No. 844,570. PATENTED FEB. 19, 1907.

E. WENTSCHER.

JUSTIFYING APPARATUS.

APPLICATION FILED AUG. 6, 1895.

4 SHEETS—SHEET 1.

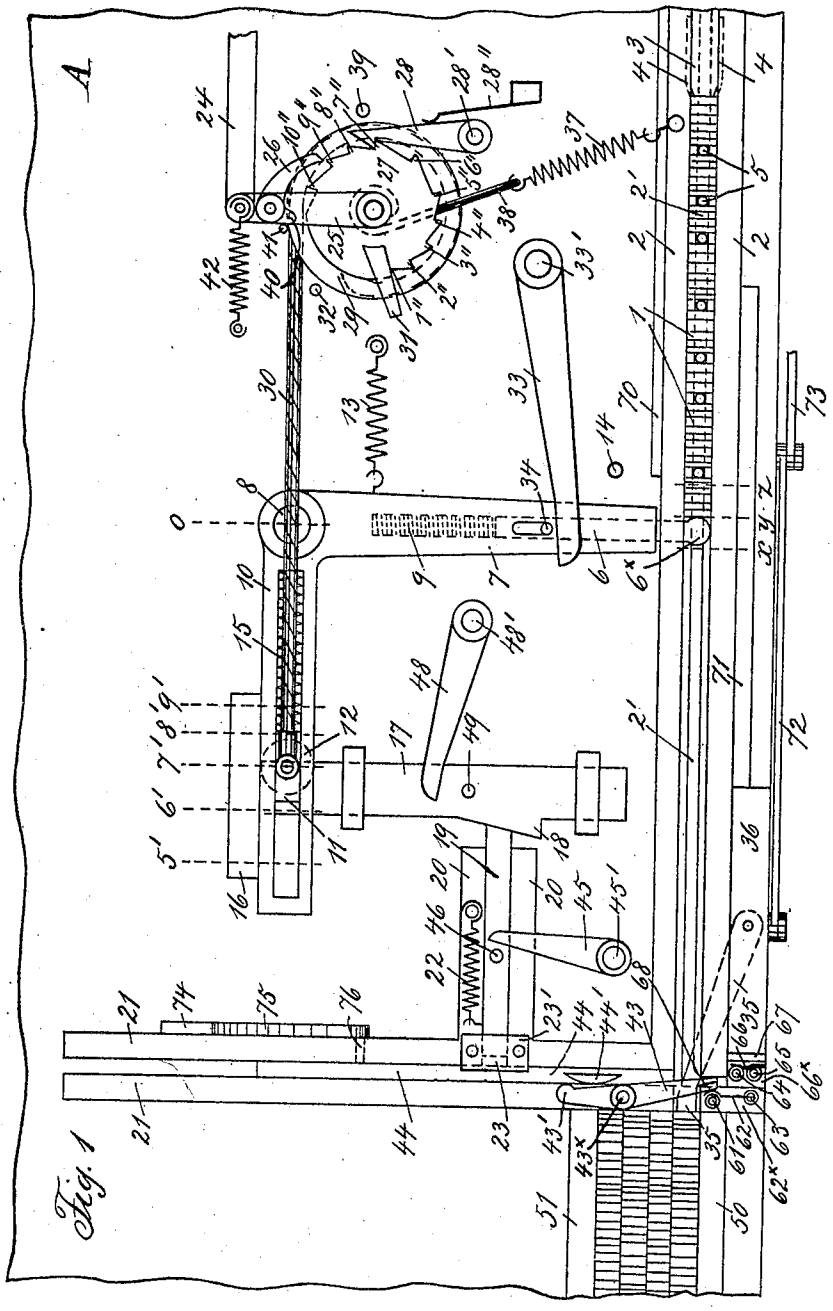

Fig. 1

Witnesses
Fr. Krauszynski
C. Hehre

Inventor
Ernst. Wentscher

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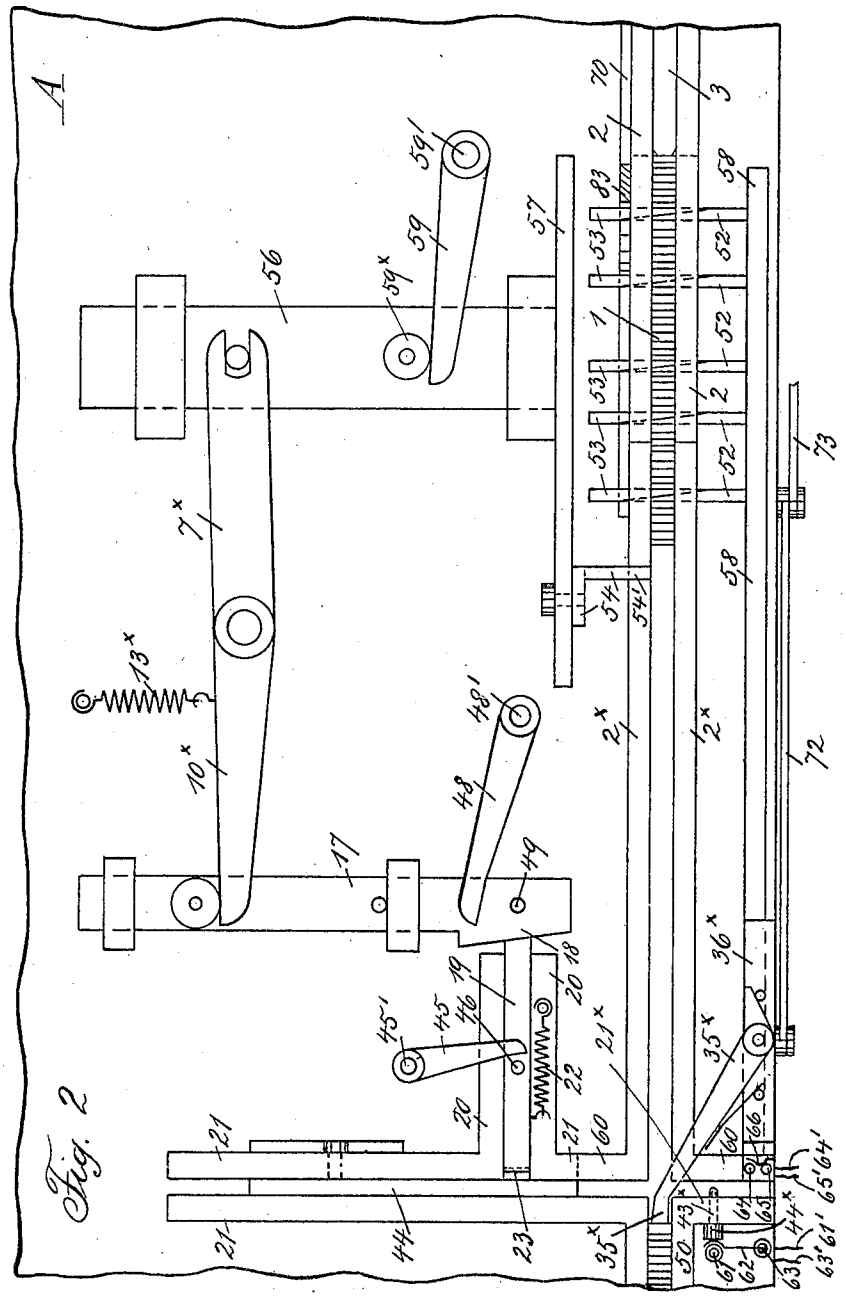

Witnesses
Fr. Kraszynski
C Hesse

Inventor
Ernst Wentscher

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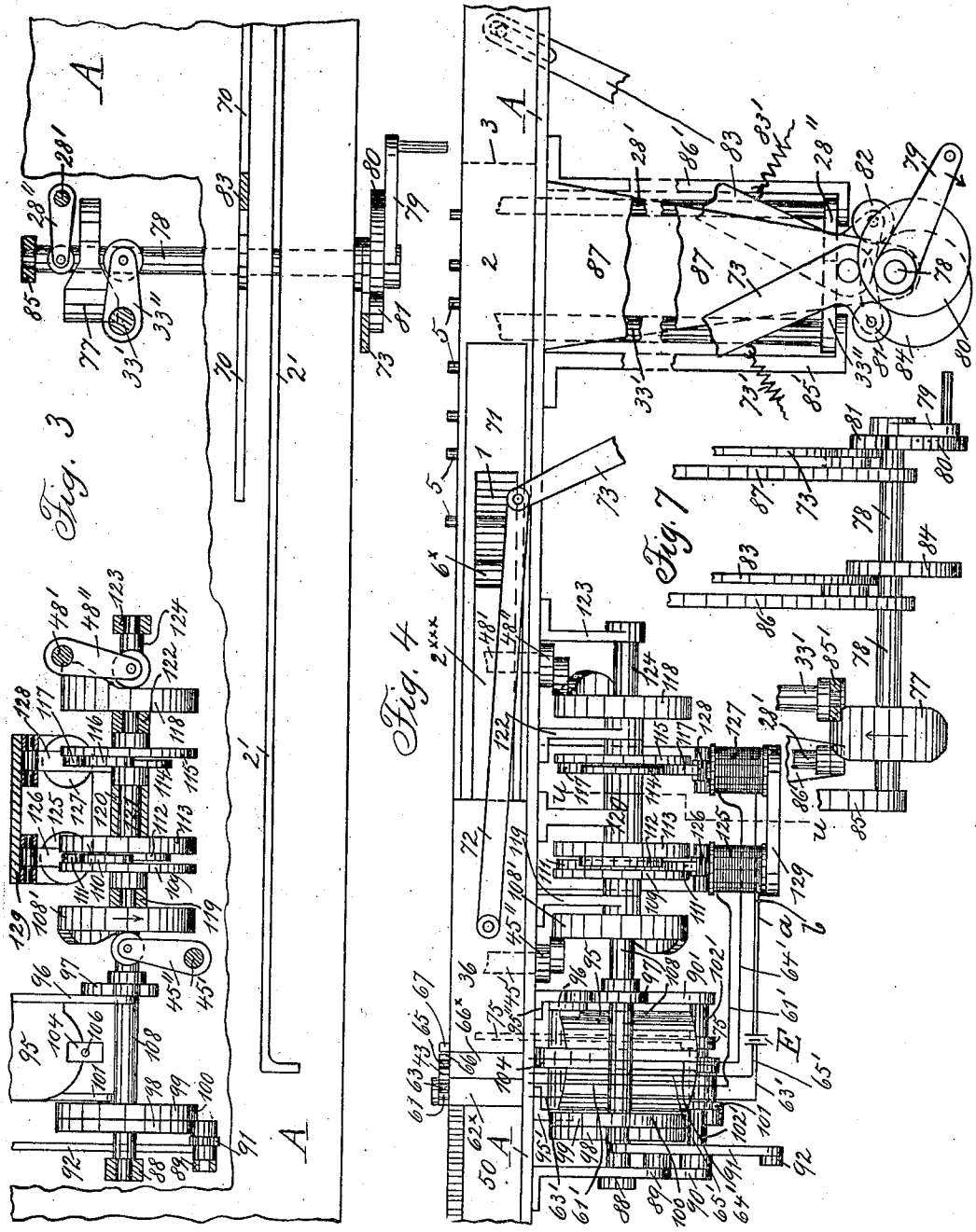
4 SHEETS—SHEET 3.



Witnesses
P. Theusznski
C Hesse

Inventor
Ernst Wentscher

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4 SHEETS—SHEET 4.

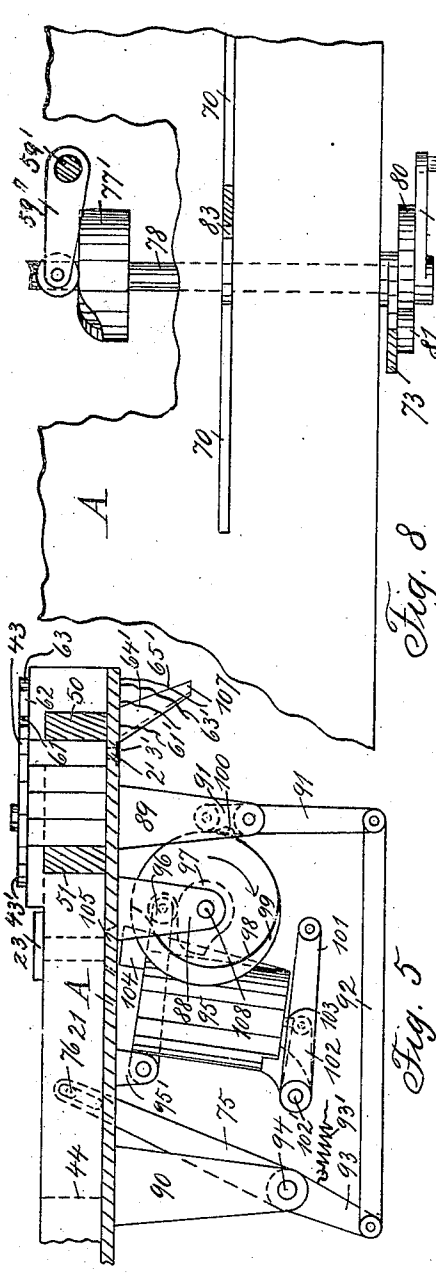

Fig. 8

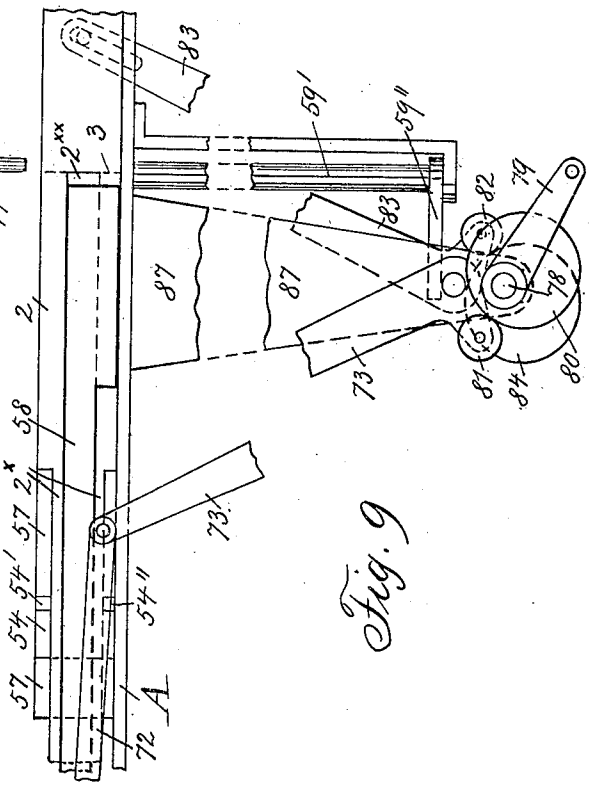

Fig. 9

Fig. 5

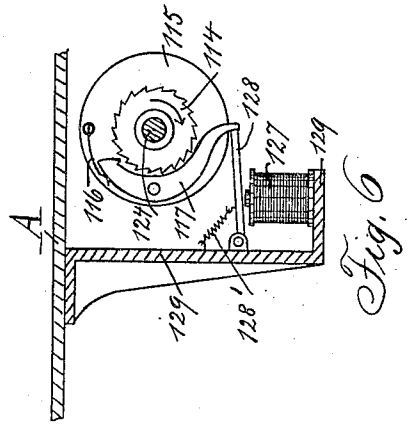

Fig. 6

Witnesses

A. Kunszyński

C. Hesse

Inventor

Ernst Wentscher.

UNITED STATES PATENT OFFICE.

ERNST WENTSCHER, OF BERLIN, GERMANY, ASSIGNOR, BY MESNE ASSIGNMENTS, TO THE UNITYPE COMPANY, A CORPORATION OF NEW JERSEY.

JUSTIFYING APPARATUS.

No. 844,570. Specification of Letters Patent. Patented Feb. 19, 1907.

Application filed August 6, 1895. Serial No. 558,429.

To all whom it may concern:

Be it known that I, ERNST WENTSCHER, a subject of the German Emperor, residing at Berlin, Germany, have invented certain new and useful Improvements in Justifying Apparatus, of which the following is a specification.

My invention relates to apparatus for justifying lines, in which provisional spaces inserted into the line by setting are substituted afterward by definitive ones, or completed by additional spaces, so as to bring the line to the required length; and the objects of my invention are to provide means by which the justifying is simply carried out and the spaces between the several words of a line will be all of equal thickness, a previous measuring or calculating of the line not being needed nor the use of types or matrices constructed on the unit system. These objects are attained by the apparatus illustrated in the accompanying drawings, embodying my invention in preferred forms, and which will now be described in detail, and the features forming this invention specifically pointed out in the claims.

Figure 1 is a plan view of one form of my apparatus, and Fig. 2 a similar view of a modified form; Fig. 3, a plan view corresponding to Fig. 1 and showing the mechanism for operating the apparatus, the supporting-plate being partially cut away; Fig. 4, a side elevation or front view of the apparatus represented in Fig. 1; Fig. 5, a left-hand end view thereof; Fig. 6, a sectional view on line *u u* of Fig. 4; Fig. 7, a side view of the right-hand part of the operating mechanism as shown in Figs. 3 and 4 in top view and in front view, respectively. Figs. 8 and 9 are a top view and a front view. Corresponding, respectively, to the right-hand parts of Figs. 3 and 4 and appertaining to the modification represented in Fig. 2.

Similar letters refer to similar parts throughout the several figures.

In the apparatus illustrated and described herein the operation consists in setting the line with provisional spaces approximatively to the required length, then varying by means of the provisionally-spaced line itself the size of an adjustable mold (which is set to the size of a provisional space if the provisionally-spaced line happens to reach just the required length) a distance directly proportional to the difference between the length of the provisionally-spaced line and the required length and in an inverse proportion to the number of the provisional spaces contained in the line, and finally in casting spaces by the adjusted mold and inserting the same into the line and ejecting at the same time the provisional spaces while the line passes step by step by the mold.

In the process described heretofore the line to be justified is supposed to be indifferently too long or too short, and the above-mentioned variation of the size of the mold is brought about either by enlarging the same, if the line is set too short, or by reducing its size, if the line is set too long. If the lines be constantly set too short and the provisional spaces be not withdrawn, but additional spaces inserted, my process is subjected only to the modification that the mold is not set to the size of a provisional space, if the provisionally-spaced line happens to reach the required length, but to the size "zero"—that is to say, it is closed if no spaces are to be added.

In my apparatus I may adjust the size of the mold in two different ways, one way consisting in shifting a movable abutment from its normal position by the lengthening line until it reaches its provisional length and in transferring this shifting movement to the adjustable body-piece of the mold, which is correspondingly shifted, and the other way consists in spreading the line to the required length by uniformly increasing the provisional spaces between its several words and transferring the movement of the spreading part to the body-piece of the mold thus being adjusted.

Fig. 1 of the drawings shows an apparatus operating in the first way. The working parts are mounted on a supporting-plate A, and the mechanism for operating these parts is placed beneath the said plate. The composed types or matrices 1 are assembled in a channel formed by two walls 2 and are successively forwarded by a vibrating pusher 3, as usual in setting-machines, pawls 4 preventing the types from starting back. Provisional spaces 5 are inserted into the line by setting the same and preferably consist of wire pieces projecting from the line at the top and at the bottom. To this latter purpose plate A, forming the bottom of the

assembling-channel, is provided with a slot 2′ and with a strip 3′, Fig. 5, closing the slot 2′ at its lower side in order to prevent the spaces from dropping down. The provisionally-spaced line represented in Fig. 1 is supposed to have reached just the required length, extending from the pusher 3 to the dotted line *y*, and to contain seven provisional spaces. A rod 6 slides in a lever 7, turning on a pin 8 and actuated by a spring 13. Rod 6 is pressed forward by a spring 9, so as to enter by a slot the type-channel. As the line increases by setting to the dotted line *z* it reaches the end of rod 6, lever 7 bearing against a stop 14, and takes it along with the line until the types or matrices of the line are assembled, the end $6^{\times}$ of rod 6 being held in close contact with the left end of the line by spring 13. The other arm 10 of lever 7 is slotted, and a slide-piece 11 is guided in the slot, provided with a roller 12 at its lower side. Slide-piece 11 is actuated by a spring 15, and thus constantly forced to the left end of the slot.

When beginning a line, slide-piece 11 and roller 12 are in the position indicated by the dotted line 5′ and will remain there until the provisional space-key is depressed the sixth time, whereby the slide-piece and the roller are shifted to dotted line 6′. Analogously slide-piece 11 and roller 12 will be brought by steps into the positions indicated by dotted lines 7′ 8′ 9′, respectively ,when the provisional space-key is struck the seventh, eighth, ninth time by means and for a purpose hereinafter fully described. In the illustrated example, the line being supposed to contain seven provisional spaces, and therefore the provisional space-key having been struck seven times, roller 12 is brought to the dotted line 7′.

When rod 6 and lever 7 are taken along by the left end of the line, roller 12, bearing against a cross-bar 16, fixed to a slide 17, takes along with the slide, which by means of a wedge-shaped projection 18 shifts to the left the movable body-piece 19 of a mold 23, formed by that piece, and walls 20 and closed at the top by a plate 23′ and at the left by a slide-piece 44, guided between walls 21. Body-piece 19 is actuated by a spring 22, so as to bear with its wedge-shaped outer end against the projection 18 of slide 17.

Arm 10 and its slot being in its normal position relatively to the path of slide 17, when the provisionally-spaced line reaches just the required length, as illustrated, slide 17 will be brought into the position shown whenever a provisionally-spaced line happens to be of the required length independently of the distance of roller 12 from the left slot end of arm 10—that is to say, independently of the number of provisional spaces contained in such a line—and in that case the size of the mold will be equal to the thickness of a provisional space, the latter spaces being supposed to have the same thickness; but in any other case, the provisionally-spaced line being either too short or to long, the shifting movement of slide 17 and its final place will depend as well on the stroke of levers 7 10 as on the place occupied by roller 12 in the slot of arm 10.

In order to clearly understand the working of my apparatus, there must be had reference to the distances of lines 5′ 6′ 7′ 8′ 9′, which mark the several positions of roller 12 from line *o*, passing through the swinging center 8 of lever 7 10. The said distances depend on the length of arm 7 from its swinging center to the end $6^{\times}$ of rod 6 in its forwarded position or to the middle of the type-channel, which length may be designated by 1, and they depend, too, on the obliquity or inclination of projection 18, which may be supposed $\frac{1}{4}$, as illustrated. In this supposition the distances of lines 5′ 6′ 7′ 8′ 9′ from line *o* are made equal to $\frac{4.1}{5}\ \frac{4.1}{6}\ \frac{4.1}{7}\ \frac{4.1}{8}\ \frac{4.7}{9}$ respectively.

If now, for instance, a provisionally-spaced line containing five provisional spaces surpasses the required length a distance *v*, roller 12, which then is placed at line 5′, will shift bar 16 and slide 17 a distance $w=\frac{4.v}{5}$ beyond the position illustrated in the drawings, as follows from the proportion or equation $w:v=\frac{4.1}{5}:1.$ Body-piece 19 will therefore be shifted to the left, so as to reduce the size of the mold a distance $=\frac{w}{4}$ that is to say, $=\frac{v}{5}$. The size of the definitive spaces cast by that size of the mold will therefore be reduced one-fifth of the excess of the line, and five of those spaces being afterward inserted instead of the provisional ones the line will be shortened just to the required length.

From the foregoing and the drawings it will be clear that if a provisionally-spaced line happens to be too short a distance K body-piece 19 will be stopped behind the position illustrated, Fig. 1, so as to increase the size of the mold a distance $\frac{K}{5}\ \frac{K}{6}\ \frac{K}{7}\ \frac{K}{8}\ \frac{K}{9}$ respectively, according as the line contains five, six, seven, eight, or nine provisional spaces.

If the provisional spaces should not be withdrawn from the line and the latter completed by additional spaces, the line must be constantly set too short. The only difference then consists in providing a body-piece 19, which closes the mold in the illustrated position of lever, the apparatus being subjected to no other modification.

I will now describe the means for shifting

roller 12 along the slot of arm 10, the purpose of the said shifting movement having been clearly shown in the foregoing. The provisional space-key is connected by a rod 24 to a ratchet-lever 25, actuated by a spring 42 and carrying a pawl 26, which engages with a ratchet-wheel 27, provided with teeth 5″ 6″ 7″ 8″ 9″ of different distances from each other corresponding to the different respective distances between lines 5′ 6′ 7′ 8′ 9′. A pawl 28, controlled by a spring 28, secures wheel 27 in its position against a spring 37, actuating the wheel in the opposite direction to the space-key by means of a cord 38, wound on its shaft. Wheel 27 is connected to a pulley 29, provided with a groove on its periphery to receive a cord 30, fixed at one end to pulley 29 and to the slide-piece 11 at the other end. By these means roller 12 is shifted step by step along the slot of lever 10 when the provisional space-key is depressed by setting a line, and roller 12 will be in the positions 5′ 6′ 7′ 8′ 9′, respectively, when the corresponding teeth 5″ 6″ 7″ 8″ 9″ are in engagement with pawl 28. Wheel 27 being returned to its normal position whenever a line has been composed, as hereinafter described, so as to bear with an arm 31, fixed to the wheel, against a stop 39 and to allow slide-piece 11 to likewise return to its normal position at 5′, when the provisional space-key has been depressed five times by setting the next line, teeth 1″ 2″ 3″ 4″ will have passed by pawl 28, and tooth 5″ will be in engagement with the pawl. Cord 30 is of such length that it will not be strained till tooth 5″ engages with pawl 28—that is to say, when the space-key is depressed for the fifth time. After that slide-piece 11 is taken along a step at each following space-key stroke, so as to be brought at 6′ 7′ 8′ 9′ by the sixth, seventh, eighth, ninth key-stroke, respectively. Ratchet-wheel 27 is then stopped by its arm 31, which reaches a stop 32, so that pawl 26, engaging with the next tooth at the next stroke—*i. e.*, the tenth—by setting a line is caught in tooth 10″, and the provisional space-key cannot be further depressed a tenth time, thus advising the operator to depress for the remainder of the line another space-key, which will supply definitive spaces, for it is not needed in justifying long lines containing more than ten words to change all the spaces, the changing of up to eight or nine spaces being fully sufficient. On the other hand, as lines commonly will contain more than five words my apparatus pays regard to this circumstance so far as the initial position of roller 12 corresponds to a line of five spaces. In consequence thereof cord 30 must have an excess of length, so as to be strained, but only on the fifth stroke of the provisional space-key.

It will be understood that if it be desired to justify lines containing more or less spaces than as described herein apparatus will be designed accordingly.

The size of the mold having been adjusted by the means described heretofore, a crank 79, Figs. 3, 4, is turned once round. By this crank movement, as will be hereinafter fully described, pawl 28 is swung to the right, so as to release ratchet-wheel 27, which is returned to its normal position together with slide-piece 11 and roller 12, as described, pawl 26 being held out of engagement with the teeth of wheel 27 by spring 42 and a projection 40 of the pawl bearing against a pin 41. Likewise lever 33 is swung upward, so as to withdraw rod 6 from the type-channel by a pin 34 and allow lever 7 to swing to the right until it is stopped by the stud 14. Pusher 3 is then forwarded and brings the line to the left end of the type-channel behind a yielding pawl 35 of a slide-piece 36, which in the same time has been shifted to the right, so as to catch the line by pawl 35 entering the assembling-channel through a longitudinal slot $2^{\times\times\times}$, Fig. 4. Slide-piece 36 is guided on a guide-piece 71 of the outer wall of the type-channel. Pusher 3 then returns to its normal position and a fresh line is composed, while the line to be justified is further driven forward by pawl 35 and slide 36, forced to the left by a weight or spring until it will be stopped at the foremost provisional space by a bridge-lever 43 striking against the upper projecting end of the space and a similar bridge-lever (not shown) connected to lever 43 by a bolt $43^{\times}$ and striking against the lower projecting end of the space. The said movements of levers 28 33, pusher 3, and slide 36 are brought about by cam-disks 77 80 84, mounted on the crank-shaft 78 and suitable lever connections, Figs. 3, 4, 7. The crank-shaft is supported by supports 85 86 87. Cam-disk 77 actuates two levers 28″ and 33″, fixed to the spindles 28′ and 33′ of levers 28 and 33, respectively. A lever 83, extending through a slot 70 of plate A, is connected to the pusher 3, engaging with its slotted end a pin fixed to the pusher, Fig. 4, and extending through a longitudinal guide-slot of the inside channel wall. Lever 83 is pivoted to the support 86 and bears with a roller 82 against the edge of cam-disk 84. The edge of the latter has a portion concentric to the center of crank-shaft 78, and this portion passes under roller 82 at the beginning of the crank movement, so that lever 83 remains stationary until lever 33 has performed its stroke and the end $6^{\times}$ of rod 6 is out of contact with the left end of the line. After that lever 83 is swung to the left, taking along with it pusher 3 and the line. Another lever 73, pivoted to the support 87, is connected by a rod 72 to slide 36 and bears with a roller 81 against cam-disk 80. By turning the crank 79 lever 73 is therefore swung to the right, so as to bring

slide 36 in line with the forwarded pusher 3 and catch the line by the spring-actuated pawl 35. Levers 73 83 are returned by springs 73′ 83′ and levers 33 28 by the springs 9 28″, referred to heretofore. By these means the crank having been turned once round to its normal position, Fig. 4, levers 83 33 28 will likewise return to their normal positions, (represented Figs. 1 and 4;) but lever 73 is held out of contact with cam-disk 84, the line bearing against the bridge-levers and stopping therefore pawl 35 and slide 36, the connecting-rod 72, and lever 73. As soon as the foremost space reaches bridge 43 the casting apparatus is started by this space, as will be hereinafter described, and as its main shaft performs a revolution the metal is forced into the mold 23, slide-piece 44 drawn back, and body-piece 19 driven forward by means of lever 45 and stud 46 so as to push out of the mold the space and bring it into line with slide 44, which then is forwarded, taking along with it the space and inserting the same into the line, the provisional space 5 being at the same time removed and dropping down through an opening of plate A and an inclined channel 107, Fig. 5, provided beneath that opening.

The casting apparatus is automatically stopped after one revolution of its main shaft, but it is started again by the next provisional space, the line being released by the removal of the foremost provisional space and proceeding again until the next provisional space reaches the bridge 43. In a similar way the second and the following spaces are cast and inserted, and the casting apparatus is finally stopped when all the provisional spaces are substituted by definitive ones. The said movements of the casting apparatus are performed by the following means, Figs. 3, 4, 5, 6: The main shaft 108 is journaled in bearings 88 119 and provided with cam-disks 98 99 97 108′. Cam-disk 108′ actuates a lever 45″, mounted on the spindle 45′ of lever 45, and thus controls the reciprocating movement of body-piece 19 of the mold. The melting-pot 95, of any well-known construction, swings in supports 95′ 95″ and bears with an arm 96, fixed to its side, against cam-disk 97. In its raised position the spout 104 of the melting-pot enters an opening 105, Fig. 5, provided in plate A, so as to close the mold from the under side. In this position of the melting-pot a cam 100 of cam-disk 99 strikes a lever 101, pivoted to the under side of the melting-pot and connected by a rocking shaft 102′ to a lever 102, which actuates the rod 103 of the force-pump. By these means the molten metal is discharged through an opening 106 of the spout and forced into the mold. In the meanwhile the recessed cam portion of cam 98 reaches the two-armed lever 91, which is pivoted to a support 89 and connected by a rod 92 to a spring-actuated lever 93, mounted on a rocking shaft 94, journaled in bearings 90 90′. A lever 75, fixed to the said shaft and extending through a slot 74 of plate A, engages by its slotted end with a pin 76 of slide 44, the latter pin extending through a longitudinal slot of the inner wall 21, Fig. 1. By these means when the recessed cam portion of cam 98 reaches lever 91 lever 75 and slide 44 are forced by a spring 93′ to the left of Fig. 5, so as to open the mold opposite to the body-piece 19. The latter, by means of cam 108′ and levers 45″ 45, is then forwarded, so as to push out of the mold the cast space and bring it into the path of slide 44, which in its return movement, depending on the cam form of cam-disk 98, takes the space along with it. As slide 44 reaches its normal position, Fig. 1, the space is inserted into the line and the provisional space at the same time removed.

In order to allow of inserting definitive spaces of larger size than the provisional ones, bridge 43, and the other bridge connected thereto, as referred to, are movably pivoted to the wall 21 and slide 44, provided with a cam-shaped projection 44′, Fig. 1, which strikes the end 43′ of bridge 43 immediately before the definitive space reaches the line, and therefore swings the other end of the bridge to the right, as shown in Fig. 1. The provisional space bearing against the bridge-levers, the line up to this space is therefore shifted a distance backward and the breach for inserting the definitive space accordingly enlarged, as the remainder of the line, which has passed under the bridge 43, remains stationary.

As stated heretofore, at each spacing the main shaft 108 performs one complete revolution and is automatically started and stopped again by the successive spacings. This will be effected by the following means, Figs. 3, 4, 6: A separate shaft 121, Fig. 3, in line with the main shaft 108, is journaled in a bearing 120 and kept in continuous revolution by means of a gear-wheel 113, for instance.

Shaft 121 is provided with toothed ratchet-wheels 112 114 at its ends. Opposite to ratchet-wheel 112 main shaft 108 carries a disk 109 and a hooked-shaped pawl 111, pivoted thereto. At the right of shaft 121 and in line therewith is journaled another separate shaft 124, the function of which will be hereinafter described, the latter shaft carrying likewise a disk 115 and a hook-shaped pawl 117, as best shown in Fig. 6. Pawls 111 117 are actuated by springs 110 116, so as to engage with the ratchet-wheels 112 114 when the ends of the pawls are released by the levers 126 128, pivoted to a supporting-plate 129 and kept in engagement with the pawls by springs 128′, Fig. 6. Beneath the levers there are placed on the supporting-

plate electromagnets 125 127, and whenever a current is sent through the reels levers 126 128 are attracted by the cores, and as the pawls then will engage with the ratchet-wheels the shafts 108 and 124 will be rotated and stopped again after one complete revolution, provided that in the meanwhile the current has been broken again and the levers 126 128 raised to their normal positions. The electric current may be supplied by any source of electricity—say, a battery E, Fig. 4, which, with reference to the starting and stopping action of main shaft 108, is connected by a wire *a* to one end of the reel 125, and by another wire 63′ to an insulated iron pin 63, provided in a block 62×, Figs. 1, 4. Another insulated iron pin 61′, secured in the said block, is connected by a wire 61′ to the other end of the reel 125. Pin 63 carries a contact-spring 62, bearing against a piece 68, of insulating material, secured to the end of bridge-lever 43. Spring 62 is normally out of contact with pin 61; but when a line bears against bridge 43 the latter is swung to the left and closes the electric circuit by making contact between spring 62 and pin 61, and thus starts the main shaft 108. If then at the end of the revolution taking place the definitive space is being inserted into the line and the provisional space removed therefrom, as stated heretofore, the circuit will be broken for a short time, until the next provisional space will reach the bridge. Lever 126, therefore, will be released by the core and raised by its spring, so as to stop pawl 111 and the revolution of the main shaft; but as the circuit is immediately closed again by the next provisional space reaching the bridge, main shaft 108 performs another revolution, and so on until all provisional spaces are substituted by definitive ones.

The last provisional space having been ejected, bridge 43 finally returns to its normal position, Fig. 1, as no further provisional space will strike the bridge. The revolution of the main shaft is therefore finally stopped and pawl 35 is released by the line and slide 36 therefore shifted to its outmost left-hand position against a block 66×, as represented, Fig. 1. A contact-spring 66 is secured to a projection 67, fixed to slide 36, and consisting of insulating material. Spring 66 is suitably shaped so as to make a momentary contact with both of two insulated iron pins 64 65, secured in the block 66×, before slide 36 reaches its outmost end position. While in the end position itself, the spring is in contact with but one of the said pins, as shown, Fig. 1. Pin 65 is connected by a wire 65′ to the battery E, and pin 64 by another wire 64′ to one end of the reel 127, a third wire *b* connecting the battery to the other end of reel 127. In consequence thereof shaft 124 will be started to perform one revolution, when the contact between spring 66 and pins 64 65 takes place, and cam-disk 118 of shaft 124 will strike a lever 48″, mounted on the shaft 48′ of lever 48, which latter thus will be swung against the pin 49 of slide 17, so as to return the latter to its normal position and open the mold to the largest size. Shaft 124 is stopped after one complete revolution. In the meanwhile the fresh line has been composed, so as to reach rod 6, projecting again into the type-channel, and the size of the mold will be adjusted again for the next line, and so on.

The justified type-lines pass into a galley on the left of my apparatus and are successively pushed sidewards by a pusher 50, the column bearing at the rear side against a movable wall 51. The justified matrix-lines are presented to the line-casting mold. When distributing the types or matrices, the spaces drop down and are recast

In the case of constantly keeping too short the provisionally-spaced lines, my apparatus can be modified, as illustrated, Figs. 2, 8, 9, by using the well-known wedge-shaped spaces of linotype-machines. The spaces consist of two wedge-shaped pieces 52 53, movably connected to each other, and are inserted into the line by setting after having been reduced to their smallest size. The composed line is brought between two abutments having a distance from each other equal to the required length of the line. One of these abutments consists of the pusher 3 and the other of an angle-piece 54, adjustably fixed to a bar 57. The latter is carried and guided by a slide 56, loosely connected to a two-armed lever 7× 10×, and actuated by a spring 13×. A lever 59, bearing against a roller 59× of slide 56, keeps it in its normal position against the pressure of spring 13×. Another lever 59″, Figs. 8, 9, mounted on the spindle 59′ of lever 59, bears against a cam-disk 77′ of the crank-shaft 78. When the latter is turned once round at the end of a provisional line, roller 59× is released by lever 59 and bar 57 pressed against the spacer parts 53, the parts 52 bearing against a stationary bar 58. By this shifting movement of bar 57 angle-piece 54, with its forked ends 54′ 54″, Fig. 9, enters the type-channel, and the line is lengthened by the expansion of the wedges, so as to fill the space between pusher 3 and piece 54. Lever 59 then returns the slide 56 and bar 57 to their normal position after the wedge-spaces have been expanded and the line lengthened to the normal length. The movement of slide 56 when forcing in the wedge members 53 is transferred by the lever 7× 10× to the slide 17, which is wedge-shaped at 18, as and for the purposes previously described, the parts designated by similar letters, as in Fig. 1, performing the same functions as described in connection with that figure.

The size of the mold 23 (represented in full lines in Fig. 2) corresponds to the normal position of bar 57 shown in that figure. As the latter bar in its shifting movement reaches the spacer parts 53, the end of body-piece 19 occupies the dotted position, the size of the mold then corresponding to the thickness of the wedge-shaped spaces reduced to their smallest size.

When the obliquity or inclining of the wedge-shaped pieces 18 19 and 52 53 is the same, as illustrated in Fig. 2, lever-arms $7^{\times}$ $10^{\times}$ will be of equal length, and it will be understood that the size of the mold, beginning from the dotted position of the body-piece, will be increased the same distance as that of each spacer; but with different inclines on the spacers and the parts 18 19, the lengths of lever-arms 7 10 must be proportionate thereto.

The extended line is forwarded to the mold by the same means as heretofore described, and the spacers projecting from the line secure in a most convenient manner the step-by-step passage of the line. A slot 60, provided in the wall 21, allows the entering of the spacers into the path of slide 44, and they are pushed out of the line and drop down into a receptacle when slide 44 is forwarded to insert a definitive space.

In accordance with the different form of the spacers the assembling-channel in Figs. 2 and 9 is slightly modified. The spacers projecting at both sides from the channel-walls, the latter are provided with opposite longitudinal slots $2^{\times\times}$, Fig. 9, which extend throughout the length of the channel. Likewise angle-piece 54 is slotted, so as to allow of the passage of the spacers between the forked ends 54′ and 54″, Fig. 9. By the same reason the guide-rail 58 for the slide $36^{\times}$ is provided in a suitable distance from the outer channel-wall $2^{\times}$, and there are two pawls $35^{\times}$, pivoted to the upper and to the under side of slide $36^{\times}$, respectively, so that the spacers do not interfere with the pawls when slide $36^{\times}$ is shifted to the right. The walls $2^{\times}$ of the channel are cut away from above and from below, as shown, Fig. 9, the reduced portions allowing of the entrance of the forked ends 54′ and 54″ of angle-piece 54 and of the pawls $35^{\times}$ into the channel.

The casting apparatus is the same as heretofore described and likewise the means for inserting the definitive spaces, with the only difference that bridges are not needed, the form of the spacers itself controlling the step-by-step movement of the line so far as they are stopped by the outer channel-wall 21 and the wall $21^{\times}$, Fig. 2.

The electric circuit for starting and stopping the casting apparatus is controlled by a pin $43^{\times}$, Fig. 2, guided in the wall $21^{\times}$ and carrying a head-piece $44^{\times}$ of insulating material. By these means when the line is stopped by the foremost spacer entering through slot 60 into the path of slide 44 pin $43^{\times}$ is pressed to the left and contact-spring 62 against pin 61, thus closing the electric circuit, and the operation is then as described in connection with Fig. 1. The circuit for actuating lever 48 and slide 17 is controlled by the same means as described with reference to Fig. 1.

The invention is not confined to the specific construction or arrangement of apparatus shown in the drawings; but there may be suggested many other modifications of this apparatus without departing from the invention as defined by the claims.

While the mechanism shown as embodying the invention is adapted for handling ordinary type, and the invention is especially intended for such use, it will be understood that the invention is not limited to machines for justifying such ordinary type, but may be applied also in justifying type-matrices or the like of any suitable material and that the word "type" is used herein in this broad sense.

Having fully described my invention, what I claim, and desire to secure by Letters Patent, is—

1. In a justifying apparatus, the combination of an adjustable mold, means for measuring the line, means for dividing the shortage of the line by the number of spaces and adjusting the mold in accordance with such division, means for casting spaces after the mold is set, means for advancing the line said line having provisional spaces, and means controlled by the provisional spaces for stopping the line and inserting the justifying-spaces cast by the mold.

2. In a mechanism for justifying a composed line, a series of tapered spacers arranged between the words of the line, means for driving the spacers uniformly into the line, abutments for limiting the spread of the line, and means controlled by the inward movement of the spacers for predetermining the width of uniform justifying-spaces for the line.

3. In a mechanism for justifying a composed line, a series of tapered spacers arranged between the words of the line, abutments for limiting the spread of the line, a common part arranged to drive the spacers into the line and spread the same until against said abutments, and devices controlled by the movement of said part for predetermining the width of justifying-spaces for the line.

4. In a mechanism for justifying a composed line, a series of tapered spacers arranged between the words of the line, abutments for limiting the spread of the line, a common part arranged to drive the spacers and spread the line against said abutments, means for yieldingly moving said part to drive the spacers, and devices controlled by the move-

ment of said part for predetermining the width of justifying-spaces for the line.

5. In a mechanism for justifying composed lines, a series of tapered spacers arranged between the words of a line, abutments for limiting the spread of the line, a common part for driving said spacers uniformly into the line to spread the same against the abutments, and a space-mold having a movable body-piece adjustable by said part to determine the width of justifying-spaces for the line.

6. In a mechanism for justifying composed lines, two series of reversely-tapered spacers arranged in pairs between the words of a line, substantially as described, a stationary bar or part against which one series of spacers abuts, abutments for limiting the spread of the line, a common part arranged to drive the other series of spacers to spread the line against said abutments, and means controlled by the movement of said part for determining the width of justifying-spaces for the line.

7. In a mechanism for justifying a composed line, a series of tapered spacers arranged between the words of the line, abutments for limiting the spread of the line, a common part for driving said spacers uniformly to spread the line against said abutments, a mold having a movable body-piece, and connections between said body-piece and said driving part whereby the body-piece is moved proportional to the movement of the spacers.

8. In a mechanism for forming justifying-spaces, the combination of tapered spacers arranged between the words of the line, abutments for limiting the spread of the line, a common part for driving said spacers to spread the line, a second part having an incline, a lever connecting said parts, and a mold having its body-piece in contact with said incline, whereby the movement of the body-piece is controlled by the movement of the spacers, for the purpose set forth.

9. In a justifying mechanism, a series of tapered spacers, means for advancing spacers into a limiting space proportional to the shortage of the line, and means controlled by the movement of the spacers for determining the uniform justifying-spaces for the line.

10. In a justifying mechanism, a series of tapered spacers, means for advancing spacers into a limiting space proportional to the shortage of the line, and means controlled by the movement of the spacers for forming the justifying-spaces for the line.

11. In a justifying mechanism, a series of tapered spacers, means for advancing spacers into a limiting space proportional to the shortage of the line, and means controlled by the movement of the spacers for casting the justifying-spaces for the line.

12. In a justifying mechanism, a series of tapered spacers, means for advancing spacers into a limiting space proportional to the shortage of the line, means controlled by the movement of the spacers for determining the uniform justifying-spaces for the line, and means for inserting the justifying-spaces into the line.

13. In a justifying mechanism, a series of tapered spacers, means for advancing spacers into a limiting space proportional to the shortage of the line, means controlled by the movement of the spacers for forming the justifying-spaces for the line, and means for inserting the justifying-spaces into the line.

14. In a justifying mechanism, a series of tapered spacers, means for advancing spacers into a limiting space proportional to the shortage of the line, means controlled by the movement of the spacers for casting the justifying-spaces for the line, and means for inserting the justifying-spaces into the line.

15. In a justifying apparatus, the combination of an adjustable space-forming device, means for measuring the line, means for dividing the shortage of the line by the number of spaces and adjusting the space-forming device in accordance with such division, means for forming spaces after the space-forming device is set, means for advancing the line said line having provisional spaces, and means controlled by the provisional spaces for stopping the line and inserting the justifying-spaces formed by the space-forming device.

16. In a justifying apparatus, the combination of means for measuring the line and dividing the shortage of the line by the number of spaces, of a space-forming device, and connections between the line-measuring and shortage-dividing means for setting said space-forming device in accordance with the division, said connections including a member having an incline by which the space-forming device is set.

In witness whereof I have hereunto signed my name in the presence of two subscribing witnesses.

ERNST WENTSCHER.

Witnesses:
WM. HAUPT,
CHAS. KRINGER.