mounted on and actuating a shaft whereby said rolls are rotated, a gear also stationarily located and adapted to actuate said shaft, and hand-operated means whereby said gear may be reversed and made to rotate the rolls backward, substantially as specified.

15. The combination with the laterally-movable paper-carriage and the feed-rolls for actuating the paper in line-spacing, of a stationarily-located ratchet and a stationarily-located gear both mounted on a shaft by which power is carried to said feed-rolls, and both adapted to actuate the shaft, and hand-operated means engaging said gear and acting to reverse the rolls to the extent of the aggregate feeding rotations received from the ratchet, whereby the paper is returned to position for starting another column, substantially as specified.

16. In a tabulating-machine, the combination with the feed-rolls for feeding the paper vertically in line-spacing, of a toothed segment mechanically connected to the rolls so it will be moved away from its normal position by the feeding movements, and also so as to enable it to impart a backward rotation to the rolls, and means for returning said segment to its normal position upon the completion of a column and thereby causing the backward rotation of the rolls, substantially as specified.

17. The combination with a single hand-lever, of a paper-carriage, means whereby said lever may shift the carriage laterally in column-spacing, and means whereby said lever may impart a backward rotation to the paper-feed rolls and thus return the paper vertically to its starting position at the time of shifting the carriage, substantially as specified.

18. The combination with a paper-carriage of a single hand-lever, means whereby said lever may shift the carriage in column-spacing and means whereby it may at the time of shifting the carriage cause backward rotation of paper-feed rolls and thus return the paper vertically to its starting position, said lever having a uniform stroke regardless of the length of the columns tabulated, substantially as specified.

19. The combination in a tabulating-machine, of paper-feed rolls for feeding the paper in line-spacing, said rolls being provided with means for operating them by hand in adjusting the paper, means for reversing said rolls and returning the paper to its starting position, and a clutch connecting said rolls with said reversing means and located so as to be readily operable by the same hand which turns the rolls to adjust the paper, substantially as specified.

20. The combination of the line-spacing feed mechanism, and the paper-returning mechanism, the latter embracing separable pinions $C^2$ and $C^3$, substantially as specified.

21. The combination with mechanism adapted to feed either continuous or short paper, of mechanism for returning the paper to its starting-point, the latter being connected to the former by separable pinions, one of which is provided with a hub extending through the case of the machine so as to be operable from the outside, substantially as specified.

22. The combination with the frame for returning the printing-hammers to their normal positions after each printing operation, of the shafts $B^4$ and $L^3$ provided with engaging projections whereby the latter must turn with the former and is also capable of independent movement, and connections between said shaft $L^3$ and said frame, substantially as specified.

23. The combination with the frame for returning the printing-hammers to their normal positions after each printing operation of shaft $B^4$ actuated with the printing mechanism at the time of the ordinary tabulating operations, a shaft $L^3$ arranged in line with shaft $B^4$ and having a projection engaged by a projection on said shaft $B^4$ and turning with the same and also capable of turning independently when actuated by the answer-printing lever, and connections between shaft $L^3$ and said frame, substantially as specified.

24. The tabulating-machine provided with feeding mechanism adapted to feed either short lengths of paper or continuous paper, and also provided with mechanism for returning the paper to its starting position, said last-named mechanism being detachably connected to said feeding mechanism, substantially as specified.

25. The tabulating-machine adapted to be used with either wide or narrow paper, having a paper-guide $H^3$ cut out at the center and with wings R R at either side of the cut-out portion, the proximate edges of the wings being cut at an angle adapted to deflect the wide sheets upward, substantially as specified.

DORR E. FELT.

Witnesses:
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L. E. CURTIS.