No. 679,479. Patented July 30, 1901.

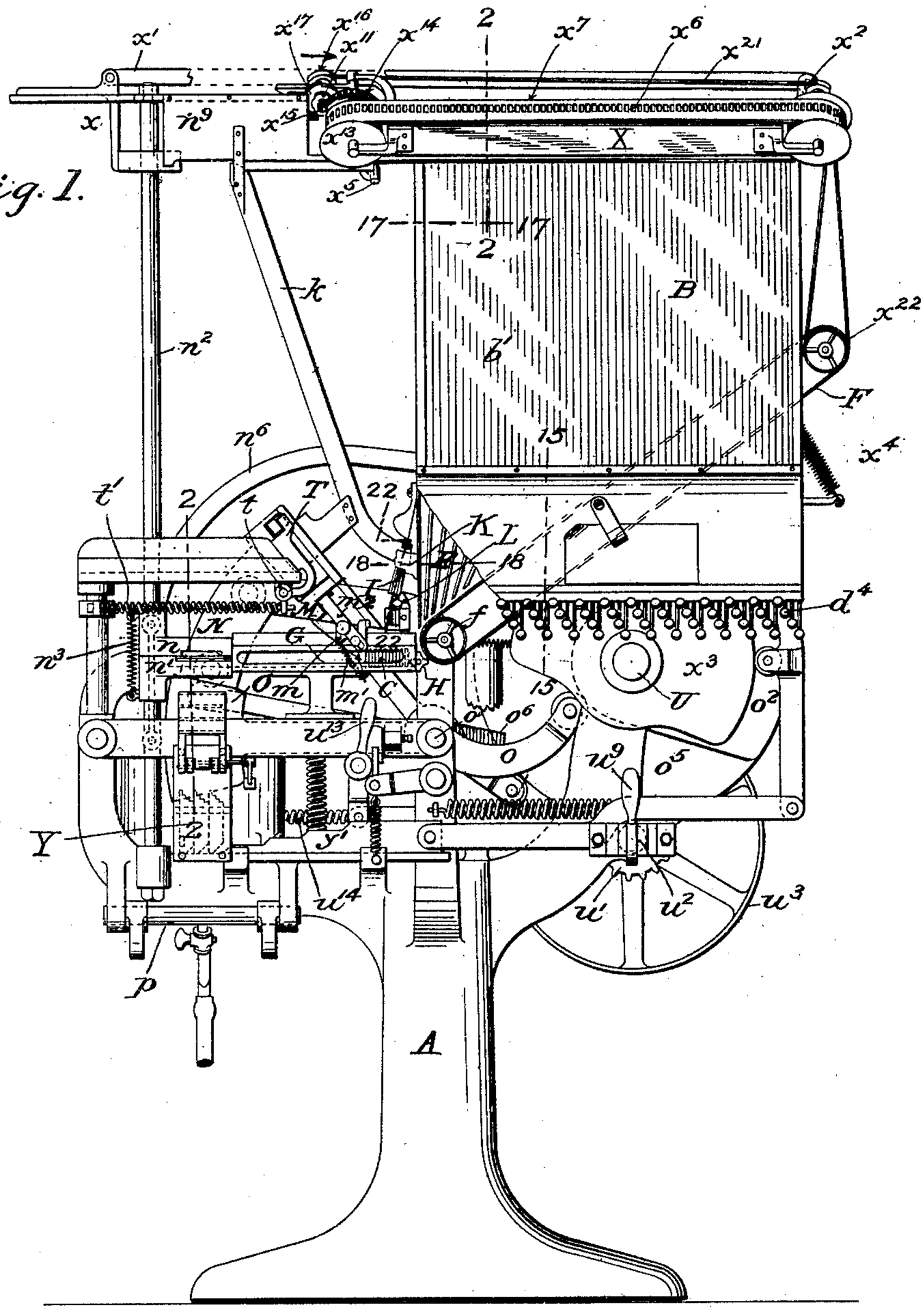
C. MUEHLEISEN.

LINOTYPE MACHINE.

(Application filed Dec. 28, 1900.)

(No Model.) 12 Sheets—Sheet 1.

Fig. 1.



Witnesses
N. R. Kennedy
F. L. Elmore

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Philip T. Dodge

No. 679,479. Patented July 30, 1901.

C. MUEHLEISEN.

LINOTYPE MACHINE.

(Application filed Dec. 28, 1900.)

(No Model.) 12 Sheets—Sheet 2.

Fig. 1.[a]

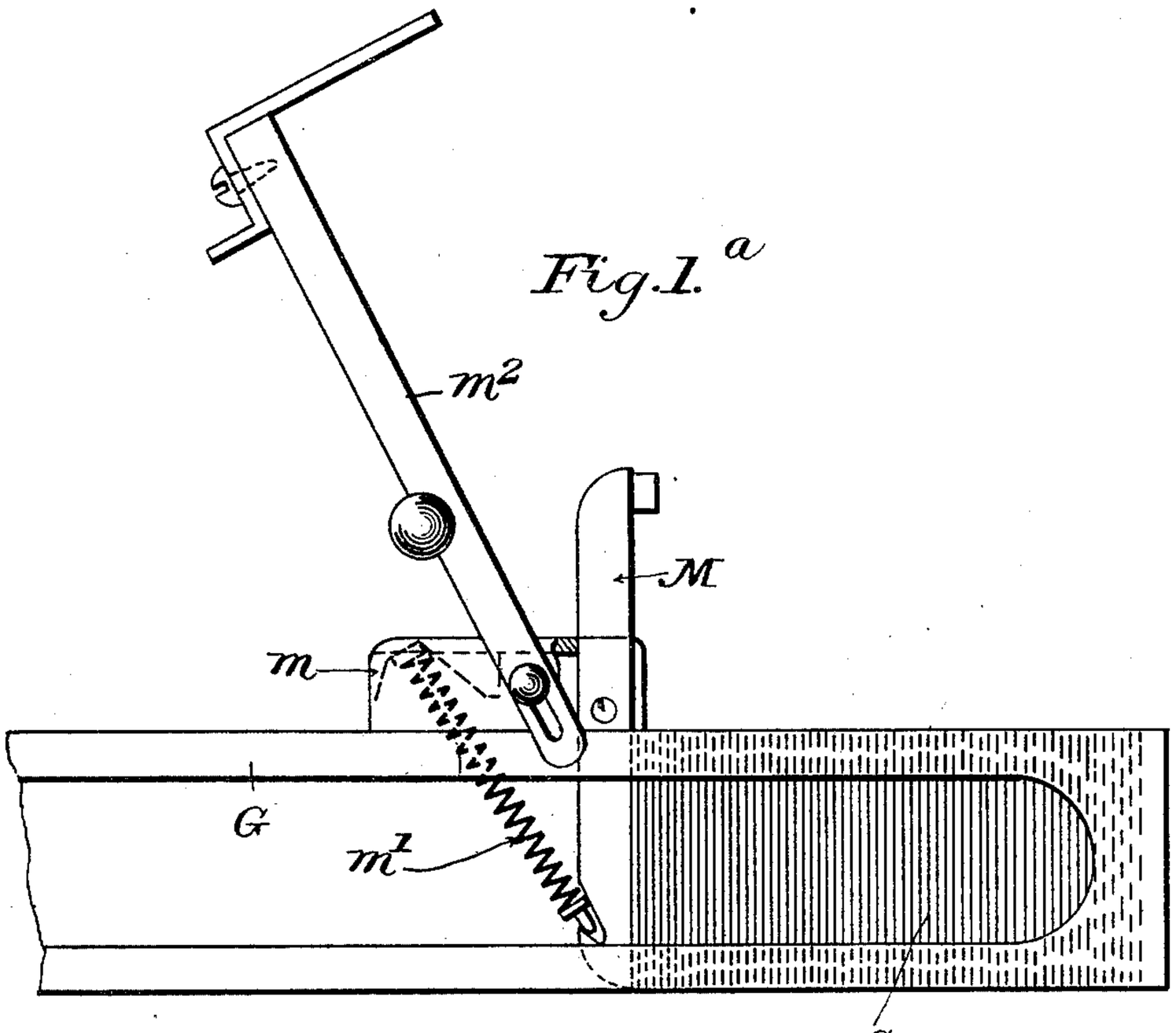
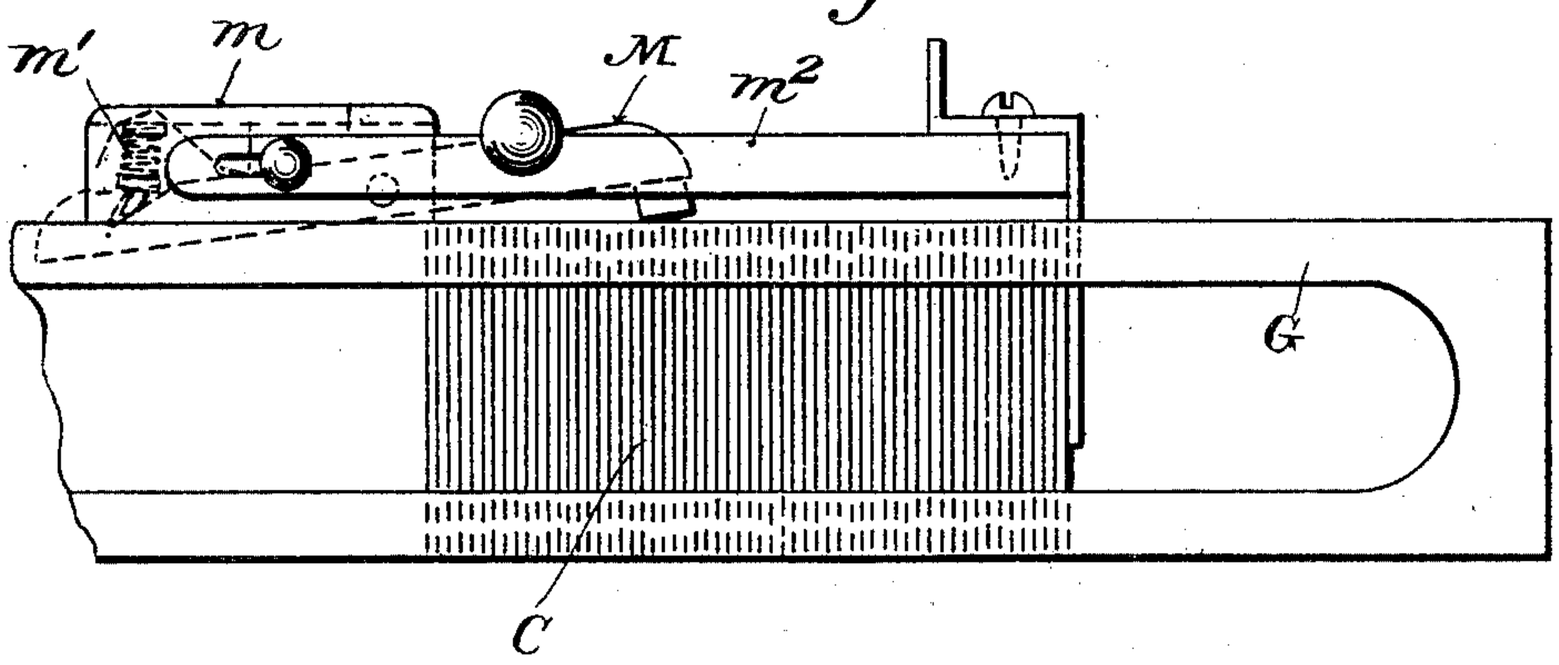


Fig. 1.[b]



Witnesses
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No. 679,479. Patented July 30, 1901.

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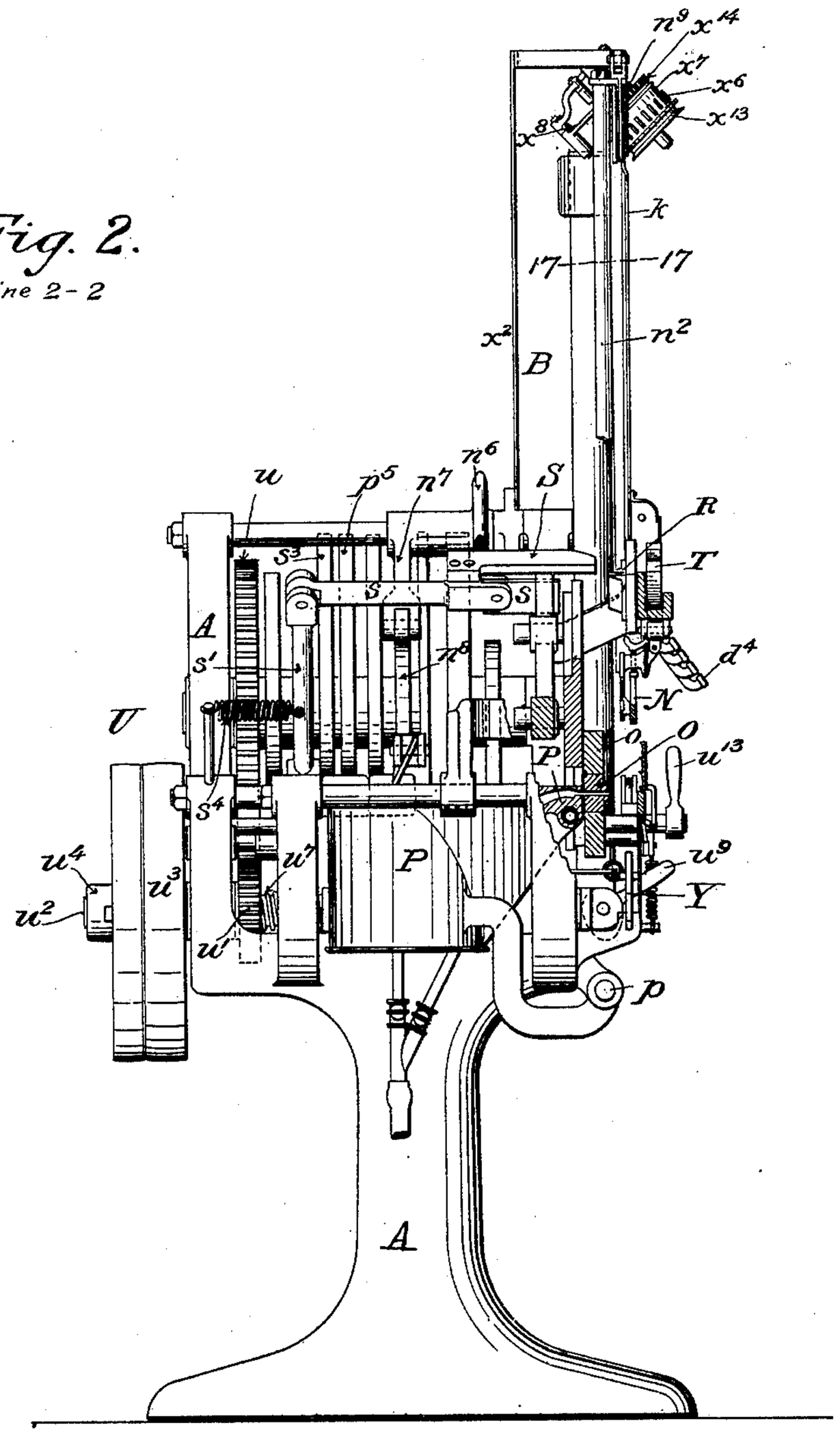
LINOTYPE MACHINE.

(Application filed Dec. 28, 1900.)

(No Model.) 12 Sheets—Sheet 3.

Fig. 2.

on line 2-2



Witnesses
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No. 679,479. Patented July 30, 1901.

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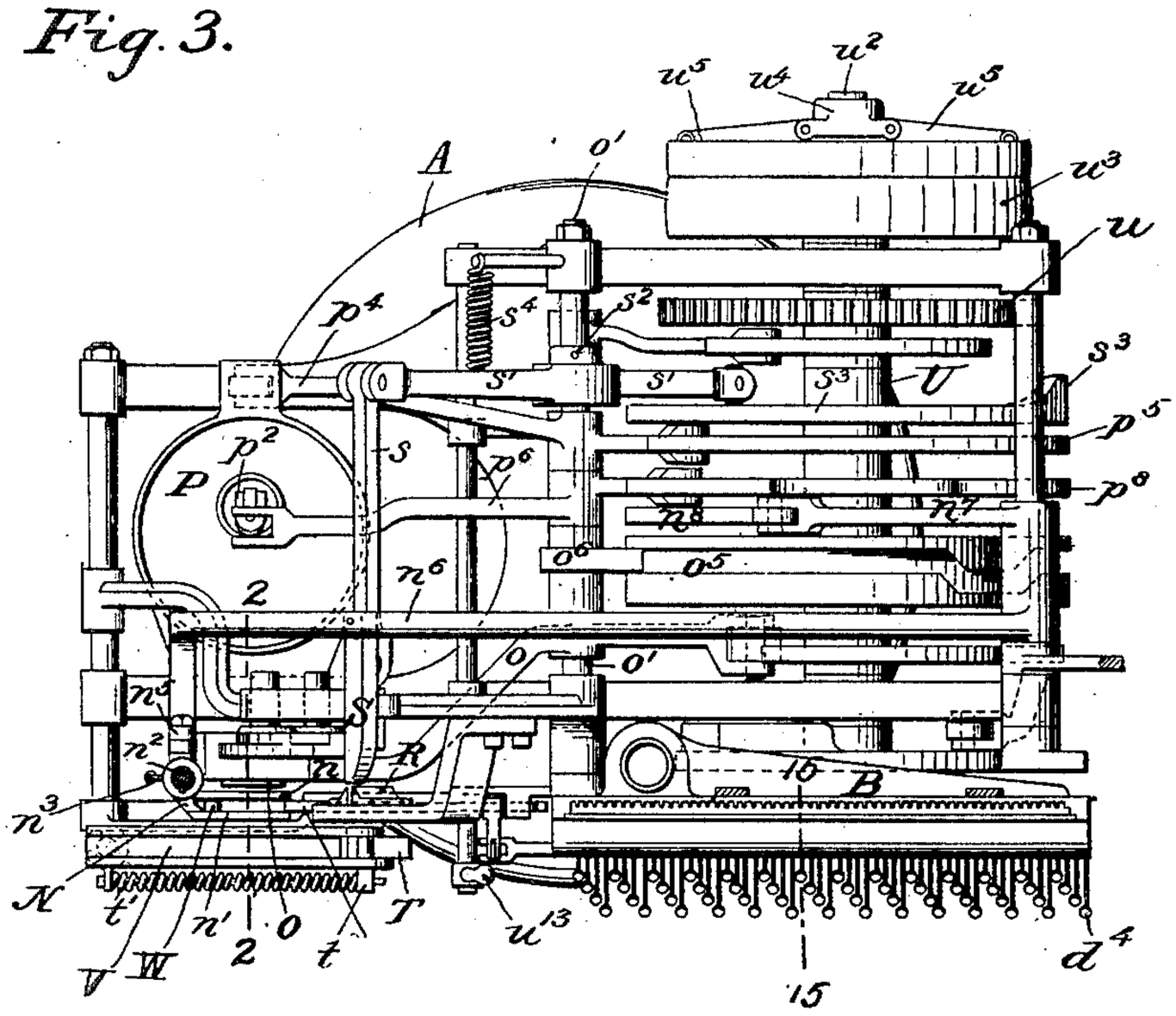
LINOTYPE MACHINE.

(Application filed Dec. 28, 1900.)

(No Model.) 12 Sheets—Sheet 4.

Fig. 3.



Witnesses
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No. 679,479. Patented July 30, 1901.

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LINOTYPE MACHINE.

(Application filed Dec. 28, 1900.)

(No Model.) 12 Sheets—Sheet 5.

Fig. 4.

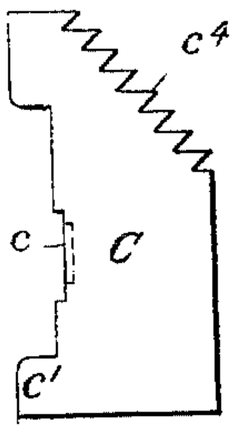


Fig. 5.

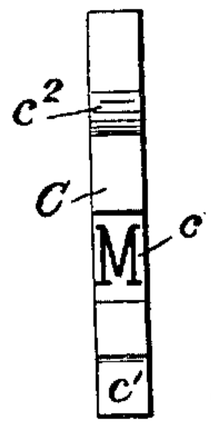


Fig. 6.

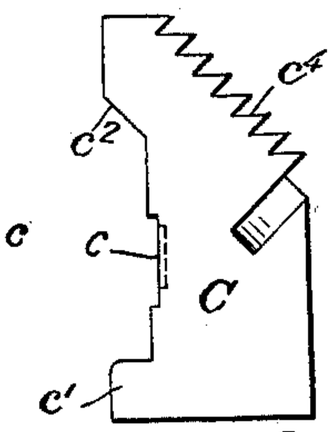


Fig. 7.

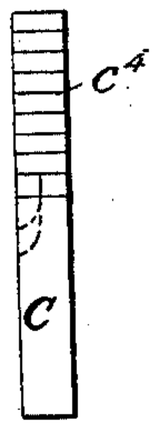


Fig. 8.

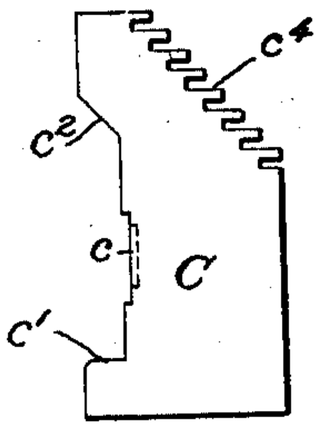


Fig. 9.

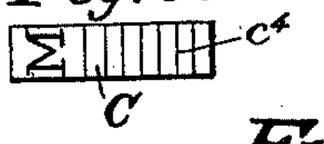


Fig. 10.

on line 2-2

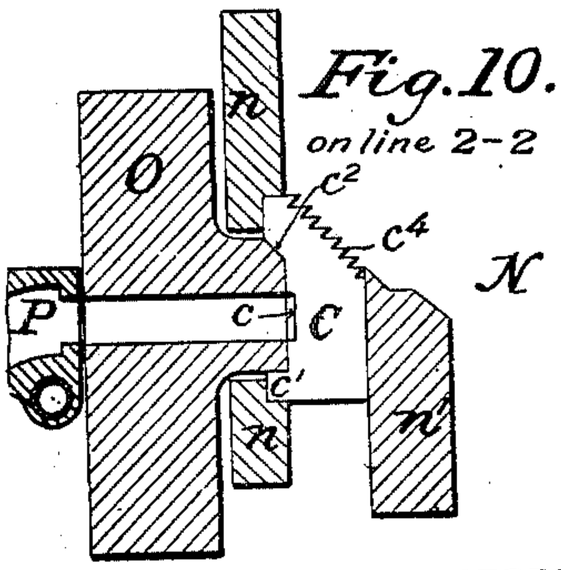


Fig. 12.

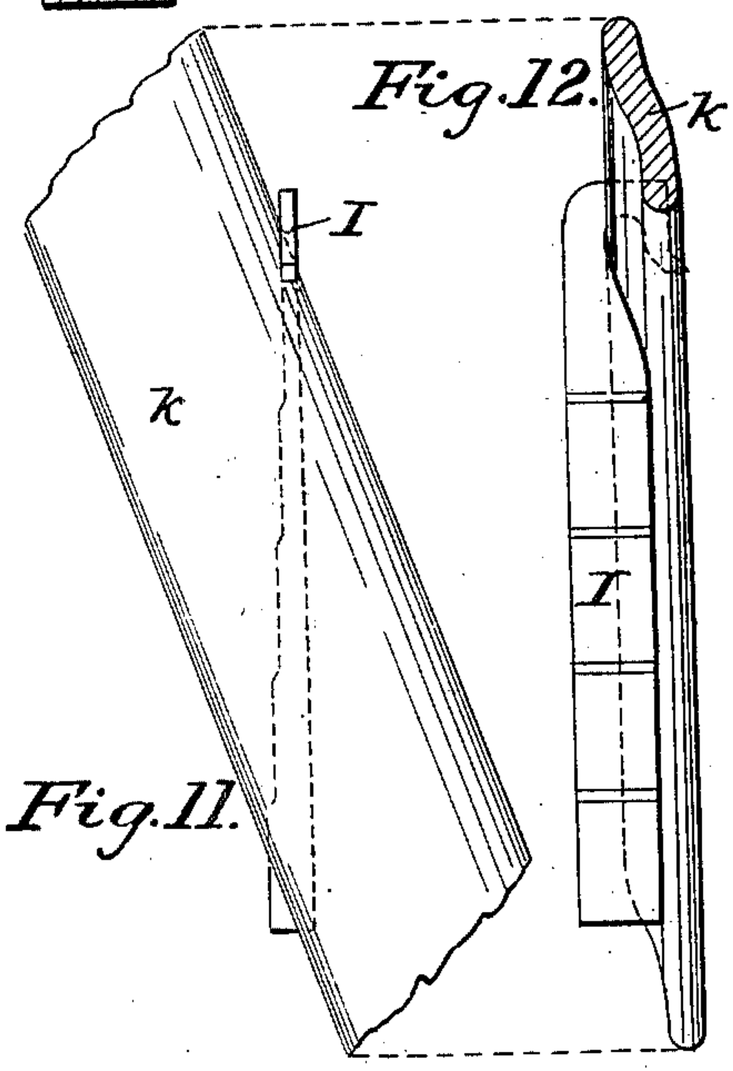


Fig. 11.

Fig. 13.

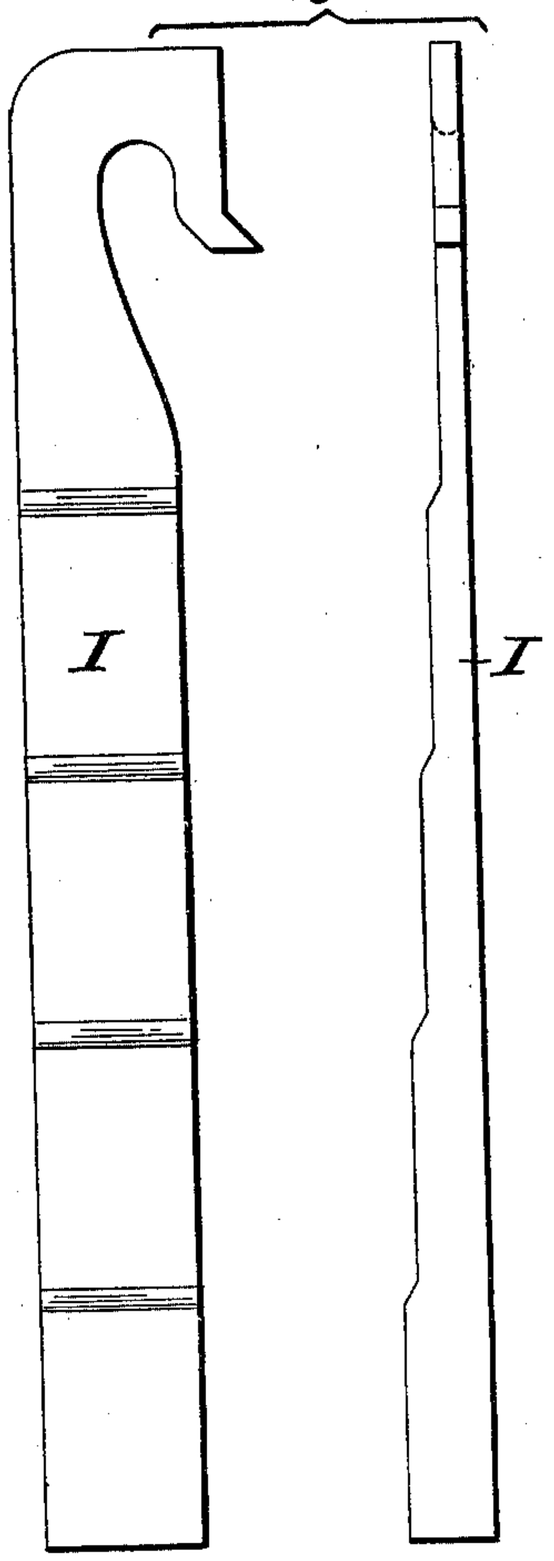
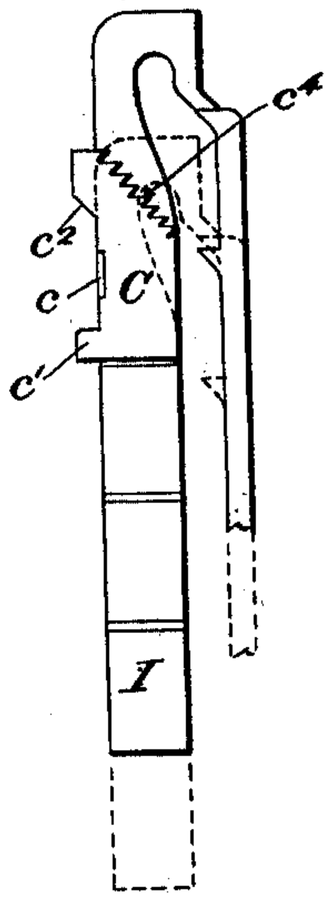


Fig. 14.



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No. 679,479. Patented July 30, 1901.

C. MUEHLEISEN.

LINOTYPE MACHINE.

(Application filed Dec. 28, 1900.)

(No Model.) 12 Sheets—Sheet 6.

Fig. 17.
on line 17-17

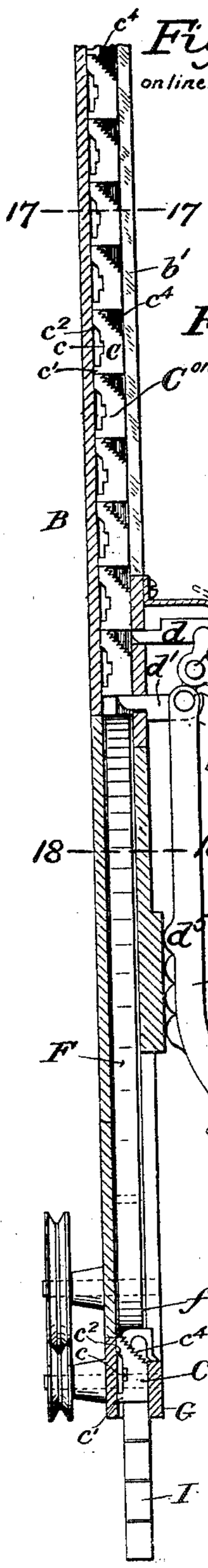


Fig. 15.
on line 15-15

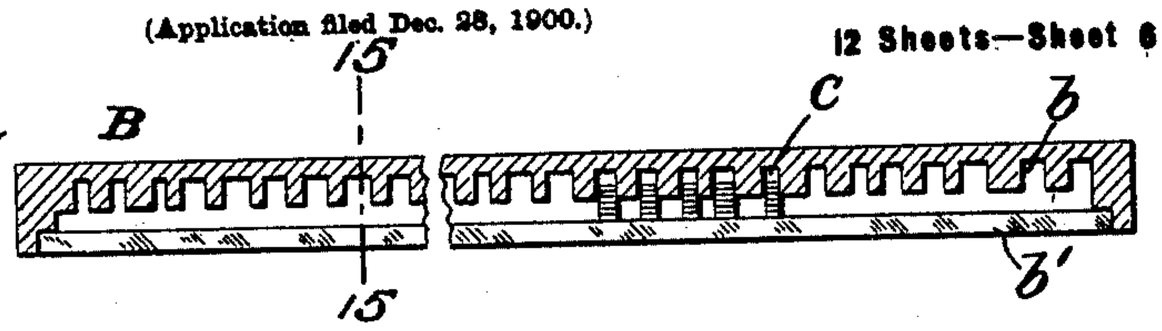


Fig. 18.
on line 18-18

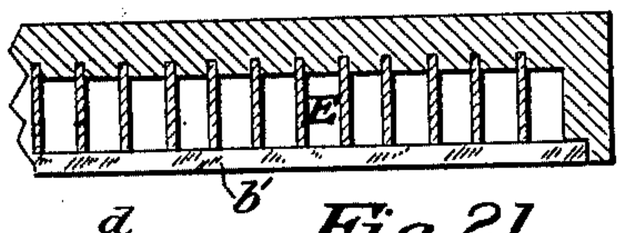


Fig. 21.

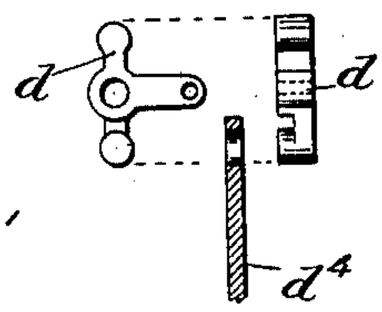


Fig. 19.

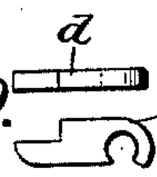


Fig. 20.

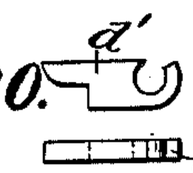


Fig. 16.

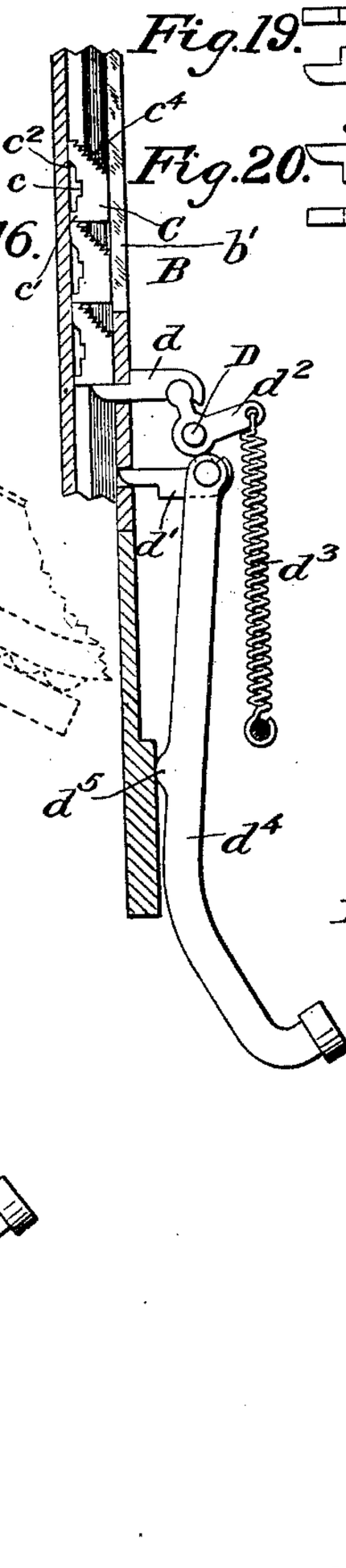
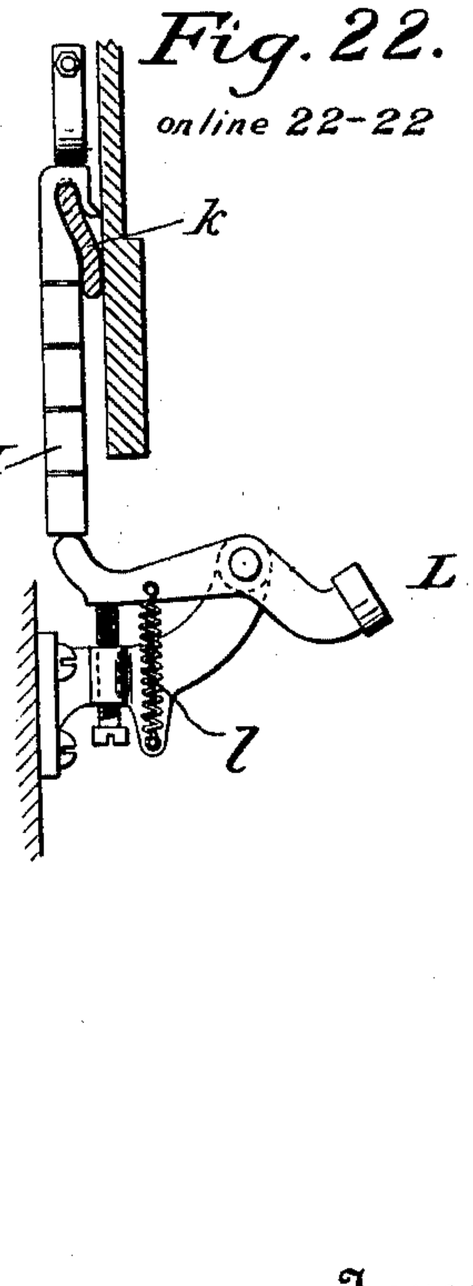


Fig. 22.
on line 22-22



Witnesses
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No. 679,479. Patented July 30, 1901.

C. MUEHLEISEN.

LINOTYPE MACHINE.

(Application filed Dec. 28, 1900.)

(No Model.) 12 Sheets—Sheet 7.

Fig. 25.

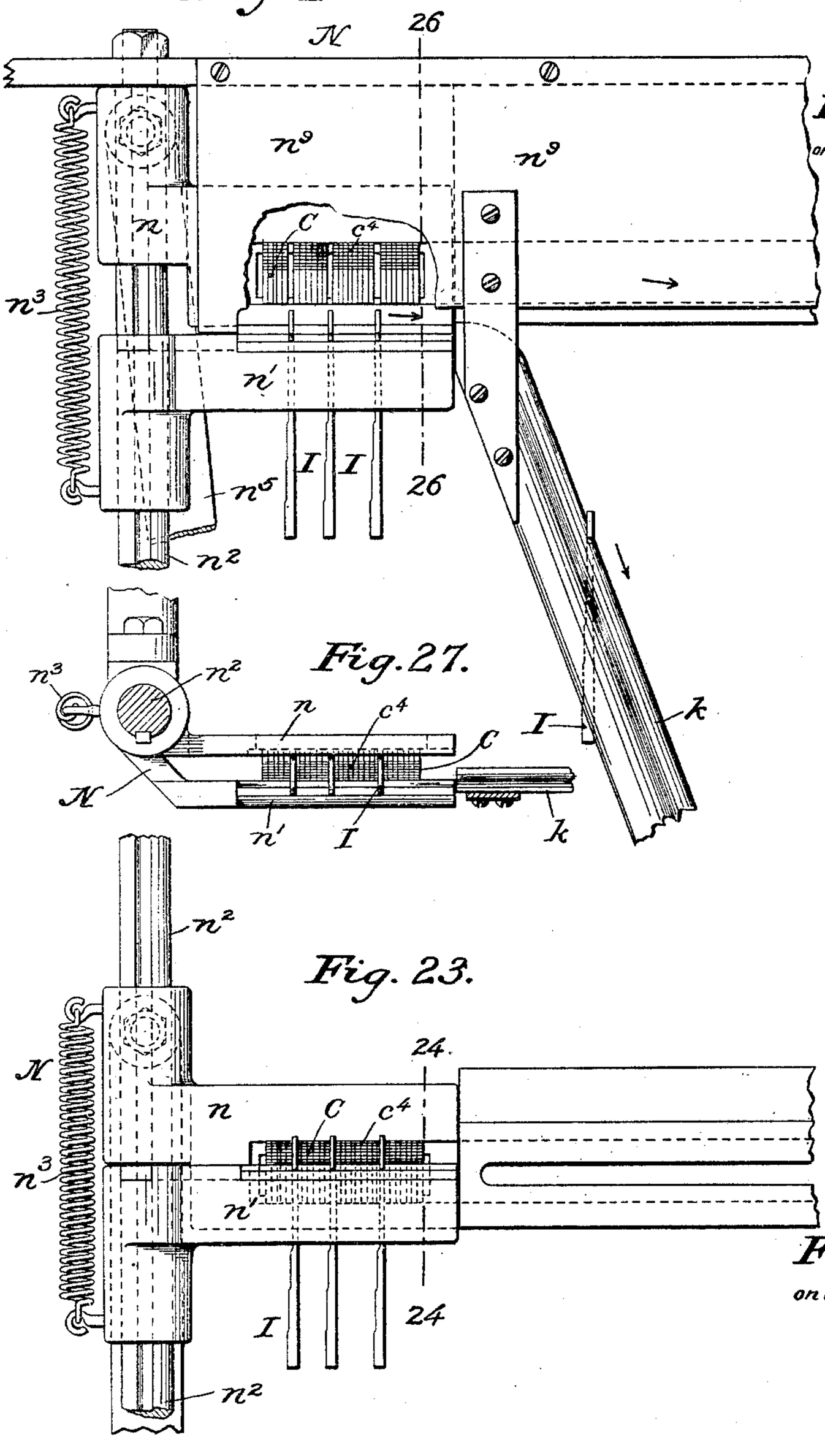


Fig. 26.
on line 26-26

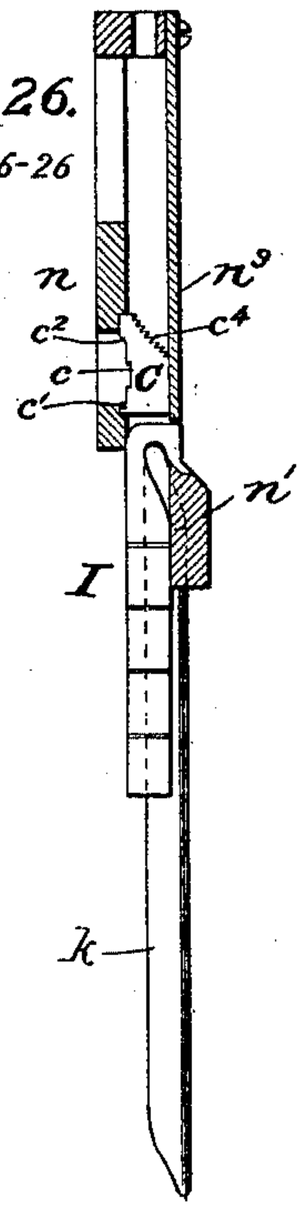
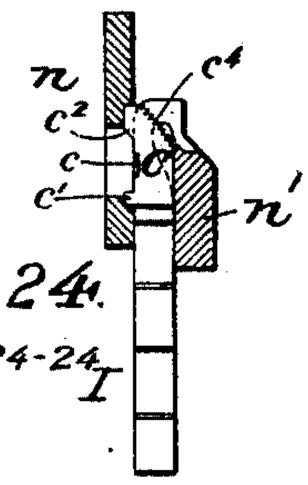


Fig. 27.

Fig. 23.

Fig. 24.
on line 24-24



Witnesses
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No. 679,479. Patented July 30, 1901.

C. MUEHLEISEN.

LINOTYPE MACHINE.

(Application filed Dec. 28, 1900.)

(No Model.) 12 Sheets—Sheet 8.

Fig. 29.

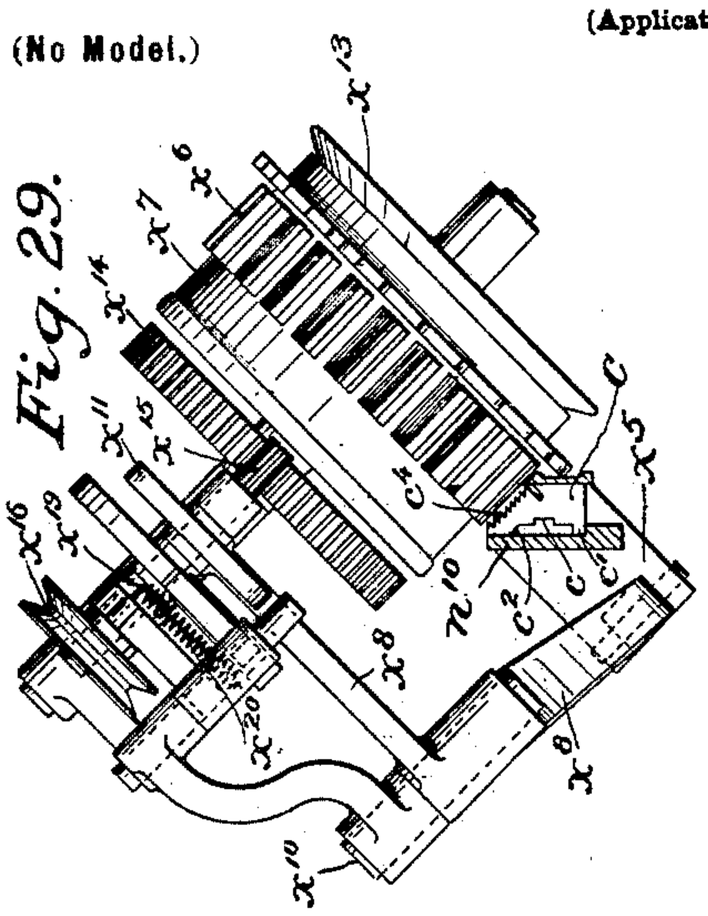


Fig. 32.

on line 32-32

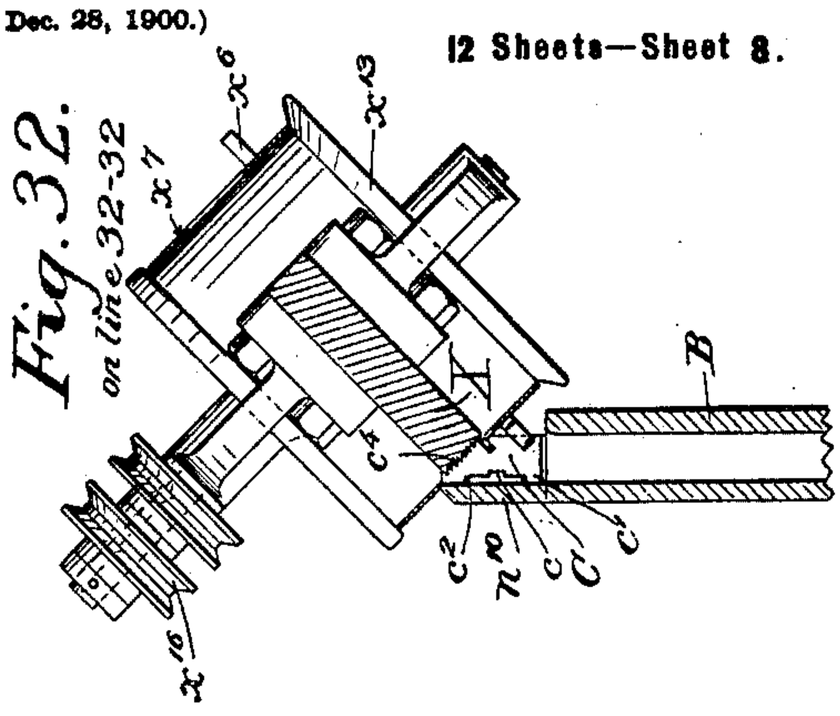


Fig. 28.

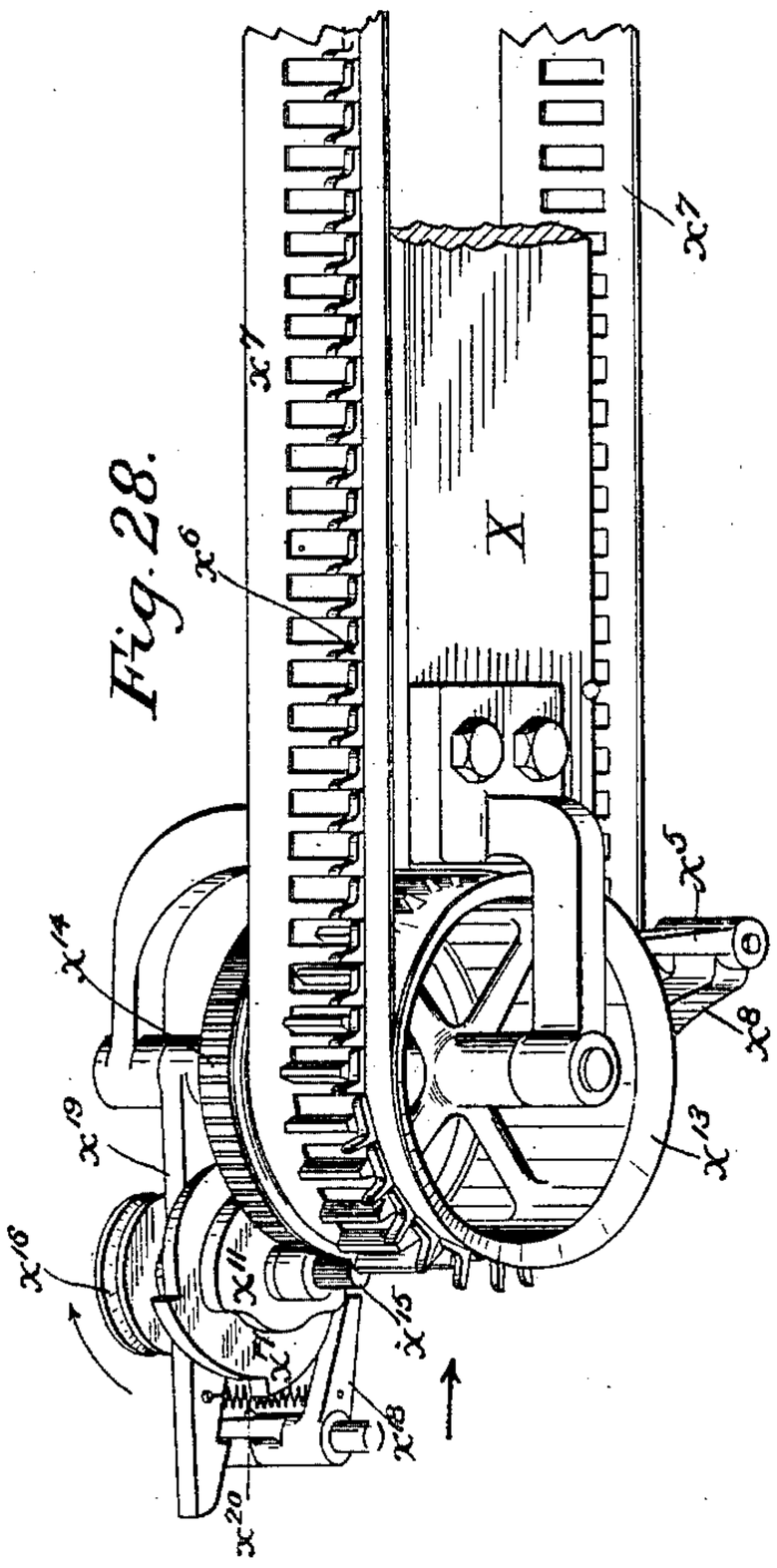


Fig. 31.

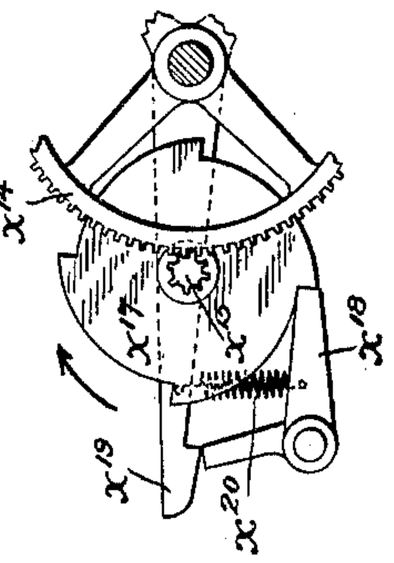
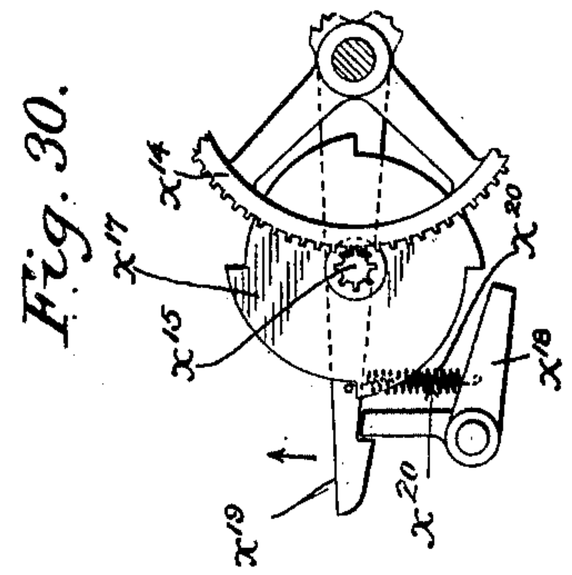


Fig. 30.



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No. 679,479. Patented July 30, 1901.

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LINOTYPE MACHINE.

(Application filed Dec. 28, 1900.)

(No Model.) 12 Sheets—Sheet 9.

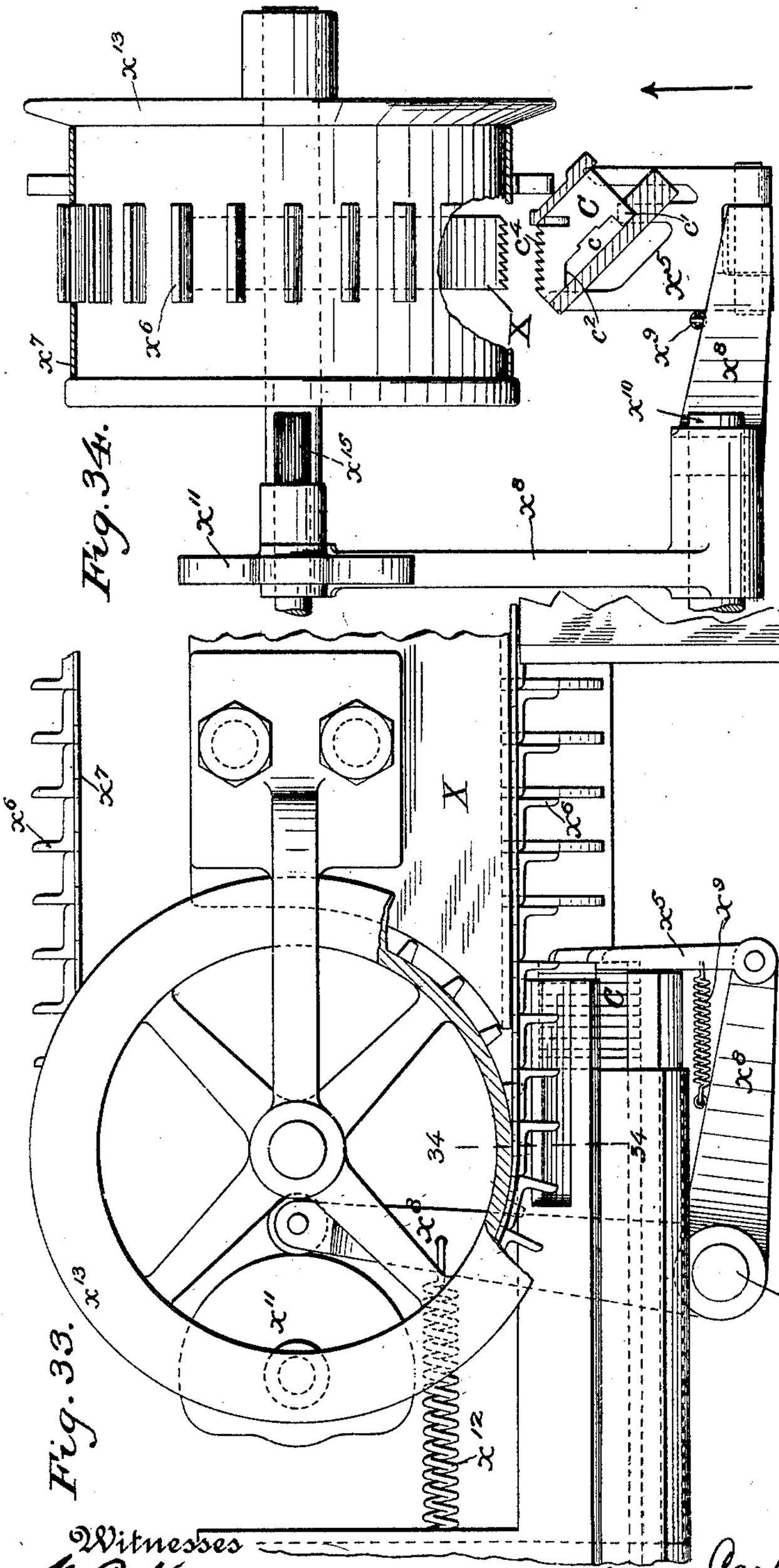

Fig. 34.

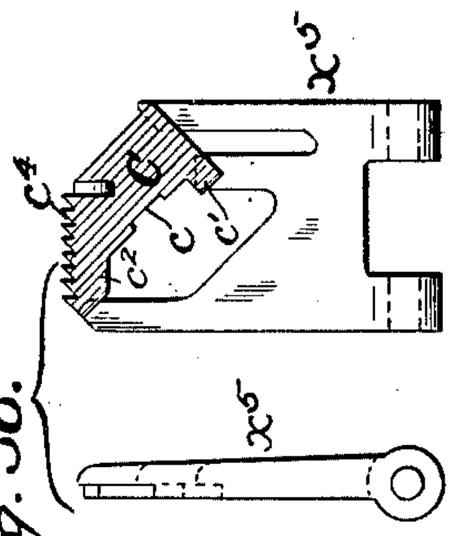

Fig. 36.

Fig. 33.

Fig. 35.

Witnesses
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No. 679,479. Patented July 30, 1901.

C. MUEHLEISEN.

LINOTYPE MACHINE.

(Application filed Dec. 28, 1900.)

(No Model.) 12 Sheets—Sheet 10.

Fig. 37.

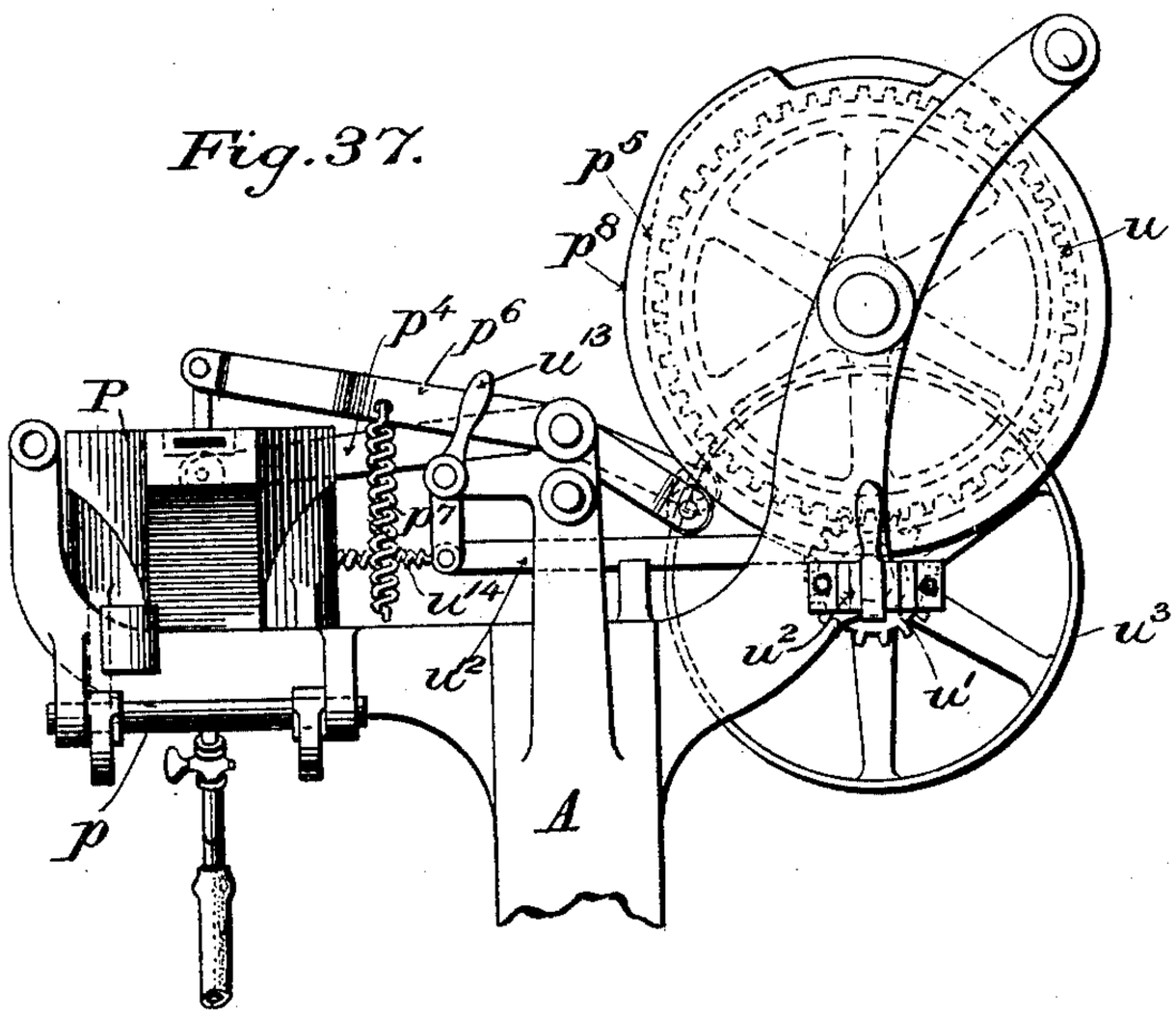
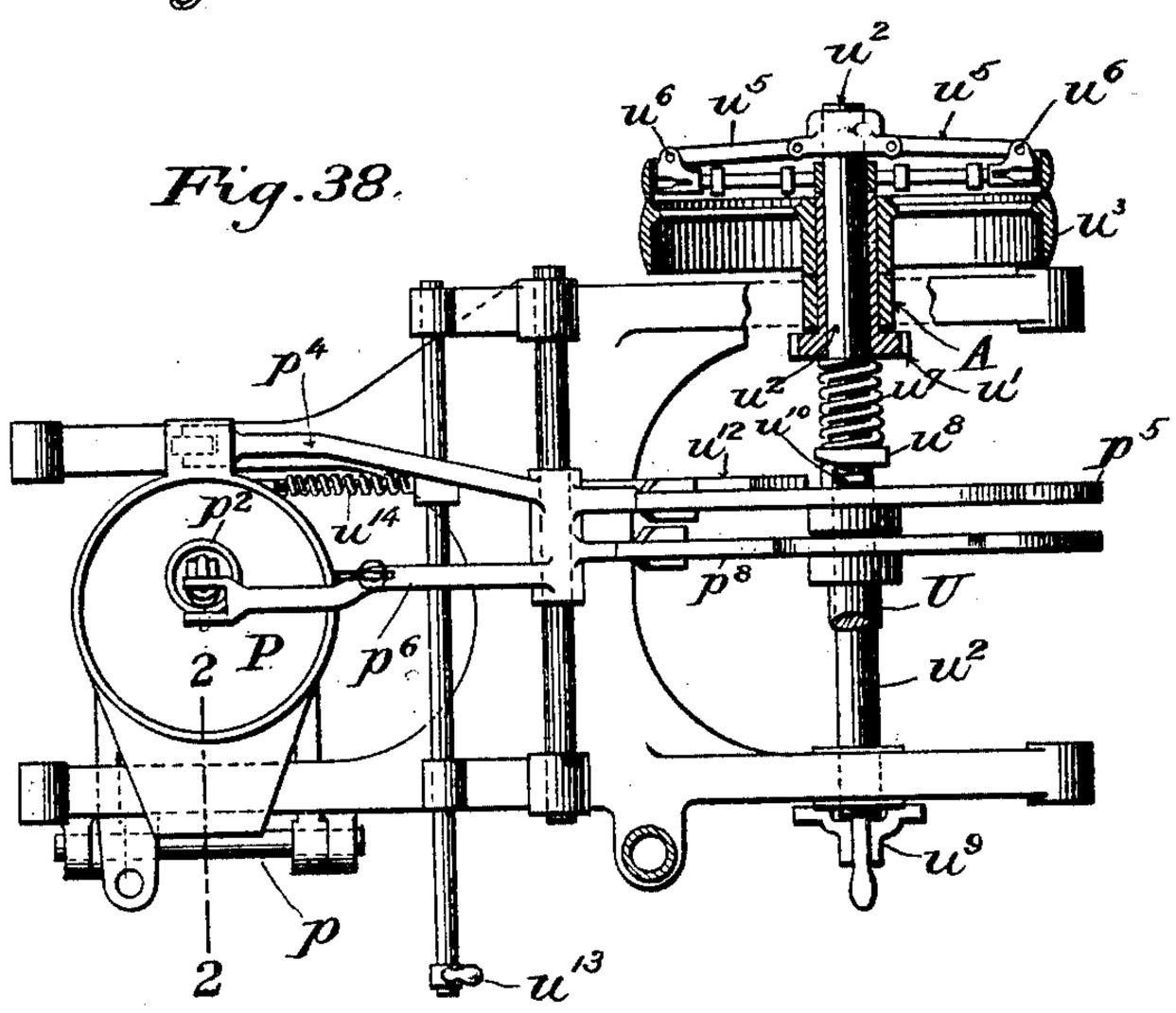


Fig. 38.



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No. 679,479. Patented July 30, 1901.

C. MUEHLEISEN.

LINOTYPE MACHINE.

(Application filed Dec. 28, 1900.)

(No Model.) 12 Sheets—Sheet 11.

Fig. 39.

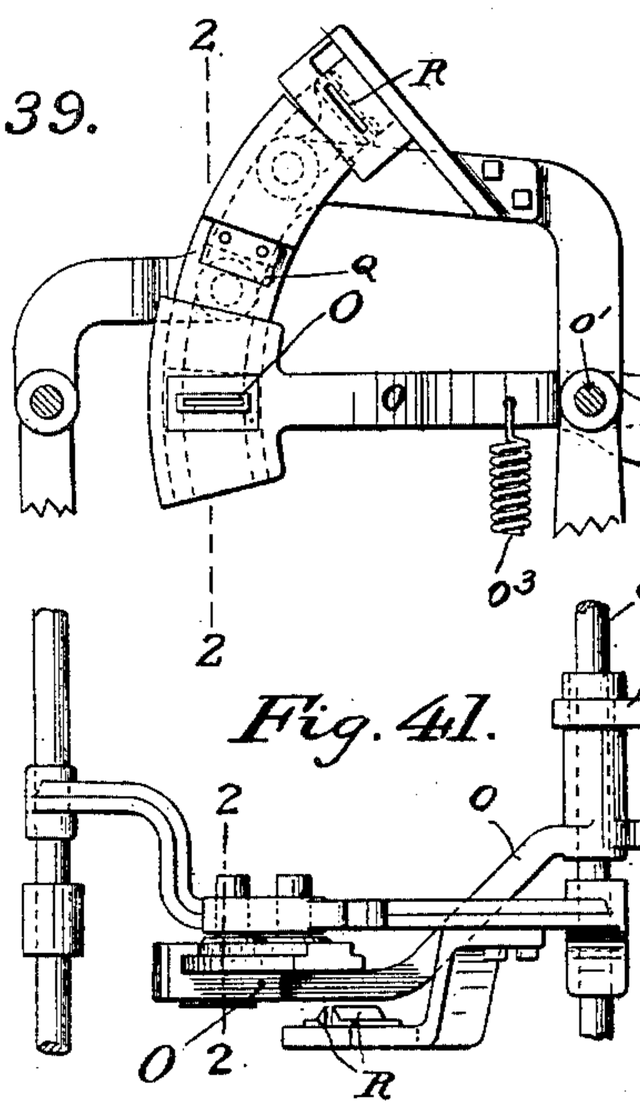


Fig. 40.

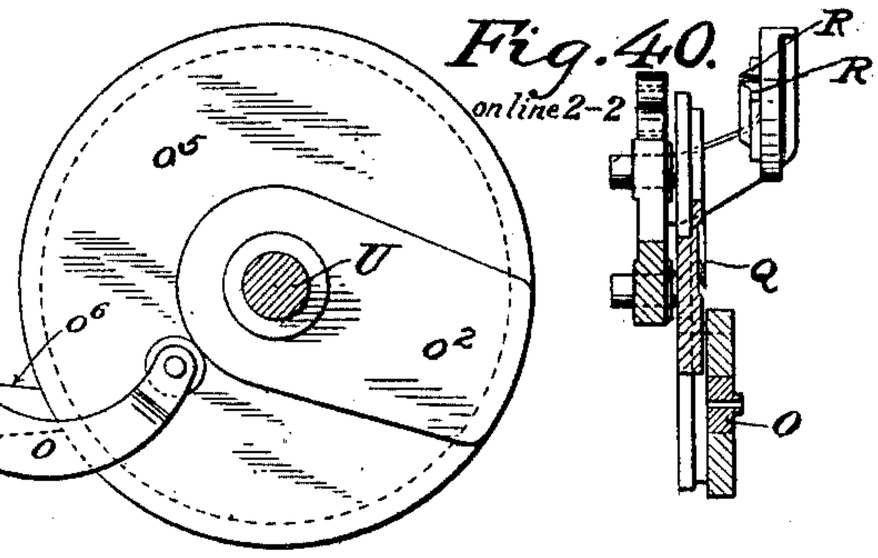


Fig. 41.

Fig. 42.

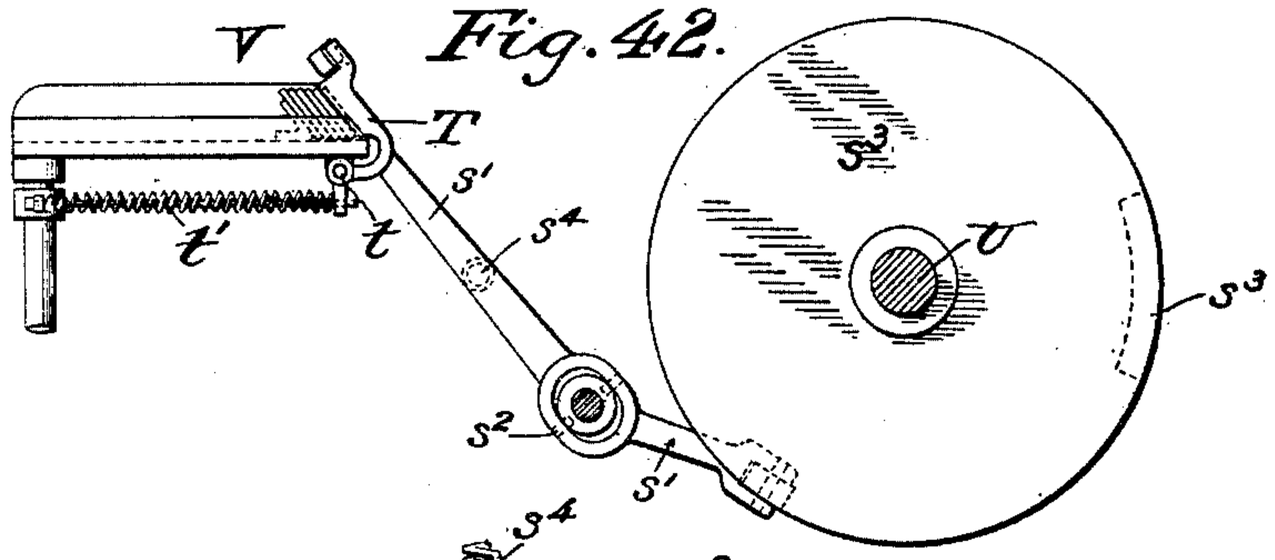
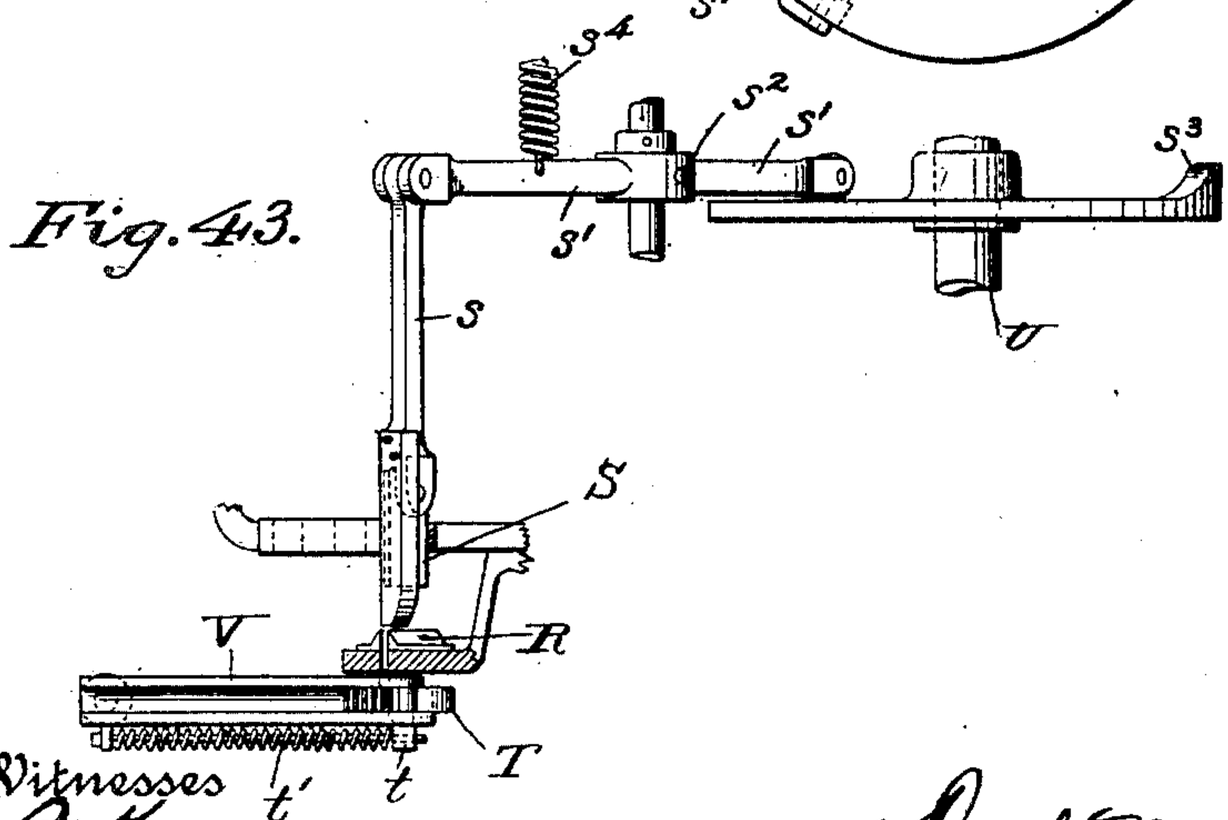


Fig. 43.



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F. D. Elmore

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Philip T. Dodge

No. 679,479. Patented July 30, 1901.

C. MUEHLEISEN.

LINOTYPE MACHINE.

(Application filed Dec. 28, 1900.)

(No Model.) 12 Sheets—Sheet 12.

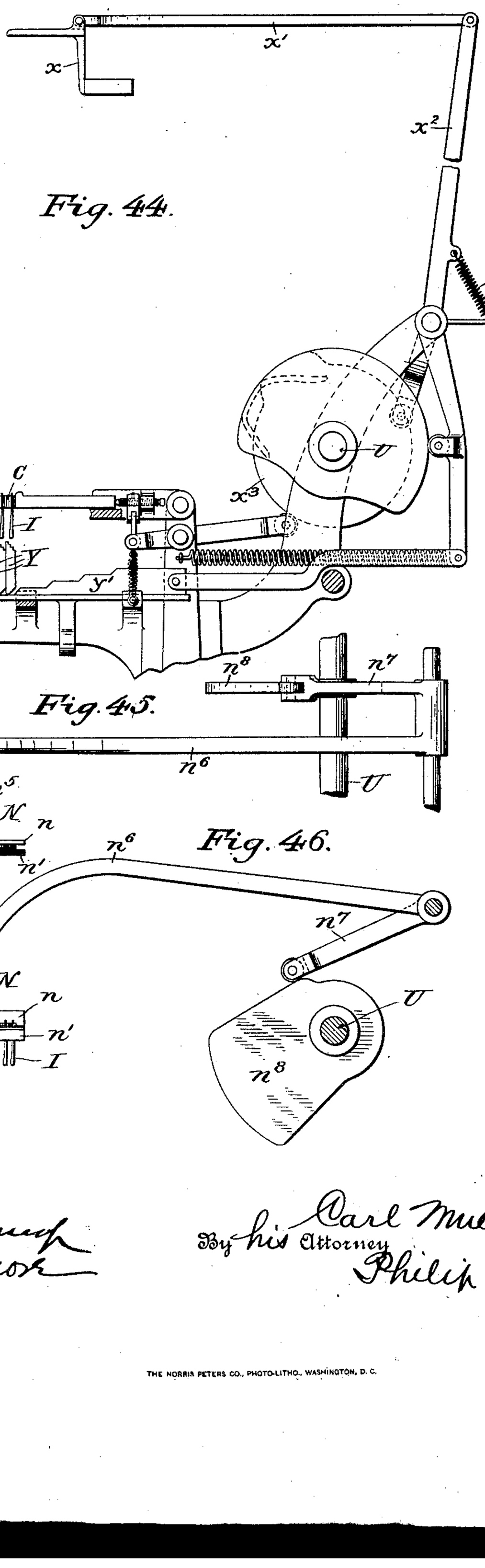

Fig. 44.

Fig. 45.

Fig. 46.

Witnesses
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Inventor
Carl Muehleisen
By his Attorney
Philip T. Dodge

UNITED STATES PATENT OFFICE.

CARL MUEHLEISEN, OF BERLIN, GERMANY, ASSIGNOR TO THE MERGENTHALER LINOTYPE CO., OF NEW YORK.

LINOTYPE-MACHINE.

SPECIFICATION forming part of Letters Patent No. 679,479, dated July 30, 1901.

Application filed December 28, 1900. Serial No. 41,384. (No model.)

To all whom it may concern:

Be it known that I, CARL MUEHLEISEN, residing at Berlin, Germany, have invented a new and useful Improvement in Linotype-Machines, of which the following is a specification.

My invention has reference to linotype-machines in which metal matrices containing letters or other characters are held in storage in a magazine, from which they are released in the required order by finger-keys and thereafter assembled in line with spacing or justifying devices, the composed lines thereafter presented to the edge of a slotted mold into which molten metal is delivered to form a slug or linotype, and finally the matrices returned through a distributing mechanism to the magazine from which they started. A machine of this general organization is to be found in Letters Patent of the United States to Mergenthaler, No. 557,000.

The aim of the present invention is to produce a machine which will be smaller, lighter, and cheaper than those now in general use and at the same time adapted for all ordinary classes of composition.

In carrying my invention into effect I employ matrices of improved form having shoulders on one edge only and having a single set of distributing-teeth arranged obliquely across the upper end. Heretofore matrices have been made with a notch or recess in the upper end and with distributing-teeth on one or both walls of the notch. My improved matrix, as shown in the present drawings, is made without a notch or recess and with the upper end inclined or beveled from one side or edge toward the other and with distributing-teeth on this outer or exposed edge. The construction is advantageous because of its cheapness, of the ease of manufacture, and of the fact that it gives an increased surface in proportion to the size of the matrix for the distributing-teeth, so that the teeth may be made larger and stronger than usual. These matrices I employ in an upright slotted magazine in connection with key mechanism of simplified construction. The devices for transferring and clamping the line are also of special and simplified construction. The mold instead of being mounted in a rotary wheel is mounted in a carrying-arm having a vibratory motion around a center, whereby the base of the slug is carried from the casting position past a stationary trimming-knife and presented opposite the ejector, by which it is delivered from the mold. The line of matrices, including spacers, is carried upward by an elevator from the casting position to the level of the distributer, into which the matrices are delivered one at a time, while the spacers are permitted to escape and travel down a guide or conductor to their magazine. The distributer-rail is toothed longitudinally on its under side to engage the matrices on one side, and the matrices are carried along the rail by an endless carrier.

Figure 1 is a front elevation of my machine. Fig. 1ª is a detail view of the line resisting and transferring device, the parts being in the position occupied during the composition of the line. Fig. 1ᵇ is a view of the same parts in the position which they occupy during the transfer and delivery of the line. Fig. 2 is an elevation of the same from the left side, the mold, the mouth of the pot, and adjacent parts being shown in vertical section on the correspondingly-numbered line of Fig. 1. Fig. 3 is a top plan view of the machine, the distributer being omitted to expose the parts lying thereunder. Figs. 4 to 8, inclusive, are side and edge views illustrating the construction of the matrices. Fig. 9 is a top plan view of one of the matrices. Fig. 10 is a vertical cross-section on the line 2 2 of Figs. 1, 3, 38, &c., through the mold, the matrix-line, and the supporting-carrier for the matrices. Figs. 11 and 12 are respectively a side view and an edge view showing the guide or conductor for returning the spacers to their magazine, the spacers being shown in position thereon. Fig. 13 illustrates one of the spacers viewed from the side and from the edge. Fig. 14 is a side view showing the relative position of the matrices, spacers, and the device for lifting the spacers to effect justification of the line. Fig. 15 is a vertical section on the correspondingly-numbered line in Figs. 1, 3, and 17 through the magazine and escapement devices. Fig. 16 is a similar view in the reversed position

which it occupies at the instant of discharging a matrix. Fig. 17 is a horizontal section of the magazine on the correspondingly-numbered line of Figs. 1, 2, 15, &c. Fig. 18 is a horizontal cross-section on the correspondingly-numbered line of Figs. 1, 15, &c., showing the assembler entrance-channels, through which the matrices pass after leaving the magazine proper. Figs. 19 and 20 are views showing the escapement-pawls for releasing the matrices viewed both edgewise and sidewise. Fig. 21 is a view showing the escapement-actuating lever viewed sidewise and edgewise, together with the end of the finger-key for operating the same. Fig. 22 is a vertical section from front to rear through the magazine for the spacers and the devices for discharging the same, taken on the line 22 22 of Fig. 1. Fig. 23 is a front elevation showing the support and elevator for the matrices in alinement with the assembler-rails to receive the matrices therefrom. Fig. 24 is a cross-section of the same on the correspondingly-numbered line of Fig. 23. Fig. 25 is a front elevation showing the matrix support and elevator of the preceding figures in its elevated position preparatory to delivering the matrices to the distributer, illustrating the separation of the spacers from the line. Fig. 26 is a vertical cross-section on the correspondingly-numbered line of Fig. 25. Fig. 27 is a top plan view of the matrix elevator and support shown in the figures immediately preceding. Fig. 28 is a front elevation of the receiving end of the distributer. Fig. 29 is an end view of the same looking from the left. Figs. 30 and 31 are front views illustrating the safety stop device for the distributer. Fig. 32 is a vertical cross-section through the distributer and the magazine thereunder on the correspondingly-numbered line of Fig. 1, &c. Fig. 33 is a front elevation of the receiving end of the distributer with portions broken away to expose the parts for lifting the matrices successively from the line in the elevator to the distributer proper. Fig. 34 is an end elevation of the same, the matrix support and elevator being shown in section on the line 34 34 of Fig. 33 and in its tilted or canted position to permit delivery of the matrices to the distributer proper. Fig. 35 is a face view of the portion of the endless carrier by which the matrices are advanced along the distributer-rail. Fig. 36 represents an edge view and a side view of the finger for lifting the matrices successively from the line to the distributer. Fig. 37 is a view looking from the front of the machine, illustrating more particularly the casting mechanism and the driving connections. Fig. 38 is a top plan view of the same parts. Fig. 39 is a front elevation illustrating more particularly the mold, trimming-knives, and adjacent parts. Fig. 40 is a vertical section on the line 2 2 of the preceding figure and Figs 1, 41, &c., the mold being shown in the casting position. Fig. 41 is a top plan view of the parts shown in Figs. 39 and 40. Fig. 42 is a front elevation illustrating more particularly the slug-receiving galley, the delivery-lever for the slugs, and the operating-cam. Fig. 43 is a top plan view of the parts shown in the preceding figure. Fig. 44 is an outline elevation looking from the front and illustrating more particularly the mechanisms for clamping the line of matrices in front of the mold, for effecting justification, for shifting the matrix-line from the elevator into the distributer, &c. Figs. 45 and 46 are respectively a top plan view and a front elevation of the support and elevator for the matrix-line and mechanisms for operating the same.

Referring to the drawings, A represents a rigid main frame, which may be of the form and construction shown in the drawings or of any other form and construction adapted to give support to the various operative parts hereinafter described.

B represents an upright fixed magazine into which the matrices are delivered at the top by the distributing mechanism and from which they are delivered at the foot one at a time preparatory to their assemblage or composition in line. This magazine is preferably constructed in the manner shown in detail in Figs. 15, 16, and 17, consisting of a metal plate containing in its forward face a series of vertical grooves or channels *b*, differing in width according to the width of the matrices they are to contain and each intended to carry a row or column of matrices C, standing on end one upon another. The front of the magazine is closed by a glass plate *b'*, fixed thereto and serving to hold the matrices in the grooves and at the same time to give the operator a view of the entire interior of the magazine and the matrices therein.

For the purpose of discharging the matrices one at a time from the magazine I mount at the lower end of each magazine-channel an escapement D, consisting of two pawls *d* and *d'*, connected to opposite ends of an operating-lever d^2, whereby they are caused to project alternately into the magazine. A spring d^3, connected with the escapement-lever, tends to hold the parts in the position shown in Fig. 15, with the lower pawl projected into the magazine to sustain the bottom matrix and the upper pawl withdrawn. The escapement is operated by a finger-key d^4, jointed at its upper end to the lever d^2 and having midway of its length a projection or fulcrum-point d^5, which bears loosely against the front of the magazine. When a finger-key is depressed, it actuates the lever d^2, reversing the position of the pawls, as shown in Fig. 16, and permitting the lower matrix to escape, while the one next above is held by the upper pawl. When the key is released, the spring causes the escapement members to resume their original position, allowing the next matrix to descend to the lower pawl preparatory to its discharge by the next action of the escapement. It will be observed

that the entire series of finger-keys, together with the front plate against which they bear, are permitted by reason of their jointed connection to the escapement to swing upward and forward, as indicated in dotted lines in Fig. 15, and this in order to give access to the channels or passages through which the matrices pass after leaving the lower end of the magazine proper. The matrices, escaping from the magazine, pass downward through guide-channels E and are received on an inclined conveyer-belt F, traveling around pulleys *f* at its ends and serving to carry the matrices downward and forward to the left and to deliver them into a slotted assembler G in front of the vertical angular wheel H, by which they are pushed forward one after another and assembled in line, this wheel serving to push the line bodily forward in order to leave room for the admission of each matrix as it descends in essentially the same manner as in the commercial linotype-machine of the present day.

The spacing or justification of the matrix-lines is effected by means of a series of spacers I in the form of stepped wedges, such as shown in Fig. 13 and hereinafter described in detail. These wedges are held in storage above the matrix-assembler in a magazine K. (Shown in cross-section in Fig. 22.) The spacers are formed at their upper ends with hooks, whereby they are held in suspension on the inclined magazine-rail *k*. The foremost spacer stands directly over the finger-key L, commonly termed the "space-key," which is pivoted at its middle and drawn downward at its rear end by a spring *l*. When the forward end of this key is depressed, its rear end lifts the foremost spacer until its hooked end is clear of the lip or shoulder at the end of the distributer-rail, whereupon the spacer is pushed forward by those behind it and released, so that it falls by gravity into the assembler between the preceding matrix and the star-wheel H, this action being very similar to that in the ordinary linotype-machine.

As the line of matrices and spacers is composed and increases in length in the assembler it must of course be held in compact form, and for this purpose I propose to employ a yielding resistant of any suitable character. In the form shown in the drawings (see Figs. 1 and 1^a) this resistant consists of a finger M, pivoted to a frictional slide *m*, arranged to slide right and left on the assembler G, the finger M being held normally downward in position opposite the matrices by a spring *m'*, extending from the slide to the lower end of the finger M. A second lever m^2 is also pivoted to this slide and connected therewith by a slot and pin. This finger m^2, serving as a transfer device, is so formed and arranged that when it is turned down to the right by hand its end will close behind or to the right of the matrix-line, as shown in Fig. 1^b, so that in moving the whole device to the left by hand the operator may transfer the composed line through the channeled assembler G and into the elevator N, to be presently described. After the line is thus transferred the operator, pressing on the upper end of the detent-finger M, lifts it clear of the matrix-line, so that the carrier and detent may be returned to the right to their original positions preparatory to the composition of the next line. During the composition of the line the lever or finger m^2 stands in the upright position out of the path of the matrices advancing to the line. It is to be understood that this particular form of resistant and transfer device is not of the essence of my invention and that it may be modified at will.

After the line of matrices and spacers has been transferred, as above mentioned, it must be first lowered into position to coöperate with the mold and thereafter lifted to the distributing mechanism at the top of the machine, and it is the object of the elevator N to effect these movements of the line. This elevator is constructed, as shown in Figs. 3, 10, 23, 24, 25, and 27, of the upper and lower members *n* and *n'*, mounted to slide vertically on the guide n^2 and connected by a vertical spring n^3, which tends to draw the two parts together. The elevator as a whole is slotted vertically from the right-hand side in order to permit the matrices and spacers to be pushed into it by the carrier already alluded to. The lower member *n'* presents an inner or rear side, as shown in Fig. 24, a vertical face to bear against the lower edges of the matrices, and also an upper edge, on which the hooks of the spacers engage to hold them in position in the line. The upper member *n* normally extends downward behind the member *n'* and behind the line of matrices and spacers, as plainly shown in Fig. 24, its front face being recessed to admit the rear edges of the matrices, which extend beyond the spacers, as shown. It will thus be seen that when the parts are in normal condition the matrices and spacers are held in line between the parts *n* and *n'*, the matrices engaging in the plate *n*, so that their vertical movement is prevented, while the spacers are free, so that they may be thrust up through the matrix-line in order to present their thicker portions therein, and thereby effect the justification of the line or, in other words, its elongation to the predetermined length, as hereinafter more fully explained. After the composed line is received in the elevator N the latter is lowered from its original or composing level (shown in Figs. 1 and 23) to the level of the mold O and casting-pot P, (see Figs. 2, 10, and 37,) preparatory to the casting of the slug in the mold and against the line of matrices. The mold O, having a slot therethrough from front to rear of the dimensions of the required linotype, is mounted in one end of an arm *o*, having both a vertical vibration and a slight motion in a fore-and-aft direction, as illustrated in detail in Figs. 39, 40, and 41. The mold-carrying arm or

lever *o* has at its middle a supporting-sleeve or hub mounted on a horizontal shaft *o'*, around which the arm is free to vibrate vertically and on which it is also permitted a slight sliding motion in a fore-and-aft direction. After the elevator N lowers the line of matrices to its position in front of the mold the latter is pushed forward through an opening in the side of the elevator until its front face fits into and against the matrix-line, as shown in Fig. 10, the matrices and spacers serving to close the front of the mold to which the matrix characters are presented.

The melting-pot P, in which a supply of molten type-metal is maintained and from which it is delivered into the mold to form the slug or linotype, has supporting-legs mounted on a horizontal shaft *p*, around which the pot vibrates in order to bring its delivery-mouth against and withdraw it from the rear face of the mold. The pot is provided with the usual delivery spout or mouth and with an internal pump well or cylinder containing a piston p^2, the depression of which serves to effect the delivery of the molten metal through the pot-mouth into the back of the mold in the manner common to all linotype-machines. After the slug is cast in the mold the pot is retracted, the mold drawn rearward from the matrices, and the mold carried upward by the vibration of its supporting-arm past a stationary knife Q, (see Figs. 39 and 40,) which serves to dress off the base of the slug flush with the rear face of the mold, whereby the slug is brought to the required type height. Continuing its motion beyond the base-trimming knife, the mold stops in the rear of two parallel knives R R, which are fixed to a portion of the main frame at a distance apart equal to the thickness of the required slug. While the mold stands at rest, sustaining the slug in line with the passage between the knives, a horizontal reciprocating ejector-blade S, suitably guided in the frame, advances from the rear and, acting on the base of the slug, drives it forward out of the mold and into the path of a vibrating lever T, mounted on a horizontal pivot *t* and urged to the left by a spring *t'*. An inclined surface on the ejector-arm raises this lever T out of the path of the slug, and when the ejector retreats, releasing the lever or slug-carrier T, the latter swings to the left under the influence of the spring and pushes the slug or linotype into the galley V, adding it to the line therein assembled and pushing the line bodily to the left to make room for the next slug. It will of course be understood that motion may be imparted to the foregoing members by any suitable mechanism. In the present instance, however, the mold-arm receives its vertical motion from a cam o^2, mounted on the main horizontal shaft U and acting on the anti-friction-roller on the rear end of the arm to effect the elevation of the mold. A spring o^3, connected to the mold-arm, as shown in Fig. 39, serves to draw the mold down when relieved from the action of the lifting-cam. The fore-and-aft motion of the mold to close it against the matrices and to withdraw it from the slug and matrices is effected, as shown in Figs. 39 and 40, by a peripherally-grooved cam o^5, also secured on the main shaft U and engaging a projection o^6 on the sleeve of the mold-lever, so that as the cam revolves the lever and mold are moved forward and backward at the proper times. The ejector-blade S, mounted in a fixed guide, is connected by link *s* to lever *s'*, mounted midway of its length on pivot s^2 and acted upon at its rear end by a side cam s^3, also mounted on the main shaft U, so that as the cam rotates it effects at the proper time a positive forward motion of the ejector, which is drawn rearward when the cam ceases its action by a spring s^4, extending from the ejector-lever *s'* to the main frame.

When the composed line after being transferred from the assembling-point into the elevator N is lowered by the latter to the operative position in front of the mold, means must be provided to limit the elongation of the line, or, in other words, to confine the line of matrices endwise, so as to limit its expansion when the spacers I are pushed upward through the line, so that all of the lines may be of the same length. For this purpose I propose to use in the machine two jaws or abutments W and W', located on the machine-frame forward of the position occupied by the mold when in its casting position. The elevator N straddles these jaws while lowering the matrices and spacers between them in a manner substantially the same as in the linotype-machines now in general use. These jaws may be stationary or movable.

After the line has served its purpose in front of the mold—that is to say, after the slug has been cast and the mold retracted—the elevator N rises, lifting the line to the top of the machine preparatory to its distribution. The upward-and-downward motion of the elevator N is effected by a pitman n^5, connecting it with a long lever or arm n^6, having a hub mounted on a horizontal axis and provided with a second arm n^7, one end of which is acted upon by a lifting-cam n^8 on the main shaft, the cam being of such form that the elevator is alternately raised and lowered and permitted to remain at rest during the casting operation and during the delivery of the matrices therefrom into the distributer. As the rising elevator N approaches the limit of its upward movement its lower member *n'* comes in contact with the lower edge of a fixed vertical plate n^9, (see Figs. 25 and 26,) whereby the movement of the lower member *n'*, on which the spacers I are suspended, is arrested, so that the member *n'* stands flush with the upper end of the inclined rail *k*, leading downward to the magazine or holder for the spacers. Although the lower member *n'* of the elevator supporting

the spacers is arrested, as above described, the upper member n is permitted by reason of the spring connection to continue its upward movement, whereby the matrices C are lifted away from the spacers and away from the lower member n' of the elevator, as shown in Figs. 25 and 26, the plate n^9 serving at this time to keep the matrices in contact with the member n, so that they may be lifted, as shown, entirely above the spacers and to a suitable level for transference to the distributer. It will be observed that the spacers left behind the matrices at a lower level are free to slide laterally onto the rail k, down which they pass by gravity to the magazine from which they started.

The distribution of the matrices to their proper magazine-channels is effected mainly by a series of teeth c^4, formed on the upper ends of the matrices and arranged to engage with corresponding teeth on the lower edge of a fixed distributer-bar X, lying over the upper end of the magazine and across the mouths of the channels therein. Each character in the keyboard is represented by a special arrangement of teeth on the corresponding matrices. All matrices bearing the same character have the same arrangement of teeth; but a matrix bearing any given character differs as to the number or the arrangement of its teeth, or both, from a matrix bearing any other character. In like manner the distributer-bar has its series of teeth cut away over each magazine-channel, so that at this point the number or relation of the teeth is different from those at any other point in the length of the bar, this mode of permuting the teeth of the matrices and the distributer-bar being analogous to that set out in United States Letters Patent No. 347,629 to Ottmar Mergenthaler, dated August 17, 1886. My improved matrices, however, differ from those shown in the Mergenthaler machine in that they are not notched in the upper end to straddle the distributer-bar and provided with two opposing sets of teeth to engage the bar on opposite sides. On the contrary, each of my matrices is beveled across the upper end from the front to the rear side and has a single series of distributing-teeth, which may therefore be made much larger and without that extreme precision as to size necessary in the Mergenthaler construction. My distributer-bar instead of being made of V form at the lower end has a flat lower surface, on which the longitudinal distributing-teeth are formed; but in order that these teeth may properly engage the vertical matrices and hold them in suspension the bar is in cross-section inclined forward toward its top, as shown particularly in Figs. 29 and 32, so that its lower toothed edge stands at an inclination to the horizontal and in position to engage the teeth of the matrices which are held in contact therewith by the vertical surface of the elevator member n and by other fixed surfaces n^{10}, (see Figs. 29 and 30,) forming the continuation of this plate, extending across the machine above the magazine. In other words, the toothed angular tops of the matrices enter the angular space between the lower inclined edge of the distributer-bar and the vertical surface of the adjacent plate n^{10}.

After the matrices have been lifted in the elevator for transference to the distributer, as before referred to and as shown in Figs. 25 and 26, they are carried forward to the right to a point immediately under the distributer-bar by a horizontally-reciprocating slide x, connected by link x' to the upright lever x^2, moved in one direction by cam x^3 and in the opposite direction by a retracting-spring x^4. The forward—that is to say, the right-hand—end of the matrix-line is pressed into the path of the rising-and-falling lifting-finger x^5, (see Figs. 29, 33, 34, and 36,) the upper end of which is formed to engage the foremost matrix and lift it away from its companions and into the path of one of the teeth x^6 on a horizontal endless belt x^7, the teeth of this carrier-belt serving to carry the separated matrices forward, one after another, along the distributer-bar until they reach points immediately over the corresponding channels in the magazine, at which points the teeth of the matrices and those of the distributer-bar have such relation to each other that the matrix is released and permitted to descend by gravity into the magazine. The lifting-finger x^5 is pivoted to one end of an angular lever x^8 (see Figs. 28, 29, 33, &c.) and is drawn backward by a spring x^9, whereby it is held in engagement with the matrices. The lifter-operating lever x^8 is mounted on an axis x^{10}, inclined from the horizontal in a fore-and-aft direction, as plainly shown in Figs. 1, 2, 29, 32, &c., so that the matrix is lifted from its support with a forward movement into engagement with the distrubuter-bar. It will be understood, of course, that the foremost matrix at the instant of being lifted is beyond the end of the guides which sustain the remaining line of matrices, so that it may be lifted past the end of these guides into engagement with the bar, as described. The lifter-lever x^8 is acted upon at its upper end by a cam x^{11} to effect the depression of the lifting-finger and is moved in the opposite direction to elevate the finger and matrix by a spring x^{12}. (Shown more particularly in Fig. 33.) It will be observed that the lifting-finger is notched or forked at the upper end to permit the forward passage of the carrier-teeth on the belt, so that the tooth engaging the matrix from the left may carry it forward to the right before the finger completes its descent. The pulley x^{13}, which sustains and drives the carrier-belt, receives motion (see Figs. 28 and 29) through a gear-wheel x^{14}, fixed on its shaft and receiving motion in turn from the pinion x^{15} on the shaft which carries the lifter-actuating cam x^{11}, already referred to. This shaft

receives motion through a driving-pulley x^{16}, secured to its end and receiving motion in turn from a continuously-acting driving-belt x^{21}, acting with moderate friction thereon, so that it may slip when the pulley is stopped, as hereinafter described. The shaft carrying pulley x^{16} on pinion x^{15} is also provided with a toothed wheel or disk x^{17}, fastened thereon. This shaft is mounted in an arm x^{19}, swinging around the axis of gear-wheel x^{14} as a center and having a lip or shoulder in its lower edge near the outer end. An angular dog or lever x^{18} is pivoted to the frame in such position that its opposite ends may be engaged alternately with the shoulder of the arm x^{19} and with the teeth of the wheel x^{17}. A spiral spring x^{20}, acting on this arm, connects the dog x^{18} with the arm x^{19} and tends to hold them in the relation shown in Figs. 28 and 30, so that the pinion x^{15} is permitted through the gear x^{14} to drive the matrix-carrying belt x^{7} continuously. If, however, a matrix from improper engagement with the distributer-bar or from any other reason is prevented from advancing properly, it will arrest the travel of the carrying-belt and through the intermediate parts arrest the rotation of the gear-wheel x^{14}, whereupon the pinion x^{15}, continuing its rotation, will climb on the gear x^{14}, thereby lifting the arm x^{19} out of engagement with dog x^{18}, allowing the latter to engage the disk x^{17}, as shown in Fig. 31, whereby the pinion x^{15} and attendant parts are brought to a stop, the driving-belt in the meantime slipping on the pulley x^{16}. After the matrix has been released by the attendant the latch or dog x^{18} is thrown by hand out of engagement with the disk x^{17} and restored to the original position, (shown in Fig. 30,) thereby unlocking the parts, so that the matrix-carrier belt may continue its movement. It will be seen that the foregoing combination of parts constitutes an automatic stop to check the feed or travel of the matrices whenever any undue resistance is offered to a matrix or to the carrying-belt. After one line of the matrices has been delivered the horizontal shifter-slide x is moved back to the left in position to act upon a succeeding line, when it is in turn lifted by the elevator N.

Reference has been made to the fact that while the line of matrices stands before the front of the mold preparatory to the casting operation it is justified or elongated to the predetermined length by the rising of the stepped spacers I through the line between the matrices while the latter are held at rest as against vertical motion. This lifting of the spaces may be effected by any suitable mechanism—such, for instance, as that represented by Letters Patent of the United States to Ottmar Mergenthaler, No. 565,490. In the drawings, Y and y represent, respectively, the stepped slides and the sector-plate of said patent. The means for operating these parts are foreign to the present invention and need not be described.

Referring again to the matrices, it will be observed that they are made with straight faces—that is, without shoulders on the front vertical edge—but that the rear edge, containing the matrix proper, c, is recessed in such manner as to present the horizontal shoulder c' to rest beneath the mold for purposes of alinement and the upper inclined shoulder c^2 to rest on the correspondingly-beveled upper edge of the mold, so that when the mold is crowded forward between these shoulders it tends to bring the matrices in the line into exact alinement vertically.

It is to be understood that the teeth on the upper ends of the matrices for purposes of distribution may be made in any appropriate form. In Figs. 4, 5, and 6 these teeth are shown as beveled or inclined on the under face, while in Figs. 7 and 8 they are shown with horizontal upper and lower edges.

The devices for imparting motion to various parts of the machine will now be described.

The main shaft U is seated horizontally in the main frame and carries all the principal cams for giving motion to the other parts, as shown in plan view in Fig. 3. On one end this shaft has fixed upon it a gear-wheel u, which receives motion from a pinion u' on an underlying shaft u^2, mounted horizontally in the main frame and having a limited end motion. The pinion u' is formed on one end of a sleeve (see Fig. 38) which surrounds the shaft and is connected thereto by a longitudinal spline or feather, so that the two are compelled to rotate together. On the outer end of the sleeve there is mounted a loose pulley u^3 to receive the driving-belt. For the purpose of connecting this pulley with the shaft when the parts are to be driven I provide a clutch consisting of a hub u^4, pinned fast to the shaft and jointed to two radial outwardly-extending links u^5, the outer ends of which are in turn jointed to friction-shoes u^6, acting against the inner surface of the rim of the driving-pulley, these shoes being sustained and guided on radial spokes or arms, so that when the shaft u^2 is drawn forward endwise it causes the shoes to firmly engage the rim of the pulley, so that rotary motion is imparted through the clutching devices from the pulley to the shaft and to the pinion and cams thereon. A spiral spring u^7 encircles the shaft-bearing between the inner side of the pinion and a collar u^8, fixed to the shaft. This spring tends to urge the shaft forward and keep the clutch in engagement. For the purpose of permitting the operator to throw the clutch out of action and to stop the machine at will the eccentric hand-lever u^9 is pivoted to the front of the frame within convenient reach of the operator and arranged to act on the forward end of the shaft to press it backward. As the machine completes at each revolution of the main shaft all the op-

erations necessary for the completion and delivery of one slug, it is necessary to automatically throw out of action at the finish of each revolution all the cams and other parts for imparting motion to the mold, casting mechanism, ejector, &c. This is effected by providing one of the cams, preferably the pot-actuating cam p^5, (see Fig. 38,) with a pivoted dog u^{10} to act on the inclined surface on the side of the shaft-collar u^8, whereby the shaft u^2 is automatically pushed endwise to disengage the clutch. When the machine is to be started, the dog u^{10} must be moved out of engagement with the collar, and this is effected, as shown in Figs. 37 and 38, by a sliding bar u^{12}, connected to a hand-lever u^{13} and held normally backward out of action by a spring u^{14}. By moving the hand-lever the bar may be thrust forward, so as to push the dog u^{10} out of engagement, whereupon the spring u^7, before referred to, will cause the reëngagement of the clutch. From the foregoing it will be understood that the main shaft is automatically stopped at the completion of each revolution and that it is in the power of the operator, by means of the handle u^9, to stop the machine at any time. The release of the handle u^9 will cause the machine to start from any position except that in which it is arrested by the automatic stop. The matrix-lifting device of the distributing mechanism has its pulley x^{16} driven by belt x^{21}, extending across the top of the machine and downward over idler-pulleys to a pulley x^{22} on the shaft which carries the pulley at the upper end of the assembling-belt F. (See Fig. 1.) These parts must be kept continuously in motion, and they will therefore be driven from a constantly-running driving-pulley, a belt being preferably extended from the pulley w^3 to a pulley on the shaft which carries the lower pulley of the assembler-belt. It is to be understood, however, that these driving connections are not of the essence of the invention and that they may be modified at the pleasure of the skilled mechanic.

The melting-pot P is swung upward and forward toward the mold by means of the lever p^4, turning on a horizontal shaft (see Figs. 3, 37, and 38) and acted upon at its rear end by a depressing-cam p^5 on the main shaft, this cam being so formed that the pot is swung upward and held against the mold the proper length of time and then permitted to fall backward therefrom.

The pot or pump plunger p^2 for delivering the molten metal is operated by a vertically-vibrating lever p^6, (see Figs. 37 and 38,) urged constantly downward by a spring p^7, and lifted at the proper times by cam p^8, mounted in the main shaft and acting on the rear end of the lever.

The devices for moving the mold and the ejector-blade have already been described.

The operation of the machine as a whole is briefly as follows: The finger-keys being manipulated in the proper order, matrices and spacers are delivered from their respective magazines into the assembler G, wherein they are assembled in close order. When the line has reached such length that the introduction of an additional word or syllable is impossible, the device M is operated to grasp the line and transfer it to the left from the assembler G into the elevator N, after which the transfer device is permitted to return to its first position to resist the matrices for the next line, the elevator N is lowered to present the matrices in front of the mold, the devices Y and y thrust the spacers I upward through the line to effect its justification, and the pot and the mold move forward until the mold is in intimate contact with the matrices and the pot in intimate contact with the back of the mold. While the parts are in this position the pump-plunger descends and molton metal is delivered into the mold against the matrices, thereby forming a slug or printing-bar with type in relief on its forward edge. The pot retreats from the mold and the mold retreats from the matrices, withdrawing the slug. The mold swings upward carrying the base of the contained slug past the stationary knife Q, by which it is trimmed to the proper height. The mold stops behind the knives R R and in front of the ejector-blade S, which, advancing from the rear, drives the slug out of the mold and between the knives R R, which trim it to the proper thickness, the advance of the slug being continued until it is in front of the stationary lever T, by which it is delivered into the galley. In due time the ejector-blade is withdrawn and the mold descends again to its operative level. While the other operations are progressing the elevator N carries the line of matrices and spacers which has been used from the casting-level upward, the lower forward member of the elevator being arrested in its ascent with the spacers thereon, so that they will be transferred to their magazine, while the matrices are carried to a higher level and into the path of the slide x, by which they are urged to the right and against the lifting device, which serves to raise the matrices one at a time from the line into engagement with the fingers of the feeding-belt, by which they are carried forward along the distributer-bar until they escape therefrom into their respective channels in the magazine.

While I have represented the stepped spacers herein, it is to be understood that they are not a necessary feature of my machine, as they may be replaced by other known forms of justifying devices—for example, the ordinary double-wedge spacers, such as shown in the Schuckers and Mergenthaler patents and now in general use in the Mergenthaler linotype-machine.

Having described my invention, what I claim is—

1. A matrix for a linotype-machine, having its upper end inclined or beveled from one edge toward the other, with distributing-teeth on the inclined portion, substantially as described.

2. A matrix for a linotype-machine, having on one side an unbroken vertical edge, at the opposite side a recess having the matrix proper therein, and on the top an inclined series of distributing-teeth, substantially as shown.

3. A linotype-matrix, having its edge recessed and provided with a character or matrix proper, and also provided with two alining-shoulders c' and c^2, one presenting a horizontal and the other an inclined surface.

4. A matrix for a linotype-machine, having its upper end inclined in an unbroken line from one edge and provided with distributing-teeth in said end.

5. A linotype-matrix having a vertical edge provided with retaining-shoulders therein, an opposite edge without shoulders, and at the upper end a series of distributing-teeth, whereby it is adapted to be circulated and mechanically handled in the manner herein described.

6. In a linotype-machine, the combination of a series of matrices, each having an inclined and a horizontal shoulder as described, in combination with a mold correspondingly formed, whereby it is adapted to effect exact alinement of the matrices when forced into contact with them.

7. In a linotype-machine, an elongated spacer of varying thickness, having at the upper end a hook adapted to travel on a sustaining wire or guide, in combination with an actuating device adapted and arranged to act on said hook for the purpose of advancing the spacer through the line in the act of justification.

8. A spacer for a linotype-machine, of varying thickness from one end to the other, its upper end provided with a hook-shaped extension projecting edgewise beyond the body portion.

9. In a linotype-machine, the combination of a matrix having its upper end inclined from one of its vertical edges upward and provided with distributing-teeth therein, a distributer-bar having a laterally-inclined toothed surface to engage the matrices, and a plate opposed to the distributer-bar and acting on the untoothed edge of the matrices to keep them in engagement with the bar.

10. In a linotype-machine, a distributer-bar having a laterally-inclined and longitudinally-toothed surface to engage the matrices, and a parallel plate adjacent to the distributer-bar, in combination with a series of matrices having their upper ends adapted to fit and travel between the two bars, and toothed from one edge inward and upward to engage the distributer-bar, substantially as described and shown.

11. In a linotype-machine, in combination with the matrices and the hooked spacers, the elevator N, consisting of the separable members n and n', and means to effect their separation at the completion of their upward movement, whereby the matrices and spacers are separated from each other.

12. In a linotype-machine, the combination of a series of matrices, a series of spacers, and an elevator adapted to raise the composed line of matrices and spacers, said elevator comprising vertically-separable members adapted to remove at one operation all the matrices in the line from the spacers.

13. In a linotype-machine and in combination with matrices and spacers, an elevating mechanism adapted to raise the matrices and the spacers of a composed line to different levels and thus sustain them, means for transferring the matrices from the elevator to the distributing devices, and means for guiding the spacers from the elevator to their magazine.

14. In a linotype-machine, the combination of a magazine for spacers, an inclined rail or guide extending thence upward to the top of the machine, mechanism for elevating bodily the composed lines of matrices and spacers to the top of the machine and thereafter effecting the separation of the matrices in a group from the spacers, and means for transferring the spacers in a group from the elevating devices to the inclined rail above referred to.

15. In a linotype-machine, the vertically-movable elevator consisting of the members n and n', adapted to engage the matrices and spacers respectively, in combination with a connecting-spring, means for separating the two parts of the elevator to cause the separation of the matrices and spacers, and means for holding the matrices and spacers respectively in engagement with the separated members of the elevator preparatory to their transfer therefrom.

16. In a linotype-machine, the elevator for the composed lines, consisting of two separable members n and n', in combination with a stationary plate n^9 to retain the matrices in position when lifted from the spacers.

17. In a linotype-machine, the elevator comprising a member n, adapted to engage and sustain the spacers, and the relatively movable member n', adapted to engage and retain the matrices.

18. In a linotype-machine, a channeled magazine for the matrices, in combination with escapement-pawls d and d', an intermediate operating-lever d^2, a finger-key directly connected to one end of said lever, and a spring connected to the lever and acting in opposition to the finger-key to project the lower pawl into the magazine, whereby the finger-key is adapted to effect the positive action of

the escapement to release the matrix, and the spring caused to restore the parts to their normal position.

19. In a linotype-machine, the combination of the magazine, escapements, and a series of finger-keys having a jointed connection at one end to the escapements and bearing loosely against a support or fulcrum, whereby they are adapted to swing away from the magazine around the joints above named.

20. In a linotype-machine, the combination of the magazine, escapements $d\,d'$, their connecting-levers, and the finger-keys having projections or fulcra arranged to bear against the front plate, substantially as described.

21. In a linotype-machine and in combination with means for delivering matrices thereto, the horizontal assembler G and means for resisting the advance of the matrix-line during composition and for transferring the completed line to and from said channel, consisting of the slide m, the coöperating fingers M and m^2, pivoted thereto, and spring m'.

22. In a linotype-machine, the combination of an assembling-channel into which the matrices are delivered successively, a horizontally-movable slide, a finger pivoted to said slide to resist the advance of the matrix-line during composition and during its transfer through and from the channel, and a second finger, also mounted in said slide, to close behind the composed line and carry the same through and from the channel.

23. In a linotype-machine, a mold-carrying arm, a shaft sustaining said arm and mounted on an axis, a spring tending to turn said arm around its axis in one direction, and a cam acting on the arm to turn the same in the opposite direction.

24. The combination of the mold-supporting arm o mounted to vibrate on its axis, a cam substantially as described, arranged to move the arm positively in the direction of its axis, a spring tending to turn said arm around its axis in one direction, and a cam acting to turn the arm in the opposite direction.

25. In a linotype-machine, a mold-carrying arm o, mounted to vibrate upon an axis and to move in the direction of the axis, in combination with cam o^5 and projection o^6 coöperating with the arm, to effect said movements.

26. In a linotype-machine, the combination of a series of matrices, a series of spacers having supporting-hooks at their upper ends, the divided elevator whereby the composed line is lifted and the series of matrices thereafter lifted from the spacers, a single rail adapted to receive and support the spacers and guide them downward to their magazine or holder, a distributer overlying the upper end of said rail, and means for transferring the matrices to the distributer and the spacers to the rail.

27. In a linotype-machine and in combination with a melting-pot mounted to swing upward and forward around a horizontal axis, a centrally-pivoted lever p^4 with one end arranged to act with lifting effect on the back of the pot, and a cam p^5 acting on the opposite end of said lever.

28. In a linotype-machine in combination with the main cam-shaft and its gear-wheel, the driving-pinion u', a shaft for said pinion having an end motion in relation thereto, a driving-pulley encircling the shaft, a clutch mechanism actuated by the end movement of the shaft, and a spring tending to hold the clutch in engagement, and means carried by the main cam-shaft to throw said clutch out of action at the completion of each revolution of the cam-shaft.

29. In a linotype-machine, in combination with the driving-pulley u^3, the longitudinally-movable shaft and pinion thereon, the spring u^7 tending to hold the clutch in engagement, and a manual device u^9 for moving the shaft endwise to effect the stoppage of the machine at any point in its action.

30. In a linotype-machine, in combination with the longitudinally-movable shaft u^2, its pinion, the clutch, clutch-operating spring, and a traveling dog u^{10} for throwing the clutch out of action, the bar u^{12} and lever u^{13}, for disengaging the dog u^{10} to permit the starting of the machine.

31. In a linotype-machine and in combination with its driving-clutch, a manual device for throwing the clutch out of action at will, means for automatically disengaging the clutch at the completion of each revolution, and a second manual device for disengaging the automatic devices, whereby the machine may be automatically stopped at a definite point and started from such point, or independently stopped and started by hand at any period in the course of its operation.

32. In a linotype-machine, a reciprocating ejector for delivering the slugs from the mold, in combination with a transversely-acting slug-delivering device T, actuated by the ejector.

33. In a linotype-machine, an elevator for lifting the composed line of matrices and spacers, comprising vertically-separable members, one of them adapted to engage and lift the entire line of matrices, while the other supports the entire series of spacers, whereby the separation of all the matrices from the spacers is effected at one operation, preparatory to the distribution of the matrices.

34. In a linotype-machine, an elevator comprising two vertically-movable members, one adapted to sustain the spacers, and the other adapted to engage and lift the matrices, in combination with means to hold the spacers in position on their supporting member while the matrices are being lifted away from the spacers by the other member.

35. In a linotype-machine, in combination with means for sustaining a line of matrices, a series of wedge spacers having sustaining-hooks at their upper ends, and an actuating device engaging said ends to advance the spacers through the line in the act of justification.

In testimony whereof I hereunto set my hand, this 27th day of November, 1900, in the presence of two attesting witnesses.

CARL MUEHLEISEN.

Witnesses:
WOLDEMAR HAUPT,
HENRY HASPER.