No. 648,116. Patented Apr. 24, 1900.

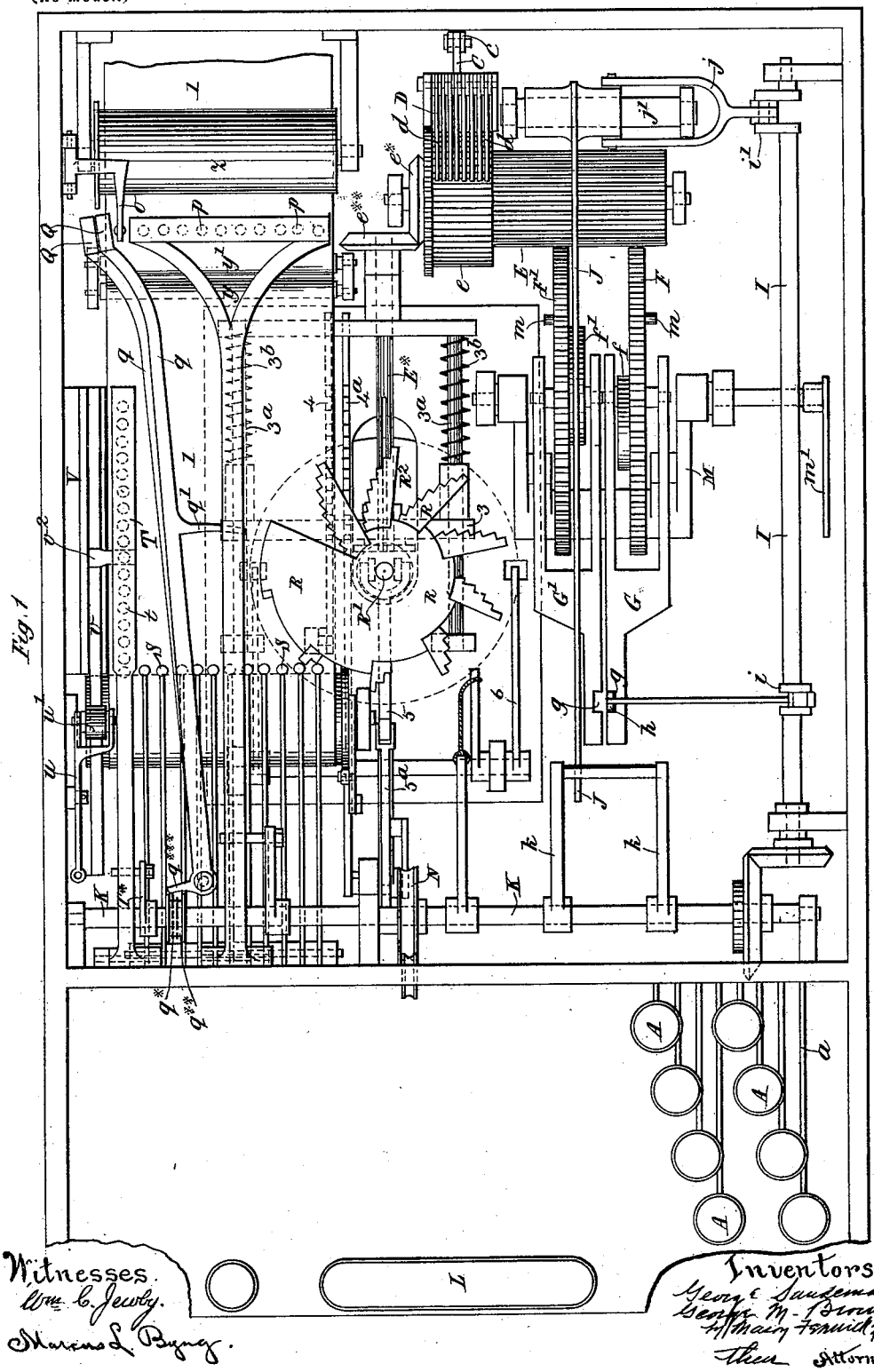
G. SANDEMAN & G. M. BROWN.

JUSTIFYING MECHANISM FOR TYPE SETTING OR SIMILAR MACHINES.

(Application filed May 21, 1898.)

(No Model.) 4 Sheets—Sheet 1.

Fig. 1.



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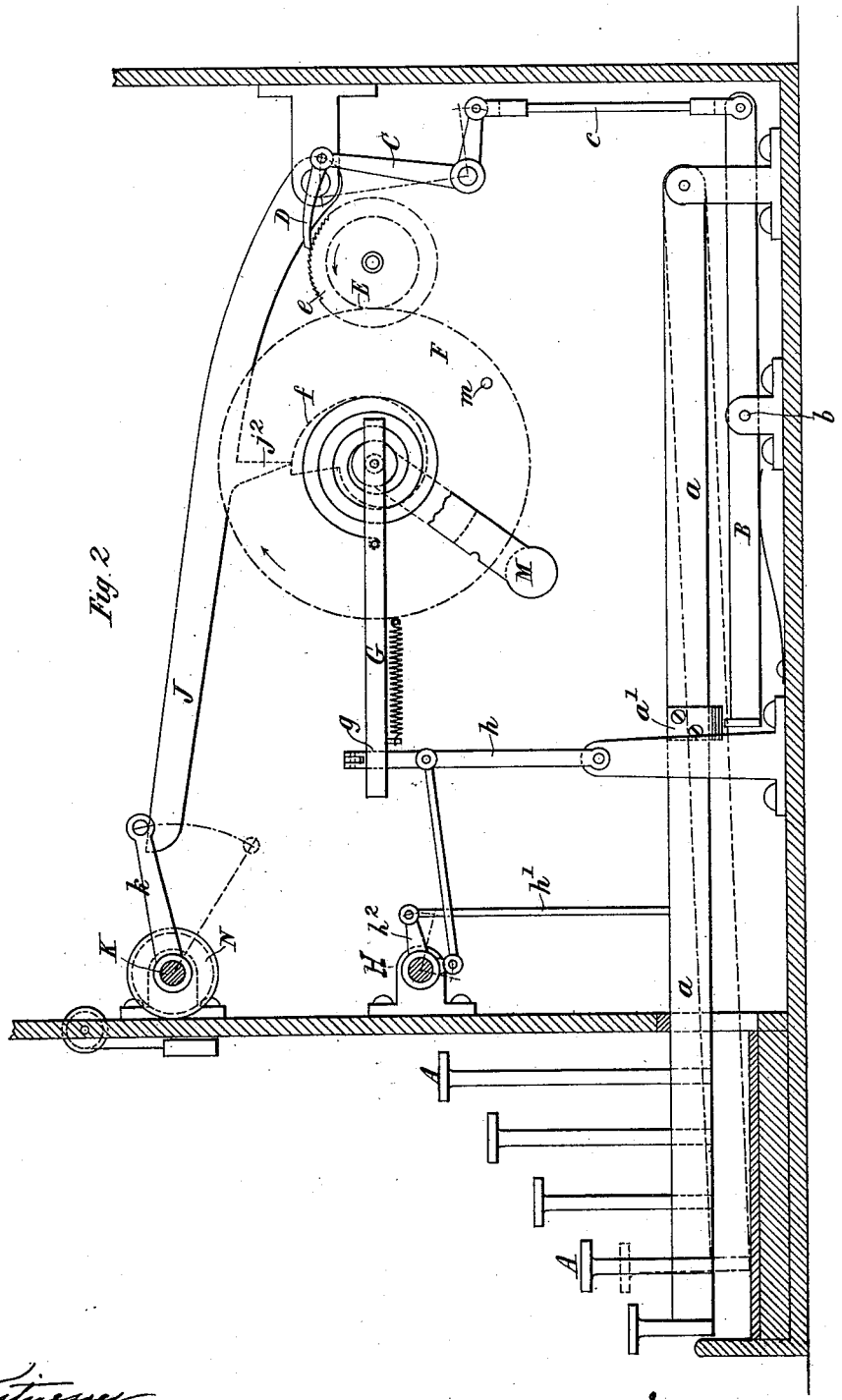
(No Model.) 4 Sheets—Sheet 2.

Fig. 2



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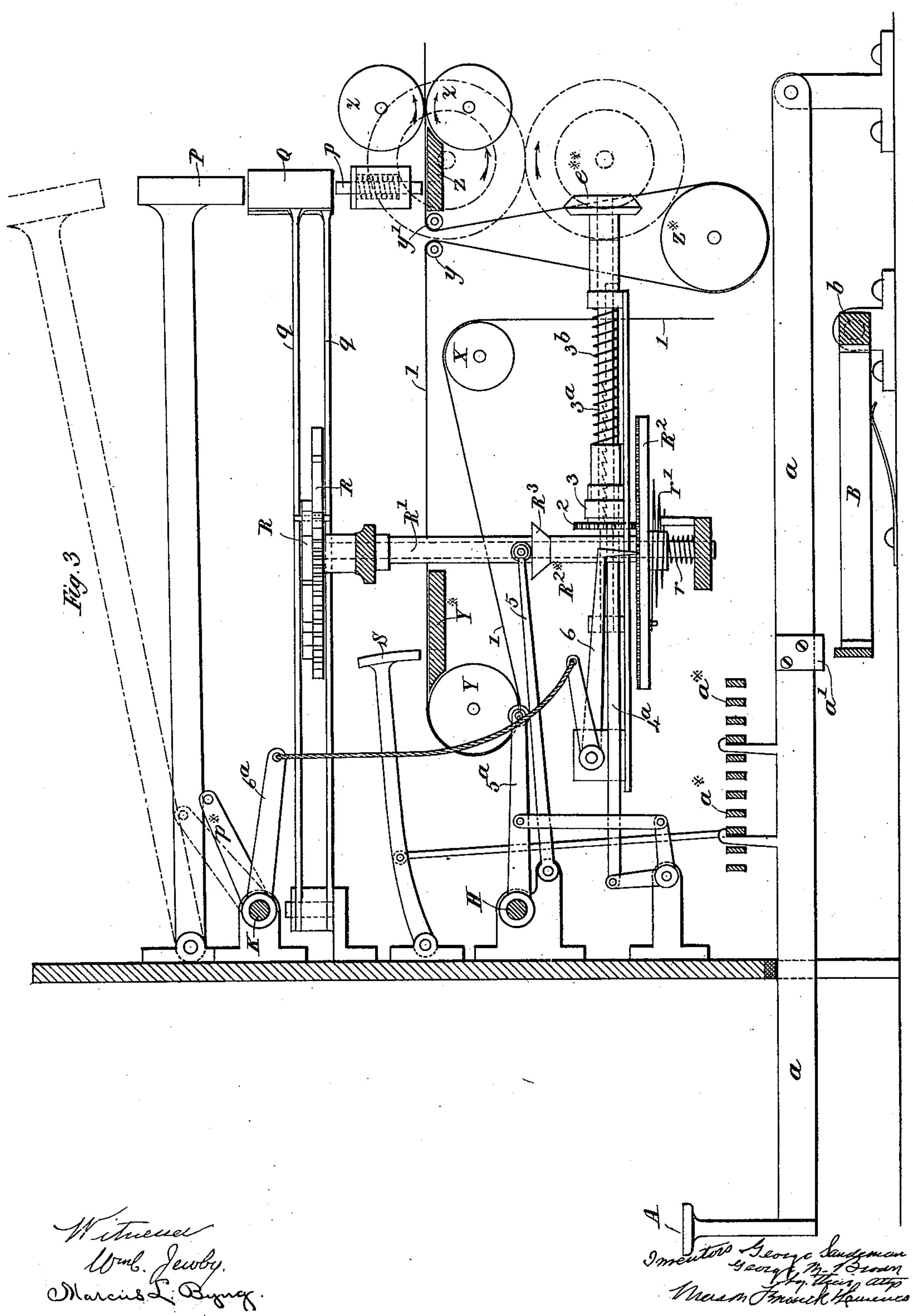
(No Model.) 4 Sheets—Sheet 3.



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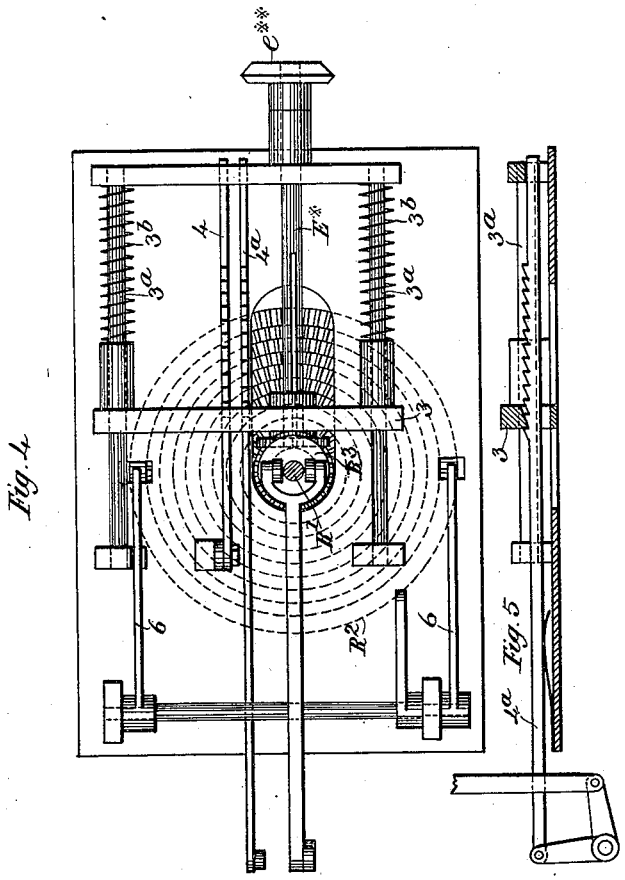
(No Model.) 4 Sheets—Sheet 4.



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UNITED STATES PATENT OFFICE.

GEORGE SANDEMAN, OF COLINTON, AND GEORGE M. BROWN, OF EDINBURGH, SCOTLAND.

JUSTIFYING MECHANISM FOR TYPE-SETTING OR SIMILAR MACHINES.

SPECIFICATION forming part of Letters Patent No. 648,116, dated April 24, 1900.

Application filed May 21, 1898. Serial No. 681,329. (No model.)

To all whom it may concern:

Be it known that we, GEORGE SANDEMAN, of Colinton, and GEORGE MACKENZIE BROWN, of Edinburgh, in the county of Mid-Lothian, Scotland, have invented certain new and useful Improvements in Justifying Mechanism for Type-Setting or Similar Apparatus, of which the following is a specification.

This invention has reference to a new mechanism adapted to be used in type-setting machines, type-writers, and the like, and is especially designed as an improvement on the Lanston monotype-machine. Its purpose is to divide automatically the "copy" into lines of any given length and automatically to space out the words in each line, so as to fill the given length of the line and automatically to make the spaces between the words of equal width. The machine effects this while the operator proceeds as if setting or writing an endless line and paying no attention whatever to lines and spaces.

The Lanston monotype-machine consists of two parts, one of which prepares a record of the copy by punching holes in a continuous paper band. The other part sets or casts type, being controlled by the holes in the paper band. The following improvements refer directly only to that part of the Lanston monotype which prepares the record and not to that part which takes up the record and sets type from it. The part to which this invention refers, which resembles a type-writer, punches for each letter two holes in the band. The machine is provided with a registering-scale from which the operator reads the amount of the line which he has filled at any moment. As soon as he is aware that the line will not contain another word or syllable or judges that, although another syllable might be put in, it would not be advisable to insert it he closes the line and reads off from the registering-scale which of the "space-keys" he has to depress in order that the spaces between the words for which holes have already been punched may be so increased from the minimum by additional interword-space that the words recorded, together with the spaces, may approximately or exactly fill a line of the length which has been chosen. Thus certain holes are punched at the end of the line, determining the necessary additional width of the spaces in that line. The type-casting machine is controlled by the record, which is fed into it backward, and by this means before it proceeds to cast the line it adjusts its space-casting mechanism for the width of space required between the words in that line.

The improvements herein described are designed to greatly increase the rapidity of such a machine, for the operator need only to set the machine for the required length of line and may then record his copy as if the line were to be endless, unless he has special reasons for interfering with the spacing of the words or with the division of the copy into lines. The machine as herein described will automatically and without hindering the operator divide the copy into lines of the required length and will also automatically punch a record of the necessary width of the spaces between the words. While it is doing so the operator may record at his utmost speed.

Unless the operator specially and designedly interferes with the action of this machine the machine will never divide a word. It will always end a line with a whole word or with a word in combination with a punctuation-mark or other "sort" which should not be separated from that word, and will always begin a line with a whole word or a whole word preceded by a quotation-mark, parenthesis, or the like. At any time the operator may with the machine herein described divide words as easily as he can do with the Lanston monotype-machine. In those rare cases where there are in a line abnormally-few spaces and abnormally-long words it might be advisable for him to do so; but as a rule he would find it better to let such cases take their chance, allowing the machine perfect automatic freedom and correcting any such cases in type.

Another and independent improvement consists in the fact that the machine herein described admits of punching the "additional-interword-space" widths for the line at the beginning instead of at the end of that line. This admits of passing the paper band into the type-casting machine forward instead of

backward, and therefore it is not necessary to finish the copy on the manual machine before it can begin to be used in the casting-machine. The two operations may go on simultaneously.

We will now describe our invention, reference being made to the accompanying drawings, whereof—

Figure 1 is a plan view. Figs. 2 and 3 are side elevations of different features. Figs. 4 and 5 are plan and edge views of a portion of the machine detached.

We will now proceed to describe as much of a machine of this class as is necessary to the full understanding of the construction and operation of those parts which form the main features of our invention, it being understood that in the application of our invention the known parts of the machine may be varied in their construction, our invention being adaptable to any of the well-known machines for the designated purposes.

The machine described and illustrated resembles a type-writer in external appearance. It has keys A for all the letters, punctuation-marks, and sorts of type which may be required, and it has, besides, three other keys named "space," "constant space" and "new line," respectively, not all of which are shown, as they do not relate, with the exception of the space-key, to the automatic operation of the machine which forms the subject of this invention. The stem of each key is fixed in the vertical position to a horizontal rod or bar a, which runs from the base of the stem to its bearing at or toward the back of the machine. All these rods are in a horizontal and parallel series. A short distance above these key-rods there are transverse horizontal bars a^*, Fig. 3, which are so carried and adjusted as to be capable of being slightly depressed from their normal position. In connection with these bars a^* are arranged the punches which correspond with the letters to be reproduced on the controller, provision being made for letters of different widths and for spaces between the words. Every key-rod a is provided on its upper surface with hooks, and each of these hooks engages a transverse bar. (See Fig. 3.) The hook of the rod a of each key is hooked over the bars corresponding to its one or more punches and over the bar corresponding to the width of the letter or space which that key represents. To depress a key, therefore, is to work one or more punches and to record a width. Every letter-key and space-key also works the primary bar, and the depression of this bar moves the primary rollers of the paper-band-feeding mechanism in a manner not necessary to be here described. In reference to the space-key and constant-space key the former is for recording such spaces as may be enlarged to justify the line—that is, the ordinary spaces between words—and the latter (not shown in the drawings) is for such spaces as may be required to be of a definite width, as the space indenting a paragraph or the like. The paper band I enters the machine from a store-roller, (not shown,) passes over the "service-roller" X, and thence it goes around the "primary" roller Y. It then runs over a table Y*, (the primary table,) then falls over a small roller y, (drop-roller,) and, making a dependent loop, ascends again over another roller y' and moves on over a secondary table Z, and finally passes out between the upper and lower pulling-rollers $z\,z$. In the dependent loop there is placed a somewhat-heavy free roller Z*, which is a cylinder lying in the loop and having no bearings, but having a flange at each side to keep it in the loop. The paper band is moved entirely by the pulling-rollers $z\,z$ of the free roller Z*. At the primary roller its motion is regulated in any well-known manner by an escapement, which allows the paper band to move a short distance every time that a key is raised from its depression.

The letter-punches S are carried on the front frame of the machine above holes in the primary table Y*. Each consists of a stem and a short head. The stem is connected by a light rod with the transverse bar a^*, which depresses that punch so as to punch a hole in the band. The punch is raised after it has been depressed by a light spring. (Not shown.) This mechanism may be modified so that the punches may be set in a frame and may be depressed by hammers. At the side of the primary table there is a slide V, and in this slide there runs a slide-rod v. This rod is pressed onto the end of one of the primary rollers Y by a small wheel u', (the presser,) carried at the end of a lever u, which is permanently pressed down by a spring. (Not shown.) Consequently the slide-rod v moves with the primary roller Y and at the same speed, and its head v^2 preserves for a time a constant relation to any spot on the paper band I as the latter travels. The head is a short transverse bar moving over a series of new-line punches t, which are set in a frame over the primary table. These punches t are exactly at that distance from one another which the paper moves at every operation on the manual. The first of these punches is in line with the letter-punches S, and the last is at the end of the primary table, though these positions may be modified.

The new-line hammer T is carried on the front frame of the machine near the top and above the new-line punches t. When this hammer falls, it strikes the head v^2 of the slide-rod v', and consequently any new-line punch over which that happens at the moment to be. The head of this hammer T is as long as the line of new-line punches. The presser is released whenever the space-key is depressed, and the slide-rod is pulled back by a spring (not shown) until its head is opposite to the letter-punches. The slide-rod is therefore always over that new-line punch which is opposite to that hole on the band which was last punched by the interword-space punch,

and so when the new-line hammer falls it will punch the new-line hole opposite to the last space between words.

As soon as a line begins to be recorded the new-line hammer is gradually raised, and on the completion of a line it is allowed to fall in a manner to be presently described.

After the paper has gone through the drop and around the free roller it comes onto the secondary table. The upper and lower pulling-rollers are pulling on it, being mechanically driven until they are stopped by a mechanism action occasioned by the fall of a catch *o* through a new-line hole. (See Fig. 1.) When this occurs, the paper rests until the additional space has been punched.

Opposite to the point of the "catch" there are one or more transverse rows of punches *p*, called the "additional-space" punches, with corresponding holes in the table. These are set in a frame, and their points are just clear of the paper. The space-hammer P is carried on the inside of the front frame of the machine. It is raised and released, as hereinafter explained. When this hammer falls, it comes down over the row or rows of additional-space punches and depresses any punch or punches over which there may happen to be at the moment a space-head Q, and thus records the additional space required for the line. When the hammer is again raised, it lifts the catch *o* out of the paper and releases the pulling-rollers, and then drops the point of the catch onto the paper again, where it rests until another new-line hole is reached. The space-heads Q, which come between the space-hammer and the space-punches, are carried on long arms *q*, which are horizontally placed over the primary table and carried at the head of a vertical bearing, which is fixed to the front frame of the machine. These arms are so arranged as to move the space-heads away from the space-punches and to return them again when required. The distance to which the arms *q*, and therefore the heads, can return depends on the position of graduated disks R. Each space-arm bears a spur *q'*, and this spur comes against the edge of the graduated disks opposite to it and is there stopped. The graduated disks are carried upon a vertical shaft R', which supports the calculator-table which calculates the proper position for the disks, itself being operated by an automatic line-closing device which forms the main feature of this invention. Of this line-closing device and its mode of operation from the key-bars the following is a description:

Beneath the key-bars *a* is arranged, according to our invention, a rocking frame B, fulcrumed at *b*. On the key-bars *a* and immediately over the front rail of the frame B are projections *a'*. The length of these projections is proportioned to the width of the letters represented by the keys to which the bars are respectively attached, so that the depression of the keys causes a depression or rocking of the frame B corresponding to the width or space required for the letter being used. In other words, the frame B is depressed differentially as the keys are depressed, according to the letters or interword-space selected.

To the back of the frame B is jointed a rod *c*, connected to the tail of the bell-crank lever C, fulcrumed to the machine-framing in any convenient manner. The lever C carries a pawl D, composed, preferably, of several members, which engage with a ratchet-drum *e* on the barrel E. The barrel E is provided with trunnions turning in suitable bearings and is capable of rotation under the impulse of the pawl D, operated by the rocking of the lever C. The members *d* of the pawl are of slightly-different lengths, so that one or other is always in operative engagement with a tooth of the ratchet-drum *e*, and an exceedingly-accurate rotation of the barrel E is thus provided for. It will thus be seen that on the depression of the key the frame B is rocked to a greater or less extent, according to the length of the projections *a'*, and the barrel E is correspondingly rotated through the agency of the rod *c*, lever C, pawl D, and ratchet-drum *e*.

The barrel E is provided with surface teeth for engaging with the periphery of a pair of wheels F F'. These engaging wheels have also circumferential surface teeth by which they engage the barrel and are rotated thereby. The engaging wheels F F', which are of the same diameter and are arranged concentrically, are mounted in separate frames G G' and are furnished at their sides with snails *f f'*—that is, pieces of metal bounded in one direction by a curved line of ever-increasing radius and terminating suddenly in a straight line. (See Fig. 2.) F has its snail on the left side and F' on its right, and each snail is set conversely of the other. (See Fig. 1.) The frames G G', which are suitably supported, are spring-pressed, so as to hold the wheels F F' normally in contact with the barrel E; but they are capable of being separately-withdrawn, so as to disengage either wheel from the said barrel and allow the said wheel to recoil, under the impulse of a spring, to its normal position. The withdrawal is effected by means of a disengaging pin *h*, situated in a notch *g* in the tails of the frames G G', which notch is deep enough in either frame to accommodate the pin *h*, which therefore withdraws only one frame at a time, according to its position. The pin *h* is operated to withdraw one of the frames at the end of every word by means of the depression of an interword-space key arranged in the usual manner and working a rod *h'* and bell-crank lever h^2, mounted on the interword-space shaft H. (See Fig. 2.) The movement of the pin *h* from side to side into one or other of the notches *g* is effected by the crank *i* of an alternating shaft I, mounted in bearings at the side of the apparatus, which by its rotation moves the said pin from one notch to the other. The shaft I has also another crank *i'*, set oppositely to the

crank i near the back of the machine. This crank i' is connected by a stirrup j to the shoulder of a lever-arm J. This shoulder is mounted on a slide j', arranged parallel to the barrel E, and is capable of endway movement and rotary movement thereon. The lever-arm J, which extends toward the front of the machine, has on its under side a spur j^2, arranged to rest on one of the snails $f f'$ of the engaging wheels. When the spur j^2 rests on the snail f', the pin h is in the notch of the frame G, and when by the rotation of the alternating shaft I the position of the pin h is reversed the spur of the lever-arm J is moved onto the snail f. The rotation of the shaft I is effected by the shaft K, which we will call the "new-line" shaft, arranged transversely across the machine. (See Fig. 1.) These shafts being at right angles are geared together by bevel-wheels, so that the rotation of the shaft K is communicated to the shaft I, the connection between the shaft K and its bevel-wheel being through a clutch of any suitable construction which drives only in one direction. The rotation of the shaft K in one direction is effected by the lever-arm J, the end of which underlies the lift-frame k, fast on the shaft K. It will thus be seen that the step-by-step rotation of the barrel E causes, by the rotation of the wheels F F' and the snails fast thereon, the lifting and sudden dropping of the lever-arm J, and with it the lift k of the shaft K.

From the return rotary movement of the new-line shaft K is taken the impulse for starting the mechanism which justifies the completed line, according to any approved system, either by dropping a hammer (indicated by P) adjacent to the shaft or in any other suitable manner. The return movement of the shaft K is also used for reversing the position of the lever-arm J onto the other snail and for changing over the disengaging pin h to the opposite side of the notch. In further explanation of this part of the invention the wheels F F' are first set to a predetermined length of line by means of a movable stop-frame M, which is adjusted to intercept the stop-pin m on the wheels F F', when the latter are free to be held back by their springs. The position of the stop-frame M is indicated by the pointer m'. (See Fig. 1.) Supposing the spur j^2 of the lever-arm J to rest, as in the drawings, on the snail f', the disengaging pin h then occupies the right-hand position shown. The step-by-step rotation of the barrel E, caused by the depression of the keys, as before explained, causes the rotation of both wheels F F' and the lifting of the arm J and the rotation of the shaft K. At the end of a word the operator depresses a space-key L and withdraws the frame G, and thereby releases the wheel F from contact with the barrel, which wheel thereupon flies back to its stop. The composing of the line then proceeds, and on the completion of a second word the space-key is again depressed and again the wheel F flies back to its stop. The same thing takes place at each succeeding word until the predetermined line length is reached. The snail f', which has all the time been carried around by the wheel F', which has remained constantly in touch with the barrel E, has by this time come to the end of its curved part, and thus the spur j^2 of the arm J, which has been resting thereon, is suddenly allowed to fall, and with it the lift k of the shaft K. The latter shaft on its return movement, under the influence of a weight or spring, rotates the shaft I and shifts the lever-arm J, so that its spur rests on the snail f of the wheel F, the pin h being at the same time shifted to the opposite side of the notch.

So far no mention has been made of any provision for dealing with words left incomplete when the line is closed and the justifying apparatus set to work at the falling of the lever-arm J. It will be remembered, however, that the wheel F has been in contact with the barrel E since the completion of the last word before the arm fell. The snail f has therefore already a record of the unfinished word, having commenced its course before receiving the spur of the arm J. The latter will continue to be raised by the snail f until the termination of the curve, as already explained with regard to the snail f', the disengaging pin h being now at work on the frame G' instead of the frame G. It will thus be seen that a word which could not wholly find a place in a line has been carried over automatically to the next line and the space thereby left vacant apportioned among the interword-spaces in a manner in accordance with the operations of a calculating device. With this arrangement the operator need take no notice of the termination of his lines, having once set the engaging wheels to the required length. He may, however, if desired, be furnished with a dial actuated by a pulley N on the shaft K, (see Fig. 1,) which will serve to show the progress of the line, and in connection with this a bell may be rung at any point in the line, so that the operator may, if he wishes, divide a word at the end of a line. If he wishes to do this, he will merely record the part of the word and a hyphen and then press the space-key, and the machine will begin a new line at that point.

The calculating device is operated from the barrel E by means of a bevel-wheel e^*, gearing with a bevel-wheel e^{**} on the calculator-shaft E*. The calculator-shaft E* being thus geared to the barrel rotates, like the latter, to an extent proportionate to the number of unit-widths of the letters recorded. The shaft E*, which only rotates in one direction, carries a small pinion 2, which is keyed thereto so as to rotate therewith, but is free to move endwise thereon. This pinion 2, which is called in another place the "sliding wheel," therefore rotates always in one direction proportionately to the number of unit-widths of the letters recorded or punched. The sliding

wheel is connected to a transverse bar 3, called the "carriage," and this carriage determines the position on the calculator-shaft which the sliding wheel shall occupy. The wheel 2 is moved along the shaft from time to time by means of the carriage. The ends of the carriage move along a pair of fixed rods 3^a 3^a, which are parallel to the shaft, and a pair of springs 3^b 3^b on these rods tend to drive the carriage, and with it the sliding wheel, in the direction away from the point at which the shaft E* is geared to the barrel, and so in the direction toward the vertical shaft R. The carriage 3 is engaged by a pair of toothed or escapement rods 4 4^a, one of which, 4, is fixed, while the other, 4^a, is capable of movement in the direction of its own length, and the action of these escapement-rods is such that they drive the carriage in a step-by-step manner from time to time against the stress of the springs 3^b upon the fixed rods 3^a, along which the ends of the carriage move—that is to say, the action of the escapement-rods is to move the sliding wheel step by step away from the vertical shaft R', upon which is mounted the calculating-table R^2 and the graduated disks hereinbefore mentioned. The two rods 4 4^a are capable of being jointly depressed in such a manner that they cease to engage the carriage, so that the sliding wheel returns, by means of the action of the springs aforesaid, along the calculator-shaft to its position nearest to the vertical shaft R'. The vertical shaft R' bears the following structures from above downward: graduated disks R, collar R^3, and calculating-table R^2. The shaft R' is itself held in position by bearings below the disk R and by a bearing at its foot. The calculating-table R^2 is attached to a sleeve R^{2*} on the shaft R', which sleeve is capable of sliding thereon, but turns therewith. This sleeve carries the collar R^3, hereinafter referred to.

r is a spring beneath the table R^2, which supports the said table, but permits of its being depressed, as hereinafter described. The calculating-table R^2 has on its upper surface a series of concentric rings of teeth, (shown by dotted lines in Fig. 4,) and these rings are at an equal radial distance from one another, and the radius of every ring is a multiple of the radius of the innermost ring. These rings are successively engaged by the sliding wheel as the latter moves outward step by step, and they are disengaged from the sliding-wheel whenever the table is depressed. Now the teeth on every ring are at an equal distance from one another, so that in a ring which has a diameter twice or three times as great as the diameter of the innermost ring there will be twice or three times as many teeth as there are on the innermost ring. Consequently the amount of rotation of the sliding wheel will result in a various amount of rotation of the vertical shaft, according as the sliding wheel is engaging one or another of the concentric rings. For instance, let the amount of rotation of the sliding wheel be *x* and the radii of the rings 1 2 3, &c. Then the amount of rotation of the vertical shaft will be $\frac{x}{1}\frac{x}{2}\frac{x}{3}$, &c., according to whether the first, the second, or the third, &c., ring be engaged. In other words, the rotation of the vertical shaft, and therefore of the graduated disks R, is an amount which is determined by two factors: first, the width of the letters recorded since the last interword space—that is to say, the number to be divided—and, secondly, the number of the ring which is engaged (whether the first, second, third, &c.)—that is to say, the number of interword spaces in the line which has been recorded, which is the divisor. The table is provided with a spring *r'*, which tends to bring it back to zero when the sliding wheel ceases to engage the same. It is also provided with a stop, so that it is stopped at zero when that spring has freedom to act, and whenever the space-key is depressed the table R^2 is depressed by it in a manner presently to be described and so ceases to engage the sliding wheel, and therefore comes back to zero. When the table is at zero, the graduated disks offer their zero edges to the spurs *q'* on the arms *q*, which carry the space-heads Q. The table R^2 is depressed in the following two ways: In the first place it is depressed every time the space-key is struck. An arm 5, jointed to the framing and having two small wheels at its end, lies on the upper surface of the collar R^3 on the sleeve R^{2*} on the vertical shaft R', and an arm 5^a is connected to the interword-space shaft H, and when shaft H revolves slightly arm 5^a is depressed and depresses arm 5 and the sleeve, and with it the table. (See Fig. 3.) The same end may be secured in any one of many ways. We may simply state that when the interword-space shaft is moved by the space-key the concentric table is depressed, so that it ceases to engage the sliding wheel and so permits the table to return to zero; but, further, as the calculation is not actually needed until the last word of the line it is not necessary for calculating purposes that the concentric table should engage the sliding wheel at all at any earlier moment than the earliest moment in the line at which the last interword space can possibly come. Therefore the table is kept permanently depressed by the table-catch 6 until the latter is raised (by means of a cord or otherwise) by the upward movement of the calculating-arm 6^a, which is an arm on the new-line shaft K. It may be here remarked that the catch must be raised prior to the insertion of the last interword space in the line in order that the table may, being depressed by the interword-space key, return to zero before finally engaging the sliding wheel. The new-line shaft K begins to turn very early in the line; but it should not raise the table-catch, and thus bring the concentric table into play, until the greater portion of the line is recorded. Now the table-catch 6 may be any mechanism which de-

presses the table, thus throwing it out of gear, and which also prevents it from rotating, thus retaining the position of the table when the catch falls. When the new-line shaft K at the end of the line makes its rapid return, the table-catch 6 immediately depresses the table and at the same time prevents it from returning to zero.

The depression of the two escapement-bars 4 4^a is effected by the return of the new-line shaft K. The movement of one of them, 4^a, by means of which the sliding or pinion wheel 2 is moved in a step-by-step manner away from the vertical shaft R′, is effected by the movement of the interword-space shaft H, which takes place every time the space-key dog is struck. The particular adjustments which effect these two results are not shown in the drawings, but may consist of any arrangements by which, first, the new-line shaft K in its return throws the escapement-bars 4 4^a out of gear with the carriage 3, and so allows the pinion-wheel 2 to slide along the calculator-shaft E* until it is as near to the vertical shaft R′ as it will go, and, second, the interword-space shaft H in its movement pushes (by means of lever or other device) one of the escapement-bars 4^a, so as to move the sliding or pinion wheel 2 one step outward.

The so-called "graduated disks" R rotate with the table R^2. The amount which that table, and consequently the disks, have moved at the end of a line, and the consequent motion of the spurs and heads of the space-arms q, depends, on the one hand, on the rotation of the sliding wheel 2, and, on the other hand, on the particular ring of teeth which the sliding wheel 2 happens to be engaging at that moment, or, in other words, it depends, on the one hand, on the width of the broken word, if any, at the end of the line, and, on the other hand, on the number of interword spaces in that line.

The graduated disks R are stepped plates prepared so as to oppose to the spurs q' of the space-arms q a graduated scale, the precise point of the graduated scale which the graduated disks will present to the spurs at any moment being determined by the width of broken word and by the number of interword spaces, as aforesaid. In preparing these disks we proceed as follows: A plate of metal is divided into two equal segments by radial lines and by ten concentric circles at equal distances from one another, these lines and circles being drawn on its surface. The distance between these circles represents the distance which the spur of a space-arm has to move in order to bring its space-head from one additional-space arm to the next in line. Having marked these lines, the segments of the circles are cut so that the first segment is bounded as to its circumference by the outer or first circle, the next or second segment by the next or second circle, the third segment by the third circle, and so on. Another plate of metal of the same size is marked with similar circles and similar radial lines, in this case called "principal" radial lines. In each of the segments produced by these circles and principal radial lines there are nine intermediate radial lines drawn, exactly dividing the segment into ten equal segments, and these small segments in every large segment are cut as follows: The first segment is bounded by the first circle, the second by the second circle, and so on. The disks having thus been cut, they are fixed to one another in such a manner that the radial lines of the first disk coincide with the principal radial lines of the second disk. By this means the two edges in combination make a graduated scale. Other disks may be added, or the two disks already described may be further subdivided in order to obtain a more finely graduated scale. In this machine the one disk presents a graduated scale representing tens of units of width, and the other disk presents a graduated scale of units of widths, the unit being such as may be required. In cutting the disk any other radical than ten, as three, four, and five, may be used, according to requirement, and in such a case each graduation on the one disk will represent three, four, or five units of width, and each graduation on the other disk will represent units of widths.

If desired, the disks may be cut with graduated curves instead of with graduated steps, after the manner described in this machine, and this in such a way that the curve in each segment shall be a helical curve passing through the points of the graduated steps in each segment, or the disks may be cut in other ways.

The graduated disks may be modified by many mechanical contrivances—as, for instance, the use of a cone turned in a series of graduated steps or of the graduated edge of a hollow cylinder or in many other ways.

The working of the table and scale may be represented as follows: Let N equal the amount of broken word at the end of a line, if any, and therefore the amount of revolution of the sliding wheel which is tending to cause the disks to revolve. Then the amount of space to be divided among the interword spaces will be represented by N^2 N^3 N^4, and so on, according to whether the sliding wheel is engaging the second or the third or the fourth ring of teeth, respectively. Should the end of a line come exactly at the end of a word, the graduated scale will be in such a position that the spurs in combination with it will be out of the line of the additional line-space punches altogether, and no additional space will be recorded for distribution between the words. The hammer P is raised by a lifter-arm p^* on the new-line shaft K when the latter is rotated, as above described, and is allowed to drop suddenly when the said shaft rotates in the opposite direction. The lever-arms q have a spring tendency to fly beneath the hammer P in their required posi-

tion as fixed by the graduated disks, but are restrained from so doing by a small cord or chain q^*, coiled on a pulley q^{**}, fast on the shaft K and attached to the tails q^{***} thereof, which chain unwinds when the shaft K rocks backward, as aforesaid, and allows the arm to move forward. The arms q are so timed that their heads Q are in position above the selected punches before the hammer P strikes. The new-line hammer T is also operated by the new-line shaft K by means of a lifter-arm T*, which alternately raises the said hammer and allows it to fall.

Having now described our invention, what we claim as new, and desire to secure by Letters Patent, is—

1. In a device for automatically starting the justifying mechanism of an apparatus for preparing controllers for type-setting and similar machines, the combination with the usual letter-keys, of a pair of independent snail-cams, connections between said cams and keys whereby the former are driven step by step by the depression of the latter, means for returning the cams to their initial positions, and a lever raised and allowed to drop by the cams, substantially as and for the purpose set forth.

2. In a device for automatically starting the justifying mechanism of an apparatus for preparing controllers for type-setting and similar machines, the combination with the usual letter-keys, of a pair of independent snail-cams, connections between said cams and keys whereby the former are driven step by step by the depression of the latter, means for disconnecting the cams separately, means for returning them to their initial positions, and a lever raised and allowed to drop by the cams, substantially as and for the purpose set forth.

3. In a device for automatically starting the justifying mechanism of an apparatus for preparing controllers for type-setting and similar machines, the combination with the usual letter-keys, and a lever, of two independent devices for raising and dropping the lever, means operated by the keys for giving a step-by-step movement to the raising devices, and means for maintaining one of said raising devices always in operative connection with the keys, substantially as and for the purpose set forth.

4. In a device for automatically starting the justifying mechanism of apparatus for preparing controllers for type-setting and similar machines, the combination with the usual letter-keys, and an interword-space key, of a pair of lever raising and dropping devices, connections with the letter-keys whereby said devices are given a step-by-step raising motion, means for holding the raising devices separately and normally in connection with the operating mechanism, connections with the interword-space key for withdrawing either of the raising devices from connection with the operating mechanism, and means for returning either raising device to its initial position when withdrawn, substantially as and for the purpose set forth.

5. In a device for automatically starting the justifying mechanism for type-setting and similar machines, a barrel driven step by step by the depression of the letter-keys, a pair of wheels driven thereby, snails fixed on the wheels, means for withdrawing the wheels separately from engagement with the barrel, means for throwing the disengaged wheel back to its initial position, and a lever-arm alternately raised and allowed to fall by the snails, as and for the purpose set forth.

6. In a device for automatically starting the justifying mechanism for type-setting and similar machines, a pair of wheels, means for maintaining one of the said wheels constantly in contact with a barrel, said barrel being rotated step by step by the depression of the key during the composition of a line of predetermined length, and means whereby the other wheel is released and returned to its initial position at every interword space, for the purpose of obtaining and carrying over, to a new line, a record of an unfinished word at a line, substantially as set forth.

7. In type-setting and similar machines, a line-closing device comprising a rocking frame beneath the key, a ratchet device driven thereby, a barrel rotated by the ratchet device, a pair of engaging wheels driven by the barrel, and a disengaging-pin for separately withdrawing the wheels by the depression of a key, snails carried by the wheels, a lever-arm adapted to rest alternately upon the snails, a new-line shaft operated by the lever-arm, and an alternating shaft operated by the new-line shaft, and adapted to reverse the positions of the lever-arm and disengaging-pin, substantially as described.

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