No. 614,230.

Patented Nov. 15, 1898.

O. MERGENTHALER.

LINOTYPE MACHINE.

(Application filed May 5, 1891.)

(No Model.)

14 Sheets—Sheet 1.

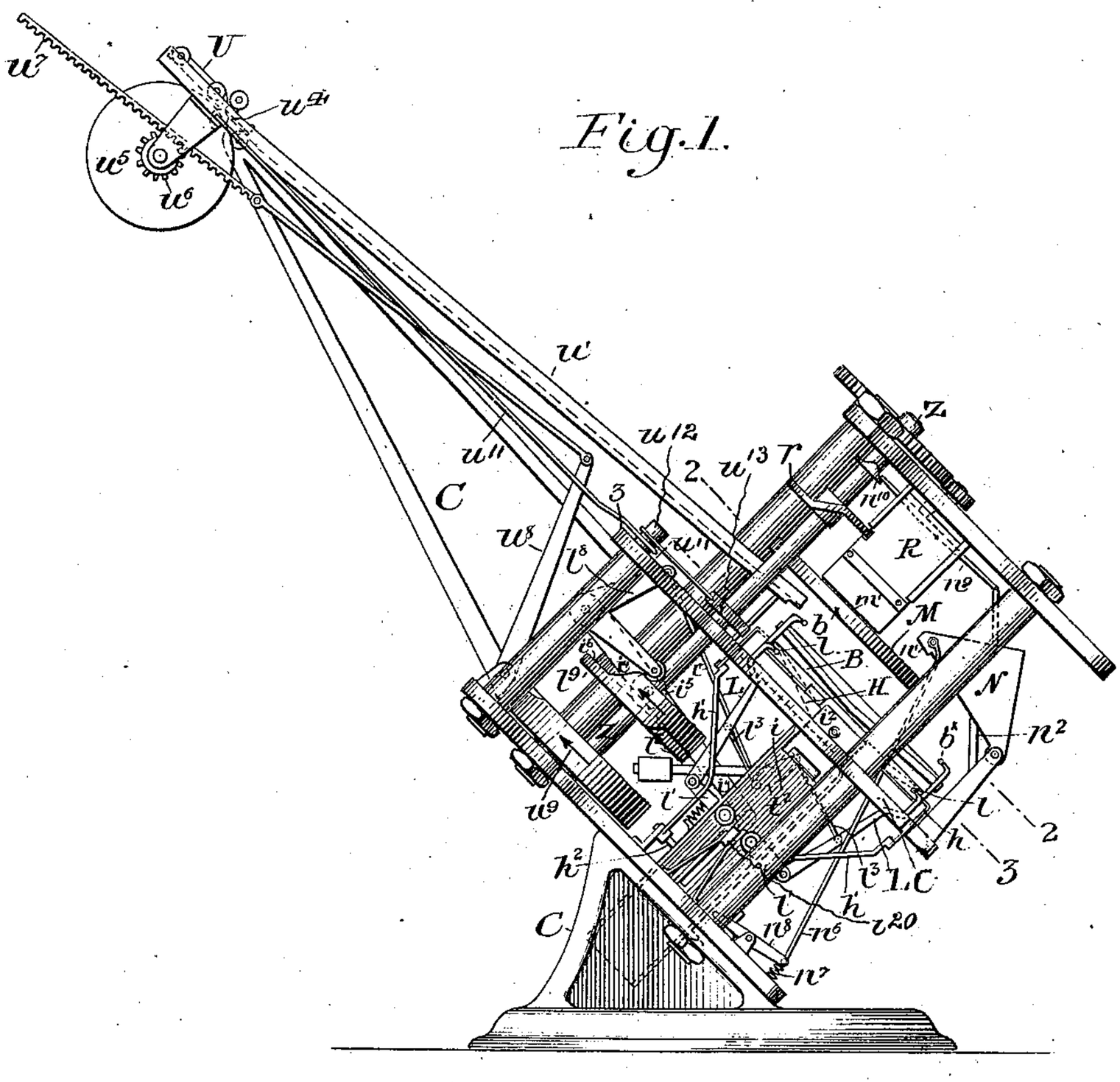

Fig. 1.

Witnesses:
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A. M. E. Kennedy.

Inventor:
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By O. T. Dodge Atty

No. 614,230. Patented Nov. 15, 1898.

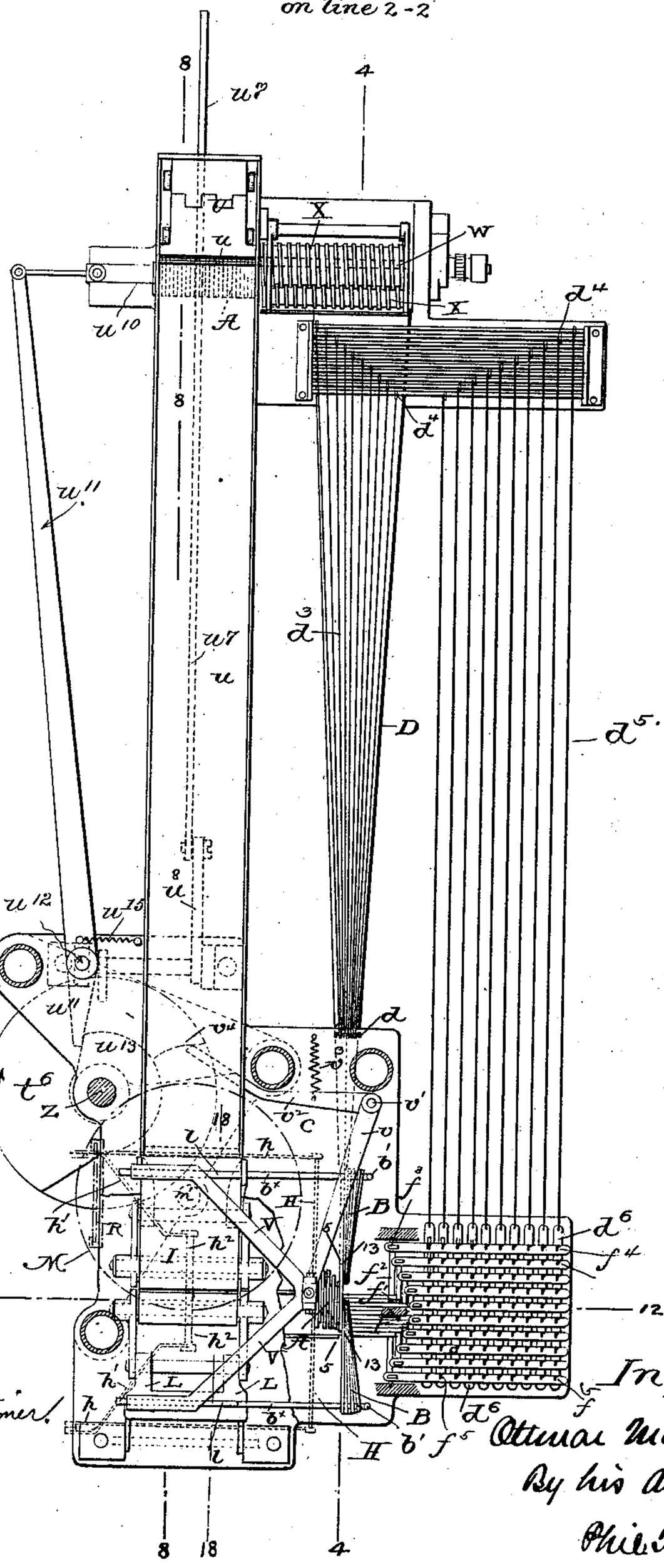
O. MERGENTHALER.

LINOTYPE MACHINE.

(Application filed May 5, 1891.)

(No Model.) 14 Sheets—Sheet 2.

Fig. 2.
on line 2-2



Witnesses:
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No. 614,230. Patented Nov. 15, 1898.

O. MERGENTHALER.

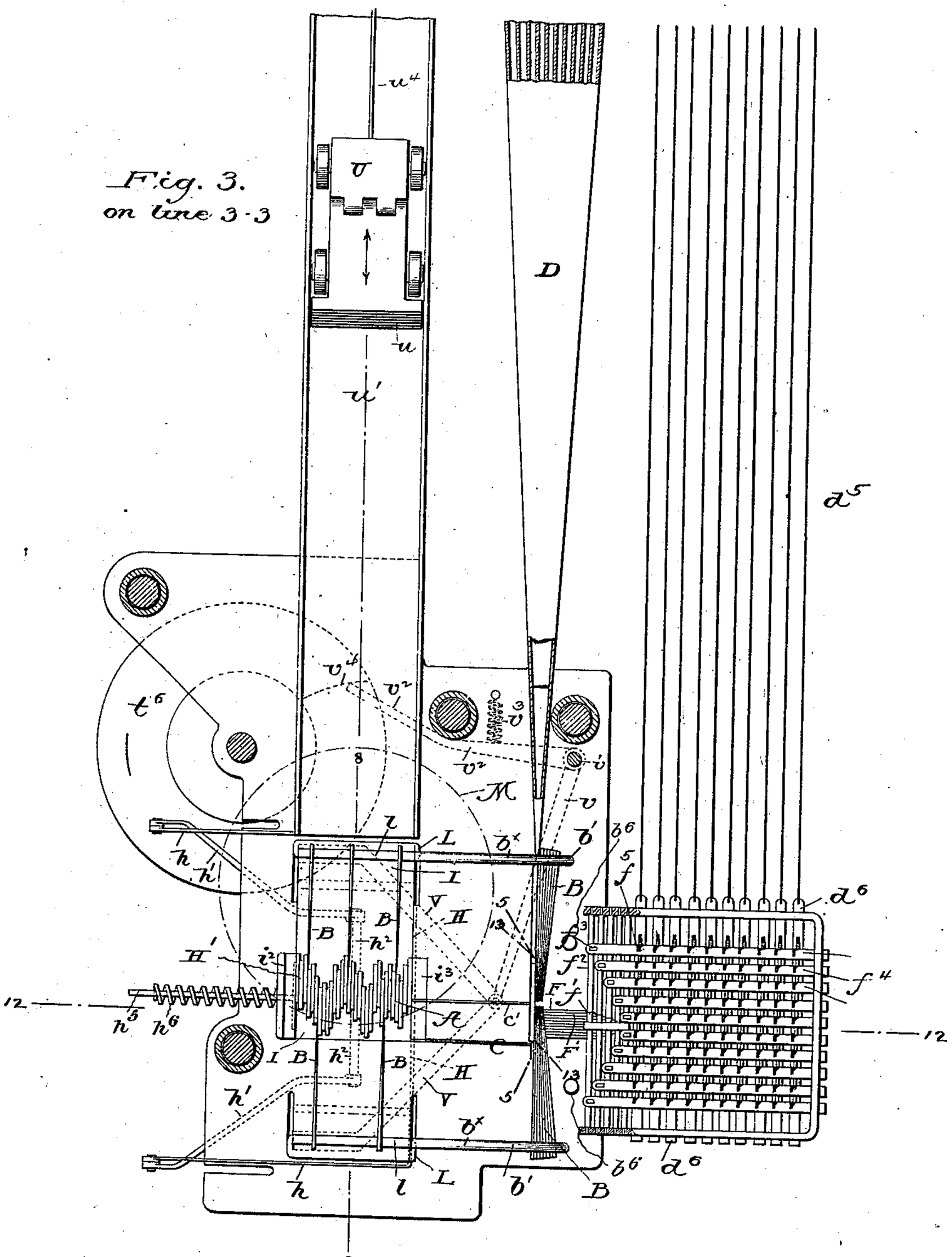
LINOTYPE MACHINE.

(Application filed May 5, 1891.)

(No Model.)

14 Sheets—Sheet 3.

Fig. 3.
on line 3-3



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LINOTYPE MACHINE.

(Application filed May 5, 1891.)

(No Model.)

14 Sheets—Sheet 4.

Fig. 4.
on line 4-4

Fig. 5.
on line 5-5

Fig. 6.

Fig. 7.

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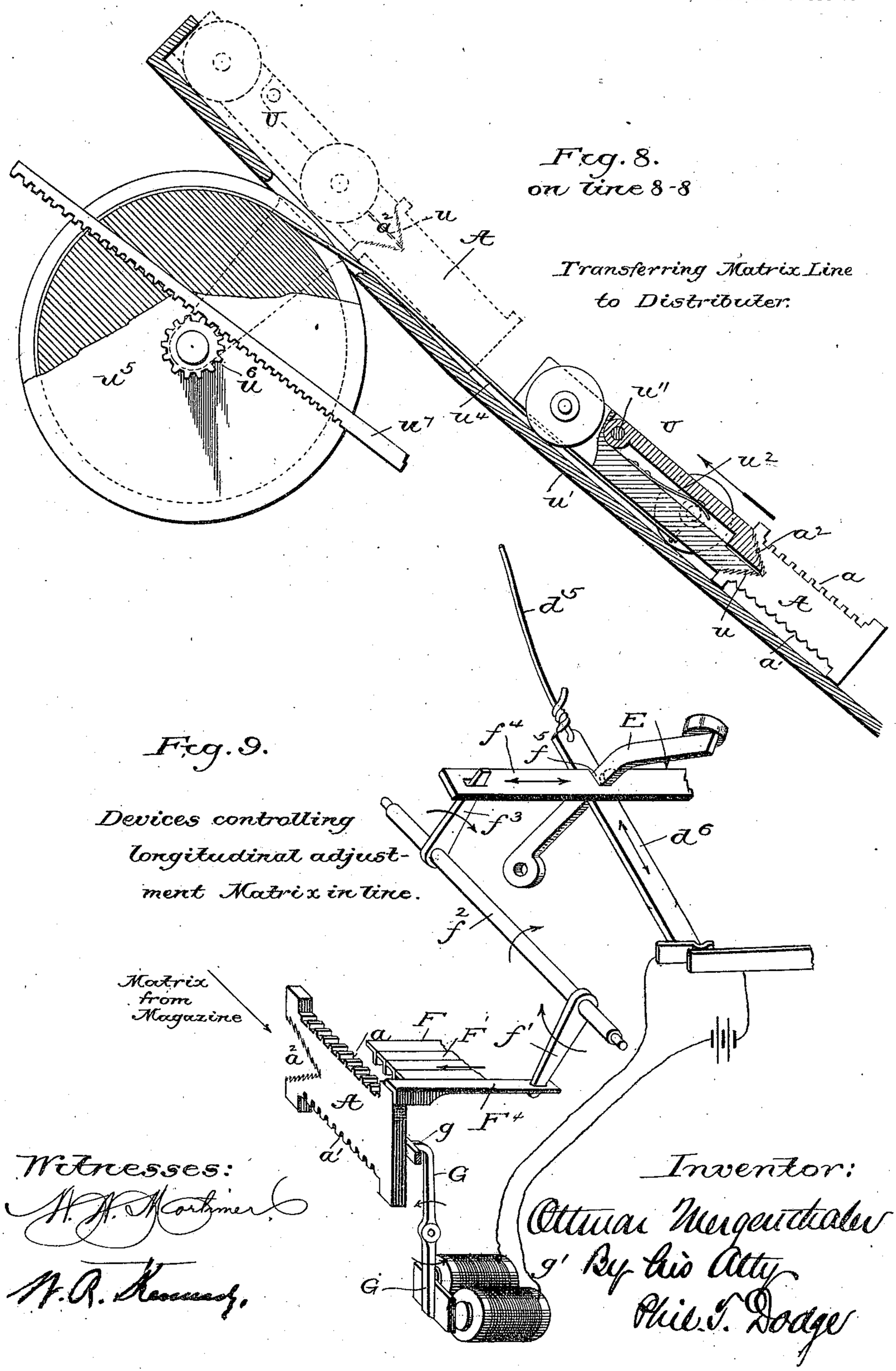
(Application filed May 5, 1891.)

(No Model.)

14 Sheets—Sheet 5.



Witnesses:
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O. MERGENTHALER.

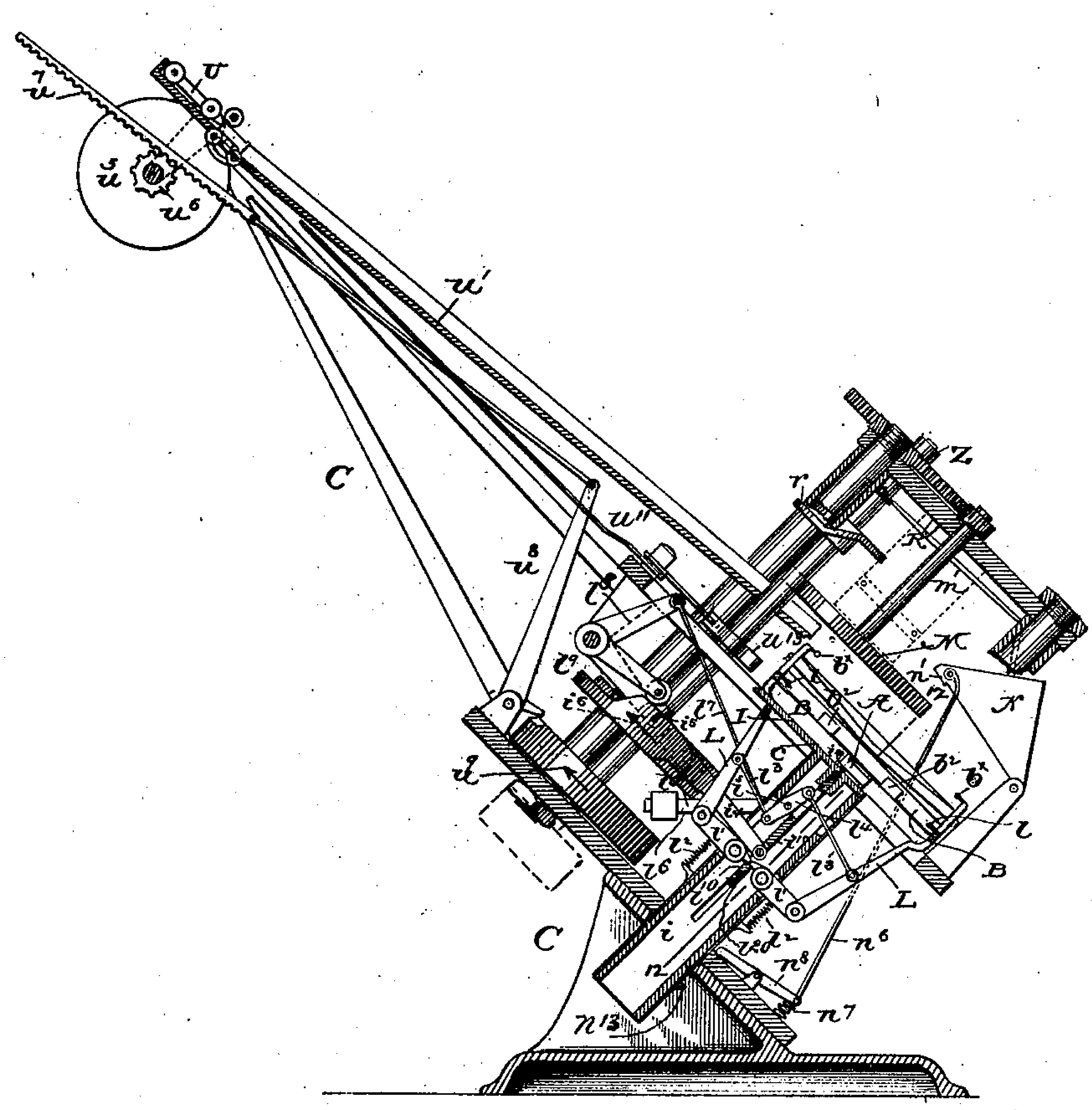
LINOTYPE MACHINE.

(Application filed May 5, 1891.)

(No Model.)

14 Sheets—Sheet 6.

Fig. 10.
on line 8–8



Witnesses:
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O. MERGENTHALER.

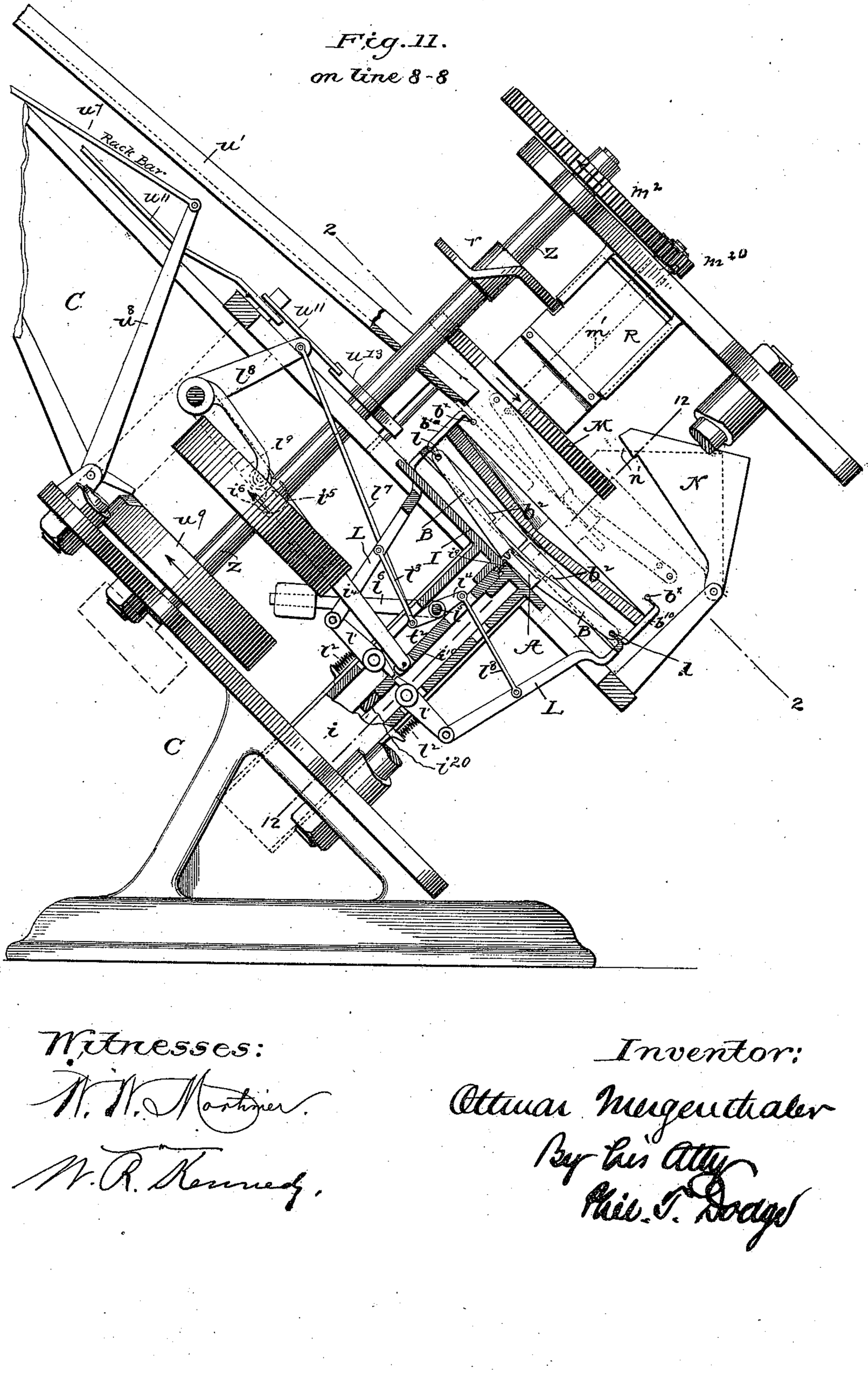
LINOTYPE MACHINE.

(Application filed May 5, 1891.)

(No Model.) 14 Sheets—Sheet 7.

Fig. 11.

on line 8-8



Witnesses:

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No. 614,230. Patented Nov. 15, 1898.

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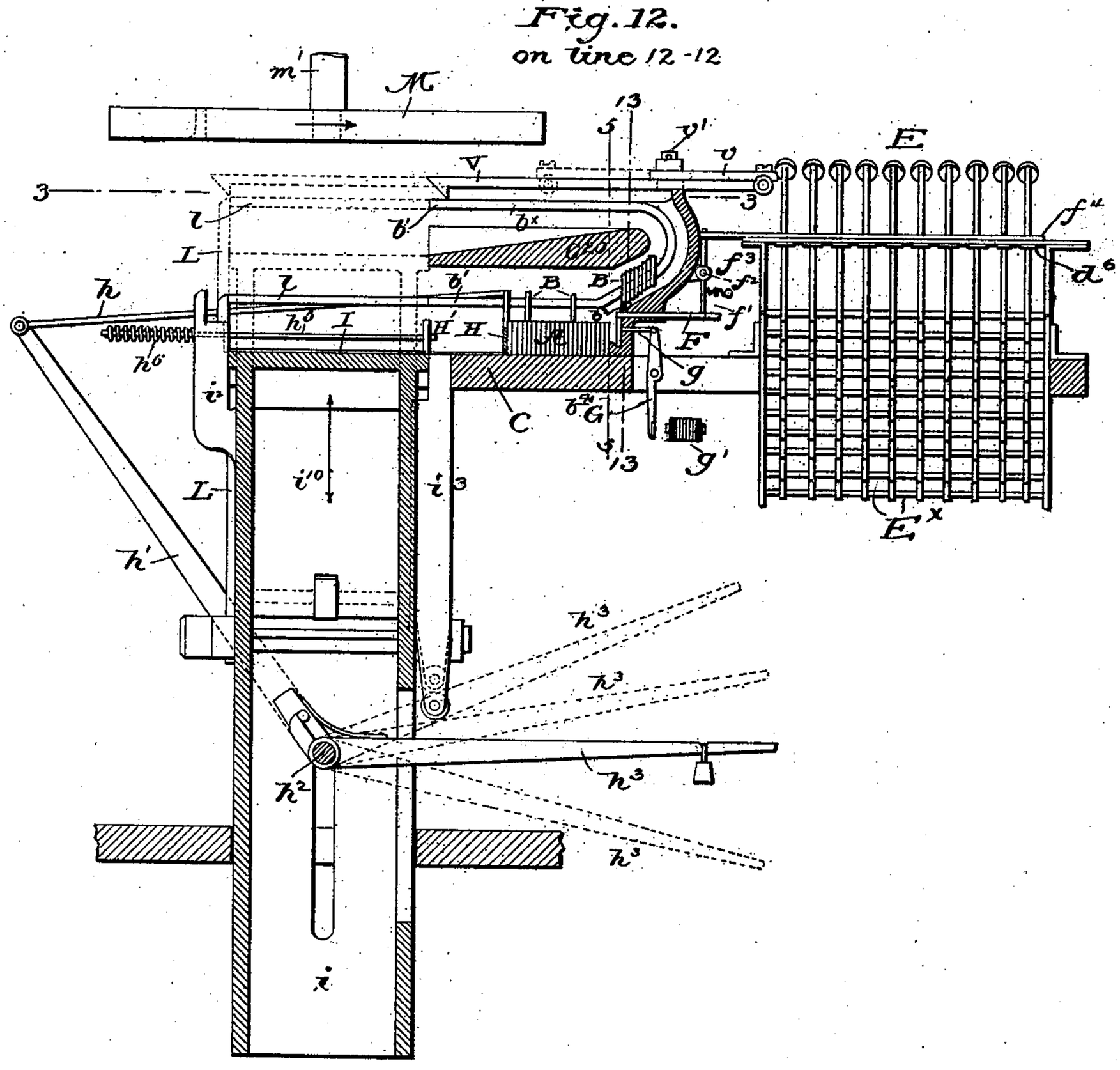
LINOTYPE MACHINE.

(Application filed May 5, 1891.)

(No Model.) 14 Sheets—Sheet 8.

Fig. 12.

on line 12-12



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O. MERGENTHALER.

LINOTYPE MACHINE.

(Application filed May 5, 1891.)

(No Model.)

14 Sheets—Sheet 9.

Fig. 12ª
on line 12-12

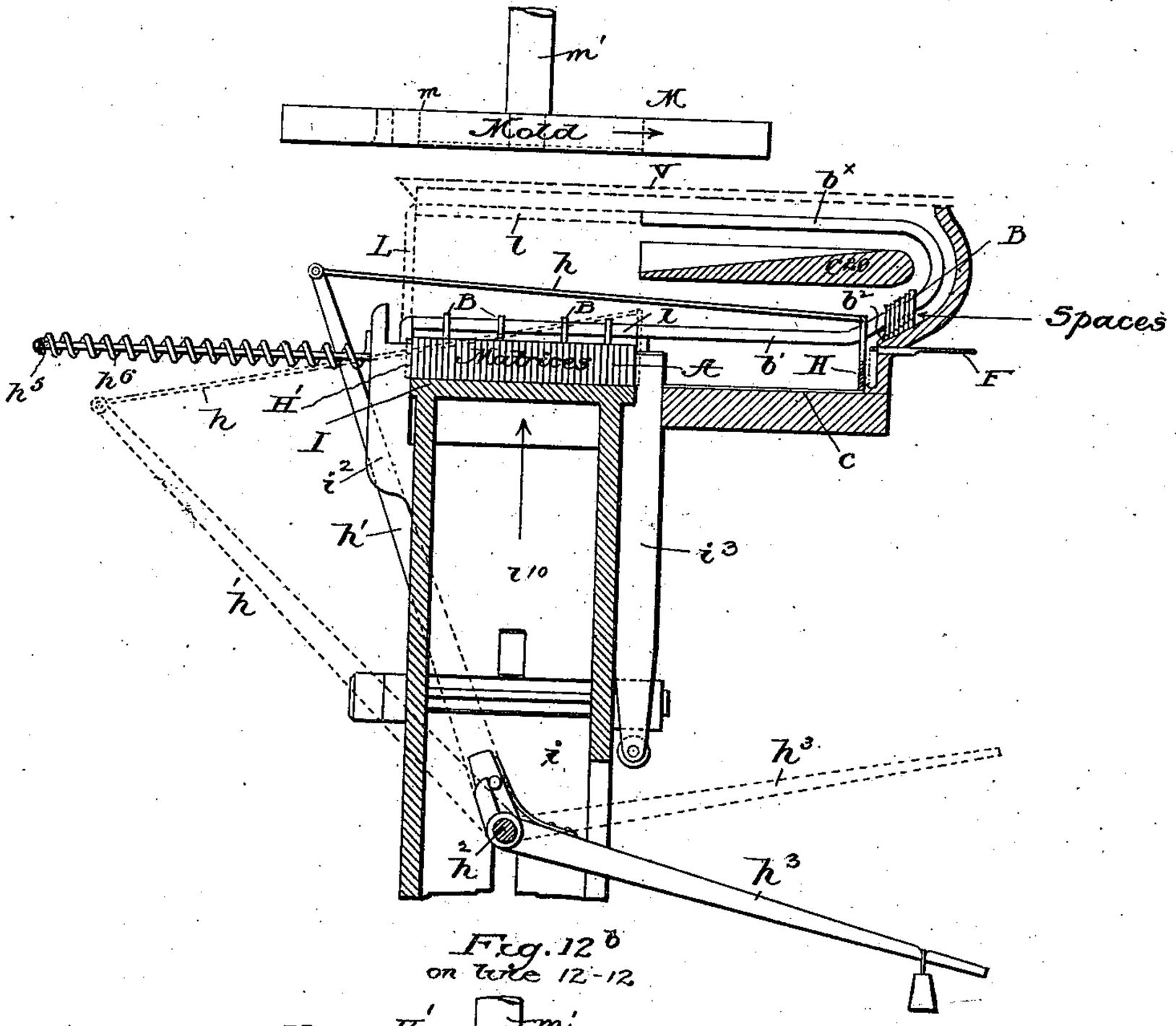
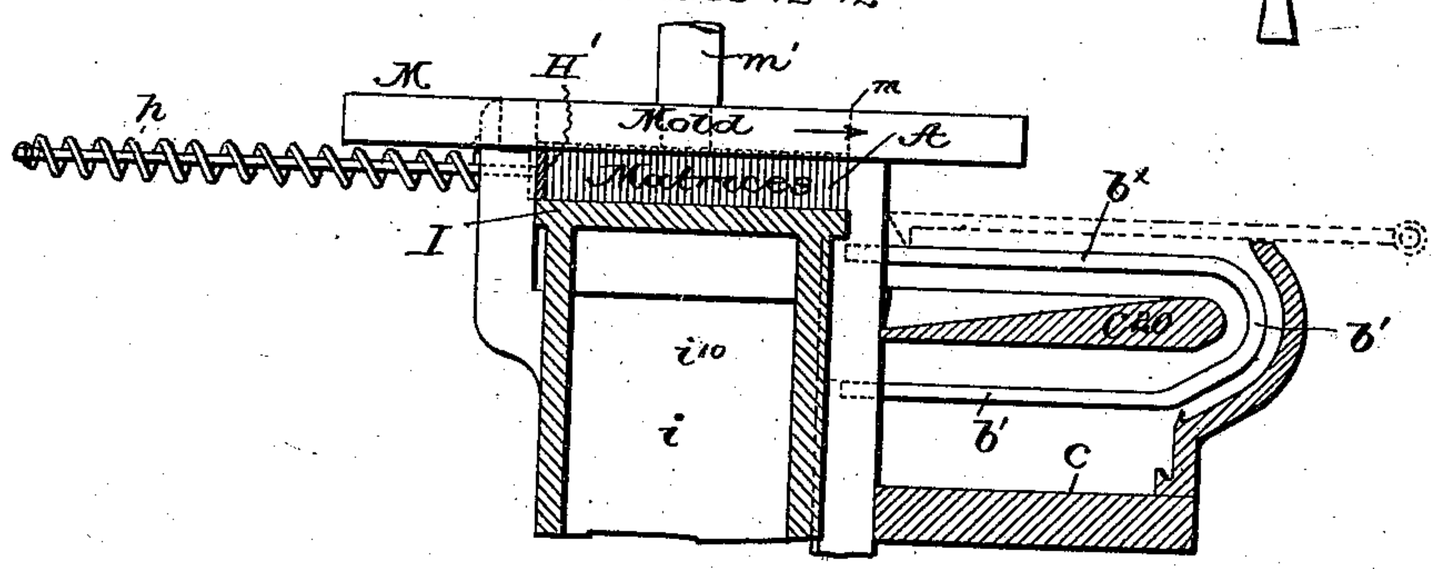


Fig. 12ᵇ
on line 12-12.



Witnesses:
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LINOTYPE MACHINE.

(Application filed May 5, 1891.)

(No Model.)

14 Sheets—Sheet 10.

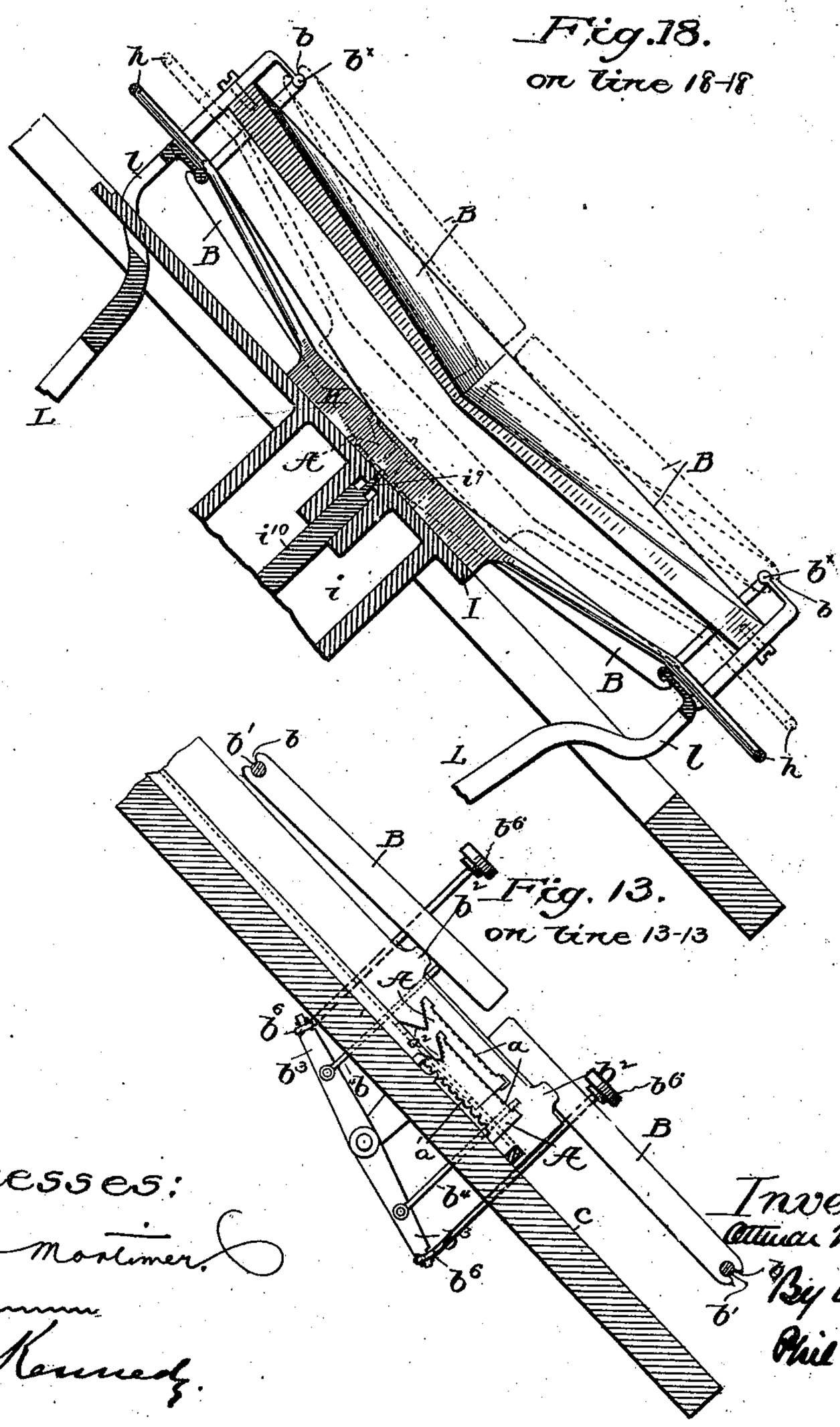

Fig. 18.
on line 18-18

Fig. 13.
on line 13-13

Witnesses:
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Patented Nov. 15, 1898.

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LINOTYPE MACHINE.

(Application filed May 5, 1891.)

(No Model.)

14 Sheets—Sheet 11.

Fig 14ª

Fig. 14.

on line 8-8

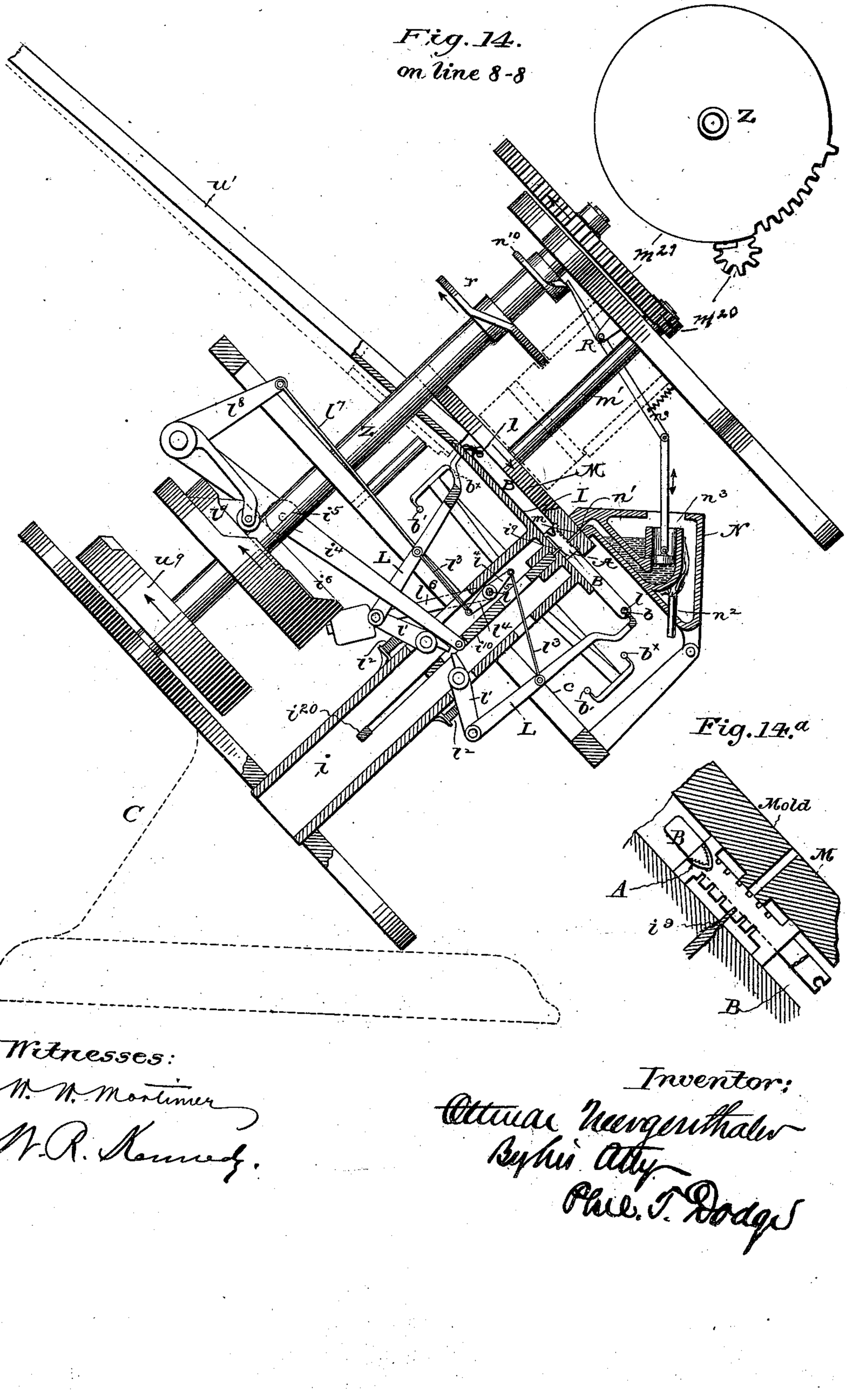

Fig. 14ª

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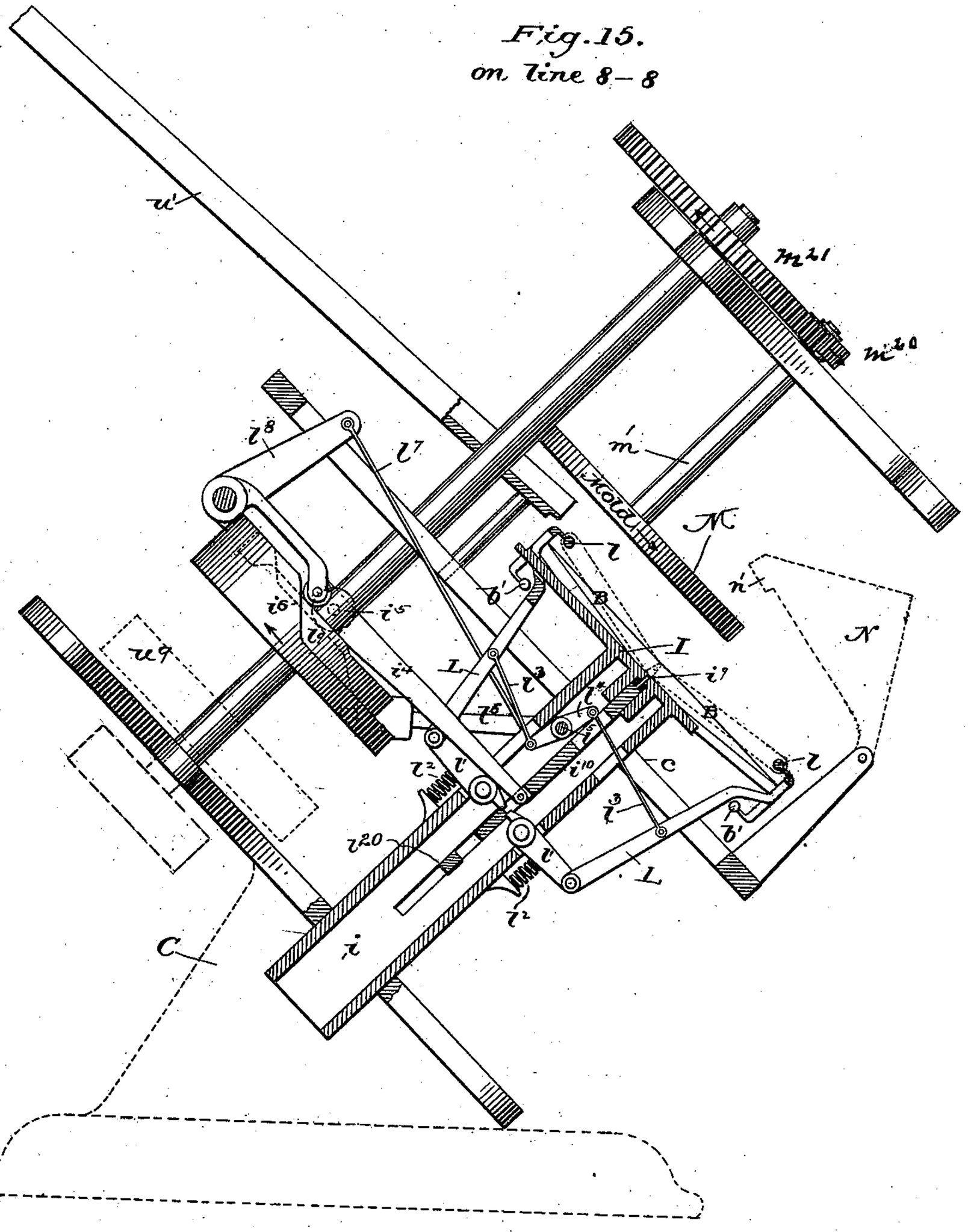
LINOTYPE MACHINE.

(Application filed May 5, 1891.)

(No Model.)

14 Sheets—Sheet 12.

Fig. 15.
on line 8—8



Witnesses:

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No. 614,230. Patented Nov. 15, 1898.

O. MERGENTHALER.

LINOTYPE MACHINE.

(Application filed May 5, 1891.)

(No Model.)

14 Sheets—Sheet 13.

Fig. 16.

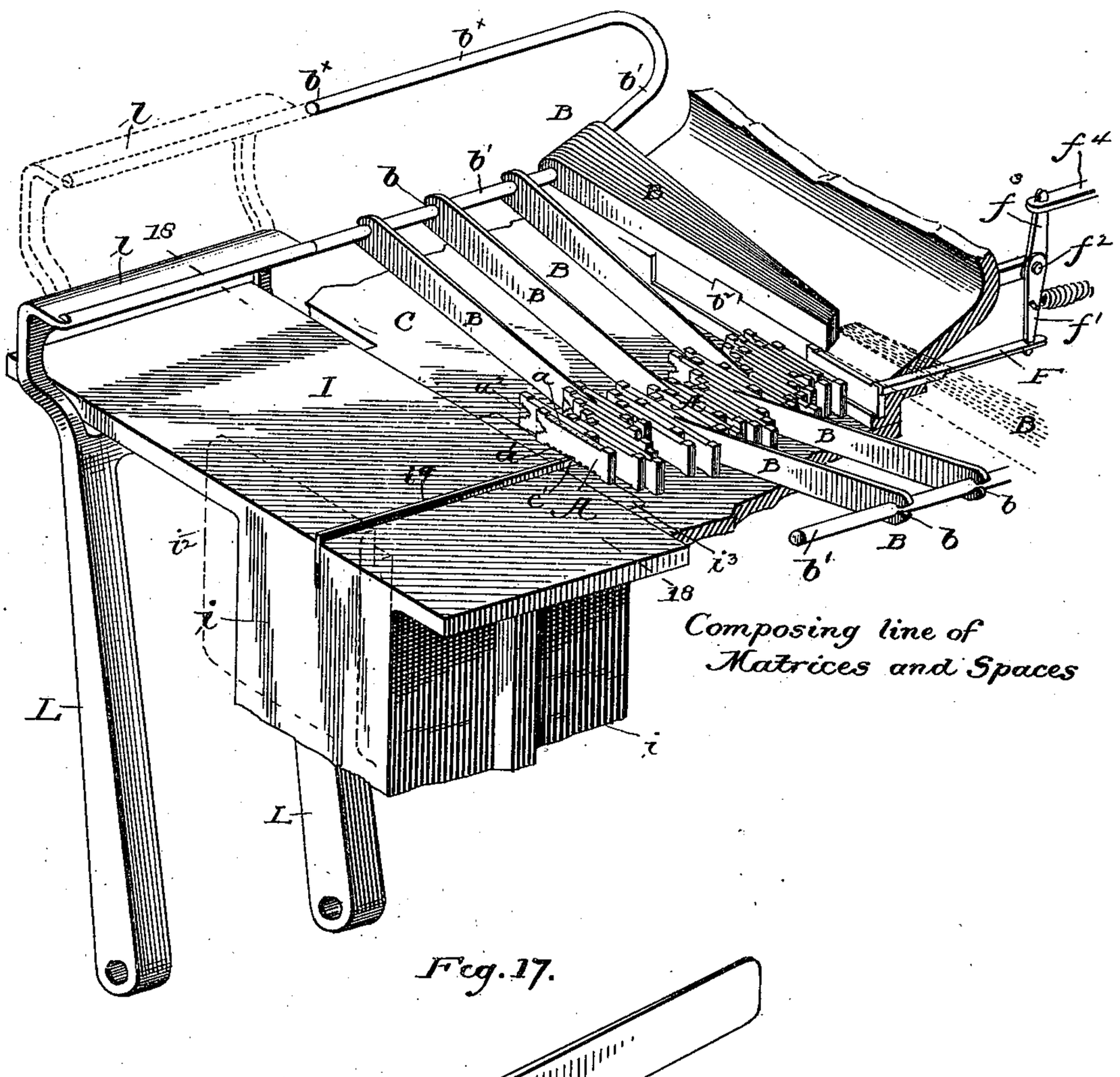
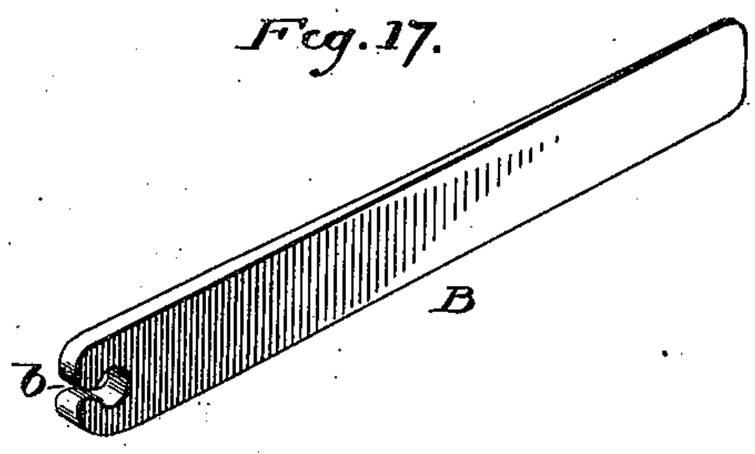


Fig. 17.



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Patented Nov. 15, 1898.

O. MERGENTHALER.

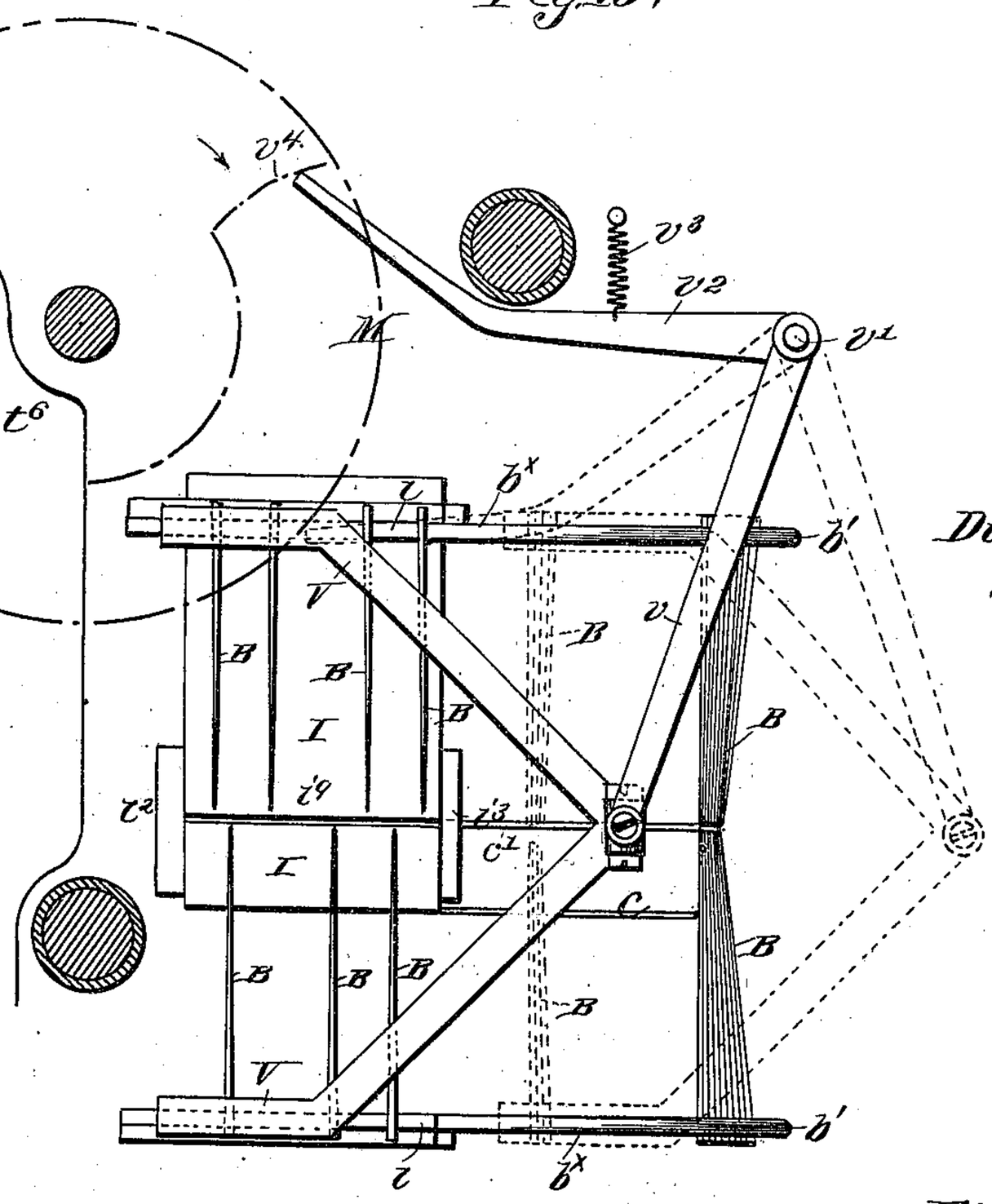
LINOTYPE MACHINE.

(Application filed May 5, 1891.)

(No Model.)

14 Sheets—Sheet 14.

Fig. 19.



Distribution of Spaces after use.

Fig. 21.

LINOTYPE

Product of machine.

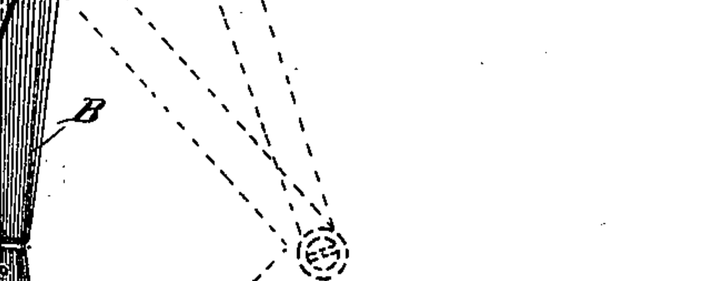
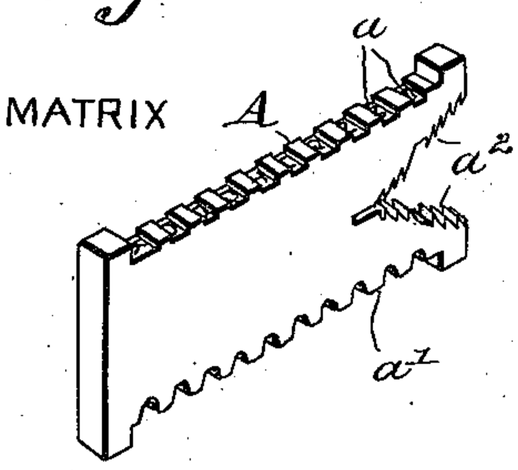


Fig. 20.



Witnesses:
G. L. Elmore.
A. M. E. Kennedy.

Inventor:
Ottmar Mergenthaler
By P. T. Dodge Atty.

UNITED STATES PATENT OFFICE.

OTTMAR MERGENTHALER, OF BALTIMORE, MARYLAND, ASSIGNOR, BY MESNE ASSIGNMENTS, TO THE MERGENTHALER LINOTYPE COMPANY, OF NEW JERSEY.

LINOTYPE-MACHINE.

SPECIFICATION forming part of Letters Patent No. 614,230, dated November 15, 1898.

Application filed May 5, 1891. Serial No. 391,702. (No model.)

To all whom it may concern:

Be it known that I, OTTMAR MERGENTHALER, of Baltimore, in the State of Maryland, have invented a new and useful Improvement in Linotype-Machines, of which the following is a specification.

This invention relates to that class of machines which, being actuated by finger-keys representing characters and spaces, produce and assemble ready for use linotypes or type-bars, each having the type characters to print an entire line. The type surfaces or forms thus created as demanded are used in the same manner as forms composed of the usual single-letter type, and being once used are returned to the melting-pot.

Like those represented in the various patents heretofore granted to me the present machine consists, essentially, of a series of matrices and spaces, mechanisms by which they are selected and assembled in line, the line presented against the open side of a mold to close the same, the mold supplied with molten metal to form the linotype bearing the characters of the opposing matrices, and, finally, the linotype delivered and the matrices and spaces returned to the magazines or holders from which they started.

The matrices of the present machine are each provided with several independent characters less than the number represented by the keyboard, so that by adjusting the matrix endwise in the composed line one or another of its characters may be brought into operative position in the same general manner as in my application, Serial No. 375,632, filed December 23, 1890.

The present machine is distinguishable from those of my earlier patents in that the matrices have a twofold movement—first, that of traveling or being transported successively from the magazine or place of storage bodily to a common assembling or composing point, where they are assembled side by side in line, and, second, that of longitudinal adjustment in relation to each other in the composed line. The first action brings together in line matrices which contain the required characters, while the second brings the special characters demanded, one on each matrix, into a common line for presentation to the mold.

The invention has reference to various improvements in the composing, spacing or justifying, casting, and distributing mechanisms and in the general organization of the machine.

In the accompanying drawings, Figure 1 is a side elevation of the machine. Fig. 2 is a top plan view of the same, with the upper portion broken away, on the line 2 2 of Fig. 1. Fig. 3 is a section on the line 3 3 of Figs. 1 and 12, looking in a downward direction. Fig. 4 is a vertical section through the upper end of the magazine on the line 4 4 of Fig. 2. Fig. 5 is a vertical section on the line 5 5 of Figs. 2, 3, and 12. Figs. 6 and 7 are plan views of mechanism for determining the longitudinal adjustment of the individual matrices in the line. Fig. 8 is a vertical section through the upper end of the magazine on the line 8 8 of Fig. 2 and with the matrix-lifting carriage in an elevated position. Fig. 9 is a perspective view of one of the finger-keys and its connections, showing the manner in which the key acts to select a matrix and also to determine its longitudinal position in the line. Fig. 10 is a vertical section through the entire length of the machine on the line 8 8 of Figs. 2 and 3. Fig. 11 is a vertical section, on a larger scale, through the lower part of the machine on the line 8 8. Fig. 12 is a transverse section on the line 12 12 of Figs. 2, 3, 10, and 11. Figs. 12^a and 12^b are views similar to Fig. 12, but with the parts in different positions. Fig. 13 is a transverse section on the line 13 13 of Figs. 2, 3, and 12. Figs. 14 and 15 are views on the same line as Fig. 11, but with the parts in different positions. Fig. 14^a is a view on the same line as Fig. 14, but on a larger scale, showing the relative width of the matrices and spacing-wedges and the relations they bear to the mold and alining-blade during the casting action. Fig. 14^b is a diagrammatic view of the gears for operating the mold. Fig. 16 is a perspective view showing in outline the arrangement and operation of the assembling and justifying devices. Fig. 17 is a perspective view of one of the justifying-wedges. Fig. 18 is a vertical cross-section on the line 18 18 of Fig. 16. Fig. 19 is a top plan view showing the mechanism for distributing the spacing-wedges or restoring them to their

original positions. Fig. 20 is a perspective view of one of the matrices. Fig. 21 is a perspective view of one of the linotypes the product of the machine.

As the basis of my machine I provide a series of matrices A, such as shown in Fig. 20, each consisting of a plate of brass or like material bearing in one edge a number of letters or characters a, and having in the opposite edge a corresponding number of aligning-notches a', and in one end a notch with distributing-teeth a^2 in its edges. Each matrix is made of a thickness corresponding with the width of the characters borne in its edge, characters of the same or practically the same width being grouped on the same matrix. There will be a sufficient number and variety of matrices to carry all the characters to be printed, and of each matrix there will be a number of duplicates. A matrix bearing any given group of characters differs as to the number or relation of its teeth a^2 from a matrix bearing any other group, so that the teeth may coöperate with a distributer-rail, and thus direct the matrices to their appropriate magazine-channels after the manner fully set forth in Letters Patent of the United States granted to me on the 16th day of August, 1886, No. 347,629. I also provide for use in connection with the matrices a series of spacing-wedges B, such as shown in Fig. 17, each consisting of a thin tapered bar of steel having a notch b in one end. These wedges are to be thrust into the assembled lines of matrices at suitable points for the purposes of producing spaces between the words, expanding or justifying the line to the predetermined length, and aiding the matrices to close the mold, so as to confine the molten metal during the casting operation.

The first part of the machine proper is the composing mechanism, designed to select in proper order the matrices bearing the designated characters and spaces and assemble them in line side by side, at the same time adjusting the matrices endwise in relation to each other, so that the designated characters, one on each matrix, will stand in a common line.

The second part of the machine comprises mechanism for transferring the assembled line of matrices and spaces to the front of the mold, that it may be closed thereby, and advancing the spaces to justify the line.

The third part comprises the mold and means for supplying the molten metal thereto and for delivering the linotypes.

The fourth part is the distributing mechanism intended to return the assembled matrices and spaces to their magazines or storage-places after each linotype is cast.

Passing now to the details of the machine, attention is directed mainly to Figs. 1, 2, 3, and 4, in which C represents a rigid main frame to be made of any form adapted to sustain the operative parts. In the present instance the frame consists of parallel plates spaced apart by connecting posts or pillars, as shown in Figs. 1, 2, and 3, but omitted to some extent in the other figures in order to expose more clearly the operative parts.

D, Fig. 2, is a stationary inclined magazine having a series of channels to contain the assorted matrices. These channels converge toward their lower ends and deliver through a common mouth or channel, so that as the matrices bearing the designated characters are released they descend one after another to the same point to be added to the end of the line in course of composition. Each channel is provided, as shown in Fig. 4, with an escapement, which may be of any suitable form, but which, as shown, consists of a lever d, pivoted at d', and carrying two pins d^2, which, as the lever is rocked, alternately enter the top of the channel, so that one matrix at a time is released and permitted to descend to the place of composition. Each escapement-lever is connected by a wire d^3, lever d^4, and wire d^5 with a bar d^6, Fig. 2, arranged to slide upward and downward in the frame.

Through each of the sliding bars d^6 there is extended loosely a series of finger-keys E, Sheet 4 and Fig. 9, arranged in a vertical row and equal in number to the characters on one matrix. These keys are pivoted at their rear ends on horizontal rods $E^\times$, mounted loosely in the main frame, as shown in Figs. 4 and 12. Each key represents one of the characters, and on operating either one of the keys in the same vertical row one and the same matrix will be discharged from the magazine. The several keys are used to release the same matrix in order that they may respectively, through devices presently to be described, act to stop the descending matrix at different points, so as to bring one or another of its characters as demanded in operative position in the composed line.

It will be noticed that there are as many vertical rows of keys as there are escapements and magazine-channels and that the keys are also arranged in horizontal rows equal in number to the characters on the individual matrices.

The mechanism for arresting the descending matrices in different positions is shown in Figs. 2, 3, 5, 6, 7, 8, and 9, in which F F', &c., are horizontal slides mounted in the frame, so that they may be advanced one at a time into the path of the matrix, as in Figs. 7 and 9, to stop it in one position or another, according to the character to be used. Each slide is connected to an arm f' on a rock-shaft f^2, carrying a second arm f^3, which engages a plate f^4, arranged to slide beneath all the keys in a horizontal row and provided with an inclined notch f^5 under each key, so that when a key is depressed to discharge a matrix it will at the same time move the bar f^4 endwise, and thereby project the appropriate stop-slide F to check the matrix, with the character represented by the key, at the desired point. All the keys in each horizon-

tal row actuate the same stop-slide, so that although they deliver matrices from different channels bearing different characters they bring into line characters bearing like positions on the matrices. In other words, all the keys in the upper horizontal row will stop the matrices with their lowermost characters at the alining-point, while the keys in the second horizontal row will bring the second matrix characters into action, and so on throughout the series. Thus it is that I am enabled to employ matrices each bearing a number of characters and to bring the characters selected, one on each matrix, into alinement, so that the machine is enabled to produce a large number of characters by the use of a small number of matrices and channels,

The matrix-arresting slides or stops F F', &c., are preferably constructed, as shown in Figs. 5 and 9, with lips F^5 to override the lower ends of the matrices as the latter are arrested in their movement, and each slide is subjected to the action of a spiral depressing-spring F^6, as shown in Fig. 5. These springs act to urge the slides down with moderate frictional effect on the matrix as it rides under the lip of the slide, the effect being to check the momentum of the matrix with an easy action and to prevent it from rebounding. As the matrices are arrested one after another the resulting line is sustained upon the bed-plate *c*, forming part of the main frame, which bed-plate is provided with a rib *c'*, Fig. 16, which enters one of the notches in the lower edge of each of the matrices and holds it from shifting endwise in relation to the others, although it permits the line to advance horizontally to the left as it lengthens. As each matrix is stopped in its descent it is carried laterally against and added to the rear end of the line and the line moved bodily forward to make room for the next matrix by means of the reciprocating pusher *g*, Figs. 9 and 12, which may be actuated by lever G and magnet *g'* or in any other suitable manner. As the line, increasing in length, advances on the bed its advance is resisted and the line held in close order, as shown in Figs. 3, 12, and 12^a, by a plate H, carried by arms *h*, attached to arms *h'* on rock-shaft h^2, having a weighted arm h^3. The magnet *g* will be mounted in a circuit closed by the action of each finger-key, so that the action of a key to bring a matrix to the line is followed by the advance of the entire line by the pusher, as already explained. Fig. 9 illustrates a simple method of thus closing the circuit by the finger-keys, the bars d^6, which are actuated by the keys, being arranged to press conducting-fingers in one side of the circuit into contacting with the bar forming a part of the other side of the circuit. It is to be understood, however, that the pusher may be constructed and operated in any other manner which will give it essentially the same mode of action.

It is necessary in the course of composition to introduce the spacing-wedges between each word and the next—that is to say, between the matrix bearing the last character of one word and the matrix bearing the first character of the next word. To this end I arrange the wedges, as shown in Fig. 16, side by side in two groups with their thin ends projected toward each other. I sustain them at their outer ends on two stationary wires or guides *b'*, passing through their notches, these wires being supported rigidly, as shown in Fig. 11, by lips b^{10}, extending inward from the frame and passing through the open ends of the notches in the spacing-wedges. The two groups of wedges are assembled normally, as shown in Figs. 12 and 16, above the points at which the incoming matrices are added to the line, and the inner ends of the wedges rest upon and are sustained by shoulders on the main frame, with lips b^2 at the front edge to prevent them from sliding downward off of the shoulder.

In order to introduce a wedge into the line, it is only necessary to lift the front wedge clear of the lip b^2, Figs. 11, 12, and 16, so that it may pass thereover and drop at its thin end into position behind the composed line and in front of the next matrix to be introduced. In this manner the ends of the wedges are introduced into and made a part of the line, with which they are free to advance by sliding along the guide-wires *b'*, as clearly shown in Fig. 16. The release of the wedges that they may thus fall into the line one after another is effected, as shown in Fig. 13, by a rocking lever b^3, having in opposite sides of its axis two pins b^4, which act beneath the front wedges of the respective groups, so that as the lever is vibrated a wedge is delivered first from one group and then from the other into the line. As the successive wedges thus introduced are tapered in opposite directions and as the taper is very slight the matrices are not thrown out of their parallel positions to any appreciable extent. If preferred, however, two wedges may be dropped into the line for each space. In such case their outer or distant surfaces will be parallel and the adjacent matrices will consequently remain parallel, so that there will be no deviation of their characters from the vertical. The rocking lever for delivering the wedges into the line will be connected in any suitable manner with finger-keys b^6, commonly designated "spacing-keys," so that when either key is depressed a space will be delivered. As shown in Fig. 13, the shanks or stems of these finger-keys are extended downward and connected directly to the opposite ends of the lever b^3.

It will be understood that the wedges are inserted in the first instance with their thin ends in the line, as shown in Fig. 16, and that they thus remain until the completion of the composition, after which they are advanced endwise through the line from opposite directions to effect the justification in a

manner hereinafter explained. The stationary wires b' b', on which the outer ends of the wedges are sustained, are continued, as shown in Figs. 12, 12ª, and 16, to sustain the wedges as they advance with the line to the casting position and they are also turned upward at their right-hand ends and carried horizontally to the left at a higher elevation, as shown at $b^{\times}$, and this in order that the wedges carried from the lower ends of the wire with the line may be reapplied to the wires at their upper ends, as hereinafter explained.

In Figs. 2, 3, 10, 11, 12, 16, and 18, I represents a rising and falling table sustained and guided by a tubular or box-like shank i, sliding through and guided by the plates of the main frame. When in its lower and normal position, this table forms a continuation of the bed-plate C, as in Figs. 12 and 16, so that the composed line of matrices and spacing-wedges may be pushed forward from the bed c onto the top of the table, as shown in Figs. 3 and 12ª. The table I, the width of which is equal to the length of the longest line required, is provided at its outer edge with a jaw or abutment i^2, by which the advancing line is arrested and supported. The table is also provided at its opposite side with a vertically-sliding jaw i^3, Fig. 12, which rises behind the transferred line to confine the same upon the table and determine its length when the justification occurs. The composed line is shifted from the bed c to the table I. The plate H, heretofore mentioned as a "yielding resistant" to sustain the front of the line during composition, is lifted by hand from the front and transferred to the rear of the line, so that it serves as a means of carrying the line forward. The plate H will be lifted from the front and transferred to the rear by hand; but it is obvious that suitable operating mechanism could be applied, if desired. It will be noticed that this plate serves, therefore, the double function of a resistant to keep the line in close order during the course of composition and thereafter of a transferring device to move the completed line from the bed to the table. In order to hold the matrix-line in compact form while it is being transferred to the table and after the plate H has been transferred to the right end of the line, I provide a second resisting or supporting plate H′, (see Figs. 3, 12, 12ª, 12ᵇ, &c.,) carried on one-end of the sliding rod h^5, acted upon by a spiral spring h^6, which tends constantly to urge the plate to the right. When, therefore, the plate H′ takes its place at the left, it offers a moderate resistance to the line as the latter is shifted to the left. The elevation of the jaw i^3 behind the line on the table is effected by means of the before-mentioned lever h^3, Fig. 12. It will be remembered that this lever is connected through intermediate parts with the plate H, and as the plate completes its movement in shifting the line the lever h^3 encounters the jaw i^3 and carries it upward. It will be understood, however, that any equivalent means may be employed for raising and lowering the jaw, as these parts are not of the essence of the invention and affect the speed rather than the operativeness of the machine. When elevated, the jaw i^3 may be sustained by leaving the plate H inside of the jaw, so as to maintain the lever H^3 in the elevated position, or if said plate is lifted clear of the line the jaw may be sustained by friction in its guides, which will be augmented for the time being by the pressure of the expanded matrix-line. As the composed line is moved upon the table the contained space-bars slide, as shown in Fig. 16, from the ends of the guide-wires b' onto horizontal ribs l, formed on the upper ends of arms L, the lower ends of which are connected by vertically-swinging levers l' to the lower part of the table, as shown in Fig. 11, this arrangement permitting the arms L to rise and fall with the table and also independently of the same to a limited extent. The ribs l when the table is down form continuations of the wires b', so that the wedges may slide freely upon them. It will be understood that when the wedges are thus transferred to the arms they are entirely free from the stationary wires b b', so that when the table rises the matrices and spaces may both be lifted thereon.

Above the table, at a considerable elevation above the position in which the line is composed, is located the mold M, Fig. 14, which may be of any suitable form, but which in the present instance consists of a rotary disk or wheel having the mold-cell m extended therethrough from front to back, the wheel being supported by a shaft m', mounted in suitable bearings in the frame. After the composed line is secured in place on the table the latter is lifted until the matrices and spaces are pressed tightly against the under side of the mold-wheel and across the mold-cell, so as to tightly close the latter on the under side and present the selected characters in front thereof, as represented in Figs. 12ᵇ and 14, this closing action being essentially the same as in the numerous patents heretofore granted to me. When the composed line is lifted and presented to the mold, as just described, it is necessary that the outer elevated ends of the wedges shall be permitted to fall until they stand in line with the matrices. It is for this reason that the arms L, Fig. 15, are connected to the levers l' and sustained by the springs l^2 in order that they may descend and lower the outer ends of the spaces from their original position (shown in Figs. 11 and 15) until they rest flatly upon the table, as shown in Fig. 14. As the rising table I lifts the upper edges of the matrices and spaces against the under face of the mold the spaces are depressed at their outer ends until they lose their inclined relations to the matrices and stand in line therewith, the arms L of course sinking at the same time. While the spaces are in this

position, as shown in Fig. 14, they are moved inward endwise to effect the justification of the line. After the slug or linotype has been cast the table is lowered and is followed by the end of the matrix-guide u' until the latter reaches the sustaining-pillar at the right of the main shaft, as shown in Figs. 1 and 11. Meantime and before the table falls away from the guide u' the arms L sustain the outer ends of the spaces in an elevated relation to the table, so that the slide or carrier U may ride under the spaces and gain access to the upper ends of the matrices. At or prior to this time the alining-blade i^9 is lowered out of the notches in the matrices, which are thus allowed to slide down endwise until their upper ends are brought into the common line by reason of the ears on their under sides at the upper ends coming in contact with the blade. After the engagement of the carrier-slide U with the teeth in the upper ends of the matrices the alining-blade sinks until it is flush with the table, so that the matrices may be carried upward thereover to the distributing mechanism. In order to release the matrices preparatory to their realinement, as above stated, the spaces are withdrawn endwise by the arms L. After the matrices are removed from the table by slide U the table sinks to its original and lowest position.

When the composed line is presented to the mold, as above described, it is necessary that the spacing-wedges shall be thrust inward until the line is justified or tightly spaced out to the predetermined length. This action of thrusting the wedges inward through the line from opposite directions is effected by the arms L L, which are connected (see particularly Figs. 14 and 15) by links l^3 to opposite ends of a cross-arm l^4 on a rock-shaft l^5, which is seated in the table and provided with a weighted lever l^6, which on being released causes the arms L to swing inward toward each other, carrying with them the wedges. The advance of the arms is controlled and their separation to withdraw the wedges effected at the proper time by a rod l^7, connected to an angular lever l^8, one end of which is acted upon by a cam-wheel l^9 on the main shaft. The wedges are preferably advanced to justify the line as the matrices are being closed against the mold by the rising action of the table, and they are preferably retracted to release the matrices immediately after the casting action as the descent of the table begins; but the time of these movements may be changed so long as they do not interfere with the other actions of the machine. The rising and falling movements of the table are effected at the proper times by a lever i^4, pivoted to the main frame and provided with a roller or projection i^5, riding on a suitably-shaped cam i^6 on the main shaft Z, mounted in the main frame.

When the composed or assembled line of matrices, having its members held in proper longitudinal relation by rib c', is shifted to the table, the relation of the matrices must be maintained, and this must be continued until the line has been raised to the mold and the casting operation completed. For this purpose the rising and falling blade i^9 is mounted in a slot in the table, as shown in Figs. 10, 12^a, 14, 15, 16, &c. During the assembling of the line the blade stands above the table, as shown in Fig. 16, forming a continuation of the fixed rib c' on the bed, so that when the completed line is shifted endwise from the bed to the table the blade i^9 enters the notches in the under edges of the matrices and prevents them from moving endwise. The blade remains in its elevated position during the rising movement of the table, during the casting action, and until the table has descended part way to its original position, to the level at which the matrices are engaged by the slide or carrier U, which elevates them to the distributer, as will be presently explained.

In order that the rising and falling movement of the table and of the blade therein may be effected by the lever i^4 mentioned above, the alining-blade i^9 is attached to a plate i^{10}, mounted in the lower part or standard of the table and having a limited sliding motion up and down therein. It is to this plate i^{10} that the end of the lever i^4 is connected. Through slots in the table-standard a fixed cross-bar i^{20} is extended, its outer ends being held by arms connected to the main bed-plate, as shown in Fig. 1. When the table is down in position to receive the matrix-line, as shown in Figs. 10 and 11, the plate i^{10} rests on and is sustained by the bar i^{20}, so that the alining-blade is held above the table-surface in position to engage the matrices.

The links or levers l' are mounted on pivots in the table-standard, and their inner ends engage the plate i^{10}. Acting under the influence of the springs l^2 they tend to depress the plate i^{10}, and thereby draw the alining-blade i^9 down within the table. As the table completes its ascent to the casting position the spacing-wedges B at their outer or elevated ends encounter the under side of the mold-wheel, as indicated in dotted lines in Fig. 11, so that as the table continues to rise the wedges are caused to swing down into the matrix-line into the plane of the matrices, as shown in Figs. 14 and 14^a. The spaces thus sinking into the line carry down, or, more strictly speaking, hold down, their actuating-arms L and the outer ends of their links or levers l' in relation to the table, the levers l' for a time ceasing their influence on the plate i^{10}, as shown in Fig. 14. As the table falls away from the mold-wheel after the casting action the springs l^2, through the levers l' and arms L, again raise the outer ends of the spaces above the table and above the level of the matrices, as shown by dotted lines in Fig. 15, the levers l' at the same time and by the same motion drawing the plate i^{10} and

alining-blade i^9 down until the blade leaves the notches in the under side of the matrices. This releases the matrices, so that they may slide downward on the table until the ears or shoulders on under side at their upper ends encounter the blade i^9, which at this time is still projecting slightly above the table. The matrices being thus arrested in their sliding motion have their upper ends brought into a common line in order that they may be engaged by the distributer lifter or slide U, presently to be described, before the plate i^9 disappears within the table.

It will be perceived that the sinking motion of the blade i^9 is caused by the springs l^2 acting through levers l' and that the latter are in turn controlled through their arms L and the spaces B bearing against the mold M. As the table sinks away from the mold with the matrices the arms L for the time being remain at rest so far as vertical motion is concerned and so long as the outer ends of the spaces bear against the mold. The levers l' are in the meanwhile sinking at their inner ends with the table. It follows that these inner ends will lower the slide and its alining-blade in relation to the table.

It is to be noted that although the lever i^4, actuated by cam i^6, operates through the plate i^{10} to raise and lower the blade and the table the motion of the blade within the table is modified or controlled in part by the levers l', actuated at one time by the springs l^2 and held at another time by the opposing arms L and the spaces thereon bearing against the mold. The parts are so timed and proportioned that the matrices are released and permitted to realine themselves, and the carrier U is permitted to engage them before the blade i^9 sink wholly within the table, and that after such engagement the blade completely disappears, so that the matrices may be carried over it toward the distributer.

In order that the spacing-wedges may not prevent the rising action of the alining-blade, they should be made of less width vertically than the matrices, so that they may rest upon the alining-blade, which will support them in contact with the mold, as shown in detail in Fig. 14^a.

While the mold is closed on the under side by the matrices and spaces, it must be filled with molten metal in order to form the linotype. This is effected by means of a melting-pot N, Fig. 14, hinged on a horizontal pivot at its lower outer side to the main frame, as shown in Figs. 10, 11, and 14, that it may swing to and from the top of the mold, and heated by any suitable burner n^2, so that a large supply of molten metal may be maintained therein. The pot is provided with a mouth adapted to fit over and close the upper or rear side of the mold-cell and is provided with a delivery-orifice n', communicating with an internal pump n^3, so that by the operation of the pump the molten metal may be forcibly delivered into the mold-cell, in which it solidifies and forms a bar or linotype bearing on its edge in relief the characters presented by the matrices which are for the time being in front of the mold.

After the casting operation is finished and the matrices removed from the mold, as hereinafter explained, the mold-wheel makes a partial revolution and presents the linotype in front of the sliding ejector-blade R, Fig. 11, which is then forced downward by a cam r, so as to drive the linotype before it out of the mold. The rotation of the mold-wheel and the movement of the ejector occur alternately, as in the linotype-machine now in general use, the intermitting rotation of the mold being effected by an ordinary stop-motion pinion m^{20}, mounted on an ordinary mold-shaft and engaging an ordinary mutilated or speed-motion gear m^{21} on the upper end of the main shaft Z, as shown in Figs. 1, 10, 14, and 15 and in the diagram 14^b adjacent to Fig. 14. This gear is not in itself an essential part of the present invention, as it is well known in the art and is similar in construction and operation to that now used for driving the mold-wheel in the commercial linotype-machines, in which the wheel is rotated and the ejector reciprocated alternately.

Motion may be communicated to the machine from any source through any ordinary means known to the mechanic—for example, a pulley on the lower end of the main shaft Z, as shown in Figs. 10, 11, 15, &c.—this feature forming no part of the invention.

The mold may be rotated, the melting-pot moved to and from the same, and the pump actuated by devices of any suitable character, as these parts are not of the essence of the invention. I recommend, however, the swinging of the pot to and from the mold by means of a rod n^6, (see Figs. 1 and 10,) lifted by a spring n^7 and depressed at suitable times by a lever n^8, acted upon by a projection n^{13} on the guide i of the table, so that as the table rises to present the matrices to the under side of the mold it acts to swing the pot against the upper side of the mold. The pump-plunger is operated by a lever n^9, Fig. 14, depressed by a cam n^{10} and elevated by a spring n^{11}, as shown in Fig. 14.

After the casting operation is completed it is necessary to distribute the matrices and spaces, returning the former to the upper ends of the magazine and restoring the latter to their sustaining-wires. This is effected in the manner following:

A slide U, Fig. 3, having its lower end provided with teeth u to engage within the upper toothed ends of the matrices, is arranged to slide upward and downward in the pivoted guide u', so arranged that when the guide completes its downward movement its teeth will enter and engage the entire line of matrices, so that on again moving upward the slide will carry with it, through the guide u', all the matrices to the distributing devices at the top of the machine, leaving the space-

bars behind. In order that the toothed end of the slide may pass beneath the ends of the spacing-wedges, so as to enter the notches in the matrices, the end of the guide u' is permitted a limited rising-and-falling motion, its ends overlapping the table, so as to be lifted thereby, as shown in Fig. 14. The upper end of the guide u' is sustained, as shown in Fig. 1, by a horizontal pivot u^4, attached to an outreaching arm of the main frame C. Before the slide U descends to engage the matrices the table falls and lowers the end of the guide until it rests on the sustaining-post, as indicated by the dotted lines in Fig. 14 and in full lines in Figs. 1, 11, and 15, thus carrying the notched ends of the matrices below the outer ends of the wedges, which at this time are still sustained at their higher elevation by the arms L. It is at this stage that the blade releases the matrices, so that they are realined, and then sinks into the table, so that the slide U may carry the matrices upward without obstruction. As the slide U passes down to engage the matrices it will lift out of the way the overlying inclined spaces.

In order that the teeth on the slide may engage the matrices, the slide is divided horizontally at its lower end and its two parts united, as in Fig. 8, by a hinge-pin and urged apart by an intermediate spring u^2, so that when the slide is moved downward its lower end may close together and permit its beveled teeth to pass over and engage the teeth of the matrices. The slide U may be moved upward and downward in any suitable manner, but I recommend the employment of the cord u^4, winding on a drum u^5, the shaft of which carries a driving-pinion u^6, actuated by a rack-bar u^7, attached to an angular lever u^8, Fig. 10, which is in turn pivoted to the main frame and acted upon by the cam-wheel u^9. The slide is provided with antifriction-rollers in order that it may descend the guide by gravity.

When the slide engages and removes the line of matrices, the spacing-wedges are left behind, their outer ends being held and sustained by the ribs l, Fig. 16, on the upper ends of the arms L, which, it will be remembered, were lifted with the table. In this intermediate elevated position the ribs l stand for the time being in alinement with the wires $b^\times$, before referred to, as shown by dotted lines in Figs. 12, 12^a, and 16. The spacing-wedges while in this position are acted upon by two hooked arms V, (see Figs. 2, 12, 12^a, and 19,) by which they are drawn to the right off the ends of the ribs l and thence along the stationary wires $b^\times$ until they reach the downwardly-turned portions of the latter, when they descend by gravity and are added to the series resting on the wires b', as plainly shown in Figs. 12, 12^a, and 16, to be again introduced in their order into another line. During this return of the wedges from the higher level and toward their original positions their inner ends travel over the horizontal plate C^{20}, (shown in section in Figs. 11, 12, and 13,) whereby the wedges are prevented from falling and coming in contact with those below.

It will be observed that each spacing-wedge has, first, a falling motion into the line; second, a lateral motion with the line; third, a rising motion with the line; fourth, an endwise motion to effect justification, and, fifth, a lateral and falling motion to the starting-point. It is to be noted also that each spacing-wedge pursues a circulatory course through the machine, passing along the wire b' to the rib l, and from the latter to the upper end of the wire $b^\times$ and along the latter to the starting-point.

The hooked arms V for restoring the spaces are attached to an arm v, Fig. 19, on an upright rock-shaft v', having a second arm v^2, acted on by a spring v^3, which moves the hooked arms forward, and by a cam v^4, which draws the arms rearward. When the matrices lifted by the slide U reach the upper end of the guide u', they are transferred laterally and successively to a distributer-rail W, Fig. 2, extending horizontally over the upper ends of the magazine-channels, this rail being constructed with longitudinal permuted teeth after the manner of that set out in my Patent No. 347,629, before referred to. Screws X, lying along the sides of this rail and suitably rotated, advance the matrices along the rail from which they are suspended by their teeth until they reach points directly over their respective channels, when their teeth disengage from the rail and they pass into the magazine by gravity. The distributer-rail, the feed-screws, and the devices for delivering the matrices successively to the rail and the screws may be in all respects identical with the corresponding parts in Letters Patent No. 436,532, granted to me on the 16th day of September, 1891. The matrix-line is transferred laterally from the lifting slide or carrier U toward the distributer-rail, as shown in Fig. 2, by the slide u^{10}, connected to lever u^{11}, which is pivoted to the main frame and moved in one direction by cam u^{13} on the main shaft and in the other direction by spring u^{15}, this arrangement being almost identical with that in my earlier machines.

The operation of the machine is as follows: The finger-keys representing the required characters are depressed in the order in which the characters are to appear. Each key operates the escapement to release from the magazine a matrix containing a corresponding character and at the same time projects the appropriate stop-slide F. The matrix descending from the magazine encounters the stop and is arrested with the designated character in line with those in the composed line. As soon as the matrix is stopped the pusher g forces it laterally against the line and pushes the line bodily forward against the resistant II in order to leave room for the admission

of the next matrix, which is added in like manner. After the composition of each word the spacing-key is operated, lifting the end of one of the spaces B over the detaining-lip b^2, so that it may fall behind the line, to which it is added by the pusher in the same manner that the matrices are added. The introduction of matrices then continues until the next space is required, and so on repeatedly until the composition of the line is completed, after which the plate H is transferred to the rear end of the line and then carried forward, pushing the line before it from the bed to the table, at the same causing the outer ends of the spaces which are in the line to slide off of the wires b' onto the ribs l. The jaw i^3 is then lifted, so as to confine the line upon the table between it and the opposite jaw i^2, after which the table is lifted bodily until the composed line is presented tightly against the face of the mold and the alining-bar i^9 elevated to hold the matrices in position. The arms L are then carried inward to advance the spacing-wedges through the line and complete the justification, and at or about the same time the mold is closed on the back by the advance of the melting-pot and the pump actuated to fill the mold and form the linotype. The table is then partly lowered by the rotation of cam i^6, the pot separated from the mold by the release of lever n^8, Fig. 7, and the lifting action of spring n^7, the mold partly rotated, and the ejector operated to deliver the linotype. The slide U, controlled by lever u^8 and cam u^9, now descends and, engaging the matrices previously released and realined through the descent of blade i^9, carries them upward to the distributer, through which they are returned to the magazine. The spacing-wedges which remain behind supported by the ribs l are engaged by the hooked arms V and carried laterally from the ribs to the wires b' and along the latter until they are in position to descend to the starting-point, after which the table continues its descent to its first position, flush with the assembling-bed.

While I have described and illustrated herein those details of the driving mechanism and other minor parts which I prefer to employ, it is to be understood that they are not of the essence of the invention and that they may be modified within the range of mechanical skill, the only requirement being that the driving or operating devices shall impart to the principal parts the requisite movements hereinbefore described.

I believe myself to be the first to combine with matrices each having a plurality of characters devices operated by finger-keys to release the matrices from a magazine and devices operated by keys to arrest the released matrices at different points, according to the characters selected for use, and it is to be understood that the details of the mechanism for thus releasing and adjusting the matrices may be modified within the range of mechanical skill, provided they operate in essentially the same manner and with essentially the same effect as those herein detailed.

I believe myself to be the first to combine with a mechanism for composing matrices in line means for introducing into the line wedges tapered in opposite directions and thereafter advancing these wedges through the line from opposite sides to effect the justification, and this combination of parts I claim in any form the mechanical equivalent of that herein shown.

It is to be understood that any other composing or assembling mechanism which will set the matrices up in line may be used as a substitute for the mechanism herein shown in connection with the other parts.

I believe myself also to be the first to combine with a series of spacing-wedges a U-shaped guide with means for transferring the spaces from one end of the guide to the other, so that they may pursue a circulatory course through the machine subject at all times to the control of the guides.

It is to be observed that in my machine each matrix contains a number of characters less than the number represented in the keyboard and that there is a common assembling-point to which each and every matrix passes when released from the magazine or storage mechanism.

As far as I am aware this is the first machine in which matrices each containing several characters are stored in a magazine or holder, carried or guided laterally to a composing or assembling point one after another to form a line, and adjusted longitudinally in relation to each other, and to bring the selected characters of the composed line in alinement.

It is also, I believe, the first machine in which matrices bearing a plurality of characters are combined with means for causing them to pursue a circulatory course—that is to say, the course from the magazine or place of storage to the place of assemblage and thence through a different path back to the magazine.

It is, I believe, the first machine in which the matrices having each a plurality of independent characters are guided or transferred from a place of storage through a common path to a place of composition or assemblage, adjusted in relation to each other when assembled to bring the selected characters in line, and finally distribute and return to the magazine or holder.

I do not claim, broadly, herein matrices each bearing a series of characters less than the whole assortment in the machine in combination with means for assembling them and determining their longitudinal relations to each other, such combination being the subject-matter of claims in my accompanying application, Serial No. 375,532, filed December 23, 1890. The present machine is, however, distinguishable from that described in

said application and from all others heretofore known in the art in that the matrices each bearing a series of separately-usable characters are ready to pursue a circulatory course, passing from the magazine through one path and returning through another, this arrangement being, as I believe, broadly new.

Having thus described my invention, what I claim is—

1. In a composing mechanism, a series of duplex matrices each bearing a plurality of characters, a magazine or holder provided with an escapement device to release the matrices, one at a time, a series of finger-keys representing the several characters and all connected with the one escapement, and stop devices connected with the respective keys to arrest the released matrix at different points: whereby the matrix may be caused to present one or another of its characters in operative position as demanded.

2. In a composing mechanism, groups of matrices those in each group bearing each a different series of characters, in combination with a magazine or holder for the assorted matrices, an escapement for each group to release the matrices one at a time, a number of finger-keys connected with each escapement so that either one may release the same matrix, a guide by which all the released matrices are delivered successively at a common point, a series of stop devices to arrest the descending matrices at distinct points, that one or another of the characters may be brought into action, and connections from each stop device to a finger-key for each escapement: whereby each finger-key is enabled to release a matrix bearing a given character, and also to stop the matrix in position to present the particular character desired in the line.

3. In a composing mechanism, a series of matrices each containing a number of characters at different points in its length, in combination with magazines or holders for the assorted matrices, a guide whereby the matrices are directed from the magazine one after another in any desired order to the end of the line being composed, a series of finger-keys representing the individual characters, and devices connected with each key to release a matrix bearing the corresponding character and to check the matrix in position to present its designated character in the line.

4. The magazine and its series of escapements, in combination with sliding bars d^6, connected to the respective escapements, a series of finger-keys acting on each bar, the stops F, and a slide f^4, connected to each stop, and arranged to be actuated by keys operating the different escapements; whereby any required matrix may be delivered to the line in any required relation to its predecessor.

5. In combination with the matrices, each having a series of characters at different points in its length, and a composing mechanism for assembling said matrices with their selected characters in line, a bed or support for the line, having a transverse rib or guide to engage the matrices and prevent them from shifting endwise in relation to each other after they are assembled, and means for shifting said composed line along the rib or guide to the required point.

6. In combination with the matrices each having a series of characters and corresponding notches, a composing mechanism to assemble the matrices one after another in any desired order with their selected characters in line, a table or support for the line having a transverse rib to enter the notches and prevent the longitudinal motion of the assembled matrices.

7. In combination with the matrices, and a composing mechanism for delivering them one after another to the end of the line under composition, the spaces, the guides whereon they slide, means for sustaining them normally above the level of the matrix-line, and mechanisms for dropping the spaces at one end edgewise into the line.

8. In combination with the matrices and a composing mechanism whereby the matrices are delivered one after another at the end of the line and advanced therewith, wedge-shaped spaces, guides whereon the spaces slide at their thicker ends as the line advances, means for supporting the thin ends of the spaces above the line in course of composition, and means for dropping them one at a time into the line: whereby the line may be composed of matrices and intermediate spaces.

9. In combination with matrices and a composing mechanism for assembling them in line and advancing the line as the composition progresses, two guides lying on opposite sides of the line, two series of spacing-wedges arranged to slide at their thicker ends on the respective guides, and means for sustaining the inner ends of the wedges and dropping them successively into the line as demanded.

10. In combination with a series of matrices and mechanism to assemble them in line, two series of oppositely-tapered spacing-wedges, means for introducing said wedges into the line, and means for advancing the wedges in opposite directions through the line to effect its justification.

11. In combination with a ↄ-shaped guide and spacing-wedges movable thereover, means for transferring the wedges from one end of the guide across the intervening space to the other end: whereby the spaces are permitted to follow a circulatory course.

12. In combination with the bed and a composing mechanism to assemble the matrices thereon, the spacing-wedges and mechanism to insert them in the line, the rising-and-falling table, means for shifting the assembled line thereto, guides movable with the table to control the wedges, and a mold to which the composed line is presented by the table.

13. In combination with the matrices, their composing mechanism, the spacing-wedges, their guides, means for delivering the wedges into the line, the rising-and-falling table, shifting mechanism to transfer the composed line to the table, devices to advance the wedges endwise in the line, the mold and the melting-pot and its delivering mechanism; whereby the spaces and matrices are assembled and presented to the mold.

14. In combination with matrix-composing mechanism, the wedges, the ↄ-shaped wedge-guides, the rising-and-falling table, the mold, the matrix-distributer, the slide to carry the assembled matrices from the table to the distributer, and means to return the wedges to the upper ends of their guides.

15. In combination with the rising-and-falling table to sustain the composed line of matrices and spaces, the arms L, to engage the spaces arranged to rise and fall and to move to and from each other whereby they are adapted to cause the justifying action of the wedges.

16. In a machine of the class described, the spacing-wedges, and the ↄ-shaped guides whereon they slide, in combination with the arms L_1 arranged to register with the two ends of the guides alternately: whereby the spaces may be removed from the guides at one end and returned to the opposite end.

17. In combination with the matrices toothed at one end, a table or support whereon they are assembled in line, a distributer and magazine remote from the table, and a carrier arranged to reciprocate between the table and the distributer and having teeth which automatically engage the teeth of the matrices by advancing toward their ends.

18. In a linotype-machine a series of matrices provided with teeth in combination with a carrier-block U having a compressible toothed end to engage the matrix-teeth.

19. In combination with the toothed carrier U, to remove the matrices therefrom, the rising-and-falling table, the spacing-wedges, and the wedge-guides L, having a rising-and-falling motion in relation to the table, whereby the ends of the wedges are raised above the ends of the matrices in order that the carrier U may engage the latter.

20. A linotype-machine, comprising in combination the following elements: a series of independent matrices each bearing a plurality of characters, a magazine or holding mechanism for the assorted matrices, a composing mechanism whereby the matrices are assembled in line and adjusted endwise in relation to each other to bring the selected characters, one on each matrix; in a common line, spacing-wedges and means for inserting them into and adjusting them endwise in the line, a mold, means for presenting and clamping the assembled line of matrices and spaces against the mold, a melting-pot and means for delivering metal thence to the mold, and distributing mechanisms distinct from the composing mechanism for returning the matrices to the magazines, and the spaces to their holders.

21. In a linotype-machine the combination of the following elements: a series of matrices each having a number of characters to be separately used, a magazine for the storage of said matrices, a composing mechanism for selecting the matrices assembling them in line and adjusting them longitudinally in relation to each other, to aline their selected characters, and a distributing mechanism by which the matrices are returned to the magazine through a path different from that pursued in the course of composition.

22. In a linotype-machine the combination of the following elements: a series of matrices each having a number of characters, a series of spaces, mechanism connected with finger-keys operating to select the matrices and spaces and assemble them in line, means connected with the finger-keys for determining the longitudinal adjustment of the matrices in relation to each other, casting mechanism to coöperate with the composed line of matrices, and a distributing mechanism distinct from the composing mechanism, to return the matrices to the magazine or place of storage.

23. In a linotype-machine a series of matrices, each bearing several distinct characters and mechanism for delivering the same successively at a common point, in combination with a series of movable stops adapted to arrest each matrix sooner or later as required and for advancing the matrices successively and laterally from said stop to the end of the line in course of composition.

24. In a linotype-machine a series of matrices, each bearing several distinct characters, means for assembling the matrices one after another in a common line, stop devices to determine the longitudinal position of the successive matrix in relation to those in the line, means for advancing the matrix-line laterally, and an alining-rib mounted to enter the series of matrices and maintain their adjustment, and recontractible, that the matrices may change their relations in the line preparatory to the action of the distributing devices.

25. In a linotype-machine, the combination of matrices, each bearing a plurality of characters, means for assembling them in line and determining their longitudinal relations, and an alining-blade along which the composed line of matrices is shifted, said blade mounted for retraction from the matrices, in order that they may be removed in a direction transverse to the length of the blade.

In testimony whereof I hereunto set my hand, this 11th day of April, 1891, in the presence of two attesting witnesses.

OTTMAR MERGENTHALER.

Witnesses:
FELIX R. SULLIVAN,
F. M. CROOK.

Correction in Letters Patent No. 614,230.

It is hereby certified that the assignee in Letters Patent No. 614,230, granted November 15, 1898, upon the application of Ottmar Mergenthaler, of Baltimore, Maryland, for an improvement in "Linotype-Machines," was erroneously described and specified as "The Mergenthaler Linotype Company, of New Jersey," whereas said assignee should have been described and specified as *Mergenthaler Linotype Company, a corporation of New York*, as shown by the records of assignments of this office; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 1st day of July, A. D., 1913.

[SEAL.]

C. C. BILLINGS,

Acting Commissioner of Patents.