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C. FORTH.

MATRIX ASSEMBLING AND DISTRIBUTING MACHINE.

No. 562,954. Patented June 30, 1896.

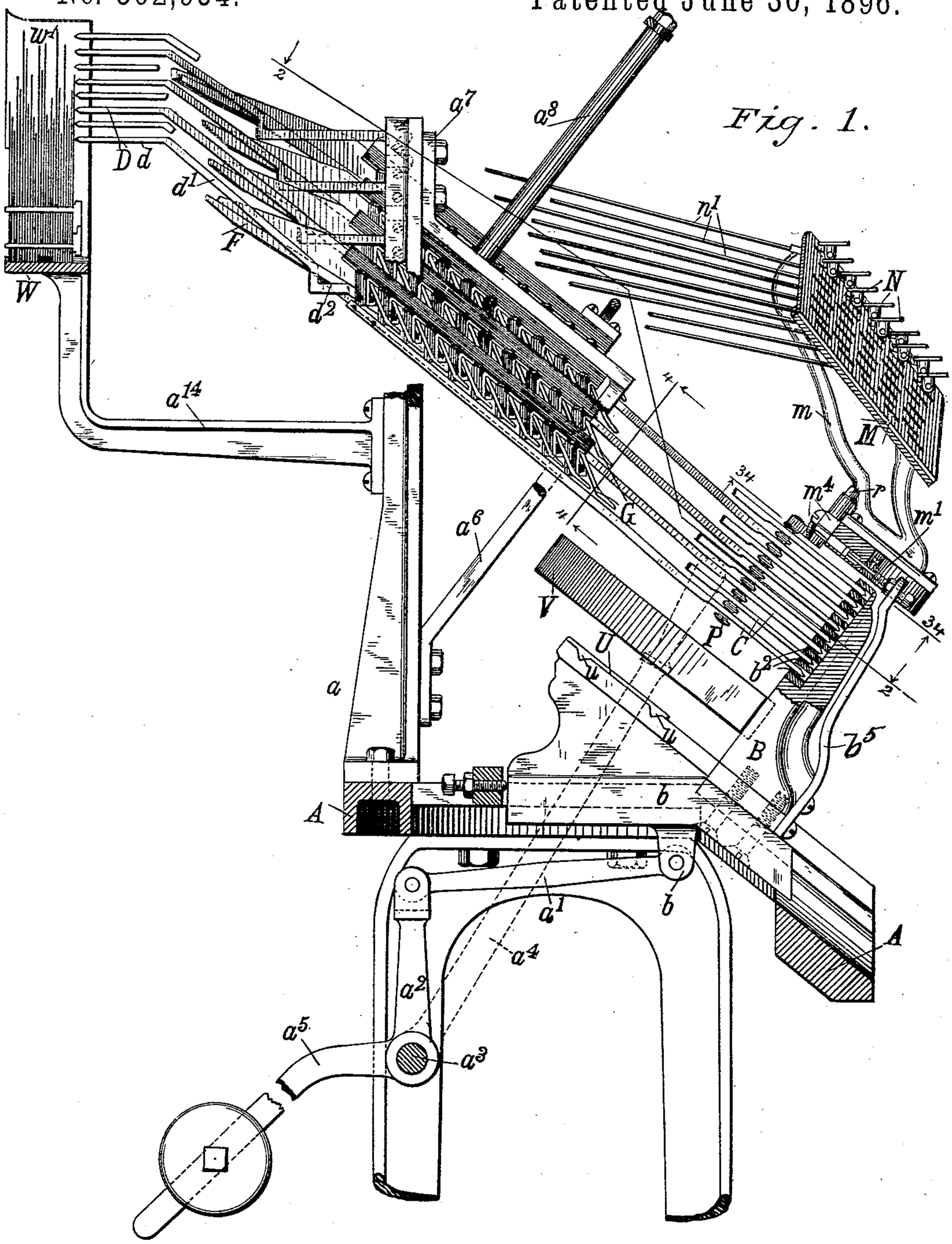

Fig. 1.

WITNESSES.

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his attorney

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MATRIX ASSEMBLING AND DISTRIBUTING MACHINE.

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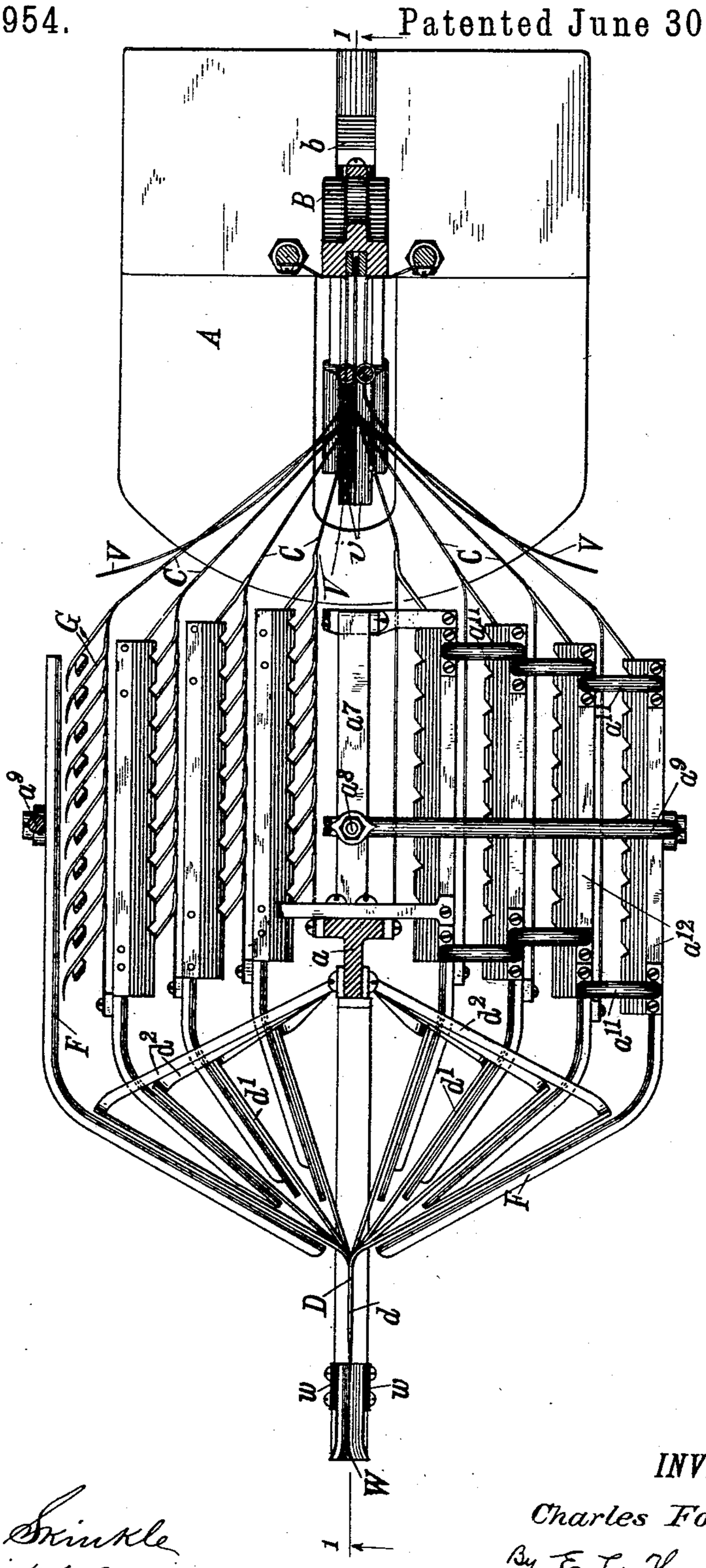
Fig. 2.



WITNESSES.

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C. FORTH.

MATRIX ASSEMBLING AND DISTRIBUTING MACHINE.

No. 562,954. Patented June 30, 1896.

Fig. 3.

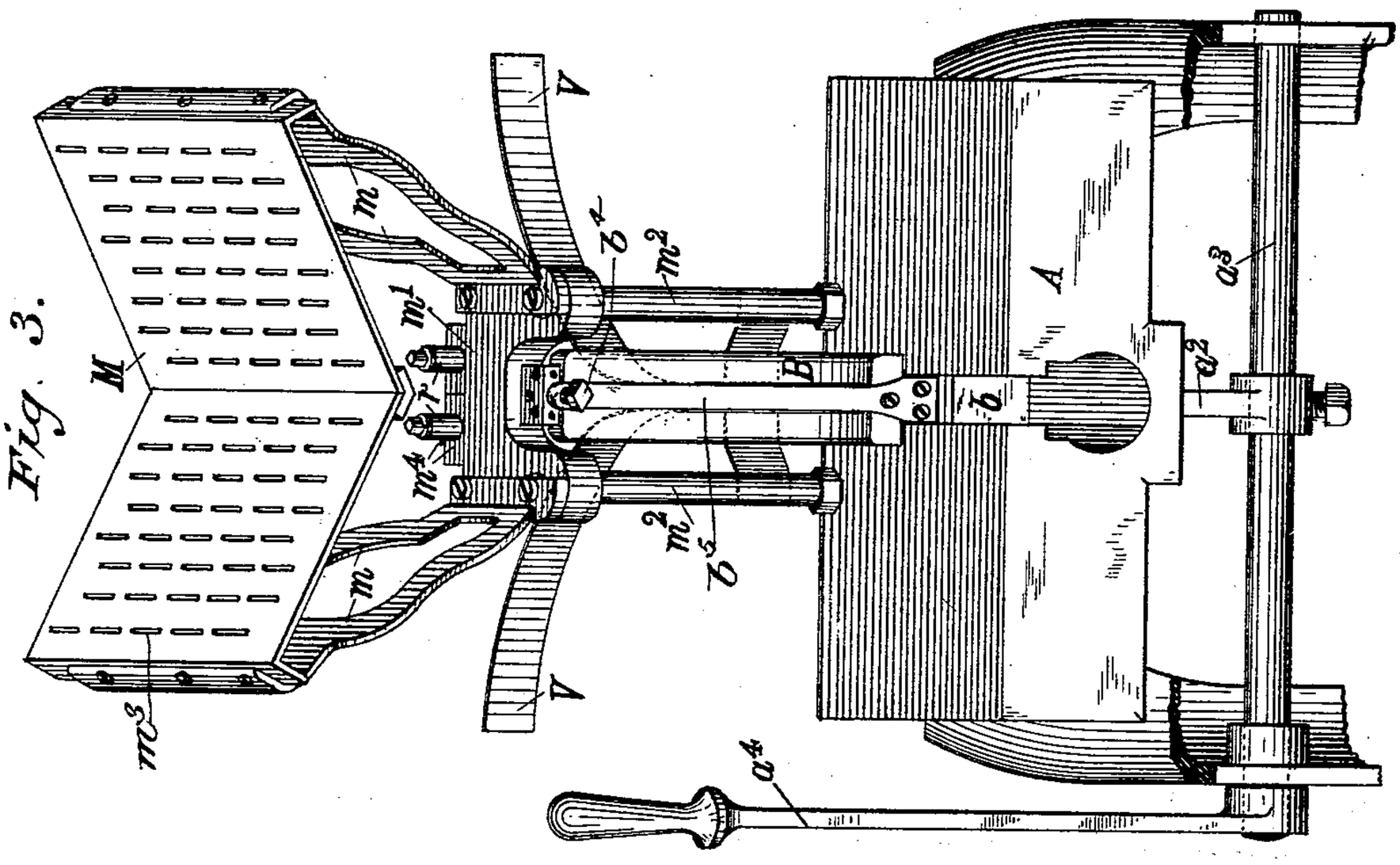


Fig. 4.

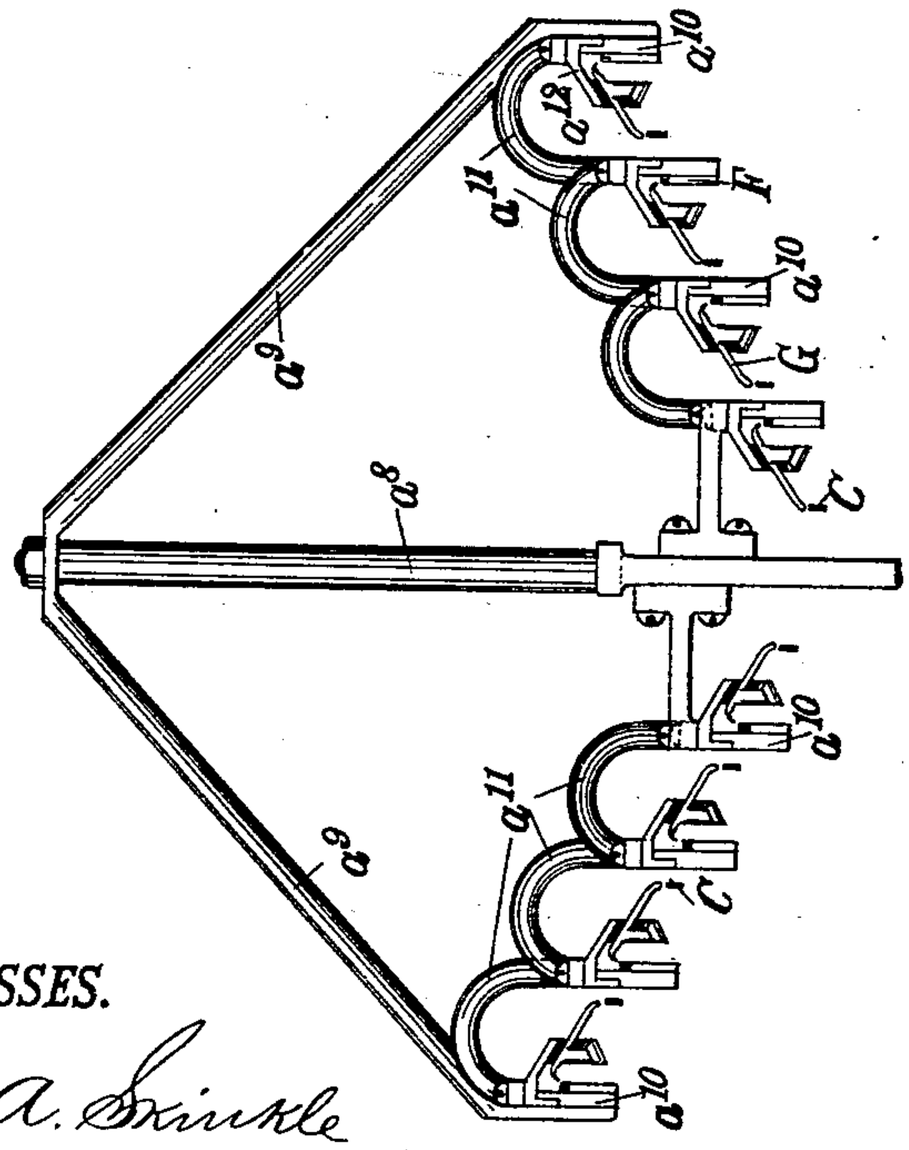


Fig. 5.

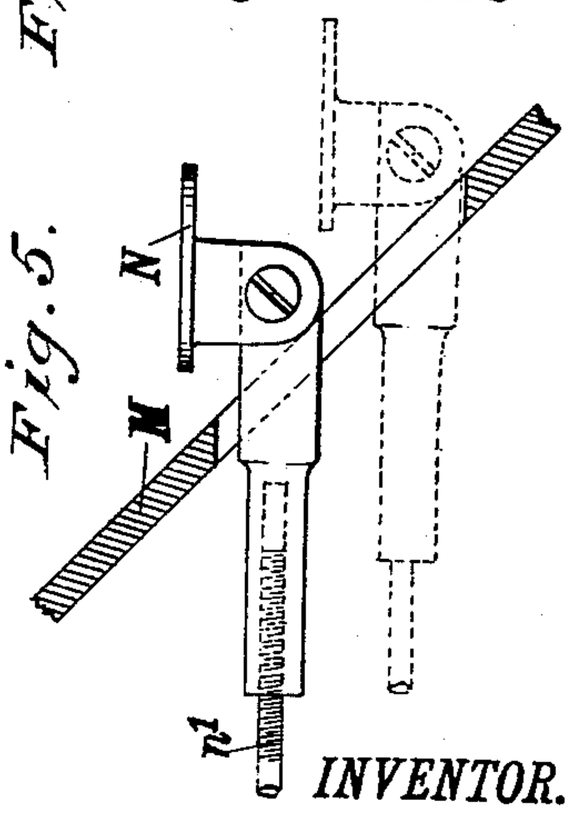
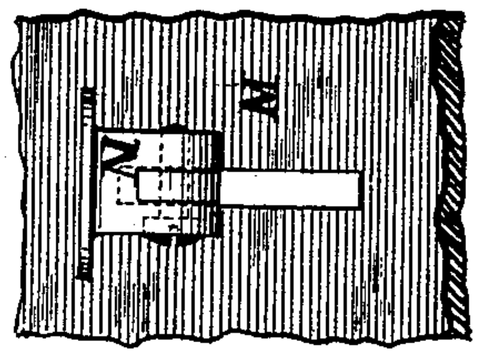


Fig. 5a.



WITNESSES.

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MATRIX ASSEMBLING AND DISTRIBUTING MACHINE.

No. 562,954. Patented June 30, 1896.

Fig. 6

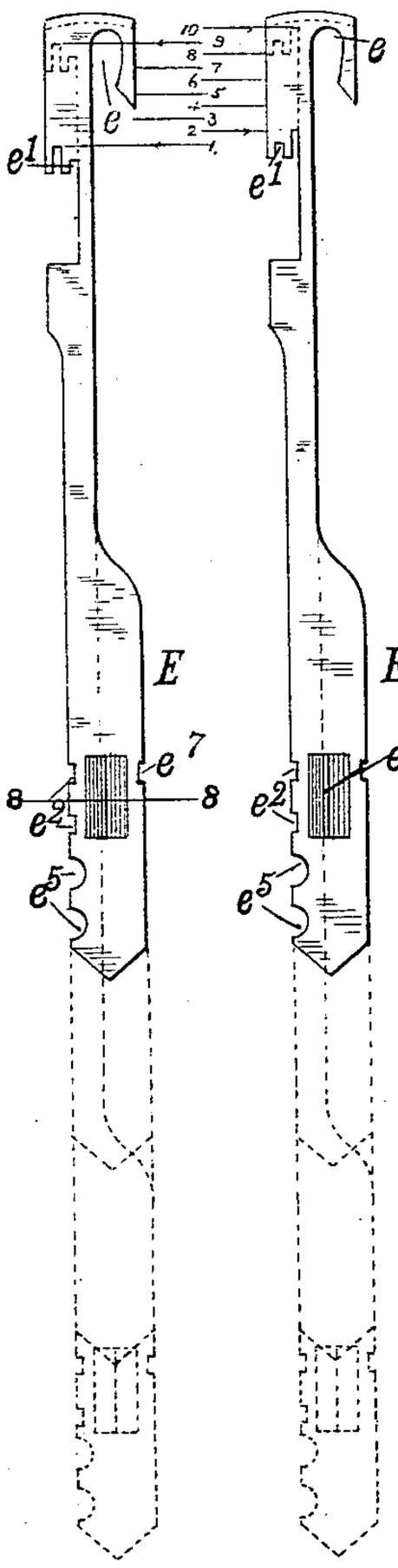


Fig. 7.

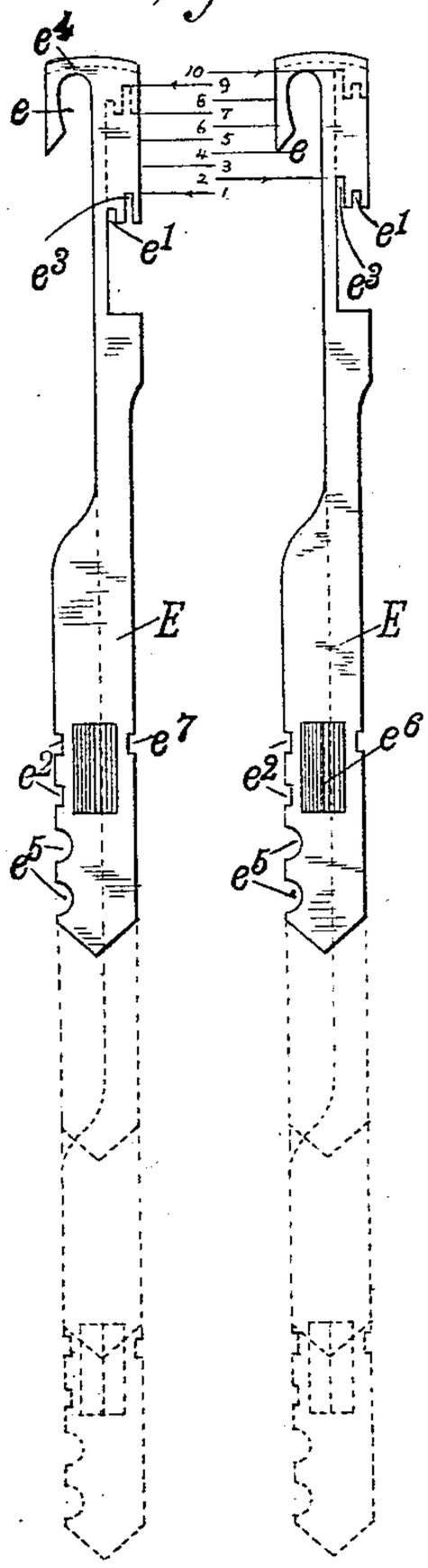


Fig. 9. *Fig. 10.*

Fig. 11.

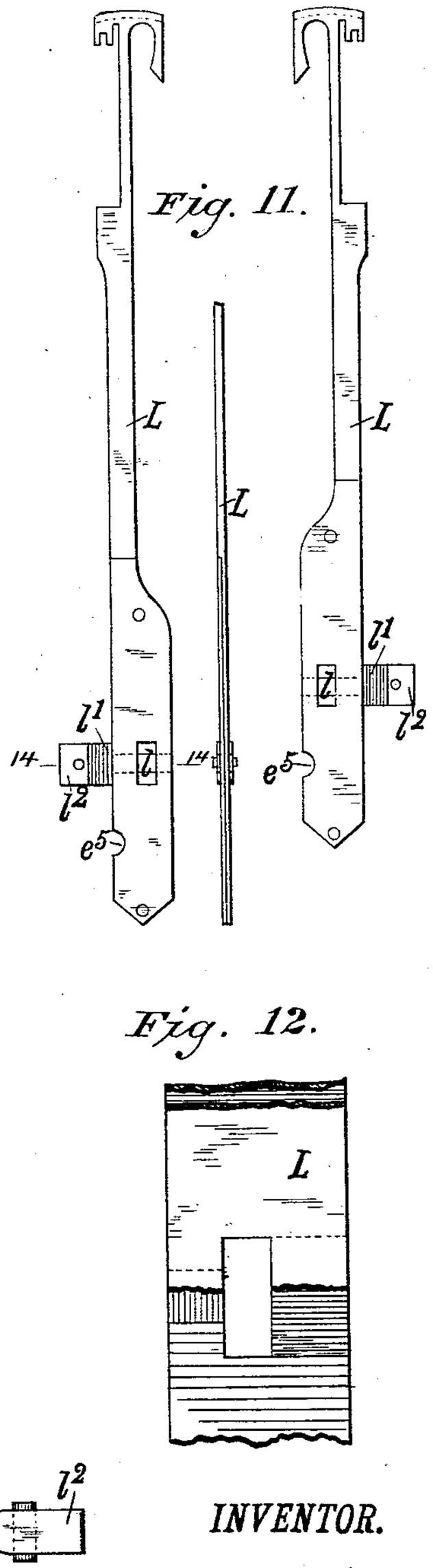


Fig. 12.

Fig. 8.

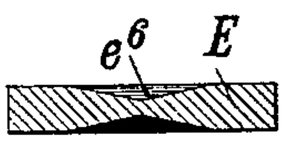


Fig. 13.

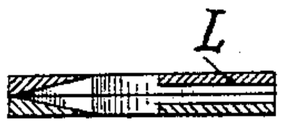


Fig. 14.

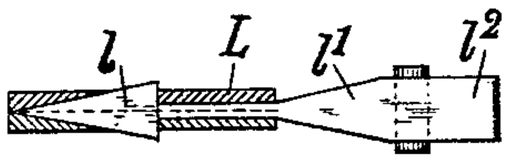
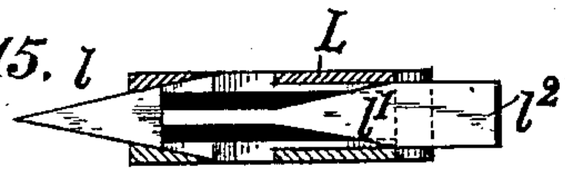


Fig. 15.



WITNESSES.

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MATRIX ASSEMBLING AND DISTRIBUTING MACHINE.

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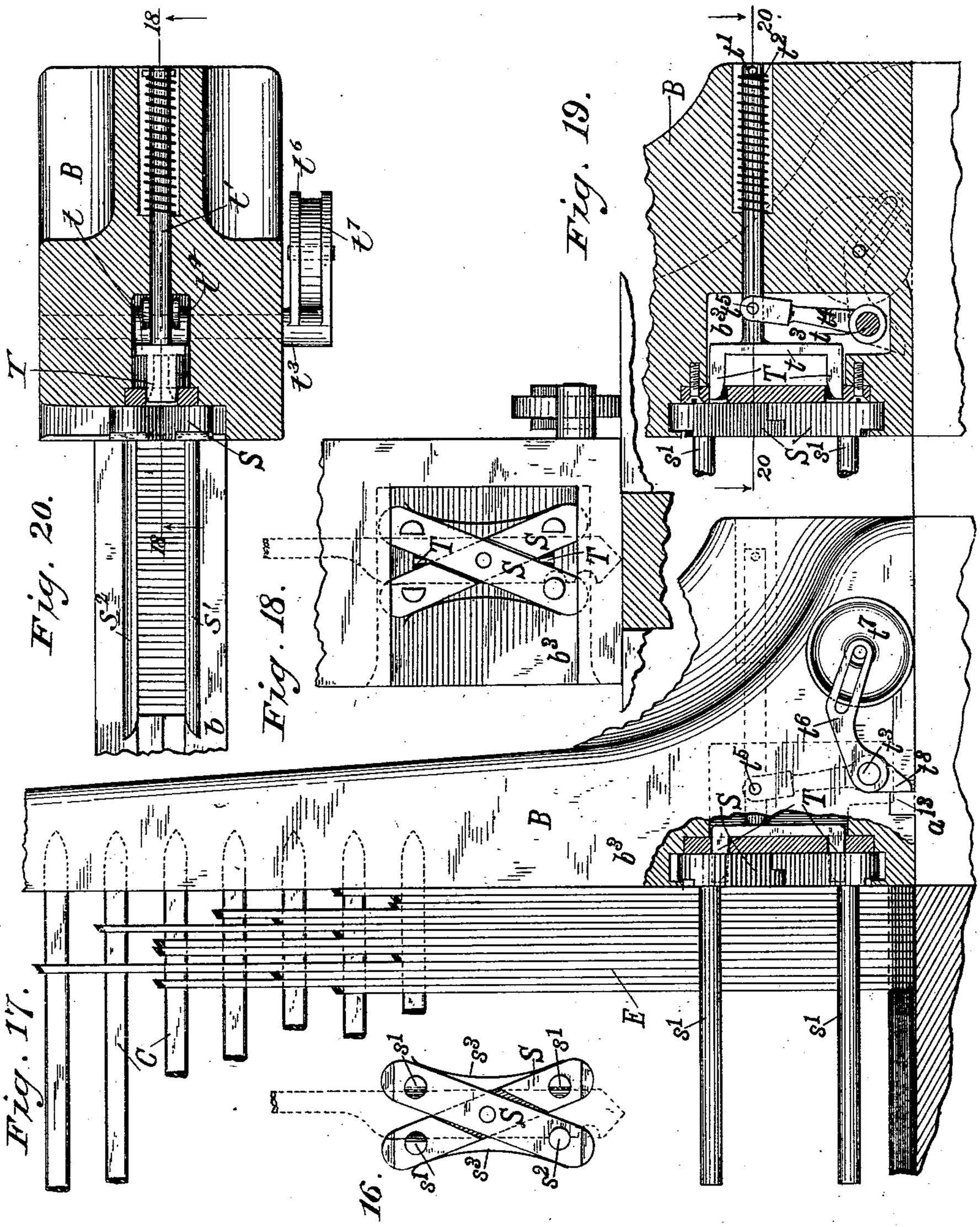

WITNESSES.

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C. FORTH.

MATRIX ASSEMBLING AND DISTRIBUTING MACHINE.

No. 562,954. Patented June 30, 1896.

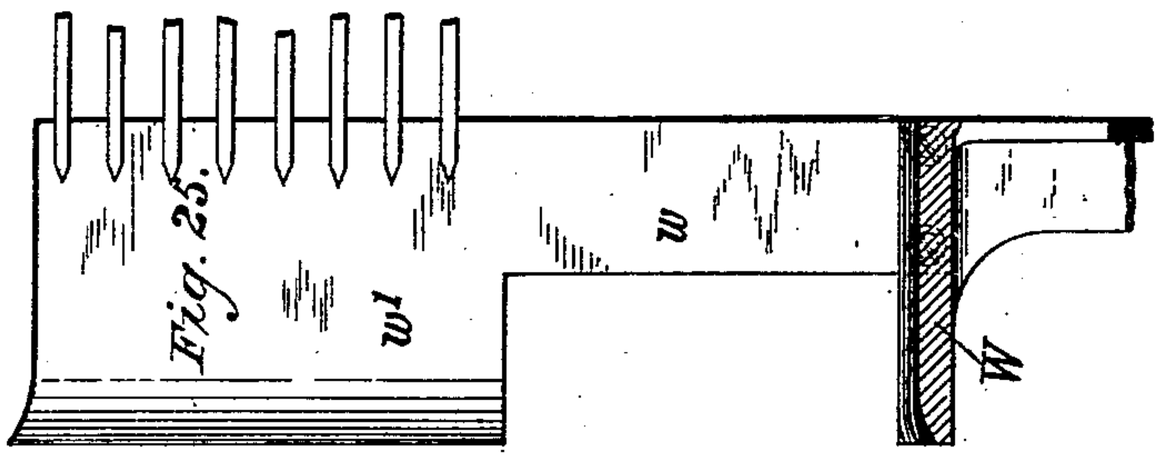

Fig. 25.

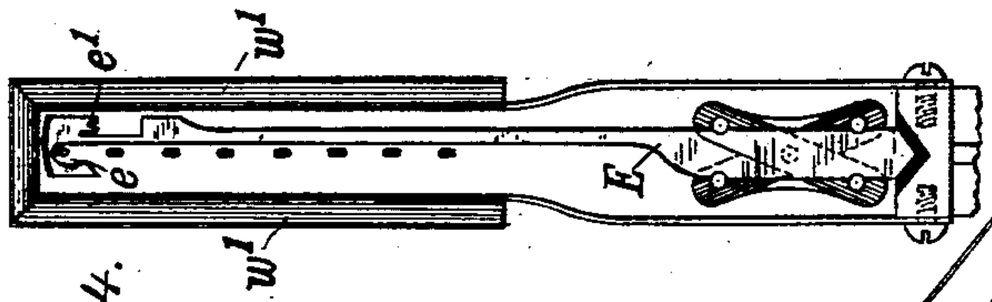

Fig. 24.

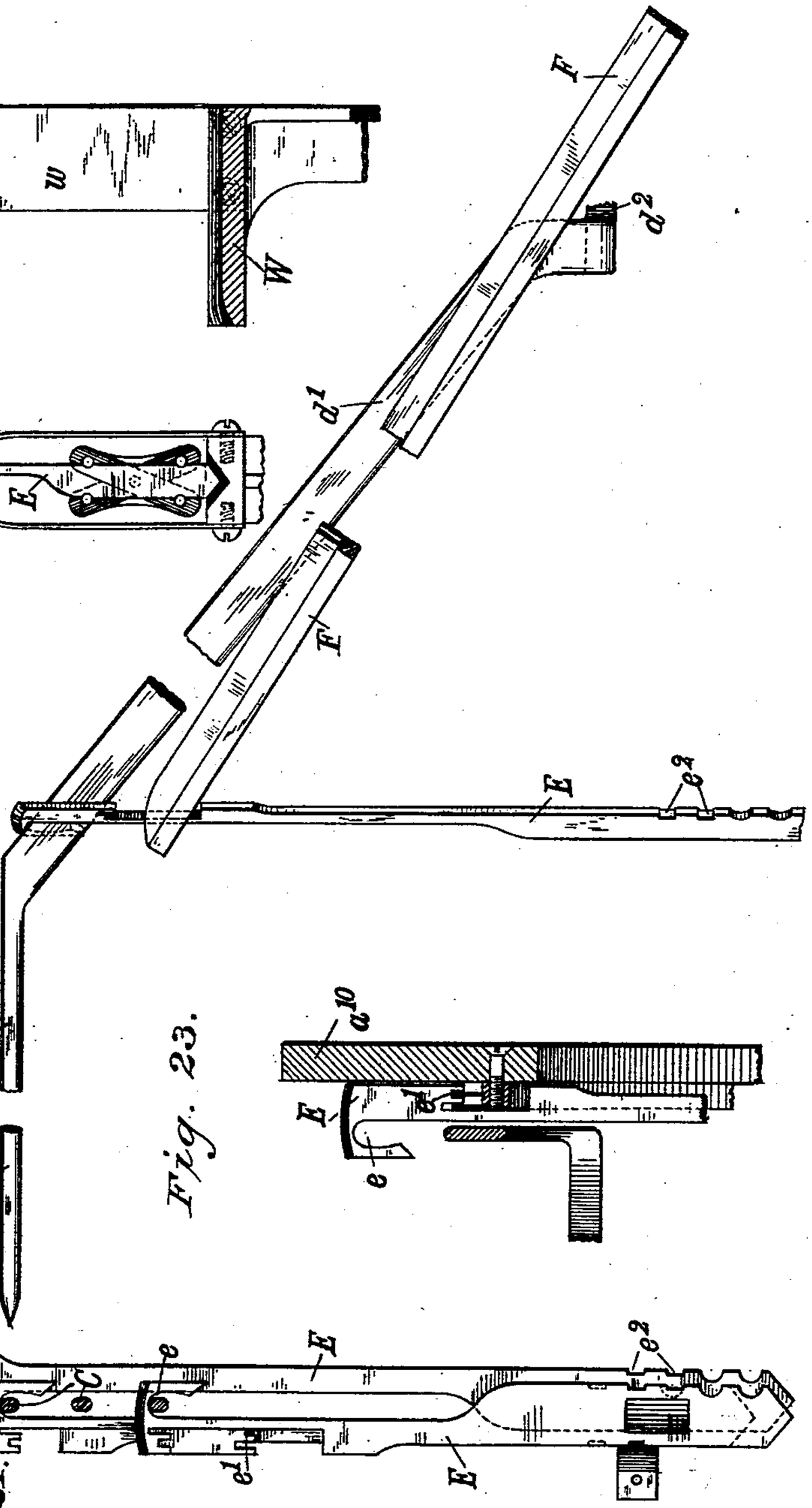

Fig. 22.

Fig. 23.

Fig. 21.

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MATRIX ASSEMBLING AND DISTRIBUTING MACHINE.

No. 562,954. Patented June 30, 1896.

Fig. 30.

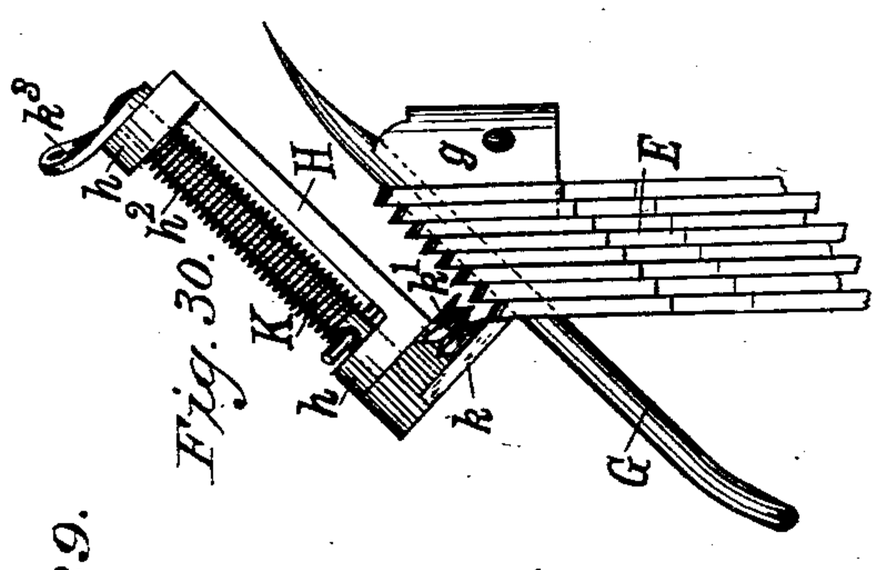


Fig. 31.

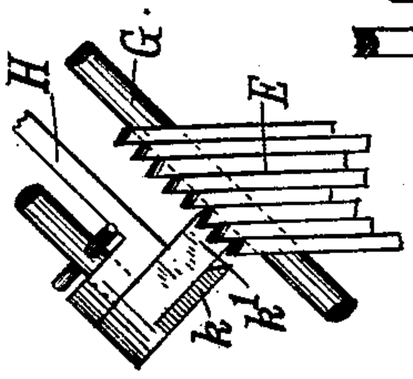


Fig. 33.

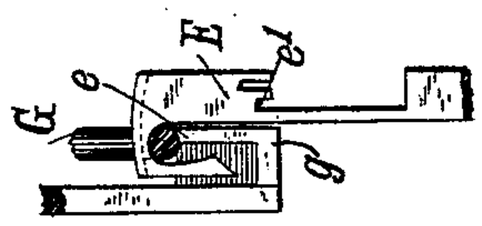


Fig. 29.

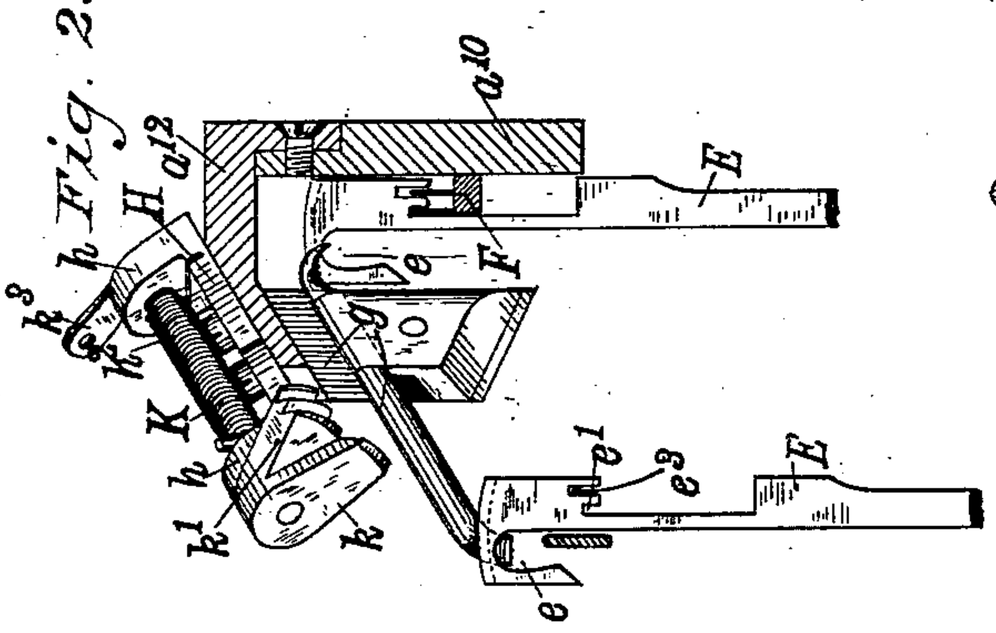


Fig. 32.

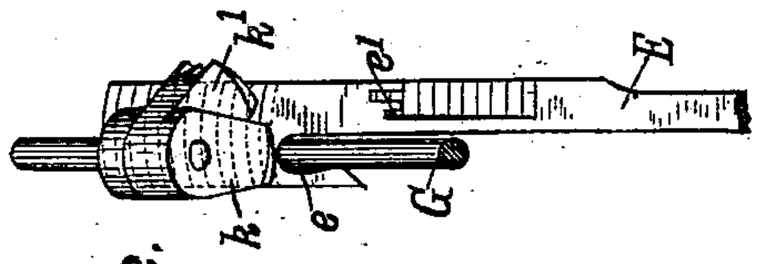


Fig. 28.

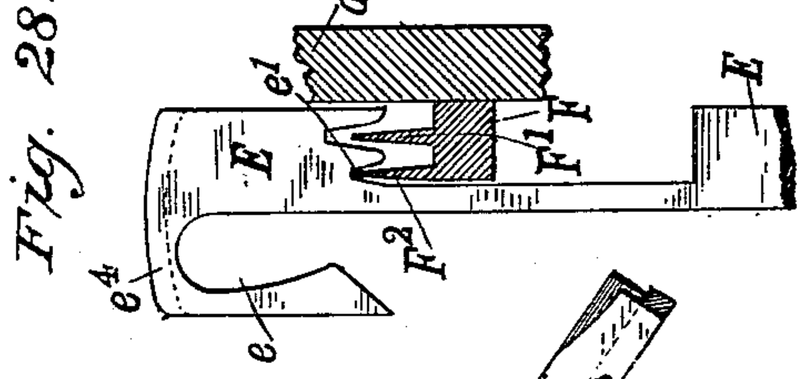


Fig. 27.

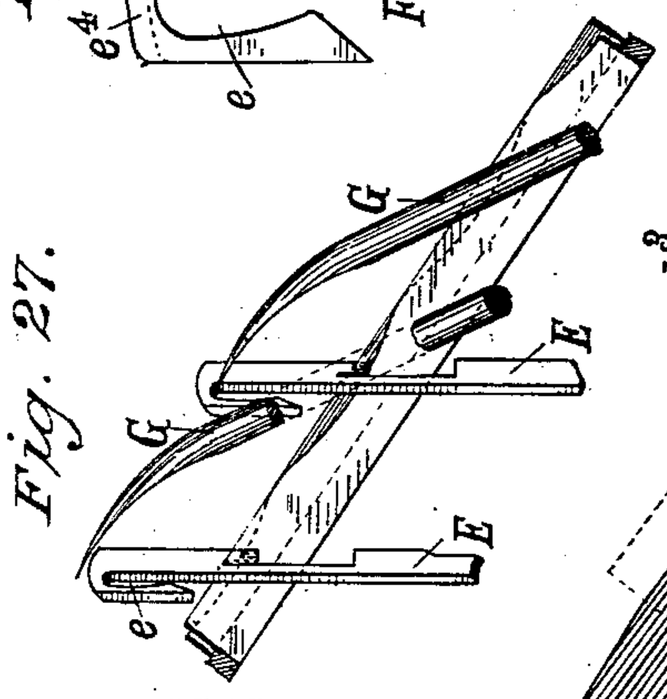
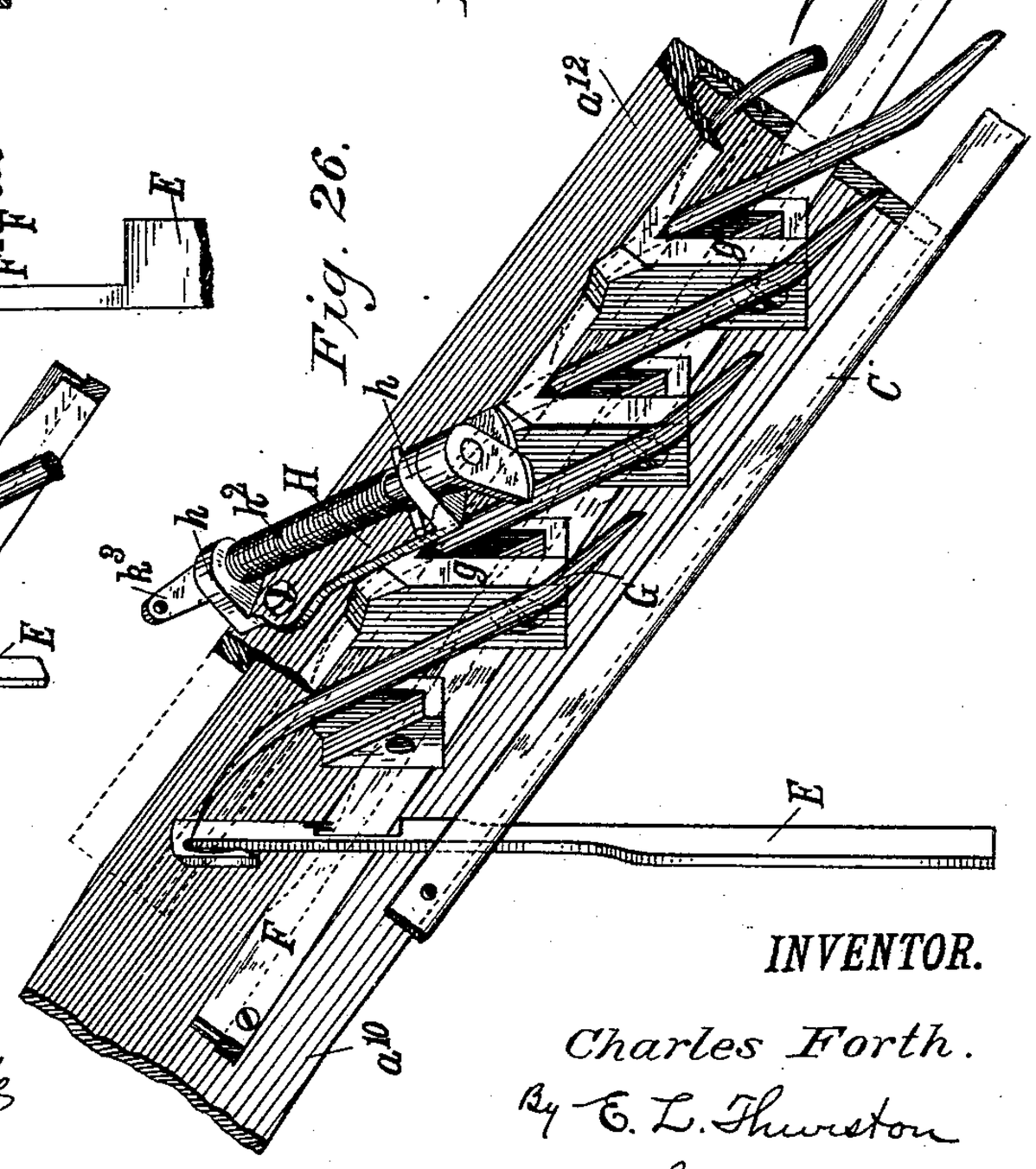


Fig. 26.



WITNESSES.

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MATRIX ASSEMBLING AND DISTRIBUTING MACHINE.

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Fig. 34.

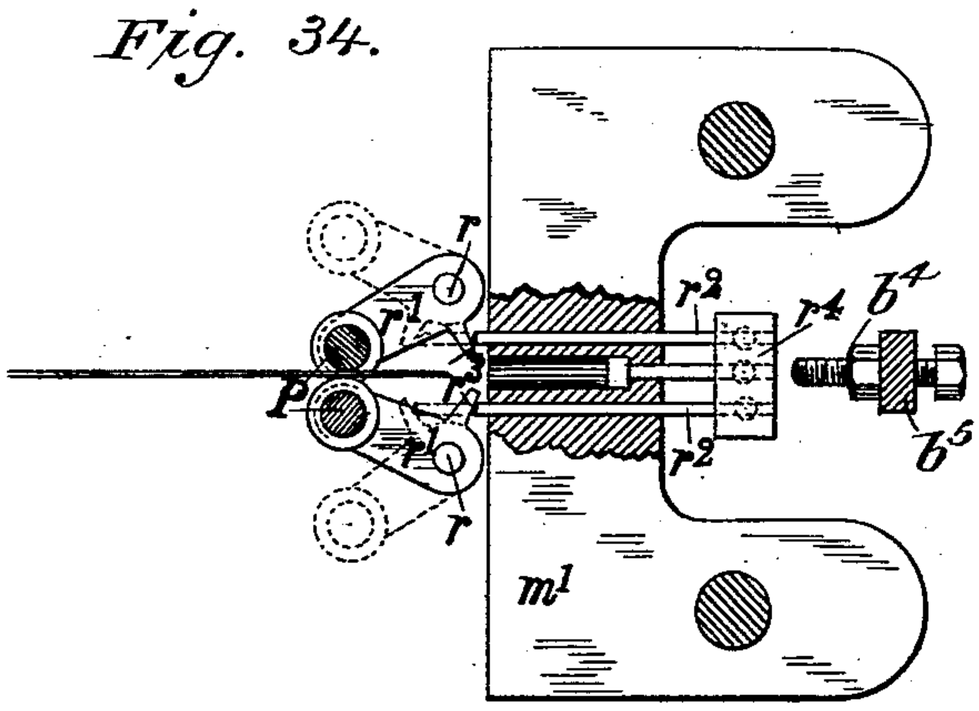


Fig. 35.

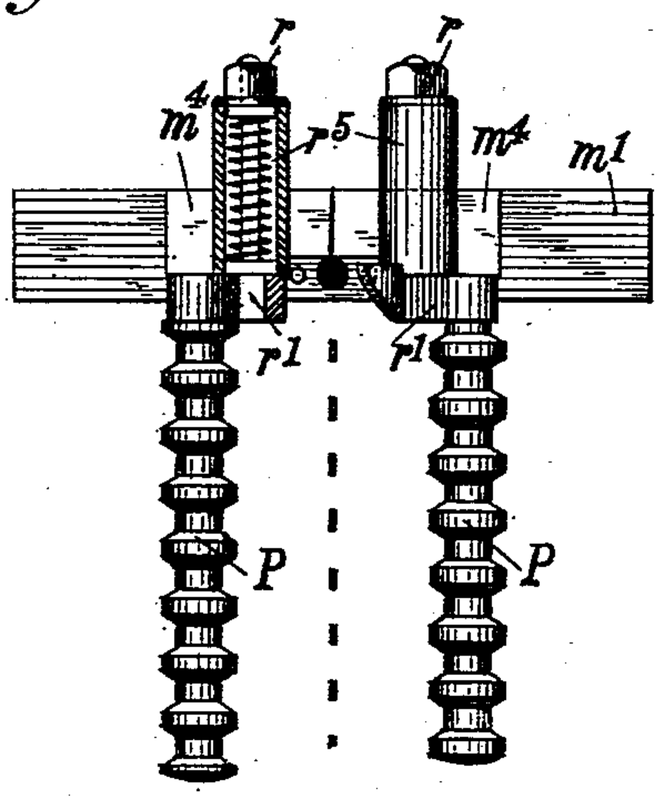


Fig. 38.

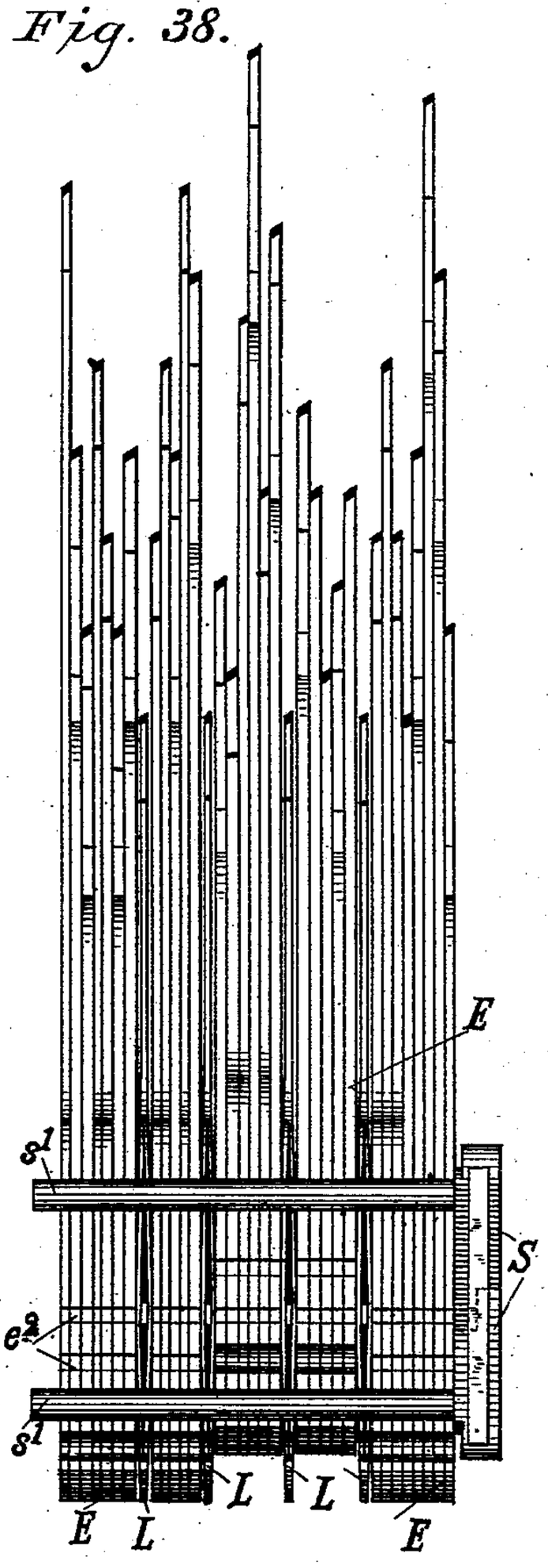


Fig. 37.

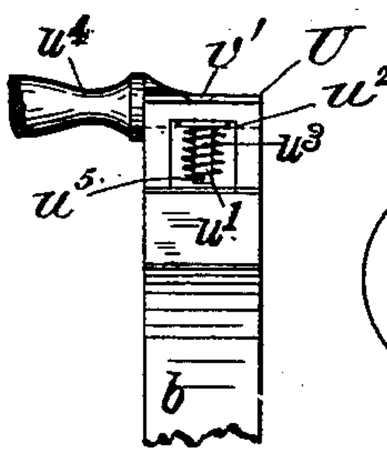
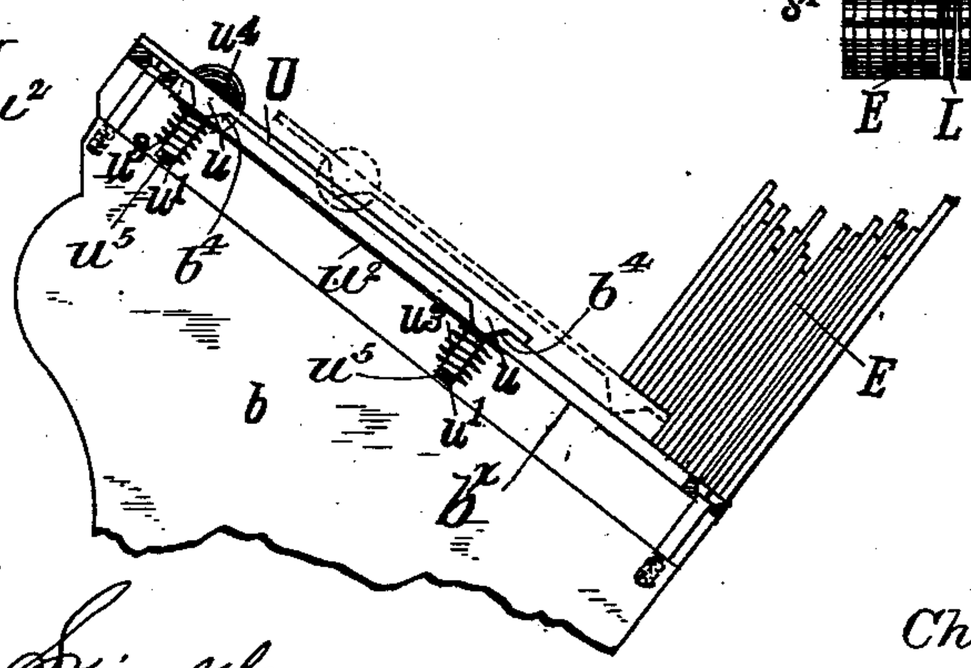


Fig. 36.



WITNESSES.

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MATRIX ASSEMBLING AND DISTRIBUTING MACHINE.

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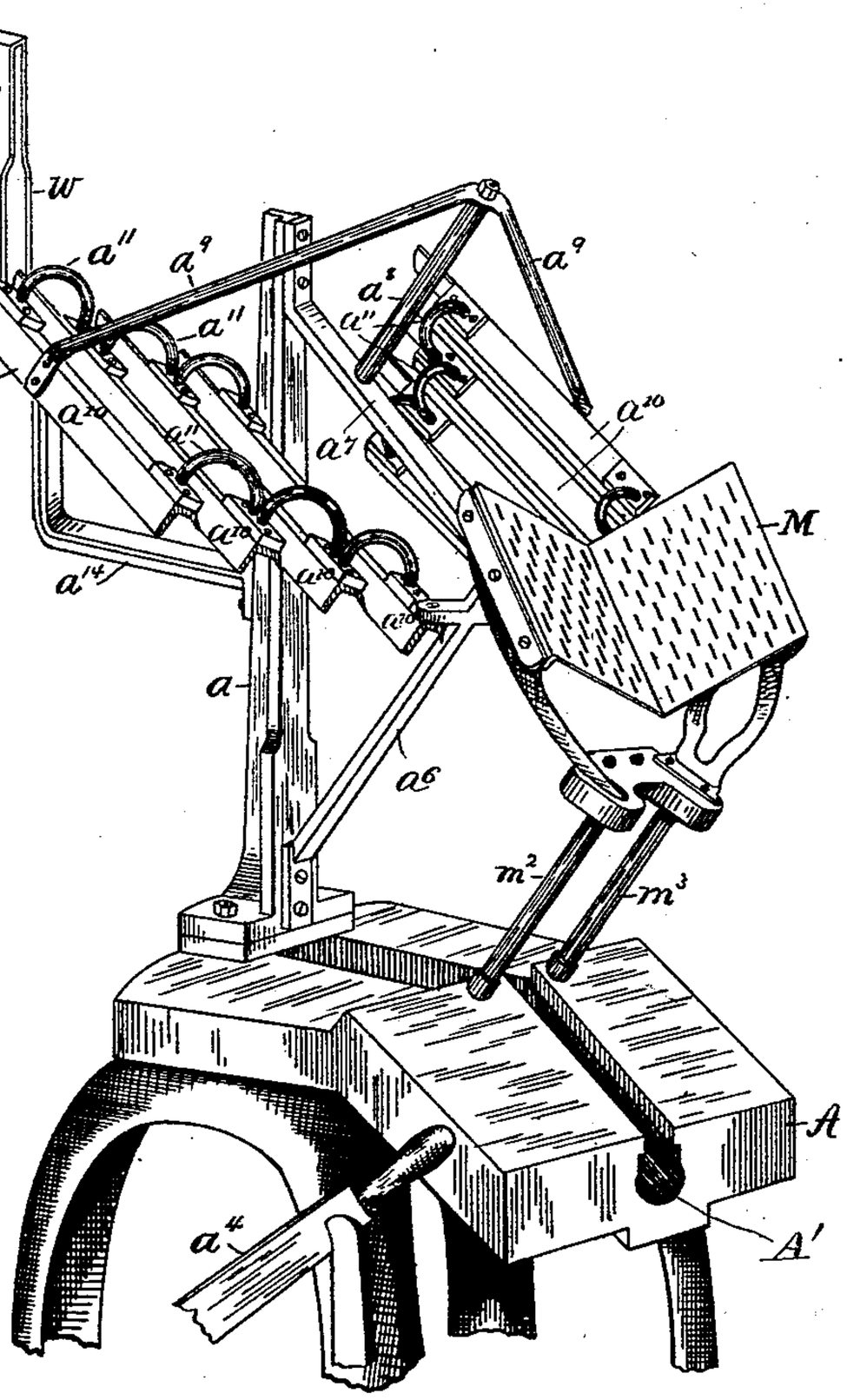

FIG. 39

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MATRIX ASSEMBLING AND DISTRIBUTING MACHINE.

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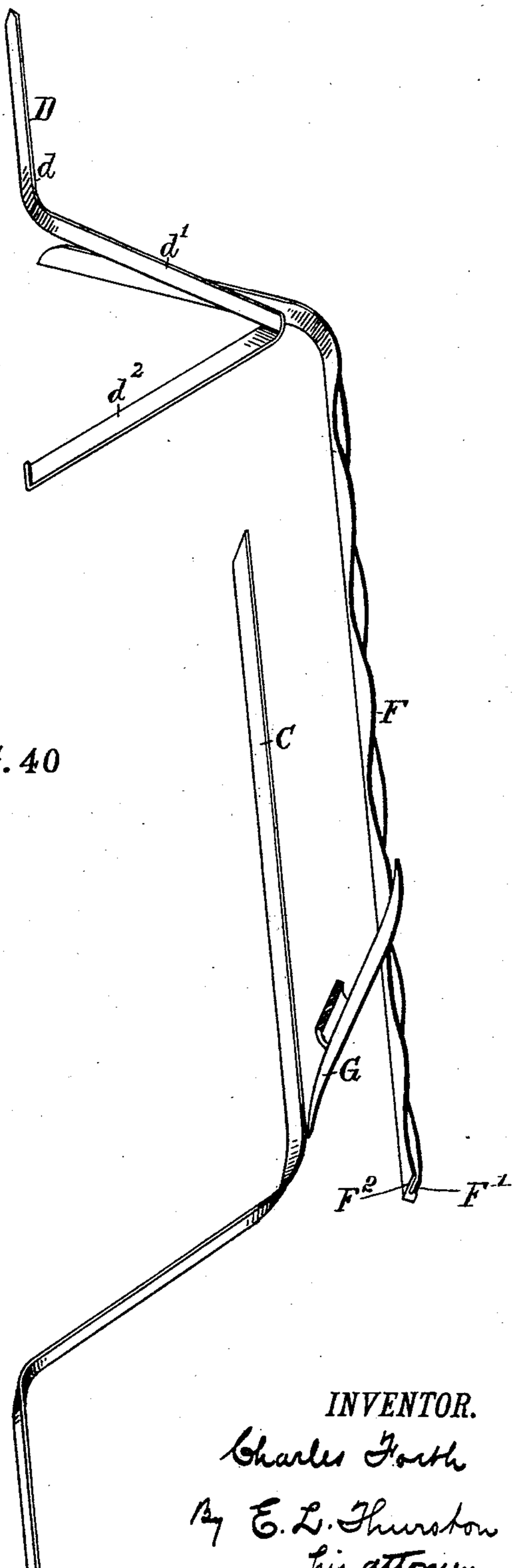

FIG. 40

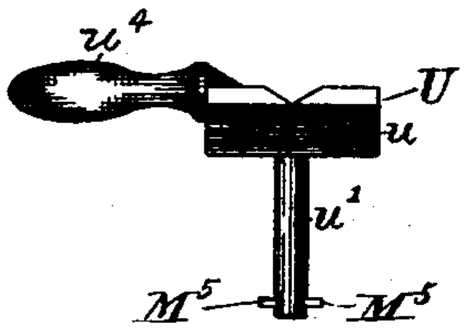

FIG. 41

WITNESSES.

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Helen M. Wood.

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his attorney

UNITED STATES PATENT OFFICE.

CHARLES FORTH, OF CLEVELAND, OHIO, ASSIGNOR, BY MESNE ASSIGNMENTS, TO THE FORTH GRAPHOTYPE COMPANY, OF SAME PLACE.

MATRIX ASSEMBLING AND DISTRIBUTING MACHINE.

SPECIFICATION forming part of Letters Patent No. 562,954, dated June 30, 1896.

Application filed September 23, 1892. Serial No. 446,681. (No model.)

To all whom it may concern:

Be it known that I, CHARLES FORTH, a citizen of the United States, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented certain new and useful Improvements in Matrix Assembling and Distributing Machines; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates particularly to the class of machines for assembling and distributing independent matrices (or type) which employ suspended matrices. There are, however, certain parts of the invention, as will appear from the subsequent description, which may likewise be used in connection with machines employing other kinds of matrices.

In all machines made prior to my invention, which were intended to assemble and distribute suspended matrices, it has been found necessary to employ as many separate and independent guides as there were different kinds of matrices. This necessary multiplicity of guides made the machines complicated and cumbersome, difficult to properly adjust in the first assembling of the parts, and expensive to keep in proper working condition.

One of the prime objects of my invention has been to provide an operative machine employing only a comparatively small number of assembling-guides, each of which is adapted to receive and conduct to the composing-point a number of different kinds of matrices, and corresponding mechanism for distributing said matrices to their respective magazines, thereby reducing the size and first cost of such machines, and rendering them less expensive to keep in operative condition.

Another important object has been to provide means for removing the matrices from the machine, a result which I believe has never before been attained with machines employing suspended matrices. One advantage which arises from this construction is that the entire font of matrices may be removed from the machine and a new font bearing the same or a different style of type may be substituted in a very short time. The chief advantage, however, is that the assembled lines of matrices may be removed to be taken to another machine in which the slug may be cast, with only a slight interruption in the assembling operation.

These are the three chief objects of the invention which are hereinafter described.

The several improvements constituting the invention relate to the construction, combination, and relative arrangement of the parts which make up the assembling and distributing systems, to the means for supporting the various parts of said systems, to the construction of the matrices, to the clamping mechanism for holding the assembled lines of matrices when they are removed from the machine, to the novel spacing mechanism, and to numerous other parts of the machine, all of which will be hereinafter described, and definitely pointed out in the claims.

The accompanying drawings show my invention as embodied in the best form of machine now known to me, but many changes in the details and arrangements of parts that would be obvious to and within the skill of a good mechanic might be made therein without departing from the spirit of my invention as set forth in the claims at the end of this specification.

Figure 1 is a side elevation, partly in vertical central section, on the line 1 1 of Fig. 2. Fig. 2 is a view of a sectional plan view on the line 2 2 of Fig. 1. Fig. 3 is a front elevation of portions of my machine as seen from the front or operator's side. Fig. 4 is a view looking endwise at the magazine-bars as seen from the line 4 4 of Fig. 1. Fig. 5 is a side elevation of one of the finger pieces or keys by means of which the detent mechanism operates to release the matrices. Fig. 5ª is a front elevation of the same. Fig. 6 is two views illustrating the several lengths and permutations of matrices which hang upon the left-hand side of the machine, looking from the direction in which it is viewed by the operator. Fig. 7 is a similar view of the matrices which hang upon the right-hand side of the machine. Fig. 8 is a horizontal section on the line 8 8 of Fig. 6, showing the side depressions in each matrix rendered necessary by the projecting wings of the wedge-blocks

in the spacers. Figs. 9 and 10 are views of the spacers which hang upon the right and left hand sides, respectively, of the machine. Fig. 11 is an edge view of one of these spacers. Fig. 12 is a side view, on an enlarged scale, of that portion of a spacer which contains the groove for the wedge-block, one side being partly broken away to better illustrate the groove in the opposite side. Figs. 13, 14, and 15 are horizontal transverse sections through a spacer on the line 14 14 of Fig. 9, Fig. 13 showing the matrix without the wedge-block, Fig. 14 having the wedge-block in place, and Fig. 15 showing the wedge-block pushed forward to spread the side plate of the spacer. Fig. 16 is an end elevation of the spring clamping device used to hold the assembling matrices in place while they are being transferred from one machine to another. It is shown as closed upon the matrix which is illustrated by dotted lines. Fig. 17 is a side elevation of the same, showing it in its position in the machine and open to receive the matrices, some of which have already been assembled. Fig. 18 is a view of the clamp similar to Fig. 16, except that the clamp is shown in its place in the machine and held open to receive the matrices, as in Fig. 17. Fig. 19 shows the sliding block by which the clamp is held open, the wedges which hold the clamp open being withdrawn and the clamp with the matrices in its embrace ready for removal from the block. Fig. 20 is a horizontal section through the sliding block on the line 20 20 of Fig. 19. Fig. 21 is a view in elevation of a number of matrices as they are entered upon the pick-up rods at the receiving side of the machine preparatory to the operation of distribution to their several magazines. Fig. 22 illustrates the position of a matrix in the act of sliding down the inclined edge of a pick-up rod and about to engage one of the distributing-rails. Fig. 23 is a vertical transverse section showing a matrix at a point in its descending movement where it has left the pick-up rod and is fully engaged with the distributing-rail which conducts it to the magazines. Fig. 24 is an end view, on a reduced scale, of the guide platform and hood to facilitate the entrance of the matrices on the pick-up rods. Fig. 25 is a vertical section through the same. Fig. 26 is a side elevation showing a matrix at that point in its descent where it is about to be engaged by one of the magazine-rods and leave the distributing-rail. Fig. 27 illustrates my plan for allowing the matrix while traversing the distributing-rails to pass below the receiving ends of all the magazine-rods preceding its own, on arriving at which it is elevated to the distributing-grade and properly engages its magazine-rod, upon which it slides after leaving the distributing-rail. Fig. 28 is a view, on an enlarged scale, showing the upper end of the matrix and the preferred form of its distributing hooks or notches and a double distributing-rail. Fig. 29 is a side view of one of the magazines, showing two matrices, one about to leave the distributing-rail and slide upon the magazine-rod, the other about to drop from the magazine-rod upon the assembling-rail by which it will be conducted to the composing-point. It also shows in perspective the gate or magazine-detent, the operation of which releases the matrices one by one from the magazine-rod, as clearly illustrated by Figs. 30, 31, and 32. Fig. 33 shows the means by which each magazine-rod is supported from the overhead plates and the manner in which the hooks pass through this support. Fig. 34 is an inverted plan view on the line 34 34 of Fig. 1, showing the groove-posts which support the free ends of the assembling-rods and the swinging arms by which these posts are carried. Fig. 35 is a side view of the same, showing the posts as swung back to the positions they occupy while composition is in progress and the assembling-rails left free for the passage of the matrices to the composing-point. Fig. 36 is a side view of a sliding plate used at the composing-point to elevate the matrices when it is desired to bring their Italic text up to the composing-line. Fig. 37 is an end view of the same. Fig. 38 is a side elevation of a matrix-clamp having within its embrace a set of matrices composed or set up to form a line for ordinary newspaper work and ready to be placed in the molding-machine preparatory to forming or casting a slug which will have upon its face raised characters corresponding to the characters on the several matrices. Fig. 39 is a perspective view of the stationary framework of the machine. Fig. 40 is a perspective view of one assembling and distributing system, including one pick-up rod, one distributing rail or guide, one magazine-rod, and one assembling rail or guide. Fig. 41 is an enlarged end view of the plate U.

I will now proceed to give a detailed description of the machine shown in the drawings, referring to the parts by letters.

A, Fig. 1, represents the bed-plate, the front edge of which inclines downward at about the same angle as do the assembling-rails. A slot A′, Fig. 39, extending from the front toward the rear of the machine, is made through the bed-plate. On the inclined ways, adjacent to said slot, a block *b*, Fig. 1, is mounted, the upper surface being below and parallel to the composing parts of the assembling-rails. An ear *b*′, on the under side of said block, projects through the slot where it is connected, by means of the link *a*′, to the arm a^2 on the rock-shaft a^3. The block is moved forward by the hand-lever a^4, and backward, to a stop, by said lever or by the weighted arm a^5 on the rock-shaft.

B represents a post fixed to the block *b* perpendicular to its top face. In the rear face of this post are formed a number of sockets b^2, lying in the same vertical plane, in which the forward ends of the assembling-rails are supported.

At the center of the rear side of the bed-plate an upright post *a*, Fig. 39, is secured. A brace a^6 extends upward and forward from the lower part of said post, and a bar a^7 extends from the upper end of said brace to the upper end of the post, said post, brace, and bar being rigidly connected. Secured to the top of the brace a^7, and extending upward at right angles thereto, is a post a^8. Attached to the upper end of this post are the stay-rods a^9, which extend toward opposite sides of the machine.

On each side of the machine and extending from the front toward the rear are a series of plates a^{10}. The outermost plate of each series is connected with the outer end of one of the stay-rods. The inner plate of each series is connected at the front and rear to the brace a^6 and post *a*, respectively; and the several plates of each series are connected together from above by the inverted-**U**-shaped straps a^{11}.

The parts explained in the last paragraph constitute a suitable rigid framework for supporting the other stationary parts of the machine to be hereinafter described.

Before describing the construction and combination of parts which coöperate in the assembling and distributing of the matrices, I will describe generally the kind of matrices which the machine is adapted to assemble and distribute.

Each matrix E, Sheet 4, consists of a body, in the edge of which the characters are formed in the ordinary way, at the points indicated by e^2, and a stem having at or near its upper end two hooks *e e'*, by means of which the matrices are suspended from the different rods and rails to be hereinafter described. These hooks must be of such character that they may be transferred in substantially the described manner from one rail or rod to another, and in the form shown one hook is on one side and one on the other side of the matrix-stem, and both are open from below. The hook *e* I term the "assembling-hook," because it is from this hook that the matrix is suspended from the assembling-rail. These hooks *e* are so placed with reference to the bodies of the several matrices that when the several matrices are suspended at the front of the machine from their different assembling-rails, which are arranged in the same vertical plane, the bodies of said matrices and the characters on the matrices shall be in line. The matrices are suspended by their assembling-hooks on the magazine-rods, and also on the pick-up rods, which coöperate in their distribution. The other hooks *e'* above referred to are the distributing-hooks, which are of such a character and so placed that when the matrices are sliding on the pick-up rods the distributing-rails may automatically engage with said hooks, thereby lifting the matrices from the pick-up rods.

A part of the assembling and distributing systems lie on one side and a part on the other side of the vertical plane in which the line of the matrices is assembled. Therefore it is necessary to make the matrices right and left handed. The matrices shown in Fig. 6 coöperate with the assembling and distributing systems on the left side of the machine, and those shown in Fig. 7 on the right side of the machine. With this partial description of the matrices shown the subsequent description of the construction, arrangement, and mode of operation of the assembling and distributing systems will be readily understood.

In the machine shown, eight assembling and distributing systems are employed. The number which shall be employed depends upon the number of different characters which are to be used and the number of magazine-rods which coöperate with and form a part of each system. The forward ends of the assembling-rails C, Figs. 1 and 2, are supported in the sockets in the post B, as before explained, and for a distance slightly greater than an assembled line of matrices, the assembling-rails lie in the same vertical plane, one above the other, whereby the matrices hanging from this portion of said rails are in line, as described. Since eight assembling-rails are employed, the matrices are necessarily of eight different lengths, one length for each rail. The rear ends of the eight pick-up rods D, Fig. 1, which form the beginning of the distributing systems, also lie in the same vertical plane, one above the other, separated the same distance vertically as the front ends of the assembling-rails, whereby when an assembled line of matrices is pushed onto the pick-up rods each pick-up rod selects, by engaging with the assembling-hooks, the matrices in said line which coöperate with the system of which it is a part. Except for the described grouping at the front and rear of the machine, and incidentally in the manner of supporting said systems, they are wholly independent of each other. Therefore a description of one system will answer for all. One complete system consists of a pick-up rod D, a distributing rail or guide F, an assembling rail or guide C, a number of magazine-rods G intermediate of the distributing rail or guide and assembling rail or guide which are adapted to receive the matrices from the former and to discharge them onto the latter rail, and suitable detent mechanism for releasing the matrices from the magazine-rods one at a time when desired and for preventing their release until such time.

The pick-up rod D, as shown, consists of three parts, viz: first, the selecting portion *d*, Fig. 1, which is horizontal, slightly longer than an assembled line, and lies in the same vertical plane with the selecting portions of the other pick-up rods; second, a separating portion *d'*, Figs. 2 and 40, which diverges to the right or left, as the case may be, from this plane, whereby the matrices which engage with it are separated sidewise from the assembled line, and, third, the supporting

portion d^2, which extends over the parts of the other system which lie between it and the center and is connected with the vertical post. The pick-up rods are preferably made of stiff flat bars, the upper edge of which is rounded and made perfectly smooth. The supporting portions d^2 extend over the intermediate systems so that they do not interfere with the depending matrices on said systems. The separating portions d' incline downward and, as shown, sufficiently to cause the matrices to slide down upon them by gravity.

I may say here that all of the parts of the several systems as shown in the drawings are inclined downward, so that the matrices fall by gravity alone from the horizontal parts of the pick-up rods to the assembling-point. This is indeed an essential feature of the machine in the form shown, although it is not a fundamentally-essential feature of the broad invention. It is a convenient and I believe the best embodiment of the invention because thereby no separate mechanism for moving the matrices is required.

The rear end of the distributing-rail lies in a vertical plane parallel to the vertical plane in which the separating portions of the pick-up rods lie, and at such a distance therefrom that when a matrix is hanging by its assembling-hook on the pick-up rod its distributing-hook is above the distributing-rail. The inclination of the distributing-rail is not so great as that of the adjacent pick-up rod, wherefore as the matrix slides down the pick-up rod its distributing-hook engages with the distributing-rail and the weight of the matrix is transferred thereto, and the matrix continues its journey hanging from its distributing-hook on the distributing-rail until it engages with and is transferred to its proper magazine-rod. The distributing-rail is supported by being secured to the inner side of one of the plates a^{10}.

On the top of the plate a^{10}, Sheet 7, and extending inward is a plate a^{12}. This plate a^{12} may be an integral part of plate a^{10} or a separate piece rigidly secured thereto. Several brackets g, which carry the magazine-rods G, are connected to and extend downward from the inner edge of the plate a^{12}. These brackets have two substantially vertical arms, which are connected at their lower ends, making the bracket substantially U-shaped, the inner arm of each being connected with the plate a^{12}, and the magazine-rods are secured near their middle on the top of the shorter outer arm of said bracket. (See Figs. 26 and 29.)

The rear end of each assembling-rail C is secured to the outer side of the plate a^{10} next nearest to the center. (See Fig. 2.) The rear ends of the assembling-rails nearest the center on both sides of the machine are connected with the post a. It extends for a considerable distance substantially parallel to the distributing-rail but in a lower plane. Each magazine-rod G extends obliquely from a point a little to the inside of the distributing-rail to a point above the assembling-rail. The rear or receiving end of each magazine-rod lies at such a point that as its proper matrix slides down on the distributing-rail the said receiving end enters the assembling-hook. The inclination of the receiving ends of the magazine-rods are less than the inclination of the distributing-rail, whereby the matrix, as it moves toward the front of the machine, is lifted from the said rail and slides down the magazine-rod and takes its place behind the other matrices thereon which are held by the detent. The front or delivery ends of the several magazine-rods lie directly over the assembling-rail, wherefore when a matrix is allowed to escape from the detent it drops off the magazine-rod onto the assembling-rail, down which it slides to the composing-point. The delivery ends of the magazine-rods are so far above the assembling-rail that they do not interfere with the matrices sliding on the rail which have been dropped thereon from the magazine-rods behind them.

The receiving ends of the magazine-rods are located at different positions relative to the distributing-rails, the rearmost rod being the highest; and these receiving ends of the magazine-rods are so placed that each will engage with the assembling-hook of its own matrix when the same is sliding down said rail on its distributing-hook.

In order that the different matrices may be adapted to engage with the different magazine-rods, which, as above explained, occupy a different position relative to the distributing-rail, it is necessary to provide means for holding the assembling-hooks at corresponding positions with respect to the distributing-rails when the matrices hang therefrom by their distributing-hooks. This result may be secured entirely by placing the distributing-hooks at different positions on the stem of the matrix in relation to the assembling-hooks, as shown for example in either matrix illustrated by Figs. 6 and 7. When ten magazine-rods are used in connection with each system, the distributing-hooks will be placed on the matrices which coöperate with said system at ten different positions relative to the assembling-hooks. In Fig. 7 only the two extreme positions of said distributing-hooks are shown. When a matrix having its distributing-hook placed as indicated by the lowest hook e' is riding on the distributing-rail, the assembling-hook e is held the highest above said rail and engages with the magazine-rod which is held at the greatest elevation, which, as before stated, is the rearmost magazine-rod. When a matrix having its distributing-hook in the position indicated by the upper dotted lines showing a distributing-hook is hanging by said hook on the distributing-rail, its assembling-hook is the least elevated and is adapted to engage with the lowest and foremost magazine-rod, and to pass under the rods behind it. The distrib-

uting-hooks are so placed at different intermediate positions (indicated in Figs. 6 and 7) on the other matrices of the system that each engages with and is picked off by its own magazine-rod, which is held at the proper position relative to the distributing-rail.

It is clear that if I relied wholly, as well I might, on the different elevations of one set of distributing-hooks as the means for causing the engagement of the several matrices with their proper magazine-rod, the lowest distributing-hook on the several matrices would have to be placed a distance below the highest distributing-hook on said matrices equal to ten times (when ten magazine-rods are employed) the thickness of the upper part e^4 of the assembling-hook. This is true because each matrix must be able to pass freely under the magazine-rod next above its own, and therefore the difference in elevation of the distributing-hooks on matrices which hang on two adjacent rods must be slightly greater than the thickness of the part of the assembling-hook above named. To avoid the necessity of having so great a variation in the position of the several distributing-hooks, I have devised a double-track distributing-rail, the two parts or tracks F′ F² of which alternately rise and fall below what I may term the "grade-line."

By grade-line I mean a line tangential with the highest points of the distributing-rails. It is when the matrices are supported by the highest parts of the distributing-rail, or at the grade-line, that they are selected and picked off by their proper magazine-rods.

I provide the alternate matrices with distributing-hooks in two different vertical planes, as shown in Figs. 6, 7, 26, 27, 28, and 29. By reference to Fig. 7, for example, it will be seen that each matrix is provided with two hooks at the point where the distributing-hooks are placed. On the matrix shown in the right of said Fig. 7 the right-hand hook e' is the distributing-hook, the other hook e^3 being merely a hook which lies over the track F² and serves to steady the matrix when it is suspended from its hook e' on the right track F′ of the distributing-rail, and when said track F′ is depressed below the grade-line, as shown at the left-hand end of Fig. 27, the matrix resting on that part of the track which is so depressed slides under the end of the magazine-rods next behind its own; but when said matrix arrives at a position adjacent to its own magazine-rod the track F′ rises to the grade, the matrix is correspondingly lifted, and its assembling-hook e slips over the receiving end of said magazine-rod. (See right-hand end of Fig. 27.) In the matrix shown at the left of Fig. 7 the left hook e' is the distributing-hook which rides upon the left track F². The part of said track which is adjacent to the magazine-rod corresponding to the matrix to be distributed is raised to the grade-line, and the assembling-hook e engages with said magazine-rod. (See Fig. 26.) From the foregoing description and the drawings it will appear that the portions of the track F′ adjacent to alternate magazine-rods is at the grade-line, and that the intermediate portions are depressed below said grade-line, and that track F² is at the grade-line when track F′ is depressed, and vice versa.

By reason of the construction last referred to each matrix is lifted to the grade-line at the point adjacent to its own magazine-rod, because the track on which said matrix slides (say, for example, track F′) is elevated to the grade-line. The part of said track F′ adjacent to the magazine-rod next behind the magazine-rod last referred to is depressed, whereby the said matrix is lowered and passes under said rear magazine-rod; but at this point where track F′ is depressed the track F² is elevated to grade-line, and that matrix which is intended to be picked off by the magazine-rod adjacent thereto rides on track F², whereby it is raised to the position where its assembling-hook engages with its magazine-rod. The matrices intended to hang on every other magazine-rod ride on track F′, while the matrices intended to hang on the intermediate magazine-rods ride on track F². Each matrix as it slides toward the front of the machine undulates just as that rail (F′ or F²) does on which it slides.

Detent mechanism operated by a finger-key is provided to act in coöperation with each magazine-rod. Each detent mechanism shown (see Figs. 26, 29, 30, 31, and 32) includes a plate H, which is secured on the top of plate a^{12}. The plate has two ears h h, which serve as bearings for a rock-shaft K. On the forward end of the rock-shaft is an arm k, which is adapted to project in front of the string of matrices hanging on the magazine-rod. A coil-spring h^2, surrounding the rock-shaft, turns it so that the said arm normally lies in the position described and shown in Figs. 30 and 32. Behind the arm k and lying at an angle thereto is a second arm k', which is so placed that, when the rock-shaft is turned to move the arm k from in front of the matrices, the arm k' moves in front of the second matrix, as shown in Fig. 31, and it moves to this position before the arm k has been wholly moved from in front of the first one. (See Fig. 32.) Therefore when the rock-shaft is rocked to release one matrix the arm k' prevents all but the first from falling off the magazine-rod. When the rock-shaft is moved in the opposite direction by its spring, the arm k again engages in front of the foremost matrix and holds that matrix and consequently all the others as before. In the outer edge of the arm k' grooves are formed like the threads of a screw, and the upper ends of the matrices, which are beveled as shown, enter said grooves when the rock-shaft is rocked. This construction distributes the strain on the arm, and at the same time permits the string of matrices to move gradually down to the position they will occupy when they are

held by the arm k. The rock-shaft is also provided with another arm k^3, to the end of which a rod is secured. This rod extends toward the front of the machine, where it is screwed into a flattened bar n', Figs. 5 and 5^a, which passes through a slot in an inclined keyboard M; and a key N is secured to the end of the bar n' on the opposite or front side of the keyboard. This key is so large that it cannot pass through this slot in the keyboard, but it does rest against it. Therefore when a key is pushed down it slides in contact with the inclined face of the board, thereby pulling upon the rod n' and causing the rock-shaft K to rock far enough to release a matrix, as above explained.

The keyboard M is an inclined plate having through it as many slots m^3 as there are keys. It is smooth on its top surface, which surface acts as an inclined plane against which the under side of the key bears. When any key is depressed, it slides against said surface whereby it is drawn forward at the same time.

The keyboard M is supported by two side pieces $m\,m$, which are secured to the plate m', which is secured to the top of two posts m^2 m^2, which are themselves secured to the inclined front of the bed-plate.

Mounted in rearwardly-projecting ears m^4 m^4 on the plate m', Fig. 8, are two spindles $r\,r$, Figs. 34 and 35, having each a crank-arm r'. To the outer ends of these crank-arms and extending downward therefrom are two grooved bars P P, which lie on opposite sides of the grouped assembling-rails. Extending through the plate m' are two rods r^2, the rear ends of which strike against lugs r^3 on the arms r', thereby causing said arms to turn on their pivots and to assume the relative position shown in Fig. 35—that is to say, to separate the bars. The rear ends of said rods r^2 are connected by a yoke r^4, which is struck by a set-screw b^4 in a bracket b^5, secured to the post B, Fig. 1, when the latter is moved toward the rear, thereby moving said rods with the above-described result. When the post is moved forward away from said yoke, to release the forward ends of the assembling-rails, the springs r^5, Fig. 35, which surround and engage with the spindles r, cause said spindles to turn and thereby move the grooved bars P P toward each other. The assembling-rails are thereby grasped between said bars (in the grooves thereof) thus holding said rails in their proper relative position until they again enter the sockets in the post B. The parts last described are relatively so placed that the assembling-rails are grasped by the grooved bars P P before they are completely released from the post B, and are held by said bars P P until the post B again engages with the assembling-rails. Moreover, the point at which the assembling-rails are grasped is behind the composing parts thereof on which the line of matrices is assembled.

The machine shown is one in which provision is made for the removal of a line of matrices which has been assembled at the front end of the machine, although this is not an essential attribute of all machines containing the improvements heretofore described. In order that the line of matrices may be removed in a practical manner in such condition as to be immediately available to make a linotype from, it is desirable to provide a clamping device for holding the matrices in line adapted to engage with said line while the matrices are still suspended from the assembling-rails. The clamping device shown in the drawings consists of two crossed bars S S, Sheet 5, which are pivoted together at the middle, and four parallel rods s' s' s' s^2, which are rigidly secured to the ends of said bars at right angles thereto. Attached to the side of each bar S is a flat spring s^3, which engages with the other bar and exerts its force to close the clamp. (See Figs. 16 and 18.) Three of the rods are flat on the faces with which they engage the matrices, and the fourth rod s^2 is round and is adapted to lie in a half-round alinement-notch e^5 in the edge of each matrix. The form of the notch and of the bar s^2 is not material except to the extent that they must correspond. The face of the post B is provided with a recess b^3, in which the bars S S are adapted to lie and into which they may slide from one side. (See Fig. 18.) When in this recess and when the post B is supporting the front ends of the assembling-rods, the clamp is held open by two wedges T T, Fig. 9, which are thrust between the bars S S, as shown in Fig. 18. This holds the rods s' s^2 far enough apart to permit the matrices to enter between them. The mechanism for actuating these wedges to open the clamp and to withdraw them, so as to allow the clamp to close is the following, viz: The rear ends of the wedges are connected by a plate t, Fig. 19, and to the front side of this plate a rod t' is secured. The wedges slide in sockets in the post, as does the rod t' also. A spring t^2, surrounding the rod, exerts its force to move it forward, thus withdrawing the wedges. A rock-shaft t^3 is mounted in the post B, and to it is secured an arm t^4, in the upper end of which is a short slot. A pin t^5, projecting from the rod t', lies in this slot. On one end of the rock-shaft an arm t^6, Fig. 17, is secured, having an inclined slot in which the axle of a wheel t^7 is mounted. This wheel is adapted to engage with the inclined face of the bed-plate, whereby when the post B is being moved forward the wheel revolves and its axle rides up in the slot, thereby tending to draw the arm down, thus rocking the rock-shaft and withdrawing the wedges, the spring t^2 before mentioned coöperating to produce this result. When the post B is returned to its former position, the action of the wheel t^7 on the arm t^6 is reversed and the wedges are moved inward. A depending lug t^8 on the rock-shaft engages with a shoulder a^{13} on the bed-plate and thus makes this inward movement of the wedges complete and positive.

V V, Figs. 1 and 2, represent two guides which at the front of the machine are substantially parallel and lie on opposite sides of the matrices which are assembled at the point of composition. They are supported by being connected with the posts. They spread apart back of the composition-point and lie in such position, substantially as shown in Fig. 2, that they will engage with the body of a matrix sliding down any assembling-rail and guide said body to the composition-point and between the rods s' s^2 of the clamp. These guides are especially useful for preventing the matrices on the outer assembling-rails from acquiring a swinging movement due to the changes in the direction of said rails. Another feature of construction which is useful in guiding the matrices between the clamping-rods s' s^2 is the V-shaped lower ends of the matrices and the V-shaped groove V′ in the upper surface of the block b and of the plate U. The V-shaped lower ends of the matrices are also useful in getting the line of matrices into perfect alinement in the casting-machine.

The spacers L for separating the words and justifying the line, which are shown in Figs. 9, 10, and 11, have the same general form as the matrices. They are provided with similar assembling and distributing hooks and are adapted to be suspended upon similar magazine-rods and are released by the same sort of detent mechanism. The bodies of the spacers are however made of two plates of spring metal, which are secured together at top and bottom by rivets or otherwise, as shown. At a point corresponding to the position of the characters on the matrices a transverse groove is made in each of the meeting faces of said plates. Between said plates and lying in said grooves is an arrow-headed wedge-block l, the rear sides of the arrow-shaped head extending out through holes in the side of the plates, which form stops to limit the backward movement of the wedge-block. These sides do not extend much beyond the outer sides of the plates, but they extend far enough to make it desirable to form depressions e in the side of the matrices, so that whichsoever matrix may be brought next to a spacer will lie flatly against it. Near the rear end of the wedge-block a second wedge l' is formed, and behind it is a stem l^2, by means of which the wedge-block may be operated. Normally this second inclined part of the wedge-block and the stem lie wholly outside the plates, as shown in Fig. 14. When a number of these spacers are in a line, their stems all project in the same plane, and it is intended to operate them all simultaneously to justify the line and proportionately space it. No means are shown for producing this simultaneous operation of the wedge-blocks, because the machine shown is not intended nor adapted to complete the justification of the line. That is done in the machine in which the slug is cast. When the wedge-block is moved forward, the arrow-shaped head thereof spreads the front edge of the two plates apart at exactly the point where the spacing is required, *i. e.*; in line with the characters, and the inclined surfaces on the rear part of said block similarly spread the rear sides of said spacers. At the same time the height of the wedge is equal to the thickness of the slug to be made, whereby the front ends of the wedges serve to prevent the molten metal from running between the plates when a cast is being made. The grooves in which the arrow-shaped heads of wedge-blocks lie are inclined to correspond to the inclination of the said wedge-surfaces, and there is in said plates sufficient spring to cause the wedge-blocks, when not pressed from behind, to resume their normal position.

By examining Figs. 6, 7, and 38 it will be seen that there are two depressions e^2 e^2 in the edge of each matrix in which characters are formed. In the lower depressions are formed the Roman characters, and in the upper depressions are formed similar Italic characters. In the edge of each matrix are likewise found two alinement-notches e^5 e^5, either of which may engage with the clamping-bar s^2 of the clamping device.

If I desire to have a word in a line or an entire line appear in Italics, I have only to raise the matrices composing the word or line so that the lower notch will engage with the clamping-rod.

In order to automatically raise the matrices to bring the lower character into the impression-line, I provide the following mechanism: A plate U, having on its under side beveled projections u u, rests upon the upper surface of the block $b^\times$, in which surface are formed the beveled depressions b^4, which are adapted to receive said projections u u. Projecting downward from the under side of the plate U are the pins u', which pass through a longitudinal slot in the block b and through a clamping-plate u^2, which lies against the under side of said block $b^\times$. Coil-springs u^3 surround the pins u' and lie between the clamping-plate u^2 and pins u^{35} which project from the side of the lower ends of the pins u'. These springs tend to draw the plate U and the clamping-plate u^2 toward each other, and these two plates and the springs form a sliding spring-clamp which embraces the block $b^\times$ on the block b. On one side of the plate U is a handle u^4, by which said plate may be moved forward and backward. When the plate U is at its rearmost position, the beveled projections u lie in the corresponding beveled depressions in the block $b^\times$ and the top surface of the plate U is then raised only slightly above the surface of the block $b^\times$ and is so far to the rear end of said block that the lower ends of the matrices do not touch it as they descend to the assembling-point. When it is desired to elevate the matrices for the purpose specified, the plate U is moved forward until its forward end strikes

the post B or the rearmost matrix of the assembled matrix-line. In moving forward the beveled projections *u* slide up the beveled sides of the depressions b^4 in the surface of block $b^\times$, the plate U being thereby elevated to the position shown by the dotted lines in Fig. 36. When the matrices are now released and slide down the assembling-guides, their lower ends strike the plate U, by which they are automatically raised so that their lower characters are brought into the impression-line.

The clamping-rods s' s' s^2 are not close enough to clamp the matrices, but they are close enough to cause the rod s^2 to enter just far enough into the notches e^5 to prevent the matrices from falling when the plate U is returned to its normal position.

It will be noticed that in addition to the two character depressions in one edge of the matrices another depression e^7 is shown in the opposite edge. In this depression is formed the same character but in another style of type, and this edge of the matrix may be employed to make the linotype from when desired. When, however, this edge is to be used, it is necessary to use a spacer with the wedge-block *l* projecting from the opposite edge. Such a spacer is shown in Fig. 10.

At the rear end of the machine is a platform W, Fig. 1, which is directly beneath the ends of the pick-up rods, just as far away therefrom as the block *b* is from the assembling-rails. This platform is supported on an arm a^{14}, which is fastened to a post *a*. Secured to this platform are two side pieces *w w*, connected by a top or hood *w'*, Fig. 24, and these pieces serve to properly guide the line of matrices which are introduced from the rear, so that each will be engaged by the pick-up rod forming a part of the system to which it belongs. When the line is introduced, it is in the embrace of the clamp, which is however removed by hand when the matrices are in position to begin to distribute.

In the operation of the above-described machine, after the matrices forming a line of composition have by the operation of the key mechanism been assembled in the front of the machine, the operator moves the hand-lever a^4 forward. This moves the block *b* and the post B carried thereby, releasing the forward ends of the assembling-rails from their engagement with said post. Before being entirely released the grooved bars P P grasp the said rails and sustain them so that upon the return of the post B the ends of the rails will enter the sockets therein. The line of matrices follow the post in its forward movement, slipping off the ends of the assembling-rails. The clamping device has in the meantime tightly grasped the matrices, and the entire line and clamp are removed and taken to another suitable machine for forming the slug.

When the slug has been formed, the matrices are placed in the rear of the machine, their lower ends resting on the platform W. When moved forward each pick-up rod engages the assembling-hook of the matrices which belong to its system, the clamp is removed, and the matrices slide down to and are picked off by their own magazine-rods.

Having thus described my invention, what I claim is—

1. In a matrix assembling and distributing machine, a matrix consisting of a body part, a stem, and two hooks projecting from opposite sides of the said stem, substantially as and for the purpose described.

2. In a matrix assembling and distributing machine, a matrix consisting of a body part, a stem and assembling-hook and a double distributing-hook secured to said stem, substantially as and for the purpose specified.

3. In a matrix assembling and distributing machine, a series of matrices each having a body part in which the character is formed, a stem, an assembling-hook, and a distributing-hook, the distributing-hooks on the different matrices being placed at different positions relative to said assembling-hooks, substantially as described.

4. In a matrix assembling and distributing machine, a plurality of series of matrices, every matrix having two hooks, the one of which is placed on all the matrices in any series at the same distance from the character depression, which distance is different in the different series, the other hooks on the different matrices in each series being placed at different positions with relation to the first hooks named, substantially as specified.

5. In a matrix-assembling machine, an assembling-guide, a series of magazine-rods, matrices adapted to hang therefrom, and means for transferring the matrices singly from any magazine-rod to said guide, substantially as specified.

6. In a matrix-assembling machine, an assembling-guide a magazine-rod supported with its delivery end above the assembling-guide, and a series of matrices each having a hook by means of which it hangs from the magazine-rod and which is adapted to catch on the assembling-guide when discharged from the magazine-rod, substantially as specified.

7. In a matrix-assembling machine, an assembling-guide, a series of downwardly-inclined magazine-rods, all arranged with their delivery ends directly over the assembling-guide, matrices having hooks by which they are suspended on said magazine-rods, and detent mechanism adapted to release said matrices singly, whereby when released the matrices fall by gravity onto the assembling-guide, substantially as specified.

8. In a matrix-assembling machine, a downwardly-inclined assembling-rail, a series of downwardly-inclined magazine-rods, all arranged with their delivery ends above said rail, matrices having hooks by which they are suspended on said magazine-rods and detent

mechanism adapted to retain said matrices thereon and to release them singly, whereby the action of gravity causes the matrices when released to drop onto the assembling-rail and slide to the composing-point, substantially as specified.

9. In a matrix assembling and distributing machine, a distributing-rail, and an assembling-rail, arranged to one side and a little below the distributing-rail, combined with a series of magazine-rods, the delivery ends of which are all above the assembling-rail, the receiving ends being adjacent to and at different elevations with relation to the distributing-rail, substantially as specified.

10. In a matrix assembling and distributing machine, a distributing-rail, an assembling-rail, a magazine-rod having its delivery end above the assembling-rail and its receiving end adjacent to the distributing-rail, and means for supporting the magazine-rod from its under side, substantially as specified.

11. In a matrix assembling and distributing machine, a distributing-rail, an assembling-rail, a substantially U-shaped bracket, a superior support to which one arm of said bracket is secured and from which it depends, and a magazine-rod secured to the top of the other arm of said bracket, having its receiving end adjacent to the distributing-rail, and its delivery end over the assembling-rail, substantially as specified.

12. In a matrix-distributing machine, in combination, a pick-up rod, a distributing-rail, a magazine-rod, and an assembling-rail, all arranged with respect to each other substantially as described whereby a matrix having two hooks is adapted to engage with each of said parts and be transferred successively from one to the other in the order named in moving from the rear to the front of the machine, substantially as and for the purpose specified.

13. In a matrix-distributing machine, in combination, a series of distributing-rails, a series of associated pick-up rods having first selecting portions which lie in the same vertical plane, second separating portions which diverge and lie in different vertical planes, and third supporting portions which extend toward the central line of the machine, each extending over the rods and rails which lie nearer said center, and a fixed support to which said supporting portions are secured, substantially as specified.

14. In a matrix assembling and distributing machine, the combination of assembling-guides which lie in one plane at their delivery ends and diverge therefrom into different planes, distributing-guides which lie in one plane at their receiving ends and diverge therefrom into different planes, and magazines intermediate of said distributing and assembling guides, substantially as set forth.

15. In a matrix assembling and distributing machine, in combination, a series of distributing-guides which lie in one vertical plane at the rear of the machine and diverge therefrom into different vertical planes, a series of assembling-guides which lie in one vertical plane at the front of the machine and diverge therefrom into different vertical planes, and mechanism intermediate of each assembling-guide and its corresponding distributing-guide, whereby the matrices are transferred from the latter to the former, substantially as and for the purpose set forth.

16. In an assembling and distributing machine, in combination, a series of assembling-rails grouped in one vertical plane at the front of the machine, and diverging therefrom into different vertical planes, an equal number of associated distributing-rails lying in different vertical planes, a series of magazine-rods intermediate of each assembling-rail and its associated distributing-rail, a series of pick-up rods each of which lies for some distance adjacent to its associated distributing-rail, all of which pick-up rods converge at the back of the machine and lie in one vertical plane, substantially as and for the purpose specified.

17. In a matrix-assembling machine, in combination, a series of matrices and their magazines, detent mechanism adapted to retain said matrices and to release them singly, an inclined slotted keyboard, a key which engages with the outer inclined face thereof, and a rod passing through said slot and connected at one end with said key and at the other end with the detent mechanism, substantially as and for the purpose specified.

18. In a matrix-assembling machine, in combination, matrix-releasing mechanism consisting of an inclined slotted keyboard, detent mechanism, a series of rods which are connected with the detent mechanism and pass through said slots, enlargements on said rods which engage with the inclined face of said keyboard, and keys secured to said rods, substantially as and for the purpose specified.

19. In a matrix assembling and distributing machine, in combination, a series of assembling-rails, means for supporting the rear ends of said rails, and movable mechanism for supporting and releasing the front ends of all of said rails, substantially as and for the purpose specified.

20. In a matrix-assembling machine, a series of assembling-rails which converge at the front end of the machine and lie in one vertical plane, a block slidable on inclined ways on the bed of the machine, a post fixed to said block and having sockets adapted to receive and support the front end of said assembling-rails, a lever and suitable mechanism connecting said block and lever whereby the block may be moved, substantially as and for the purpose specified.

21. In a matrix assembling and distributing machine, in combination, a series of assembling-rails which lie in the same vertical plane at the composing-point, a movable post

adapted to engage with and support the front ends of said rails, means for moving said post to release said rails, and mechanism adapted to engage with and support said rails when released by said post and to release said rails when they are engaged by said post, substantially as set forth.

22. In a matrix assembling and distributing machine, in combination, a series of assembling-rails, which converge and lie in one vertical plane at the composing-point, a movable post having sockets adapted to receive and support the front ends of said rails, two arms pivoted to a fixed support, a grooved bar attached to each arm, and mechanism for swinging said arms on their pivots, substantially as and for the purpose specified.

23. In a matrix-assembling machine, in combination, a set of assembling-rails which converge and lie in one vertical plane at the front of the machine, a movable post B having sockets which are adapted to receive and support the front end of said assembling-rails, two arms pivoted to a fixed support, grooved bars secured to said arms and lying on opposite sides of said rails, springs for moving said arms to cause the approach of said bars, and sliding rods engaging with said arms and adapted to be struck and moved by the post B thereby swinging the arms in the opposite direction, substantially as and for the purpose specified.

24. In a matrix assembling and distributing machine, in combination, a fixed support, a series of plates a^{10}, an assembling and a distributing rail secured to each of said plates, arms a^{11} extending over said plates and connecting them together, mechanism connecting the inner plate of the series with the fixed support, and the overhead stay-rod connecting the outer plate to the fixed support, substantially as set forth.

25. In a matrix assembling and distributing machine, in combination, a series of plates a^{10}, plates a^{12} secured to the upper edge of said plates a^{10}, arms a^{11} which lie above and connect together the several plates a^{10}, a series of U-shaped brackets depending by one arm from said plates a^{12}, a series of independent magazine-rods, each secured on the top of the free arm of said U-shaped brackets, a distributing-rail and an assembling-rail connected to opposite sides of each of said plates a^{10}, and mechanism for supporting the said series of plates in the described relation to each other.

26. In a matrix-assembling machine, the combination of a series of assembling-rails permanently supported at their rear ends, mechanism for holding and releasing their front ends, a removable clamping device, and means for holding said clamping device beneath the composing parts of said rails, substantially as and for the purpose specified.

27. In a matrix-assembling machine, in combination, independent matrices, a series of assembling-rails adapted to guide the matrices to the composing-point, a movable post adapted to support and release the front end of said rails, and having a socket adapted to receive a clamp, and a clamp lying in said socket and adapted to grasp and hold in line the assembled matrices, substantially as and for the purpose specified.

28. In a matrix-assembling machine, in combination, independent matrices, a set of assembling-rails adapted to guide the matrices to the composing-point, and means for holding and releasing their front ends, with a spring-clamp consisting of the pivoted bars S S, and the rods s' s^2 which are adapted to engage with said matrices, and mechanism for holding said clamp open during the time the front ends of said rails are being held, substantially as set forth.

29. In a matrix-assembling machine, in combination, independent matrices, a set of assembling-rails, a movable post having sockets adapted to receive and support the front ends of said rails, and having also a recess adapted to receive a clamp, with a clamp consisting of the pivoted bars S S, springs for closing them, and the rods s' s^2, the sliding wedges adapted to engage with and spread the bars, and a spring for withdrawing said wedges, a rock-shaft, an arm secured thereto and engaging with a rod which is connected with said wedges, a shoulder on the frame, and an arm secured to the rock-shaft engaging therewith, substantially as and for the purpose specified.

30. A spacer for a matrix-line, consisting of two plates connected at top and bottom, and a transversely-movable wedge-block lying between said plates and adapted to spread them apart, said wedge-block being as high as the thickness of the slug to be formed, substantially as set forth.

31. A spacer for a matrix-line, consisting of two plates secured together at two points a suitable distance apart, and having transverse grooves in their meeting faces, with a wedge-block which lies in said grooves and projects outward from between said plates, substantially as set forth.

32. A spacer for a matrix-line having a body composed of two similar plates secured together at their ends, said plates having grooves in their meeting faces, a stem, and two hooks secured thereto, combined with a wedge-block which lies in said grooves and projects from between said plates, substantially as and for the purpose specified.

33. A spacer for a matrix-line, consisting of two plates secured together at two points a suitable distance apart, each plate having on its inner face an inclined transverse groove located at a point corresponding with the characters assembled in the impression-line, and a transversely-movable wedge-block lying in said groove and projecting from between said plates, substantially as set forth.

34. A spacer for a matrix-line, consisting of

two plates which are secured together at two points a suitable distance apart, said plates being transversely grooved on their meeting faces at a point corresponding with the characters in the impression-line, combined with an arrow-headed wedge-block which has also two wedge-surfaces near its rear end, lying in said grooves, and shoulders on said plates adapted to engage with the rear ends of said arrow-shaped head, substantially as and for the purpose set forth.

In testimony whereof I affix my signature in presence of two witnesses.

CHARLES FORTH.

Witnesses:
E. L. THURSTON,
FRANK MILLER.