No. 844,556. PATENTED FEB. 19, 1907.

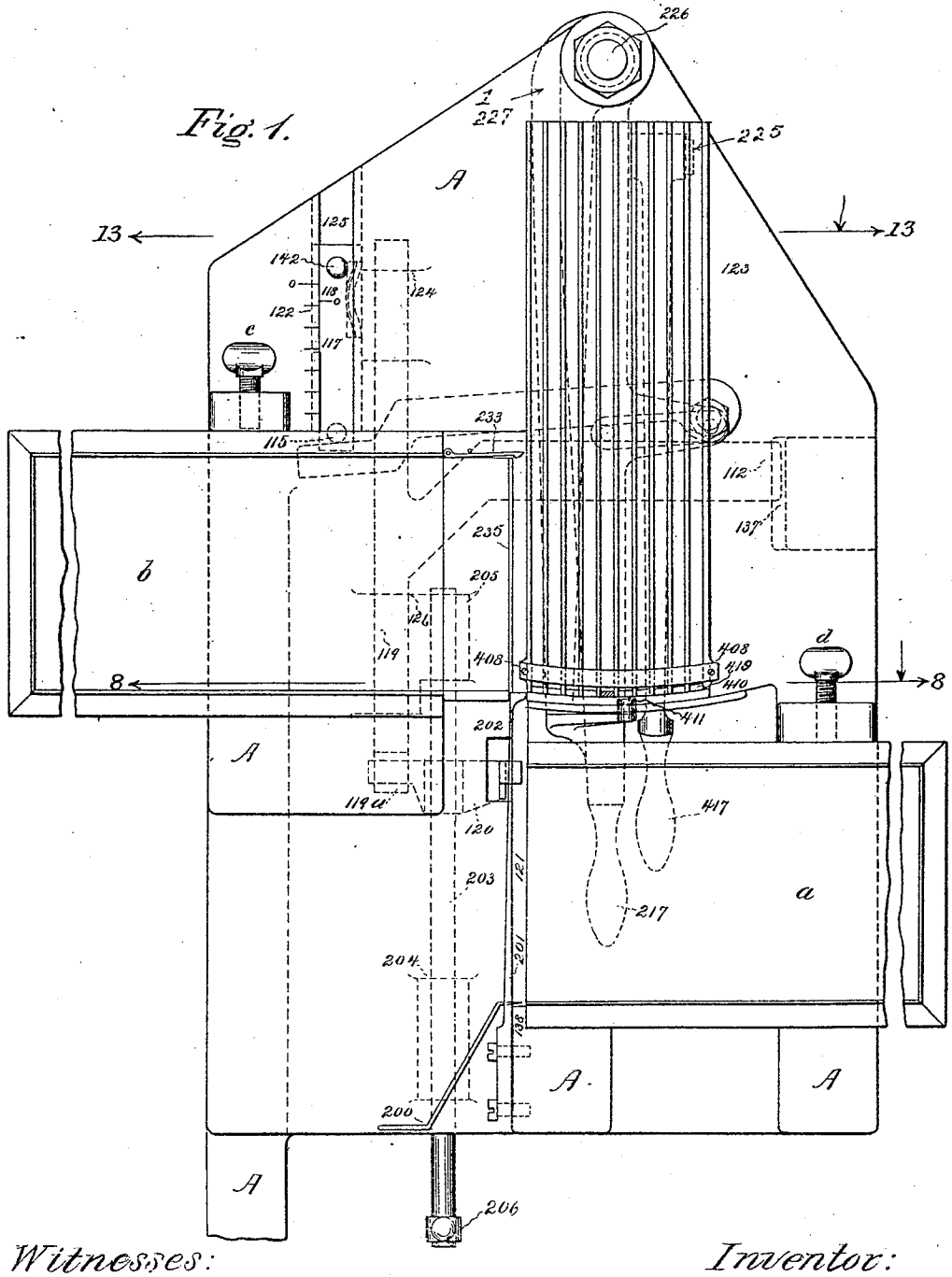
B. M. DES JARDINS.

TYPE JUSTIFYING MACHINE.

APPLICATION FILED MAY 20, 1895.

7 SHEETS—SHEET 1.

Fig. 1.



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7 SHEETS—SHEET 2.

Fig. 2.

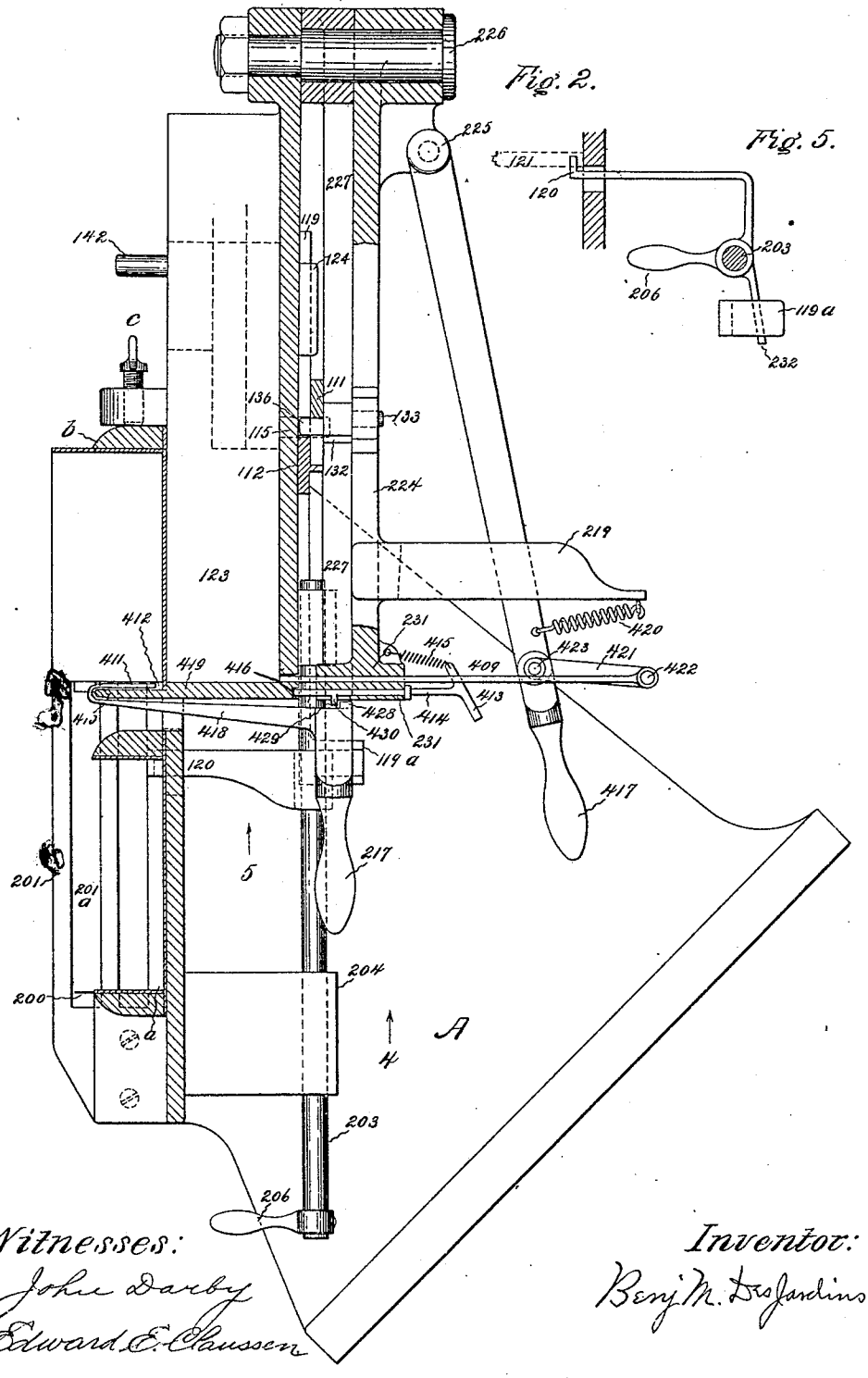

Fig. 5.

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7 SHEETS—SHEET 3.

Fig. 4.

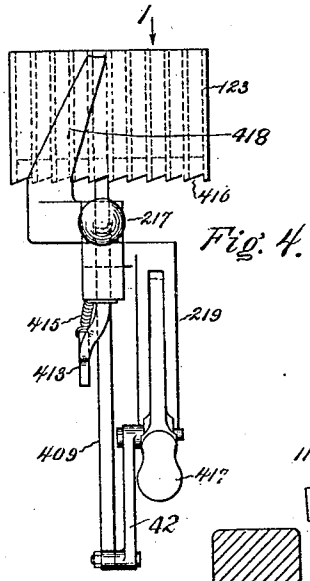
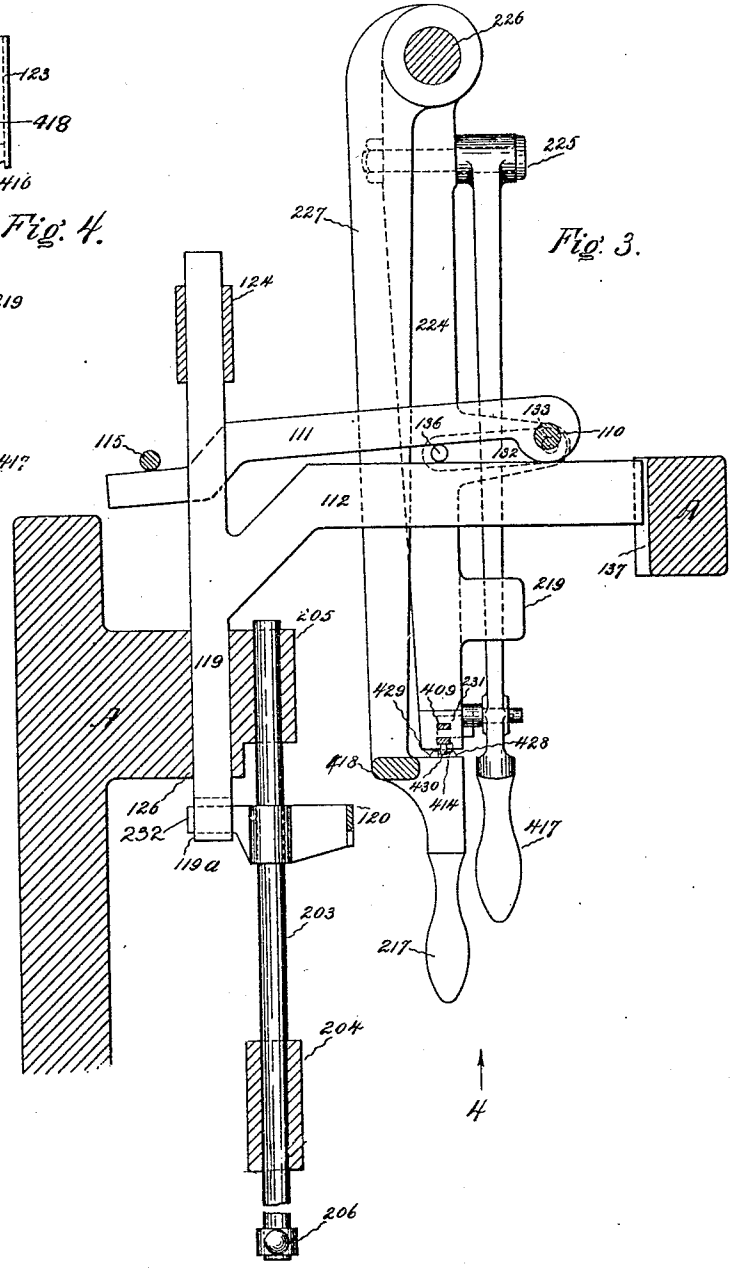


Fig. 3.



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7 SHEETS—SHEET 4.

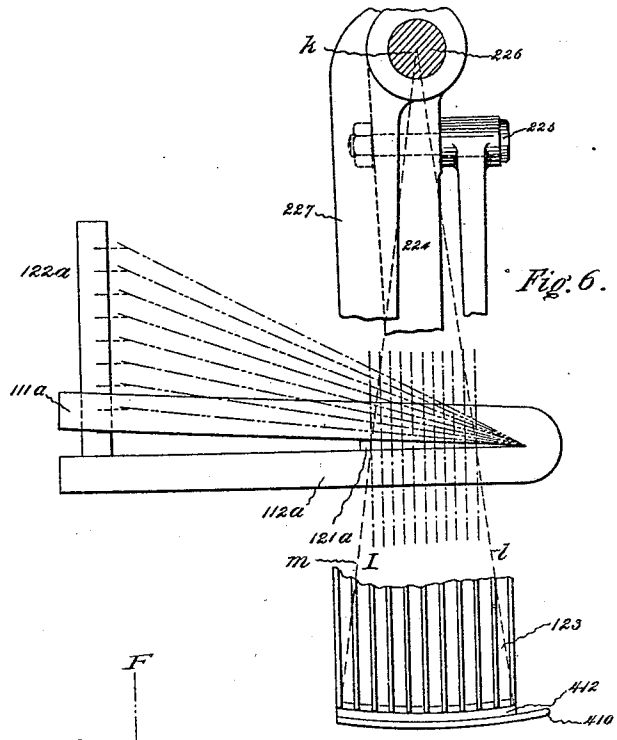

Fig. 6.

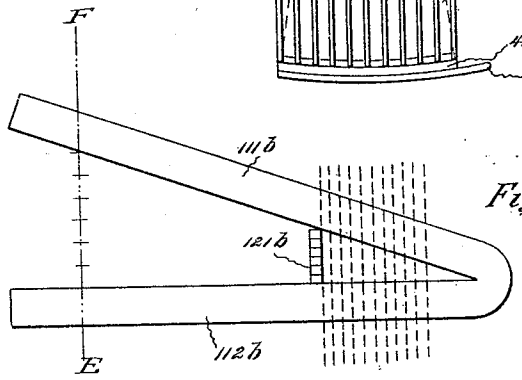

Fig. 7.

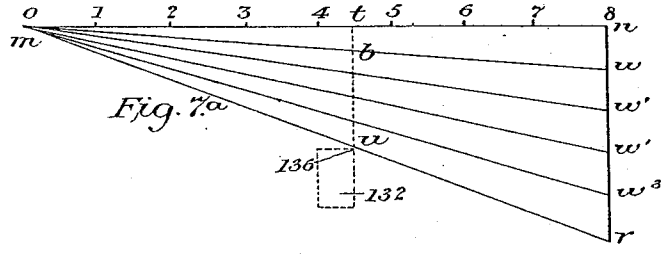

Fig. 7a

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7 SHEETS—SHEET 5.

Fig. 8

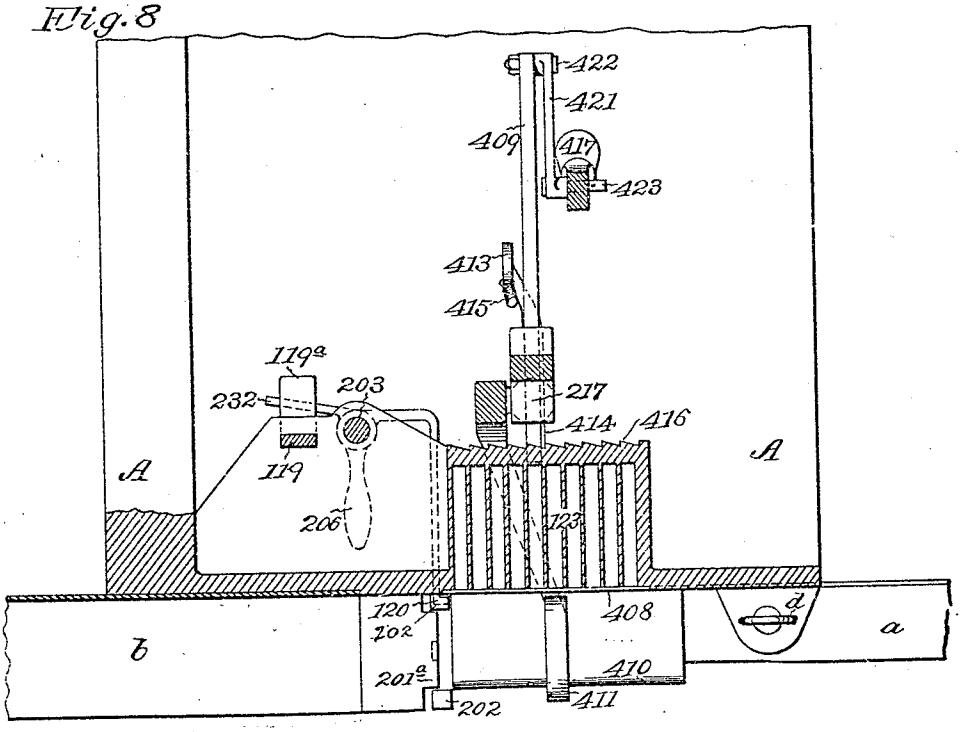


Fig. 9

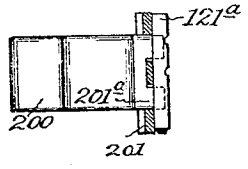
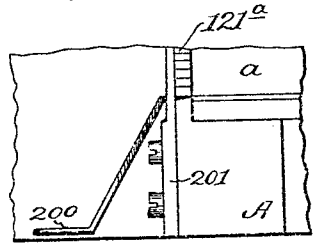


Fig. 10



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7 SHEETS—SHEET 6.

Fig. 12

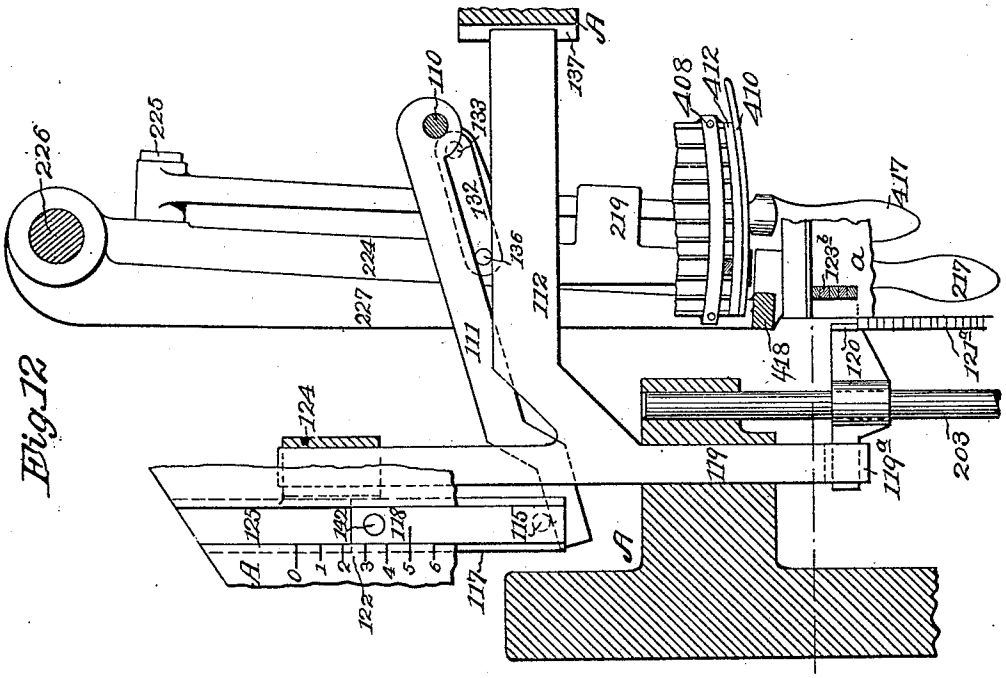
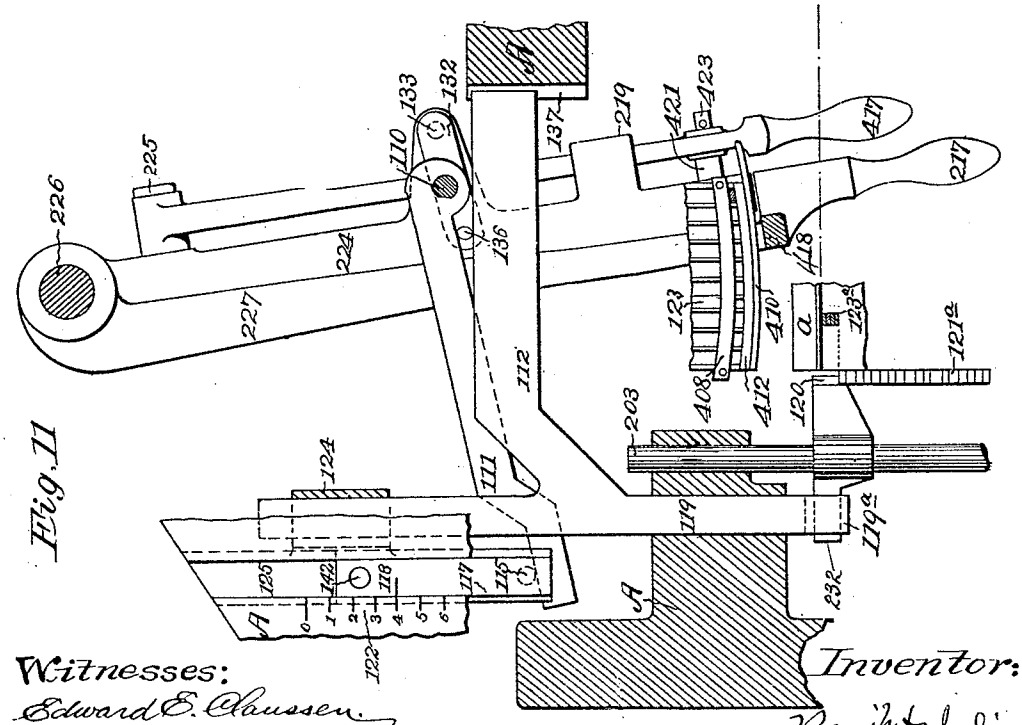


Fig. 11



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Eva S. Shelton.

Inventor:
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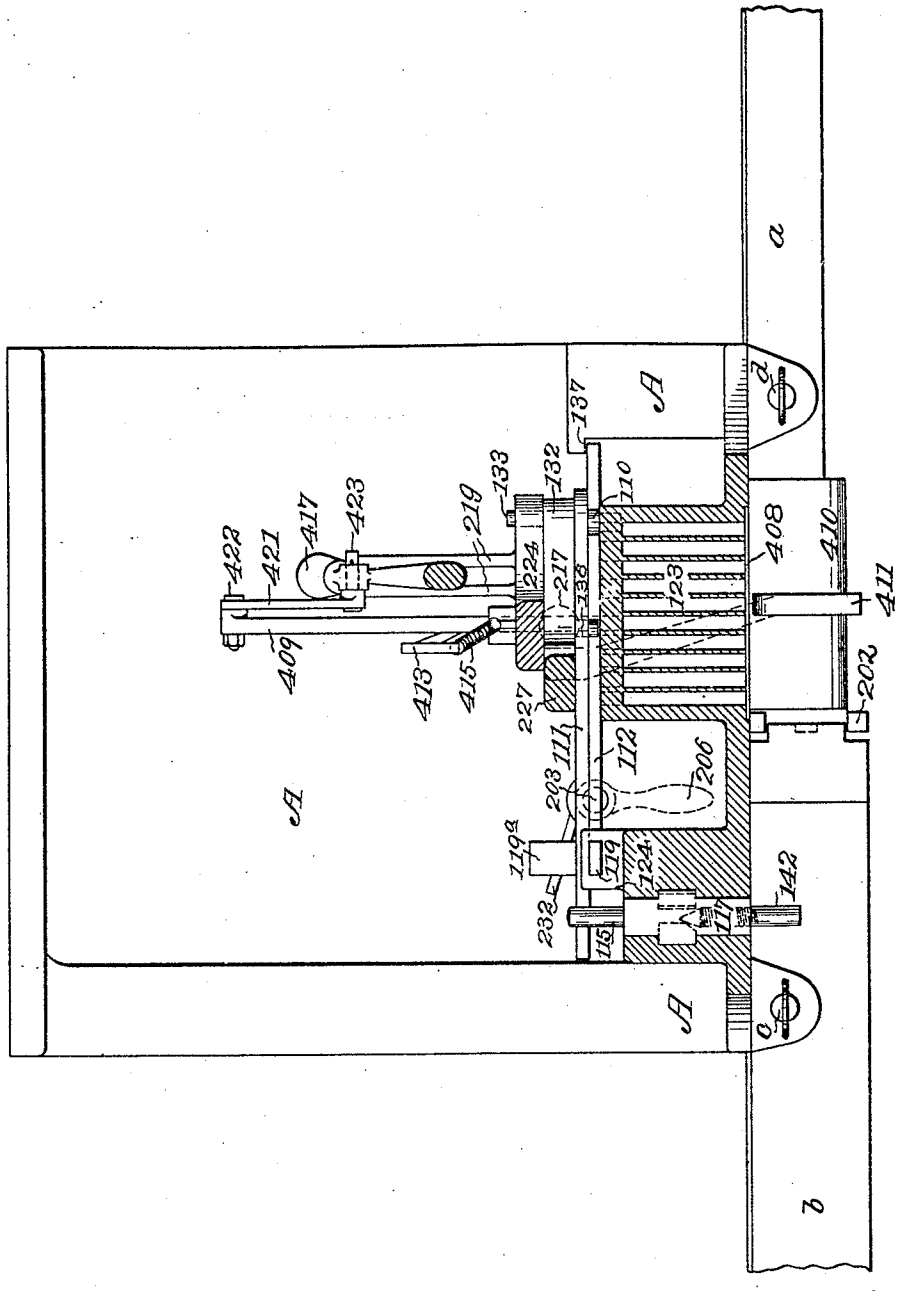
7 SHEETS—SHEET 7.

Fig. 13.



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UNITED STATES PATENT OFFICE.

BENJAMIN M. DES JARDINS, OF HARTFORD, CONNECTICUT, ASSIGNOR, BY MESNE ASSIGNMENTS, TO THE UNITYPE COMPANY, A CORPORATION OF NEW JERSEY.

TYPE-JUSTIFYING MACHINE.

No. 844,556. Specification of Letters Patent. Patented Feb. 19, 1907.

Application filed May 20, 1895. Serial No. 550,015.

To all whom it may concern:

Be it known that I, BENJAMIN M. DES JARDINS, a citizen of the United States, residing at Hartford, in the county of Hartford and State of Connecticut, have invented a new and useful Type-Justifying Machine, of which the following is a specification.

This invention relates to mechanism for justifying lines of type.

This improved mechanism automatically determines the sizes of spaces necessary to fill out and justify type-lines, being governed for that purpose by the number of word-spaces and the amount of matter in the unjustified lines.

While the present machine is not entirely automatic, it will be found to greatly facilitate the work of justification, and it will greatly cheapen such work, as an inexperienced operator can by its use quickly select the proper spaces for justification.

In the following specification I shall term the difference between the amount of matter in an unjustified line and the required length of the line or column measure the "shortage" of the line. The places between words in which justifying-spaces are to be inserted I shall term "intervals," and the final quads or pieces used to separate the words in the justified lines will be termed "justifying-spaces." The shortage of the line divided by the number of intervals will give the average width of the justifying-spaces, and this average width I shall term a "normal space." The term "type" as used herein will be understood as including matrices, such as are used in linotyping, as well as ordinary printers' type.

Briefly stated, the present invention consists in calculating mechanism which measures the line shortage and divides such shortage by the number of intervals in a line, the result being the proper width of justifying-spaces, and mechanism for transferring the selected justifying-spaces from the space-magazine to the lines of type. The calculating mechanism controls the space-selecting mechanism automatically; so that the operator is entirely relieved of the mental work which has to be performed in the ordinary hand process of selecting and inserting justifying-spaces. This calculating mechanism for measuring the line shortage and dividing such shortage by the number of intervals in the line to determine the proper width of justifying-spaces is applicable not only in machines for justifying composed lines of type or matrices, but in line-justifying mechanism of other classes, and the terms "justifying mechanism" and "typographic machine" herein are used in this broad sense to include all classes of typographic work in which lines are to be justified for printing or the production of printing-surfaces. In the machine illustrated and described herein the calculating devices are combined with a space-magazine and devices for supplying and inserting ready-made spaces; but it will be understood that the justifying-spaces, the value of which is determined by these calculating devices, may be provided otherwise than by using ready-made spaces, suitable space-forming devices being combined with the calculating devices for this purpose. In the present case the justifying-spaces are arranged in channels of a space-magazine in the order of their sizes. They increase in size by uniform amounts, and for convenience the difference between two consecutive sizes will be termed a "unit." The number of sizes used will depend upon the degree of accuracy required in the work. The greater the number of sizes the smaller the unit and the greater the accuracy, as will be evident.

The type-lines may be composed for this justifier either by hand or by type-setting machinery, and in this particular construction they are preferably left solid without any spaces between the words, and they are separated or leaded to prevent the upper uneven ends from becoming mixed or dislocated. The column of type-matter is first placed in a suitable galley, and all of the corrections are made before the lines are justified. The galley containing the corrected column is next placed in the machine, and the operator pushes said column along until the first line is in proper position in the line-channel. Then after the measuring factors have been located he transfers the line, one word at a time, by means of a forked rule held in the left hand, while with the right he manipulates a lever to insert the required spaces between the words, pushing the latter up in front of the upper galley and when completed sliding the line into conjunction with the newly-justified column by means of

a suitable rule fastened by a spring-catch to prevent said column from falling back into the open channel.

That my invention may be more fully understood reference is had to the annexed drawings, in which—

Figure 1 is a front view of the machine; Fig. 2, a sectional side view of said machine; Fig. 3, a detailed view of the measuring mechanism; Fig. 4, a detailed plan view looking upward in the direction of the arrow 4, Figs. 2 and 3, the frame A being removed; Fig. 5, a plan view of the connecting members between the measuring instrument and the line in the direction of the arrow 5, Fig. 2. Figs. 6 and 7 are views illustrating the application of the measuring-gage to the different sizes of spaces, the position of the gaging-points being indicated by dotted parallel lines. Fig. 7[a] is a diagram illustrating the computing devices. Fig. 8 is a section about on line 8, Fig. 1, directly above the bottom plate 419 of the space-channels. Figs. 9 and 10 show the forked rule 200 and its application. Figs. 11 and 12 illustrate the measuring-angle at different positions; and Fig. 13 is a sectional plan view on line 13, Fig. 1.

The frame which supports the mechanism, galleys, and space-channels is designated by A. The brackets and other parts of the frame A that carry the several operative members are tilted back at a suitable angle to safely hold for manipulation loose type lines and spaces, as will be understood by referring to Fig. 2. In the drawings and specification, however, these operative parts which are inclined in practice are shown and described for the sake of convenience and brevity as "standing vertically." The galley *b* for justified lines is located at the left of the machine, over the main supporting-frame A. The space-channels 123 are in the center on a plate projecting to the right from said frame, and below said channels is situated the galley *a*, in which the column of unjustified lines is placed, the space-channels 123 having their bottoms convenient to the lower edge of the upper galley *b* and their front edges near the plane of the bottom of said galley. The guard 408 extends across the front of the channels 123 to prevent more than the bottom spaces from being disturbed by the ejector 409.

The plate 419, that forms a common bottom for the space-channels 123, takes the form of an arc struck from the center of the stud 226 in order to line up with the lateral path of the swinging ejector 409, which has its bearings in the enlarged part or lug 231 at the lower end of the oscillating arm 224. Said arc also designates the path of the lower terminal of the oscillating transferring-arm 227, both this and the arm 224 being mounted on the stud 226, which has its bearing in the top of the frame A. The spaces in the channels 123 increase in size toward the left—that is, the right-hand channel contains the smallest size and the left-hand channel the largest, with the intermediate sizes in the intermediate channels. The bottoms of the channels 123 are preferably made of shorter radius toward the right in order to cause the central plane of each of the bottom spaces to intersect an arc struck from the center of the stud 226, thereby keeping said spaces well in the path of the ejector 409. The space-receiving platform 410, which is a forward extension of the plate 419, is provided with the shoulder 412 to prevent the spaces from sliding back against the channel-partitions. The platform 410 projects in front of the channels 123 a little below the bottom spaces and occupies a position at the right of the lower edge of the upper galley *b*.

The lower galley *a* terminates in the open line-channel 121, the right wall of which is removed for a distance equal to the width of said galley for the reception of the first unjustified line from the adjacent end of the column. The abutment 138 is located below the base of the channel 121, being flush with or slightly below the lower edge of the galley *a*, and serves as a fixed support upon which the type-line rests while being measured. The block 138 receives the lower end of the unjustified line as the latter slides from the galley *a* into the channel 121. The movement of said column to the left is limited by the slotted wall 201 of the channel 121. The wall 201 is supplemented at its upper terminal by the laterally-projecting flat spring-catches 202, one behind the other, the parts of said catches which extend across the channel 121 being square on top and tapered from above downward to the left to permit of the passage of the words and to support them after said passage has taken place. The catches 202 are designed to spring to the left when a space is pushed against them from the platform 410, being thereby thrust out of the channel 121 to allow the next word to pass as it is raised from the lower part of said channel to a position at the right of the galley *b*.

The forked rule 200, by means of which the operator manipulates the words, is provided with a handle projecting to the left and upper laterally-extending prongs with knife-edges designed to enter the slots 201[a] in the wall 201 and be inserted wedge-like between the words. Said prongs are offset or bent upward, so that when the rule 200 is raised to its fullest extent the forked end projects above the slots 201[a] and between the catches 202 in line with the bottom edge of the galley *b*.

The rocking supporting-rod 203 for the intermediate measuring-gage 120 has sufficient longitudinal motion to permit it to be ad-

justed to the lengths of the various lines. The rod 203 is located at the left far enough to clear the transferring-arm 227 when said arm is at the left end of its stroke and is mounted in the lugs 204 and 205, extending from the frame A. The rod 203 is provided with the gage 120 and the projection 232, rigidly attached thereto, and has the handle 206, by means of which said rod is rocked or rotated for the purpose of swinging the free end of said gage either onto or off of a type-line in the channel 121.

On the upper surface of an offset to the right from the arm 227 is the stop or lug 429, extending clear across, and the lug 428, extending from the rear edge to the center, of said offset. The arm 227 is further provided with the depending handle 217 and the forwardly-projecting offset or finger 418, which passes beneath the plate 419 and the platform 410 and is then turned over the top of said platform to form the pusher 411, extending nearly to the shoulder 412. The function of the pusher 411 is to propel a space from its position in front of any one of the channels 123 to the line-channel 121. The configuration of the finger 418 is such that a space when expelled from either channel 123 by the ejector 409 always comes between the pusher 411 and the channel 121. The arm 224 has a projection on its right edge provided with the stud 133, to which the connecting-rod 132 is pivoted. The free end of the rod 132 is equipped with the contact-stud or feeler-gage 136, which bears on the upper edge of the bar 112 and moves up and down therewith. The slotted guide 219 extends to the rear of the arm 224, and the lever 417, pivoted at 225 to a lug on the arm 224, operates through the slot in said guide. The lower end of the lever 417 terminates in a handle. The lug 231 on the arm 224 forms a bearing for the latch 414, as well as the ejector 409.

The vertically-sliding guide-bar 119 has its bearings in the projections 124 and 126 in the frame A and supports the horizontal line-gage bar or blade 112, the right end of which operates in the slot 137 in a projection from said frame. The bar 112 is constructed to register the height of unjustified type-lines by the position of its upper horizontal edge, which at its normal height represents that of a full type-line and lies below the center of the pivot 110 a distance equal to the diameter of the stud 136. In other words, the top of the stud 136 when slide 119 is supported upon a full type-line is even with the center of the pivot 110. The guide-bar 119 rests upon the intermediate gage projection 232, (best shown in Fig. 5,) being connected to the said projection by the integral foot 119^a. The gage 120 is bent around and extends through a suitable slot or opening in a plate of the frame A, the internal end of said gage being adapted, as previously stated, to be swung onto and off of the line of type 121^a in the channel 121 by a rotary and longitudinal movement of the rod 203, whereby it engages said type while the line is undergoing measurement and disengages the same when the words are transferred to a position opposite the galley *b*.

The angle-bar or computing-bar 111 has its right end mounted on the pivot 110, extending from the frame A, and its free left end capable of adjustment at the required positions by the vertical movement of the counting-slide 117 in the T groove or guideway 125 in the frame A. The counting-slide 117 has a friction-spring to hold it in position and the screw 142 to clamp the same. The stud 115 projects from the slide 117 and extends above the upper edge of the left end of the bar 111 to hold the latter against the wedging action of the stud or feeler-gage 136. The indicator-mark 118 registers with the graduations on the scale 122 to indicate the position of the stud 115. The free left terminal of the bar 111 is offset so that the lower edge of the main body and the upper edge of said terminal are in the same line, and said line passes through the center of the pivot 110. Said straight line is adapted to assume a different position and form a different angle with the upper edge of the blade 112 for every changed position of the stud 115. The graduations on the scale 122 are equal distances apart to enable the stud 115, which is adjusted thereby, to locate said straight line at positions necessary to construct the successive triangles illustrated in Fig. 6. Said triangles have their common apices at the center of the pivot 110 and their bases on lines parallel with the slide 117, all measurements being made on lines parallel with the path of said slide.

Fig. 6 illustrates the relation of the computing devices to the space-magazine. The lines drawn from the apex of the angle to the divisions of the scale 122^a indicate the angles between the computing-bar and the measuring-blade corresponding to different numbers of word-spaces. The bars 111^a 112^a (shown in full lines) are arranged at the angle for a line having a single interval. The machine practically thrusts the line shortage into this angle, and the point where the shortage forms a chord for the angle corresponds to channel 123, having the correct size of justifying-space for the line. Thus in Fig. 6, 121^a indicates the shortage, which is equal to the largest space in the magazine—that is, the space in the left-hand channel in said figure. If the shortage were less, it would form a chord nearer the apex of the angle and control the selection of a smaller space, as will be evident. In the machine herein described the ejecting-plunger is located opposite the space-channel in a manner substantially simi-

lar to that illustrated in the diagram Fig. 6—that is, the lever carrying the plunger is swung about its axis until it is stopped by the angle formed between the computing-bar and the measuring-blade.

In the diagram Fig. 7 the angle formed between the parts 111^b and 112^b corresponds to six intervals, and the shortage indicated by 121^b is equal to six of the largest spaces in the magazine. If the shortage were less, it would fit in the angle nearer to the apex thereof, but would still be divided into six equal parts, and the mechanism would select spaces equal or nearly equal to said parts. Theoretically the mechanism described locates normal spaces for the line; but if no spaces in the magazine are exactly equal to the normal spaces the mechanism will select the nearest size thereto. The normal space is equal to the quotient of the shortage divided by the number of intervals, and I shall now describe the theoretical manner of obtaining this quotient by reference to the diagram in Fig. 7^a. I obtain the quotient of the shortage of the line divided by the number of intervals by constructing mechanically two similar triangles. The dimensions of one of the triangles are known quantities, and one of the dimensions of the remaining triangle being known the remaining dimensions, one of which will be proportional to the quotient sought, are readily obtainable.

Referring to Fig. 7^a, *m n r* indicates a right-angled triangle, in which the side *n m* represents a justifying-space, which, for instance, may be eight units, as indicated on the diagram. The side *n r* represents the number of intervals in the line and is equal to the number of intervals multiplied by eight unit-spaces. The side *m n* is always constant, and the side *n r* is a known quantity determined by the number of intervals. In the second triangle *m t u* the side *t u*, which is parallel to *n r*, is equal to the measured shortage of the line under treatment. If now we indicate by *w w'*, &c., the eight unit-spaces on the side *n r* and draw lines from *m* to the points *w w'*, the shortage or the line *t u* will be divided into a number of equal parts, and each of these parts, as *t b*, will equal the quotient sought. It will also be evident that if *m n* represents eight units *m t* will represent the quotient sought in the same proportion. As shown on the diagram, the quotient of the shortage *t u* divided by the number of intervals equals four and one-half, and the line under treatment will be justified by inserting spaces of four and one-half units.

Comparing the diagram Fig. 7^a with the mechanism in Fig. 3, the line *m n* corresponds to the lower edge of the computing-bar 111 when the latter is in its normal horizontal position. The line *n r* corresponds to the downward movement of the bar 117. The space *n w* corresponds to one division of said bar. The line *t u* corresponds to the downward movement of the bar 112, which equals the shortage of the line. The point *u* is the place of contact of the gage-point 136 with the bar 111, and the distance *m t* is the amount of movement of the contact-point 136 when drawn over by the arm 224, provided said point starts from the vertical line through the pivot 110. The distance *m t* is simply proportional to the thickness of the quotient-space and is, in fact, very much greater. It will be evident that this movement in proportion to the desired space may be utilized in many ways in locating or selecting justifying-spaces.

Fig. 11 shows the indicator-mark 118 adjusted for a line containing four spaces and the gage 120 resting upon a line of unknown length. The position of the bars 111 and 112 and the arresting of the ejector 409 by the contact of the stud 136 with said bars locates said ejector opposite the right-hand channel 123, which contains the smallest size of spaces. In Fig. 12 the mark 118 is opposite the fifth graduation on the scale 122 to indicate that five spaces are wanted. The gage 120 is placed upon a line also of unknown length, and the adjustment of parts above described brings the ejector 409 opposite the third channel 123 from the left, and five of these spaces make a pile which is large enough to fill out the line there shown to its required length. Two space piles 123^a and 123^b are shown in Figs. 11 and 12, respectively, out of their normal positions to better illustrate the above examples.

The lever 417, which passes through the guide 319, is connected to the ejector 409 by the link 421, said link being pivoted at 423 to said lever and at 422 to said ejector. The forward end of the latch 414 is adapted to engage any one of the ratchet-teeth 416. The ratchet-teeth 416 are cut into the rear of the channel-plate 419 and correspond in number and distances apart with the channels 123. The latch 414 is provided with the depending catch 430, adapted when in its forward position to form a stop for the lug 429 of the space-transferring arm 227. When the latch 414 is in its rearward position and withdrawn from the teeth 416, the catch 430 enters between the lugs 429 and 428 of the arm 227 and locks the latter to the arm 224. The latch 414 is further provided with the thumb-piece 413, situated so as to be readily grasped with the handle 417 to pull said latch out of engagement with the teeth 416 against the resiliency of the spring 415. The spring 415 extends between the latch 414 and the arm 224 and normally draws said latch into engagement with the teeth 416. The operator releases the thumb-piece 413 and allows the latch 414 to reëngage the teeth 416, when the stud 136 is arrested by contact with the angle-bar 111, the

ejector 409 being located behind the required size of spaces. The space-ejector 409 is longitudinally operated, by means of the lever 417, through the lug 231 on the arm 224, said lever swinging with said arm transversely to the channels 123. The lever 417 is tensioned to the rear by the spring 420, extending between said lever and the back end of the guide 219. When the lever 417 is located back of the selected channel 123, it is designed to be drawn toward the operator against the resiliency of the spring 420 and at right angles to the locating motion of the arm 224. This action of the lever 417 pushes the ejector 409 against the bottom space of the channel 123 which happens to be in front of said ejector. The ejector 409 has a longitudinal movement sufficient to thrust a space from the channel 123 and lodge it on the front platform 410.

The operation of the machine is as follows: The column of loose unjustified type is first placed in the galley *a*, with the top or beginning of the reading matter against the wall 201, and an ordinary spring-tensioned block is inserted against the opposite end of said column to keep the last lines from falling over. The operator removes the first lead with his left hand and pushes the column to the left, tight against the wall 201. By keeping the run of the reading matter in mind the operator is able to count the number of places for spaces between the words and sets the slide 117 opposite the graduation on the scale 122 that corresponds with said number and with a turn of the screw 142 secures said slide in place. While this latter adjustment is taking place the right hand of the operator grasps the handle of the lever 417 with the thumb on the thumb-piece 413. The latch 414 is drawn back, and its catch 430 enters between the lugs 429 and 428 as the point of said latch clears the teeth 416. The whole of this portion of the mechanism is now swung to the extreme right. The parts referred to include the handle of the lever 417, the handle 217, the ejector 409, the latch 414, the pusher 411, and the feeler-gage 136. Meanwhile the operator seizes the handle 206 with his left hand and gives it a partial turn to the right to bring the gage 120 into the channel 121 above the short type-line therein. The partial rotation of the bar 203 to the right is followed by a downward movement of said bar, induced by pressure on the handle 206 in that direction, until the gage 120 rests upon the type-line. Said downward movement of the rod 203 carries with it the sliding bar 119 and the horizontal line-gage bar 112. The location of the bar 112 fixes the height of the intercepting feeler-gage 136.

The operations thus far described have brought the parts of the calculating instrument into proper adjustment for performing the desired operation of division. While the handle 206 is held tightly downward the operator, with his hand still on the handle of the lever 417 and his thumb on the thumb-piece 413, carries said lever and the connected members to the left until the feeler-gage 136 is intercepted in the angle formed by the bars 111 and 112. Upon the interception above alluded to taking place the operator allows his thumb to slip off of the thumb-piece 413 and gives the lever-handle a slight pull to the right until the point of the latch 414 is tight against the adjoining tooth 416, thereby locating the ejector 409 directly behind the channel 123 containing the required size of space. The gage 120 is now turned away from the upper end of the type-line by a partial rotation to the left of the handle 206. The lever-handle is now pulled forward until the bottom space has been transferred to the platform 410 by the ejector 409. The space so ejected is prevented from sliding back by the shoulder 412. The operator now changes from the lever-handle to the handle 217, which operates the space-pusher 411. In the meantime he is manipulating the rule 200 with the left hand. Having thrust the knife-edge of the rule 200 under the upper word and raised the same above the catches 202 into a position in front of the upper galley *b* prior to inserting the first space, he raises the second word in a similar manner until the top of it is in line with the upper surface of the platform 410. By a movement of the handle 217 to the left in Fig. 1 the pusher 411 is caused to move the space on the platform 410 through a suitable opening in the wall of the channel 121, against the catches 202, and over the second word in the channel 121. The handle 217 is kept pressed to the left and the pusher 411, extending through the opening in the channel-wall through which the spaces pass, holds the space being acted upon suspended between itself and the catches 202 under the new line until the operator raises the word above said catches and into that part of the channel 121 which is at the end of the galley *b*, carrying said space with it. The space is now incorporated with the new line between the first and second words. As the second word reaches the plane above the catches 202 the latter snap back across the channel 121 to prevent the new line or the justified part of the original line from dropping when the rule 200 is withdrawn. These operations are continued until all of the words in the lower part of the channel 121 have been successively transferred into line with the galley *b*. The operator withdraws the rule 235 upon the completion of the line and inserts it on the opposite side of said line, pushing the same, with the balance of the justified column, to the left until said rule snaps back into place under the hooked spring 233. By a

repetition of the several operations hereinbefore described the entire column of type in the galley *a* is transferred to the galley *b*, being justified during the passage from one of said galleys to the other. If it is desired to lead the new column, the operator simply transfers the lead which he removes from the end of the old column to the end of the new instead of laying it aside.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. In a justifying mechanism for a typographic machine, a pivotally-mounted bar or lever movable to different positions for the justification of different lines, in combination with means for measuring the shortage of a line, and means for indicating the number of intervals in the line.

2. In a justifying mechanism for a typographic machine, a pivotally-mounted bar or lever movable to different positions for the justification of different lines, in combination with means for measuring the shortage of a line, means for indicating the number of intervals in the line, and devices controlled by said bar or lever and said means for determining justifying-spaces.

3. In a justifying mechanism for determining the justifying-spaces from the elements of line shortage and number of intervals, a device for mechanically representing the line shortage, in combination with a device for mechanically representing the number of intervals in a line, said devices including a part having an inclination corresponding to one of said elements.

4. In a justifying mechanism for determining the justifying-spaces from the elements of line shortage and the number of intervals, a device for mechanically representing the line shortage, in combination with a device for mechanically representing the number of intervals in a line, said devices including means for providing different angles or inclines for the justification of different lines.

5. In a justifying mechanism for a typographic machine, a pivoted computing bar or lever, in combination with means for representing the line shortage, means for representing the number of intervals in a line, and means for bringing said bar and said representing means into conjunction to determine the justifying-spaces for a line.

6. In a justifying mechanism for determining the justifying-spaces from the elements of line shortage and number of intervals, devices for dividing the line shortage by the number of intervals, said devices including a part having an inclination corresponding to one of said elements.

7. In a justifying mechanism for determining the justifying-spaces from the elements of line shortage and number of intervals, devices for dividing the line shortage by the number of intervals, said devices including a part having an inclination corresponding to one of said elements, and being movable to vary the inclination for different lines.

8. In a justifying mechanism for determining the justifying-spaces from the elements of line shortage and number of intervals, devices for dividing the line shortage by the number of intervals, said devices including a part having an inclination corresponding to the number of intervals in a line, and being movable to vary the inclination for different lines.

9. In a typographic machine, a mechanism for justifying comprising an element having an angular movement, means for moving said element in accordance with the number of intervals in a line, and means for bringing said element into conjunction with another element representing the shortage of a line to determine the width of justifying-spaces for the line.

10. In a typographic machine, a mechanism for justifying comprising a pivoted element, and means for moving said element about its pivot in accordance with the number of intervals in a line to be justified, the successive elements of said angular movement corresponding to equal increments of a tangent to the angle.

11. In a typographic machine, a justifying mechanism comprising a pivoted element having a straight edge radial to its pivot, and means for imparting to said element an angular movement, said means comprising a part movable tangentially to a circle described about said pivot and in proportion to the number of intervals in a line.

12. In a typographic machine, a justifying mechanism comprising a computing-bar having an angular movement controlled in accordance with the number of intervals in a line to be justified, means for measuring the line, and means for combining said measurement and said angular movement to determine the justifying-spaces for the line.

13. In a typographic machine, a justifying mechanism comprising a pivoted computing-bar having a straight edge radial to its pivot, means for moving said computing-bar to correspond with the number of intervals in the line to be justified, and means for applying to said computing-bar an element representing the shortage of the line, whereby the thickness of justifying-spaces for the line is obtained.

14. In a justifying mechanism, the combination with means for measuring the line of type, of a space-magazine, mechanism for dividing the shortage of a line by the number of intervals therein said mechanism including a member having an incline corresponding to one of said elements, and means controlled by said mechanism for selecting justifying-spaces from the magazine.

15. In a justifying mechanism, the combi-

nation with a line-channel, and means for measuring a line of type in said channel, of a space-magazine, mechanism for dividing the shortage of a line by the number of intervals therein said mechanism including a member having an incline corresponding to one of said elements, and means controlled by said mechanism for selecting justifying-spaces from the magazine.

16. In a justifying mechanism for a typographic machine, the combination with a space-magazine having compartments for a plurality of sizes of spaces, of means for measuring an unjustified line of type, justifying means comprising an element having an incline capable of being varied for different lines, and means operating in conjunction with said element for selecting proper justifying-spaces from the magazine.

17. In a typographic machine, the combination with a magazine having channels for a plurality of sizes of spaces, of a mechanism for justifying comprising an element having an angular movement, means for moving said element in accordance with the number of intervals in a line, means for measuring the line, means for bringing said angular element into conjunction with another element representing the shortage of the line, and means controlled by said latter element for selecting justifying-spaces from the magazine.

18. A mechanism for justifying lines of type comprising an element having an angular movement controlled by the number of word-intervals in the line and a second element having a movement controlled by the shortage of the line, the relative positions assumed by said elements for a given line determining the values of the justifying-spaces for said line.

19. In a mechanism for justifying composed lines of type, an element having a parallel movement in proportion to the shortage of the line, in combination with an element having an angular movement controlled by the number of intervals in the line, the relation of said elements when adjusted for a given line being adapted to determine the justifying-spaces for said line.

20. In a mechanism for justifying lines of type, the combination of an element having a parallel movement in proportion to the shortage of the line, an element having an angular movement controlled by the number of intervals in the line, and a part guided by one of said elements and movable into contact with the other, the position of said part when in contact being adapted to indicate the quotient of the line shortage divided by the number of intervals.

21. In a mechanism for justifying lines of type, mechanical means for obtaining the quotient of the line shortage divided by the number of word-intervals, comprising a bar having a parallel movement in proportion to the shortage of the line, a computing-bar having an angular movement from an initial position parallel with the first-named bar, said angular movement being controlled by the number of word-intervals in the line, and a part guided by the first-named bar and movable into contact with the computing-bar, the position of said part when in contact with the computing-bar being adapted to indicate the desired quotient.

22. In a type-justifying machine, in combination with a computing-bar having an angular movement controlled by the number of intervals occurring in the type-line, a feeler-gage movable at right angles with the starting position of said bar in proportion to the shortage of the line under justification, and means for moving said feeler-gage along a path parallel with the initial position of the computing-bar until intercepted by said bar, for the purpose specified.

23. In a justifying mechanism, in combination, a computing-bar having an angular movement controlled in accordance with the number of intervals occurring in the line under justification, a pivotal support for one end of said bar, and slide arranged to engage and move the other end of the bar, said slide being in engagement with a part of said bar in line with its computing edge, for the purpose specified.

24. In a type-justifying mechanism, in combination, a computing-bar provided with a pivotal support, a counting-slide arranged to move in tangential relation to the movement of said bar upon its pivot in accordance with the number of intervals occurring in the line under justification, said bar and slide having a sliding engagement with each other, for the purpose specified.

25. In a justifying mechanism a pivoted computing-bar, and a slide connected to said bar and movable in accordance with the number of word-spaces in the line under justification, said bar and slide forming two sides of a triangle, combined with means for constructively laying off the shortage of the line parallel with the slide to form the base of a similar triangle, and means for utilizing the measure of one of the remaining sides of said latter triangle to determine the normal word-space value.

26. In a justifying mechanism, the combination with a line-measuring channel, a gage mounted on a rotatable and longitudinally-movable support, said gage being movable into and out of said channel, a line-gage blade adjustable according to the longitudinal movements of the gage, and a computing-bar coöperating with the gage-blade.

27. In a justifying mechanism, the combination with the line-gage, and the supporting-rod for said gage having a longitudinal and

rotary movement, of the line-gage blade, and connections between said gage and said blade whereby the blade is moved longitudinally with the gage-support and is not affected by the rotary movement of said support.

28. In a justifying mechanism, the combination with the line-gage blade, and the pivoted computing-bar, of the lever 224, and the contact-piece connected with and operated by said lever, said contact-piece coöperating with said bar and blade.

29. In a justifying mechanism, the combination with the line-gage blade adjustable in accordance with the line-gage, and the pivoted computing-bar, of a lever such as 224, a link connected to said lever, and a contact-piece connected with the link and extending between said blade and bar.

30. In a type-justifying mechanism, the combination with justifying space-determining devices and a space-magazine having the lower ends of its channels arranged substantially in the arc of a circle, of a pivot at the center of said circle, a lever mounted on said pivot, and a space-plunger mounted in said lever and adapted to eject spaces from any channel of the magazine.

31. In a type-justifying mechanism, the combination with justifying space-determining devices and a space-magazine having a plurality of channels, of a space-ejecting plunger, a lever in the rear of the magazine in which said plunger is mounted, a receiving-platform in front of the magazine to sustain the ejected spaces, and a carrier operating on said platform to move the spaces to the line.

32. In a type-justifying mechanism, the combination with the fixed magazine having a plurality of space-channels, of a lever mounted in the rear of said magazine, a space-receiving platform in front of said magazine, a space-ejecting plunger mounted in said lever, and a second lever in the rear of said magazine and having a finger extending forward under the magazine and over the receiving-platform for the purpose of sweeping the ejected spaces over said platform.

33. In a type-justifying mechanism, the combination of a space-magazine having a plurality of channels, a lever movable in a plane parallel with the plane of the space-magazine, an ejecting-plunger mounted in said lever and movable transversely to said plane, and an ejecting hand-lever pivoted to said first-named lever and connected with the space-ejector.

34. In a type-justifying mechanism, the combination with a space-magazine having channels for different sizes of spaces, of a line-gage blade and means for setting the same in accordance with the line shortage, a pivoted computing-bar and means for setting the same in accordance with the number of intervals in a line, a lever in which said space-ejector is mounted, and means for adjusting said lever in accordance with the intersection of said bar and blade, for the selection of justifying-spaces.

35. In a type-justifying mechanism, the combination of a space-magazine having channels for different sizes of spaces, an arm pivotally mounted and adapted to rock in a plane parallel to said magazine, a series of ratchet-teeth in the rear of the magazine and corresponding in location to the several channels thereof, a pawl carried by said arm and adapted to engage with said ratchet-teeth, and an ejecting-plunger also carried by said arm and adapted to be located accurately in the rear of a channel by said pawl and ratchet-teeth.

36. In a type-justifying mechanism, in combination a channeled magazine arranged to contain different sizes of spaces and having ratchet-teeth thereon corresponding to the number of channels in said member and to their distances apart, a space-ejector, a space-pusher, arms carrying said ejector and said pusher, a latch operating in one of said arms and adapted to engage or release said teeth, and means for causing said arms to be locked together by said latch when the same is out of engagement with said teeth, for the purpose set forth.

37. In a type-justifying mechanism, in combination, a space-magazine, a space-ejector, an adjustable arm to locate the same back of a given size of spaces, a latch in said arm for locking said ejector in position, a space-pusher supported by a second arm provided with lugs, and a catch on said latch adapted to engage said lugs and lock said arms together, or to disengage the former and permit one of the latter to move independently of the other, according to the position of said latch, for the purpose set forth.

38. In a typographic machine, a mechanism for justifying comprising an element having a straight edge and a pivotal point to which said edge is radial, in combination with means for setting said element in accordance with the number of intervals in a line.

39. A mechanism for justifying a composed line of type comprising a device for measuring an unjustified line to ascertain the total shortage and devices including a member having an incline variable for different lines for dividing the said shortage by the number of word-spaces in the line.

40. In a type-justifying machine, a riveted computing-bar, in combination with type-engaging means movable in proportion to the aggregate shortage of a line, and with a device engaging said bar and movable in accordance with the number of intervals occurring in the line.

41. In a type-justifying machine, a pivoted computing-bar operatively connected

with a slide adapted to move in tangential relation to the movement of the bar upon its pivot, the slide being located adjacent to and adapted to engage with the line of type to be measured.

42. In a mechanism for justifying composed lines of type, measuring devices comprising an element having an angular movement controlled by the number of word-intervals in the line and a second element having a movement controlled by the length of the line, the relative positions assumed by said elements for a given line being adapted to determine the values of the justifying-spaces for said line.

43. In a justifying mechanism, the combination with a pivoted computing-bar and means for setting said bar in accordance with the number of intervals in the line, of the line-measuring bar, an arm extending at right angles from said measuring-bar, and a gage-block movable on said arm.

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Witnesses:
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