H. E. BROWN.

BAROTYPE MACHINE.

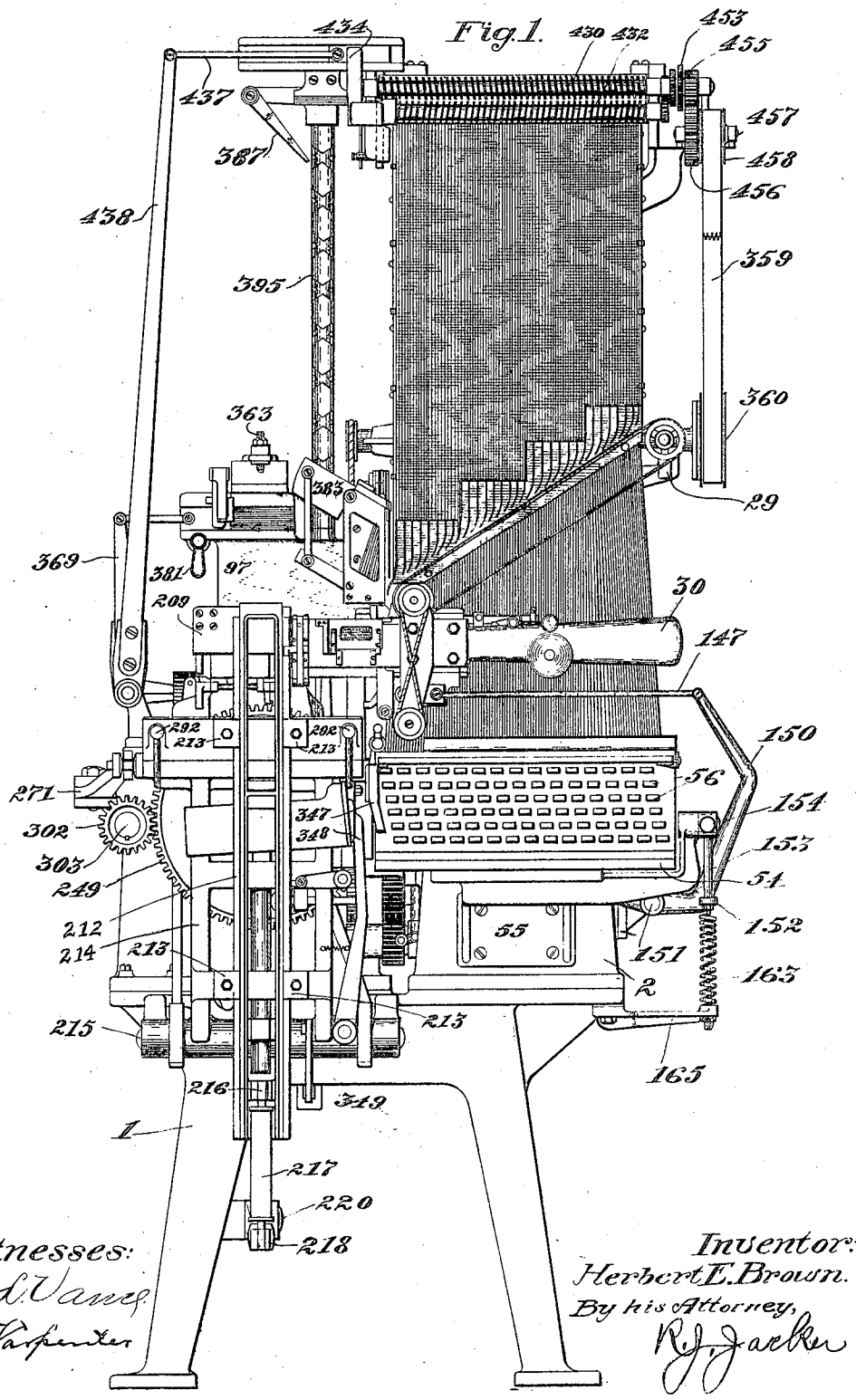
APPLICATION FILED MAY 23, 1913. RENEWED OCT. 18, 1919.

1,345,660.

Patented July 6, 1920.

19 SHEETS—SHEET 1.

Fig. 1.



Witnesses:

M. d. Vance

F. N. Carpenter

Inventor:

Herbert E. Brown.

By his Attorney,

R. J. Parker

H. E. BROWN.

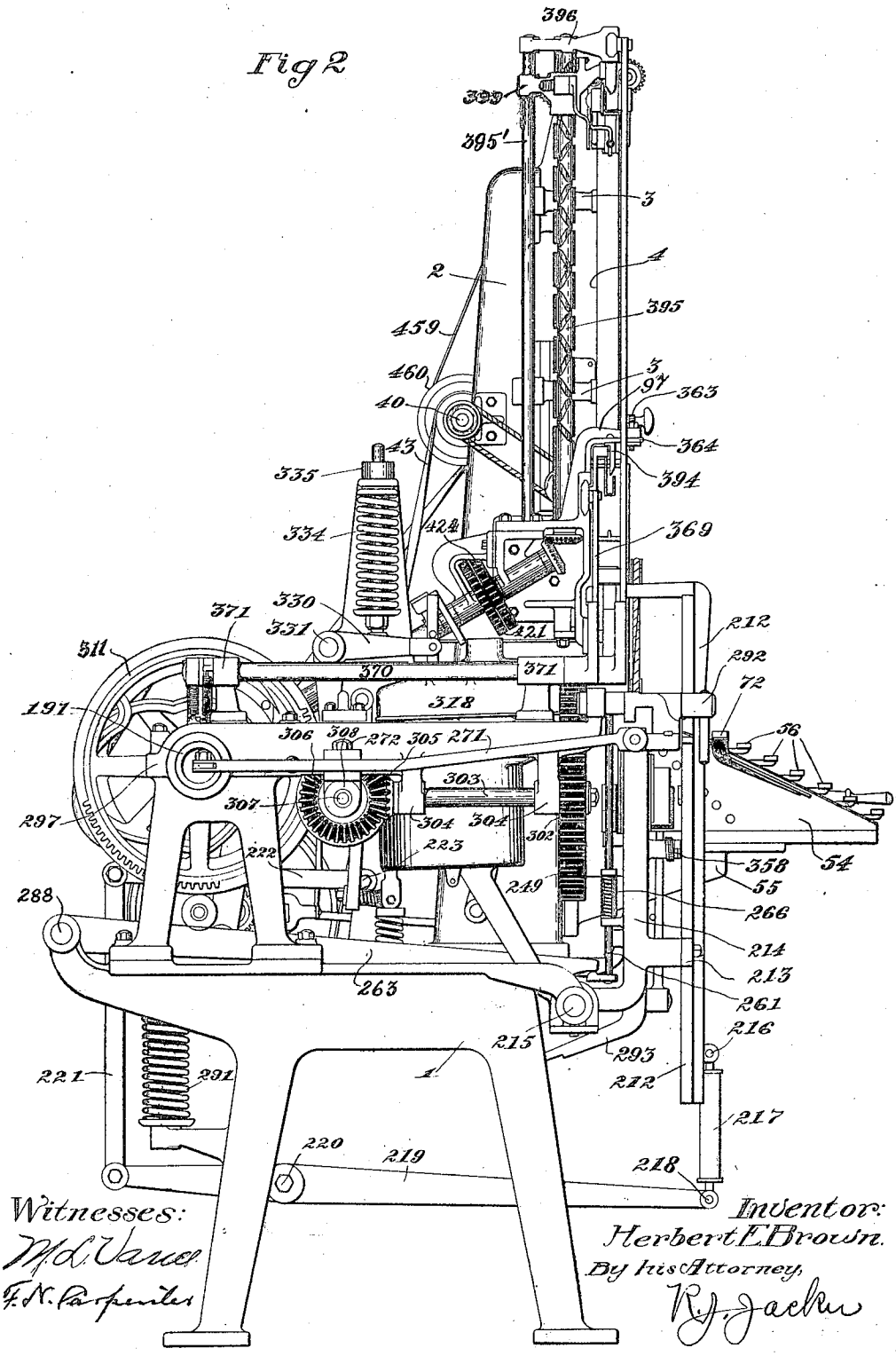
BAROTYPE MACHINE.

APPLICATION FILED MAY 23, 1913. RENEWED OCT. 18, 1919.

1,345,660. Patented July 6, 1920.

19 SHEETS—SHEET 2.

Fig 2



Witnesses:

W. A. Vance

F. N. Carpenter

Inventor:

Herbert E. Brown.

By his Attorney,

R. J. Jackson

H. E. BROWN.

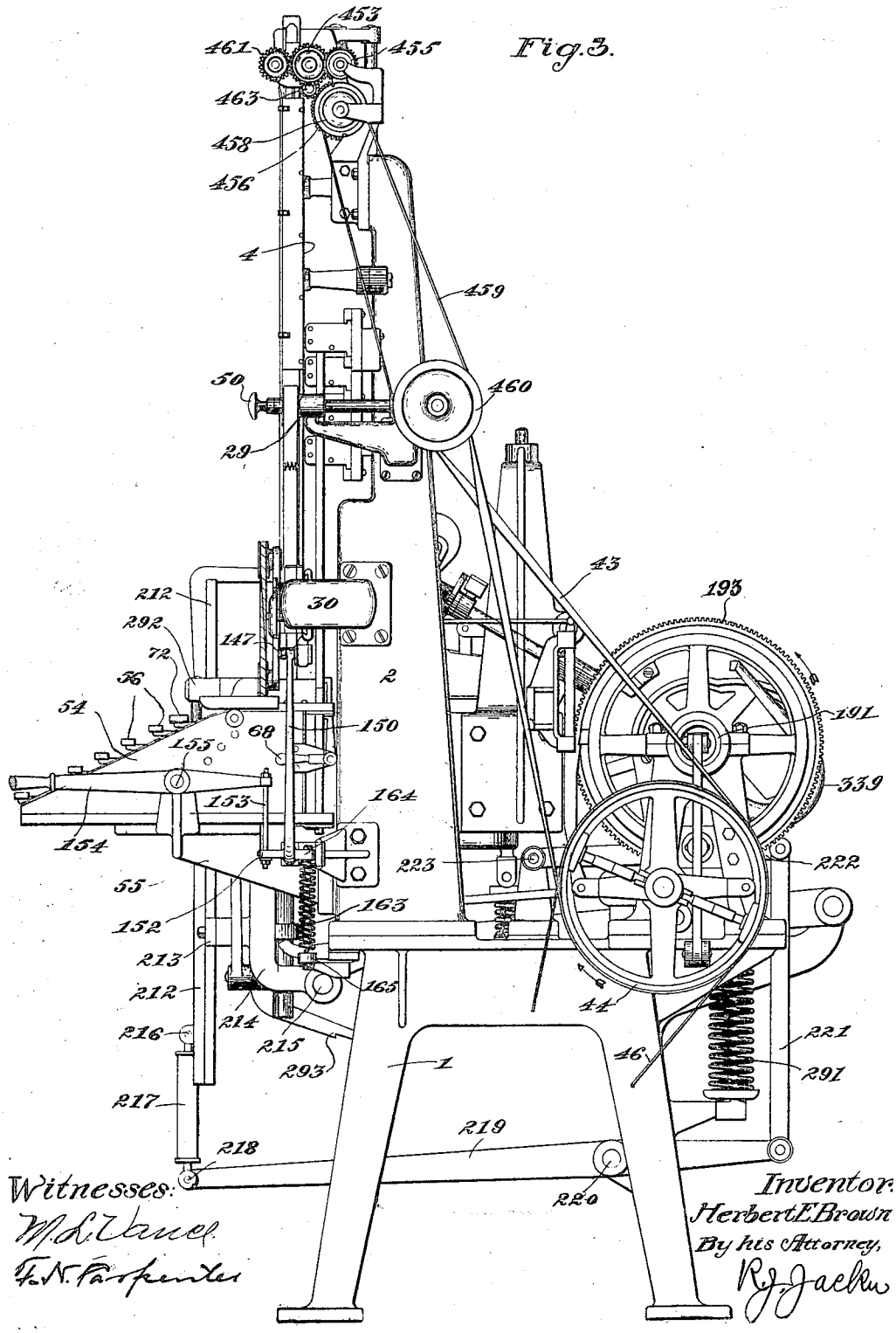
BAROTYPE MACHINE.

APPLICATION FILED MAY 23, 1913. RENEWED OCT. 18, 1919.

1,345,660. Patented July 6, 1920.

19 SHEETS—SHEET 3.

Fig. 3.



Witnesses:

W. S. Lane

F. N. Carpenter

Inventor:

Herbert E. Brown

By his Attorney,

R. J. Jackson

H. E. BROWN.

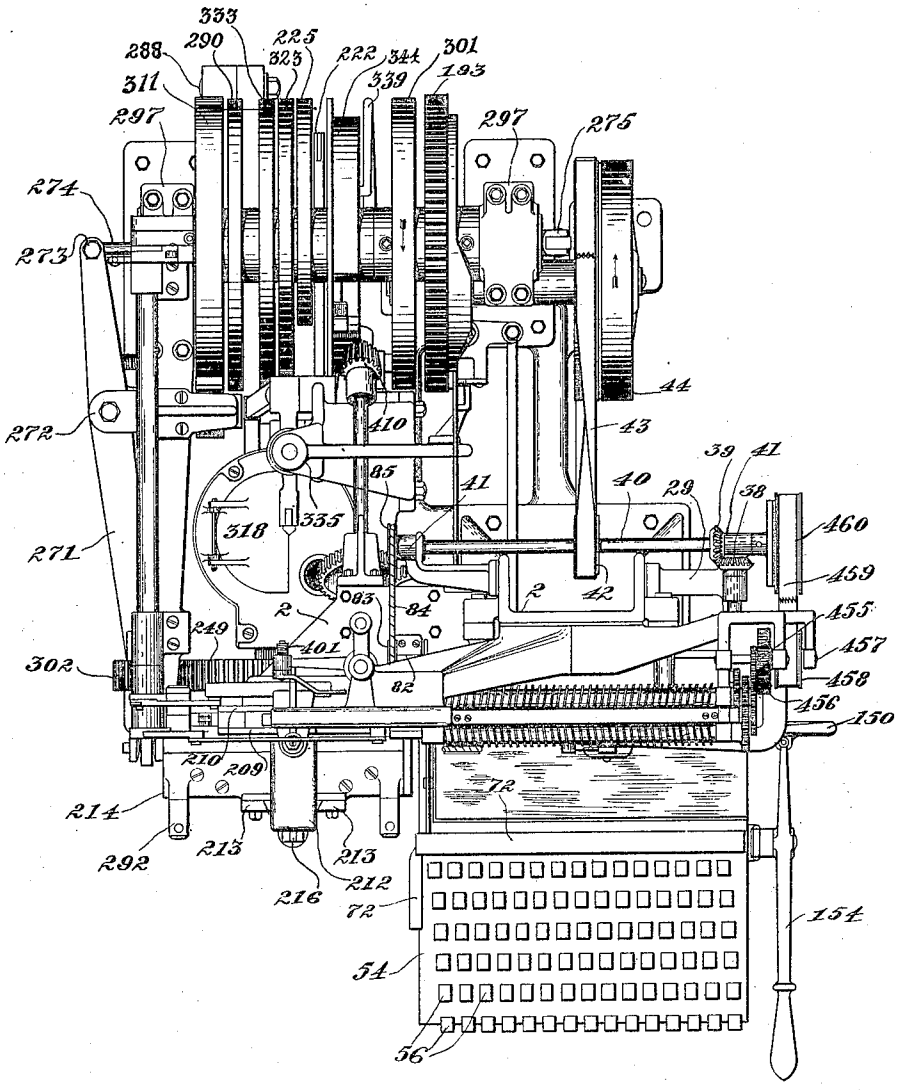
BAROTYPE MACHINE.

APPLICATION FILED MAY 23, 1913. RENEWED OCT. 18, 1919.

1,345,660. Patented July 6, 1920.

19 SHEETS—SHEET 4.

Fig. 4.



Witnesses:

M. L. Vanell.

F. N. Carpenter

Inventor:

Herbert E. Brown.

By his Attorney,

R. J. Jackson

H. E. BROWN.

BAROTYPE MACHINE.

APPLICATION FILED MAY 23, 1913. RENEWED OCT. 18, 1919.

1,345,660. Patented July 6, 1920.

19 SHEETS—SHEET 5.

Fig. 5.

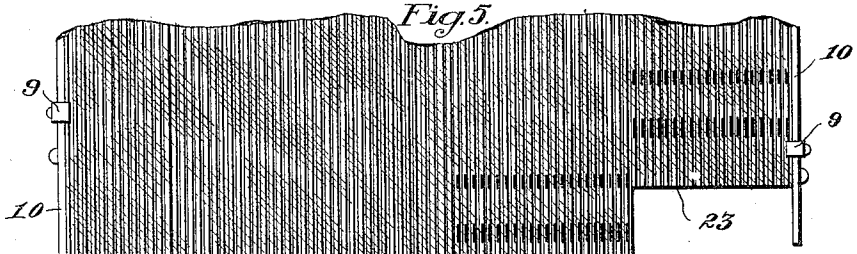


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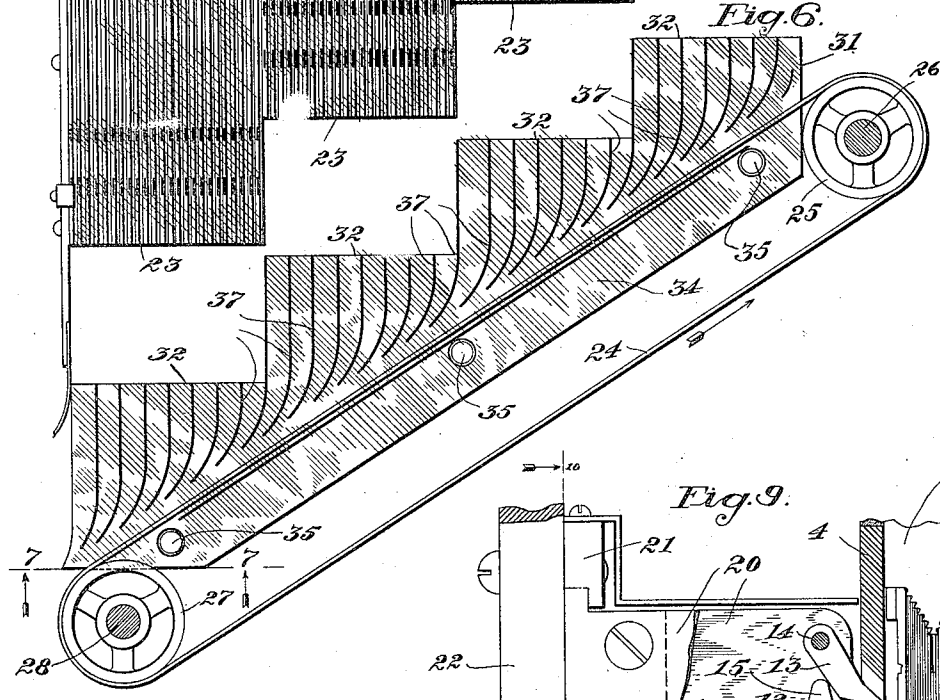


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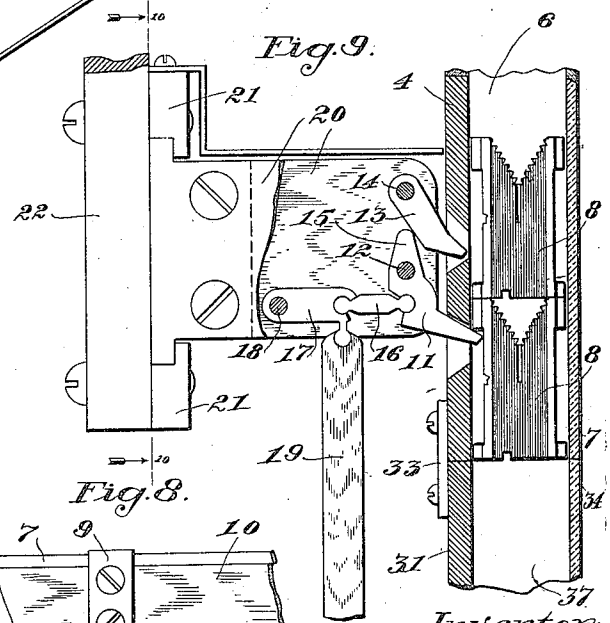


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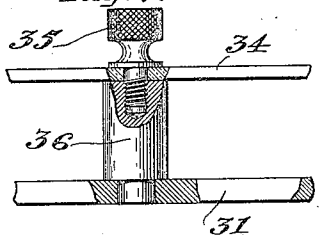
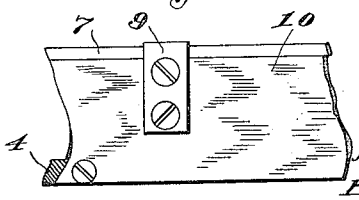


Fig. 8.



Witnesses:

M. O. Hunt

F. N. Carpenter

Inventor:

Herbert E. Brown.

By his Attorney.

R. J. Jackson

H. E. BROWN.

BAROTYPE MACHINE.

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1,345,660. Patented July 6, 1920.

19 SHEETS—SHEET 6.

Fig. 10.

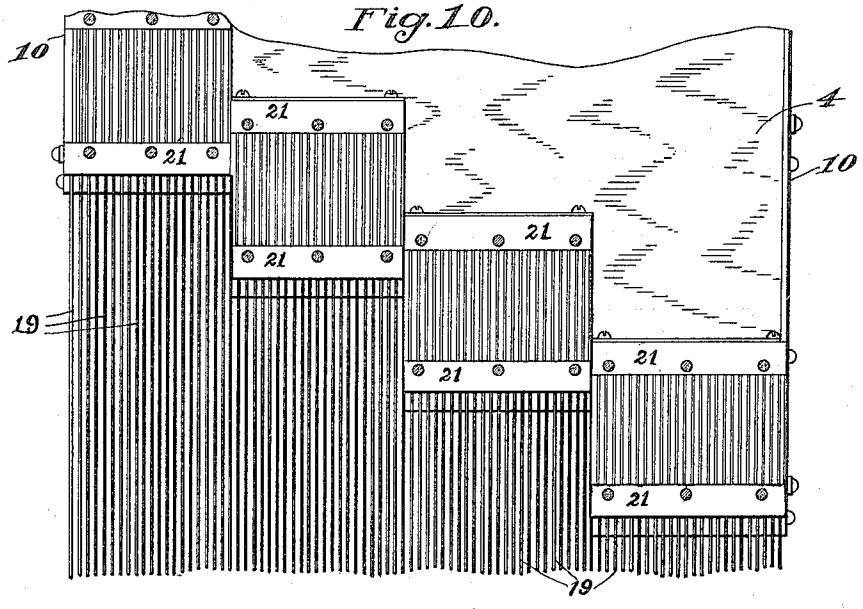


Fig. 11.

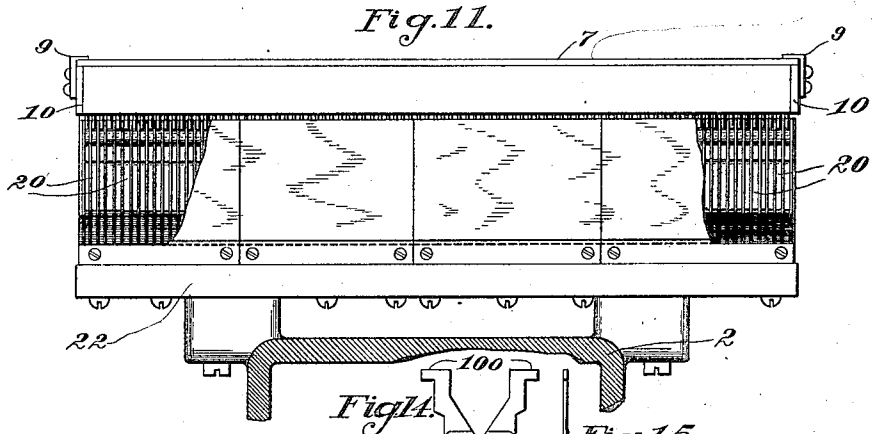


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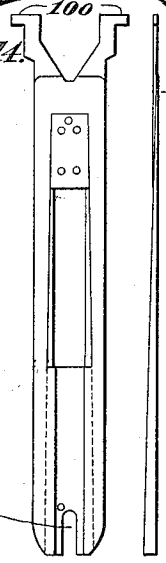


Fig. 15.

Fig. 13.

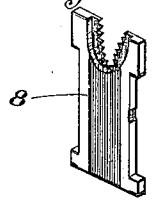
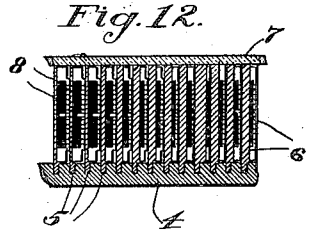


Fig. 12.



Witnesses:

W. L. Vance

F. N. Carpenter

Inventor:

Herbert E. Brown.

By his Attorney,

R. J. Jackson

H. E. BROWN.

BAROTYPE MACHINE.

APPLICATION FILED MAY 23, 1913. RENEWED OCT. 18, 1919.

1,345,660. Patented July 6, 1920.

19 SHEETS—SHEET 7.

Fig. 16.

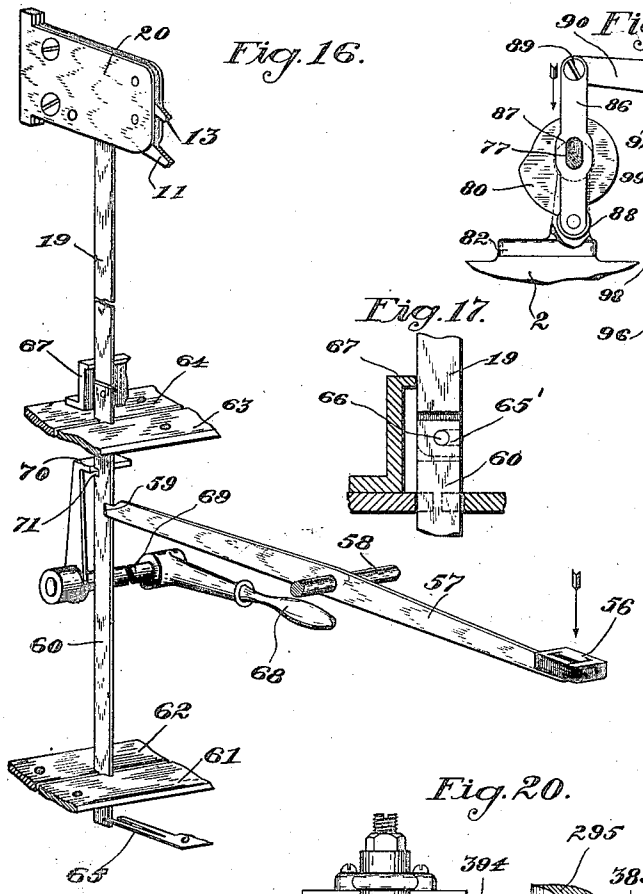


Fig. 17.

Fig. 18.

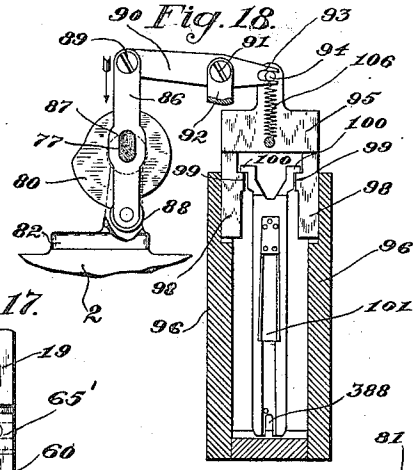


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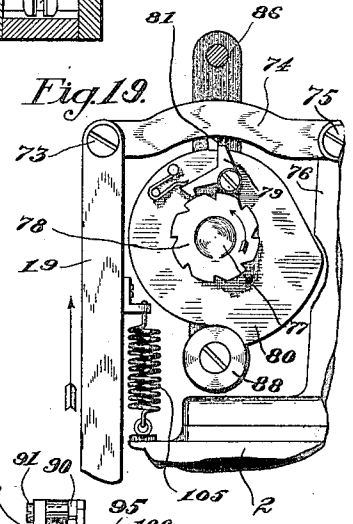


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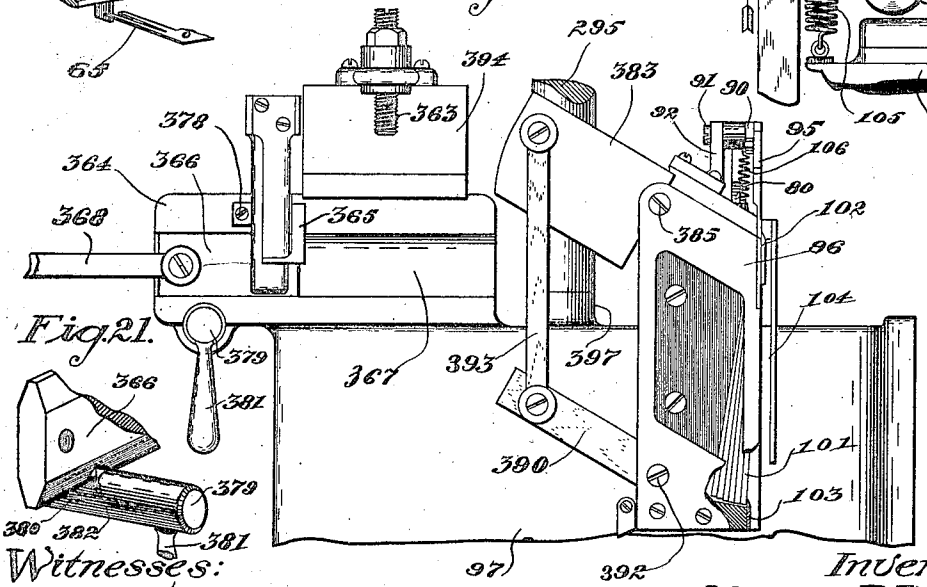


Fig. 21.

Witnesses:

M. L. Vance

F. K. Carpenter

Inventor:

Herbert E. Brown.

By his Attorney

R. J. Jacka

H. E. BROWN.

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19 SHEETS—SHEET 8.

Fig.22.

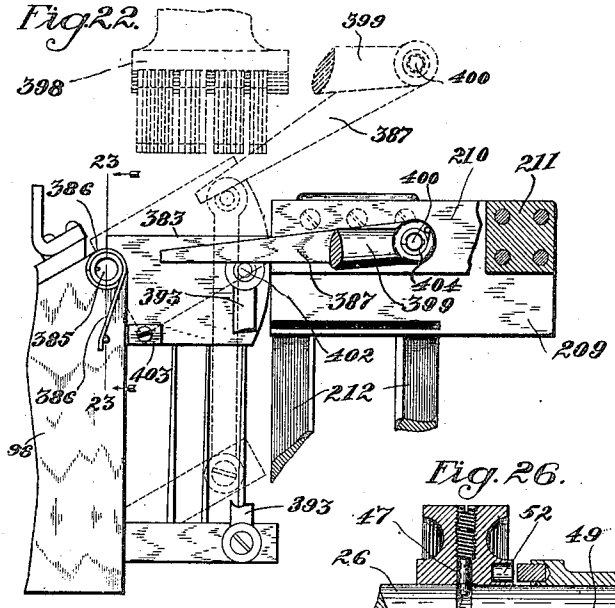


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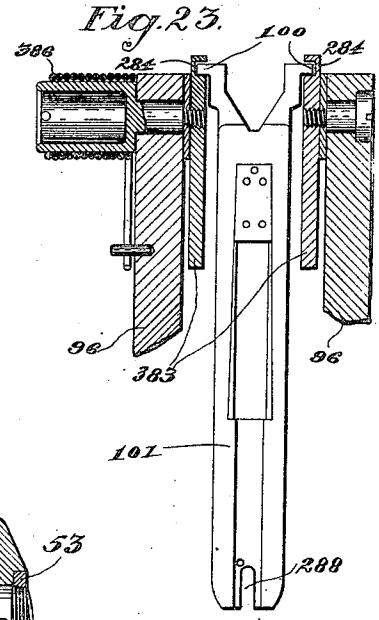


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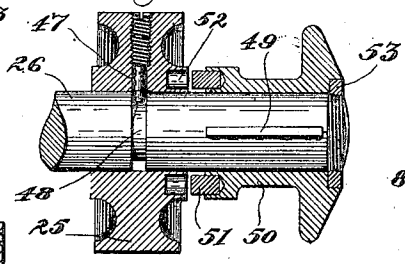


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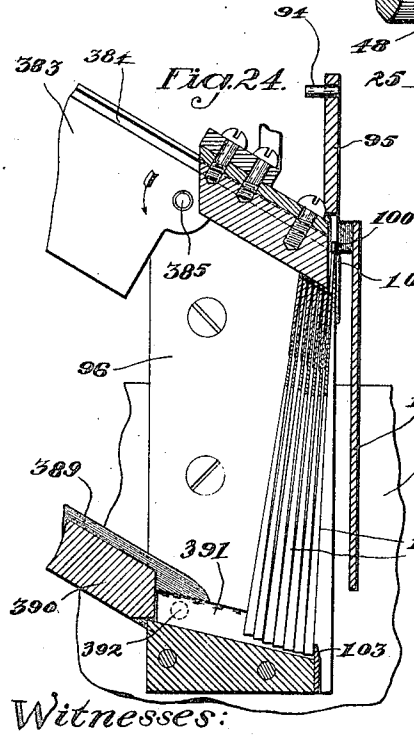


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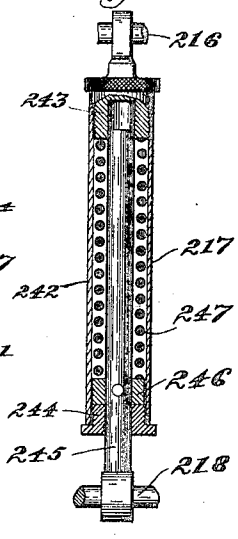
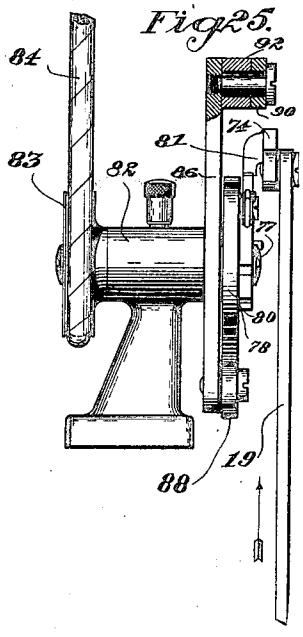


Fig.25.



Witnesses:

M. K. Vance

F. N. Carpenter

Inventor:

Herbert E. Brown

By his Attorney,

R. J. Jack.

H. E. BROWN.

BAROTYPE MACHINE.

APPLICATION FILED MAY 23, 1913. RENEWED OCT. 18, 1919.

1,345,660. Patented July 6, 1920.

19 SHEETS—SHEET 9.

Fig. 28.

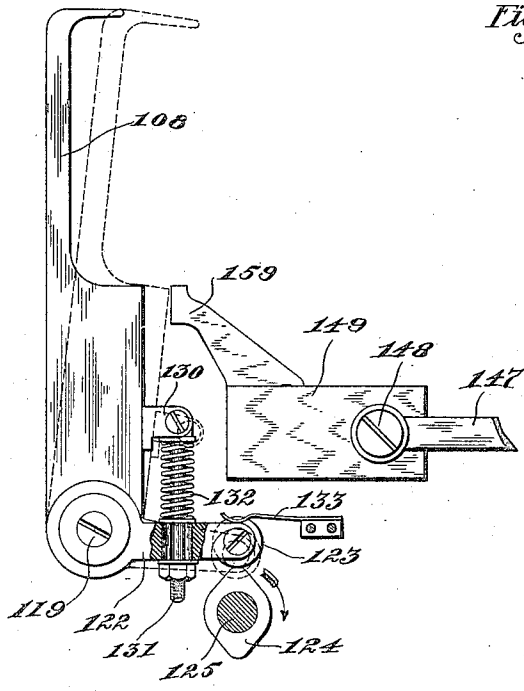


Fig. 29.

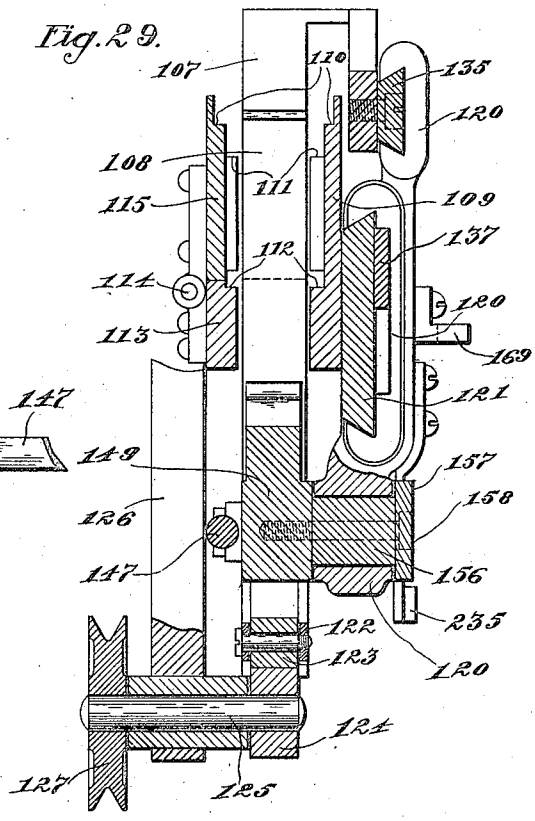


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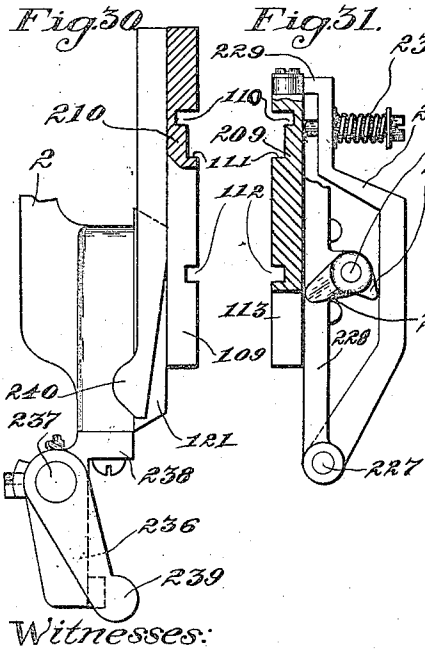
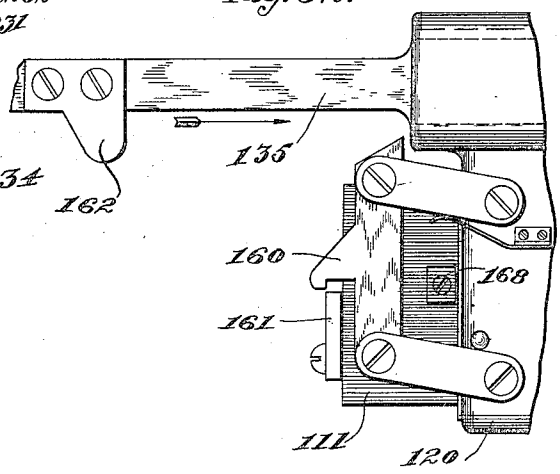


Fig. 31.

Fig. 32.



Witnesses:

M. L. Vance.

F. A. Carpenter

Inventor:

Herbert E. Brown.

By his Attorney,

R. J. Jackson

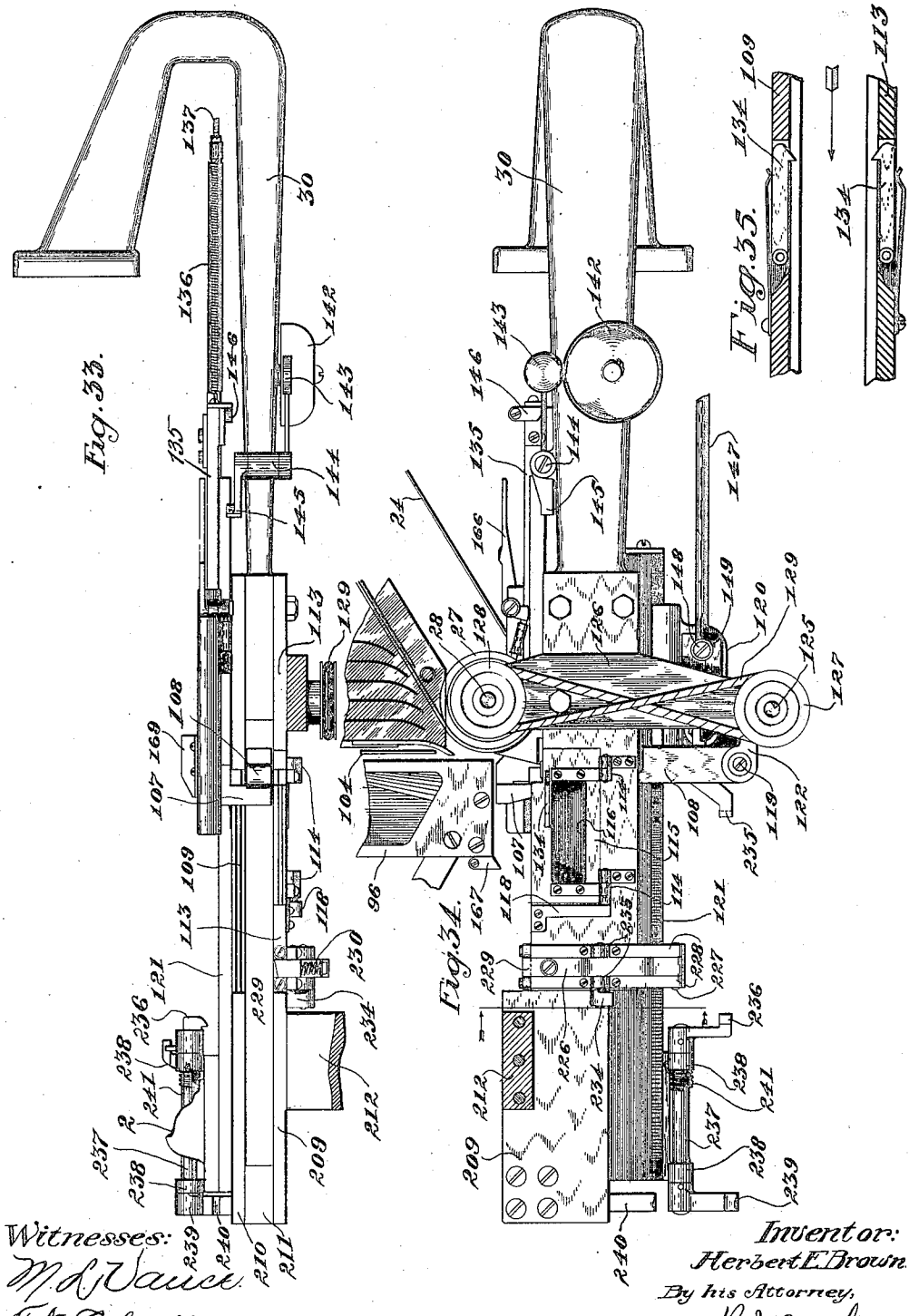
H. E. BROWN.

BAROTYPE MACHINE.

APPLICATION FILED MAY 23, 1913. RENEWED OCT. 18, 1919.

1,345,660. Patented July 6, 1920.

19 SHEETS—SHEET 10.



Witnesses:
M. J. Vance
F. K. Fairfield

Inventor:
Herbert E. Brown
By his Attorney,
R. J. Jackson

H. E. BROWN.

BAROTYPE MACHINE.

APPLICATION FILED MAY 23, 1913. RENEWED OCT. 18, 1919.

1,345,660. Patented July 6, 1920.

19 SHEETS—SHEET 11.

Fig.36.

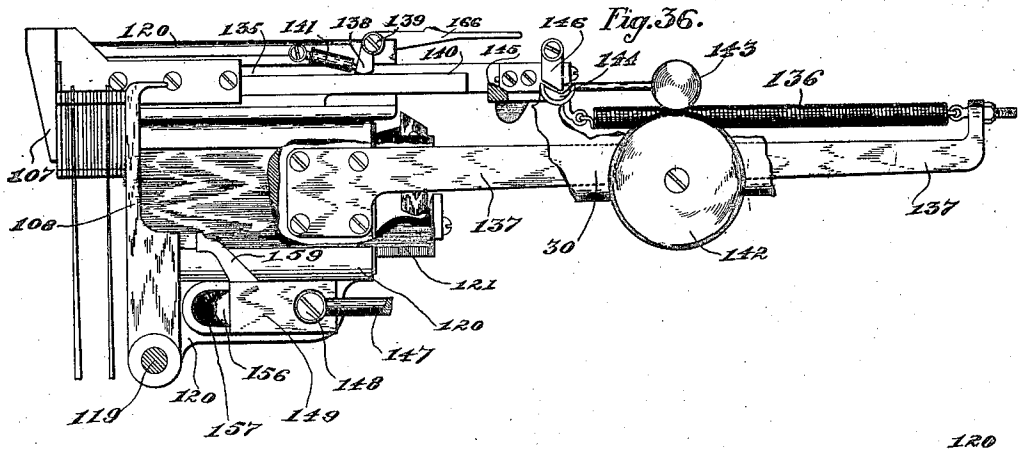
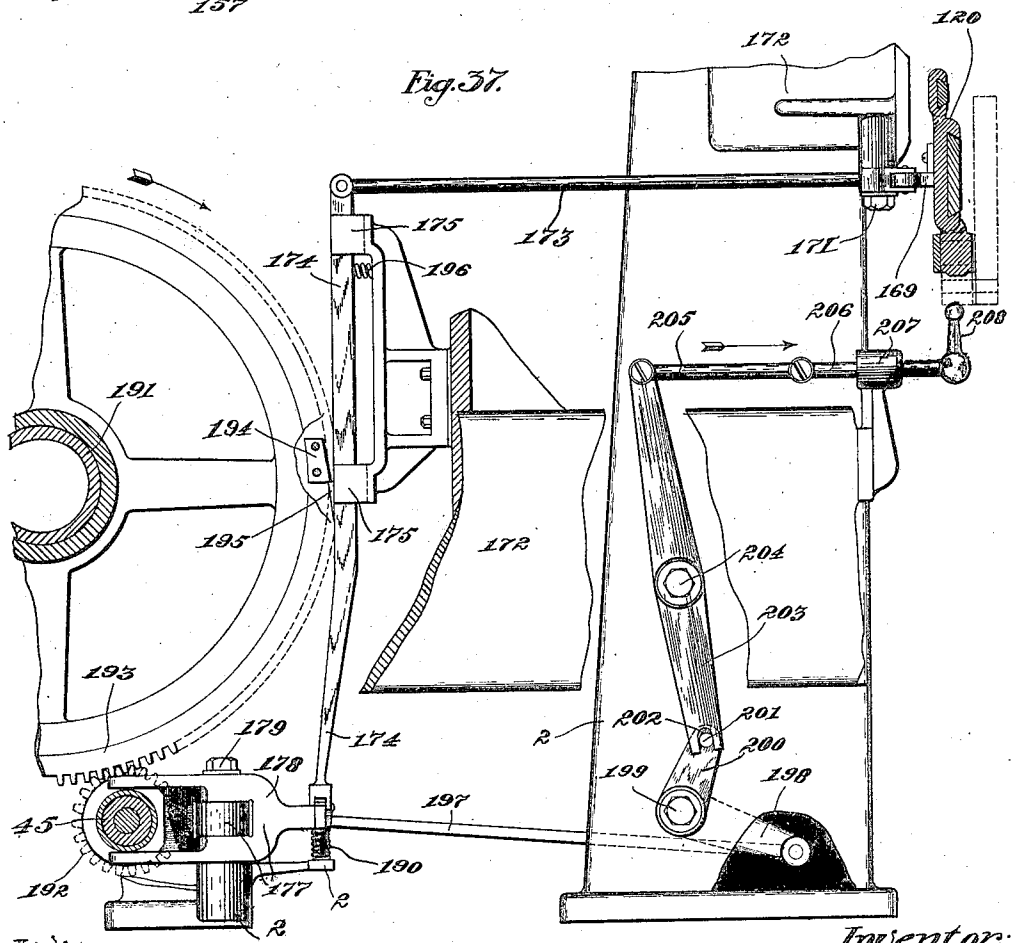


Fig.37.



Witnesses:

W. L. Vauck.

T. N. Carpenter

Inventor:

Herbert E. Brown.

By his Attorney.

K. J. Jacks

H. E. BROWN.

BAROTYPE MACHINE.

APPLICATION FILED MAY 23, 1913. RENEWED OCT. 18, 1919.

1,345,660.

Patented July 6, 1920.

19 SHEETS—SHEET 12.

Fig.38.

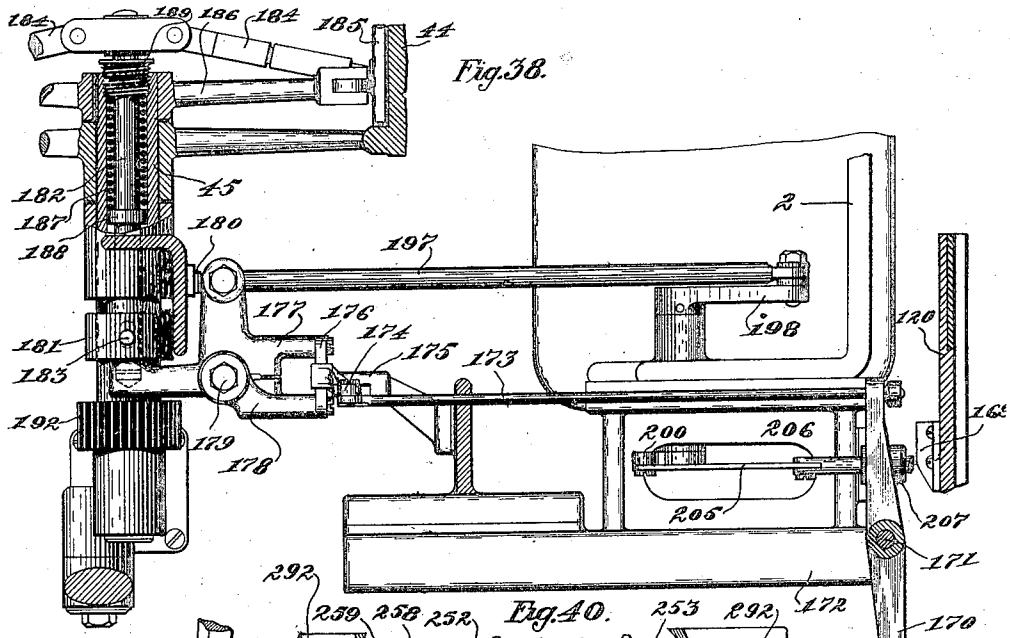


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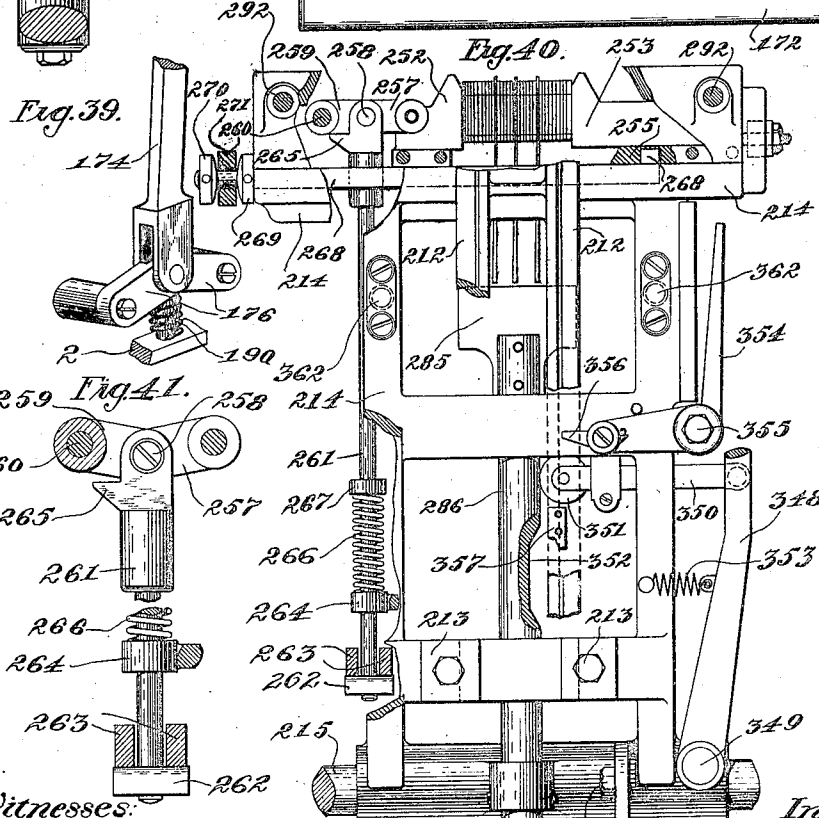


Fig.40.

Fig.41.

Witnesses:

M. S. Vance.

F. N. Carpenter.

Inventor:

Herbert E. Brown.

By his Attorney

R. J. Jackson

H. E. BROWN.

BAROTYPE MACHINE.

APPLICATION FILED MAY 23, 1913. RENEWED OCT. 18, 1919.

1,345,660. Patented July 6, 1920.

19 SHEETS—SHEET 13.

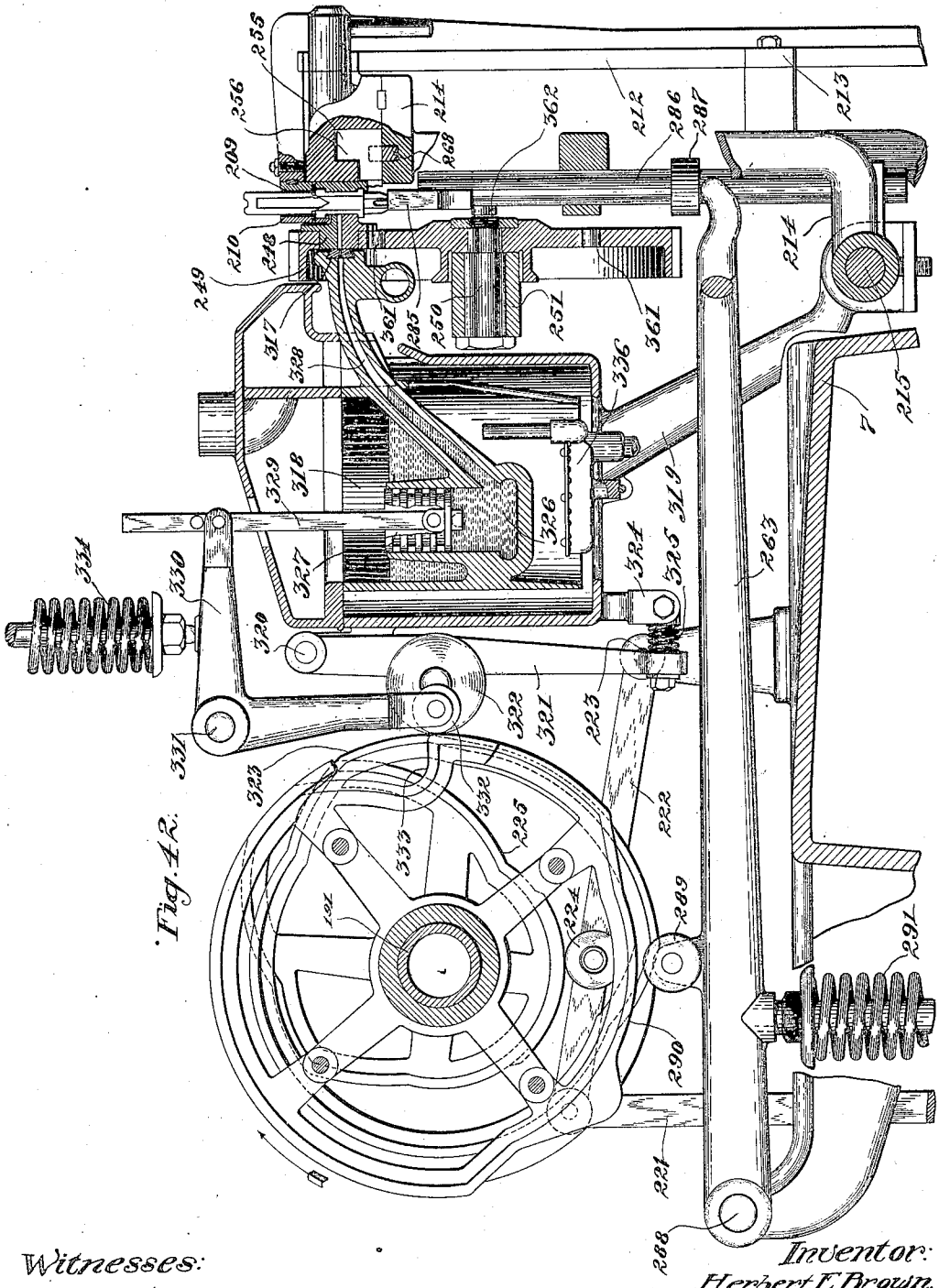


Fig. 42.

Witnesses:
W. D. Vance
F. N. Carpenter

Inventor:
Herbert E. Brown.
By his Attorney,
R. J. Jackson

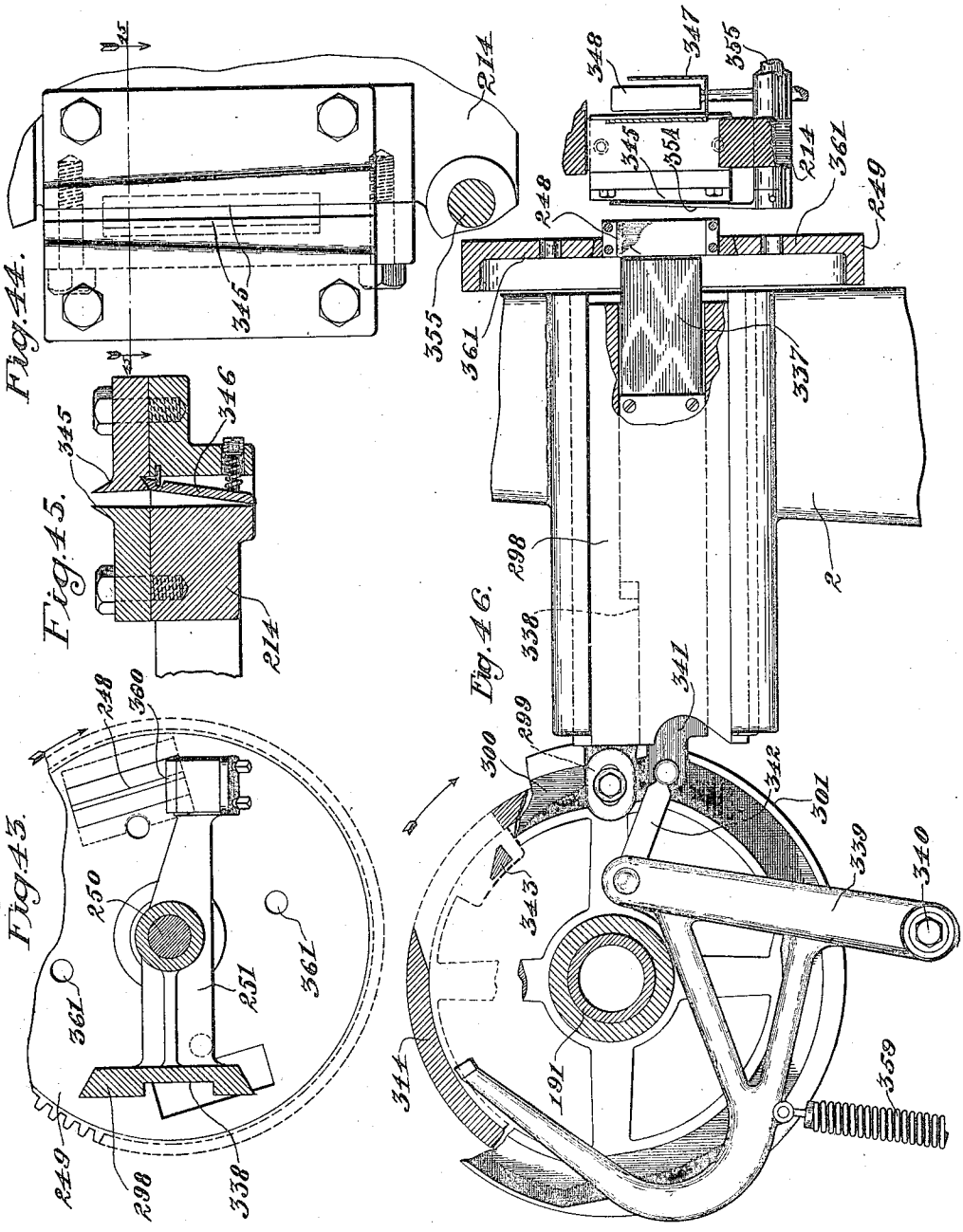
H. E. BROWN.

BAROTYPE MACHINE.

APPLICATION FILED MAY 23, 1913. RENEWED OCT. 18, 1919.

1,345,660. Patented July 6, 1920.

19 SHEETS—SHEET 14.



Witnesses:

M. G. Vauer

F. N. Carpenter

Inventor:

Herbert E. Brown.

By his Attorney

R. J. Jackson

H. E. BROWN.

BAROTYPE MACHINE.

APPLICATION FILED MAY 23, 1913. RENEWED OCT. 18, 1919.

1,345,660. Patented July 6, 1920.

19 SHEETS—SHEET 15.

Fig. 47.

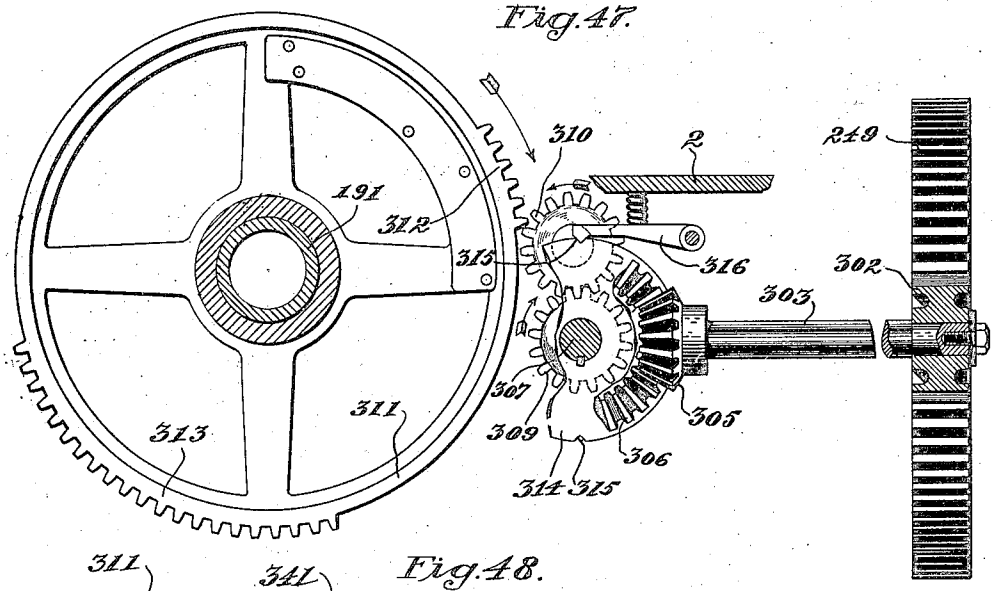


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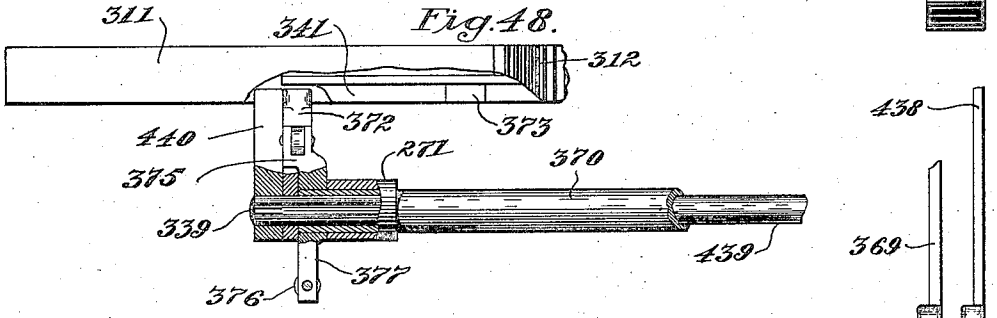


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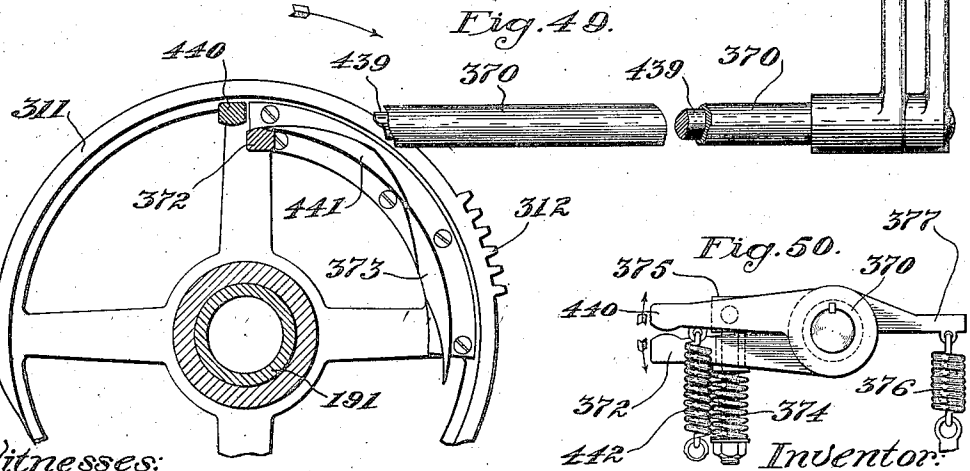


Fig. 50.

Witnesses:

W. R. Vance

G. N. Fairbanks

Inventor:

Herbert E. Brown.

By his Attorney,

R. J. Jacke

H. E. BROWN.

BAROTYPE MACHINE.

APPLICATION FILED MAY 23, 1913. RENEWED OCT. 18, 1919.

1,345,660. Patented July 6, 1920.

19 SHEETS—SHEET 16.

Fig. 51.

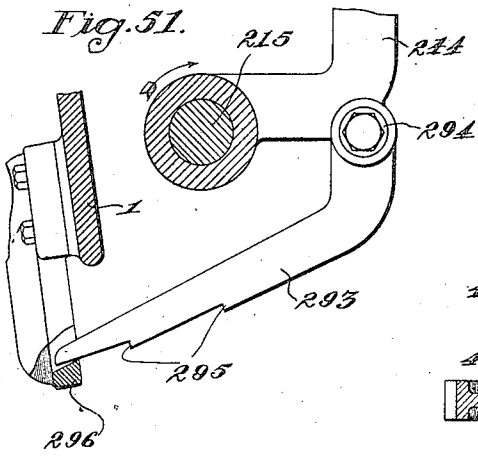


Fig. 52.

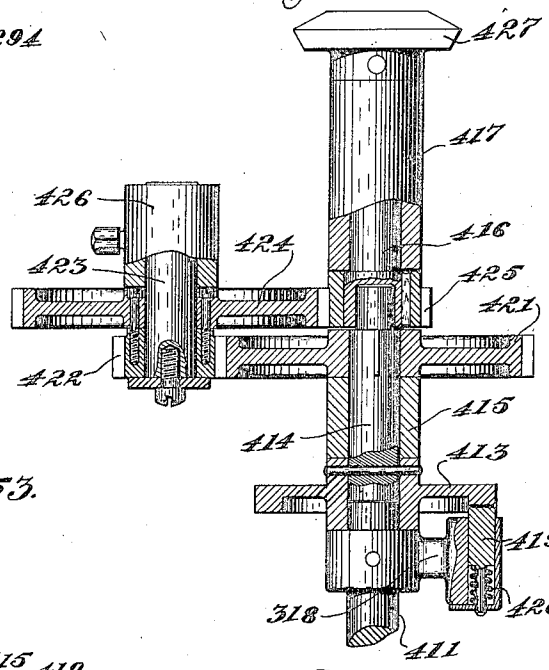


Fig. 53.

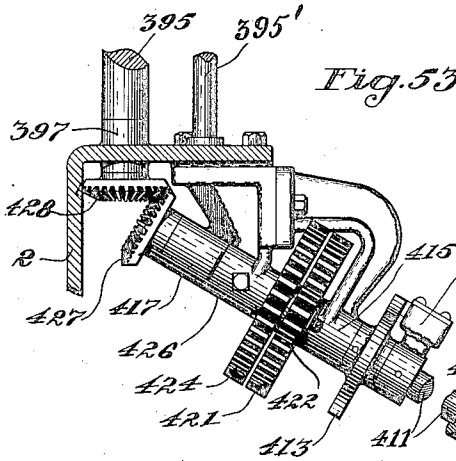
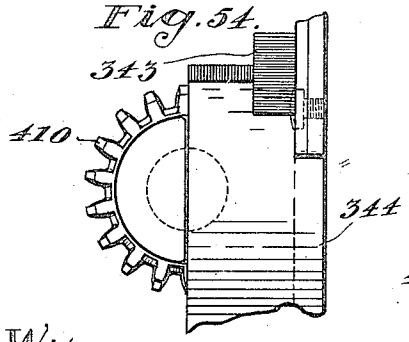
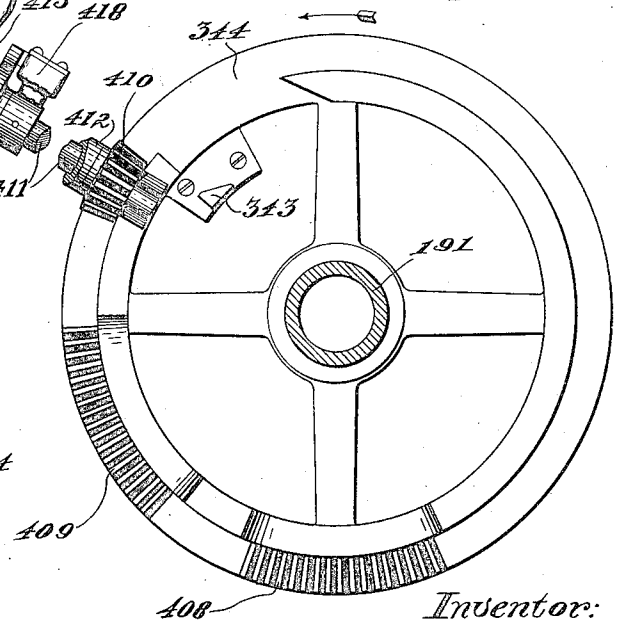


Fig. 54.





Witnesses:

M. C. Lancel

F. N. Carpenter

Inventor:

Herbert E. Brown.

By his Attorney,

R. J. Jackson

H. E. BROWN.

BAROTYPE MACHINE.

APPLICATION FILED MAY 23, 1913. RENEWED OCT. 18, 1919.

1,345,660. Patented July 6, 1920.

19 SHEETS—SHEET 17.

Fig. 55.

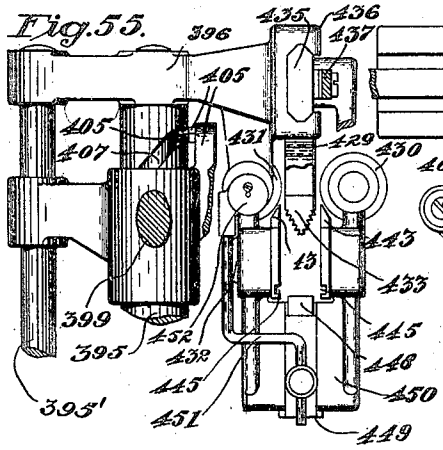


Fig. 56.

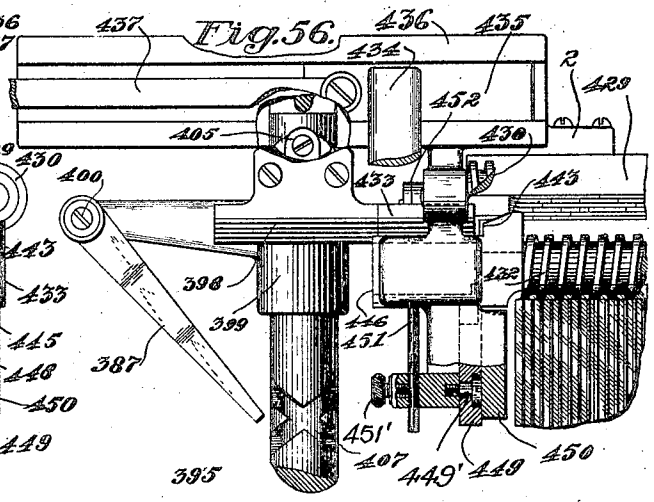


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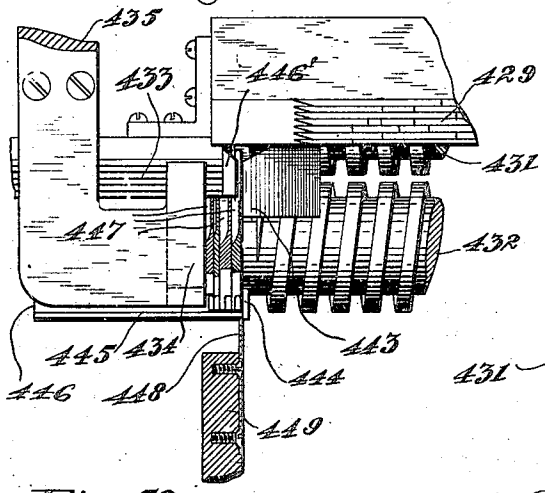


Fig. 58.

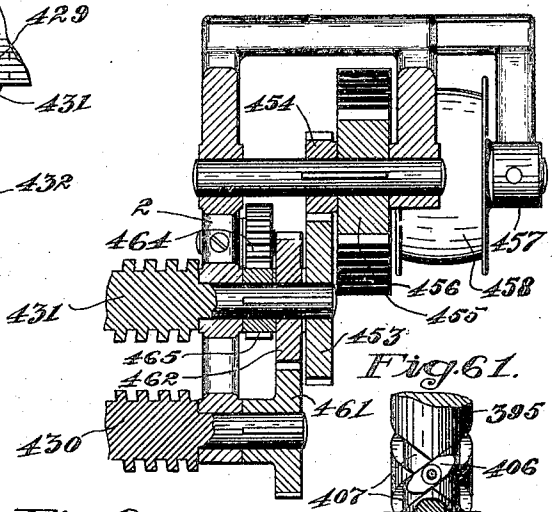


Fig. 59.

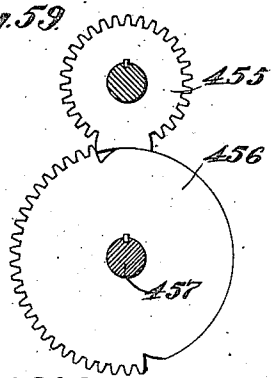


Fig. 60.

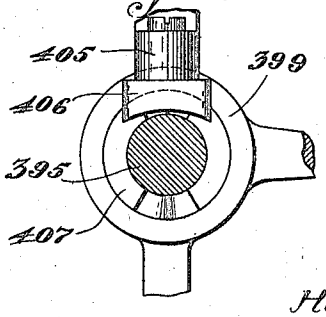
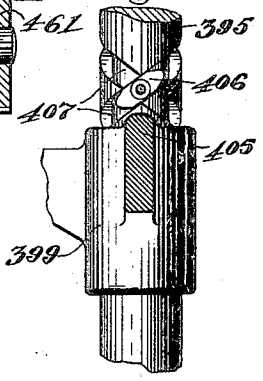


Fig. 61.



Witnesses:

W. J. Bauer.

F. K. Carpenter

Inventor.

Herbert E. Brown.

By his Attorney,

R. J. Jackson

H. E. BROWN.

BAROTYPE MACHINE.

APPLICATION FILED MAY 23, 1913. RENEWED OCT. 18, 1919.

1,345,660. Patented July 6, 1920.

19 SHEETS—SHEET 18.

Fig. 63.

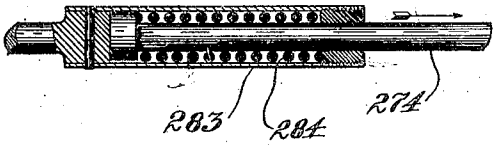
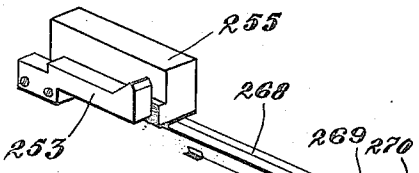
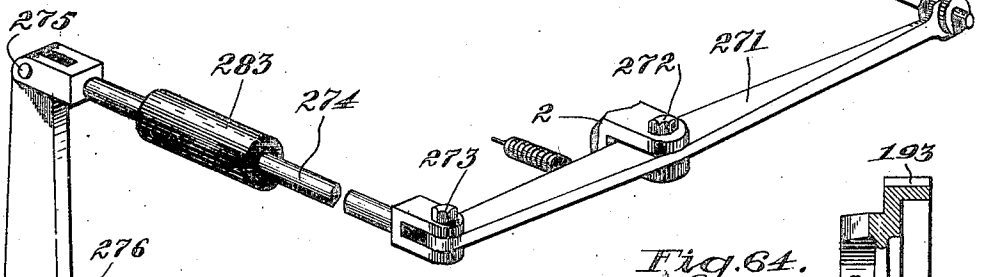


Fig. 62.





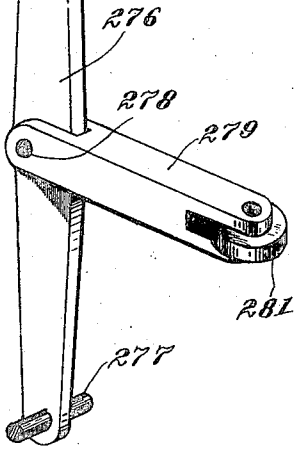


Fig. 64.

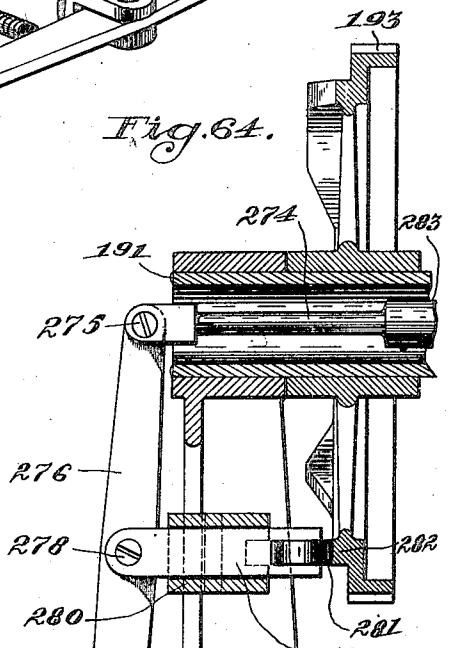
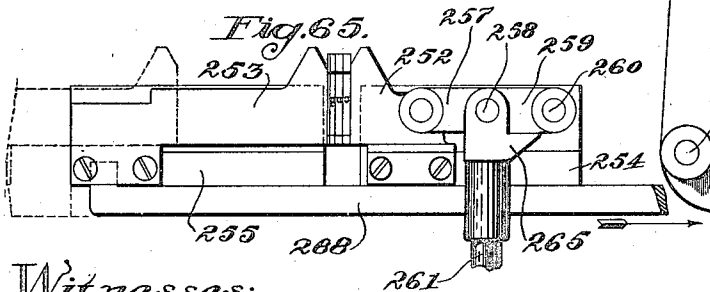


Fig. 65.



Witnesses:
M. L. Vanel
F. K. Carpenter

Inventor:
Herbert E. Brown.
By his Attorney,
R. J. Jackson

H. E. BROWN.

BAROTYPE MACHINE.

APPLICATION FILED MAY 23, 1913. RENEWED OCT. 18, 1919.

1,345,660. Patented July 6, 1920.

19 SHEETS—SHEET 19.

Fig. 66.

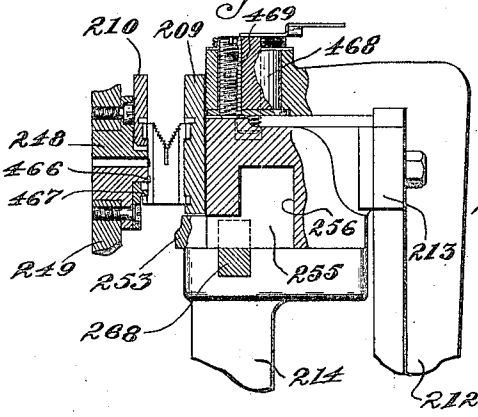


Fig. 69.

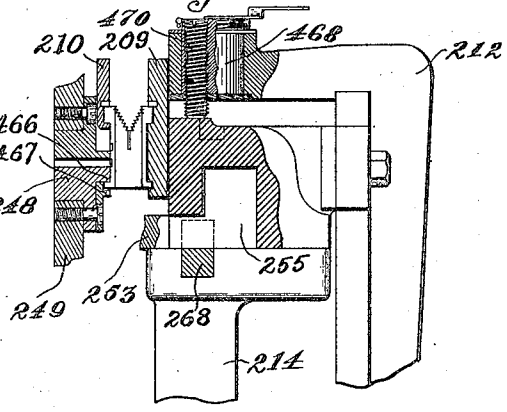


Fig. 70.

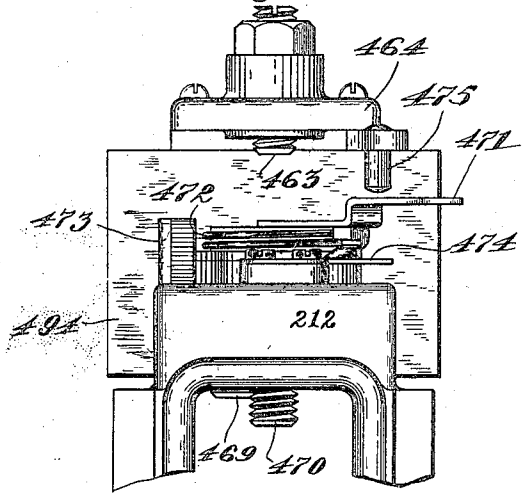


Fig. 67.

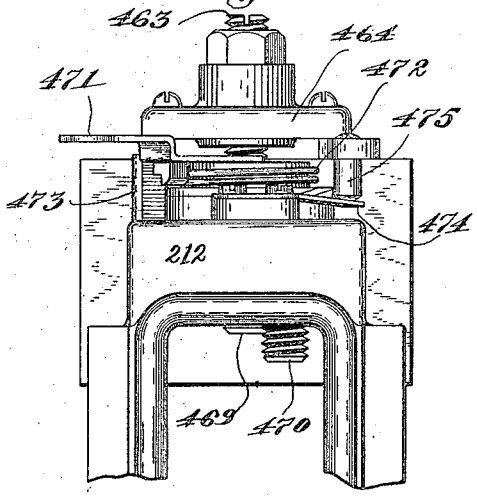


Fig. 71.

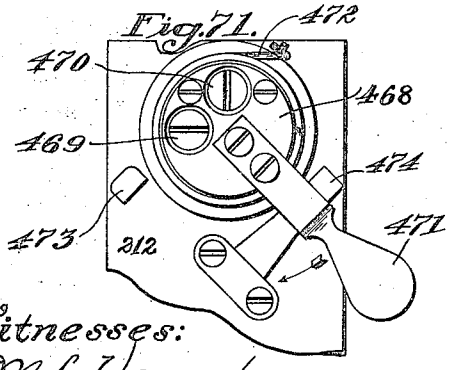
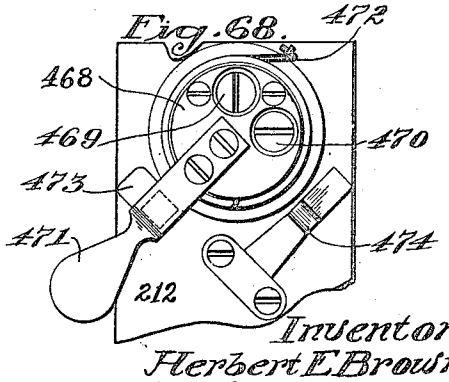


Fig. 68.



Witnesses:

M. L. Vauck.

F. N. Lasperites.

Inventor:

Herbert E. Brown,

By his Attorney,

R. J. Jacker

UNITED STATES PATENT OFFICE.

HERBERT E. BROWN, OF STERLING, ILLINOIS, ASSIGNOR, BY MESNE ASSIGNMENTS, TO BROWN BAROTYPE COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

BAROTYPE-MACHINE.

1,345,660. Specification of Letters Patent. Patented July 6, 1920.

Application filed May 23, 1913, Serial No. 769,778. Renewed October 18, 1919. Serial No. 331,746.

To all whom it may concern:

Be it known that I, HERBERT E. BROWN, a citizen of the United States, residing at Sterling, in the county of Whiteside and State of Illinois, have invented a new and useful Barotype-Machine, of which the following is a specification.

This invention relates to what are now known in the art of printing as linotype-machines, designed to produce printing surfaces comprising a slug, or bar, or linotype—that is to say, a solid line of type, bearing on its face or top edge, properly justified, the characters to print an entire line. It is of that class of composing machines in which a series of independently connected matrices, bearing individual, or duplicated characters, are stored in a magazine and assembled into a line, one at a time and in the order desired, by the instrumentality of escapement mechanism operated by keyboard mechanism provided with finger keys; the composed or assembled line having justifiers or expandible space bands inserted between the several words, as the line is composed, and the completed line of matrices and justifiers transferred and presented, in a locking-up and justifying mechanism, before the face of a mold, to close the said mold; a metal pot and pump being provided, molten metal is forced into the mold and against the assembled line of characters on said matrices thus forming the said slug or bar; the slug or bar is trimmed, ejected and delivered automatically onto a galley, the matrices are elevated and separated from the justifiers and presented to a distributing mechanism which returns them to their proper and stored positions in the matrix magazine and also returns the justifiers to their stored positions in readiness to be again used as above described.

The objects of my invention are; first, to provide a new and novel matrix storage magazine; second, to make a new and novel matrix distribution mechanism whereby the said matrices can be distributed or dropped into a magazine having its storage chutes spaced close together, thus admitting of a much narrower magazine; third, to provide a new and simplified matrix releasing mechanism; fourth, to make an improved and simple keyboard; fifth, to provide a simple locking device for the keyboard; sixth, to provide a novel space band releasing mechanism; seventh, to employ a new simple and effective assembling mechanism comprising an oscillating finger that also is employed to transfer the assembled line; eighth, to provide an assembling box or mechanism whereby the composed line cannot be transferred if it is over-set; ninth, to provide against the possibility of transferring the assembled line until the first elevator jaws are in position to receive the same, also to retard the transferring devices until the line has been carried down and out of the way of the same; tenth, to cast a partly set line without the necessity of quadding or spacing out the said partly composed line; eleventh, to make a new and novel clamping device for the assembled line; twelfth, to make a new and very simple device whereby the duplicated or italic second characters which are frequently carried on what is called two-letter matrices may be brought to the casting position; thirteenth, to make a simple and effective device for separating the matrices from the space bands and presenting the space bands to their stored position; fourteenth, to make the matrix magazine readily interchangeable; fifteenth, to make a simplified, accessible, cheap and complete machine and other features to become apparent from the description to follow.

To describe my invention so that others versed in the art to which it pertains can make and use the same, I have illustrated it on the accompanying nineteen sheets of drawings in which:—

Figure 1, is a front elevation of a machine embodying my invention; Fig. 2, is a left side elevation of the same; Fig. 3, is a right side elevation of the same; Fig. 4, is a plan view of the same; Fig. 5, is an enlarged front elevation of the lower "stepped" end of the matrix storage magazine; Fig. 6, is a front elevation of the matrix assembling belt and its adjacent parts disconnected from the machine; Fig. 7, is a detail sectional view partly broken away taken on line 7—7 of Fig. 6; Fig. 8, is a detail view showing the manner of fastening the front glass on the matrix storage magazine; Fig. 9, is a vertical sectional view through the lower end of the matrix magazine showing one of the escapement devices; Fig. 10, is a rear elevation of the lower end of the matrix magazine showing the escapement groups; Fig. 11 is a plan view of the same; Fig. 12, is a frag-

mentary horizontal sectional view through the matrix magazine showing the construction of same; Fig. 13, is a perspective view of one of the matrices used in the machine; Fig. 14, is a face view of one of the wedge justifiers used in the machine; Fig. 15, is an edge elevation of the same; Fig. 16, is a detail perspective view showing the connection between the keyboard and the matrix releasing mechanism; Fig. 17, is a detail showing the construction of a lever shown in Fig. 16; Fig. 18, is a detail sectional view showing the justifier releasing mechanism; Fig. 19, is a similar view of the same viewed from the opposite side; Fig. 20, is a fragmentary front elevation showing the justifier storage magazine and the connecting parts; Fig. 21, is a detail perspective view showing the construction of a part shown in Fig. 20; Fig. 22, is a rear elevation of the same partly broken away; Fig. 23, is a sectional view taken on line 23—23 of Fig. 22; Fig. 24, is a vertical longitudinal sectional view through the justifier storage magazine shown in Fig. 20; Fig. 25, is a rear elevation of the part shown in Figs. 18 and 19; Fig. 26, is a central sectional view through a hand operated clutch to control the assembling belt; Fig. 27, is a central sectional view showing a cushion spring for the first elevator; Fig. 28, is a detail view partly in section showing the matrix assembling and transfer finger and its connections; Fig. 29, is a vertical cross section through the assembling box showing the assembling finger and its connections; Fig. 30, is a detail view showing the mechanism to release the line transferring finger as the elevator passes down to the casting position; Fig. 31, is a detail view showing mechanism to prevent the line from being transferred if the elevator is not in position to receive said line; Fig. 32, is a detail view showing mechanism employed to prevent the transfer of the line in case the line is overset; Fig. 33, is a fragmentary plan view of the assembling box and its connections; Fig. 34, is a front elevation of the same; Fig. 35, is a plan section through the assembling box showing the matrix retaining catches; Fig. 36, is a front elevation of the line assembling and transferring mechanism. Fig. 37, is a fragmentary view looking from the left hand side of the machine showing the lever arrangements for starting and stopping the machine; Fig. 38, is a plan view of the same; Fig. 39, is a detail view showing the upwardly spring pressed starting and stopping lever; Fig. 40, is a front elevation partly broken away of the assembled line clamping mechanism; Fig. 41, is a detail view of a jaw locking lever seen in Fig. 40, shown in its other of two positions; Fig. 42, is a vertical central section through the melting pot and mold wheel partly in elevation showing the cam wheel for operating the melting pot and associated parts. Fig. 43, is a rear elevation of the mold wheel and trimming knife; Fig. 44, is an elevation of a pair of trimming knives for the slug; Fig. 45, is a section on line 45—45 of Fig. 44; Fig. 46, is a detail sectional view showing the ejector blade and related parts; Fig. 47, is a detail view showing the connection between the mold wheel and the driving or cam shaft; Fig. 48, is a detail plan view showing the connection between the line transferring arms and the cam shaft; Fig. 49, is a side elevation of the same; Fig. 50, is a detail view showing the construction of the cam fingers shown in Figs. 48 and 49; Fig. 51, is a detail sectional view showing the manner of adjusting the position of the clamping mechanism; Fig. 52, is a detail sectional view partly in elevation illustrating the multiple gearing employed in connection with the line elevator; Fig. 53, is a detail view showing the connection between the line elevator and the driving or cam shaft; Fig. 54, is an end elevation of a small bevel gear which meshes with a segmental gear shown in Fig. 53; Fig. 55, is an end elevation of the line elevator and matrix distributer partly broken away; Fig. 56, is a front elevation of the same partly broken away; Fig. 57, is a front elevation partly in section of the left hand end of the matrix distributing mechanism; Fig. 58, is a vertical sectional view of the right hand end of the same; Fig. 59, is a face view of intermittent one revolution bearing used on the distributing mechanism; Fig. 60, is a horizontal plan section through the elevator screw showing the sliding shoe in position; Fig. 61, is a front elevation of the same partly broken away; Fig. 62, is a perspective view showing the operative connection between the line clamping jaw and the cam shaft; Fig. 63, is a detail sectional view of a cushion connection shown in Fig. 62; Fig. 64, is a longitudinal section through the cam shaft illustrating a portion shown in Fig. 62; Fig. 65, is a detail view showing the line clamping jaws in position on a short set line; Fig. 66, is a detail sectional view of the clamping head showing an attachment to the same for use when using duplicate or two character matrices; Fig. 67, is a front elevation of the same. Fig. 68, is a plan view of the same and Figs. 69, 70 and 71 are views similar respectively to Figs. 66, 67 and 68, but showing the attachment in a position to bring the other character on the matrix into the casting position.

Similar reference characters refer to similar parts throughout the several views.

Since the machine comprises several parts or portions which in themselves are composed of considerable mechanism and have distinctive important features I will describe these several portions in the following order:—the matrix storage magazine; the

keyboard; the assembling mechanism; the first elevator; the line clamping mechanism; the casting mechanism; the justifier distributer; the second elevator; the distributing mechanism.

The matrix storage magazine.

The particular design of machine illustrated is provided with the base frame 1, upon which is mounted a suitable upper frame 2, to which, by means of forwardly extending posts 3, the main supporting back plate 4 of the matrix storage magazine is removably secured. It will be noted that the upper end of the matrix magazine is not in any way connected to the working parts of the machine but is properly positioned under the distributing mechanism to be described; also that the lower end of the magazine is not secured to any working part of the machine but is positioned properly above the assembling mechanism to be described, and is free to be removed from such position without interfering with any other parts of the machine. As seen in Fig. 12, the back plate 4 has provided on its front surface a series of parallel grooves 5 arranged vertically, into which are secured one edge of the partition plates 6. The front edges of the partition plates 6 all terminate in the same vertical plane and a sheet of glass 7 is secured in place resting against said front edges whereby a series of storage chutes as seen in Fig. 5, 9, and 12 are formed to contain the matrices 8. Since the matrices bearing the different characters vary considerably in thickness the different chutes containing the same must vary in thickness correspondingly, and this variance I conveniently accomplish by spacing the slots 5 equal distances apart and varying the thicknesses of the partition plates 6. The slots 5 are preferably all of equal widths so that they can be cut with the same cutter and the back edges of the plates 6 made to fit snugly into said slots. The glass 7 is held in place by means of the brackets 9 secured to end plates 10 of the back plate 4. The upper end of each matrix chute is open and the lower end is provided with an escapement device by means of which one matrix is released each time the escapement is operated. It will be noted that a plurality of matrices bearing similar characters are stacked up edgewise, one on another, in each chute as shown in Fig. 9, where only two matrices are illustrated. Since the escapements at the lower end of all the chutes are similar I describe one such device which is best shown in Fig. 9. A lower pawl 11 is pivotally mounted on a suitable pin 12 and an upper pawl 13 is pivotally mounted on a suitable pin 14; both pawls having their lower ends arranged to be moved into and out of the path of the gravitating matrices within the chute. When in the normal position the lower end of pawl 11 is in the path of the matrix and the lower end of pawl 13 is out of the path of the matrix and when in the operated position the positions of the pawls 11 and 13 are just the reverse, *i. e.*, pawl 11 is out of the path of the matrix and pawl 13 is in the path of the matrix, which operation necessarily permits the lowermost matrix to gravitate out of the chute. The pawls 11 and 13 are arranged to move simultaneously to prevent two or more matrices passing at one operation of the pawls. The pawl 11 has an extension 15 above the pivotal pin 12 which engages the pawl 13 in such manner as to move the said pawl 13 into the path of the matrices when the pawl 11 is withdrawn from such path, and will serve to move the pawl 11 into the same path when the pawl 13 is withdrawn from the said path.

Furthermore, I have so arranged the pawls 11 and 13 relative to the gravitating matrices that the weight of the matrices themselves will assist in moving both pawls 11 and 13 in their movements about their pivots.

The pawl 11 is locked in its normal position as seen in Fig. 9, and as one form of lock for this purpose I show a toggle consisting of the links 16 and 17 pivotally connected together, with the one end of link 16 pivoted to pawl 11 and the one end of link 17 pivoted on pin 18. Obviously when the center of this toggle is raised from the position shown in Fig. 9, the pawl 11 will be withdrawn from the path of the matrices in the chute and the pawl 13 will be moved into the path of the matrices. To raise the center of the toggle I provide a lever 19 with its upper end pivotally connected to the toggle, which is operated by the keyboard to be described.

The pawls 11 and 13, the toggle links 16 and 17 and the upper end of lever 19 are all retained in the same vertical plane by suitable plates 20, which are secured by means of the cleats 21, to the supporting bar 22 secured to the frame 2.

The pivot pins 12, 14 and 18 for the pawls and toggles take the form of long rods and serve as pivots for a series of escapement devices. The lower end of the matrix storage magazine is stepped as at 23, Fig. 5, and one group or series of escapement devices is arranged at each step. The purpose of making the lower end of the storage magazine stepped is to facilitate the assembling of the parts, to enable the storing of a greater number of matrices in the chutes nearest the assembling mechanism and to bring the escapement devices as close as possible above the inclined belt 24. Said belt 24, passes over wheel 25 mounted on shaft 26 and wheel 27 mounted on shaft 28.

The shaft 26 has its bearings secured to the extension 29 of frame 2, and the shaft 28 has its bearings secured to the arm 30 of frame 2 as seen in Fig. 1.

Just below the plate 4, (see Figs. 9 and 6) and in the same vertical plane is another plate 31 having an inclined lower edge and a stepped upper edge 32 arranged to fit into the stepped lower end of the plate 4. The plate 31 is secured into position in any suitable manner as by cleats 33 fastened to plate 4 seen in Fig. 9. The lower edge of the glass 7 forming the front side of the matrix bar magazine is stepped to conform with the lower edge of the plate 4, and a glass plate 34 is secured just below said plate 7 and in the same vertical plane, which conforms in contour to the plate 31. The glass plate 34 is secured in position by the screws 35 which are screwed into the spacing posts 36 secured to plate 31 as seen in Fig. 7. One span of the belt 24 between wheels 25 and 27 passes on an incline between plate 31 and glass 34 upon which the gravitating matrices fall after being released by the escapement devices. The belt 24 is kept constantly running, by mechanism to be described, for the purpose of quickly carrying the released matrices to the assembling mechanism. A series of curved deflector plates 37 are provided just above the belt 24 to deflect the gravitating matrices on an incline downward along on the belt. Said deflectors 37 are secured to the plate 31 in any suitable manner as by being pressed into slots provided in plate 31.

To drive the belt 24 the wheel 25 is driven by means of a bevel gear 38 (Fig. 4) mounted on shaft 26 meshing with a bevel gear 39 mounted on shaft 40 journaled in bearings 41 mounted on the frame 2; a belt wheel 42 is rigidly mounted on shaft 40 and is connected by the crossed belt 43 to the wide belt wheel 44 which is loosely mounted on the hollow shaft 45 (Fig. 38). The belt wheel 44 is constantly rotated by means of a belt 46, see Fig. 3, which is connected to any suitable motor.

As seen in Fig. 26, the wheel 25 is loosely mounted on shaft 26 but is held against longitudinal movement on the shaft by a pin 47 secured in said wheel extending into an annular groove 48 provided in shaft 26. The end of shaft 26 extends a short distance in front of the wheel 25 where it is provided with a key 49 and a clutch member 50 is arranged on said end of shaft 26 to slide longitudinally thereon for a sufficient distance to have the extending prongs 51 engage and disengage the sockets 52 provided in the hub of wheel 25. By this means the operator can at any time stop the running of belt 24 by simply pulling forward the clutch member 50; and of course, when it is desired to have the belt running the clutch member 50 is pushed in toward the wheel 25. Any suitable stop as a nut 53 is provided on the end of shaft 26 to prevent the member 50 sliding completely off the shaft.

The keyboard.

The keyboard 54 is supported on a bracket 55 mounted on frame 2 on the front side of the machine within easy reach of the operator. Upon the keyboard 54 are mounted a plurality of keys 56, one for each class of character bearing matrices in the storage magazine. Since the connection between each key 56 and its coöperating matrix escapement device is similar I will proceed to describe a single key and its connection, best illustrated in Fig. 16.

The key 56 is secured to the front end of a lever 57 pivoted on a rod 58 and arranged with its rear end resting in a notch 59 provided in the edge of a vertically sliding bar 60, guided at its lower end by notches in the two opposing edges of the plates 61 and 62 located near the bottom of the keyboard 54 and at its upper end by notches in the two opposing edges of the plates 63 and 64 located near the top of the keyboard. The bar is normally held in its proper position vertically by a leaf spring 65 secured to the bottom plate of the keyboard and whose free end takes into a notch in the edge of bar 60 near its lower end; and the upper end of bar 60 is connected to the lower end of the bar 19 which operates the matrix escapement device previously referred to. For the purpose of ease and rapidity in assembling I prefer to make the connection between the bar 60 and bar 19 by providing in the lower end of bar 19 a transverse slot 65′ extending about one-half way across said bar 19 into which fits the pin 66 secured in the upper end of bar 60. The bar 19 is prevented from leaving its position directly in line with bar 60 by a bracket 67 secured to plate 64. Since the bars 19 are all arranged in a straight line, one long bracket 67 will suffice for retaining all the bars 19 in proper connection with all the bars 60.

When an operator desires to lock his machine for any reason he simply presses down on the handle 68 arranged on the right hand rear end of the keyboard 54, see Fig. 3, which movement of said handle will rock shaft 69 to which it is secured, in such direction as to move the free end of the integral locking bar 70 into notches 71 provided therefor in the bars 60. The leaf springs 65 heretofore referred to are preferably formed from one piece of sheet metal which is cut in the shape of a comb each tooth of the comb being one spring 65; this construction facilitates the assembling of the machine.

The key 72 which extends across the top of the keyboard and forward on the left side of the same is the one which coöperates with the spaceband releasing mechanism, and its coöperating vertically sliding bar 60, as seen in Figs. 19, and 25, has its upper end pivotally connected at 73 to one end of the lever 74 which has its other end pivotally connected at 75 to a bracket 76 secured to the frame 2. Below the middle portion of the lever 74 is mounted a constantly rotating shaft 77 on which is keyed a notched wheel 78, which coöperates with a spring pressed catch 79 mounted on the cam disk 80 which is loosely mounted on shaft 77.

The catch 79 always tends to be pressed into engagement with the notches on disk 78 but is normally held out of engagement therewith by means of an extension 81 on the lever 74, and obviously when the extension 81 is withdrawn from engagement with the catch 79, said catch will be moved into engagement with the notched wheel 78 and thus the disk 80 will be rotated with the wheel 78. Thus it will be seen that when the key 72 is depressed the lever 74 will be lifted in an arc about its pivot 75 and the disk 80 will be rotated with shaft 77 until it makes one revolution and the catch 79 by engagement with the extension 81 will be withdrawn from the notched wheel 78 and remain stationary until the key 72 is again depressed. The shaft 77 is mounted in bearing 82 secured to frame 2, and is driven by means of a pulley wheel 83 mounted thereon which is connected by belt 84 to the wheel 85 mounted on shaft 40. See Fig. 4.

Mounted adjacent to the cam disk 80 is a vertically sliding bar 86, see Figs. 18 and 25, which is guided by a central slot 87 through which the shaft 77 extends. A roller 88 is pivoted to the lower end of bar 86 and engages the periphery of the cam disk 80 in such manner that the bar 86 will move down and up as the disk 80 rotates. The upper end of the bar 86 is pivotally connected at 89 to one end of a lever 90 pivoted intermediate the ends at 91 to the bracket 92 secured to frame 2. The other end of lever 90 is provided with a slot 93 into which extends a pin 94 secured to the upper end of the slide 95 which is guided in vertical ways formed in the U-shaped frame 96 secured to bracket 97 secured to frame 2, see Fig. 20. As seen in Figs. 18 and 24, the slide 95 is provided with two depending extensions 98 in the same vertical plane which are provided with the opposing offsets 99 arranged to normally rest below the oppositely extending ears 100 on the lowermost space-band 101, so that if the slide 95 is lifted it will lift the lowermost space-band 101 over the stops 102 and 103. The stops 102 are secured to frame 96 in such position as to lie in the path of the ears 100 of the space-bands while said space-bands are in the act of sliding downward in the grooves in the opposing walls of the frame 96 and act to retard their movement, while the stop 103 is secured to frame 96 to retard the movement of the lower ends of the space-bands. When the foremost space-band is released from its position in the fame 96 the next succeeding space-band moves by gravity to rest against stops 102 and 103 and is then in position to be released by the movement of the slide 95. When a space-band is released from the frame 96 it falls by gravity until its ears 100 rest on the assembling rails and to prevent the space bands from turning during their descent I provide the baffle 104 which is secured at its upper end to the frame 96 and consists of a flat plate placed so close to the stored space-bands that a released space-band cannot twist out of position as seen in Fig. 24. As seen in Fig. 19, an additional spring 105 is provided to yieldingly hold the bar 60 coöperating with the space key 72 in its lowermost inoperative position because of the possible tendency of the same being forced up by the action of the cam 80. A coiled contracting spring 106 is connected at the top end to the pin 94 and at the lower end to a pin secured in frame 96, see Fig. 18, to normally yieldingly hold the roller 88 against the cam 80 and also to return the slide 95 to its lower inoperative position. The purpose of providing the cam disk 80 to release the space bands is to cause a delay in dropping the space-band after the key is depressed, to prevent transposition in the assembled line, because the space-band will reach the assembled position much quicker than any matrix after being released.

Assembling mechanism.

The assembling mechanism comprises an assembling box into which the matrices and space-bands drop by gravity and mechanism consisting of a forward retaining finger 107 and a rear assembling and transfer finger 108 as seen in Figs. 28 to 36.

The rear wall 109 of the assembling box is provided on its upper edge with the space band rail 110 and the matrix rails or grooves 111 and 112 and is rigidly secured to the arm 30 of frame 2. The front and rear walls 113 and 109 are spaced apart to permit the matrices and space-bands to be freely moved along on their respective rails in an assembled position in the same vertical plane with belt 24.

A portion of the front wall 113 is mounted on hinges 114 forming the door 115 which is provided with the central opening 116 to enable the operator to at all times see the assembled line of matrices.

The purpose of the hinged door 115 is to

enable the operator to have access to the assembled lines and correct any mistakes in the same by swinging the door 115 away from the rear wall 109 against the tension of spring 118 which tends to yieldingly hold the door 115 in its closed normal position.

When the matrices are released from their stored positions by the mechanism already described they are carried downward upon the inclined belt 24, and after passing pulley 27 will fall into the assembling box and come to rest upon the lower rails 112 seen best in Fig. 29; that portion of the walls 109 and 113 above rails 112 being cut away at this point for the purpose. The assembling finger 108 is pivotally mounted at 119 to a suitable frame 120 slidably mounted on the dovetailed bar 121 rigidly secured to the rear wall 109 of the assembling box and having its extreme left hand end as viewed in Figs. 1, 33 and 34 secured to a portion of frame 2. The assembling finger 108 is pivoted some distance below the assembling box and has its upper end extending into the assembling box just back of the assembled line. As seen in Fig. 28, there is a short arm 122 having mounted on its free end an anti-friction roller 123 which is engaged by the cam 124 rigidly secured to shaft 125 which has its bearing in the lower end of the support 126 rigidly secured to the front wall 113 of the assembling box. The upper end of the support 126 carries the shaft 28. The shaft 125 is rotated by having a pulley 127 rigidly secured to rotate with the pulley 27 by a belt 129 and pulley 128.

An arm 130 is provided on the finger 108 which is connected by the bolt 131 to the arm 122 as clearly seen in Fig. 28. The upper end of the belt 131 is pivotally connected to the arm 130 and the lower end of said bolt passes loosely through a slot in the arm 122 and is provided with a nut below said arm 122. A coiled expanding spring 132 is interposed between the arm 122 and the arm 130 arranged about the belt 131 so that the finger 108 will be positively moved in one direction by the belt 131 and will be yieldingly moved in the other direction about the pivot 119 by the arm 122. The arm 122 is held yieldingly against the cam 124 by the spring 133. The arrangement and construction of the assembling finger 108, arm 130, spring 132, arm 122 and cam 124, is such that the constant rotation of cam 124 will vibrate the upper end of the finger 108 yieldingly to the left as viewed in Fig. 28, by spring 132 and yieldingly to the right by spring 133. Thus when the belt 24 is constantly running the upper end of the finger 108 will constantly vibrate from left to right and from right to left which action will move the matrices and space-bands in the assembled line to the left as viewed in Figs. 1, 34, and 36. To prevent the hindermost matrix or space-band in the assembled line from bounding or falling back against the finger 108, I provide in the side walls 109 and 113, the spring pressed retaining catches 134 best seen in Fig. 35.

The forward retaining finger or resistant 107, is mounted on a bar 135 arranged to slide in the frame 120. To the right hand end of bar 135 is connected one end of a coiled contracting spring 136 whose other end is connected to the free end of a flat rod 137 which is secured to the frame 120, so that the finger 107 is yieldingly held toward the right or against the finger 108. Thus as seen in Fig. 36, as additional matrices and space-bands are permitted to enter the assembled line the finger 107 is pushed to the left against the tension of the spring 136 by the action of the finger 108. As the finger 107 is moved to the left it is retained in its moved position by the cam lever 138 pivoted at 139 to the frame 120 by said lever 138 taking against the surface 140 of the bar 135, said cam lever 138 being constantly pressed against the surface 140 by the spring device 141 (see Fig. 36).

To signal when the full line is assembled a bell 142 secured to bracket 30, is provided which is sounded by the hammer 143 pivoted at 144 to the frame 30 and provided with the extension 145 on the opposite side of the pivot. A pawl 146 is loosely pivoted to the extremity of the bar 135 whose lower free end hangs in the path of the extension 145 and is so arranged that as the bar 135 moves to the left the proper distance the pawl 146 will depress the extension 145 and swing the hammer 143 upward about its pivot 144 and as the bar 135 moves still farther to the left the pawl 146 passes beyond the extension 145 and permits the hammer to fall by force of gravity onto the bell 142. When the bar 135 is moved to the right the pawl 146 swings about its pivot and does not effect the extension 145 and of course the bell is not sounded.

After a full line is assembled in the assembling box the line of assembled matrices and space-bands is bodily moved to the left into the first elevator jaws which are substantially a continuation of the walls 109 and 113 of the assembling box with their rails 110, 111, and 112. The transfer of the assembled line is accomplished by sliding the frame 120 and thereby the assembling finger 108 to the left the required distance which is done by means of the link 147 having one end pivotally connected at 148 to a block 149 slidably mounted in the frame 120 and having its other end, as seen in Figs. 1 and 3, pivotally connected to the free end of the lever 150 pivoted at 151 to a bracket secured to frame 2. A laterally extending lug 152 is provided on the lever 150 near the pivot 151 and the lower end of

a rod 153 passes loosely through a hole in said lug 152 with a head or nut on the end of same below the lug. The upper end of rod 153 passes loosely through a hole provided in the rear end of a lever 154 pivoted at 155 to an extension on the keyboard bracket 55, and the upper extremity of the rod 153 above the lever 154 is provided with a head or nut, so that if the front end of lever 154 is depressed the rear end of same will move upward and through the connecting rod 153 will swing the lever 150 about its pivot 151 to the left and this by reason of the connecting rod 147 will slide the frame 120 to the left which of course by reason of the fingers 107 and 108 engaging the line of matrices transfers the assembled line of matrices to the left into the first elevator jaws the matrices and space-bands being supported on the rails 110, 111 and 112. The block 149 is mounted on the frame 120 by means of the extension 156 passing through the slot 157 in frame 120 and an enlarged head or plate 158 secured to the extension 156 and resting on the rear surface of frame 120 to prevent the extension 156 leaving the slot 157.

The extension 156 is somewhat shorter than the slot 157 so that the block 149 has some lost motion with relation to the frame 120. As best seen in Figs. 28 and 36 the block 149 is provided with an extension 159 which is arranged to engage the finger 108 when the block 149 is in the left hand end of the slot 157. Thus when the block 149 is moved to the left by the action of rod 147, said block will first move in slot 157 till its end contacts with the end of said slot when its further movement will carry the frame 120, and by means of finger 108 will also push or slide the assembled line, to the left until the said assembled line of matrices and space-bands reach their proper position in the elevator jaws.

If the assembled line of matrices should be overset, *i. e.*, be longer than the predetermined length, the frame 120 will be automatically locked against movement by the pivoted catch 160 engaging the lug 161 secured to the bar 121 as seen in Fig. 32. It will be seen that as the bar 135 is advanced toward the left side of the machine with the finger 107, the cam lug 162 which is secured to said bar 135, when moved a sufficient distance, will engage the catch 160 and move it into engagement with the lug 161 so that the frame 120 will be held against movement. Obviously the cam lug 162 is set the proper distance from the catch 160 so that a full assembled line can be set before the frame 120 is locked against movement by said catch.

To return the frame 120 to its normal position to the right a coiled contracting spring 163 (see Figs. 1 and 3), is connected between a lug 164 on lever 150 and a bracket 165 secured to the frame 2. When the frame 120 is thus returned to the right by the action of spring 163, the cam lever 138 (see Figs. 34 and 36) is turned on its pivot away from the rail 140 by means of the lever 166 rigid with lever 138 being depressed by engagement with the latch 167 pivotally secured to the space band frame 96 and thus permitting the slide 135 to be moved by the spring 136 to its extreme right hand position with the forward finger 107 adjacent the vibrating assembling finger 108. The latch 167 is so arranged that it will swing freely on its pivot when engaged by the lever 166 on its movement to the left. The movement of the frame 120 to the right is limited by the stop block 168 secured to the rear side of the rail 111 as clearly shown in Fig. 32, so as to properly position the catch 160 to engage the lug 161 and the roller 123 of the vibrating assembling finger 108 (see Fig. 28) to engage the cam 124. The block 149 will of course be moved to the right hand end of the slot 157 so as to have the extension 159 out of the path of the vibrating assembling finger 108.

Secured to the rear side of the sliding frame 120 is a cam lug 169, seen in Figs. 29, 33, 37, and 38, which when the frame 120 is moved to its farthest position to the left, will contact with and swing the lever 170 about its pivot 171 secured to a bracket 172 mounted on frame 2. As the one end of the lever 170 is moved backward by the cam lug 169 the other end of the lever is moved forward and releases a trip lever which by means to be described sets the main cam shaft into motion automatically, which after making one complete revolution is automatically stopped by mechanism to be described.

The lever 170 as seen in Fig. 38, is pivoted about midway its length and as its left hand end is moved backward its right hand end moves forward and this latter end is connected by link 173 to the upper end of trip lever 174 which is guided to move vertically and forward and back in the ways 175 supported by bracket 172. The lower end of the trip lever 174 as clearly seen in Fig. 39, is pivotally connected to the pivoted connected ends of the double link or toggle joint 176 the free ends of which are pivotally connected to the free ends of the levers 177 and 178 pivotally mounted about the vertical bolt 179 secured in an extension of frame 2. The lever 177 is arranged to contact with a stop 180 which limits the non-clockwise movement of said lever 177 about its pivot 179 as seen in Fig. 38. The lever 178 is pivoted at about midway its length and the end remote from the toggle 176 is forked and straddles the hollow shaft 45 and is arranged to bear against the collar 181 secured to the inner shaft or rod 182 by

means of the pin 183 which passes through longitudinal slots in the hollow shaft 45 so as to permit the longitudinal movement of collar 181 and rod 182 independent of shaft 45.

The one end of rod 182 extends out beyond the end of shaft 45 where it is connected to a toggle joint 184 arranged to operate the clutch 185 which coöperates with the constantly running wheel 44, in such manner that the shaft 45 will rotate with wheel 44 when the clutch 185 is in an operative position, the clutch 185 being mounted on a spider 186 keyed to shaft 45. A coiled expanding spring 187 is interposed between a collar 188 rigid on rod 182 and a sleeve 189 secured in the end of shaft 45, which spring constantly tends to press the clutch 185 against wheel 44 so as to rotate shaft 45. The clutch 185 is normally held disengaged from the wheel 44 by the lever 178 pressing against the collar 181, which pressure is exerted by the toggle joint 176 between the free ends of levers 177 and 178. It will be noted by observing Fig. 39 that the free ends of said levers 177 and 178 are pressed apart when the toggle joint 176 is depressed by trip lever 174 against the tension of spring 190 resting on a portion of frame 2. The parts are so adjusted that the clutch 185 will be disengaged from wheel 44 when the trip lever 174 is in its lower position and said clutch 185 will be engaging the wheel 44 when said trip lever 174 is in its raised position. It will be noted that the force of spring 187, when the clutch 185 is disengaged from wheel 44, will be exerted against the stop 180 through levers 177 and 178, collar 181, pin 183, rod 182 and collar 188, and of course said course of spring 187 is exerted against wheel 44 when the clutch 185 is engaging wheel 44, through collar 188, rod 182, toggle 184 and clutch 185.

The rotation of shaft 45, rotates the cam shaft 191 by means of the intermeshing gears 192 fixed on shaft 45 and 193 fixed on shaft 191. As viewed in Fig. 37, the gear 192 rotates nonclockwise and the gear 193 rotates clockwise. The gear 193 has secured to one side near its periphery a block 194 which is arranged to engage the lug 195 on trip lever 174 when said gear 193 is in its normal stationary position and retains said lever 174 in its lower position against the tension of spring 190. As previously stated the lever 174 is mounted to freely move in ways 175 in four directions up, down, forward and back, and it is normally held back with its lug 195 in the path of the block 194 on gear 193 by the coiled expanding spring 196 interposed between it and a portion of frame. 2.

From the description given it will be understood that when the hand lever 154 is depressed the sliding frame 120 will be moved to the left and its cam lug 169 will engage and swing the lever 170 about its pivot to pull the link 173 and also the upper end of the lever 174 forward so as to withdraw the lug 195 from under the block 194 so that said lever 174 will be lifted by the action of spring 190, thus permitting the free ends of levers 177 and 178 to approach each other and the clutch 185 to grip the wheel 44 to cause the gear 193 to rotate clockwise as viewed in Fig. 37. When the gear 193 makes one complete revolution the block 194 contacts with the lug 195 and moves the lever 174 downward thereby moving the toggle 176 down against the tension of spring 190 and spreading the free ends of levers 177 and 178, which movement as has been described, releases the clutch 185 from wheel 44. It may be stated that long before the gear 193 has completed its one revolution, the sliding frame 120 with its cam lug 169 has been returned to the right hand normal position where it remains until the next operation of the machine.

During the time that the gear 193 makes its revolution it may become necessary to stop the same on account of some error or breakage and for this purpose a stopping mechanism is provided consisting of the link 197 having its one end pivotally connected to the one arm of lever 177 and its other end pivotally connected to the crank arm 198 secured to the rock shaft 199 mounted in a suitable bearing secured to frame 2. A second crank arm 200 is rigidly secured to the shaft 199 which is provided with laterally extending pin 201 on its free end which pin rests in the slot 202 provided in one end of lever 203 which is pivoted midway its length at 204 to frame 2. The other end of the lever 203 is connected by means of link 205 to a rod 206 mounted to slide longitudinally in a bearing 207 secured to frame 2 and provided on its forward end with a handle 208 within easy reach of the operator. As seen in Figs. 37 and 38, if the handle 208 is pulled forward, *i. e.*, to the right as viewed in said figures, the crank arm 198 will be turned non-clockwise about its pivot and thus through the link 197 swings the lever 177 about its pivot 179 so as to contact with lever 178 and swing said lever 178 about its pivot to move the rod 182 against the tension of spring 187 and disengage the clutch 185 from the wheel 44, thus stopping the rotation of the gear 193 and cam shaft 191. Of course, the handle 208 is never employed to stop the machine at the normal stopping point. Referring to Figs. 34 and 36, should it become necessary at any time to make correction in the assembled line of matrices the forward retarding finger 107 can be released so that

it is free to be moved to the right by spring 136 by depressing the lever 166 by hand.

The first elevator.

The first elevator as seen in Figs. 1, 2, 3, 4, 33, 34, 40 and 42 comprises the front and rear matrix carrying plates 209 and 210 spaced apart and connected rigidly together by the block 211 which are carried at the upper end of the vertically sliding frame 212. The frame 212 is mounted to slide vertically in the ways 213 secured to the frame 214 pivotally mounted at 215 to the frame 1. This first elevator has three positions, first, its middle or normal position with its matrix carrying rails or grooves in the plates 209 and 210 in alinement with the assembling box rails 110, 111 and 112 as shown in Figs. 1, 33 and 34; second its lower or casting position with the matrices carried thereby in proper alinement in front of the mold as seen in Fig. 42, and third, its higher or distributing position with its space band carrying rails in alinement with the rails in the space band hopper as seen in Fig. 22. To move the frame 212 vertically so as to bring the first elevator consecutively into its three proper positions it has pivotally connected at 216 the upper end of a compound spring link 217 which has its lower end pivotally connected at 218 to the front end of a lever 219 pivotally mounted intermediate its ends at 220 to the frame 1, and the rear end of lever 219 is connected by link 221 to the rear end of a horizontally disposed lever 222, (see Fig. 42) which has its front end pivotally mounted at 223 to a bracket on frame 1. On the lever 222 is rotatably mounted a roller 224 arranged to constantly contact with the cam 225 rigidly mounted on shaft 191, it being held against said cam by the weight of frame 212. When the shaft 191 makes one revolution in the direction indicated by the arrow in Fig. 42, the cam 225 will act on roller 224 in such manner as to move the first elevator, first down to its casting position from its normal position, then up to its distributing position and finally down to its normal position again.

To prevent the assembled line of matrices being pushed off of the assembling box rails to the left by manipulating hand lever 154 when the first elevator is not in its normal position to receive the same a locking lever 226 is provided which is pivoted at 227 between the ends of the two depending arms 228 secured to the front plate of the assembling box 113 and has its upper end 229 arranged to enter the path of the retarding finger 107 in the assembling box as seen in Figs. 31, 33 and 34. The upper end 229 of lever 226 is yieldingly pressed into the path of the retarding finger 107 by a spring 230 and is held out from such path by the short crank arm 231 secured on rock shaft 232 mounted in bearings 233. A second crank arm 234 is secured to shaft 232 which is arranged to normally lie in the path of the first elevator plate 209 so that when said first elevator is moving downward it will engage said crank arm 234 and rock the shaft 232 with crank arm 231 in such direction as to move the upper end 229 of lever 226 out of the path of retarding finger 107 against the tension of spring 230 and the said finger 107 will be free to move to the left out of the assembling box and into the first elevator, but when the elevator is moving upward, its contacting with the crank arm 234 will simply rock the shaft 232 clockwise as viewed in Fig. 31, and swing the crank arm 231 farther away from the lever 226 and permit the same to remain in the path of the finger 107. Thus the only time that the finger 107, and of course the assembled line also, is free to be moved from the assembling box into the first elevator, is when the said elevator is in proper position to receive said assembled line of matrices.

As clearly seen in Figs. 30 and 31, the tracks or grooves in the elevator plates 209 and 210 to receive the matrices and space band ears 100 have an overhanging portion so that the matrices and the space bands can only be removed from said elevator by sliding horizontally and when the elevator moves downward after an assembled line has been moved into the same, the said assembled line will be pulled downward and out from between the retarding finger 107 and the assembling or transfer finger 108. After the said assembled line has been removed from between said two fingers 107 and 108 the frame 120 carrying said two fingers can again be returned to its normal position to the right. However, said frame 120 cannot return to the right until the elevator with the assembled line has moved down far enough to bring the upper ends of the matrices below the lower end of the retarding finger 107, and to block the frame 120 in its left hand position until the elevator is sufficiently lowered a hook shaped member 235 is provided on the frame 120 which is adapted to engage the spring pressed latch 236 as seen in Figs. 29, 30, 33 and 34. The latch 236 is made in the form of a crank arm secured to one end of rock shaft 237 mounted in bearings 238 secured to frame 2. The other end of the shaft 237 is provided with an arm 239 whose free end is in the path of an extension 240 secured to the rear elevator plate 210 so that each time the elevator passes the arm 239 said arm will be moved with the shaft 237 as an axis, clockwise as viewed in Fig. 30, and thus rock the latch 236 out of the path of the hook member 235 against the tension of

spring 241. The positions of the arm 239 and the extension 240 are so arranged that they will contact operatively when the tops of the matrices in the assembled line on the elevator are slightly below the lower end of the retarding finger 107 so that the frame 120 at that moment will be free to move to the right and will be thus moved by the tension of the spring 163. Of course, when the elevator moves upward past the arm 239 the latch 236 will also be moved out of the path of the hook member 235, but since the frame 120 bearing member 235, had already been returned to its normal position, no results will be effected. In Fig. 27, is shown a detail of how the spring link 217 may be made which consists of a tube 242 closed on either end by the screw plug 243 carrying the pivotal end 216 and the screw plug 244 provided with a perforation through which the rod 245 carrying the pivotal end 218 passes freely. Within the tube 242 adjacent the plug 244 a stop or washer 246 is rigidly secured to the rod 245 and an expanding coiled spring 247 is interposed between said washer 246 and the plug 243 so that when extreme pressure is exerted on pivot 218 toward pivot 216 the spring 247 will be compressed.

The line clamping mechanism.

To describe the line clamping mechanism, reference will be made to Figs. 1, 2, 3, 4, 40, 41, 42, 51, 62, 63, 64, and 65. The assembled line of matrices is clamped while in position on the first elevator against the mold 248 of the mold wheel 249 pivoted at 250 to the frame 251 as clearly seen in Fig. 42. That edge of the matrices bearing the characters are pressed against the mold and the lower shoulder on said edge fits upward against an extension on the mold so that when the elevator is spring pressed upward slightly all the matrices in the assembled line will be forced up in a horizontal line by the elevator rear plate 209 and the extension on the mold 248. To aline the matrices as to their forward and back position the mold is pressed tightly against the matrices clamping them against the rear side of the front plate, 209 of the elevator. The matrices are tightly clamped together laterally by the end jaws 252 and 253 mounted on the sliding blocks 254 and 255 respectively both of which blocks are mounted to slide in the guideway 256 provided therefor in the upper end of the frame 214 as seen in Figs. 40, 42 and 65. The jaw 252 is the fixed or stationary jaw but it is arranged to have a slight movement by having pivotally connected thereto one end of a link 257 which has its other end pivotally connected at 258 to the one end of link 259 which has its other end pivotally connected at 260 to the frame 214. The links 257 and 259 form a toggle joint and the upper end of a rod 261 is pivotally connected to said toggle at 258 while the lower end of said rod is provided with a head 262 arranged to be depressed by one arm of a bifurcated lever 263 pivoted to a bracket on frame 1. The rod 261 is guided to move vertically by the perforated lug 264 integral with frame 214 and the said rod 261 is normally held in its uppermost position with its stop 265 against the lower side of link 259 by means of the coiled expanding spring 266 being interposed between the lug 264 and the collar 267 rigidly mounted on rod 261. In Fig. 41, the rod 261 is shown as being depressed by lever 263 against the tension of spring 266 which lowers the pivot 258 and draws the jaw 252 slightly toward the pivot 260. The purpose of having the jaw 252 slightly moved in a direction away from the jaw 253 is to increase the distance between the jaws so that the assembled line of matrices will pass down between the same easily. The stop 265 serves to limit the upward movement of the rod 261. The jaw 253 is formed with a flat face of sufficient length to close the entire mold slot, and when only a portion of a full line of matrices is set and pushed into the first elevator it will be lowered into position between the two jaws 252 and 253 and further operation of mechanism to be described will slide the jaw 253 toward the jaw 252 until it rests tightly against the nearest matrix; thus when the mold slot is filled with molten metal a portion of the slug face will be formed with characters against the matrices and a portion will be formed a blank against the face of the jaw 253 as seen in Fig. 65. A full line of matrices is shown in Fig. 40. If the machine is set in operation without placing any matrices into the line a complete blank slug will be formed against the face of jaw 253.

The lower side of the block 255 is provided with a hole into which the upturned end of a bar 268 rests snugly, and the bar 268 is arranged to slide in a groove formed therefor in the frame 214 in the lower side of the guideway 256 in which the blocks 254 and 255 fit. The left hand end of the bar 268 just beyond the side surface of the frame 214 is provided with two collars 269 and 270 rigidly secured thereto. The collar 269 rests against the side surface of the frame 214 and thus limits the movement of jaw 253 away from jaw 252 which determines the length of the justified assembled line. When less than a full line of matrices are in the assembled line between the jaws 252 and 253 the jaw 253 is forced to the left and pushes the partly full line of matrices tightly against the jaw 252 and such movement of the jaw 253 is accomplished by means of a lever 271 pivoted

midway its ends at 272 to a bracket on frame 2. The one end of lever 271 fits snugly between the collars 269 and 270 on rod 268 and the other end of said lever 271 is pivotally connected at 273 to one end of a link 274 whose other end is pivotally connected at 275 to the upper end of the lever 276 pivoted at its lower end at 277 to a bracket on frame 1. Pivotally secured to the lever 276 at 278 is one end of a sliding bar 279 guided to slide in bracket 280 secured to frame 1. The other end of the bar 279 is provided with an anti-friction roller 281 which coöperates with a cam 282 rigidly mounted on shaft 191. The connecting rod or link 274 conveniently is arranged to extend longitudinally through the hollow shaft 191 and is provided with a yielding connection 283 shown in section in Fig. 63. When the shaft 191 makes its one revolution the cam 282 acts on roller 281 in such manner that the jaw 253 will be moved toward the jaw 252 and clamp the assembled line of matrices at the proper time. The lever 276 is moved a sufficient distance by the action of cam 282 to move the jaw 253 entirely against the jaw 252 and according to the length of the assembled line the spring 284 will be compressed more or less. The cam 282 is conveniently made integral with gear 193. A coiled compression spring is provided between frame 2 and the lever 271 to yieldingly hold the roller 281 against the cam 282.

The space bands or justifiers are of the usual construction having a short wedge shaped member provided with the ears 100 and a long wedge shaped member whose lower end normally extends a considerable distance below the assembled line of matrices as seen in Fig. 40. While between the jaws 252 and 253 the short wedge shaped members of the justifiers are prevented from moving upward by their ears 100 resting in the grooves or tracks of the first elevator and to finally adjust a fully set line of matrices the long depending wedge shaped members of the justifiers are pushed upward by the justifier pusher bar 285 secured to the upper end of the vertically sliding rod 286 mounted in suitable bearings provided on frame 214. The rod 286 is moved upward by means of one arm of the bifurcated lever 263 engaging the under side of a collar 287 rigidly secured to rod 286. The lever 263 is pivotally mounted at 288 to a bracket on frame 1, and is provided with an anti-friction roller 289 arranged to coöperate with the cam 290 rigidly secured on shaft 191. The free end of lever 263 is normally yieldingly pressed upward by the coiled expanding spring 291 interposed between the lever 263 and a suitable bracket on frame 1. As the shaft 191 makes one complete revolution it of course carries the cam 290 with it and the said cam is so formed that it will coöperate with roller 289 and spring 291 as to force the long wedge shaped members of the justifiers upward at the same time that the molten metal is forced into the mold slot or slightly before such action. The upper end of the frame 214 is removably secured to the frame of the machine by means of the two handled screws 292 which when necessary can be removed so as to have the frame 214 free to swing forward about its pivot 215 and to hold said frame in either of its two forwardly tilted positions the arm 293 is pivotally connected at 294 to frame 214 arranged to have its notches 295 engage the bracket 296 secured to frame 1, as clearly seen in Fig. 51.

The shaft 191 is mounted to rotate in suitable bearings 297 secured to the top of frame 1 and the different cams and segmental gears secured to the same are so positioned with relation to the rotation of the shaft that the different operations and movements of parts take place at the proper time to automatically carry the assembled line of matrices to the casting position, cast the slug, carry the matrices up, withdraw the justifiers from the assembled line, and finally distribute the matrices, returning them to their normal stored position in the storage magazine.

The casting mechanism.

The casting mechanism is seen in Figs. 1, 2, 4, 42, 43, 44, 45, 46, and 47. As previously referred to the mold 248 is carried by the casting wheel 249 pivotally mounted at 250 to the bracket 251. As shown in Figs. 43 and 46 the bracket 251 is provided with the dovetailed end 298 which is arranged to slide backward and forward in a suitable groove provided in frame 2, so that the casting wheel 249 moves laterally backward and forward. The rear end of the dovetailed end 298 is provided with an extension to which a roller 299 is pivotally mounted, said roller 299 being arranged to cooperate with the groove 300 in the cam 301 rigidly secured to shaft 191. The casting wheel 249 has four positions laterally—viz., normal forward or ejecting, backward between ejecting and casting, forward or casting and backward between casting and ejecting. The said four positions are given to the casting wheel during the one revolution of shaft 191 because of the shape of the groove 300 in cam 301. Each time that the casting wheel 249 is in its backward position it is rotated by means of its teeth which are provided on its periphery meshing with the small gear 302 secured to one end of shaft 303 mounted in suitable bearings 304 secured to frame 1. The other end of shaft 303 has secured thereto a bevel

gear 305 meshing with the bevel gear 306 (see Fig. 47) which is rigidly mounted on shaft 307 mounted in suitable bearings 308 secured to frame 1. Also secured to shaft 307 is a spur gear 309 meshing with the gear 310 which also meshes with the segmental gear 311 rigidly mounted on shaft 191. The segmental gear 311 is provided with two segments of teeth 312 and 313 which serve to rotate the casting wheel when the shaft 191 makes one revolution. The teeth 312 on gear 311 serve to revolve the casting wheel 249 from its ejecting position to its casting position, *i. e.*, a one-quarter revolution, and the teeth 313 on gear 311 serve to revolve the casting wheel 249 a three-quarter revolution. A disk 314 is rigidly mounted on shaft 307 and is provided on its periphery with two diametrically opposed V notches 315 into which the V shaped end of the spring pressed lever 316 is arranged to fit, to yieldingly stop the rotation of shaft 307 when the gear 310 is not being engaged by either of the segments of gears 312 or 313. The position of the notches 315 in disk 314 are such that one notch will be engaged by lever 316 every time the casting wheel 249 makes a quarter revolution so that said casting wheel is certain of being properly held stationary every time it reaches either its ejecting position or its casting position.

As usual in machines of this class the mold slot is as long as desired, that is to fit the column on the paper where the printing is to be done, the thickness of the slot is made to suit the face of the letters used and the width of said slot is made to conform to the height of standard type. When in the casting position the mold slot lies in a horizontal plane between the assembled line of matrices which close the one open edge of the slot and the nozzle 317 of the melting pot 318 which closes the other open edge of the mold slot as seen in Fig. 42.

The casting pot 318 is provided with two forwardly extending depending arms 319 pivotally mounted at 215 so that the melting pot 318 can swing toward and away from the mold 248 about said pivot 215. Pivotally secured to the melting pot 318 at 320 is the upper end of a lever 321 to which is rotatably secured a roller 322 which is constantly held in engagement with the cam 323 rigidly mounted on the shaft 191. The lower end of the lever 321 is yieldingly held away from the lug 324 secured to the casting pot 318 by a coiled expanding spring 325 and a headed bolt or other suitable means is provided to retain the lower end of lever 321 in its proper position relative to the melting pot. The spring 325 is constantly under considerable tension and when the cam 323 rotates once around with shaft 191 it will because of its form press the melting pot nozzle 317 tightly against the mold 248, and the parts are so arranged that the final movement or pressure exerted by the rotation of the cam 323, against the nozzle 317 will be a yielding one through the spring 325.

At the same time that the nozzle 317 is pressed against the mold 248 the molten type metal 326 is forced through the nozzle 317 into the mold slot by means of the downward movement of the piston 327. The piston 327 is mounted to slide in a well within the melting pot and is arranged to force the molten metal up through the spout 328 to the mold by its downward movement, which is accomplished by means of the piston rod 329 which has its lower end pivotally connected to the piston 327 and its upper end pivotally connected to one arm of the bell crank lever 330 pivoted at 331 to a part of frame 2. The other arm of the bell crank lever 330 is provided with a roller 332 which coöperates with a cam 333 rigidly secured on shaft 191. A spring 334 is interposed between one arm of the bell crank lever 330 and a bracket 335 secured to frame 2 to constantly press the piston 327 downward as seen in Figs. 42 and 2, and thus also press the roller 332 against the cam 333. The cam 333 is so formed as to permit the spring 334 to move the piston 327 downward and force the molten metal into the mold at the same time that the nozzle 317 is pressed against the mold 248 during the revolution of shaft 191. Suitable gas burners 336 are provided to heat the metal pot.

Immediately after the molten metal has been forced into the mold slot, the melting pot with its nozzle 317 is moved away from the mold 248 through the action of gravity and cam 323, and the piston is raised by the action of cam 333; then the mold wheel 249 is rotated to bring the mold slot in proper position in front of the ejecting blade 337 by the action of the mutilated gear wheel 311 as seen in Figs. 46 to 49. The ejector 337 is secured to a slide mounted in a groove 338 in the frame 251 which slide is actuated by means of a bifurcated lever 339 pivotally secured at 340 to a suitable portion of frame 2. The one arm of lever 339 is connected to slide 341 by link 342 and the other arm of lever 339 is arranged in the path of a lug 343 carried by the wheel 344 rigidly mounted on shaft 191, so that as the shaft 191 makes one revolution in the direction indicated by the arrow in Fig. 46, the lug 343 will contact with and swing the lever 339 about its pivot 340 and thus slide the ejector 337 to the right as seen in said Fig. 46, and push the bar or line of type out of the mold 248 and through between the trimming knives 345 which are rigidly secured to the

frame 214. A detent plate 346, (see Fig. 45), is provided in the slot beyond the trimming knives to prevent the bar of type from falling by gravity and thus possibly become clogged in the slot. The ejector 337 pushes the bar of type completely past the trimming knives and detent plate into the galley 347 secured to the frame 214 and a pusher arm 348 pivoted at 349 to frame 214 serves to push the accumulated bars along in the galley against the usual retarding block not shown and thus stacks the bars of type successively in proper order in the galley. The pusher arm 348 has an arm 350 pivoted to it which is provided on its free end with a pivoted roller 351 normally pressed against the vertical rod 286 provided on the one side with the depression 352 into which the roller 351 is arranged to pass clearly shown in Fig. 40. The parts are so arranged that as the rod 286 moves upward the roller 351 will enter the depression 352 by reason of the coiled contracting spring 353 connected between arm 348 and frame 214, and the upper end of arm 348 will engage the last bar of type ejected from the mold 248 and push it along in the galley 347. The arm 350 is properly guided in frame 214 to keep the roller 351 in engagement with the rod 286. To prevent any trimmings from the bars of type gathering on the trimming knives a wiping arm 354 is provided to brush past the cutting edges of the knives 345 each time a bar of type is pushed through the same. Said wiping arm is pivoted at 355 to frame 214 and is provided with an integral arm provided at its extremity with a pivoted pawl 356 arranged in the path of the lug 357 secured to the rear side of the first elevator frame 212 as clearly seen in Fig. 40. The parts are so arranged that when the frame 212 moves downward the lug 357 will engage the pawl 356 and swing the wiping arm 354 about its pivot 355 so that its upper end will brush close past the cutting edges of the trimming knives 345 and remove any trimmings that may adhere thereto, and when the frame 212 returns upward the lug 357 will contact with the pawl 356 and swing it about its pivot, thus not effecting any movement of the arm 354. The arm 354 is returned to its normal position to the right of the trimming knives by the spring 358 seen in Fig. 2. The ejecting blade 337 is returned to its normal position rearwardly as seen in Fig. 46, by the coiled contracting spring 359 connected between the lever 339 and the frame 1. The back edge of the bar of type is trimmed off by the stationary knife 360 secured to bracket 251, while said bar of type is being carried by the casting or mold wheel from the casting position to the ejecting position, as clearly shown in Fig. 43. To exactly center the mold wheel in its casting position and its ejecting position the wheel is provided with holes 361 into which are arranged to fit the pins 362 secured to frame 214.

The justifier distributer.

To distribute the justifier or space bands from out of the assembled line back to their stored position the first elevator with the complete assembled line of matrices and space-bands is lifted by mechanism described from the casting position to its uppermost position where said elevator is stopped in its upward movement by contact with the set screw 363 secured in bracket 364 on the frame 97, see Fig. 20. When the first elevator is thus in its uppermost position the pusher 365 will be in a position to register with the matrices in said first elevator. The pusher 365 is mounted on the sliding block 366 mounted in the dovetailed groove 367 provided in bracket 364. The block 366 is arranged to be moved to the right by means of the connecting rod 368 which connects it to the upper free end of the arm 369 (see Figs. 1 and 2) secured to the hollow shaft 370 mounted in bearings 371 on a portion of frame 1. To the rear end of the shaft 370 is secured an arm 372 (see Figs. 48 and 49) whose free end is arranged to be actuated by the cam 373 mounted on the mutilated gear wheel 311. As the wheel 311 rotates clockwise as viewed in Fig. 49, the cam 373 will depress the free end of arm 372, rock the shaft 370 and slide the block 366 to the right as viewed in Fig. 20. The cam 373 is so positioned about shaft 191 that the block 366 is thus moved to the right when the first elevator is in position to the right of the pusher 365, so that the assembled line of matrices and space-bands will be pushed by said pusher 365 out of the first elevator and onto the second elevator and the space-band hopper seen in Figs. 1, 21, 22 and 56 and to be described. The arm 372 is loosely pivoted about the shaft 370 but is yieldingly connected thereto by means of the spring 374 which constantly presses the arm 372 against the arm 375 which is rigidly secured to the shaft 370 as seen in Fig. 50. A coiled contracting spring 376 is connected to a short arm 377 rigidly secured to shaft 370 which serves to rock said shaft so as to normally hold the block 366 in its left hand position against the stop 378. If for any reason a line which has been cast is to be cast over again, the operator simply rocks the locking bar 379 provided in the bracket 364 to intersect the path of the lower edge of the block 366, see Figs. 20 and 21. The locking bar 379 is provided with a notch 380 which permits the free passage of the block 366 when said bar is in a position with the notch 380 on its upper side

and the handle 381 extending down as seen in said Figs. 20 and 21. The lower edge of the block 366 is provided with a notch 382 which registers with the bar 379 when said block is in its left hand position resting against the stop 378, so that when the bar 379 is partly rotated its unnotched portion will take into the notch 382 in the block 366 and prevent said block 366 from moving to the right when the cam shaft 191 rotates, however, the arm 372 will be depressed by the cam 373 during the revolution of shaft 191 and of course will compress the spring 374 because the arm 375 secured to shaft 370 cannot move. Thus as the block 366 cannot move to push the assembled line out of the first elevator, said line will remain in the elevator and will be carried back down into the casting position as soon as the machines is again set into operation. Of course if the rod 379 is left in a rocked position the same line can be cast over and over again as often as desired.

The space-band hopper 383 comprises two side plates provided with grooves 384 in their opposing sides and pivotally mounted at 385 to the upper end of the frame 96 as seen in Figs. 20, 22, 23 and 24. The hopper 383 is in its lower horizontal position with its grooves 384 registering with the justifier or space-band tracks 110 in the first elevator when said elevator is in its uppermost position; and when the assembled line is pushed off of said elevator by the pusher 365 the ears 100 of the space-bands slide into the grooves 384 of the hopper 383. The space-band hopper 383 is normally yieldingly pressed upward about its pivot by the torsion spring 386 seen in Figs. 22 and 23, but is held down in its horizontal or lower position by the spring pressed arm 387 pivotally mounted on the second elevator as shown in Fig. 22, so that as soon as the second elevator is lifted up away from the hopper 383, said hopper will, because of the spring 386, assume its raised or tilted position as seen in Figs. 1, 20 and 24, and the space-bands 101 will gravitate down the grooves 384 and into the grooves provided for the ears 100 in the opposing walls of the frame 96 into their stored position against the stops 102. It will be noted in Fig. 24, that the grooves 384 register with the grooves in frame 96. The space bands are provided at their lower end with a slot 388 in which the rail 389, provided on the hopper bottom 390, fits loosely to prevent the space-bands from turning during their descent along in the grooves 384. A similar rail 391 is provided on the bottom of frame 96 for the same purpose. The bottom 390 of the hopper 383 is pivotally connected at 392 to the frame 96, and the links 393 connect either side of the free end of the bottom 390 with the free end of each of the side plates of the hopper 383, so that the side plates of the hopper will always move in unison up or down, about the pivots 385, as the case may be. To adjust the line when in the casting position the space-bands are forced upward through the line by the bar 285 as described and if any of said space-bands fail to recede to their normal lower position by force of gravity they will be forced down to such position by the plate 394 secured to frame 364, see Fig. 20, contacting with the upper end of the sliding member of the space-bands, when the first elevator with the assembled line thereon reaches its uppermost position as seen in Fig. 22.

The second elevator.

The second elevator which lifts the matrices from the space-band hopper to the distributing rail comprises the vertical shaft 395′ which lies parallel to the right and left hand screw threaded vertical shaft 395 mounted at the top end in the bearing 396 secured to a suitable bracket on frame 2, and at the bottom end in the bearing 397 secured to frame 2 and also the carrying rail 398 secured to the bracket 399 arranged to travel up and down on the shafts 395 and 395′, see Figs. 52 and 56. The lifting rail 398 is provided with a V shaped bottom edge which has grooves cut therein so as to fit the supporting lugs on any and all the matrices. The normal position of the rail 398 is at the upper end of the shaft 395 registering with the distributing mechanism, but when it receives the line of matrices to be distributed it is at rest near the bottom of shaft 395 between the side plates of the space-band hopper 383 so that the supporting teeth on the matrices will register with the grooves provided therefor in the V shaped bottom of rail 398. The spring pressed finger or arm 387, see Figs. 4, 22, 55 and 56, is pivotally mounted at 400 to an extension on bracket 399 so that the rail 398 and the arm 387 travel up and down at the same time. The free end of arm 387 is depressed by the torsion spring 401 arranged at the pivot 400 and when the bracket 399 moves down to its lowermost position the free end of the arm 387 engages the protruding end of pivot 402 on the hopper 383 and swings the free end of the hopper downward about its pivot 385 until the stop 403 contacts with the edge of the frame 96 and stops the hopper 383 in a position to have its grooves 384 register with the space-band grooves in the first elevator. It will be understood that the torsion spring 401 which depresses the arm 387 is stronger than the torsion spring 386 which lifts the free end of the hopper 383.

The bracket 399 is provided with suitable holes to fit slidingly over the shafts 395

and 395′ and it is also provided with an upward extending lug 405 to which is pivotally mounted the shoe 406 arranged to slide in the right and left hand screw thread groove 407 in the shaft 395, so that as the shaft 395 is rotated the bracket 399 will be moved down and up on the shaft 395; the shoe 406 first traveling down in the right hand screw thread and then traveling up in the left hand screw thread, the shaft 395 rotating in one direction. The shaft 395 is driven by automatic means so that the bracket 399 with the carrying rail 398 will first be moved down to its lowermost position and after pausing a short time will be moved back up to its normal position as seen in Fig. 56. The said automatic means comprises the segmental gears 408 and 409 rigid with the wheel 314 which are arranged to mesh with the small bevel gear 410 rigidly secured on shaft 411 mounted in a suitable bearing 412 at one end, and at the other end is mounted rotatably in the hub of a wheel 413, which wheel is rigidly secured on shaft 414, mounted to rotate in the bearing 415 and in a socket formed in the end of shaft 416, which is mounted to rotate in the bearing 417. The arm 418 is rigidly secured to shaft 411 adjacent the wheel 413 and a spring pressed pin 419 is arranged to engage a V notch provided in said wheel 413 which connection serves to rotate the wheel 413 with shaft 411; however, if for any reason the wheel 413 should refuse to rotate the pin 419 will slip out of the V notch in the wheel 413 against the tension of spring 420. Rigidly secured to shaft 414 is a large gear 421 which meshes with a small gear 422 secured to rotate loosely on shaft 423 with the large gear 424 which meshes with the small gear 525 rigidly secured on shaft 416. The shaft 423 is rigidly secured to the bracket 426. To the free end of the shaft 416 is rigidly secured the bevel gear 427 which meshes with the bevel gear 428 rigidly secured to the lower end of the shaft 395. Thus it will be seen if the shaft 191 makes one revolution in the direction indicated by the arrow in Fig. 53, the segment 408 by meshing with gear 410 will rotate the shaft 395 and move the carrying track 398 from its uppermost position to its lowermost position; while the space between the segments 408 and 409 is passing the gear 410, the track 398 will remain stationary and the segment 409 by meshing with the gear 410, will rotate shaft 395 and move the track 398 from its lowermost position to its uppermost or normal position.

The matrix distributing mechanism.

The distributing of the matrices is accomplished by means of the distributing rail 429 secured at each end to suitable extensions on frame 2 and the three screws 430, 431 and 432 which are rotatably mounted in suitable bearings on extensions of the frame 2. The rail 429 is arranged centrally above the matrix magazine and is provided with longitudinal ribs on which the matrices are supported by their combination teeth well known in the art. The matrices are fed one by one onto the rail 429 from a short rail 433 arranged in the same vertical plane with rail 429 at the left hand thereof and somewhat below said rail 429. The rail 433 is arranged to aline exactly with the carrying rail 398 of the second elevator when said rail 398 is in its uppermost position so that the line of matrices is pushed to the right onto said rail 433, by the pusher 434 rigidly secured to the block 435 arranged to slide parallel to the rails 433 and 398 in the dovetailed groove provided in frame 436 which is rigidly secured to an extension of frame 2. The block 435 is connected by means of link 437 to the upper free end of arm 438 rigidly secured to the front end of shaft 439 which is mounted to rotate inside the shaft 370 and has rigidly secured on its rear end the arm 440 whose free end is arranged to be actuated by the cam 441 secured to the mutilated gear wheel 311, see Figs. 48 and 49. The parts are so positioned and arranged that at the proper time during the revolution of shaft 191 the cam 441 will lift the free end of arm 440, rock the shaft 439 and move the block 435 with the pusher 434 to the left of the carrying rail 398 so as to bring said pusher 434 to the left of the carrying rail 398 so as to bring said pusher 434 to the left of the line of matrices supported on rail 398. The free end of arm 440 is normally yieldingly held down by means of the spring 442 seen in Fig. 50, and of course when the cam 441 passes away from under the free end of arm 440 the pusher 434 will be forced to the right by the force of spring 442, and all the matrices on rail 398 will also be pushed to the right until the one farthest to the right contacts with the stops 443 and 444 arranged at the left hand end of the screws 430, 431 and 432 as best seen in Fig. 57. The stops 444 are arranged in the path of the lower ears of the matrices and the stops 443 are in the path of the upper ears of the matrices so that the matrix in contact with said stops is held in a perpendicular position while resting on the lower ledge 445 formed on the opposing sides of the side pieces 446 which may conveniently be continuations of the parts provided with the stops 443 and 444. The rail 433 terminates a short distance to the left of stops 443 and 444 and is provided on its right hand end with a vertical blade 446′ which takes into the grooves 447 provided in the matrices when said matrices are lifted

by the blade 448 seen in Fig. 57. The blade 448 is secured to a vertically sliding block 449 mounted in a suitable way in bracket 450 secured to an extension of frame 2. The block 449 is moved up and down by being connected by a connecting rod 451 to an eccentric 452 secured to the left hand end of screw 431. Referring to Figs. 55 and 56, the connecting rod 451 necessarily must be pivotally connected to the lifter 449 as is indicated at 449′; and in addition to this it is adjustably connected to the lifter by means of its lower end passing through a perforation and a set screw 451′ to secure it in any desired position. In operation as the screw 431 rotates the slide 449 will by means of its blade 448 contacting the bottom end of the matrix lift the matrix resting against the stops 443 and 444 so that it will be clear of said stops and will be pushed by the force of the pusher 434 to the right so that the upper ears of the matrix ride upon the inclined upper edge of the stops 443 and the threads of the screws 430, 431, and 432 will engage the two upper ears and the rear lower ear of the matrix and move said matrix to the right as the screws rotate. It will be understood that as long as any matrices remain on the rail 433 one matrix will be lifted into engagement with the screws 430, 431 and 432 each time the lifting blade 448 is raised by mechanism described. The inclined upper edge of the stops 443 serve to carry the matrices upward until they engage the tracks or ridges on rail 429, which tracks or ridges terminate at the proper places to allow the respective matrices to fall by gravity from said rail 429 into their respective storage chute of the storage magazine.

As clearly seen in Fig. 58, the screw 431 is driven by means of a gear 453 rigid with screw 431 and meshing with the gear 454 rigid with the segmental gear 455 which is driven by the segmental gear 456 rigidly mounted on shaft 457 on which is rigidly mounted the belt wheel 458 connected by belt 459 to the belt wheel 460 rigidly secured on the constantly rotating shaft 40. As clearly seen in Fig. 59, the gear 455 makes one revolution each time that the gear 456 makes one revolution but since the gear 456 is twice the diameter of gear 455 the latter will rotate twice as fast as the former and the former is provided with teeth only on one half of its periphery so that during one half of the revolution of gear 456 the gear 455 is stationary; suitable stop movement mechanism being provided on said gears, as seen in Figs. 1, 3, and 59. The screw 430 is driven by means of the gear 461 rigid with said screw 430 and meshing with the gear 462 rigid with the screw 431; the screw 432 is rotated by means of the gear 463 rigid with said screw 432 and meshing with the idler gear 464 which meshes with the gear 465 rigid with the screw 431. The gears connecting the three screws 430, 431 and 432 are of such size that all three screws will rotate in unison, and the gear 454 is one-half the diameter of gear 453, so that gear 453 and all these screws 430, 431 and 432 will only make a one-half revolution each time the gears 455 and 454 make a complete revolution. Thus it will be seen that all three screws 430, 431 and 432 rotate in unison intermittently, *i. e.*, they make a one-half revolution, then stop, then another half revolution and so on continually. Each time the said screws stop rotating each of the matrices being carried along on rail 429 by the screws will be stopped directly above one of the chutes of the storage magazine and if any of said matrices are at that moment at their proper storage chute they will fall vertically in the chute by gravity. The stopping of the matrices above their respective chutes permits them to drop in a vertical plane and thus avoids the necessity of widening the open upper end of each chute and thus increase the width of the machine. The upper end of the storage magazine is horizontal so that the screws 430, 431 and 432 are also arranged horizontally. In ordinary use certain characters are used a great deal more often than other characters, and therefore more matrices bearing some characters must be provided in the storage magazine than some bearing other characters and necessarily, all the matrices being of uniform length, some of the storage chutes must be longer than others. For convenience the longer chutes of the storage magazine are arranged at the left hand side and the shorter ones at the right hand side.

In Figs. 66 to 71, I have illustrated a modification of the line clamping mechanism by means of which it is possible to use matrices bearing two characters, one above the other; preferably both characters on the same bar are the same letter or figure but each of different class, as for instance, one plain and the other italic. The mechanism comprises the two stops 466 and 467 provided on the mold 248 against the one or the other of which the lower lugs on the character edges of the matrices are pressed when in a casting position. To determine which of the two stops, 466 or 467 shall be engaged by the said matrix lugs the block 468 mounted to rotate on a vertical axis in the upper end of the first elevator 212, is rotated to one or the other of its two positions. Secured rigidly in the block 468 are two stops 469 and 470, conveniently made in the form of screws for the purpose of adjustment arranged to contact with the upper surface of the frame 214 and thus stop the downward movement of the first elevator

and of course the assembled line of matrices. The stop 469 is of such length that it will cause the lower lugs of the matrices to contact with the stop 467 and bring the upper characters on the matrices to register with the mold slot as shown in Figs. 66, 67, and 68 and the stop 470 is of such length as to cause the lower lugs of the matrices to contact with the stop 466 and bring the lower characters on the matrices to register with the mold slot, as clearly seen in Figs. 69, 70 and 71.

The block 468 is provided with a handle 471 by means of which it can be turned and the block 468 is preferably normally held by the spring 472 in a position to have the stop 469 act on frame 214 with the handle 471 against the stop 473 as seen in Figs. 66, 67, and 68. When the block 468 is turned by the operator into the position shown in Figs. 69, 70 and 71 the spring catch 474 engaging the handle 471 retains the block 468 in such moved position against the tension of spring 472.

After the line is cast and the first elevator is lifted as described to its uppermost position the extension 475 secured to the frame 364 depresses the spring catch 474 and disengages it from the handle 471, whereupon the spring 472 will return the block 468 to its normal position with the handle 471 resting against stop 473. When a number of lines are to be cast in succession with the block 468 in the positions shown in Figs. 69, 70 and 71, the extension 475 may be swung out of the path of spring catch 474, about its pivot not shown, to avoid the necessity of moving the handle 471 before each casting operation.

In illustrating my invention, I have shown such constructions which at present are considered the most practical but it will be understood that various changes can be made in the details of construction without in the least departing from the spirit of the invention.

Having thus fully described my invention, what I claim is new and desire to secure by Letters Patent of the United States is:—

1. In a device of the class described a matrix storage magazine comprising a plurality of parallel vertical chutes to receive the matrices, escapement devices at the lower ends of said chutes and the bottom edge of the magazine arranged in right angular offsets or staggers to bring the said escapement devices in a plurality of groups in different horizontal planes.

2. In a device of the class described, a matrix storage magazine comprising a plurality of parallel vertical chutes to receive the matrices, escapement devices comprising pivoted members at the lower ends of said chutes, horizontally disposed rods passing through a plurality of said chutes to form the pivots of said escapement devices, and the bottom edge of said magazine arranged in right angular offsets to bring said escapement devices in a plurality of groups in different horizontal planes.

3. In a device of the class described, a matrix storage magazine comprising a plurality of parallel vertical chutes to receive the matrices, and escapement devices comprising a pivoted toggle and two pivoted pawls at the lower end of each chute, horizontally disposed rods passing through a plurality of said chutes to form the pivots of said toggle and two pawls in each chute and the bottom edge of said magazine arranged in right angular offsets to bring said escapement devices in a plurality of groups in different horizontal planes.

4. In a device of the class described, a matrix storage magazine comprising a plurality of chutes to receive the matrices, an escapement device for the matrices at the lower end of each chute comprising an upper pivoted pawl having its free end below the pivot and arranged to enter the path of the gravitating matrix in the chute so that the passing matrix will tend to force the end of the pawl out of the chute, and a lower pivoted pawl having its free end below the pivot and arranged to enter the path of the gravitating matrix in the chute so that the passing matrix will tend to force the end of the said pawl out of the chute and an extension on the lower pawl to engage the upper pawl so arranged that the pawls will alternately enter the path of the gravitating matrix.

5. In a device of the class described, a matrix storage magazine comprising a plurality of chutes to receive the matrices, and an escapement device at the lower end of each chute comprising an upper pivoted pawl, a lower pivoted pawl provided with an extension to engage the upper pawl and a toggle to normally retain the lower pawl in the path of the gravitating matrix, so arranged that only one pawl is in the path of the gravitating matrix at a time.

6. In a device of the class described, a fixed matrix distributing device, a fixed matrix assembling device below the said distributing device, a suitable vertically disposed frame fixedly connecting said distributing device and said assembling device, a matrix storage magazine removably secured in position between the distributing device and the assembling device, a plurality of forwardly extending posts on said frame, said storage magazine provided with means for securing the same removably to the forward ends of said posts, whereby the storage magazine can be removed from and replaced into position without disturbing any other part of the machine.

7. In a device of the class described, a keyboard comprising keys which when depressed will release the matrices from their stored position, a vertically sliding bar comprising two pieces detachably connected arranged at each key to be moved by the key, said vertically sliding bars arranged in a straight row and provided with notches in the same horizontal plane, and a locking bar arranged to be moved to enter the notches in said bars to lock the bars against movement.

8. In a device of the class described, a keyboard comprising a plurality of keys mounted to rock on horizontally disposed pivots which when depressed will release the matrices from their stored position, a vertically sliding bar comprising two pieces detachably connected end to end arranged at the rear end of each key to be moved thereby, plates above and below the keys to guide the vertically sliding bars, the vertically sliding bars arranged in a straight row and provided on their rear edges with notches in the same horizontal plane and a locking bar mounted to swing about a horizontal axis and arranged to be moved to enter the notches in said bars to lock the bars against movement.

9. In a device of the class described, an escapement device for releasing the matrices from their stored position comprising a housing formed of two walls spaced apart; three pivotal pins extending laterally through said housing, an upper pawl loosely mounted on one of said pins, a lower pawl loosely mounted on the second one of said pins and one member of a toggle loosely mounted on the third one of said pins and means for operating the toggle.

10. In a device of the class described, an escapement device for releasing the matrices from their stored position comprising a pivoted lower pawl provided with an extension near its pivot and an upper pivoted pawl arranged to be engaged by said extension on the lower pawl, so arranged that the weight of the gravitating matrix tends to move the pawls out of its path and that only one pawl is in the path of the gravitating matrix at a time and means comprising a toggle for normally holding the lower pawl in the path of the gravitating matrix and for actuating said pawl.

11. In a device of the class described, an escapement device for releasing the matrices from their stored position comprising a pivoted pawl and a toggle directly connected thereto, a keyboard comprising a plurality of keys, a vertically sliding bar comprising two parts connected end to end at each key arranged to be moved by the key and its upper end connected to said toggle, each of said vertically sliding bars provided with a notch in one edge arranged in a horizontal line, and a movable locking bar arranged to be moved into engagement with the notches in said bars to lock them against vertical movement.

12. In a device of the class described, means for storing spacebands, means for releasing the spacebands from their stored position comprising a vertically movable slide, a cam wheel; suitable levers operatively connecting said slide with said cam wheel, a constantly rotating shaft, said cam wheel loosely mounted on said shaft, a ratchet wheel mounted on said shaft adjacent the cam wheel, means comprising a pivoted pawl on the cam wheel for connecting the cam wheel to the ratchet wheel, a lever for normally holding said pawl out of contact with said ratchet wheel and means connecting said last named lever with a key on the keyboard, whereby the operation of the key causes a complete revolution of the cam wheel and lifts the slide to release one space-band.

13. In a device of the class described, means for assembling matrices comprising assembling rails between and onto which the matrices gravitate, a retarding finger in the path of the assembled matrices at the head end, a reciprocating finger to feed the matrices along on said rails at the rear end and means for yieldingly pushing the last named finger against the assembled line of matrices.

14. In a device of the class described, means for assembling matrices comprising assembling rails spaced apart between and onto which the matrices gravitate, a retarding finger ahead and in the path of the assembled matrices to be moved by the matrices, a reciprocating pusher finger behind the assembled matrices to push them along on the rails, means for yieldingly moving the last named finger against the assembled line of matrices and a door carrying a section of the rails on one side provided to give access to the assembled matrices.

15. In a device of the class described, means for assembling matrices comprising horizontal assembling rails between and onto which the matrices gravitate, a slide for transferring the assembled line from the assembling rails onto the first elevator, means for operating said slide, a retarding finger mounted on said slide in the path of the assembled matrices, a spring to constantly tend to move said retarding finger back against the assembled line of matrices, a frictional means to hold the retarding finger against movement under the tension of said spring, means for automatically withdrawing said frictional means from the retarding finger when the slide is returned after transferring the assembled line of matrices and a reciprocating push finger mounted on the slide to feed the matrices along on said assembling rails.

16. In a device of the class described,

means for assembling matrices comprising a pair of rails between and onto which the matrices gravitate, a bar mounted to slide in ways parallel to said assembling rails, a retarding finger secured to said bar and arranged in the path of the assembled matrices, an assembling finger to push the assembled matrices along the rails, a constantly rotating cam to operate said assembling finger and a spring interposed between the said cam and said assembling finger whereby the assembling finger is moved against the assembled matrices by a yielding push.

17. In a device of the class described, means for assembling matrices comprising a pair of horizontal assembling rails spaced apart between and onto which the matrices gravitate, a frame mounted to slide in ways parallel to said rails, a retarding finger in the path of the assembled matrices slidably mounted in ways on said frame parallel to said rails, a reciprocating assembling finger pivotally mounted on said frame arranged to push the matrices along on said rails, means to move said frame and means for reciprocating said finger.

18. In a device of the class described, means for assembling matrices and transferring the assembled line comprising a pair of horizontal assembling rails spaced apart between and onto which the matrices gravitate, an assembling finger mounted to reciprocate to push the matrices along on the assembling rails and later to move bodily to push the whole assembled line off of said rails.

19. In a device of the class described, means for assembling matrices and transferring the assembled line comprising a pair of horizontal assembling rails spaced apart between and onto which the matrices gravitate, a suitable sliding frame mounted in ways parallel to said rails, a reciprocating matrix assembling finger pivotally mounted on said frame to push the matrices along on said rails and transfer the complete assembled line, and means for reciprocating said assembling finger comprising a constantly rotating shaft mounted on a stationary frame.

20. In a device of the class described, means for assembling matrices and transferring the assembled line comprising an assembling finger mounted pivotally to reciprocate and mounted slidably to move parallel to said rails to assemble the matrices and to transfer the assembled line.

21. In a device of the class described, assembling mechanism for the matrices, an elevator to receive the assembled line from the assembling mechanism, means for transferring the assembled line of matrices from the assembling mechanism to the elevator and means comprising a vertically moving latch whereby the said transferring mechanism is automatically locked against operation when the assembled line is over set or too long.

22. In a device of the class described, assembling mechanism for the matrices, an elevator arranged to travel down and up in suitable ways, means for transferring the assembled line of matrices from the assembling mechanism onto said elevator and stopping means comprising a rock shaft whereby the assembled line is prevented from being moved out of the assembling mechanism when the elevator is not in a position to receive said assembled line.

23. In a device of the class described, line assembling mechanism, an elevator to lower and raise the assembled line, means for transferring the assembled line from the assembling mechanism to said elevator and locking mechanism comprising a rock shaft whereby the said transferring means is prevented from returning to its normal position until the elevator with the assembled line has been lowered out of the path of said transferring means.

24. In a device of the class described, the combination with matrix-assembling means and casting mechanism, of a suitable frame; an elevator for lowering and raising the assembled line, a suitable transfer to move the assembled line from the assembler to said elevator, means for moving the elevator, means for moving the transfer, and a pivoted latch on the frame to retain the transfer in its moved position.

25. In a device of the class described, the combination with matrix-assembling means and casting mechanism, of an elevator for lowering and raising the assembled line of matrices comprising a vertically sliding frame provided with a pair of spaced carrying rails, means for moving said frame, a second frame, on which the first named frame is mounted, mounted to swing on a horizontal pivot and means comprising a handled screw for normally holding said second named frame stationary.

26. In a device of the class described, the combination with matrix-assembling means and casting mechanism, of an elevator for lowering and raising the assembled line of matrices comprising a vertically sliding frame provided with a pair of spaced carrying rails, means for moving said frame, a second frame, normally held stationary and on which said first named frame is mounted, mounted to swing on a horizontal pivot and a link provided with a plurality of notches pivotally connected to said second named frame to serve as a stop when swinging said second named frame on its pivot.

27. In a device of the class described, the combination with matrix-assembling means

and casting mechanism of a suitable frame; an elevator for lowering and raising the assembled line, of matrices comprising a vertically sliding frame provided with a pair of spaced carrying rails, a suitable transfer for moving the assembled line onto the elevator and means for retaining the said transfer in its moved position comprising an extension on the transfer and a pivoted catch mounted on the frame.

28. In a device of the class described, the combination of matrix assembling means and casting mechanism of an elevator for lowering and raising the assembled line of matrices comprising a vertically sliding frame provided with a pair of spaced supporting rails, a sliding pusher for pushing the assembled line of matrices off of the elevator when in its uppermost position, yielding means for operating said pusher and means comprising a cam to engage said pusher and lock it against movement by said yielding means so that the assembled line of matrices remain on the elevator and in position to cast a duplicate barotype.

29. In a device of the class described, means for separating the matrices and the spacebands in the assembled line comprising a pair of spaced plates provided with grooves in their opposing sides to receive the ears on the space-bands and mounted to swing on a horizontal axis to an inclined position, a lifting rail provided with combination grooves to receive the combination lugs on the matrices and means for operating said rail and said plates.

30. In a device of the class described, means for separating the matrices from the space-bands in the assembled line comprising a matrix elevator a pivoted space-band hopper comprising a pair of spaced plates provided with grooves in their opposing sides and mounted to swing on concentric horizontal pivots, means for yieldingly holding said hopper up in an inclined position, yielding means on the said elevator for depressing said hopper to a horizontal position and means for operating said elevator.

31. In a device of the class described, a pivoted hopper for separating the space-bands from the matrices in the assembled line comprising a pair of spaced plates provided with grooves on their opposing sides and mounted to swing on concentric horizontal pivots and means for normally yieldingly holding said plates up in an inclined position.

32. In a device of the class described, the combination with means for moving the matrices to the assembled position, of means for clamping the assembled line of matrices in the casting position comprising a movable jaw at each end of the line, means in connection with one jaw comprising a toggle for moving the jaw to a certain fixed position in clamping the line and means in connection with the other jaw for moving it yieldingly against the line of matrices.

In testimony whereof I have hereunto signed my name in the presence of two subscribing witnesses this 11th day of March, 1913, at Chicago, Illinois.

HERBERT E. BROWN.

Witnesses:
R. J. JACKER,
H. MOGILL.