

No. 867,867.

PATENTED OCT. 8, 1907.

E. V. BEALS.

JUSTIFYING MECHANISM FOR TYPE MATRICES AND TYPES.

APPLICATION FILED FEB. 21, 1898.

5. SHEETS—SHEET 1.

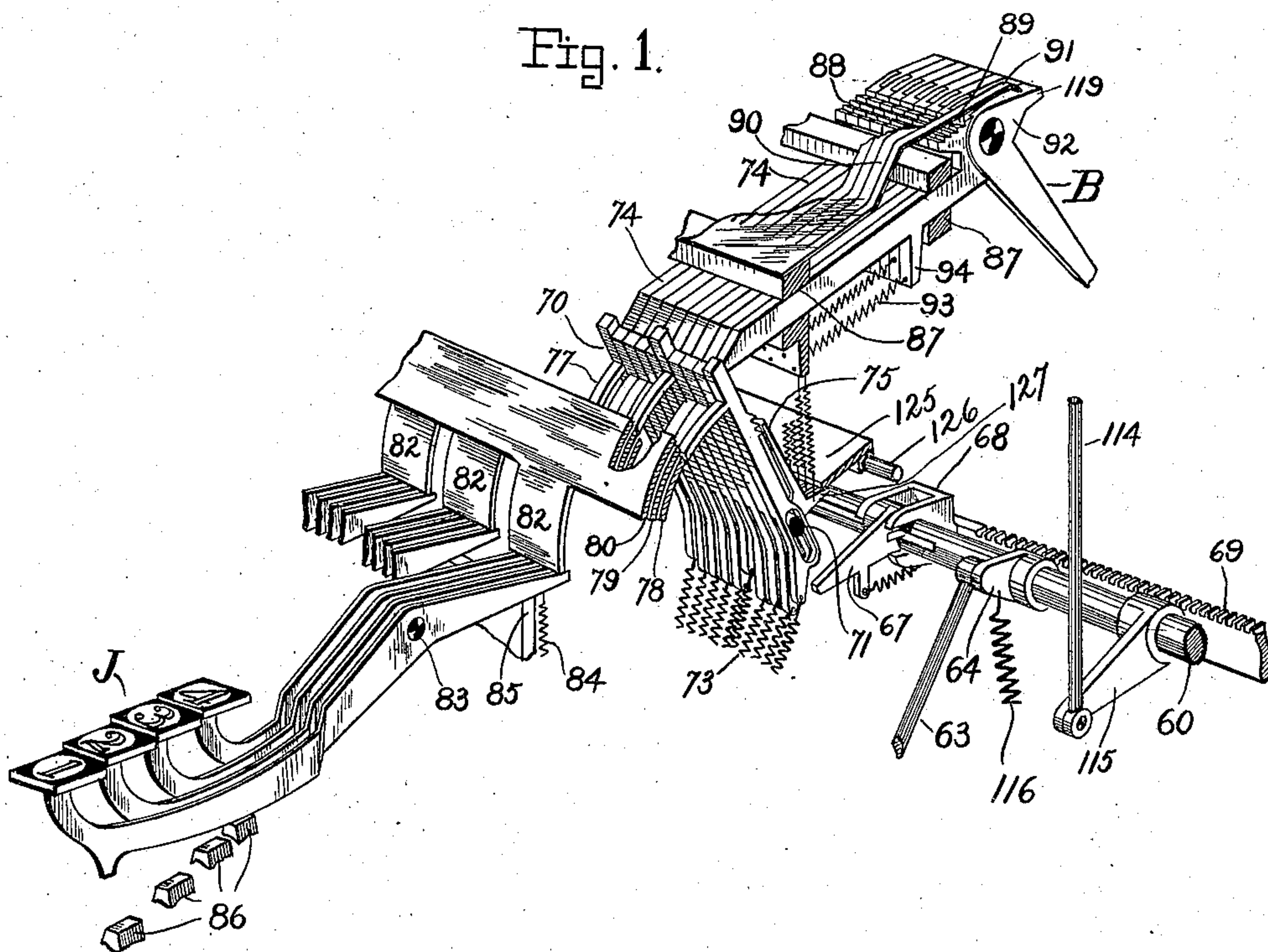


Fig. 14.

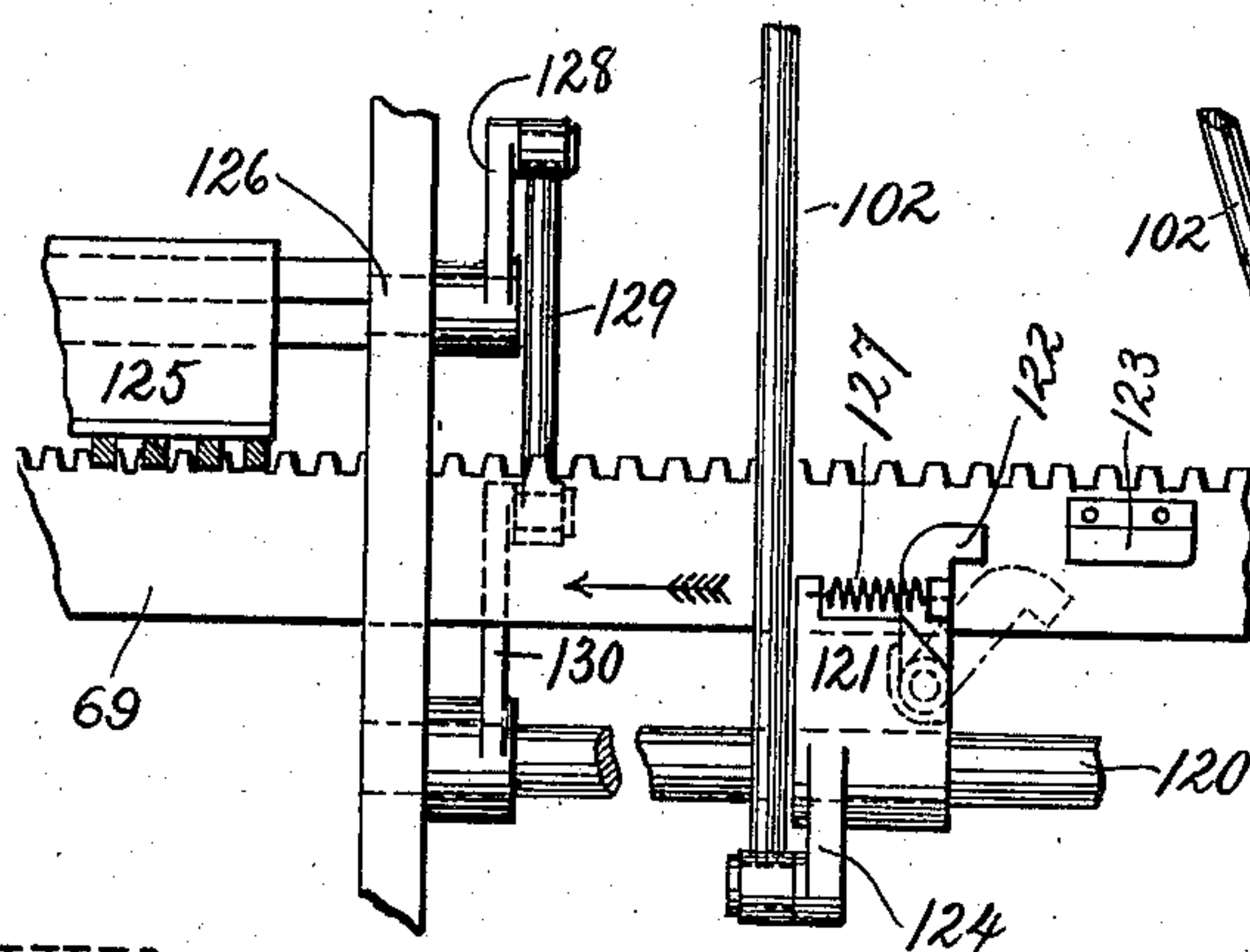
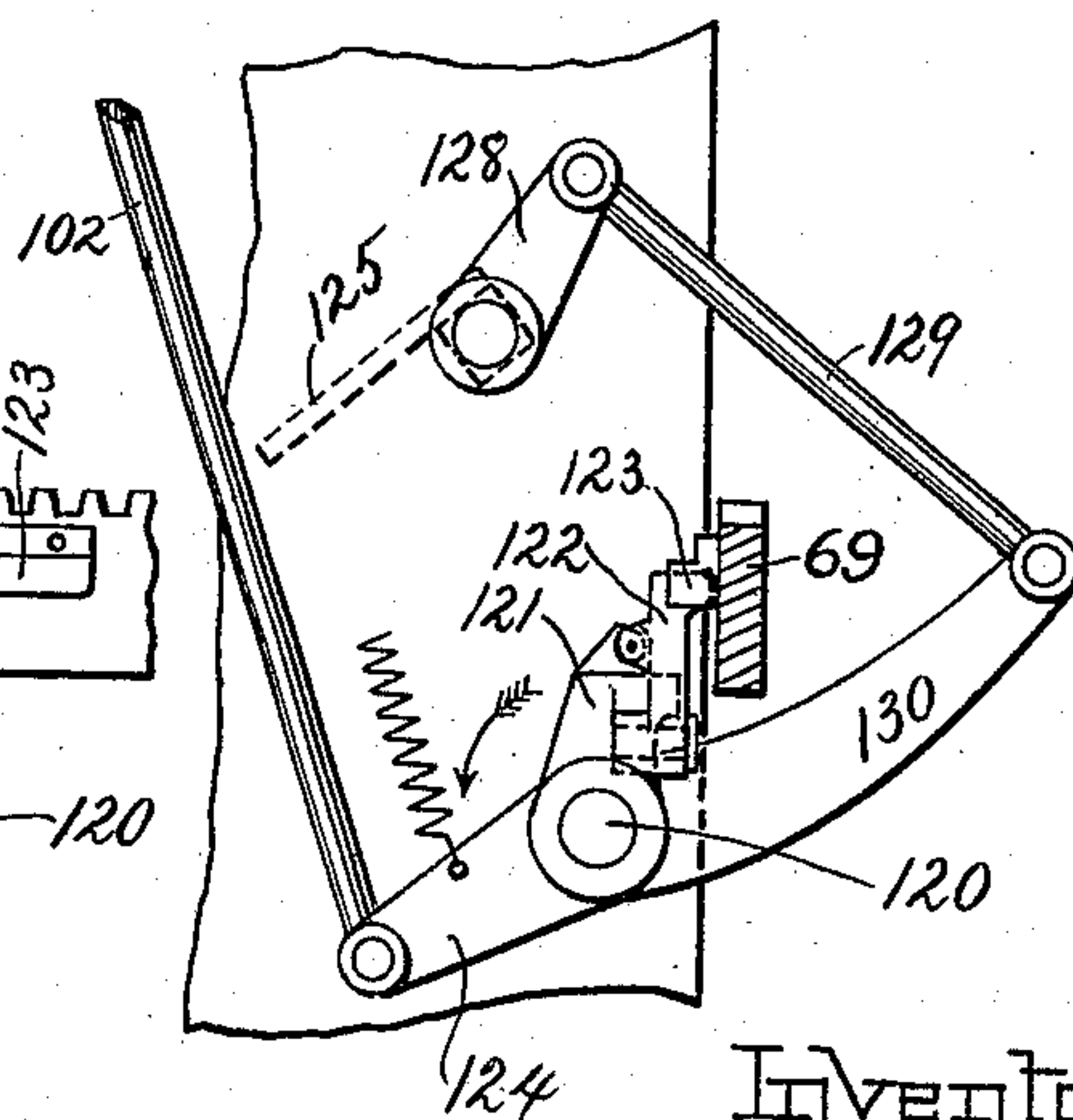


Fig.15.



Witnesses.

H. L. Chapin.
Louise A. Chase

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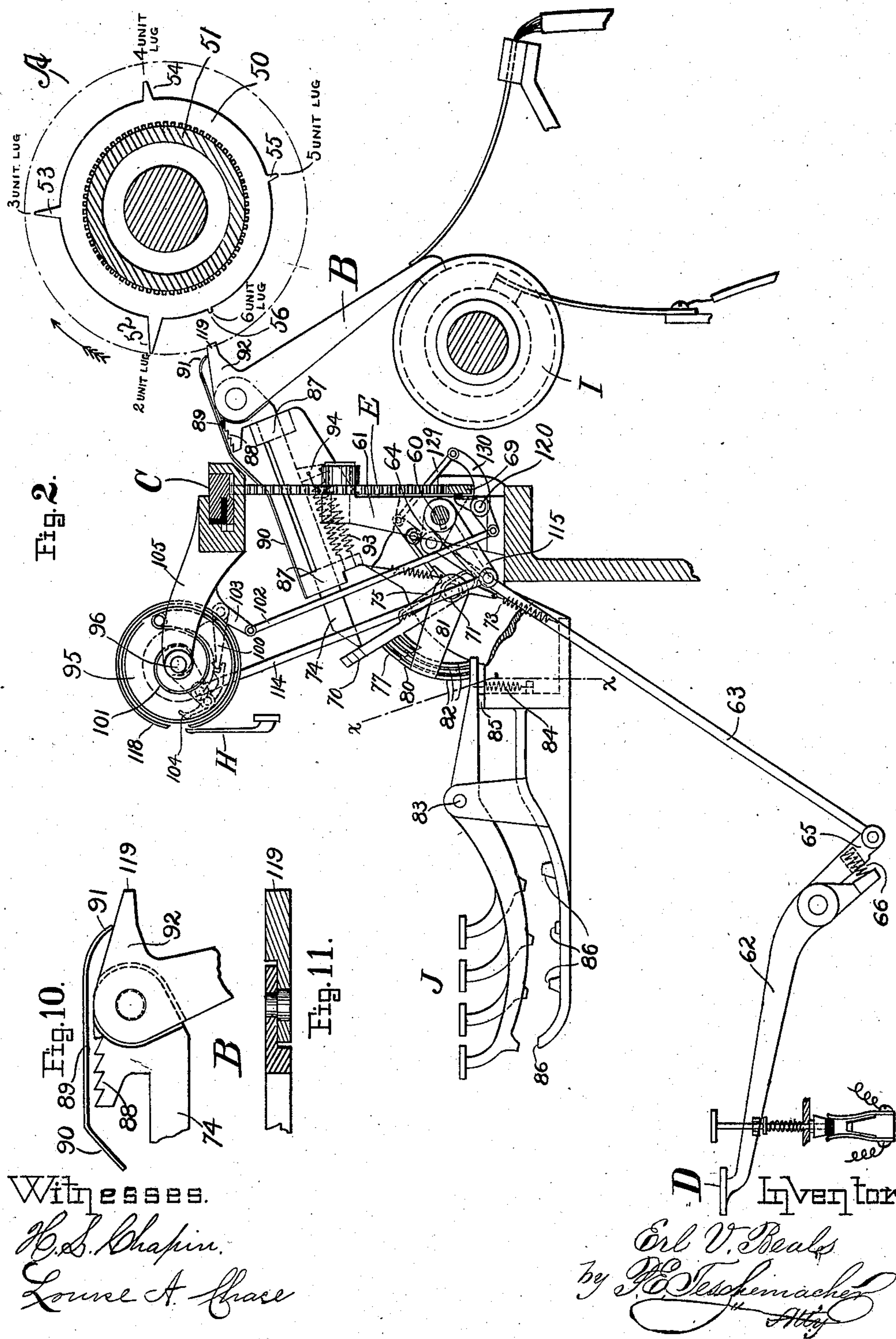
Erst V. Beals
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11 May

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5 SHEETS—SHEET 2.



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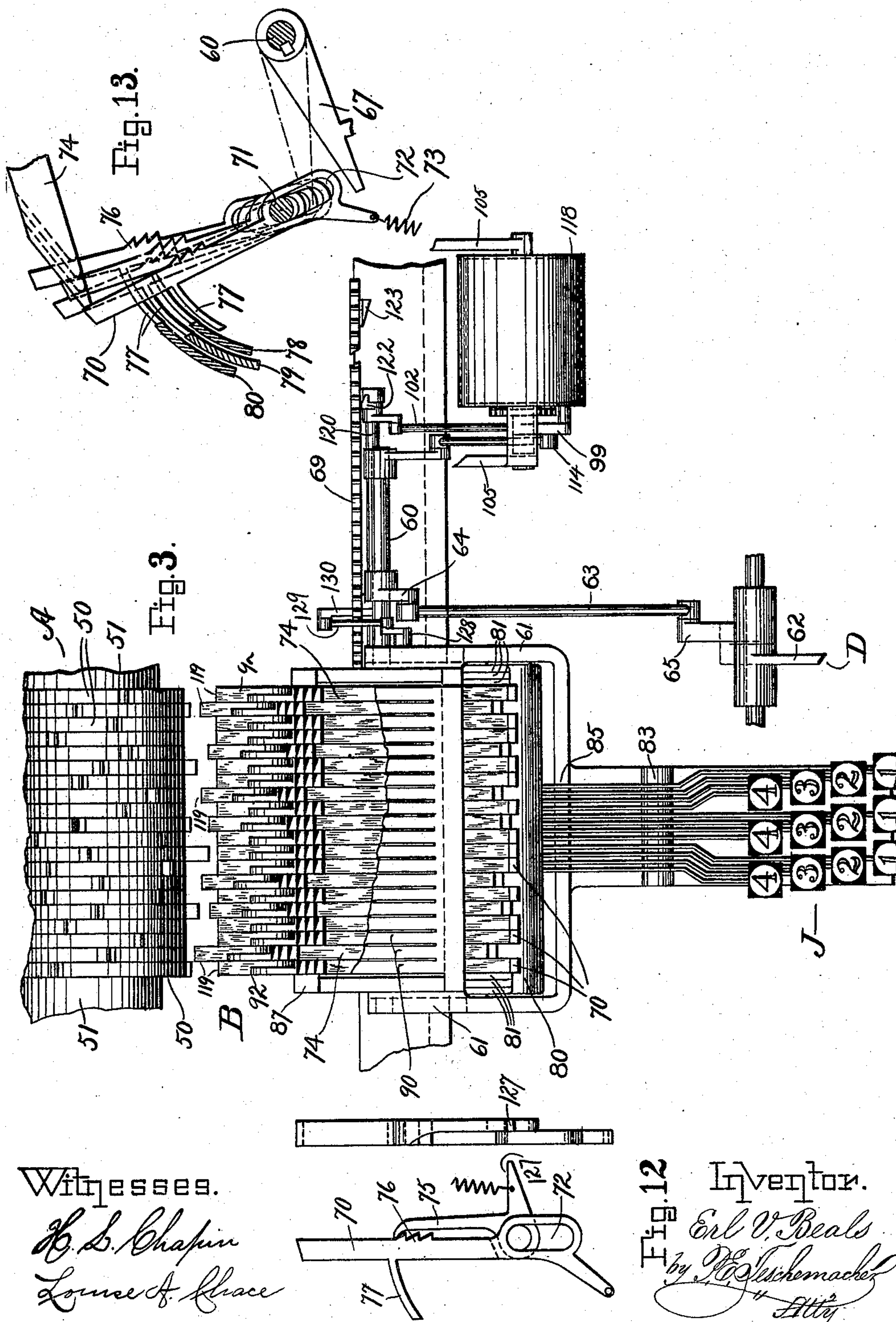
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6 SHEETS—SHEET 3.



Witnesses.

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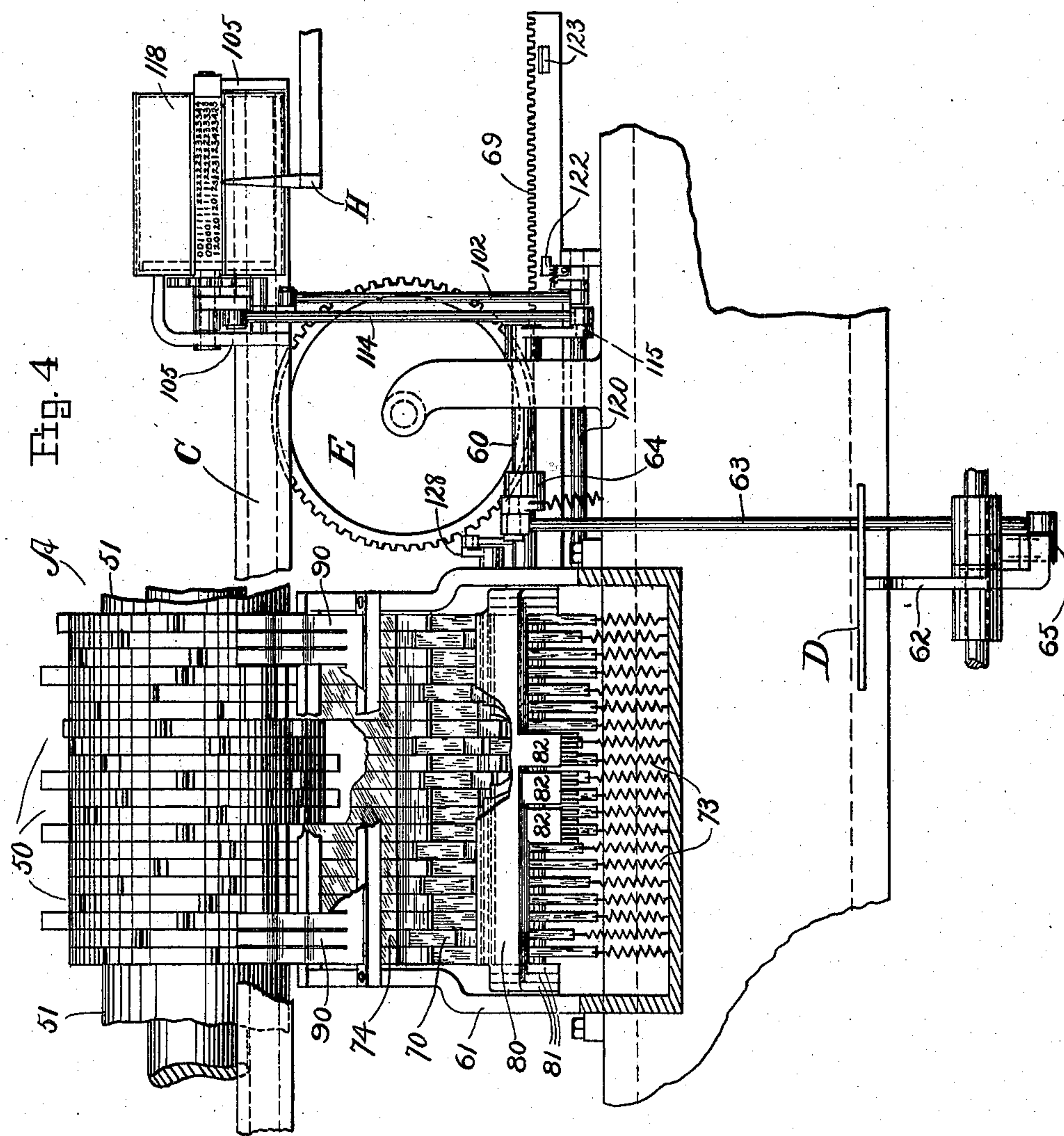
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5 SHEETS—SHEET 4.



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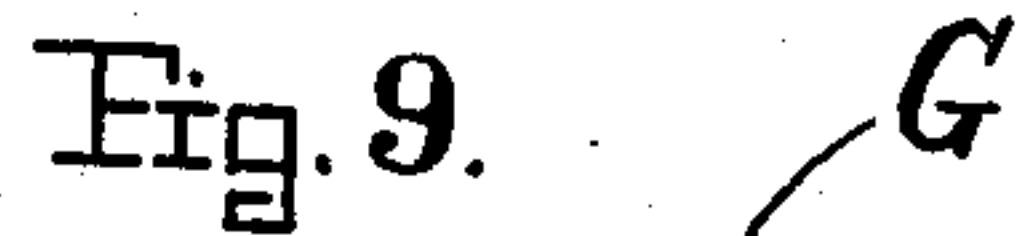
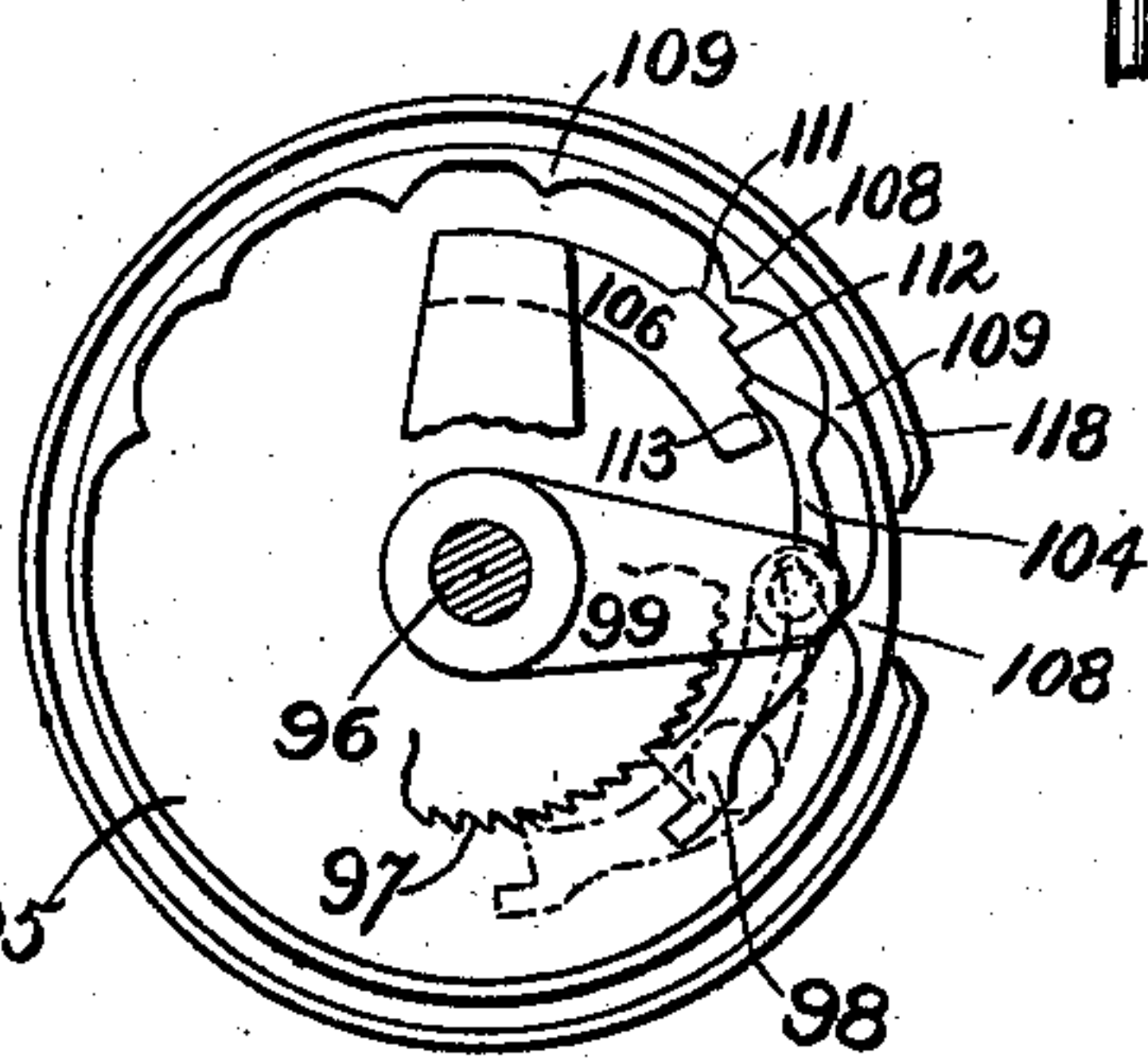
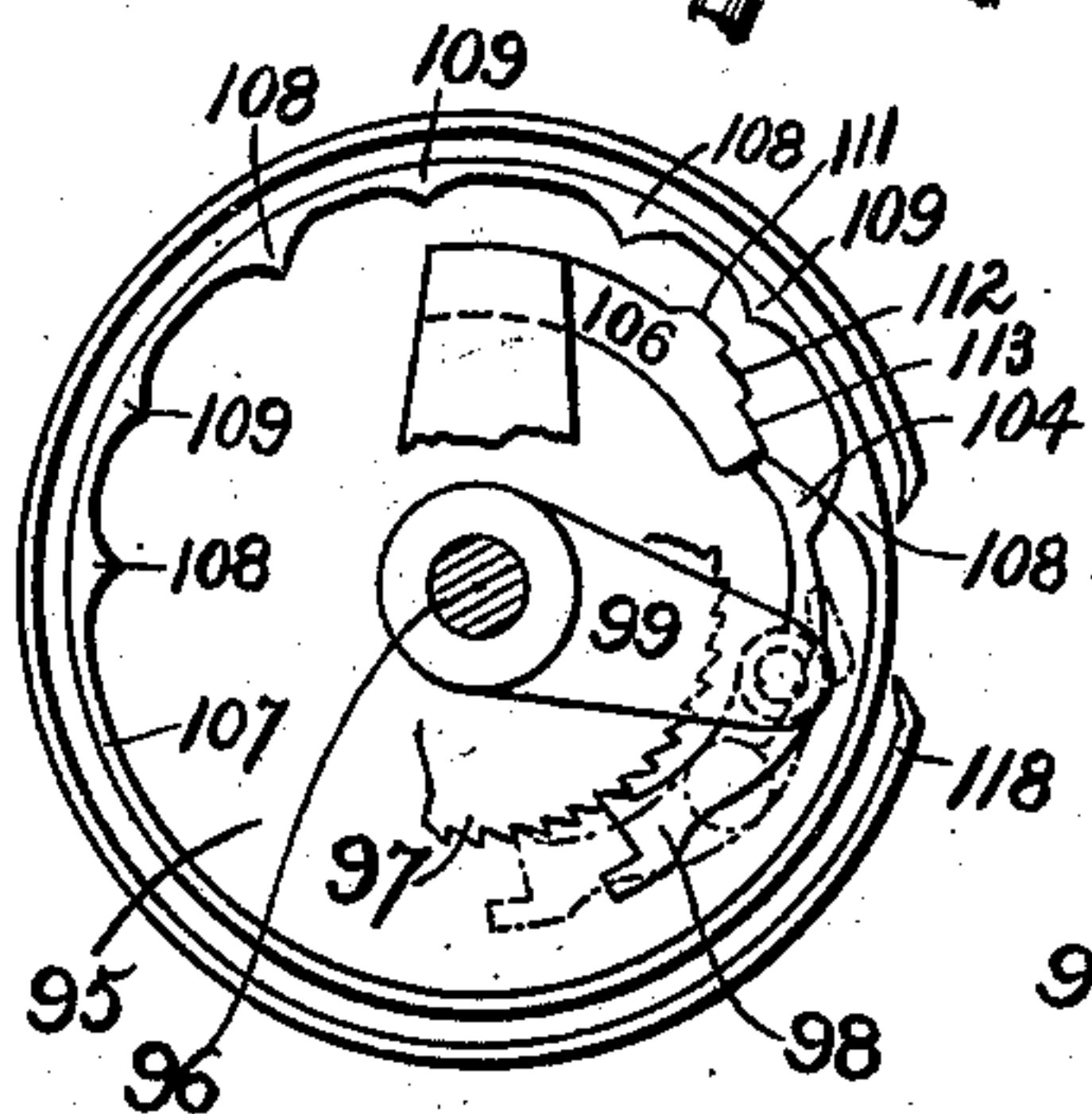
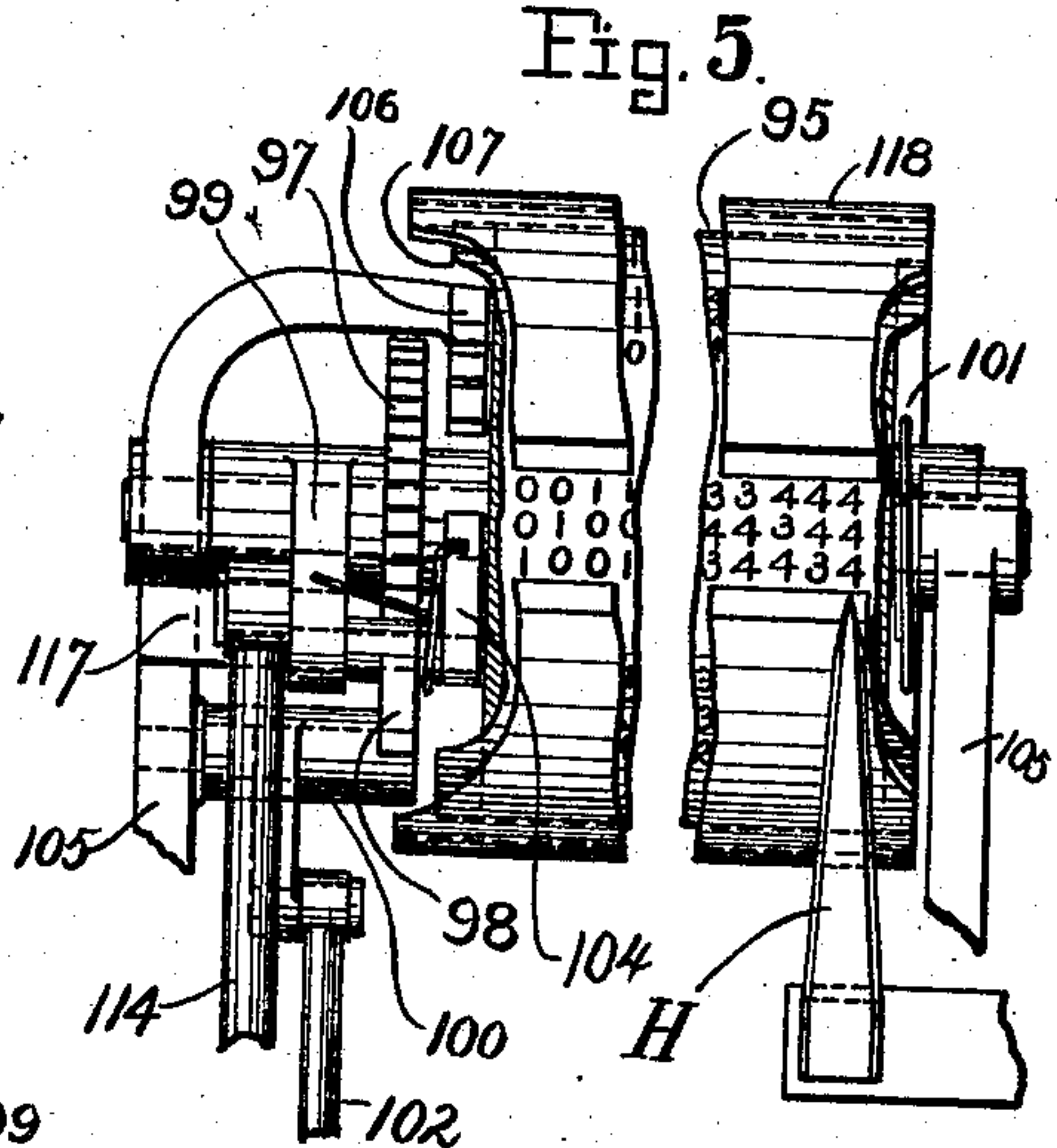
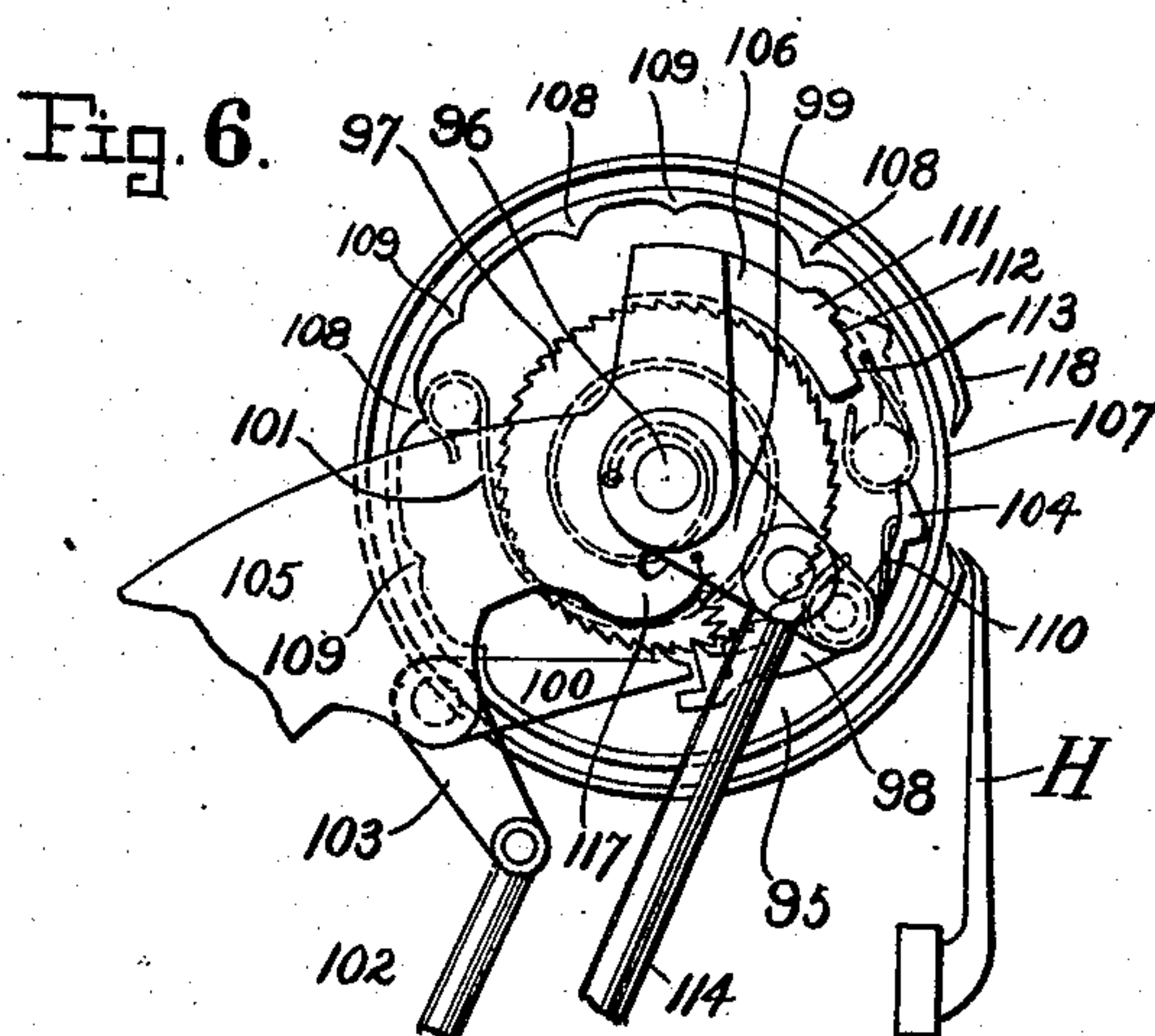
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5 SHEETS—SHEET 5.

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Witnesses.

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UNITED STATES PATENT OFFICE.

ERL V. BEALS, OF BOSTON, MASSACHUSETTS.

JUSTIFYING MECHANISM FOR TYPE-MATRICES AND TYPES.

No. 867,867.

Specification of Letters Patent.

Patented Oct. 8, 1907.

Application filed February 21, 1898. Serial No. 671,171.

To all whom it may concern:

Be it known that I, ERL V. BEALS, of Boston, in the county of Suffolk and State of Massachusetts, have invented certain new and useful Improvements in
5 Mechanism for Justifying Type-Matrices and Types, of which the following is a specification.

This invention relates to an attachment for justifying assembled lines of types or matrices, and has for its object the facilitating of the composition of printing
10 matter, whether this work be done by the mechanical setting of individual types, by the making of a matrix from an assembled line of male matrices, or by the casting of complete lines from assembled female matrices.

Heretofore in all practical-working line casting machines the justifying has been accomplished by introducing a wedge or stepped-bar mechanism between words during assembling of the matrices which mechanism is subsequently acted upon in a manner to flush or spread the line of matrices before the cast is made.

This method has several serious objections, however. The general operation of the parts of such machines is retarded by the time taken to actuate the wedges or stepped-bars, which time, though small in itself, is great in the aggregate, and is one of the elements of
25 limitation to the capacity of such machines. The wedge mechanism, furthermore, is a delicate one requiring daily attention and constant and careful lubrication, with a further objection which exists in the danger of the wedges becoming injured at any time
30 and then ruining the whole set of matrices in the machine. In matrix-making machines, so called, expansible spring spaces have been used between the words of a line and the justification has been entrusted entirely to the springs which are an uncertain element,
35 and especially so in the intricate surroundings of a line matrix.

My invention consists in a mechanism to coöperate with any finger-board whose object is to produce lines of printing faces, said mechanism being automatic in
40 exactly the same sense that the general machines are said to be automatic—in every respect except in the operation of the fingerboards. My justifying mechanism is of such construction as to require only that the fingerboard operator touch what is now commonly
45 called a "spacer-key" at the end of each word, during the ordinary composing of the lines, and by this act the mechanism will be so set or effected that it will cause to be inserted between the words of each line, at the conclusion of the composition thereof, blank,
50 parallel and solid bodies, without printing faces, in such number, of such thickness or thicknesses, and in such combination as will accurately flush the various lines it may have to justify.

My invention, furthermore, consists in part in a chart
55 containing a set of all the varied combinations which are designed to effect the justification of any line of

types or matrices of whatever composition. Working in conjunction with this movable chart is a registering pointer operated in the general machine at intervals, once for each type or matrix assembled, and depending
60 for the extent of its throw or indexing, directly upon the width of the type or matrix so assembled. The purpose of this registering pointer is to show to the operator and to point out on the chart the residue or unfilled portion of the line he is at work upon, and for this
65 reason it first indicates at the beginning of the composition of the line the total number of units in the line of predetermined length, corresponding to the width of the column for which the matter is intended. From showing this total the pointer successively, as the line
70 is being filled, indicates a less residue and gradually works toward the cipher point which, when arrived at, means the line is full. When within twenty-four units of the cipher (a point which can be varied) the operator is to know, by bell or otherwise, that the line is justifiable by the justifying mechanism and that he can
75 terminate the further composition of that line at once or at any interval thereafter up to the cipher point itself. So that if the word or syllable is incomplete when the twenty-four unit limit is reached, further composition
80 of the line may proceed and may be completed within this limit since there are very few words or syllables more than twenty-four units in extent. The coöperation of the movable chart with the traveling registering pointer is designed to indicate to the operator, after the
85 reaching of the twenty-four unit limit has been signaled, without requiring of him the slightest mental calculation, a single but varying combination depending upon the relative movements which each element of said coöperation had made during the composing of the
90 line, said combination being such as will be the means of exactly justifying said line. This combination in the present invention consists of three figures made up of numerals from zero to four, and all the combinations
95 necessary for the justification of all lines, made up of whatever sized type—pica, small pica, bourgeoisie, brevier, minion, nonpareil, agate, etc.,—will be formed of three figures from zero to four only. This combination of three figures, pointed out automatically by the chart and pointer after the twenty-four unit limit is
100 reached, will change automatically and a new combination of three figures will be presented for each additional key depressed by the operator or for each unit of type or matrix assembled, the new combination so shown depending for the particular figures of its composition upon the particular thickness of the character or characters, space or spaces added to the line being composed after said twenty-four unit limit has been reached.

My invention furthermore consists in part of a series
110 of depressible keys, twelve in number, which are arranged in a series of three rows with four keys in each

row. The keys in each row bear the figures 1, 2, 3, and 4, and each row has them arranged thereon in an order common to all three. This series of keys is designed to be acted upon by the operator once at the conclusion of each line of composition, and the keys are to be depressed one in each row, one in each of two rows, one from one row, or none at all, simultaneously or consecutively and as is indicated to the operator by the three-figure combination which is pointed out on the revolving chart by the registering pointer. Such depressing of these keys (and this act may also deliver the composed line) exacts scarcely more of the operator than the throwing of the line-delivery lever alone would. Beyond this action of the operator the justifying device fulfils all the remaining requirements, such as the selection and insertion of the proper spaces in the proper places, and as will be hereinafter particularly described.

In the drawings:—Figure 1 is a perspective view of a portion of my justifying mechanism, showing only one of three rows of justifying keys and a portion of the key levers of the other two rows. Fig. 2 is a side elevation of the same, showing a portion of the mechanism intermediate between the justifying mechanism and the main machine with which it coöperates. Fig. 3 is a plan view of my justifying mechanism complete. Fig. 4 is a front elevation of the same, with the justifying keys broken off at the line $x-x$ of Fig. 2. Fig. 5 is an elevation of the revolving cylindrical combination chart, showing the registering pointer which coöperates therewith and the space-key "check mechanism" at one end of the said chart. Fig. 6 is an end elevation of the same. Figs. 7 and 8 are details of the same, showing the parts in two different positions. Fig. 9 is the plan of the cylindrical combination chart developed. Figs. 10, 11, 12, and 13 are details to be referred to. Figs. 14 and 15 are side and end elevation details of the mechanisms for automatically restoring to their normal positions the series of plunger bars 70 and the revolving combination chart shown in Figs. 5, 6, 7, and 8.

In the accompanying drawings, my improved justifying machine or mechanism is illustrated as adapted for use in connection with any electrically controlled organized assembling mechanism by means of which printing bars are produced, matrix impressions made or individual types set, the magnets of said mechanism being operated by circuit breakers, which in turn are actuated by a sectional cylinder composed of lug-bearing rings which are properly arranged side by side upon an arbor to produce the desired effect by mechanism controlled by composing keys. As one example of a machine to which my present invention may be applied, I will refer to Letters Patent of the United States No. 490,263, granted to me January 24, 1893, for a matrix-making machine. In the machine shown and described in the said patent, the assembling of matrices is electrically controlled by a perforated strip or roll of paper, which passed beneath a series of electric needles connected by wires with the assembling mechanism. My present invention is intended to operate conjointly with a sectional cylinder composed of rearrangeable lug-bearing rings hereinafter fully described, which sectional cylinder is designed to supplant the electric needles, reeling device and perforated roll of said patented

machine, and to coöperate with said machine in substantially the same manner as did the perforated roll. In the said patented machine, the justification of lines was effected by the insertion of compressible and expansible spring spacers between the words, whereas by the employment of the present invention, blank, parallel and solid bodies without printing faces, are caused to be assembled along with the types in such number, of such thickness or thicknesses and in such combination as will accurately justify the line.

In the said drawings, A represents the sectional cylinder of an electrically controlled printing-bar producing machine of the character heretofore referred to, said cylinder being composed of a series of independent rings 50 arranged side by side upon an arbor 51 and each provided with a series of lugs 52, 53, 54, 55, 56, extending radially from its periphery and of varying heights as shown in Fig. 2, said rings being moved or set up upon the rotatable arbor 51 in such relative positions as to produce the desired combination of lugs by means of mechanism controlled by the composing keys (not shown) of the keyboard of the printing-bar producing machine. The number of rings on the cylinder A equals the greatest probable number of letters or characters that may be placed side by side in a line for a specified size of type and length of line for which the machine is adapted.

B represents the series of circuit-breakers which are to be operated by the lug-bearing cylinder A, there being a separate circuit-breaker for each ring of said cylinder.

C is an escapement bar which is actuated in the usual manner after the depression of each key of the main machine by means of any suitable connection therewith.

D is the space-key which has a mechanical connection to be hereinafter described with the justifying devices and an electrical connection shown in Fig. 2 with an assembling magnet among the character magnets of the main machine; said electrical connection arranging the particular ring which is to produce a space in the composed line in the same manner as a character-key would arrange another ring to produce a character, stopping the ring so that its longest lug 52 will stand in a certain definite radial position that will produce the thinnest space between two words of a line unless a different result is effected through the justifying mechanism which will now be described.

60 represents a rock-shaft supported in suitable bearings in the frame 61. This shaft 60 is rocked by the space-key lever 62 Fig. 2, through the medium of a connecting rod 63 and an arm 64 on said shaft, said rod 63 being pivoted to a short arm 65 turning on the key-lever fulcrum, and said arm 65 being actuated by the end of the key-lever acting on a spring 66, whereby a full stroke of the key-lever is always permitted while the movement of the connecting rod may be limited as will be hereinafter described.

67 is a short arm splined on the rock-shaft and adapted to be moved longitudinally thereon by means of a yoke 68 carried by the escapement rack-bar 69 connected by an intermediate gear E with the main escapement bar C forming a part of the main machine.

70 represents a series of plunger-bars supported on a single rod 71 passing through slots 72 in the said plun-

gers, which slots permit of a longitudinal upward movement of the same against the resistance of springs 73, the lower ends of which are fastened to the frame of the machine. The upper ends of these plungers bear against a corresponding series of slides 74 against which they are held by the springs 73. The plungers are actuated against the resistance of the springs by the swinging arm 67 of the rock-shaft, a single plunger only being raised at each depression of the space-key; and as each plunger bar is raised, it is retained in its elevated position by spring-actuated pawl 75 engaging teeth 76 on the side of plunger bar as shown in Fig. 12, said pawls being pivoted on the same rod 71 as are the plunger-bars. Each plunger-bar is provided on the side opposite the teeth 76 with a curved projection 77, said projection being acted upon in a manner to be hereinafter described, by reciprocating pusher-bars 78, 79, 80 which are provided at their ends with arms 81 Figs. 2, 3, and 4, fulcrumed on the rod 71, whereby said bars are enabled to swing in the arcs of circles having the same center as the arcs in which move the projections of the plunger-bars. Each pusher-bar is provided with a curved projection 82, said projections being located in different planes as shown in Figs. 1 and 4 and contacting with the inner ends of the justifying key-levers, which are fulcrumed at 83, there being four key-levers for each projection, which key-levers bear on their outer ends the numerals 1, 2, 3, 4. Each key-lever is held in its normal position by a spring 84 against a stop-bar 85, and said levers are provided with fixed stops 86 so located as to give varied downward movements to the keys of each row, and in a manner common to all three rows. The slides 74 move longitudinally in suitable supports or slideways 87 in the main frame against the resistance of springs 93 secured to projections 94 on the under sides thereof, each slide having an enlargement or head at the outer end provided on the upper edge with retaining notches 88 shown particularly in Fig. 10 designed to be engaged by a tooth 89 on one of a series of springs 90 fastened at the inner end to a fixed support, the outer ends 91 of said springs resting upon arms 92, formed upon the circuit-breakers B which are pivoted to the heads of the slides 74, so that when the circuit-breaker B is swung on its pivot by mechanism to be hereinafter described, it will disengage the tooth 89 from the notched head to permit said slide to be carried back to its normal position by its spring 93.

The variable checking device or stop for limiting the oscillations of the rock-shaft 60 when actuated by the space-key and the consequent distance which a plunger bar is raised by the depression of said key, will now be described.

95 is a drum or cylinder around which is secured a chart G, having certain combinations of numerals designed to indicate to the operator the particular justifying keys to be struck to effect the justification of the composed line. This cylinder is secured to a shaft 96 supported in suitable bearings in supporting-arms 105 forming a part of the framework, and having secured to it a ratchet wheel 97 which is engaged by a spring-actuated pawl 98 pivoted to an arm 99 swinging on the shaft 96 and having pivoted to it the upper end of a connecting rod 114 which receives its movement from an arm 115 on the rock-shaft 60 at each depression of the space key-lever, a retaining pawl 100 pivoted to the

supporting arm 105 serving to prevent the ratchet wheel and cylinder from being moved backward by the return movement of the actuating pawl 98 which intermittently rotates said cylinder against the resistance of a coiled spring 101 which returns said cylinder to its normal position at the conclusion of the justifying operation upon the release of the ratchet wheel by the withdrawal of the pawls 100 and 98, the latter being withdrawn by the former contacting with a projection on said pawl 98. To the outer end of the arm 99 is pivoted a spring-pressed check-pawl 104 which is adapted to engage a stepped block 106 secured to a projection on the arm 105. At one end of the cylinder 95 is a projecting lip or flange 107 provided on its inner periphery with two sets of cams 108 and 109 of two different lengths, the number of cams corresponding to the greatest probable number of spaces in a composed line of given length. The check-pawl 104 lies in the same plane as the cams and is forced outward to contact therewith by its spring 110. The parts being in their normal positions at the commencement of a line as shown in Fig. 6, the first forward movement of the arm 99 carries forward the check-pawl 104 together with the actuating pawl 98 a distance limited by the contact of the check-pawl with the last step 111 on the stepped block 106 as shown in dotted lines. The arm 99 is then returned through the medium of the rod 114 by a spring 116 connected with the arm 64 upon the rock-shaft 60, this return movement of the arm being limited by a stop-lug 117 on the arm 105, the action of the pawl 98 on the ratchet wheel 97 turning the cylinder a distance equal to the previous forward movement of the said arm 99. This movement of the cylinder carries the first cam 108 past the stepped-block into such position that on the next forward movement of the arm 99 caused by the depression of the space-key for a second space, the rounded head of the check-pawl 104 will contact with said first cam 108 at the point shown in Fig. 7 causing it to be depressed to strike the end 113 of the stepped-block 106, thus checking the forward motion of said arm at a point which will produce a less movement of the cylinder upon the backward stroke of said arm. Upon this second movement of the cylinder, the first low cam 109, which is the second cam in the series, is carried past the stepped-block and is arrested in such a position that on the next forward movement of the arm 99, caused by the depression of the space-key for a third space, the rounded head of the check pawl 104 will contact with said first low cam 109 in the position shown in Fig. 8, causing it to be depressed to strike the intermediate step 113 of the stepped-block 106, thus checking the forward motion of said arm at a point which will produce a movement of the cylinder on the backward stroke of said arm in the same manner as in the previous operations, this movement being less than at the first operation but greater than at the second operation, the cams 108, 109 being alternately brought around into radial positions so as to cause the check-pawl 104 to be depressed as it contacts therewith and engage in regular order the steps 113 and 112, the chart cylinder being thus caused to present a varying row of combinations on a common line showing through a long narrow slot or opening in the casing 118 encircling said chart cylinder. After the composed line has been justified, the pawls 98, 100 are withdrawn when

the spring 101 will return the chart cylinder to its normal position, as previously described.

H is the registering pointer of the main machine which travels from right to left longitudinally across the chart-cylinder 95, said pointer after the depression of each composing key moving a distance corresponding exactly to the thickness of the character last struck. This pointer may be operated in any suitable manner varying with the construction of the machine to which it is applied. The chart G extends only partly around the cylinder 95 and is provided with as many rows of combinations of three figures as there are probable spaces to be put into a composed line. The rows of combinations are made up of twenty-four equal divisions, each division extending laterally a distance exactly equal to the distance moved by the pointer for each unit of measure of which the character to be assembled is made up, said unit in this instance being a known fraction of an inch, consequently the pointer in registering the size of the character struck will travel across as many of these divisions as there are units in the character struck, but if the width of the character to be registered is not the exact multiple of the unit, the pointer will stand somewhere between the divisions and the operator can then use the combinations on either side of the pointer or preferably the one nearest thereto to effect the proper justification. In the composition of a line the pointer does not reach the right hand edge of the chart until the line is filled within twenty-four units, at which time a signal is given by the main machine, the pointer thereafter traveling across whatever row of combinations may be presented by the revolving chart on the common line as seen through the opening in the casing, the particular row so showing depending upon the number of times the space-key has been struck during the composition of the line. After the signal, the pointer will point out as it travels, different combinations of three figures, one beneath the other, to indicate to the operator what particular justifying key should be struck to effect the justification of the line after the depression of any of the composing keys. These tabular combinations are figured out and established so as to effect the most even "spacing" of all lines that can be composed.

The sectional lug-bearing ring cylinder A after being set up by the composing keys makes a single revolution as one piece synchronously with the movements of the mechanism in the main machine which is designed to directly assemble in line the matrices or types together with their accompanying spaces, the selection of any particular matrix, type or space being determined by the distance that the said cylinder travels from the commencement of its movement to bring the lug of the particular ring which is to assemble said matrix, type or space, into contact with the circuit-breaking lever B which lies in the path of that particular ring, it being understood that there is a lug-bearing ring and circuit-breaking-lever for each character and space in the composed line.

I, is a rotatable metallic cylinder interposed in an electric-circuit and having the ends of the circuit-breaking-levers B normally in contact therewith, said levers having wire electrical connections with magnets forming a part of the assembling mechanism of the main machine, and thus it would be understood that

as the levers are raised out of contact with the periphery of the cylinder I, the circuits are broken as required. The function of the justifying mechanism previously described is to break such of these circuits as are devoted to the selection of spaces in the composed line at such varying intervals that spaces of correspondingly varying thicknesses will be assembled along with the characters to properly justify the line. To accomplish this result such of the slides 74, as will come in the same order in the line as the spaces between the words of said line, are thrust out at varying distances so that the tip ends 119 of the proper levers B will be intercepted and raised to break the circuits sooner or later by the lugs 53, 54, 55, 56 of varying lengths, the particular lugs which break the circuits depending upon the distances to which the slides 74 are thrust outward, and by thrusting said slides out in combination distances lugs of different lengths will operate the circuit-breakers at different times and spaces of different thickness will result in the composed line, since they are assembled according to the relative distances of the lugs from the actuating point. The shorter lugs are used to select spaces by breaking the circuits only when the slides 74 have been thrust out, the long lugs 52 otherwise assembling the spaces. When any of the slides 74 are thrust out to the greatest distance, which I will call the fourth position of said slides, the tips 119 of the circuit-breaking levers pivoted thereto will be intercepted by the shortest lugs 56 in line therewith which are designed in the assembling machine to select the thickest spaces which I will term six unit spaces. Any of the slides 74 which are thrust out the next lesser distance, which I will call the third position of said slides, will cause the tips of the circuit-breaking levers pivoted thereto to be intercepted by the lugs 55 in line therewith, which select the next thinner spaces, which I will call five unit spaces. Any of the slides 74 which are thrust out the next lesser distance, which I will call the second position of said slides, will cause the tips 119 of the circuit-breaking levers pivoted thereto, to be intercepted by the lugs 54 in line therewith, which select still thinner spaces, which I will call four unit spaces. Any of the slides 74 which are thrust out the shortest distance, which I will call the first position of said slides, will cause the tips 119 of the circuit-breaking levers pivoted thereto to be intercepted by the lugs 53 in line therewith which selects the next thinner spaces, which I will call the three unit spaces. If these slides 74 are not thrust out at all, the tips 119 of said circuit-breaking levers will be intercepted by the longest lugs 52 only, which will select the thinnest spaces used, which I will call two unit spaces, which are assembled by the lugs 52 in the same manner as said lugs would otherwise assemble characters instead of spaces.

The operation of the justifying mechanism is as follows: At the beginning of the composed line the traveling splined arm 67 stands under the first left-hand plunger-bar 70 of the series, and after the first character-key is struck said arm is moved along the rock-shaft 60 by the escapement rack-bar 69 connected therewith, so that said arm will be brought under the second plunger-bar 70, and said arm will continue after the depression of each character-key to pass successively under the plunger-bars until the end of a word is reached. The

space-key lever 62 is then depressed which, through the connections with the rock-shaft, causes the particular plunger-bar which happens to be over said arm to be raised and retained in its raised position by one of the 5 pawls 75 entering one of the three notches according to the height to which it is raised. The arm 67 then continues to travel lengthwise the shaft 60 upon the depression of each character-key until the end of the second word is reached, when the space-key lever is depressed 10 the second time causing the plunger bar then standing over the arm to be raised in the same manner as the previous one and so on until the line is filled. The plunger bars are raised by the means described three different heights, the plunger bar first raised in every line 15 always being raised to the extreme or third height, the second plunger bar in any line being raised only to the lowest or first height, the third to the intermediate or second height, the fourth to the lowest of first height, the fifth again to the intermediate or second height, and 20 so on for the rest of the line, alternating between the first and intermediate heights. These varied movements are controlled by the check mechanism before described as shown in Figs. 5, 6, 7, and 8, the same order in the raising of the plunger-bars being observed in 25 every line. If one space only should occur in a line, only one plunger-bar would be raised and that to the highest position, the chart at the same time through the connections described being rotated to bring into view, at the common line, the first of its several rows of combinations, and as the line continues to be filled without 30 more spaces being introduced, the registering pointer will move and ultimately begin to traverse the row of combinations, so shown, and point out the particular combination required to justify a line of one space. If 35 there are no figures in the division opposite the pointer, the operator will know that more characters must be inserted to effect the justification, said insertion of characters continuing until the pointer arrives opposite to a combination. If there were two spaces in the line the 40 second plunger-bar, in addition to the one already raised, would be raised to the lowest or first position and the chart would be further rotated sufficiently to bring the second row of combinations into view, a particular and different one of which is pointed out by the pointer 45 after each composing key has been struck. Additional plunger-bars are raised and corresponding movements of the chart take place as the number of spaces in the line are added, so that no matter what residue or unfilled portion of the line or number of spaces in the line 50 may exist, the pointer will always indicate the proper combination required to justify the line.

Having raised the plunger-bars and rotated the chart, so as to present the proper row of combinations to the pointer in the manner described, such of the justifying- 55 keys J are depressed as are indicated by the particular combination of figures pointed out on the chart. For example, if the combination pointed out is 2—1—3, which combination is the particular one for justifying a line of seven spaces with a residue of twelve units to 60 fill, the key bearing the numeral 2 in the first or left hand row, the key bearing the numeral 1 of the middle row, and the key bearing the numeral 3 of the right hand row should be depressed simultaneously or independently as far as permitted by their respective stops 86, 65 which as before stated give a different movement of the

keys of each row and in a manner common to all three rows. The first key struck in the first row which bears the numeral 2 acting upon the projection 82 of the lower 70 pusher-bar 78, contacts with the projection or projections 77 of such plunger-bars as have been raised to the least height or first position, rocking them forward on the pivot-rod 71 against the resistance of their springs and thereby thrusting out their particular slides 74 a distance controlled and determined by the key-stops 86, which in this particular case will give them what I 75 have heretofore termed the second position. The key bearing the numeral 1 in the middle row acting upon the projection 82 of the pusher-bar 79 which contacts with the projection or projections 77 of such plunger-bars as have been raised to the intermediate height or 80 second position, rocks forward the plunger-bars and thereby thrusts out their particular slides 74 a distance controlled and determined by the key-stop 86 beneath the key bearing the said numeral 1 in the same manner 85 as did the first described key, the said slides then standing in what I have termed the first position. The key bearing the numeral 3 in the third row, acting upon the projection 82 of the pusher-bar 80, contacts with the single projection 77 of the first raised plunger-bar in the 90 line, which was raised to the highest position, (there being only one of this kind in a single line) rocking it and thrusting out its particular slide 74 a distance determined or controlled by the key-stop 86 beneath the said key bearing the numeral 3, which in this instance 95 will give the said slide 74 what I have termed the third position. The slides 74, having now been thrust out by the mechanism described into combination-positions corresponding to the numerals 2—1—3 pointed out 100 by the chart, it remains to be shown how the justification of the line is produced, which as before stated is assumed to be twelve units short with seven spaces.

It should be remembered that the number of plunger-bars raised determines how many slides 74 are thrust out, and that the key determines how far said slides are pushed out, and furthermore that the number of plunger-bars raised to the first position determines the number of slides 74 that are thrust out by the justifying keys 105 of the first row; also that the number of plunger-bars raised to the second position determines the number of slides 74 that are thrust out by the justifying keys of the middle row; also that the single plunger-bar raised to 110 the third position always thrusts out a single slide 74 only to a position determined by the justifying keys of the third row. It has been stated that by means of the space-key and the check-device cooperating therewith, 115 these plunger-bars are raised in all the lines in the same order, viz; the first always to the highest position, the second always to the lowest, the third always to the intermediate, and the remaining ones to the lowest and intermediate positions alternately. Now from this it 120 will be obvious that in a line of seven spaces there will be seven plunger-bars raised as follows, one to the third position, three to the lowest position, and three to the intermediate position, and that when key number two of the first row was pressed, three slides 74 were thrust 125 out to the second position; when key number one of the middle row was pressed, three slides 74 were thrust out to the first position, and when key number three of the last row was pressed a single slide 74 was thrust out to the third position; thus there will be projecting slides, 130

three in the first position, three in the second position, and one in the third position. The slides being now in the combination position stated, the lug bearing cylinder A is revolved in the direction of the arrows causing the lugs to contact with the tips 119 of the circuit-breaking levers B, the long lugs 52 contacting only with such slides 74 as have not been thrust out at all, and the shorter or "space" lugs contacting with the slides that have been thrust out, the lugs 53 contacting with the tips 119 of such slides that have been thrust out to the first position, the lugs 54 contacting with such tips as have been thrust out to the second position, the lugs 55 with such tips as have been thrust out to the third position, and the lugs 56 with such tips as have been thrust out to the fourth position. It should be remembered that such slides 74 as were thrust out, are returned back to their normal position immediately after the tips 119 are struck or actuated by any of the lugs just described, and that this is effected through the outer ends 91 of the springs 90 being raised so as to disengage the teeth 89 from the notches 88, said slides being then drawn back by their springs 93. As has been stated, the longest lugs 52, if none of the slides 74 have been thrust out, will produce two unit spaces in the line, the lugs 53 acting on such slides as were thrust out to the second position producing three unit spaces, and in like manner the lugs 54 will produce four unit spaces, lugs 55 five unit spaces, and lugs 56 six unit spaces, and consequently with the slide 74 thrust out in the combination position stated, which is three in the first position, three in the second, and one in the third position, there will be three slides contacting with three three-unit space producing lugs 53, three slides contacting with three four-unit space producing lugs 54, and one slide contacting with one five-unit space producing lug 55, the sum of the unit spaces put in, thus being 26, viz: three times three, or nine in the first instance, three times four, or twelve in the second instance, and once five, or five in the third instance. Since in the combination of this assumed line, the seven particular lug-bearing-rings of the cylinder A which were to produce the seven spaces in the line, (the other lug bearing rings producing the characters) were all set with their lugs 52 in the same radial position so that said lugs would produce seven two unit spaces if not interfered with by the justifying mechanism, and since the registering pointer recorded these seven two unit spaces (the thinnest spaces intended to be used) the same as though they were finally inserted in the line, it follows that in putting in the 26 units of spaces as just described, they are in reality taking the places of the seven two unit spaces, or fourteen units total already counted in; hence by the action of the justifying mechanism the line is increased only by the difference between 26 and 14 units viz: twelve units which is the exact amount that the pointer indicated as necessary to exactly justify the line.

At the conclusion of the composed line and after the operator has depressed such of the justifying keys as were indicated by the combination chart, the rack 69, carrying the yoke 68 and arm 67, is automatically returned to the left to its first position for the beginning of a new line, through suitable means in the machine to which the justifying mechanism is attached. As this rack 69 thus returns, a wedge-block 123, located

on its side, comes in contact with a spring-pressed latch 122, pivoted in a projecting arm 121, which is secured to a rock-shaft 120 supported in suitable bearings in the frame, said latch 122 being capable of swinging on its pivot in only one direction and that opposite to the motion of the rack-bar 69 just described. The wedge 123 is designed to press outwardly the arm 121 as the rack 69 carries it past said latch, and to thus rock the shaft 120. The rocking of the shaft 120 has two functions, viz: to release the pawls 100 and 98, Fig. 6, and thus permit the coiled spring 101 to return the combination chart drum 95 to its normal position; and also to withdraw the pawls 75 from engagement with such of the plunger-bars 70 as are raised during the composing of the line and permit such plunger-bars to be restored to their normal position by their springs 73. The releasing of the pawls 100 and 98 is effected through a connecting rod 102 one end of which is connected to an arm 124 secured to said rack-shaft 120 and the other end of which is connected to an arm 103 secured to the shaft to which the pawl 100 is fastened, said connecting rod 102 being drawn downward as the shaft 120 is rocked. The withdrawing of the pawls 75 is effected by the depression of a bar 125, pivoted at each end at 126 said bar acting upon tail pieces 127 integral with said pawls 75. The depression of the bar 125 is caused by the rocking of the shaft 120 to which it is connected by an arm 128, connecting rod 129, and arm 130 as is plainly shown in Fig. 15. As the rack bar 69 is moved to the right during the composing of a line, the thick end of the wedge 123 contacts with the spring pressed latch 122 swinging on its pivot into the dotted position shown in Fig. 14, against the resistance of its spring 127 and passing over said latch without rocking the shaft 120.

I believe myself to be the first to provide means for automatically pointing out to the operator the combination of spaces to be inserted in a line to justify it at and during the composition thereof, and thus relieving the operator of all mental calculation; and while I have shown and described a revolving chart coöperating with a registering pointer to effect this result, it will be evident to any skilled mechanic that the construction may be modified in various ways without departing from my invention.

Reference may be made to my co-pending application, Serial No. 671,170, filed February 21, 1898, for details of the machine of which the present invention forms a part. I do not herein claim the subject-matter of the claims of said co-pending application.

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

1. In a matrix and type justifying mechanism, a lever and slide device for justifying lines of matrices and types adapted to be set during the composition of a line by a key operated at intervals between the words of said line, and justifying keys to produce the insertion of spaces in proper position and of such thickness as to justify the line.

2. In a matrix and type justifying mechanism, the combination of a registering pointer, a series of justifying keys, and means consisting of a movable chart, sliding levers and intermediate connections operated by a space key for determining the particular justifying key or keys to be operated to produce the justification of a line.

3. The combination with a matrix and type justifying mechanism, provided with justifying keys, of a movable chart bearing certain predetermined combinations of sym-

bols, and a registering pointer for directly indicating on said chart the particular justifying key or keys required to be operated to produce the justification of a line.

4. The combination with a matrix and type justifying mechanism, provided with a plurality of sets of justifying keys, of a movable chart bearing certain predetermined combinations of symbols, and means for directly indicating on said chart the particular justifying key or keys of the several sets required to be operated to produce the justification of a line.

5. The combination with a matrix and type justifying mechanism, provided with a plurality of sets of justifying keys, of a rotating chart containing certain predetermined combinations of symbols, mechanism actuated by a space key for variably rotating said chart, and means for indicating on said chart the particular justifying key or keys of the several sets to be operated to produce the justification of a line.

6. The herein described ring for use with a matrix and type justifying mechanism, said ring having lugs of various lengths projecting from its outer periphery as the means for selecting blank spaces or types of the same or varying thicknesses.

7. In a series of set rings adapted to control mechanism for assembling a line of matrices or types, one or more space selecting rings to control the assembling of spaces for justifying said line.

8. The combination with means for controlling the assembling of blank matrices or types, of one or more space selecting rings adapted to actuate the same.

9. In a matrix and type justifying mechanism, rings for controlling the selection of the space blanks of a matrix or type assembling mechanism, mechanism for controlling said rings, means operated by a space key during the composition of a line for setting said mechanism to operate said rings, and special keys for operating said mechanism when so set after the composition of a line to produce the justification thereof.

10. In a matrix and type justifying mechanism, rings for controlling the selection of the space blanks in a matrix or type assembling mechanism, mechanism for controlling said rings, means operated by a space key during the composition of a line for setting said mechanism to operate said rings, means for operating said mechanism when so set after the composition of a line to produce the justification thereof, a chart and a pointer for indicating the manipulations required to operate the justifying mechanism.

11. The combination with a matrix and type justifying mechanism, provided with a plurality of justifying keys, of a rotating cylinder carrying a chart containing predetermined combinations of symbols, mechanism actuated by the space key for variably rotating said chart, said mechanism comprising a ratchet wheel fixed to the shaft of the chart cylinder, an actuating pawl mounted on a reciprocating arm, and suitable connections between the same and the space key, a stepped-stop, a pawl pivoted to said reciprocating arm and adapted to engage the different steps of said stop, and a series of cams at the end of the chart cylinder for controlling the latter pawl, whereby it is caused to engage the different steps of the stop in a predetermined order, and a registering pointer cooperating with said chart to indicate thereon the particular justifying key or keys to be operated to produce the justification of a line.

12. In a matrix and type justifying mechanism, rings for controlling the selection of the space blanks in a matrix or type assembling mechanism, mechanism for controlling said rings, means operated by a space key during the composition of a line for setting said mechanism to operate said rings, and a series of keys for operating said mechanism when so set after the composition of a line to produce the justification thereof.

13. A series of space producing rings provided with lugs and adapted to control the assembling of spaces in a matrix or type assembling machine.

14. A series of space producing rings provided with lugs adapted to control the assembling of spaces in a matrix or type assembling machine combined with mechanism set by

justifying devices and adapted to cooperate with the lugs of said rings to produce the justification of a line.

15. In a matrix and type justifying mechanism provided with a plurality of justifying keys, a rotating cylinder carrying a chart containing certain predetermined combinations of symbols, a pointer cooperating therewith a space key and means connected therewith for intermittently rotating said chart cylinder and an automatic variable checking device whereby the movement of said cylinder is varied at each depression of the space key.

16. In a matrix and type justifying mechanism, a series of slides adapted to be projected different distances to control mechanism for assembling blank matrices or types, a series of justifying keys, mechanism intermediate between said keys and slides, whereby the latter are projected by said keys.

17. In a matrix and type justifying mechanism, a series of slides adapted to be projected different distances to control mechanism for assembling blank matrices or types, a series of justifying keys, mechanism intermediate between said keys and slides whereby the latter are projected by said keys, and stops for varying the throw of said keys.

18. In a matrix and type justifying mechanism, the combination of a series of slides carrying circuit-breakers controlling a matrix or type assembling mechanism, said slides being adapted to be projected different distances, a series of justifying keys, and intermediate mechanism whereby said slides are projected by said keys, and a rotating cylinder composed of a series of rings provided with lugs set in the same or different radial positions and adapted to actuate said circuit-breakers to produce the justification of a line.

19. In a matrix and type justifying mechanism, the combination with the swinging and sliding plunger-bars and the slides actuated thereby, of a rock-shaft carrying an arm splined thereon and adapted to raise any one of said plunger-bars beneath which it may be temporarily located, a rack-bar coupled to said splined arm and having an intermittent or step-by-step movement, a space key connected with and adapted to oscillate said rock-shaft, a rotating cylinder carrying a chart containing predetermined combinations of symbols, a pointer cooperating therewith means connected with the rock-shaft for variably and intermittently rotating said chart-cylinder, and means substantially as described for variably checking the movement of the rock-shaft and chart-cylinder-actuating-mechanism connected therewith.

20. In a matrix and type justifying mechanism, the combination with the circuit-breaker carrying slides provided with retracting springs, of retaining devices for holding the same when projected by the justifying keys, and means for automatically releasing said slides after the justification of a line.

21. The combination with the plunger-bars and their retracting springs, of retaining pawls for holding the same in their different raised positions, and means for automatically releasing said bars at the conclusion of the justification of a line.

22. In a mechanism for justifying matrices and types, a series of slides adapted to be projected different distances to control mechanism for assembling blank matrices or types, a series of swinging and sliding plunger-bars for projecting said slides, means for selecting one of said bars and raising the same to a predetermined height at each depression of a space key, a series of pusher-bars arranged one above the other acting on said raised plunger-bars, and a set of justifying keys for each pusher-bar, each key of a set being provided with a different stop to determine its throw.

23. In a matrix and type justifying mechanism, a series of slides adapted to be projected different distances to control mechanism for assembling blank matrices and types, a series of sliding and swinging plunger-bars adapted to be raised to varying heights by means of a space key, a variable check-mechanism operated by said space key for determining the height to which said plunger-bars are raised, a combination chart connected with and operated by said check-mechanism, a pointer cooperating there-

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- with a series of pusher-bars arranged in different planes and moving in arcs of circles and acting on said plunger-bars to swing the same and thereby thrust out the slides in contact therewith, justifying keys arranged in sets to
 5 act on said pusher-bars, and means for limiting the throw of each key.
24. In a matrix and type justifying mechanism, the combination of a registering pointer, a movable chart, a series of justifying keys, mechanism operated by said keys
 10 for controlling the assembling of blank matrices or types, and means operated by a space-key for determining the particular justifying key or keys to be operated to produce the justification of a line.
25. In a matrix and type justifying mechanism, the combination of a registering pointer, a movable chart, justifying keys, mechanism operated by the same for controlling the assembling of blank matrices or types, a space key for setting said mechanism, and means operated by said
 20 space key for determining the particular justifying key or keys to be operated to produce the justification of a line.
26. In a matrix and type justifying mechanism, the combination of a registering pointer, a chart, justifying keys, a series of space-selecting rings, mechanism operated by said justifying keys and coöperating with said rings for
 25 controlling the assembling of blank matrices or types, a space key for setting said mechanism, and means operated also by said space key for determining the particular justifying key or keys to be operated to produce the justification of a line.
- 30 27. A movable chart for use in mechanism for justifying matrices or types, said chart having groups of symbols arranged in as many rows as will equal the greatest number of spaces to be put into a composed line, each of
 35 said rows containing all the combinations of symbols necessary to effect the justification of a composed line having a certain definite number of words, there being a different

row of groups for each different number of spaces which may occur in a line.

28. A movable chart for use in mechanism for justifying matrices or types said chart having groups of symbols arranged in as many rows as will equal the greatest number of spaces to be put into a composed line, said rows being equally spaced transversely, and each space containing a single group or combination of symbols, and the number of said spaces corresponding to the greatest number of units of residue in a composed line which can be filled by spaces inserted between the words of said line by the justifying mechanism.

29. The combination with the matrix and type justifying mechanism, of a movable chart having certain predetermined combinations of symbols and a registering pointer for indicating on said chart the subsequent manipulation to produce the justification of a line.

30. In a matrix and type justifying mechanism, the combination of a movable chart and pointer for pointing out directly, definitely, and without mental calculation, a succeeding mechanical manipulation by which "spaces" may be inserted in a composed line of types or matrices in such number and of such thicknesses as to accurately justify or flush said line.

31. A movable chart having groups of symbols arranged thereon for use in mechanism for justifying matrices or types, said chart coöperating with a pointer to designate directly such key or keys of a series of justifying keys as will exactly produce the insertion of "spaces" in such number and of such thicknesses as will accurately justify or flush a composed line of types or matrices.

Witness my hand this 19th day of February A. D. 1898.

ERL V. BEALS.

In presence of—

P. E. TESCHEMACHER,

LOUISE A. CHACE.