No. 642,263. Patented Jan. 30, 1900.

C. SEARS.

MATRIX MAKING MACHINE.

(Application filed Mar. 8, 1899.)

(No Model.) 8 Sheets—Sheet 1.

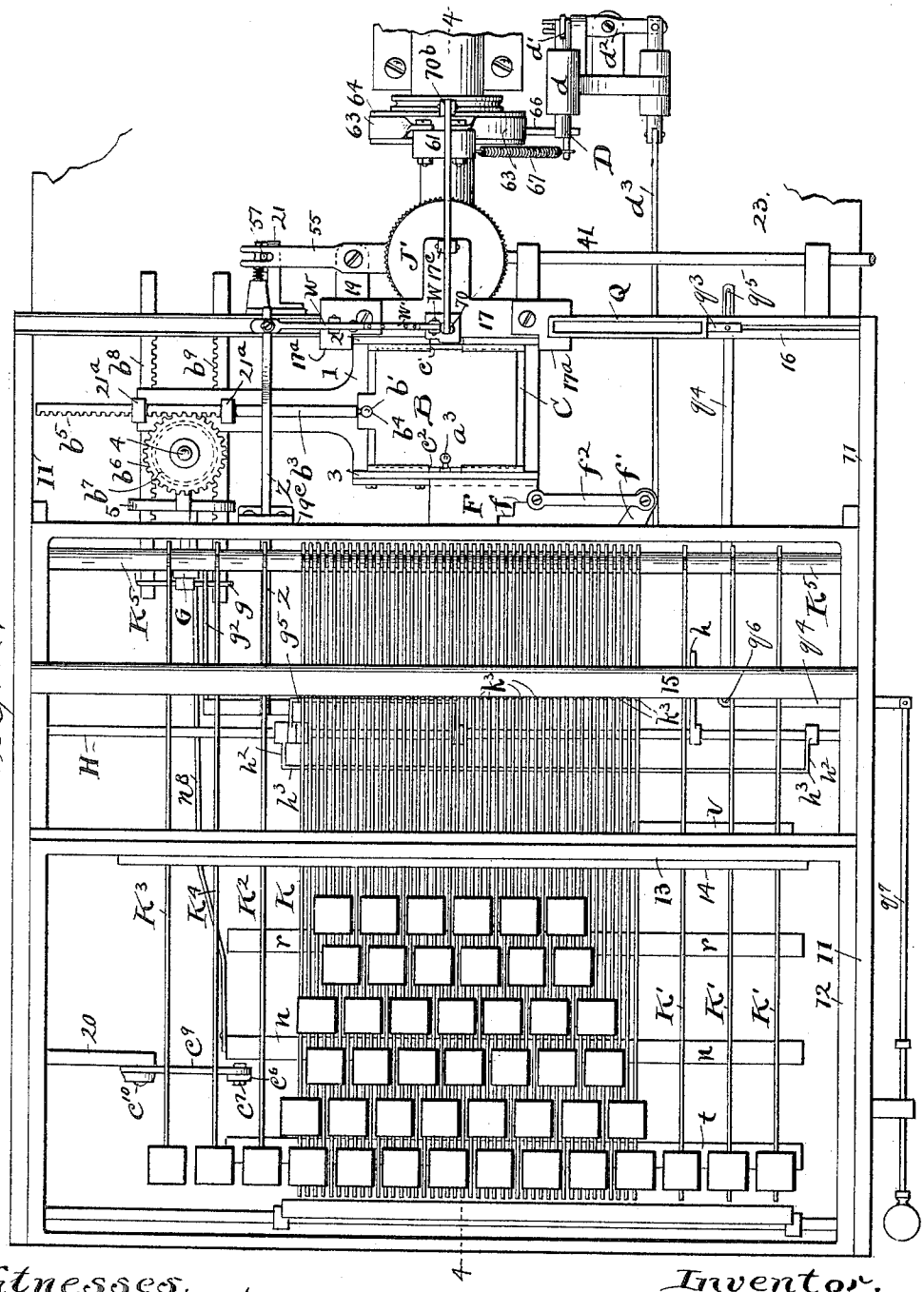


Fig. 1.

Witnesses.
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Philip E. Knowlton

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Charles Sears,
By his Attorneys,
Thurston & Bates

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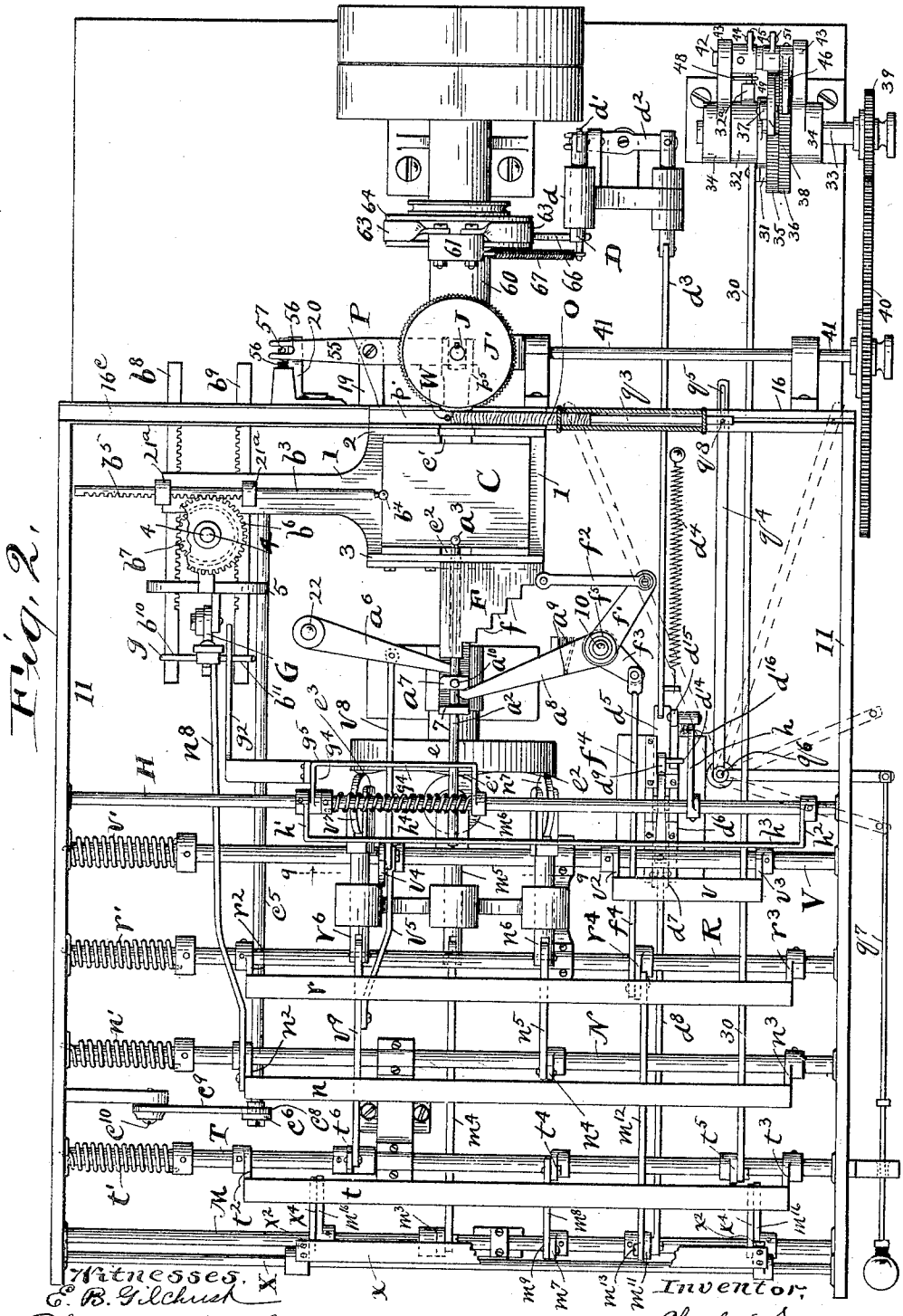
C. SEARS.

MATRIX MAKING MACHINE.

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(No Model.) 8 Sheets—Sheet 2.

Fig. 2.



Witnesses.
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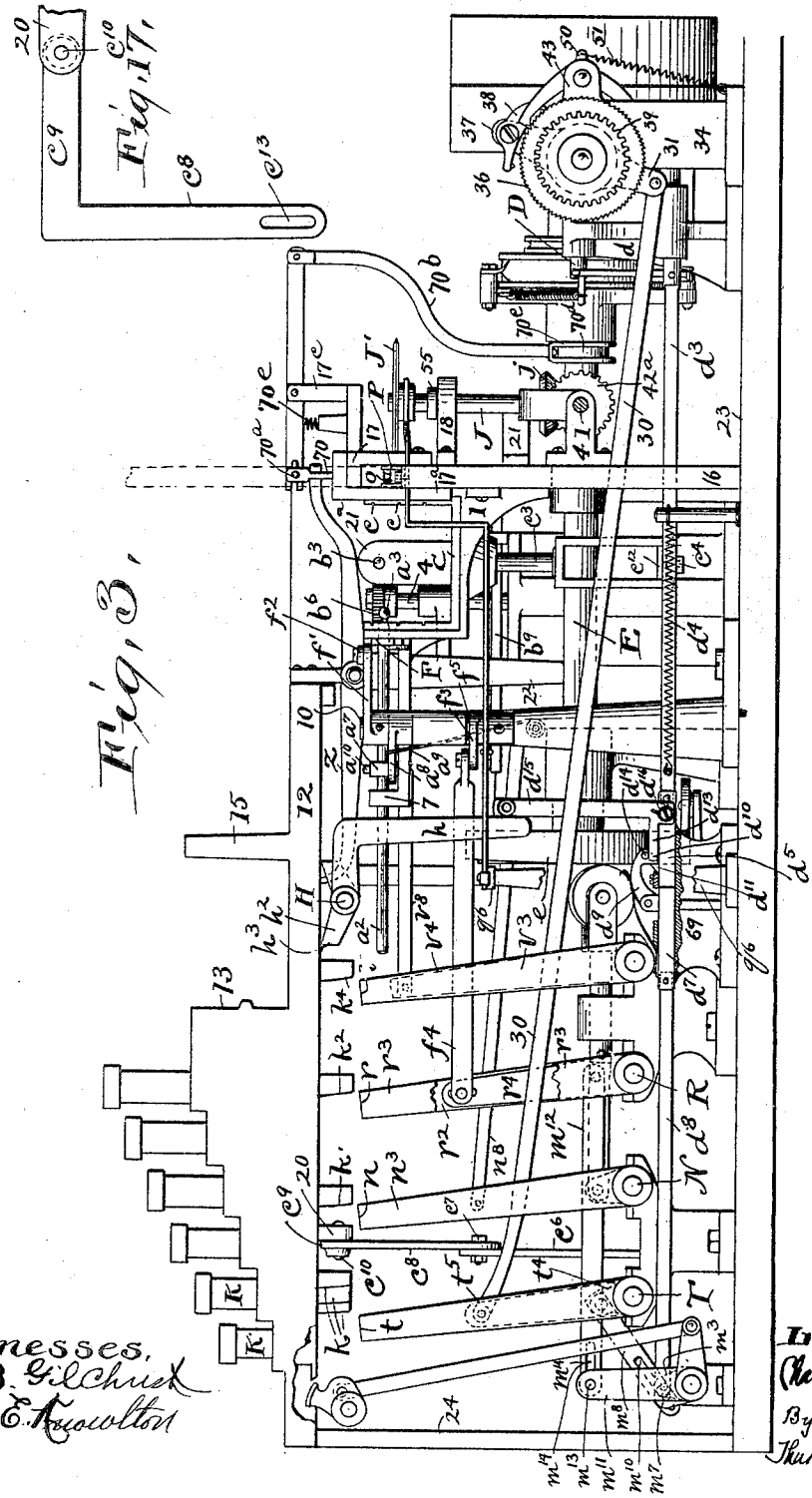
MATRIX MAKING MACHINE.

(Application filed Mar. 8, 1899.)

(No Model.) 8 Sheets—Sheet 3.

Fig. 17.

Fig. 3.



Witnesses,
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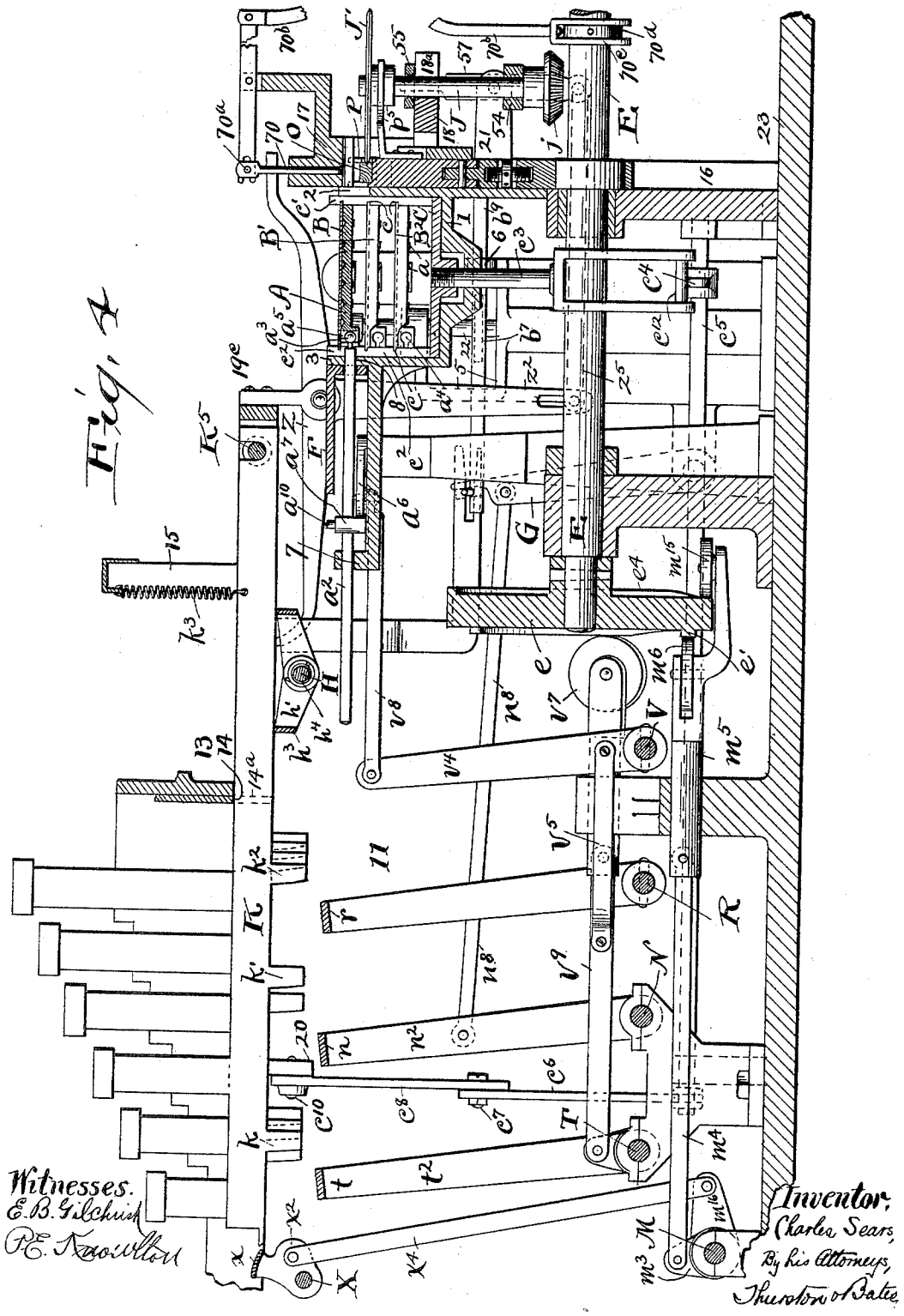
C. SEARS.

MATRIX MAKING MACHINE.

(Application filed Mar. 8, 1899.)

(No Model.) 8 Sheets—Sheet 4.

Fig. 4.



Witnesses.
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C. SEARS.

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(No Model.) 8 Sheets—Sheet 5.

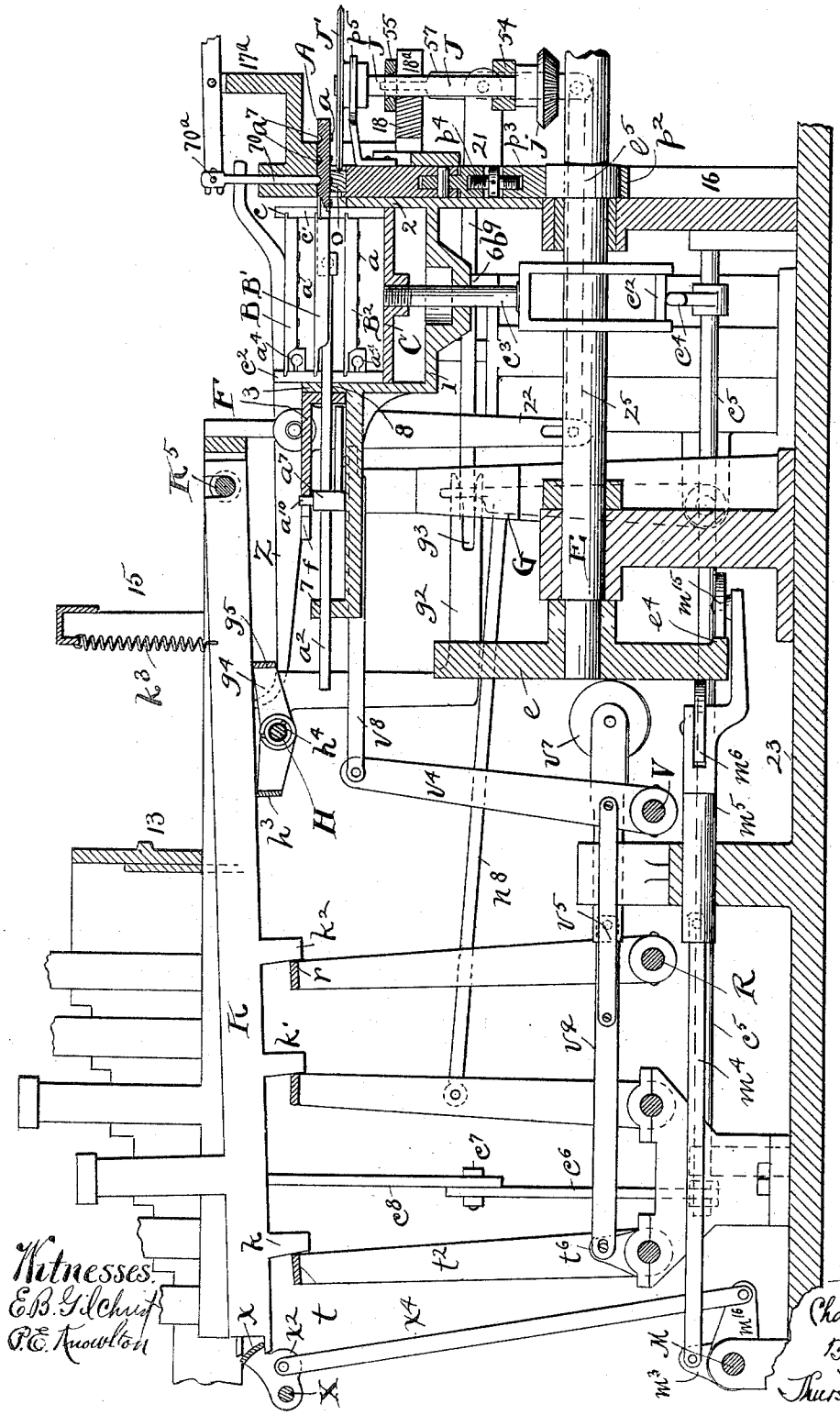


Fig. 5.

Witnesses.
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MATRIX MAKING MACHINE.

(Application filed Mar. 8, 1899.)

(No Model.) 8 Sheets—Sheet 6.

Fig. 6.

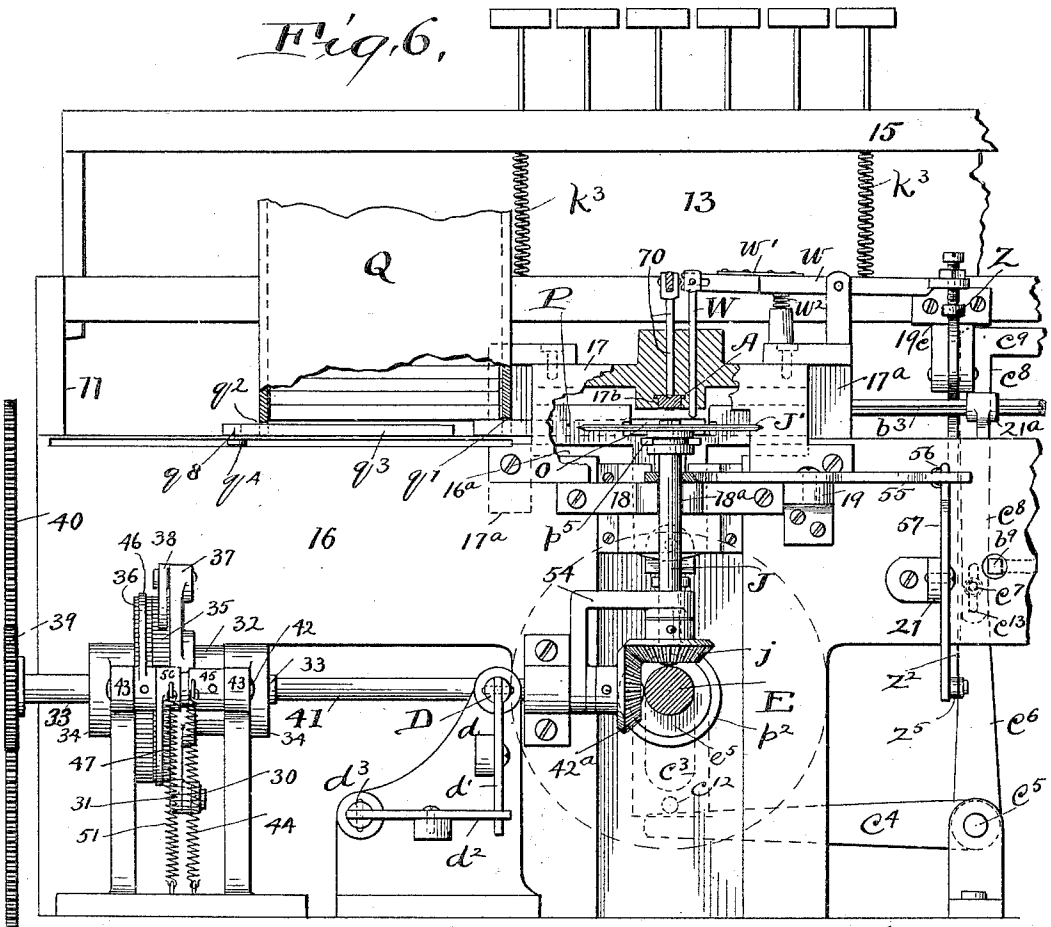


Fig. 7.

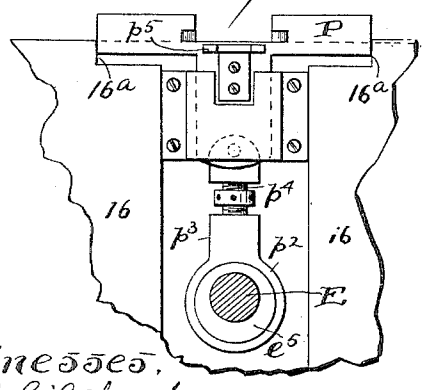
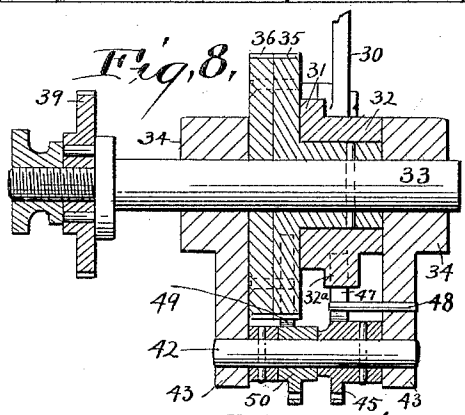


Fig. 8.



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MATRIX MAKING MACHINE.

(Application filed Mar. 8, 1899.)

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Fig. 9.

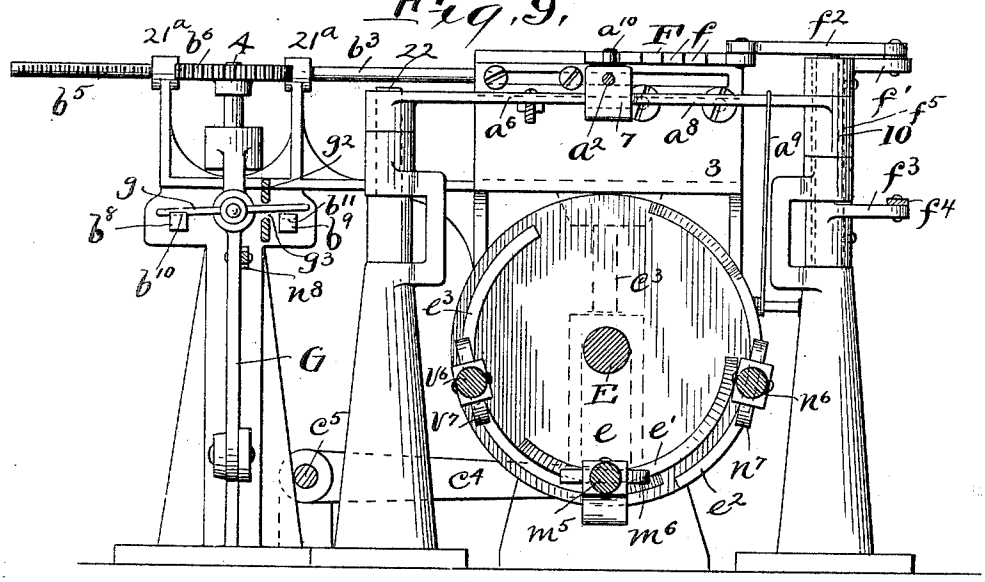


Fig. 10.

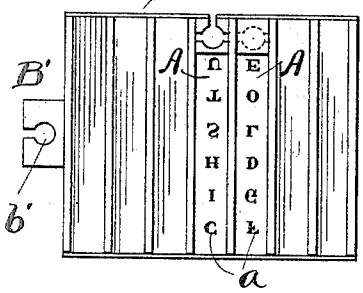
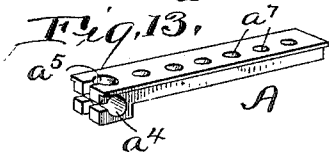


Fig. 12.



Fig. 13.



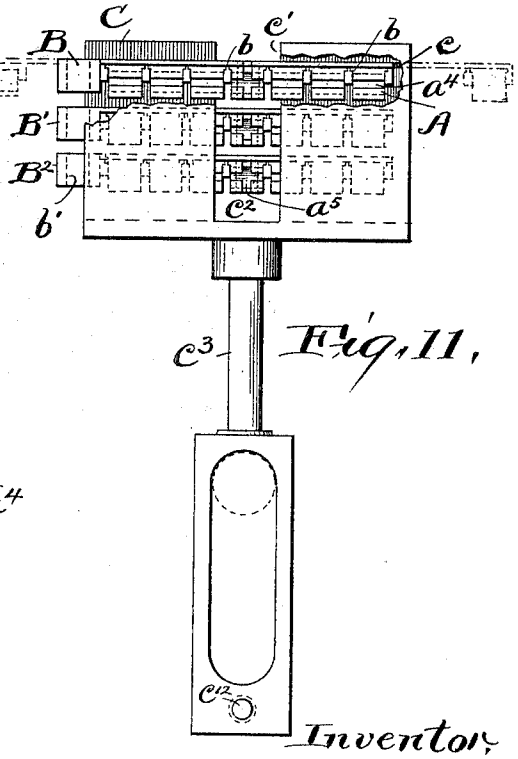


Fig. 11.

Witnesses,
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No. 642,263. Patented Jan. 30, 1900.

C. SEARS.

MATRIX MAKING MACHINE.

(Application filed Mar. 8, 1899.)

(No Model.) 8 Sheets—Sheet 8.

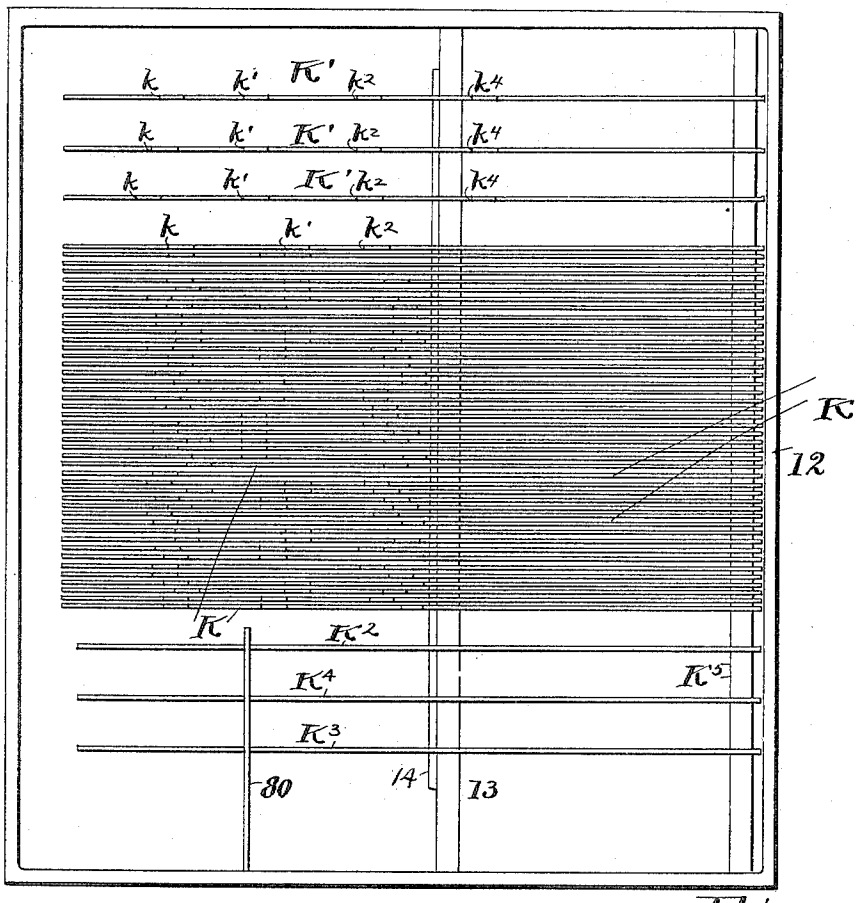


Fig. 14.

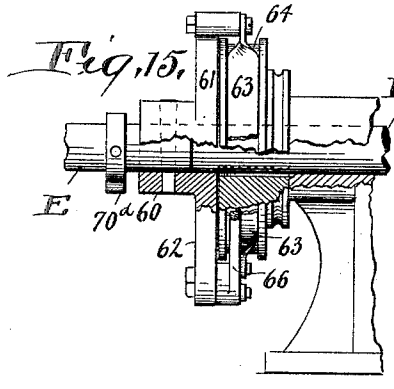


Fig. 15.

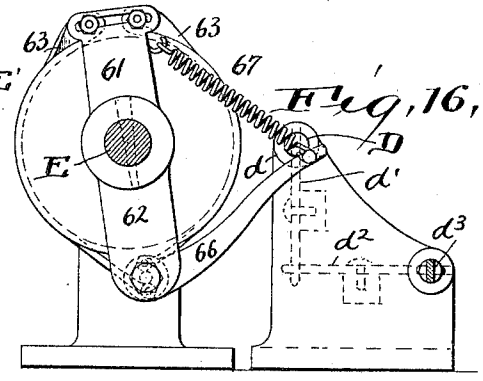


Fig. 16.

Witnesses.
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UNITED STATES PATENT OFFICE.

CHARLES SEARS, OF CLEVELAND, OHIO.

MATRIX-MAKING MACHINE.

SPECIFICATION forming part of Letters Patent No. 642,263, dated January 30, 1900.

Application filed March 8, 1899. Serial No. 708,165. (No model.)

To all whom it may concern:

Be it known that I, CHARLES SEARS, a citizen of the United States, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented a certain new and useful Improvement in Matrix-Making Machines, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings.

The invention relates particularly to a machine in which as finger-keys are operated corresponding characters are impressed in proper relation to each other into suitable impression-receiving material—as, for example, a wood block—thereby producing a line-matrix adapted for use in casting a type-bar; but the various features of the invention are for the most part adapted for use on type-writing machines.

The principal object of the invention is to provide a machine of the character described which shall be cheap and durable and capable of doing the work for which it is intended rapidly and accurately.

Another object of the invention is to provide a machine in which it is easy to remove the type and substitute other type of a different size or style and to adapt the machine for use with the substituted type.

These and other beneficial results which will be apparent to one skilled in the art are attained in the construction and combinations of parts contained in the machine shown in the drawings and constituting the invention, as hereinafter described and set forth definitely in the claims.

In the drawings, Figure 1 is a plan view of a machine embodying the invention. Fig. 2 is a plan view of the machine when certain parts have been removed, notably the key-lever frame and the parts carried thereby, the sliding carrier-plates, the plate 17 and parts supported thereby, &c. Fig. 3 is a side elevation of the machine when the right side 11 of the frame is removed. Fig. 4 is a sectional side elevation on line 4 4 of Fig. 1. Fig. 5 is a similar view; but it shows the positions which the parts assume when a key-lever is depressed. All of the other views show the parts in their "home" positions. Fig. 6 is a rear elevation of the machine, partly in section and when the rear end of shaft E and the clutch mechanism are removed. Fig. 7 is an enlarged rear elevation of the matrix-holder and its operating mechanism. Fig. 8 is a sectional view of the escapement mechanism. Fig. 9 is a sectional front elevation of certain parts of the machine, the sectional line being indicated by 9 9 on Fig. 2. Fig. 10 is a bottom view of one of the carrier-plates when all but two of the type-carriers have been removed. Fig. 11 is a rear elevation, partly broken away, of the box C when it contains the carrier-plate, &c. Fig. 12 is a perspective view of one of the type-carriers. Fig. 13 is a perspective view of one of the middle type-carriers. Fig. 14 is a bottom plan view of the key-levers and their frame. Fig. 15 is a side elevation, partly in section, of the clutching mechanism. Fig. 16 is a front elevation of said clutching mechanism and the clutch-releasing mechanism, and Fig. 17 is a detached front view of the lever c^9.

The various characters to be employed, including letters, figures, punctuation-marks, &c., are formed on and they project downward from the lower faces of the sliding bars A, which bars will be hereinafter called "type-carriers." A plurality of these type-carriers are employed. They are severally mounted in suitable dovetail ways or grooves b on the under side of the sliding plates B B′ B^2, which ways extend lengthwise of the machine—that is to say, forward and backward. These plates, which will be called "carrier-plates," are capable of sliding crosswise of the machine in horizontal grooves c in the vertical front and back walls of a vertically-movable box C. In the back and front walls of this box are respectively the vertical openings c' c^2. It is obvious from the foregoing description that any one of the characters indicated by a may be brought to the impression-point by first moving the box vertically (if necessary) to bring the proper carrier-plate into the operative plane by moving said plate (if necessary) horizontally across the impression-line to the right or left to bring the proper type-carrier into said line, and, finally, by moving said carrier rearward until the proper character thereon is at the impression-point.

Each carrier A may be provided with any convenient number of characters a, six being the preferred number. When these carriers

are in their home positions, they are withdrawn entirely into the box C, so as to present no obstacle to the described movement of the plates B′ B B², upon which they are mounted. Any desired number of these carriers may be mounted on each plate, seven being the number shown. Each one of the carrier-plates carries, therefore, forty-two characters. When these plates are in their home positions in the box C, as shown in Fig. 11, the middle carriers are in line with the openings c' c^2 in the box—that is to say, they are in the impression-line or directly above or beneath it. The carrier-plates must be moved either to the right or left from their home positions to bring the other type-carriers into this line. The box C slides vertically between and is guided by the vertical parts 2 and 3 of the frame of the machine, and when the box C is in its home position it rests upon a part 1 of said frame, (see Fig. 4,) the top carrier-plate being at that time in the operative plane. The other carrier-plates B′ B², of which two are shown, (but any desired number may be employed,) are brought into the operative plane by raising this box.

The machine as shown contains or may contain one hundred and twenty-six characters. The lower-case letters and some of the most-used punctuation-marks are preferably formed on those carriers which are supported on the top carrier-plate B, wherefore it will be unnecessary to move box C to bring these most-used characters to the impression-point. Capital letters and other punctuation-marks will be formed on the carriers which are supported by the carrier-plate B′, and the characters which are least used—as, for example, figures, double letters, punctuation-marks not much used, and various abbreviations and signs—will be formed on the carriers which are supported by the lower carrier-plate B².

The box C is raised to bring either of the carrier-plates B′ or B² into the operative plane by two shift-keys K³ K⁴ and certain intermediate mechanism, which will now be described. The box C has a stem c^3, which extends down through a hole in the frame member 1, straddling and passing below the shaft E. The end of a lever-arm c^4 lies beneath and in contact with the lower end of this stem or, specifically, with a pin c^{12}, secured thereto. This lever-arm is secured to a rock-shaft c^5, having a vertical arm c^6 near the front of the machine. A lever c^9, which is pivoted to a fixed bracket 20, lies beneath and in contact with two shift key-levers K³ K⁴, and a vertical arm c^8, which is rigid with the outer end of the lever c^9, extends downward and is connected with the upper end of the arm c^6 by means of a pin c^7, which pin is rigidly fastened to one of these arms and passes through a slot c^{13} in the other. Each of the shift key-levers K³ K⁴, like the other key-levers in the machine, is pivoted at its rear end on a rod K⁵, and its front end is caused to swing upward to its home position by a spring k^3. These shift key-levers engage with the arm c^9 at different distances from its fulcrum c^{10}, wherefore the like downward movement of said shift key-levers—to wit, a full stroke, which terminates when the levers strike a bar 80—produces different movements of the outer end of the lever c^9. The shift key-lever K³, which is farthest from the fulcrum, produces such a movement of the lever c^9 that, transmitted through the described intermediate mechanism, causes the box C to be raised a short distance only, but far enough to bring the plate B² into the operative plane. The shift key-lever K⁴, which is nearer to the fulcrum of the lever c^9, produces a greater movement of this lever, and consequently causes the box C to move upward a greater distance and far enough to bring the plate B² into the operative plane.

That one of the carrier-plates B B′ B² which is in the operative plane, is moved to the right or left by the rod b^3, which is capable of sliding endwise transversely of the machine in suitable bearings 21ª. This rod has a ball-shaped tongue b^4 on that end which is adjacent to the carrier-plates, and this tongue is adapted to engage with a dovetail notch b' in the adjacent edge of that plate which is in the operative plane. Each of said plates has such a notch, said notches being vertical, one above the other, wherefore when the box C is raised or lowered the notch in one plate slides off of and the notch in the next plates slides on to the ball-shaped tongue on the rod, and when the box C comes to rest in either of the three positions referred to this tongue will be in engagement, as described, with that plate which is in the operative plane. Therefore that plate may be moved by the rod b^3 to bring the proper type-carrier into the impression-line. The rod b^3 has a rack b^5 cut in its side. A pinion b^6, which is secured to a vertical shaft 4, engages with this rack. Another pinion b^7, which is secured to the lower end of this shaft, is engaged on opposite sides of its axis by two sliding rack-bars b^8 b^9, which bars are movable endwise and lengthwise of the machine in suitable bearings 5 and 6. If the rack-bar b^8 is moved rearward, the other must slide idly in the opposite direction, the result being that the carrier-plate which is in the operative plane is moved proportionately to the right. If the rack-bar b^9 is moved rearward, said plate is moved proportionately to the left. These rack-bars are moved by a swinging lever G, whose upper end is connected with one or the other of the said bars by a latching device. This latching device is a rocking lever g, pivoted at its middle point to the upper end of the lever G. In these rack-bars are the vertical slots b^{10} b^{11}, and when the rack-bars are in their home positions these slots are in line with each other and in the same plane with this latch-lever. This latch-lever is rocked to cause its engagement with the proper rack-bar by the following mechanism: One end of the lever

enters a horizontal slot g^3 in an arm g^2, which is fastened to a spring-actuated rocking frame g^4, loosely mounted on a rock-shaft H. The horizontal bar g^5 of the frame extends beneath one-half of the character-keys K and is held against said keys by the spring h^4. When one depresses one of these key-levers K, which engage with this rocking frame g^4, said frame is rocked and its movement transmitted through the arm g^2 rocks the latch-lever and carries it into engagement with the slot in the rack-bar b^9, at the same time disengaging it from the rack-bar b^8, with which, however, it always engages when in its home position, for when the key-lever K is returned to its home position the spring-actuated frame g^4 swings upward and the arm g^2 rocks the latch-lever into engagement with the notch in the rack-bar b^8. When one of the other key-levers is depressed—that is to say, one of the key-levers which does not engage with this rocking frame g^4—this latch-lever remains in engagement with the last-named rack-bar. It is apparent, therefore, that the depression of one-half of the keys will lock this swinging lever G to the rack-bars b^9, but that at other times the latch-lever is in such position that it locks said swinging lever to the other rack-bar b^8. The result is that when any one of the keys first named is depressed and the lever G rocks the carrier-plate in the operative plane is moved to the left and that when any of the other keys are depressed said carrier-plate is moved to the right.

The type-carriers A are moved rearward to bring the proper character to the impression-point and then forward to their home positions by a bar a^2, which is mounted in suitable bearings 7 and 8, in which it is movable endwise and lengthwise of the machine. On its rear end there is a ball-shaped tongue a^3, which is adapted to engage in a correspondingly-shaped notch a^4 in the front end of that carrier which is in the impression-line. Each carrier has one of these notches. The notches are horizontal, and when the carriers are in their home positions the notches on all of the carriers supported by any plate are in the same horizontal plane. This makes the transverse movement of the carrier-plates possible, for as the plate in the operative plane slides in either direction from its home position these notches slide sidewise over said ball-shaped tongue, and when the carrier-plate stops the notch in that carrier which is in the impression-line is embracing said tongue.

The three middle carriers—viz., one on each carrier-plate—have also in their front ends the vertical dovetailed notches a^5, which intersect the horizontal notches a^4. These vertical notches permit the vertical movement of the carrier and plates as the box C moves vertically, and when the box comes to rest the notch in the middle type-carrier on that carrier-plate which is in the operative plane is embracing this ball-shaped tongue.

The sliding bar a^2 is moved forward to and held for the time being in its home position by a swinging lever a^6, which is mounted on a vertical stud 22, the outer end of this lever being in contact with a shoulder which is formed by the rear side of a collar a^7, fastened to said bar a^2. This bar a^2 is moved rearward by a lever a^8, which is loosely pivoted on a sleeve f^5, which sleeve is independently mounted on a stud 10. The outer end of this bar is in contact with the shoulder formed by the front side of this collar a^7. This lever is under the influence of a spring a^9, which acts to swing its outer end rearward and does so swing it, thereby moving the bar a^2 rearward when the lever a^6 will allow it to so move. This rearward movement of the bar a^2 moves rearward that carrier with which it is engaging, and when the carrier has moved far enough to bring the proper character to the impression-point it is stopped by the engagement of a pin a^{10}, carried by the bar a^2, with one or another of the steps f on a transversely-movable sliding plate F. This plate is moved from its home position (in which the highest step f is in the path of the pin a^{10} wherefore the shortest movement of the bar a^2 is permitted) by the oscillating vertical sleeve f^5. An arm f', secured to this sleeve, is connected by a link f^2 with the slide F, and another arm f^3, secured to the sleeve, is connected by a link f^4 with an arm r^4, which forms a part of a certain swinging frame to be presently described.

From the foregoing description one will understand that the box C is raised by the manually-operated shift-keys K^2 K^3; that the carrier-plate on the operative plane is moved to the right or left by the bar b^3, which is moved, through the described intermediate mechanism, by the swinging lever G; that the direction in which said plates move depends upon whether said lever is latched to the one or the other of the rack-bars b^8 b^9; that the carrier in the impression-line is moved rearward to bring the proper character to the impression-point by the spring-actuated lever a^8 and is returned to its home position by the lever a^6; that the distance which said carrier shall move rearward is determined by the position of the stepped plate F, and this plate is moved by the oscillating sleeve f^5.

In the machine are forty-two (or less) character-keys K, each of which is associated with three characters, one supported by each of the three carrier-plates. There are also two shift-keys K^4 K^3, whose functions and operations have been explained, three (more or less) space-keys K', and a key K^2, which is used when a new matrix-block is to be moved onto the matrix-carriers. All of these keys are pivoted on a rod K^5, which is secured to a key-frame, which frame and all of the parts which it supports may be removed bodily off of the box-like machine-frame upon which it normally rests. This machine-frame includes the base-plate 23, the two sides 11, the rear

end member 16, and the front member 24, which parts inclose and support most of the mechanism, as will appear from the description and drawings.

The key-frame has the side bars 12, the vertically-kerfed cross-bar or comb 14, and the cross-bar 15, to which are fastened the upper ends of the springs k^3, the lower ends of which are fastened to the key-levers, whereby they are raised and held up. The keys respectively enter the kerfs 14^a in the comb 14 and are thereby guided.

On the under side of the character key-levers K and the space key-levers K′ are the three sets of stubs k k' k^2, and on each of the space key-levers is another stub k^4. These stubs are provided for checking the movement of various spring-actuated frames which severally move various parts of the mechanism. These stubs can have no effect upon these several frames until the keys are depressed; but by the depression of each key the stubs thereon are moved into the path of the top bars of these frames, which bars engage with said stubs and are stopped thereby. The stubs are variously placed upon the several keys, whereby these frames are permitted to move various distances or are prevented from moving at all, as the case may be. Each of these frames includes a rock-shaft, two parallel arms secured to it, and a cross-bar secured to the upper end of the arms, which cross-bars extend under the key-levers K and K′. Each frame is under the influence of a spring tending to swing it rearward, the springs being in the form shown torsion coiled springs surrounding the rock-shaft and secured at one end to the rock-shaft and at the other to the fixed frame of the machine. Any other suitable kind of springs may be used, however. One of these frames includes the rock-shaft N, the arms n^2 n^3, and the top bar n. Its operating-spring is indicated by n'. One of the arms n^2 is connected by a link n^8 with the swinging lever G, which, as before explained, operates through the described intermediate mechanism the carrier-plates B B′ B^2. This frame is held in its home position by a cam e^2 on the front face of a disk e, which is secured to a rotatable shaft E. This cam engages with a friction-roller n^7 in the end of a longitudinally-movable slide n^6, which is connected by link n^5 to an arm n^4, which is attached to rock-shaft N. When this shaft E rotates, as it does whenever a key-lever is depressed, the cam e^2 moves away from the roller n^7, whereupon the frame is moved rearward by its spring until it is stopped by the engagement of its top bar n with one of the stubs k' on the depressed key-lever, or when the largest movement of said frame is required, until the roller n^7 strikes the face of disk e. The cam as it completes its revolution with shaft E engages with the friction-roller n^7 and acts through the intermediate mechanism to return the frame to its home position. The cam e^2 acts to release this frame before any of the other frames to be explained are released. Another of the frames referred to includes a rock-shaft R, the arms r^2 r^3, and the top bar r. Its operating-spring is indicated by r'. An arm r^4, secured to the rock-shaft, is connected by the link f^4 with the arm f^3, before referred to, whereby the stepped plate F is moved a distance proportionate to the movement of said frame. The top bar of this frame lies in front of the stubs k^2 on the key-levers, wherefore when a key-lever is depressed and the frame is released to the action of its spring it swings rearward until it engages with and is stopped by the stub k^2 on said key, or when the largest movement of said frame is desired, until the roller m^6 strikes the face of disk e. Another of the swinging frames includes a rock-shaft T, the arms t^2 t^3, and the top bar t. Its spring is indicated by t'. This frame moves the escapement mechanism, as will be presently explained. Its top bar, however, lies in front of the stubs k on the key-levers and is stopped in its rearward movement by its engagement with the stub k on the depressed lever, or when the largest movement of said frame is required, by the engagement of the roller m^6 with the face of the disk e. It is clear that the frame will, when released to the action of its spring, move various distances, depending upon the position relative to its top bar of the stubs k on the key-levers, and it will presently appear that these different movements of this frame will result in corresponding feed movements of the matrix-block.

The two frames last described, which include the two rock-shafts T and R, are released to the action of their springs and are returned to their home positions by the action of a cam e' on disk e upon the slide m^5, which carries the roller m^6. This slide is connected by a link m^4 with an arm m^3, secured to a rock-shaft M. An arm m^7 on said rock-shaft is connected by a link m^8 with an arm t^4 on rock-shaft T. The rock-shaft M is rocked rearward by the action of a cam e^4 on the rear side of disk e upon a second friction-roller m^{15}, carried by slide m^5. This rock-shaft M moves backward and forward with each revolution of shaft E through the same path; but since the rock-shaft T may, because of the stubs k, be permitted to move its full distance away from its home positions only occasionally, the link m^8 has a slot m^{10}, and the pin m^9, which connects the link with the arm m^7, passes through this slot. When the shaft m is rocked rearward, the shaft T may rock its full distance or any less distance; but when the shaft m returns to its home position the said pin m^9 engages with the end of slot m^{10}, and therefore the shaft T is returned to its home position. The shaft R is controlled in like manner by shaft M. A link m^{12} connects an arm r^4 on shaft R with an arm m^{11} on shaft M, said link having a slot m^{14}, through which the pin m^{13} passes.

A rock-shaft V is a part of a swinging frame which includes the arms v^2 v^3 and the top bar v, v' being the operating-spring. The top bar v lies in front of the stubs k^4 on the space-key K', and when one of these keys is depressed these stubs engage with the said top bar and prevent any substantial movement of the swinging frame of which it and the rock-shaft V are parts. It might be here stated that the stubs k' and k^2 on the space-keys act in like manner on bars n and r', thereby preventing any movement of the frames of which said bars are parts. An arm v^4 is connected by the links v^5 v^9 with the slide v^6. A friction-roller v^7, mounted in slide v^6, engages with cam e^3, whereby said rock-shaft V is returned to its home position. The link v^9 is pivoted to an arm t^6, which is loosely mounted on shaft T, but cannot move along said shaft. This connection for link v^9 is provided to hold it in position to transmit motion from slide v^6 to link v^5. In this case, as in the other analogous cases, the specific mechanical connection between the slide which the cam moves and the rocking frame is not material. The arm v^4 is connected by link v^8 to the lever a^6. When, therefore, the cam e^3 so moves that the rock-shaft V may be rocked by its spring, the rod a^2 may be moved by the spring-actuated lever a^8 and is so moved until the rod is stopped by its engagement with one of the steps f on the stop-plate F. When the cam e^3 acts, through the described intermediate mechanism, to swing lever a^6 forward, the rod a^2 and the type-carrier with which it engages are returned to their home positions.

The three cams e' e^2 e^3 must act in a certain order to produce the proper operation of the mechanism to bring the proper character to the impression-point and return said parts to their home positions. When any character-key K is depressed, the shaft E begins to rotate and after making one complete revolution stops. The mechanism for causing this action will be explained presently. When it begins to revolve, the cam e^2 first recedes from the roller n^7, whereupon the rock-shaft N is rocked by its spring as far as stub k' will allow it to go. This movement transmitted through the described mechanism moves that carrier-plate which is in the operative plane to the right or left, as the case may be, to bring the proper carrier into the impression-line. It will be understood that if the character corresponding with the depressed key is on the middle carrier the stub k' will prevent any movement of rock-shaft N. The cam e' must then recede from the roller m^6, whereby the rock-shaft R may be moved by its spring as far as the stub k^2 will let it go, so as to move the stepped plate F into the proper position. Finally, the cam e^3 must recede from roller v^7 to allow the rock-shaft V to be rocked by its spring, whereby the rod a^2 may be moved by the spring-arm a^8 to move the carrier rearward. As the shaft E nears the completion of one revolution cam e^3 must first act to move rock-shaft V to its home position, whereby the type-carrier is moved to its home position. Then the cam e^2 acts to return the carrier-plate to its home position, and, finally, the cam e' acts to return the other parts to their home positions. As the rock-shaft T returns to its home position it moves the escapement mechanism in the feeding direction.

Before describing the escapement mechanism and the matrix-feeding mechanism which it operates I will describe the mechanism by which each key which is depressed is caused to move down as far as it should and is held down until the impression of the corresponding character has been made.

Just in front of and below the front end of all of the key-levers a transverse rock-shaft X is mounted. Two arms x^2 x^2 are secured to it, and a cross-bar x is secured to them. The front edge of this bar x lies close to the front ends of the key-levers. When this rock-shaft X is rocked rearward, this bar engages with the top of the depressed key-lever and draws and holds it down, and at the same time it moves under all of the other key-levers and prevents them from being depressed. This rock-shaft X is rocked by the rock-shaft M to which it is connected by means of the two arms x^2 x^2, the two arms m^{16} m^{16}, secured to shaft M, and the links x^4 x^4, which connect these arms.

The matrix-block O is held guided in its feed movements and is moved upward against the character at the impression-point for the purpose of making the impressions by a movable matrix-holder P, which is movable vertically, but not otherwise, in a groove 16^a in the rear face of the vertical frame member 16.

A plate 17 lies over the matrix-holder and is there held through its downwardly-extended legs 17^a, which are secured to the rear face of the frame member 16. These legs overlap the ends of the matrix-holder like gibs and hold it in said groove 16^a. The matrix-holder has a groove p' in its top to receive the matrix-block. The frame member 16 and the front and rear walls of this groove p' are cut away in the impression-line to receive the type-carrier. A dovetailed groove 17^b is cut in the under side of the plate 17 above the impression-line, and the type-carriers, when moved rearward, enter and are guided by this groove. The matrix-holder is moved up and down by an eccentric e^5 on the shaft E. An eccentric-strap p^2 embraces the eccentric, and the eccentric-rod p^3, which is adjustable in length, is pivotally connected at its upper end with the lower end of the matrix-holder. It is made adjustable in length so that the impression produced by its upward movement may be regulated. The eccentric-rod is made of two parts, which are connected together by a screw p^4, having right-hand threads at one end, which screw into the upper part of the rod, and left-hand threads in the lower end,

which screw into the lower part of said rod. It follows that the matrix-holder is moved upward during each revolution of shaft E, and each upward movement causes the character at the impression-point to be impressed into the word-block.

The proper feed movements of the matrix-block O are produced by the following mechanism: A link 30 is connected at one end with an arm t^5, which is made fast to rock-shaft T, which shaft, it will be remembered, is checked in its spring-actuated movements by the stubs k on the key-levers. The other end of this link 30 is connected with an arm 31, which is fast to a hub 32. This hub is loosely mounted on a shaft 33, which is mounted in the fixed standards 34. To this shaft two reversely-cut ratchets 35 36 are secured. The hub 32 has also a pawl-arm 37, to which a spring-pawl 38 is pivoted, which pawl engages with ratchet 35. When the frame, of which rock-shaft T is a part, moves rearward under the influence of its spring, this pawl-arm swings around the shaft and the pawl 38 is carried idly over the ratchet-teeth, the movement of the pawl being of course proportionate to the movement of the rock-shaft T. When the rock-shaft is returned to its home position, the pawl-arm 37 is moved back to its home position, the pawl 38 engaging with and compelling a simultaneous movement of the ratchet 35 and shaft 33. The mechanism last described I term the "escapement" mechanism, although, perhaps, the term is lacking in exactness, since it does not permit the escape from restraint of a spring-actuated carriage, as do the escapements of type-writers in most cases. The function of this mechanism is to transform the varying oscillations of the rock-shaft T into proportionate movements in one direction of the shaft 33. This movement is transmitted through the pinion 39 and gear 40 to a shaft 41. This shaft carries a bevel-gear 42^a, which meshes with a bevel-gear j on a vertical shaft J. This shaft carries a toothed wheel J', which engages with the matrix-block and moves it a proportionate distance. The pinion 39 and gear 40 may be removed and others of different relative sizes substituted, whereby the movements of the shaft 33 may produce different although proportionate movements of the matrix-block. This is a desirable feature, because obviously the type-carriers A may be easily removed and others having different-size type substituted, and by changing this gear and pinion like movements of the shaft 33 may cause increased or diminished feed movements of the matrix-block, whereby such movements will be suitable for the new type.

Certain retaining pawls or detents are provided to prevent any improper movement in either direction of the shaft 33. A rock-shaft 42 is mounted in two fixed ears 43, and a spring 44, secured to an arm 45 on said shaft, acts constantly to turn the shaft in one direction, whereby to lift a detent 46, secured to said shaft, out of engagement with the ratchet 36. An arm 47, secured to the rock-shaft 42, engages with a fixed pin 48, whereby this spring-actuated movement of the rock-shaft is stopped. When the detent 46 is engaging with the ratchet 36, any movement of the shaft in the feeding direction is prevented. A detent 49 is secured to a collar 50, loosely mounted on rock-shaft 42, and it is always held by spring 51 in engagement with the ratchet 35, and it prevents any reverse or backward movement of said ratchet and the shaft 33. On the hub 32 is an arm 32^a, which when the parts are in their home position engages with the arm 47, thereby moving the rock shaft 42, so as to cause the detent 46 to engage with the ratchet 36. These parts act in the following manner: When the rock-shaft T begins its spring-actuated rearward movement, this movement, transmitted through link 30, rocks the hub 32. As soon as this hub begins to move the arm 32^a releases the arm 47, and thereupon spring 44 lifts detent 46 out of engagement with ratchet 36. The pawl 38 slides on ratchet 35, which cannot move backward, because detent 49 prevents it. When the pawl 38 is moved in the opposite or feeding direction as shaft T is returned to its home position, it turns the ratchet and shaft 33, and just as the hub 32 reaches its home position its arm 32^a engages with the arm 47, whereupon the detent 46 is carried into engagement with ratchet 36 and any further movement of shaft 33 is prevented.

The shaft J, before referred to, is mounted in a frame 54, which is supported by and capable of swinging upon the shaft 41. The upper end of the shaft J enters a slot 18^a in a bracket 18, secured to the frame of the machine. A lever 55 embraces this shaft J just above this bracket, the lever being pivoted to a bracket 19. A spring 56 acts upon this lever, so as to swing the end which embraces the shaft J toward the matrix-block. The upper end of this shaft J finds its bearing in the fork in the bracket 18 and the hole in the lever 55. This lever has in its other end a fork or slot 56, into which projects the upper end of a lever 57, which is pivoted to a bracket 21. The lower end of this lever is connected by a link z^5 with a downwardly-extended arm z^2, which is integral with the lever Z, which lever is pivoted to a fixed bar 19^c. The forward end of this lever lies just under and in contact with key-lever K^2. When therefore this key is depressed, the upper end of the shaft J is moved rearwardly in the slot 18^a and about the shaft as a center, and thereby the toothed wheel is carried rearwardly out of engagement with the matrix-block. The depression of this key likewise forces downward a stop-pin W. This pin is vertically movable through plate 17 into the path of the matrix-block on the matrix-holder. One end of a lever w, which is pivoted on the plate 17, engages with the top of pin W. The other end of this lever engages with the rear end

of the lever Z. The lever w is made of two parts, which are connected by a spring w'. Wherefore if when the force is applied to move the pin W downward the lower end of the pin strikes the top of the matrix-block the lever bends at the point described; but when the matrix-block is pushed from beneath it the spring w' carries this pin down into the path of the next matrix. A spring w^2 acts upon the lever w to raise the pin. This lever K^2 is depressed after one matrix is completed and just before it is removed and another one substituted. This pin W serves as a stop against which the end of the new matrix-block is moved. The matrix-blocks to be introduced into the machine are placed in a hopper Q, which is secured to the frame member 16. Its bottom is in line with the top surface of the matrix-holder when it is at its lowest position. Close to the bottom of this hopper and in its side walls the holes q' q^2 are cut. The slide q^3 enters the hopper through the slot q^2 and is adapted to push the lowest matrix-block in said hopper out through the hole q' and onto the matrix-holder P. This slide may be operated by means of a bell-crank lever q^4, whose rear arm is provided with a slot q^5, which receives a pin q^8, carried by said slide q^3. This lever is pivoted to a stud q^6, and one arm thereof projects out through a slot in one side 11 of the box-like frame of the machine and is pivotally connected with an operating-rod q^7. When this rod is pushed rearward, the slide q^3 is adapted to push the lowest matrix-block out of the hopper and onto the matrix-holder P. When the impressions have all been made in the matrix-block, as hereinafter explained, this rod is pushed still farther rearward, the result being that the slide q^3 will push the finished matrix-block off of the matrix-holder and into a groove 16^c in the top of the frame member 16. In Fig. 2 the positions assumed by this lever q^4 are shown. The lower dotted lines show its position when about to push a matrix-block out of the hopper onto the matrix-holder. The full lines show its position when it has accomplished this work. The upper dotted lines show its position when it has pushed a finished matrix-block past the stop-pin W. The stop-pin W referred to is provided for the purpose of furnishing an abutment against which the matrix-holder is pushed when it is first moved onto the holder, whereby the first impression on all of the blocks will be the same distance from its end. It will be understood, therefore, that when one matrix it finished and it is desired to remove it and introduce another the key K^2 is depressed. This causes the toothed feed-wheel to be drawn backward and the stop-pin to be forced downward. The lower end of this stop-pin will strike the top of the matrix-block and the lever w will bend. Then the rod q^7 is moved rearward, whereby the slide q^3 acts to push the finished matrix from under and past the stop-pin. Then the rod is moved forward, whereby the slide is drawn to the right from under the matrix-blocks, which thereupon fall, the lowest resting on the bottom of the hopper. The rod is then pushed rearward again, whereby the slide pushes the lowest matrix out of the hopper onto the matrix-holder against the stop-pin. The key K^2 is then released and the parts return to their former positions, in which the toothed wheel engages with said matrix-block. The machine is now in readiness to make the character impressions in the matrix-block. The power for making these impressions and for performing certain other functions, which are apparent from the description of the mechanism, is obtained from a constantly-rotating shaft E', which is mounted in suitable bearings in line with and close to the rear end of shaft E. A clutch is provided for connecting these two shafts. This clutch is automatic in its action, whereby to connect the shafts, and clutch-operating mechanism is provided whereby the clutch is released when the shafts have made one complete revolution in unison. The particular description of the clutch is as follows: A hub 60, having two oppositely-extended arms 61 62, is made fast to the shaft E. Two coacting flexible brake-bands are secured at one end to the end of the arm 61, and they are adapted to embrace the periphery of a disk 64, made fast to the shaft E'. To the arm 62, which extends oppositely to the arm 61, is pivoted a clutch-operating lever 66, and the ends of the brake-bands are connected with this lever on opposite sides of its pivot. A spring 67 is connected with the outer end of this arm and with the arm 61, to which the brake-bands are pivoted. This spring acts to so move the operating-lever that the brake-bands forcibly grasp the disk on shaft E', thereby connecting the two shafts. The spring therefore closes the clutch when it is permitted to do so. The clutch is open, however, after the shaft E has made one complete revolution by the engagement of the clutch-arm with a movable pin D, which is projected into its path. This pin is mounted on a standard d, in which it may slide endwise to so project its front end into or to withdraw it from the path of said clutch-arm 66. This pin is connected by a system of levers d' d^2 with a rod d^3, which is under the influence of a spring d^4, acting to draw it rearward, and consequently to withdraw the pin D out of engagement with the clutch-arm. To the front end of this rod d^3 is secured a slide d^5, which is movable in guideways in the block 69. Another slide d^7, movable in the same guideways, is connected with the rear end of a rod d^8, the front end of which is pivotally connected with an arm m'' on the rock-shaft M. A latch d^9 is provided for automatically connecting said slides when they are moved near enough to each other. This latch is pivoted at its front end to the slide d^7 and has a nose-piece d^{10}, which is adapted to slide upon the inclined front face

of a lug d^{11} on slide d^5 and to finally drop behind the substantially vertical rear face of said lug. A latch-tripping lever is pivoted to the slide d^5. It is a bell-crank lever, and one arm d^{13} lies beneath a pin d^{14}, which projects laterally from the side of the latch. A spring d^{16} acts upon this tripping-lever to hold it in a position in which the latch may engage with the lug. The other arm d^{15} of this latch-tripping lever is adapted to be moved to lift the latch by an arm h, which extends down from a rock-shaft H. This rock-shaft has two arms h' h^2 secured to it, and a cross-bar h^3, secured to these arms, which lies beneath and in contact with all of the key-levers and is held up into contact with them by a spring h^4. When any key-lever is depressed, the latch-tripping lever is caused to rock and the latch is lifted, whereby the two slides are disconnected. Thereupon the spring d^4 draws the slide d^5 backward, wherefore the pin D is withdrawn from the path of the clutch-arm, the clutch thereupon is closed by its spring, and the shaft E begins to revolve. The revolution of the shaft so moves the disk e, carrying the cams e' e^2 e^3, that the swinging frames referred to are released to the action of their several springs, and they swing back until stopped by the stubs on the depressed key-lever. The corresponding character is through the mechanism described brought to the impression-point. Then a centering-pin 70, having a conical lower end, is moved downward through plate 17, and the end enters a conical hole a^7 in the top of the type-carrier, whereby the said carrier is accurately positioned. This pin is operated by a lever pivoted to a standard 17^c. Its forward end is slotted and straddles a horizontal pin 70^a on the centering-pin. Its rear end is connected by a link 70^b with a slotted guide-block 70^c, which embraces the shaft E, and a cam 70^d on shaft E engages with this block, whereby the pin 70 is moved downward. A spring 70^e moves the lever and pin 70 in the contrary direction. The cam e^5 then moves the matrix-holder up, whereby the impression is made in the matrix-block. The toothed feed-wheel J' is movable up and down on shaft J, to which it is connected by a tongue and groove, and it is so moved with the matrix-holder by a forked arm p^5, which is secured to said holder and engages in a circumferential groove in the hub of said wheel. The feed-pawl 38 has in the rearward movement of the rock-shaft T been set for the proper feed movement of the escapement. When, therefore, the shaft E in its further revolution brings the cams e' e^2 e^3 into contact with the several friction-rollers, the parts are all drawn back to their home positions. The slide d^7 has been moved back and the latch d^9 has connected it with the slide d^4, and as it is moved forward the stop-pin D again comes into the path of the clutch-arm 66, which strikes it, whereby the clutch is opened and shaft E stops. As the rock-shaft T returns to its home position the escapement mechanism is operated and the matrix-block is fed forward the proper distance.

Having described my invention, I claim—

1. In a matrix-making machine, in combination, a sliding carrier-plate having a plurality of guides at right angles to its path of movement, a plurality of type-carriers mounted upon said plate and movable in said guide, and mechanisms for independently moving said plate and type-carriers, substantially as specified.

2. In a matrix-making machine, in combination, a sliding carrier-plate having a plurality of guides at right angles to its path of movement, a plurality of type-carriers mounted upon said plate and movable in said guide, mechanisms for independently moving said plate and type-carriers, a series of finger-keys and mechanism whereby the operation of each finger-key controls the movements of both of said mechanisms for moving said plate and type-carriers, substantially as specified.

3. In a matrix-making machine, the combination of a sliding carrier-plate having a plurality of guides at right angles to its path of movement, sliding type-carriers mounted upon said plate and movable in said guide, said type-carriers having horizontal dovetail notches in one end which notches are in line when the type-carriers are in their home positions, and an endwise-movable rod having in its end a dovetail tongue adapted to take into said notches, and mechanisms for independently moving said plate and rod, substantially as specified.

4. In a matrix-making machine, the combination of a sliding carrier-plate having a plurality of guides at right angles to its path of movement, sliding type-carriers mounted upon said plate and movable in said guide, said type-carriers having horizontal dovetail notches in one end which notches are in line when the type-carriers are in their home positions, and an endwise-movable rod having in its end a dovetail tongue adapted to take into said notches, and mechanisms for independently moving said plate and rod, and a series of finger-keys and mechanism whereby the operation of each finger-key controls the movements of both of such mechanisms for moving said plate and rod, substantially as specified.

5. In a matrix-making machine, a sliding type-carrier having a horizontal dovetail notch in one end and having projecting from one horizontal face a single row of cameo type arranged end to end, substantially as specified.

6. In a matrix-making machine, the sliding type-carrier having, projecting from one of its horizontal faces, a row of cameo type arranged end to end and having in its other horizontal face an equal number of conical depressions, substantially as specified.

7. In a matrix-making machine, in combi-

nation, a horizontally-movable carrier-plate having a plurality of guides at right angles to its path of movement, a plurality of sliding type-carriers mounted on said plate and movable in said guides, spring-actuated mechanisms for moving the plates and type-carriers from their home positions, a plurality of keys each adapted to limit the movements of said spring-actuated mechanisms from their home positions, and means for returning said mechanisms to their home positions, substantially as specified.

8. In a matrix-making machine, in combination, a sliding carrier-plate having a plurality of guides at right angles to its path of movement, a plurality of type-carriers mounted upon said plate and movable in said guide, each type-carrier having in its end a dovetail notch, which notches, when the carriers are in their home positions are in the same horizontal line, with a longitudinally-movable rod having a dovetail tongue adapted to take into said notches, and having a projection, a series of movable stops with which said projection is adapted to engage, mechanism for moving any stop into the path of said projection, mechanism for moving said plate definite distances, and spring-actuated mechanism for moving said rod to bring the projection thereon against said stop, substantially as specified.

9. In a matrix-making machine, the combination of a horizontally-movable carrier-plate, a plurality of type-carriers mounted on said plate and movable in paths at right angles to its movement, spring-actuated mechanisms for independently moving said plate and carriers from their home positions, a plurality of finger-keys, and mechanism whereby the depression of said finger-keys determines the extent of the spring-actuated movements of said mechanism for moving said plate and carriers, substantially as specified.

10. In a matrix-making machine, a sliding type-carrier having a plurality of cameo type projecting from its outer face and two intersecting dovetail notches in one end, substantially as specified.

11. In a matrix-making machine, in combination, a sliding carrier-plate having a plurality of guides at right angles to its path of movement, a plurality of type-carriers mounted upon said plate and movable in said guides, each type-carrier having in its end a dovetail notch, which notches, when the carriers are in their home positions are in the same horizontal line, with a longitudinally-movable rod having a dovetail tongue adapted to take into said notches, a stepped plate movable across the path of said rod, a projection on the rod for engagement with the steps on said plate, and mechanisms for independently moving the carrier-plate, the stepped plate, and the sliding rod, substantially as specified.

12. In a matrix-making machine, in combination, a sliding carrier-plate having a plurality of guides at right angles to its path of movement, a plurality of type-carriers mounted upon said plate and movable in said guide, each type-carrier having in its end a dovetail notch, which notches, when the carriers are in their home positions are in the same horizontal line, with a longitudinally-movable rod having a dovetail tongue adapted to take into said notches, and having a projection, a series of movable stops with which said projection is adapted to engage, mechanism for moving any stop into the path of said projection, mechanism for moving said plate definite distances, and spring-actuated mechanism for moving said rod to bring the projection thereon against said stop, and a series of finger-keys each adapted to control the movement of said carrier-plate and stepped plate from their home positions, substantially as specified.

13. In a matrix-making machine, in combination, a sliding carrier-plate having a plurality of guides at right angles to its path of movement, a plurality of sliding type-carriers mounted on each plate and movable in said guides, each of said carriers having in one end a horizontal dovetailed notch, which notches, when the carriers are in their home positions, are in line with each other, mechanism for moving said carrier-plate, a movable stepped plate, and mechanism for moving it various distances from its home position, a longitudinally-movable rod having a dovetail tongue adapted to take into the notches in the type-carriers, a spring-actuated device for moving said rod in one direction away from its home position, a projection on said rod adapted to engage with said stepped plate, and mechanisms for severally returning said carrier-plate, sliding rod, and stepped plate to their home positions, substantially as specified.

14. In a matrix-making machine, in combination, a vertically-movable box having horizontal guides, a plurality of sliding carrier-plates supported by said box and mounted in said guides one above the other, said carrier-plates having each a plurality of guides at right angles to its path of movement, a plurality of sliding type-carriers mounted on said plates and movable in said guides, and mechanisms for independently moving the box, carrier-plates, and slides, substantially as and for the purpose specified.

15. In a matrix-making machine, in combination, a vertically-movable box having horizontal guides, a plurality of sliding carrier-plates mounted on said guides, said plates having guides at right angles to the guides in which they move, a plurality of type-carriers mounted in the guides in said plates, said plates having in one end vertical dovetailed notches which, when the plates are in their home positions, are in the same vertical line, with a shift-key and intermediate mechanism for raising said box, a longitudinally-movable rod having a dovetailed tongue adapted to

take into the notches in said plates, mechanism for moving said rod, each of said type-carriers also having in one end horizontal dovetailed notches, a longitudinally-movable rod having a dovetail tongue adapted to take into said notches, and mechanism for moving said rod, substantially as specified.

16. In a machine of the character stated, in combination, a spring-actuated swinging frame, mechanism operated thereby, a plurality of key-levers each having a stub which will be moved into the path of said frame when the lever is depressed, said stubs being placed different distances from the parts of the frame which will engage with them, whereby the spring-actuated movements of said frame which follows the depression of any key-lever will be stopped by the engagement of said frame with the stub on the depressed key-lever, substantially as specified.

17. In a machine of the stated character, in combination, a spring-actuated swinging frame, the escapement mechanism, mechanism connecting the same with the swinging frame, a plurality of key-levers each having a stub which will be moved into the path of said frame when the lever is depressed, said stubs being placed different distances from the parts of the frame which will engage with them, which distances are proportionate to the widths of the characters with which said key-levers are severally associated, whereby the spring-actuated movements of the frame which follows the depression of a key-lever will be stopped by the engagement of the frame with the stub of the depressed key-lever, and mechanism for returning the said frame and the parts connected with it to their home positions, substantially as specified.

18. In a matrix-making machine, in combination, a spring-actuated swinging frame, a rotatable shaft, a cam carried by said shaft, mechanism intermediate of said cam and frame whereby the cam may move the frame to and hold it in its home position in opposition to its spring, a plurality of key-levers, each having a stub which will be moved into the path of said frame when the lever is depressed, and mechanism whereby the shaft is caused to make one revolution whenever a key-lever is depressed, substantially as specified.

19. In a matrix-making machine, in combination, a spring-actuated swinging frame adapted to impart motion to the mechanism which assists in bringing the proper character to the impression-point, a plurality of key-levers each having a stub in its under side which will be moved into the path of said frame when the key is depressed and will act as a stop to limit the spring-actuated mechanism of said frame, said stubs on the several levers being variously placed with reference to the frame whereby they permit different movements of said frame, substantially as specified.

20. In a matrix-making machine, in combination, a spring-actuated swinging frame adapted for imparting motion to the mechanism which assists in bringing the proper character to the impression-point, a plurality of key-levers each having a stub in its under side which will be moved into the path of said frame when the key is depressed and will act as a stop to limit the spring-actuated mechanism of said frame, said stubs on the several levers being variously placed with reference to the frame whereby they permit different movements of said frame, and mechanism whereby the depression of each key-lever causes the release of said frame to the action of its spring, substantially as specified.

21. In a matrix-making machine, in combination, a plurality of spring-actuated independently-moving swinging frames, each of which is adapted to move certain parts of the mechanism to the end that the proper character shall be brought to the impression-point, and the escapement mechanism shall be set, mechanisms for returning said frames to and holding them in their home positions, a plurality of key-levers each having stubs which are so placed that they will be moved into the paths of said frames when any lever is depressed, and thereby act as stops to limit the spring-actuated movements of said frames, said stubs being differently placed on different levers whereby they permit various movements of said frames, and mechanisms whereby the depression of any lever causes the release of said frames to the action of their spring, substantially as specified.

22. In a matrix-making machine, in combination, a plurality of spring-actuated independently-movable swinging frames, a constantly-driven shaft, a rotatable shaft, cams secured to said shaft, slides with which said cams engage, mechanisms intermediate of said slides and frames whereby the cams serve to return the frames to their home positions, a spring-actuated clutch for connecting said shafts which clutch has a releasing lever-arm, a movable stop for engaging said arm which stop is movable into and out of the path of said arm, key-levers having stubs which when the levers are depressed are moved into the paths of said frames and serve to limit their movement, and mechanisms intermediate of said key-levers and clutch-arm stop, whereby the latter is withdrawn whenever a lever is depressed, substantially as specified.

23. In a matrix-making machine, in combination, a spring-actuated swinging frame, a constantly-driven shaft, a rotatable shaft, a cam secured to the latter, slides with which said cam engages, a link connecting said slide and spring-actuated swinging frame, a plurality of finger-keys each having a stub which will be projected into the path of said frame when the lever is depressed, a spring-actuated clutch for connecting said two shafts, an operating-lever for said clutch, a movable pin for engagement with said lever, and means whereby the depression of each key-lever

causes the withdrawal of said pin from its engagement with the clutch-operating lever, substantially as specified.

24. In a matrix-making machine, in combination, a sliding stepped plate, a bell-crank lever, a link connecting an arm thereof with the plate, a spring-actuated swinging frame, a link connecting the same with the other arm of the bell-crank lever, and a plurality of finger-keys each having a stub adapted to be moved into the path of said frame by the depression of the lever, substantially as specified.

25. In a matrix-making machine, in combination, a sliding stepped plate, a bell-crank lever, a link connecting one arm thereof with the plate, a spring-actuated swinging frame, a link connecting the same with the other arm of the bell-crank lever, and a plurality of finger-keys each having a stub adapted to be moved into the path of said frame by the depression of the lever, a spring-actuated sliding rod having a projection adapted to engage with the steps on said plate, and a sliding type-carrier adapted to be moved by said rod, substantially as specified.

26. In a matrix-making machine, in combination, a sliding carrier-plate, a sliding operating-rod having rack-teeth, a pinion engaging with said rack-teeth, a spring-actuated swinging frame, mechanism whereby the movement of said frame turns said pinion, a plurality of key-levers each having a stub which will be moved into the path of said frame, and mechanism for moving said frame against its spring back to its home position, substantially as specified.

27. In a matrix-making machine, in combination, a sliding carrier-plate, a rod having rack-teeth and adapted to move the plate in both directions, a pinion engaging with said rack-teeth, another pinion connected with the first-named pinion, two rack-bars engaging with the latter pinion on opposite sides of its center, a rack-bar operator and a latch for connecting either of said rack-bars with said operator, substantially as specified.

28. In a matrix-making machine, in combination, a sliding carrier-plate, a rod having rack-teeth and adapted to move the plate in both directions, a pinion engaging with said rack-teeth, another pinion connected with the first-named pinion, two rack-bars engaging with the latter pinion on opposite sides of its center, a rack-bar operator and a latch for connecting either of said rack-bars with said operator, and mechanism operated by some of the finger-keys for moving the latch out of engagement with one rack-bar and into engagement with the other, substantially as specified.

29. In a matrix-making machine, in combination, a sliding carrier-plate, a rod having rack-teeth and adapted to move the plate in both directions, a pinion engaging with said rack-teeth, another pinion connected with the first-named pinion, two rack-bars engaging with the latter pinion on opposite sides of its center, a rack-bar operator and a latch for connecting either of said rack-bars with said operator, and mechanism operated by some of the finger-keys for moving the latch out of engagement with one rack-bar and into engagement with the other, a spring-actuated swinging frame, mechanism connecting it with the rack-bar operator, a plurality of key-levers, each having a stub which will be moved into the path of said frame when the key-lever is depressed, substantially as specified.

30. In a matrix-making machine, in combination, a constantly-driven shaft, a rotatable shaft, a clutch for connecting said shafts, a clutch-operating arm, a spring for moving said arm to close the clutch, a pin adapted to be projected into the path of said arm whereby the engagement of said arm with said pin releases the clutch, a plurality of key-levers, and mechanism whereby the depression of any key-lever causes the pin to be withdrawn from the path of said clutch-arm, substantially as specified.

31. In a matrix-making machine, in combination, a constantly-driven shaft, a rotatable shaft, an automatic clutch secured to the latter shaft and adapted to connect the two shafts, said clutch having a releasing-arm, a movable stop, a spring for moving the same out of the path of said arm, a plurality of key-levers and mechanism whereby the depression of each key-lever releases said stop to the action of its spring, substantially as specified.

32. In a matrix-making machine, in combination, a constantly-driven shaft, a rotatable shaft, an automatic clutch for connecting the shafts, and a clutch releasing the arm with a stop adapted to be moved into and out of the path of said arm whereby the clutch will be released when the arm engages with the stop, a slide, and mechanism connecting the slide and movable stop, a spring for moving said slide in the direction which causes the withdrawal of said stop, a second slide, an automatic latch for connecting the two slides, a plurality of key-levers, mechanism operated by each lever for tripping said latch, and mechanism which acts during each revolution of the rotatable shaft to move the second slide backward, whereby it is latched to the first-named slide and then forward to return the latter to its home position, substantially as specified.

33. In a matrix-making machine, in combination, a rotatable shaft, a constantly-driven shaft and an automatic clutch for connecting the said shafts, which clutch has a releasing-arm, a movable stop for engaging with said arm, a slide and mechanism connecting the same with said stop, with a spring for operating said mechanism, an automatic latch engaging with said slide and holding it against the pull of its spring, a latch-releasing lever adapted to engage with said latch, a swinging frame extending beneath and in contact

with the key-levers, an arm secured to said frame and adapted to engage with the latch-releasing lever, and a plurality of key-levers, substantially as specified.

34. The combination of a rotatable shaft, a rotating shaft, a self-acting clutch for connecting said shafts, which clutch has a releasing-arm, a stop-pin adapted to be projected into the path of said arm, a spring for withdrawing it, a system of levers for moving the pin in the contrary direction, a slide connected with said levers, a second slide, an automatic latch for connecting the slides, a plurality of key-levers, latch-releasing mechanism operable by all of said key-levers, a rock-shaft, connections between the same and the last-named slide, a cam carried by the rotatable shaft, and mechanism operated by said cam for rocking said rock-shaft, substantially as specified.

35. In a matrix-making machine, in combination, the escapement-shaft, a ratchet secured thereto, a pawl-carrier adapted to oscillate upon the same axis, a spring-pawl mounted thereon, mechanism whereby the depression of each key-lever results in the oscillation of said pawl-carrier backward and forward a distance proportionate to the character which corresponds with said key-lever, substantially as specified.

36. In a matrix-making machine, in combination, the escapement-shaft, a ratchet secured thereto, a pawl-carrier adapted to oscillate upon the same axis, a spring-pawl mounted thereon, mechanism whereby the depression of each key-lever results in the oscillation of said pawl-carrier backward and forward a distance proportionate to the character which corresponds with said key-lever, a second shaft, removable and exchangeable gears connecting said shafts, a vertical shaft, bevel-gears connecting the second shaft with the vertical shaft and a toothed feed-wheel on the vertical shaft, substantially as specified.

37. In a matrix-making machine, in combination, the escapement-shaft, a ratchet secured thereto, a pawl-carrier adapted to oscillate upon the same axis, a spring-pawl mounted thereon, mechanism whereby the depression of each key-lever results in the oscillation of said pawl-carrier backward and forward a distance proportionate to the character which corresponds with said key-lever, and connected thereto by a tongue and groove which permits the feed-wheel to slide upon the vertical shaft, substantially as specified.

38. In a matrix-making machine, escapement mechanism consisting of the following parts in combination, a shaft, two reversely-placed ratchets secured thereto, a spring-pawl, an oscillating hub mounted axially with respect to the shaft, and having one arm in which said spring-pawl is mounted, and also a second arm, a spring-detent, a spring-actuated rock-shaft, a detent secured thereto and adapted to engage with the other ratchet, a stop-pin, and an arm secured to the rock-shaft and adapted to engage with the stop-pin and with the second arm on the oscillating hub, substantially as and for the purpose specified.

39. In a matrix-making machine, in combination, the escapement-shaft, reversely-cut ratchets secured thereto, an oscillating hub mounted axially with respect to said shaft, a plurality of finger-keys, and mechanism whereby said hub is, whenever a finger-key is depressed, oscillated back and forth through an arc whose length is proportionate to the width of the corresponding character, an operating spring-pawl mounted on an arm secured to said hub and engaging with one ratchet, a spring-actuated detent engaging with the same ratchet, a detent engaging with the other ratchet, a rock-shaft to which it is secured, a spring acting thereon to withdraw the detent from engagement with said ratchet, an arm secured to said rock-shaft, an arm secured to the oscillating hub and adapted to engage with the arm last referred to, and a fixed stop-pin also adapted to engage with said arm, substantially as specified.

40. In a matrix-making machine, in combination, a spring-actuated swinging frame, escapement mechanism suitably connected with said frame, a rotary shaft, a cam secured thereto, and mechanism whereby said cam moves the frame in opposition to its spring back to its home position, and a series of pivoted key-levers having stubs projecting from their under sides which stubs will be moved into the path of said swinging frame and serve to stop its spring-actuated movements, said stubs being variously placed on different levers, substantially as specified.

41. In a matrix-making machine, the combination of a rotatable toothed feed-wheel adapted to move the matrix-block, a vertical shaft with which said wheel has a sliding connection, a shaft at right angles to the feed-wheel shaft, a frame in which the feed-wheel shaft is mounted which frame is adapted to swing upon an axis coincident with the axis of the other shaft, beveled gears connecting said two shafts, escapement mechanism for rotating the second shaft, and mechanism for swinging said frame to carry the feed-wheel away from the matrix, substantially as and for the purpose specified.

42. In a matrix-making machine, in combination, escapement mechanism, a horizontal shaft connected thereto, a frame mounted upon said shaft, a vertical shaft mounted in said frame, beveled gears secured to said two shafts and meshing with each other, a toothed feed-wheel on the vertical shaft and having a sliding connection therewith, a fixed forked bracket-arm which embraces said vertical shaft, a lever which likewise engages with said shaft, mechanism for operating said lever to rock the shaft-frame and thereby move the toothed feed-wheel toward and from the matrix, a vertically-movable matrix-holder, its operating mechanism, and a forked arm

secured to said holder and engaging in a circumferential groove in the hub of the feed-wheel, substantially as specified.

43. In a matrix-making machine, escapement mechanism, a horizontal shaft connected thereto, a frame mounted upon said shaft, a vertical shaft mounted in said frame, beveled gears secured to said two shafts and meshing with each other, a toothed feed-wheel on the vertical shaft and having a sliding connection therewith, a fixed forked bracket-arm which embraces said vertical shaft, a lever which likewise engages with said shaft, mechanism for operating said lever to rock the shaft-frame and thereby move the toothed feed-wheel toward and from the matrix, a vertically-movable matrix-holder, its operating mechanism, and a forked arm secured to said holder and engaging in a circumferential groove in the hub of the feed-wheel, a spring-actuated swinging frame adapted to move certain parts of that machine from its home position, a slide connected with said frame, a cam adapted to engage with said slide whereby the frame is returned to its home position, a rotatable shaft to which said cam is secured, and means for causing said shaft to make one revolution only when each key-lever is depressed, substantially as specified.

44. In a matrix-making machine, in combination, a vertically-movable matrix-holder, a vertical feed-shaft and its operating mechanism, a toothed feed-wheel movable vertically on said shaft and connected thereto by a tongue and groove, and mechanism connected with the matrix-holder for moving said feed-wheel up and down upon said shaft, substantially as specified.

45. In a matrix-making machine, in combination, a vertically-movable matrix-holder, a vertical shaft and its operating mechanism, a toothed feed-wheel which is movable vertically on said shaft and is connected thereto by a tongue and groove, the hub of said feed-wheel having a circumferential groove and a forked arm secured to said matrix-holder and engaging in said circumferential groove, substantially as specified.

46. In a matrix-making machine, in combination, a vertically-movable matrix-holder, and its operating mechanism, a plate secured over said holder having in its under side a dovetail groove, a sliding carrier-plate having a plurality of dovetail grooves on its under side, a plurality of type-carriers mounted on said grooves, means for moving the carrier-plate to bring any type-carrier into line with the groove in the plate above the matrix-holder, and means for moving said type-carrier into the groove in said plate and for withdrawing it therefrom, substantially as specified.

47. In a matrix-making machine, in combination, type-carriers, and mechanism for moving them to bring any character to the impression-point, a vertically-movable matrix-holder, and its operating mechanism whereby the matrix-block is moved against the character, substantially as specified.

48. In a matrix-making machine, in combination, a vertically-movable matrix-holder, a matrix-holding hopper, and a slide for moving the matrix-blocks out of the latter and onto the former, with a stop-pin adapted to be moved into and out of the path of said matrix-blocks whereby it serves to stop them all in the same position relative to the impression-point, substantially as specified.

49. In a matrix-making machine, in combination, a vertically-movable matrix-holder, a matrix-holding hopper, and a slide for moving the matrix-blocks out of the latter and onto the former, with a stop-pin adapted to be moved into and out of the path of said matrix-blocks whereby it serves to stop them all in the same position relative to the impression-point, a lever pivoted between its ends and engaging with said stop-pin, one arm of said lever being formed of two relatively-movable parts, a spring for holding said parts in line with each other, and mechanism for operating said lever, substantially as specified.

50. In a matrix-making machine, in combination, a stop-pin adapted to be moved into the path of the matrix, and the toothed wheel for feeding the matrix step by step which feed-wheel is adapted to be moved away from and into engagement with a matrix, a key-lever, and mechanism operated by said key-lever for simultaneously moving the stop-pin into the path of the matrix-block and the feed-wheel away from the matrix, substantially as specified.

51. The combination of a type-carrier having cameo characters on one face and having also an equal number of conical depressions with a pin having a conical end adapted to engage with said depressions, means for moving the type-carrier to bring any character approximately to the impression-point, and means for operating said pin to exactly position said slide, substantially as and for the purpose specified.

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

CHARLES SEARS.

Witnesses:
THOS. C. BRINKLEY,
PHILIP E. KNOWLTON.