(No Model.) 3 Sheets—Sheet 1.

O. MERGENTHALER.

LINOTYPE MACHINE.

No. 565,484. Patented Aug. 11, 1896.

Fig. 1.
On line 1-1

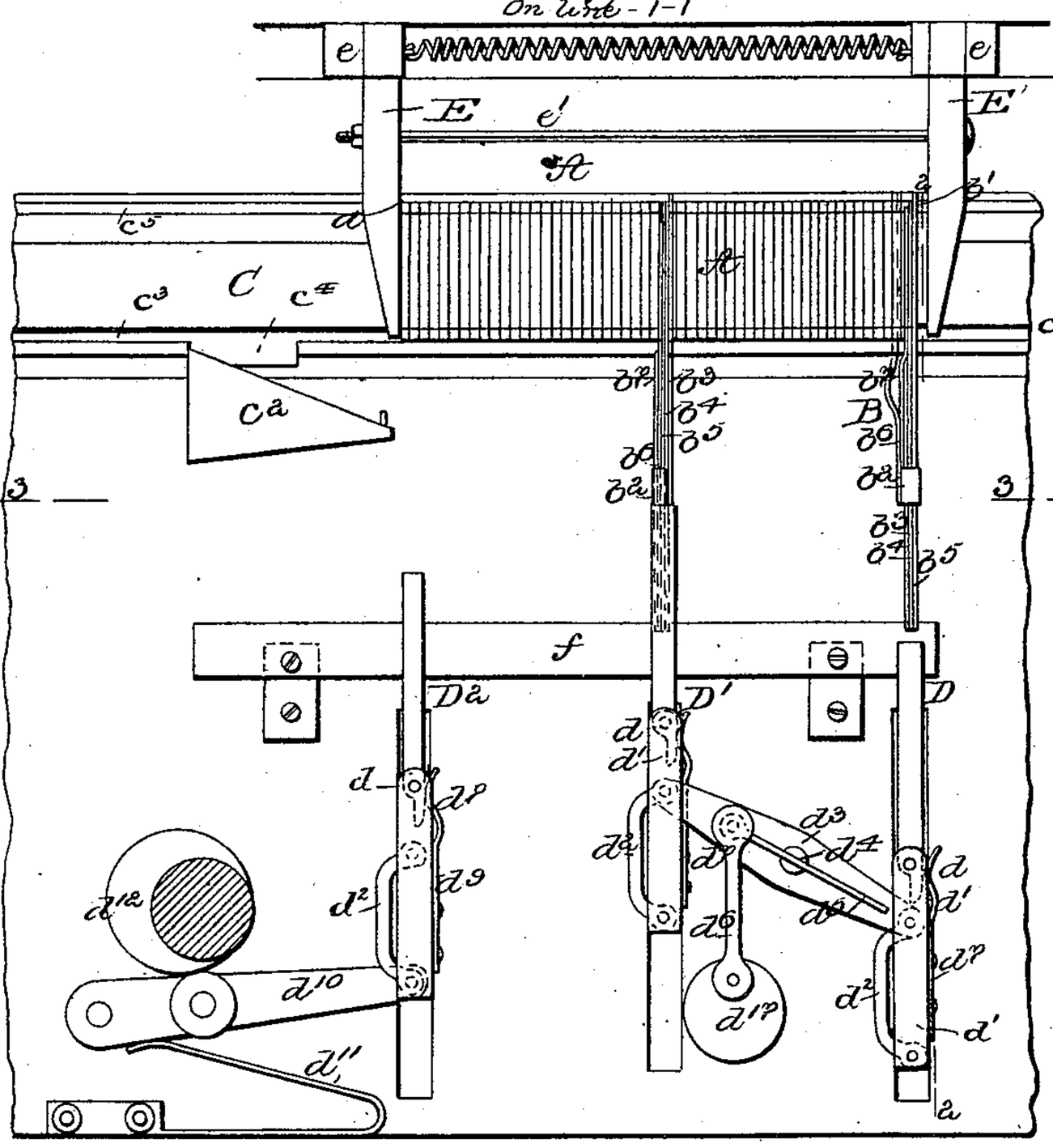


Fig. 2.
On line 2-2

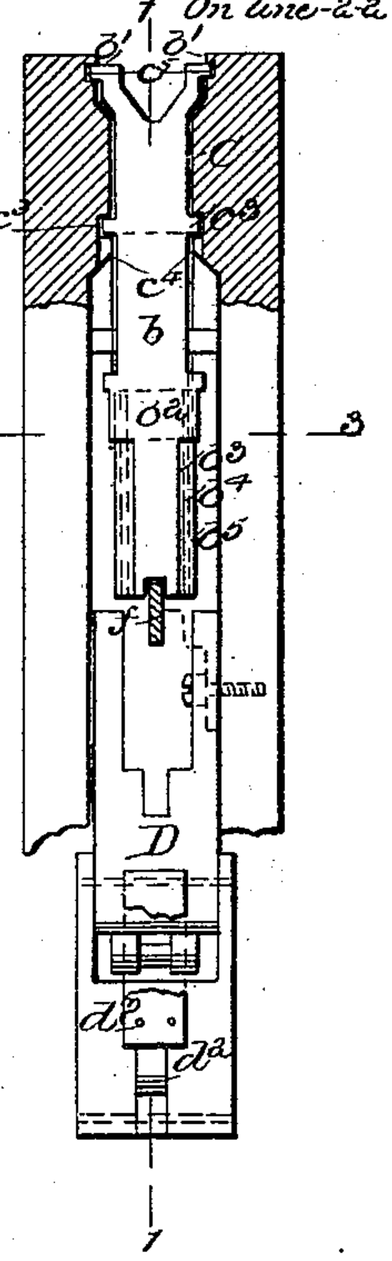


Fig. 4.

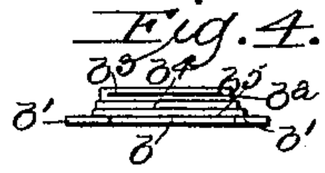


Fig. 3.
On line 3-3

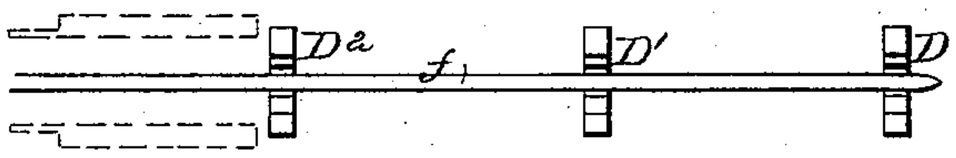


Fig. 5.

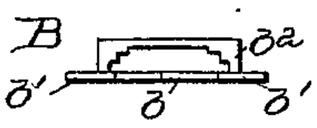
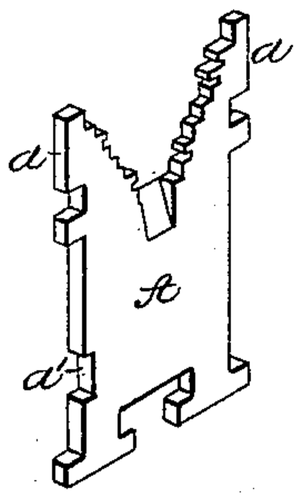


Fig. 6.



WITNESSES

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(No Model.) 3 Sheets—Sheet 2.

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Fig. 7.

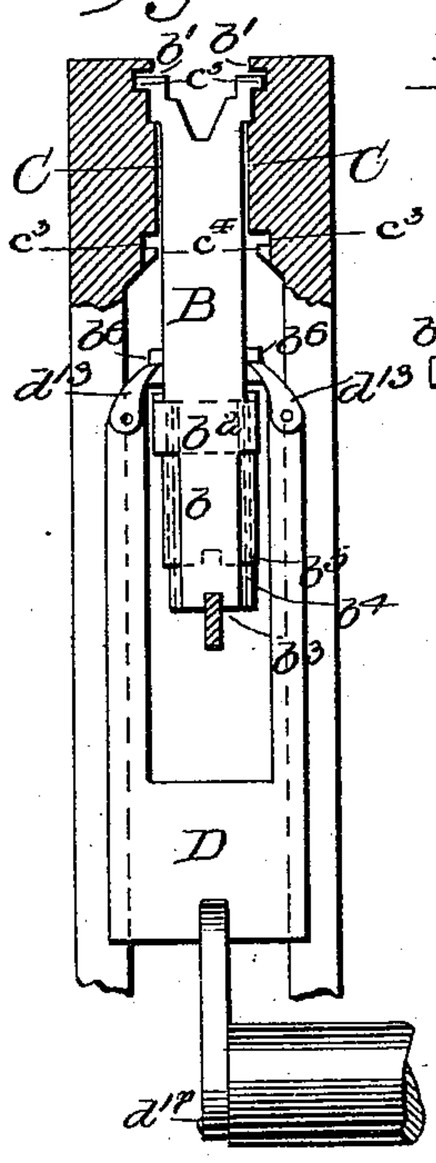

Fig. 7a.

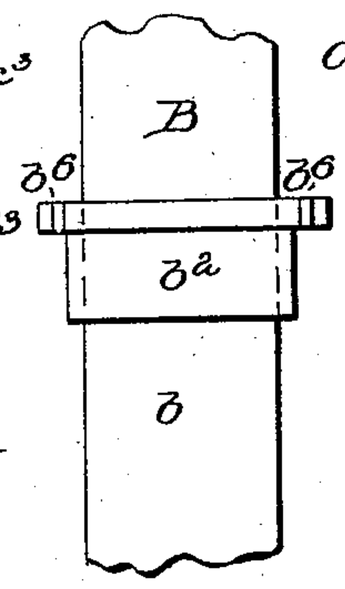

Fig. 8.

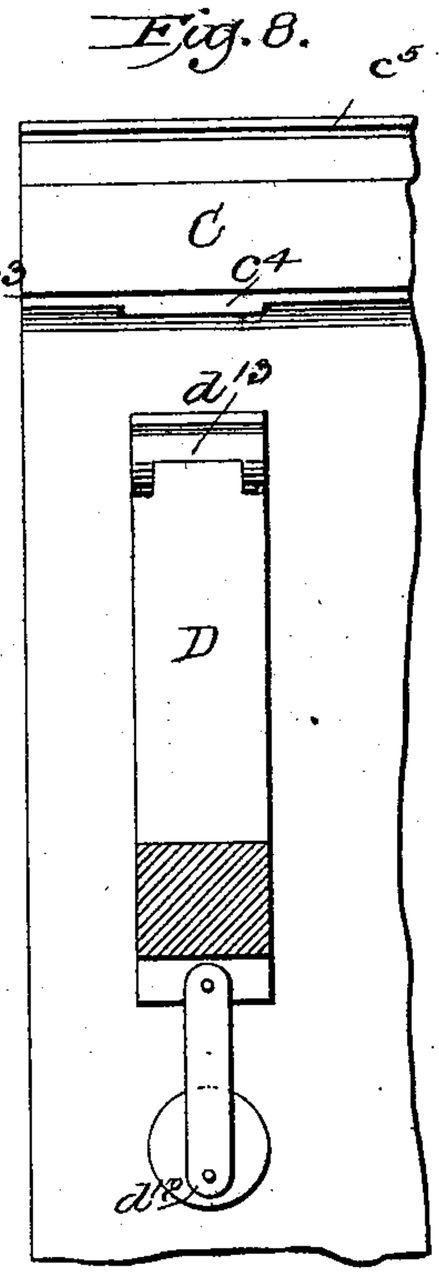

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Fig. 9.

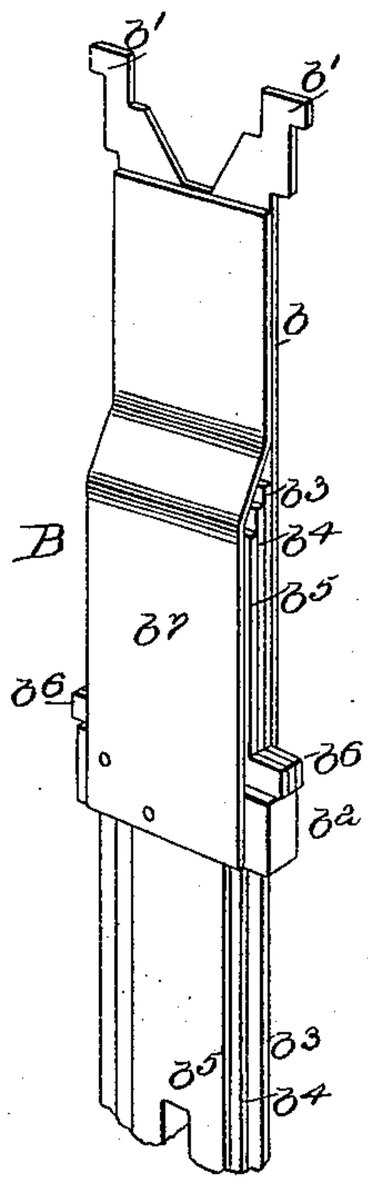
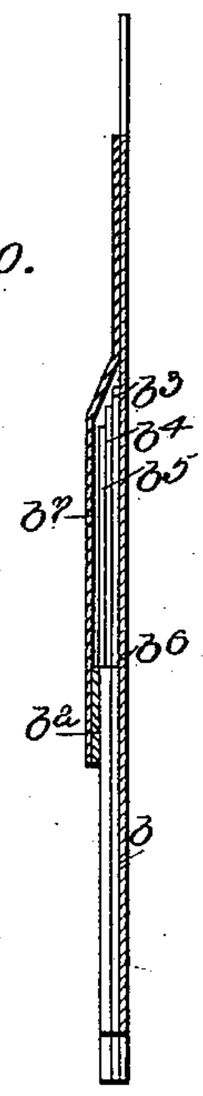


Fig. 10.



WITNESSES

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UNITED STATES PATENT OFFICE.

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

LINOTYPE-MACHINE.

SPECIFICATION forming part of Letters Patent No. 565,484, dated August 11, 1896.

Application filed February 24, 1893. Serial No. 463,585. (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 means for justifying or spacing out to a predetermined length lines of type-matrices or type, and is intended more particularly for use in connection with the so-called "linotype-machines" of the character of the type represented in Letters Patent of the United States issued to me on the 13th day of July, 1886, No. 345,526, and September 16, 1890, Nos. 436,531 and 436,532.

In carrying the present invention into effect I introduce into the composed line of matrices, at the points where spaces are to occur, that is to say, between characters at the beginning and end of words, compound expansible spaces. These spaces, when introduced into the line, are adjusted to their minimum width or thickness. After the completion of the composition, and in order to increase the thickness of the spaces in the line, I advance into the line between, or in connection with the thin ends of the compound spaces, one or more secondary spaces or slides forming parts of the compound spaces, thus spreading, expanding, or increasing the thickness of the active portion of the compound space. The compound space consists of a series of thin flat spaces or slides connected to an elongated body or primary space in such manner that they may be moved longitudinally in relation to each other and to the body, so that after the end of the body or compound space is inserted within the line its thickness may be increased, as above indicated, by advancing one or more of the slides or secondary spaces along or within the body and into the line. It will be perceived that justification is thus effected by introducing additional thin spaces into the line, in addition to the primary space, until the line, as a whole, is extended to the required length. In connection with a series of the compound spaces, the matrices or type, and suitable means for sustaining the spaces and matrices in line, I employ automatic mechanism for advancing the slides or secondary spaces successively into the line, as may be required. The mechanism for advancing the secondary spaces may be variously constructed, as will appear to the skilled mechanic after consideration of this specification and the accompanying drawings, within the range of mechanical skill, and without departing from the limits of my invention.

As my justifying mechanism may be used in machines variously constructed in other respects, and as the present invention relates exclusively to the means for effecting justification, I have limited my drawings thereto.

Referring to the drawings, Figure 1 is a vertical section of my mechanism on the line 1 1. Fig. 2 is a section of the same on the line 2 2; Fig. 3, a plan view of the parts, looking downward from the line 3 3 of Figs. 1 and 2. Fig. 4 is a top plan view of a compound space with the spring or side plate b^7 detached. Fig. 5 is a plan view of the main portion of the same with the slides or secondary spaces removable. Fig. 6 is a perspective view of one of the matrices. Figs. 7, 7ª, and 8 are respectively a cross-section, an enlarged detail view, and a longitudinal section, of a portion of a mechanism in a modified or alternative form. Fig. 9 is a perspective view of one of the compound spaces complete. Fig. 10 is a vertical cross-section of the same.

Referring to the accompanying drawings, A A represent a series of type-matrices which are to be assembled in line and justified. In the form shown they consist of flat metal plates provided with supporting shoulders a and with a matrix a' in one edge, these matrices being the same as those described in my patent before referred to. It is to be understood, however, that the matrices or type—the word "type" being used in a generic sense to include both male and female characters—may be modified in form and sustained in any suitable manner.

B represents my compound space or space-bars, each consisting of an elongated bar or plate b, provided at its upper end with sustaining-shoulders b', and on one side, midway of its length or thereabout, with a vertical sleeve or guide b^2, secured thereto and con-

taining a series of secondary spaces or slides b^3, b^4, and b^5, adapted to slide vertically in relation to each other and to the main space or body. These secondary spaces or slides are of equal, or substantially equal length, but are all shorter than the body or bar b. Each of the secondary spaces or slides is provided with lateral shoulders or projections b^6, which rest on top of the sleeve b^2, thus sustaining the slides with their upper ends a considerable distance below the upper end of the body b. This admits of the upper end of the body or bar being inserted into the composed line or matrix as a primary space, while all the secondary spaces or sections remain below the line and out of action. A spring plate or spring b^7, attached to the sleeve b^2, and forming part of the body of the compound space, is bent inward and upward above the slides or secondary spaces and seated against the face of the bar or body b, so that it is introduced into the line therewith, the upper end of the body being thus composed of two thicknesses, so that when the slides are pushed upward into the line they pass between the upper ends of the members b and b^7, spreading them apart and thus increasing the thickness of the compound space within the line. The slide b^3, lying next the body-bar b, is of less width than the bar, the second slide b^4 of less width than b^3, and so on successively throughout the series, and this in order that the lifting devices presently to be explained may distinguish between the secondary spaces or slides, and lift them one at a time. It will be perceived that the members b and b^7 and the intermediate slides or secondary spaces constitute, jointly, an expansible space, the upper end of which may be introduced into the line and there increased in thickness to a greater or less extent by lifting one or more of the slides into an operative position between the outer members.

Passing now to the mechanism for supporting and operating the matrices and compound spaces, C represents a horizontal guide or support vertically slotted to admit the assembled line of matrices from one side and adapted by the groove c^5 to engage the shoulder b' at the upper ends of the compound spaces and retain them in line horizontally, the matrices and space-bars standing vertically side by side, as shown in Figs. 1 and 2.

The entire line of matrices and compound spaces may be moved horizontally through the guide from right to left, either by hand or by shifting the arms E E', which are mounted on slides e and move horizontally, and connected with each other by a rod e', or otherwise, to limit their separation and thus adapt them to limit the extension or elongation of the line during the justifying operation. The two arms E E' are connected, as shown, by a spiral spring, which tends to draw them together and thus applies an edgewise pressure to the line, and this in order to hold the matrices and spaces in orderly position and to prevent the secondary spaces or slides from falling out of their adjusted positions.

In assembling the line, the upper end of the compound space, that is to say, the upper ends of the members b and b^7, are alone inserted between the matrices, while the secondary spaces or slides remain, as shown on the right hand in Fig. 1, wholly below the matrices, and, for the time being, inactive.

Below the guide C is mounted a series of vertically-reciprocating pushers or slides D, D', and D^2, intended to act successively on respective secondary slides of the compound spaces in order to force them upward, one after another, into the line within the upper end of the compound space, thus increasing the width or thickness of the space in the line.

The pushers D D' are connected by horizontal pivots d to the upper ends of two slides d', vertically guided by slots in the framework and connected by links d^2 to the opposite ends of a lever d^3, carried by a central horizontal axis d^4, and connected through a spring-arm d^5 and a pitman d^6 to a crank d^{17}, whereby the lever is constantly vibrated, so as to thrust pushers D and D' upward alternately.

The pushers proper are held normally in upright positions by springs d^7, riveted to the slots and bearing against the lower ends of the pushers, the upper ends of which are permitted by the springs to yield laterally toward the left when required, in order to follow the lateral movements of the compound spaces. As shown, the pushers are each provided with a projection below its supporting-pivot, against which the spring acts to hold the pusher normally to the upright position. The pusher D^2, located at the extreme left, is connected in like manner by a pivot and spring to a reciprocating vertical slide d^9, operated through an intermediate link from a lever d^{10}, which is urged upward by a spring d^{11} and depressed at regular intervals by a constantly-rotating eccentric d^{12}. The mechanism for reciprocating the pushers is of a secondary importance and may be replaced by any other different devices which will impart motion thereto. The pushers are each slotted transversely through the upper end from side to side, or, in other words, made of U shape at the upper end, their slots or openings being of different widths, corresponding to the variations in the width of the secondary spaces or slides previously referred to. The first pusher D has its opening of such width that it will engage beneath and lift only the first and widest slide b^3, and in so doing straddle the remaining sections without effect upon them. The second pusher D' has its opening of less width than the first and is adapted to push upward the second slide b^4, together with the slide b^3, if the latter should chance, before being elevated, to come within its reach. The third pusher D^2,

having a still narrower opening, is adapted to push upward the slide b^5, as well as those which are wider.

To prevent the compound spaces from swaying edgewise out of position, their lower ends are preferably notched to ride upon the upper edge of a fixed horizontal guide f as the line is being shifted to the left.

The operation in justifying is as follows: The assembled line of matrices and intermediate compound spaces is introduced horizontally into the guide C and between the confining-arms E E′. By means of any suitable motor the pushers D D′, &c., are constantly reciprocated. As the line advances the compound spaces are brought in succession over the ends of the successive pushers. As each compound space passes over the first pusher D it acts upon the first slide or secondary space d^3, urging the same upward, and if there is a space remaining in the line to be filled the section b^3 is forced into the line between the upper ends of the members b and b^7. It will be observed that the additional space in entering a line does not slide against or bear directly on the adjacent matrices. On the contrary, it bears against the members b and b^7, which remain at rest against the matrices. As the compound space continues its advance to the left with the shifting line it is brought, in time, over the pusher D, which in its turn acts upon the second slide b^4, crowding it upward into the line if there is sufficient space to receive it. In due time the compound space is finally brought over to the third pusher D^2, which, in its turn, pushes the slide or secondary space b^5 upward into the line. Each of the compound spaces has its slides operated on in like manner by being thus added to the line, provided it has not reached the predetermined length. When the three pushers in succession, three spaces ever the line reaches the proper limit of length, (determined by the arms E E′,) it is impossible to introduce additional spaces, and the resistance offered to the rising movement of the slides or secondary spaces causes them to remain at rest, the springs through which the pushers are driven yielding at such time and allowing their driving devices to continue their action. In order that the length of movement of the last pusher D^2 may be shortened, I propose to provide the guide C on each side with a stationary cam or incline c^2, in proper position to underride and engage the shoulders b^5 of the slide or secondary spaces after they have been partly lifted by the pusher D^2. As the line is carried further to the left, the slides riding upward along the stationary incline are pushed upward thereby to their final operative positions in the line. It will, of course, be understood that the inclines act only on the shoulders of those secondary spaces which have already been lifted by the pushers sufficiently to carry their shoulders over the lower end of the incline. The shoulders of these slides or secondary spaces which have not been previously lifted will pass beneath the incline c^2 and be unaffected thereby.

When the guide C is provided with a groove c^3, as shown in Fig. 8, an opening similar to the opening c^4 is left immediately above the cams c^2, so as to permit the elevation of the shoulders b^6 and their engagement with the said groove, as the carrier E E′ continues to move to the left.

By constructing the space sections or slides of suitable thickness, and particularly when the space-sections and matrices are in thickness multiples of a common unit, I am enabled to effect a perfect and automatic justification of the line without reference to the number or the width of the spaces required to effect such justification.

Instead of constructing the forked pushers in the form shown in Figs. 1 and 2 they may be made, as shown in Figs. 7 and 8, each with two pivoted pawls d^{13} at the upper end to close inward edgewise beneath the shoulders of the secondary spaces or slides and force them upward. This construction is in some cases advantageous, in that the lifting strain is applied nearer the upper ends of the sections, so that there is less liability of springing or bending them than when the pressure is applied against their lower ends. When this modified operating mechanism is used, the secondary spaces or slots of each compound space should be of different widths across their shoulders, as shown in Fig. 7^a, so that the widest slide will be lifted by the first pusher, the next by the second, and so on repeatedly. It will be understood, of course, that the play of pawls d^{13} on the pusher D will be such that they will engage only with the slides having the widest shoulders, those on the pusher D′ to engage the next widest, and so on through the series, in manner similar to the arrangement of transverse slots in the form of pushers first described.

The guide C may be provided, as shown in Fig. 8, with longitudinal grooves c^3, having a bottom opening c^4 directly over the pushers, so that when the slides are lifted their shoulders will enter the groove and ride forward therein, the slides being thus prevented from falling accidentally out of the positions to which they are lifted. This is not, however, a necessary feature of the invention, as the friction between the slides and the outer members of the compound space is easily sufficient to insure the same purpose.

The machine in which my spaces are used will be provided with suitable means for depressing the secondary or supplemental spaces to their original position after the device has performed its function; but as this constitutes no part of the present invention it is deemed unnecessary to describe it herein.

As regards the construction of my compound space, the only essential requirement is that it shall consist of a plurality of spaces,

slides, or sections having parallel sides and arranged to slide endwise in relation to each other, so that additional spaces may be introduced in connection with those already in the line.

The relative form, size, and construction of the sliding connections and other details are of secondary importance and susceptible of modification.

I do not claim here the form of justifying mechanism represented in my application for Letters Patent, Serial No. 327,079.

I do not claim herein, broadly, mechanism for advancing a series of stepped spaces into a line successively; nor do I claim, broadly, two or more pusher-fingers acting successively to advance spaces into a line, these matters forming the subject of my earlier application, Serial No. 327,079.

I do not claim, broadly, herein mechanism for advancing spaces by yielding pressure, and a movable pusher for positively advancing them to a predetermined position.

Having thus described my invention, what I claim is—

1. A compound space-bar consisting of a plurality of sections or spaces, each having parallel sides and connected to slide endwise in relation to each other.

2. The compound space-bar consisting of a main or body portion provided with suspending shoulders and one or more secondary spaces each having parallel sides and united thereto by a sliding connection, whereby the main space suspended in the line is enabled to maintain the secondary spaces in position for insertion into the line.

3. A compound space-bar consisting of a plurality of sections or spaces, of different lengths, each having parallel sides and connected to slide endwise in relation to each other.

4. A compound space-bar consisting of a bar provided with suspending shoulders and with a sleeve on one side, in combination with one or more secondary bars provided with supporting-shoulders and mounted to slide through the sleeve.

5. The compound space-bar consisting of spaces or sections differing in width and length, and connected to slide endwise in relation to each other.

6. In combination with the body *b*, and the independently-sliding secondary spaces connected thereto, the spring b^7 acting to hold the series of secondary spaces against accidental motion.

7. In combination with a guide to sustain a line of matrices and space-bars, the matrices, the space-bars each consisting of sections differing in width and connected to slide endwise in relation to each other, and a series of pushers, substantially as described, arranged to act upon the respective sections of the space-bars as the bars are advanced laterally with the line of matrices through the guides; whereby the several sections of each bar are carried successively into the line to increase the width of the spaces therein.

8. In combination with a suitable guide or support for the matrices and space-bars, the space-bars each consisting of sliding sections differing in width, and a series of pushers arranged in the path of the space-bars and provided respectively with openings differing in width; whereby the successive sections of the space-bars are advanced into the line as the bars are presented to the successive pushers.

9. In a combination with a sectional space-bar and a support for the matrices and space-bars, a pusher to start a space-bar section into the line of matrices, and stationary cams or inclines as c^2, to continue the movement of the space-section into the line as the latter is shifted laterally.

10. In combination with a guide for the matrices and space-bars, the space-bars each provided with suspending shoulders and a notch in the lower end and the horizontal guide *f*, to enter said notch; whereby the bars are prevented from swaying edgewise.

11. The combination of a guide or support C, a line of matrices therein, space-bars consisting of sections having parallel faces and movable longitudinally with respect to each other, substantially as described, seated by one end within the line, confining devices as the arms E E′ to limit the length of the line, and means to insert the sections of the successive bars into the line one after another.

12. In combination with a guide or support C, to sustain a line of matrices, a space-bar consisting of a body *b*, of uniform thickness inserted at one end in the line and engaging the guide to prevent end motion, and a secondary space b^3, with parallel sides having a sliding connection to the body *b*, whereby it is adapted to be thrust into the line at the side of the body.

13. In combination with the guide C, having longitudinal grooves c^3 and c^5, the space-bar consisting of the main portion *b*, having shoulders to enter the grooves c^5, and a sliding section attached to the member *b*, and provided with shoulders to enter the groove c^3.

14. A space-bar presenting two external members in combination with one or more movable spaces or sections, having parallel outer sides and adapted to be advanced between the outer members to effect their separation, whereby the outer surfaces are maintained in parallel lines, and the space caused to present a solid face, adapting it to close the face of a mold.

15. In a justifying mechanism and in combination with means for entering spaces into the line, stationary means for forcing the partly-entered spaces positively and fully home to their places in the line.

16. In a justifying mechanism, the combi-

nation of a line of matrices, mechanism for entering spaces into the said line, mechanism for shifting the line with its contained spaces endwise and mechanism acting on the spaces during such shifting movement to force them fully home to their places in the line.

In testimony whereof I hereunto set my hand, this 14th day of February, 1893, in the presence of two attesting witnesses.

OTT. MERGENTHALER.

Witnesses:

PH. H. HOFFMAN,

THOS. P. ELLIOTT.