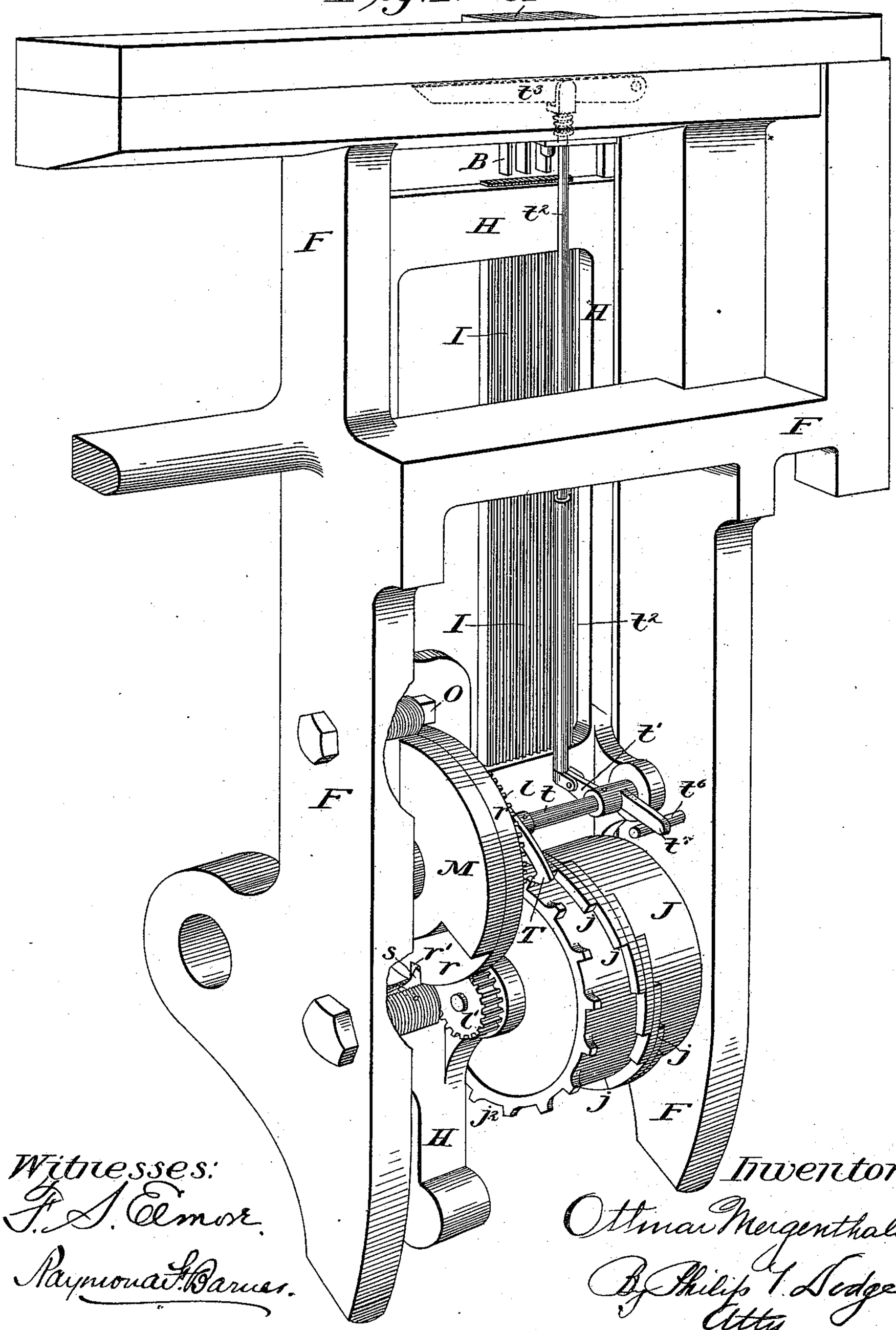
(No Model.) 6 Sheets—Sheet 1.

O. MERGENTHALER.

TYPE JUSTIFYING MECHANISM.

No. 565,489. Patented Aug. 11, 1896.

Fig. 1. A



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By Philip T. Dodge
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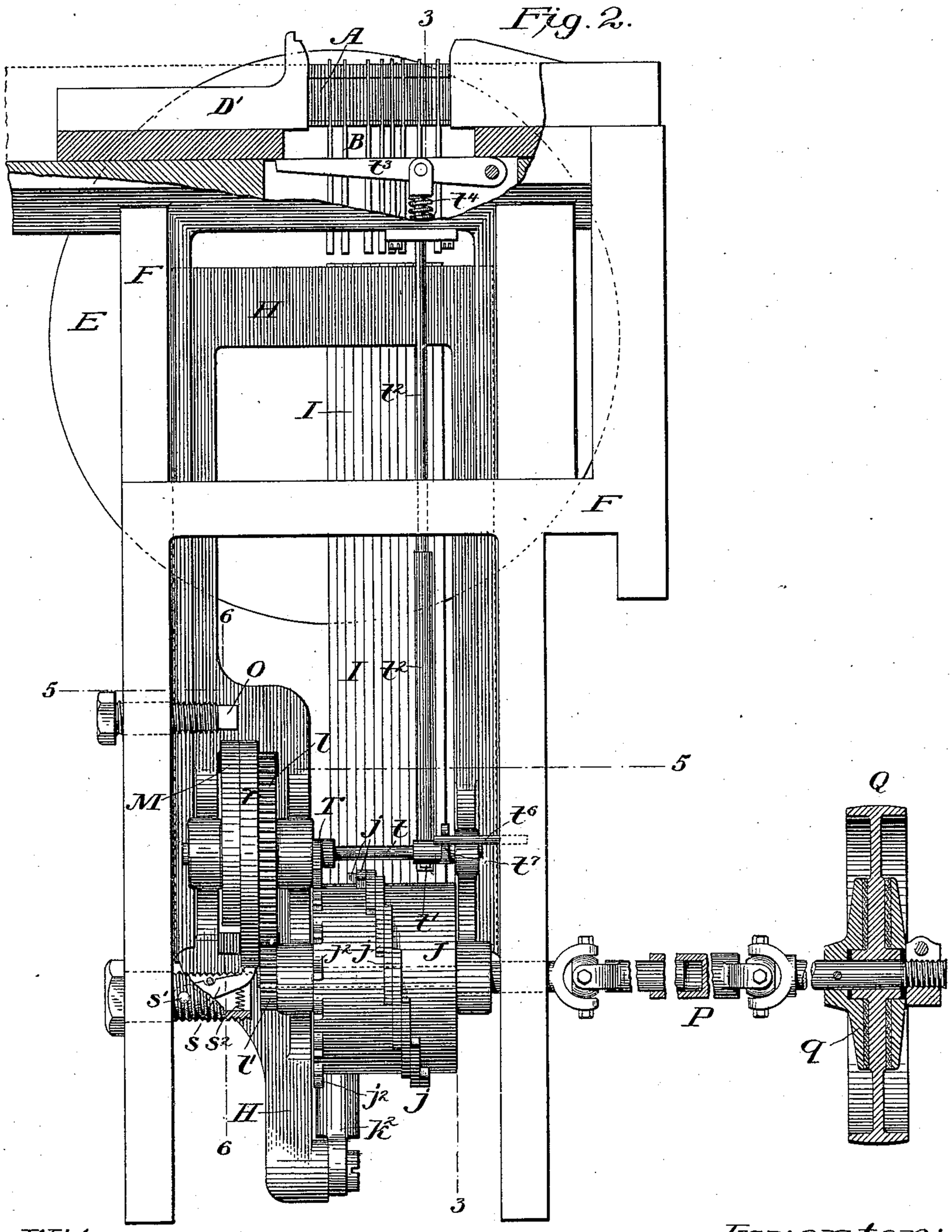
(No Model.) 6 Sheets—Sheet 2.

O. MERGENTHALER.

TYPE JUSTIFYING MECHANISM.

No. 565,489. Patented Aug. 11, 1896.

Fig. 2.



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(No Model.) 6 Sheets—Sheet 3.

O. MERGENTHALER.

TYPE JUSTIFYING MECHANISM.

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Fig. 3.

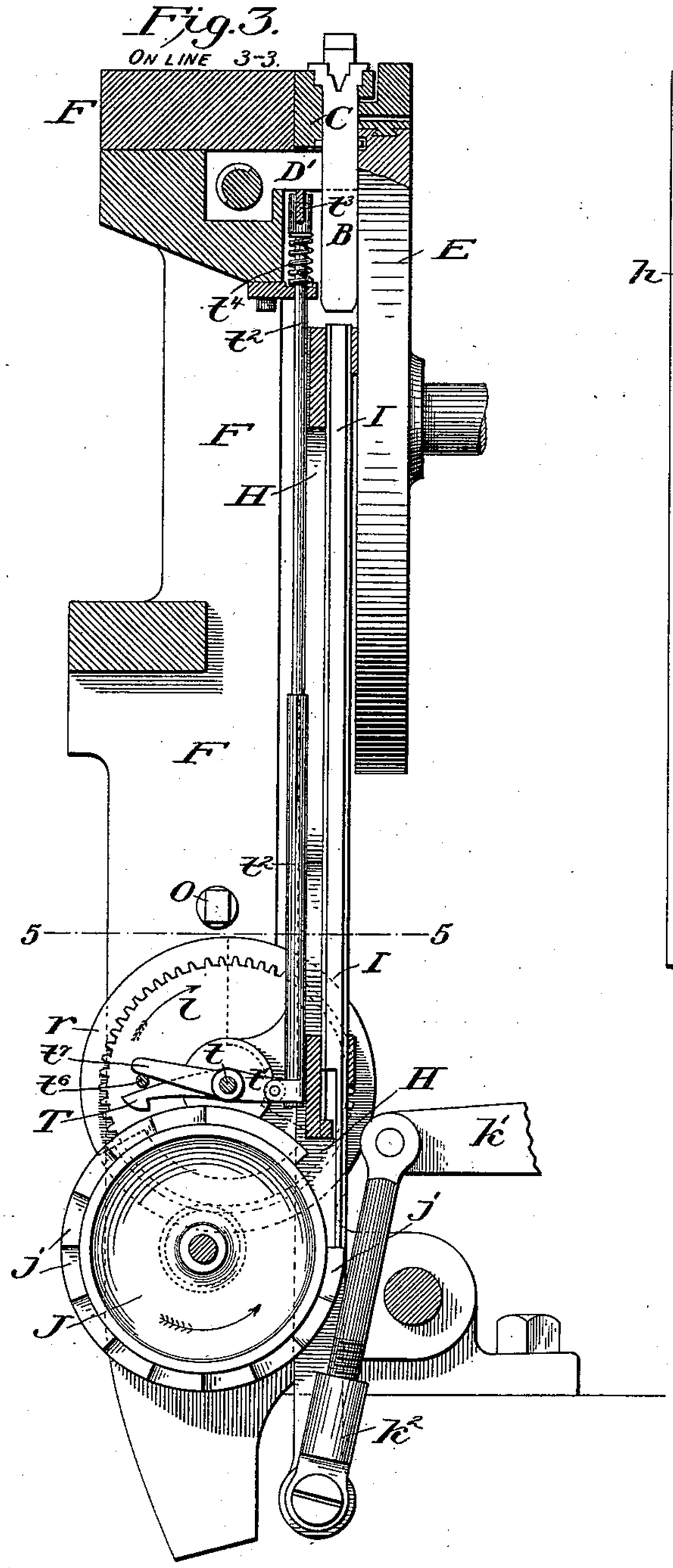
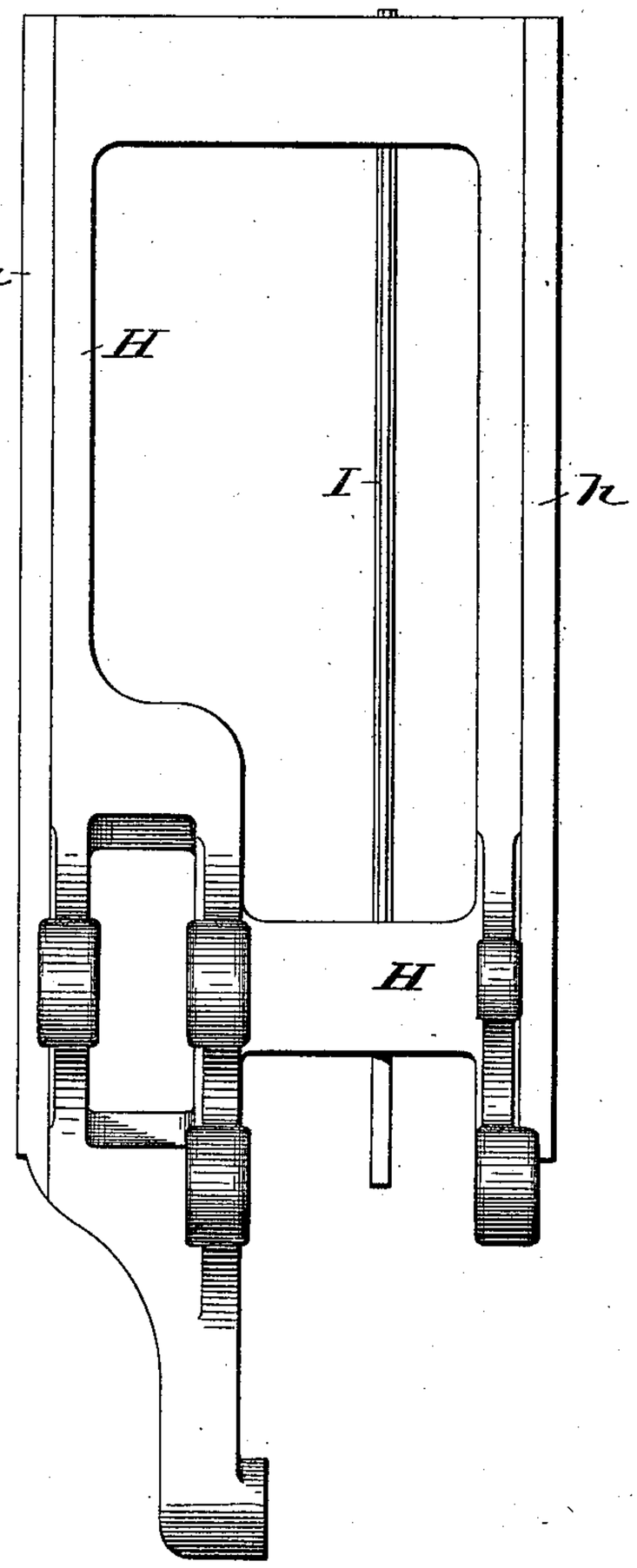


Fig 4.



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O. MERGENTHALER.

TYPE JUSTIFYING MECHANISM.

No. 565,489. Patented Aug. 11, 1896.

Fig. 9.

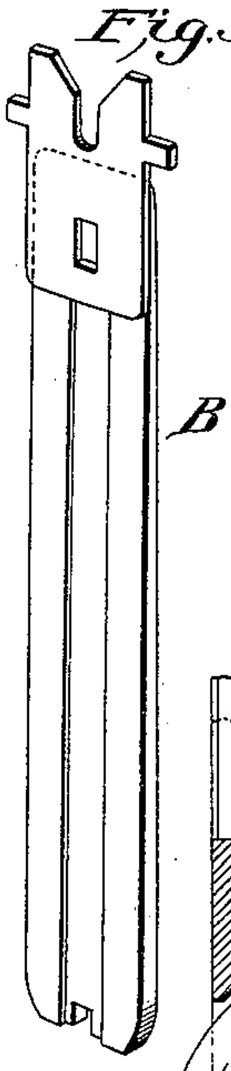


Fig. 5.

ON LINE 5-5.

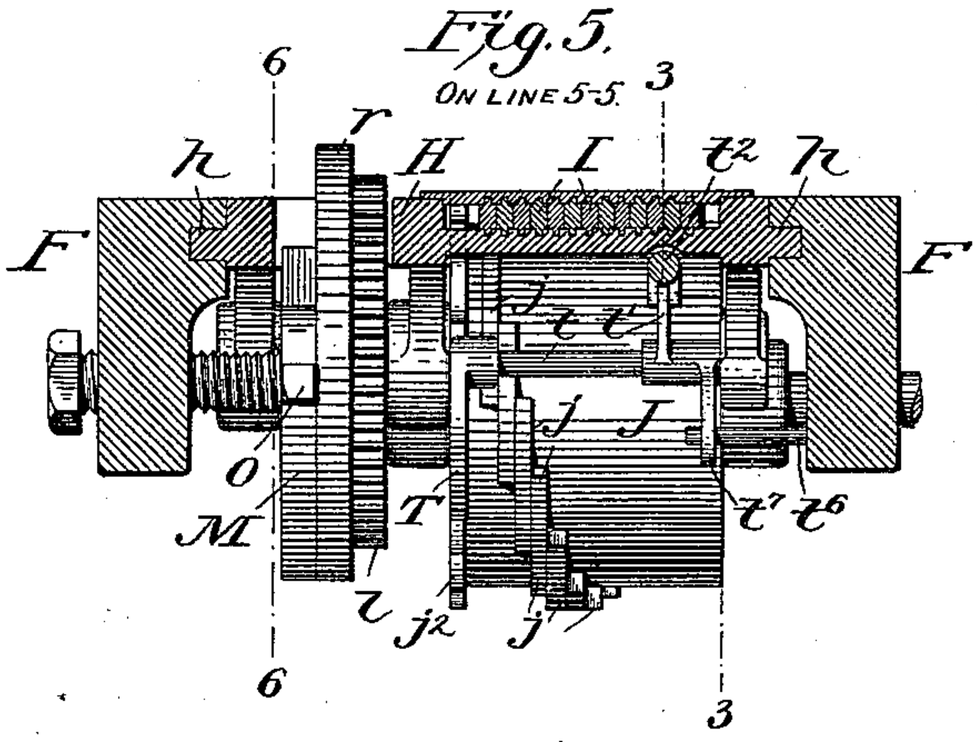


Fig. 8.

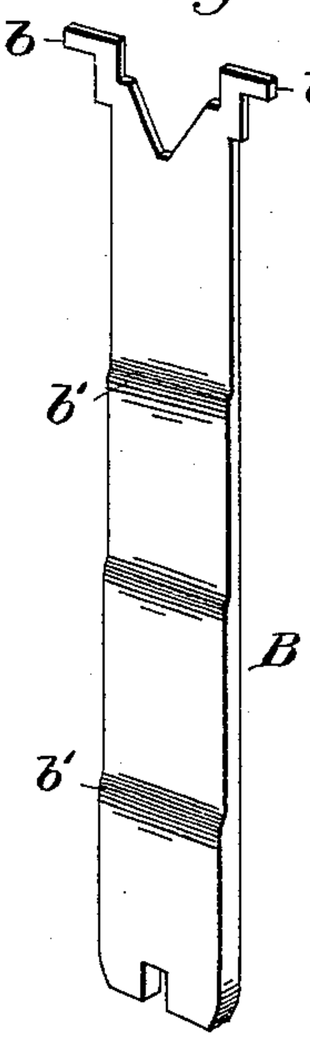


Fig. 6.

ON LINE 6-6.

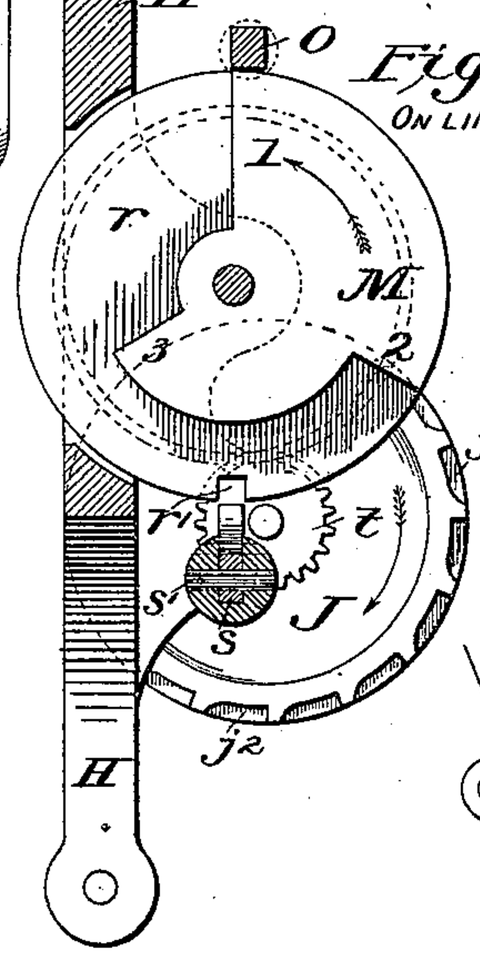
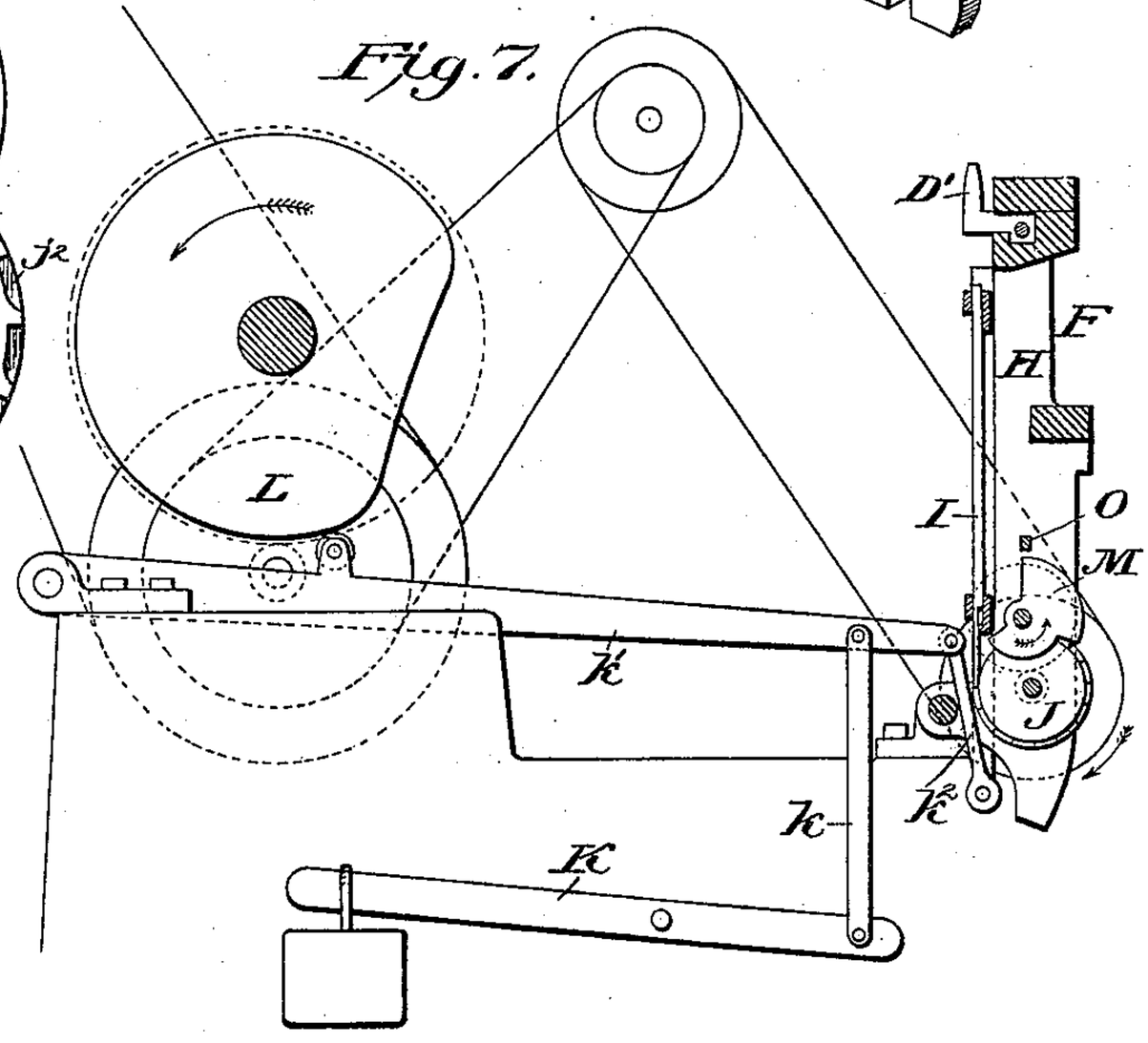


Fig. 7.



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O. MERGENTHALER.

TYPE JUSTIFYING MECHANISM.

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Fig. 14.

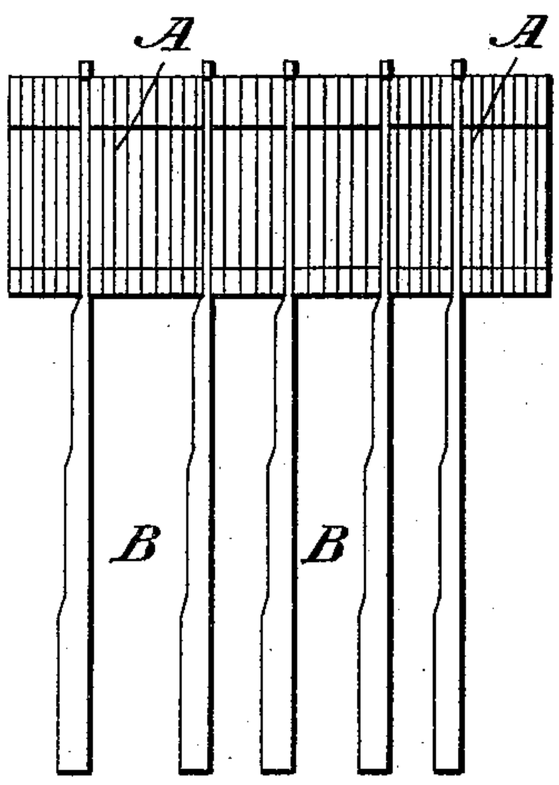


Fig. 15.

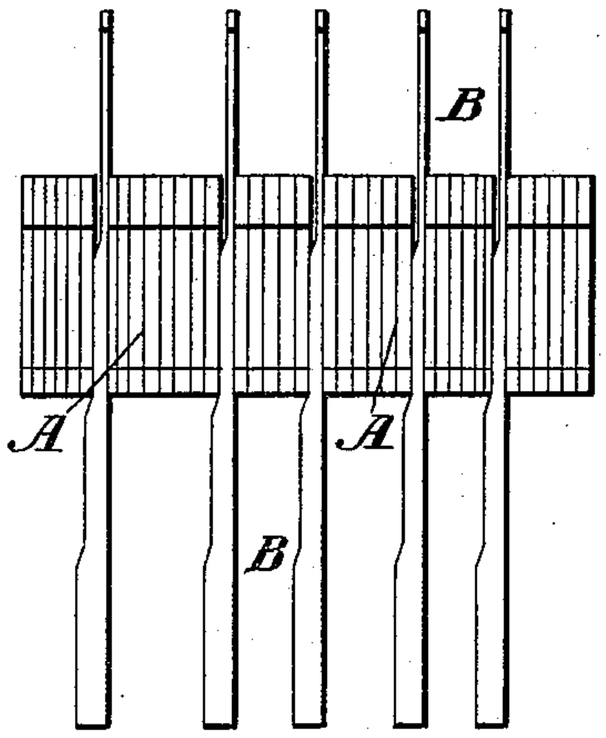


Fig. 16.

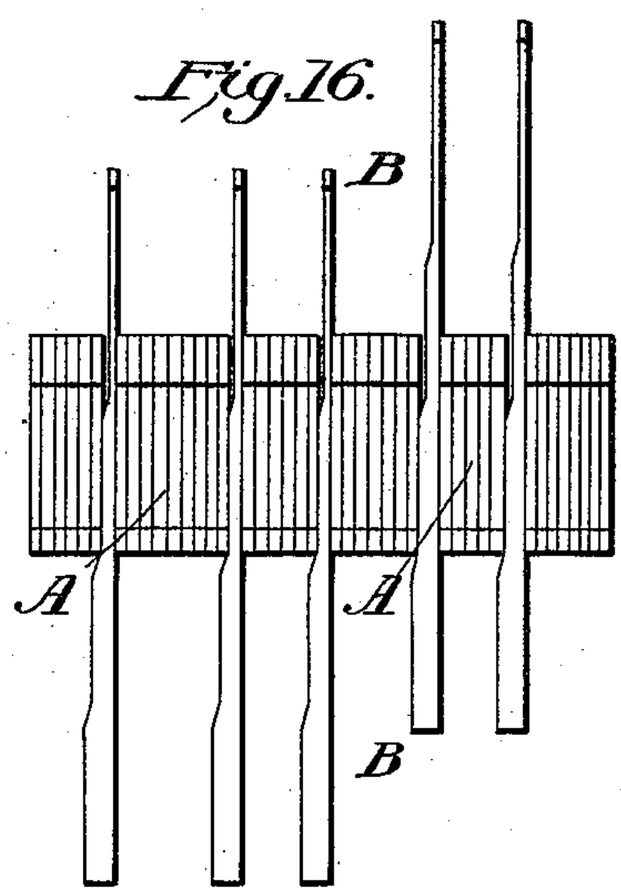


Fig. 10.

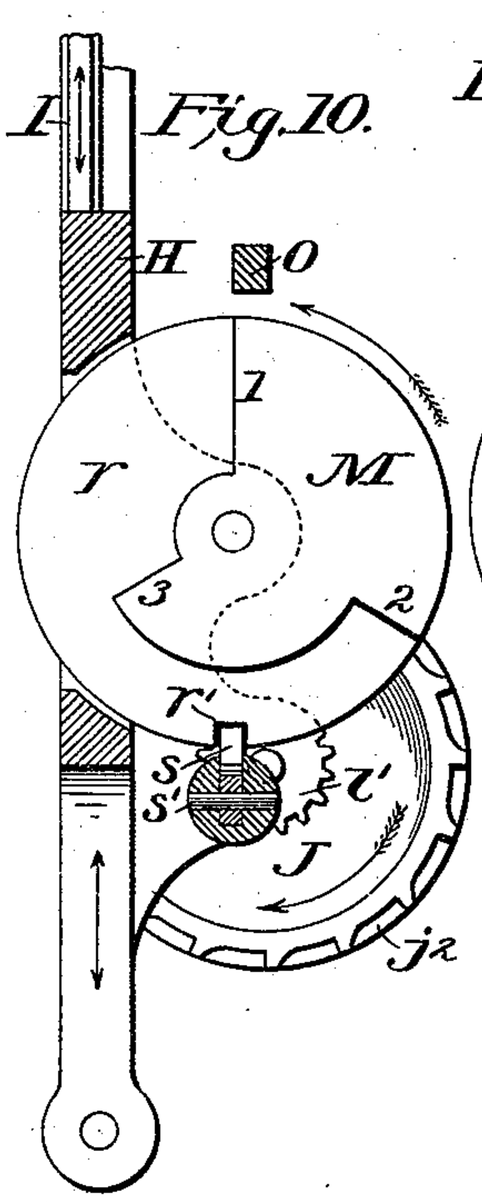


Fig. 11.

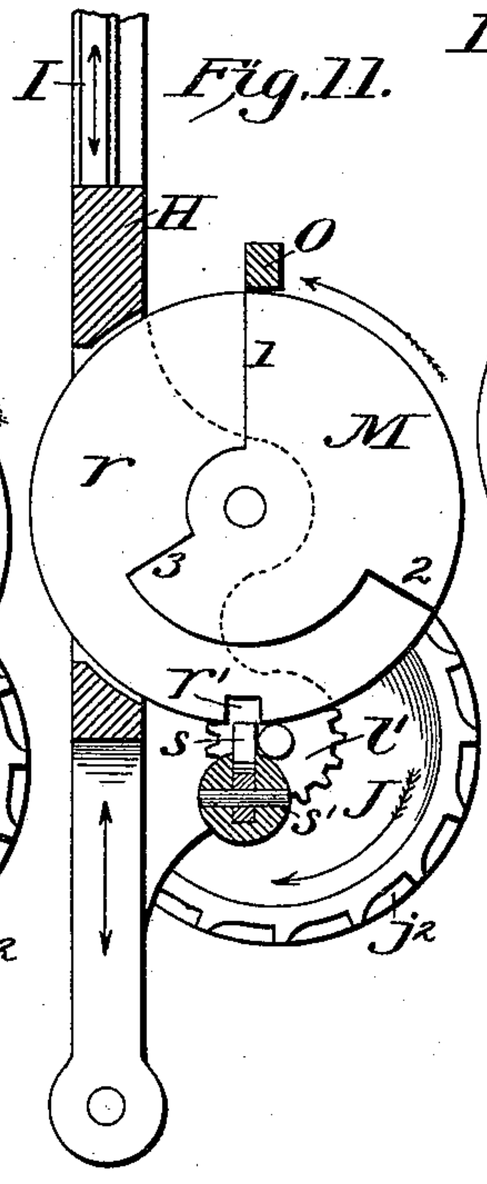


Fig. 12.

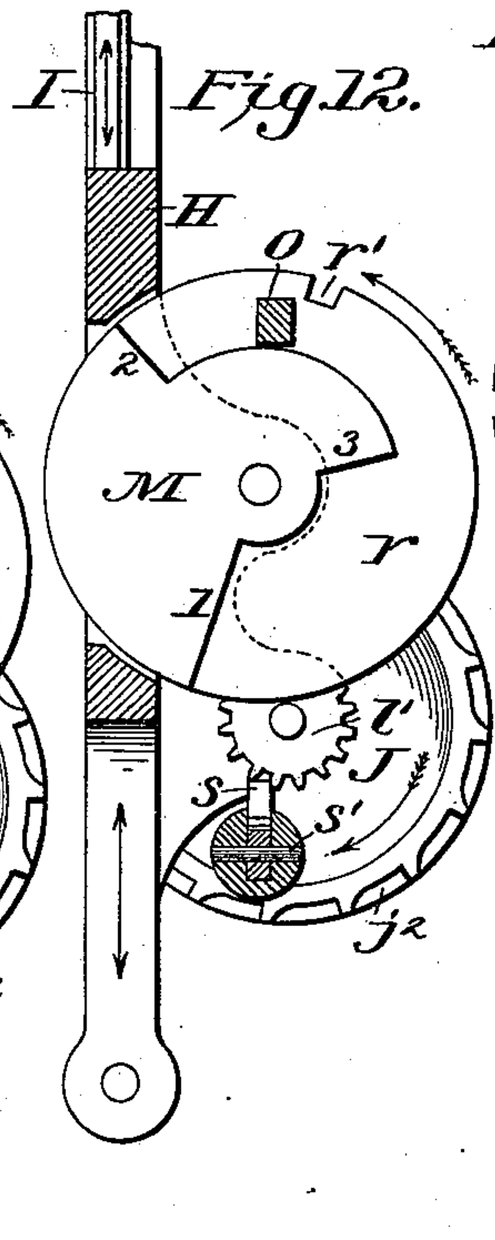
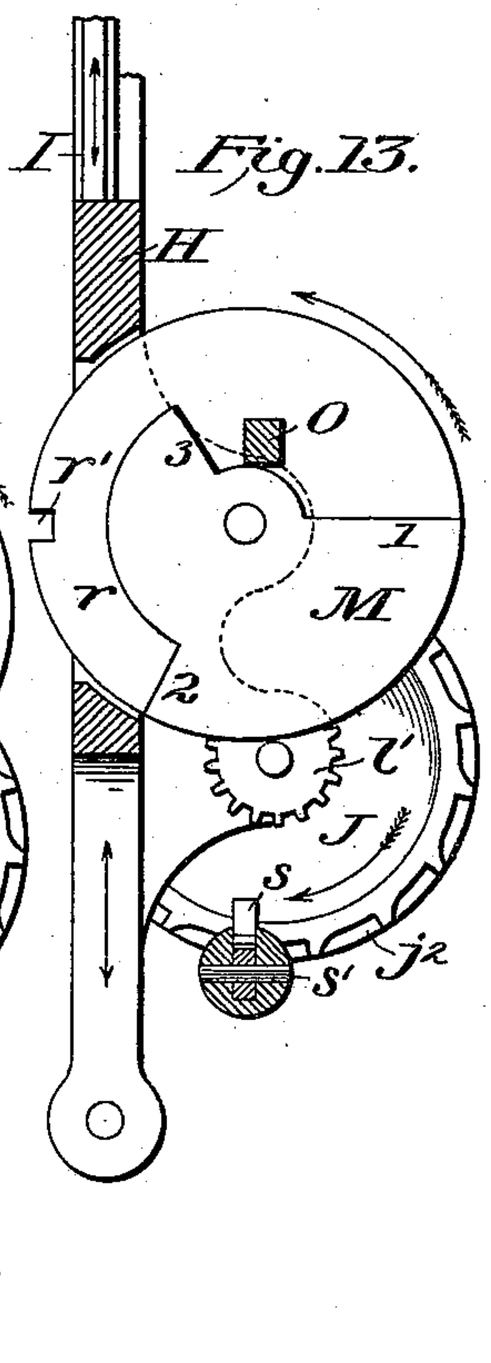


Fig. 13.



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(No Model.) 6 Sheets—Sheet 6.

O. MERGENTHALER.

TYPE JUSTIFYING MECHANISM.

No. 565,489. Patented Aug. 11, 1896.

Fig. 17.

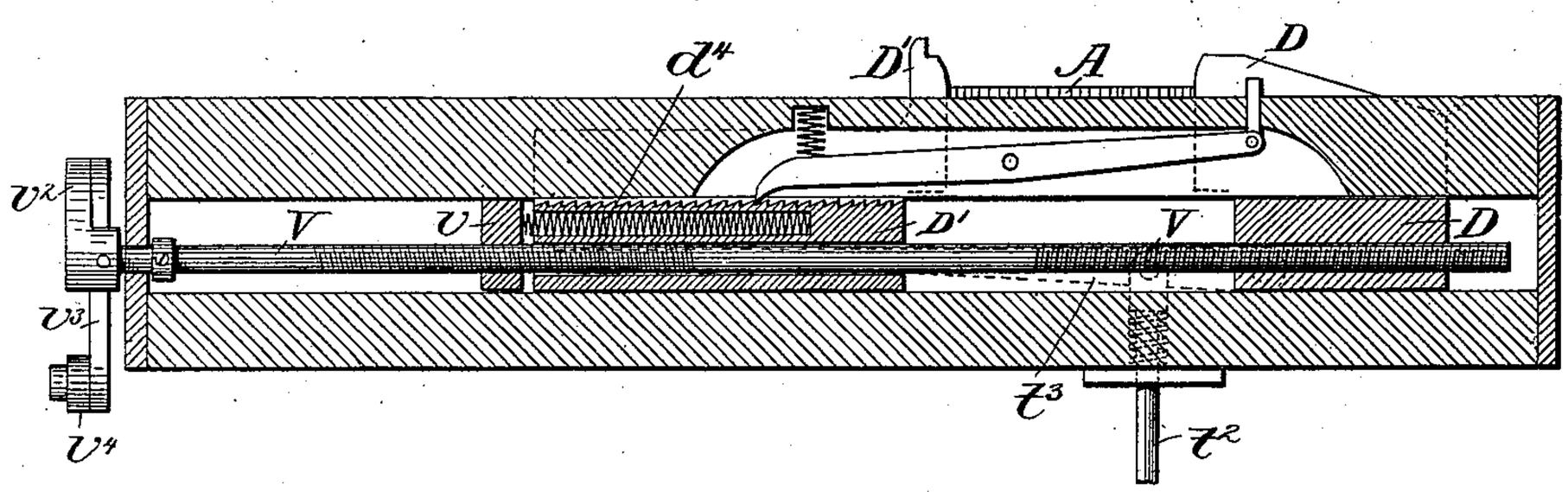
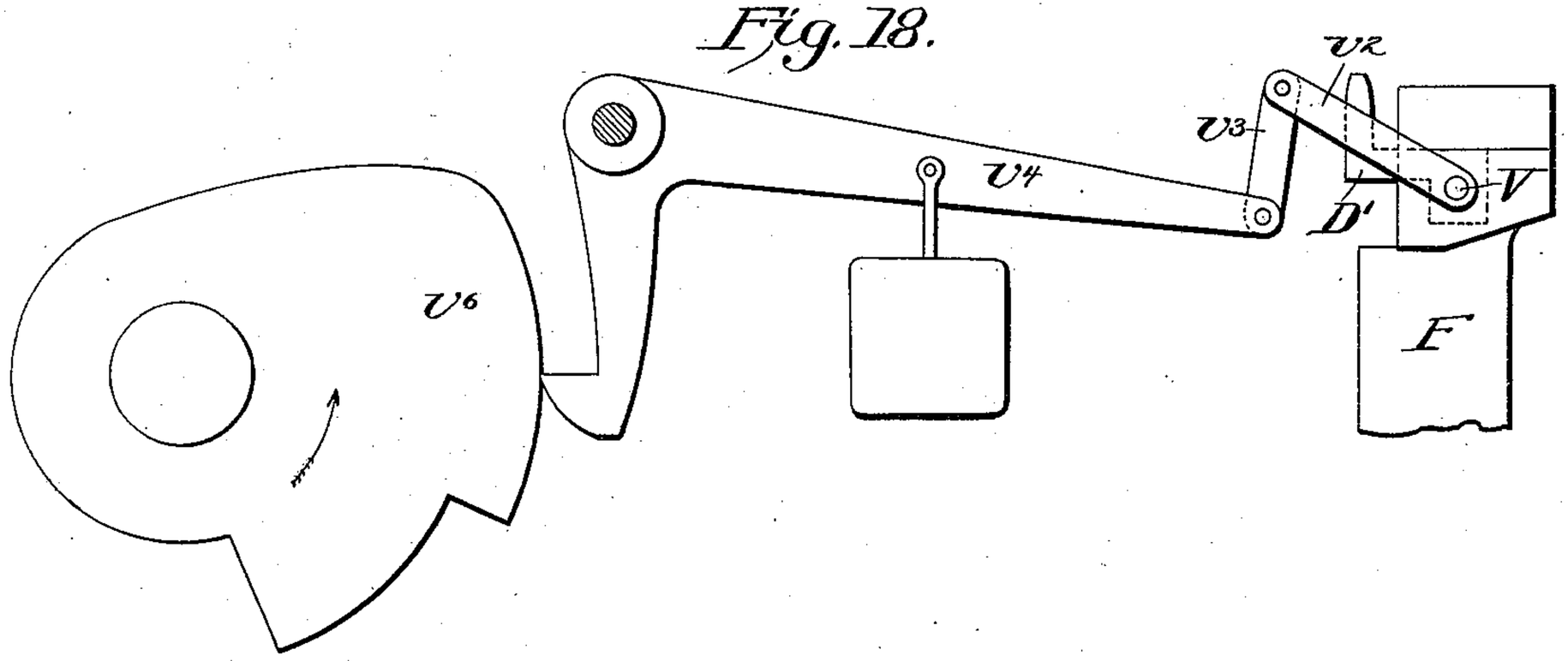


Fig. 18.



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UNITED STATES PATENT OFFICE.

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TYPE-JUSTIFYING MECHANISM.

SPECIFICATION forming part of Letters Patent No. 565,489, dated August 11, 1896.

Application filed May 28, 1894. Serial No. 512,786. (No model.)

To all whom it may concern:

Be it known that I, OTTMAR MERGENTHALER, a citizen of the United States, residing in the city of Baltimore, State of Maryland, have invented certain Improvements in Linotype-Machines, of which the following is a specification.

My invention is intended for use in machines in which metal matrices or dies representing single characters are composed or assembled temporarily in line in the order in which their characters are to be printed, together with suitable spaces, and the entire line then justified, if of matrices, to produce raised type-characters on a printing-bar or linotype, or, if of dies, to impress their characters in papier-mâché or similar material and thereby produce a matrix in which to cast a linotype. As the lines must be of uniform length, it is usual to introduce during the course of composition spaces into the line between the words, and, finally, when the composition has so far progressed that another word or syllable cannot be inserted, to increase the width of the spaces and thus elongate the line to the predetermined length. Now my invention is directed to automatic adjustment of the spaces to give the line the requisite length, technically known as the "justification" of the line.

The invention consists in a means, substantially such as hereinafter described, for advancing a series of stepped or tapered spaces through a composed line and automatically determining their positions to effect a proper justification of the line; in combining with automatic space-adjusting mechanism means controlled by the expansion or elongation of the line to arrest the action of the space-adjusting devices, and in various details hereinafter described and claimed.

In the drawings I have represented my mechanism in its preferred form, a form which has in practice given entire satisfaction, but it will be apparent to the skilled mechanic that the construction and arrangement of parts may be greatly modified without passing beyond the scope of my invention. I prefer to use for spacing purposes elongated bars, increasing in thickness step by step from one end to the other, and I have represented the same in connection with my operating mechanism, but it is to be understood that I may use spaces consisting of two wedges oppositely inclined and fitted to slide one upon or along the other, as used in other machines of the present day, and represented in Figure 9.

In the particular form herein shown my mechanism is intended for use in the machine represented in Letters Patent of the United States granted to me on the 16th day of September, 1890, No. 436,532, for casting linotypes from molten metal against matrices. As the composing, clamping, casting, and distributing mechanisms may all be of the construction and arrangement set forth in said patent, I have confined the drawings herein to my novel devices and such attendant parts as are necessary to an understanding of the invention.

In the accompanying drawings, Fig. 1 is a perspective view of the justifying mechanism complete. Fig. 2 is a front elevation of the same with portions in vertical section. Fig. 3 is a vertical section from front to rear on the line 3 3, Fig. 2. Fig. 4 is a front view of the internal vertically-sliding frame in which the justifying devices proper are mounted. Fig. 5 is a horizontal section on the line 5 5 of Figs. 2 and 3. Fig. 6 is a vertical section on the line 6 6, Figs. 2 and 5. Fig. 7 is a sectional elevation of the entire justifying mechanism and its driving and controlling devices. Fig. 8 is a perspective view of one of the stepped space-bars, hereinafter termed "space-bars." Fig. 9 is a perspective view of another form of space-bar which may be used with my mechanism. Figs. 10 to 13 are views illustrating the successive positions of the space-adjusting devices during the course of justification. Figs. 14, 15, and 16 are views illustrating a line of matrices and the successive positions assumed by the spaces during the course of the justification. Figs. 17 and 18 are views showing additional parts which may be used.

In Figs. 1, 2, 3, 14, &c., A A represent a series of type-matrices assembled temporarily side by side, so as to present their characters or matrices proper in a common line, and B a series of space-bars having their ends seated at the proper points in the line, between the

adjacent matrices. The spaces are thus inserted during the composition of the line, and the entire line is sustained and presented by a vertically-movable yoke C, between two horizontally-adjustable jaws or clamps D D′ in position to close the open side of the mold-cell E, which is supplied with molten metal to produce the linotype or type-bar. The jaws or clamps D D′ are mounted in the fixed frame or casting F, and serve when in proper position to limit the expansion or elongation of the line by the space-bars.

Each space-bar consists, as shown in Fig. 8, of a single piece of metal, much longer than the matrices, provided at its upper end with sustaining-ears *b*, and increased in thickness step by step from the upper to the lower end. I commonly construct the bar of four steps or sections, or, in other words, of four thicknesses, with the opposite outer faces parallel, except at the points where it changes from one thickness to another. At these points the surface is inclined, as shown at *b*, in order to admit of the bar being advanced vertically endwise through the line, so as to present an increasing thickness therein, and thus expand or "justify" the line as demanded.

It is the function of the mechanism now to be described to advance the spaces one after another with a lifting action, so that each will present its next greater thickness in the line, and then repeat the action. To this end I mount in the main frame F the secondary and vertically-sliding frame H, guided by tongues *h* on its edges, seated in grooves in the main frame. In this secondary frame I mount side by side a series of independent vertically-movable bars or slides I, the upper ends of which stand in a row beneath the position occupied by the line of matrices and spaces, so that when raised they will act against the lower ends of the space-bars and push them upward between the matrices. In bearings in the secondary frame, below the slides I, I mount a horizontal lifting-drum J, having on its surface a spirally-arranged series of shoulders *j*, adapted to act, as the drum is rotated, against the lower ends of the respective slides and lift them, one after another, a distance equal to the length of one of the sections or thicknesses of the space-bars. In this manner one revolution of the drum will cause all the spaces in the line to be raised to present its second and wider section in the line. If this is insufficient to give the line the required expansion, the spaces must be raised another step to present a still greater thickness in the line. This is accomplished by raising the secondary frame H bodily, with the slides and lifting-drum, and then rotating the drum a second time, the effect being to lift the slides and space-bars successively, as before, but to a higher level. If this second adjustment is still insufficient, the secondary frame is lifted still higher and the drum again rotated. The lifting action is effected, as shown in Fig. 7, by a weighted lever K on the main frame, acting through a link *k* on a second lever *k′*, which is in turn connected by link *k²* to the secondary frame, which rises whenever it is released.

A large cam-wheel L on the main shaft of the machine acts against a roller on lever *k′* to depress the lever and secondary frame after the completion of all the operations and to prevent the lever from lifting the secondary frame until the proper time for justification to begin.

The time and the extent of the rising movement of the secondary frame are controlled by a rotating wheel or cam M, mounted in the secondary frame and connected to a gear-wheel *l*, which constantly engages a driving-pinion *l′* on the lifting-drum J. The pinion and drum make three revolutions while the cam M revolves once, and the edge of the cam is divided into three sections 1, 2, and 3, standing at different distances from the center and directly beneath a rigid stud or stop O on the main frame. As shown in Fig. 2, the lifting-drum is connected by a universally-jointed driving-shaft P to the frictionally-driven hub *q* of a constantly-rotating driving-pulley Q. A circular disk *r*, fixed to the side of the small cam-wheel M, is notched in one side at *r′* to receive the end of a latch *s*, pivoted in a slot in a fixed stud *s′* and urged upward by a spring *s²*. When the secondary frame is depressed and held down by the main cam M, the justifying devices are all inactive, and the rotation of the small cam and lifting-drum is prevented, as shown in Figs. 1, 2, and 11, by the latch *s* engaging disk *r*.

After the frame has been raised to disengage the disk from the latch, and when the justification of the line is completed, the rotation of the drum must be automatically stopped. For this purpose I form one end of the drum with teeth *j²*, and to engage these teeth provide a hooked dog T, mounted on rock-shaft *t*, seated in the secondary frame. This shaft carries an oppositely-projected arm *t′*, connected by a telescoping rod *t²*, as in Figs. 1, 2, and 3, to a lever *t³*, pivoted on the main frame and urged upward by a spring *t⁴*. The friction between the parts of the rod is such that when the upper section is released or lowered it moves the lower member, which in turn operates the rock-shaft and dog.

When the line of matrices and spaces is inserted between the jaws D D′, they are closed, so that the distance between them is less than the required length of the line, and the end of the lever *t³* rests against the under side of jaw D′, as shown. As the spaces are raised, or advanced one after another the line, increased in length thereby, forces back the jaw D′, until finally, when the line has attained the requisite length, the jaw passes the end of the lever, allowing it to rise, and thereby allowing the dog T to stop the rotation of the lifting-drum, so that it shall not advance the

spaces farther or extend the line beyond the proper limit.

The operation is as follows: The assembled line of matrices and space-bars, sustained by the vertically-movable yoke C, or otherwise, is presented in front of the mold and between the jaws D D′, the matrices being held against vertical motion by engagement with the yoke, as in my previous machines, while the space-bars are free to rise under suitable pressure between the matrices. At this time the space-bars stand with their thin ends or sections in line and with their thicker ends projecting below the line, which is of less than the required length. The lower ends of the space-bars stand directly over the vertical slides I. At this time the secondary frame is in its lowest position and the rotation of the drum is prevented by the latch *s*, as shown in Figs. 1, 2, 3, 7, and 10. At the proper time the main cam L releases the lever *k′*, which, through the influence of the weighted lever, urges the secondary frame H upward until the highest section 1 of the cam M encounters the stop O, as shown in Figs. 6 and 11, whereby further rise of the frame is for the time being prevented. This lifting action disengages the notched disk *r* from the latch *s*, whereupon the lifting-drum J and the cam M commence their rotation. The drum, lifting the slides I one after another, causes them to act upon the space-bars thereover and push the latter upward through the line, each over its original position (shown in Fig. 14) to the position shown in Fig. 15, so that it presents an increased thickness or space in the line. After the drum has completed one revolution and thus lifted all the space-bars one step, the first section of the cam passes the stop O, thus allowing the secondary frame, with the drum-cam and lifting-bars, to rise bodily until the section 2 of the cam encounters the stop O, as shown in Fig. 12. The drum, continuing its revolution, again lifts the slides I in succession, causing them to push the space-bars upward successively an additional step, so that they present still thicker portions in the line, as shown in Fig. 16. In this manner the line is elongated or expanded step by step, the spaces therein being increased in width uniformly. If a still further elongation of the line is required, the second revolution of the drum will be followed by the passage of the cam-surface 2 beyond the stop O and by the rising of the secondary frame until section 3 of the cam encounters the stop O, as shown in Fig. 13, when the lifting action of the slides and spaces is again repeated.

Whenever the line reaches the predetermined length, which may be during the first, second, or third advance of the spaces, the retreating jaw D′ releases the lever t^3, allowing the dog T to engage the teeth of the lifting-drum and stop its rotation. The justification is now complete and the cast or impression may be effected from the justified line.

The main cam L in due time causes the lever K′ to depress the secondary frame and its adjuncts to the original position, (shown in Figs. 1 and 2,) the cam and drum rotating to their original or normal positions, where they are stopped by the latch *s* entering the notch in disk *r*. During the successive elevations of the lifting-frame the stop-dog T is held out of engagement by the rod l^2, the two parts of which bear upon each other with sufficient friction to prevent the dog from falling. As the secondary frame is lowered the telescopic rod adjusts itself to the increasing distance between the parts, and the dog T is lifted out of engagement with the drum by a fixed stud t^6 encountering an arm t^7 on shaft *t*.

In practice it will frequently happen that the justification will be completed at a time when a part of the space-bars in the line have been advanced one step beyond the remainder, as shown in Fig. 16, but as the rise of the successive steps is very slight the variation in the width of the spaces in the line is immaterial. In order, however, to insure a uniformity in the length of the line under all circumstances, I may provide the machine with the supplemental device represented in Figs. 17 and 18, in which V represents a right and left hand screw, mounted in the main frame and fixed against end motion. One end is seated directly in the matrix-confining jaw D, and the other passed through a nut or abutment *v* to sustain the sliding jaw D′. This jaw slides loosely around the screw and is urged toward its companion by a spiral spring d^4. As the matrix-line is expanded the jaw D is forced back until it encounters the supporting-nut *v*, the jaws being separated at this time a distance slightly greater than the required length of the line, so that a slightly excessive spacing is permitted. After the automatic devices have inserted all the spaces that are allowable, (the number being limited by the fact that the line confined by the jaws will admit no wider spaces,) the screw is turned and the jaws crowded together, so as to compress the line to the exact length required. The sliding jaw D′ is provided on its side with ratchet-teeth, engaged by a pivoted lever to hold the jaw back or in its open position in the manner and for the purpose described in my Patent No. 436,532, dated September 16, 1890, above referred to. At the time the screw is actuated to advance the nut *v* the dog or pawl is held out of engagement with the teeth of the jaw D′ by the overlying yoke C, which acts on a pin rising from the end of the lever, as in my previous machine, so that the pawl or dog offers no obstacle to the clamping action of the screw. As the quantities or distances to be thus reduced are very slight, usually not to exceed a few thousandths of an inch, there is no difficulty in securing perfect justification. The turning of the screw

may be effected by any suitable means, but in Fig. 18 I have shown it as provided at one end with a cranked arm v^2, connected by link v^3 to a weighted angular lever v^4, fitted to the main frame and resting at the opposite end against a shouldered cam v^6, mounted on the main shaft of the machine. This cam is so timed or adjusted that it permits the weighted lever to turn the screw after the advancement of the space-bars in the line is completed. It will be understood that the expression "tapered space-bars" is used in its broadest sense to include bars of wedge shape with smooth sides, and also those which are stepped on the sides, as herein shown, or, in other words, to include any form of space-bar which is thicker at one end than at the other, so that it will present an increasing thickness in the line as it is advanced therethrough, and that so far as the spreading action is concerned matrices, dies, and type are to be considered equivalents in the combinations hereinafter recited.

I do not claim, broadly, herein the separation of the jaws to permit the introduction of the final step or shoulder and the subsequent closing of the jaws to compress the line to its proper length, as this feature is broadly claimed in my application, Serial No. 481,339, filed July 24, 1893.

Having thus described my invention, what I claim is—

1. In a mechanism for longitudinally adjusting space-bars seated in a line of matrices, the series of slides and the lifting-drum having spirally-arranged shoulders to lift the slides successively.

2. In a mechanism for longitudinally adjusting spaces in a line of matrices or dies, a frame movable to and from the line and a series of space-adjusting devices and means for moving the same successively, mounted in the movable frame, whereby the space-adjusting mechanism may be advanced bodily toward the spaces.

3. In combination with a line of matrices, a support therefor, tapered spaces seated in and movable endwise through the line, in combination with a sliding frame, a series of space-adjusting slides mounted in said frame, mechanism also mounted in the frame to effect the advance and retreat of the slides successively, and mechanism for advancing the frame after all the slides are once actuated and preparatory to their second action; whereby the spaces are advanced one after another through the series and then advanced again in like manner.

4. In combination with the sliding frame, the weight connected to and tending to advance the same, the main cam to restore the frame, the stepped cam to control the advance of the frame, the slides and their lifting-drum mounted in the frame, and motive devices to turn the drum and cams.

5. The sliding frame, means to advance the same, and the stepped cam to control its advance, in combination with the slides and their toothed actuating-drum in said frame, friction driving devices to turn the drum, the stop-dog to limit its rotation, the dog-controlling lever and the matrix-clamping jaw controlling the lever; whereby the movement of the jaw is caused to stop the spacing mechanism.

6. A line of matrices or dies, means for sustaining them, tapered spaces movable endwise through the line, and matrix-confining jaws or clamps separable under the influence of the expanding line, in combination with mechanism for automatically advancing the spaces to elongate the line, and a stop device for said mechanism controlled by one of the clamps; whereby the movement of the clamp under the influence of the line, is caused to stop the spacing action when the line reaches the predetermined length.

7. In combination, a line of matrices, tapered spaces movable endwise through the line, to expand the same, mechanism to advance the spaces, and devices actuated by the expansion of the line to arrest the action of the space-advancing devices; whereby the line is made self-controlling as to the expansion or elongation.

8. In combination, the matrix-confining jaws, the screw to close them, the slides to advance the spaces and mechanism to first operate the slides and then the screw.

9. In a justifying mechanism and in combination with a line of matrices, mechanism for introducing spaces into said line to increase its length and a device to arrest the action of said mechanism, operated by the expansion of the line during its justification.

10. In combination with a support therefor, a line of matrices, stepped space-bars movable endwise through the line to expand the same, jaws or clamps to limit the expansion of the line, mechanism to advance the spaces and effect approximate justification, a screw for adjusting one of the jaws or clamps, and a screw-actuating mechanism, substantially as shown, operating to open the jaw during the adjustment of the spaces and to close the jaw and compress the line, after the final adjustment of the spaces.

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