(No Model.)

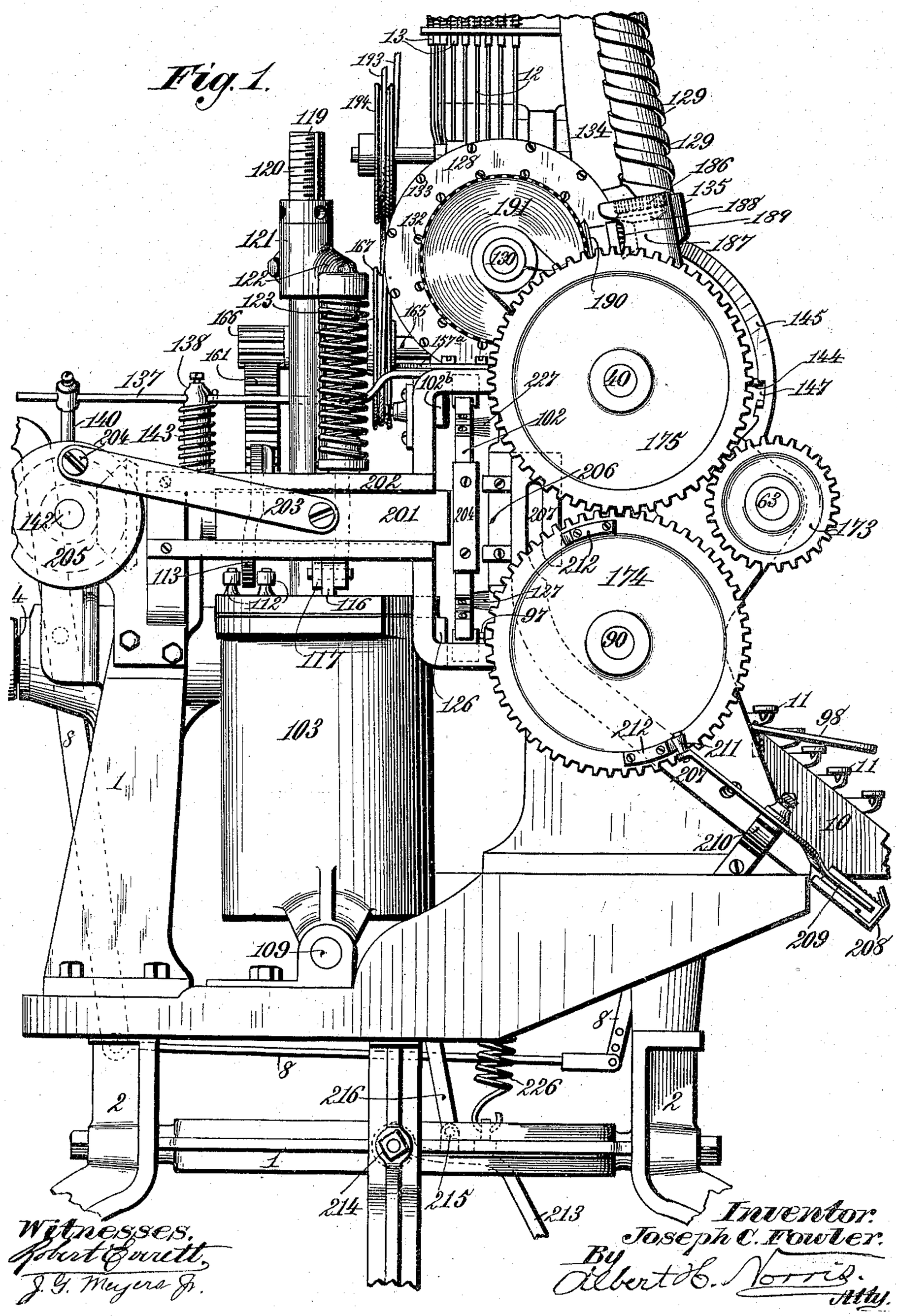
11 Sheets—Sheet 1.

J. C. FOWLER.

MACHINE FOR PRODUCING TYPE BARS

No. 533,285. Patented Jan. 29, 1895.

Fig. 1.



Witnesses,
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(No Model.) 11 Sheets—Sheet 2.

J. C. FOWLER.

MACHINE FOR PRODUCING TYPE BARS.

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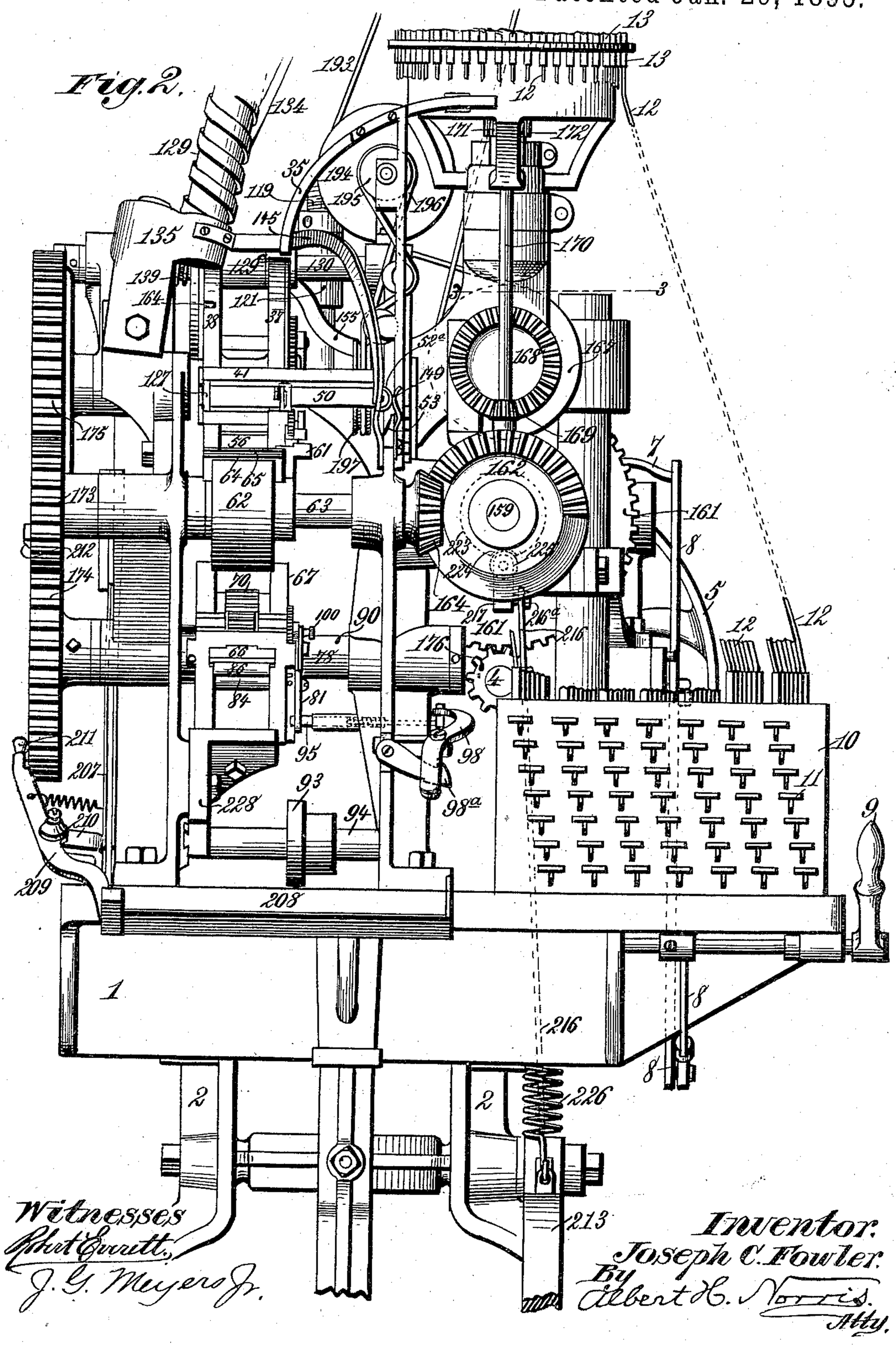
Fig. 2.



Witnesses
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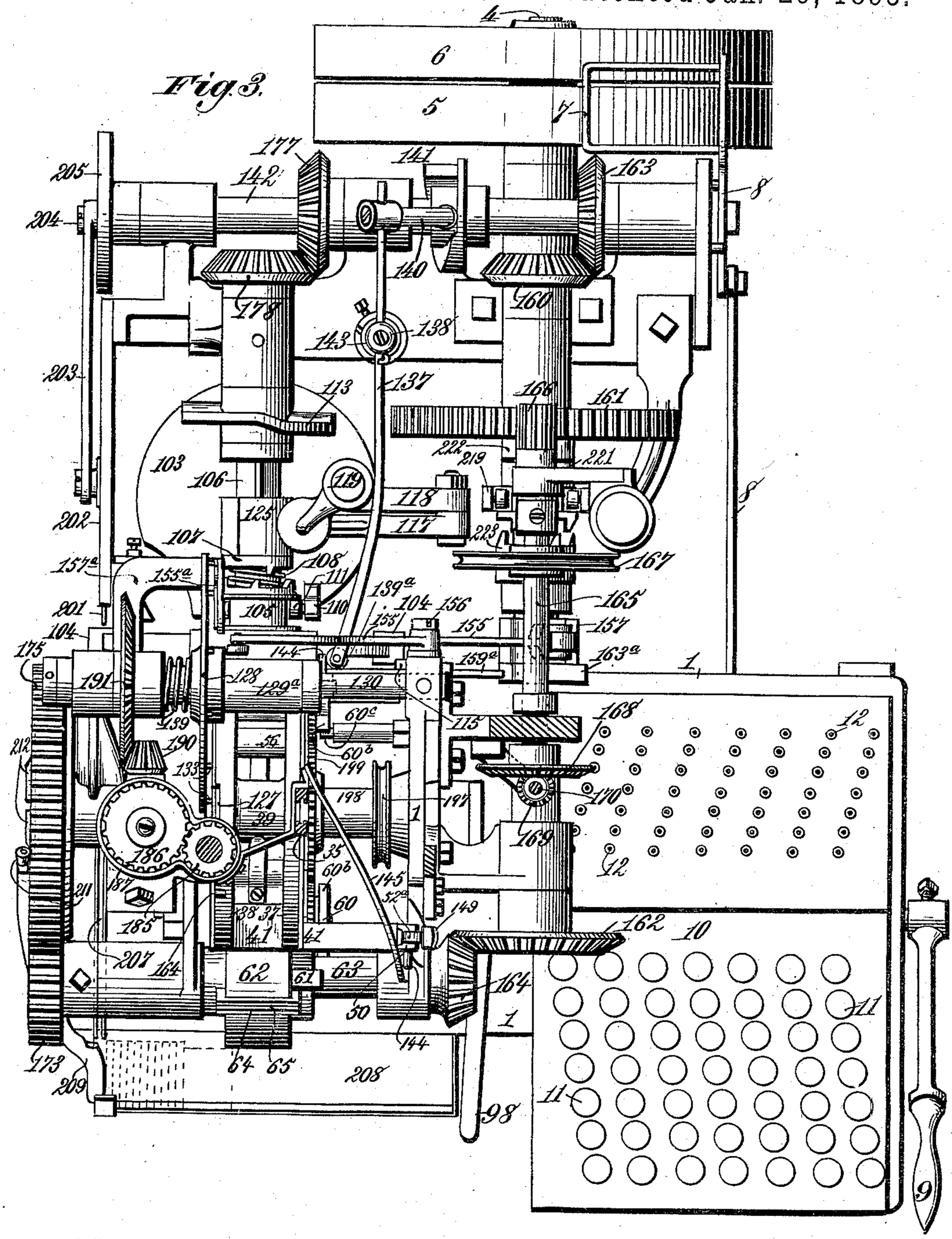
11 Sheets—Sheet 3.

J. C. FOWLER.

MACHINE FOR PRODUCING TYPE BARS.

No. 533,285. Patented Jan. 29, 1895.

Fig. 3.



Witnesses.
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(No Model.) 11 Sheets—Sheet 4.

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MACHINE FOR PRODUCING TYPF BARS.

No. 533,285. Patented Jan. 29, 1895.

Fig. 4

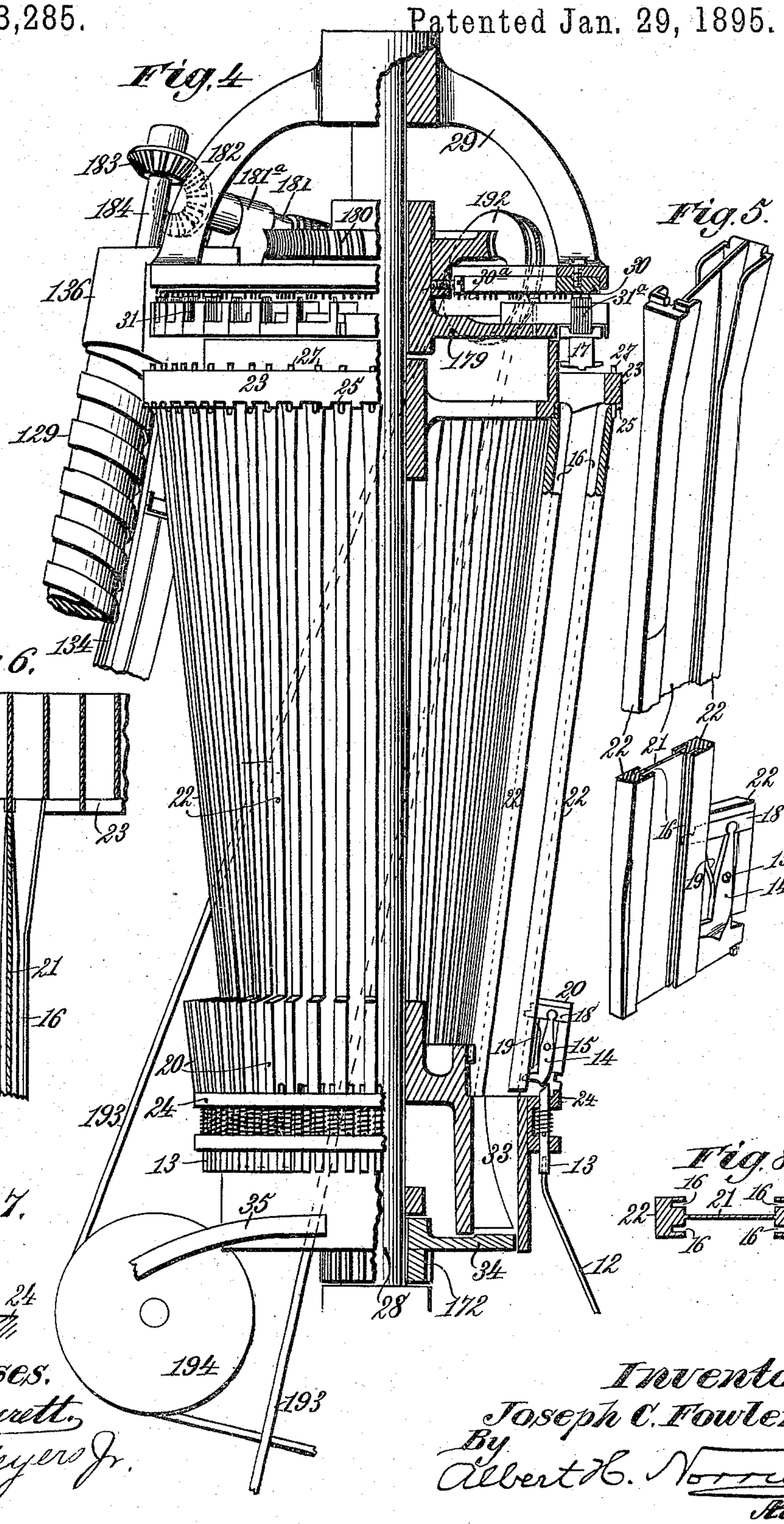

Fig. 5.

Fig. 6.

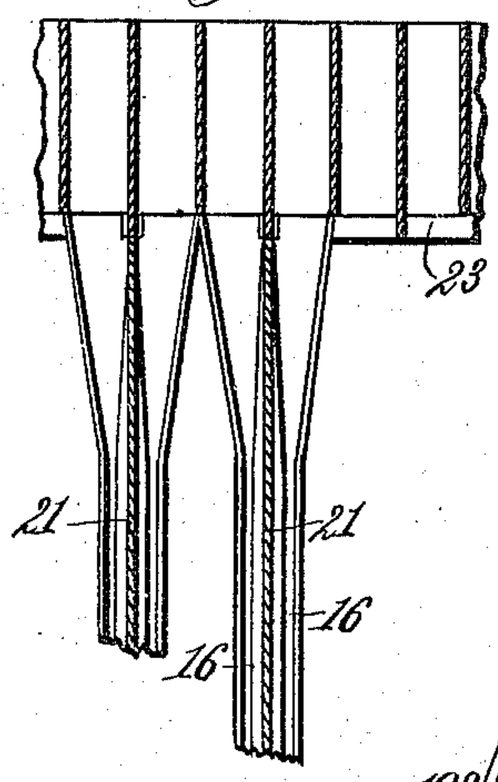

Fig. 7.

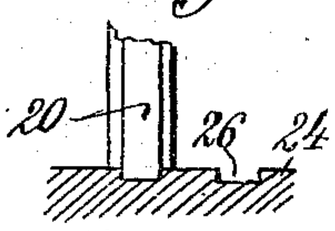

Fig. 8.

Witnesses.
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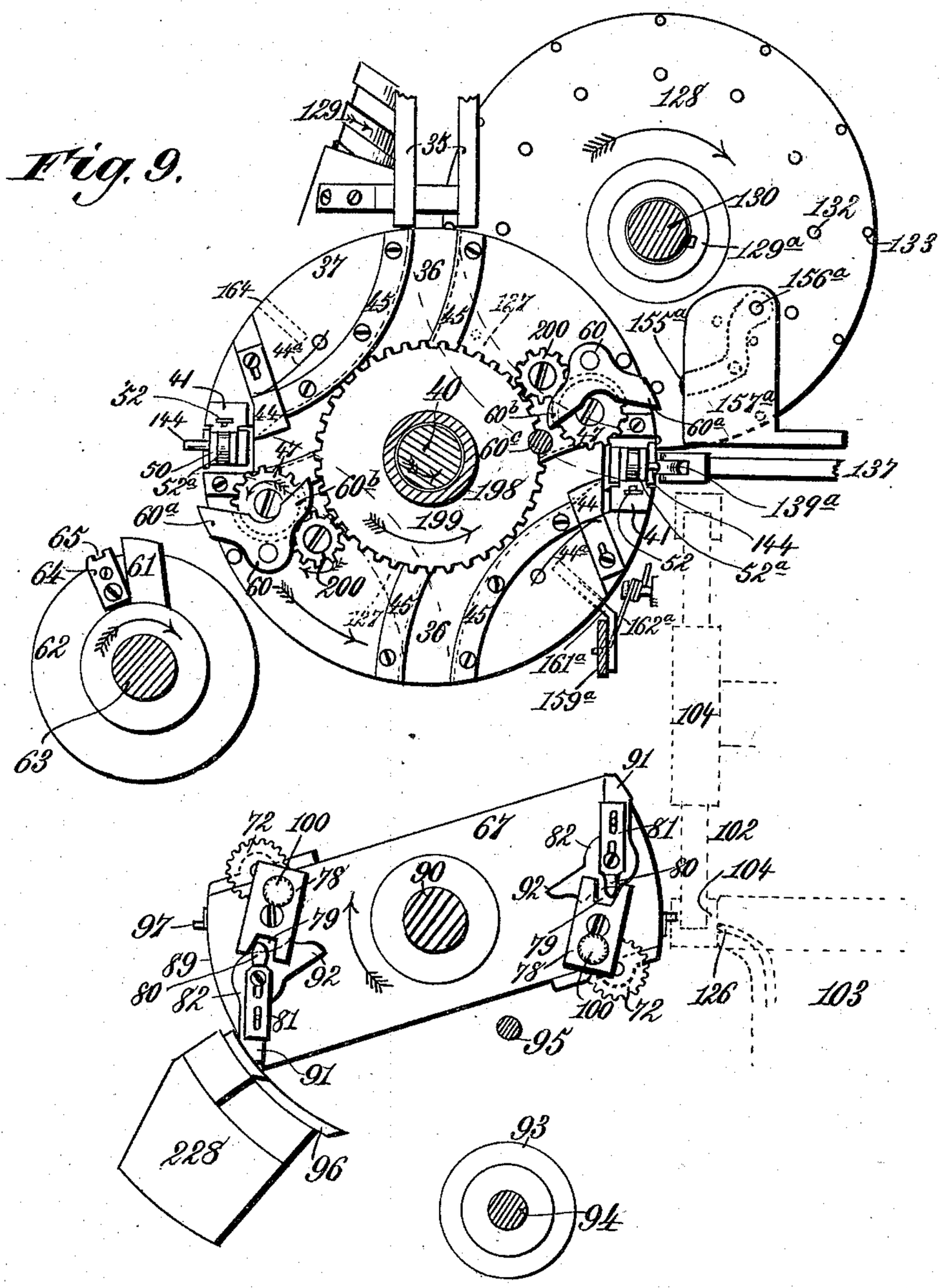
(No Model.) 11 Sheets—Sheet 5.

J. C. FOWLER.

MACHINE FOR PRODUCING TYPE BARS.

No. 533,285. Patented Jan. 29, 1895.

Fig. 9.



Witnesses.
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J. C. FOWLER.

MACHINE FOR PRODUCING TYPE BARS.

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Fig. 10.

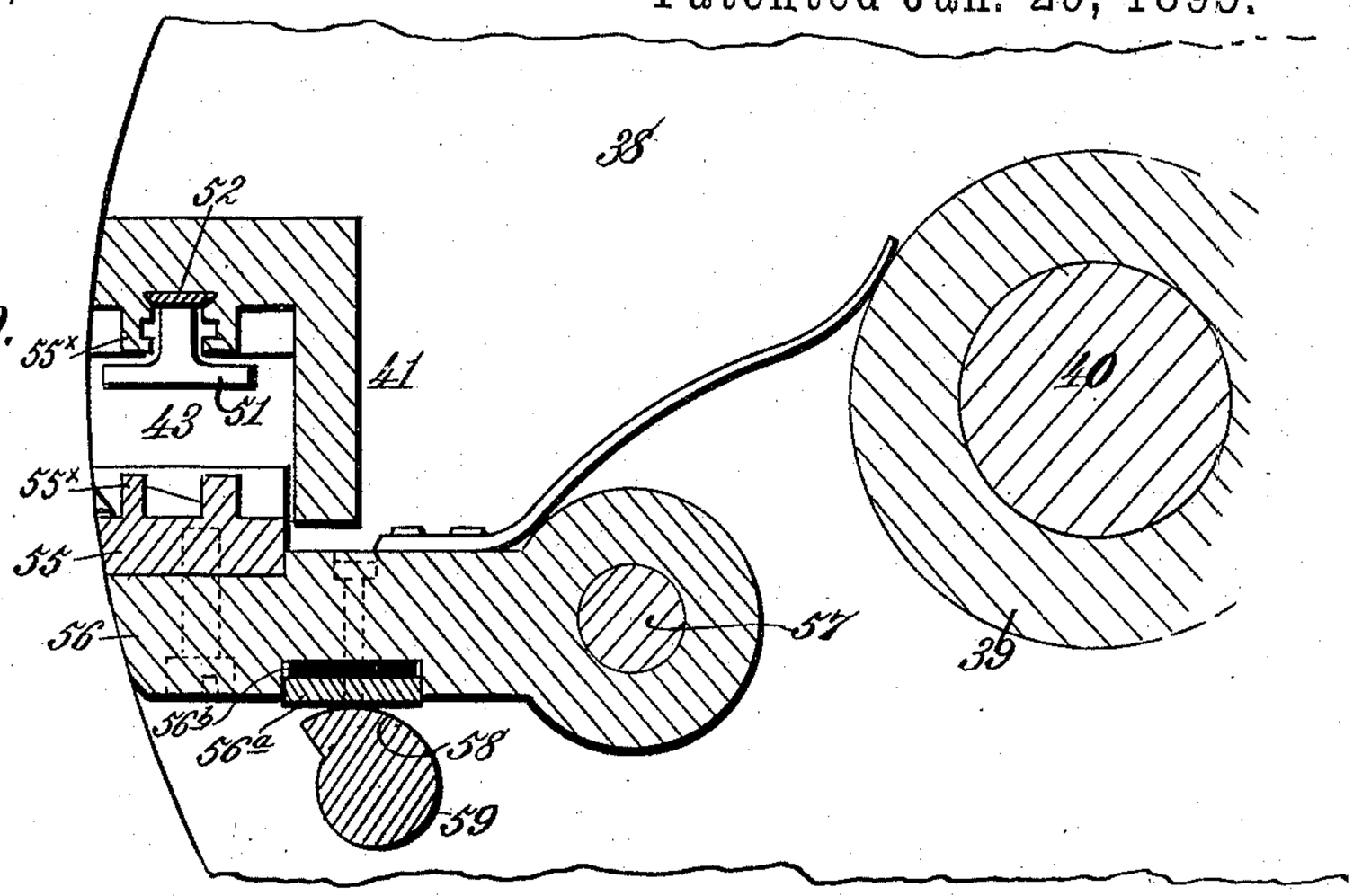

Fig. 11.

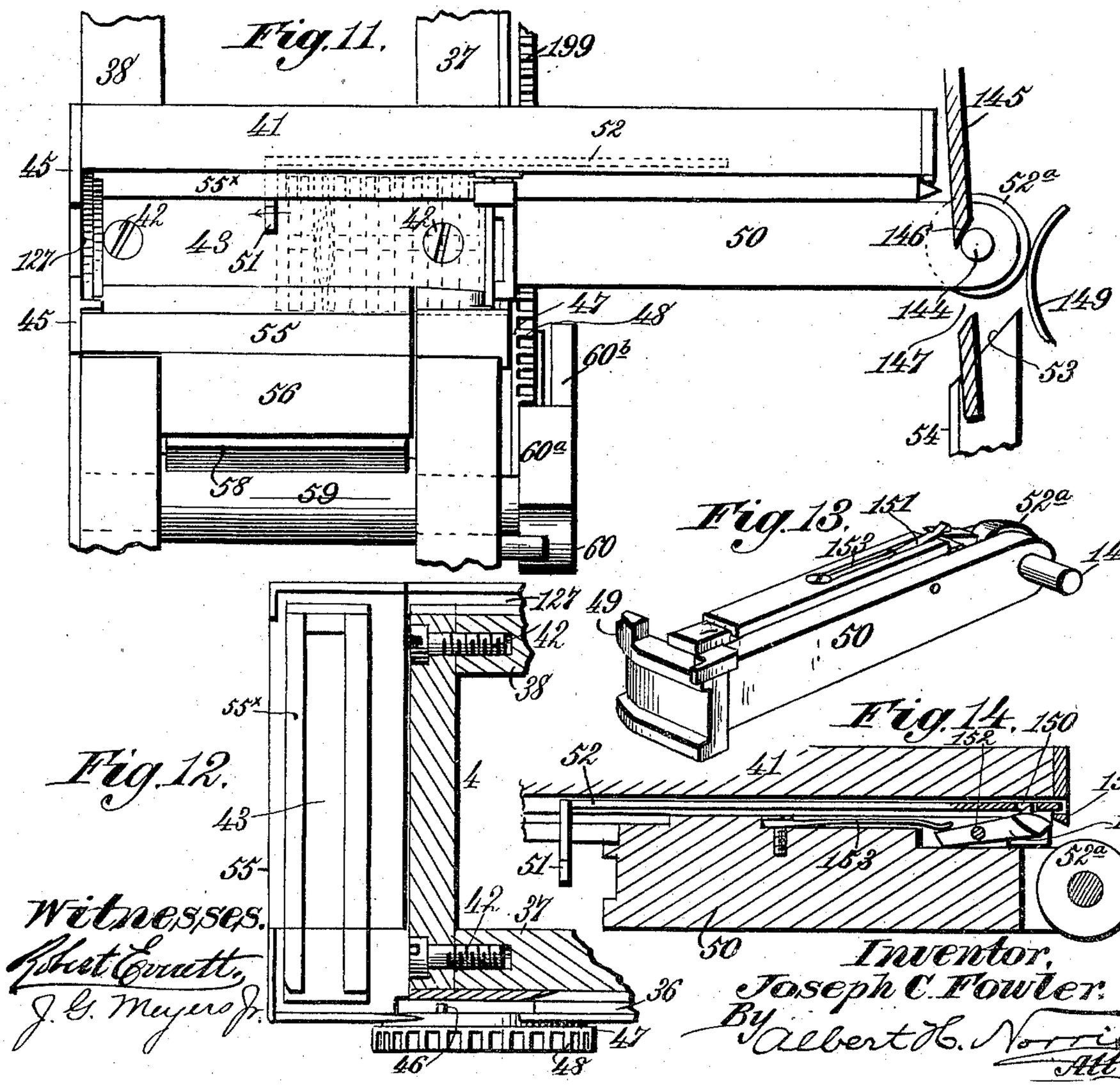

Fig. 12.

Fig. 13.

Fig. 14.

Witnesses.
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(No Model.) 11 Sheets—Sheet 7.

J. C. FOWLER.

MACHINE FOR PRODUCING TYPE BARS.

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Fig. 15.

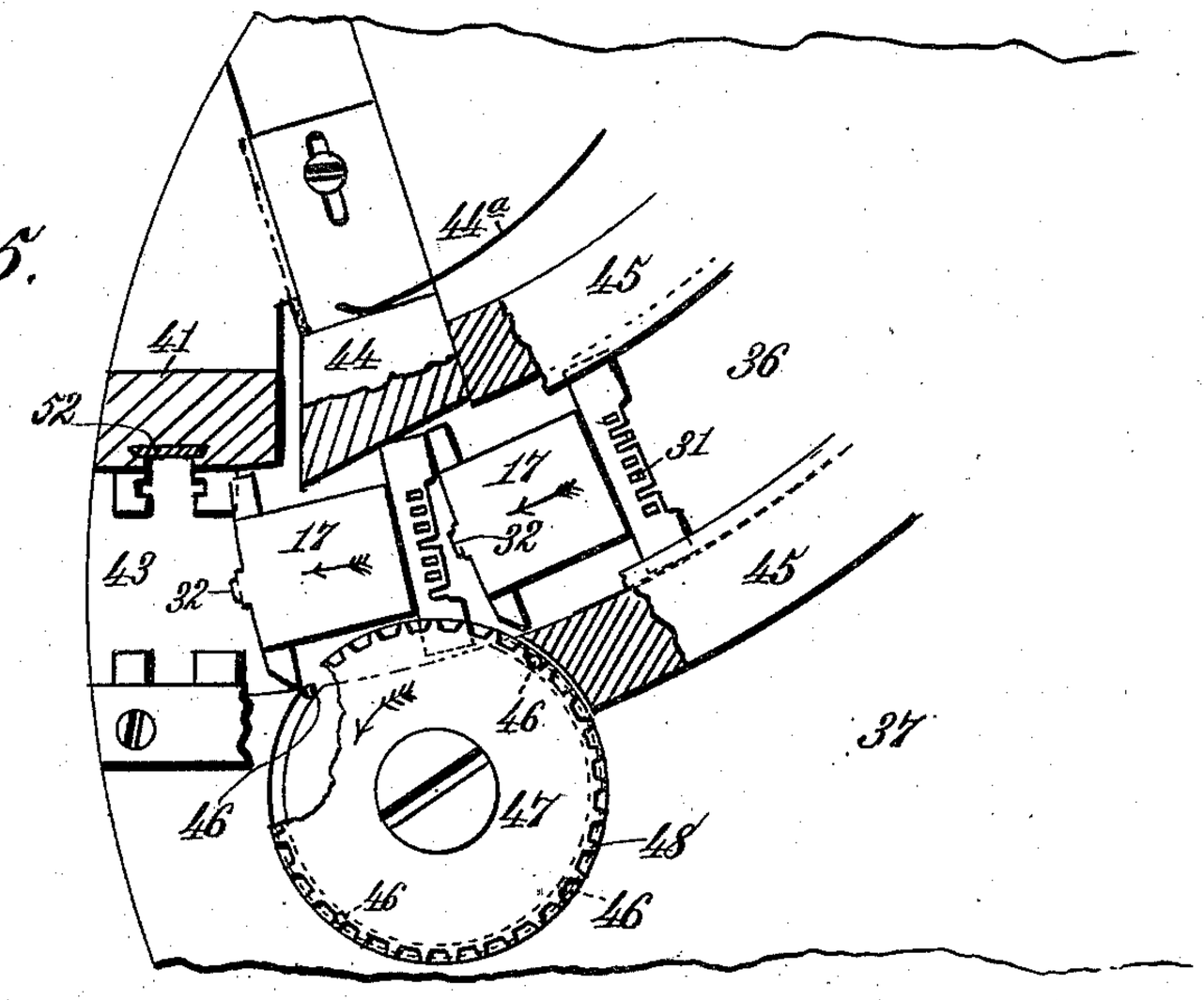


Fig. 16.

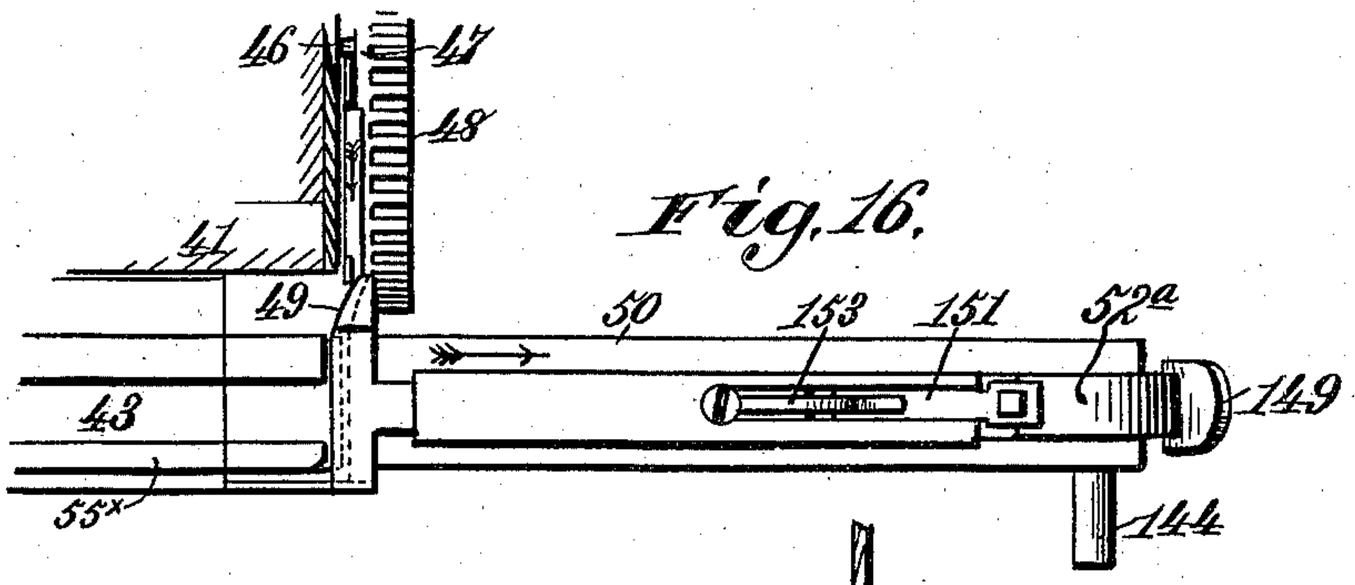
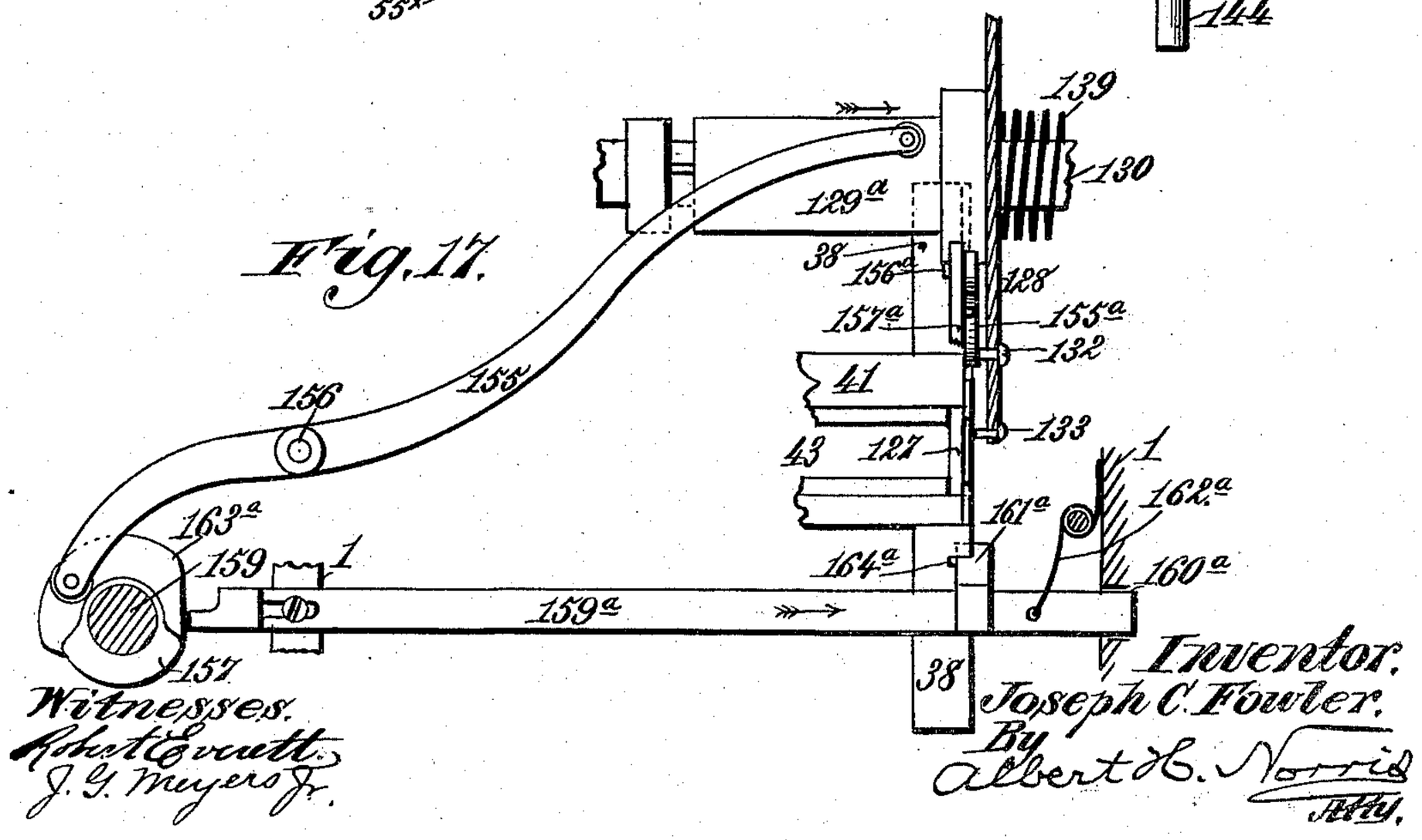


Fig. 17.



Witnesses.
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(No Model.) 11 Sheets—Sheet 8.

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MACHINE FOR PRODUCING TYPE BARS.

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Fig. 18.

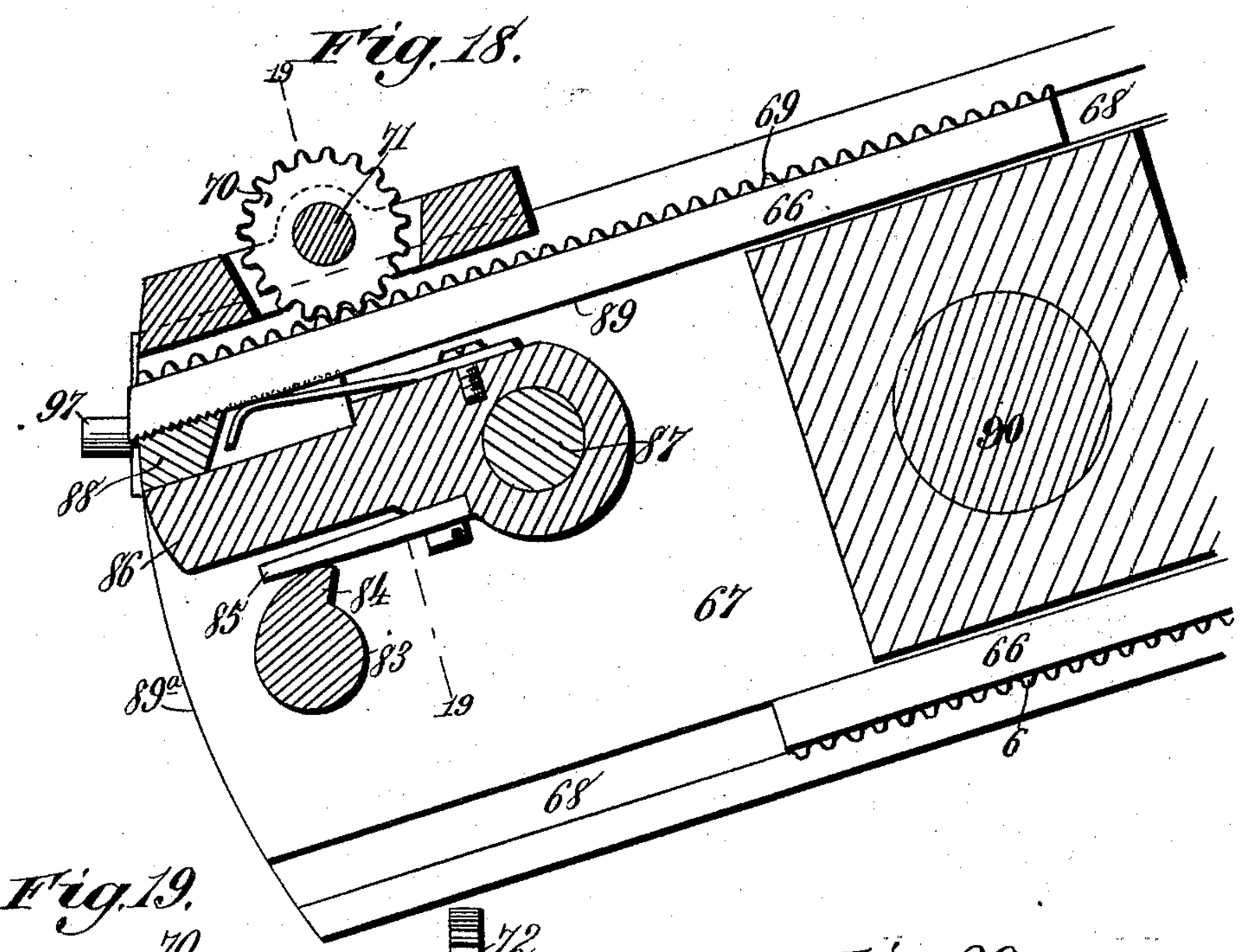


Fig. 19.

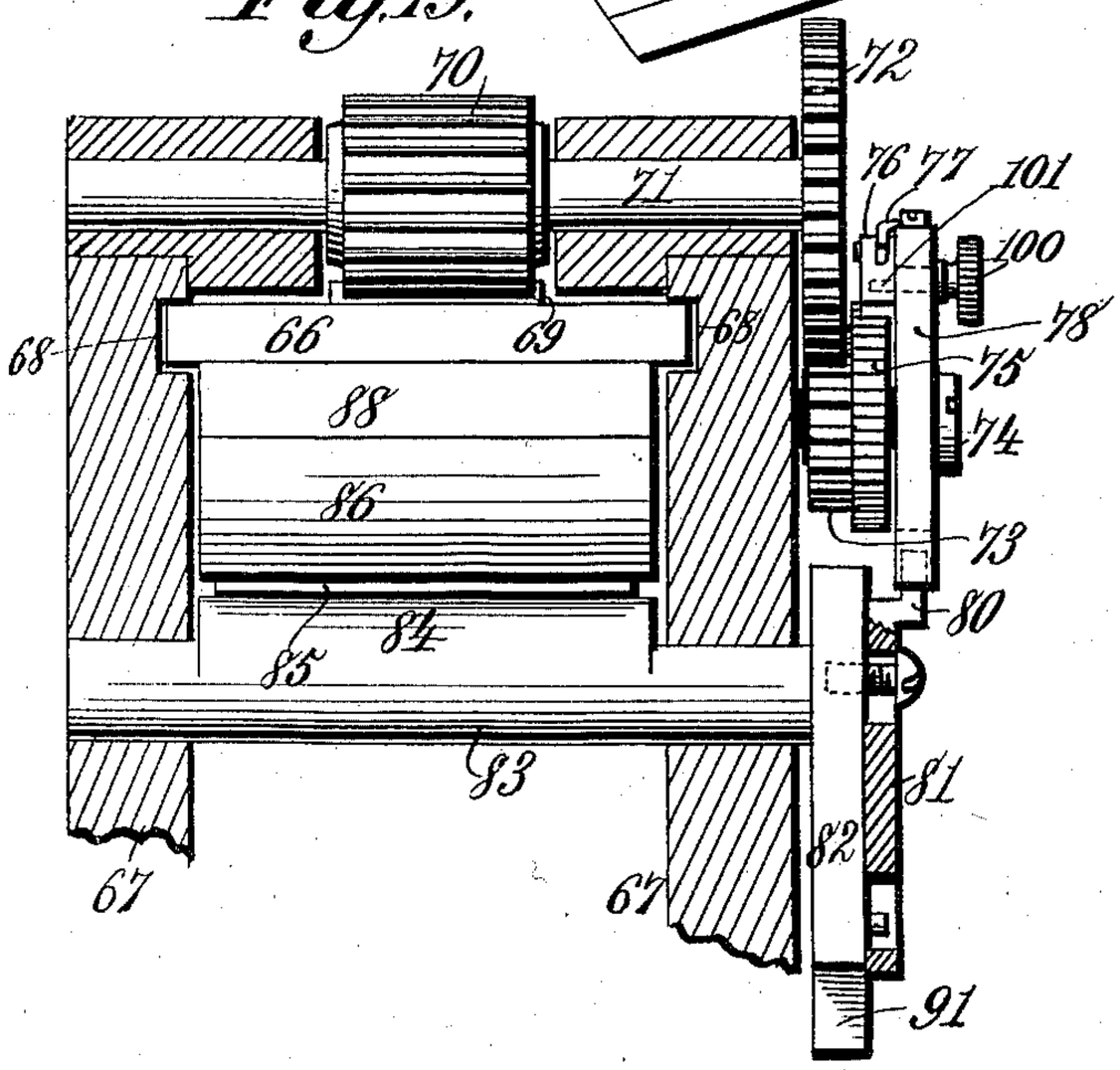
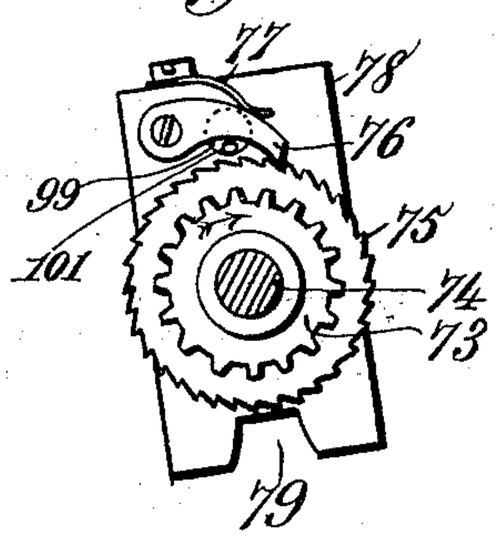


Fig. 20.



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MACHINE FOR PRODUCING TYPE BARS.

No. 533,285. Patented Jan. 29, 1895.

Fig. 21.

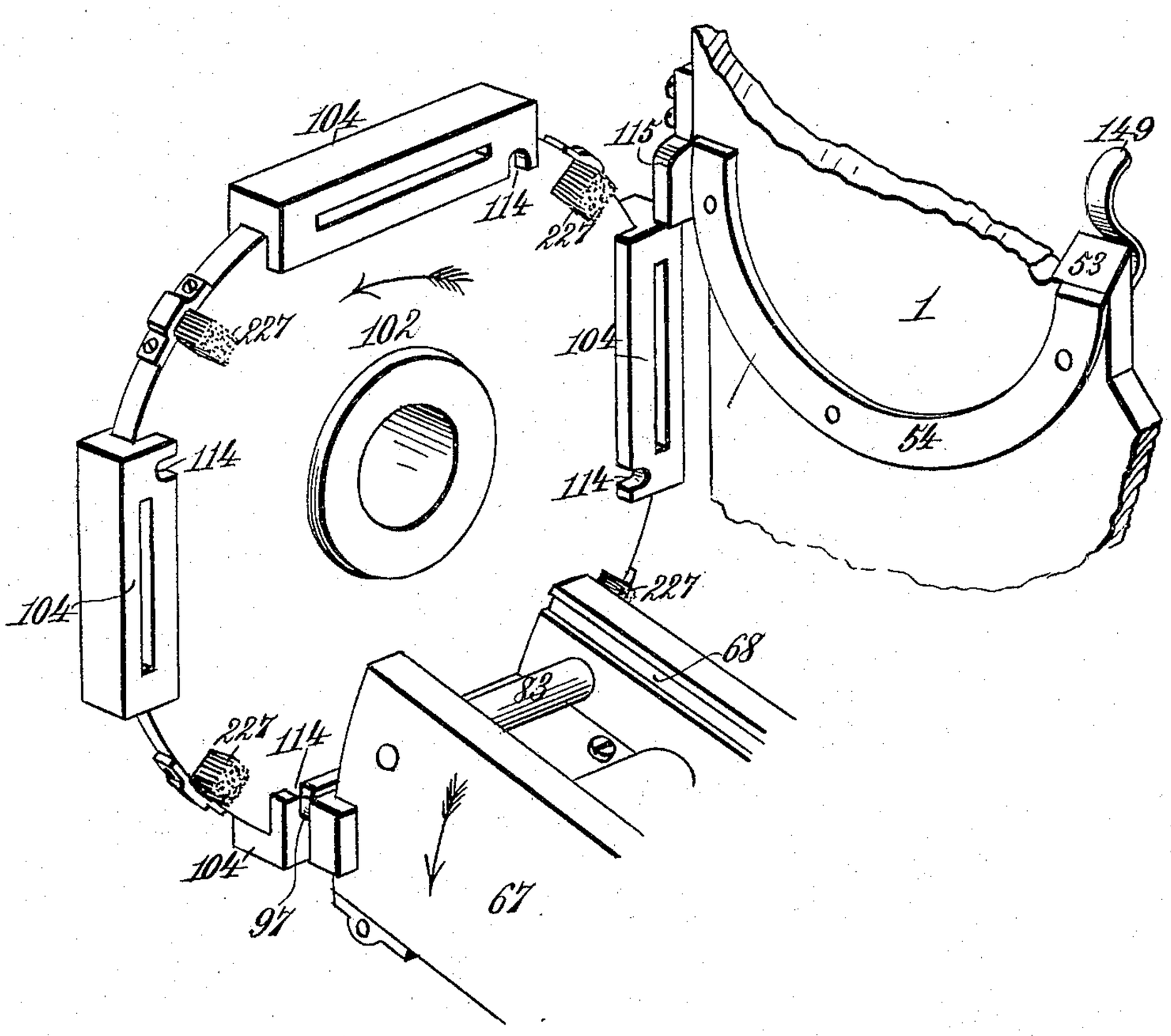
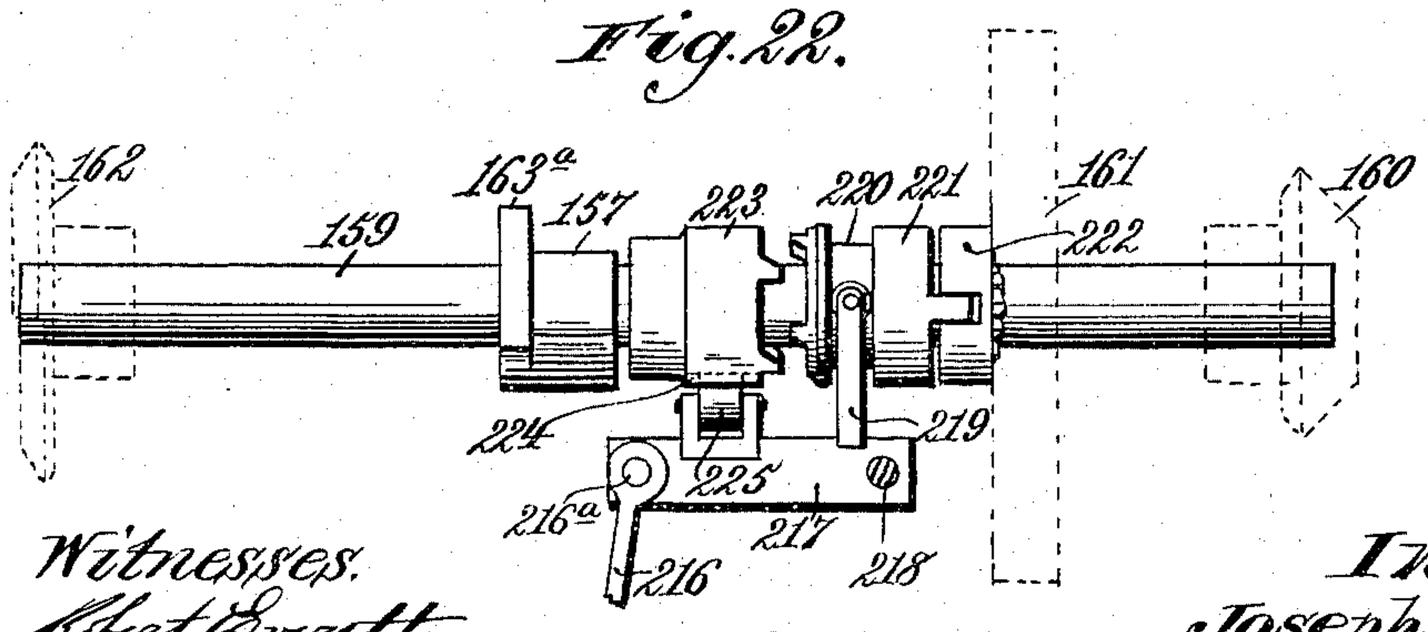


Fig. 22.



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(No Model.) 11 Sheets—Sheet 10.

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MACHINE FOR PRODUCING TYPE BARS.

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Fig. 23.

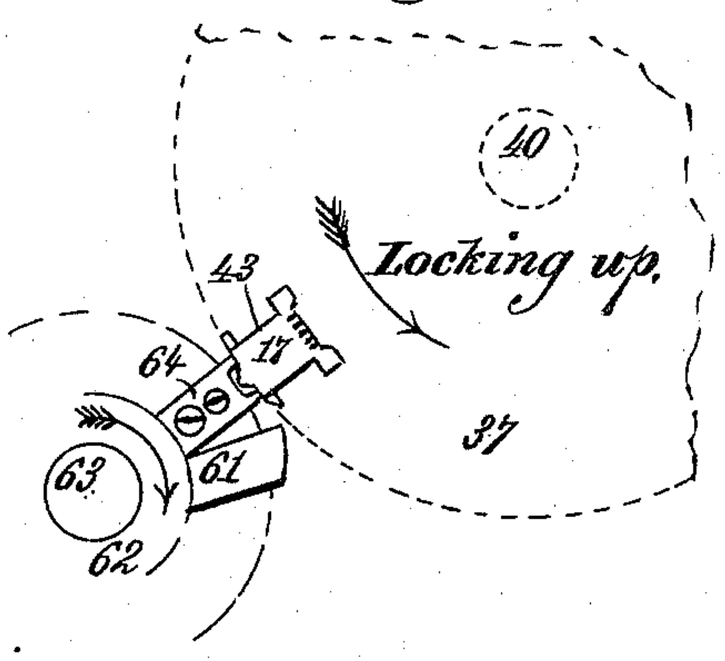


Fig. 24.

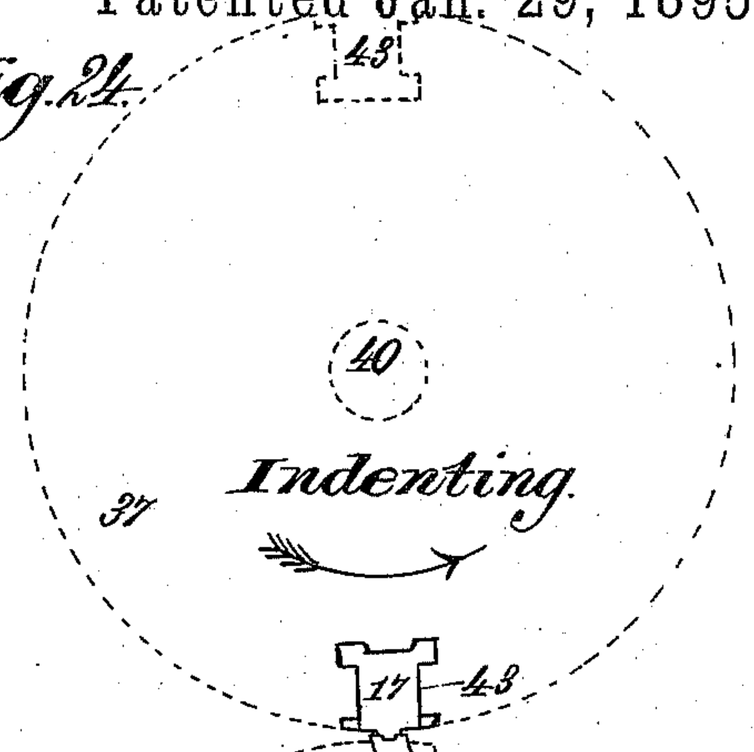


Fig. 25.

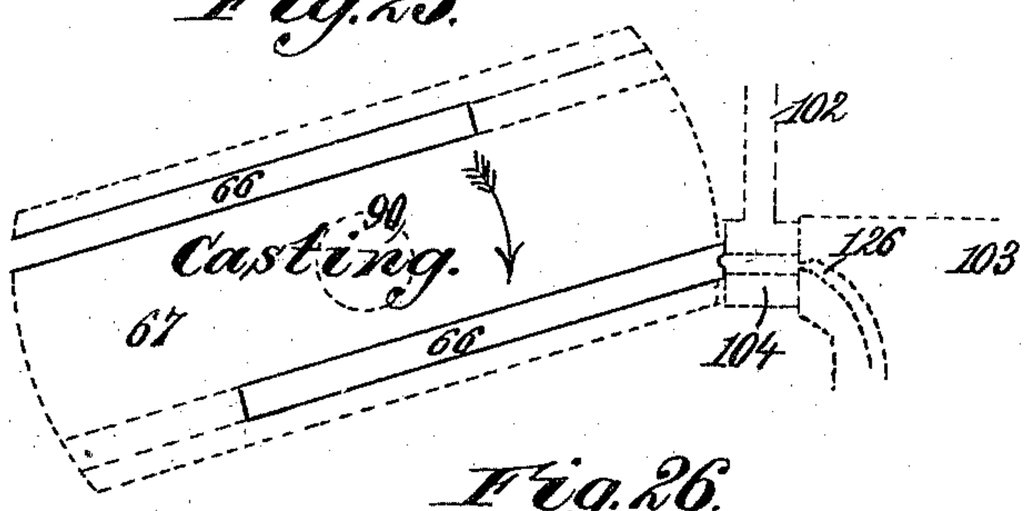


Fig. 26.

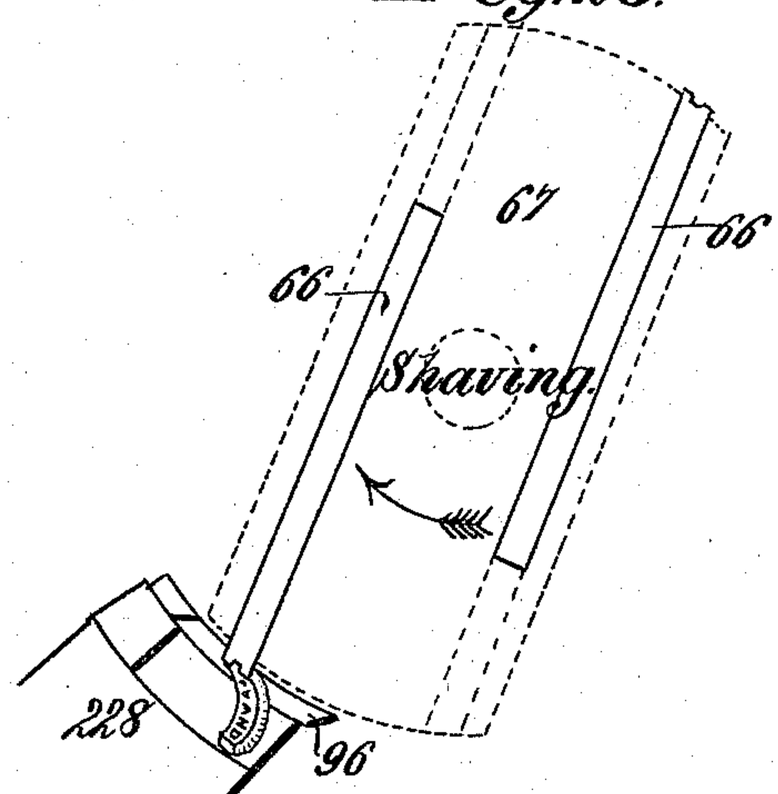
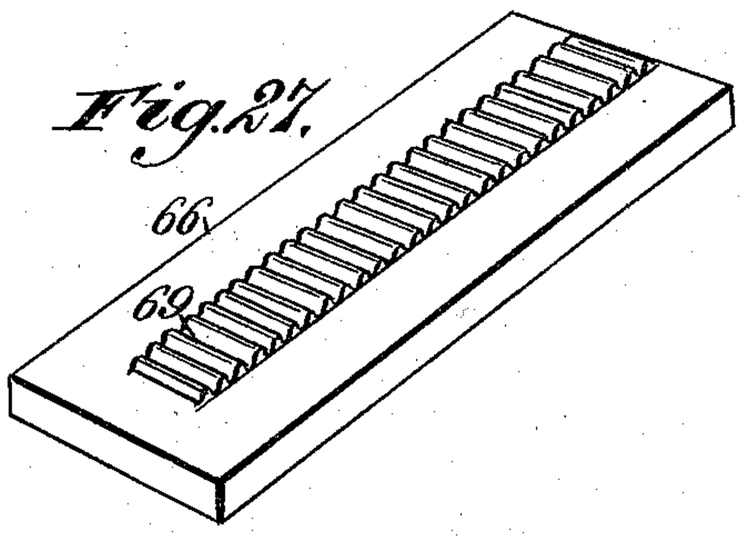


Fig. 27.



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(No Model.) 11 Sheets—Sheet 11.

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MACHINE FOR PRODUCING TYPE BARS.

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Fig. 28.

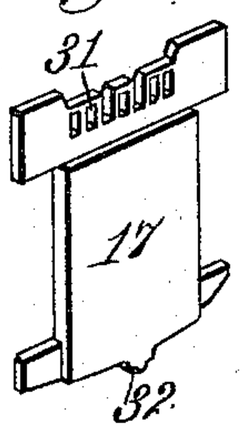


Fig. 29.

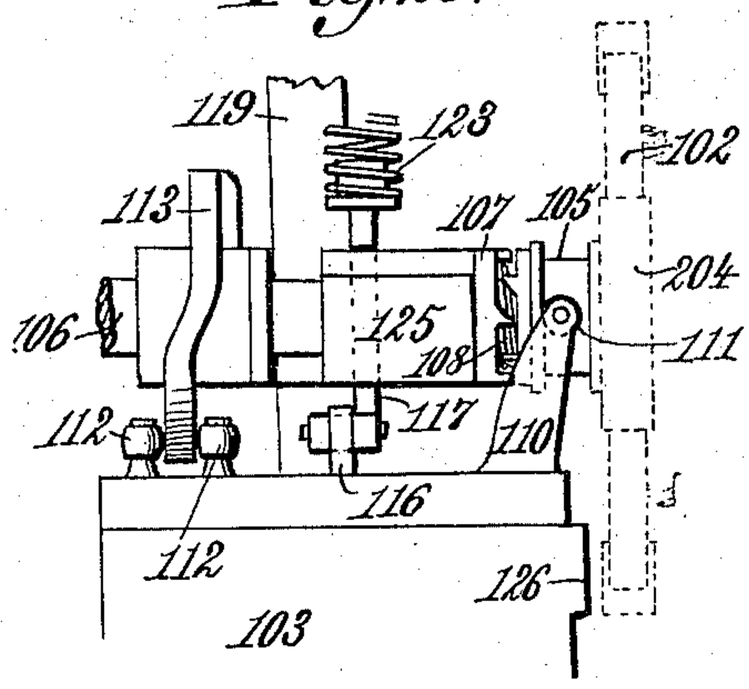


Fig. 30.

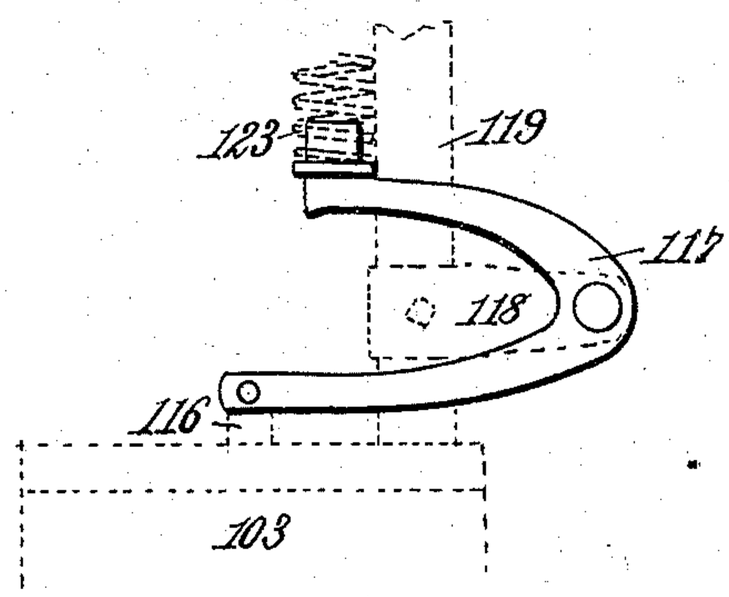
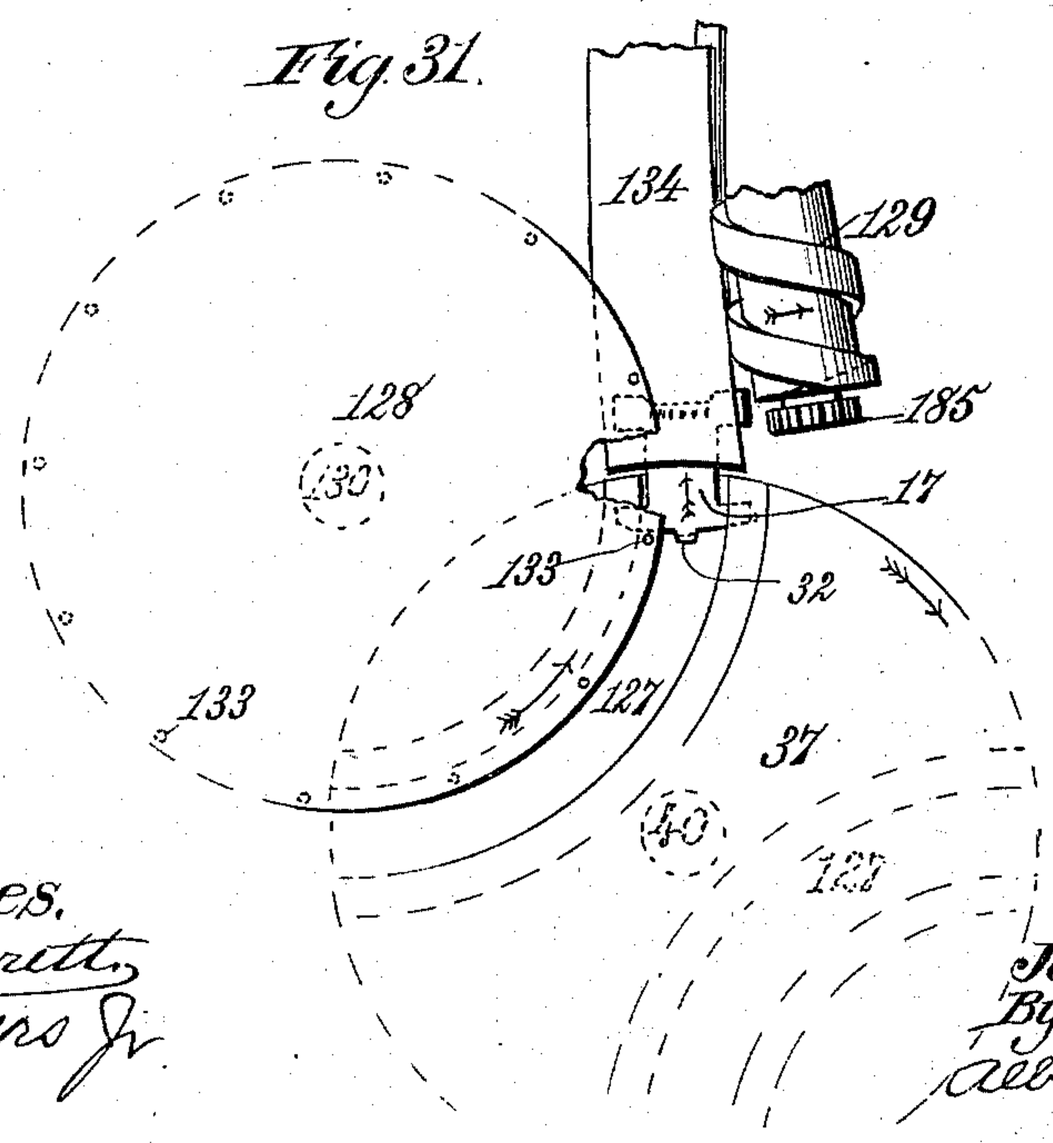


Fig. 31.



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UNITED STATES PATENT OFFICE.

JOSEPH C. FOWLER, OF WASHINGTON, DISTRICT OF COLUMBIA, ASSIGNOR TO THE FOWLER COMPOSING AND TYPE SETTING COMPANY, OF CHICAGO, ILLINOIS.

MACHINE FOR PRODUCING TYPE-BARS.

SPECIFICATION forming part of Letters Patent No. 533,285, dated January 29, 1895.

Application filed September 24, 1894. Serial No. 523,978. (No model.)

To all whom it may concern:

Be it known that I, JOSEPH C. FOWLER, a citizen of the United States, residing at Washington city, in the District of Columbia, have invented new and useful Improvements in Machines for Producing Type-Bars, of which the following is a specification.

This invention relates to that class of machines for making type-high printing bars, wherein male types, or types bearing characters or letters in relief, are released in proper order by finger-key mechanism, and composed or set in a line which is justified and caused to impress or indent some suitable matrix material to form a line of matrices therein from or by which the printing-bar is cast by injecting type-metal into one side of a mold, the opposite side of which is closed by the material in which the line of matrices is impressed or indented.

In prior machines of the character alluded to, it is difficult to produce printing-bars having type characters which possess the required sharp angles and perfect formation necessary for finely executed work and the high perfection required in the printing art. The chief reason for imperfect work in this method of casting printing bars resides in the fact that the impressions or indentations have heretofore always been made in comparatively irregular or rough and dark, dull or lusterless surfaces of lead or other soft metal bars or blanks, which are comparatively thin and lack the required body or solid foundation necessary for the production of perfect matrices.

I have discovered that by shaving the matrix block or material, and thus providing it with a smooth and bright or lustrous, or polished surface, the impressions or indentations of the types produce accurate and perfect matrices, with the result that I have obtained type-high printing-bars bearing characters or letters having all the necessary sharpness of angles and susceptible of producing as finely executed printing as type-high printing bars cast direct from or by disconnected and interchangeable matrices, or type-bearing female characters or letters assembled in a line.

I have also discovered that by impressing or indenting into the shaved surface of a body of soft metal of comparatively large dimensions, the metal is compressed or consolidated and the large body presents a hard foundation for the formation of the matrices, while the edges of each matrix are higher than is ordinarily the case, because the metal flows upward or outward when the impression is made, in a better manner than when the impression is made in a comparatively thin matrix-bar or blank.

The objects of my invention are to improve machines designed for producing printing or type-bars by casting from or by lines of matrices obtained by causing male types to indent or impress some suitable soft metal or other suitable material; to obtain superior lines of matrices in soft metal or matrix material; to improve the devices for mechanically handling or manipulating the types; to simplify the construction of this class of machines; to reduce the dimensions of the machines and render them susceptible of being conveniently and swiftly operated.

The machine involves several new improvements, and, concisely stated, it comprises a magazine having a plurality of individual removable and replaceable type cases or channels in which cameo or male types are arranged in columns, and are individually released by finger-key mechanism. The released types fall upon a rapidly rotating table or wheel which delivers them to a curved chute, and the curved chute deposits the types vertically in a line-assembling or composing-channel formed in an intermittently rotating carrier, into which channel the type are successively fed by a horizontal line-composing stick or feed-bar. When the desired line is assembled, the carrier turns, the types are aligned by a rotary-drum, the composing-stick is locked, and the type are rolled into the shaved end of a solid block of soft metal which is locked at intervals in an intermittently rotatable matrix-block holder. This holder rotates in unison with the line on type-carrier, and after the impression or indentation is made to produce a line of matrices in the shaved end of the block of metal, the holder stops in proper position relatively to a mold, into which type metal is injected, for the purpose of producing a type-high printing-bar

bearing at one edge a line of cameo or relief characters. During each rotation of the matrix-block holder, the matrix-block is shaved to provide it with a fresh impression surface which is bright or lustrous. While the casting of a printing-bar is being effected, the types are successively delivered into an exit-channel in the rotary line-carrier, from which they are delivered into engagement with an elevating screw. The screw carries the types to a circular distributing mechanism, and as the types are carried in a circular path, they are automatically assorted into the type-cases or channels of the magazine.

The spacers employed in the machine may be similar in form to the types, and are mechanically handled in the same manner, but all are deposited in the same channel or cell of the magazine. The cast-type bars are ejected from the mold and descend through an inclined chute into a galley.

The invention consists in the several features hereinafter described and set forth in the claims, reference being made to the accompanying drawings, in which—

Figure 1 is a broken side elevation, looking at the left hand side of a portion of my improved machine. Fig. 2 is a front elevation of the same. Fig. 3 is a sectional plan view, taken on the line 3—3, Fig. 2. Fig. 4 is a detail sectional elevation of the type magazine, showing a portion of the spiral-lift or type elevating screw. Fig. 5 is a detail broken perspective view of one of the removable and replaceable type-cases or channels. Fig. 6 is a detail vertical sectional view of a portion of the upper end of the type-magazine. Fig. 7 is a detail sectional view, showing the manner of supporting the lower ends of the type-cases or channels. Fig. 8 is a transverse sectional view of one of the type-cases or channels. Fig. 9 is a detail side elevation, showing the pin-wheel, the rotary line-carrier, and the holder for the matrix-block, and indicating, by dotted lines, the mold-disk or carrier and a part of the tilting casting-pot. Fig. 10 is a detail vertical sectional view, showing a portion of the rotary line-carrier, and a jaw or clamp for clamping a line of types in a line-assembling or composing channel or space. Fig. 11 is a detail front elevation, showing a portion of the rotary line-carrier and the composing-stick or feed-bar. Fig. 12 is a detail horizontal sectional view of a portion of the rotary line-carrier. Fig. 13 is a detail perspective view of the composing stick or feed-bar, omitting the yielding slide-bar for maintaining the first type of the line in an upright position. Fig. 14 is a detail horizontal sectional view, showing the composing-stick or feed-bar and the yielding slide-bar in operative connection. Fig. 15 is a detail sectional side elevation, showing the transfer-wheel for delivering the types from the curved inlet chute of the rotary line-carrier to the horizontal line-assembling or composing channel or space thereof. Fig. 16 is a detail sectional top plan view, showing the composing-stick or feed-bar in normal position, and a type in transit to the line-assembling or composing-channel or space. Fig. 17 is a detail sectional elevation, showing a portion of the pin-wheel for discharging or removing the types from the rotary line-carrier; and also showing devices for laterally shifting the pin-wheel, and for temporarily locking the rotary line-carrier in a stationary position. Fig. 18 is a detail longitudinal sectional view of the rotary matrix-block holder, showing one of the lock-up clamps or jaws for the matrix-block. Fig. 19 is a sectional view, taken on the line 19—19, Fig. 18. Fig. 20 is a detail view of the pawl and ratchet devices for intermittently advancing or feeding the matrix-block, so that one end thereof can be successively shaved. Fig. 21 is a detail perspective view of the mold-disk or carrier, showing a part of the main-frame, and one end portion of the matrix-block-holder. Fig. 22 is a detail plan view of the countershaft, showing the clutch devices for stopping and starting the motion of the line-carrier, the matrix-block holder, and the casting mechanism. Fig. 23 is a diagram, showing the position of the parts in locking up the line of type and aligning the same. Fig. 24 is a similar view, showing the line of type indenting a matrix-block. Fig. 25 is a similar view, showing the position of the parts in casting a printing-bar. Fig. 26 is a similar view, showing the end portion of a matrix-block in the act of being shaved, to provide it with a smooth and bright or lustrous impression surface. Fig. 27 is a detail perspective view of one of the soft metal matrix-blocks. Fig. 28 is a detail perspective view of one of the male or cameo types used in my improved machine. Fig. 29 is a detail side elevation, showing a portion of the casting-pot and the devices whereby the pot is rocked and the mold-disk, or carrier is rotated and moved back and forth. Fig. 30 is a detail front elevation, showing the lever connection with the piston-rod of the casting-pot; and Fig. 31 is a detail diagrammatical view, showing the relative arrangement of the line-carrier, the pin-wheel, and the lower end portion of the distributing chute into which the types are raised by the pin-wheel.

In order to enable those skilled in the art to make and use my invention, I will now describe the same in detail, referring to the drawings, wherein—

The numerals 1 indicate parts of a main frame supported by legs or standards 2, and provided with bearings for a main power-shaft 4 Fig. 3, having fast and loose pulleys 5 and 6, to either one of which a drive-belt, not shown, can be shifted by a belt-shifter 7, under control of the operator through the medium of suitable connections 8, with a hand-lever 9, located in convenient relation to the key-board 10, so that the operator, sitting in front of the key-board, can manipulate the hand-lever, and also operate the finger-keys

11. The hand-lever controls the rotation of the main power-shaft and the finger-keys connect by slender rods 12 with vertically slidable pins, as at 13, Figs. 4 and 5, each of which is provided with a beveled upper end bearing against the lower end of a lever 14 pivoted between its extremities to a pin 15. The lower end of the lever 14 projects inwardly and lies within one of the grooves 16, in which the flat types 17 are adapted to move. The upper end of the lever is articulated to a latch-bolt 18, and the lever is acted upon by a spring 19, which normally holds the latch-bolt in the position shown in Fig. 4, with its inner end lying in one of the grooves or recesses 16 to arrest the descent of the types in the grooves or recesses.

The lever 14, and latch-bolt 18 constitute an escapement mechanism which lies in a recessed extension or housing 20, at the lower end of a type-case composed of a thin plate 21, Figs. 5 and 8, having at each longitudinal edge a thick rib 22, in each of which is formed two longitudinal grooves 16, one at each side of the plate 21, whereby each type case is provided with two cells or channels, and is adapted to contain one series of type-characters at one side of the plate 21, and another series at the opposite side thereof. By this means the dimensions of the magazine are reduced, and its construction is simplified.

The type-cases and escapement mechanisms are alike in construction, and therefore a description of one is sufficient for all.

The type-cases are designed to be removable and replaceable for conveniently and quickly changing the font of types, and to accomplish this by a very simple and economical construction, the upper and lower heads 23 and 24 of the magazine are formed with radial grooves or recesses 25 and 26 to receive the upper and lower ends of the type-cases. The lower end of each type-case can be easily set in one of the grooves or recesses 26, and the upper end of the type-case can then be moved into one of the grooves or recesses 25, after which a vertically movable pin 27, Fig. 4, can be moved downward into engagement with the upper end of the type-case, thus holding the latter firmly in position while permitting it to be conveniently and quickly removed when occasion demands.

The construction of the type-case, with two cells or channels in the manner described and shown, is very desirable, in that, as before stated, two sets of different characters can be contained in a single removable and replaceable type-case.

The magazine is mounted at its center on a cylindrical column or shaft 28, Fig. 4, on the upper end of which is fixed a yoke 29, carrying a horizontal bar 30, formed as an annulus or ring, and provided with pins or projections 30^a, the linear arrangement of which is changed or varied to form a permutation-bar which serves to properly operate oscillatory hooks 31^a for automatically releasing the types 17 and assorting them into the type-cases or channels.

The specific construction and operation of the permutation-bar and the oscillatory hooks are fully described and shown in my application for Letters Patent filed September 8, 1894, Serial No. 522,489, and is claimed in that application, for which reason I do not herein claim the same, and do not deem it necessary to more fully describe and illustrate the features, especially in view of the fact that in the present machine I do not confine myself to any particular devices for automatically distributing the types into the type-cases or channels.

The types 17 devised by me are each constructed as best shown in Fig. 15, with a series of slots 31 at one end, one or more of which has its outer end removed or omitted, so that the types can be suspended by the oscillatory hooks and released over the proper type-cases or channels. The construction of the types is also described and claimed in my application, Serial No. 522,489, above referred to, and therefore I will not more fully explain the same in this application, further than to say that the end of the type opposite the slotted end is slightly convex or rounded off, and provided with a cameo or male type-character 32, or other character used in printing.

The escapements at the lower end of the magazine are substantially the same as in my Letters-Patent No. 510,853, dated December 12, 1893, and in application for Letters Patent filed October 21, 1893, Serial No. 488,800.

The selections from the type-cases or channels are made by the keys 11, and as the types are released they pass by gravity into the chutes 33 and are received by the rapidly rotating table or wheel 34, from which they are discharged in the order of their selection into a chute 35, Figs. 2 and 4, which conducts the types to the inlet-channel 36, Fig. 9, in one end of a rotary line-carrier. The rotary line-carrier comprises two circular heads 37 and 38, Figs. 9, 11, 12, and 15, connected by a sleeve 39 fixed on a shaft 40, Fig. 10. The heads 37 and 38, are rigidly connected by intermediate angular blocks 41, Figs. 9 and 10, which may be formed in one piece with the heads, but which are preferably constructed as separate parts, and are attached by screws, as at 42, Fig. 12. The angular blocks 41 are each formed with a line-assembling or composing-channel 43, having a shape which corresponds to the outline of the types, the depth and arrangement of the channels being such that when a type is placed therein, with its slotted end lying against the vertical wall of the angular block 41, Fig. 10, the convex end of the type will lie in the plane of the perimeter of the two heads 37 and 38. The convex end of the type is curved in an arc struck from the center of the shaft 40. The assembling or composing-channels 43 are so arranged that they are open one upon the top

and the other upon the bottom of the angular blocks, so that they will always lie in proper position for assembling or distributing when the line-carrier is rotated.

The line-carrier is so arranged that one of its heads—as 37—lies beneath the delivery end of the chute 35, Fig. 9, and in the outer face of this head 37 is formed the curved or segmental channel or chute 36, which cuts the periphery of the head substantially in the direction of a radius of the latter. The segmental channel is curved to avoid the shaft 40, and one of its extremities cuts the periphery of the head at a point separated by an arc of about ninety degrees from the other extremity. The head 37 is provided with two of the inlet channels 36, each of which is the counterpart of the other. The form of the channels in cross section is such as to permit the body portion of the type to enter the same. The channels 36 are partially covered by plates 45, thereby forming a curved chute in which the types may slide freely in the direction of their length, as in my application for Letters Patent, Serial No. 488,800, above mentioned.

When the shaft 40 is rotated, and the line-carrier is turned until the entrance end of one of the chutes or channels 36 lies in a vertical line, as shown in Fig. 9, said chute or channel will then constitute practically a continuation of the chute 35, so that the types will pass freely from the latter into one of the chutes or channels 36, and will swiftly traverse the latter by gravity until they arrive at the lower end of the chute or channel, where each type is successively arrested by an elastic or yielding dog or stop 44, Fig. 15, pressed by a spring 44^a toward the channel or chute 36. As each type is arrested by the elastic or yielding dog 44, such type is acted upon by pins 46 on a rotary transfer-wheel 47 having teeth 48, whereby each type is positively moved into alignment with the line-assembling or composing-channel 43, Fig. 15. In the movement of the type into alignment with the line-assembling or composing channel 43, it acts upon a curved foot-piece 49, Fig. 16, on the inner end of a reciprocatory composing-stick or feed-bar 50. As the type is forced against the foot-piece 49, the composing-stick or feed-bar 50 yields in the direction of the arrow, Fig. 16, and as soon as the type arrives in alignment with the line-assembling or composing-channel 43, the composing-stick or feed-bar is suddenly forced in the opposite direction by a spring 149, Fig. 11, and thus urges the type into the line-assembling or composing channel, so that the type lies upright against the head 51, of a slide-bar 52, which is adapted to yield as the types accumulate in line. The head 51, of the sliding-bar, serves to retain the blank or quad which first enters the channel or space 43 in an upright position, and consequently all the types which subsequently enter are likewise sustained in upright positions.

When the necessary number of types to constitute a line of the required length have been introduced into the line-assembling or composing-channel 43, and when this line is to be impressed into matrix material, as hereinafter explained, the composing-stick or feed-bar 50 is locked for the purpose of compressing and locking the line of type in the direction of its length. This is accomplished by providing the outer end of the composing-stick or feed-bar with a roller-bearing 52^a, Fig. 11, which, when the line-carrier commences to rotate, as will hereinafter appear, passes into engagement with a stationary incline 53, and thence on to a segmental track 54, Fig. 21, whereby the composing-stick or feed-bar is forced inward and rigidly held during a half revolution of the line-carrier. By this means the line of type, including the whole number representing a line, or part of a line of printed matter, as well as the necessary spaces and characters, is compressed in the direction of the length of the line, so as to force the types closer together and secure uniformity in the length of the successive lines.

The series of types being compressed longitudinally, as stated, it is necessary to clamp the type plates edgewise, in order to place the cameo or male characters in accurate alignment and firmly hold the type in the line-assembling or composing-channel or space 43. To accomplish this I provide a clamp-jaw 55, Fig. 10, secured to a support 56, pivotally mounted on a shaft 57 fixed in the heads 37 and 38. The jaw 55 lies in the open side of the line assembling or composing channel 43, and when the line carrier is in the position shown in Figs. 9 and 10, the jaw 55 lies directly beneath the lower edges of the types as they enter and are moved forward in the line-assembling or composing-channel. The support 56 is sustained in position by a yielding plate 56^a bearing upon a cam 58 which underlies the support and forms a part of, or is rigidly mounted upon a cam-shaft 59, one end of which is extended through the head 37, and is provided with a lever 60, Fig. 9, comprising two arms 60^a and 60^b. The lever-arm 60^a is operated by a projection 61 having a beveled outer end and mounted on a type-aligning drum 62, hereinafter referred to. As the line-carrier rotates, the lever 60 is operated by the projection 61, thereby forcing the cam 58 against the yielding plate 56^a and causing the support 56 to yieldingly force the jaw 55 against the edges of the type-plates. This occurs as the movement of the line-carrier is initiated, and when the jaw 55 is forced against the edges of the type-plates the lever 60 rides off of the projection 61, leaving the cam 58 in such position that the jaw 55 is locked against the types. In the subsequent rotation of the line carrier, the jaw 55 is unlocked to release the edges of the types by the lever-arm 60^b striking a pin or lug 60^c,

Figs. 3 and 9, which is fixed to and projects laterally from a suitable part of the main frame.

The provision of a yielding device, such as a plate 56ª, backed by a rubber or other cushion 56ᵇ, is important, in that it compensates for irregularities, or overthrow of the positively operating parts. For instance, if the throw of the cam 58 were greater than the distance the support 56 could swing when the type are in line in channel 43, the plate 56ª would yield and permit proper locking up without danger of any rigid part breaking or becoming strained or injured.

In order to place the faces of the cameo or male types in the same plane, should one or more project slightly beyond the others, I provide the type-aligning drum 62, Fig. 9, which is carried by a shaft 63 journaled upon the main frame at the front of the machine, said drum being of about half the diameter of the line-carrier. The periphery of the drum is provided with a seat in juxtaposition to the projection 61, in which is seated a metallic bar 64, having a longitudinal groove 65 lying parallel with the axis of the drum. The bar 64 is substantially the same length as channel 43, and the drum is so timed relatively to the line-carrier that the bar 64 will roll upon and abut forcibly against the convex ends of the types, the projecting type characters of the types entering the groove 65, and being free from contact with the base of the groove. The action of the bar 64 against the convex edges of the types, forces back any one or more of the types which project more than others, so that the lugs on the outer ends of the types bear against the rib 55ˣ, Fig. 10. By this means the types are aligned, and the entire series is placed in such condition that a perfect impression can be made by the types in the matrix material, as will hereinafter appear.

I have only explained the construction of one of the line-assembling or composing channels 43, and the elements co-operating therewith, but a similar channel is formed in the opposite side of the line-carrier, and therefore the composing-stick or feed-bar and lock-up devices are duplicated at such side, in order that the second line-assembling or composing channel may be brought into a position to receive types from the chute 35.

The line or series of types being set up, compressed, and accurately aligned, the next step in the order of operation is the formation of a type impression in the soft metal or other material which is to form the solid line of matrices from or by which the cast-bar is produced.

The matrix material is in the form of a rectangular block 66, Fig. 27, of soft metal of suitable thickness, and of a width approximately coextensive with the length of the line-assembling or composing-channels 43. The matrix-block is mounted in a rotatable holder 67, Figs. 9, 18, 19, and 20, which is specially constructed to carry two matrix-blocks which alternately receive the impressions of the lines of types.

The matrix-blocks are each arranged to slide longitudinally in guide-ways 68, and on one surface the block is provided with a rack or series of teeth 69 engaged by the teeth of a pinion 70, mounted on a shaft 71 and having at one end a gear-wheel 72, engaging a pinion 73, on a shaft 74. The shaft 74 is provided with a ratchet-wheel 75, with which engages a pawl 76, acted on by a spring 77, to hold it in engagement with the ratchet-wheel while permitting the latter to rotate in one direction. The pawl 76 is pivotally mounted on a carrier block 78, Fig. 4, adapted to oscillate on the shaft 74, and having at its lower end a recess 79, into which projects the end 80 of an actuating bolt 81, adapted to slide on an osciliatory duplex armed lever 82 which is secured to a shaft 83 Fig. 19, having a cam 84 which is adapted to act upon an elastic or yielding plate 85 Fig. 18, secured to a support 86, which is mounted on a shaft 87 carried by the side pieces of the rotatable matrix-block holder 67. The support 86 is provided with a jaw 88 preferably provided with a serrated face to engage the face 89 of the matrix-block 66, for locking up the matrix-block prior to making the type impression in the outer end thereof.

The provision of a yielding device, such as the elastic plate 85, compensates for overthrow of positively acting parts the same as hereinbefore described with reference to the yielding plate 56ª, Fig. 10.

The lock-up devices for each matrix-block are the same, and therefore a description of one is sufficient for both. The ends 89ª Fig. 18, of the matrix-block holder are formed in the arc of a circle struck from the center of the shaft 90 on which the holder is mounted. The levers 82 Fig. 9 are each formed with a long arm 91 and a short arm 92. As the matrix-block holder rotates, the long arm 91, strikes a stud or roller-bearing 93 Figs. 2 and 9, on a shaft 94, whereby the lever 82 is rocked and the cam-shaft 83 Fig. 18 is turned to cause its cam 84 to press the yielding plate 85 and move the support 86 for causing the jaw 88 to lock up the matrix-block 66 and hold it in a fixed position in the holder 67. The short arm 92 Figs. 2 and 9, of each lever 82, is adapted to strike a shaft 95, and thereby swing the lever 82 in the proper direction to release the support 86, Fig. 18, and unlock the matrix-block 66, so that the latter can be advanced one step by the rack and pinion 69 and 70, as will hereinafter appear.

In my present invention, the outer end of each matrix-block is successively impressed and shaved, so that the matrix-block is provided with a smooth and bright or lustrous impression surface for every type-impression. To accomplish this, the projecting end of the matrix-block is shaved off by a shear-knife 96, Fig. 9, during the rotation of the matrix-

block holder, and before the projecting end of the block has been shaved off, the block is advanced a predetermined distance, or one step, to cause the outer end of the block to project the required distance that it may be shaved off by the shear-knife 96.

The matrix-block holder 67 Fig. 9, is timed to rotate in unison with the line-carrier, and as the greatest diameter of the matrix-block holder is the same as the diameter of the line-carrier, the surfaces 89 of the holder roll against the peripheries of the heads 37 and 38 of the line-carrier. During this movement the male type-characters are driven or forced into the shaved end of the matrix-block 66, thereby forming a series of intaglio impressions or indentations which are the converse of the cameo letters or characters of the types, thus producing a solid line of matrices from which a type-high printing-bar may be cast by the casting mechanism hereinafter described.

The opposite edges of the recesses 79 in each carrier block 78 are separated such a distance that the end of the bolt 81 entering the recess is susceptible of a limited play therein, so that when the lever-arm 92 first strikes the rod 95, the lever 82 and the bolt 81 will be moved or swung a short distance without actually moving the pawl-carrier block 78, whereby the matrix-block is unclamped or unlocked, and then the carrier-block 78 is subsequently moved for causing the pawl 76 to move the ratchet-wheel 75 one step, or a predetermined distance, for the purpose of rotating or turning the pinion 70 and causing it to move the matrix-block outward a distance corresponding to the distance the ratchet-wheel is moved. By this means the matrix-block is fed outward, so that the previously impressed or indented surface will be shaved off by the shear-knife 96, but previous to the shaving of this impressed or indented end of the matrix-block, the lever-arm 91 strikes the stud or roller-bearing 93 and the matrix-block is clamped or locked rigidly in position in the matrix-block holder. After the impressed or indented end of the matrix-block is shaved off to provide a bright or lustrous impression surface, the end of the matrix-block still projects a slight distance, as shown in Fig. 24, for receiving the impression of the line of type assembled in the rotary line-carrier. The ends of the matrix-block holder 67 are provided with projecting lugs 97 which act upon the rotary mold, and cause it to accurately register with the mouth of the casting-pot, as will hereinafter appear.

The rod 95 is suspectible of being shifted lengthwise through the medium of a lever 98, Figs. 2 and 3, so that the inner end of the rod can be moved out of the path of the lever arms 92, of the levers 82, to permit the matrix-block holder to be repeatedly rotated without feeding or shaving the matrix-block. The purpose of this is to produce duplicate castings of the same line of matrices. The same result can also be obtained by providing a device for temporarily holding the pawl out of engagement with the ratchet-wheel 75. Such a device is illustrated in Figs. 19 and 20, and consists of a disk 99, adapted to be rotated through the medium of a finger-piece 100, and having an eccentrically arranged pin 101 which lies under the pawl 76, so that when the finger-piece is turned, the pin 101 will serve to lift the pawl 76 out of engagement with the ratchet-wheel 75. Therefore, the matrix-block holder can be repeatedly rotated without feeding or shaving the end of the matrix-block, and two or more castings from the same line of matrices can thus be obtained if occasion demands. The lever 98 can be locked by a latch 98^a, for the purpose of holding the rod 95 when shifted out of the path of the lever-arms 92 of levers 82.

In Fig. 9 the matrix-block holder is shown in position when a type-high printing-bar is being cast from the impressed face of one of the matrix-blocks. The mold-disk or carrier 102 and the casting-pot 103 are indicated by dotted lines in Fig. 9.

The rolling of the line of cameo or male type characters into the matrix material is very advantageous, but is not claimed in this specification, as it contitutes an element of some of the claims in my application for Letters Patent, Serial No. 488,800, hereinbefore alluded to.

The line-carrier in which the types are assembled and justified, and the matrix-block holder make a half revolution in unison at each action of the machine in casting a printing-bar, and the said carrier and holder are arrested when in the position shown in Fig. 9. While at rest the printing or type-bar is cast, and the line of types by which the line of matrices was produced is returned to and distributed in the type cases or channels of the magazine, and a new line of types is at the same time set up in that one of the line assembling or composing channels 43 opposite that from which the types are being removed. As these operations are all carried on concurrently, I will now describe the means for casting the type-bar or line of characters or words, and then explain the mechanism for accomplishing the other mechanical operations referred to.

The mold-disk 102 Fig. 21, is preferably provided, upon its periphery with four molds 104, of suitable dimensions for the production of the body portion of the type-bars. The mold-disk 102 is attached to a clutch-section 105, Figs. 3 and 29, loosely mounted on and adapted to slide lengthwise of a shaft 106. The shaft 106 is provided with a clutch-section 107 which rotates therewith, and between the clutch-sections 105 and 107 is arranged a coiled or other suitable spring 108. This spring constantly tends to force the clutch-section 105 and the mold-disk or carrier 102 toward the rotatable matrix-block-holder 67. The casting-pot 103 is arranged beneath the

shaft 106, and is pivotally mounted, as at 109, and on the upper end of the pot is an arm 110 having a roller stud 111 entering an annular groove in the clutch-section 105, and susceptible of slight play back and forth between the walls of the groove. The arm 110 rises from that part of the top of the casting-pot which lies nearest the mold-disk or carrier, and upon the opposite side of the top of the said pot are mounted two anti-friction rollers 112, Fig. 1, between which engages a cam-disk 113, secured to a hub which is mounted on the shaft 106, Fig. 3. The cam 113 is so shaped that in its revolution the casting-pot will be vibrated toward and from the mold-disk or carrier. The vibration of the casting-pot operates the clutch-section 105 and causes it to engage or disengage the clutch-section 107, and the shifting movement of the clutch-section 105, causes the mold-disk or carrier 102 to move to or from the projecting smooth face of a matrix-block, so that during the casting of a printing-bar a tight closure is effected between a mold and the impressed or indented end of the matrix-block, while after the printing-bar has been cast, the mold-disk or carrier is moved slightly rearward, so that it can be rotated without obstruction to place another mold in position for casting. When the casting-pot swings in a direction away from the matrix-block holder, or away from the mold-disk or carrier, the clutch-sections engage and the mold-disk or carrier makes a quarter revolution, but the clutch-sections disengage just prior to the completion of this quarter revolution. Therefore it is desirable to positively complete the quarter revolution of the mold disk or carrier, and to stop it at the proper point, so that a mold will register accurately with the mouth of the casting-pot, and with an impressed line of matrices in the matrix-block carried by the matrix-block holder. To accomplish this the lugs 97 Figs. 21, on the matrix-block holder 67 are utilized. Each one of these lugs is adapted to enter a recess 114 at one end of each mold-box, so that as the matrix-block-holder 67 rotates in the direction of the arrow thereupon in Fig. 21, one of the lugs, 97, enters one of the recesses 114 and completes the quarter revolution of the mold-disk or carrier. At the same time the mold-disk or carrier is moved toward the matrix-block-holder 67 by the action of arm 110 on the clutch-section 105, and one of the mold boxes passes beneath a rigid projection 115 Fig. 21, formed on a part of the main frame 1, whereby the mold-disk or carrier is stopped at the proper point for the casting operation and the discharge of a previously cast printing-bar. The rotation of the matrix-block-holder 67 is so timed and the operating mechanism hereinafter explained is such that the holder 67 stops the instant the proper mold registers with the mouth of the casting-pot and with the line of matrices formed in the bright or lustrous shaved end or face of the matrix-block.

The casting-pot, as regards its internal construction, is substantially the same as in my patent and in my application, Serial No. 488,800, before mentioned.

The piston-rod, 116 Figs. 1 and 30, is pivotally connected, at its upper end, to a lever-arm, 117, pivotally mounted on a rigid bracket 118, extending from an upright shaft 119 fixed to the top of the casting-pot. The shaft 119 may be solid or tubular, and is provided at its upper end with a screw-threaded portion 120, on which is adjustably mounted a collar 121 having an arm 122, constructed with a lug which enters the upper end of a coiled spring 123. The lower end of the spring bears against the lever 117 to depress the latter and thus depress the piston in the casting-pot. The object of the adjustable collar 121 is to vary or regulate the tension of the spring according to the conditions required in the operation of the piston of the casting-pot. The lever-arm 117 is adapted to be raised at proper intervals by a lifter or cam 125 which is keyed or otherwise secured to the shaft 106 so as to rotate therewith.

The casting-pot is supplied with heat by any suitable means, and is formed with an exit-channel or mouth 126, Fig. 25, through which the molten metal flows under the pressure of the piston in the usual manner. The exit-channel or mouth 126, communicates with the mouth of any one of the molds 104 when such mold is in the proper position for casting a printing-bar. While the casting mechanism is acting to cast a printing-bar, the line of types from which the preceding printing-bar has been cast is being removed from one of the channels 43 in the line-carrier, and returned to the type-cases or channels of the magazine. For this purpose the head 38, Fig. 11, is provided with curved exit-channels or chutes 127 the same as the inlet-channels or chutes 36, Figs. 9, 10, and 11. The exit-channels or chutes 127 are the same as the corresponding channels or chutes in the line-carrier described and shown in my application for patent hereinbefore referred to, and such channels, or chutes 127, alternate in their arrangement with the channels or chutes 36, so that the types can be successively received by a channel 127 and carried upward therethrough by a pin-wheel 128, into engagement with the spiral-lift or screw 129. The first type which enters the channel 43 in the line-carrier will lie, when the series is complete, in that end of the exit-channel 127, which coincides with the left hand end of the channel 43, and for this reason it is desirable that the first plate introduced be a quad, or a mere blank, or a spacer.

In the upper part of the main frame is journaled a shaft 130, Fig. 1, on which is keyed a sleeve 129^a, Fig. 17, adapted to slide along but rotate with the shaft. The sleeve carries a disk or pin-wheel 128, rotatable in a plane parallel with the plane of rotation of the line-carrier, as shown in Fig. 9. A spring 139,

Fig. 17, coiled on the shaft, acts to press the pin-wheel against the head 38 of the line-carrier, and from the face of the pin-wheel project two annular rows of pins 132 and 133, for a purpose hereinafter explained. The pin-wheel 128 rotates continuously, and the pins 133 sweep through one of the exit-channels or chutes 127, and successively move the types therethrough into engagement with the lower end of the spiral-lift or screw 129. The pins 133 are arranged at regular intervals, and they engage the types successively, force them upward through one of the exit-channels or chutes 127, and into the lower end of a distributing chute 134, Fig. 31, where the lugs or shoulders of the types engage with the rotating spiral-lift or screw 129. The spiral-lift or screw is journaled at its lower end in a bracket 135, Fig. 2, and at its upper end, in a fixed block 136, Fig. 4, forming a stationary part of the main frame.

As before stated, the composing-stick or feed-block 50, Fig. 11, is forced inward to compress the line of assembled types by the incline 53, Fig. 21, and is held in this position during a partial rotation of the line-carrier by engagement with the segmental track 54. At the end of the partial rotation of the line-carrier, after the line of type has impressed the bright or lustrous impression face of the matrix-block, and when the line-carrier is in the position indicated in Fig. 9, the composing-stick or feed-block is automatically forced lengthwise so as to move the line of type one step every time one of the types enters an exit-channel or chute 127, whereby the entire line of types can be discharged from the line-assembling or composing space 43. The lengthwise movement of the composing-stick or feed-bar is effected through the medium of a vibratory arm 137, Figs. 1 and 3, secured intermediate its extremities in a rotatable post 138. The front end of the arm 137 is provided with a stud or roller-bearing 139^a, and the rear end is secured to a laterally projecting arm or rod 140, adapted to be acted upon by a face-cam 141, secured to a transverse-shaft 142, which is driven as will hereinafter appear. The face-cam 141 is so constructed that the arm 140 can lie down in a recessed portion thereof, as shown in Fig. 3, into which position it is forced by the action of a spiral or other suitable spring 143 mounted on the rotatable post 138, and acting against the arm 137 with a tendency to force the front roller-carrying end of the arm 137 to the left, Fig. 3, and the rear end of the arm, which carries the arm or rod 140, to the right, Fig. 3 The parts are so timed that when the line-carrier rotates to impress the matrix-block and place the assembled line of types in position for distribution, the stud or roller-bearing 139^a will bear against a laterally projecting pin 144 Fig. 13, on the outer end of the composing-stick or feed-bar 50.

In Fig. 3 the arm 137, and the composing-stick or feed-bar 50, are shown in the position they occupy when all the types have been removed from the line-assembling or composing-chamber. In the operation of the parts, when the stud or roller-bearing 139^a first engages the pin 144 of the composing-stick or feed-bar, the spring 143 forces the rear end of arm 137 to the right, Fig. 3, and the front end to the left, and as the types are successively removed by the pins 133 of the pin-wheel 128, the composing-stick or feed-bar is moved step by step to the left, Fig. 3, by the action of spring 143 and arm 137, so that as each type is removed by the pin-wheel, the remaining portion of the line of type is bodily shifted to place another type in coincidence with the exit-channel or chute 127. When the full line of type is assembled in the assembling or composing chamber of the line-carrier, the head 51 of the feed-bar 50 will lie at such distance toward the left, Fig. 11, past the exit-channel or chute 127, that the types can be successively removed by the pin-wheel without interference from the head 51. As before stated, in assembling a line I prefer to first introduce a blank or quad, because when the full line is assembled, such blank or quad will register with the channel or chute 127 and serve to prevent a type proper from being pushed back into the channel or chute until the proper time arrives. When all the types are removed from the line-assembling or composing-channel in the manner described, and this channel is to be placed in position for the assemblage of another line of type, it is necessary to restore the composing block or feed-bar to its normal position, Fig. 11, so that its inner end is adapted to receive the types as in Fig. 16. When the arm 137 is in the position shown in Fig. 3, it is restored to normal position by face-cam 141, acting on the rear end of the arm, which causes the front end to swing to the right, thus placing spring 143 under increased tension to again move the composing-stick or feed-bar to the left, the same as before. The composing-stick or feed-bar is restored to normal position during the rotation of the line-carrier through the medium of an inclined track or cam 145, Figs. 3 and 11, which at its front extremity is formed with a beveled portion 146, and an opening 147. The normal position of the composing-stick or feed-bar is shown in Fig. 11, in which the pin 144 lies against the beveled portion 146, while the roller 52^a which may be mounted on the pin 144, bears against a suitable leaf or other spring 149, the arrangement being such that, although the pin 144 is adapted to bear against the beveled portion 146, the composing-stick or feed-bar can yield outwardly or to the right, Figs. 11 and 16, for the entrance of a type under pressure exerted by the pins 46 of the transfer-wheel 47.

In assembling a series of type in the assembling or composing-channel or space 43, the types are rapidly introduced, and therefore a rapid reciprocating motion is imparted to the composing-stick or feed-bar, it being moved

outward or to the right, Figs. 11 and 16, by the pressure of the incoming type, and inward, or to the left, by the action of the spring 149, the inward motion being limited by the pin 144 striking the beveled portion 146 of the inclined track or cam 145.

When a line of type has been assembled in a line-assembling or composing-space or channel 43, the head 51 of the slide 52, will lie at or near that end of the line-assembling or composing-channel or space nearest the exit-channel or chute 127, Fig. 11. When the composing-stick or feed-bar is restored to its normal position, Fig. 11, it is necessary to restore the slide 52 to its normal position, so that the head of the slide will lie near the head 49 of the composing-stick or feed-bar and be in the proper position to support the first type of the line. To accomplish this, the outer end of the slide 52 is provided with a recess or notch 150, adapted to be engaged by a pawl 151 pivoted to the composing-stick or feed-block 50, at 152, Fig. 14. The tail end of the pawl is acted on by a suitable spring 153, which tends to throw the acting end of the pawl into engagement with the notch or recess 150. The angular portion 41, which constitutes the top or rear wall of a line-assembling or composing space 43 is extended to the right, as shown in Fig. 11, and the outer end of such extension is provided with a beveled projection 154, Fig. 14, which, when the composing-stick or feed-bar is moved to the limit of its outward motion, or to the right, acts upon the pawl 151 and disengages it from the notch or recess 150, thereby leaving the slide 52 free to be moved inward step by step as the types are successively introduced. When the line of types has been assembled, and the line-carrier has been rotated to impress the bright or lustrous face of the matrix-block, and the parts are in position to distribute the said line of types, the operation hereinbefore described, with reference to moving the composing-stick or feed-bar inwardly, or to the left, Fig. 11, takes place, and, therefore, when all the types have been pushed out of the line-assembling or composing-channel or space by the action of the composing-stick or feed-bar, the pawl 151 will have moved into the position required to engage the notch or recess 150. When this occurs it will be obvious that the outward movement of the composing-stick or feed-block, to restore it to its normal position, Figs. 11 and 16, will automatically move the slide 52 outward to its normal position, and when the parts are in the proper position, and the outer beveled end of the pawl 151 is acted upon by the beveled projection 154, the pawl is freed from engagement with the notch or recess 150, and the slide can then be moved inward step by step, as before explained.

I will here explain that in my former application, Serial No. 488,800, I employ a single annular row of pins corresponding to the pins 133 Fig. 9, of the pin-wheel 128, but in the present case I employ two annular rows, 132 and 133, so that the pins 132 can be used as stop-pins, to prevent the pin-wheel 128 from being moved inwardly at an improper time to place the pins 133 in one of the exit-channels or chutes 127 for sweeping the types therethrough to the distributing mechanism.

I will first premise by stating that when the line-carrier is to be rotated, it is necessary to remove the pins 133 laterally from an exit-channel or chute 127, and to accomplish this I provide a lever 155, Fig. 17, pivoted intermediate its ends, as at 156, and having one end adapted to be acted on by a cam 157, while the other end is adapted to act upon the hub of the pin-wheel 128, or a part of the sleeve 129^a, to push the sleeve in the direction of the arrow, Fig. 17, and thus shift the pin-wheel laterally the distance required to move the pins 133 out of the exit-channel or chute 127, whereupon the line-carrier can be rotated without obstruction. When the line-carrier has been rotated the desired extent, and the pins 133 are to be again moved into the exit-channel or chute 127, it is possible that one or more pins would enter this channel or chute at the improper time or point and prevent the proper engagement of a pin 133 with the end portion of one of the types. The pin-wheel is shifted back and forth at regular and uniform intervals, and, therefore, it is desirable, to prevent restoration of the pin-wheel into position to discharge the types from the line-assembling or composing-channel or space until the first pin of the pin-wheel to act on a type is in the proper position, so that only one type can be between two pins, as otherwise the acting pin might strike the body of a type and by friction push out the type improperly, in consequence of which the spiral-lift or screw would not properly take or receive such type. To avoid this I provide the annular row of pins 132, Fig. 9, each of which is arranged directly opposite one of the pins 133, and is adapted to operate in connection with an irregularly shaped plate or latch 155^a, pivoted, as at 156^a, to a suitable supporting plate 157^a. The pin-wheel rotates continuously and its restoration after lateral shifting should take place when a pin 133 is in correct position to strike one end of a type. The acting-pin will be in correct position if the pin-wheel is restored when such pin lies anywhere between the lower end of plate or latch 155^a and the periphery of the line-carrier. Therefore, the pin-wheel should be prevented from restoration to normal position until the pin 133 to act on a type is in the correct position referred to. If the pin 133, which is to act on the type, is in correct position, and the pin-wheel has been restored, the pins 132, act upon and lift the plate or latch 155^a out of its path. While the pin-wheel is shifted laterally it cannot be restored so long as any one of the pins 132 lies opposite the plate or latch 155^a, because the pin 132 will bear against and move

along the outer flat face of the plate or latch; but the instant the pin 132 rides off the plate or latch, the pin 133 to act on a type, will be in correct position and the pin-wheel is instantly restored by spring 139, Fig. 17, so that the pin can act properly on the end of the type. If the restoration of the pin-wheel could occur at any time after being free from restraint of lever 155 and cam 157, a pin might strike the body of a type at a point between its ends and the friction would drag or shift the type, so that it would not lie in proper position for correct working of the pins 133 of the pin-wheel. The same result can be obtained if the plate or latch is arranged to operate in connection with the pins 133, thus dispensing with the pins 132, but I prefer to use two annular rows of pins, because this enables one row to act directly on the types and the other row to act in combination with the plate or latch, thus saving the pins 133 from the friction and wear incident to acting on the plate or latch.

It is desirable to lock the line-carrier in a fixed position during the time that a line of type is being assembled and another line is being distributed, and to accomplish this I mount upon parts of the main frame 1, Fig. 17, in suitable juxtaposition to the line-carrier, a lengthwise movable locking-bolt 159ª, adapted to slide at one end in a socket 160ª in the main frame, and provided with a laterally projecting lug or arm 161ª. The locking-bolt is acted upon by a suitable spring 162ª which tends to force the bolt in a direction opposite to the arrow thereupon, Fig. 17, so that when the bolt is free from direct pressure of a cam 163ª, the lug or arm 161ª will be forced into engagement with a locking notch 164ª formed in the head 38 of the line-carrier. At the time that the line-carrier is to be rotated, the cam 163ª acts upon the end of the bolt 159ª and forces it in the direction of the arrow, and thereby removes the arm or lug 161ª from engagement with the locking-notch or recess 164ª, whereupon the line-carrier is free to be rotated. The head 38 is provided with two of the locking-notches 164ª located diametrically opposite each other, so that each time the line-carrier makes a half revolution it will be locked stationary by the arm or lug 161ª engaging a locking-notch.

The cams 157 and 163ª are fixed to a countershaft 159, Figs. 17 and 22, which shaft is provided with a bevel-gear 160, a large spur-gear 161, and a bevel-gear 162. The gear 160 is at the rear end of the countershaft and engages a bevel-gear 163, Fig. 3, on the transverse shaft 142. The bevel-gear 162 is at the front end of said countershaft and engages a small bevel-gear or pinion 164 on the shaft 63 of the aligning drum 62. In suitable bearings above the countershaft 159 is mounted a short shaft 165, having at its inner end a small pinion 166 driven by engagement with the large spur-gear 161. The shaft 165 carries between its ends a grooved pulley 167, and on the front end of this shaft is secured a bevel-gear 168, engaging a small pinion 169 on the lower end of a vertical shaft or spindle 170, Fig. 2. The upper end of this vertical shaft or spindle is provided with a small pinion 171, meshing into a larger pinion 172, rigidly attached to the rotary table or wheel 34, Fig. 4, on which the types are delivered when they are released by the escapement mechanisms from the type cases or channels of the magazine.

The end of the shaft 63, Fig. 3, opposite the bevel-gear or pinion 164, is provided with a gear-wheel 173, meshing into a large spur-gear 175, which in turn engages a similar large spur-gear 174, Fig. 2. The spur-gear 174 is mounted on the shaft 90 of the matrix-block holder 67, while the large spur-gear 175 is mounted on the shaft 40 of the line carrier.

The main power-shaft 4, Fig. 3, is provided with a pinion 176, Fig. 2, which engages the large spur-gear 161 on the countershaft 159, and transmits continuous motion thereto so long as the power-shaft is driven.

The bevel-gear 162 is a mutilated gear, whereby the pinion 164 is only rotated intermittently, and consequently the matrix-block-holder and the line-carrier are given a half revolution in unison, and then stop while the bevel-gear 162 may make a complete revolution.

The shaft 142 Fig. 3, is rotated by the engagement of its bevel-gear 163 with the bevel-gear 160 on the countershaft 159. On the shaft 142 is secured a bevel-gear 177 engaging a bevel-gear 178 on the shaft 106, whereby rotary motion is imparted to the clutch-section 107 and lifter or cam 125.

The oscillatory hooks 31, Fig. 4, which constitute a part of the type-distributing mechanism and hereinbefore briefly referred to, are supported by a rotary disk or carrier 179, the hub of which is mounted on the cylindrical column or shaft 28, and is provided with a worm 180 with which engages a worm-shaft 181, mounted in suitable bearings, as at 181ª, and provided with a bevel-gear 182, which engages a bevel-gear 183, on the upper end 184 of the rotary spiral-lift or screw 129. The lower end of the spiral-lift or screw is provided with a pinion 185, Fig. 3, meshing into a pinion 186 of greater diameter. These two pinions are arranged in a suitable housing 187, Figs. 1 and 3, and the lower side of the pinion 186, Fig. 1, is provided with a bevel-pinion 188, engaging a bevel-pinion 189, on a short shaft which has at its opposite end a bevel-pinion 190, engaging a bevel-gear wheel 191 on the shaft 130 of the pin-wheel 132.

The worm-shaft 181, Fig. 4, is provided at its end opposite the bevel-gear 182, with a grooved-pulley 192, over which passes an endless belt 193, which belt passes around a guide-pulley 194, and around the grooved-pulley 167, whereby the grooved-pulley 167, which is driven by the shaft 165, imparts motion to the belt 193, and this in turn transmits motion

to the worm-shaft 181, for rotating the carrier 179 and the spiral-lift or screw 129. The spiral-lift or screw, through the medium of the pinions 185, 186, and 188, and bevel-gears 190 and 191, imparts rotary motion to the pin-wheel 132. If any obstruction occurs in the distribution of the types, the screw can be held by the hand, the belt 193 will slip, and the rotation of the carrier 179, Fig. 4, is stopped. The grooved-pulley 194, Fig. 2, is provided at one side with a pulley 195, of smaller diameter, over which passes a belt 196. This belt is crossed and extends over suitable guides and around the grooved-pulley 197, fixed to a sleeve 198, Figs. 3 and 9, on the shaft 40 of the line-carrier. The sleeve 198 is provided with a spur-gear 199, Fig. 9, engaging small pinions 200, each of which meshes into the teeth of one of the transfer-wheels 47, whereby a continuous rotary motion is imparted to the said transfer-wheels.

It will be obvious that through the medium of the sleeve 198, and the belt mechanism above explained, the spur-gear 191, pinions 200, and transfer-wheel 47 can be rotated while the line-carrier remains stationary.

The cast printing-bar is ejected from the mold while the latter stands stationary in the position indicated in Figs. 3 and 21, through the medium of an ejector 201, Fig. 1, movable back and forth in a guide 202, and actuated by a pitman 203, connected with a wrist-pin 204 on a disk 205 secured to the shaft 142. The printing-bar as it passes from the front side of the mold is trimmed at its sides by the usual knives 206, and descends through the chute 207 to the left hand end of the galley 208, where it is acted on by the lower end of a vibrating arm 209, Fig. 2, pivoted to a support 210, and having at its upper end an anti-friction roller 211 operated on at proper intervals by cams or inclines 212, Fig. 1, fixed to the upper surface of the large spur-gear 174. The vibrations of the arm 209 are so timed that the printing-bars delivered to the left hand of the galley are successively pushed along the same toward the right hand end thereof.

In the operation of the machine, the carrier 179 of the distributing mechanism, the table or wheel 34, the spiral-lift 129, the pin-wheel 128, and the transfer-wheels 47, are designed to run continuously while the power shaft is rotating; but the line-carrier, the matrix-block-holder 67, the type-aligning drum 62, and the casting mechanism can be operated at intervals, as required, by the operator actuating a lever 213, Fig. 1, pivoted at 214 to a fixed part of the main frame, and pivotally connected at 215 to the lower end of a link 216, which, at its upper end is pivoted, as at 216ª, Fig. 22, to a block or plate 217. This block or plate is pivoted at one end, as at 218, and near its pivoted end it is provided with an arm, or fork 219, engaging an annular groove 220, in a clutch-section 221, adapted to slidably engage a recess in a hub 222, rigidly secured to the large spur-gear 161. The clutch-section 221, rotates constantly with the large spur-gear 161, and in order to transmit rotary motion to the countershaft 159, the clutch-section 221 is adapted to be thrown into connection with a clutch-section 223 which is fixed to the countershaft. The clutch-section 223 is in the form of a disk, and at a suitable point in its periphery it is formed with a recess 224, adapted to receive a stud or roller-bearing 225, mounted on the block 217. When the operator presses or pulls down upon the lever 213, the stud or roller-bearing 225, is moved out of engagement with the notch or recess 224, and the arm 219 shifts the clutch-section 221 into engagement with the clutch-section 223, whereupon rotary motion is imparted to the countershaft 159. During the rotation of the clutch-section 223, its periphery bears upon the stud or roller-bearing 225, and thereby holds the clutch-section 221 in engagement with the clutch-section 223, until the latter makes one revolution, or until the notch or recess 224, coincides with the stud or roller-bearing 225, whereupon the latter enters the notch or recess, and, the operator having released the lever 213, a spring 226, Fig. 1, pulls the lever 213 upward and thereby shifts the clutch-sections out of engagement with each other, and causes the stud or roller-bearing 225 to enter the notch or recess 224, to instantly stop the rotation of the countershaft 159. The spring 226, is fastened at its lower end to the lever 213, and at its upper end to a suitable part of the main frame. By the means described the operator can at any time impart a half revolution to the line-carrier, the matrix-block holder, and cause the casting pot to tilt and the mold-disk or carrier to shift forward.

In Fig. 21 I have illustrated brushes 227, immovably mounted on the mold-disk or carrier 102 between the mold-boxes 104, for the purpose of wiping off the cutting edges of the knives 206, Fig. 1, to keep the same clean, so that they will perfectly trim the sides of the cast printing-bars as they are ejected from the mold.

To practicably eject or remove the cast-type bar from the mold, the rear edge of the type-bar, which is usually formed with fins or "whiskers" in the casting operation, should be dressed or trimmed, as otherwise the type-bar cannot be ejected. This dressing or trimming can be effected as the mold-disk or carrier rotates, through the medium of a dressing or trimming knife, substantially as in my patent hereinbefore referred to.

In the drawings the various fixed or stationary parts comprising the main frame are all indicated by the numeral 1 and, although a specific form of frame has been illustrated in the drawings, it should be clearly understood that the construction of the main frame may be variously modified to suit the conditions required.

In the operation of the machine, to produce

type-high printing-bars, the operator manipulates the keys and selects the proper types from the type cases or channels of the magazine. The selected types being released by the escapement mechanisms descend and fall in an approximately horizontal plane on the rapidly rotating table or wheel 34, and are delivered by a swift movement through the chute 35, which abruptly curves downward. The chute successively delivers the types to one of the inlet-channels or chutes 36 in the head 37, of the line-carrier, and as each type strikes the yielding dog 44, Fig. 15, its velocity is arrested. The pins 46 of a transfer-wheel 47 operate upon the shoulders or lugs at the ends of the types and force the types past the yielding dog and against the curved head 49 of the composing-stick or feed-bar 50, which yields in the direction of the arrow, Fig. 16. The type is advanced by the transfer-wheel 47, until it registers with the right hand end of one of the line-assembling or composing-channels or spaces 43, whereupon the composing-stick or feed bar, under the impulse of the spring 149, pushes the type into the channel or space 43 against the head 51 of the slide 52.

In Fig. 11 I have indicated, by dotted lines, a partial line of types assembled in one of the line-assembling or composing spaces 43. When the desired number of types have been assembled in line, the operator depresses the lever 213, and instantly the line-carrier and matrix-block-holder commence to turn or rotate, thus moving the pin 144, Fig. 11, of the composing stick or feed-bar away from the inclined portion 146 into coincidence with the opening 147, so that the stud or roller-bearing 52, can strike the incline 53, which moves the composing stick or feed-bar inward to compress the line of type in the direction of its length. The stud or roller-bearing then rides upon the track 54, and the composing-stick or feed-bar is locked during a partial revolution of the line-carrier. As the line-carrier rotates the matrix-block-holder also rotates, and the projecting end of the matrix-block is shaved off to provide a bright or lustrous impression surface. The line of type is rolled into this bright or lustrous surface, and then the line-carrier stops in position for the distribution of the types. When the casting mechanism comes into operation the mold-disk or carrier is moved up against one end of the matrix-block-holder which has come to rest, the casting-pot tilts forward, and the type metal is injected into the mold. During this time another line of types is being assembled in a line assembling channel or space in the line-carrier. When a printing-bar has been cast and the line of types has been removed from the line-assembling or composing-space 43, a repetition of the above mentioned operation takes place.

The line-assembling or composing channels or spaces and the matrix-blocks, and lock-up mechanisms therefor, are duplicated, in order to render the machine very swift and effective in operation. The action of the duplicate parts is the same in all respects.

The shear-knife 96, which shaves the ends of the matrix-blocks, has its body portion formed in the arc of a circle struck from the center of the shaft 90, and this shear-knife is mounted on a suitable block or support 228, Fig. 9, which is secured to some part of the main frame, as in Fig. 2.

While the line-carrier is at rest, and the line of types is being set up in one of the line-assembling or composing channels or spaces 43, the line of type in the other line-assembling or composing channel or space is being removed by the action of the composing-stick or feed-bar and the pin-wheel as hereinbefore explained.

The types are successively elevated by the spiral-lift or screw and delivered to the oscillatory hooks 31^a which carry the types in a circular path, and through the medium of the permutation-bar 30 release the types at the proper points and thus assort them in the type-cases or channels. Inasmuch as I do not, in this application, confine myself to any special distributing mechanism, and as the mechanism illustrated constitutes the subject-matter of my application, Serial No. 522,489, I do not deem it necessary to more fully explain the specific devices for distributing the types.

It will he seen from the foregoing that my invention involves a new method of producing matrices in soft metal or other material, in that I shave the matrix material to provide a smooth and bright or lustrous impression surface into which the type characters are impressed. By this means I produce, in this class of machines, type-high printing-bars bearing characters which possess all requisite sharp angles and prominence necessary for the high perfection required in the art of printing. If type impressions are made in ordinary lead or other soft metal-bars, the matrix-characters are dim and rough, because the impression surface is dim and rough. By shaving the matrix material a polished or bright or lustrous impression surface is produced, and the desired result is attained, and perfect matrices are the result.

I do not herein claim the article consisting of matrix material having a shaved impression surface for receiving impressions of type characters; nor do I herein broadly claim the method of preparing matrix material by shaving the same to form a fresh smooth impression surface for receiving the impression of a line of types, as such features are claimed in my application for Letters Patent filed December 28, 1894, Serial No. 533,190, the last mentioned application being a division of the present case. The present application is confined to producing lines of matrices by alternately shaving and impressing or indenting a block of matrix material, and to improve-

ments in the machine and mechanical devices for alternately shaving and impressing or indenting a block of matrix material.

Having thus described my invention, what I claim is—

1. The method herein described of producing lines of matrices for cast printing-bars, which consists in alternately shaving a block of matrix material and impressing type characters into the shaved surface, substantially as set forth.

2. The combination of a matrix holder, and means for impressing a line of assembled type-characters into the matrix material, with a shaving knife for shaving the matrix material to form a smooth impression surface, substantially as described.

3. The combination of a matrix block holder, means for advancing the matrix block, lock-up devices for holding the matrix-block stationary on the holder, means for operating the lock-up devices, and a knife for shaving the matrix block to form a smooth impression surface, substantially as described.

4. The combination of a matrix-block holder, a lock-up jaw for the matrix-block, means for operating the lock-up jaw, means for intermittently advancing the matrix-block, and a knife for intermittently shaving the outer end of the matrix-block, substantially as described.

5. The combination of a matrix-block holder, a lock-up jaw for the matrix-block, a cam for operating the lock-up jaw, means for actuating the cam, mechanism for advancing the matrix-block at intervals, and means for providing the outer end of the matrix-block with a smooth impression surface, substantially as described.

6. The combination of a rotary matrix-block holder, with mechanisms mounted on the holder and operating to lock-up and release the matrix-block and intermittently advance the same, and a knife for shaving the outer end of the matrix-block to form a smooth impression surface, substantially as described.

7. The combination of a rotary matrix-block holder, a lock-up jaw mounted on the holder, devices for operating the lock-up jaw to lock and release the matrix-block, gearing for intermittently advancing the matrix-block, and means for shaving the outer end of the matrix-block at intervals, substantially as described.

8. The combination of a matrix-block-holder, a matrix-block having teeth, gear mechanism for intermittently advancing the matrix-block on the holder, lock-up devices for locking and releasing the matrix-block, and means for operating the lock-up devices, substantially as described.

9. The combination of a rotary matrix-block holder, a lock-up jaw for locking and releasing the matrix-block, cam mechanism for operating the lock-up jaw, a pinion adapted to advance the matrix-block, mechanism for intermittently rotating the pinion, and a knife for shaving the outer end of the matrix-block, substantially as described.

10. The combination of a rotary matrix-block holder, a lock-up jaw for locking and releasing the matrix-block, a cam for operating the lock-up jaw, a pinion for advancing the matrix-block, a pawl and ratchet mechanism for intermittently rotating the pinion, means for operating the pawl to rotate the ratchet-wheel, and a knife for shaving the outer end of the matrix-block, substantially as described.

11. The combination of a matrix-block holder, a lock-up jaw for locking and releasing the matrix-block, means for operating the lock-up jaw, a pinion for advancing the matrix-block, pawl and ratchet mechanism for intermittently rotating the pinion, a carrier-block on which the pawl is mounted, and means for oscillating the carrier-block, substantially as described.

12. The combination of a rotary matrix-block holder, lock-up devices for holding and releasing a matrix-block mounted on the holder, means for advancing the matrix-block on the holder, a knife for shaving the outer end of the matrix-block, and a rotatable line-carrier adapted to carry a line of cameo type which is rolled against the shaved face of the matrix-block to impress the letters or characters of the type thereinto and form a line of matrices, substantially as described.

13. The combination of a rotary matrix-block holder, lock-up devices for holding and releasing a matrix-block mounted on the holder, means for intermittently advancing the matrix-block, means for shaving the outer end of the matrix-block, a rotatable line-carrier adapted to carry a line of cameo type which is rolled against the shaved face of the matrix-block to impress the letters or characters of the type thereinto and form a line of matrices, and casting mechanism arranged in operative connection with the matrix-block holder for casting a type-bar from or by said line of matrices, substantially as described.

14. The combination of a matrix-block holder, lock-up devices for holding and releasing a matrix-block mounted on the holder, mechanism for advancing the matrix-block at intervals on the holder, means for operating the lock-up devices, a knife for shaving the outer end of the matrix-block, and a line-carrier adapted to carry a line of cameo type which is impressed into the shaved face of the matrix-block to form a line of matrices, substantially as described.

15. The combination of a matrix-block-holder, lock-up devices for holding and releasing a matrix-block mounted on the holder, mechanism for advancing the matrix-block at intervals on the holder, means for operating the lock-up devices, a knife for shaving the outer end of the matrix-block, a line-carrier adapted to carry a line of cameo type which is impressed into the shaved face of the matrix-block to form a line of matrices, and casting mechanism arranged in operative relation to

the matrix-block holder for casting a type-bar from or by the said line of matrices, substantially as described.

16. The combination of a rotary matrix-block-holder, lock-up devices for a matrix-block mounted on the holder, means for operating the lock-up devices, mechanism for intermittently advancing the matrix-block, means for shaving the projecting end of the matrix-block at intervals, a rotary line-carrier adapted to carry a line of cameo type, and means for assembling the type in the line-carrier, substantially as described.

17. The combination of a matrix-block-holder provided with lock-up devices and means for advancing the matrix-block at intervals, a shear-knife for shaving the outer end of the matrix-block at intervals, a line-carrier adapted to carry a line of type, and means for assembling the type in the line-carrier, substantially as described.

18. The combination of a matrix-block-holder provided with lock-up devices, means for advancing the matrix-block at intervals, a shear-knife for shaving the outer end of the matrix-block at intervals, a line-carrier adapted to carry a line of type, means for assembling the type in the line-carrier, and casting-mechanism arranged in operative connection with the matrix-block-holder for casting a type-bar from or by a line of matrices impressed into the shaved face of the matrix-block, substantially as described.

19. The combination of a matrix-block-holder, lock-up devices for holding and releasing a matrix-block mounted on the holder, means for operating the lock-up devices, mechanism for intermittently feeding the matrix-block, means for shaving the outer end of the matrix-block, a line-carrier, mechanism for assembling type in the line-carrier, and casting-mechanism for casting a type-bar from or by a line of matrices impressed into the shaved face of the matrix-block, substantially as described.

20. The combination with a line-carrier having a line-assembling or composing channel or space, mechanism for assembling a line of type in said channel or space, a matrix-block holder, lock-up devices for a matrix-block mounted on the holder, means for operating the lock-up devices for locking and releasing the matrix-block, means for intermittently advancing the matrix-block, a knife for shaving the outer end of the matrix-block, and mechanism for removing the types from said channel or space after an impression has been made in the shaved portion of the matrix-block, substantially as described.

21. The combination of a rotary line-carrier having a line-assembling or composing channel or space, mechanism for assembling a line of types in said channel or space, a rotary matrix-block-holder, lock-up devices for a matrix block mounted on the holder, means for operating the lock-up devices to lock and release the matrix-block, mechanism for advancing the matrix-block at intervals, a knife for shaving the outer end of the matrix-block at intervals, means for rotating the line-carrier and matrix-block holder in unison to impress the line of type into the shaved face of the matrix-block, and mechanism for removing the types from the said channel or space after an impression has been made, substantially as described.

22. The combination of a rotary line-carrier having a line-assembling or composing channel or space, mechanism for assembing a line of types in said channel or space, a rotary matrix block-holder, lock-up devices for a matrix-block mounted on the holder, means for operating the lock-up devices to lock and release the matrix-block, mechanism for advancing the matrix-block at intervals, a knife for shaving the outer end of the matrix-block at intervals, means for rotating the line-carrier and matrix-block-holder in unison to impress the line of type into the shaved face of the matrix-block, mechanism for removing the types from the said channel or space after an impression has been made, and casting mechanism for casting a printing-bar from or by the line of matrices impressed into the shaved portion of the matrix-block, substantially as described.

23. The combination of a line-carrier having a line-assembling or composing channel or space, means for delivering types to one end of said channel or space, a yielding composing stick or feed-bar operating to successively push the types into said channel or space, means for forcing the composing-stick or feed-bar in the direction of its length to compress the line of type lengthwise, and means for temporarily locking the composing-stick or feed-bar, and subsequently automatically restoring it to its normal position, substantially as described.

24. The combination of a rotary line-carrier having a line-assembling channel or space, means for delivering types to one end of said channel or space, a yielding composing stick or feed-bar adapted to successively push the types into the channel or space, means for forcing the composing-stick or feed-bar in the direction of its length to compress the line of types lengthwise, and means for locking the composing stick or feed-bar during a partial rotation of the line-carrier, substantially as described.

25. The combination with a rotary line-carrier having a line-assembling channel or space, and means for delivering types to one end of said channel or space, of a yielding composing-stick or feed-bar adapted to successively push the types into the channel or space, means for forcing the composing-stick or feed-bar lengthwise to compress the line of types, means for locking the composing-stick or feed-bar during a partial rotation of the line-carrier, means for impressing the line of type into matrix material as the line-carrier rotates, and mechanism for assembling the

types from said channel or space after the impression has been made, substantially as described.

26. The combination of a line-carrier, a yielding composing-stick or feed-bar, a spring acting upon the composing-stick or feed-bar, a pin and incline for retaining the composing-stick or feed-bar under limited restraint, means for delivering types and forcing the same against the inner end of the composing-stick or feed-bar, means for forcing the composing-stick or feed-bar lengthwise to compress the line of types, and means for locking the composing-stick or feed-bar while an impression is made in the matrix material, substantially as described.

27. The combination with a rotary line-carrier having an inlet channel, and a type-assembling or composing channel or space, and means for delivering types to the inlet channel, of a rotary transfer-wheel for forcing the types successively into alignment with one end of the line-assembling or composing channel or space, a device for successively pushing the types into the line-assembling or composing channel or space, and means for impressing the line of types into matrix material, substantially as described.

28. The combination with a rotary line-carrier having an inlet channel, and a line-assembling or composing channel or space, and means for delivering types to the inlet channel, of a rotary transfer-wheel for forcing the types successively into alignment with the line-assembling or composing channel or space, a composing-stick or feed-bar for pushing the types successively into the line-assembling or composing channel or space, means for forcing the composing-stick or feed-bar lengthwise and locking it during a partial rotation of the line-carrier, and means for impressing the line of types into matrix material, substantially as described.

29. The combination with a line-carrier, of a reciprocating composing-stick or feed-bar adapted to push types into the line-assembling or composing channel or space, a slide-bar adapted to slide on the composing-stick or feed-bar and having a head for retaining the first type upright, and means for connecting the slide-bar with and disconnecting it from the composing-stick or feed-bar, substantially as described.

30. The combination with a line-carrier, of a reciprocating composing-stick or feed-bar 50, a slide-bar 52 having a head 51 and slidable on the composing-stick or feed-bar, a pawl for engaging the slide-bar, and means for releasing the pawl from engagement with said slide-bar, substantially as described.

31. The combination with a line-carrier having a line-assembling channel or space, a jaw for clamping a line of types in said channel or space, and a cam for operating the said jaw, of a yielding device carried by the jaw, substantially as described.

32. The combination with a rotary line-carrier having an inlet channel, and a line-assembling or composing-channel or space, and means for delivering types to said inlet channel, of a yielding dog for arresting the types at the lower end of the inlet channel, and means for successively forcing the types past the said dog and into alignment with the said line assembling channel or space, substantially as described.

33. The combination with a rotary line-carrier having an inlet channel and a line-assembling or composing channel or space, and means for delivering types to said inlet channel, of a yielding dog for arresting the types at the lower end of the inlet-channel, and a rotary transfer-wheel for forcing the types successively past the said yielding dog and into alignment with the said line-assembling-channel or space, substantially as described.

34. The combination with a rotary line-carrier having an inlet-channel, a line-assembling or composing-channel or space, and an exit-channel, and a laterally movable pin-wheel having an annular row of pins for successively removing types from the line-assembling channel or space into the exit-channel, of devices for preventing the restoration of the pin-wheel to its normal position until the proper pin to act on a type is in the correct position, substantially as described.

35. The combination with a rotary line-carrier having a line-assembling or composing-channel or space, and an exit-channel leading from one end thereof, of means for assembling types in said line-assembling or composing-channel or space, a pin-wheel having pins for removing the types from the line-assembling or composing-channel or space into the exit-channel, mechanism for shifting the pin-wheel laterally, and devices for preventing the restoration of the pin-wheel to its normal position until the proper pin to act on a type is in correct position, substantially as described.

36. The combination with a rotary line-carrier having a line-assembling or composing-channel or space, and an exit-channel leading from one end thereof, of means for assembling types in said line-assembling or composing-channel or space, a pin-wheel having pins for removing the types from the line-assembling or composing-channel or space into the exit-channel, mechanism for shifting the pin-wheel laterally, and a pivoted latch for preventing the restoration of the pin-wheel to its normal position until the proper pin to act on a type is in correct position, substantially as described.

37. The combination with a rotary line-carrier, and mechanism for assembling types in a line in said line-carrier, of a locking-bolt for locking the line-carrier temporarily in a stationary position, means for rotating the line-carrier, and a device for releasing the bolt from engagement with the line-carrier imme-

diately preceding the commencement of the rotation of said line-carrier, substantially as described.

38. The combination with a rotating mold-disk or carrier having mold boxes, and mechanism for rotating said mold-disk or carrier and shifting it back and forth, of a rotating matrix-blank holder having a device adapted to engage a part of the rotary mold-disk or carrier to complete the turning motion thereof for the purpose of placing a mold in proper coincidence with the line of matrices impressed into the matrix-blank, substantially as described.

39. The combination with a casting-pot, of a rotary matrix blank-holder, and a mold-disk or carrier having mold boxes and adapted to rotate and move back and forth between the casting-pot and matrix blank-holder, said holder having means for engaging a part of the mold-disk or carrier to complete a turning motion thereof and place one of the molds in proper coincidence with the mouth of the casting-pot, and a line of matrices impressed in the matrix-blank, substantially as described.

40. A type-distributing magazine, consisting of a plurality of removable and replaceable type-cases or channels, each of which is composed of a plate 21 having vertical ribs 22 provided with two grooves located at opposite sides of said plate, whereby each type case is adapted to carry two distinct or separate sets of type-characters, substantially as described.

41. A type-distributing magazine, consisting of a plurality of removable and replaceable type cases or channels, each composed of a plate 21 having vertical ribs 22 provided with two grooves located at opposite sides of said plate, said type-case or channel carrying at its lower end two sets of escapement devices for controlling the passage of type from the grooves at opposite sides of the said plate, substantially as described.

In testimony whereof I have hereunto set my hand and affixed my seal in presence of two subscribing witnesses.

JOS. C. FOWLER. [L. S.]

Witnesses:
NATHAN H. ROBBINS,
C. P. ELWELL.