No. 890,706. PATENTED JUNE 16, 1908.

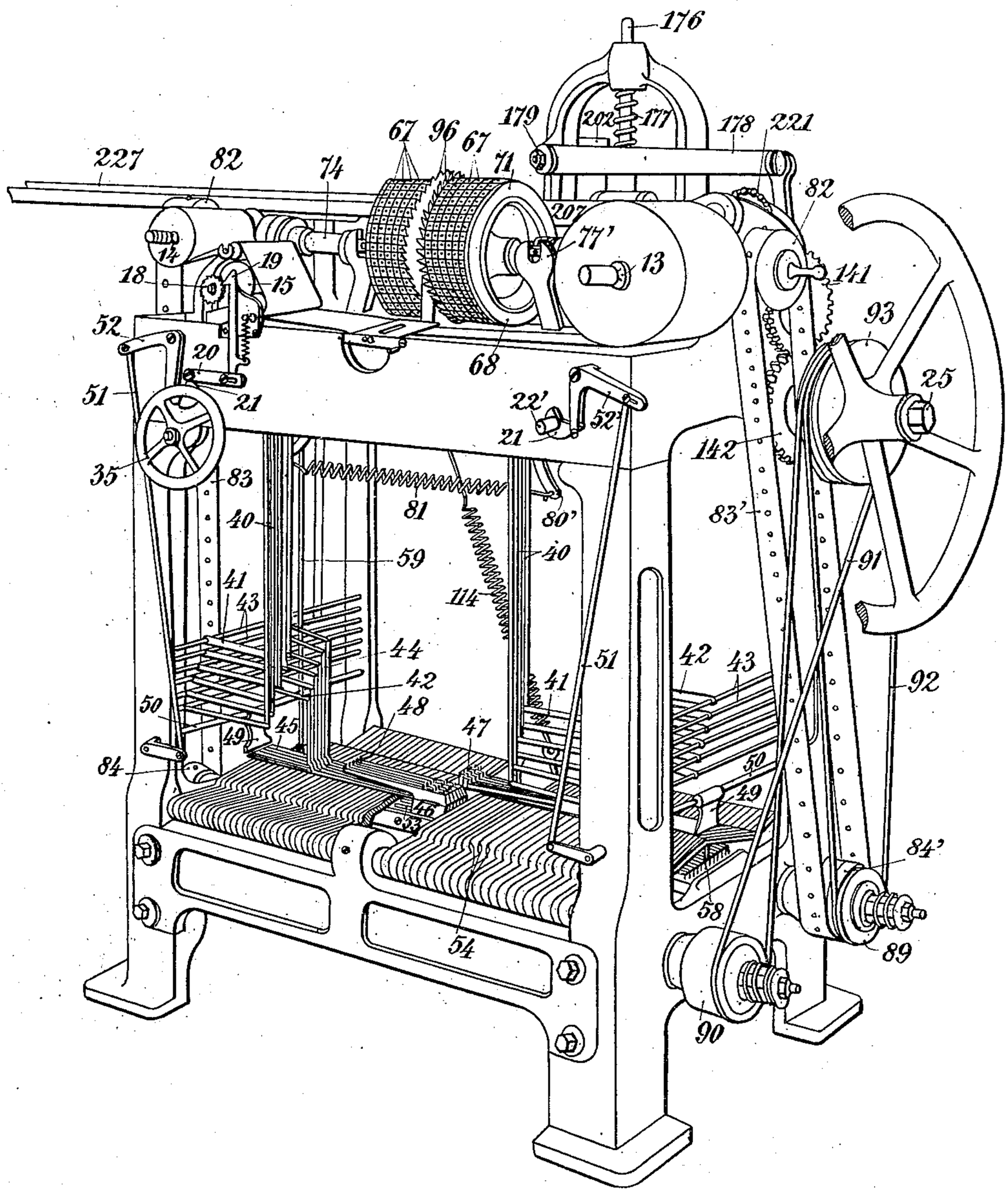
J. PINEL.

MACHINE FOR CASTING AND SETTING PRINTING TYPES.

APPLICATION FILED JUNE 26, 1905.

20 SHEETS—SHEET 1.

Fig. 1.



WITNESSES:

John A. Kehlenbeck

John Lotka

INVENTOR.

Joseph Pinel

BY

Bierent Knauth

ATTORNEYS

No. 890,706. PATENTED JUNE 16, 1908.

J. PINEL.

MACHINE FOR CASTING AND SETTING PRINTING TYPES.

APPLICATION FILED JUNE 26, 1905.

20 SHEETS—SHEET 2.

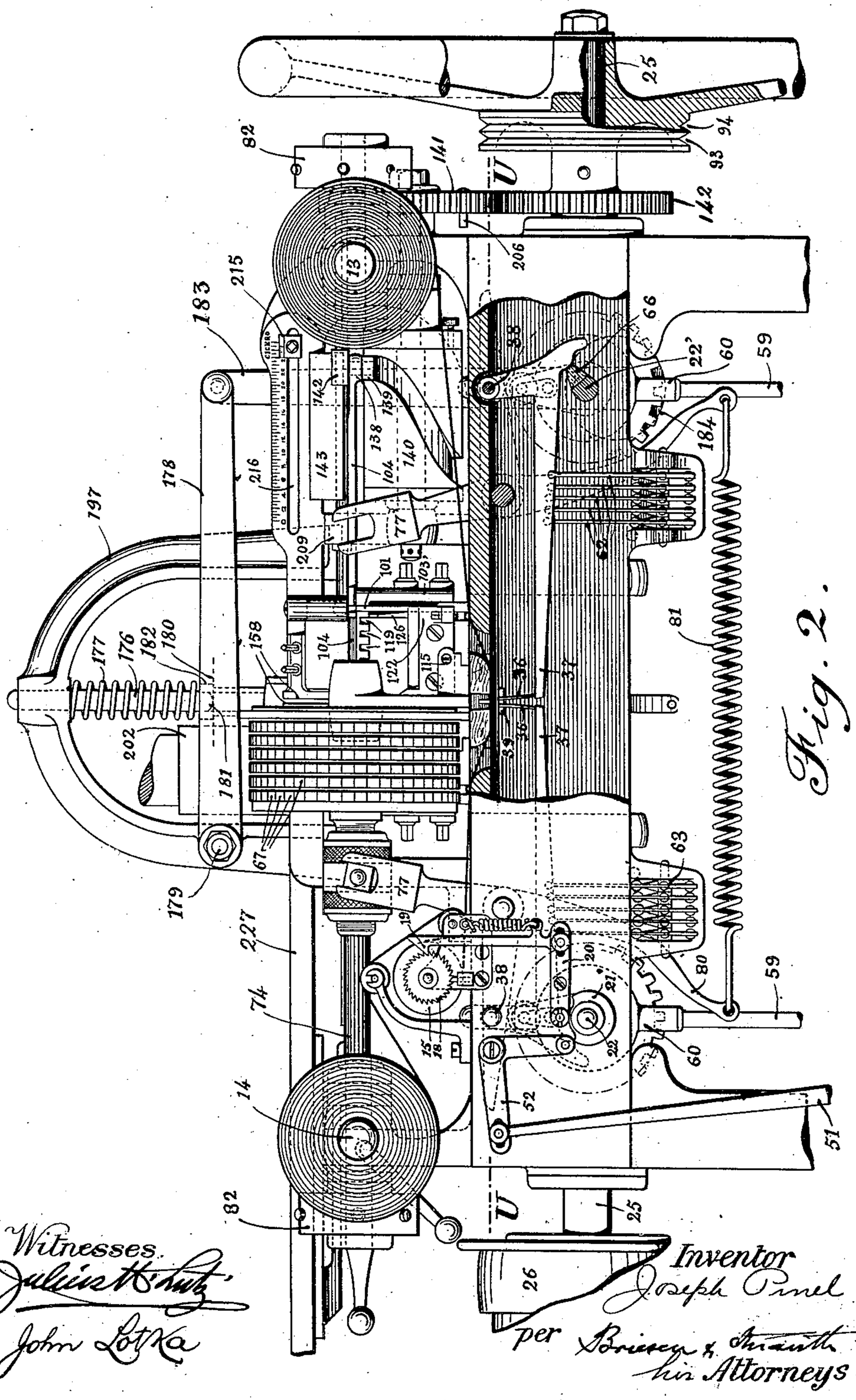


Fig. 2.

Witnesses.
Julius Hoch
John Lotka

Inventor
Joseph Pinel
per Briesen & Knauth
his Attorneys

No. 890,706. PATENTED JUNE 16, 1908.

J. PINEL.

MACHINE FOR CASTING AND SETTING PRINTING TYPES.

APPLICATION FILED JUNE 26, 1905.

20 SHEETS—SHEET 3

Fig. 3.

Fig. 4.

Witnesses.
Julius H. Lutz.
John Lotka

Inventor
Joseph Pinel
per Brisco & Staats
his Attorneys.

No. 890,706. PATENTED JUNE 16, 1908.

J. PINEL.

MACHINE FOR CASTING AND SETTING PRINTING TYPES.

APPLICATION FILED JUNE 26, 1905.

20 SHEETS—SHEET 4.

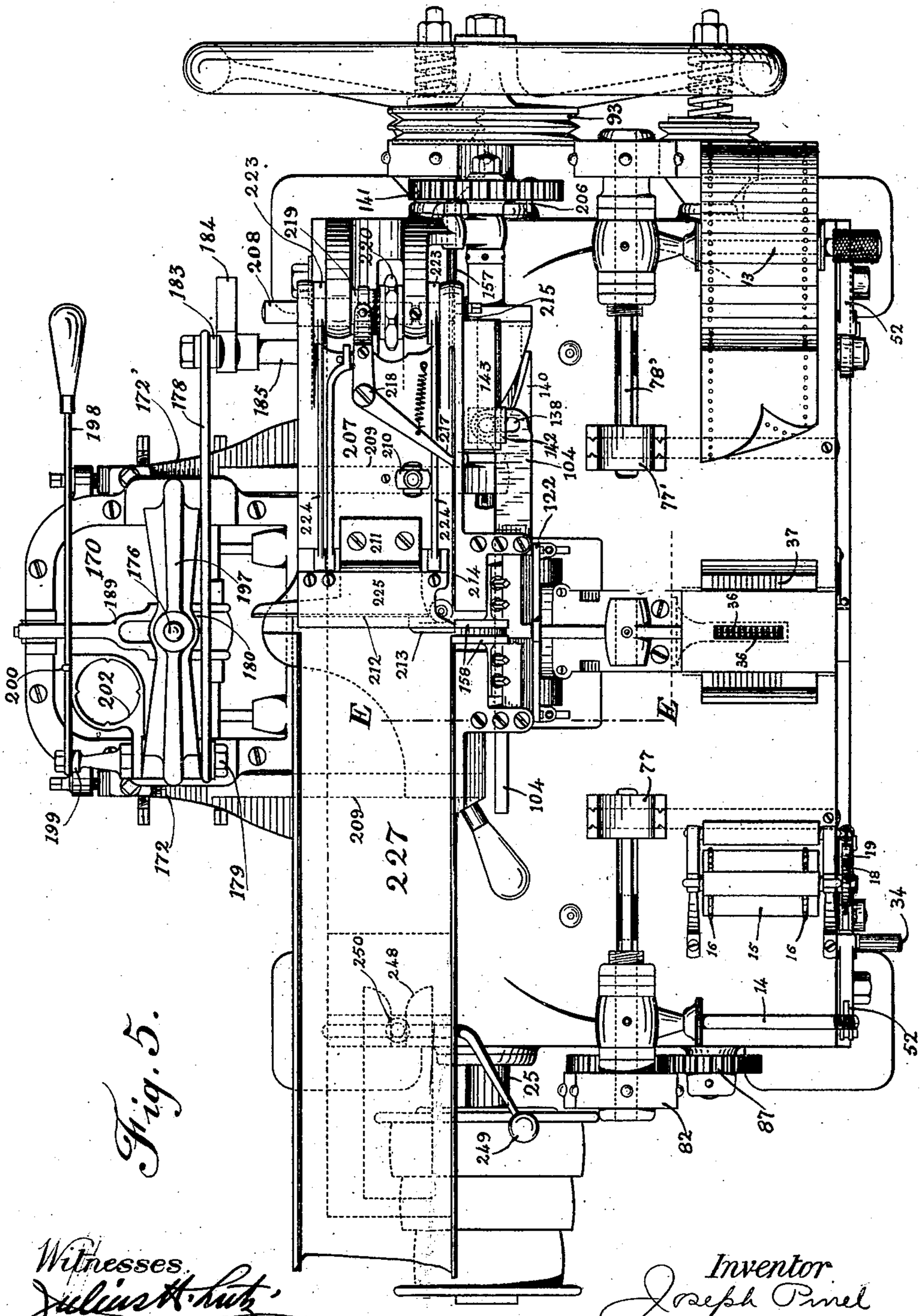


Fig. 5.

Witnesses.
Julius A. Lutz
John Lotka

Inventor
Joseph Pinel
per Briesen & Straith
his Attorneys.

No. 890,706.

PATENTED JUNE 16, 1908.

J. PINEL.

MACHINE FOR CASTING AND SETTING PRINTING TYPES.

APPLICATION FILED JUNE 26, 1905.

20 SHEETS—SHEET 5.

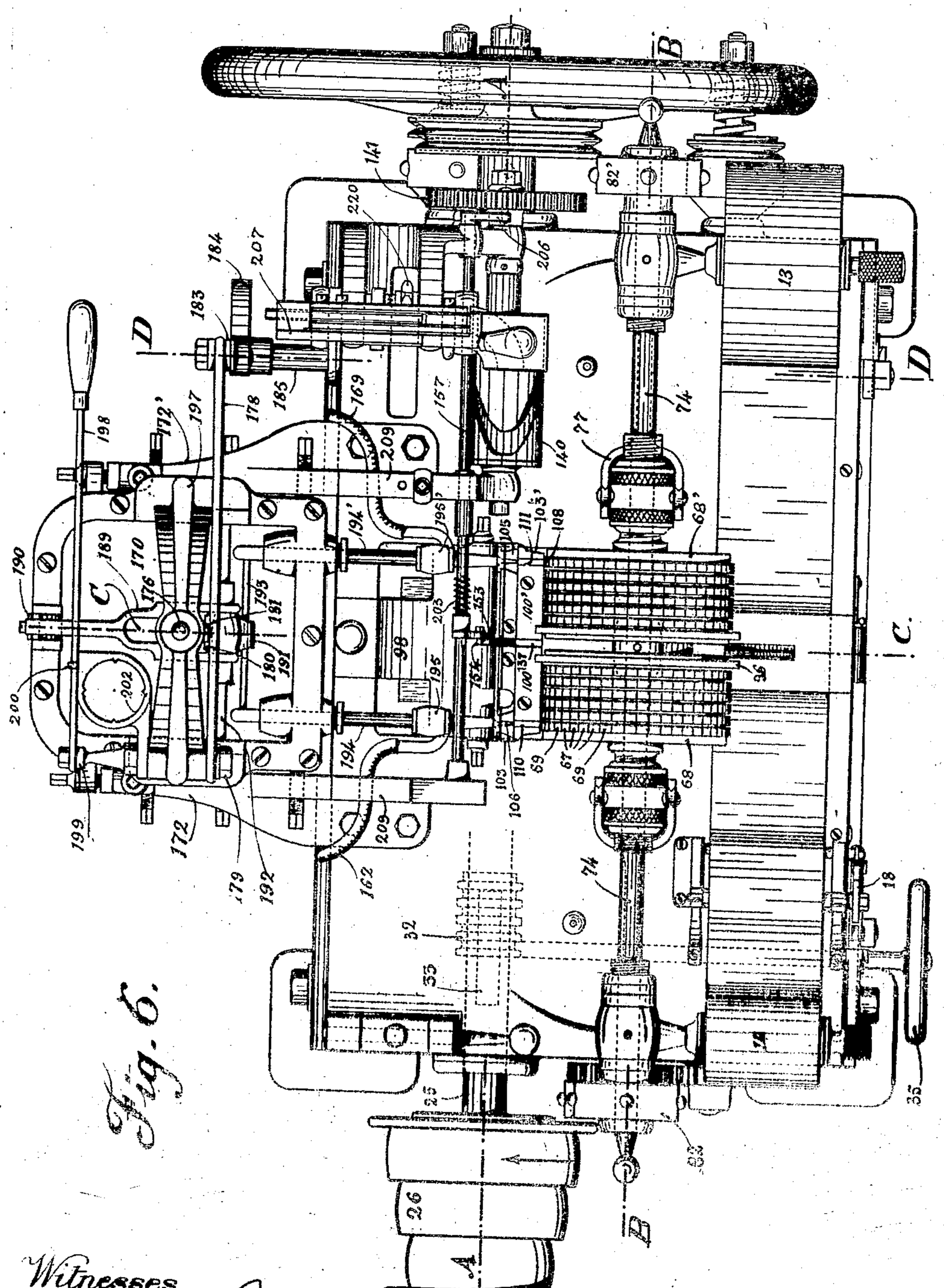


Fig. 6.

Witnesses.
Julius Hoffheinz.
John Lotka

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No. 890,706.

PATENTED JUNE 16, 1908.

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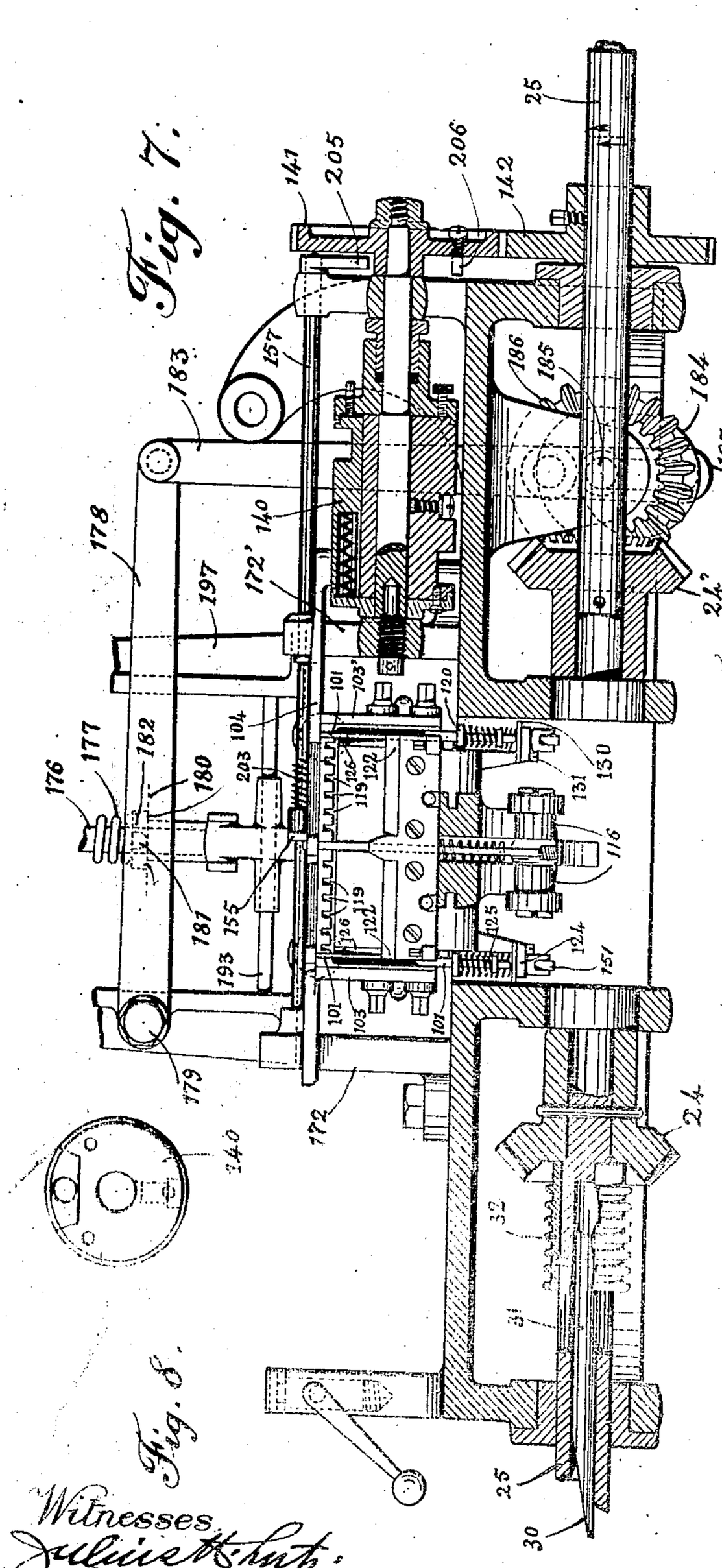
MACHINE FOR CASTING AND SETTING PRINTING TYPES.

APPLICATION FILED JUNE 26, 1905.

20 SHEETS—SHEET 6.

Fig. 7.



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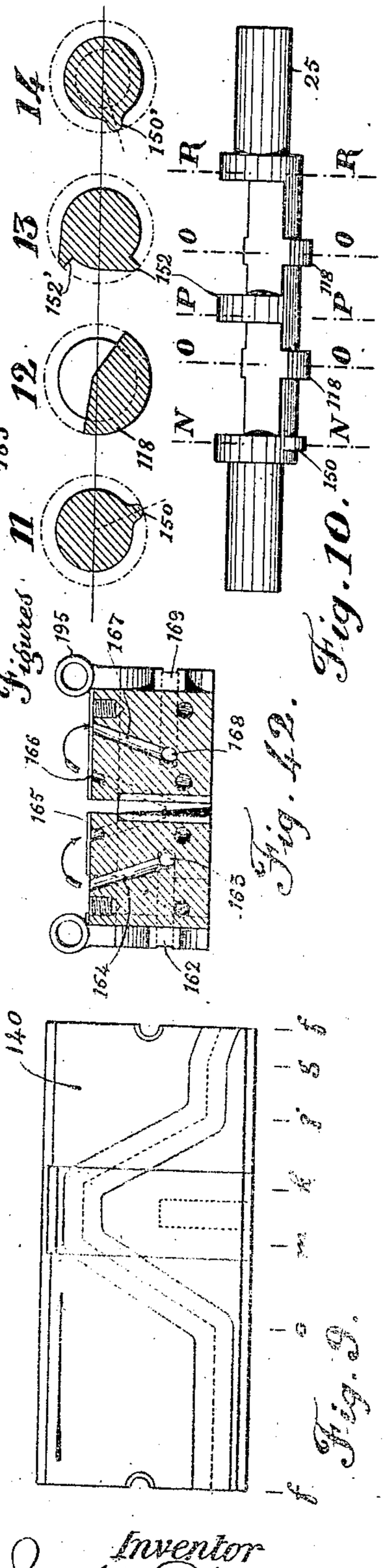

Fig. 10.

Fig. 12.

Fig. 9.

Witnesses.
Julius E. Lutz.
John Lotka

Inventor
Joseph Pinel
per Bricsy & Lauth
his Attorneys.

No. 890,706.

PATENTED JUNE 16, 1908.

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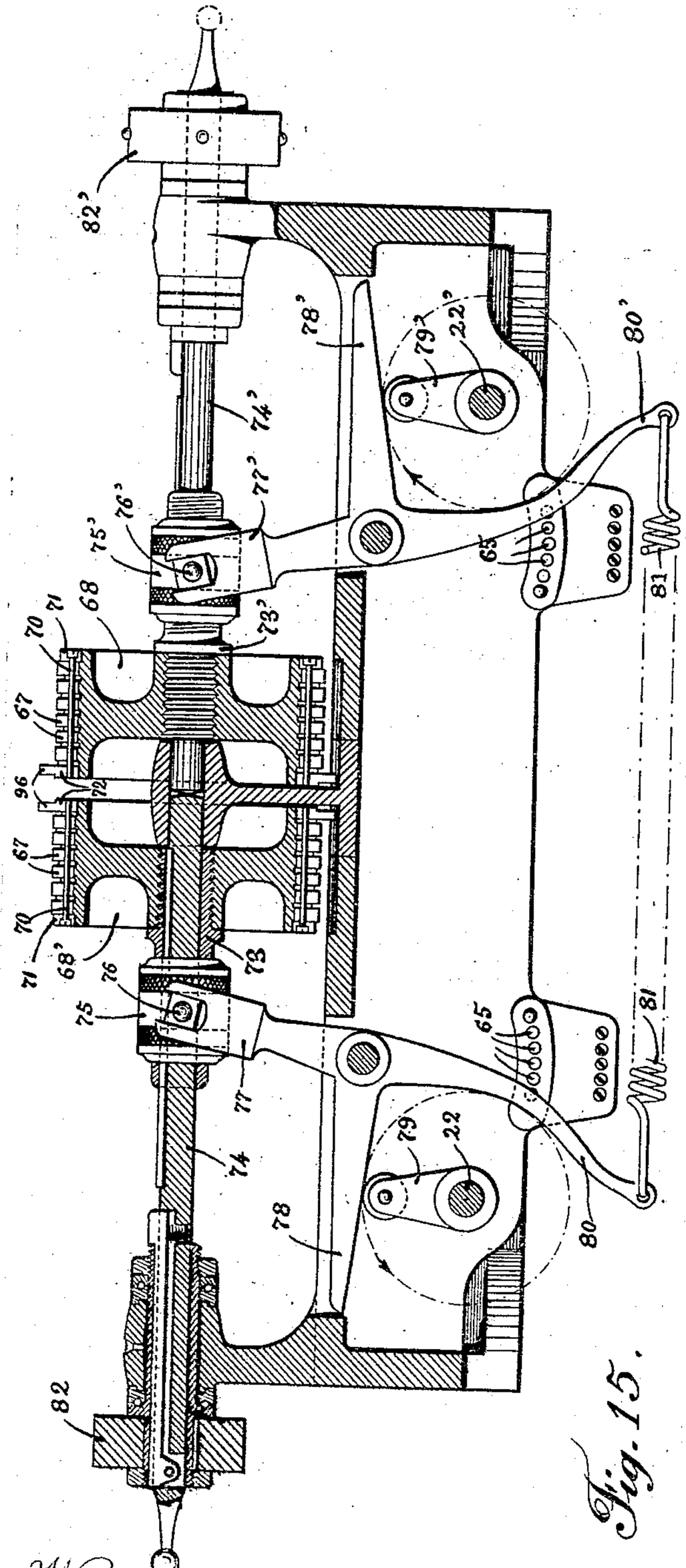
MACHINE FOR CASTING AND SETTING PRINTING TYPES.

APPLICATION FILED JUNE 26, 1905.

20 SHEETS—SHEET 7.



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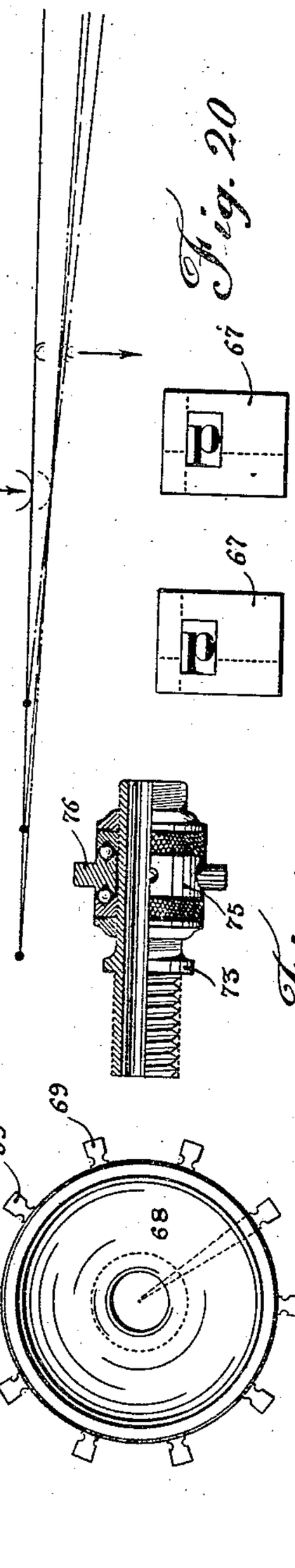

Fig. 20

Fig. 19.

Fig. 17.

Fig. 18.

Fig. 16.

Witnesses.
Julius H. Lutz.
John Lotka

Inventor
Joseph Pinel
per Briesen & Knauth
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No. 890,706.

J. PINEL. PATENTED JUNE 16, 1908.

MACHINE FOR CASTING AND SETTING PRINTING TYPES

APPLICATION FILED JUNE 26, 1905.

20 SHEETS—SHEET 8.

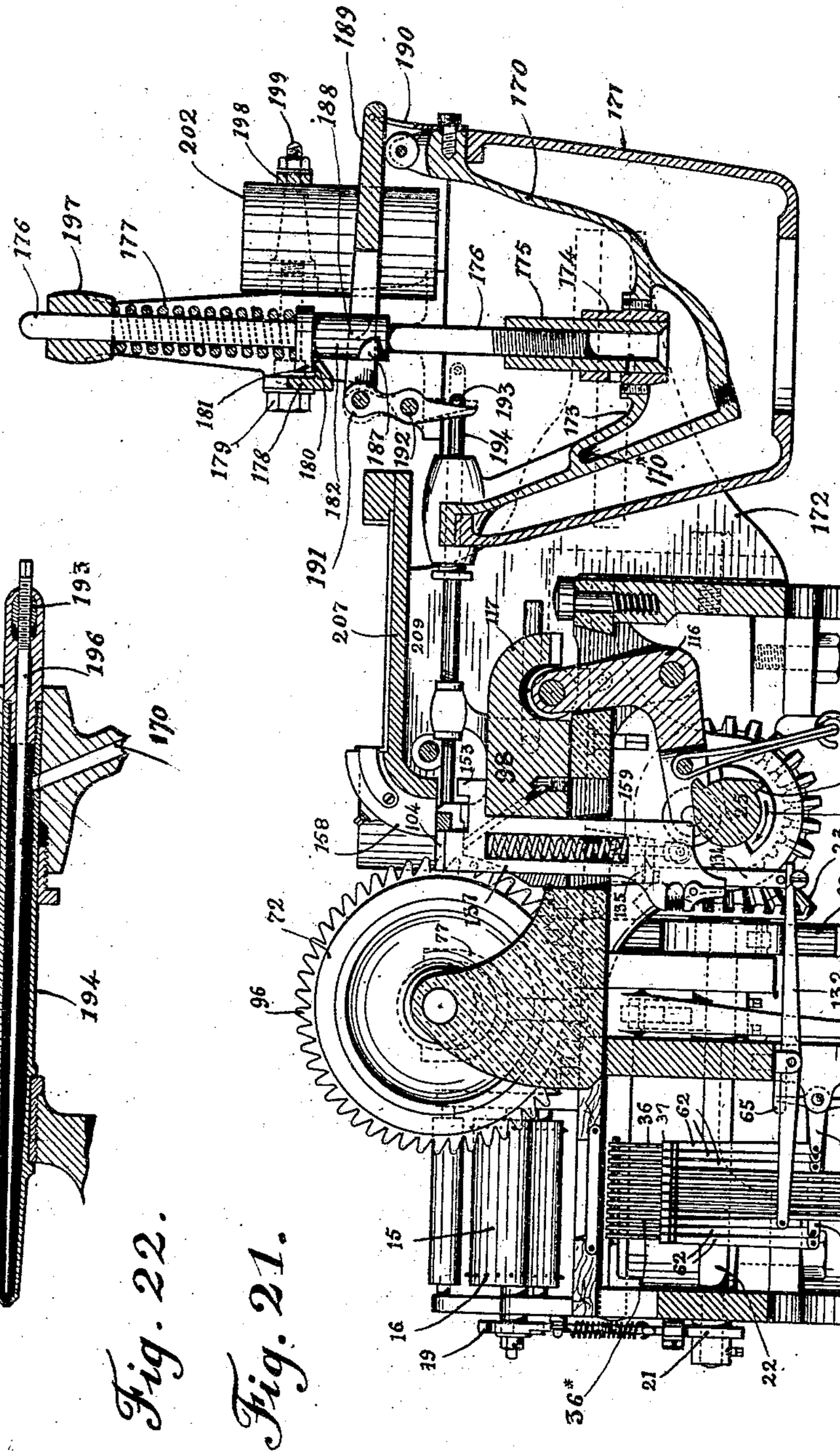

Fig. 22.

Fig. 21.

Witnesses,
Julius H. Lutz,
John Lotka

Inventor
Joseph Pinel
per Briesen & Knauth
his Attorneys.

No. 890,706. PATENTED JUNE 16, 1908.

J. PINEL.

MACHINE FOR CASTING AND SETTING PRINTING TYPES.

APPLICATION FILED JUNE 26, 1905.

20 SHEETS—SHEET 9.

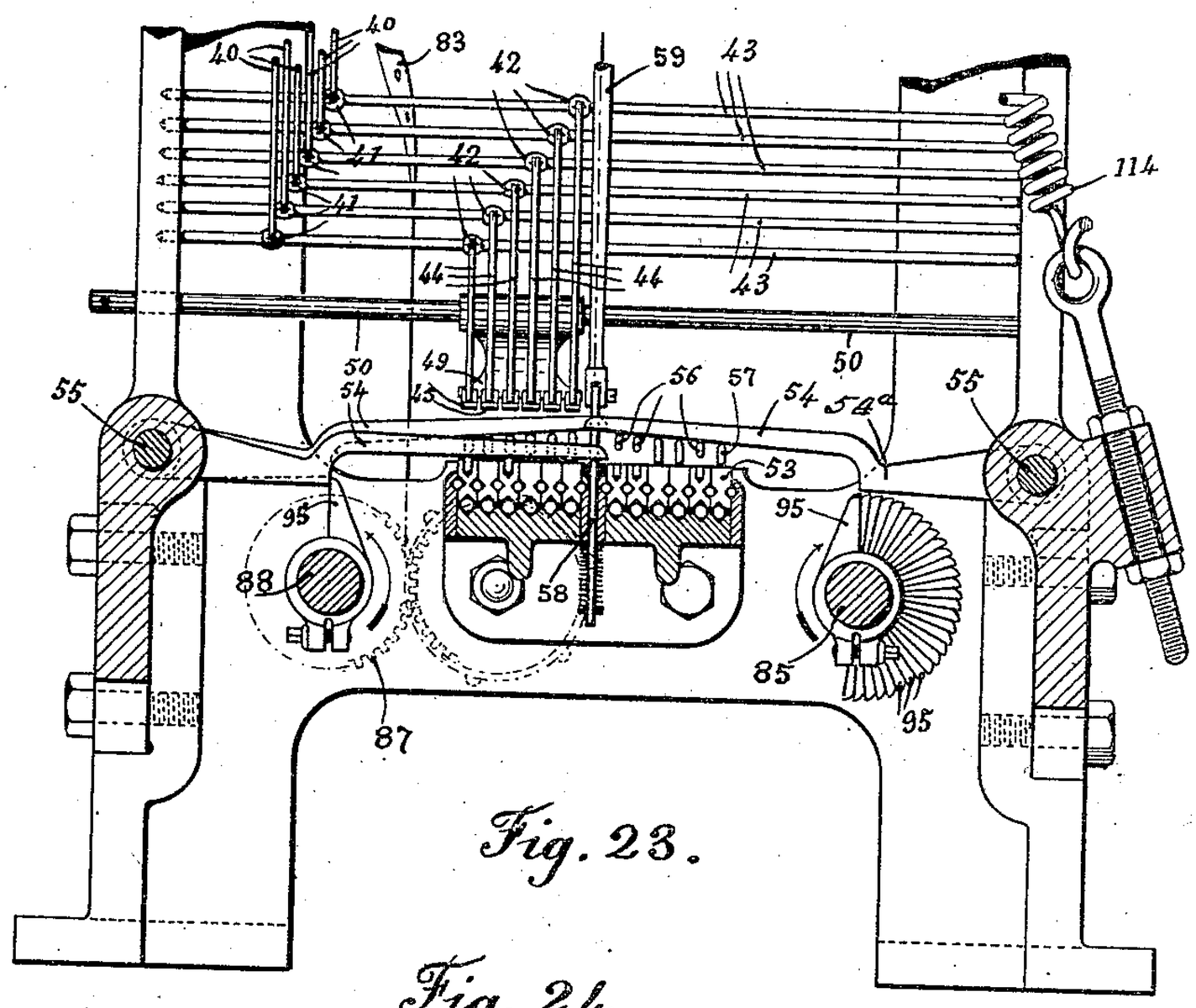

Fig. 23.

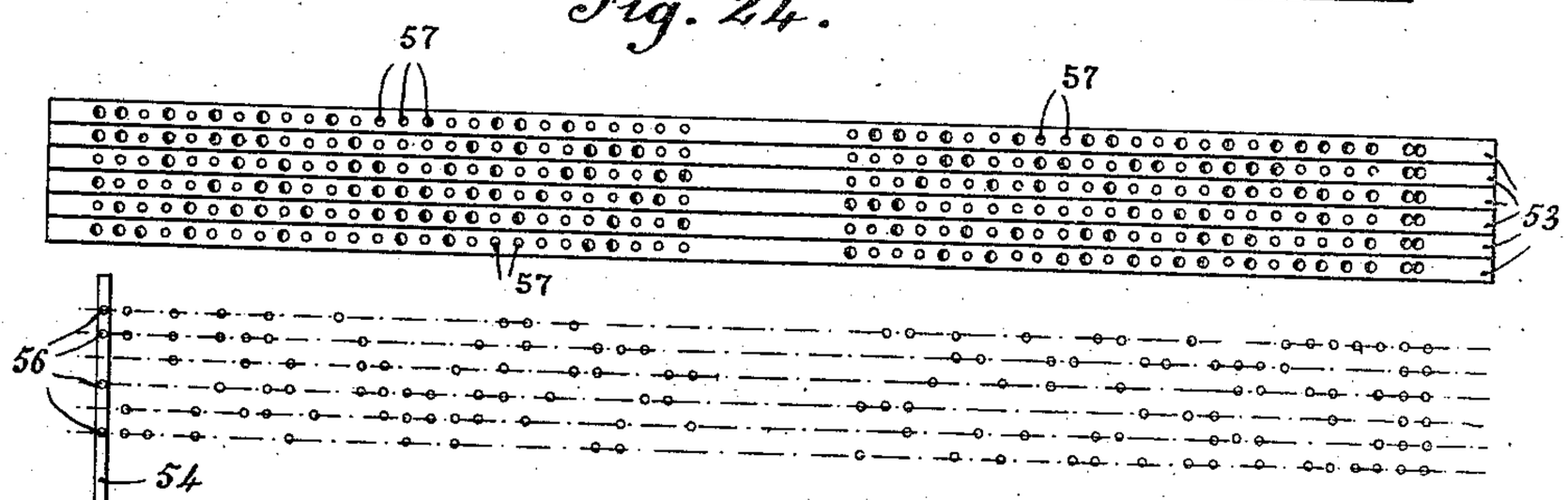

Fig. 24.

Fig. 25.

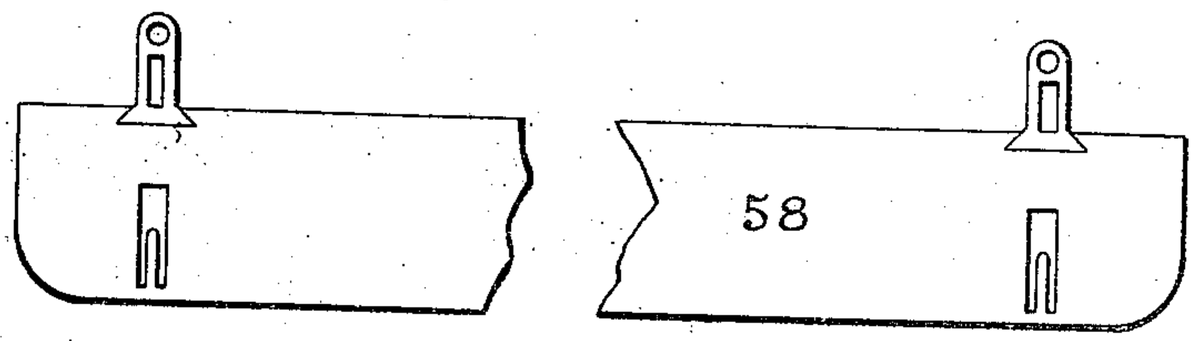

Fig. 26.

Witnesses.
Julius Hirtz
John Lotka

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his Attorneys.

No. 890,706.

J. PINEL. PATENTED JUNE 16, 1908.

MACHINE FOR CASTING AND SETTING PRINTING TYPES.

APPLICATION FILED JUNE 26, 1905.

20 SHEETS—SHEET 10.

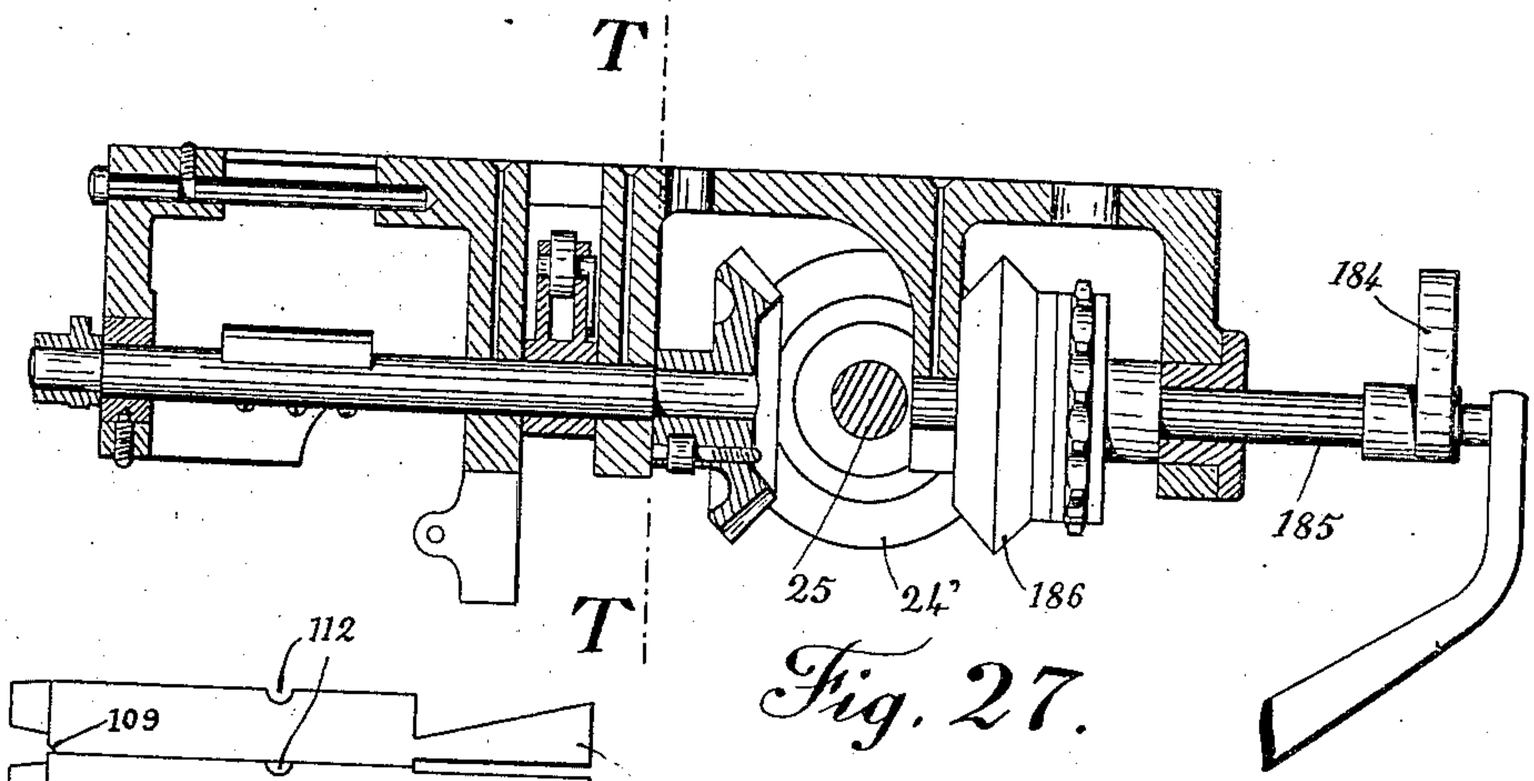

Fig. 27.

Fig. 29.

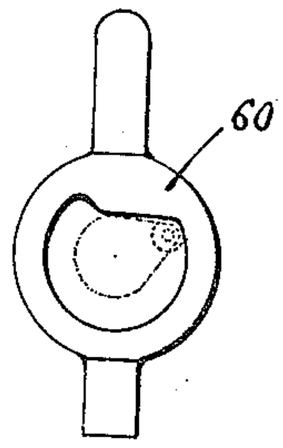

Fig. 28.

Fig. 30.

Witnesses:
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his Attorneys.

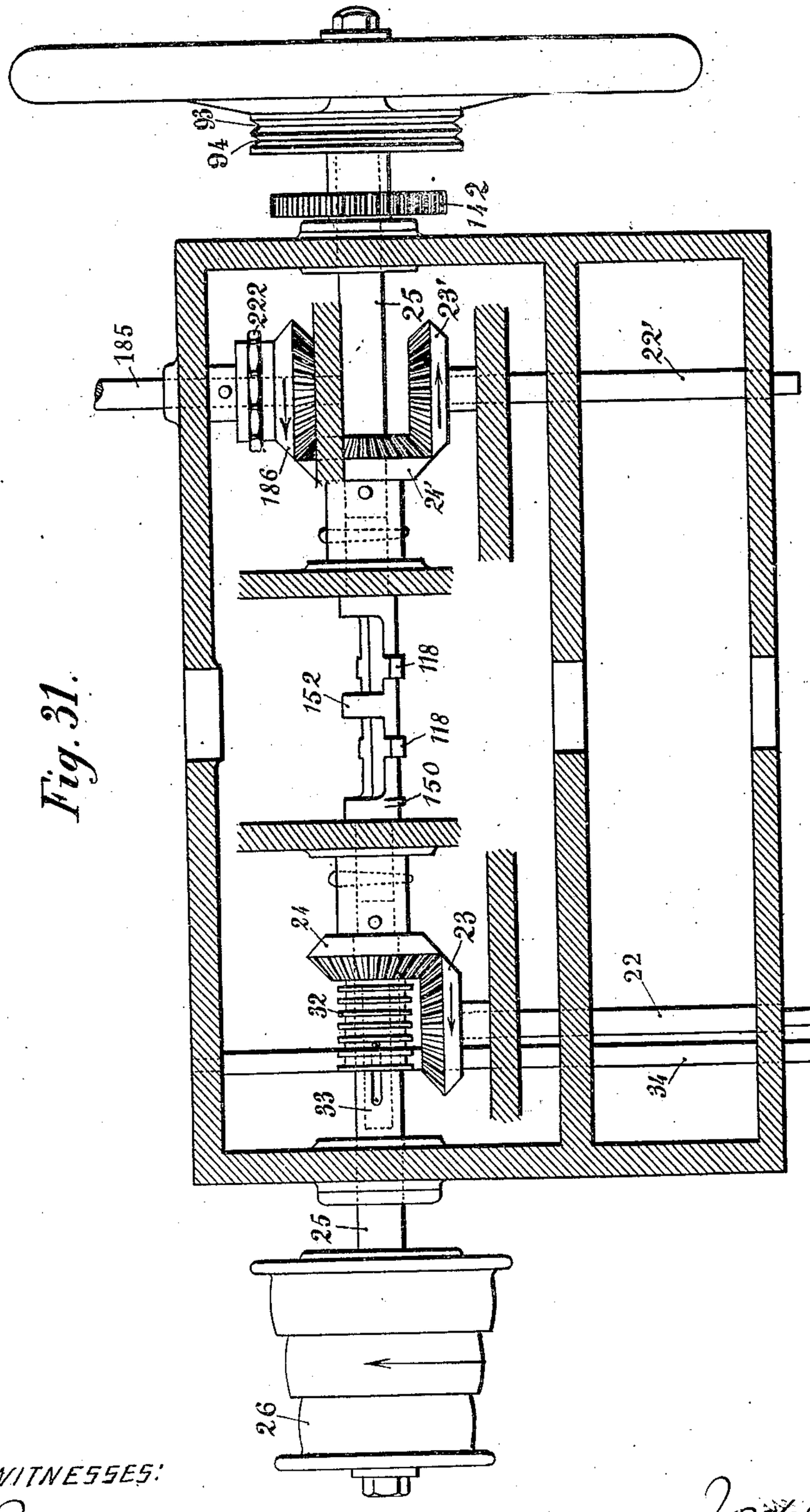
No. 890,706. PATENTED JUNE 16, 1908.

J. PINEL.

MACHINE FOR CASTING AND SETTING PRINTING TYPES.

APPLICATION FILED JUNE 26, 1905. 20 SHEETS—SHEET 11.

Fig. 31.



WITNESSES:

John A. Tekkenbeck

John Lotka

INVENTOR

Joseph Pinel

BY

Briesen & Knauth

ATTORNEYS

No. 890,706. PATENTED JUNE 16, 1908.

J. PINEL.

MACHINE FOR CASTING AND SETTING PRINTING TYPES.

APPLICATION FILED JUNE 26, 1905.

20 SHEETS—SHEET 12.

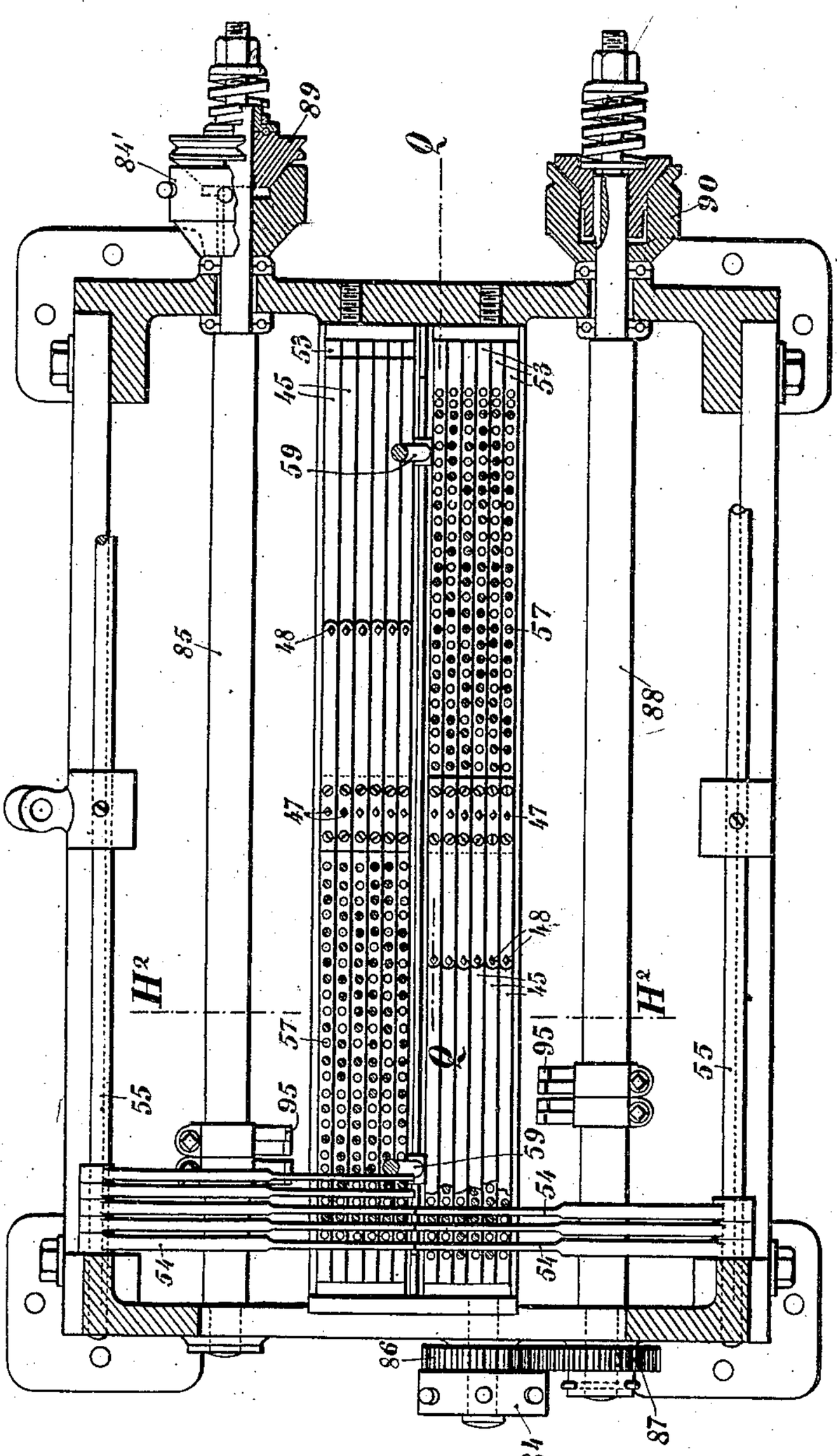


Fig. 32.

WITNESSES:
John A. Kellenbeck.
John Lotka

INVENTOR
Joseph Pinel
BY
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ATTORNEYS

No. 890,706. PATENTED JUNE 16, 1908.

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MACHINE FOR CASTING AND SETTING PRINTING TYPES.

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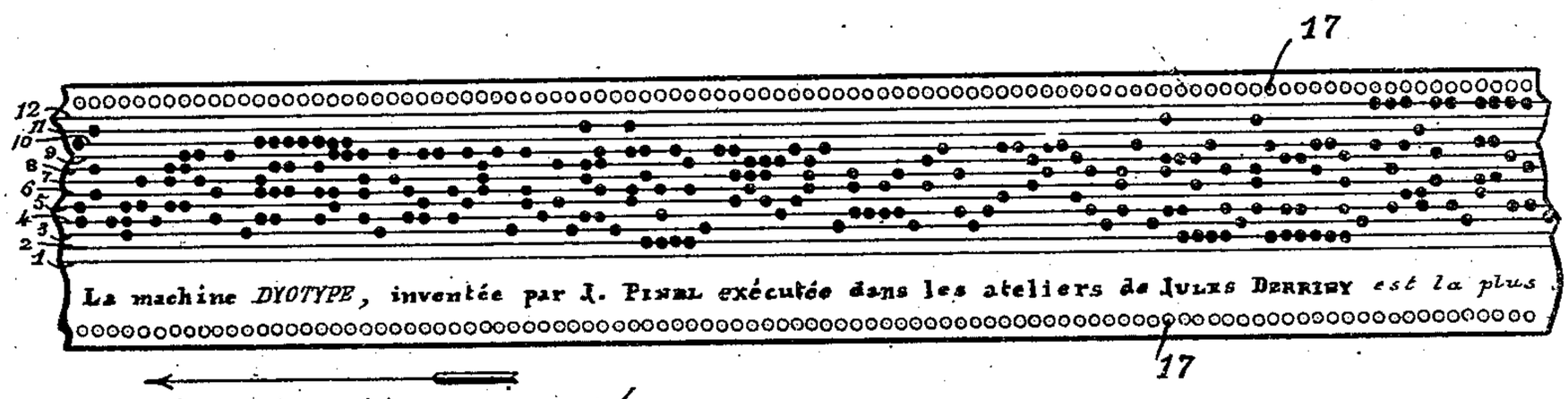
20 SHEETS—SHEET 13.



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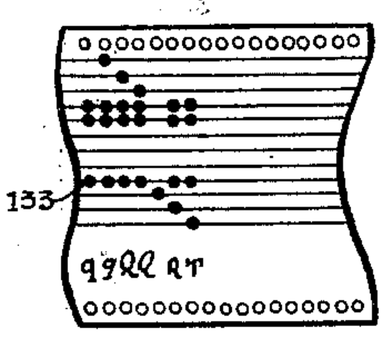

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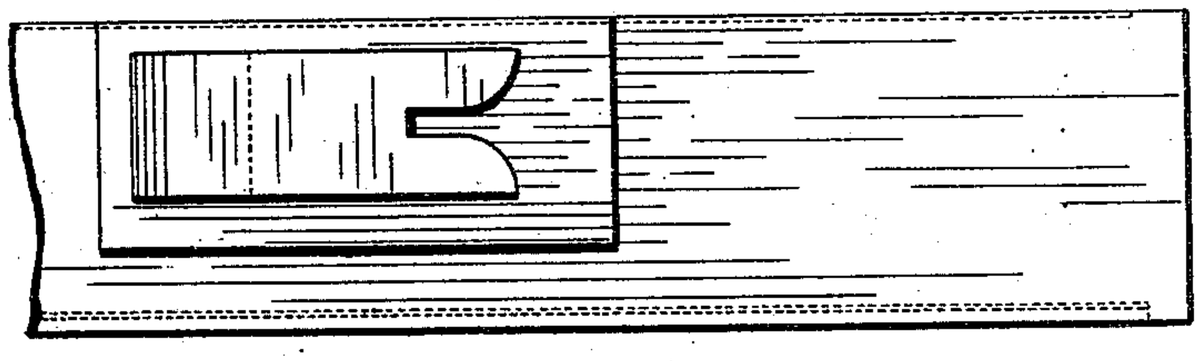
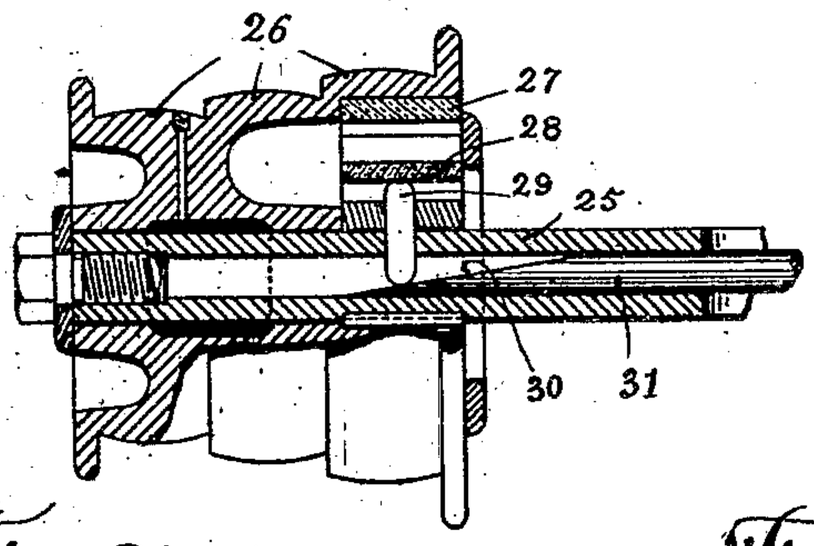


Fig. 36

Fig. 35.



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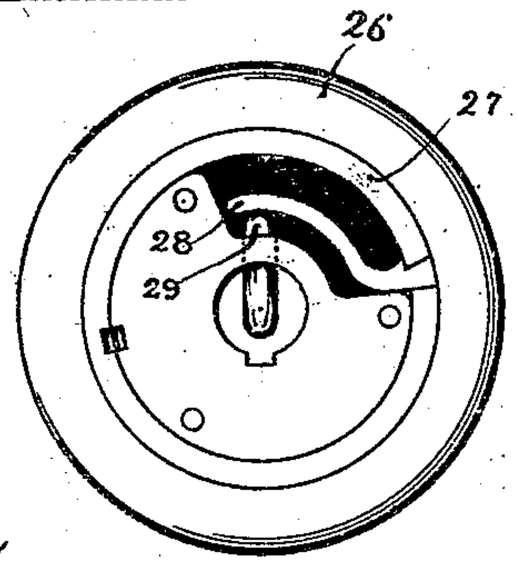

Fig. 38.

Witnesses.
Julius H. Lutz,
John Lotka

Inventor
Joseph Pinel
per Brisco & Staunton
his Attorneys

No. 890,706. PATENTED JUNE 16, 1908.

J. PINEL.

MACHINE FOR CASTING AND SETTING PRINTING TYPES.

APPLICATION FILED JUNE 26, 1905.

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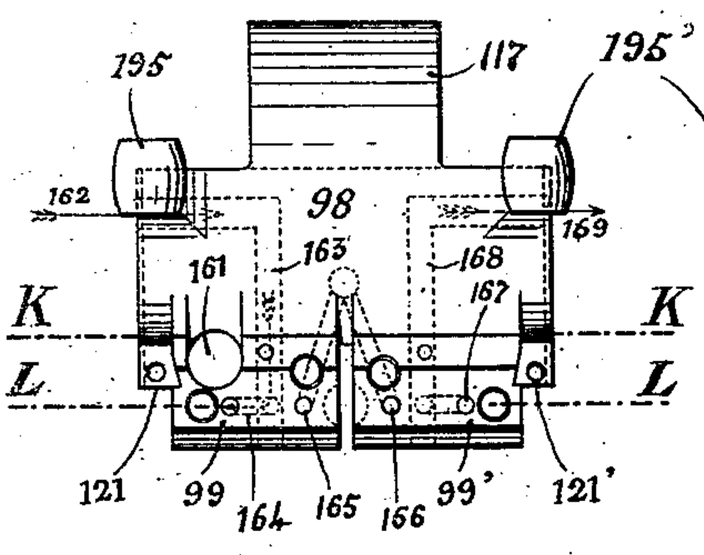

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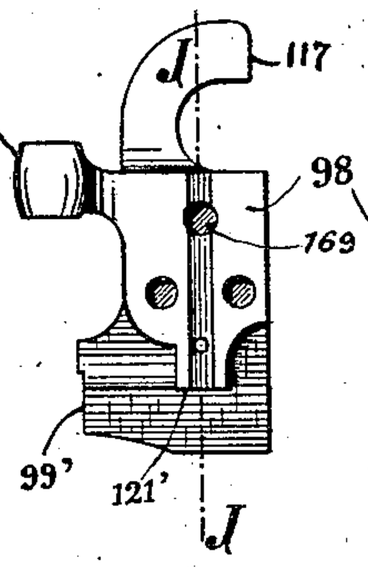

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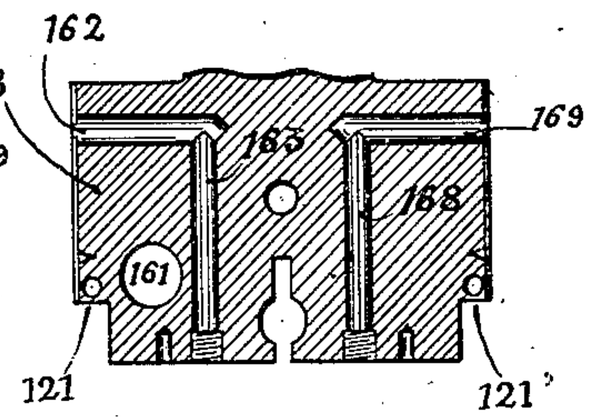

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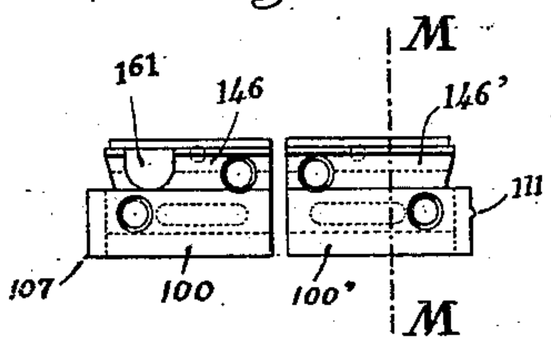


Fig. 43.

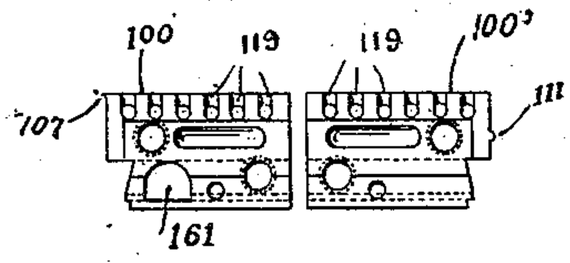


Fig. 44.

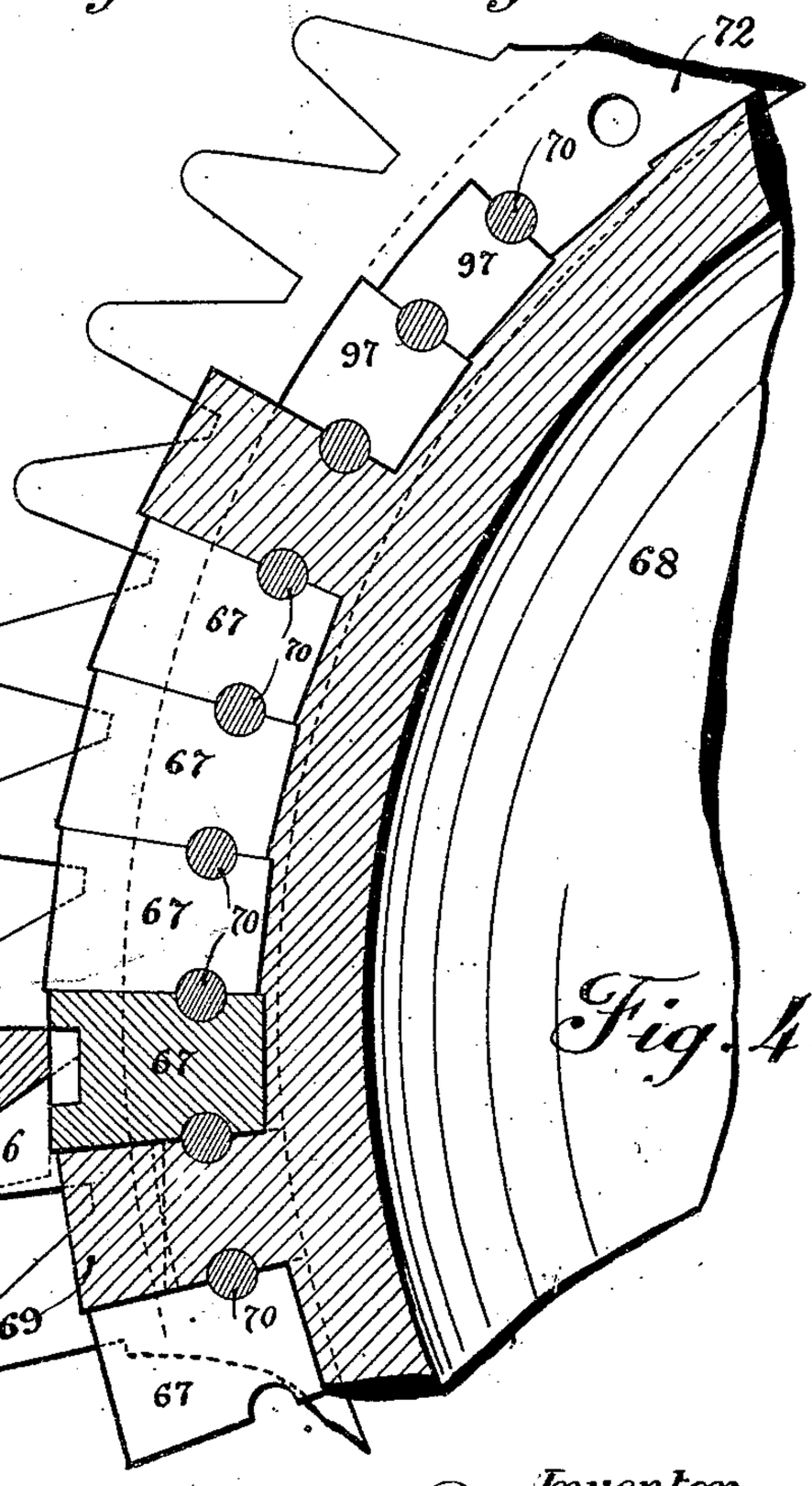


Fig. 45.

Witnesses.
Julius Schutz
John Lotka

Inventor
Joseph Pinel
per Briesen & Arnold
his Attorneys.

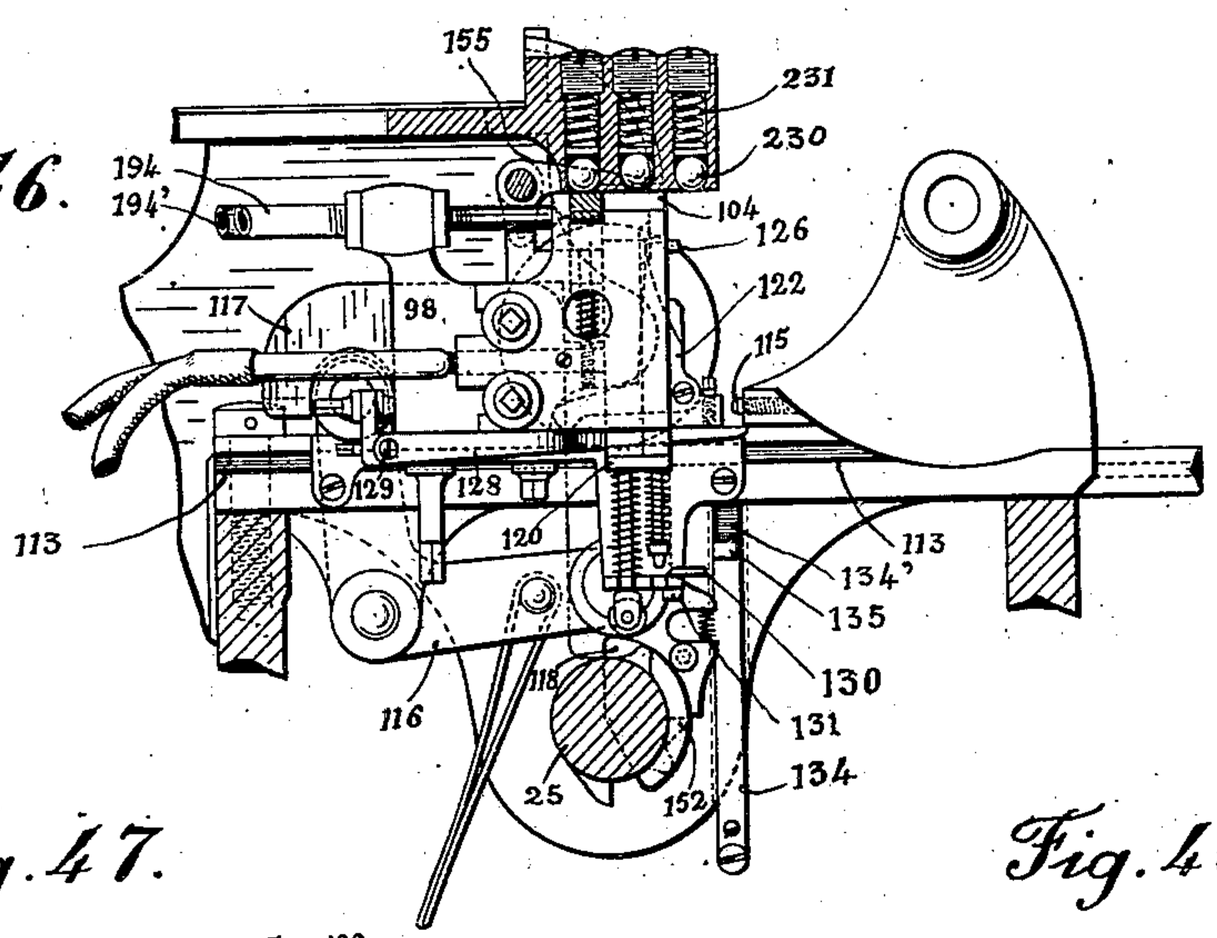
No. 890,706. PATENTED JUNE 16, 1908.

J. PINEL.

MACHINE FOR CASTING AND SETTING PRINTING TYPES.

APPLICATION FILED JUNE 26, 1905. 20 SHEETS—SHEET 15.

Fig. 46.



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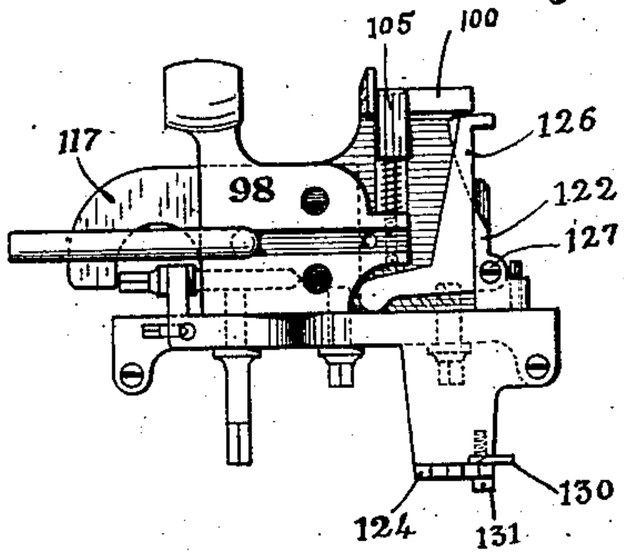

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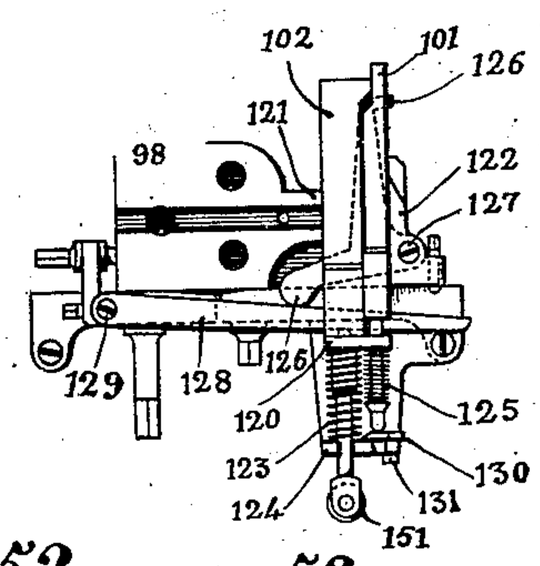

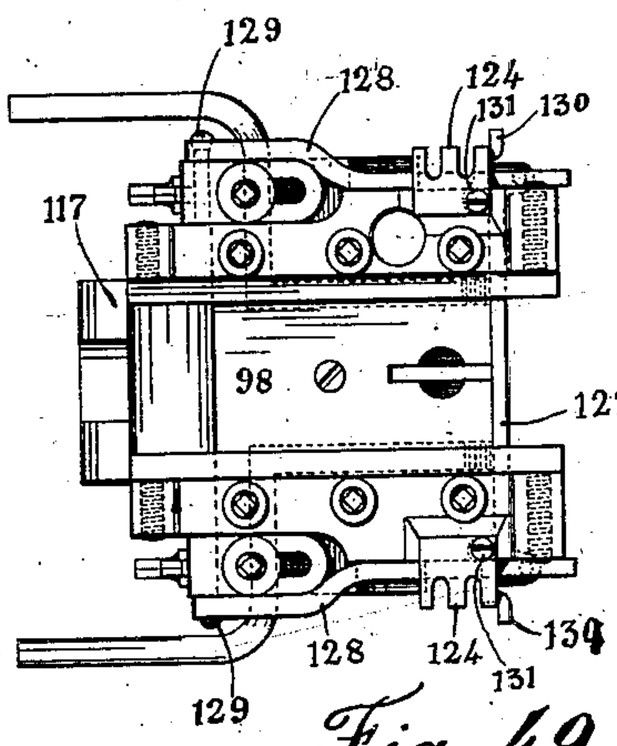

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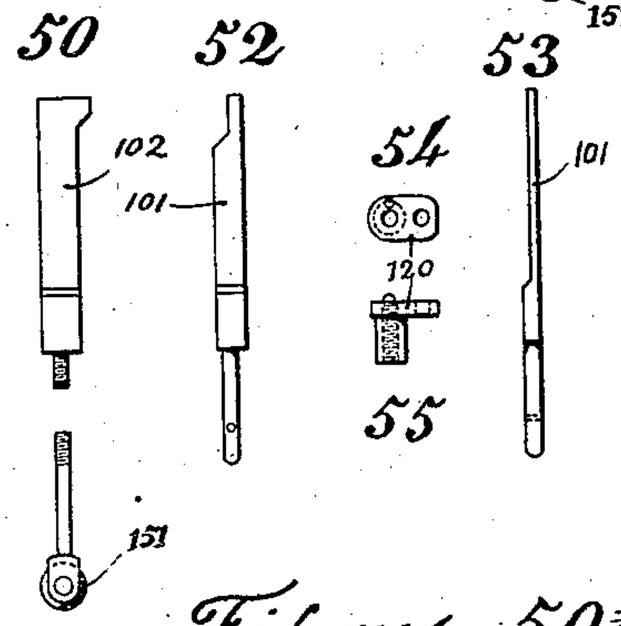


51. Figures 50 to 55.

Witnesses.
Julius A. Lutz,
John Lotka

Inventor
Joseph Pinel
per Brisco & Staats
his Attorneys

No. 890,706. PATENTED JUNE 16, 1908.

J. PINEL.

MACHINE FOR CASTING AND SETTING PRINTING TYPES.

APPLICATION FILED JUNE 26, 1905. 20 SHEETS—SHEET 16.

Fig. 57.

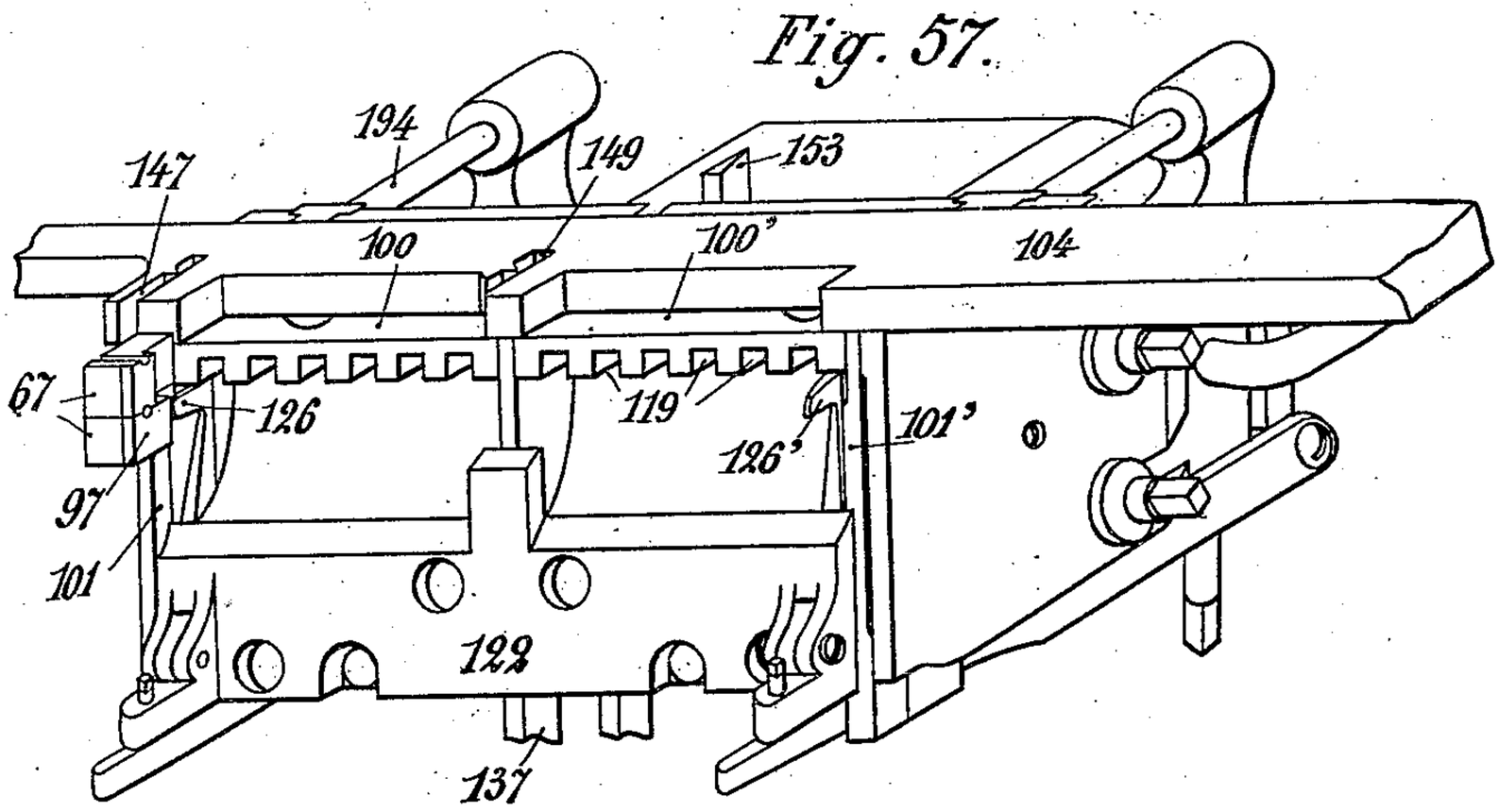
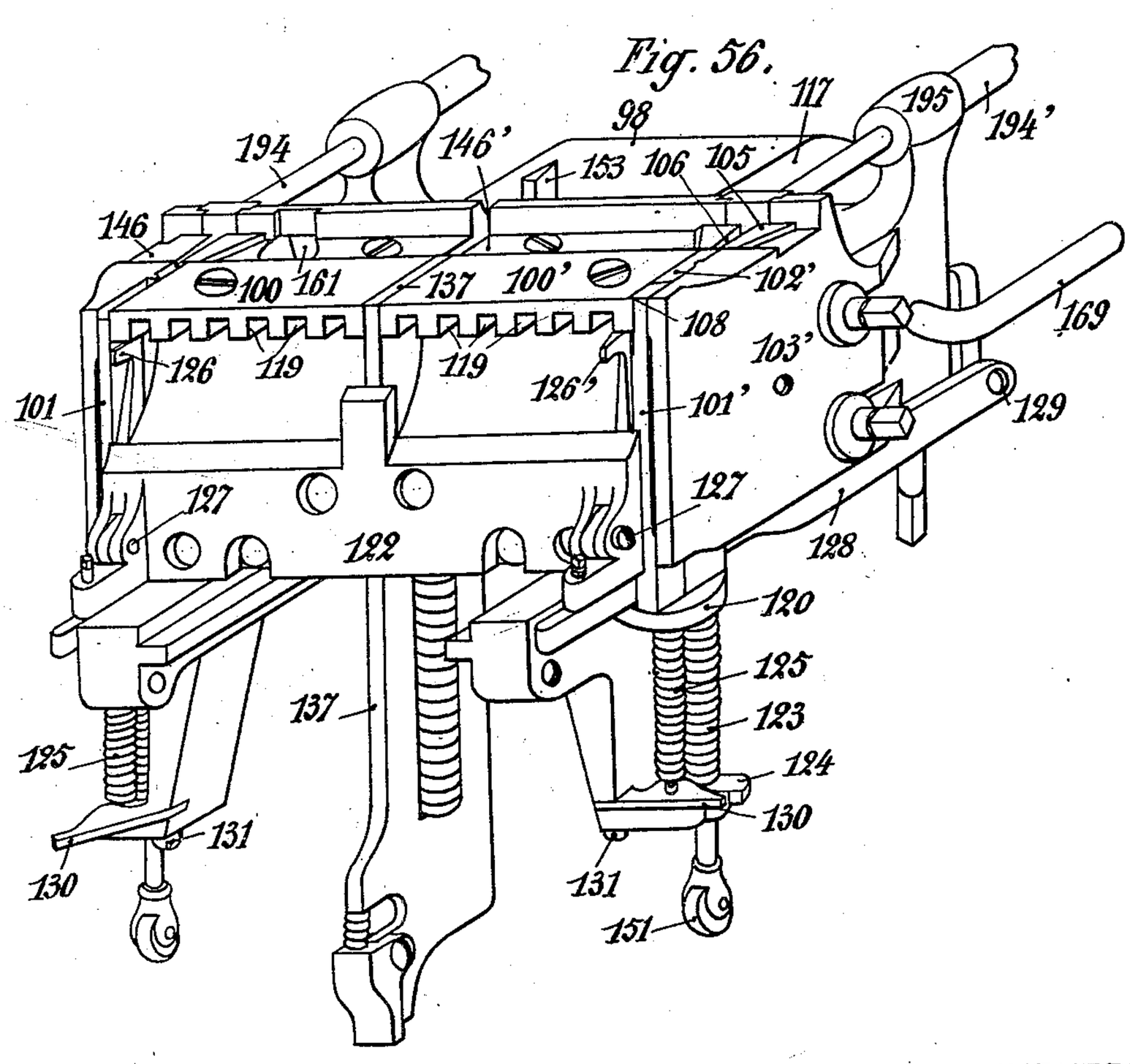


Fig. 56.



WITNESSES:

John A. Tecklenteert.

John Lotka

INVENTOR

Joseph Pinel

BY

Bierend Church

ATTORNEYS

No. 890,706. PATENTED JUNE 16, 1908.

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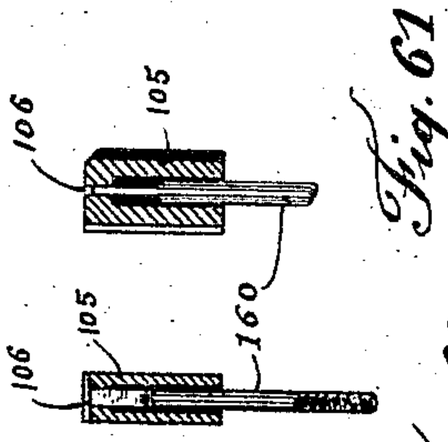
MACHINE FOR CASTING AND SETTING PRINTING TYPES.

APPLICATION FILED JUNE 26, 1905.

20 SHEETS—SHEET 17.



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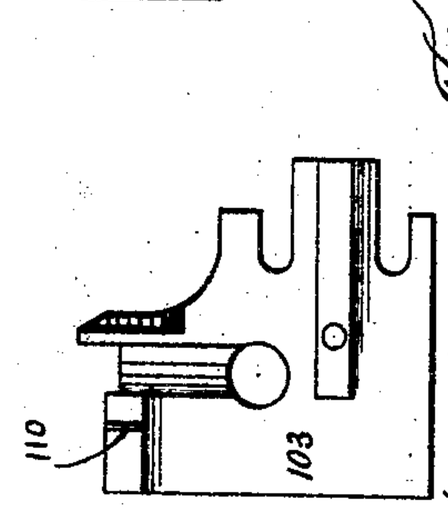

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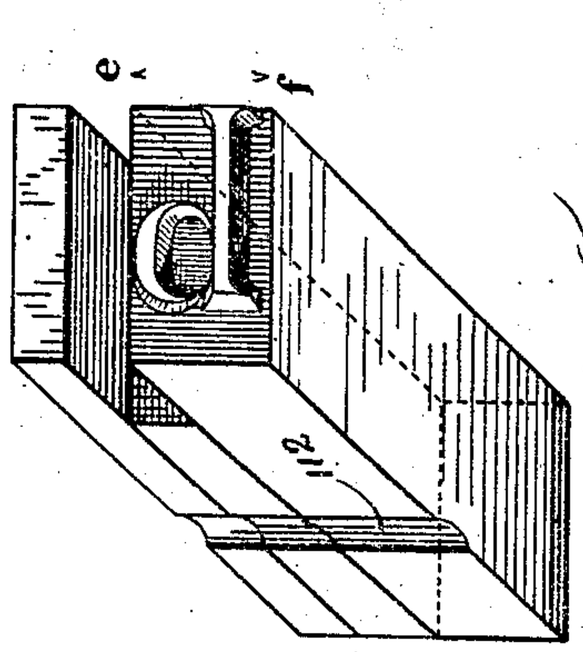
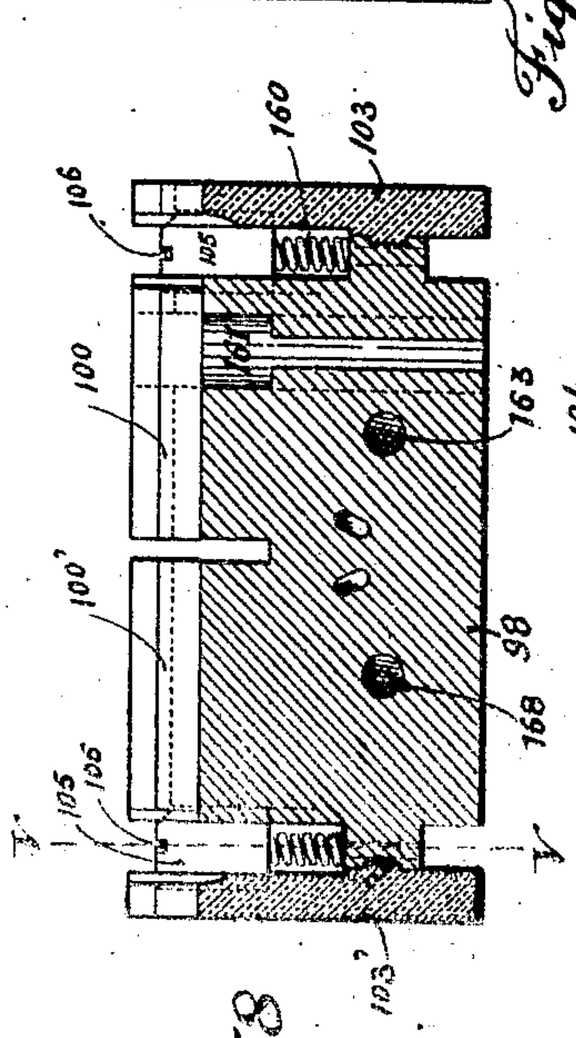


Fig. 59.

Fig. 62.



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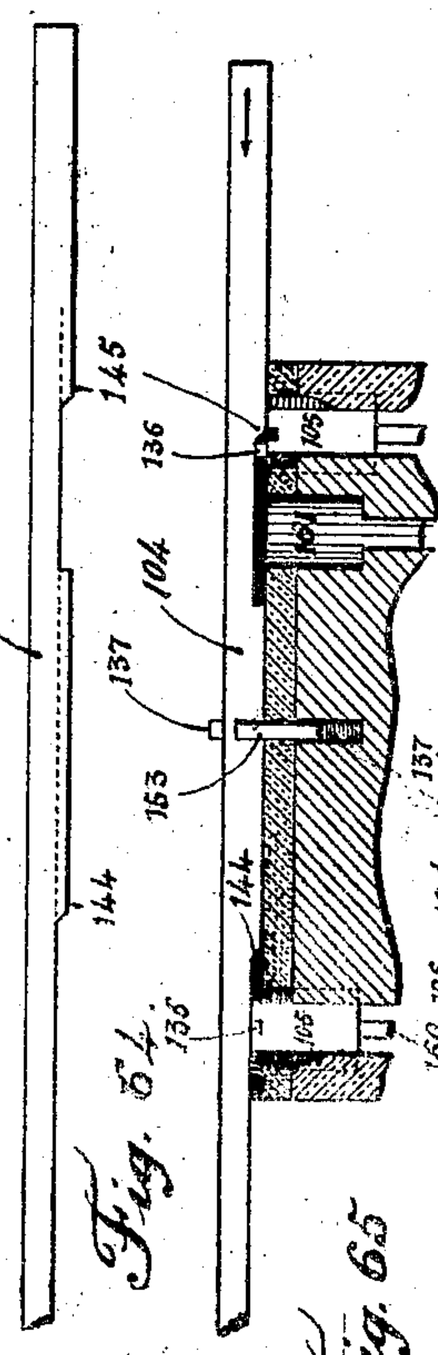

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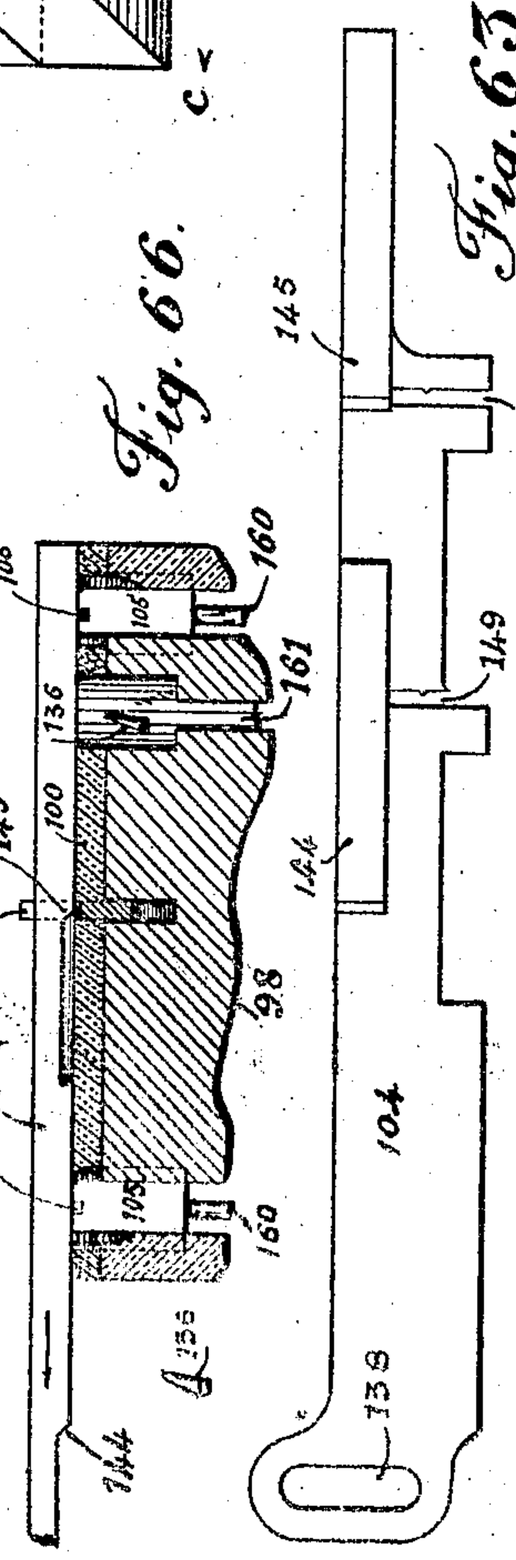

Fig. 63.

Fig. 65.

Witnesses.
Julius Hoch.
John Lotka

Inventor
Joseph Pinel
per Brisco & Staunton
his Attorneys

No. 890,706. PATENTED JUNE 16, 1908.

J. PINEL.

MACHINE FOR CASTING AND SETTING PRINTING TYPES.

APPLICATION FILED JUNE 26, 1905.

20 SHEETS—SHEET 18.

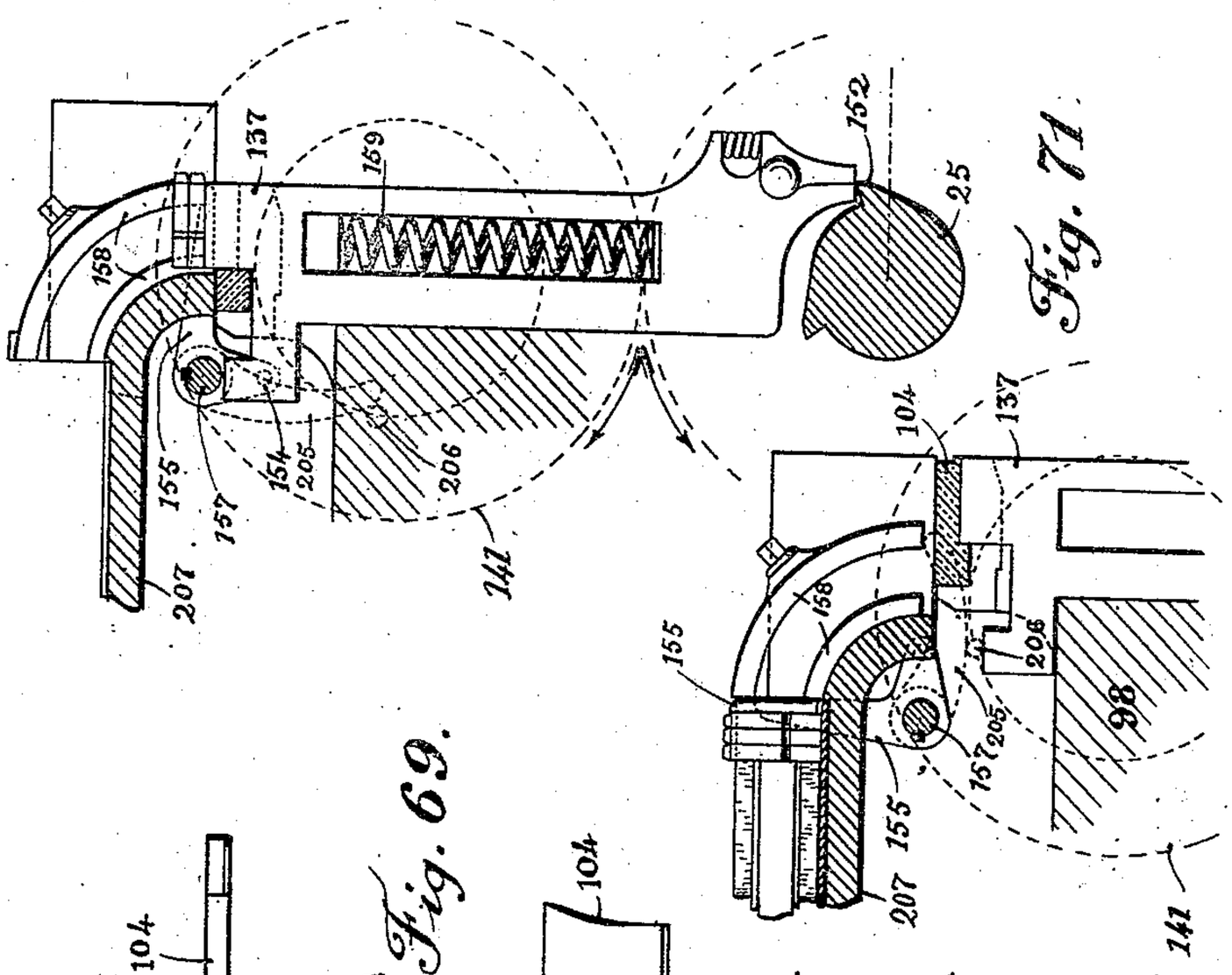

Fig. 71.

Fig. 72.

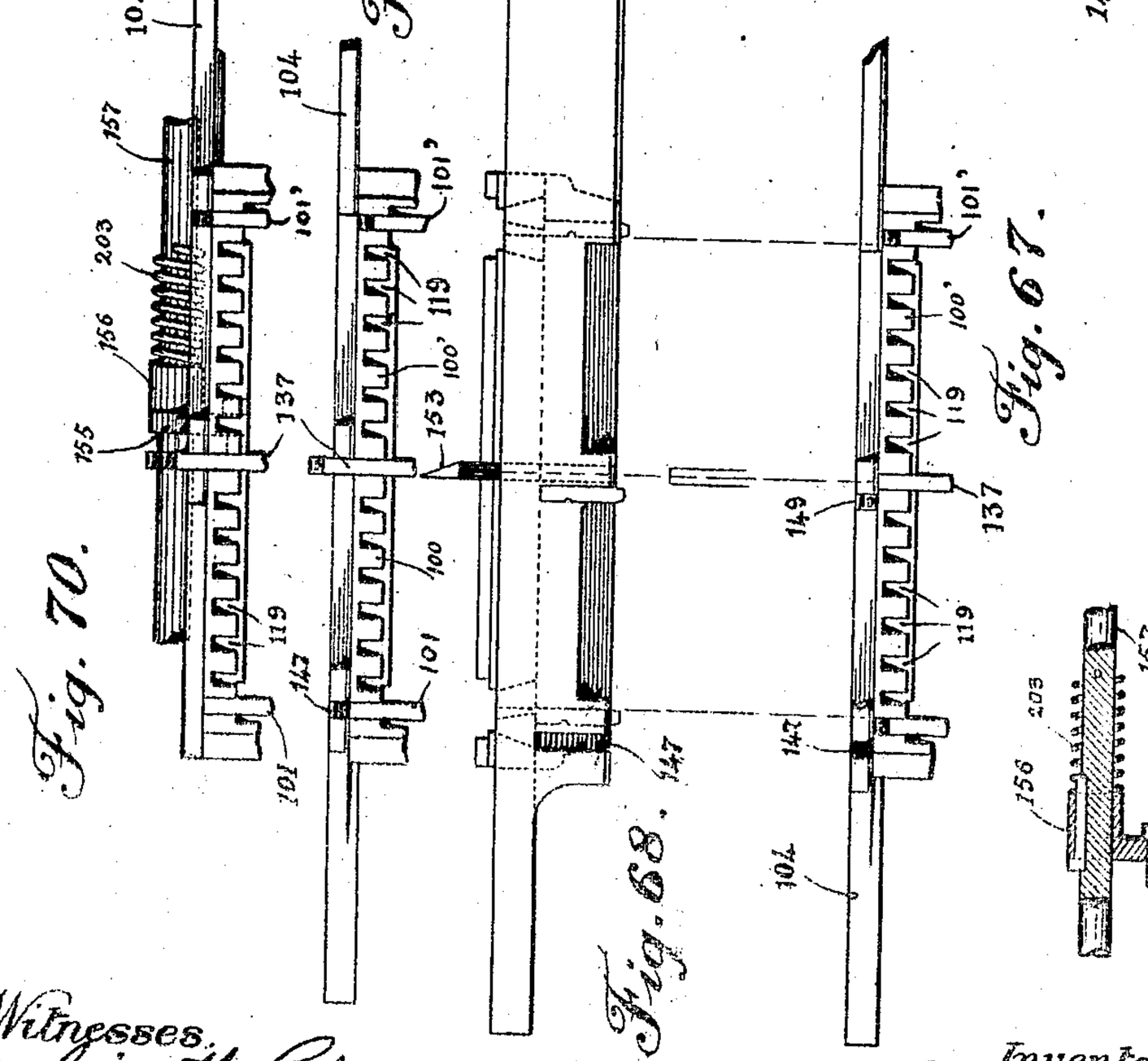

Fig. 69.

Fig. 70.

Fig. 68.

Fig. 67.

Fig. 73.

Witnesses.
Julius K. Hoch
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Joseph Pinel
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No. 890,706. PATENTED JUNE 16, 1908.

J. PINEL.

MACHINE FOR CASTING AND SETTING PRINTING TYPES.

APPLICATION FILED JUNE 26, 1905.

20 SHEETS—SHEET 19.

Fig. 74.

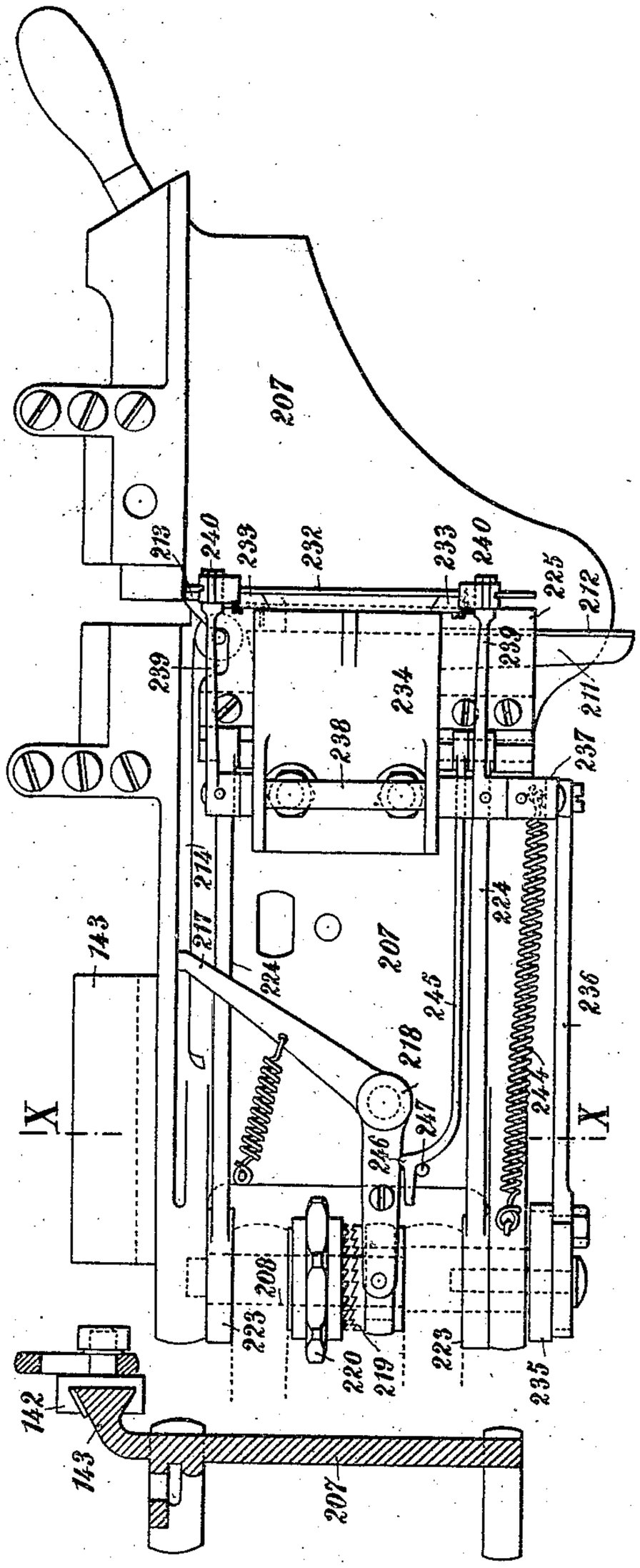

Fig. 75.

WITNESSES:

John A. Steenbeck

John Lotka

INVENTOR

Joseph Pinel

BY

Bierens Kuenith

ATTORNEYS

No. 890,706. PATENTED JUNE 16, 1908.

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MACHINE FOR CASTING AND SETTING PRINTING TYPES.

APPLICATION FILED JUNE 26, 1906.

20 SHEETS—SHEET 20.

Fig. 81.

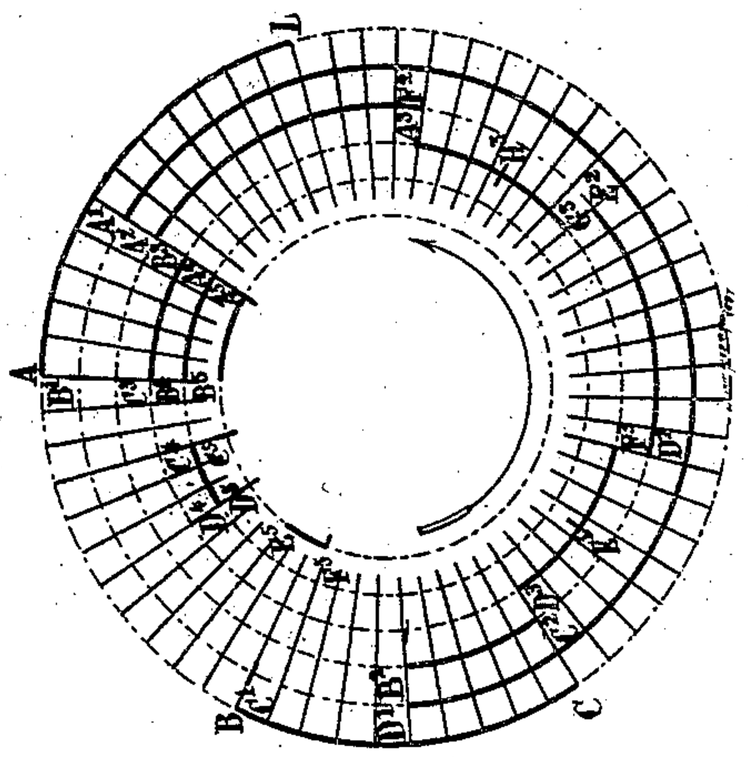


Fig. 77.

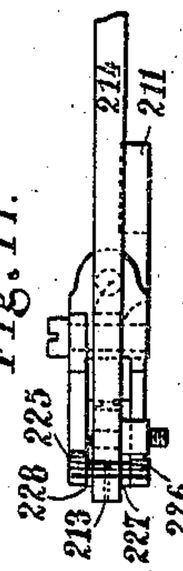


Fig. 76.

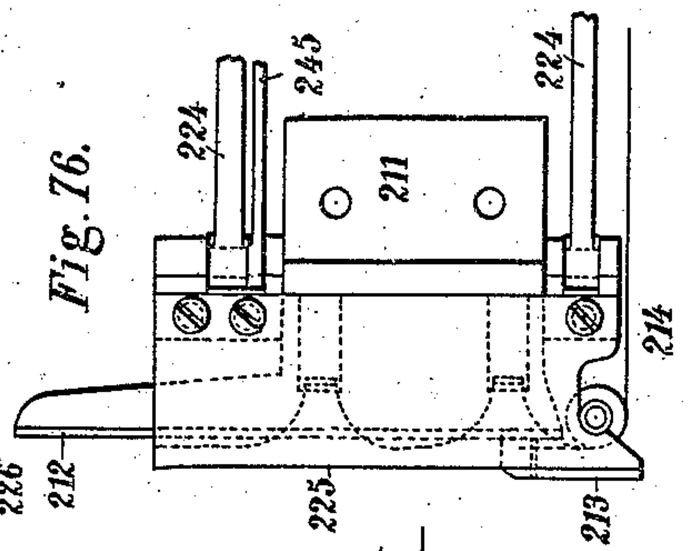


Fig. 79.

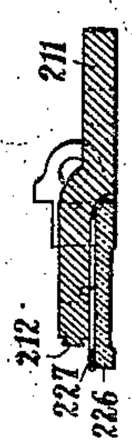


Fig. 78.

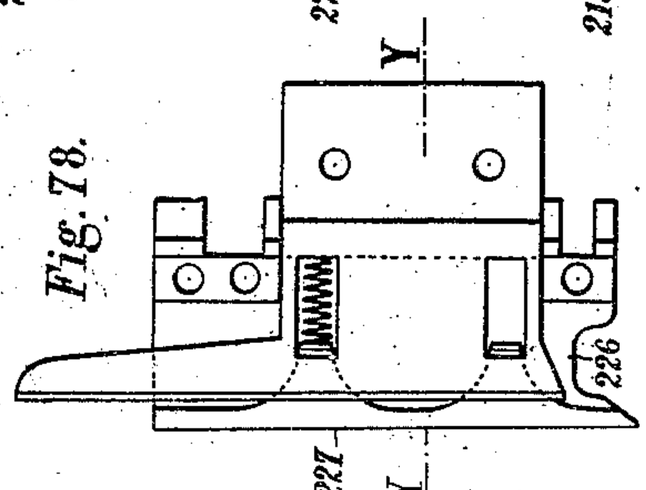
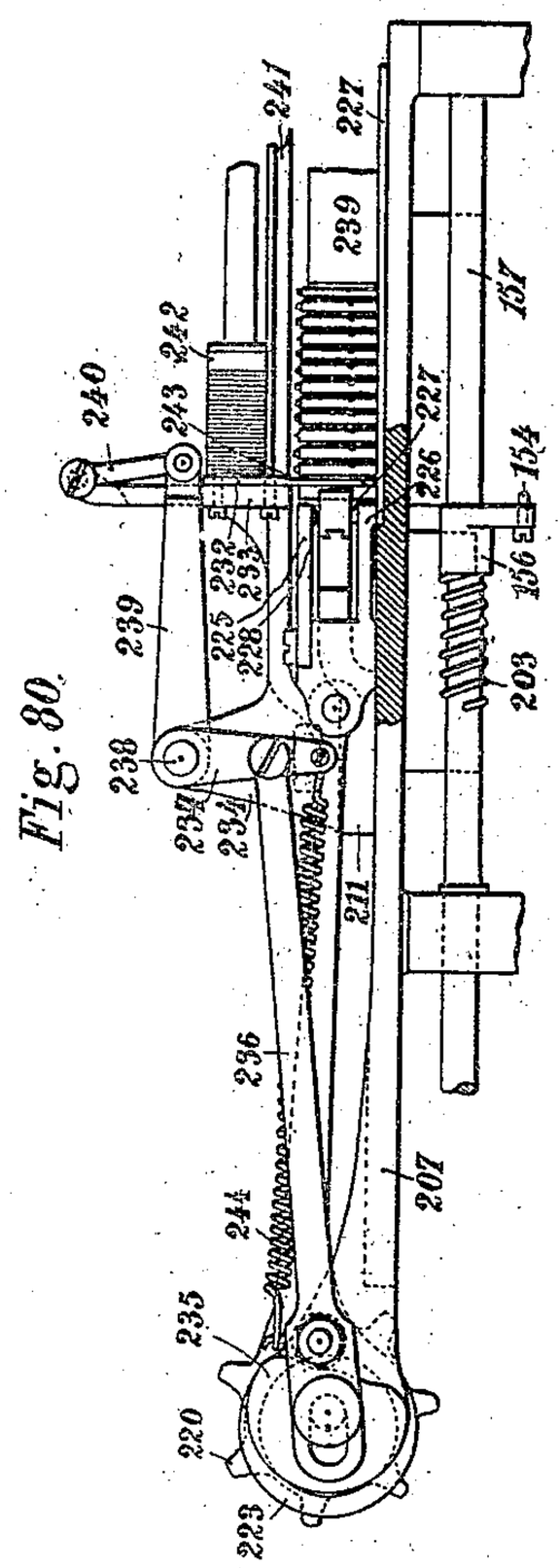


Fig. 80.



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JOSEPH PINEL, OF MONTREUIL-SOUS-BOIS, FRANCE.

MACHINE FOR CASTING AND SETTING PRINTING-TYPES.

No. 890,706. Specification of Letters Patent. Patented June 16, 1908.

Application filed June 26, 1905. Serial No. 267,014.

To all whom it may concern:

Be it known that I, JOSEPH PINEL, of 118 Rue des Savarts, Montreuil-sous-Bois, Seine, Republic of France, engineer, have invented a Machine for Casting and Setting Printing-Type, of which the following is a full, clear, and exact description.

The present invention has for its object a machine capable of casting at one time two or more printing characters entirely separated and of then assembling said characters in succession according as they are produced in a composing stick in lines of exactly determined length, in the order of composition previously established by means of a perforated strip controlling the different organs of the machine.

This system of machine is essentially constituted by the combination of:

(*a*) A double mold presenting two regulable capacities of special construction each presenting an open side, which is closed at the moment of casting a character by a matrix upon which the said cavity is applied, the matrix having a cavity of the form of the character to be obtained;

(*b*) Two matrix carrying drums respectively disposed opposite each of the cavities of the double mold and upon each of which are mounted the matrices corresponding to the various characters, to the different fonts of characters and to the different spaces; the matrices corresponding to the various characters of the same font being disposed on the same circumference and the matrices corresponding to the different fonts of the same character being on a same generatrix and each matrix-carrying drum being adapted to receive a double movement, viz: (1) a movement longitudinally of its axis in the case of a change of font in order to bring opposite the mold, the circle of matrices corresponding to the kind of font selected; (2) an angular movement about its axis for the purpose of bringing opposite to said mold the matrix bearing the character corresponding to the perforated combination of the controlling strip.

(*c*) Selecting organs and combination corresponding to each character, to each kind of font and to each value of space, said organs being set in movement by the perforations successively presented by the controlling strip and serving to regulate the amplitude of the longitudinal and angular movements communicated to each of the matrix-carrying drums, so as to cause the latter to present opposite the two cavities of the double mold the two matrices corresponding either to the characters or to the spaces indicated by the two lines of perforations presented by the strip to the selector and combinator organs.

(*d*) A collector which closes the upper part of the molds and capable of displacement upon the latter for the purpose of successively collecting the cast characters on their exit from the molds and conducting them on to an elevator by which they are conducted to a guide-clip by which they are held and transported to a composing stick.

(*e*) A device for pushing out the line composed into a movable galley and interposing a space line if desired The movable characters thus placed in line may then be automatically cemented together so as to leave the machine in solid lines if desired.

The invention is illustrated by way of example in the accompanying drawings wherein

Figure 1 represents a perspective view of the entire machine. Fig. 2 is a face view of the upper part of the machine with one of the matrix carriers removed. Fig. 3 is a face view of the lower part of the machine. Fig. 4 is a detail view of a combinator partly in section on line Q—Q, Fig. 32. Fig. 5 is a plan view with the matrix-carriers removed. Fig. 6 is a similar view with the matrix-carriers in position, but in which the galley is removed and the composing stick raised. Fig. 7 is a longitudinal vertical section on line A—A, Fig. 6 the cam shaft being taken away. Figs. 8 and 9 are detail views in end view and developed in the flat of an operating cam. Fig. 10 is a detail view of the cam shaft. Figs. 11 to 14 are cross sections of said shaft, Fig. 11 being a section taken on line N—N, Fig. 12 a section on line O—O, Fig. 13 a section on line P—P, and Fig. 14 a section on line R—R of Fig. 10. Fig. 15 is a longitudinal vertical section on line B—B, Fig. 6. Fig. 16 is a side view of a matrix-carrying drum. Fig. 17 shows a part elevation, part section of the drum spindle. Figs. 18 and 19 show in face view two matrices designed to be mounted the one on the right hand and the other on the left hand drum. Fig. 20 is a diagram showing the means employed for varying the spacing out of the characters. Fig. 21 is a transverse vertical section on line C—C Fig. 6, showing the up-

per part only of the machine. Fig. 22 is a detail view of the channel through which the metal is conducted to the molds. Fig. 23 represents a section of the lower part of the machine on line C—C Fig. 6 or line H—H Fig. 3, the combinators being in section on line H′—H′, Fig. 4. Fig. 24 is a detail plan view of the combinator bars. Fig. 25 is a diagram showing the combinations of projections carried by each of the combinator levers. Fig. 26 is an elevation of the bar which serves to raise the combinator levers. Fig. 27 is a transverse vertical section on line D—D Fig. 6 of the upper part of the machine. Fig. 28 is a face view of the collar upon which acts the roller placed to the right of the line T—T in Fig. 27. Fig. 29 shows two of the cast types with their jets attached. Fig. 30 shows a part sectional elevation of the rear face of the melting pot of the machine. Figs. 31 and 32 show horizontal sections taken on lines U—U Fig. 2 and F—F, G—G Fig. 3 respectively. Figs. 33 and 34 are detail views of the controlling strip. Fig. 35 is a diagrammatic view showing the course of the strip on the machine. Fig. 36 is an underside view of the movable galley. Figs. 37 and 38 show a section and face view of a friction clutch. Figs. 39 to 42 are detail views of the double mold, Fig. 39 being a plan, Fig. 40 a side view of the body of the double mold, Fig. 41 a horizontal section on line J—J Fig. 40, and Fig. 42 a vertical section on line L—L Fig. 39. Figs. 43 and 44 are detail views showing the upper and under faces of the steel blocks forming the fixed side of each mold. Fig. 45 shows one of these blocks on a larger scale in section on line M—M Fig. 43, in engagement with the matching teeth of one of the matrix-carriers. Fig. 46 shows in side view the general arrangement of the double mold mounted in its support, the composing stick being shown in section on line E—E Fig. 5. Fig. 47 is a side view of the double mold, the blades and cheeks being removed. Fig. 48 is a similar view showing the blades in position upon the double mold. Fig. 49 is an underside plan of the double mold. Figs. 50 to 55 are detail views of the blades of the double mold and their attachments. Fig. 56 shows a perspective view of the double mold with the collector removed. Fig. 57 is a perspective view of the mold with the collector in position. Fig. 58 is a vertical section on line K—K Fig. 39, showing the double mold provided with its lateral cheek plates and orifices for the introduction of the metal. Fig. 59 is an interior view of a cheek plate. Fig. 60 is a vertical section of the jet piece on line V—V Fig. 58. Fig. 61 is another vertical section of same, taken at right angles, to Fig. 60. Fig. 62 shows on a larger scale a printing type joined to two spaces. Fig. 63 is an underside plan and Fig. 64 a rear view of the collector. Figs. 65 and 66 show the collector in two different positions, viz., upon the double mold and when detaching the jets from the characters. Figs. 67 to 70 show the different positions of the collector for conducting the characters to the layer-on. Fig. 68 is a plan corresponding to Fig. 67. Figs. 71 and 72 show in vertical section on line C—C Fig. 6, the two extreme positions of the layer-on. Fig. 73 is a longitudinal section of the same. Fig. 74 is a plan view of the composing stick and Fig. 75 is a transverse section of the same on line X—X Fig. 74. Figs. 76 to 79 are detail views of the composing stick, Fig. 77 being an end view corresponding to Fig. 76, and Fig. 79 a transverse section on line Y—Y Fig. 78. Fig. 80 is a side view of the composing stick provided with its space line. Fig. 81 is a diagram of the different movements of the machine.

The various organs of the machine are controlled by a paper or other strip (Fig. 33) bearing in a transverse direction combinations of perforations each of which represents a letter or character. This strip, which is perforated in a special machine, bears twelve division lines numbered 1 to 12; the perforations on lines 4, 5, 6, 7, 8, 9 indicate the different characters, letters or signs; the perforations on lines 1, 2, 10, 11, 12 indicate the kind of type font; the perforations on line 3 control the casting of spaces; and when line 3 bears a perforation and no other perforation is presented by the strip above it, the strip controls the casting of a middle-sized space; on the other hand if there are other perforations above that in line 3 this combination of perforations controls the casting of the justifying space, that is to say of a space whose thickness is modified to permit of the justification of the line.

The strip on leaving the perforating machine may either be directly engaged in the casting machine, or may be wound on a reel. In the casting machine here represented, the strip unwinds from spindle 13 and winds upon spindle 14 (Figs. 1, 2, 6, 35). As the machine is arranged to produce at every revolution of the driving shaft the selection, casting and placing in the composing stick of two characters, the strip is shifted at every revolution two columns of perforations, this movement of the strip being effected with the aid of a roller 15 provided toward each end with a ring of teeth 16 (Fig. 5) which engage in perforations 17 in the edges of the strip (Fig. 33), said roller 15 being also provided with a ratchet wheel 18, upon which acts a pawl 19 jointed to a lever 20 operated by a cam 21 keyed on a shaft 22 which receives motion through bevel pinions 23, 24 from the main driving shaft 25 (Fig. 31). This shaft 25 carries at one end a speed pulley 26 loosely mounted thereon and adapted to be put in engagement therewith by means

of any suitable clutch, such as the following for example. In the interior of one of the cones of the speed pulley 26 is mounted a friction clutch consisting of a circular spring blade 27 (Figs. 37 and 38) which is capable of being pressed against the inner face of the pulley under the action of a lever 28 operated by a pin 29 projecting into the interior of shaft 25 and capable of being forced outwards by the beveled end 30 of a rod 31 contained in the interior of said shaft 25 and connected to a circularly grooved sleeve 32 (Fig. 7) fitted to slide longitudinally upon shaft 25 and gearing with a toothed wheel 33 shown in dotted lines in Fig. 31, and keyed upon a shaft 34 provided with a hand wheel 35 at its end, as shown in Figs. 6 and 31. The strip is thus unwound by a regular intermittent movement, which is dependent upon the speed of the driving shaft 25 which may for example be 60 revolutions per minute. The strip at each movement presents two transverse rows of perforations above the two series of selector needles 36 (Figs. 2, 5, 21). The number of selectors of each series is equal to the number of longitudinal lines of perforations on the strip, consequently the number of selectors in each series will be twelve (Fig. 21).

Each vertical needle is mounted on the end of a horizontal lever 37 pivoted at 38 (Fig. 2). The needles 36 are guided in their vertical movement by a comb 39. Each of the six selector levers 37 corresponding to the lines 4, 5, 6, 7, 8, 9 on the strip, that is to the lines bearing the perforations indicating characters, is connected, by means of a rod 40 (Fig. 21), levers 41, 42 keyed on the same axis 43 (Fig. 23) and rod 44, to a steel spring plate 45. These spring plates are mounted as shown in Figs. 1, 3, 23 at one of their ends upon a bearing 46 (Figs. 1 and 4) and subjected to the action of an adjusting screw 47 by means of which their free ends are forced to rise, to an extent regulated by a screw stop 48. The ends of the springs 45 which correspond to one of the groups of selector levers, project toward the left of the machine, and the ends of the spring plates which correspond with the other group of selector levers, project towards the right of the machine as shown in Figs. 1, 4 and 32. Each of said spring plates imparts an upward movement to the needle 36 to which it is connected in such manner that the needles which come opposite the perforations pass through the strip while those which do not coincide with the perforations will be arrested in their upward movement by said strip.

The ends of the spring plates of each group which correspond to the needles which have passed through the perforations in the strip will be raised higher than the rest and be presented to the action of a pallet 49 mounted upon a shaft 50 receiving oscillatory motion through a connecting rod 51 and bell-crank lever 52 from a cam 21 keyed on shaft 22 (Figs. 1, 2, 3 and 23).

The supports 46 of the flexible plates 45 are mounted respectively upon bars 53 (Figs. 1 and 4) which are adapted to be shifted in a longitudinal direction when the flexible plates carried thereon are struck by the pallet 49. Each of the bars 53 is provided with a row of holes (Figs. 4, 24 and 32) the assemblage of six bars of each group constituting a combinator which by the sliding movement imparted to one, two, three, four or five of the series of six bars is capable of reproducing in a same transverse line a combination of holes identical with those presented by the strip opposite the selector needles 36.

The perforated bars 53 are movable in their support and rest upon ball-bearings (Fig. 23) balls being also interposed between the bars for preventing excessive friction.

Above each set of perforated bars are disposed transversely thereto, lever-arms 54, the two sets of levers 54 being loosely mounted respectively upon shafts 55 mounted upon the machine frame. The lever 54 each carry a combination of projections 56 corresponding to the combination of holes representative of one of the divisions arranged upon the circumference of the matrix-carrying drums; the number of these transverse levers is thus equal to the number of divisions, each division comprising six matrices as hereinafter described. The projections 56 of levers 54 bear in the position of rest upon the perforated bars 53 in the intervals comprised between the transverse rows of holes (Figs. 24 and 32).

When the bars 53 after being shifted present opposite the combination of projections 56 of one of the levers 54 a similar combination of holes, said lever having no longer any point of support drops and constitutes as will be hereinafter described an abutment which serves to arrest the movement of the matrix-carrying drum at the moment when the latter, by reason of the rotary motion imparted thereto, presents opposite the mold, the matrix bearing the character indicated by the combination of perforations which the strip presents above the needles 36. As however it might happen that certain combinations of holes presented by the bars 53 might give passage to different combinations of projections 56 of levers 54; the said bars 53 are also provided with projections 57 at those points of the transverse columns of combinations which do not contain any holes (Figs. 4, 23, 24 and 32) in such manner that at each sliding movement of bars 53 there can only be produced such a combination as will afford a passage for a single lever 54 only.

Between the two sets of combinators is disposed a lifter 58 (Figs. 23 and 26) which serves at the moment of shifting the strip to

raise the two transverse levers 54 which have been depressed at the two previous selections, this movement of bar 58 being produced with the aid of a pair of connecting rods 59 receiving motion from a pair of eccentrics 60 (Figs. 2, 21 and 28) keyed respectively upon shafts 22 and 22′, to which motion is transmitted from the main driving shaft 25 through the bevel gear 23, 24, 23′, 24′ (Figs. 2 and 31).

Immediately the levers 54 have returned to their initial position the perforated bars 53 which have been shifted, are returned to their initial position by means of the retracting spring 61 (Fig. 4).

The five selector levers corresponding to the lines 1, 2, 10, 11 and 12 on the strip, that is to say to the lines bearing the perforations indicating the kind of font of type are connected by rods 62 to the three-armed levers 63 (Figs. 2, 21), the lower arm of each of said levers being acted on by a spring 64 which constantly tends to operate the corresponding selector lever 37 when the strip presents a perforation opposite one of the needles 36 carried by said levers, which needle being no longer retained is caused by the action of spring 64 to receive an upward movement, while the upper arm of the lever pushes a bolt 65 (Fig. 21) for arresting as hereinafter described the sliding movement imparted to the matrix carrying drum at the moment when said drum presents opposite the mold, the series of matrices corresponding to the kind of font indicated by the hole or holes presented by the strip above said needles. During the shifting of the controlling strip, the needles 36 are held down by the cams 66 keyed on the two shafts 22 and 22′, and which act on the heels of selector levers 37 (Fig. 2).

The matrices 67 are composed of small blocks of copper, bronze or steel of parallelopiped form presenting upon one of their faces a sunk engraving of the character or sign (Figs. 18, 19, 45). The matrices corresponding to the different characters or signs and to the different fonts are mounted upon a drum.

The machine is provided with two matrix-carrying drums 68, 68′ corresponding to two groups of selectors. Each matrix-carrying drum presents upon its periphery ten longitudinal positions 69 (Figs. 16 and 45) and between two consecutive partitions are placed four rows of matrices 67 each containing six matrices as shown in Figs. 1, 2, 6, 15 and 45. These matrices are held in position by small rods 70 (Figs. 15 and 45) which are received in semi-circular grooves on the upper and under sides of each matrix and fixed in the two lateral rings 71, 72 by means of which the matrices are held upon the drums 68, 68′. The partitions are reserved for the casting of spaces or blanks (Fig. 16). The matrices are so disposed upon the drum that those which correspond to the characters of the same font will be found on the same circumference, the six circles of matrices corresponding to different fonts.

Each matrix-holding drum receives a double movement, viz: (1) a longitudinal sliding movement upon its shaft in the case of a change of font for the purpose of bringing opposite to the mold, the circle of matrices corresponding to the font desired (2) an angular movement about its axis for bringing opposite the mold, the matrix bearing the character or sign indicated by the perforated combination presented to the selectors. Each matrix-carrying drum is screwed as shown in Figs. 15 and 17 upon a hollow shaft 73, 73′ capable of sliding upon a solid shaft 74, 74′ but which partakes in the rotary motion of the latter. Each of the hollow shafts 73, 73′ carries a ring 75, 75′ in which it is capable of turning freely, said ring being provided with gudgeons 76, 76′ engaging in a fork 77, 77′ upon one end of a three-armed lever, the second arm 78, 78′ of which lever is acted on by a crank-arm 79, 79′ keyed on shaft 22, 22′, while to the third arm 80 of said lever is attached one end of a retracting spring 81, whose other end is attached to the corresponding arm 80′ of the other lever.

The shafts 22, 22′ receive continuous rotary motion in such manner that at every revolution the cranks 79, 79′ in acting on the arms 78, 78′ of the levers tend to move the two drums 68, 68′ toward each other; on the other hand immediately the cranks 79, 79′ cease to act upon the arms 78, 78′ of the levers, the retracting spring 81 produces a movement in the reverse direction of the three-armed levers which causes the two matrix-carrying drums 68, 68′ to separate the one from the other until the moment when the arm 80, 80′ is arrested by that one of the bolts 65 which has been brought by the selector lever 37 opposite the needle of which the strip has presented a perforation indicative of the kind of font. Thus at each revolution of shafts 22, 22′, the drums 68, 68′ receive a longitudinal sliding motion upon shaft 74, 74′ upon which they are mounted, the amplitude of which movement is regulated by the bolt 65 corresponding to the kind of font indicated by the perforation upon the strip.

The angular movement of the matrix-carrying drum is produced by the following means:—The shafts 74, 74′ upon which the two matrix-carrying drums are mounted, each carries a pulley 82, 82′ provided with studs in which engage the perforations of an endless steel band 83, 83′ (Fig. 1) the two steel bands passing respectively around pulleys 84, 84′ which are similarly provided with studs the pulley 84′ being keyed on shaft 85 and pulley 84 being fast on a toothed wheel 86 in gear with a toothed wheel 87

keyed on shaft 88 (Fig. 32). The two shafts 85, 88 are driven by means of friction drums 89, 90 and spring cords 91, 92 from the main shaft 25 (Figs. 1, 2, 31 and 32) upon which is keyed a double grooved pulley 93, 94 around which said cords pass. Each of the shafts 85, 88 carries beneath each of the levers 54 a stop 95, said stops which are equal in number to that of the divisions upon the circumference of each drum being helically disposed and corresponding to the angular positions of the several matrices. (Fig. 23.) The rotary motion of a drum is arrested when one of said stops meets the heel 54ª of the stop lever 54 which has been depressed as before stated, and which corresponds to the character indicated by the perforation presented by the strip above the needles 36. The amplitude of the angular movement of each of the matrix-carrying drums is thus variable for each character and will always be such that the drum will be arrested at the moment when it presents opposite the mold the matrix bearing the character indicated by the perforated combination presented by the strip above the needles.

In order that the matrix shall always be presented exactly opposite to the mold, the ring 72 on each matrix-carrying drum is provided with teeth 96 (Figs. 21 and 45) between two of which engages the upper part of the mold, as hereinafter described. Each matrix is also provided on one side with a small steel plate 97 for a purpose hereinafter described.

The mold, or to speak more exactly, the double mold is so constituted as to permit of casting two characters simultaneously. This double mold comprises a movable support 98 (Figs. 6, 39, 40, 46 to 49) provided with two projecting parts 99, 99′ to the upper part of which are screwed two plates of tempered steel 100, 100′, forming the fixed side of each of the molds. Upon one side of each of the plates 100, 100′ are applied the movable blades 101, 102 (Figs. 7, 48, 50 and 52) the upper faces of which form the lower face of each mold. Upon the two lateral faces of the movable support 98 are fixed the cheek plates 103, 103′, whose interior faces form the side of each mold opposite to that formed by the plates 100, 100′. (Figs. 6, 58 and 59). The two molds are closed at their upper part by a removable plate 104 (Figs. 63 and 67) fitted to slide (as hereinafter described) in a groove provided in each of the plates 100, 100′ (Figs. 43, 56 and 57). The rear face of each mold is constituted by a "jet piece" 105 in which is formed a channel 106 at which the melted metal is introduced (see Figs. 58, 60, 61). The front face of each mold is constituted by the matrix which is presented thereto and upon which it is applied as will be hereinafter described.

The steel plate 100 of the one mold and the inner face of cheek plate 103′ (Figs. 6, 43, 44 and 56) of the other mold are each provided at their front part with a small ledge 107, 108 projecting into the interior of the mold, with the object of obtaining molded types or characters presenting a beveled edge 109, as shown in Fig. 29 for the purpose of affording a lodgment for any small fins which may be presented by the character in the next line and of thus insuring in all cases the perfect application of the lines of characters one against the other and consequently of obtaining a perfect alinement of said characters. The cheek plate 103 of the one mold and the steel plate 100′ of the other mold are each provided with a rib or projection 110, 111, for forming the nick 112 (Figs. 29 and 62) necessary for hand composing.

The movable support 98 is adapted to slide upon ways 113 (Fig. 46) provided upon the frame of the machine, said support constantly tending under the action of a retracting spring 114 (Figs. 21 and 23) to bring the two molds over the matrices presented to them by the two matrix-holding drums, this forward movement of the mold carrier 98 being limited by screw stops 115 mounted on the slide-way 113 (Fig. 46). The rearward movement of the slide 98 and consequently of the molds carried thereby is effected with the aid of the bell-crank lever 116 of which one of the arms engages in the tail end 117 of slide 98, and whose other arm is operated by a cam 118 keyed on the main shaft 25 of the machine (Figs. 10 and 46).

The plates 100, 100′ are provided with grooves 119 (Figs. 7, 44, 67) in each of which engages a tooth 96 presented to them by the two matrix-carrying drums 68, 68′, so as to insure the absolute coincidence of the matrices and molds.

The movable blades 101, 102 which form as before stated, the lower face of the molds, are (1) removable and interchangeable and thus permit of varying the height *c*, *d* (Fig. 62) of the body or shank of the printing character; (2) movable in the vertical direction so as to permit of varying the "depth" *e*, *f* of the characters.

The two blades owing to their being capable of movement in a vertical direction permit of casting in the same mold either characters or spaces, the height of which latter being greatly reduced as compared with the spaces obtained in other known machines. The blades 101, 102 which are united together by a connecting piece 120, (Figs. 48, 54 and 55) are capable of sliding independently one of the other; each mold plate 102 slides against a shoulder 121, 121′ (Figs. 39, 40, 41, 48) upon the mold carrier 98 and the blade 101 is clamped upon the blade 102 by the plate 122. The connecting piece 120 is fixed to the shank of blade 102 while the shank or blade 101 is capable of passing

freely through said piece 120. A coiled spring 123 is interposed between the connecting piece 120 and a fixed abutment 124 upon the mold carrier 98; another coiled spring 125 is interposed between the connecting piece 120 and an abutment upon the shank of blade 101 (Fig. 56).

In casting a character the two blades 101, 102 act together and with their upper part at the same level. In casting a space the front blade 101 remains stationary at the highest point of its course as will hereinafter appear, the rear blade 102 only being movable. The two blades are made vertically movable for the purpose of regulating the thickness of the characters.

As has been hereinbefore stated, each matrix is provided on its lateral face with a small steel plate 97 (Fig. 45) whose height is a function of the thickness of the character carried by said matrix. When a mold is upon a matrix the plate 97 serves to force back the end of a bell-crank lever 126 (Figs. 47, 48 and 56) pivoted at 127 upon the mold; the other end of said bell-crank lever acting upon an intermediate lever 128 also pivoted upon the mold at 129, which latter lever 128 rests upon a cross-piece 120 carried by the blade 102; under these conditions the small plate 97 (Fig. 57) in forcing back the lever 126 imparts to the cross-piece 120 and consequently to the two blades 101, 102 a downward movement whose amplitude is proportionate to the thickness of the character to be cast.

In order to render it possible to regulate with the greatest precision the value of the thickness of the body of the characters so as to obtain exactly the length of line imposed, the center of oscillation 129 of lever 128 is made movable and may be adjusted by means of a screw, so that its distance from the point of contact of lever 128 and cross-piece 120 may be varied. If the distance is diminished the amplitude of the angular movement imparted by the lever 126 to lever 128, is greater and consequently the downward movement will be greater and the mold cavity will therefore be higher; if on the contrary the pivot 129 be shifted further away from the point of contact of the lever 128 and cross-piece 120, the amplitude of the downward stroke of the blades 101, 102 will be reduced, and consequently the cavity of the mold will be less elevated.

The diagram represented in Fig. 20 serves to show the differences in the amplitude of the movements communicated to the blades 101, 102 by the shifting of the center of oscillation 129. For casting spaces, the plate 101 should be fixed with its upper part level with the upper edge of the mold, as shown in Fig. 48; the length of the mold cavity being thus diminished by the breadth of the blade 101. This blocking of blade 101 is effected with the aid of a stop 130 pivoted at 131 upon the mold carrier 98 (Fig. 49).

When the strip presents a perforation 133 (Fig. 34) indicating an interval or space above the needle 36* (Fig. 21) said needle which is pressed upwards by its spring contained in the cavity 134′ (Fig. 46) passes through the perforation, thus imparting an angular movement to the lever 132 (Fig. 21) whereby the slide 134 jointed to said lever is drawn downwards and the lug 135 (Fig. 46) carried thereby brought into the path of the adjustable stop 130 (Figs. 7, 46 to 49, and 56), so that on the forward movement of the mold, said adjustable stop on striking against the lug 135 is forced to turn upon its center 131 and places itself beneath the shank of blade 101 (Figs. 48 and 56). Under these conditions when blade 102 is operated by lever 128 the cross-piece 120 compresses springs 123 and 125 and blade 101 remains stationary.

In order to cast the characters without any blow holes it is necessary that the air contained in the molds should be expelled and for this purpose the metal is admitted into the interior of the mold by means of a jet-piece 105 provided with a splayed channel 106 (Fig. 56) in which the air expelled from the mold may be received. Each type body in this manner is furnished after molding with a small tail piece 136, as shown in Fig. 29, which is severed at the moment that the character is expelled from the mold as hereinafter described.

The cast characters on their exit from the molds are seized by a collector 104, the function of which is to bring the characters on to an elevator 137 mounted upon the mold carrier 98 by which they are raised in succession so as to enable each of them to be seized by a layer-on by which they are conducted to the composing stick as hereinafter described. The collector 104 is provided upon its under face with projections 144, 145 adapted to slide in guides 146, 146′ in the parts 100, 100′ (Figs. 21, 43, 45, 46, 56, 57, 63 and 72). This collector plate serves to close the upper part of the molds during the casting operation (Fig. 67) after which the collector receives a sliding movement for removing the cast character for which purpose the collector 104 is provided at one end with a slot 138 (Figs. 2 and 63) through which passes the axis of a roller 139 engaging in the groove of a cylindrical cam 140 keyed upon a shaft carrying a toothed wheel 141 gearing with a wheel 142 keyed on the driving shaft 25 (Figs. 2 and 5). The axis of roller 139 carries a slide 142′ (Figs. 2 and 5) movable along a guide 143 upon the composing stick, as hereinafter described (Figs. 74, 75).

The slot 138 enables the collector 104 to partake in the movement of the molds and of receiving at same time the definite sliding

movement before referred to. When the characters are cast, the collector receives a slight shifting movement from the cylindrical cam 140 so as to present above one of the molds, the top one for example, a space 147 of a form corresponding to that of the character cast (Fig. 68) and a space 149 (Fig. 63) above the elevator 137 (Fig. 69). The introduction of the cast character into the space 147 of collector 104 is produced by the backward movement of the mold, by means of which on the elbow lever 126 (Fig. 56) becoming freed, the two blades 101, 102, are enabled to rise under the action of the compressed spring 123. The upward movement of these blades 101, 102 is moreover assured by means of the cam 150 carried by the main shaft 25 (Fig. 10) acting upon the roller 151 carried by the shank of blade 102. In this manner the blades 101, 102 on reaching the upper end of their course (Fig. 69) introduce the cast character into the space 147 of collector 104. The collector next receives a fresh movement in the same direction immediately on the descent of the elevator 137 as will be hereinafter explained, so as to present the space 149 above the right hand mold, the character cast in which being introduced into said space by the upward movement imparted to the blades 101′, 102′ of said second mold by the aid of the spring 123 as above explained for the blades 101, 102 of the left-hand mold. During this second movement the collector 104 conducts the characters produced in the left hand mold above the elevator 137 (Fig. 70). The elevator 137 receives vertical movement between the projecting parts 99, 99′ on the mold-carrier 98, with the aid of a cam 152 (Figs. 10, 13, 21, 31 and 46) keyed on main shaft 25. The elevator 137 is provided upon its rear side with a beveled surface 153 (Figs. 6, 21 and 68) which acts when the mold returns backward upon a stud 154 (Figs. 6, 71 and 73) mounted upon the "layer-on", which latter consists of an arm 155 carried by a socket 156 adapted to slide upon a shaft 157. On the elevator 137 rising, the incline 153 thereon forces back the arm 155 and thus moves the latter out of the path so as to permit of the passage of the character raised by the elevator 137. When the elevator has arrived at the highest point of its course it engages the character which it carries into a guide clip 158 (Figs. 2, 5, 71, 72) mounted upon the composing stick as hereinafter described. The elevator 137 is then returned to the bottom of its course by the action of the retracting spring 159 (Fig. 21) and the collector 104 is returned from right to left to its point of departure, during which movement it carries the character from the right-hand mold a little beyond the elevator 137 (Fig. 67) and closes the two molds during the casting of the two following characters.

When the casting operation is terminated the collector 104, to which is imparted a fresh or primary movement towards the right, brings the character from the preceding casting in the right-hand mold above the elevator 137 by which it is conducted into the guide clip 158 as hereinbefore described, at same time that the blades 101, 102 of the left-hand mold engage the newly cast character in the cavity 147 in the collector 104, the same operations being repeated in succession. As has been before stated the characters before they leave the molds have a jet 136 attached as shown in Fig. 29 of which they require to be deprived, for which purpose projections 144, 145 are formed on the underside of the collector 104 for severing and expelling said jets. On the first movement towards the right of the collector 104 (Fig. 65) which is a rear view of the device (the right-hand of the collector being on the left in the drawing) the chamber of the projection 145 commences by causing the jet piece 105 to descend so as to cause the latter to disengage from the jet 136.

In order to prevent the jet 136 from partaking in the downward movement of the jet piece 105 the latter is traversed by a fixed stem 160 upon the upper extremity of which the jet 136 rests (Figs. 60 and 61). The collector 104 on continuing its movement in the direction of the arrow in Fig. 66, the projection 145 which forms a shear edge strikes the jet 136, severs the same and carries it over a channel 161 into which it falls. The severance of the jet of the second character is effected by the projecting shear edge 144 in a similar manner.

In order to avoid overheating of the mold a circulation of air or of cold water is established in the mold-carriers 98 (Figs. 39, 41, 42, 44, 45). The cooling fluid enters by the channel 162 passes in a forward direction through channel 163 (Fig. 41) upwards through the channel 164 (Fig. 42), redescends through the channel 165 and upward through channel 166, then re-descends through channel 167 and returns backward through channel 168 and passes out through channel 169.

The alloy of which the characters are composed is maintained in a fluid condition in a melting pot or container 170 (Fig. 21) which is heated by any suitable source of heat, such as by means of gas for example, said melting pot being supported upon a cylindrical or truncated conical casing 171 which is open at its lower end and constitutes a combustion chamber, said casing 171 being supported by brackets 172, 172′ bolted to the frame of the machine (Figs. 6 and 30). The melting pot is provided with a partition 173 (Fig. 21) dividing it into two compartments, said partition being provided with a pump barrel 174 similar to those of other casting

machines, in which works a piston 175 whose rod 176 is drawn constantly in an upward direction by a spring 177; while the upward movement of the piston 175 is produced by a lever 178 pivoted at 179 and provided with a projection 180 which engages beneath a stud 181 carried by a sleeve 182 fixed on rod 176, said lever 178 being jointed to a connecting rod 183 operated by a crank disk 184 keyed on a shaft 185 which receives motion from the main driving shaft 25 by means of bevel pinions 186 and 24′ (Figs. 5, 6, 7, 27 and 31). The sleeve 182 carries two lugs 187 which on the rising of the pump piston rod 176 comes into engagement with two projections 188 carried by a fork 189 controlled by a flat spring 190 (Figs. 6 and 21). The fork thus constitutes a kind of lock for maintaining the piston at the highest point of its course and compressing spring 177.

The fork 189 is jointed to a lever 191 pivoted at 192 and upon the extremity of which acts a bar 193 carried by the two tubes 194, 194′ which conduct the melted metal to the molds when the latter are placed in position upon the matrices (Figs. 6 and 21). The tubes 194, 194′ are mounted in sockets 195, 195′ upon the mold-carriers 98 in such manner that during the forward movement of the molds, the cross-bar 193 carried by the tubes 194, 194′ being caused to partake in the movement will effect the disengagement of spring 177 and produce the descent of the piston 175 and thus cause an injection of molten metal into the molds.

The tubes 194, 194′ through which the molten metal is introduced into the molds each contain a needle 196 (Fig. 22) which is adapted to slide longitudinally therein for the purpose of obstructing the mouth of the tube at the moment the injection is to be cut off and of unclosing it when the metal is to be introduced. The needles 196 are fixed to the cross-bar 193 which has slight play in the tubes 194, 194′, which are for this purpose provided with elliptical holes in which the ends of bar 193 are received. In this manner slightly before the molds are applied upon the molds the cross-bar 193 strikes against the lever 191 whereby the needles 196 are arrested by said lever for a very short period, whereas the tubes 194, 194′ continue to advance, in consequence of which relative movement of the tubes as compared with that of the needles, the extremities of the latter will completely unclose the ends of the tubes and the molten metal injected by the downward motion of piston 175 can then freely enter into the molds.

In order that the metal may be maintained in fusion at a sensibly constant temperature and always at the same level in the melting pot 170 the machine is provided with a feed apparatus which is carried by the bridge piece 197 which serves as a guide for the rod 176 of piston 175. This feed apparatus comprises a lever 198 pivoted at 199 and capable of being held in different positions by stops 200 (Fig. 30) from which lever is suspended a support 201 upon which rests a cylindrical cake of alloy contained in the cylinder 202 (Figs. 5, 6 and 30).

When the operator starts the machine in motion he simply depresses lever 198 so as to bring the cake of alloy in contact with the surface of the bath of molten metal contained in melting pot 170. It has been before stated that on the retrograde movement of the mold carriers 98 the beveled end 153 of the elevator 137 (Fig. 60) forces back the layer-on 155 along its shaft to afford passage for the character raised by the elevator 137 and permit of the introduction of the latter into the guide clip 158. In the forward movement of the mold carrier 98 the inclined end 153 of elevator releases the layer-on 155 which latter under the action of its spring 203 (Figs. 6, 7, 73) returns to its original position and the end of arm 155 is presented opposite the entrance to guide clip 158. The arm 155 then receives an angular movement as hereinafter described for conducting the character into the interior of the guide clip 158 by which it is supplied to the composing stick in which the character is placed vertically (Figs. 71 and 72).

The arm 155 is mounted on shaft 157 in such manner as to be capable of sliding longitudinally thereon as well as to partake in its angular movement, for which purpose said shaft 157 is provided with an arm 205 upon which acts a stud 206 carried by the wheel 141 which stud in striking arm 205 imparts an angular movement to this latter and consequently to the layer-on 155 so as to finally bring the latter to the vertical position shown in Fig. 72.

The composing stick consists of a plate 207 (Figs. 5 and 74) movable about an axis 208 and resting upon two supports 209 (Figs. 2, 6 and 46) to which it is fixed by means of screws 210 (Fig. 5). Upon this plate is bolted a plate 211 provided with a dovetail 212 serving as a guide for a slider 213 (Fig. 76) connected by a band 214 to an adjustable index plate 215 (Figs. 2 and 5) movable in a slot 216 graduated on one of its edges, the position of the index 215 upon the scale indicating at any moment the length of the line in course of being composed, each character supplied by the layer-on 155 imparting movement to the slider 213. When the line is completed the index 215 abuts against one of the arms of an elbow lever 217 pivoted at 218 (Figs. 5 and 74) the other arm of said lever operating the sliding member of a clutch 219, the other member of which is fast on a pinion 220 to which continuous rotary motion is imparted by an endless chain 221 (Fig. 1) which is driven by a sprocket pinion

222 keyed on shaft 185 (Fig. 31). In the two members of clutch 219 being thrown into gear rotary motion is imparted to the shaft 208 and the two eccentrics 223 keyed on said shaft 208 transmit longitudinal movement to the two connecting rods 224 whereby the two pushers 225, 226 mounted respectively above and below the plate 211 are caused to drive the line after it has been set up into the galley 227 (Fig. 5). Each of the pushers 225, 226 is provided with a plate 227, 228 pressed on by a spring 229 (Figs. 76, 77, 78 and 80) for insuring the perfect contact of the pushers with the characters. The composing stick also has for effect to exert a certain pressure upon the collector 104 for the purpose of maintaining it in position upon the mold, but in order that the sliding movement of said collector may not be impeded, the pressure is transmitted to the latter through the medium of the balls 230 (Fig. 46) pressed on by springs 231. The characters are in this manner caused to aline themselves in front of the pushers 225, 226 and are retained upon the opposite side by a plate 232 (Figs. 74 and 80) capable of sliding vertically in guides 233 carried by guides 234 screwed to plate 211. When a line of characters is finished the plate 232 is raised in order to allow of the passage of the line of characters driven by the pushers 225, 226, this vertical movement being produced by means of a cam 235 keyed on shaft 208 actuating a connecting rod 236 jointed to an arm 237 pivoted on a center 238 upon which is also pivoted another arm 239 connected by a rod 240 to plate 232. The plate 232 also serves to place a lead behind the line which has been pushed into the galley if required. For this purpose above the galley 227 is placed another galley 241 (Fig. 80) in which the leads are placed, which latter are constantly pressed by a spring against plate 232 which is caused to present when in its highest position a recess 243 in which to receive a lead which will be carried downwards on the downward movement of plate 232 produced by a spring 244 acting on lever arm 237.

In order that the driving up of the line set up at the desired moment may always be insured, the clutch 219 is provided with a locking device arranged as follows.

Upon the pushers 225, 226 is mounted an arm 245 (Fig. 74) provided at its free end with a lug 246 which, when in a state of rest, engages in a notch provided for the purpose in the elbow lever 217; a fixed stop 247 serves to guide the extremity of arm 245 when it partakes in the sliding movement of the pushers.

When the elbow lever 217 is acted on by the index 215 (Figs. 2 and 5) attached to the band 214, the clutch member 219 commences to engage with the member fast on pinion 220, this clutching action having for effect to impart as has been before stated, a sliding movement to the pushers 225, 226 on the commencement of which movement the lug 246 on the arm 245 will be disengaged from its notch and throw the sliding member 219 of the clutch into engagement with its corresponding member fast on wheel 220 (see Figs. 5 and 74). When the pushers 225, 226 return to the starting point, the lug 246 on arm 245, which is constantly guided by the stud 247, resumes its original position in the notch of lever 217 and the clutch member 219 can then be thrown out of action.

The composition of movable characters is always exposed to the liability of being pied or disarranged during their subsequent manipulation owing to their being independent of each other. In order to partially remedy this inconvenience, the lines after being set up are subject to a special treatment for the purpose of rendering the characters adherent the one to the other, while still enabling them to be separated if desired such as in the case of correction for example. This operation consists in interposing between the last line in galley 227 and that which is added a thin adhesive layer preferably of a solution of resin in alcohol, the different lines in the galley being maintained at a temperature of about 100° C., under the effect of which temperature the resinous solution penetrates on volatilizing into the interstices presented by the different faces of the characters owing to the crystallization of the metal following on its solidification, thus insuring sufficient adhesion between the characters and lines of characters to prevent their becoming disarranged in handling them subsequently. A similar result may also be obtained by maintaining the line fed to the galley at a temperature of from about 160° to 170° C., and causing it to enter the galley through a passage of slightly diminishing breadth, so as to exert a pressure on the characters constituting the line, whereby under the combined action of heat and pressure they are caused to adhere together. Pressure may also be employed in connection with the first method described, it being understood that when pressure is applied allowance should be made in justifying for the slight shrinkage resulting from such compression.

When the galley 227 is filled with lines of characters it should be emptied or replaced by an empty one, in which latter case the galley should be made removable as shown in Figs. 2, 8 and 36. In this case the galley is provided upon its underside with a fork 248 in which engages a locking device 250 actuated by the lever 249 by moving which in a downward direction the part 250 is caused to bear on fork 248 and so hold the galley in place.

The working of the machine is as follows:— As has been described above the registering

strip at each revolution of the driving shaft receives a movement of translation so as to present above the two rows of needles 36 (Fig. 2) the two transverse columns of perforations following. During this movement of the strip the needles 36 are lowered by the cams 66 and as soon as the strip is brought to its new position the cams 66 permit the needles to rise under the action of the springs 45 (Figs. 1, 3 and 4), the needles which are below the perforated portions of the strip completing their ascensional movement and the other needles being stopped by the non-perforated portions of the strip. The needles which correspond to the selected types and which have traversed the strip permit the springs 45 by which they are operated to rise and place themselves in front of the pallet 49; which latter in its oscillatory movement repels the springs 45 and as a consequence the combination bars 53 upon which these springs are mounted (Figs. 3 and 32). The displacement of these bars re-forms two combinations of holes identical to those of the two columns of perforations presented by the strip. That one of the transverse levers 54 of each combinator group which carries the combination of projections adapted to engage in the combination of holes formed by the displacement of the bars 53 is lowered and the heel which it presents forms a stop to one of the stepped abutments 95 which the shafts 85 and 88 carry. These shafts 85 and 88 which are acted on by the friction clutches 89 and 90 (Figs. 1 and 32) are thus stopped after having received an angular displacement the amplitude of which is equal to the angle comprised between the abutment 95 corresponding to the lever 54 which is lowered and the abutment 95 which has caused the preceding stoppage. These shafts 85 and 88 drive in their rotation shafts 74, 74′ (Fig. 15) which carry the matrix carrier drums 68, 68′; by this movement the drums bring opposite to the cavities of the double mold the two rows of matrices corresponding to the two characters indicated by the perforations of the strip.

The needles which correspond to the font selected receive the same ascending movement as the type selection needles and in each group the needle which finds itself in front of a perforation in continuing its ascending movement brings about the movement of a bolt 65, placed in the oscillatory path of the lever 80 (Figs. 15 and 21) so as to limit the amplitude of the sliding movement communicated by the spring 81 to the two matrix-carrying drums and thus determine the position of the latter in such manner that the two matrices brought in front of the cavities of the double mold correspond to two characters of the kind of font indicated by the two columns of perforations of the strip.

When a perforation corresponding to an interval or space is presented by the strip above the selector needles the needle 36 of one or the other group also receives a rising movement and communicates by means of lever 132 a downward movement to the connecting rod 134 which causes the abutment 135 to be presented in front of the part 130 carried by the double mold (Figs. 21, 46 and 56) as hereafter seen. The two matrices being selected the cam 118 escaping from the roller carried by the lever 116 (Fig. 46) permits the spring 144 to bring forward the double mold (Fig. 2). When the latter is at the point of arriving at the end of its course one of the notches 119 carried by each of the parts 100, 100′ receives one of the teeth 96 of the ring 72 with which each of the matrix-carrying drums is provided and insures the correct position of the matrices relatively to the cavities of the mold (Fig. 45). At same time the two lateral plates 97 which the two matrices which are brought over the cavities of the double mold carry, press on the two levers 126, 126′ (Fig. 57), which levers act by their lower portion upon the intermediate levers 128 which cause the movable blades 101, 102 of each mold to descend a distance proportional to the projection presented by the plates 97 accompanying each matrix, this projection being itself the function of the thickness of the type. The capacity of each of the mold cavities being thus determined each metal supply tube 194 which has been made to partake in the movement of the double mold is uncovered by the stoppage of the needle 196 brought about by the contact of the cross piece 193 which unites the two tubes 194 (Fig. 21) with the extremity of the lever 191. These tubes 194 in completing their course present an opening opposite the channel 170* (Fig. 22) which opens into the metal pot 170. The cross-piece 193 bearing on the extremity of the lever 191 causes the latter to push back the strap 189 during which movement the abutments 188 escape from the abutments 187 and thus permit of the descent of the piston 175 which is acted on by the spring 177. This piston in descending forces the molten metal by means of the channels 170* (Figs. 21, 22) into the tubes 194 which open into the two cavities of the mold. The metal being thus injected under pressure into the molds the casting of the two types is effected at the same time. The casting being completed, the double mold is drawn back by the lever 116 which is controlled by the cam 118, during which movement the tubes 194, 194′ are immediately moved backward, while the cross piece 193 meeting the stop constituted for example by the piston rod 176 the needles 196 close the tubes 194, 194′ and thus stop all passage of the metal.

The double mold in its backward movement carries with it the two cast types and

liberates the two matrix-carrying drums. When the mold is brought to the end of its course the two types are thrown out, to effect which the collector 104 (Fig. 5) which is acted on by the cam 140 places the cavity 147 above the left mold and the cavity 149 above the elevator strip 137 (Fig. 69). The spring 123 of the blade 102 of the left mold being then able to expand the blade 102 receives an upward movement and carries with it the blade 101, the two blades 101, 102, thus raising the type in the cavity 147. The elevator blade receives at the same time a rising movement produced by the cam 152 carried by the shaft 25 (Fig. 71) and thus brings into the guide clip 158 the type from the right hand mold of the preceding font. The collector 104 then receives a fresh movement in the same sense so as to bring the cavity 147 above the elevator and the cavity 149 above the mold at the right. The spring 123 of this right-hand mold can then expand as has been described with reference to the left-hand elevator and the blades 101′ and 102′ in the ascending movement which they receive raise the cast type and place it in the cavity 149 of the collector 104 (Fig. 70) while the elevator 137 delivers to the guide clip 158 the type which has just been cast in the left mold. The collector 104 is brought in the reverse sense to its initial position so as to close the molds and place the type coming from the mold at the right to the left of the elevator 137 as seen in Fig. 67. In its return movement the double mold has in addition for effect to thrust back by its inclined plane 153 the layer-on 155 so as to uncover the guide clip 158 (Figs. 6 and 71). When the mold returns forward at the next operation, the inclined plane 153 escaping from the abutment 154 of the layer-on, places itself beneath the types introduced into the guide clip 158 and receives an angular movement from shaft 157 upon which it is mounted. The types thus pressed on by the layer-on 155 are delivered into the composing stick 207; at each delivery of the type the heel 213 is pressed back and the index 215 is carried along in this movement (Fig. 5).

When the line is completed the index 215 comes into contact with the lever 217 (Figs. 5, 74) and throws the clutch sleeve 219 into engagement; the shaft 208 turns, the pushers 225, 226 (Fig. 18) receive a forward movement while the plate 232 rises and the line of type is thus driven into the galley 227. The pushers 225, 226 then return backward and when the heel 246 has arrived in front of the notch in the lever 217, the index 215 being freed by reason of the expulsion of the line of type permits the lever 217 to return under the action of its spring to its initial position and thus bring about the disengagement of the clutch 219 and as a consequence arrest the movement of the pushers (Fig. 74). During the return of the pushers the plate 232 is lowered and places a lead behind the line of type which has been brought into the galley.

Fig. 81 is a diagram showing the times of the different movements effected at each revolution of the driving shaft of the machine by the essential organs. In this diagram the first exterior circles indicate the times of the movements communicated to the double mold; the second circle those of the matrix-carrying drums; the third those of the collector; the fourth those of the movable blades of the double mold and of the elevator; the fifth those of the selector levers; the sixth those of the combinators. Assuming the speed of the driving shaft to be one revolution per second, each of these circles is divided into sixty portions so that each division corresponds to a third. Upon these circles the portions in full lines indicate the times of working and those portions marked in dot and dash lines the times of repose.

1st circle.—The starting point A corresponds to the moment of running in the metal; the molds which have been previously brought forward and applied upon the matrices remain stationary during a fraction of a turn A B, that is to say 11‴, during which period of arrest the face of the type becomes cooled in the matrices; they then move backward during a fraction of a turn B C, that is to say 10‴, remain stationary in their rearward position during a fraction of a turn C D, that is to say 27‴ and finally they are moved forward upon the matrices during the fraction of a turn D A that is to say 12‴.

2nd circle.—The matrix-carrying drums upon which are applied the two cavities of the double mold remain stationary during the fraction B′, C′, that is to say 11‴; the registering teeth carried by the matrix-carrying drums are disengaged by the molds for a fraction C^1, D^1, that is to say 5‴; the matrix-carrying drums receive their double movement, (angular and longitudinal movements) during the fraction D^1, A^1, that is to say 39‴, and finally during the fraction A^1, B^1, that is to say 5‴, effect the registry of the position of the matrix-carrying drums by the advance of the double molds.

3rd circle.—The collector has been brought into the position which corresponds to the closing of the molds at A^2, that is to say 5‴ before the time of casting; after the metal has been run in the collector remains stationary in this position until B^2, that is to say another 16‴ after which it effects its first movement for uncovering the left-hand mold during the fraction B^2, C^2 that is to say 5‴ and remains stationary during the fraction C^2, D^2 that is to say 7‴, after which it effects its second movement for uncovering the right-hand mold during the fraction D^2, E^2, that is to say 9‴ and remains stationary during the

fraction E^2 F^2 that is to say 9‴; finally it returns to its initial position for closing the molds during the fraction F^2, A^2, that is to say 11‴.

4th circle.—The two movable blades of each mold having been previously lowered so as to form in the double mold a cavity of a height corresponding to the thickness of the character presented by each matrix, the said blades remain stationary during the fraction C^3, D^3 that is to say 21‴; the two movable blades of the left-hand mold then receive their upward movement and expel the cast character during the fraction D^3, E^3, that is to say 3.5‴; the character cast in the left mold is driven into the cavity 147 of the collector (Fig. 69) and the elevator 137 during this time introduces into the guide clip 158, the character produced in the right hand mold in the previous casting; the two movable blades of the left-hand mold remain at the highest point of their course during the fraction E^3, B^3, that is to say 30.5‴ the elevator re-descending to its initial position during the fraction E^3 F^3, that is to say 3.5‴ and then remains stationary at the bottom of its course during the fraction F^3, G^3, that is to say 9‴; the two movable blades of the right hand mold receive an upward movement and expel the cast character in said right hand mold into the cavity 149 of the collector during the fraction G^3, H^3, that is to say 3.5‴ during which time, the elevator 137 is again raised and introduces into the guide clip 158 the character from the left-hand mold; the two movable blades of the right hand mold remain at the upper end of their course during the fraction H^3, B^3, that is to say 14.5‴; the elevator re-descends to its initial position during the fraction H^3, A^3, or 3.5‴; then rests in this position until the moment of expulsion of the cast character into the left-hand mold in the next revolution; the two movable blades of each mold are then lowered during the fraction B^3, C^3, that is to say 5‴, so as to form in the double mold the two cavities corresponding to the thicknesses of the two characters to be cast during the next revolution.

5th circle.—The selectors which carry the needles 36, 36* having been lowered remain stationary in this position during the fraction B^4, C^4, that is to say 3‴, during which time the registering strip is shifted so as to present fresh perforations above the selector needles; the selectors perform their upward movement during the fraction C^4, D^4, that is to say 3‴; the selector needles which come opposite the perforations remain engaged in the strip during the fraction D^4, A^4, that is to say 49‴; the selectors are then caused to descend and the needles are disengaged from the registering strip during the fraction A^4, B^4 or 5‴.

6th circle.—The levers 54 which have just been raised and disengaged from the perforated bars 53, remain in this position during the fraction B^5, E^5 or 9‴; during which time the perforated bars 53 are returned to their initial position during the fraction B^5, C^5, that is to say 3‴; and remain stationary in this position during the fraction C^5, D^5 or 3‴ and the bars selected by the levers whose needles have penetrated the strip are shifted during the fraction D^5, E^5 that is to say 3‴; the levers 54 re-descend, the projections presented by the two levers bearing the combination corresponding to the two combinations formed by the perforated bars, engage with the latter during the fraction E^5, F^5 or 3‴ and remain in this position during the fraction F^5, A^5, or 43‴; the levers 54 are then raised and disengaged from the perforated bars during the fraction A^5, B^5, that is to say 5‴.

The same operations are repeated in succession at each revolution of the driving shaft.

The number of mold cavities, the number of matrices in each circle and the number of circles of matrices may be increased for the purpose of obtaining an increased output and of disposing of a larger number of characters.

The winding of the registering strip upon the receiving drum may be effected by any suitable means, such as for example by means of an endless band of elastic material.

To this machine may also be applied any apparatus for welding together the characters in the same line.

The machine would be provided with a safety device for arresting the movement of the parts in case of accident such as for example the breakage of the registering strip.

This type casting machine may be combined with a perforating machine in such manner as to be controlled by the latter, so as to constitute in this manner a single machine in which the operator by acting upon the keys of a keyboard produces the perforated combinations on the strip, the said perforated strip then producing proportionately to the registration of the lines, the casting of the characters of the latter.

As the machine comprises several molds, each of these may be arranged to produce characters of different depths, in which case means would be provided for throwing one or other of said molds into gear.

The forms, dimensions and arrangements of the various constitutive parts of the machine may be modified to suit different applications.

Claims:

1. In a type-casting and type-setting machine, the combination of a movable mold having a plurality of cavities open at one side, a pump for injecting molten metal into said cavities, movable drums, matrices carried by said drums and adapted to register with the mold cavities, a perforated register-

ing strip, selectors and combinators operated by the perforations of the registering strip and controlling the movement of the matrix-carrying drums, a movable collector for closing the mold cav ty during casting and receiving the character cast, a conveyer for the cast characters, a cl.; for receiving the character from the conveyer, a composing stick to receive the character from said clip, a galley, and a pusher device for transferring a line of set type to the galley.

2. In a type-casting machine, a mold having a plurality of cavities, means for regulating the height of such cavities, vertically movable blades at the lower portion of each cavity, means for lowering one of said blades or both for the purposes set forth, a stop device for holding one of the blades stationary when only the other blade is to be operated, and matrices arranged to coöperate with said molds, each matrix having a stud of a height corresponding to the thickness of the matrix.

3. In a type-casting machine, a matrix-carrying drum movable lengthwise of its axis to effect a change of fonts, and also mounted to turn for bringing the several characters into operative position, in combination with a mold arranged to coöperate with the matrices, and mechanism for turning the drum, said mechanism consisting of a drive shaft, an intermediate shaft driven thereby, vertically disposed adjustable stops carried by said intermediate shaft in positions corresponding to those of the matrices upon the drum, levers disposed in registry with said stops and adapted to be depressed into the path of the stops, each lever bearing projections, combinator bars movable in the direction of their length and arranged to support the projections of said levers, said bars having holes adapted to register with the lever projections, a registering strip provided with holes adapted to register with those of the bars, a flexible blade mounted on each bar, selector levers, needles carried by said levers and pressed by said blades, and an oscillating tappet arranged to strike those flexible blades which correspond to needles that have entered the perforations of the registering strip.

4. In a type-casting machine, a mold, a matrix-carrying drum movable lengthwise of its axis and also mounted to turn, abutments for arresting the movement of the drum at various points, a registering strip having perforations, needles adapted to enter said perforations, and selector levers connected with said needles and adapted to control the said abutments.

5 In a type-casting machine, a mold having a cavity and provided upon the front edge of said cavity with a projection directed toward the interior of the cavity to produce a chamfered edge on the type during casting, and a matrix to coöperate with the mold.

6. In a type-casting machine the combination of the mold having notches, and a matrix-carrying drum provided with a toothed ring adapted to engage the mold at the notches to insure accurate registry of the drum and mold cavity.

7. In a type-casting machine, a metal-supply pump, a matrix-carrying drum, a movable mold, and mechanism for throwing the piston of said pump into and out of gear, which mechanism consists of two projections on the piston rod, and a lever having abutments on which said projections rest, said lever being arranged to be operated by the movement of the mold.

8. In a type-casting machine, a matrix-carrying drum, a movable mold having cavities, pipes mounted on the mold and adapted to supply metal to the mold cavities, a melting pot, channels leading from the melting pot and adapted to register with said pipes, and needles movable in the pipes lengthwise upon the movement of the mold to expel any metal adhering to the walls of the pipes.

9. In a type-casting machine, a composing stick, consisting of an alining plate, a layer-on for bringing the types against said plate, a slide adapted to be engaged by the first type fed, and to move along the front edge of said plate, said slide being provided with an index, a graduated scale for said index, a pusher comprising two plates mounted on the front edge of the alining plate, a lever arranged in the path of the index to be operated thereby, means for operating the pusher by the movement of said lever, a vertically movable panel arranged in front of the composing stick to retain the types, means for causing said panel to rise when the line of types is expelled by the pusher plates, a rod carried by the pusher and provided with a lug, and a clutch having a fixed member and a sliding member adapted to be engaged by said lug to insure the expulsion of the line at the desired moment.

The foregoing specification of my "machine for casting and setting printing type" signed by me this twenty-seventh day of May 1905.

JOSEPH PINEL.

Witnesses:
HANSON C. COXE,
MAURICE N. PIGNET.