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A. J. KLETZKER.

MATRIX MAKING MACHINE.

No. 432,627. Patented July 22, 1890.

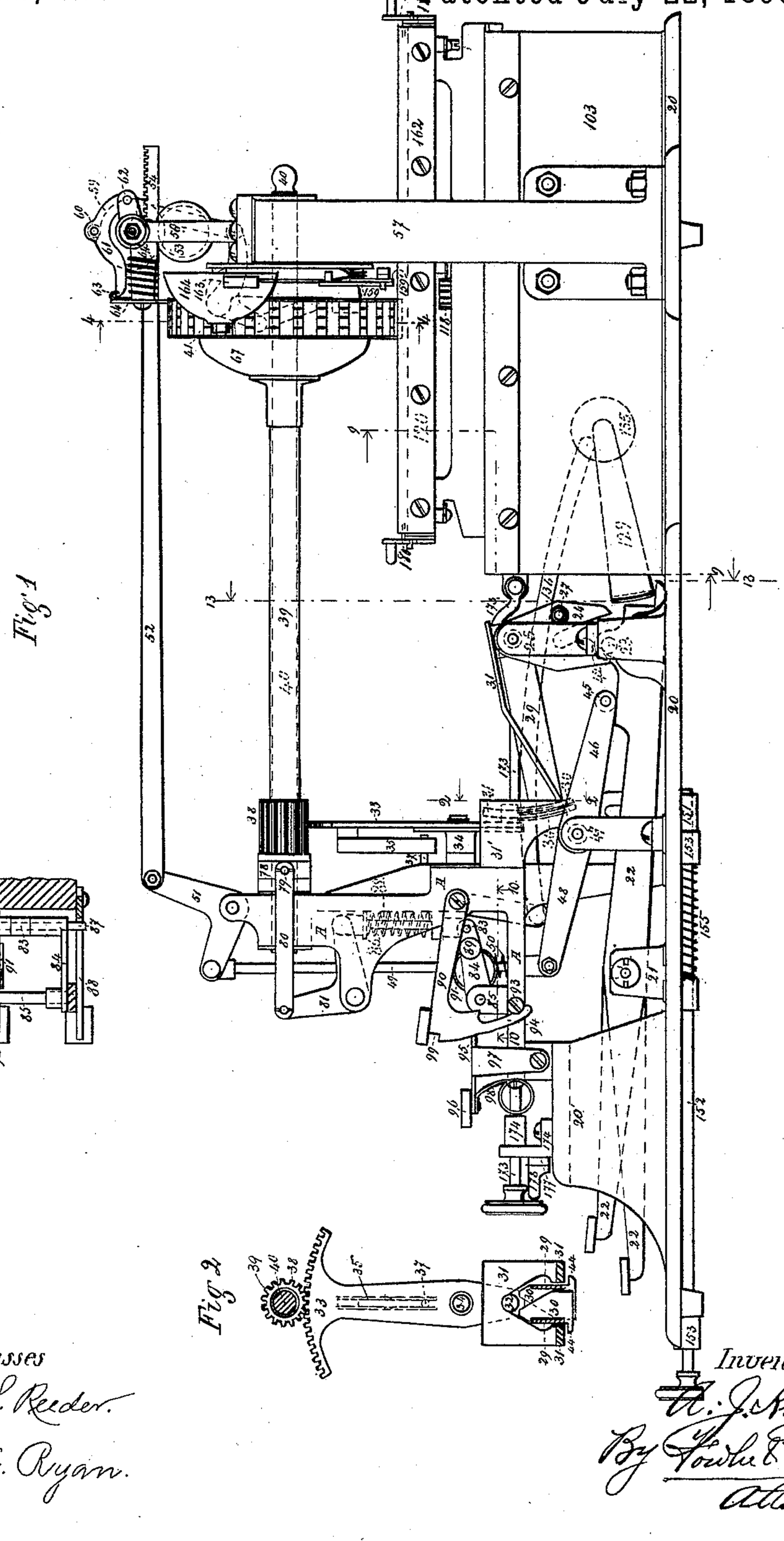

Fig 1

Fig 10

Fig 2

Witnesses
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(No Model:)

6 Sheets—Sheet 2.

A. J. KLETZKER.

MATRIX MAKING MACHINE.

No. 432,627. Patented July 22, 1890.

Fig 3

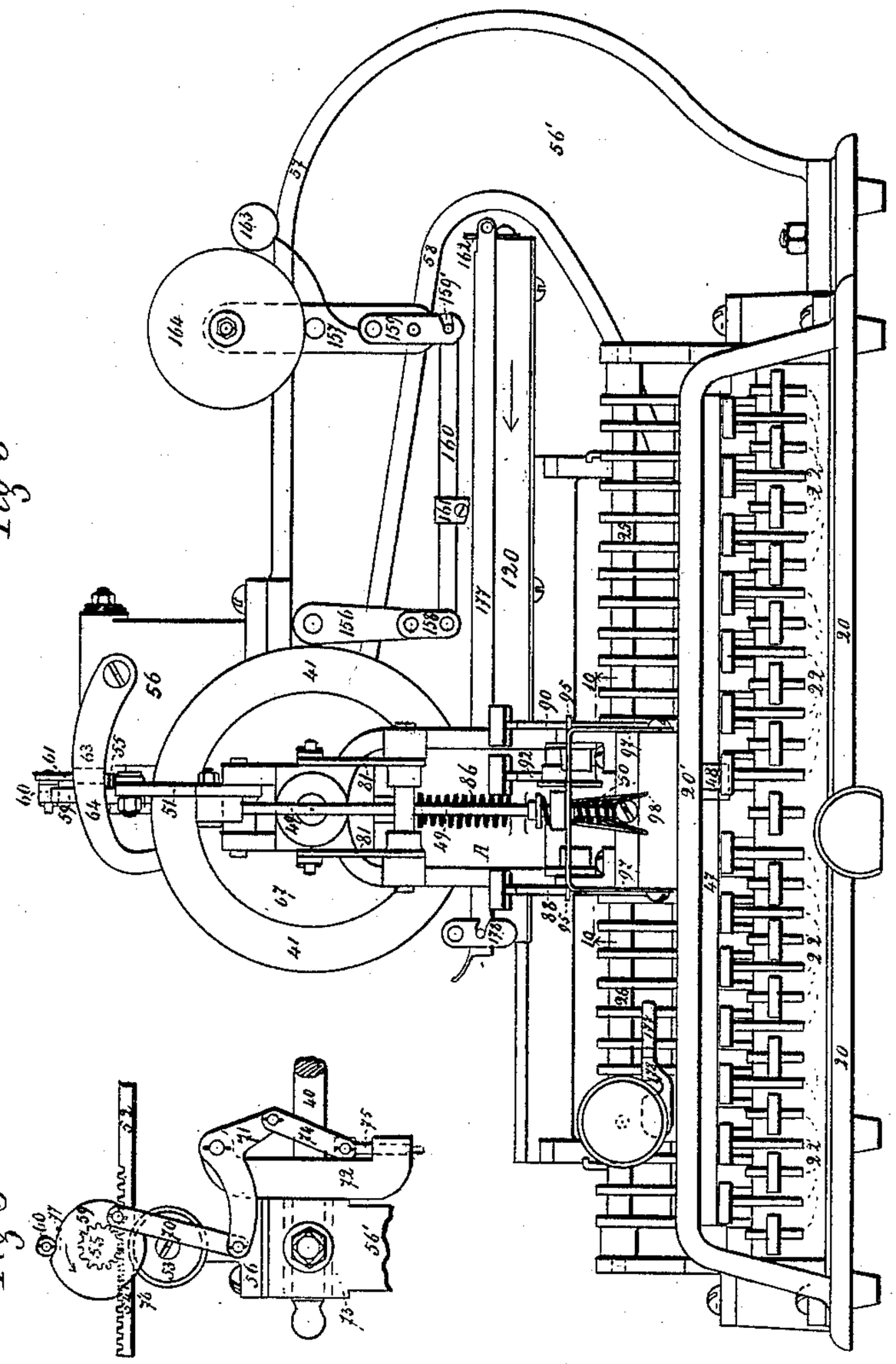


Fig 5

Fig 4

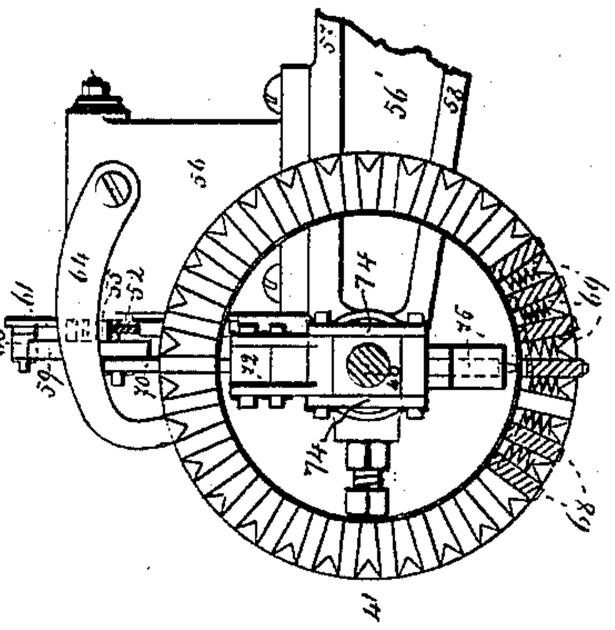
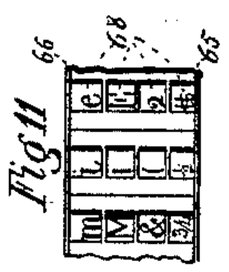


Fig 11



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(No Model.) 6 Sheets—Sheet 3.

A. J. KLETZKER.

MATRIX MAKING MACHINE.

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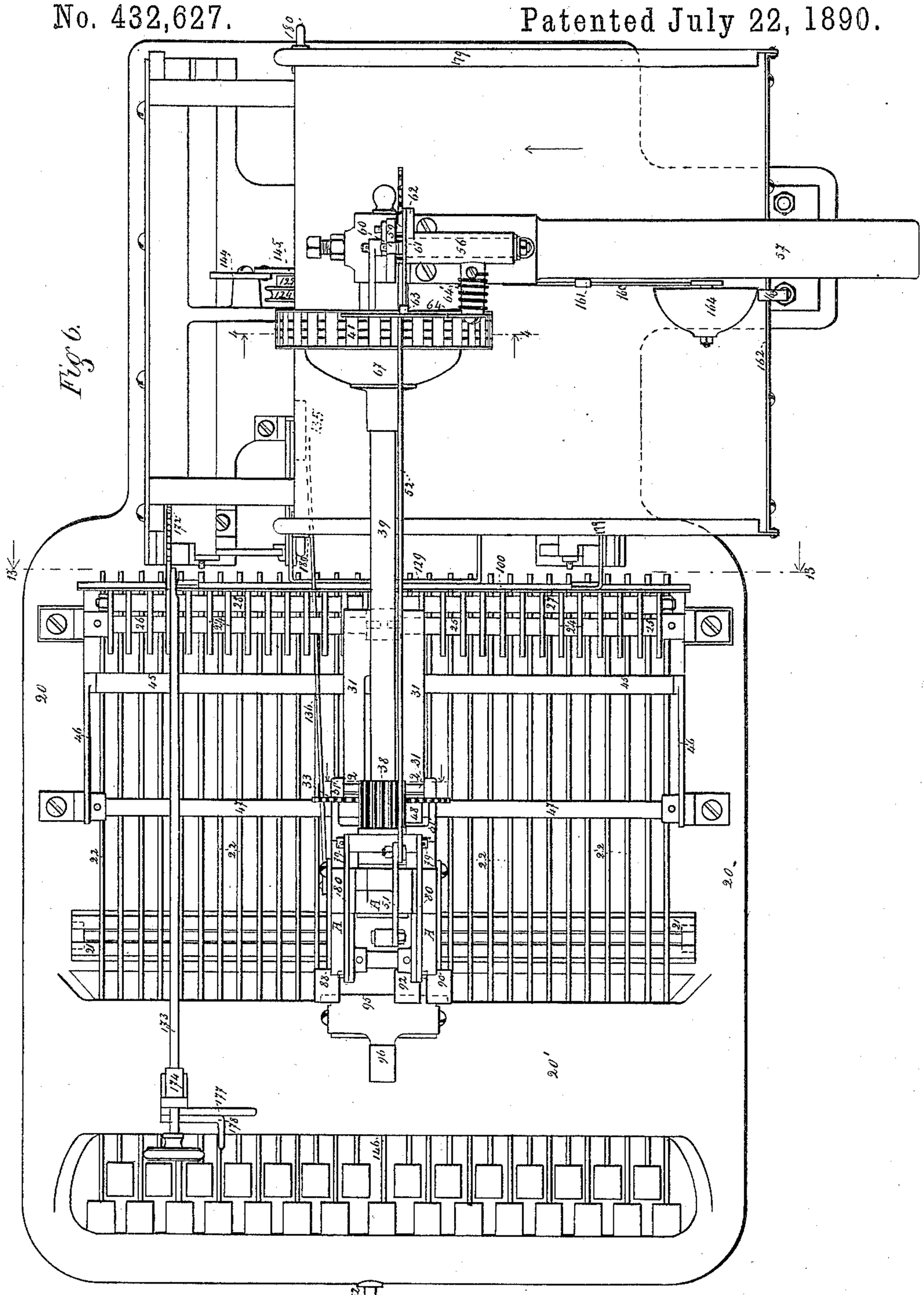

Fig 6.

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(No Model.) 6 Sheets—Sheet 4.

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MATRIX MAKING MACHINE.

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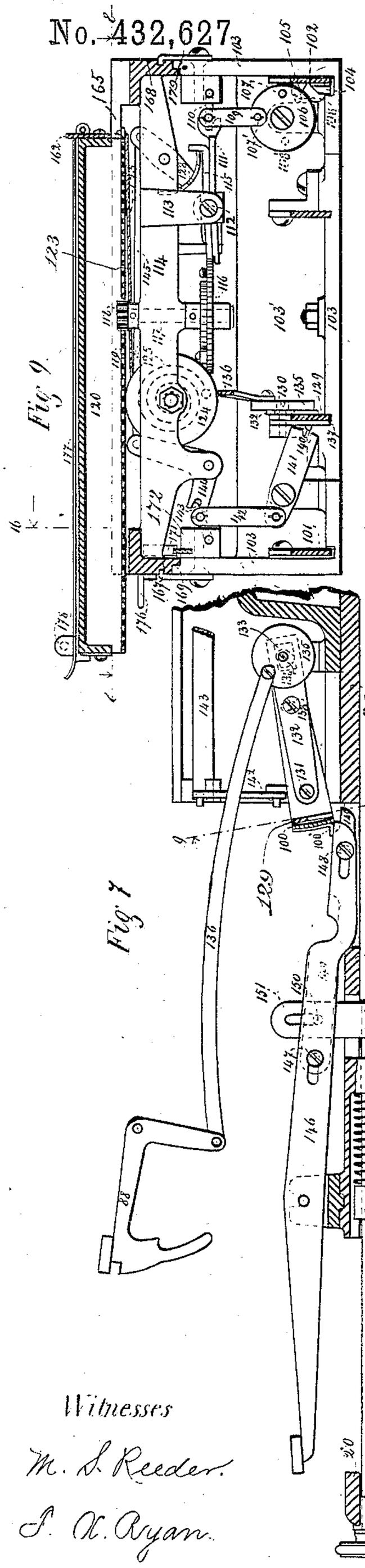

Fig 9

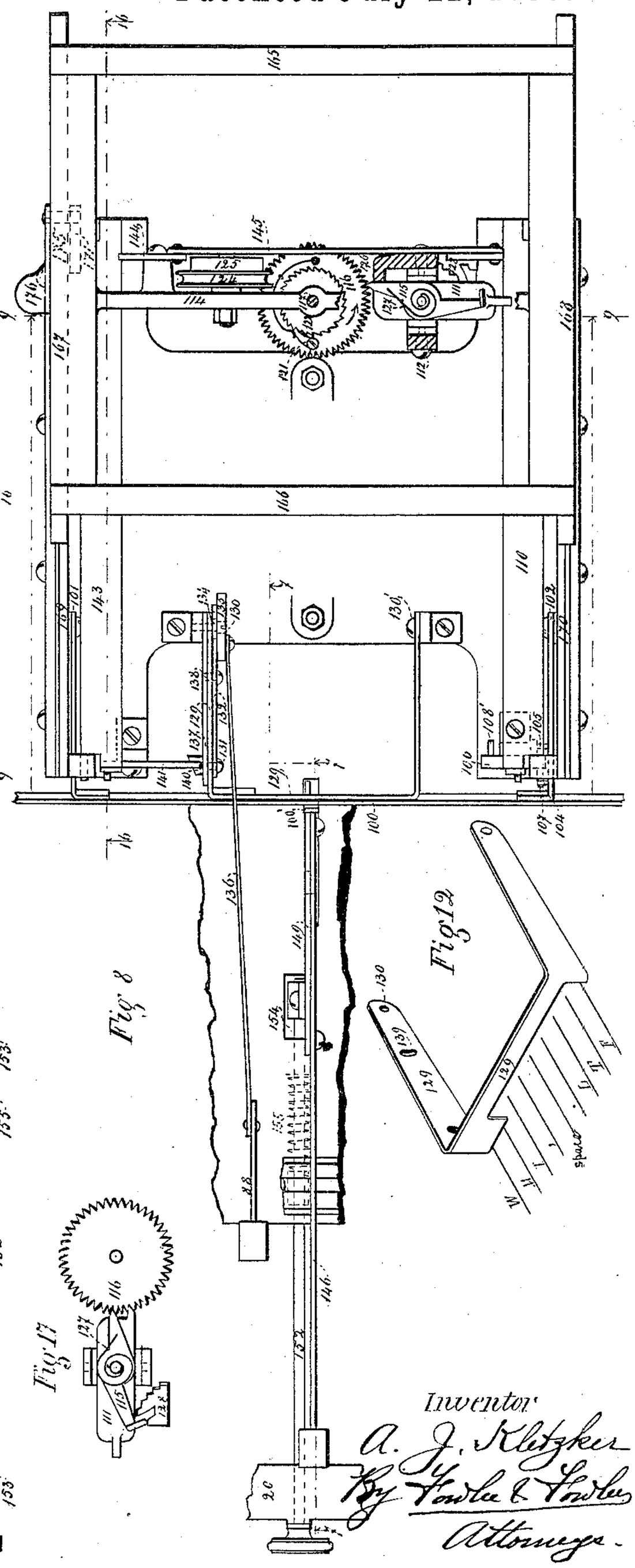

Fig 8

Fig 7

Fig 17

Fig 12

Witnesses

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(No Model.) 6 Sheets—Sheet 5.

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MATRIX MAKING MACHINE.

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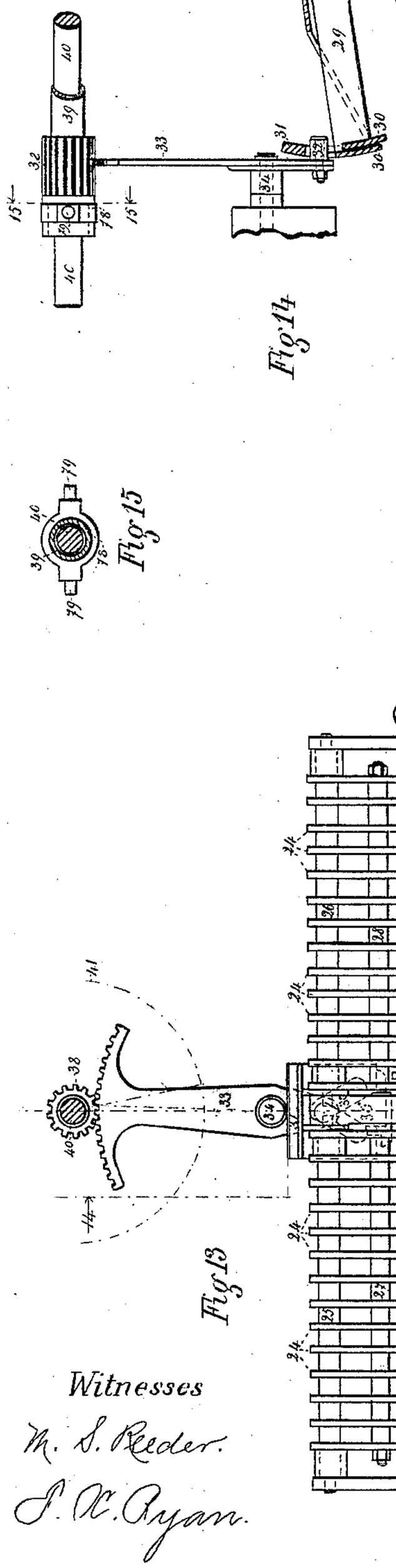

Fig 14

Fig 15

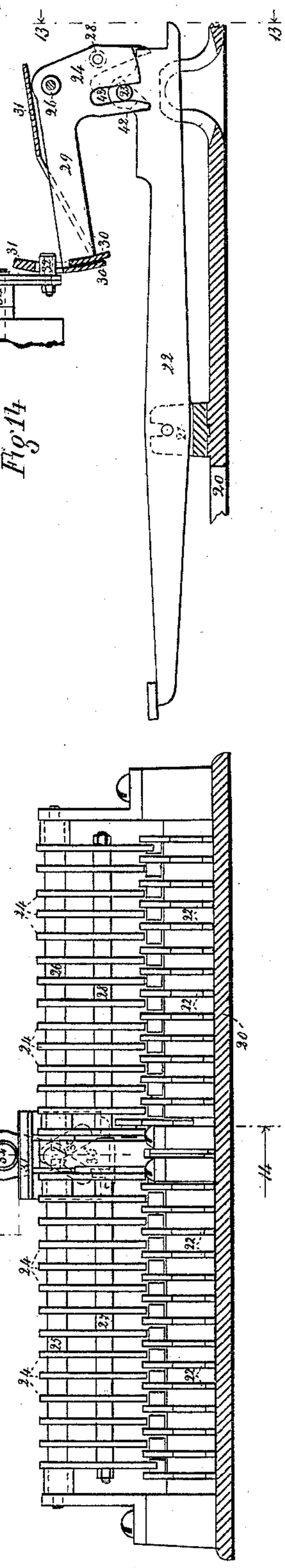

Fig 13

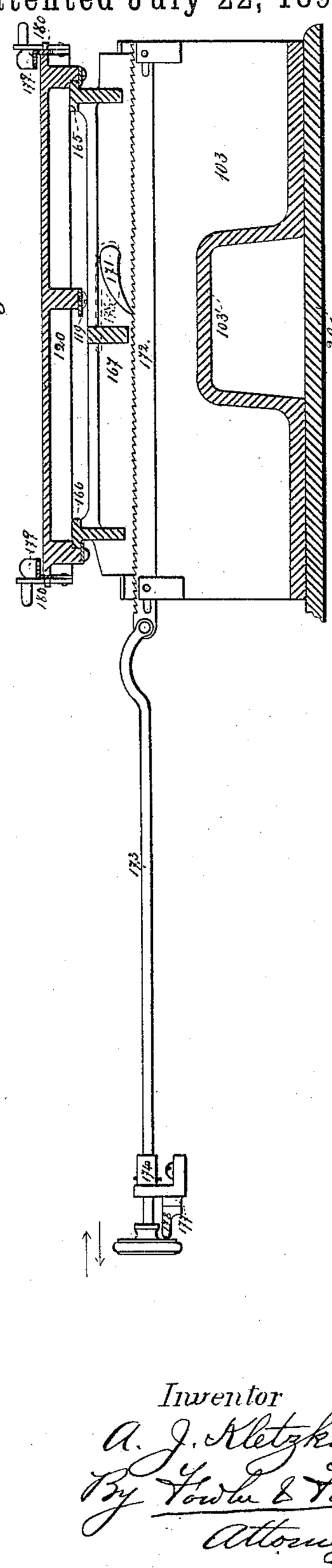

Fig 16

Witnesses

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(No Model.) 6 Sheets—Sheet 6.

A. J. KLETZKER.

MATRIX MAKING MACHINE.

No. 432,627. Patented July 22, 1890.

Fig 18

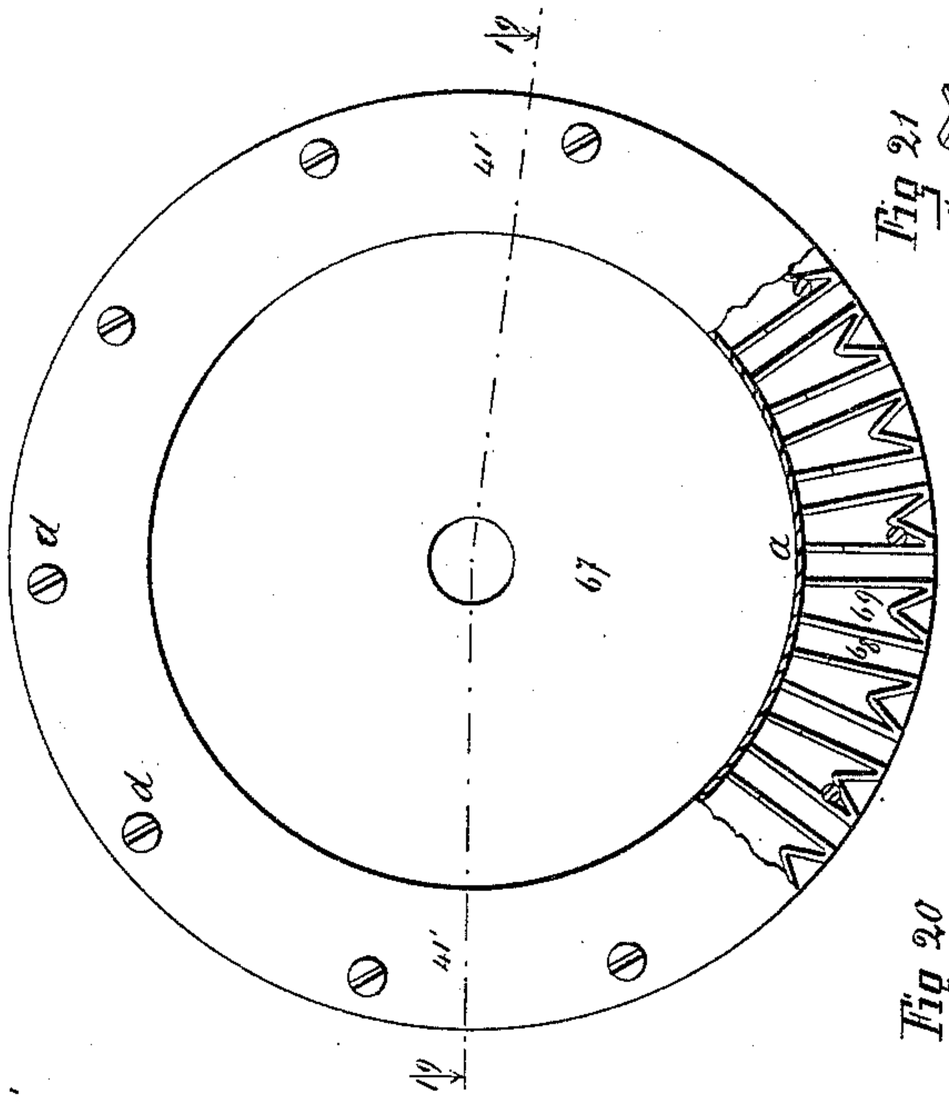
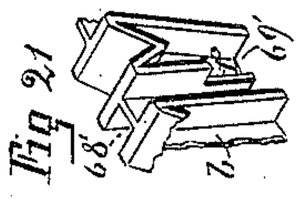


Fig 21



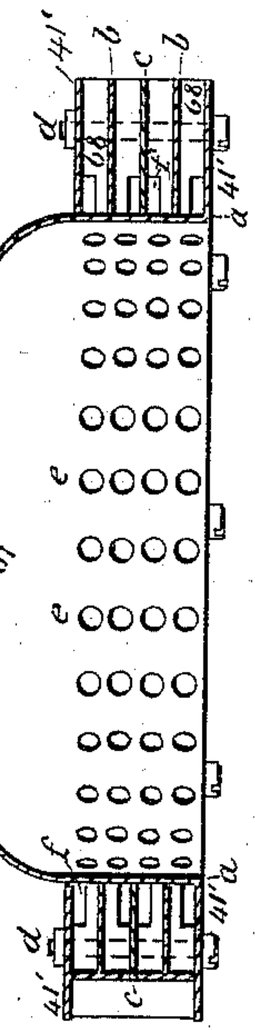


Fig 19

Fig 20

Fig 26

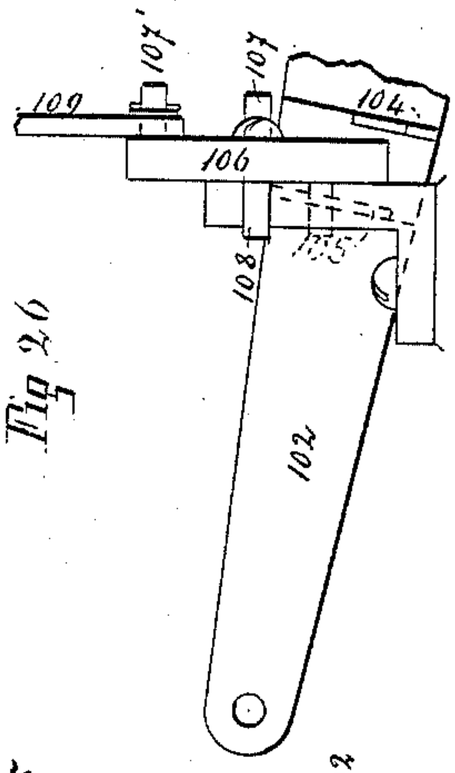


Fig 27

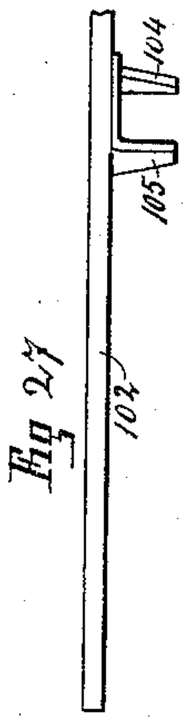


Fig 24

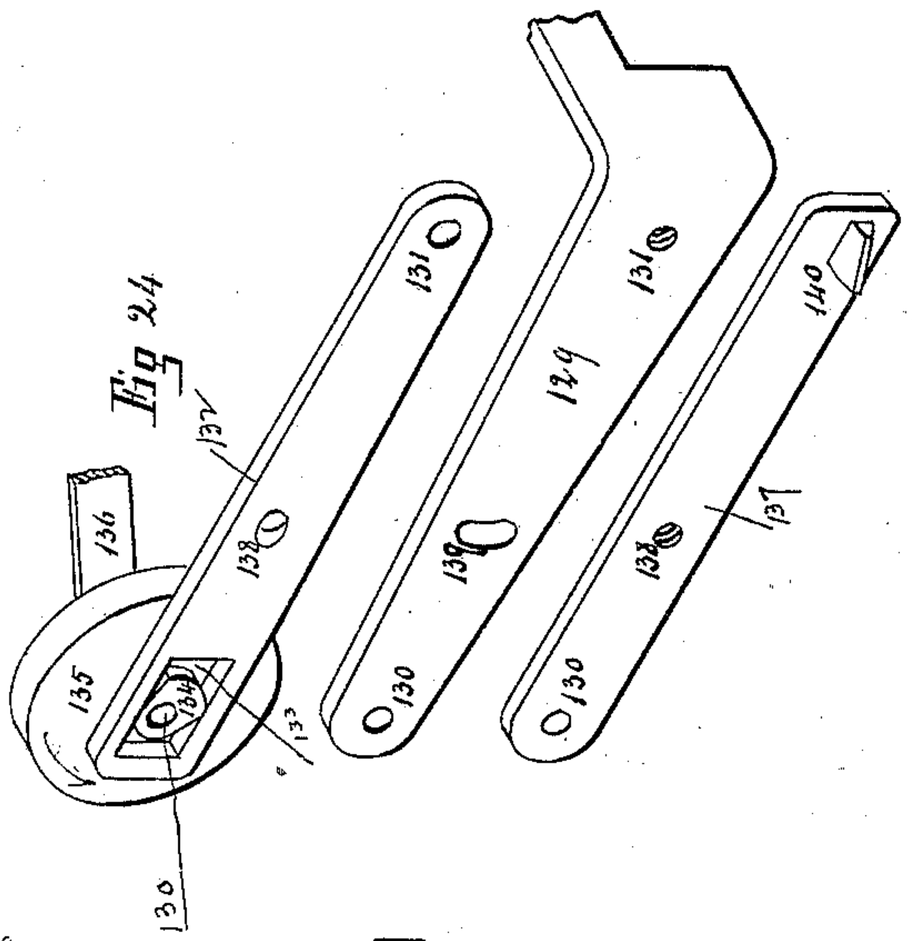


Fig 25

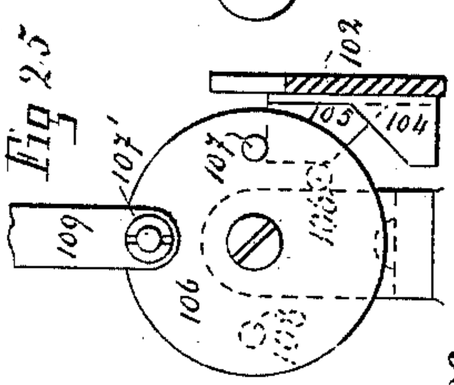


Fig 22

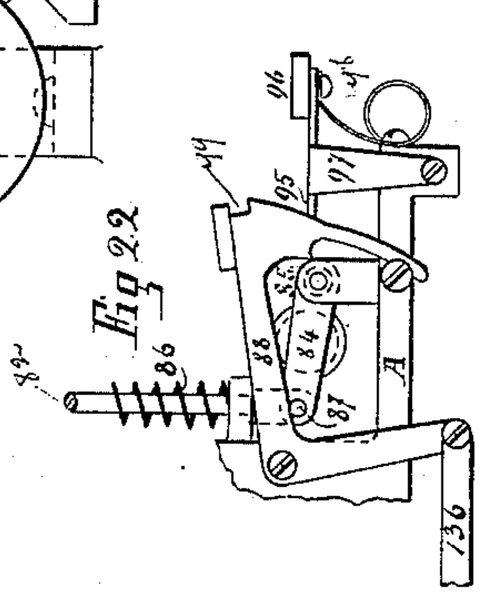


Fig 23

Witnesses

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UNITED STATES PATENT OFFICE.

ALBERT J. KLETZKER, OF ST. LOUIS, MISSOURI.

MATRIX-MAKING MACHINE.

SPECIFICATION forming part of Letters Patent No. 432,627, dated July 22, 1890.

Application filed April 25, 1889. Serial No. 308,634. (No model.)

To all whom it may concern:

Be it known that I, ALBERT J. KLETZKER, a citizen of the United States, residing at St. Louis, in the State of Missouri, have invented a Matrix-Making Machine, of which the following is such a full, clear, and exact description as will enable any one skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, forming part of this specification.

My invention relates to machines for producing matrices, more especially for stereotyping, but is not necessarily confined to stereotyping, as the matrices produced by my machine can be used for electrotyping and other work as well.

The object of the invention is to construct a matrix-making machine which is simple in operation and will produce a matrix in all respects similar to that obtained from a type-form.

The invention briefly consists, among other things, in providing a matrix-making machine with a variable spacing apparatus of the construction set forth, whereby letters requiring a variable spacing can be given such spacing, and whereby also extra spacing may be given to the letters before the end of a line is reached, so as to make the ends of the lines even and the printing in all respects similar to set-up type.

It consists, further, in a novel means for actuating the type to produce an impression in the matrix-surface and in a novel means for shifting the type-wheel along its shaft, so as to bring the different rows of characters in position to be actuated by the new and useful means referred to, whereby capitals, small letters, punctuation, and fractions can be obtained at will by operating in a predetermined manner the mechanism.

The invention consists, further, in a new and useful means for oscillating the type-wheel, so as to bring the desired type in proper position to be actuated by the impression-producing mechanism.

It also consists in a novel means for operating the carriage which bears the matrix-surface and in other features and details of construction, which will hereinafter be set forth, and particularly pointed out in the claims making a part hereof.

In the drawings accompanying this application, Figure 1 is a side elevation of one form of a matrix-making machine made in accordance with my invention. Fig. 2 is a face view of the means for oscillating the type-wheel, partly sectioned on the line 2 2 of Fig. 1. Fig. 3 is a front elevation thereof. Fig. 4 is a section of the type-wheel, its controlling devices, and impression-producing mechanism on the line 4 4 of Figs. 1 and 6. Fig. 5 is a side elevation of Fig. 4 with the type-wheel omitted; Fig. 6, a plan of the entire machine; Fig. 7, a sectional elevation, on the line 7 7 of Fig. 8, of parts of the spacing mechanism; Fig. 8, a sectional plan of the matrix-carriage, showing the spacing devices illustrated in Figs. 7 and 9, the same being on the line 8 8 of Fig. 9 and having parts broken away for the purpose of showing the construction more clearly; Fig. 9, a cross-section of the matrix-carriage and the various mechanisms for actuating the same to space the letters, said cross-section being on the lines 9 9 of Figs. 1, 7, and 8; Fig. 10, a bottom plan of the finger-key mechanism for bringing the various circumferential rows of characters on the type-wheel in position to be actuated, the same being seen from the line 10 10 of Figs. 1 and 3; Fig. 11, an enlarged view of a portion of the type-wheel, showing four different circumferential rows of characters; Fig. 12, an isometric projection of the space-regulating strap for letters requiring irregular spacing; Fig. 13, a back view from the line 13 13 of Figs. 1, 6, and 14; Fig. 14, a section on the line 14 14 of Fig. 13, showing the first key-lever to one side of the center of the machine, and also the intermediate devices for oscillating the type-wheel; Fig. 15, a cross-section of the type-wheel shaft on the line 15 15 of Fig. 14; Fig. 16, a longitudinal section on the line 16 16 of Fig. 8, showing the matrix-carriage and means for operating the same to produce spaces between the lines; Fig. 17, a detached plan view showing the escapement-wheel and levers and regulator for controlling the same, whereby irregular feed is produced for letters requiring the same. Fig. 18 is a rear elevation of the type-wheel, full size; Fig. 19, a section on radial lines 19 19 of Fig. 18; Figs. 20 and 21, details pertaining to the type-wheel; Fig. 22, a side eleva-

tion of the shifting and latch keys; Fig. 23, a top view of same; Fig. 24, a full size detail perspective of controlling devices for producing variation in spacing of letters; Figs. 25 and 26, front and side elevations, respectively, of disk, pins, and lever-arm for controlling the ordinary spacing mechanism; Fig. 27, a plan of lever-arm shown in Fig. 26, illustrating projecting plates carried thereby.

20 is a base-plate, which may support the entire apparatus. Pivoted in bearings 21, extending from said base-plate, may be any number of key-levers 22, supported by said bearings 21 near the middle of said key-levers.

20′ is a raised part of the base-plate 20, which passes over the keys 22 and serves as a support for certain parts to be hereinafter described.

Having now more particular reference to Figs. 1, 2, 6, 13, and 14, the inner ends of the key-levers 22 are each provided with a pin 23. For each of the key-levers there is a slotted plate 24, in the slot of which the pins 23 are adapted to play. These slotted plates are suspended from two shafts 25 and 26, which are carried in bearings at the center and sides of the machine. The two shafts 25 and 26 are in every way independent of each other. The slotted plates on the shaft 25 are joined together by a rod 27, and the slotted plates carried by the shaft 26 are joined together by a rod 28, so that the motions of the slotted plates 24 on each side of the center of the machine are independent of each other. The slots in the plates 24 at each side of the center occupy a different position for each key-lever. Fig. 14 shows the first key-lever to one side of the center of the machine, with the key half-depressed, and illustrates the extreme positions of the slots in the plates 24 in full and dotted lines. The first slotted plate 24 at each side of the middle of the machine is preferably made integral with projecting arms 29, making the first slotted plates 24 at each side of the center of the machine take the form of a bell-crank lever. The free ends of the arms 29 are each provided with plates 30, arranged in slightly-different planes, that extend out at right angles from said arms, and are made in the shape shown in Fig. 2. The two plates 30, Figs. 2 and 14, are independent of each other, so that while one moves the other remains stationary. Said plates 30 play in a heart-shaped slot cut in the upright part of a saddle 31, which is vertically guided by a saddle-guide 31′, formed by the frame of the machine, and hangs from a pin 32, that projects from a segmental gear 33, pivoted at 34. The rear horizontal end of the saddle 31 is supported by the shafts 25 and 26, about which said saddle is fulcrumed. Said saddle is cut away for the arms 29 to play through, Figs. 1 and 6. The segmental gear 33 has attached to it flat springs 35, which are arranged a slight distance apart and bear upon a pin 37, that projects from an upright part of the frame of the machine. The object of these springs is to maintain the segmental gear in its normal position. Said segmental gear 33 may be oscillated about the pivot 34 as a center, and the springs 35 will bring it back to its normal position after it is so oscillated. The teeth of said segmental gear mesh with a broad spur-wheel 38, which is rigidly attached to a sleeve 39, journaled upon a stationary shaft 40, supported at front and rear of the machine in brackets A and 56′.

41 is the type-wheel, which is rigidly connected with the sleeve 39, and therefore rotates as the spur-wheel 38 is rotated by the oscillations of the segmental gear 33. The said type-wheel bears the movable type which are to be imprinted in the matrix-board or other substance. If the type-wheel be given a certain rotation, a certain letter will be brought in position to be operated upon by the impression-producing mechanism, and if rotated to another point another character will be brought in position to be operated upon by said mechanism.

The slotted plates 24 are cut away so as to leave an incline 42 and a slot 43 with parallel sides. The incline 42 is made of a different length for each key. In the first slotted plate 24 at each side of the center of the machine the incline 42 will be of slight length, whereas in the last slotted plate 24 at each side of the machine the incline will be much longer, as clearly shown in dotted lines in Fig. 14. When the keys 22 are struck, the pins 23 ride along the inclines 42, and as said pins are riding over said inclines the plates 30, secured to the ends of the projecting arms 29, will be thrown upward. The greater the extent of the incline the greater the distance the plates 30 will be lifted. It will therefore be apparent that the plates 30 are raised a different height for each key-lever upon each side of the center of the machine, as the extent of the inclines 42 varies for each key at each side of the center of the machine. This variableness in the rising of the plates 30 therefore lifts the saddle 31 a certain height for each key-lever upon each side of the center of the machine. Therefore when one key is struck the saddle 31 will rise a certain height, and when another key is struck the saddle will rise to a certain other height. As the saddle is raised by one or the other of the plates 30, (see Fig. 2,) the pin 32 will pass diagonally down a slot which is formed by one of the inclined sides of the heart-shaped slot and the inclined face of one of said plates 30. The other plate 30 does not interfere with this action, because it remains in its normal position while the first-mentioned plate raises the saddle. Each of the plates 30 is provided with a projection 44, which raises the saddle, a slight play being allowed between these projections and the bottom of the saddle, the purpose of which will be explained hereinafter. As the saddle is lifted by one or the

other plates 30 and the pin 32 passes diagonally down the inclined slots to one or the other side of the center of the saddle, the segmental gear 33 will be rotated by the plates and saddle to correspond to the extent of the lateral movement of the pin 32 produced by the raising of the saddle and the plates 30. The extent to which the saddle and plates are raised governs the degree of rotation of the segmental gear 33, and thus controls the extent of rotation of the type-wheel and determines the character to be imprinted in the matrix-surface. As before explained, one of the plates 30 is controlled by the key-levers upon one side of the center of the machine through the instrumentality of one of the arms 29, and the other plate 30 is controlled by the keys upon the other side of the center of the machine through the instrumentality of the other arm 29. One of said plates will shift the segmental gear and type-wheel in one direction, and the other plate will shift the segmental gear and type-wheel in the other direction. There will therefore be one key at each side of the center of the machine, which will shift the oscillating segmental gear and the type-wheel to the same extent; but these oscillations will be in opposite directions, so that a different type will be presented for the impression-producing mechanism to operate upon. The normal position of the key-levers and slotted plates 24 is shown in Fig. 1. The inclines 42 normally rest against the pins 23, and the relation of the slots to the pins is such that the pins upon the keys that are not manipulated do not interfere with the operation of the slotted plates when said slotted plates are actuated by other keys.

Having now more particular reference to Figs. 1, 3, 4, 5, and 6, 45 is a bar that rests near the rear end of all the keys. It is hung at the end of lever-arms 46, which are rigidly secured to a shaft 47, that extends across the machine and is supported by bearings at each side thereof. From near the center of said shaft 47 extends in an opposite direction from the lever-arms 46 a lever 48, to the end of which is pivoted a rod 49, that may be encircled by a spiral spring 50, which returns the parts to their normal positions. Said rod 49 extends upward in a vertical direction, and is in turn pivoted to a bell-crank lever 51, which is itself pivoted to the upper part of the frame of the machine. To said bell-crank lever is pivotally secured a second rod 52, which is supported at its outer end by an anti-friction wheel 53, and is provided at said outer end with a rack 54, which meshes with a pinion-wheel 55. The said pinion-wheel 55 and anti-friction wheel 53 are sustained by a standard 56, that is supported by a curved bracket 56′, from which extend two ribs 57 and 58, which act to stiffen the bracket. This bracket is curved, as shown in Fig. 3, in order to accommodate the movement of the matrix-carriage, which will be explained hereinafter. Secured to the pinion-wheel 55 is a cam-disk 59, which operates upon an anti-friction roller 60, that is secured to a lifting-arm 61, journaled upon a projecting part 62, that extends from the standard 56. The lifting-arm 61 engages with a hook 63, located upon a pawl 64, which is adapted to engage with a ratchet on the type-wheel 41 to hold said type-wheel in every position in which it is placed. The pawl 64, by engaging the teeth of the ratchet, acts to adjust the type-wheel so as to bring each type in the exact position required.

The type-wheel (see Figs. 4 and 11) is preferably made up of two flat rings 65 66, the inner peripheries of which are secured to a curved hub 67, Fig. 1, that is secured to the sleeve 39. Between the two flat rings the type 68 are located and held in place by springs 69. The type of said type-wheel are normally held about flush with the outer periphery of said flat rings by the springs 69 and are movable radially in the type-wheel.

The details of the type-wheel will be more plainly visible in Figs. 18, 19, 20, and 21. It is composed, first, of a shell consisting of the hollow body 67, a rim *a*, and the two flanges 41′, said body being fastened to the sleeve 39 by means of a flanged collar removably secured thereto, so as to make the type-wheel interchangeable and detachable; second, of two cell-rings, each consisting of a partition-ring *b*, which is provided on each face with one circumferential row of type, and spring-cells 68′ and 69′, respectively disposed back to back, as shown in perspective view of two pair of cells in Fig. 21. Between the two cell-rings *b b* is placed a partition-ring *c*. The whole is held together by means of bolts or screws *d*. The periphery of the type-wheel is corrugated or provided with serrations, as clearly shown in Figs. 4, 18, and 21. At the center of each type-cell 68 rim *a* is provided with a hole *e*, through which the punch 75 passes in forcing the type outwardly to make an impression. To the type 68′, Fig. 20, is fastened at the upper end a coiled spring 69′, and each type and spring are placed in the cells of the type-wheel, so that the connecting part of wire between the type and spring is placed in the recess *f*, Figs. 19 and 21.

The type-wheel may have any number of rows of circumferential characters, which feature will be referred to hereinafter. When any of the type in said type-wheel become worn, they may be removed and new type inserted in place thereof, and any type in said type-wheel may be interchanged for any other type therein—that is to say, the type carried by said type-wheel are detachable and interchangeable. So, also, the type-wheel itself may be removed and be replaced by another type-wheel.

The cam-disk 59 has pivoted to it a pitman 70, Fig. 5, which is itself pivoted to a bell-crank lever 71, that is supported by a curved piece 72, which is connected with the bearing

73, that supports the outer end of the shaft 40, carrying the sleeve 39, that bears the type-wheel. Said shaft 40 passes through the curved piece 72. To the bell-crank lever 71 are pivoted connecting-links 74, which are themselves pivoted to a punch 75, guided in the lower curved end of the piece 72. The pitman 70, bell-crank lever 71, and connecting-links 74 make a double toggle-joint. The punch 75, when the toggle-joint is properly operated, drives the type outward and makes an impression in the matrix-surface.

Fig. 5 shows the position of parts just as a type is being struck to make an impression. The normal position of parts is such that when the key is first struck the cam-disk 59 begins at once to raise the anti-friction roller 60, and thus to lift the pawl 64 from the type-wheel the very instant the machine starts to operate. A key when depressed raises the bar 45 and arms 46, rotates the shaft 47, depresses the arm 48, draws down the rod 49, and operates the bell-crank lever 51, so as to draw forward the rod 52, which rotates the cam-disk 59 through the instrumentality of the spur-wheel 55 and rack 54. As the pins 23 upon the key-levers begin to act upon the inclines 42 and thereby to rotate the type-wheel, the pawl is free from the type-wheel, so that it can perform its rotation. The play between the saddle 31 and the projections 44 on the plates 30, Fig. 2, as before described, is for the purpose of allowing the pawl 64 to be raised from the type-wheel before the saddle begins to rotate said type-wheel. The type-wheel will be rotated all the time the pins are riding along the inclines 42; but as soon as the parallel part of the slot 43 is reached the rotation of the type-wheel ceases, and the cam-disk 59 allows the anti-friction roller and pawl 64 to resume their normal positions (shown in Figs. 4 and 5) during the rest of the rotation of said cam-disk. The pawl therefore holds the type-wheel at the character required. The nose of the pawl will pass down the space between the teeth of the ratchet and bring the type in the exact position for printing. As the key is depressed farther and the pin 23 is passing through the parallel part 43 of the slot, the arms 46 are still being raised by the key-levers, and will be lifted thereby until the pins 23 reach the end of the slot 43. As the pins 23 are beginning to travel up the parallel part of the slot 43, the impression-taking mechanism assumes the position shown in Fig. 5, and as said pins progress upward in the said slot 43 the pitman 70 is drawn upward, which actuates the toggle-joints so as to depress the punch 75 and force the desired character into the matrix-surface. After the keys are operated they will by gravity assume their normal position, and thus the rod 52 will be reciprocated in the opposite direction. This action may be assisted by means of the spring 50, if necessary. The reverse movement of the rod 52 rotates the pinion-wheel 55 in an opposite direction and withdraws the punch 75. At the beginning of the return movement of the key the cam-disk 59 acts at once upon the anti-friction roller 60, so as to raise the pawl 64 from the type-wheel and allow said type-wheel to return to its normal or blank position, to which position said type-wheel is brought through the instrumentality of the oscillating segmental gear 33 by means of the springs 35 and the pin 37. When the type-wheel reaches its normal position, the pawl 64 enters the ratchet upon said type-wheel, as before. In the normal position of parts the pin upon the cam-disk 59, to which the pitman 70 is pivoted, is to the right of the center of said cam-disk and on the opposite side of the center from that shown in Fig. 5. The anti-friction roller 60 normally rests in the depression 76 of the cam-disk and passes into the depression 77 of said cam-disk only after the type-wheel has been positioned and the pawl has entered the ratchet to hold said type-wheel in position, at which time the punching mechanism begins to act, as clearly shown in Fig. 5. During the time the depression 76 leaves the roller 60 and until the depression 77 comes under it the pawl is free from the type-wheel, so that said type-wheel can be rotated to the desired character.

Having now more particular reference to Figs. 1, 3, 6, and 10, it will be noted, as before described, that the type-wheel is mounted upon a sleeve 39, that rotates and slides upon a stationary shaft 40. Said type-wheel may be provided with a plurality of circumferential rows of characters, as clearly shown in an enlarged view in Fig. 11. The punch which actuates the type to make an impression operates upon a certain row of circumferential characters when the type-wheel has a certain longitudinal position upon the shaft 40 and strikes but a single one of said type at a time. In one row of circumferential characters I design to have small letters—for instance, Fig. 11. In another row thereof I provide capital letters corresponding to the small letters, and in still another row may be arranged various characters, numerals, punctuation, &c., while in another row fractions and other characters can be placed. Normally I design to have the type-wheel stand so that the punch will operate upon the row of characters containing the small letters, as they in practice will be most frequently used. By shifting the type-wheel along the shaft 40 any other row of circumferential characters can be brought in position under the punch. The shifting mechanism, determining which circumferential row of characters shall be operated upon, is controlled by finger-keys, and when any one of said finger-keys is depressed it holds the type-wheel in required position. Connected to the spur-wheel 38, which is fast upon the sleeve 39, is a collar 78, which has two pins 79 79 extending therefrom at each side. 80 80 are two links pivotally connected to said collar 78. Said links couple said collar to a double bell-crank lever 81, which is

in turn pivotally connected to a rod 82, that is connected to a shaft 83, which is sustained by arms 84 84 from a shaft 85, that is supported from bearings extending from the bracket A of the machine. Said shaft 83 and arms 84 84 swing about the shaft 85 as the center. Encircling the rod 82 is a spiral spring 86, which returns the parts to and maintains them in their normal position. From the shaft 83 extends a pin 87, Figs. 10 and 22, which is arranged in the path of a finger-key 88, that is pivoted to the frame of the machine. By depressing the key 88 the shaft 83 will be drawn down and will operate the bell-crank lever 81 and move the type-wheel toward the rear of the machine. This will bring the circumferential row of characters corresponding to capitals in position to be operated upon by the punch, so that when said key is depressed nothing but capital letters will be operated by the punch. Extending from one of the arms 84 is also a pin 89, which is arranged within the path of a finger-key 90, that is also pivoted to the frame or bracket A of the machine. The pin 89 is arranged nearer to the shaft 85 than the pin 87, about which shaft 85 the arms 84 swing as a center. Therefore when the key 90 is depressed the rod 82 will be drawn down a greater distance than when the key 88 is actuated. This greater movement of the rod 82 of course moves the type-wheel a greater distance toward the rear of the machine and brings the third row of circumferential characters in position to be operated by the punch. The key 90 therefore gives punctuation and numerals. Projecting from the inside of one of the arms 84 is also a pin, which carries a small anti-friction wheel 91, which is arranged within the path of the finger-key 92. Said anti-friction wheel is pivoted nearer to the shaft 85 than either of the pins 87 and 89, and hence when the key 92 is depressed will move the rod 82 a greater distance, and consequently push the type-wheel still farther toward the rear of the apparatus. This will then bring in position to be operated upon the last row of circumferential characters, and will give fractions and other characters.

Any number of circumferential characters may be arranged upon the type-wheel, and any manner of arranging said circumferential rows of characters may be adopted without departing from my invention. When any other characters are required to be printed than small letters, the shifting-keys 88, 90, or 92, as the case may be, must be operated before the finger-keys 22 are struck. Each of the shifting-keys 88, 90, and 92 is adapted to strike against a stop 93, which is secured to the frame of the machine, and is cut away at its lower end to form a guide-finger 94, which rides along said stop and steadies the movement of said keys. The stop 93 bears against a curved shoulder at the base of said guide-finger and prevents said keys from moving down any farther. Bearing across a downward extension of said keys is a lip 95, Fig. 1, which is carried by a finger-key 96 hinged by a downward extension 97 to the frame of the machine. This latch-key 96 is held up by a spring 98, so that the lip 95 bears against the outer face of each of the shifting key-levers, whereby when any one of said keys is depressed said lip takes into a notch 99, cut in said key-levers, and holds them in their depressed position, and thus keeps the type-wheel in whatever longitudinal position any of said keys place it. The key-shifting levers are of slightly different lengths. (See Fig. 10.) The key-lever intended to produce the greatest movement (92) is shorter than the other key-levers 88 and 90, which give less movement. So, also, the key-lever 88 is of less length than the key-lever 90, so that if a key of greater movement is down it will be released by depressing a key of less movement without manipulating the latch-key 96, as the lip 95 will be pressed out of the notch 99 by a longer key-lever. Any of said keys can, however, be liberated by manipulating the key 96. This withdraws the lip 95 from the notch 99, whereupon the spiral spring 86 restores the type-wheel to its normal position, lifts the rod 82, raises the arms 84 and pins carried thereby, and thereby raises said keys.

Having now more particular reference to Figs. 6, 7, 8, and 9, 100 is a bar that passes across all of the finger-keys 22 at the rear end of the machine. This bar is pivoted by arms 101 102 to each side of a casing 103, that contains the feeding and spacing mechanism for the matrix-carriage. Said casing 103 is open at the front and back and is provided with a raised part 103′, Fig. 16, which serves to brace the sides together and to stiffen the same. The arm 102 has on it plates 104 and 105, Figs. 8, 9, 25, and 26, arranged one above the other at a slight distance apart, so that the rim of a disk 106 can pass between said plates. Said disk carries two pins 107 and 108 on opposite faces, and placed so that when struck by projections 104 and 105, respectively, the proper motion will be produced. 108′ is a stop for limiting the play of said disk. A link 109 is pivoted to said disk, and said link in turn is pivoted to a longitudinal transmitting-bar 110, hinged to two brackets projecting from the casing 103. Its acting edge is shaped like the tooth of a gear and engages in a notch in an escapement-lever 111, pivoted at 112 to a downward extension 113, which hangs from a transverse bridge-piece 114, which supports the word and letter spacing mechanism. The said bridge-piece 114 is carried by a movable frame that supports the matrix-carriage, all of which will be explained hereinafter. The bar 110 extends nearly the full length of the casing 103, Fig. 8, so that the escapement-lever 111 may slide along the same and still be in engagement therewith. Pivoted to the escapement-lever 111 is a second lever 115, which moves at right angles to the movement of the escapement-lever 111.

The noses of these escapement-levers are adapted to take into an escapement-wheel 116, which is loosely mounted upon a vertical shaft 117, journaled in the bridge-piece 114. This shaft 117 carries upon its upper end a pinion-wheel 118, which meshes in a rack 119 upon the carriage 120, that supports the matrix-surface. The escapement-wheel 116 is coupled to the shaft 117, when the same is moved in one direction by means of a spring-pressed pawl 121 and a ratchet-wheel 122, which is rigidly secured to said shaft, the object of which is to allow the carriage 120 to be returned by hand to its normal position without moving the escapement-wheel 116. This action is the same as in the ordinary type-writer carriage. Connected to the matrix-carriage 120 is a cord 123, which winds and unwinds upon a drum 124, that is actuated by a coiled spring 125. The said drum is pivoted to the bridge-piece 114. As the escapement-levers are operated, the carriage is therefore fed along by the coiled spring 125. This coiled spring gives the ratchet 122 and escapement 116 a tendency to rotate in the direction of the arrow shown in Fig. 8; but the escapement-wheel 116 is normally held from rotation by the escapement-lever 115, which the escapement-wheel forces against a stop 126. Said escapement-lever is also provided with a coiled spring 127, which, when said escapement-lever 115 is liberated from the escapement-wheel, throws the said lever 115 in the position shown in Fig. 17 and forces the outer end of the escapement-lever 115 against the first projection of a regulator 128, which is pivoted to the bridge piece 114. The full purpose of this regulator will be explained hereinafter.

It will be noted from the foregoing that when any of the key-levers 22 are struck the bar 100 will be raised, thereby raising the arms 101 and 102, the latter of which will cause the plate 104 to strike upon the pin 107 and rotate the disk 106, which will draw the link 109 down and depress the outer end of the escapement-lever 111, thus throwing the nose of said escapement-lever into engagement with the escapement-wheel 116 and liberating the lever 115 from it. Lever 115 is then thrown by the spring 127 in the position shown by Fig. 17 against the first projection of the regulator 128. During this period the ratchet-wheel 116 has not moved, (therefore the carriage has remained stationary during this time,) for the nose of the escapement-lever 111 takes into the ratchet-wheel 116 the very instant the nose of the ratchet-wheel 115 leaves the same. All this takes place during the time a finger-key 22 is being depressed, near the end of which time, as before explained, the punch is brought into operation to make an impression in the matrix-surface. As soon, however, as the finger-key 22 begins to return to its normal position, and after the impression has been made in the matrix-surface, the bar 100 will resume by gravity its normal position, and the arms 101 and 102 will also gravitate downward, and the plate 105 will strike the pin 108, which is now in its path, and rotate the disk 106 in the opposite direction, bringing the link 109 and the other parts in their normal position, as shown in Fig. 9. The escapement-lever 111 will therefore leave the escapement-wheel 116, which will now be caught by the lever 115, that has previously been thrown forward by the spring 127, Fig. 17. The escapement-wheel 116 will therefore rotate until the lever 115 comes against the stop 126, and will feed the matrix-carriage a distance corresponding to this, giving a feed of three teeth of the wheel 116 for ordinary small letters. It will be noted, therefore, that the feeding for the letters takes place after the type have been struck and while the keys 22 and type-wheel are returning to their normal positions.

Independent of the bar 100 is a strap 129, which is pivoted by pins 130 and 130′ to brackets extending from the bottom flange of the casing 103. This strap 129 is clearly shown in Figs. 12 and 24. Pivoted at one side of the strap 129, at a point 131, is a lever 132, which has a quadrangular slot 133 cut in it where the pin 130 passes through the same. The said pin 130 carries a cam 134, which plays in said quadrangular slot cut in the lever 132. To the pin 130 is also rigidly connected a disk 135, which is connected by a rod 136 to the capitalizing-key 88, the purpose of which connection will be described in a short while. Fulcrumed about the pin 130, so as to turn freely around it, is a second lever 137, to which is secured a screw 138, that passes through a slot 139 in the strap 129 and through a tight-fitting hole in the lever 132. The lever 137 is provided with a projection 140, that takes into the notched end of a lever 141, fulcrumed to a bracket secured to the base of the apparatus, Figs. 8 and 9. This lever 141 is pivoted to a link 142, that is in turn pivoted to a longitudinal transmitting-bar 143, which is itself pivoted in extensions from the side of the casing 103. Said bar takes into a notch in a bell-crank lever 144, that is pivoted in the bridge-piece 114 and extends nearly the full length of the casing 103. The notch in the bell-crank lever 144 slides along the bar 143 as the matrix-carriage is fed for space between the lines, the same as the notch in lever 111 slides along the transmitting-bar 110. The bell-crank lever is connected with a bar 145, that is pivoted to the upper end of the regulating device 128, before referred to, the purpose of which is to produce a variable or irregular spacing or feed for the letters that require such spacing. Capital letters, being larger than small letters, of course require more space, and this is effected through the instrumentality of the bar 136, which connects the mechanism described with the capitalizing-key 88. When said key is depressed, it rotates the disk 135 and cam 134 in the direction of the hands of a watch, and thereby

raises the lever 132 and the screw 138, which connects said lever with the lever 137 upon the outside of the strap 129 and works in a slot through said strap. The screw 138 raises the free end of said lever 137 and causes the projection 140 thereon to actuate the lever 141, draw down the link 142, and operate the bell-crank lever 144 and connecting-rod 145 through the instrumentality of the transmitting-bar 143, and thus operates to bring another depression in the regulator 128 opposite the outer end of the lever 115, so that when the escapement-levers are operated to feed the carriage the lever 115 will give a greater movement to said carriage, for the feed of the lever 115, as previously described, is limited by the depressions and projections carried by the regulator 128. This feeds the wheel 116 through a space of six teeth for ordinary capitals.

There are certain characters—notably "w," "W," "m," "M," "i," "I," "l," "L," "t," "T," "f," "F," "(,)," and "(.)"—which do not require the same spacing as other letters and characters.

The "i," "I," "(,)," "(.)," "l," "L," "t," "T," and "f" "F" require less spacing than the ordinary letters, whereas the "w" "W" and "m" "M" require more spacing than the ordinary letters of the alphabet. The object of the strap 129 and the mechanism actuated by it is to give this variableness in spacing. Said strap is cut away, as shown in Fig. 12, and rests across those letter-keys requiring this variable spacing. These keys are located, preferably, at the center of the machine. They are shown diagrammatically in Fig. 12, the center one being the spacing-key. When the small "i," the small "l," small "t," small "f," "(.)," and "(,)" keys are depressed, they not only raise the bar 100, but they also raise the strap 129, which, by means of the screw 138, raises the lever 137 a greater distance than before and operates the connecting mechanism to bring the second highest projection on the regulator opposite the outer end of the lever 115, and produce a feed of the carriage equal to two teeth of the wheel 116.

When the capital-key 88 is depressed and the keys beneath the cut-away portion of the strap 129 are operated, this will bring the next notch in the regulator 128 in position beneath the outer end of the lever 115 and make the spacing for the capitals "L," "T," and "J" greater than for the corresponding small letters, but not so great as for ordinary capitals, and will feed five teeth of the wheel 116. In this instance the strap 129 will be raised the same as in the previous instance, and in addition thereto the lever 137 will be raised independently of this latter movement by the mechanism connected with said capital-key 88.

At the center of the machine is a spacing-key 146. This key is pivoted the same as the ordinary letter-giving finger-keys 22, but has no pin 23 thereon, Fig. 7, and does not operate upon any of the slotted plates 24. Said spacing-key is made shorter than the other keys, and the inner end thereof engages with a projection 100′ on the bar 100, and when said key is depressed said bar operates the spacing mechanism, as previously described, the same as it does for ordinary letters. It will be noted, as the spacing-key 146 has no pin 23 and does not operate upon any of the slotted plates 24, that the type-wheel during the manipulation of said key is not moved, and, inasmuch as the type-wheel normally stands at a blank space when said key is depressed, no impression will be made in the matrix-surface. The spacing mechanism only will therefore be operated.

Secured to the spacing-key 146 by screws 147 and 148, that work in slots in said spacing-key, is a blade 149, which has a pin 150 extending therefrom, engaged by an upright slotted piece 151, that is secured to a rod 152, said rod 152 being supported by bearings 153, extending from the base-plate 20 of the apparatus. The said upright piece 151 works though a slot 154 cut in the base-plate 20. Encircling the rod 152 is a spiral spring 155, which returns said rod and the parts connected therewith to their normal position when liberated. The object of this mechanism is to give an extra blank space to the characters to be imprinted in the matrix-surface, and this is required in order to make the ends of the lines of printing even, the same as in the type-form—that is, to justify the matter. This feature constitutes one of the principal ones of my invention. The blank extra key gives one-half of a space and corresponds to the feed of one tooth of the escapement-wheel 116. About fifteen (15) spaces from the end of the line I design to have a signal-giving device to notify the operator of his approach to the end of the line. The operator can then make his calculations so as to have the line space out evenly, and for this purpose he may put in as many extra blank spaces as necessary. To do this he pushes in the rod 152, which slides the blade 149 forward and brings the nose of said plate beneath the strap 129. He thereupon depresses the key 146, which not only raises the bar 100, but also the strap 129. As soon as the finger is removed from the rod 152 it resumes its normal position by means of the spring 155.

Certain of the small letters—notably "w" and "m"—require more spacing than the ordinary small letters, and to give this extra spacing and make the work of my machine in every respect similar to type-form work I construct said machine so as to give this extra space for these letters, and for this purpose the "w" and "m" keys are arranged beneath the part of the strap 129, Fig. 12, that is not cut away, so that when the keys corresponding to said letters are depressed these keys will raise the strap 129 through a greater distance than the other keys arranged

beneath said strap 129 and will lift said strap to such a height that a notch of the regulator 128 will be brought opposite the outer end of the lever 115, so as to feed the carriage a space corresponding to that required by the "w" and "m"—viz., four teeth of the wheel 116. The capital letters "W" and "M" also require more space than other capital letters, and the spacing for these letters is given, as will be evident from the foregoing, by depressing the capital-key 88 and the key-levers "W" and "M," which will actuate the spacing mechanism of the matrix carriage in the manner hereinbefore set forth to such an extent (the manner of which will be evident from the foregoing) as will bring a notch of the regulating device 128 opposite the outer end of the lever 115, which will give a feed to the matrix-carriage 120 corresponding to the space required by said capital letters "W" and "M"—viz., seven teeth of the wheel 116. It will be understood of course that the regulator and the spacing mechanism resumes its normal position after the keys resume their original positions.

Supported through the instrumentality of a curved bracket 56′, from which extend two ribs 57 and 58, that serve to stiffen the same, are two arms 156 and 157. To the arm 156 is pivoted a link 158, and to the arm 157 is pivoted a lever 159. The link 158 and the lever 159 support a horizontal bar 160, that carries a rider 161, that is arranged within the path of the projecting strip 162 upon the matrix-carriage 120, so that said projecting strip 162, when the carriage reaches a certain point in its travel to the left, Fig. 3, will strike the rider 161 and operate the lever 159, which actuates a spring-mounted striker 163 upon the return of said lever 159 to its normal position after the rider escapes said strip, and will strike a bell 164, affixed to the arm 157, and thus notify the operator that the end of the line is near. The rider 161 can be adjusted to any point along the horizontal piece 160. The bar 160 is joined to the lever 159 by a pin 159′, which takes in a notch in said lever, so that when the carriage is moved to the right (in an opposite direction to the arrow, Fig. 3) said bar will not operate said lever and no signal will be given.

The matrix-carriage 120 slides between ways 165 and 166, which are connected together by slides 167 and 168 and the bridge-piece 114, before described, and together form an intermediate carriage. The slides 167 and 168 work on ways 169 and 170 on top of the casing 103. The intermediate carriage supports the matrix-carriage 120 and is movable at right angles to the movement which is given to the matrix-carriage by the spacing mechanism previously described. Pivoted to the intermediate carriage, preferably to the side piece 167 thereof, is a pawl 171, which takes into a ratchet-bar 172. This ratchet-bar 172 is connected with a push-and-pull rod 173, and is supported by pins extending from the casing 103 and working in slots in said ratchet-bar, so that said ratchet-bar may be reciprocated. The object of this mechanism is to feed the lines. The push-and-pull bar 173 passes to the front of the machine and is fashioned into a finger-key and supported at the front end of said machine by a bearing 174. When the bar 173 is pushed in, it moves the intermediate carriage that carries the matrix-carriage toward the rear of the machine, and thus moves the matrix-surface in a direction at right angles to the letter-spacing mechanism. After the bar 173 has been pushed in it is pulled forward into its normal position, whereupon the pawl 171 will ride over the ratchet-teeth without feeding the intermediate carriage; but whenever said bar is pushed inwardly the matrix-carriage will be fed to space the lines. The pawl 171 is arranged upon a spindle 175, which passes through the casing 103 and has secured to it a finger-piece 176, that projects beyond said casing, whereby said pawl may be raised from the ratchet-bar 172 and the intermediate carriage moved by hand to the starting or any other position.

Pivoted to the bearing 174 or to the raised part 20′ of the base-plate 20 of the machine are plates 177 and 178, which have projecting ends that may be grasped by the fingers to rotate either one of said plates and interpose them between the bearing 174 and the shank of the finger-button upon the end of the rod 173, so that the limit of the excursion of the rod 173 can be regulated and more or less space given to the lines of printing. Ordinarily the shank of the finger-button arranged upon the plate 177 will strike the bearing 174; but when the plate 177 is turned up in position the base of said shank will strike against the plate 177, and thus the ratchet-bar 172 will move through less space and feed the intermediate carriage that supports the matrix-carriage a less distance. When the plate 178 is raised in position, the intermediate carriage and matrix-carriage will be fed through less distance still. Any number of plates may be so arranged as to make the space between the lines less, if desired. The matrix-board or other substance is held on the matrix-carriage 120 by means of two clamp-bars 179, Figs. 1, 6, 9, and 16, hinged to rectangular projections on strip 162 and locked in place by two catches 180, fastened to carriage 120, having notches therein, which engage projecting pins on the clamp-bars 179. Any suitable material may be used for a matrix, such as wax, bibulous paper, &c.

Various changes may be made in the mechanism herein described without departing from the spirit of my invention. I wish, therefore, to have it understood that I do not limit myself to the exact construction set forth. Other form of type-wheel may be used, if desired. It will be understood that the mechanism herein described for shifting the type-

wheel, as well as the mechanism set forth herein for taking an impression and the various spacing mechanisms, can each be used independently of the other and each adapted for use with other mechanisms for accomplishing the same purposes—that is to say, that the mechanism herein described for rotating the type-wheel to any character may be used with other forms of mechanism for taking an impression, and also with other mechanism for shifting the type-wheel, should a shiftable type-wheel be used. So, too, these two latter mechanisms could be used independently of the mechanism herein described for rotating said type-wheel and be used with other mechanism for rotating the type-wheel to the desired character, and, further, the various spacing and feeding mechanisms could be used with other impression-producing mechanism, and also with other means for shifting the type-wheel and with other means for rotating the type-wheel to any desired character. The mechanisms herein set forth, however, are specially designed for one another and have a special community of operation.

What I desire to claim as my invention is—

1. A type-wheel having independently-movable type and normally held at the blank space, key-levers for moving said type-wheel to any desired character, a punch for actuating separately each independently-movable type when positioned, and a toggle-joint controlled by the key-levers for operating said punch.

2. A type-wheel with independently-movable type, key-levers for moving said type-wheel to any desired character by means of slotted plates and pins, a toggle-joint controlled by said key-levers, and a punch operated thereby to actuate separately each independently-movable type when positioned beneath the same.

3. The combination, in a type-printing machine, of a number of key-levers, a number of slotted plates arranged adjacent to the ends of said key-levers, pins carried by said key-levers for operating upon said slotted plates, a type-wheel, and connections intermediate the type-wheel and said slotted plates and pins controlled by the key-levers for positioning said type-wheel.

4. In a type-printing machine, a number of key-levers, a type-wheel, an oscillating gear for positioning said type-wheel, a saddle having a heart-shaped slot, saddle-guide, and plates and arms operated upon by the key-levers controlling said saddle and oscillating gear.

5. The combination, in a matrix-making machine, of a number of key-levers, a number of slotted plates arranged adjacent to the inner ends of said key-levers, pins carried by said key-levers for operating upon said slotted plates, arms and plates controlled by said slotted plates, a saddle governed by said arms, an oscillating segmental gear actuated by said plates and saddle, a spur-wheel controlled by said segmental gear, and a type-wheel rotated thereby.

6. In a matrix-making machine, the combination of a number of pivoted key-levers, two sets of slotted plates controlled by said key-levers, an arm governed by each set of slotted plates, plates 30, carried by said arms, a saddle controlled by said arms, a segmental gear oscillated by said plates 30 and governed by said saddle, a spur-wheel meshing with said segmental gear, a type-wheel rotated by said spur-wheel, and springs for returning the said segmental gear to its normal position.

7. The combination of a number of pivoted finger-keys 22, pins 23, carried by said finger-keys, two sets of slotted plates 24, controlled by said pins, an arm 29, actuated by each set of slotted plates, plates 30, of the form described, carried thereby, a saddle 31, having a heart-shaped slot therein, a guide 31′ therefor, a pin 32, carrying said saddle, a segmental gear 33, carrying said pin and controlled by said plates 30 and saddle, a spur-wheel 38, rotated thereby, and a type-wheel coupled thereto.

8. The combination, in a printing-machine, of a number of key-levers, a type-wheel with independently-movable type positioned thereby, connections controlled by the said key-levers, a punch operated by said connections to actuate any one of said movable type, a single adjusting-pawl operated by the connections controlled by the key-levers for holding said type-wheel in whatever position it is placed by the aforesaid connections and liberating said type-wheel as soon as the key-levers are struck, and a printing-surface arranged in the path of said type.

9. The combination, in a printing-machine, of a number of key-levers 22, a type-wheel with independently-movable type positioned thereby, arms 46 and 48, controlled by said key-levers, a connecting-rod 49, governed by the arm 48, a bell-crank lever 51, actuated by said connecting-rod, a reciprocating bar 52, a rack 54 upon said bar, a spur-wheel 55, controlled thereby, a cam 59, of the shape set forth, carrying said spur-wheel 55, a punch 75, controlled by said cam through the instrumentality of a toggle-joint to force any one of said type into a printing-surface arranged adjacent to said type-wheel, an adjusting-pawl 64, for holding said type-wheel in whatever position it is placed, and an arm 61, controlling said adjusting-pawl through the instrumentality of said cam, substantially as set forth.

10. The combination, in a printing-machine, of a type-wheel having a serrated periphery, a single pawl which tends to seek engagement with the serrations for holding and adjusting said type-wheel in whatever position it is placed, a lifting-lever for raising said pawl from said type-wheel, and a cam, as described,

controlling said lifting-lever to raise said pawl from the serrations and to permit the same to seek engagement therewith.

11. A finger-key mechanism for shifting a type-wheel in the direction of its axis, consisting of one or more connections intermediate of the type-wheel and a bar 83, arms 84, carrying said bar, a shaft 85, by which said arms are hinged, pins projecting from said arms at varying distances from said shaft, and finger-keys arranged to operate upon said pins, substantially as set forth.

12. The combination of a type-wheel having a plurality of circumferential rows of characters, a sleeve 39, upon which said type-wheel is mounted, a shaft carrying said sleeve, gearing for rotating said type-wheel to any desired position, links 80, for shifting said sleeve, a bell-crank lever 81, pivoted to said links, a rod 82, encircled by a spring 86 and pivoted to said bell-crank lever and to a bar 83, arms 84, connected to said bar 83, pins projecting from said arms 84 at variable distances from a shaft 85, upon which said arms are hung, and finger-keys for acting upon said pins.

13. The combination, in a printing-machine, of a number of keys, a bar resting across said keys, arms for pivoting said bar, plates 104 and 105, carried by one of said arms, arranged a slight distance apart and above each other, a disk 106, arranged between said plates and carrying-pins, upon which said plates operate, a link 109, pivoted to said disk, transmitting-bar 110, pivoted thereto, a pivoted lever 111, movable along said bar, a spring-actuated lever pivoted so as to move at right angles to the aforesaid lever, a shaft controlled by the movement of said pawls through the instrumentality of an escapement-wheel, and a carriage 120, controlled by means of gearing through the instrumentality of said shaft.

14. The combination, in a type-printing machine, of a bar 100, controlled by the key-levers to operate the spacing mechanism, a strap 129, cut away, as shown, for the purpose described, and arranged above certain of said key-levers, and a regulator under the control of said strap and keys governing the aforesaid spacing mechanism, whereby when the keys beneath such strap are operated the regulator will be moved to control the spacing apparatus in accordance with the movement of said strap and the carriage will be moved through a corresponding distance.

15. The combination, in a type-printing machine, of a bar 100, controlled by the key-levers to operate the spacing mechanism, a strap 129, cut away, as shown, for the purpose described, and arranged above certain of said key-levers, a regulator governing the aforesaid spacing mechanism under the control of said strap, and connections between said capitalizing-key and said strap, whereby when the capitalizing-key is depressed the strap 129 will be raised, so that when the key-levers are depressed the carriage will be spaced for capitals, but when the keys beneath said strap are depressed the regulator will be moved to give greater or less spacing than that required by the ordinary capitals, substantially as set forth.

16. The combination, with a type-printing apparatus, of a spacing mechanism, a regulator governing said spacing mechanism, and a mechanism controlling said regulator governed by the operation of certain keys, consisting of a strap 129, cut away as set forth, a lever 132, pivoted to said strap by a screw 131, a cam 134, controlling said lever through the instrumentality of a disk 135, a bar 136, connected with the capitalizing-key, also controlling said disk, a second lever 137, swung about the pivot of said strap, a screw 138, connecting the first-mentioned lever with the second-mentioned lever through a slot in said strap 129, a projection 140, carried by said second lever, and connections intermediate of said projection and regulator, substantially as specified.

17. The combination, in a type-printing machine, of an ordinary spacing apparatus, a blank or spacing key, a regulator controlling said spacing apparatus, independent connections governing said regulator, a strap 129, for actuating said independent connections, an extensible blade 149, mounted upon the blank spacing-key and adapted when extended to control said strap, and a key or bar 152, for projecting said blade forward to control said strap.

18. The combination, in a type-printing machine, of an ordinary spacing mechanism governed by the key-levers, one member of which slides upon another, and a regulating mechanism controlling said spacing mechanism and also governed by said key-levers, one member of which regulating mechanism also slides upon another, whereby the carriage may be fed for space between the lines without interfering with the operation of said spacing mechanisms.

19. The combination, in a type-printing machine, of a sliding carriage constructed to be fed as the letter-keys are operated, an intermediate carriage in which said sliding carriage is mounted movable at right angles to the motion of said carriage, a pawl secured to said intermediate carriage, and a ratchet-bar controlling said pawl and operated by a reciprocating finger-key bar for spacing the lines of printing.

20. The combination, in a type-printing machine, of a sliding carriage constructed to be fed as the letter-keys are operated, an intermediate carriage in which said sliding carriage is mounted movable at right angles to the motion of said sliding carriage, a pawl secured to said intermediate carriage, a ratchet-bar controlling said pawl and operated by a key-bar for spacing the lines of printing, and a finger-button for disengaging the pawl from

the ratchet-bar, whereby said intermediate carriage can be moved independently of said ratchet-bar.

21. The combination, in a type-printing machine, of a sliding carriage constructed to be fed as the letter-keys are operated, an intermediate reciprocating carriage in which said sliding carriage is mounted movable at right angles to the motion of said sliding carriage, a reciprocating key-bar for sliding said intermediate carriage to space the lines, and a plurality of pivoted stops for limiting the movement of said reciprocating key-bar when moved in the path of the same.

In testimony whereof I have hereunto set my hand and affixed my seal, this 22d day of April, 1889, in the presence of the two subscribing witnesses.

ALBERT J. KLETZKER. [L. S.]

Witnesses:

A. C. FOWLER,

M. S. REEDER.