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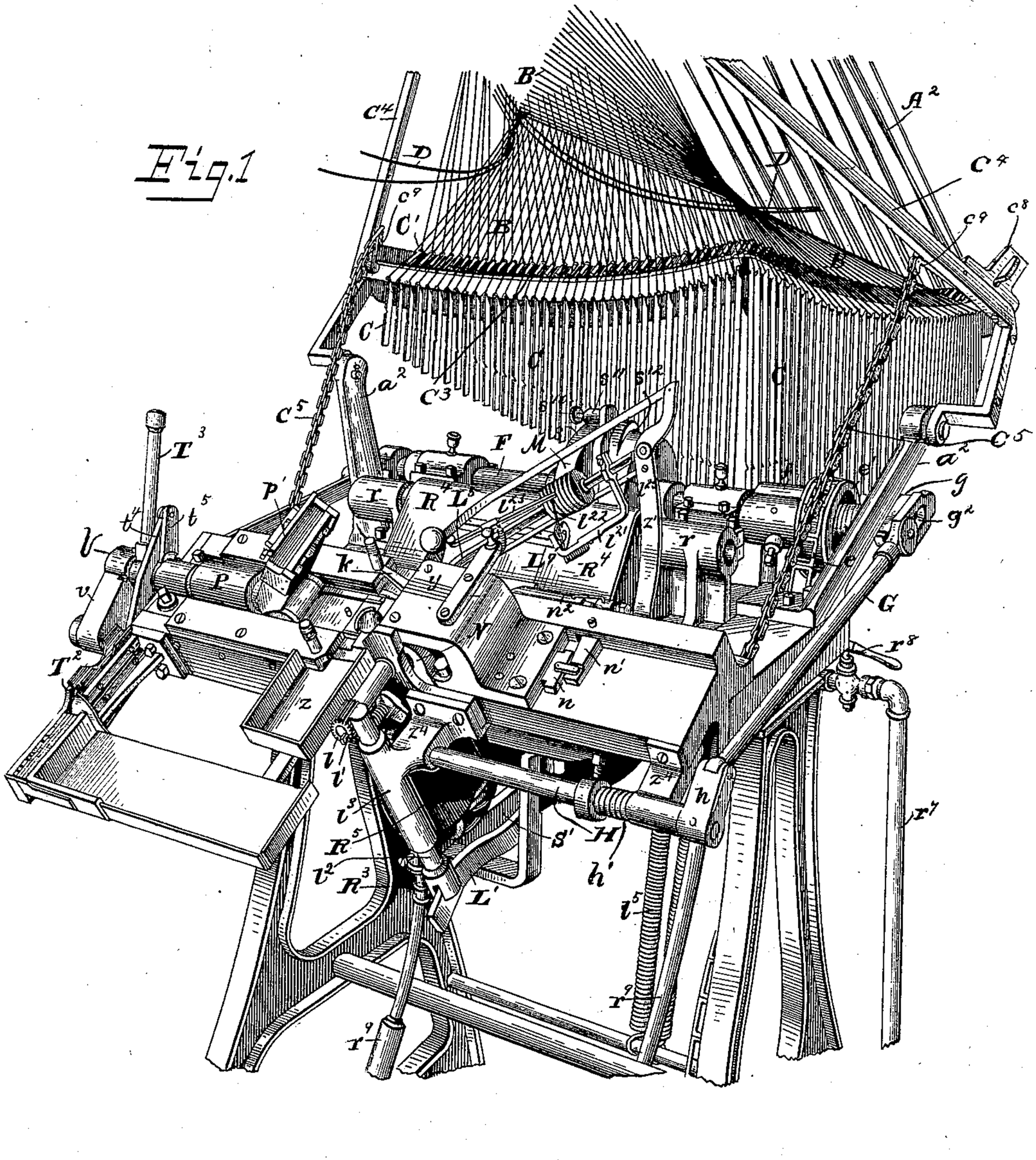
F. E. BRIGHT

TYPOGRAPH.

No. 557,184.

Patented Mar. 31, 1896.

Fig. 1



WITNESSES:

Victor J. Evans.

J. C. Turner

INVENTOR:

F. E. Bright

By Hall and Fay

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F. E. BRIGHT.

TYPOGRAPH.

No. 557,184. Patented Mar. 31, 1896.

Fig. 10

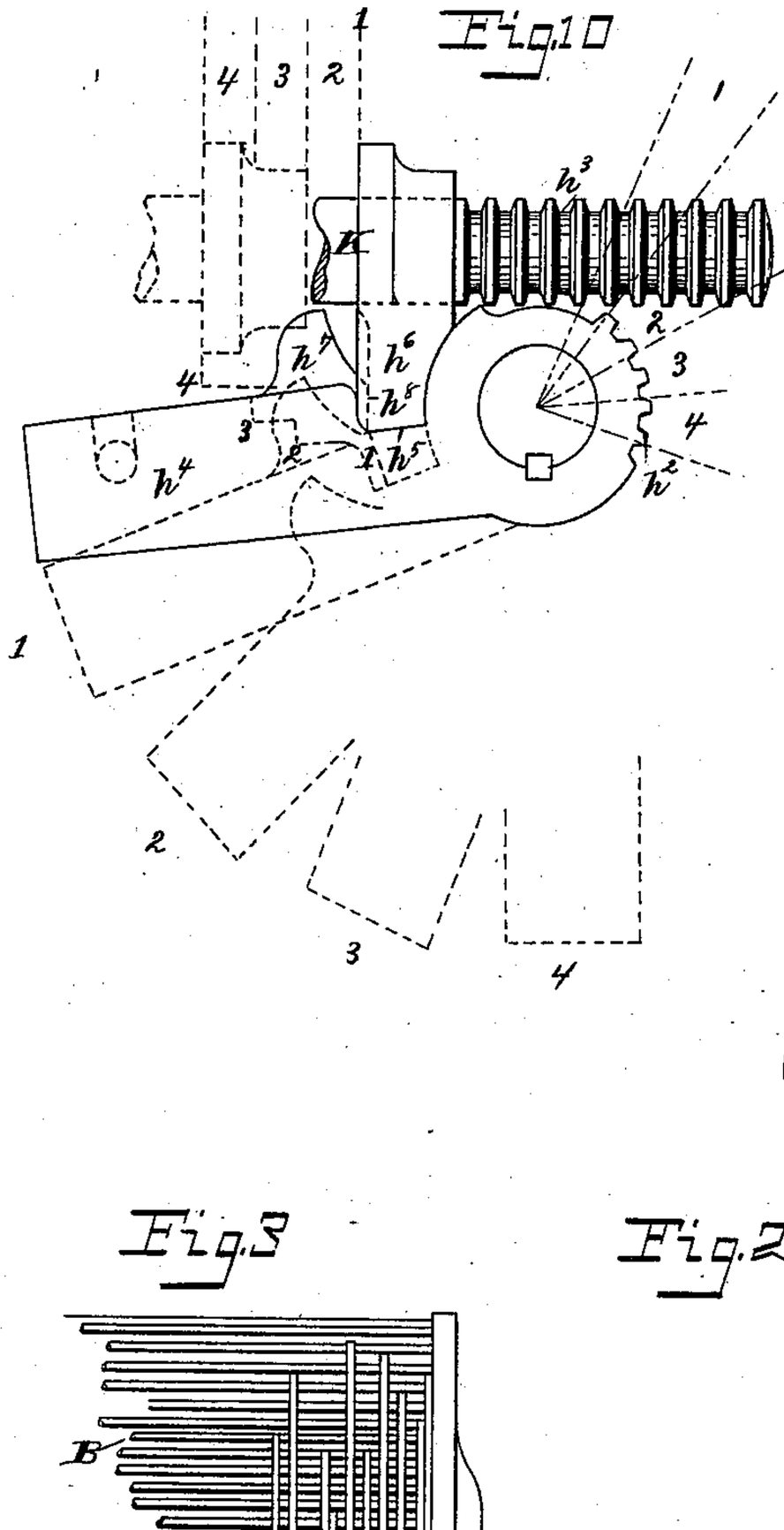
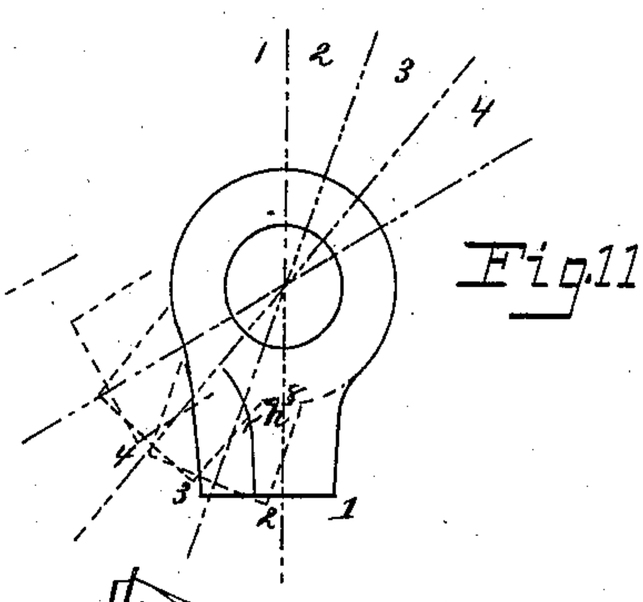


Fig. 11



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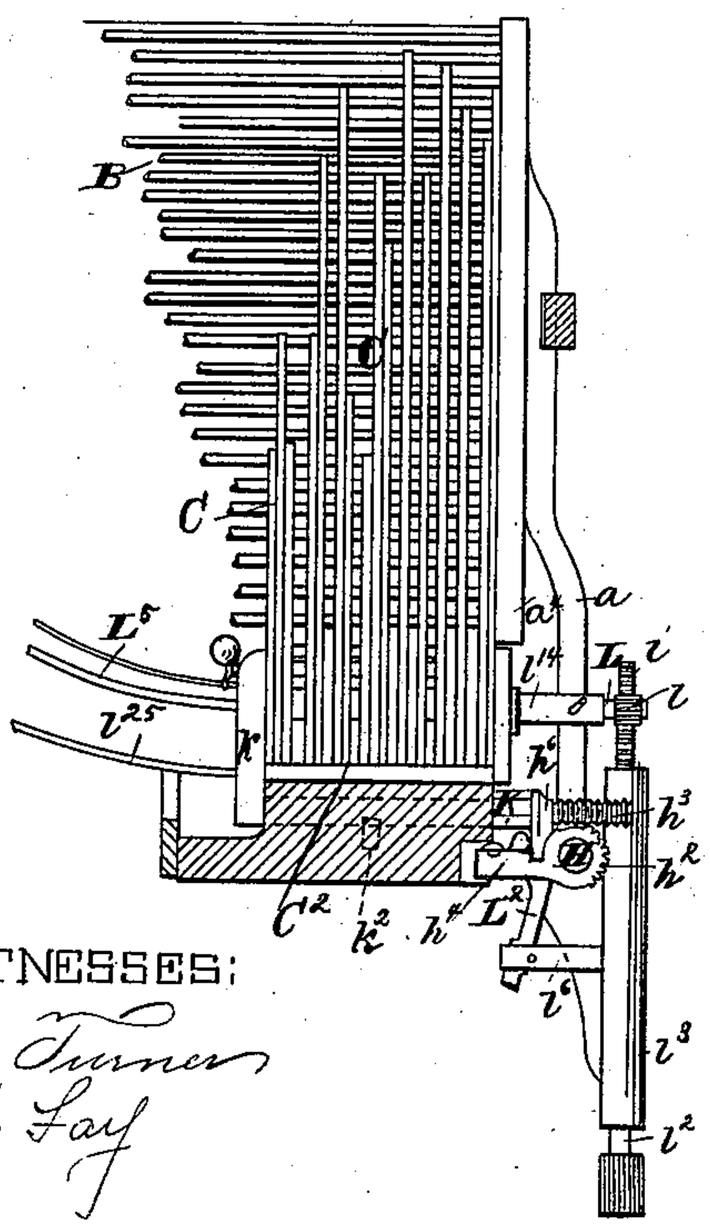

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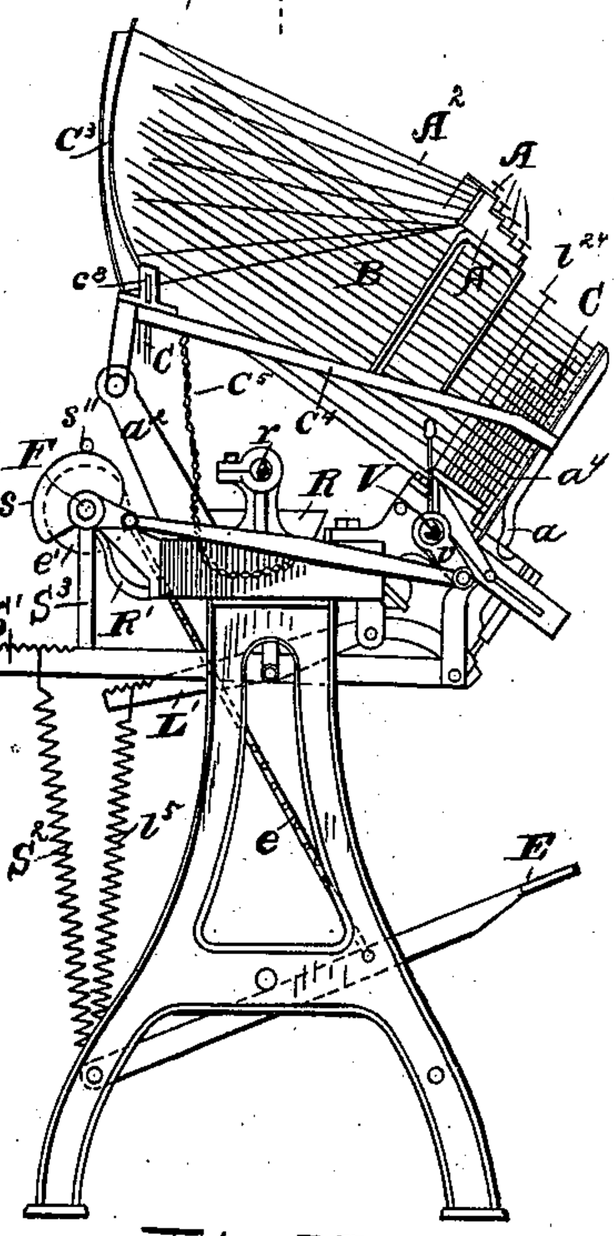

Fig. 23

WITNESSES:

J. C. Turner

N. A. Fay

INVENTOR:

F. E. Bright

By Hall and Fay

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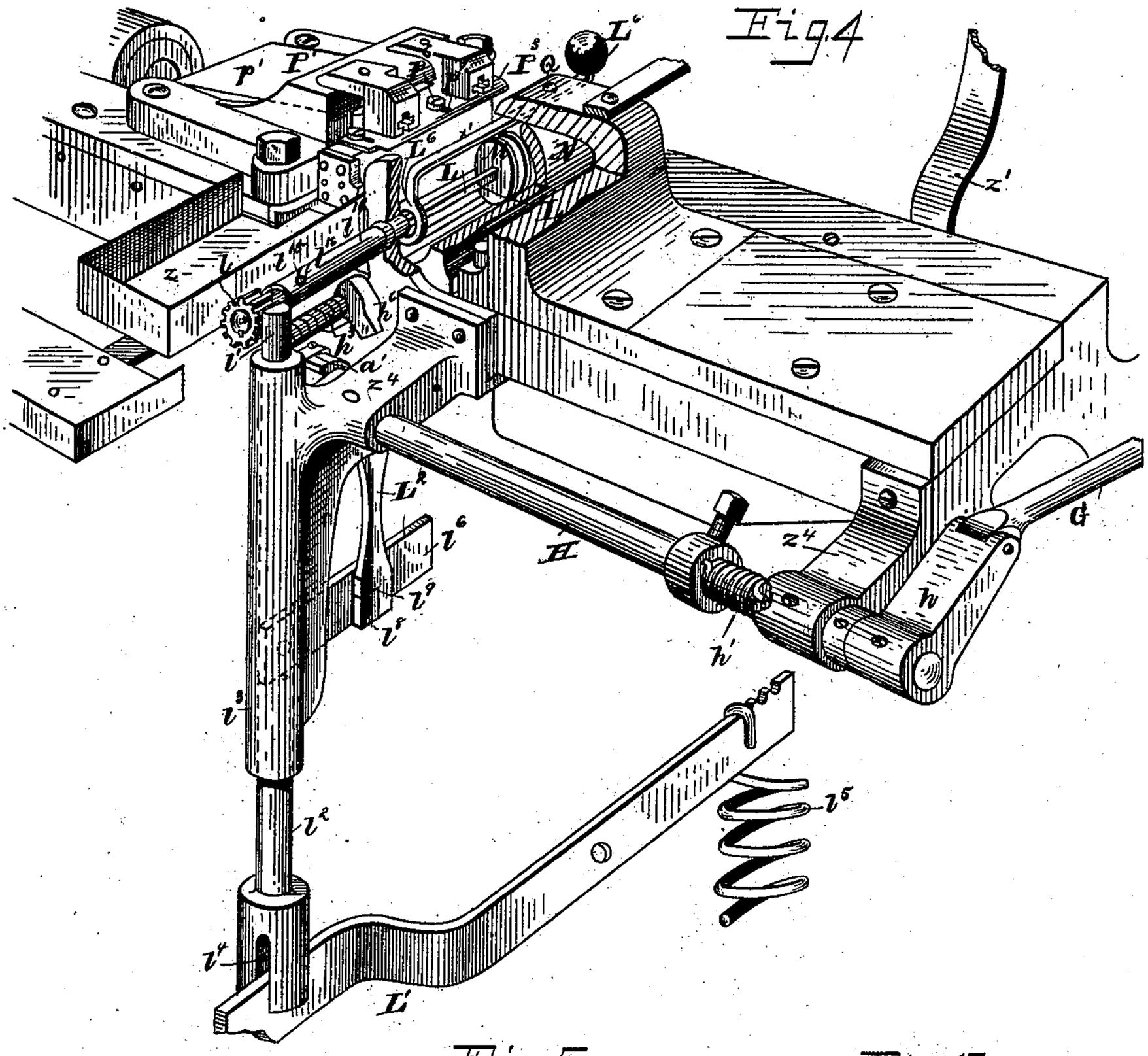
TYPOGRAPH.

No. 557,184. Patented Mar. 31, 1896.

Fig. 4



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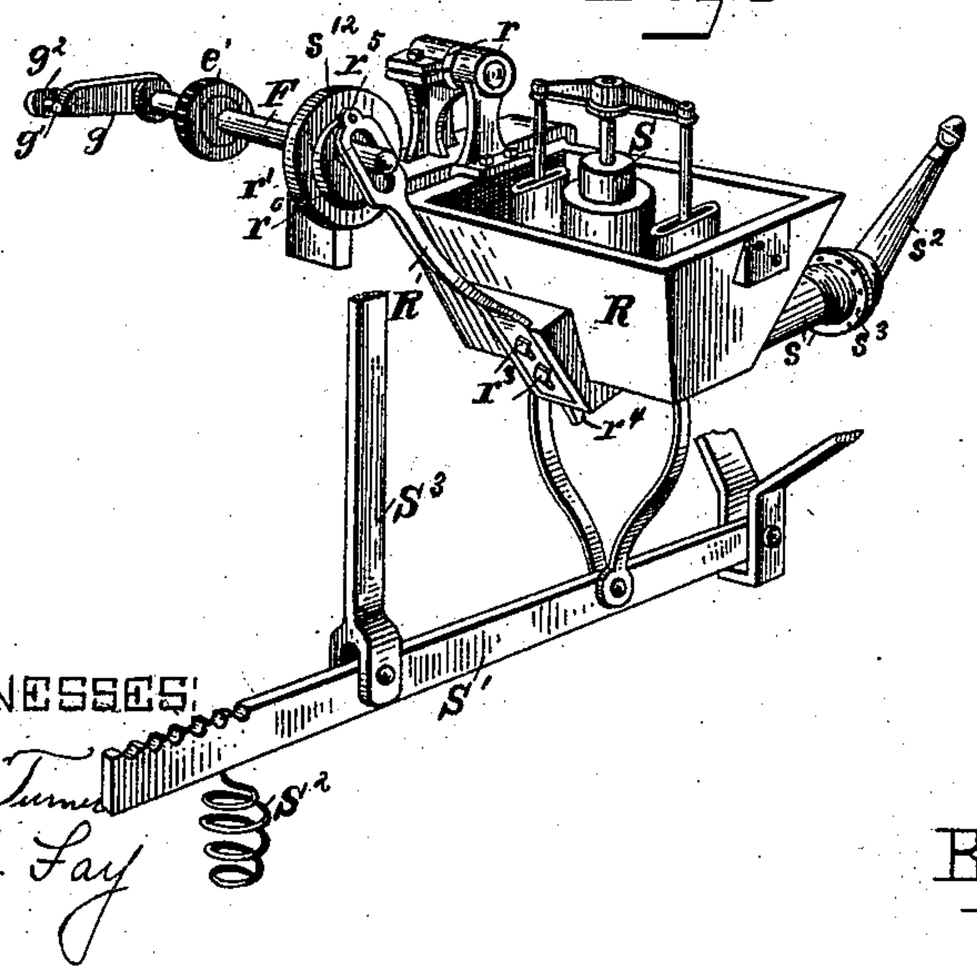

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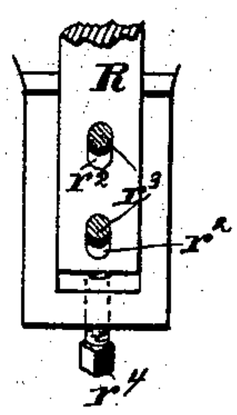

WITNESSES:

J. C. Turner

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F. E. Bright

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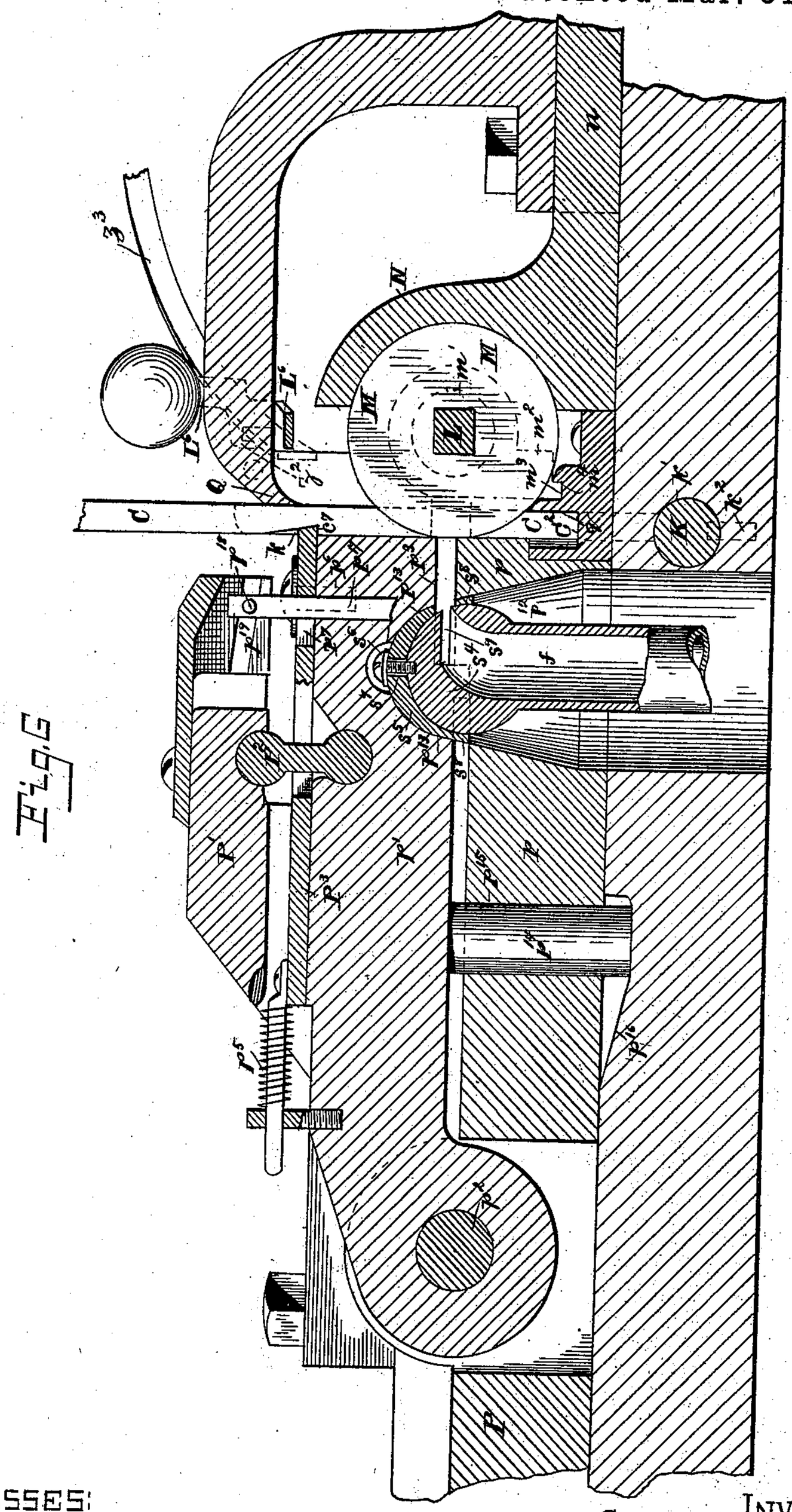

Fig. 5.

WITNESSES:

J. C. Turner

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INVENTOR

F. E. Bright

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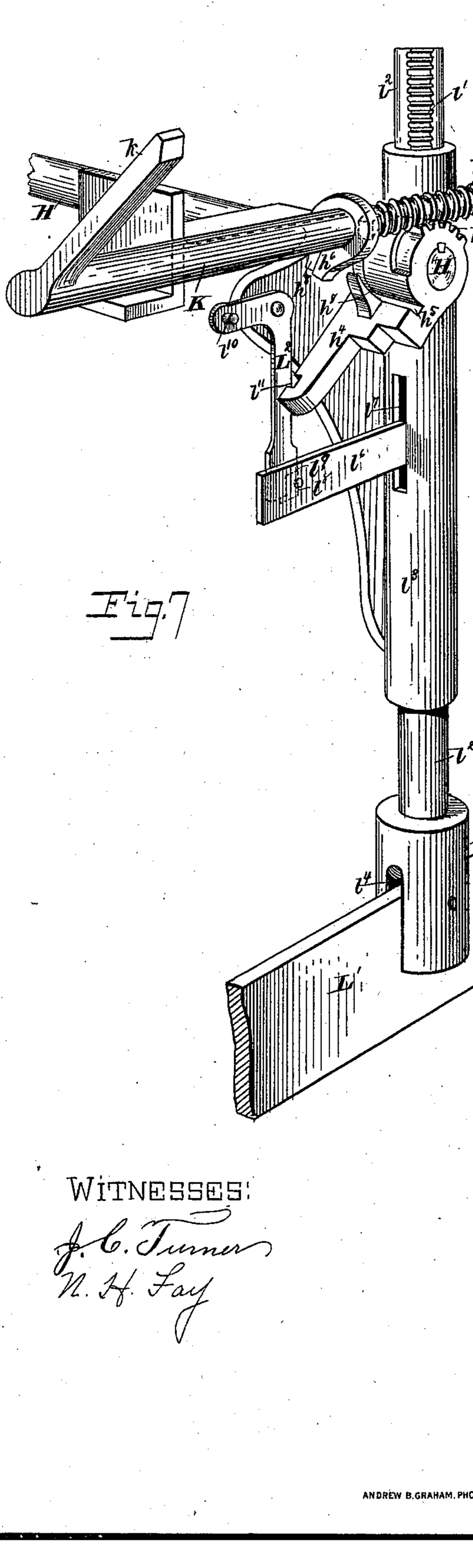

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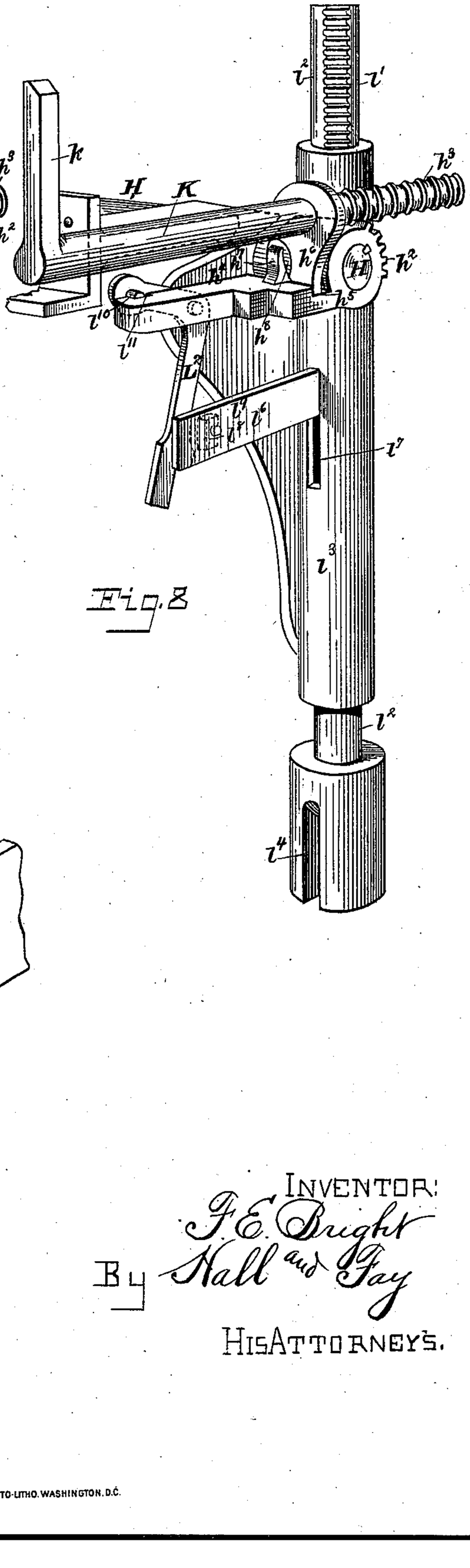

Fig. 8

WITNESSES:

J. C. Turner

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INVENTOR:

F. E. Bright

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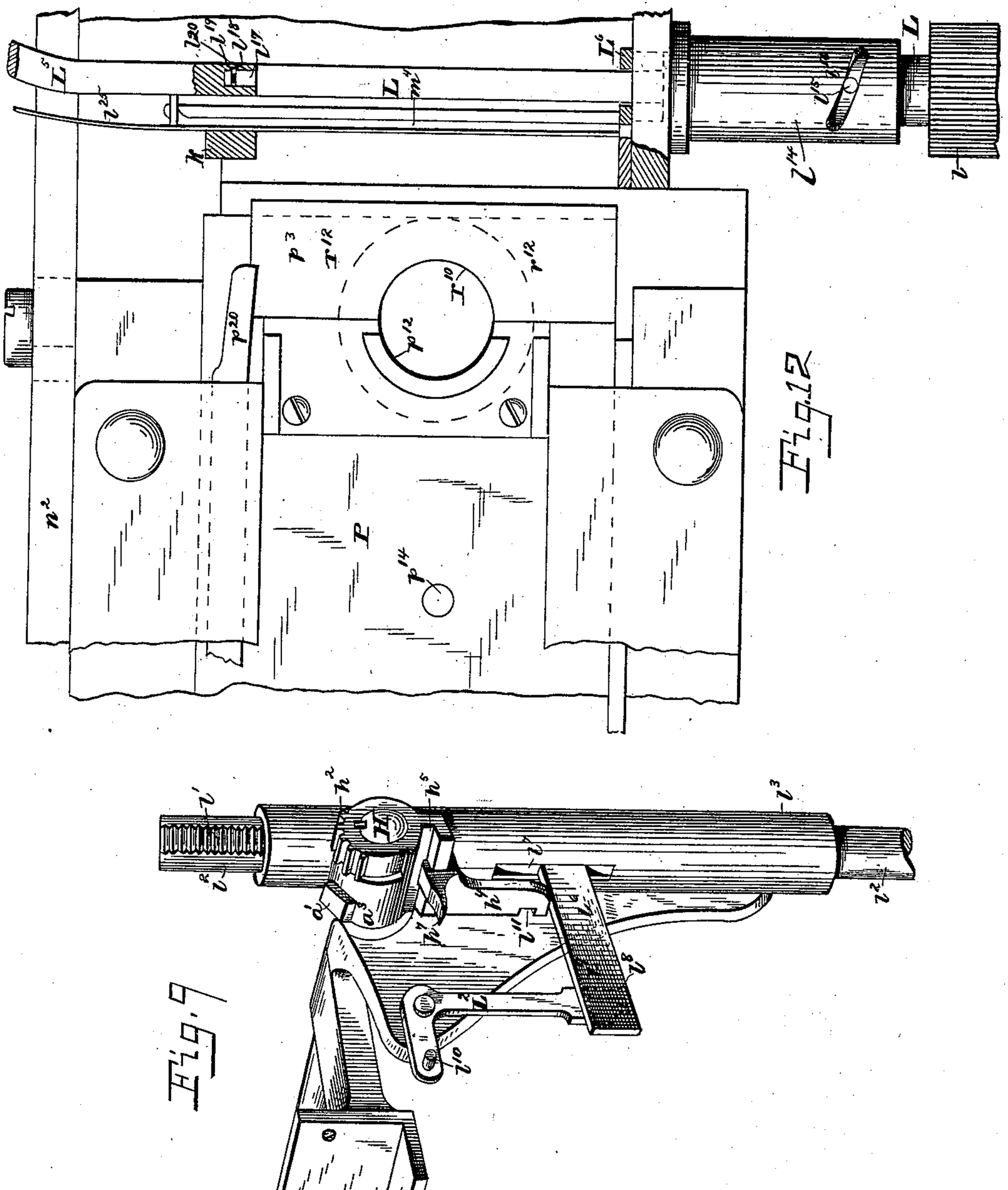

Fig. 12.

Fig. 7.

WITNESSES:

J. C. Turner

N. H. Fay

INVENTOR:

F. E. Bright

By Hall & Fay

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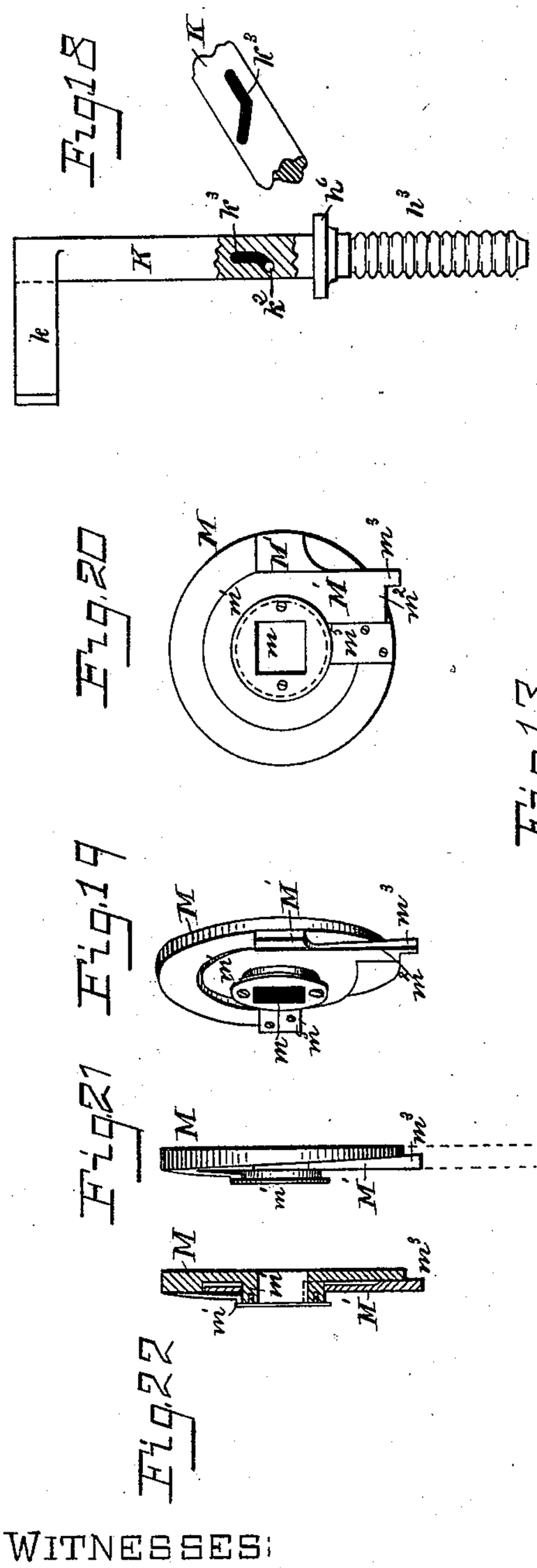

WITNESSES:

J. C. Turner
N. A. Fay

INVENTOR:

F. E. Bright
By Hall and Fay

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F. E. BRIGHT.

TYPOGRAPH.

No. 557,184. Patented Mar. 31, 1896.

Fig 15

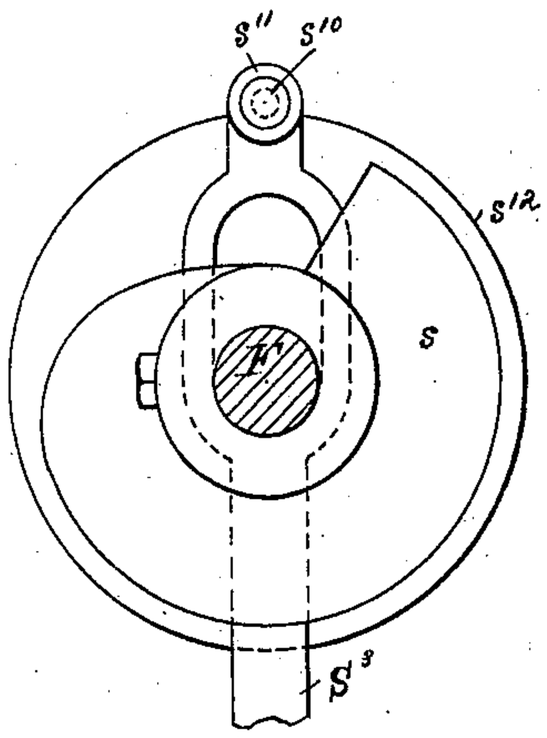


Fig 16

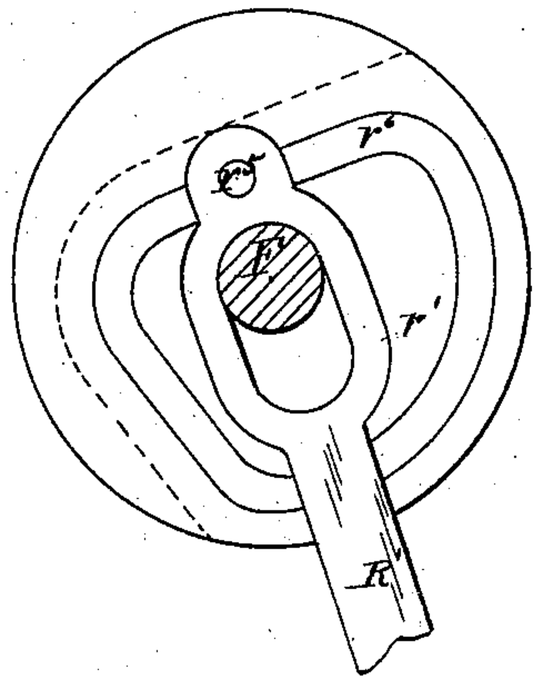
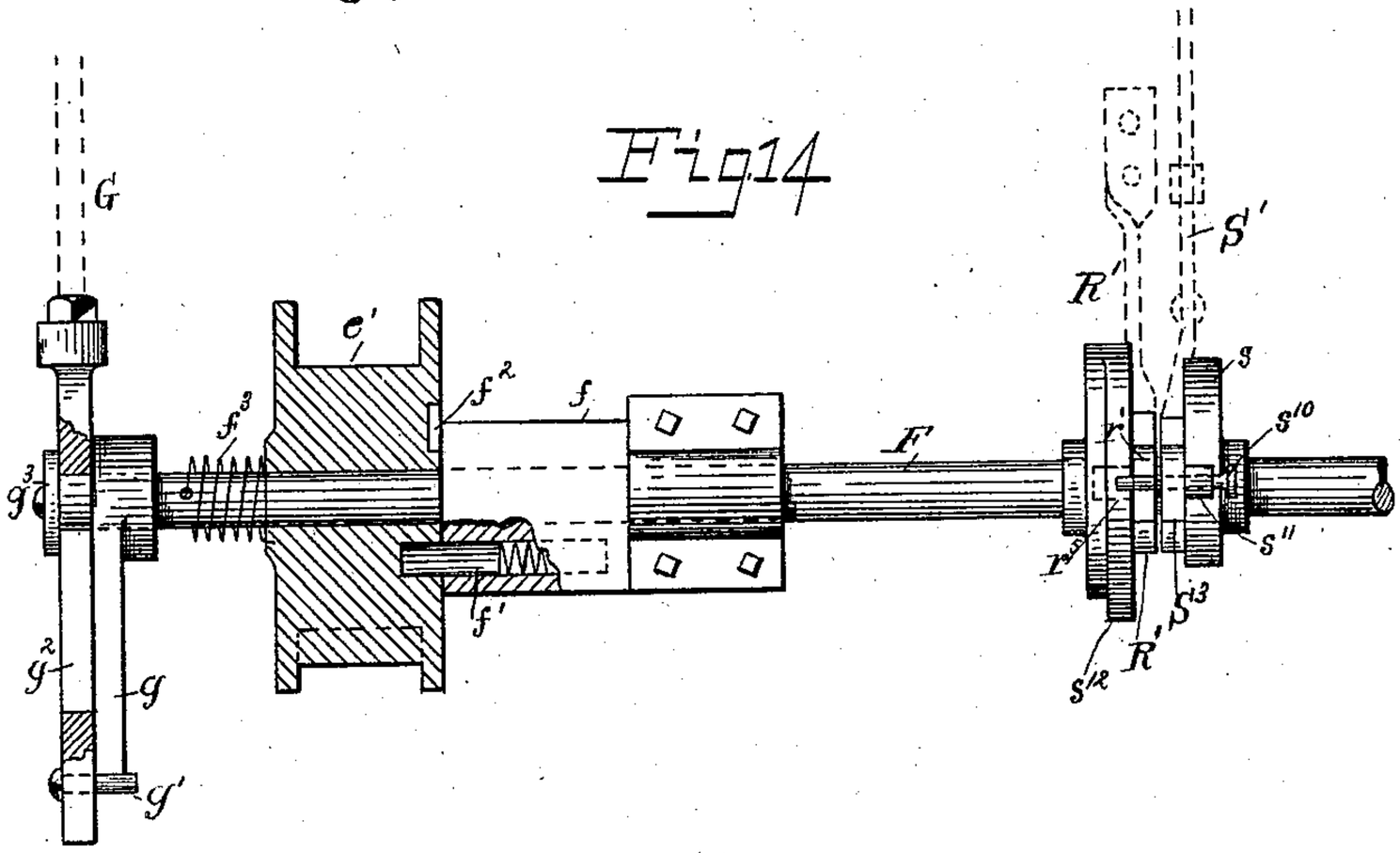


Fig 14



WITNESSES:

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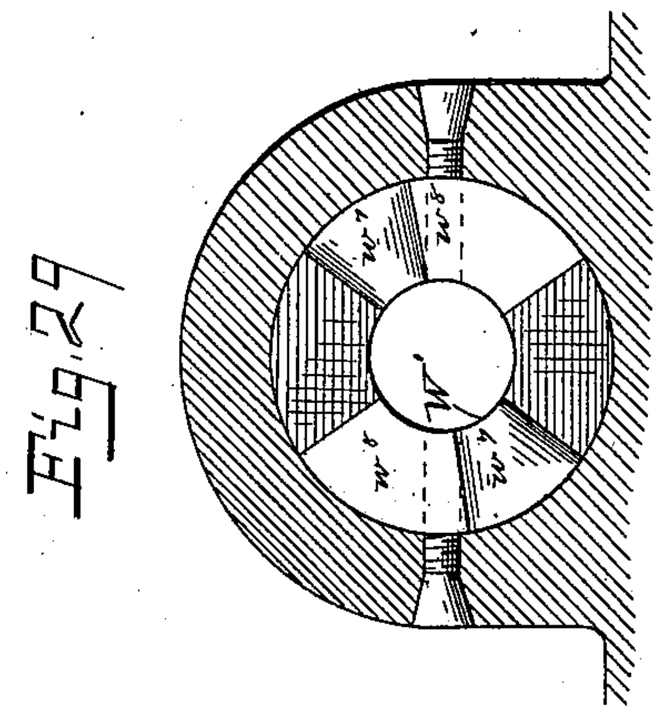

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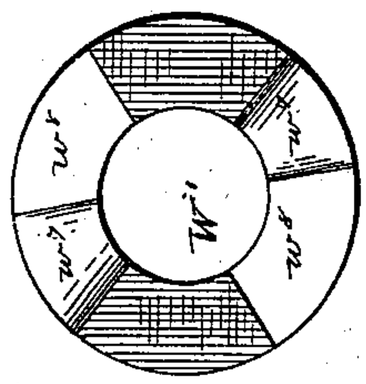

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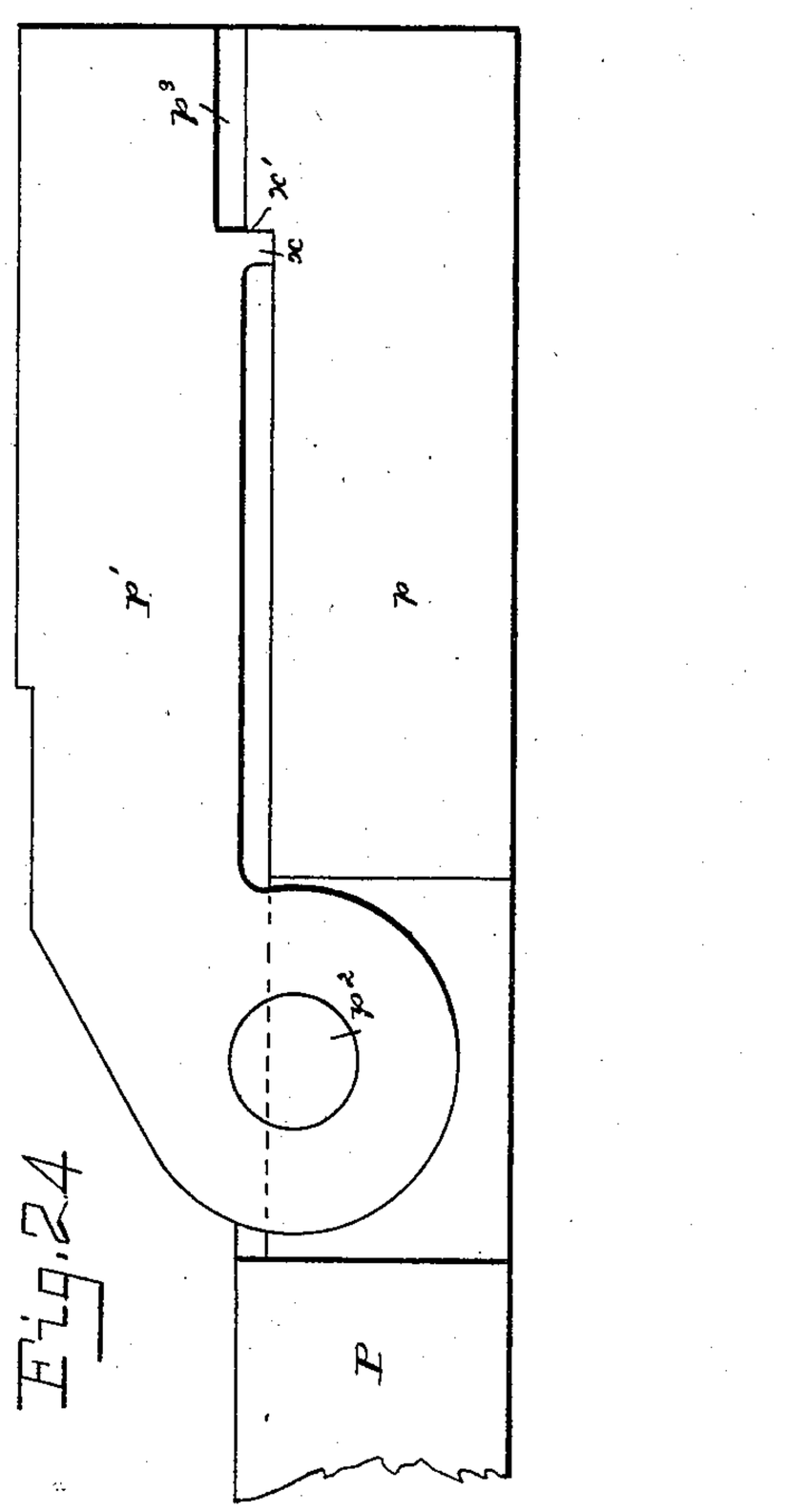

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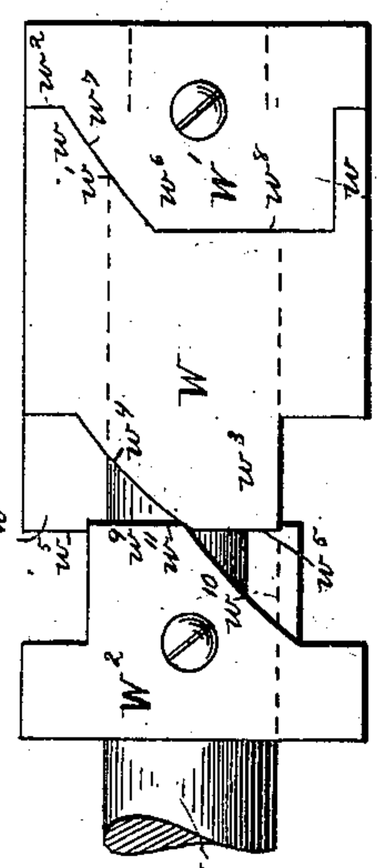

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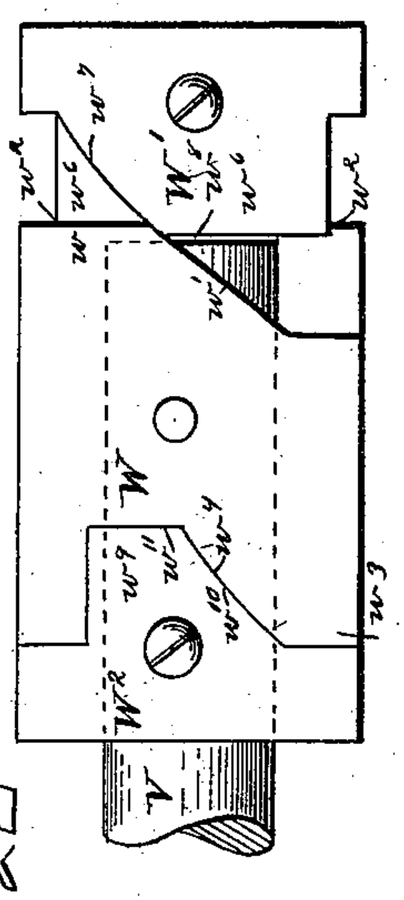

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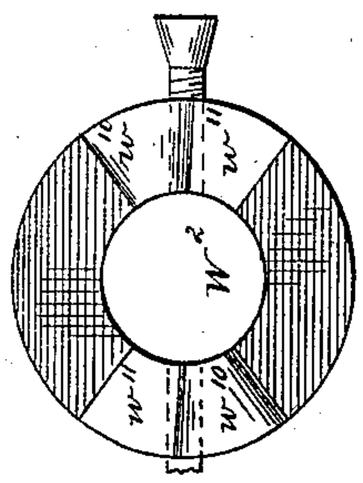

Fig. 29.

WITNESSES:

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F. E. BRIGHT.

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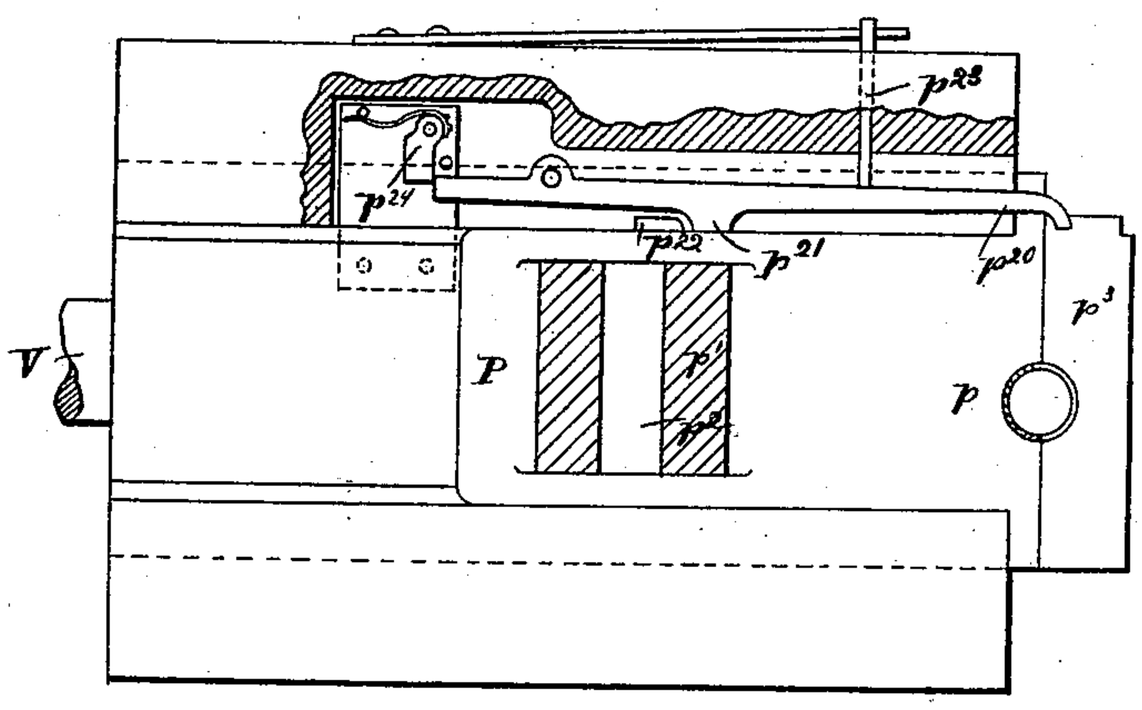
Fig. 31



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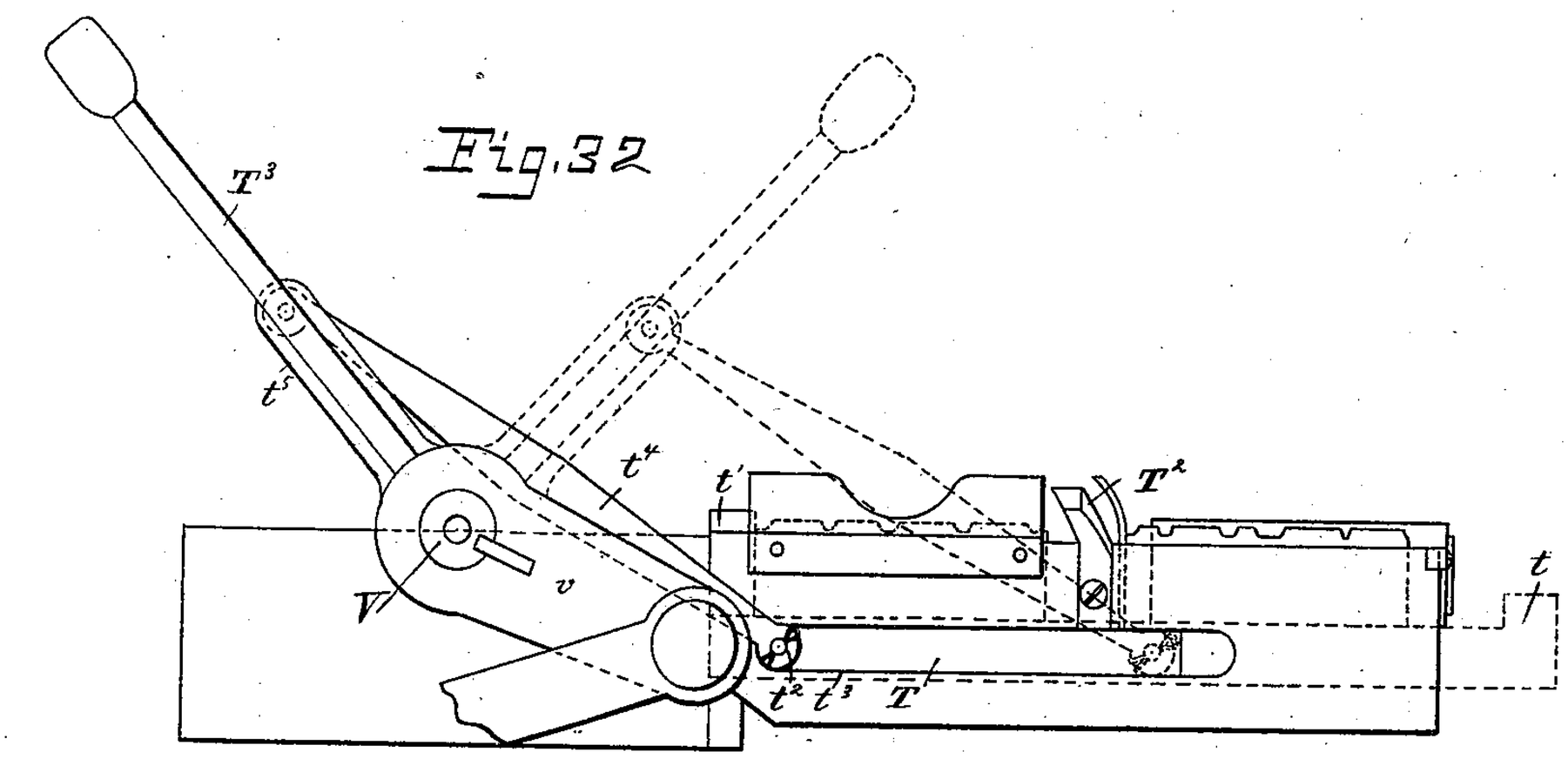

WITNESSES:

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F. E. BRIGHT.

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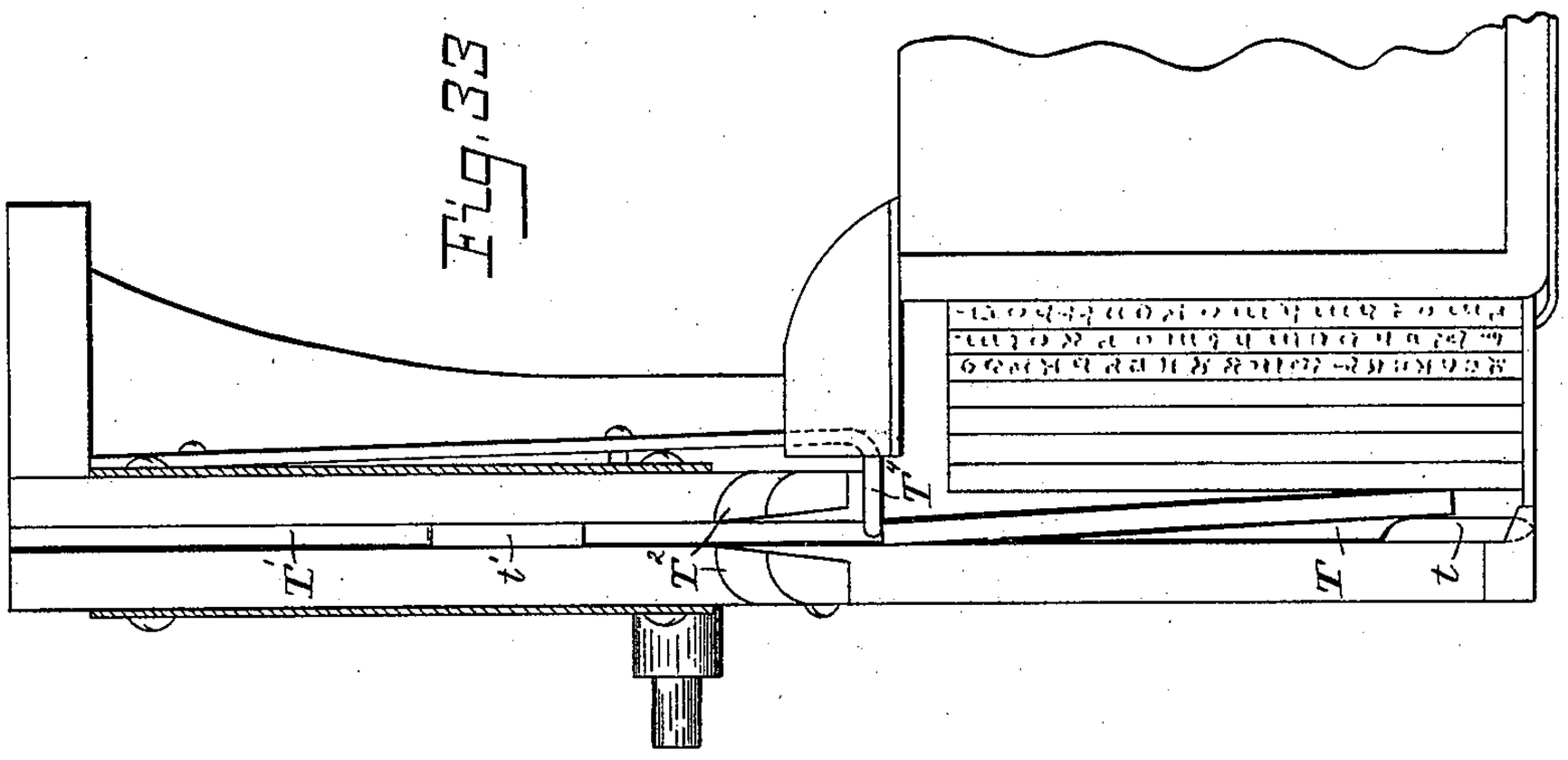
Fig. 33.



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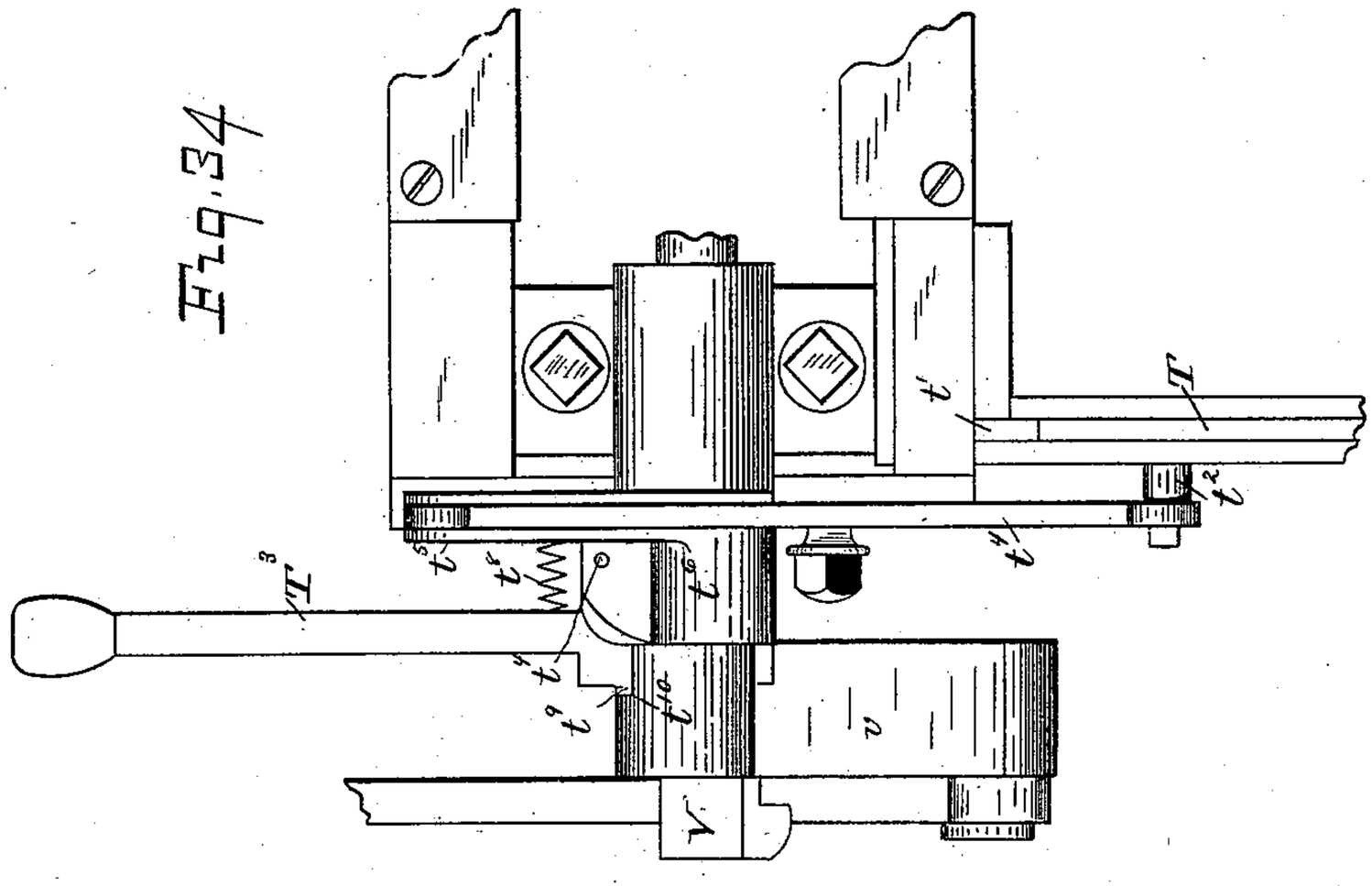

WITNESSES:

J. C. Turner

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INVENTOR:

F. E. Bright

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HIS ATTORNEYS:

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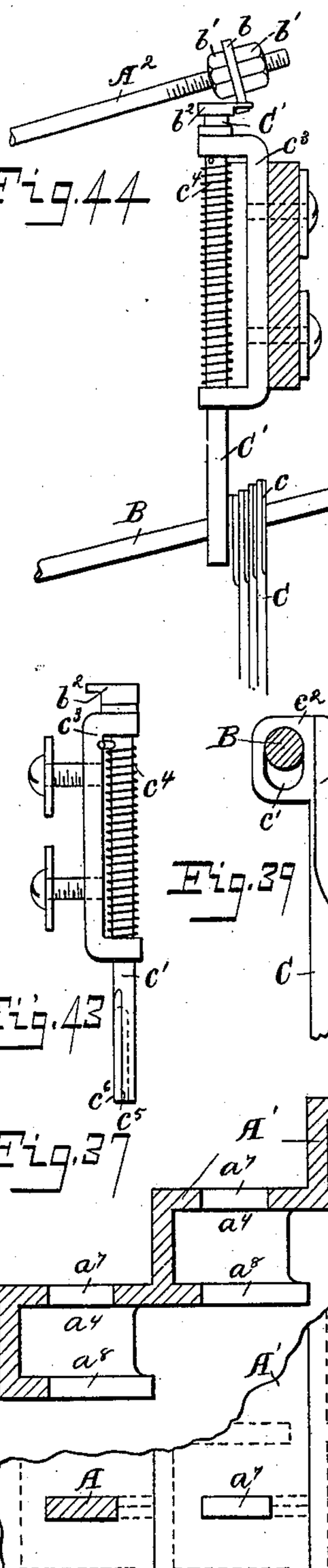
F. E. BRIGHT.

TYPOGRAPH.

No. 557,184. Patented Mar. 31, 1896.

Fig. 44



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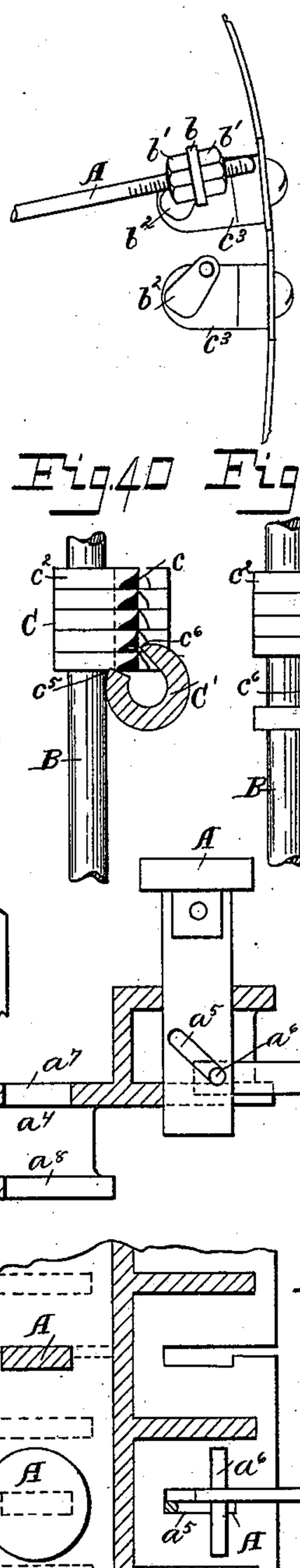
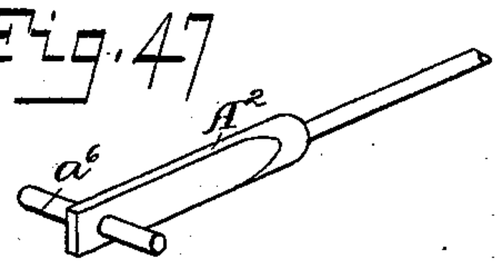


Fig. 46

Fig. 47



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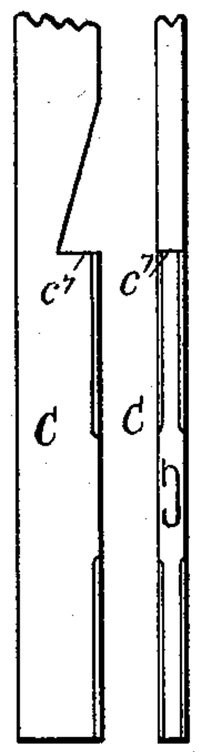


Fig. 40

Fig. 41

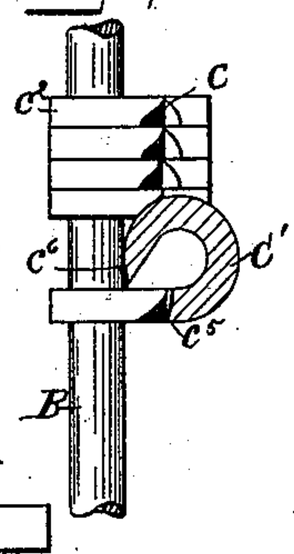


Fig. 42

Fig. 48

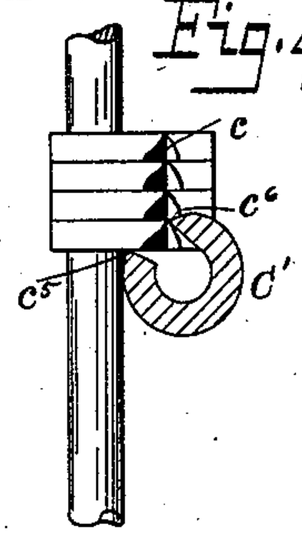
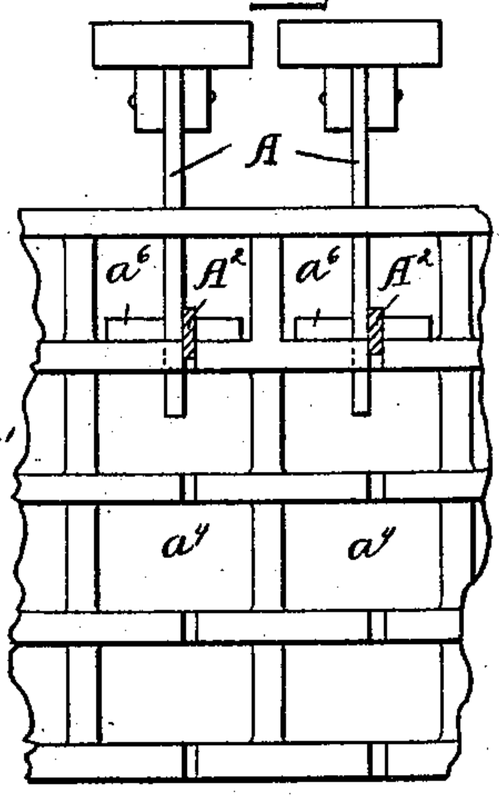


Fig. 39

Fig. 43

Fig. 38



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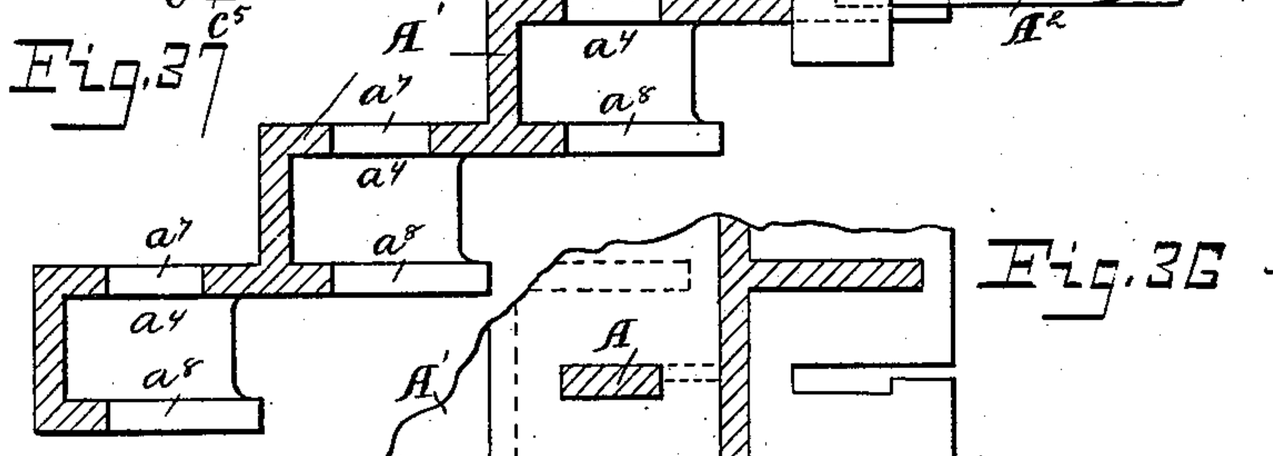
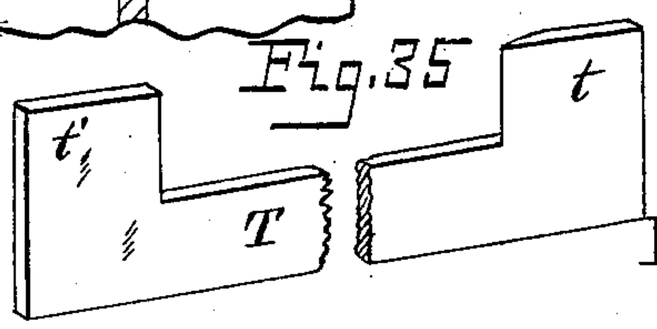


Fig. 36

Fig. 35



WITNESSES:

J. B. Turner

N. H. Fay

INVENTOR:

F. E. Bright

By Hall and Fay

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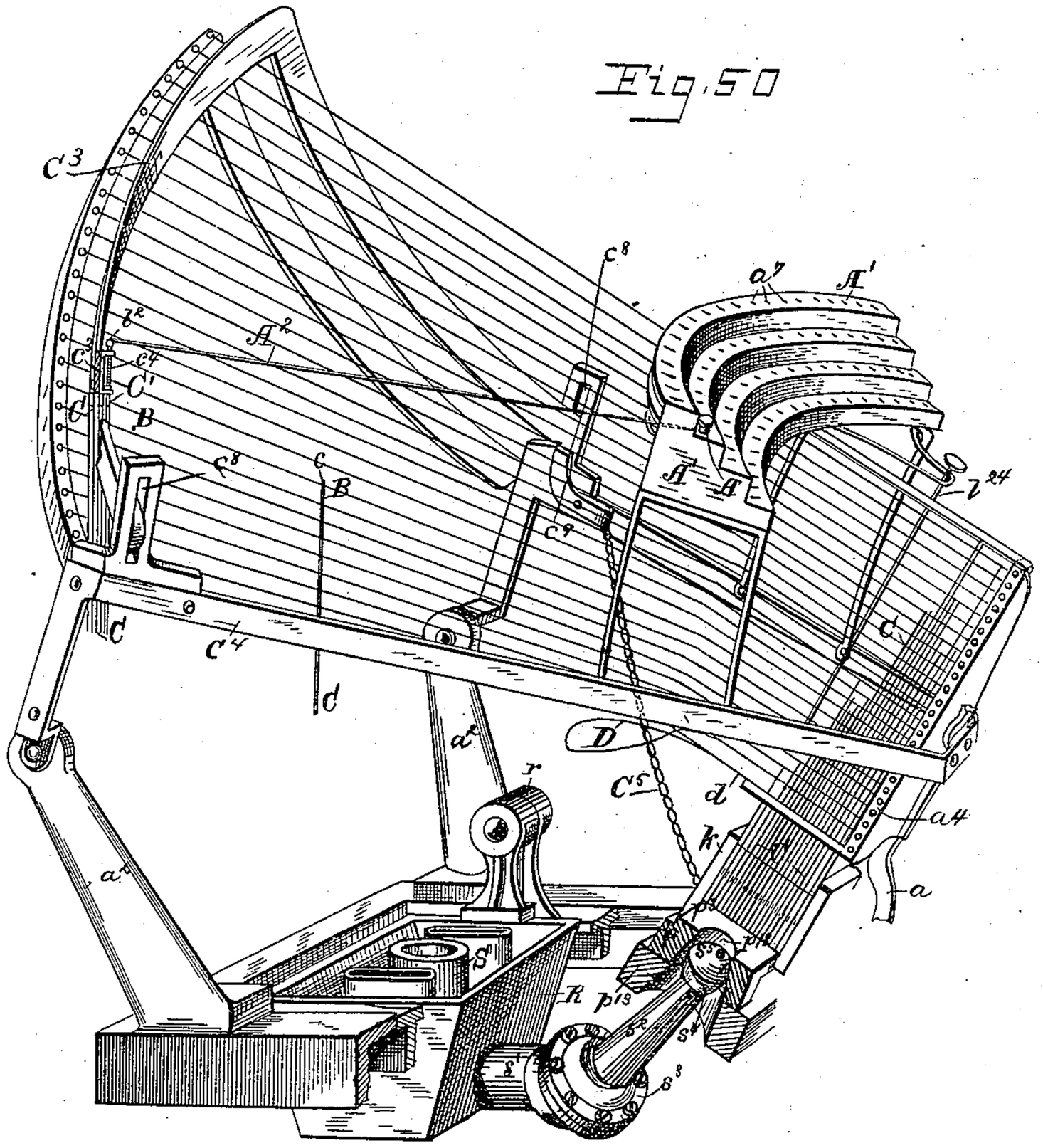
Fig. 50



WITNESSES:

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F. E. BRIGHT.

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Fig. 63

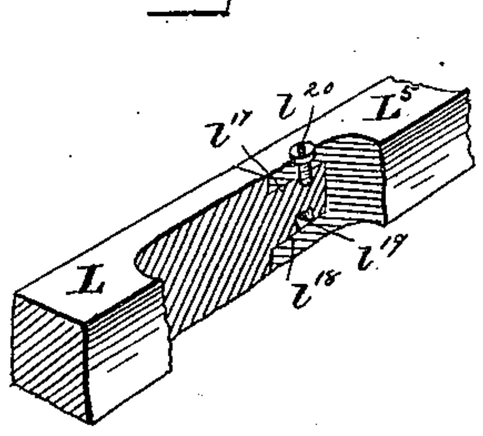
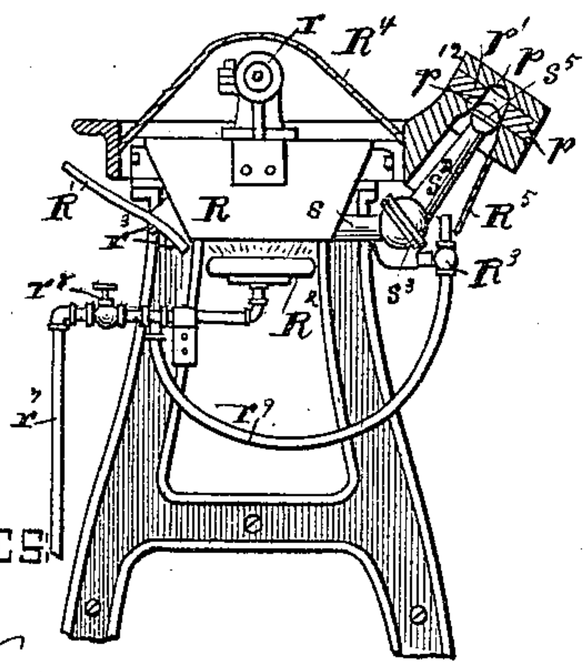


Fig. 51

Fig. 64



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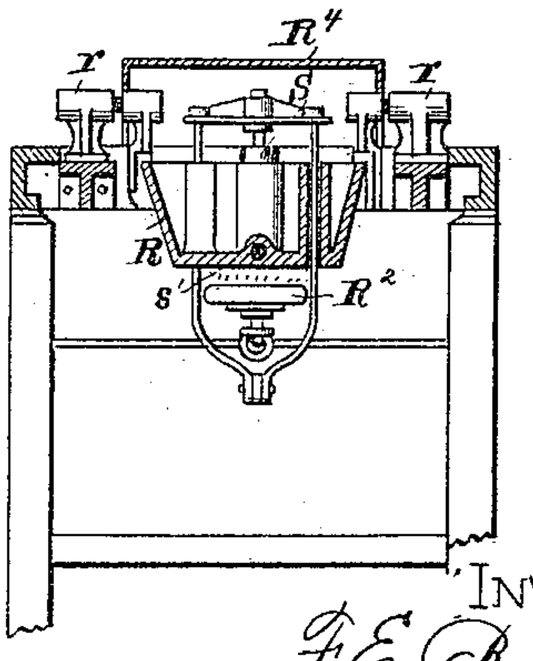

WITNESSES:

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F. E. BRIGHT.

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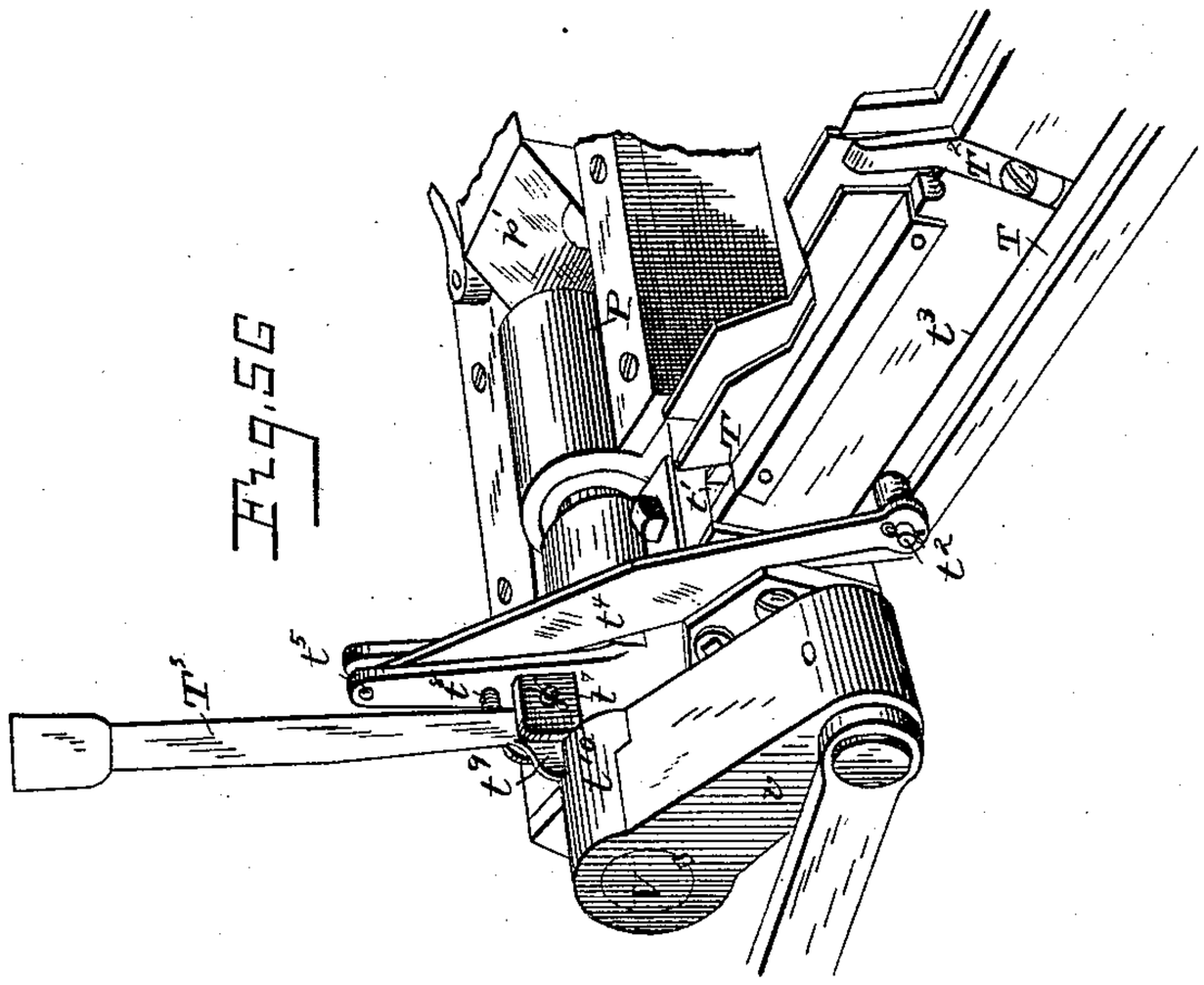
Fig. 56



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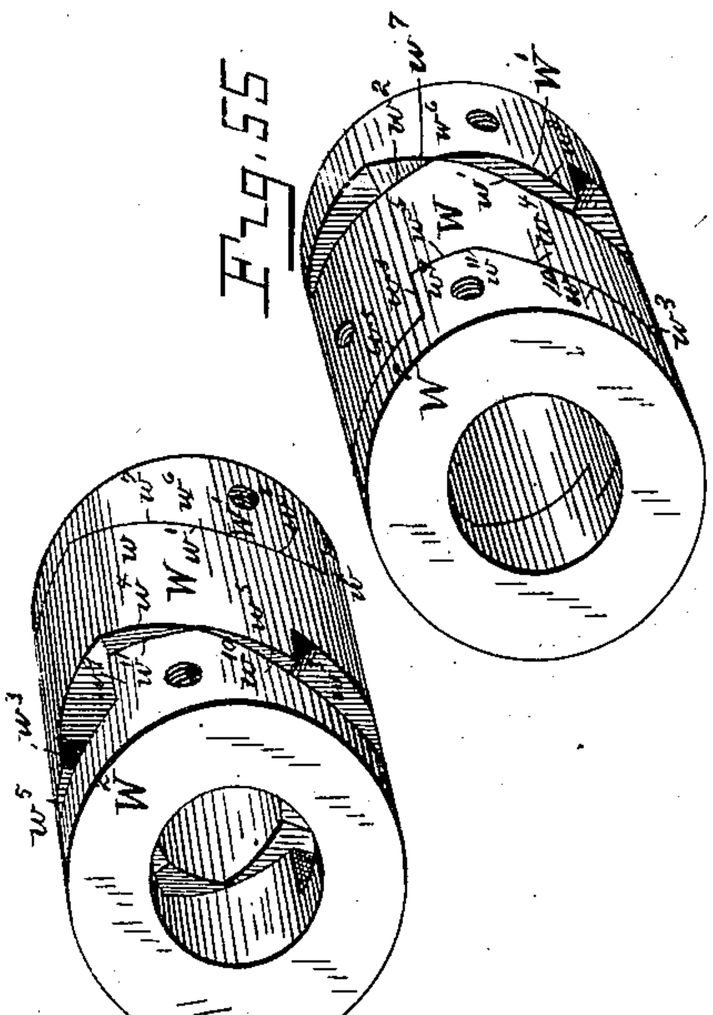

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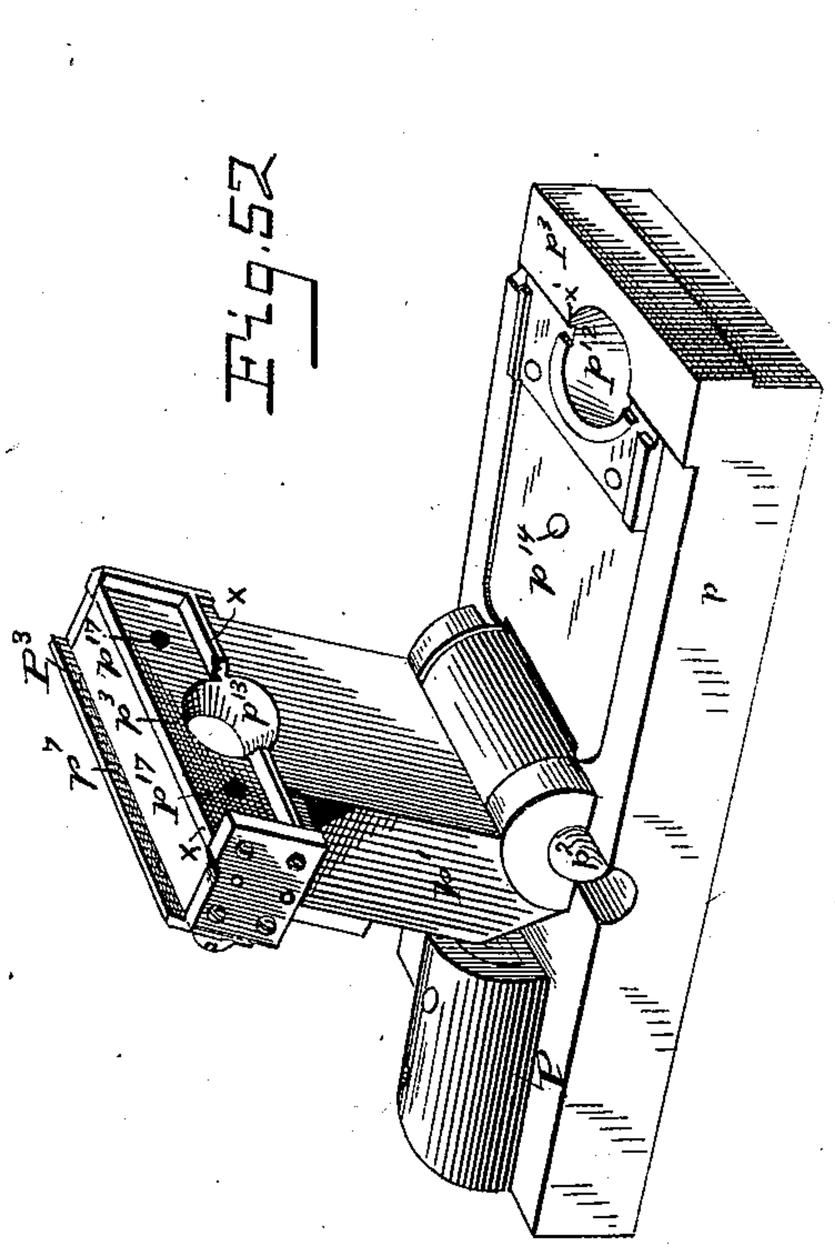

Fig. 52

WITNESSES:

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INVENTOR

F. E. Bright

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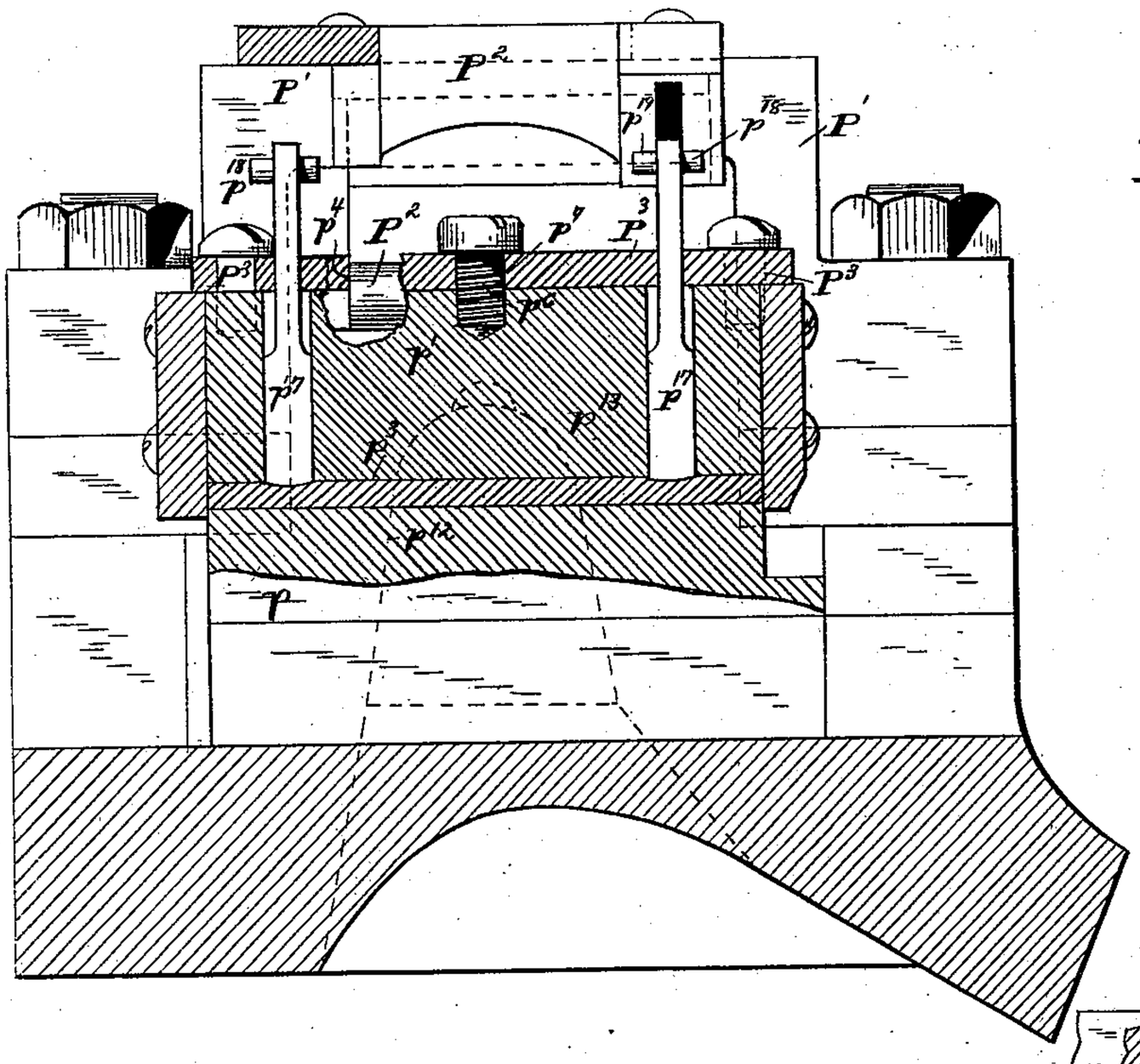
TYPOGRAPH.

No. 557,184. Patented Mar. 31, 1896.

Fig. 53



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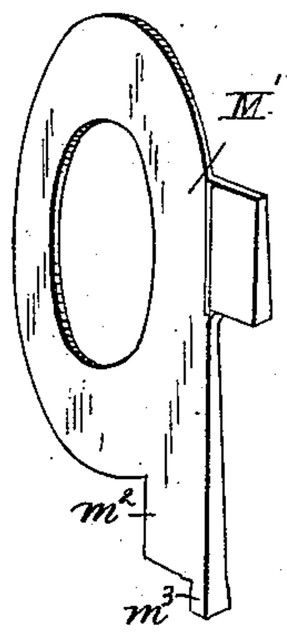

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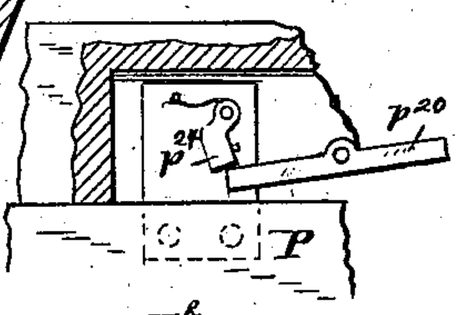

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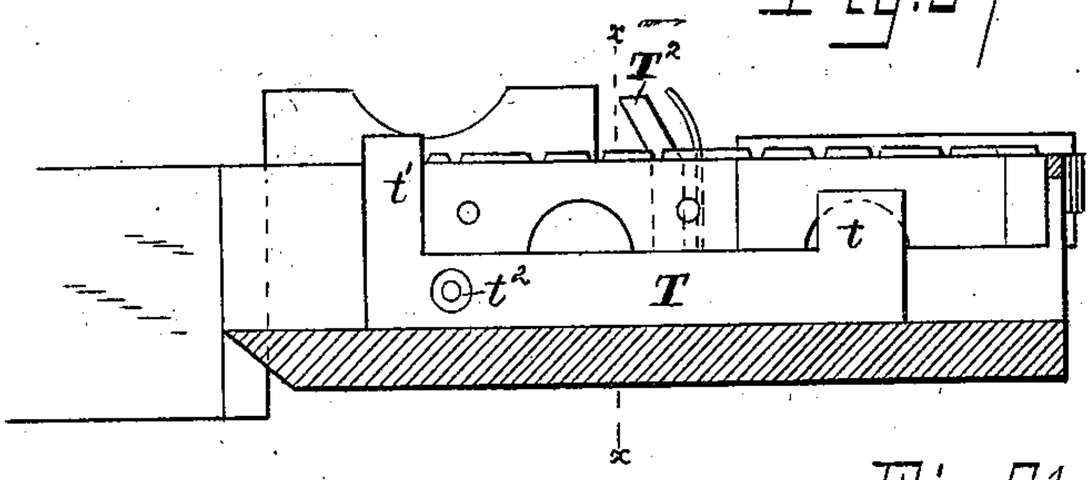

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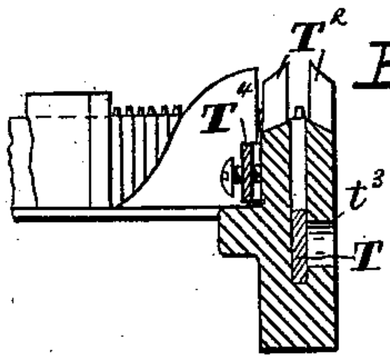

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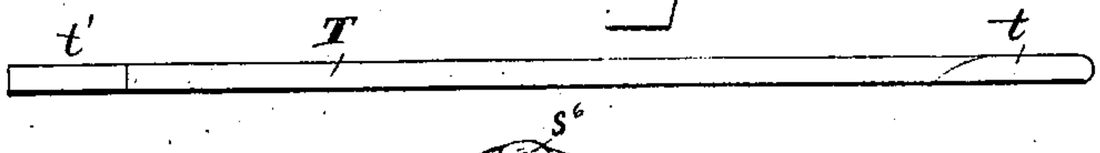

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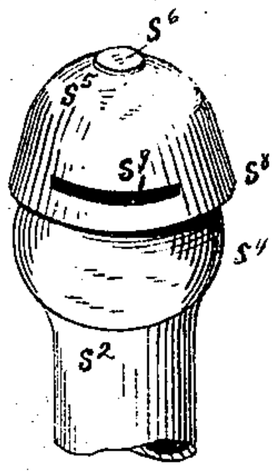

WITNESSES:

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M. H. Fay

INVENTOR:
F. E. Bright
By Hall and Fay
HIS ATTORNEYS.

UNITED STATES PATENT OFFICE.

FRED E. BRIGHT, OF CLEVELAND, OHIO, ASSIGNOR, BY MESNE ASSIGNMENTS, TO THE MERGENTHALER LINOTYPE COMPANY, OF NEW JERSEY.

TYPOGRAPH.

SPECIFICATION forming part of Letters Patent No. 557,184, dated March 31, 1896.

Original application filed April 8, 1890, Serial No. 347,079. Divided and this application filed September 23, 1890. Renewed February 14, 1896. Serial No. 579,321. (No model.)

To all whom it may concern:

Be it known that I, FRED E. BRIGHT, a citizen of the United States, and a resident of Cleveland, county of Cuyahoga, and State of Ohio, have invented certain new and useful Improvements in Typographs, of which the following is a specification, the principle of the invention being herein explained and the best mode in which I have contemplated applying that principle, so as to distinguish it from other inventions.

This application covers subject-matter of invention which was originally a part of application, Serial No. 347,079, filed by me April 8, 1890, and upon which Patent No. 437,741 was granted September 23, 1890, to The Rogers Typograph Company, as my assignee, I having withdrawn from said patent application the subject-matter of the present application, which constitutes a divisional application.

My invention includes, respectively, different members of a machine, which latter has as its object and result, briefly stated, assemblage of character or space members into a line of composition-copy of said line and preparation of the machine for a repetition of the foregoing.

The improvements which relate to the production of a copy of a line of composition are improvements in mechanism for justifying a line of composition and improvements in mechanism for casting a type-bar from such line.

The invention has been devised with especial reference to the mechanism for assembling and distributing character and space members illustrated in the drawings and described in the specification of United States Letters Patent No. 389,108, granted September 4, 1888, to Hoyt, Ruthrauff, and Wagner, for machine for making stereotype-matrices, upon the application and assignment of John R. Rogers. Instead of employing bars having characters formed in relief on their lower ends, as shown in said patent, I herein employ bars having their vertical edges formed with intaglio characters adapted to directly cast type, the product of such casting being a stereotype-line plate in copy of type-matrices and the spaces and is called a "cast" type-bar.

The annexed drawings and the following description set forth in detail one mechanical form of embodiment of the invention, such detail construction illustrating the principle of the invention and being but one of various different mechanical forms in which such principle of invention may be used. Such drawings and description set forth certain construction of members which are in common with the drawings and description of application for United States Letters Patent, Serial No. 365,883, filed September 23, 1890, by John R. Rogers, for improvements in typographs, the inventions respectively set forth in this my application and in the said Rogers' application being the property of The Rogers Typograph Company, a corporation under the laws of the State of New Jersey; and it will be understood that my invention does not consist in the construction claimed in said Rogers' application. As regards all construction to which claim is laid broadly in said Rogers' application, and also more narrowly in this my application, it should be understood that my invention consists solely in the subject-matter of such narrower claims and does not consist in the subject-matter of said broader claims.

Referring to the drawings, Figure 1 is a perspective view of a portion of a typograph embodying the invention. Fig. 2 is a side elevation of the entire machine, showing the matrix-carrier in its lowered position. Fig. 3 is an enlarged view of the assembled matrices, showing the operative relation of the compressor and its connections. Fig. 4 is a detail perspective view, portions being broken away to disclose the spaces, space-shaft, space-supporter, and connected mechanism. Fig. 5 illustrates in perspective the metal-pot and its operating connection, also a portion of the main driving-shaft. Fig. 6 is an elevation in vertical section through the mold-section, space-supporter, and connected mechanism, showing in detail the sealing of the metal-discharge conduit and the mechanism for opening and closing the mold. Fig. 7 illustrates in perspective the compressor-shaft and connecting mechanism. Fig. 8 is a perspective view showing the same features

of invention as are shown in the preceding view, but in different positions. Fig. 9 is a perspective view of the mechanism shown in the two preceding views and representing the members in different relative positions from either of said views. Fig. 10 is a diagrammatic elevation of the compressor-shaft, showing its relation to the toothed segment. Fig. 11 is a diagrammatic elevation of the compressor-shaft-locking lug, showing an arbitrary number of its different positions, said positions corresponding to the dotted-position lines of Fig. 10, the positions being designated in both of the figures by numbers 1 2 3 4. Fig. 12 is a detail view of the lower mold-section in plan and a horizontal sectional view of certain portions of the line-assembling portion of the machine. Fig. 13 is a top plan view, partly in section, showing the mechanism for operating the space-supporter. Fig. 14 represents in top plan diagrammatic view the cams on the main driving-shaft, together with the pulley-and-pawl connection. Fig. 15 is an elevation of the cam mechanism which operates the metal-pump. Fig. 16 is a diagrammatic elevation of the cam mechanism which operates the metal-pot. Fig. 17 is a detail elevation showing the adjustable relation of the metal-pot to its actuating-arm. Fig. 18 illustrates the compressor-shaft and its groove for deflecting the compressing-arm. Fig. 19 is a perspective view of the compound space. Fig. 20 is a detail view representing a compound space in side elevation, the spaceway in transverse section, and the wing-space-section guide in transverse section. Fig. 21 is an edge elevation of said compound space. Fig. 22 is an edge elevation in section of Fig. 21, showing the relation between the wing and disk sections of said space. Fig. 23 is a perspective view showing the character-member guides or checks. Fig. 24 is a diagrammatic view of the two mold-sections, showing the relation of their hinging to each other with regard to the meeting of the side walls of the casting-chamber. Fig. 25 is a plan view of the barrel-cam, which serves to move the mold-slide to and from the assembled matrices. Fig. 26 is an end elevation of one of the stationary portions of said cam. Fig. 27 is an end elevation of the movable portion of the cam. Fig. 28 is a plan view of the parts shown in Fig. 25, showing them in their counter positions. Fig. 29 is a cross-section of the cam-housing, which is a part of the mold-slide. Fig. 30 is an end elevation of the end stationary section of said cam. Fig. 31 is a plan view, portions being broken away, showing the construction of the end ejecting mechanism. Fig. 32 is a side elevation of the trimming mechanism, showing the second position of the trimmer-slide-actuating connections in dotted lines. Fig. 33 is a top plan view of the trimming mechanism. Fig. 34 is a top plan view of the lever connection from the actuating-shaft to the trimmer. Fig. 35 is a perspective view of the trimmer-slide detached. Fig. 36 is a top plan view of a portion of the keyboard, a portion being broken away to disclose the construction. Fig. 37 is an end elevation in section of the keyboard. Fig. 38 is a rear elevation of a portion of the same. Fig. 39 is an enlarged elevation of the upper portion of a suspended matrix-bar. Fig. 40 is a cross-sectional view of the two-lip latch in its relation to the distributed matrix-bars. Fig. 41 is a view similar to Fig. 40, showing the unlatching of a matrix-bar. Fig. 42 is a view the same as Fig. 40, showing the number of distributed matrix-bars to have been decreased by reason of the operation of Fig. 41. Fig. 43 is an elevation of the two-lip latch in its bracket-support. Fig. 44 is an elevation of the two-lip latch in its bracket-support, showing its relation to its key-connecting rod and the distributed matrix-bars. Fig. 45 is a plan view of a pair of latches and their connections. Fig. 46 is a perspective of the hook which connects the key-connecting rod with the latch. Fig. 47 is a perspective view of the keyboard end of the latch-connecting rod. Fig. 48 is a side elevation of the lower end of the matrix-bar. Fig. 49 is an edge elevation of the said bar. Fig. 50 is an outline perspective of the matrix-carrier, showing the same diagrammatically in its assembling relation to the casting mechanism, the connection from the keyboard being shown from one key alone, so as not to confuse the drawing by a multiplicity of lines incident to showing the connections from all the keys. Fig. 51 is a perspective view with portions of the machine broken away to disclose the relation of the space-carrier, space-distributer, and space-latch mechanism to each other. Fig. 52 illustrates in perspective the two mold-sections as detached from the machine and opened so as to disclose the faces of both sections. Fig. 53 is an elevation in transverse section through the casting-chamber on a line through the top ejectors, the mold-sections thereof being closed. Fig. 54 is a detail perspective view showing the central barrel-cam section as against one end section. Fig. 55 illustrates in perspective the relation of the barrel-cam sections when one end section and the central section are in contact with each other. Fig. 56 is a perspective view showing the relation of the trimming mechanism to its actuating crank-arm. Fig. 57 is a side elevation of the trimming mechanism in section through the trimmer-slide groove, showing the trimmer-slide as moving out a cast type-bar. Fig. 58 is an elevation in transverse section of Fig. 57 on line $x\ x$ of said figure. Fig. 59 is a perspective view of a detached wing-section of the compound space. Fig. 60 is a plan view, partly in section, of the end ejector and its latch, showing their relation to each other while the one is being held by the other. Fig. 61 is an enlarged plan view of the trimmer-slide, showing the bevel portion thereof. Fig. 62 is a detail perspective of the metal-pot noz-

zle, showing its cap. Fig. 63 is an enlarged perspective of the spaceway and the space-carrier, showing in section the manner of joining them. Fig. 64 is a side elevation of the machine, the frame thereof being in section, showing the metal-pot and its relation to the heating arrangement. Fig. 65 is a transverse elevation of the machine, the frame being in section as well as the metal-pot, showing the transverse relation of the heating-burner to the metal-pot.

The matrix-carrier has a front central leg *a*, which rests on a base *a'* when the matrix-carrier is in position for the assemblage of the matrix-bars in a line of composition. The matrix-carrier is pivoted at its rear portion to stationary supports a^2 of the machine, and when the matrix-carrier is in lowered position, either for assembling the matrix-bars or for casting from the latter, it is supported by its pivotal connections with said stationary supports a^2 and by said front leg *a* resting either on base *a'* or base a^3. Said two bases project radially from and are rigid with the hereinafter-described counter-shaft H, base *a'* being of greater radial projection than base a^3. Base *a'* maintains the matrix-carrier slightly elevated above its lowest possible position, so that when the matrix-bars are being assembled in the line of composition their lower ends may be free from frictional contact with the matrix-bar rest C^2, Figs. 3 and 6, located immediately below said line. Base a^3 maintains the matrix-carrier in its lowest possible position, which position is proper for taking the cast of the assembled line, and in such casting position the matrix-bars have their lower ends resting upon said rest C^2 to aline them.

The keys A, Sheet 12, which operate on the keyboard A', are arranged in four quadrantal banks, each key having vertical reciprocal movement in a suitable guideway a^4 of the keyboard-bank and provided in its lower portion with an oblique slot a^5, which extends from the rear portion of the key-body upwardly and forwardly to near the forward portion of the body. Loosely fitted transversely within said slot a^5 is one arm of a cross-bar a^6, which latter passes transversely through and is rigidly secured to the forward extremity of a longitudinally-reciprocating connecting-rod A^2.

The keyboard has each key provided with two bearings, an upper bearing a^7 and a lower bearing a^8, the reciprocating connecting-rod A^2 being connected to said key between said two bearings.

The ways B, Figs. 1, 2, and 3, which are carried by the matrix-carrier and which in turn directly carry the matrix-bars C, have assemblage portions and distributive portions. The portions of the ways on which the matrix-bars are suspended when assembled together in a line of composition are assemblage portions, while the portions of the ways on which the matrix-bars are suspended, either while distributed or while being distributed, are distributive portions.

The character-bars C are maintained in their distributive portions on the ways B, as the matrix-carrier is in lowered position suitable for assembling the matrix-bars, by two-lip latches C', Sheet 12, which latter are operated by connecting-rods A^2. Each character-bar C has one side of its upper extremity formed with a beveled edge *c*, said beveled edge permitting passage of the appropriate lip of the latch between two matrix-bars. The character-bar is provided at its upper extremity with an oblong eye *c'*, having its length parallel with the longitudinal body of the character-bar, said length of the oblong eye being greater than the section of the way B in the direction of the suspension of said bar therefrom, the transverse section of said eye being of such size that the character-bar may have free sliding movement on its way B, and yet prevents undue swinging movement of the character-bar in a plane transverse to said way. This oblong eye aids to prevent undue swinging of the character-bar on the way and also permits the character-bar to have a limited longitudinal movement independent of its way B, which independent longitudinal movement is of advantage when the different character-bars are assembled in the line of composition, permitting accurate alinement of the matrices without undue strain on the assemblage portions of the ways from which said character-bars are suspended. Said oblong eye *c'* is formed in a lug c^2 projecting from one side of the character-bar opposite to the side of the character-bar provided with said incline *c*. The rear extremity of each connecting-rod A^2 has fitted thereon a hook *b*, interposed between two nuts *b'* threaded on said connecting-rod, said hook having its free extremity loosely fitted in an eye formed in a crank b^2 rigidly secured to the upper extremity of the two-lip latch C'. Each latch can thus be easily and accurately adjusted relatively to its respective connecting-rod. Each said two-lip latch has bearing in a two-arm bracket c^3 and is incoiled by a spring c^4 having one end secured to said latch and its outer end secured to the bracket, said spring tending to turn the latch in circular movement the reverse of that which is caused by the depression of the key. The lower portion of each latch is provided with two longitudinal lips which extend both above and below the line of the corresponding way B, said lips being respectively a forward longitudinal lip c^5 and a rear longitudinal lip c^6, said two lips being respectively located in same line with the body of the latch.

The latches C' are loosely fitted and have longitudinal rocking bearing in brackets c^3 secured to bow C^3, said bow being loosely mounted on the frame C^4 of the matrix-carrier, so as to have limited independent movement thereon, the ends of the bow being loosely fitted in slotted bearings c^8, which lat-

ter are rigid with frame C^4, and the levers c^9, pivoted to said frame, having their rear ends adapted to engage with the ends of bow C^3, and having their forward ends connected to chains C^5, said chains extending forwardly and downwardly and there connected to the lower stationary framework of the machine. The construction is such that when the matrix-carrier is swung rearwardly for the purpose of distributing the character members the bow C^3 is moved by the levers c^9 away from the ways B sufficiently to permit the character members to travel rearwardly on their said ways, free from engagement with the latches C′, the bow C^3 being moved by the levers c^9 as the latter are operated by the taut of the chains C^5 and carrying the latches clear from the path of the character members as the latter pass into their complete distributed position. After the character members are so distributed, and when the matrix-carrier is swung in its reverse movement forwardly into position suitable for assembling the character members, the chains C^5 slack, and the levers c^9 permit bow C^3 to fall by its own gravity in bearings c^8, so as to again carry the latches C′ toward ways B, and said latches are thereupon located in position suitable for engaging with the distributed character members and locking the latter against assembling movement on the ways, except as released by the latches under key operation.

Character-member guides or checks D, Figs. 1, 2, and 3, are located, respectively, to the right and left of the path of movement of the matrix-bars as the latter pass down on the distributive portions of the ways to the assemblage portions, said guides or checks being wires substantially parallel with ways B, and having their stems d parallel with and below the assemblage portions of the ways, the forward end of each said wires D being secured to the front central standard a^4 of the matrix-carrier, while the body of each said wire projects rearwardly and in lateral inclination from said path of movement of the matrix-bars, said rearwardly and laterally projecting extremity of such wire being disconnected from any support and having free spring action. These guide or check wires furnish a cushion-bearing for any improperly-swinging matrix-bars as the latter approach the assemblage portions of the ways B, temporarily checking the travel of the lower portions of such matrix-bars, arresting their lateral swing, and restoring equilibrium to them, thereby obviating any tendency of such matrix-bars to cross or interlace with each other in movement, interfering with normal operation.

The foot of a matrix-bar C travels ahead of the eye on account of the friction of the way, while the foot of the matrix-bar has only the resistance of the air. It is desirable, therefore, in order to have the matrix-bar go around the curve in the angular way B and enter the channel between the two parallel planes of the assemblage portions of the ways B, that the foot of the matrix-bar should be checked up, so as to allow the eye of the matrix-bar to catch up therewith, and thereby cause the matrix-bar to glide into said channel in correct position. When two matrix-bars follow each other closely, one coming from one side of the matrix-carrier and the other coming from the other side of said carrier, there would be a tendency for them to strike each other and lock together in the head or upper part of said channel. Especially would such a tendency obtain when the foot of one matrix-bar swings forward farther than the foot of the other matrix-bar, and to obviate such tendency is the object of these guides or checks D. In addition to such checking of the advance travel of the foot of the matrix-bar the guides or checks cause each matrix-bar to be deflected slightly from its regular course across the head of said channel, thereby bringing such matrix-bar directly in the path of a matrix-bar following it from the other side of the matrix-carrier, and thus tending to prevent the locking or clogging in the head of the channel.

Treadle E, Fig. 2, is connected to the lower extremity of a chain e, the upward extremity of said chain being connected to a pulley e', Fig. 14, loose on main driving-shaft F. Said shaft carries a rigid housing f, in which a spring-pawl f' works, and the adjacent face of said pulley e' has groove f^2, with which said pawl engages, while a coil-spring f^3 has one end secured to said pulley and its opposite end secured to shaft F. The construction of said members is such that one stroke of the treadle causes said pulley-groove to engage with said pawl, so as to rotate shaft F in a one-half revolution, and upon release of the treadle spring f^3 returns the pulley to its previous position, while shaft F remains stationary.

The right-hand end of shaft F is provided with a cam g, Figs. 1 and 14, which engages with a pin g' projecting from the rear end of a slide-link g^2, which latter is secured to the rear extremity of a connecting-rod G. Said slide-link is connected to shaft F by a guide g^3 rigid with said shaft and fitting in the opening of the slide-link. The forward extremity of connecting-rod G is pivoted to an arm h, Figs. 4, 7, 8, and 9, rigidly secured to the right-hand end of counter-shaft H. Said counter-shaft is provided with a coil-spring h', having one end secured thereto, while its opposite end is secured to a stationary part of the machine, said spring when under tension being adapted to rock the counter-shaft forwardly. Said counter-shaft extends from the right-hand side of the machine horizontally to about the central cross portion of the machine and has rocking movement in suitable bearings Z^4 projecting from the stationary part of the machine. The left-hand end of said counter-shaft has keyed to it a toothed segment h^2, which gears with a rack h^3 formed

on the forward portion of compressor-shaft K. Said compressor-shaft is provided at its rear extremity with a compressing-arm k projecting at right angles therefrom.

The central body of the compressor-shaft is loosely fitted in a cylindrical opening k', Fig. 3, formed in the bed-plate of the machine, in vertical plane with and below the assemblage location of the line of composition, the bottom of said cylindrical opening being provided with a pin k^2 projecting upwardly therefrom and loosely fitted in groove k^3 formed in the lower portion of said compressor-shaft. Said groove, Fig. 18, is in part of its length oblique to the longitudinal axis of the compressor-shaft, its rear portion being parallel with the longitudinal axis of said shaft, while its forward portion inclines from said rear branch simultaneously toward the front and left side of the machine. The construction of said pin and angular groove is to cause the compressor-shaft to be turned sufficiently on its longitudinal axis, as the shaft is longitudinally moved rearward by the segment and rack gearing, to cause the compressing-arm to be deflected laterally toward the left side of the machine and thereby throw said arm to one side of the path of movement of the character or space members as the latter are assembled or distributed with reference to the line of composition and thus avoid interference with the movement of the matrices. Said angular groove also fulfils the office of bringing the compressing-arm parallel with the members of such line, as said toothed segment and rack operate to longitudinally move the compressor-shaft forwardly. The hub of said segment h^2 is provided with an arm h^4, Figs. 7 and 8, having recess h^5, in which lug h^6 on the compressor-shaft is adapted to lock, said lug h^6 being rigidly secured to the compressor-shaft rearwardly of its rack h^3 and adapted to depend in vertical plane below the compressor-shaft as the latter is at the limit of its forward longitudinal movement, the arm h^4 being at such time located parallel with and below the compressor-shaft, and its recess h^5 then so interlocking with said lug h^6 as to positively lock the compressor-shaft against longitudinal movement. Said arm h^4 is also provided with a lug h^7, which fits into a corresponding recess h^8 formed in lug h^6, such interlocking of lug h^7 with said recess h^8 taking place as arm h^4 is brought upward into position parallel with the compressor-shaft and as lug h^6 interlocks with recess h^5, this lock h^7 h^8 serving to insure the maintenance of the compressor-shaft in proper position, while the non-toothed portion of the hub of segment rides under the rack h^3, thereby insuring the gearing of the proper teeth of segment h^2 with the proper teeth of rack h^3 as the shaft H is moved in its rearward rocking, so that the compressor-shaft may not vary in its range of longitudinal reciprocation. The construction of said members is such that the teeth of segment h^2 clear the teeth of rack h^3 before the shaft H completes its forward-rocking movement. The interlocking of lug h^7 with recess h^8 continues after lug h^6 disengages from recess h^5 as shaft H is on the first portion of its rearward rocking movement. Said parts are so constructed as to properly coöperate.

The space-shaft L, Figs. 3 and 4, is located parallel with and above the compressor-shaft, and its forward extremity is provided with a pinion l, which gears with a rack l' formed on the upper extremity of a bar l^2, which has longitudinal sliding movement within a supporting-sleeve l^3. The lower extremity of said bar l^2 is provided with a parallel central slot l^4, in which loosely fits the forward extremity of a lever L', the rear extremity of said lever being connected to a tension-spring l^5, which latter may be secured to any suitable support. To the forward central portion of rack-bar l^2 is secured an arm l^6, Figs. 4, 7 and 8, projecting at right angles therefrom, and loosely fitted in a longitudinal slot l^7 formed in sleeve l^3. A block l^8 projects laterally from the forward extremity of said arm l^6 and is adapted to be locked in a recess l^9 formed in the lower extremity of a bell-crank L^2, and when so locked it prevents rack-bar l^2 from upward longitudinal movement, as said rack-bar is under the influence of tension-spring l^5. The forward extremity of the upper arm of bell-crank L^2 is provided with a laterally-projecting pin l^{10}, which is adapted to engage with a recess l^{11} formed in the forward extremity of locking-arm h^4, said engagement of pin l^{10} in recess l^{11} operating to withdraw recess l^9 of the bell-crank from block l^8 of arm l^6, and thereby permitting rack-bar l^2 to be operated by the spring l^5.

Rack-bar l^2 is operated in its reverse movement by engagement of arm h^4 with arm l^6 as counter-shaft H is rocked rearwardly, the same serving to effect the following several operations: rocking of the space-shaft L in movement reverse to that by which the compound spaces expand and justify the line of composition; lowering of arm l^6, so that bell-crank L^2 may by its own gravity interlock with said arm l^6; depressing the forward extremity of lever L', so that the rear extremity of said lever is raised and spring l^5 is drawn up in tension.

On the space-shaft L, Fig. 4, are fitted a series of compound spaces, respectively formed in two sections, the adjacent faces of which sections are respectively inclined reversely to each other, one section, M, Figs. 19 and 22, being a disk having a central square opening m corresponding to the square cross-section of the shaft L, said space-disk being adapted to have free sliding movement longitudinally on said space-shaft and to be rocked with the latter. The other section, M', of each space is formed as a wing having a circular opening loosely fitted on a circular hub m' of disk M and has free rocking movement thereon. That portion of the wing-section M' which is

adjacent to the casting-mold has a depending foot m^2, which extends to about the lower periphery of disk-section M and is provided with a toe m^3, which depends from the forward portion of said foot beyond the periphery of said disk-section. Said toe m^3 is adapted to loosely fit in a groove m^4 formed in the bed-plate of the machine parallel with the space-shaft, said groove permitting toe m^3 to have travel longitudinally therein and restraining said toe from having movement such as would be possible by rocking movement of the wing-section on hub m'.

The wing-section has its face adjacent to the disk-section, inclining upwardly and away from the latter, while the face of the disk-section which is adjacent to the wing-section is inclined in the reverse direction to the inclination of the adjacent face of said wing-section, the degree of inclination being the same for each of said inside faces of the two sections of the compound space. The disk-section has its outside face formed at right angles to space-shaft L, while the wing-section has its outside face formed also at right angles to said space-shaft. As the space-shaft rocks toward the mold to justify the line of composition, it correspondingly rocks the disk-sections thereon, while the wing-sections are maintained without rocking movement, thereby causing the inclined engaging faces of the disk-sections respectively with their companion wing-sections to have movement such as results in moving the non-inclined faces of the disk-sections and wing-sections away from each other, while maintaining said non-inclined faces at right angles to the space-shaft. Hence the character members, which may be assembled in a line of composition against these compound spaces, are maintained throughout their lengths parallel to each other while the line of composition is justified.

Space-shaft L is provided with a rigid pin l^{15}, Figs. 4 and 51, which works in a groove l^{16} formed in a sleeve l^{14}, said sleeve being loosely fitted over shaft L intermediate of pinion l and that portion of the shaft on which the spaces are assembled, said sleeve being rigidly secured to the stationary framework of the machine at a point adjacent to said space-assemblage portion of shaft L. That portion of space-shaft L which is inclosed within said sleeve l^{14} rocks freely therein and is also supported thereby, said sleeve being of such length as to permit shaft L to have a limited longitudinal movement therein. Said groove l^{16} of said sleeve is formed oblique to the length of said sleeve, and hence as shaft L is rocked said pin-and-groove mechanism $l^{15}l^{16}$ causes said shaft L to have a longitudinal movement simultaneously with its rocking movement, such longitudinal movement of the space-shaft being adapted to carry the compound spaces with the latter, so that as the shaft rocks and the assembled spaces expand within the line of composition said spaces are simultaneously bodily moved transversely to their planes of circular movement, such longitudinal movement of the space-shaft L being in the direction of the take-up of the spaces as the latter have their disk-sections circularly moved, maintaining said spaces steady, allowing them to move without cramping or binding on said shaft, and giving the spaces the free movement desirable to well accomplish their office of justifying the line of composition.

Space-shaft L has its rear extremity connected with a spaceway L^5, said shaft and way being of the same size and shape in cross-section, space-shaft L, however, having rocking movement, while way L^5 has no rocking movement. When said shaft and way have their sides in the same planes, the joint between them is such as to permit the spaces to pass readily from one to the other.

Space-shaft L, Fig. 63, is provided at its end adjacent to way L^5 with a tenon l^{17} circular in cross-section, fitted loosely in a corresponding mortise l^{18}, said tenon having a transverse annular groove l^{19}, in which loosely fits the free extremity of a pin l^{20} rigidly secured to way L^5. This construction permits shaft L to have rocking movement independent of way L^5 and to have longitudinal movement together with way L^5, the upper end of way L^5 having free longitudinal sliding bearing in a suitable support z', so that the said shaft and way may together have the described longitudinal reciprocation.

A space-distributer L^6, Fig. 51, is loosely fitted on the space-shaft and spaceway and is adapted to be moved by the operator's hand rearwardly along them, so as to carry all spaces to the rear side of the pivotal two-lip latch L^7, Fig. 1, by which said spaces are maintained until released at will of the operator. The upper portion of said space-distributer is provided with a suitable guide-eye z^2, Figs. 6 and 51, which loosely fits about the handle-guide z^3, said handle-guide extending in such direction and so formed as to properly conduct the handle end of said space-distributer as the latter performs its office. Said way L^5 inclines upwardly and rearwardly from shaft L and in lateral inclination toward the right of the machine, so as to permit space-distributer L^6 to carry all spaces from shaft L rearwardly on way L^5 out of the path of movement of the matrix-bars. Said way L^5 has sufficient inclination to cause the spaces to be assembled by gravity as they are respectively released one at a time by said two-lip latch L^7, said latch being pivoted on a support l^{21} and having its stem connected by small rod l^{22} to a lever l^{23}, said lever being adapted to be rocked by a key l^{24} carried by and having reciprocating longitudinal movement on the matrix-carrier. Said key l^{24} is carried by the matrix-carrier, and when the latter is in position for assembling a line of composition said key may be pressed downward by the operator so as to

depress the power end of lever l^{23}, and said lever then operates the space-latch mechanism to release a space, said key having sliding movement in suitable guiding-supports formed on the matrix-carrier. A guide l^{25} insures the deflection and delivery of the wing-section of the compound spaces into guard-groove m^4 of the bed-plate, said guide having its forward and lower portion located in line with the left wall of said groove m^4, and having the remainder of its body located in a line substantially parallel with the line of way L^5. As any one of the compound spaces travels down the way L^5 the toe m^3 of the wing-section m' engages with said guide and is thereby conducted into said groove m^4. The wing-section of each compound space has edge bearing in direction toward the right of the machine against a shoulder m^5 formed on the contiguous face of the companion disk-section M, said shoulder-bearing preventing the wing-section from movement in that direction, as it depends below hub m', inasmuch as said shoulder is normally in a line below and at right angles to the spaceway as the compound space travels on said spaceway. Said guide l^{25} prevents any movement of the wing-section M' in direction toward the mold, while said shoulder m^5 prevents movement of said wing-section in direction away from the mold, and thus the wing-section of each compound space is maintained in proper position relative to its companion disk-section as said compound space travels from spaceway L^5 to space-shaft L. Said guard-groove m^4 permits toe m^3 of the wing-section of each compound space to have travel longitudinally therein and guards said toe from having movement such as would be possible by rocking movement of the wing-section on hub m', and thus said groove acts as a guard to prevent rocking movement of the wing-section while the disk-section of the compound space is being rocked.

To the right-hand side of the space-shaft L and parallel therewith is a space-supporter N. This space-supporter when in forward position holds the spaces firmly in position and maintains them in close contact against the casting-mold, preventing formation of fins on the cast type-bar and aiding to produce a more perfect type-bar than otherwise would be the result. Said space-supporter further operates to relieve space-shaft L from the strain otherwise incident thereto by reason of the close engagement of the spaces with the casting-mold. This space-supporter, Fig. 6, has its space-engaging face formed concave and adapted to closely surround the disk-section of the spaces on their sides opposite to their sides facing the mold. Thus the space-supporter engages with and embraces both the upper and the lower portion of the disk-sections of the compound spaces as well as the horizontal central portion thereof. The space-supporter slightly raises the disk-sections from off their bearings on the space-shaft L and forces them in close contact against the mold in proper operative position, thereby insuring their most advantageous coöperation in the casting operation. The controlling aim and advantage of the space-supporter is the centralization of the spaces relatively to the engaging walls of the casting-chamber, so that the space may have equal bearing against the walls alike of the upper and lower mold-sections. It will be observed that this my space-supporter does not operate to expand the spaces and is not part of the justifying mechanism. The space-supporter N is provided with a tongue n, Fig. 13, projecting rearwardly and having sliding bearing on the bed-plate of the machine through a suitable guideway. The rear extremity of said tongue is connected to a transverse lever n' pivoted to the rear portion of the machine and suitably connected at its rear extremity to the right-hand end of a rod n^2. Said rod is longitudinally parallel with the machine-bed and has its left end provided, respectively, with a forward stop n^3 and a rearward stop n^4, and between said two stops an arm n^5 is loosely fitted over the rod, so as to have transverse movement thereon without moving the rod, except as said arm engages with either of said two stops. Said arm n^5 has its opposite and forward extremity secured rigidly at right angles with the rear side of the mold-slide P, and said arm has free lateral movement in a transverse slot n^6 formed in the rear part of the machine-bed. As the mold-slide P moves forward toward the right of the machine and the line of composition, said arm n^5 is thereby carried forward and engages against stop n^3, moving connecting-rod n^2 toward the right of the machine and thereby causing lever n' to force the space-supporter N against the spaces in the line of composition. Said engagement of members operates to maintain the space-supporter in suitable pressure against the spaces until after the type-bar has been cast, whereupon by the rearward movement of the mold-slide P toward the left of the machine the arm n^5 is carried toward the left side of the machine, thereby releasing connecting-rod n^2 from pressure toward the right of the machine, and said arm n^5 engages with stop n^4, so as to draw connecting-rod n^2 toward the left of the machine and thereby retract space-supporter N from the spaces. Said mold-slide P, Fig. 24, has reciprocating movement in a horizontal line and is rigidly connected with the lower section p of the casting-chamber, the upper section p' of the casting-chamber being hinged to said slide P by a knuckle-joint p^2, said two sections having the forward portions of their adjacent faces suitably formed to constitute a casting-chamber p^3.

The axial line of joint p^2, Fig. 24, is located in a plane below the plane of the lower face of the rear side wall x of the casting-chamber p^3, and said lower face of said wall x is in a plane below the plane of the bottom of said

casting-chamber when the upper mold-section is in position to form the casting-chamber p^3. By thus locating the axial center of the pivotal joint p^2 in such a plane below the plane of the lower face of said rear side wall x of the casting-chamber the upper mold-section may be swung upwardly and downwardly without causing undue wear between said end wall x and the shoulder x' of the lower mold-section, while nevertheless a closely-sealed joint is effected between said wall x and said shoulder x' when the upper mold-section is swung down into proper position for the casting operation, for by so locating the axial center of the pivotal joint p^2 in a plane below that of the lower face of side wall x the arc of the circle described by said wall x as the upper mold-section is swung in either direction is such as to cause said wall x to be free from abrading action on shoulder x', and such arc of the circle is also such as to insure a metal-tight joint between said wall and shoulder when the mold-sections are in casting position.

Yoke P′ is a metal plate, which has two depending side portions detachably clamped rigidly to the framework of the machine respectively on opposite sides of the guideway in which mold-slide P reciprocates, the body portion of said yoke having its lower face located above the alining-plate P^3 sufficiently to permit of the upward swinging movement of the upper mold-section p'.

When slide P is moved toward the right of the machine, brace P^2, Fig. 6, is brought upright in strongly-clamping position between the yoke P′ and the upper mold-section p', maintaining the upper section of the mold in securely-fixed position as the casting metal expands in cooling.

Lying on the upper face of upper mold-section p' is the alining-plate P^3, provided with an opening p^4, in which works brace P^2. The rear portion of said alining-plate is connected with the upper mold-section p' by a spring-pressure device p^5, which tends to throw it forward. Said spring-pressure device p^5 consists of a spiral spring loosely fitted on a pin projecting from the mold-slide and having its forward extremity bearing against the central rear portion of the alining-plate and having its rear extremity bearing against a fixed guide-eye on the upper rear face of the upper mold-section p'. A screw p^6, Fig. 13, projects on the forward extremity of the upper mold-section p' and passes loosely through a slot p^7 in the alining-plate, thus properly holding the latter down onto mold-section p', while permitting it to have free spring-pressed sliding movement on said mold-section, the construction of said members being such as to cause said alining-plate to project forwardly under operation of the spring-pressure device p^5 sufficiently to engage said alining-plate with the character members in the line of composition and to bring said character members into alinement prior to the engagement of the casting-mold with said character members, the spring-pressure device p^5 and slot p^7 thereupon operating to permit the upper mold-section p' to be carried forwardly against the line of composition in sliding movement beneath the alining-plate. When said alining-plate engages with the shoulders c^7 of the matrix-bars, the matrix-carrier is in its lowest possible position and the matrix-bars have their lower ends resting on rest C^2, and said matrix-bars, being loosely fitted on the ways B by their oblong eyes c', are permitted to have their respective matrices brought into accurate alinement and are at the same time longitudinally clamped between said alining-plate P^3 and said matrix-bar rest C^2.

Mold-slide P is longitudinally reciprocated by suitable mechanism connecting same with the main driving-shaft F, said mechanism being hereinafter described and serving to advance said mold-slide into the desired forward position, maintain said mold-slide in such position during the casting operation, and then withdraw said mold-slide in suitable return movement.

A matrix-bar bearing Q, Fig. 6, is located parallel with the mold and in front of and higher than the latter, said bearing being for the rear edges of the matrix-bars above their matrices. The wall q to the right of rest C^2 is located in the same vertical plane with said bearing Q and lower than the mold-guides, and provides bearing for the lower ends of the matrix-bars, the mold being adapted by the forward movement of mold-slide P to compress the matrix-bars between it on their front edges and said bearing Q and right wall of groove q on their rear edges, such compression of the matrix-bars serving to closely seal their joints with the mold.

The melting-pot R, Figs. 1 and 5, is suspended from trunnions r, and is oscillated in forward and rearward movement by an arm R′ having its lower portion secured to the back central portion of the melting-pot, while the upper extremity of said arm is provided with a link r', within which the main driving-shaft is loosely fitted, said arm extending from the melting-pot to said driving-shaft in a direction upwardly and toward the rear of the machine. The lower portion of said arm has longitudinal slots r^2, Figs. 5 and 17, through which clamping-bolts r^3 pass. A set-screw r^4 has bearing against the lower end of said arm, and is adapted to secure said arm to the melting-pot at any desired point of vertical adjustment. The upper portion of said link r' is provided with a lateral stud r^5, Figs. 5 and 16, which rides on the upper periphery of a cam r^6 rigid with said driving-shaft. The construction of such members is to cause a positive movement of the melting-pot forward and upward during a certain portion of the revolution of the main driving-shaft F and to cause a positive withdrawal of said melting-pot from said forward and upward position back to its normal position during a cer-

tain other part of the revolution of said driving-shaft. The melting-pot may be heated by any suitable means. In Figs. 64 and 65 of the drawings I, however, show one form of heating means which I have heretofore used, the same consisting of a gas-burner R^2 of circular shape, supported beneath the melting-pot and having a gas-supply pipe r^7 provided with a valve r^8 to regulate the supply. Between said valve and burner a flexible pipe r^9 is located, which connects with an auxiliary burner R^3 supported on the primary conduit s' of said melting-pot. A hood R^4 covers the melting-pot to assist in concentrating the heat, and a deflector R^5 is secured in front of the secondary conduit s^2 of the melting-pot for the same purpose. It will be understood that the reason why I do not show said heating means in certain other of the drawings illustrating the same mechanical members shown in said Figs. 64 and 65 is because it would detract from the clear representation therein of the said mechanical members.

The melting-pot is provided with a force-pump S, Fig. 5, operated by a lever S', said lever having a spring S^2 which tends to maintain it in lowered position, and being connected with a link S^3 whose upper extremity is engaged with a cam s rigid with the main driving-shaft F. During a certain portion of the revolution of the main driving-shaft said link s^3 is operated so as to raise the plunger of the force-pump ready for the latter's action, while at another portion of the revolution of said driving-shaft said spring S^2 becomes operative to draw lever S' downward, and thereby cause the plunger of said force-pump to eject molten metal from the melting-pot through the intermediate discharge into casting chamber p^3.

The force-pump S, Fig. 5, is provided with a primary conduit s', rigid therewith. A secondary conduit s^2 has its rear extremity connected to the forward extremity of said primary conduit by a universal-joint connection s^3. The forward extremity of said secondary conduit s^2, Fig. 6, is provided with a semispherical nozzle s^4, over which loosely fits a cap s^5, a screw s^6 being threaded into the central top of said nozzle, while the stem of said screw is loosely fitted in a hole s^7 formed in the central top of said cap. The head of said screw s^6 has bearing on the top of said cap s^5, and the relative dimensions of said members are such that said cap may have a limited movement in any direction over said nozzle, so as to conform itself accurately to the opening p^{12}, which passes in a transverse direction completely through the central part of the forward portion of lower mold-section p and into the lower portion of the forward central part of upper mold-section p'. Said opening p^{12} is formed with front and rear straight-sided walls p^{13} in that portion thereof which is located in the same plane with casting-chamber p^3, and cap s^5 is formed with straight exterior front and rear sides s^8, which exactly fit and have a wedge action between said walls p^{13}, said walls p^{13} inclining toward each other as they extend upwardly, and walls s^8 also inclining toward each other as they extend upwardly. Said cap s^5 may be wedged in said opening p^{12}. In the drawings I have shown the engaging-wall of the melting-pot discharge-conduit as conical; but it may be of other form, provided same corresponds with the foregoing description. Both the nozzle s^4 and the cap s^5 are provided with lateral discharge-opening s^9, adapted to be located in the same plane and to communicate with casting-chamber p^3 when said cap s^5 has been thrust upwardly as far as possible within opening p^{12}. The upper portion of said opening p^{12}, Figs. 6 and 12, forms at its front side a semicircular recess r^{10}, having an ingate for the molten metal from the melting-pot to be discharged into the mold-chamber p^3, said recess being formed in the rear wall of the mold-chamber and opposite to the front open side of the mold-chamber which is for presentation to the line of composition. The mold-chamber has said recess r^{10} formed therein midway of its length, and has two end portions r^{12} respectively located on opposite sides of said recess, and the spherical conduit of the melting-pot is constructed to fit within said recess and to have its lateral discharge-orifice register with the ingate, the upper portion of said opening p^{12} being of such dimension relative to the discharge-conduit of the melting-pot that the extreme upper portion of said discharge-conduit may pass above the plane of the mold-chamber, and thereby bring its lateral discharge-orifice s^9 into same plane with the ingate and the mold-chamber. Should the discharge-conduit so expand by heat that it will not at any operation pass up into opening p^{12} quite so far as it does under normal conditions, said lateral orifice s^9 may still register sufficiently with said ingate, and at the same time the discharge-conduit will be wedged tightly between the front and rear walls p^{13} of said opening p^{12}, said front wall of opening p^{12} being located at the central rear portion of the mold opposite its open front side, while said rear wall of opening p^{12} is located to the rear of said front wall, and between said front and rear walls p^{13} the spherical discharge-conduit of the melting-pot is constructed to be tightly wedge fitted.

When for any reason in the operation or handling of the machine it is desirable to have the main driving-shaft operated without operating the force-pump S, the latter may be maintained idle by adjusting a locking-pin s^{10}, Figs. 14 and 15, in a suitable hole formed in the upper extremity of link S^3 and through stud s^{11}, so that said pin may have bearing on the disk s^{12} of cam r^6, said pin s^{10} being of length and so formed as to have its end portion ride on the top of the periphery of said disk s^{12} as the latter rotates with shaft F, and thereby to maintain the lateral stud s^{11}, which is rigid on the upper extremity of

link S^3, free from cam *s*, and thereby shaft F may rotate without imparting action to said link, and the upper mold-section p', Fig. 6, is swung open after the type-bar has been cast by pin p^{14} loosely fitted in an opening p^{15} formed transversely in the lower mold-section *p*, the top of said pin having engagement against the bottom of the upper mold-section p', while the bottom of said pin has free sliding engagement with an incline p^{16} in the bed of the machine below the lower mold-section *p*. Said incline extends upwardly and toward the left of the machine, so that as the mold-slide P moves toward the left side of the machine and carries the mold-sections with it said pin p^{14} is also bodily carried with lower mold-section *p*, and its bottom rides upwardly on incline p^{16}, thereby raising said pin p^{14}, so that its top will be forced against the upper mold-section p', and the latter will be thereby swung upwardly on its knuckle-joint, so as to permit of free delivery of the cast type-bar from the casting-chamber.

Two top ejectors p^{17}, Figs. 6 and 53, respectively, depend from yoke P', the upper extremities of each being formed with a cross-head p^{18} working in a guideway p^{19} in the forward portion of said yoke P', said guideway inclining upwardly very slightly from the lower forward portion of said yoke as it extends rearwardly. Each said ejector passes through a suitable slot in alining-plate p^3 and through a suitable opening in the upper mold-section p', which latter opening communicates with the top of casting-chamber p^3. As the upper mold-section p' is in its backward movement, it carries with it said top ejectors, and the guideways p^{19} are adapted relatively to the upper swinging movement of the upper mold-section p', so that the said ejectors are properly operated in longitudinal sliding movement toward the casting-chamber p^3 to insure proper release of the cast type-bar from said upper mold-section.

An end ejector p^{20}, Figs. 31 and 60, has its forward ejecting end working within the rear end of the casting-chamber p^3, while its body portion has a lug p^{21}, said lug engaging with a companion lug p^{22} on the rear side of the lower mold-section *p*. A spring-pressure device p^{23} tends to press the ejecting end endwise into the casting-chamber, and pivotal spring-pressed latch p^{24} engages with the heel of said lever-ejector to prevent such action of spring device p^{23} until after lug p^{22} has so far passed beyond lug p^{21} as to be out of line with any portion thereof, and also until after latch p^{24} is carried from engagement with ejector p^{20} by the movement of mold-slide P. The ejector p^{20} is pivoted to the stationary framework of the machine, while latch p^{24} is pivoted to a rigid portion of mold-slide P. The construction of said members is such that as the mold-sections are in their forward position, with the casting-chamber against the line of composition, lug p^{21} of the pivotal ejector p^{20} is in line with and in engagement against lug p^{22} of the lower mold-section, so that the ejecting end of the ejector is withdrawn from the casting-chamber p^3. As the mold-sections are on their backward movement, the said ejector becomes free to act under the operation of spring-pressure device p^{23} as soon as said latch p^{24} becomes disengaged from the heel of the ejector, and then the type-bar is subjected to the spring thrust of the ejecting end of the pivotal ejector, so as to insure said type-bar being quickly ejected endwise from the casting-chamber p^3 when the latter has its upper mold-section thrown upward.

The cast type-bar is discharged into galley *z*, to be taken from said galley by the hand of the operator and placed on the trimmer-slide T as the latter is in its rearward position. Said trimmer-slide has a front upward projection *t* and a rear upward projection t', between which two projections the type-bar is loosely fitted when placed on the trimmer-slide, said front projection being shorter than the rear projection and having both its front and rear ends beveled, so the said front projection, respectively on the forward and rearward movement, may pass by the adjacent type-bar. Said trimmer-slide has forward and rearward longitudinally-reciprocating movement in a slideway T' formed in the left side of the bed-plate of the machine. Two trimming-cutters T^2 are secured to the stationary part of the machine, respectively to opposite sides of said slideway T'. The trimmer-slide T is provided with a lateral stud t^2 projecting from its left side and working in a slot t^3, the outer extremity of said stud being loosely connected by link t^4 to a crank-arm t^5 rigidly secured at right angles to a hub t^6, which latter is loosely mounted on shaft V, which reciprocates mold-slide P. Hand-lever T^3 is connected by pivot t^7 to the hub t^6, and a spring t^8 interposed between said hand-lever T^3 and the crank-arm t^5 tends to maintain detent t^9 in the respective notch t^{10} formed in the hub of the crank *v*, which latter is rigidly keyed to shaft V. As the hand-lever T^3 has its rigid finger t^9 engaged in said notch of crank *v*, the trimmer-slide T is automatically reciprocated in its longitudinal movement by the intermediate mechanism connecting the latter with said hand-lever, so that said trimmer-slide is operated by the rocking of crank *v*, and when, for any reason, it is desirable to operate said trimmer-slide independently of said crank *v* such operation can be had by swinging said hand-lever on its pivot t^7 in opposition to spring t^8, so as to release its detent t^9 from notch t^{10}, and then said hand-lever can be moved so as to rock crank-hub t^6, and thereby operate the trimmer-slide as desired.

A spring-latch T^4 tends to maintain position partially across slideway T', and in the path of movement of front projection *t* of trimmer-slide T. The inclined forward and rear edges of said projection *t* engage with the free end of said spring-latch, so as to displace the latter and throw it temporarily

out of the path of movement of the trimmer-slide. The cast type-bar carried by said trimmer-slide is of less length than the distance between the front and rear projections $t\,t'$. Said spring-latch therefore automatically passes in between the rear end of the cast type-bar and the rear projection t' of the trimmer-slide, and thus prevents said type-bar from being carried backward in the return movement of the trimmer-slide, the conjoint action of said spring-latch T^4 and the front projection t of the trimmer-slide being therefore such as to cause a type-bar once between said two members to be deflected laterally in the direction of the right-hand side of the machine as said front projection t is on its rearward movement.

Shaft V, Figs. 1 and 34, is a rocking shaft constructed to have movement in each direction to the extent of about one-quarter of an entire revolution, such rocking movement being adapted to impart to the mold-slide the desired movement thereof, as follows: A tripartite barrel-cam mechanism has its central cam-section W rigidly secured to said shaft V, while the two end sections of the cam mechanism, respectively W′ and W^2, are rigidly secured to mold-slide P. The central cam-section is provided with two forward projections w, respectively located on opposite sides of the rock-shaft, each said forward projection having a side w' inclined to the longitudinal axis of the rock-shaft and having an end w^2 at right angles to said axis. Said central section is also provided with two rear projections w^3, each said projection having a side w^4 inclined to the longitudinal axis of the rock-shaft, and also having an end w^5 at right angles to the said axis, said two ends w^5 respectively located to opposite sides of the rock-shaft and in a plane at right angles to the plane in which two ends w^2 are located. Said two ends w^2 have their centers located from the centers of the two ends w^5 a distance about equal to a quarter of the circle which would be described by a complete revolution of the central cam-section W. The forward end section W′ has its face adjacent to the central cam-section formed with two rearward projections w^6, the counterpart of projections w, each said projection w^6 having an inclined side w^7, which is the counterpart of and engages with side w' of the companion projection w, each said projection w^6 having an end w^8, the counterpart of and engaging with the end w^2 of the companion projection w. The rear end section W^2 has its face adjacent to the central cam-section formed with two forward projections w^9, the counterpart of projections w^3, each said projection w^9 having an inclined side w^{10}, which is the counterpart of and engages with side w^4 of the companion projection w^3, each said projection w^9 having an end w^{11}, the counterpart of and engaging with the end w^5 of the companion projection w^3. The construction of said members is such that when the mold-slide is in its withdrawn position said ends w^5 are in engagement with said ends w^{11} and said inclined sides w' are in engagement with said inclined sides w^7. As the rock-shaft is rocked forwardly an eighth of a revolution said inclined sides w' ride over said inclined sides w^7, while simultaneously said inclined sides w^{11} ride over said inclined sides w^4, thereby moving the mold-slide forward to its complete advanced position. Said ends w^2 thereupon ride on said ends w^8 during the next eighth of a revolution of said rock-shaft, while simultaneously the projections w^3 have free movement between projections w^9, and said projections w^9 in like manner have free movement between projections w^3. The rock-shaft has now made one-quarter of its revolution in a forward direction, such quarter-revolution having served to move the mold-slide to its advanced position during the first half portion of said quarter-revolution and to have maintained the mold-slide stationary during the second half of said quarter-revolution. The rock-shaft now makes its return movement, describing one-quarter of its revolution. Ends w^2 now ride in return movement on ends w^8, while simultaneously projections v^5 ride freely between projections w^9, and projections w^9 ride freely between projections w^3, and the mold-slide is maintained stationary in its said advanced position during the first half portion of this return quarter-revolution of the rock-shaft. During the second half of this return quarter-revolution of the rock-shaft inclined sides w^4 ride on inclined sides w^{10}, and simultaneously inclined sides w^7 ride on inclined sides w', and the mold-slide is thereby retracted.

The operation of the invention is as follows: The matrix-carrier being in downwardly-swung position and having its front leg a resting on base a' of counter-shaft H, and compressing-arm k being swung to the left of the path of movement of the matrix-bars, the latter, together with the spaces, are suitably assembled by proper key movement to form a line of composition in front of the mold. As key A is depressed by the operator, and its latch C′ is correspondingly rocked, the forward lip c^5 of said latch is thereby actuated in rocking movement from its corresponding way B sufficiently to permit the first matrix-bar C held by said lip to pass down on the inclined way B by reason of its own gravity when clear of said lip, while the same rocking movement of the latch causes the rear lip c^6 to pass in front of and engage with the incline c of the next succeeding matrix-bar, so as to lock said succeeding matrix-bar and the remaining successive matrix-bars against movement down said inclined way B. As key A is then released by the operator, spring c^4 operates to immediately rock latch C′ in movement reversed to that caused by the depression of said key. The rear longitudinal lip c^6 is thereupon moved clear of the matrix-bar with which it was in engagement, and incline

c^{14} of such matrix-bar being out of line with said rear lip c^6, such matrix-bar, together with the succeeding matrix-bars, thereupon slide by gravity down their inclined way B a limited distance and are then arrested by the forward longitudinal lip c^5 engaging with the first one of said restrained matrix-bars, said members being then in position such as normally obtains when the latch C′ is at rest, and the matrix-bars C are likewise at rest on the particular way B controlled by said particular latch C′. The latches C′ have their appropriate lips inserted between any two matrix-bars by reason of the latters' inclines *c*, so as to cause release from said latches of only the proper matrix-bars.

The operator having observed, aided by gage-lines *y*, the assembling of matrix-bars and spaces in estimated quantity sufficient to constitute the desired line of composition, he desists further key manipulation and gives treadle E its primary stroke.

The operation of the members of the machine incident to casting each type-bar is divided into two movements, respectively, of the treadle and of the main driving-shaft F, each said movement of said driving-shaft being a half-revolution of the latter, and the two together constituting a complete revolution of the shaft in one direction, so that the production of each cast type-bar from the machine is caused by one complete revolution of the main driving-shaft, divided into two semirevolutions in the same direction, each said complete revolution of the main driving-shaft being the result of two full-stroke movements of the treadle, respectively a primary and a secondary treadle movement.

The primary treadle movement operates through the hereinbefore-described mechanism, as follows: first, to bring compressing-arm *k* into position parallel with the line of composition and to a predetermined point positively fixed for the length of the line of composition when the latter is finally justified; secondly, to rock and longitudinally move space-shaft L, so as to cause disk-sections M of the compound spaces to suitably move together to cause the spaces to expand the line of composition to its fullest possible extent, as limited by the set position of compressing-arm *k;* thirdly, to move mold-slide P toward the justified line of composition, said mold-slide carrying alining-plate P^3, which engages with the matrix-bars to place their matrices in line, said mold-slide also operating space-supporter N, so that the latter may provide rear bearing for the spaces as the latter are pressed at their forward edges by the mold, said mold-slide also forcing the mold closely against the front edges of the matrix-bars and the spaces of the line of composition; fourthly, to swing the melting-pot R forwardly and upwardly with its discharge-conduit wedged against the casting-chamber p^3; fifthly, to actuate the pump-plunger in discharge of molten metal into the casting-chamber.

The secondary treadle movement, which rotates the main driving-shaft F in its final half of its complete revolution, actuates the members of the machine through the hereinbefore-described mechanism, as follows: first, to withdraw the plunger of the pump; secondly, to withdraw the melting-pot discharge-conduit from the casting-chamber; thirdly, to move mold-slide P toward the left of the machine, thereby releasing the line of composition from the pressure of the mold, releasing the spaces from the pressure of the space-supporter, swinging up the upper mold-section, and actuating the mechanism which ejects the type-bar from the casting-chamber; fourthly, to rock the space-shaft L in reverse to its previous movement and place the connecting mechanism in suitable position for a repetition of the operation thereof described under the first treadle movement; fifthly, to move compressor-shaft K rearwardly and throw its arm *k* out of the path of movement of the matrix-bars in reverse to its movement described under the first treadle movement.

Said primary treadle movement accomplishes its previously-described operation more in detail as follows: Driving-shaft F releases its cam *g* from slide-link g^2, and counter-shaft H is thereupon quickly moved in forward rocking movement by the recoil of the tension-spring *h′*. Base *a′* is moved forward from leg *a* of the matrix-carrier, and said leg thereupon rests on base a^3. Compressor-shaft K is moved longitudinally forward by gearing h^2 h^3, and is also rocked, so as to swing compressing-arm *k* upwardly and toward the right of the machine, thereby bringing said compressing-arm into parallel line with the assembled matrix-bars, the extent of the said forward longitudinal movement of the compressor-shaft being positively predetermined by the construction of the connecting members to correspond with the length of the type-bar to be cast. Rack-bar l^2 is thereupon released from its locked lowered position by arm h^4 tripping bell-crank L^2 from its engagement with arm l^6, and said rack-bar l^2 is quickly thrown in upward movement by the spring l^5 operating lever L′. Said upward movement of rack-bar l^2, by its engagement with pinion *l* of space-shaft L, rocks the latter toward the mold in movement suitable to expand and justify the line of composition, and by the pin-and-groove mechanism l^{15} l^{16} also moves said space-shaft L longitudinally toward the rear of the machine. Such movement of the space-shaft moves the compound spaces in a transverse movement bodily toward the rear of the machine and simultaneously rocks the disk-sections M of the spaces. Said rocking movement of the disk-sections M, in connection with the non-rocking movement of the wing-sections M′, expands the line of composition to its fullest

extent and accurately justifies the same, while simultaneously the matrix-bars are maintained parallel to each other throughout their entire lengths by reason of the reverse transverse inclination of the two companion sections of each compound space. The main driving-shaft thereupon, by the mechanism intermediate thereof and the mold-slide P, moves the latter forwardly toward the right of the machine, the alining-plate P^3 thereupon engaging with the notched edges c^7 of the matrix-bars prior to the engagement of the mold with the latter, and said matrix-bars are alined, so that their characters may be all in the same transverse plane suitable for casting. Such forward movement of the mold-slide also throws space-supporter N forwardly in movement toward the left of the machine by the described mechanism connecting said space-supporter with the mold-slide, and said space-supporter thereupon bears against the rear or right-hand edges of the disk-sections M of the compound spaces, and the front walls of the upper and lower mold-sections $p\,p'$ are forced in, bearing against the front or left-hand edges of the matrix-bars and the spaces of the line of composition. Main driving-shaft F thereupon, through its cam r^3, operates arm R′ of the melting-pot R, so as to swing the latter forwardly and upwardly. Cap s^5 of the discharge-conduit is forced in wedge-bearing up within opening p^{12} of the mold, and lateral discharge-opening s^9 is thereupon placed in same plane and in open communication with casting-chamber p^3. Driving-shaft F thereupon, through its cam s, operates the plunger-actuating mechanism of force-pump S, and a charge of molten metal suitable for taking a cast is discharged into the casting-chamber p^3. The treadle E is then given its secondary movement, which accomplishes its previously-described operation, more in detail as follows: Cam s of the main shaft F draws link S^3 upwardly, thereby withdrawing the plunger of the force-pump S from its forward-stroke position, and placing same in position for a repetition of its metal-discharging action, said upward movement of link S^3 also simultaneously placing spring S^2 under tension, so that upon release of said arm by said cam said spring may have the power to again operate the metal-pump in its discharging action. The main driving-shaft thereupon, by the mechanism connecting same with mold-slide P, withdraws the latter from its forward position, such withdrawal of the mold-slide toward the left of the machine releasing the line of composition from the pressure of the mold and the alining-plate against the front edges of said line of composition, also releasing the space-supporter N from its pressure against the rear side of the spaces in the line of composition, also releasing the upper mold-section p' from the locking-section of brace P^2, also opening the upper mold-section p' by the pin p^{14} and inclined plane p^{16}, and operating the ejectors which discharge the type-bar from the casting-chamber. Main driving-shaft F finally, through its cam g, operates slide-link g^2 so as to draw connecting-rod G longitudinally toward the rear of the machine, thereby rocking counter-shaft H rearwardly, and in turn moving compressor-shaft K toward the rear of the machine and swinging compressing-arm k downwardly and to the left of the machine out of the path of movement of the matrix-bars, and also lowering rack-bar l^2 by the engagement of the lower end of arm h^4 with the upper edge of arm l^6, so as to rock space-shaft L in reverse to its movement in justifying the line of composition, permitting bell-crank L^2 by its gravity to interlock with and hold down arm l^6 and raising spring l^5 in tension. The matrix-carrier may then be swung backwardly, so as to distribute the matrix-bars which were previously in the line of composition, and the spaces which were previously in the line of composition may be moved by the space-distributer L^6 rearwardly and off from the space-shaft L onto spaceway L^5, and upwardly on the latter till the spaces are to the right of and locked by the two-lip latch L^7, the construction of the space-shaft L, spaceway L^5, and the mechanism which operates shaft L being conjointly adapted to cause the angular sides of said shaft and way to register with each other at such time, so as to permit the spaces to pass readily from the one to the other.

The cast type-bar which constitutes the product of the foregoing-described operation of the invention may then be trimmed by the trimming mechanism hereinbefore described, such trimming mechanism being operated automatically by means of the connections intervening between it and the treadle through the main driving-shaft, or such trimming mechanism may be operated by hand, at the will of the operator, as the trimming mechanism may be disconnected from the rock-shaft V.

The foregoing description and accompanying drawings set forth in detail mechanism embodying my invention. Change may be made therein, provided the principles of construction respectively recited in the following claims are employed.

I therefore particularly point out and distinctly claim as my invention—

1. The combination with a compressor-shaft, having a rack, and a rocking shaft carrying a toothed segment gearing with the rack to reciprocate said compressor-shaft longitudinally, of a lug rigid with said toothed segment-shaft and engaging with a companion lug rigid with said compressor-shaft, to lock the latter against movement while said toothed segment is clear of said rack, substantially as set forth.

2. The combination with a compressor-shaft having a circular toothed rack, and a rocking shaft having a toothed segment engaging with said rack to longitudinally reciprocate

the compressor-shaft, of an arm rigid with said toothed segment-shaft and having a lug which interlocks in a recess in a companion lug rigid with said compressor-shaft, to prevent the latter from movement while its rack is free from the teeth of said segment, substantially as set forth.

3. The combination with a longitudinally-movable compressor-shaft carrying an angular projection, of a rocking shaft having a toothed segment adapted to be intermittently in and out of mesh with a rack formed on said compressor-shaft, said rocking shaft having an arm provided with a groove in which said projection fits when said segment is out of mesh with said rack, substantially as set forth.

4. The combination with a longitudinally-movable compressor-shaft, having a rack, of a rocking shaft having a toothed segment; said two shafts respectively provided with interlocking mechanism; the teeth of said segment adapted to clear said rack prior to the completion of the appropriate movement of said rocking shaft, and prior to the completion of the engagement of said interlocking mechanism of the two shafts, substantially as set forth.

5. The combination with a longitudinally-movable compressor-shaft having a rack, of a rocking shaft having a toothed segment which gears with said rack; said two shafts respectively having angular projections constructed to interlock with each other; the teeth of said segment constructed to be out of gear with said rack during the movement of the rocking shaft in one direction before said two projections have completely interlocked, and to engage with said rack during the return movement of said rocking shaft before said two projections have unlocked from each other, substantially as set forth.

6. The combination with a longitudinally-reciprocating compressor-shaft, a rocking space-carrier, a rack engaging with the latter, and a bell-crank engaging with an arm of said rack, of a rocking shaft in toothed engagement with said compressor-shaft and having an arm adapted to lock in tongue-and-groove engagement with said compressor-shaft, and also adapted to engage said bell-crank, substantially as set forth.

7. The combination with a longitudinally-movable compressor-shaft, a rocking space-carrier, and a rack meshing with the latter, of a bell-crank having its lower arm locking with an arm of said rack, and a rocking shaft carrying an arm having its hub in toothed engagement with said compressor-shaft and having its free extremity adapted to engage with the upper arm of said bell-crank, and having its intermediate portion provided with a groove which receives a tongue projection from said compressor-shaft, substantially as set forth.

8. The combination with a mold, of a lever-ejector having its ejecting-arm located to one side of its fulcrum and connected with a spring which tends to operate said lever in ejecting action, the opposite arm of the lever being intermittently engaged by a spring-pressed rotary latch, substantially as set forth.

9. The combination with a movable mold having a lug, and an ejector having a companion lug, of a spring which tends to maintain the ejecting-arm in the casting-chamber, said two lugs registering with each other while the mold is in position to receive a cast, and said two lugs being thrown out of engagement by the movement of the mold subsequently to making the cast, substantially as set forth.

10. The combination with a movable mold having a lug, and an ejector having a companion lug, of a spring which tends to throw the ejecting-arm into the casting-chamber, and a latch which by engagement with the the ejector, prevents such spring action until said mold-lug has fully cleared said ejector-lug, substantially as set forth.

11. The combination with the movable mold having a lug, and the spring-pressed ejector-lever having a companion lug, of the spring-pressed latch which engages with said lever-ejector, substantially as set forth.

12. The combination with the mold having bodily movement in a horizontal line and provided with a lateral lug, of the lever-ejector provided with a companion lateral lug, the spring connecting with one arm of said lever-ejector, and the rotary spring-pressed latch engaging with the opposite arm of said lever, substantially as set forth.

In testimony that I claim the foregoing to be my invention I have hereunto set my hand this 19th day of September, A. D. 1890.

FRED E. BRIGHT.

Witnesses:
J. B. FAY,
J. F. BARR.