



N° 8634



A.D. 1899

*Date of Application, 25th Apr., 1899*

*Complete Specification Left, 24th Jan., 1900—Accepted, 14th Apr., 1900*

PROVISIONAL SPECIFICATION.

**Improvements in Machines for Preparing Perforated Record  
or Control Strips.**

A communication from the LANSTON MONOTYPE MACHINE COMPANY, a Corporation created and existing under the laws of the State of Virginia, and having its principal place of business at Washington, District of Columbia, United States of America.

I, ALFRED JULIUS BOULT, of 111, Hatton Garden, in the County of London, Chartered Patent Agent, do hereby declare the nature of this invention to be as follows:—

This invention relates to improvements in apparatus or machines for preparing  
5 perforated record strips or ribbons such for instance as are designed primarily  
for controlling the production of printing characters or type, through the medium  
of appropriate mechanism, that for instance employed in what is known as the  
“Lanston Monotype System” although features of the invention may be utilized  
in producing perforated record or control strips, ribbons or the like for other  
10 purposes.

In English Patent No. 22208, dated September 28th, 1897, a machine is set  
forth in detail for producing perforated record strips of the character mentioned  
and in its functions the machine contemplated by the present invention approxi-  
15 mates closely that set forth in the said patent, to which reference may be had  
for a more clear understanding of the general objects to be accomplished,  
especially in respect to the relationship existing between the strip producing  
mechanism, and strip produced thereby, and the subsequent functions performed  
by the strip in the character producing mechanism.

While the said points of similarity exist between the formerly patented  
20 apparatus and the present invention, by the present improvement, the mechanisms  
for accomplishing the desired ends are greatly simplified; the labor of the  
operator materially reduced, and generally, more accurate and complete results  
are attained, particularly with respect to the justification perforations, the  
machine indicating to the operator exactly which keys are to be struck to com-  
25 plete the justification of every line, thereby eliminating all mental calculation  
and liability of error and reducing the problem to a mechanical certainty.

Generally speaking, while the machine is an organized whole designed for  
accomplishing a unitary result embodied in the record or control strip, yet for  
the purposes of a detail description and a more ready understanding of the  
30 mechanical elements organized to produce such result, the mechanism may be  
divided into groups, such groups comprising, first the paper feeding mechanism  
for advancing the strip or ribbon at regular intervals and holding it in position  
to receive the punches; second, the punching mechanism by means of which the  
perforations are made in the record strip, said perforations being properly dis-  
35 tributed and combined so as to represent and control the production of the

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separate types, points, spaces, *etc.*, pertaining to the selected font, while certain other perforations control the setting of the justifying mechanism to vary the thickness of the bodies (preferably only certain selected bodies, as spaces and full stop type) set ways, and to inaugurate the movement of the galley mechanism at the completion of each line; third, the key board, or finger mechanism operating either mediately or immediately upon the mechanisms to control their movements; fourth, the justifying indicator for indicating to the operator the appropriate justification keys to be operated to make the indications for a properly justified line; fifth, a line indicator for indicating the number of units which can be included in a line, or the number of units remaining unfilled in a line; sixth, the resetting mechanism for restoring the parts, particularly the indicating mechanism to the zero point, ready for subsequent operations.

With this preliminary explanation, the details of the several mechanisms and their co-relation will now be described, the particular features of novelty of the invention being set forth in the appended claims.

In the accompanying drawings:—

Figure 1 is a perspective view of a key board record producing mechanism embodying the present improvements.

Figure 2 is a front elevation of the same, these two figures showing the parts in their zero position.

Figure 3 is an elevation looking at the left hand side of the machine with the parts in the position indicated in Figures 1 and 2.

Figure 4 is a vertical section taken centrally through the upper portion of the machine and looking towards the left hand side, the paper feeding mechanism being shown in elevation.

Figure 5 is a detail sectional view of the rigid and limber pawls of the paper feeding mechanism.

Figure 6 is an elevation with the side casing removed, looking towards the left hand side, this figure showing the lower portion of the machine, while Figure 4 shows the upper portion on substantially the same scale.

Figure 7 is a horizontal section taken above the indicator operating mechanism and showing the main portion of such mechanism in top plan.

Figure 8 is a vertical section taken through the upper portion of the machine looking towards the left, and showing the indicator mechanism in side elevation.

Figure 9 is a corresponding view taken to the left of the indicating mechanism, looking towards the right, and showing such mechanism in elevation from the side opposite that illustrated in Figure 8.

Figure 10 is a front elevation of the upper portion of the machine with the front of the casing and justification indicators removed.

Figure 11 is a vertical section taken transversely of the units wheel shaft to show the units wheel controlling mechanism.

Figure 12 is a view looking at the opposite side of the mechanism illustrated in Figure 11 and showing the rack and pinion for advancing the justification indicator upon the operation of certain predetermined keys (space keys for instance.)

Figure 13 is a vertical section of the units wheel and indicator controlling mechanism taken in a plane just in front of the units wheel rack and showing the upper end of the driving weight and its rack for imparting motion to the units wheel rack, units wheel and line indicator.

Figure 14 is a detail horizontal section looking downwardly and taken on a plane coincident with the axis of the units wheel and justification indicator shaft.

Figure 15 is a detail sectional elevation showing the operating mechanism for advancing the justification indicator in accordance with the number of justifying type bodies included in any particular line.

Figure 16 is a sectional view taken transversely of the indicator shaft in a plane intersecting the indicator rack and pinion.

Figure 17 is a detail perspective view showing the assembled group of units

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wheel stops for limiting the movement of the said units wheel in accordance with the number of units contained in the bodies of the particular type designated in the operation of the key levers.

Figure 18 is a detail perspective view of one of said stops showing a section 5 of one of the stop operating bars.

Figure 19 is a vertical section through the power weight and the gearing for transmitting the power to the several mechanisms.

Figure 20 is a diagrammatic view illustrating the justification chart and indicator.

10 Figure 21 is a rear elevation of the whole machine with the rear plates of the casing removed to show the upper rock bars, the ends of the lower rock bars, the rear ends of the key levers and the guide bars for positioning the key levers.

Figure 22 is a diagrammatic view illustrating the upper and lower units bars 15 with the lugs on the latter with which the key levers cooperate, this view also showing in dotted lines, the upper series of rock bars for operating the units system of punches and the stop bars.

Figure 23 is a similar view showing the stop bars, the punch bars, the lower 20 punch bars, and in dotted lines, the rock shafts shown in Figure 22, and in addition, in dotted lines, the rock shaft for communicating motion from the key levers to the lower punch bars.

Figure 24 is a side elevation of one of the upper punch bars.

Figure 25 is a side elevation of one of the stop bars.

Figure 26 is a side elevation of one of the lower stop bars.

25 Figure 27 is a detail perspective view showing the main and supplemental racks for operating the units wheel and justification indicator arm, together with the locking pawl for uniting said racks, and the throw-out arm for said pawl, said arm and pawl being shown in dotted lines.

Figure 28 is a perspective view showing one of the lower rack bars and the 30 means for imparting motion therefrom to the lower punch bars, a key lever and lower units bar being shown in dotted lines.

The working mechanism of the machine which latter will be termed a key 35 board, may be conveniently mounted in a frame or casing, which is preferably divided into a bottom section 1, and intermediate section 2, and a paper supporting frame 3, surmounting the section 2. The bottom section 1 of the casing preferably has an extended base for the accommodation of the key levers and at its front is arranged to permit the key levers to project for the attachment 40 of the finger pieces 4, these finger pieces and key levers being arranged in vertical columns and horizontal rows, as will hereinafter appear in the description of this particular part of the machine. The intermediate portion of the casing 2, preferably contains the indicating mechanism and a portion of the punch bar operating mechanism and at the left hand side provision is made for supporting the weight from which the driving power is secured and the racks 45 and mechanism through which such power is transmitted to the operating parts of the key board.

For convenience in manufacture, both in respect to the assembling of the parts and in respect to the cost, the three sections of the casing and the mechanism carried thereby are made up of independent parts, which, however, in the assembled structure are connected up for unitary action.

#### MECHANISM FOR HOLDING AND FEEDING THE PAPER.

50 The frame 3 at the top of the machine is arranged with bearings 5 for the reception of the journals of the spools upon which the paper or record strip is wound, this strip being preferably in long lengths, previously prepared with marginal perforations and wound upon a spool or bobbin adapted to be held in place in the bearings 5 by a shaft or pin 6, upon which the spool may be

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placed and from which it may be drawn around a hollow die 7 by means of pin wheels 8 arranged to engage the marginal perforations in the strip and from which it is carried to and wound upon the receiving roller or spool 9 journaled on a removable shaft 10, said spool being adapted to be rotated to maintain the tension on the paper regardless of the particular size of the roll, as will be now described.

The receiving roll 9 at one end contacts or is removably connected with a short shaft 11, carrying at its outer end a pinion 12 meshing with a vertical rack 13, the connection between the shaft 11 and the pinion 12 being made by means of a spring pressed clutch section 14, whereby the rack may be raised without reversing the rotation of the roll and tend by its weight and the driving weight, to be presently referred to, to rotate the roll forwardly for winding the paper. The pin wheels 8 are mounted on a corresponding shaft having a pinion 15 connected therewith through a clutch section 16, Figure 2, and adapted to be driven by means of a vertical rack 17. The two racks 13 and 17, Figures 1 and 3, are arranged to work vertically in parallelism in suitable guides on the side of the frame or casing and between them is suspended a pinion or gear wheel 18, from the journal of which a weight 19 is suspended and hence tends to draw said racks downwardly for advancing the paper, but permits the said racks to move independently, in order to allow for the variation in the size of the receiving roll, and at the same time maintain a proper and constant pressure, on both the pin wheels and receiving roll, for advancing the paper across the die 7, where it is in position to be acted upon by the punches for producing the perforations therein which constitute the record.

To check the feed of the paper and hold it stationary during the time the punches are acting thereon, the pin wheel shaft is provided at the end opposite the pinion 15, with an escapement wheel 20, with which an escapement formed by stiff and limber pawls is adapted to cooperate for permitting the feed of the paper one tooth at a time, upon the operation of any one of the key levers and for holding the paper stationary at all other times.

By reference particularly to Figures 4 and 5, it will be seen that the escapement wheel 20, is preferably an ordinary ratchet wheel and the pawls are mounted upon the frame 3, so as to vibrate transversely of the wheel, the stiff pawl 21 being rigidly mounted upon an oscillatory shaft 22, held in bearings on the frame 3, and adapted to abut against a single adjustable stop 23, readily accessible from the front of the machine for adjusting the position of the rigid pawl with respect to the escapement wheel and at the same time, by throwing said pawl out of engagement with the escapement wheel, its shaft may be moved backwardly in its bearings, or the paper advanced or retracted as desired, without interference by the pawls. The limber pawl 24 is pivoted upon the stiff pawl 21 and is drawn backwardly against a stop 25 on the stiff pawl by means of a spring 26, the extent of independent movement of this limber pawl being equal to the distance between two adjacent teeth on the escapement wheel and thus when the stiff pawl is vibrated transversely of the wheel, the pawls will be drawn alternately into engagement therewith and the wheel permitted to advance one tooth at a time in the ordinary way.

The pawl shaft 22 is provided with a transversely arranged arm 27, to one end of which the returning spring 28, Figures 1, 4 and 10, is attached and to the opposite end of which a link 29 extends down through the top of the casing and is attached to an arm projecting from a shaft 30, which shaft will herein be designated the feed shaft, and is shown clearly in Figures 4, 9, 10 and 22. This feed shaft 30 is provided with a bail 31 by means of which it is operated, and is designed not only to operate the paper or record strip feed, but also to operate the feed mechanism of the units wheel and justification arm, as will hereinafter appear.

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## THE PUNCHING MECHANISM

The die 7 is made hollow for the reception of the punchings, and beneath the die 7, the frame 3 forms a guide 32, Figure 9, for directing the entry of the paper through between the punch guides 33 and the die 7, from which point the paper passes around the front 34 of the die which is preferably curved to conform to the contour of the pin wheels so as to maintain the paper in its correct alignment without wrinkling it. The punches themselves 35, (thirty-one in number) are arranged in a line and preferably in a plane radial to the axis of the pin wheels. They pass through the guides 33 whereby their position is maintained. For convenience and efficiency, their upper ends or operative faces may be notched as shown in Figure 9, to secure a cleaner cut and easier entry or passage of the punches through the paper. At their lower ends they are each connected to the upper ends of a corresponding series of vertically arranged punch bars 36, preferably extending down to the bottom of the intermediate section 2 of the casing and held in suitable guides therein so as to be capable of a limited longitudinal movement but be held against transverse movement in any direction. The whole body of punches is arranged in a line having a length somewhat less than the width of the record strip or paper within the marginal perforations, as will be seen from an inspection of figures 1, 2 and 10. In their several combinations they are designed to represent, by their perforations, all of the characters on the finger pieces of the key board, including the spaces and the justification indications for varying the body thickness of the particular characters, selected for justification, (such as the space and full stop characters for instance). Bearing in mind the fact that the strip itself is designed to control in the casting machine, the positioning of the die case for forming the characters in two different directions so as to center any character to be formed thereby, and further that it is convenient, both for the purposes of producing the record strip and for the production of the characters themselves, to arrange the characters in the die case in columns, the characters in each column being of the same body thickness set-ways, and in lines at right angles to said columns, the body thickness of the characters in the lines varying according to the particular column in which they are located, it will be seen that it will be convenient to similarly arrange the punches and the key levers. That is to say, the finger pieces of the key levers may be grouped to correspond to the columns and lines of the die case, in the character producing or casting machine, and in order to produce the proper combinations of punches, those punches producing representations of characters in the columns will be operated through a different train of connection from those representing the characters in the lines, and hence when any one finger piece is depressed, these two mechanisms will be operated thereby, so as to move a punch for indicating the proper column, and also a second punch for indicating the proper character in that column. In this description therefore, those punches for selecting the desired column of characters, will be designated as the units punches, this designation being appropriate because of the fact that these punches make perforations for selecting the column having characters of the desired number of units of width or body thickness therein, and the punches for selecting the characters in those columns will be designated as the character punches, a corresponding distinction being followed with respect to the operating mechanism for the said punches.

Extending across the machine and journaled in the sides of the intermediate section 2 and in rear of the punch bars is a vertical series of units punch operating rock shafts 37, the number of rock shafts being one in excess of the number of punch bars to be operated thereby, inasmuch as two of the said rock shafts are adapted to operate upon the same punch bar, as will be hereinafter referred to. These units punch operating rock shafts are each provided with a forwardly extending bail 38 adapted to cooperate with lugs or projections 39 on the rear edges of the punch bars as will be readily understood from

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an inspection of Figures 6, 9 and 23, the latter figure particularly, showing diagrammatically, which punch bar in this particular machine is adapted to be operated by each of the rock shafts. For operating the rock shafts and their bails, there is provided a series of units bars corresponding in number to the number of columns in the key board, which in the present instance is fifteen, 5 and these units bars for convenience are divided into upper and lower units bars, the upper units bars being numbered 40, Figures 4, 9 and 22. The bars 40 are guided to work vertically in the intermediate section 2 of the casing, being spaced transversely to correspond approximately to the column arrangement of the key board and are each provided with a forwardly projecting lug or lugs 42, 10 embracing or engaging the bail on the appropriate rock shaft and so raise and lower the appropriate punch bar and punch. From an inspection of Figures 10 and 22 it will be seen that it is not necessary that all of the bails on the rock shafts shall extend entirely across the casing, inasmuch as the lower rock shafts are operated by the units bars on the left hand side of the machine only, and 15 hence for convenience in manufacture, these bails are somewhat shorter than the bails on the upper units bar rock shafts. The upper units bars 40 at their lower ends rest upon and are adapted to be raised by the lower units bars 41, Figure 22, the planes of the two bars being at right angles to each other to secure a sufficient bearing, and at the same time to facilitate the construction 20 and assembling of the parts. The said lower units bars extend down through the columns of key levers and are adapted to be operated thereby, as will be presently explained, in connection with the key board or finger mechanism.

The character selecting punch bars rest at their lower ends upon the upper ends of the lower sections 43 of the character selecting punch bars, the latter 25 sections being held in guides in the bottom section 1 of the casing so as to work vertically, and are adapted to be operated, *i.e.* raised and lowered by means of lower rock shafts 44 journaled in the bottom section 1 of the casing and extending transversely of the key levers. For this purpose the said punch bar sections are provided at the proper points, indicated in Figure 23, with lugs or 30 projections 45 which engage or embrace bails 46 on the rock shafts 44, as shown clearly in the detail perspective view, Figure 28, and the rock shafts are operated by the key levers, as will be presently described in connection with the key board mechanism.

These lower sections of the character selecting punches being grouped together at the left hand side of the machine would occupy practically all of the space and leave no room for the vertical columns of key levers at this point and in order to provide space for these columns of key levers some of the lower sections of the punch bars may be omitted leaving spaces 47, Figure 23, and in order to transmit the movement of the appropriate rock bars to the punch bars above such spaces, suitable lower sections such as 48 may be provided at any other convenient point and the said sections 48 at their upper ends engage corresponding upper sections 49, which in turn cooperate with upper rock bars 50 and the latter engage those punch bars (the lower sections of which are omitted as before described) to raise and lower the same and thereby produce the desired 45 perforations. As shown in this Figure 23, it will be seen that the third and sixth lower sections are omitted and the third and sixth lower rock bars which would normally cooperate with such sections, now cooperate with the added lower sections 48, and the third and sixth punch bars cooperate with the third and fourth upper rock bars which derive their motion from the added upper sections 49. The tenth punch bar is a constant punch bar for those characters 50 "space and full stop characters," the bodies of which are varied for justification and this punch bar is operated by the lowermost of the upper series of rock bars and is adapted to be operated by the units bars moved by the key levers corresponding to those characters, as will be presently explained. The spaces 55 thus provided in the series of lower sections of the punch bars will accommodate

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three vertical rows or columns of key levers and in connection with the fourth vertical row or column of key levers, a different method of providing the space is shown. Referring again to this Figure 23, it will be seen that the lower punch bar section corresponding to the 13th punch, counting from the right hand side in this figure (left hand side of the machine) is simply deflected to one side, or bent at the top and bottom so as to leave the vertical space 51, in which the key levers may work.

The 17th punch bar, Figure 23, counting from the right hand side of this figure, left hand side of the machine, it will be observed is provided with two projections 39, adapting this punch bar to be operated by the second and fifth upper rock bars, counting from the bottom. This is done in order to economize the number of punches as it is found that the punch which is operated by the units bar corresponding to the left hand column of character keys may be also utilized as one of the punches in the space combination, thus the space key operating the unit bar 65 will operate the tenth and seventeenth punch bars, counting from the right hand side of Figure 23, and the 17th punch bar will also be operated in proper combination by any one of the vertical columns of keys at the left hand side of the key board and representing characters having a body thickness less than any of the other characters, except the space.

20 **KEY BOARD OR FINGER MECHANISM.**

In the base section 1 of the casing there is arranged a series of key levers 52 corresponding in number to the number of finger pieces 4 and the number of characters including justification keys, space keys and quad, designed to be represented by the several combinations of punches and to be reproduced by the casting or type forming machine. These key levers (see Figures 6 and 21) are preferably flat bars or punchings pivoted at substantially the center, on shafts 53 running through from side to side of the casing, the pivotal point being at about the center of gravity of the levers whereby the levers will be substantially balanced, and the series of pivots is arranged on a diagonal line so as to give as near as practical, a uniform angular movement to the rock shafts operated thereby.

The movement of the key levers is limited by the slots 56 in the front plate of the lower section of the casing and at their rear ends, they are spaced and held in the proper vertical plane by guide bars 57 suitably mounted in the casing and held in place by cross bars 58 at the top and bottom.

To economize space and at the same time permit the use of relatively thin wide key levers which will be rigid enough to perform the work imposed upon them the vertical columns of key levers corresponding to or for producing indications of characters having uniform widths are staggered, that is to say, the key levers in the top horizontal row will be located on the opposite sides of the guide bars 57 from the key levers in the second horizontal row, but starting from the right hand side of the key board, for instance, the key levers located on both sides of the first guide bar 57, will correspond to and be adapted to operate a punch for indicating a uniform body width, and this result is secured by adapting all of said key levers in this vertical column to cooperate with a single one of the lower units bars, but each of said key levers except the lowermost, will cooperate with and operate a different lower rock bar, thus each of said key levers will select or produce an indication for a different character in that column.

It will be seen that the key levers are each provided with a transverse aperture 59, elongated lengthwise of the key levers and through which aperture the lower rock shafts 44 and their bails 46 work, the bails 46, however, resting at the bottom of the rear portions of the apertures 59, whereby when any one of the key levers is depressed at the forward end and raised at the rear end, the bails will be moved upwardly and the rock shafts oscillated to a corresponding degree. The lower units bars 41 also extend down between the key levers,

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one of said units bars being arranged between the staggered key levers of each column and upon opposite sides of these lower units bars are formed a series of projections or lugs 60 corresponding in number and position to the key levers with which the units bars cooperate. The lugs are arranged on opposite sides of the lower units bar to correspond with the staggered arrangement of the key levers and are adapted to be located within the openings 59 in the key levers, preferably in rear of the bails 46. 5

This arrangement, it will be observed, permits the keylevers to have a considerable width vertically and at the same time the vertical height of the entire column or series may be very much reduced by over-lapping the tops and bottoms of the key levers and in fact only sufficient space need be left for the operation of the rock shafts and the lower units bars, thus the size of the key board may be reduced, or a larger number of characters included in a key board of given size. 10

As before intimated, the character producing or casting machine, for which the representations or character indications in the record strip are produced in the present machine contemplates the use of a die carrier having movements back and forth at right angles to each other, such combined movements being adapted to bring any particular character to the centering or casting point, and the extreme advance movement in each direction of this die carrier is determined by a fixed stop, hence in the record producing or punching machine, it is unnecessary to provide indications for these two positions of adjustment, that is to say, assuming that the characters along one edge of the die carrier or block are all of a given width, or in one column, it is only necessary to employ a perforation or indication for selecting the proper character in that column, and on the other hand, if the movement is in the other direction, the particular line is determined by the fixed stop, against which the die carrier is arrested and it is only necessary to provide a perforation for the particular column in which the desired character is located. Because of this arrangement, it is not necessary to provide a punch operating units bar for the right hand column on the key board, although from Figure 22, it will be seen that such a bar both an upper and a lower section, is provided, not, however, for operating a punch but only for feeding the paper and justification or indicating mechanism as will be presently explained. Neither is it necessary to provide a rock shaft and bail for the bottom row or line of key levers and consequently the rock shaft is omitted entirely from this place as shown clearly in Figure 6, the lower units bars, however, are operated by the lower line of key levers for selecting the particular column in which the characters are located and each of the key levers of the right hand column operates its appropriate rock bar for indicating its particular character in that column. The operation of the lower right hand key at the junction of the lower line and right hand vertical column will cause an extreme throw of the die carrier in both directions and in the present structure, this character is a quad and is given a determinate body width. 15  
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The space key 61 and the leader full stop or period key 62 in the present machine are arranged in the bottom row or line and inasmuch as in the practical application of the present invention, it is designed to have these keys produce indications which will in turn enable the justification of the line to be secured by the variation in the body widths of these type and no others, special connections between the key levers and the punches are provided for said keys. Mechanically, the connections are similar to those already described, and the particular arrangement of the mechanical parts will be best understood from an inspection of Figures 22 and 23. Referring to Figure 22, 63 indicates a bar corresponding to the lower units bars but adapted to be operated solely by the space key 61, and 64 is a corresponding bar adapted to be operated solely by the leader full stop or period key 62. These two bars 63 and 64 at their upper ends contact with and are adapted to operate space and period units bars 65 and 66. Both these bars 65 and 66 have lugs 67 thereon, adapted to cooperate 50  
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with the lowermost of the upper rock bar or its bail, numbered 68, for convenience in distinguishing it. In addition, the space bar 65 has a lug 69 adapted to cooperate with the next to the lower one of the upper rock bars and through these two rock bars the space key will elevate the tenth and seventeenth punch bars, counting from the right hand side, Figure 23, (left hand side of the machine). The upper full stop or period bar 66 also has a second lug or projection 70 which cooperates with the seventh rock bar from the bottom of the upper series of rock bars and this rock bar in turn will raise the twentieth punch bar, counting from the right hand side of Figure 23, in addition, the tenth punch bar, is raised as just explained, making perforations which indicate and will control the production of justifying type bodies in the line when the casting or producing mechanism has been properly set by the desired justification perforations.

The justification perforations are formed by a combination of punches controlled from the two uppermost rows or lines of key levers and insofar as the operation of the punches by these key levers, is concerned, it does not differ mechanically from the operation of the other punches. Referring again to Figures 22 and 23, it will be seen that the upper line or row of key levers will each operate its appropriate units punch through the units bars and upper rock shafts and in addition, this upper row will from the top-most of the upper rock shafts operate the thirteenth punch, counting from the left hand side, Figure 23, while the key levers in the second row or line will each operate its proper units punch and also the second of the lower rock shafts and this second rock shaft will operate a lower punch bar 71, Figure 23, which will in turn raise the first punch on the left hand side in said figure, and on the right hand side of the machine.

It will be noted that in working out the combinations of punches for producing the many characters covered by the key board, namely 255 in the illustration, the mechanism is such that each horizontal row or line has a constant punch, that is to say, a punch which may be operated through one of the lower rock bars when any key lever in that horizontal line is operated and in addition, each of said keys will operate a different punch corresponding to the units value or body width of the character represented by that particular key, the connections for this punch being made through the units bars and upper rock shaft, as before explained, the exception however, being the right hand column and bottom row in connection with which it is only necessary to operate a single punch owing to the intended use of the strip in the casting machine or producer having two fixed stops. The so-called constant punch operating mechanism is that illustrated in Figure 23, in connection with the punches on the left hand side of the figure, while the variable punch operating mechanism is that illustrated in Figure 22, from which two figures it is thought that a clear understanding of this portion of the invention may be had.

When a key lever on any one of them is operated to form the indication in the strip or record ribbon, it is of course necessary that before the next designation is formed that the strip or ribbon shall be fed forward by the paper feeding mechanism before described, and to secure the operation of the escapement upon the operation of any one of the key levers, each of the upper units bars and the bars 65 and 66 as well as the right hand bar in Figure 22, corresponding to the right hand column of key levers in the machine, each carry at the upper end a lug or projection 72, which rests under and is adapted to raise the bail 31 of the feed shaft 30, whereby when any one of said units bars is raised, the said feed shaft 30 will be oscillated and through the before described connection 29, with the pawls, the escapement will be operated, and as the units bars and key levers return to normal position, the escapement wheel will be allowed to advance and feed the paper forward a proper distance.

The spring 28, which draws the escapement pawls back to normal position, it will be observed, is relatively long to secure a uniform tension throughout a

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somewhat wide range of movement and in addition to returning the escapement pawls to their normal position, it also serves to put a tension on the punch operating mechanism and key mechanism generally for returning them to their proper position with an elastic pressure, as it will be observed, that when the units bars raise the feed shaft bail, the tendency of said bars is to return to their normal position under the influence of this spring, as well as under the influence of gravity. The punch bars themselves are also provided with lugs or projections 73 also resting under the feed shaft bail and serving to return the punch bars to their lower position, or on the other hand, said projections 73, when the punch bars are raised, or any one of them is raised, will ensure the operation of the feed shaft and a consequent feeding of the paper the desired distance.

## JUSTIFYING MECHANISM AND MECHANISM FOR OPERATING THE SAME

This mechanism is designed to provide for indicating to the operator exactly which justification keys are to be struck for producing indications of the amount of body thickness set-ways is to be added to each of the justifying type bodies in any given line. It is one of the objects of the invention to provide a mechanism which will register accurately the number of units set-ways in the characters previously indicated in the record strip or ribbon in any given line, by causing an indicating hand to register with a suitable chart, dial, or card, or the like, bearing upon it combinations of letters or figures corresponding to justifying keys, which latter when struck, will produce perforations or indications representing the exact increment or body width to be added to each of the justifying type bodies to produce a perfectly justified line, thereby eliminating from the problem all mental calculation on the part of the operator and enabling him to, by simply consulting the chart, dial or card, strike proper justification keys at the termination of each line of indications.

The invention contemplates the employment of a units wheel which is advanced or given an angular movement corresponding with, or in definite proportion to, the number of units contained in each one of the characters designated in the record strip; a chart bearing the requisite justification key indications (letters or numbers corresponding to similar letters or numbers on the justification keys themselves), and a justification indicator which is advanced each time one of the types, the body of which is varied to produce justification is indicated, so as to register with a line on the chart corresponding to the number of type bodies contained in the line of type or indications thereof in the record ribbon, provision being also made for securing a relative movement of the indicator and chart for showing the amount of unfilled justification space remaining in the line, this being preferably as before stated, simply by reference to the proper justification keys to be struck for indicating the justification in the record ribbon.

Obviously the indicator itself may be swept across the dial or chart for showing the amount of justification space, or the dial or chart may be moved to secure the same result, but in the present machine, the first mentioned plan has been adopted, that is to say, there is a fixed dial or chart and a justification indicator which is moved transversely of the chart in accordance with the number of justifying type bodies indicated and longitudinally of the chart in accordance with the body widths or units values in the portion of the line not previously designated.

Referring particularly to Figures 1, 2 and 20, it will be seen that on the front of the casing, preferably on the middle section 2 thereof, there is mounted removably upon studs 71, a chart 75 which is shown as substantially segmental in form, although as will presently appear, the lines of characters thereon are not true arcs of a circle but are spiral for adapting them to register with the particular indicating hand or pointer employed.

The units wheel 76, Figures 10, 11, 12, 13 and 14 is a toothed wheel, preferably journaled in a frame 77 which also preferably supports most of the

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registering mechanism. The shaft upon which the units wheel is mounted, preferably takes the form of a sleeve 78, Figure 14, and the face of the units wheel is provided with a clutch section 199 with which a longitudinally movable pinion sleeve 79, Figures 4 and 14, engages to rotate the units wheel forwardly, but which will permit the pinion 79 to rotate in a reverse direction without rotating the units wheel itself. The pinion is held in engagement with the clutch section by means of a spring 80 enclosed in a casing 81 carried by the units wheel and surrounding the rear end of the pinion sleeve. The pinion constituting the forward end of this sleeve 79 is adapted to mesh with a rack bar 82, Figures 13, and 27, and the motor or weight for driving the indicator is applied to this rack bar and tends to advance the same across the machine towards the right hand side. In the preferred construction, the rack bar 82 extends out to the left hand side of the casing and meshes with a gear wheel 83 journaled in a bracket 84 and carrying a smaller gear wheel 85 with which a vertical rack 86 meshes. The rack 86 is guided in suitable ways in the bracket 84 and from its lower end, the weight 87 for moving the parts is suspended. This weight may be called a prime motor weight and the connection between it and the rack 86 is a yielding connection preferably formed by confining a spring 88 in the weight, and extending a rod 89 down through the spring and providing its lower end with a nut or enlargement 90 upon which the lower end of the spring will rest. The spring thus forms the real motor, the tension of which is determined by the weight and the impact of the weight when once set in motion by the downward movement of the rack will not impart a shock to the mechanism.

The forward movement or rotation of the units wheel is normally prevented by the locking pawl 91 having its end toothed to accurately fit and center the teeth on the units wheel, said pawl preferably being mounted in bearings to slide radially with relation to the wheel.

Above the units wheel and pivoted on a center 92 is a units rack carrier 93, Figure 11, having ways therein in which a units rack 94 reciprocates in a plane tangential to the periphery of the units wheel, and in position to mesh and cooperate with said units wheel whenever the carrier 93 is depressed. The units rack 94 is provided with a stop or projection 95 normally adapted to arrest the movement of the units rack in each direction by coming in contact with the ends of the slot or way in the carrier in which it is mounted, unless arrested by the units stops, to be presently described. In the operation of the machine or upon the depression of any of the finger pieces, the units rack bar carrier is first depressed until the units rack is in mesh with the units wheel and then the locking pawl 91 is withdrawn, allowing the units wheel to advance in accordance with the range of movement of the units rack, and upon the release of said key, the locking pawl 91 is first moved into engagement with the units wheel and then the units rack moves out of mesh therewith, hence it will be seen, that the advance of the units wheel is directly controlled by the range of movement allowed the units rack and this is varied in accordance with the number of units contained in the body of the type designated by any particular finger piece or key.

For securing the relative movements of the units rack carrier 93 and the locking pawl 91, just described, a bell crank lever 96 is journaled at its angle on the frame 97 and one of its arms extends downwardly and cooperates with the locking pawl 91, Figure 11, while its other arm extends horizontally and has connected to it a link 97 extending vertically and this link 97 is in turn connected with a horizontal link 98 having its opposite end pivotally connected with the units bar rack carrier at 99.

The link 98 is centrally pivoted to a depending connecting rod 100 which at its upper end is supported by an arm 101, pivoted at one end on the casing and at its opposite end pivotally connected with an arm 102, Figure 8, on the feed shaft 30, thus when the feed shaft 30 is oscillated by the operation of any one

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of the key levers, the connecting rod 100 will be depressed against the tension of the spring 28.

A spring 103, Figure 13, is connected at one end to the units rack bar carrier 93 and at the opposite end to the frame 77 and by its tension tends to draw said rack bar carrier and rack bar down into engagement with the units wheel, but the superior strength of the spring 28 overcomes the tension of the spring 103 and normally holds said rack bar carrier 93 up and the rack bar out of engagement with the units wheel. Because of this arrangement, it will be seen that the link 98 operates as a lever and as the link or connecting rod 100 moves downwardly the spring 103, also drawing down on the rack bar carrier 93, will hold the outer end of the link 98 upwardly and the locking pawl 91 in engagement with the wheel until the rack bar is in engagement with the units wheel and the rack bar carrier comes to rest against its stop 104 when the outer end of the link 98 will be swung downwardly by the further movement of the connecting rod 100 and this in turn will swing the bell crank 96 and withdraw the locking pawl 91 from engagement with the units wheel, permitting the wheel to turn and carry with it the units rack. On the reverse movement of the feed shaft and connecting rod 100, the spring 103 still exerting its tension will cause the link 98 to act as a lever until the locking pawl 91 comes to rest in engagement with the units wheel and then as the outer end of the link cannot move upwardly any further, its inner end will be swung upwardly, raising the units rack carrier 92 and disengaging the rack from the units wheel.

For returning the units rack 94 to its normal position, in its carrier, which is the position indicated in Figure 11, a link 105 is connected to its rear end and extends out to one end of the frame 77 where it is jointed to a vertical lever 106 pivoted to the frame 77 and having a spring 107 for drawing it outwardly. The opposite end of this spring 107, for convenience, is connected with an arm 108, extending out from the frame 77.

The mechanism for limiting the movement of the units rack and units wheel, cooperates with the units rack directly and in the present embodiment embraces a series of stops, fifteen in number, and the extreme range of travel of the units rack to the end of its slot or way, constitutes another stop, making sixteen in all.

The number of stopping points of the units wheel and rack bar correspond therefore to the number of vertical columns of characters in the key board, having different body widths, there being fifteen of such vertical columns, and the other stop is for the normal space indication, the character for which has a less number of units of body thickness therein than any one of the columns.

By reference to Figure 13, it will be seen that the units rack carrier 93 is provided with a series of vertical slots or guides 109, and the forward ends of a series of stop levers 110, Figure 17, are adapted to play in these slots or guides. In order to reduce as much as possible, the lateral space occupied by the stop levers and at the same time to secure the advantages of independent guides for the forward ends of the levers, as near as possible, to the point where the units rack strikes the same, only one half of the total number of stop levers are adapted to project into such guides, and between each of the levers which do project into these guides there is arranged a second series of stops 111, Figure 17, the stop levers 111 being provided with downwardly extending nose portions 112, which project between the levers 110, and an over-hanging portion 113, which when any one of the series 111 is depressed, will carry with it the next lever of the series 110 and thus each of the series of levers 111 when depressed, carries with it its supporting lever of the other series and the strain is taken up by the guide 109 in which the lever 10 works.

The stops when thus arranged, it will be observed may individually be comparatively loose and free in action thereby preventing any sticking or liability to catch in the guides and furthermore by providing individual guides for holding each lever, the wear incident to the use of the levers is not cumulative in its action on the units wheel and the error due to this or due to the accumula-

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tion of dirt is reduced to practically nothing. The stop levers are journaled on a through pin 196 and their rear ends are rounded for co-operation with slots in a vertical series of stop bars 114, Figures 4, 7, 8, 10, 21, 23 and 25. These stop bars are supported in guides at top and bottom of the intermediate section 2  
5 of the casing and at an intermediate point they are also held against lateral movement by guides 115, carried on a central transverse rod 116. Centrally they are provided with slots 117, Figures 18 and 25, for the reception of the rounded rear ends of the stops 110 and 111. The stop bars correspond in number to the number of stops 110 and 111, an additional one being provided for the space  
10 stop and key before described.

One of the stop bars is designed to be operated from each of the vertical columns of key levers, and in order to accomplish this, the stop bars are each provided on their rear edge with a projection 118 which overlies and is adapted to be operated by the bail on one of the upper rock shafts. These rock shafts, it  
15 will be remembered correspond to and are operated by the respective vertical columns of key levers. Referring again to Figures 22 and 23, it will be remembered that the space key alone operates the next to the bottom rock shaft of the upper series and if reference be had to Figure 23, it will be seen that this rock shaft operates the first stop bar of the series 114 and when  
20 this first stop of the series is operated, the first stop towards the left hand side of the machine and the first with which the rack can come in contact will be depressed, and hence, when this stop is operated the units wheel will be given a minimum feed, corresponding to the body width of the space. The intermediate stop bars, and stops, corresponding thereto, will give a different feed in accordance  
25 with the body width of the characters designated by the intermediate columns of key levers, each being operated from its appropriate rock bar of the upper series, but the extreme right hand column, it will be remembered, and as shown in Figures 22 and 23, does not operate any of the rock bars of the upper series but only the feed shaft, hence when any key lever in this column is moved  
30 to produce a character indication, no movable stop is thrown into the path of the units rack but said rack is permitted to have a full stroke and come to rest against the fixed stop at the end of its guides, registering the maximum number of units of body width.

To arrange the mechanism in as compact form as possible, the units rack is provided with the projection 95 for directly cooperating with the stops and thus  
35 the rack itself may be extended on either side of said projection, a sufficient distance to ensure engagement with the units wheel for a maximum throw without requiring the location of the stops beyond the end of the rack.

It will be observed that the units wheel has a progressively forward movement, in other words, it is never given a reverse rotation even when the driving rack 82 is returned to its normal position, ready to again advance the units wheel, for during such return movement, the ratchet connection between the sleeve 79 and the units wheel allows the sleeve and rack to move reversely  
40 independently of the units wheel.

The justification arm 119 is mounted on or formed as a portion of a pinion 120, Figure 14, and the rotation of this pinion by the rack, gives a relative movement of the justification arm and chart, for indicating the amount of justification space left in a line, and inasmuch as the justification area or that portion  
50 of the line wherein justification must be taken into consideration by the operator is only a relatively small proportion of the whole line, it is obvious that this justification hand or arm need not be moved continuously but its movement must commence when the rack and units wheel have together moved throughout a large portion of the line indicated. To secure this result, the justification arm and pinion 120 are directly operated by the supplemental rack 121 (shown clearly  
55 in Figure 27) guided in ways in the frame 77 and adapted to be stopped in normal position by a lug or projection 122 which abuts against the frame 77 when the supplemental rack is at the left hand extreme of its movement. A pick-up

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projection 123 on the main rack 82 is adapted to co-operate with the supplemental rack 121, as the justification area is reached, to move the same towards the right hand side of the machine and thereby rotate the pinion 120 and justification arm 119. As the main rack 82 returns to its first position at the left hand side of the machine, obviously the projection 123 will move out of 5 engagement with the supplemental rack 121 and the justification arm is therefore freed from its influence until the main rack 82 advances again, far enough to move the same, *i.e.*, when the justification area is reached.

For returning the justification arm and supplemental rack to normal position without imparting thereto an undue momentum, or breaking or bending the 10 mechanism, should the justification arm get caught or stopped in its return movement, a vertical rack 124 also meshes with the pinion 120, Figures 8, 10 and 14, and is itself carried by a weight 125, Figures 10, 13 and 14 and 16, sliding on a vertical guide 126. This weight will serve to return the justification arm to its normal position, but it is desirable that the returning power for the 15 justification arm should be increased as the arm reaches the last portion of its travel, and to accomplish this, a lever 126 is pivoted on the frame 77, its longer arm extending into a position where, as the weight 125 rises, it will contact therewith and swing the lever on its pivot. The lever is spring pressed, a spring 128 connected with the shorter arm of the lever being employed for the 20 purpose and consequently, while the weight itself operates alone as the returning power during the last portion of the return movement of the justification arm, during the first portion of such movement, the action of the weight is supplemented by the action of the spring pressed lever 127, and at the same time the 25 lever 127 is arrested in its action by striking the frame 77 when the justification arm passes its center of gravity, after which time its own weight will tend to return it to normal position.

During the time that the supplemental rack 121 is being moved by the main rack 82, it is of course desirable that the two racks should be locked together 30 to prevent any possible overthrow or independence of action, and for the purpose of locking them, a pawl 129 (Figure 10 and in dotted lines Figure 27) is pivotally mounted upon the main rack 82 and adapted to drop into a notch 130 in the supplemental rack at the instant when the pick-up projection 123 engages the supplemental rack, thereby locking the two together for unitary movement. The 35 pawl 129 is disengaged from the supplemental rack for the independent return of the two racks by an arm 131 operated through mechanism to be presently described, either when the justification key is operated at the end of the line or when the resetting mechanism commences its operation, as will be presently described.

From Figure 20, it will be seen that the dial or chart is divided off into a 40 series of spirally arranged rows of combinations of letters radially divided, which correspond to letters on the two uppermost rows of keys or finger pieces, these being the justification keys. The number of such rows of letters on the chart counting radially, correspond to the number of possible justification type 45 bodies in a given line and the indicator for registering with such letters on the chart is adapted to be advanced transversely of the chart, so as to register with a new row thereon each time one of the justification type is indicated on the 50 paper or ribbon and the letters in that row with which the indicator registers, will show the proper justification keys to be operated for producing indications which will, in the casting or reproducing machine, cause the mechanism to vary 50 the body widths of the justification types to the proper extent.

The justification indicator 132, Figures 1, 2 and 14, is a pointer or hand carried by the justification arm 119, and while it is adapted to swing on its center in unison with said arm, it is given a longitudinal movement each time 55 one of the type, the body of which is varied for justification, is indicated. Each longitudinal movement of the justification indicator 132 will cause it to register with a new line of letters on the chart, for which purpose it is mounted in

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guides 133 on the justification arm 119, and its inner end formed into a rack bar 134 adapted to mesh with a pinion 135, Figures 2 and 14, carried upon a shaft 136 extending through the sleeve shaft 78 of the units wheel and carrying upon its rear end a second pinion 137. Pinion 137 meshes with a vertical rack bar 138, Figures 12 and 14, guided in suitable guides on the frame 77 and preferably weighted so as to normally remain in its lowermost position, but adapted to be moved upwardly by the operation of the key levers for indicating type bodies whose body thickness is varied for justification. The two type bodies in which such justification is produced in the present apparatus, it will be remembered, are the space type and the full stop type, and the key levers for these two type indications, it will also be remembered, oscillate or rock the lowermost of the upper series of rock shafts together with its bail, and if reference be had to Figure 4, it will be seen that this rock shaft carries a forwardly projecting arm 139 having upon its forward end a pivoted pawl 140 provided with a spring 141 for holding it in its operative position. The rack bar 138 has upon its side a series of ratchet teeth 142 with which, from Figure 15 it will be seen that the pawl 140 is adapted to engage, whenever the lower rock shaft is operated by either one of the two before mentioned key levers, but normally the pawl 140 is out of engagement with the ratchet teeth 142 of the rack 138, being held with its nose elevated by means of a throw-out incline 143, and off of which it will ride whenever the lower rock bar is oscillated, thereby raising the rack bar 138 one tooth, or a sufficient distance to cause the justification indicator 132 to register with a new line of characters on the chart. The throw of the pawl 140 is limited and the rack bar locked by an adjustable stop 144, Figure 15, and when the rack bar is so moved, it is caught and held by a pawl 145, Figures 8 and 9, which is normally held in position to engage with the ratchet teeth by the spring 146, this latter pawl however, being adapted to be thrown out of engagement with the rack bar to permit the rack bar to drop and so retract the justification indicator through the medium of mechanism thrown into action either by the justification keys when operated, or by the resetting mechanism, as will presently appear.

The object of having the lines of characters on the chart spiral rather than concentric with the center on which the justification hand turns, will now be apparent, for assuming that the space and full stop keys are not operated, but that other character keys are operated, the justification arm will be rotated as soon as the justification area is reached, and inasmuch as the pinion 135 controlling the justification indicator is not moved except when either the space or the full stop key is operated, the justification indicator will be carried around such pinion 135, and its indicating point or hand will be moved with respect to the justification arm 119. The spiral arrangement of the characters on the chart is such as to accord with this movement, and thus, if no space or full stops are included in the line, the justification indicator will follow around on a single line of chart characters, and regardless of the position of the justification arm 119, whenever one of the said keys (space or full stop keys) is operated, the justification indicator will be moved outward radially to register with a new line of characters on the chart.

The rack 138 is preferably only provided with a sufficient number of ratchet teeth to move the indicator across the chart or dial and thus no injury can result from a too frequent operation of the space or justifying character key or keys.

For ensuring the operation of the units rack carrier in unison with the stop bars 114, or any one of them, said stop bars 114 are each provided near their upper ends with a projection or lug 191, Figures 8, 23 and 25, which underlie the bail 31 on the feed shaft 30. Thus there is a direct inter-independence or co-action between the stop bars and the units rack carrier, ensuring the operation of the units rack carrier and the locking pawl whenever one of said stop bars is operated to throw a stop into the path of the units rack,

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## LINE INDICATOR.

In the front plate of the intermediate section 2 of the casing, there is formed a transverse slot 117, preferably located below the chart and along the edges of the slot there is provided a line scale 148 with which registers a pointer 149 carried by the main rack 82, Figures 2, 7 and 27. The rack 82 advances upon 5 the operation of each of the key levers and the line scale pointer 149 will consequently indicate to the operator exactly the point of starting a line, or the approximate amount of space remaining in the line at any moment.

In the brackets 84, Figure 13, it will be noticed that there is arranged a fixed rack 150 and sliding upon suitable guides in proximity to this rack there is a stop block 151 which may be adjusted longitudinally of the fixed rack 150, by withdrawing the holding pawl 152 from engagement with the rack 150 and allowing it to again enter at the desired point of adjustment under the influence of its spring 153. This stop block 151 serves as the stop for limiting the retrograde movement of the main rack 82, hence the adjustment of this block in 15 connection with the line indicator 149 will enable the length of any particular line to be accurately gaged.

For indicating to the operator audibly when the line is approximately full, an alarm or gong 154 is mounted on the casing and its striker 155 is adapted to be engaged and operated by an arm or projection 156, Figure 7, when the rack has advanced to the proper point. This audible alarm is preferably so located that it will be sounded when the justification area is reached and the operator, hearing it, may then consult the chart and ascertain exactly how much justification space remains, whether additional characters may be struck, and if not, exactly which of the justification keys, shown in Figure 7, are to be operated 25 to set the reproducing machine for increasing the body thickness of the justification characters to exactly fill the line.

## RESETTING MECHANISM.

At the right hand side of the machine, Figures 1 and 3, there is pivoted a resetting handle or arm 157, normally held elevated by a spring 158, and with this arm is connected through a spring link or yielding connection 159, a vertically moving rack bar 160. Rack bar 160 is suitably guided in the bracket 84 and is adapted to mesh with a gear wheel 161, keyed to a shaft 162 upon which the gear wheel and pinion 83, 85, are journaled. A pin 163, Figure 19, projecting from the gear wheel 83 is adapted to be engaged by a similar pin 164 35 on the wheel 161 and in the operation of the machine for forming a complete line these two wheels 83 and 161 do not make quite a complete revolution, thus, assuming that the wheel 83 which is connected for unitary movement with the rack 82 has been rotated by the weight 87, or that a line has been completed, when the rack bar 160 is drawn down by the handle 157, the pins 163 and 164 40 will engage and the wheel 83 be rotated in a reverse direction to return the rack bar to its normal position and elevate the weight 87, ready for a new operation. When the handle 157 is released, its spring 158 will again elevate the rack bar 160 and rotate the wheel 161 back to its normal position, leaving the weight elevated and causing the pin 164 to move away from the pin 163 45 until the handle is again depressed for again returning the parts to normal position.

For again raising the weight 19 and racks 13 and 17 through which the paper is driven or advanced, another vertical rack 165 is mounted in a guide in the bracket 84 and in a second guide 166. Rack 165 is provided with an arm 167, 50 Figures 1 and 3, adapted when the rack is raised to rise up beneath projections 168 on the racks 13 and 17 and shaft of weight pinion 18, and thereby raise these parts, the ratchet connections between the pinions 12 and 15 and the paper shafts permitting this reverse movement without causing an unwinding of the paper. From Figure 19, it will be seen that the rack bar 165 has meshing 55

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with it, a gear wheel 169, which gear wheel is geared on the shaft 162 and is adapted to be rotated in unison with the gear wheel 161 whenever the resetting handle 157 is moved. The rack 165 and the arm 167 after raising the paper motor mechanism (as the two lugs and weight 19 may be termed) return to  
5 normal position as just explained.

In resetting the indicating mechanism, the holding pawl for the justification indicator rack must be thrown out of engagement to permit said rack to drop and draw the justification indicator inwardly on the justification arm; the  
10 pawl 129 connecting the main rack bar and supplemental rack bar 121 must be disengaged and held out of engagement until the rack bars separate; and the units wheel must be brought to a point which may be termed a zero point, and of which there may be in such an arrangement as that herein described, a large number, so as to begin its registration with proper relation to the scale, or in  
15 other words, so as to begin its registration at a proper point to ensure accurate justification. It is preferable also that mechanism should be provided whereby when the last key or keys of a line, namely, the justification keys, are struck, that these particular mechanisms, namely, the two rack bar releases and the  
20 resetting of the units wheel, should be accomplished and there is in the present machine, provision made for performing these operations when the justification keys are struck, and in addition, and in order to prevent any possible rupture  
of the mechanism when the resetting handle is depressed, connections are also made between the rack bars at the left hand side of the machine and the throw  
out mechanism for the pawls, whereby even though no justification keys are  
struck, these parts will be properly reset.

25 If reference be had now to Figures 11 and 13, it will be seen that to the frame 77 there is pivoted a vertical arm or lever 170, to the upper end of which a link 171 is connected, the opposite end of said link being pivotally connected to an arm 172, on the rock shaft, 173, carrying the pawl releasing arm 131,  
30 Figure 27. The lever 170 is provided with a spring 174, for holding it in its advanced position and in position to raise the arm 131. The advance movement of the lever 170 then, it will be seen, will raise the arm 131 and if the pin 175  
on the pawl 129 overlies the said arm the pawl will be out of engagement with the secondary rack and the two racks disengaged. In order to at the same time  
35 release the vertical rack 138 from its holding pawl 145, a bell crank lever 176, shown best in dotted lines in Figure 14, is pivoted on the frame 77 and has one of its arms projecting in front of the lever 170, Figure 11, and its opposite arm  
projecting in front of the holding pawl 145, consequently when the lever 170 moves forwardly, this pawl 145 will be disengaged from the rack 138 and  
40 inasmuch as the operating pawl 140 for the last mentioned rack is normally out of engagement therewith, the rack is free to drop under the influence of gravity and draw the justification indicator back to its normal position with relation to  
the justification arm.

To prevent the lever 170 from advancing under the influence of its spring 174, a second lever 177, Figures 11 and 13, is pivoted on the frame 77, and at its  
45 upper end carries a pivoted pawl 178, the end of which works in a slot in the lever 170 and is adapted to hook over the same, as shown clearly in Figure 11. Also connected with this lever 177 is a link 179, the opposite end of which link  
is pivotally connected with a lever 180, Figure 14, pivoted just outside of the side of the casing upon the bracket 84 and in position for its opposite end to  
50 engage a cam or incline 181 on the vertical rack 165. This incline 181 moves into operative position when the rack 165 is down in its normal position, as shown in Figure 10, and consequently, when the resetting handle 157 begins its  
downward movement, and the rack bar its upward movement, the lever 180 will ride off of the incline 181 and the two pawls, namely, 129 and 145, will be  
55 thrown out of engagement with the respective racks; on the other hand, when the rack returns to its normal position the pawl release arm 131 and the bell

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crank lever 176 will be moved into position for allowing the pawls to engage with the racks, this being the normal operative position of the parts.

A spring 182 is provided for ensuring a return of the levers 177 and 180 into position for the re-engagement of the pawl 178, which pawl in the normal operation of the machine is adapted to be disengaged from the lever 170 by the operation of the justification keys or any of them. To throw this pawl out of engagement, a transverse rock shaft 183, Figure 7, is journaled at one end in the casing, and at the opposite end in the frame 77 and carries on its forward side an arm 184 which overlies the rear end of the pawl 178 in position to throw the forward end of said pawl upwardly and out of engagement with the lever 170 whenever the rock shaft is operated. On the rear side of the rock shaft there is mounted a bail 185 extending back into proximity to the punch bars 36, and upon the forward edges of the constant punch bars for the justification keys, there is formed a lug or projection 186, Figure 4, underlying the bail 185, and in position to oscillate the rock shaft 183 whenever either one of said constant punch bars is moved by the operation of the justification keys.

To reset the units wheel 76 to a proper point where it will begin to register correctly for the next succeeding line, said units wheel is provided on its front face with a ratchet or toothed wheel 187, Figures 11 and 13, with which a pawl 188 is adapted to cooperate to arrest the units wheel and the relation of the teeth on the ratchet wheel, the teeth on the periphery of the units wheel and the pawl, is such that when the units wheel is arrested with the pawl in engagement with any one of the teeth, the units wheel will be in a proper zero position for subsequent operations. The spring 189 normally tends to hold the pawl 188 in engagement with the ratchet wheel 187, and in order to hold it out of engagement except when the line is completed, and the justification key is struck, to throw the parts into resetting position, the said pawl is connected with the lever 170 by a link 190, Figure 13, whereby when the lever 170 has gone back, the pawl will be held out of engagement, but when the lever 170 is released by the operation of any one of the justification keys, said pawl will enter between the teeth on the wheel 187 and inasmuch as when any one of the justification keys is struck, the locking pawl 91 is drawn out of engagement with the units wheel, just as in the case of any of the other keys in the machine, the units wheel will advance until arrested by the pawl 188, and upon the release of the justification key, the pawl 91 will again be thrown into engagement, locking the units wheel in its zero position.

The number of ratchet teeth on the wheel 187 and the corresponding number of zero positions on the units wheel should be sufficient to cause the units wheel to reach a zero position before the units rack comes into contact with any one of the stops, as will be readily understood, for otherwise the units wheel would be arrested by the stop rather than by the zero pawl 188.

## OPERATION OF THE MACHINE.

It is perhaps appropriate to state at this point that a number of suitable charts or dials are provided for use in connection with each machine having combinations of characters thereon for indicating justification necessary to be added to the justification type in different fonts of characters, and the operator, knowing the font or style of characters to be used and having selected the chart for that font and placed the same in position on the casing and having placed the previously prepared supply roll of paper in position, passed the same through the guides, ready for the action of the punches and attached it to the winding roller, is ready to commence the operation of indicating in the record strip the desired characters with the justification indications for controlling the justification thereof. To set the machine for operation to produce a line of given length the operator manipulates the stop on the bracket on the left hand side of the machine, in connection with the line scale. Having done this, he manipulates the finger pieces or key levers to produce indications for the desired characters, points,

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spaces, *etc.*, in the line, until the line is nearly completed, or the justification area approached or reached, which may be ascertained by consulting the line scale, or by the audible signal sounding at the appropriate time. The operator then takes notice of the justification indicator and seeing that he has no more  
 5 room in the line for other characters, he will find that the justification indicator registers with a combination of characters on the chart which corresponds exactly to the keys in the justification rows of keys, which are to be operated to produce justification indications corresponding to the increment in body thickness of the justification type necessary to produce a complete and justified line in the casting  
 10 machine.

As the main rack reaches the justification area and the justification arm begins its movement carrying with it the justification indicator, the pin 175 on the pawl 129 rides over the arm 131 and continues its movement over the said  
 15 arm until the line is completed. When the first justification key is operated, it not only operates the desired punches for producing the indications but it also operates the rock shaft 183, tripping the pawl 178 out of engagement with the lever 170 and this lever being released under the action of its spring 174, will raise the pawl releasing arm 131 and pawl, disconnecting the two racks and at the same time, it will release the pawl 145, allowing the justification indicator  
 20 to be retracted to its normal position on the arm. It also resets the units wheel by throwing the zero pawl into engagement with the teeth thereon and allowing said wheel to rotate forwardly until one of the teeth is arrested against the pawl.

The operator then depresses the resetting handle, drawing back the main  
 25 rack, the pawl 129 meanwhile being held elevated by the arm 131, until moved out of range of the supplemental rack, this movement also raises the motor weights, as before explained, and by raising the rack bar 165, moves the incline 181 out of its operative relation to the lever 180, and the arm 177 carrying the pawl 178, under the influence of the spring 182, will swing inwardly, re-engaging  
 30 said pawl with the lever 170. When the resetting handle is then released the rack bar, returning to its normal position, carrying with it the incline 181, will operate the levers 180, 177 and 170, returning the releasing arm for the pawls into position for allowing said pawls to re-engage and also moving the zero pawl out of engagement with the units wheel, the parts being then in position for  
 35 subsequent operations.

Dated this 25th day of April 1899.

BOULT & WADE,  
 Agents for the Applicant.

## COMPLETE SPECIFICATION.

40 **Improvements in Machines for Preparing Perforated Record  
 or Control Strips.**

A communication from the LANSTON MONO-TYPE MACHINE COMPANY, a Corporation created and existing under the laws of the State of Virginia, and having its principal place of business at Washington, District of Columbia,  
 45 United States of America.

I, ALFRED JULIUS BOULT, of 111, Hatton Garden, in the County of London, Chartered Patent Agent, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

50 This invention relates to improvements in apparatus or machines for preparing

*Improvements in Machines for Preparing Perforated Record or Control Strips.*

perforated record strips or ribbons such for instance as are designed primarily for controlling the production of printing characters or type, through the medium or appropriate mechanism, that for instance employed in what is known as the "Lanston Monotype System" although features of the invention may be utilized in producing perforated record or control strips, ribbons or the like for other purposes. 5

In Letters Patent of Great Britain No. 22208, dated September 28, 1897, a machine is set forth in detail for producing perforated record strips of the character mentioned and in its functions the machine contemplated by the present invention approximates closely that set forth in the said patent, to which reference may be had for a more clear understanding of the general objects to be accomplished, especially in respect to the relationship existing between the strip producing mechanism, and strip produced thereby and the subsequent functions performed by the strip in the character producing mechanism. 10

While the said points of similarity exist between the formerly patented apparatus and the present invention, by the present improvement the mechanisms for accomplishing the desired ends are greatly simplified, the labor of the operator materially reduced, and generally, more accurate and complete results are attained, particularly with respect to the justification perforations, the machine indicating to the operator exactly which keys are to be struck to complete the justification of every line, thereby eliminating all mental calculation and liability of error and reducing the problem to a mechanical certainty. 15 20

Generally speaking, while the machine is an organized whole designed for accomplishing a unitary result embodied in the record or control strip, yet for the purposes of a detail description and a more ready understanding of the mechanical elements organized to produce such result, the mechanism may be divided into groups, such groups comprising, first the paper feeding mechanism for advancing the strip or ribbon at regular intervals and holding it in position to receive the punches; second, the punching mechanism by means of which the perforations are made in the record strip, said perforations being properly distributed and combined so as to represent and control the production of the separate types, points, spaces, *etc.*, pertaining to the selected font, while certain other perforations control the setting of the justifying mechanism to vary the thickness of the bodies (preferably only certain selected bodies, as spaces and full stop type) set ways, and to inaugurate the movement of the galley mechanism at the completion of each line; third, the key board, or finger mechanism operating either mediately or immediately upon the mechanisms to control their movements; fourth, the justifying indicator for indicating to the operator the appropriate justification keys to be operated to make the indications for a properly justified line; fifth, a line indicator for indicating the number of units which can be included in a line, or the number of units remaining unfilled in a line; sixth, the resetting mechanism for restoring the parts, particularly the indicating mechanism to the zero point, ready for subsequent operations. 25 30 35 40

With this preliminary explanation, the details of the several mechanisms and their co-relation will now be described, the particular features of novelty of the invention being set forth in the appended claims. In this description reference is made to the following drawings filed with the Provisional Specification. 45

Figure 1 is a perspective view of a key board record producing mechanism embodying the present improvements.

Figure 2 is a front elevation of the same, these two figures showing the parts in their zero position. 50

Figure 3 is an elevation looking at the left hand side of the machine with the parts in the position indicated in Figures 1 and 2.

Figure 4 is a vertical section taken centrally through the upper portion of the machine and looking towards the left hand side, the paper feeding mechanism being shown in elevation. 55

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Figure 5 is a detail sectional view of the rigid and limber pawls of the paper feeding mechanism.

Figure 6 is an elevation with the side casing removed, looking towards the left hand side, this figure showing the lower portion of the machine, while 5 Figure 4 shows the upper portion on substantially the same scale.

Figure 7 is a horizontal section taken above the indicator operating mechanism and showing the main portion of such mechanism in top plan.

Figure 8 is a vertical section taken through the upper portion of the machine looking towards the left, and showing the indicator mechanism in side elevation. 10

Figure 9 is a corresponding view taken to the left of the indicating mechanism, looking towards the right, and showing such mechanism in elevation from the side opposite that illustrated in Figure 8.

Figure 10 is a front elevation of the upper portion of the machine with the front of the casing and justification indicators removed.

15 Figure 11 is a vertical section taken transversely of the units wheel shaft to show the units wheel controlling mechanism.

Figure 12 is a view looking at the opposite side of the mechanism illustrated in Figure 11 and showing the rack and pinion for advancing the justification indicator upon the operation of certain predetermined keys (space keys for 20 instance).

Figure 13 is a vertical section of the units wheel and indicator controlling mechanism taken in a plane just in front of the units wheel rack and showing the upper end of the driving weight and its rack for imparting motion to the units wheel rack, units wheel and line indicator.

25 Figure 14 is a detail horizontal section looking downwardly and taken on a plane coincident with the axis of the units wheel and justification indicator shaft.

Figure 15 is a detail sectional elevation showing the operating mechanism for advancing the justification indicator in accordance with the number of justifying type bodies included in any particular line.

30 Figure 16 is a sectional view taken transversely of the indicator shaft in a plane intersecting the indicator rack and pinion.

Figure 17 is a detail perspective view showing the assembled group of units wheel stops for limiting the movement of the said units wheel in accordance with the number of units contained in the bodies of the particular type designated 35 in the operation of the key levers.

Figure 18 is a detail perspective view of one of said stops showing a section of one of the stop operating bars.

Figure 19 is a vertical section through the power weight and the gearing for transmitting the power to the several mechanisms.

40 Figure 20 is a diagrammatic view illustrating the justification chart and indicator.

Figure 21 is a rear elevation of the whole machine with the rear plates of the casing removed to show the upper rock bars, the ends of the lower rock bars, the rear ends of the key levers and the guide bars for positioning the key 45 levers.

Figure 22 is a diagrammatic view illustrating the upper and lower units bars with the lugs on the latter with which the key levers cooperate, this view also showing in dotted lines, the upper series of rock bars for operating the units system of punches and the stop bars.

50 Figure 23 is a similar view showing the stop bars, the punch bars, the lower punch bars, and in dotted lines, the rock shafts shown in Figure 22, and in addition, in dotted lines, the rock shaft for communicating motion from the key levers to the lower punch bars.

Figure 24 is a side elevation of one of the upper punch bars.

55 Figure 25 is a side elevation of one of the stop bars.

Figure 26 is a side elevation of one of the lower stop bars.

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Figure 27 is a detail perspective view showing the main and supplemental racks for operating the units wheel and justification indicator arm, together with the locking pawl for uniting said racks, and the throw-out arm for said pawl, said arm and pawl being shown in dotted lines.

Figure 28 is a perspective view showing one of the lower rack bars and the means for imparting motion therefrom to the lower punch bars, a key lever and lower units bar being shown in dotted lines.

The working mechanism of the machine may be conveniently mounted in a frame or casing which is preferably divided into a bottom section 1, and intermediate section 2, and a paper supporting frame 3, surmounting the section 2. The bottom section 1 of the casing preferably has an extended base for the accommodation of the key levers and at its front is arranged to permit the key levers to project for the attachment of the finger pieces 4, these finger pieces and key levers being arranged in vertical columns and horizontal rows, as will hereinafter appear in the description of this particular part of the machine. The intermediate portion of the casing 2, preferably contains the indicating mechanism and a portion of the punch bar operating mechanism and at the left hand side provision is made for supporting the weight from which the driving power is secured and the racks and mechanism through which such power is transmitted to the operating parts of the key board.

For convenience in manufacture, both in respect to the assembling of the parts and in respect to the cost, the three sections of the casing and the mechanism carried thereby are made up of independent parts, which, however, in the assembled structure are connected up for unitary action.

**MECHANISM FOR HOLDING AND FEEDING THE PAPER.**

The frame 3 at the top of the machine is arranged with bearings 5 for the reception of the journals of the spools upon which the paper or record strip is wound, this strip being preferably in long lengths, previously prepared with marginal perforations and wound upon a spool or bobbin adapted to be held in place in the bearings 5 by a shaft or pin 6, upon which the spool may be placed and from which the strip may be drawn around a hollow die 7 by means of pin wheels 8 arranged to engage the marginal perforations in the strip and from which it is carried to and wound upon the receiving roller or spool 9 journaled on a removable shaft 10, said spool being adapted to be rotated to maintain the tension on the paper regardless of the particular size of the roll, as will be now described.

The receiving roll 9 at one end contacts or is removably connected with a short shaft 11, carrying at its outer end a pinion 12 meshing with a vertical rack 13, the connection between the shaft 11 and the pinion 12 being made by means of a spring pressed clutch section 14, whereby the rack may be raised without reversing the rotation of the roll and tend by its weight and the driving weight to be presently referred to, to rotate the roll forwardly for winding the paper. The pin wheels 8 are mounted on a corresponding shaft having a pinion 15 connected therewith through a clutch section 16, Figure 2, and adapted to be driven by means of a vertical rack 17. The two racks 13 and 17, Figures 1 and 3, are arranged to work vertically in parallelism in suitable guides on the side of the frame or casing and between them is suspended a pinion or gear wheel 18, from the journal of which a weight 19 is suspended and hence tends to draw said racks downwardly for advancing the paper, but permits the said racks to move independently, in order to allow for the variation in the size of the receiving roll, and at the same time maintain a proper and constant pressure, on both the pin wheels and receiving roll, for advancing the paper across the die 7, where it is in position to be acted upon by the punches for producing the perforations therein which constitute the record.

To check the feed of the paper and hold it stationary during the time the

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punches are acting thereon, the pin wheel shaft is provided at the end opposite the pinion 15, with an escapement wheel 20 with which an escapement formed by stiff and limber pawls is adapted to cooperate for permitting the feed of the paper one tooth at a time, upon the operation of any one of the key levers and for holding the paper stationary at all other times.

By reference particularly to Figures 4 and 5, it will be seen that the escapement wheel 20 is preferably an ordinary ratchet wheel and the pawls are mounted upon the frame 3, so as to vibrate transversely of the wheel, the stiff pawl 21 being rigidly mounted upon an oscillatory shaft 22, which is held in bearings on the frame 3 and adapted to abut against a single adjustable stop 23, readily accessible from the front of the machine for adjusting the position of the rigid pawl with respect to the escapement wheel. Furthermore, by throwing said pawl out of engagement with the escapement wheel, the shaft of the said escapement wheel may be moved backward in its bearings, or the paper advanced or retracted as desired without interference by the pawls. The limber pawl 24 is pivoted upon the stiff pawl 21 and is drawn backward against a stop 25 on the stiff pawl by means of a spring 26, the extent of independent movement of this limber pawl being equal to the distance between two adjacent teeth on the escapement wheel and thus when the stiff pawl is vibrated transversely of the wheel, the pawls will be drawn alternately into engagement therewith and the wheel permitted to advance one tooth at a time in the ordinary way.

The pawl shaft 22 is provided with a transversely arranged arm 27, to one end of which the returning spring 28, Figures 1, 4 and 10, is attached and to the opposite end of which a link 29 extends down through the top of the casing and is attached to an arm projecting from a shaft 30, which shaft will be herein designated the feed shaft, and as shown clearly in Figures 4, 9, and 10. This feed shaft 30 is provided with a bail 31 by means of which it is operated, and is designed not only to operate the paper or record strip feed, but also to operate the feed mechanism of the units wheel and justification arm, as will hereinafter appear.

## THE PUNCHING MECHANISM

The die 7 is made hollow for the reception of the punchings, and beneath the die 7, the frame 3 forms a guide 32, Figure 9, for directing the entry of the paper through between the punch guides 33 and the die 7, from which point the paper passes around the front 34 of the die which is preferably curved to conform to the contour of the pin wheels so as to maintain the paper in its correct alignment without wrinkling it. The punches themselves 35, (thirty-one in number) are arranged in a line and preferably in a plane radial to the axis of the pin wheels. They pass through the guides 33 whereby their position is maintained. For convenience and efficiency, their upper ends or operative faces may be notched as shown in Figure 9, to secure a cleaner cut and easier entry or passage of the punches through the paper. At their lower ends they are each connected to the upper ends of a corresponding series of vertically arranged punch bars 36, preferably extending down to the bottom of the intermediate section 2 of the casing and held in suitable guides therein so as to be capable of a limited longitudinal movement but be held against transverse movement in any direction. The whole body of punches is arranged in a line having a length somewhat less than the width of the record strip or paper within the marginal perforations, as will be seen from an inspection of Figures 1, 2 and 10. In their several combinations they are designed to represent, by their perforations, all of the characters on the finger pieces of the key board, including the spaces and the justification indications for varying the body thickness of the particular characters selected for justification, (such as the space and full stop characters for instance). Bearing in mind the fact that the strip itself is designed to control in the casting machine, the positioning of the die case for forming the characters in two different directions so as to center any character to be formed

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thereby, and further that it is convenient both for the purposes of producing the record strip and for the production of the characters themselves, to arrange the characters in the die case in columns, the characters in each column being of the same body thickness set-ways, and in lines at right angles to said columns, the body thickness of the characters in the lines varying according to the particular column in which they are located, it will be seen that it will be convenient to similarly arrange the punches and the key levers. That is to say, the finger pieces of the key levers may be grouped to correspond to the columns and lines of the die case, in the character producing or casting machine, and in order to produce the proper combinations of punches, those punches producing representations of characters in the columns will be operated through a different train of connection from those representing the characters in the lines, and hence when any one finger piece is depressed these two mechanisms will be operated thereby, so as to move a punch for indicating the proper column, and also a second punch for indicating the proper character in that column. In this description therefore, those punches for selecting the desired column of characters will be designated as the units punches, this designation being appropriate because of the fact that these punches make perforations for selecting the column having characters of the desired number of units of width or body thickness therein, and the punches for selecting the characters in those columns will be designated as the character punches, a corresponding distinction being followed with respect to the operating mechanism for the said punches.

Extending across the machine and journaled in the sides of the intermediate section 2 and in rear of the punch bars is a vertical series of units punch operating rock shafts 37, the number of rock shafts being one in excess of the number of punch bars to be operated thereby, inasmuch as two of the said rock shafts are adapted to operate upon the same punch bar, as will be hereinafter referred to. These units punch operating rock shafts are each provided with a forwardly extending bail 38 adapted to cooperate with lugs or projections 39 on the rear edges of the punch bars as will be readily understood from an inspection of Figures 8, 9 and 23, the latter figure particularly, showing diagrammatically, which punch bar in this particular machine is adapted to be operated by each of the rock shafts. For operating the rock shafts and their bails, there is provided a series of units bars corresponding in number to the number of columns in the key board, which in the present instance is fifteen, and these units bars for convenience are divided into upper and lower units bars, the upper units bars being numbered 40, Figures 4, 9 and 22. The bars 40 are guided to work vertically in the intermediate section 2 of the casing, being spaced transversely to correspond approximately to the column arrangement of the key board and are each provided with a forwardly projecting lug or lugs 42, embracing or engaging the bail on the appropriate rock shaft and so raise and lower the appropriate punch bar and punch. From an inspection of Figures 10 and 22 it will be seen that it is not necessary that all of the bails on the rock shafts shall extend entirely across the casing, inasmuch as the lower rock shafts are operated by the units bars on the left hand side of the machine only, and hence for convenience in manufacture, these bails are somewhat shorter than the bails on the upper units bar rock shafts. The upper units bars 40 at their lower ends rest upon and are adapted to be raised by the lower units bars 41, Figure 22, the planes of the two bars being at right angles to each other to secure a sufficient bearing, and at the same time to facilitate the construction and assembling of the parts. The said lower units bars extend down through the columns of key levers and are adapted to be operated thereby, as will be presently explained, in connection with the key board or finger mechanism.

The character selecting punch bars rest at their lower ends upon the upper ends of the lower sections 43 of the character selecting punch bars, the latter sections being held in guides in the bottom section 1 of the casing so as to work vertically, and are adapted to be operated, *i.e.* raised and lowered by means

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of lower rock shafts 44 journaled in the bottom section 1 of the casing and extending transversely of the key levers. For this purpose the said punch bar sections are provided at the proper points, indicated in Figure 23, with lugs or projections 45 which engage or embrace bails 46 on the rock shafts 44, as shown  
 5 clearly in the detail perspective view, Figure 28, and the rock shafts are operated by the key levers, as will be presently described in connection with the key board mechanism.

These lower sections of the character selecting punches being grouped together at the left hand side of the machine would occupy practically all of the  
 10 space and leave no room for the vertical columns of key levers at this point and in order to provide space for these columns of key levers some of the lower sections of the punch bars may be omitted leaving spaces 47, Figure 23, and in order to transmit the movement of the appropriate rock bars to the punch bars above such spaces, suitable lower sections such as 48 may be provided at  
 15 any other convenient point and the said sections 48 at their upper ends engage corresponding upper sections 49, which in turn cooperate with upper rock bars 50 and the latter engage those punch bars (the lower sections of which are omitted as before described) to raise and lower the same and thereby produce the desired perforations. As shown in this Figure 23, it will be seen that the third and  
 20 sixth lower sections are omitted and the third and sixth lower rock bars which would normally cooperate with such sections now cooperate with the added lower sections 48, and the third and sixth punch bars cooperate with the third and fourth upper rock bars which derive their motion from the added upper sections 49. The tenth punch bar is a constant punch bar for those characters  
 25 "space and full stop characters," the bodies of which are varied for justification and this punch bar is operated by the lowermost of the upper series of rock bars and is adapted to be operated by the units bars moved by the key levers corresponding to those characters, as will be presently explained. The spaces thus provided in the series of lower sections of the punch bars will accommodate  
 30 three vertical rows or columns of key levers and in connection with the fourth vertical row or column of key levers, a different method of providing the space is shown. Referring again to this Figure 23, it will be seen that the lower punch bar section corresponding to the 13th punch, counting from the right hand side in this figure (left hand side of the machine) is simply deflected to one  
 35 side, or bent at the top and bottom so as to leave the vertical space 51, in which the key levers may work.

The 17th punch bar, Figure 23, counting from the right hand side of this figure, left hand side of the machine, it will be observed is provided with two  
 40 projections 39, adapting this punch bar to be operated by the second and fifth upper rock bars, counting from the bottom. This is done in order to economize the number of punches as it is found that the punch which is operated by the units bar corresponding to the left hand column of character keys may be also utilized as one of the punches in the space combination, thus the space key operating the units bar 65 Fig. 22, will operate the tenth and seventeenth punch bars.  
 45 counting from the right hand side of Figure 23, and the 17th punch bar will also be operated in proper combination by any one of the vertical columns of keys at the left hand side of the key board and representing characters having a body thickness less than any of the other characters, except the space.

## KEY BOARD OR FINGER MECHANISM.

In the base section 1 of the casing there is arranged a series of key levers  
 50 corresponding in number to the number of finger pieces 4 and the number of characters including justification keys, space keys and quad, designed to be represented by the several combinations of punches and to be reproduced by the casting or type forming machine. These key levers (see Figures 6 and 21) are  
 55 preferably flat bars or punchings pivoted at substantially the center, on shafts 53 running through from side to side of the casing, the pivotal point being at

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about the center of gravity of the levers whereby the levers will be substantially balanced, and the series of pivots is arranged on a diagonal line so as to give as near as practical a uniform angular movement to the rock shafts operated thereby.

The movement of the key levers is limited by the slots 56 in the front plate of the lower section of the casing and at their rear ends they are spaced and held in the proper vertical plane by guide bars 57 suitably mounted in the casing and held in place by cross bars 58 at the top and bottom.

To economize space and at the same time permit the use of relatively thin wide key levers which will be rigid enough to perform the work imposed upon them the vertical columns of key levers corresponding to or for producing indications of characters having uniform widths are staggered, that is to say, the key levers in the top horizontal row will be located on the opposite sides of the guide bars 57 from the key levers in the second horizontal row, but starting from the right hand side of the key board, for instance, the key levers located on both sides of the first guide bar 57 will correspond to and be adapted to operate a punch for indicating a uniform body width, and this result is secured by adapting all of said key levers in this vertical column to cooperate with a single one of the lower units bars, but each of said key levers except the lowermost will cooperate with and operate a different lower rock bar, thus each of said key levers will select or produce an indication for a different character in that column.

It will be seen that the key levers are each provided with a transverse aperture 59, elongated lengthwise of the key levers and through which aperture the lower rock shafts 44 and their bails 46 work, the bails 46, however, resting at the bottom of the rear portions of the apertures 59, whereby when any one of the key levers is depressed at the forward end and raised at the rear end the bails will be moved upwardly and the rock shafts oscillated to a corresponding degree. The lower units bars 41 also extend down between the key levers, one of said units bars being arranged between the staggered key levers of each column and upon opposite sides of these lower units bars are formed a series of projections or lugs 60 corresponding in number and position to the key levers with which the units bars cooperate. The lugs are arranged on opposite sides of the lower units bar to correspond with the staggered arrangement of the key levers and are adapted to be located within the openings 59 in the key levers, preferably in rear of the bails 46.

This arrangement, it will be observed, permits the key levers to have a considerable width vertically and at the same time the vertical height of the entire column or series may be very much reduced by over-lapping the tops and bottoms of the key levers and in fact only sufficient space need be left for the operation of the rock shafts and the lower units bars, thus the size of the key board may be reduced, or a larger number of characters included in a key board of given size.

As before intimated, the character producing or casting machine, for which the representations or character indications in the record strip are produced in the present machine contemplates the use of a die carrier having movements back and forth at right angles to each other, such combined movements being adapted to bring any particular character to the centering or casting point, and the extreme advance movement in each direction of this die carrier is determined by a fixed stop, hence in the record producing or punching machine, it is unnecessary to provide indications for these two positions of adjustment, that is to say, assuming that the characters along one edge of the die carrier or block are all of a given width, or in one column, it is only necessary to employ a perforation or indication for selecting the proper character in that column, and on the other hand, if the movement is in the other direction, the particular line is determined by the fixed stop against which the die carrier is arrested and it is only necessary to provide a perforation for the particular column in which the

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desired character is located. Because of this arrangement it is not necessary to provide a punch operating units bar for the right hand column on the key board, although from Figure 22, it will be seen that such a bar both an upper and a lower section, is provided, not, however, for operating a punch but only  
5 for feeding the paper and justification or indicating mechanism, as will be presently explained. Neither is it necessary to provide a rock shaft and bail for the bottom row or line of key levers and consequently the rock shaft is omitted entirely from this place as shown clearly in Figure 6, the lower units bars,  
10 however, are operated by the lower line of key levers for selecting the particular column in which the characters are located and each of the key levers of the right hand column operates its appropriate rock bar for indicating its particular character in that column. The operation of the lower right hand key at the junction of the lower line and right hand vertical column will cause an extreme  
15 throw of the die carrier in both directions and in the present structure, this character is a quad and is given a determinate body width.

The space key 61 and the leader full stop or period key 62 in the present machine are arranged in the bottom row or line and inasmuch as in the practical application of the present invention, it is designed to have these keys produce  
20 indications which will in turn enable the justification of the line to be secured by the variation in the body widths of these type and no others, special connections between the key levers and the punches are provided for said keys. Mechanically, the connections are similar to those already described, and the particular arrangement of the mechanical parts will be best understood from  
25 an inspection of Figures 22 and 23. Referring to Figure 22, 63 indicates a bar corresponding to the lower units bars but adapted to be operated solely by the space key 61, and 64 is a corresponding bar adapted to be operated solely by the leader full stop or period key 62. These two bars 63 and 64 at their upper  
30 ends contact with and are adapted to operate space and period units bars 65 and 66. Both those bars 65 and 66 have lugs 67 thereon, adapted to co-operate with the lowermost of the upper rock bars or its bail, numbered 68, for convenience in distinguishing it. In addition, the space bar 65 has a lug 69  
35 adapted to cooperate with the next to the lower one of the upper rock bars and through these two rock bars the space key will elevate the tenth and seventeenth punch bars, counting from the right hand side, Figure 23 (left hand side of the machine). The upper full stop or period bar 66 also has a second lug or  
40 projection 70 which cooperates with the seventh rock bar from the bottom of the upper series of rock bars and this rock bar in turn will raise the twentieth punch bar, counting from the right hand side of Figure 23 in addition, the tenth punch bar is raised as just explained, making perforations which indicate  
45 and will control the production of justifying type bodies in the line when the casting or producing mechanism has been properly set by the desired justification perforations.

The justification perforations are formed by a combination of punches controlled from the two uppermost rows or lines of key levers and insofar as the  
45 operation of the punches by these key levers is concerned, it does not differ mechanically from the operation of the other punches. Referring again to Figures 22 and 23, it will be seen that the upper line or row of key levers will each operate its appropriate unit punch through the units bars and upper  
50 rock shafts and in addition, this upper row will from the top-most of the upper rock shafts operate the thirteenth punch, counting from the left hand side, Figure 23, while the key levers in the second row or line will each operate its proper units punch and also the second of the lower rock shafts and this second  
55 rock shaft will operate a lower punch bar 71, Figure 23, which will in turn raise the first punch on the left hand side in said figure, and on the right hand side of the machine.

It will be noted that in working out the combinations of punches for producing the many characters covered by the key board, namely 255 in the illus-

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tration, the mechanism is such that each horizontal row or line has a constant punch, that is to say, a punch which may be operated through one of the lower rock bars when any key lever in that horizontal line is operated, and in addition, each of said keys will operate a different punch corresponding to the unit value or body width of the character represented by that particular key, the connections for this punch being made through the units bars and upper rock shaft, as before explained, the exception, however, being the right hand column and bottom row in connection with which it is only necessary to operate a single punch owing to the intended use of the strip in the casting machine or producer, having two fixed stops. The so-called constant punch operating mechanism is that illustrated in Figure 23, in connection with the punches on the left hand side of the figure, while the variable punch operating mechanism is that illustrated in Figure 22, from which two figures it is thought that a clear understanding of this portion of the invention may be had.

When a key lever or any one of them is operated to form the indication in the strip or record ribbon, it is of course necessary before the next designation is formed that the strip or ribbon shall be fed forward by the paper feeding mechanism before described, and to secure the operation of the escapement upon the operation of any one of the key levers, each of the upper units bars and the bars 65 and 66 as well as the right hand bar in Figure 22, corresponding to the right hand column of key levers in the machine, each carry at the upper end a lug or projection 72, which rests under and is adapted to raise the bail 31 of the feed shaft 30, whereby when any one of said units bars is raised, the said feed shaft 30 will be oscillated and through the before described connection 29, with the pawls, the escapement will be operated and as the units bars and key levers return to normal position, the escapement wheel will be allowed to advance and feed the paper forward a proper distance.

The spring 28, which draws the escapement pawls back to normal position, it will be observed, is relatively long to secure a uniform tension throughout a somewhat wide range of movement and in addition to returning the escapement pawls to their normal position, it also serves to put a tension on the punch operating mechanism and key mechanism generally for returning them to their proper positions with an elastic pressure as it will be observed, that when the units bars raise the feed shaft bail, the tendency of said bars is to return to their normal position under the influence of this spring, as well as under the influence of gravity. The punch bars themselves are also provided with lugs or projections 73 also resting under the feed shaft bail and serving to return the punch bars to their lower position, or on the other hand, said projections 73, when the punch bars are raised, or any one of them is raised, will ensure the operation of the feed shaft and a consequent feeding of the paper the desired distance.

## JUSTIFYING MECHANISM AND MECHANISM FOR OPERATING THE SAME.

This mechanism is designed to provide for indicating to the operator exactly which justification keys are to be struck for producing indications of the amount of body thickness set-ways is to be added to each of the justifying type bodies in any given line. It is one of the objects of the invention to provide a mechanism which will register accurately the number of units set-ways in the characters previously indicated in the record strip or ribbon in any given line, by causing an indicating hand to register with a suitable chart, dial or card or the like, bearing upon it combinations of letters or figures corresponding to justifying keys, which latter when struck, will produce perforations or indications representing the exact increment or body width to be added to each of the justifying type bodies to produce a perfectly justified line, thereby eliminating from the problem all mental calculation on the part of the operator and enabling him to, by simply consulting the chart, card or dial, strike proper justification keys at the termination of each line of indications.

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The invention contemplates the employment of a units wheel which is advanced or given an angular movement corresponding with, or in definite proportion to, the number of units contained in each one of the characters designated in the record strip; a chart bearing the requisite justification key indications (letters or numbers corresponding to similar letters or numbers on the justification keys themselves), and a justification indicator which is advanced each time one of the types, the body of which is varied to produce justification is indicated, so as to register with a line on the chart corresponding to the number of type bodies contained in the line of type or indications thereof in the record ribbon, provision being also made for securing a relative movement of the indicator and chart for showing the amount of unfilled justification space remaining in the line, this being preferably as before stated, simply by reference to the proper justification keys to be struck for indicating the justification in the record ribbon.

Obviously the indicator itself may be swept across the dial or chart for showing the amount of justification space, or the dial or chart may be moved to secure the same result, but in the present machine the first mentioned plan has been adopted, that is to say, there is a fixed dial or chart and a justification indicator which is moved transversely of the chart in accordance with the number of justifying type bodies indicated and longitudinally of the chart in accordance with the body widths or units values in the portion of the line not previously designated.

Referring particularly to Figures 1, 2 and 20, it will be seen that on the front of the casing, preferably on the middle section 2 thereof, there is mounted removably upon studs 74, a chart 75 which is shown as substantially segmental in form, although as will presently appear, the lines of characters thereon are not true arcs of a circle but are spiral for adapting them to register with the particular indicating hand or pointer employed.

The units wheel 76, Figures 10, 11, 12, 13 and 14 is a toothed wheel, preferably journaled in a frame 77 which also preferably supports most of the registering mechanism. The shaft upon which the units wheel is mounted preferably takes the form of a sleeve 78, Figure 14, and the face of the units wheel is provided with a clutch section 199 with which a longitudinally movable pinion sleeve 79, Figures 4 and 14, engages to rotate the units wheel forwardly, but which will permit the pinion 79 to rotate in a reverse direction without rotating the units wheel itself. The pinion is held in engagement with the clutch section by means of a spring 80 enclosed in a casing 81 carried by the units wheel and surrounding the rear end of the pinion sleeve. The pinion constituting the forward end of this sleeve 79 is adapted to mesh with a rack bar 82, Figures 13, and 27, and the motor or weight for driving the indicator is applied to this rack bar and tends to advance the same across the machine towards the right hand side. In the preferred construction, the rack bar 82 extends out to the left hand side of the casing and meshes with a gear wheel 83 journaled in a bracket 84 and carrying a smaller gear wheel 85 with which a vertical rack 86 meshes. The rack 86 is guided in suitable ways in the bracket 84 and from its lower end, the weight 87 for moving the parts is suspended. This weight may be called a prime motor weight and the connection between it and the rack 86 is a yielding connection preferably formed by confining a spring 88 in the weight, and extending a rod 89 down through the spring and providing its lower end with a nut or enlargement 90 upon which the lower end of the spring will rest. The spring thus forms the real motor, the tension of which is determined by the weight, and the impact of the weight when once set in motion by the downward movement of the rack will not impart a shock to the mechanism.

The forward movement or rotation of the units wheel is normally prevented by the locking pawl 91 having its end toothed to accurately fit and center the teeth on the units wheel, said pawl preferably being mounted in bearings to slide radially with relation to the wheel.

Above the units wheel and pivoted on a center 92 is a units rack carrier 93,

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Figure 11, having ways therein in which a units rack 94 reciprocates in a plane tangential to the periphery of the units wheel, and in position to mesh and cooperate with said units wheel whenever the carrier 93 is depressed. The units rack 94 is provided with a stop or projection 95 normally adapted to arrest the movement of the units rack in each direction by coming in contact with the ends of the slot or way in the carrier in which it is mounted, unless arrested by the units stops, to be presently described. In the operation of the machine or upon the depression of any of the finger pieces, the units rack bar carrier is first depressed until the units rack is in mesh with the units wheel and then the locking pawl 91 is withdrawn, allowing the units wheel to advance in accordance with the range of movement of the units rack, and upon the release of said key the locking pawl 91 is first moved into engagement with the units wheel and then the units rack moves out of mesh therewith, hence it will be seen, that the advance of the units wheel is directly controlled by the range of movement allowed the units rack and this is varied in accordance with the number of units contained in the body of the type designated by any particular finger piece or key.

For securing the relative movements of the units rack carrier 93 and the locking pawl 91, just described, a bell crank lever 96 is journaled at its angle on the frame 77 and one of its arms extends downwardly and cooperates with the locking pawl 91, Figure 11, while its other arm extends horizontally and has connected to it a link 97 extending vertically and this link 97 is in turn connected with a horizontal link 98 having its opposite end pivotally connected with the units bar rack carrier at 99.

The link 98 is centrally pivoted to a depending connecting rod 100 which at its upper end is supported by an arm 101, pivoted at one end on the casing and at its opposite end pivotally connected with an arm 102, Figure 8, on the feed shaft 30, thus when the feed shaft 30 is oscillated by the operation of any one of the key levers, the connecting rod 100 will be depressed against the tension of the spring 28.

A spring 103, Figure 13, is connected at one end to the units rack bar carrier 93 and at the opposite end to the frame 77 and by its tension tends to draw said rack bar carrier and rack bar down into engagement with the units wheel, but the superior strength of the spring 28 overcomes the tension of the spring 103 and normally holds said rack bar carrier 93 up and the rack bar out of engagement with the units wheel. Because of this arrangement, it will be seen that the link 98 operates as a lever and as the link or connecting rod 100 moves downwardly the spring 103, also drawing down on the rack bar carrier 93, will hold the outer end of the link 98 upwardly and the locking pawl 91 in engagement with the wheel until the rack bar is in engagement with the units wheel and the rack bar carrier comes to rest against its stop 104 when the outer end of the link 98 will be swung downwardly by the further movement of the connecting rod 100 and this in turn will swing the bell crank 96 and withdraw the locking pawl 91 from engagement with the units wheel, permitting the wheel to turn and carry with it the units rack. On the reverse movement of the feed shaft and connecting rod 100, the spring 103 still exerting its tension will cause the link 98 to act as a lever until the locking pawl 91 comes to rest in engagement with the units wheel and then as the outer end of the link cannot move upwardly any further, its inner end will be swung upwardly, raising the units rack carrier 92 and disengaging the rack from the units wheel.

For returning the units rack 94 to its normal position, in its carrier, which is the position indicated in Figure 11, a link 105 is connected to its rear end and extends out to one end of the frame 77 where it is jointed to a vertical lever 106 pivoted to the frame 77 and having a spring 107 for drawing it outwardly. The opposite end of this spring 107, for convenience, is connected with an arm 108, extending out from the frame 77.

The mechanism for limiting the movement of the units rack and units wheel

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cooperates with the units rack directly and in the present embodiment embraces a series of stops, fifteen in number, and the extreme range of travel of the units rack to the end of its slot or way, constitutes another stop, making sixteen in all.

5 The number of stopping points of the units wheel and rack bar correspond therefore to the number of vertical columns of characters in the key board, having different body widths, there being fifteen of such vertical columns, and the other stop is for the normal space indication, the character for which has a less number of units of body thickness therein than any one of the columns.

10 By reference to Figure 13, it will be seen that the units rack carrier 93 is provided with a series of vertical slots or guides 109, and the forward ends of a series of stop levers 110, Figure 17, are adapted to play in these slots or guides. In order to reduce as much as possible the lateral space occupied by the stop levers and at the same time to secure the advantages of independent guides for the forward ends of the levers, as near as possible to the point where  
15 the units rack strikes the same, only one half of the total number of stop levers are adapted to project into such guides, and between each of the levers which do project into these guides there is arranged a second series of stops 111, Figure 17, the stop levers 111 being provided with downwardly extending nose portions 112, which project between the levers 110, and an over-hanging portion 113, which when any one of the series 111 is depressed, will carry with it the next lever of the series 110, and thus each of the series of levers 111 when depressed, carries with it its supporting lever of the other series and the strain  
20 is taken up by the guide 109 in which the lever 110 works.

The stops when thus arranged, it will be observed may individually be comparatively loose and free in action thereby preventing any sticking or liability  
25 to catch in the guides and furthermore by providing individual guides for holding each lever, the wear incident to the use of the levers is not cumulative in its action on the units wheel and the error due to this or due to the accumulation of dirt is reduced to practically nothing. The stop levers are journaled on a through pin 196 and their rear ends are rounded for co-operation with slots  
30 in a vertical series of stop bars 114, Figures 4, 7, 8, 10, 21, 23 and 25. These stop bars are supported in guides at top and bottom of the intermediate section 2 of the casing and at an intermediate point they are also held against lateral movement by guides 115, carried on a central transverse rod 116. Centrally they  
35 are provided with slots 117, Figures 18 and 25, for the reception of the rounded rear ends of the stops 110 and 111. The stop bars correspond in number to the number of stops 110 and 111, an additional one being provided for the space stop and key before described.

One of the stop bars is designed to be operated from each of the vertical  
40 columns of key levers, and in order to accomplish this, the stop bars are each provided on their rear edge with a projection 118 which overlies and is adapted to be operated by the bail on one of the upper rock shafts. These rock shafts, it will be remembered, correspond to and are operated by the respective vertical columns of key levers. Referring again to Figures 22 and 23, it will be  
45 remembered that the space key alone operates the next to the bottom rock shaft of the upper series and if reference be had to Figure 23, it will be seen that this rock shaft operates the first stop bar of the series 114 and when this first stop of the series is operated, the first stop towards the left hand side of the machine and the first with which the rack can come in contact will be  
50 depressed, and hence, when this stop is operated, the units wheel will be given a minimum feed, corresponding to the body width of the space. The intermediate stop bars, and stops, corresponding thereto, will give a different feed in accordance with the body width of the characters designated by the intermediate columns of key levers, each being operated from its appropriate rock bar of the upper series, but the extreme right hand column, it will be remembered, and as  
55 shown in Figures 22 and 23, does not operate any of the rock bars of the upper series but only the feed shaft, hence when any key lever in this column is moved

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to produce a character indication, no movable stop is thrown into the path of the units rack but said rack is permitted to have a full stroke and come to rest against the fixed stop at the end of its guides, registering the maximum number of units of body width.

To arrange the mechanism in as compact form as possible, the units rack is provided with the projection 95 for directly cooperating with the stops and thus the rack itself may be extended on either side of said projection a sufficient distance to ensure engagement with the units wheel for a maximum throw without requiring the location of the stops beyond the end of the rack.

It will be observed that the units wheel has a progressively forward movement, in other words, it is never given a reverse rotation even when the driving rack 82 is returned to its normal position, ready to again advance the units wheel, for during such return movement, the ratchet connection between the sleeve 79 and the units wheel allows the sleeve and rack to move reversely independently of the units wheel.

The justification arm 119 is mounted on or formed as a portion of a pinion 120, Figure 14, and the rotation of this pinion by the rack, gives a relative movement of the justification arm and chart, for indicating the amount of justification space left in a line, and inasmuch as the justification area or that portion of the line wherein justification must be taken into consideration by the operator is only a relatively small proportion of the whole line, it is obvious that this justification hand or arm need not be moved continuously but its movement must commence when the rack and units wheel have together moved throughout a large portion of the line indicated. To secure this result, the justification arm and pinion 120 are directly operated by the supplemental rack 121 (shown clearly in Figure 27) guided in ways in the frame 77 and adapted to be stopped in normal position by a lug or projection 122 which abuts against the frame 77 when the supplemental rack is at the left hand extreme of its movement. A pick-up projection 123 on the main rack 82 is adapted to co-operate with the supplemental rack 121, as the justification area is reached, to move the same towards the right hand side of the machine and thereby rotate the pinion 120 and justification arm 119. As the main rack 82 returns to its first position at the left hand side of the machine, obviously the projection 123 will move out of engagement with the supplemental rack 121 and the justification arm is therefore freed from its influence until the main rack 82 advances again, far enough to move the same *i.e.*, when the justification area is reached.

For returning the justification arm and supplemental rack to normal position without imparting thereto an undue momentum, or breaking or bending the mechanism, should the justification arm get caught or stopped in its return movement, a vertical rack 124 also meshes with the pinion 120, Figures 8, 10 and 11, and is itself carried by a weight 125, Figures 10, 13 and 14 and 16, sliding on a vertical guide 126. This weight will serve to return the justification arm to its normal position, but it is desirable that the returning power for the justification arm should be decreased as the arm reaches the last portion of its travel, and to accomplish this, a lever 127 is pivoted on the frame 77, its longer arm extending into a position where as the weight 125 rises, it will contact therewith and swing the lever on its pivot. The lever is spring pressed, a spring 128 connected with the shorter arm of the lever being employed for the purpose and consequently while the weight itself operates alone as the returning power during the last portion of the return movement of the justification arm, during the first portion of such movement, the action of the weight is supplemented by the action of the spring-pressed lever 127, and at the same time the lever 127 is arrested in its action by striking the frame 77 when the justification arm passes its center of gravity, after which time its own weight will tend to return it to normal position.

During the time that the supplemental rack 121 is being moved by the main rack 82, it is of course desirable that the two racks should be locked together

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to prevent any possible overthrow or independence of action, and for the purpose of locking them, a pawl 129 (Figure 10 and in dotted lines Figure 27) is pivotally mounted upon the main rack 82 and adapted to drop into a notch 130 in the supplemental rack at the instant when the pick-up projection 123 engages the supplemental rack, thereby locking the two together for unitary movement. The pawl 129 is disengaged from the supplemental rack for the independent return of the two racks by an arm 131 operated through the mechanism to be presently described, either when the justification key is operated at the end of the line or when the resetting mechanism commences its operation, as will be presently described.

From Figure 20 it will be seen that the dial or chart is divided off into a series of spirally arranged rows of combinations of letters radially divided, which correspond to letters on the two uppermost rows of keys or finger pieces, these being the justification keys. The number of such rows of letters on the chart counting radially, correspond to the number of possible justification type bodies in a given line and the indicator for registering with such letters on the chart is adapted to be advanced transversely of the chart, so as to register with a new row thereon each time one of the justification type is indicated on the paper or ribbon and the letters in that row with which the indicator registers, will show the proper justification keys to be operated for producing indications which will, in the casting or reproducing machine, cause the mechanism to vary the body widths of the justification types to the proper extent.

The justification indicator 132, Figures 1, 2 and 14, is a pointer or hand carried by the justification arm 119, and while it is adapted to swing on its center in unison with said arm, it is given a longitudinal movement each time one of the type, the body of which is varied for justification, is indicated. Each longitudinal movement of the justification indicator 132 will cause it to register with a new line of letters on the chart, for which purpose it is mounted in guides 133 on the justification arm 119, and its inner end formed into a rack bar 134 adapted to mesh with a pinion 135, Figures 2 and 14, carried upon a shaft 136 extending through the sleeve shaft 78 on the units wheel and carrying upon its rear end a second pinion 137. Pinion 137 meshes with a vertical rack bar 138, Figures 12 and 14, guided in suitable guides on the frame 77 and preferably weighted so as to normally remain in its lowermost position, but adapted to be moved upwardly by the operation of the key levers for indicating type bodies whose body thickness is varied for justification. The two type bodies in which such justification is produced in the present apparatus, it will be remembered, are the space type and the full stop type, and the key levers for these two type indications, it will also be remembered, oscillate or rock the lowermost of the upper series of rock shafts together with its bail, and if reference be had to Figure 1, it will be seen that this rock shaft carries a forwardly projecting arm 139 having upon its forward end a pivoted pawl 140 provided with a spring 141 for holding it in its operative position. The rack bar 138 has upon its side a series of ratchet teeth 142 with which, from Figure 15, it will be seen that the pawl 140 is adapted to engage, whenever the lower rock shaft is operated by either one of the two before mentioned key levers, but normally the pawl 140 is out of engagement with the ratchet teeth 142 of the rack 138, being held with its nose elevated by means of a throw-out incline 143, and off of which it will ride whenever the lower rock shaft is oscillated, thereby raising the rack bar 138 one tooth, or a sufficient distance to cause the justification indicator 132 to register with a new line of characters on the chart. The throw of the pawl 140 is limited and the rack bar locked by an adjustable stop 144, Figure 15, and when the rack bar is so moved, it is caught and held by a pawl 145, Figures 8 and 9, which is normally held in position to engage with the ratchet teeth by the spring 146, this latter pawl however, being adapted to be thrown out of engagement with the rack bar to permit the rack bar to drop and so retract the justification indicator through

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the medium of mechanism thrown into action either by the justification keys when operated, or by the resetting mechanism, as will presently appear.

The object of having the lines of characters on the chart spiral rather than concentric with the center on which the justification hand turns, will now be apparent, for assuming that the space and full stop keys are not operated, but that other character keys are operated, the justification arm will be rotated as soon as the justification area is reached, and inasmuch as the pinion 135 controlling the justification indicator is not moved except when either the space or the full stop key is operated, the justification indicator will be carried around such pinion 135, and its indicating point or hand will be moved with respect to the justification arm 119. The spiral arrangement of the characters on the chart is such as to accord with this movement, and thus, if no space or full stops are included in the line, the justification indicator will follow around on a single line of chart characters, and regardless of the position of the justification arm 119, whenever one of the said keys (space or full stop keys) is operated, the justification indicator will be moved outward radially to register with a new line of characters on the chart.

The rack 138 is preferably only provided with a sufficient number of ratchet teeth to move the indicator across the chart or dial and thus no injury can result from a too frequent operation of the space or justifying character key or keys.

For ensuring the operation of the units rack carrier in unison with the stop bar 114, or any one of them, the said stop bars 114 are each provided near their upper ends with a projection or lug 191, Figures 8, 23 and 25, which underlie the bail 31 on the feed shaft 30. Thus there is a direct inter-dependence or co-action between the stop bars and the units rack carrier, ensuring the operation of the units rack carrier and the locking pawl whenever one of said stop bars is operated to throw a stop into the path of the units rack.

## LINE INDICATOR:

In the front plate of the intermediate section 2 of the casing, there is formed a transverse slot 147 preferably located below the chart and along the edges of the slot there is provided a line scale 148 with which registers a pointer 149 carried by the main rack 82, Figures 2, 7 and 27. The rack 82 advances upon the operation of each of the key levers and the line scale pointer 149 will consequently indicate to the operator exactly the point of starting a line, or the approximate amount of space remaining in the line at any moment.

In the brackets 84, Figure 13, it will be noticed that there is arranged a fixed rack 150, and sliding upon suitable guides in proximity to this rack there is a stop block 151 which may be adjusted longitudinally of the fixed rack 150, by withdrawing the holding pawl 152 from engagement with the rack 150 and allowing it to again enter at the desired point of adjustment under the influence of its spring 153. This stop block 151 serves as the stop for limiting the retrograde movement of the main rack 82, hence the adjustment of this block in connection with the line indicator 149 will enable the length of any particular line to be accurately gauged.

For indicating to the operator audibly when the line is approximately full, an alarm or gong 154 is mounted on the casing and its striker 155 is adapted to be engaged and operated by an arm or projection 156, Figure 7, when the rack has advanced to the proper point. This audible alarm is preferably so located that it will be sounded when the justification area is reached and the operator, hearing it, may then consult the chart and ascertain exactly how much justification space remains, whether additional characters may be struck, and if not, exactly which of the justification keys, shown in Figure 7, are to be operated to set the reproducing machine for increasing the body thickness of the justification characters to exactly fill the line.

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## RESETTING MECHANISM.

At the left hand side of the machine, Figures 1 and 3, there is pivoted a resetting handle or arm 157, normally held elevated by a spring 158, and with this arm is connected through a spring link or yielding connection 159, a vertically moving rack bar 160. Rack bar 160 is suitably guided in the bracket 81 and is adapted to mesh with a gear wheel 161, keyed to a shaft 162 upon which the gear wheel and pinion 83, 85, are journaled. A pin 163, Figure 19, projecting from the gear wheel 83 is adapted to be engaged by a similar pin 164 on the wheel 161 and in the operation of the machine for forming a complete line these two wheels 83 and 161 do not make quite a complete revolution, thus, assuming that the wheel 83 which is connected for unitary movement with the rack 82 has been rotated by the weight 87, or that a line has been completed, when the rack bar 160 is drawn down by the handle 157, the pins 163 and 164 will engage and the wheel 83 be rotated in a reverse direction to return the rack bar to its normal position and elevate the weight 87, ready for a new operation. When the handle 157 is released, its spring 158 will again elevate the rack bar 160 and rotate the wheel 161 back to its normal position, leaving the weight elevated and causing the pin 164 to move away from the pin 163 until the handle is again depressed for again returning the parts to normal position.

For again raising the weight 19 and racks 13 and 17 through which the paper is driven or advanced, another vertical rack 165 is mounted in a guide in the bracket 84 and in a second guide 166. Rack 165 is provided with an arm 167, Figures 1 and 3, adapted when the rack is raised to rise up beneath projections 168 on the racks 13 and 17 and shaft of weight pinion 18, and thereby raise these parts, the ratchet connections between the pinions 12 and 15 and the paper shafts permitting this reverse movement without causing an unwinding of the paper. From Figure 19, it will be seen that the rack bar 165 has meshing with it, a gear wheel 169, which gear wheel is geared on the shaft 162 and is adapted to be rotated in unison with the gear wheel 161 whenever the resetting handle 157 is moved. The rack 165 and the arm 167 after raising the paper motor mechanism (as the two lugs and weight 19 may be termed) return to normal position as just explained.

In resetting the indicating mechanism, the holding pawl for the justification indicator rack must be thrown out of engagement to permit said rack to drop and draw the justification indicator inwardly on the justification arm; the pawl 129 connecting the main rack bar and supplemental rack bar 121 must be disengaged and held out of engagement until the rack bars separate, and the units wheel must be brought to a point which may be termed a zero point, and of which there may be in such an arrangement as that herein described, a large number, so as to begin its registration with proper relation to the scale, or in other words, so as to begin its registration at a proper point to ensure accurate justification. It is preferable also that mechanism should be provided whereby when the last key or keys of a line, namely, the justification keys, are struck, that these particular mechanisms, namely, the two rack bar releases and the resetting of the units wheel, should be accomplished and there is in the present machine, provision made for performing these operations when the justification keys are struck, and in addition, and in order to prevent any possible rupture of the mechanism when the resetting handle is depressed, connections are also made between the rack bars at the left hand side of the machine and the throw out mechanism for the pawls, whereby even though no justification keys are struck, these parts will be properly reset.

If reference be had now to Figures 11 and 13, it will be seen that to the frame 77 there is pivoted a vertical arm or lever 170, to the upper end of which a link 171 is connected, the opposite end of said link being pivotally connected to an arm 172, on the rock shaft, 173, carrying the pawl releasing arm 131,

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Figure 27. The lever 170 is provided with a spring 174, for holding it in its advanced position and in position to raise the arm 131. The advance movement of the lever 170 then, it will be seen, will raise the arm 131 and if the pin 175 on the pawl 129 overlies the said arm the pawl will be out of engagement with the secondary rack and the two racks disengaged. In order to at the same time 5 release the vertical rack 138 from its holding pawl 145, a bell crank lever 176, shown best in dotted lines in Figure 14, is pivoted on the frame 77 and has one of its arms projecting in front of the lever 170, Figure 11, and its opposite arm projecting in front of the holding pawl 145, consequently when the lever 170 moves forwardly this pawl 145 will be disengaged from the rack 138 and 10 inasmuch as the operating pawl 140 for the last mentioned rack is normally out of engagement therewith, the rack is free to drop under the influence of gravity and draw the justification indicator back to its normal position with relation to the justification arm.

To prevent the lever 170 from advancing under the influence of its spring 174, 15 a second lever 177, Figures 11 and 13, is pivoted on the frame 77, and at its upper end carries a pivoted pawl 178, the end of which works in a slot in the lever 170 and is adapted to hook over the same, as shown clearly in Figure 11. Also connected with this lever 177 is a link 179, the opposite end of which link is pivotally connected with a lever 180, Figure 14, pivoted just outside of 20 the side of the casing upon the bracket 84 and in position for its opposite end to engage a cam or incline 181 on the vertical rack 165. This incline 181 moves into operative position when the rack 165 is down in its normal position, as shown in Figure 10, and consequently, when the resetting handle 157 begins its downward movement, and the rack bar its upward movement, the lever 180 will 25 ride off of the incline 181 and the two pawls, namely, 129 and 145, will be thrown out of engagement with the respective racks; on the other hand, when the rack returns to its normal position the pawl release arm 131 and the bell crank lever 176 will be moved into position for allowing the pawls to engage with the racks, this being the normal operative position of the parts. 30

A spring 182 is provided for ensuring a return of the levers 177 and 180 into position for the re-engagement of the pawl 178, which pawl in the normal operation of the machine is adapted to be disengaged from the lever 170 by the operation of the justification keys or any of them. To throw this pawl out of 35 engagement, a transverse rock shaft 183, Figure 7, is journaled at one end in the casing, and at the opposite end in the frame 77 and carries on its forward side an arm 181 which overlies the rear end of the pawl 178 in position to throw the forward end of said pawl upwardly and out of engagement with the lever 170 whenever the rock shaft is operated. On the rear side of the rock shaft there is mounted a bail 185 extending back into proximity to the punch 40 bars 36, and upon the forward edges of the constant punch bars for the justification keys, there is formed a lug or projection 186, Figure 4, underlying the bail 185, and in position to oscillate the rock shaft whenever either one of said constant punch bars is moved by the operation of the justification keys.

To reset the units wheel 76 to a proper point where it will begin to register 45 correctly for the next succeeding line, said units wheel is provided on its front face with a ratchet or toothed wheel 187, Figures 11 and 13, with which a pawl 188 is adapted to cooperate to arrest the units wheel and the relation of the teeth on the ratchet wheel, the teeth on the periphery of the units wheel and the pawl, is such that when the units wheel is arrested with the pawl in engagement with any one of the teeth, the units wheel will be in a proper 50 zero position for subsequent operations. The spring 189 normally tends to hold the pawl 188 in engagement with the ratchet wheel 187, and in order to hold it out of engagement except when the line is completed, and the justification key is struck, to throw the parts into resetting position, the said pawl is connected with the lever 170 by a link 190, Figure 13, whereby when the lever 170 55

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has gone back, the pawl will be held out of engagement, but when the lever 170 is released by the operation of any one of the justification keys, said pawl will enter between the teeth on the wheel 187 and inasmuch as when any one of the justification keys is struck, the locking pawl 91 is drawn out of engagement with the units wheel, just as in the case of any of the other keys in the machine, the units wheel will advance until arrested by the pawl 188, and upon the release of the justification key, the pawl 91 will again be thrown into engagement, locking the units wheel in its zero position.

The number of ratchet teeth on the wheel 187 and the corresponding number of zero positions on the units wheel should be sufficient to cause the units wheel to reach a zero position before the units rack comes into contact with any one of the stops, as will be readily understood, for otherwise the units wheel would be arrested by the stop rather than by the zero pawl 188.

## OPERATION OF THE MACHINE.

It is perhaps appropriate to state at this point that a number of suitable charts or dials are provided for use in connection with each machine having combinations of characters thereon for indicating justification necessary to be added to the justification type in different fonts of characters, and the operator, knowing the font or style of characters to be used and having selected the chart for that font and placed the same in position on the casing and having placed the previously prepared supply roll of paper in position, passed the same through the guides, ready for the action of the punches and attached it to the winding roller, is ready to commence the operation of indicating in the record strip the desired characters with the justification indications for controlling the justification thereof. To set the machine for operation to produce a line of given length the operator manipulates the stop on the bracket on the left hand side of the machine, in connection with the line scale. Having done this, he manipulates the finger pieces or key levers to produce indications for the desired characters, points, spaces, *etc.*, in the line, until the line is nearly completed, or the justification area approached or reached, which may be ascertained by consulting the line scale, or by the audible signal sounding at the appropriate time. The operator then takes notice of the justification indicator and seeing that he has no more room in the line for other characters, he will find that the justification indicator registers with a combination of characters on the chart which corresponds exactly to the keys in the justification rows of keys, which are to be operated to produce justification indications corresponding to the increment in body thickness of the justification type necessary to produce a complete and justified line in the casting machine.

As the main rack reaches the justification area and the justification arm begins its movement carrying with it the justification indicator, the pin 175 on the pawl 129 rides over the arm 131 and continues its movement over the said arm until the line is completed. When the first justification key is operated, it not only operates the desired punches for producing the indications but it also operates the rock shaft 183, tripping the pawl 178 out of engagement with the lever 170 and this lever being released under the action of its spring 174, will raise the pawl releasing arm 131 and pawl, disconnecting the two racks and at the same time, it will release the pawl 145, allowing the justification indicator to be retracted to its normal position on the arm. It also resets the units wheel by throwing the zero pawl into engagement with the teeth thereon and allowing said wheel to rotate forwardly until one of the teeth is arrested against the pawl.

The operator then depresses the resetting handle, drawing back the main rack, the pawl 129 meanwhile being held elevated by the arm 131, until moved out of range of the supplemental rack, this movement also raises the motor weights, as before explained, and by raising the rack bar 165, moves the incline 181

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out of its operative relation to the lever 180, and the arm 177 carrying the pawl 178, under the influence of the spring 182, will swing inwardly, re-engaging said pawl with the lever 170. When the resetting handle is then released the rack bar, returning to its normal position, carrying with it the incline 181, will operate the levers 180, 177 and 170, returning the releasing arm for the pawls 5 into position for allowing said pawls to re-engage and also moving the zero pawl out of engagement with the units wheel, the parts being then in position for subsequent operation.

Having now particularly described and ascertained the nature of the said invention as communicated to me by my foreign correspondents and in what 10 manner the same is to be performed, I declare that what I claim is:—

1. The combination with a series of character designating punches that is to say "units" and "character" punches as hereinbefore mentioned) and a series of key levers, each having a finger piece and arranged in vertical columns and in horizontal rows or lines whereby each key lever is located at the intersection of 15 a column and a row with connections between each of said vertical columns and a punch corresponding thereto in the series of punches, and an independent connection between each of said horizontal rows or lines and a punch corresponding thereto in said series of punches, whereby upon the operation of any key, two punches will be operated, one corresponding to the vertical column in which the 20 key is located and the other corresponding to the horizontal row or line in which the key is located; substantially as described.
2. The combination with a series of character designating punches, and a series of key levers, arranged in vertical columns and horizontal rows or lines, whereby each key lever is located at the intersection of a row and a column of a 25 series of rock bars for operating certain punches in the series of punches and corresponding to and operated by the vertical columns of key levers and a second series of rock bars for operating other punches of the series of punches, and corresponding to and operated by the horizontal rows or lines of key levers; substantially as described. 30
3. The combination with a series of character designating punches and a series of key levers arranged in vertical columns and horizontal rows or lines, of a series of rock bars for operating certain punches of the series of punches and having bails co-operating with the horizontal rows or lines of key levers, a second 35 series of rock bars for operating certain other punches of the series of punches and connections between said second series of rock bars and the vertical columns of key levers; substantially as described.
4. The combination with a series of character designating punches, and a series of key levers arranged in vertical columns and horizontal rows or lines, of a 40 series of rock shafts for operating certain of the punches of the series of punches and having bails with which the key levers directly co-operate, a second series of rock shafts for operating certain other punches of the series of punches and units bars for operating said last mentioned series of rock shafts, with connections between said units bars and the vertical columns of key levers; substantially as described. 45
5. The combination with a series of character designating punches and a series of vertically arranged units bars with connections between said units bars and punches for operating the latter, of vertical columns of key levers for operating 50 said units bars, the key levers of said vertical columns being arranged alternately on opposite sides of the units bars; substantially as described.
6. The combination with a series of character designating punches and vertically arranged units bars, operating said punches, having oppositely extending 55 projections or lugs thereon, of a series of key levers arranged in vertical columns corresponding to said units bars, said key levers being arranged alternately on opposite sides of said units bars and adapted to co-operate with the lugs or projections thereon for operating the punches; substantially as described.

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7. The combination with a series of character designating punches, a series of vertically arranged units bars for operating certain of the said punches and a series of key levers, arranged in vertical columns corresponding to and adapted to operate said units bars, of a series of rock shafts corresponding to the key levers in each of said columns and adapted to be operated thereby, and connections between said rock shafts and certain punches of the series of punches not operated by the units bars; substantially as described.

8. The combination with a series of character designating punches, a series of rock shafts having bails directly co-operating with certain punches of said series to operate the same, a series of vertically arranged units bars for operating said rock shafts, and a series of key levers arranged in vertical columns, the key levers in each column co-operating with the same units bars, of a series of rock shafts having bails directly co-operating with the key levers, the key levers in the same horizontal plane co-operating with the same rock shaft and connections between said last mentioned series of rock shafts and certain of the punches of the series of punches; substantially as described.

9. In a character designating apparatus, the combination with a series of character designating punches and a series of key levers arranged in vertical columns, the key levers in each column being arranged alternately in different vertical planes, of a series of units bars for operating the unit punches of the said series of character designating punches the said unit bars being arranged vertically between the key levers in each vertical column; substantially as described.

10. In a character designating apparatus, the combination of a series of character designating punches, and a series of key levers arranged in vertical columns, the key levers in each column being located alternately in different vertical planes, of units bars for operating the unit punches of the said series of character designating punches the said unit bars being arranged vertically between the key levers of each column and having oppositely extending projections with which the key levers co-operate; substantially as described.

11. In a character designating apparatus, the combination with a series of character designating punches and a series of key levers arranged in vertical columns, of a series of lower units bars arranged vertically and corresponding to the vertical columns of key levers and an upper series of units bars for operating the punches resting upon and adapted to be operated by the lower series of units bars; substantially as described.

12. In a character designating apparatus, the combination with a series of character designating punches and a series of key levers arranged in vertical columns, of a series of lower units bars arranged vertically and corresponding to the vertical columns of key levers and an upper series of units bars for operating the punches resting upon and adapted to be operated by the lower series of units bars, the said upper and lower series of units bars being arranged with their greatest width in planes at right angles to each other to afford wide bearings at their meeting points; substantially as described.

13. In a character designating apparatus, the combination with a series of character designating punches and vertically arranged upper punch bars therefor, of a lower series of vertically arranged punch bars upon which said upper punch bars rest, a series of rock shafts for operating said lower punch bars and a series of key levers for operating said rock shafts; substantially as described.

14. In a character designating apparatus, the combination with a series of character designating punches and vertically arranged punch bars therefor, of a lower series of vertically arranged punch bars upon which some of said punch bars rest, rock shafts for operating said lower series of punch bars and thereby operating the punches, an upper series of rock bars for operating the punches not operated by the lower series of punch bars, vertically arranged units bars for operating said upper series of rock bars and a series of key levers, each of which co-operates with one of the units bars and one of the lower series of rock

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bars, whereby two punches are operated by each of the key levers; substantially as described.

15. In a character designating apparatus, the combination with a series of character designating punches and mechanism for operating different punches of said series embodying vertically arranged punch bars and horizontally arranged rock shafts having laterally extending bails or projections, of a series of key levers having apertures through which said rock shafts extend and the walls of which apertures are adapted to co-operate with the bails or projections; substantially as described.

16. In a paper feeding mechanism, such as described, and in combination with the shaft for actuating the paper feed wheel, and an escapement controlling the same, of a gear wheel or pinion journaled on said shaft, a clutch interposed between said gear wheel and shaft for permitting the reverse movement of the gear wheel, a motor rack in mesh with said gear wheel, a motor weight, a gear wheel supporting the weight and in mesh with said rack and restoring mechanism for resetting the rack and weight.

17. In a paper feeding mechanism, such as described, and in combination with the shaft for actuating the paper feed wheel, and an escapement controlling the same, of a gear wheel or pinion journaled on said shaft, a clutch interposed between said gear wheel and shaft for permitting the reverse movement of the gear wheel, a motor rack in mesh with said gear wheel, a motor weight in gear with said rack, a vertically movable resetting mechanism for elevating said weight and rack and co-operating projections on said resetting mechanism and motor; substantially as described.

18. In a paper feeding mechanism, such as described, and in combination with a record ribbon or strip feeding mechanism, embodying a feed shaft, and a winding shaft, of a single motor with differential gearing interposed between said shafts and motor whereby the movements of said shafts under the influence of said motor may vary, substantially as described.

19. In a paper feeding mechanism, such as described, and in combination with a record ribbon or strip feeding mechanism embodying a feed shaft and winding shaft and an escapement for controlling the movement thereof, of a motor and differential gearing interposed between said shafts and motor, whereby the movements of the shaft under the influence of the motor may vary; substantially as described.

20. In a paper feeding mechanism, such as described, and in combination with a record ribbon or strip feeding mechanism embodying a feed shaft, a winding shaft and an escapement, of racks in gear with said feed and winding shafts, gearing interposed between said racks and a motor applied to said gearing whereby said racks may be moved independently or in unison, under the influence of said motor.

21. In a paper feeding mechanism, and in combination with a record ribbon or strip feeding mechanism, embodying a feed shaft, a winding shaft and an escapement, of racks in gear with said shafts, a gear wheel interposed between and meshing with both of said racks and a motor weight suspended from said gear wheel; substantially as described.

22. In a character designating apparatus embodying a key controlled mechanism adapted for co-operation with a record ribbon or strip, and in combination therewith, a record ribbon or strip feeding mechanism embodying a feed shaft and a winding shaft, and a motor, with differential gearing interposed between said shafts and motor whereby the movements of the shafts under the influence of said motor may be varied; substantially as described.

23. In a character designating apparatus, the combination with the character designating mechanism having controlling keys and adapted to co-operate with a record ribbon or strip, of a record ribbon or strip feeding mechanism embodying a feed shaft and a winding shaft, a motor, gearing interposed between said

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motor and both of said shafts and a resetting mechanism for restoring the power of said motor; substantially as described.

24. In a paper feeding mechanism, such as described, and in combination with a record ribbon or strip feeding mechanism embodying a feed shaft and a motor therefor, of an escapement wheel for said shaft, stiff and limber pawls for cooperating with the said wheel, a longitudinally movable shaft on which said pawls are mounted to oscillate transversely of the escapement wheel, bearings in which said shaft is mounted and an adjustable stop for the forward end only of said shaft whereby the shaft is free to move rearwardly in its bearings; substantially as described.

25. In a paper feeding mechanism, such as described, and in combination with a record ribbon or strip feeding mechanism embodying a feed shaft and a motor therefor, of an escapement wheel for said shaft, stiff and limber pawls for cooperating with said wheel, a longitudinally movable shaft on which said pawls are mounted to oscillate transversely of the escapement wheel, bearings in which said shaft is mounted and a transverse arm constituting a finger piece for throwing said pawls out of engagement with the escapement wheel, and means for limiting the movement of the pawl shaft in one direction; substantially as described.

26. In a character measuring mechanism for a machine such as described, the combination with a units wheel controlling the movement of the indicator and having a progressively forward movement and having mechanism for controlling its movement in accordance with the body widths of the characters, of a motor mechanism for impelling said wheel forwardly with a clutch connection interposed between said motor and wheel, and a resetting mechanism for the motor, whereby the wheel may be held against backward movement; substantially as described.

27. In a character measuring mechanism for a character designating machine, the combination with the units wheel, having a progressively forward movement, and having mechanism for controlling such movement in accordance with the body widths of the characters designated, of an indicator controlled by said wheel, a motor for impelling the wheel and a clutch interposed between the wheel and the motor.

28. In a character measuring mechanism for a character designating machine, such as described, the combination with the units wheel having a progressively forward movement and having means for controlling such movement in accordance with the body widths of the characters designated, of a motor connected with said wheel through a clutch connection for advancing it, and an indicator controlled by said wheel and a setting mechanism for arresting the movement of said wheel at a zero point.

29. In a character measuring mechanism for a character designating machine, such as described, the combination with a units wheel, its shaft and the rack bar engaging a pinion on the units wheel shaft and controlling the line indicator, of the units rack reciprocating in ways in a pivoted support and a locking pawl for the units wheel with mechanism between said locking pawl and units rack, whereby when the units rack is moved into engagement with the wheel, the pawl will be withdrawn and the units wheel abandoned to the control of the units rack.

30. In a character measuring mechanism for a character designating machine, such as described, the combination with the units wheel, its shaft, a rack bar engaging a pinion on the units wheel shaft, a motor for advancing the said rack bar and units wheel and an indicator for indicating the extent of such movement controlled by said units rack reciprocating in ways in a pivoted support, a locking pawl for the units wheel, mechanism between said locking pawl and units rack, whereby when the rack is moved into engagement, the pawl is disengaged from said wheel, abandoning the wheel to the control of

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the rack, and a clutch interposed between the units wheel and the pinion carried by the units wheel shaft.

31. In combination with a units wheel, the units rack, the pivoted support for said rack, and the locking pawl, of the series of stop bars operating through intermediate connections to move the units rack support and withdraw the locking pawl, and a series of stops controlled by said bars for arresting the movement of the units rack, substantially as described, 5

32. In combination with the units wheel, the units rack, the pivoted support for said rack, and the series of stops working transversely of said support to limit the movement of the rack, of a locking pawl and an operating mechanism for said stops with intermediate connections between said stop operating mechanism, the units rack carrier and the locking pawl, whereby when any one of said stops is operated, the units rack will be thrown into engagement with the wheel and the locking pawl out of engagement therewith, and a motor for advancing the units wheel; substantially as described. 10 15

33. In a character designating apparatus, the combination with an indicator, for indicating the space occupied by said characters, a units wheel controlling said indicator and a feed shaft, of a locking pawl for the units wheel, a units rack for limiting the movement of the units wheel, a units rack carrier for moving the rack towards and from the units wheel, a link connected at one end with the units rack carrier and at the opposite end with the locking pawl and an intermediate connection between said link and the feed shaft, whereby said link will operate as a lever to secure the proper sequence of movements of the rack carrier and pawl. 20

34. In a character designating apparatus, the combination with an indicator and units wheel controlling the same, a locking pawl for said units wheel and a units rack for limiting the movement of said units wheel when released by the locking pawl, of a units rack carrier movable towards and from the units wheel, a link pivotally connected at one end with said units rack carrier and at the opposite end with the mechanism actuating the locking pawl and an operating rod or connection pivotally connected with said link at an intermediate point, whereby said link will move both the units rack carrier and locking pawl, but will permit them to move independently in order that the units wheel may be held under control at all times. 25 30

35. In a machine such as described, comprising character designating apparatus, and an indicating mechanism the combination with a units wheel controlling the indicating mechanism a units wheel rack mounted to reciprocate in ways movable towards and from the units wheel, and a locking pawl, of a series of stops with which said units rack co-operates to limit the movement of the units wheel, said stops being arranged in two series, the stops of one series forming the supports for the stops of the other series, but capable of moving independently thereby; substantially as described. 35 40

36. In a character designating apparatus, such as described, and in combination with the units wheel thereof, adapted to advance in accordance with the body widths of the characters designated, of a units rack adapted to engage said units wheel, a series of pivoted stops with which said rack co-operates to arrest the movement of the units wheel and a guide or slot for each of said pivoted stops; substantially as described. 45

37. In a character designating apparatus, such as described, and in combination with the units wheel thereof, adapted to advance in accordance with the body widths of the characters designated, and a units rack, of a units rack carrier movable towards and from the units wheel, a series of guides or slots in said units rack carrier and a series of stops working in said slots and adapted to arrest the movement of the units rack and units wheel; substantially as described. 50

38. In a character designating apparatus, such as described, embodying a units wheel adapted to advance in accordance with the body widths of the designating characters, and in combination with said units wheel, of a units rack, a units 55

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rack carrier movable towards and from the units wheel and having a series of slots or guides therein, a series of long stops working in said slots or guides, a series of short stops arranged between said long stops and having overhanging portions adapted to co-operate with and move the long stops, whereby when any one of said shorter stops is operated to move into position to arrest the rack, it will carry with it the adjacent long stop for supporting it against lateral movement.

39. In a character designating apparatus, such as described, embodying a character designating mechanism and a units wheel adapted to advance in accordance with the body widths of the character designated, and in combination with said wheel, of a units rack carrier movable towards and from the wheel, a units rack mounted to reciprocate in ways in said carrier, stops for arresting said rack, a spring pressed lever and a link connecting said lever and rack to return it to normal position.

40. In a character designating apparatus, the combination with character designating mechanism, and an indicating mechanism embodying a units wheel adapted to advance in accordance with the body widths of the characters designated, of a units rack, a units rack carrier movable towards and from the units wheel, a spring set to move said rack towards the units wheel, a locking pawl for the units wheel, a link pivotally connected at its opposite ends with said units rack carrier, and locking pawl, a feed shaft, a connection between said feed shaft and said link between the ends of the latter and a superior spring operating through said connection for holding the units rack carrier away from the units wheel; substantially as described.

41. In a character designating apparatus, the combination with character designating mechanism and indicating mechanism embodying a units wheel adapted to advance in accordance with the body widths of the characters designated, and an indicator controlled by said units wheel, of a rack for advancing the units wheel, and a motor connected with said rack; substantially as described.

42. In a character designating apparatus, the combination with character designating mechanism and an indicating mechanism embodying a units wheel adapted to advance in accordance with the body widths of the characters designated, and an indicator controlled by said units wheel, of a pinion connected with the units wheel, a rack meshing with the said pinion, a motor connected with said rack and a resetting mechanism for returning the rack to normal position; substantially as described.

43. In a character designating apparatus, the combination with character designating mechanism, and an indicating mechanism, embodying a units wheel adapted to advance in accordance with the body widths of the characters designated, of an indicator controlled by said units wheel, a rack and pinion connected with said units wheel through a ratchet connection for advancing the units wheel and returning independently thereof, a motor for advancing said rack and a resetting mechanism for returning the rack to normal position; substantially as described.

44. In a character designating apparatus, the combination with character designating mechanism, and an indicating mechanism embodying a units wheel adapted to advance in accordance with the body widths of the characters designated and an indicator controlled by said units wheel, of a pinion connected with said units wheel through a ratchet connection, a motor impelled rack bar meshing with said pinion, a resetting mechanism for said rack bar and a zero stop for positioning the units wheel at the end of the line of character designations; substantially as described.

45. In a character designating apparatus, the combination with character designating mechanism and an indicating mechanism embodying a units wheel adapted to be advanced in accordance with the body widths of the characters designated, of a rack bar for advancing said units wheel and a motor weight in gear with said rack bar for advancing the same, with a resetting mechanism for the rack bar; substantially as described.

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46. In a character designating apparatus, the combination with the character designating mechanism, an indicating mechanism embodying a units wheel adapted to be advanced in accordance with the body widths of the characters designated, of a rack bar for advancing the units wheel, a gear wheel with which said rack bar meshes having a pinion connected therewith, a vertical rack in mesh with said pinion and a motor weight connected with said last mentioned rack, substantially as described. 5

47. In a character designating apparatus, the combination with the character designating mechanism, and the indicating mechanism embodying a units wheel adapted to be advanced in accordance with the body widths of the characters designated, of a rack bar for moving said units wheel, a gear wheel with which said rack bar meshes, a motor applied to said gear wheel, a second gear wheel with engaging projections between said gear wheels, whereby one will be rotated by the other, a resetting rack in mesh with said last mentioned gear wheel and a resetting handle for moving said last mentioned rack; substantially as described. 10 15

48. In a character designating apparatus, the combination with the character designating mechanism and indicating mechanism, embodying a units wheel adapted to be advanced in accordance with the body widths of the characters designated, of a rack bar for moving said units wheel, a gear wheel with which said rack bar meshes, a motor applied to said gear wheel, a second gear wheel with engaging projections between said gear wheels, whereby one will be rotated by the other, a resetting rack in mesh with said last mentioned gear wheel, a resetting handle and a spring connection between said resetting handle and last mentioned rack for re-energizing the motor and restoring the units wheel impelling rack to normal position; substantially as described. 20 25

49. In a character designating apparatus, the combination with the character designating mechanism the indicating mechanism embodying a units wheel adapted to be advanced in accordance with the body widths of the characters designated, and a motor rack for advancing said units wheel, of a motor weight and an elastic connection between said motor weight and rack whereby shock incident to the momentum of the weight is avoided. 30

50. In a character designating apparatus, the combination with a character designating mechanism, a paper or record strip feeding mechanism embodying a weight motor and a rack for connecting the same with the paper feeding mechanism and an indicating mechanism embodying a motor weight and a rack for communicating power therefrom to the indicating mechanism, of a resetting mechanism for elevating both of said motor weights; substantially as described. 35

51. In a character designating apparatus, the combination with character designating mechanism, a paper or record strip feeding mechanism embodying a motor weight and a rack for connecting the same with the paper feeding mechanism and an indicating mechanism embodying a motor weight and a rack for communicating power therefrom to the indicating mechanism, of a resetting mechanism embodying a vertically movable rack for raising the paper feed motor weight, a resetting handle and a rack and gear for raising the indicator mechanism weight and the vertically movable rack; substantially as described. 40 45

52. In an apparatus such as described, the combination of the following elements, to wit, a series of keys for characters of unvarying widths, one or more keys representing characters or spaces variable as to width, a series of keys representing different degrees of variation for the variable characters or spaces, a chart showing rows or sets of characters, having reference to keys of the series representing varieties in width of the variable characters or spaces, an indicating mechanism controlled by the keys for the unvarying and variable width characters or spaces, for shifting the relative positions of the indicator from one character to another in a set or row, and independent connections controlled by the keys for variable width characters or spaces, for shifting the indicator from one row or series of characters to another, whereby the operation of any key of 50 55

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the series denoting characters or spaces of variable widths, will effect a transfer of the indicator from one set or series of charted characters to another; substantially as described.

53. In an apparatus such as described, the combination with designating mechanism embodying character designating keys, some one or more of which designate characters, the body width of which is adapted to be varied for justification, of an indicating mechanism embodying a chart having sets or rows of characters referring to different numbers of characters in a line, the body width of which is adapted to be varied, and the characters in each set or row of which have reference to the normal body width of the characters designated, and a pointer or indicator for registering with said characters on the chart, said chart and pointer or indicator being adapted to be moved with relation to each other in two directions, the movement in one direction being controlled by all of the character designating keys, causing registration with different characters in each row or set and the movement in the other direction being controlled by the key or keys for designating characters whose body widths are to be varied, for causing registration with different sets or rows of charted characters.

54. The combination in an apparatus such as described, embodying designating keys, some one or more of which designate justification characters adapted to have their body widths varied, of an indicating mechanism embodying a chart having rows or sets of characters, each row or set having reference to a given number of justification characters in a line, and a pointer or indicator for registering with the characters on said chart, connections between said designating keys and the indicating mechanism for varying the relative positions of the pointer or indicator and characters in each set or row on the chart, and independent connections between the justification character designating key or keys and the indicating mechanism for varying the relative positions of the pointer or indicator and the sets of characters on the chart; substantially as described.

55. The combination in an apparatus such as described, embodying designating keys, some one or more of which designate justification characters adapted to have their body widths varied and a units wheel controlled by the designating keys, of an indicator controlled by the units wheel and connections between the said indicator and the justification character designating key or keys independent of the units wheel for imparting to the indicator a movement in addition to the movement controlled by the units wheel; substantially as described.

56. The combination in an apparatus such as described, embodying designating keys, some one or more of which designate justification characters, adapted to have their body widths varied and a units wheel controlled by the designating keys, of a justification arm controlled by the units wheel and a justification indicator movably supported by said arm with connections between the justification indicator and the justification character designating key or keys; substantially as described.

57. The combination in an apparatus such as described, embodying designating keys, some one or more of which designate characters adapted to have their body widths varied, a units wheel controlled by the designating keys and a justification chart, of a justification arm controlled by the units wheel, a justification indicator for registering with the chart mounted to move longitudinally on the justification arm and connections between the justification indicator and the justification character designating keys or keys; substantially as described.

58. The combination in an apparatus such as described, embodying character designating keys, some one or more of which designate justification characters adapted to have their body widths varied, a units wheel controlled by the designating keys and a justification chart, of a pivotally supported justification arm controlled by the units wheel, a justification indicator for registering with the chart and connections between the justification indicator and the justification character designating key or keys arranged on an axis coincident to the axis of the justification arm; substantially as described.

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59. In a character designating apparatus, the combination of the following elements, to wit: a key board having designating keys for designating characters having constant but different body widths and a designating key or keys for designating characters or spaces having variable body widths; a units wheel controlled by the designating keys and having an angular movement proportioned to the relative normal body width of the characters designated; an indicator moved by but movable independently of said units wheel and independent connections between said indicator and the key or keys for designating characters of variable body widths; substantially as described. 5

60. In a character designating apparatus, the combination of the following elements, to wit: keys for designating characters having constant body widths; a key or keys for designating characters or spaces having variable body widths; a units wheel having an angular movement controlled in its extent by the character designating keys; an indicator controlled by the units wheel for indicating the space occupied by the characters designated in a given line but movable independently of said units wheel and connections independent of said units wheel between the indicator and the key or keys for designating characters having variable body widths, and a chart with which said indicator registers having sets or rows of characters thereon; substantially as described. 10 15

61. In an apparatus such as described, for designating characters in a record strip or ribbon, the combination of the following elements, to wit: keys for designating characters having constant body widths; a key or keys for designating characters or spaces having variable body widths; keys for designating justification; a units wheel controlled in its advance movement by said character and space designating keys in accordance with the widths of the characters designated; a justification arm movable in unison with said units wheel, a justification indicator radially movable on said arm; independent connections between said justification indicator and key or keys for designating characters having variable body widths; and a chart with which said justification indicator registers having sets of characters corresponding to the number of possible operations in any one line of the key or keys for designating characters having variable body widths; substantially as described. 20 25 30

62. In an apparatus such as described the combination with character designating keys for designating characters of constant body width and a key or keys for designating characters having variable body widths, of a units wheel controlled by said character designating keys and an adjustable chart; a justification arm rotated by said units wheel; a radially movable indicator carried by said arm for registering with the chart, a rack bar and pinion controlling said justification indicator and connections between said pinion and the key or keys for designating characters having variable body widths; substantially as described. 35 40

63. In an apparatus such as described, the combination with character designating keys, embodying a key or keys for designating characters having a variable body width, a units wheel controlled by said character designating keys, and a chart, of an angularly and radially movable indicator, with connections between said indicator and units wheel for moving the same angularly and connections between said indicator and the keys for designating variable characters for moving the indicator radially; substantially as described. 45

64. In an apparatus such as described, the combination with the character designating keys embodying a key or keys for designating characters having a variable body width, a units wheel controlled in its angular movement by said character designating keys, an arm adapted to be controlled in its angular movement by said units wheel and carrying a radially movable justification indicator, a rack bar and pinion controlling the radial movement of said indicator, and a second rack bar controlling the movement of the pinion and a pawl moved by the variable character designating key or keys for advancing last mentioned rack bar; substantially as described. 50 55

65. In a character designating mechanism, the combination with the following

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elements, to wit: keys for designating characters having constant body widths; a key or keys for designating a character or characters having variable body width and keys for designating justification, of an indicator advanced by the operation of the key or keys for designating characters of variable body width, and connections between the justification designating keys and the indicator operating mechanism for releasing said indicator upon the operation of any one of the justification designating keys.

66. In an apparatus such as described, the combination of the following elements, to wit: character designating keys embodying a key or keys for designating characters having variable body widths; an indicating mechanism; connections between said indicating mechanism and the key or keys for designating characters having variable body widths, embodying a rack bar, an operating pawl and a holding pawl; justification designating keys and connections controlled by said justification designating keys for releasing the holding pawl of the indicating mechanism; substantially as described.

67. In an apparatus such as described, the combination of the following elements: the character designating keys embodying a key or keys for designating characters having variable body widths; a units wheel controlled in its angular movement by said character designating keys; a justification arm controlled by said units wheel; a justification indicator mounted on said arm; a rack bar on said justification indicator; a pinion and shaft arranged axially of the justification arm and carrying a second pinion; a vertically movable rack bar meshing with said second pinion; a rock bar operated by the key or keys for designating characters of variable body widths, a pawl operated by said rock bar and cooperating with the vertically movable rack and a holding pawl for said vertically movable rack, with means for releasing said holding pawl to reset the mechanism; substantially as described.

68. In an apparatus such as described, the combination with character designating keys and a units wheel controlled in its angular movement by said character designating keys, of a rack bar arranged in horizontal guides, and adapted to advance in unison with the units wheel, a supplemental rack also mounted in horizontal guides, a projection on the main rack for co-operation with the supplemental rack to move the latter at a predetermined point in the travel of the main rack, and an indicator moved by the supplemental rack with independent resetting mechanism for the two racks; substantially as described.

69. In an apparatus such as described the combination with character designating keys, a units wheel controlled in its angular movement by the said character designating keys, a rack bar arranged in horizontal guides, and adapted to advance in unison with the units wheel, a supplemental rack also mounted in horizontal guides, a projection on the main rack for co-operation with the supplemental rack, to move the latter at a predetermined point in the travel of the main rack, and an indicator moved by the supplemental rack, of a locking pawl for locking the two racks together for unitary movement, a releasing arm for said locking pawl and resetting mechanism controlling said releasing arm; substantially as described.

70. In an apparatus such as described, the combination with character designating keys and an indicating mechanism, embodying main and supplemental racks, arranged in horizontal guides with a projection on the main rack for engaging and moving the supplemental rack at a predetermined point, of an indicator moved by the supplemental rack, a pinion in mesh with said supplemental rack, and a supplemental rack and indicator resetting mechanism embodying a second rack in mesh with said pinion and means for moving said second rack; substantially as described.

71. In an apparatus such as described, the combination with character designating keys and an indicating mechanism embodying main and supplemental racks, arranged in horizontal guides with a projection on the main rack for engaging and moving the supplemental rack at a predetermined point, of an

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indicator moved by the supplemental rack, a pinion in mesh with said supplemental rack and a supplemental rack and indicator resetting mechanism embodying a second rack in mesh with said pinion, a weight applied to said second rack and a spring pressed lever co-operating therewith as set forth.

72. In an apparatus such as described, the combination with character designating keys, of an indicator embodying the following elements, to wit: a main rack with means for controlling its movement in accordance with the body widths of the type designated; a supplemental rack; a projection on the main rack adapted to co-operate with and move the supplemental rack at a predetermined point in the travel of the main rack; an indicator moved by the supplemental rack and a locking pawl interposed between the main and supplemental racks for holding them in their correct relative positions while moving in unison; substantially as described. 5 10

73. In an apparatus such as described, the combination with character designating keys, or an indicator embodying the following elements, to wit: a main rack with means for controlling its movement in accordance with the body widths of the type designated; a supplemental rack; a projection on the main rack adapted to co-operate with and move the supplemental rack at a predetermined point in the travel of the main rack; an indicator moved by the supplemental rack; a locking pawl interposed between the main and supplemental racks; a releasing arm for said locking pawl and a resetting mechanism for the main rack controlling said releasing arm; substantially as described. 15 20

74. In an apparatus such as described, the combination of the following elements, to wit: character designating keys; justification designating keys; a units wheel having zero teeth or projections thereon and adapted to be released and controlled by said keys; an indicator controlled by said units wheel and a zero stop for resetting said units wheel, thrown into operative position by the operation of any one of the justification keys; substantially as described. 25

75. In an apparatus such as described, the combination of the following elements, to wit: the character designating keys; justification designating keys; an indicator; a units wheel controlling said indicator and itself controlled by the character designating keys; a motor for said units wheel; a ratchet connection between said motor and units wheel; a resetting mechanism for the motor and a zero stop for positioning the units wheel controlled by the justification designating keys; substantially as described. 30 35

76. In a character designating apparatus, the combination with character designating keys; justification designating keys and an indicator controlling a units wheel having a series of zero teeth or projections thereon, of a motor for impelling said units wheel constantly in one direction, a ratchet interposed between the motor and units wheel, with a resetting mechanism for the motor, and a zero stop for co-operating with the teeth or projections on the units wheel and connections between the justification designating keys and the zero stop, whereby when said justification keys are operated, the units wheel is permitted to advance to a zero point prior to the resetting of the motor; substantially as described. 40 45

77. In a character designating apparatus, the combination with character designating keys, justification designating keys, a units wheel, an indicator controlled by said units wheel, and a motor for impelling said units wheel in one direction, of a zero stop normally in position to arrest the units wheel at a zero point, a resetting mechanism for the motor and connections between the resetting mechanism and zero stop for holding the stop out of operative position save when the resetting mechanism is being operated, substantially as described. 50

78. In a character designating apparatus, the combination with character designating keys, justification designating keys, a units wheel, an indicator controlled by said units wheel, and a motor for impelling said units wheel in one direction, of a zero stop normally in position to arrest the units wheel at a zero point, a resetting mechanism for the motor, connections between the resetting 55

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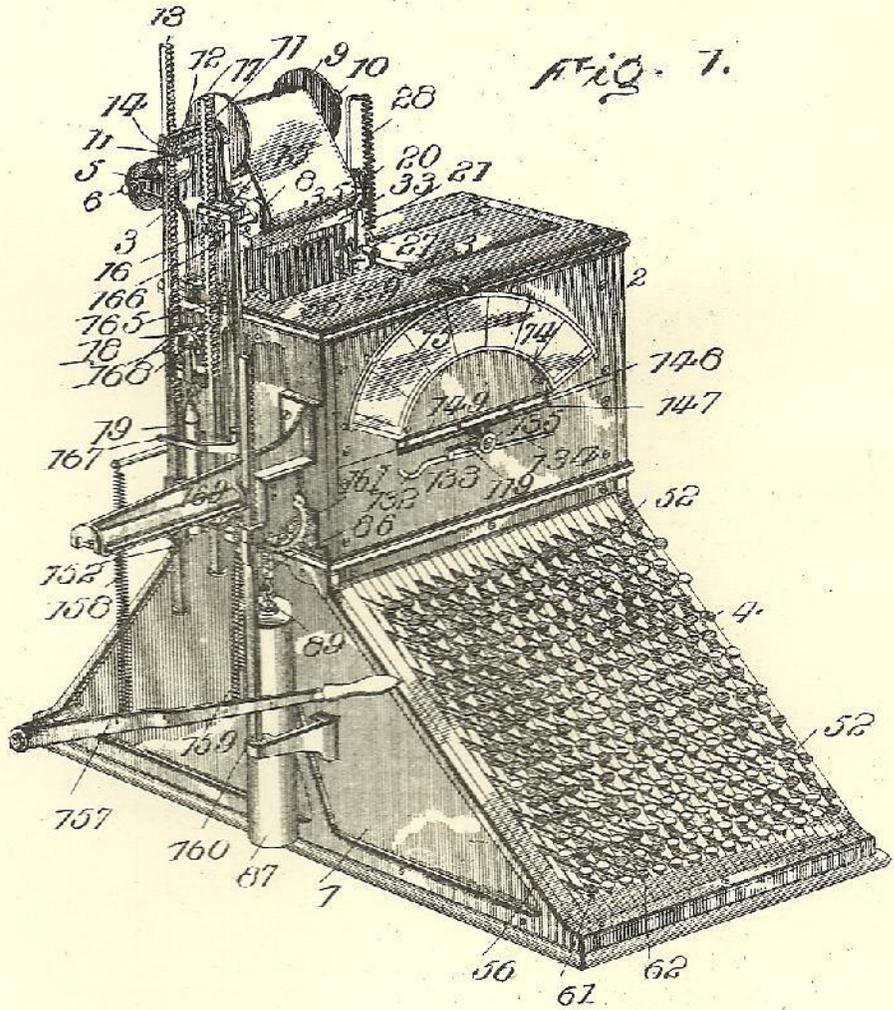
mechanism and zero stop embodying a releasing pawl and connections between the justification designating keys and said releasing pawl, whereby when the justification keys are operated, the units wheel will advance under the influence of its motor to a zero point; substantially as described.

79. In a character designating apparatus, the combination with character designating keys, justification designating keys, a units wheel, an indicator controlled by said units wheel, and a motor for impelling said units wheel in one direction a zero stop normally in position to arrest the units wheel at a zero point, a resetting mechanism for the motor, connections between the resetting mechanism and zero stop embodying a releasing pawl with means for holding said pawl out of engagement when released, and connections between said pawl and the justification designating keys, whereby upon the operation of said justification designating keys, the pawl is released, the units wheel permitted to advance under the influence of its motor to a zero point and further movement of the units wheel prevented until the mechanism has been reset; substantially as described.

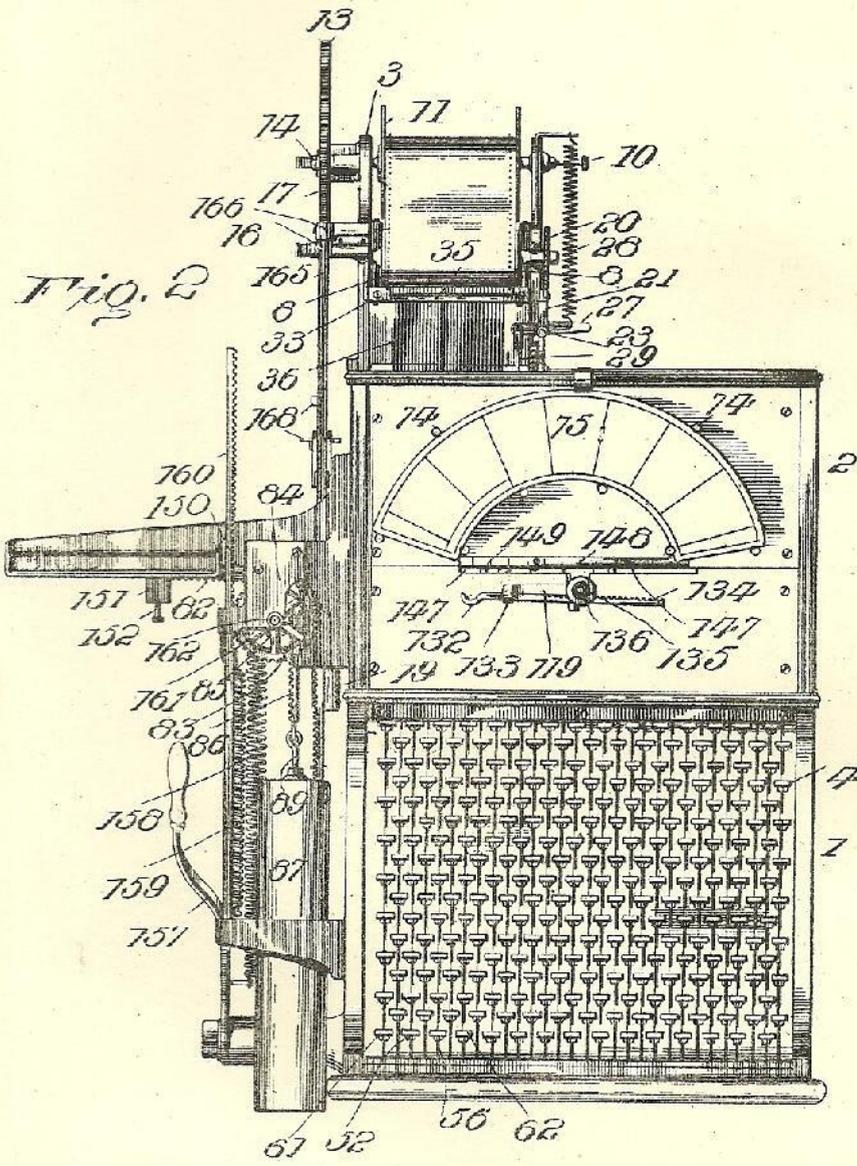
80. In a character designating apparatus the combination of the following elements, to wit; key controlled character designating mechanism; an indicating mechanism embodying a horizontally movable rack bar; a line scale indicator controlled by the rack bar; a resetting mechanism for the rack bar, and an adjustable stop for determining the normal position of the rack bar or the length of the line; as set forth.

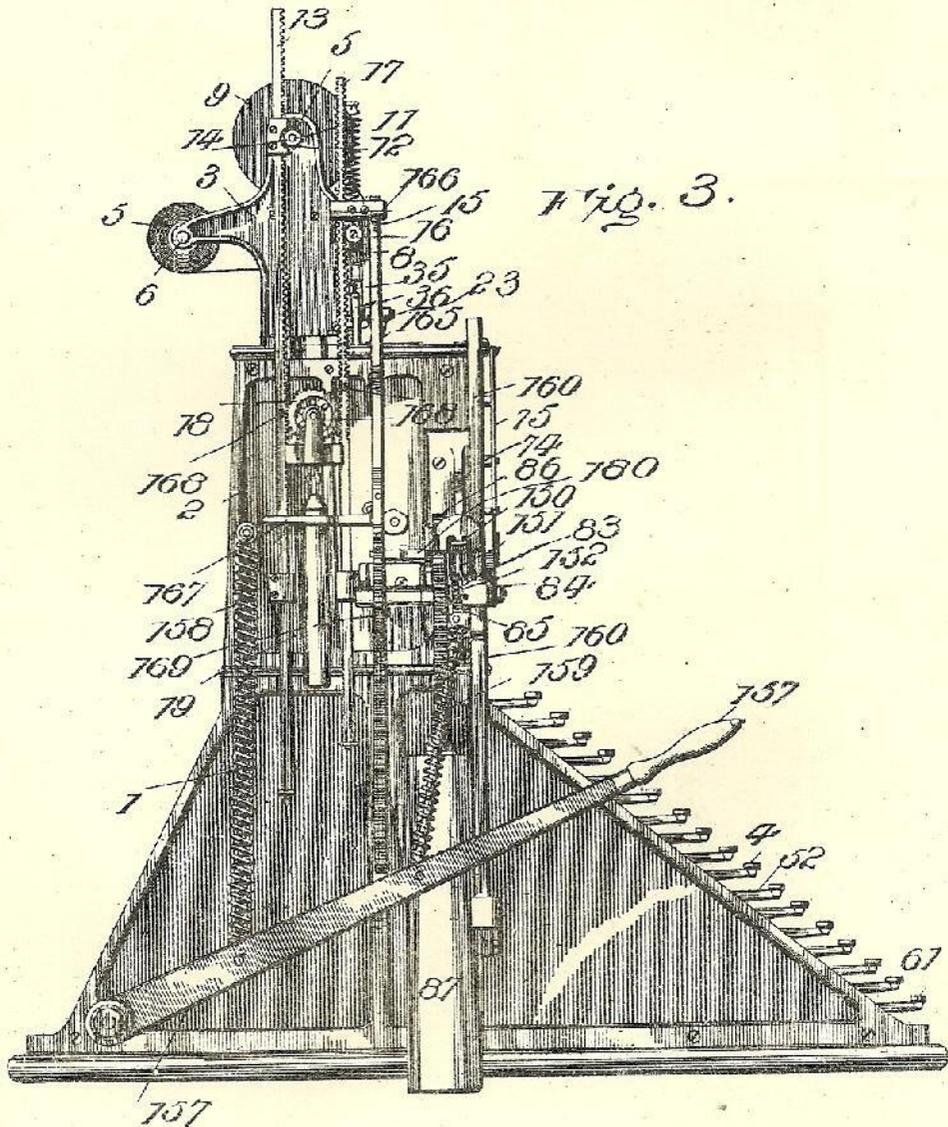
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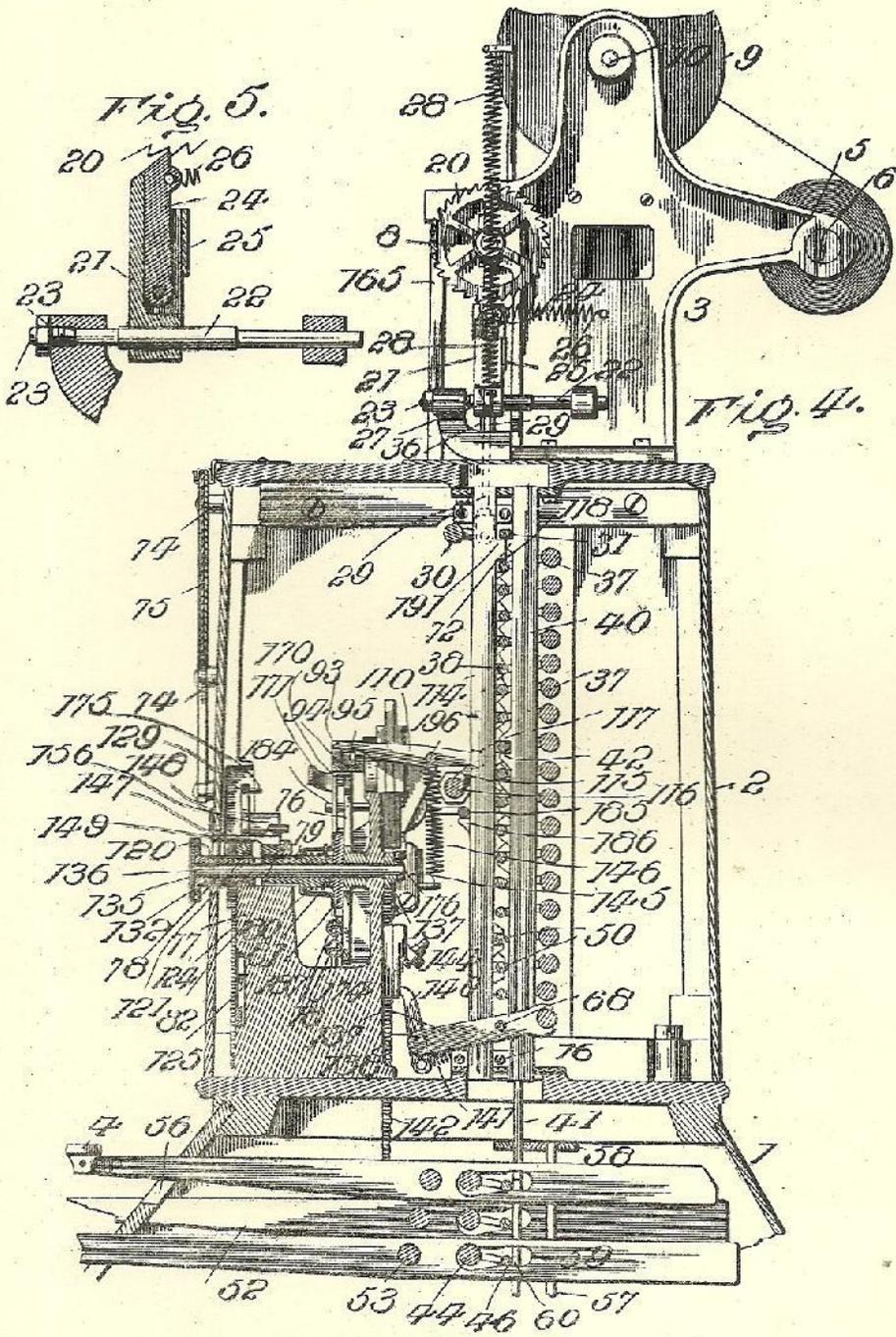
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Agents for the Applicant.



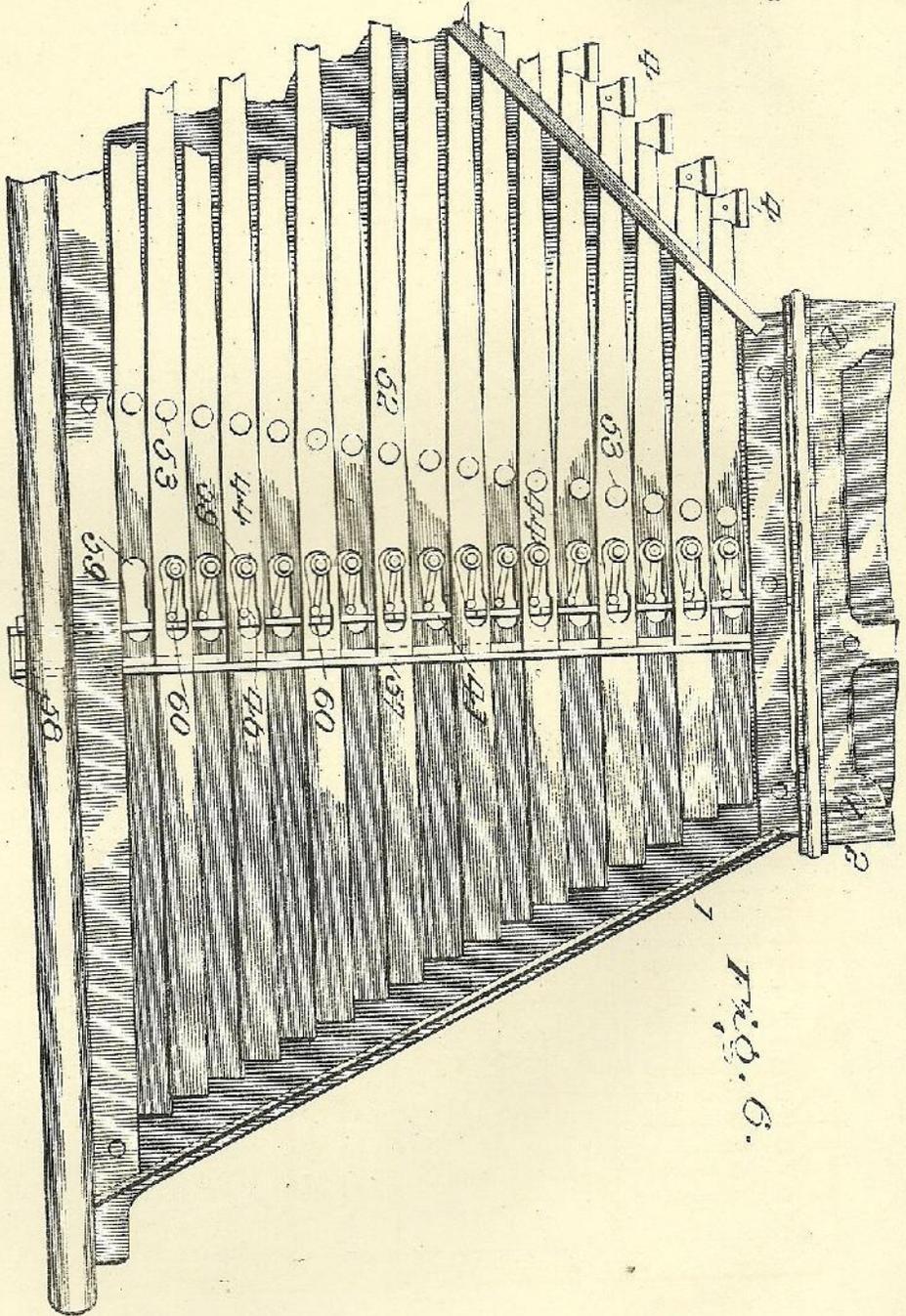
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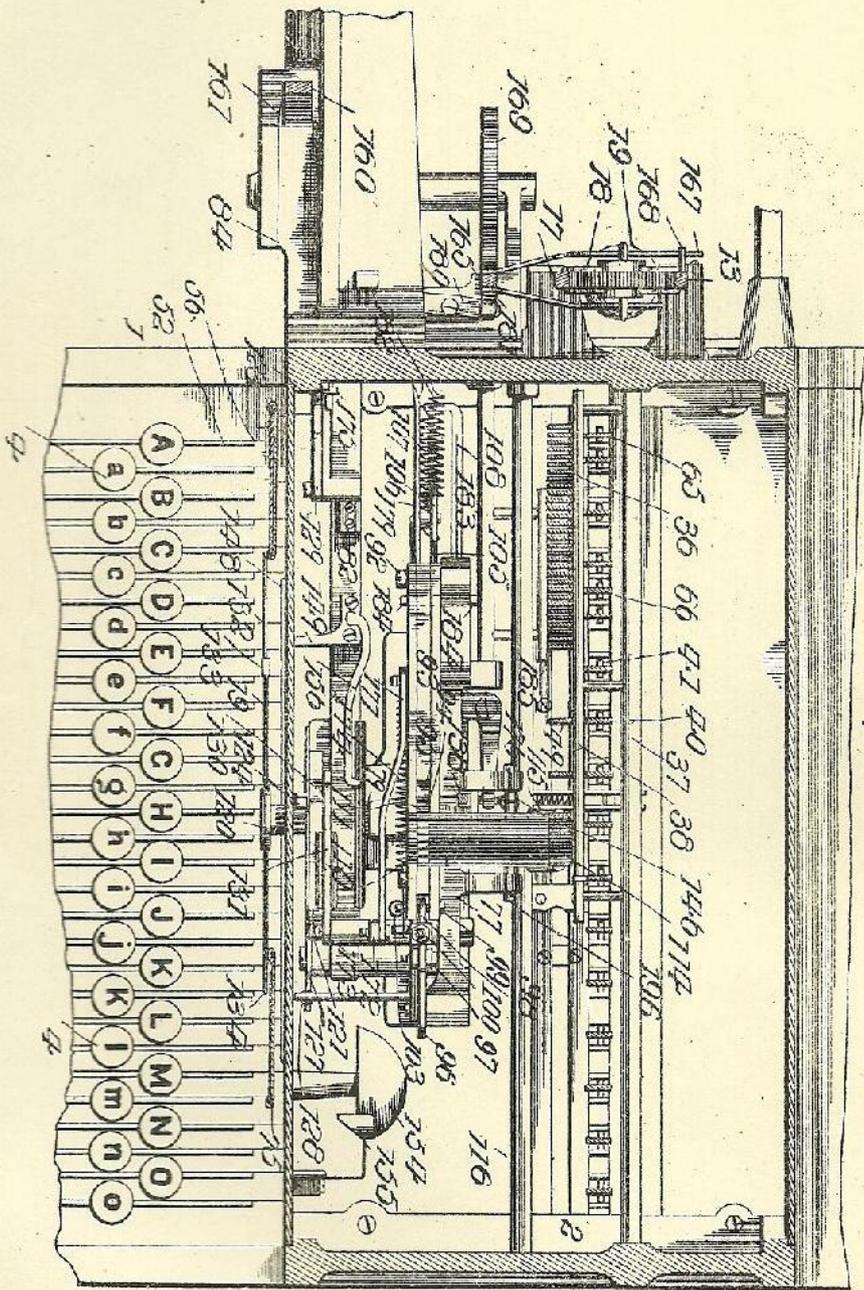
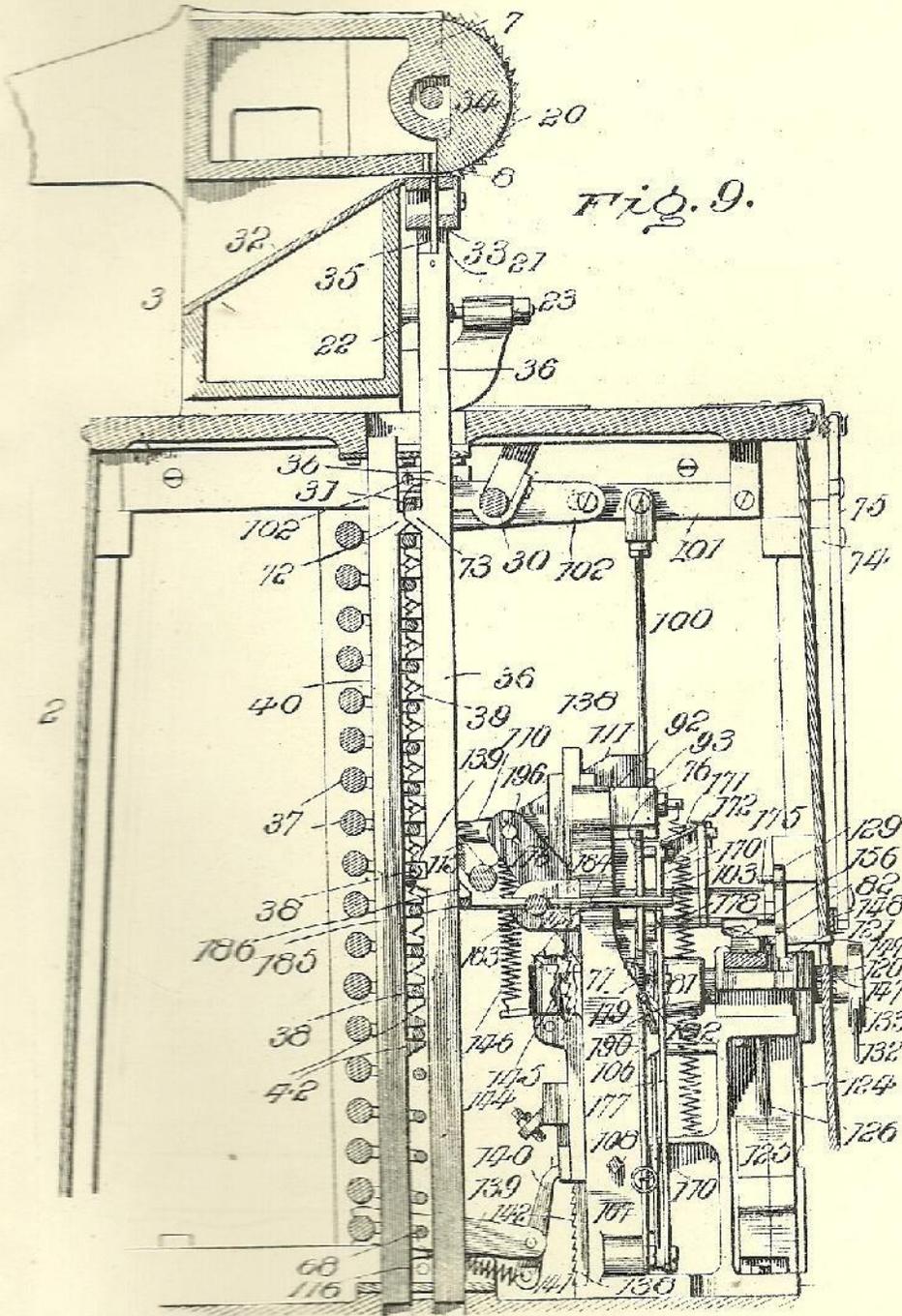


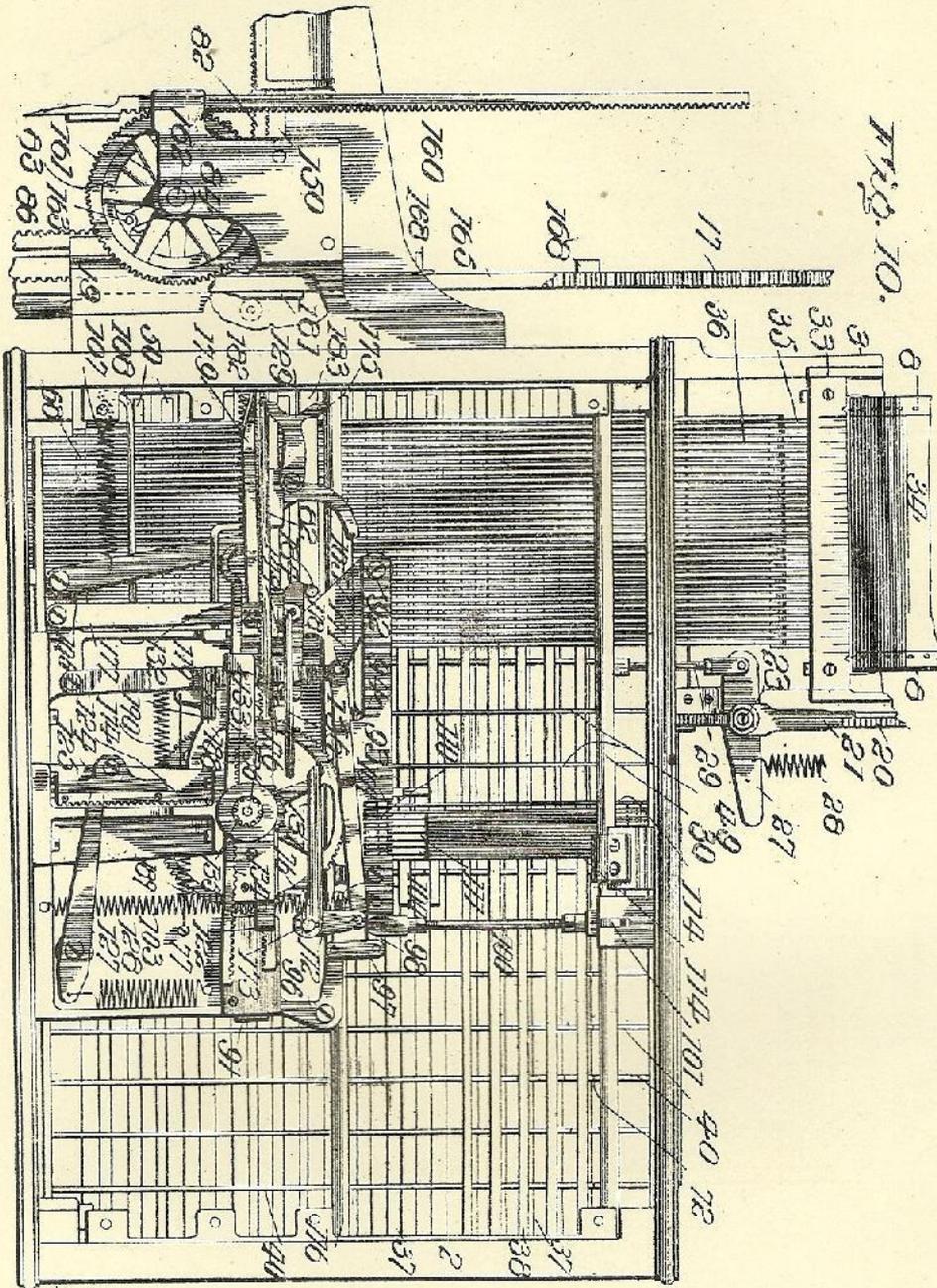
FIG. 7.

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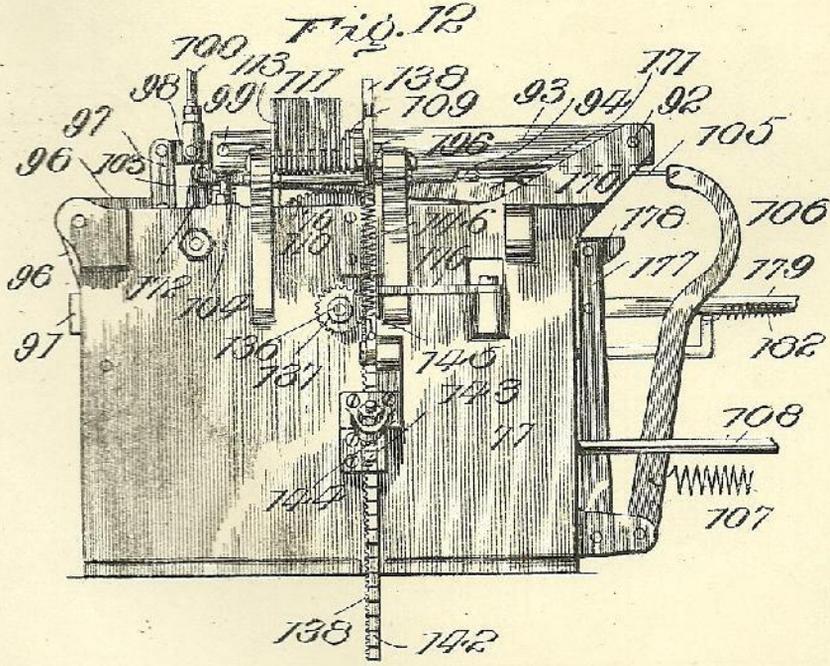
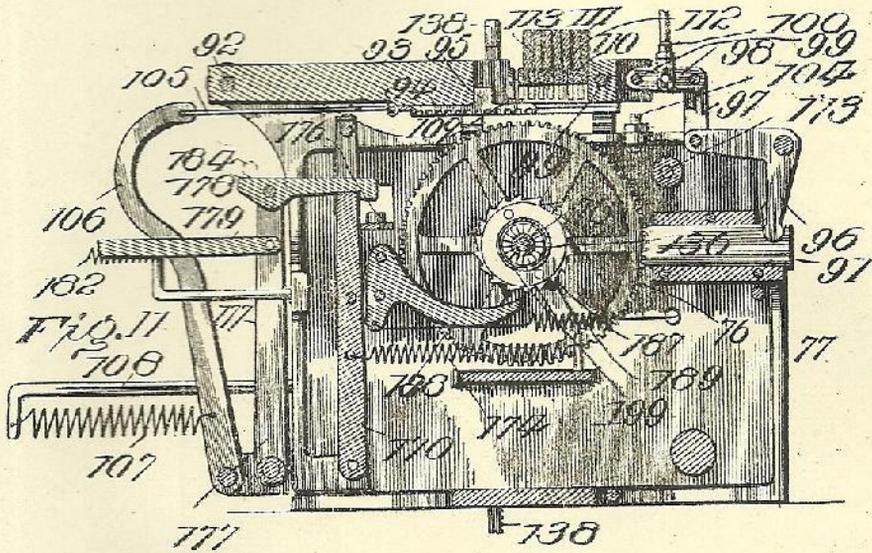


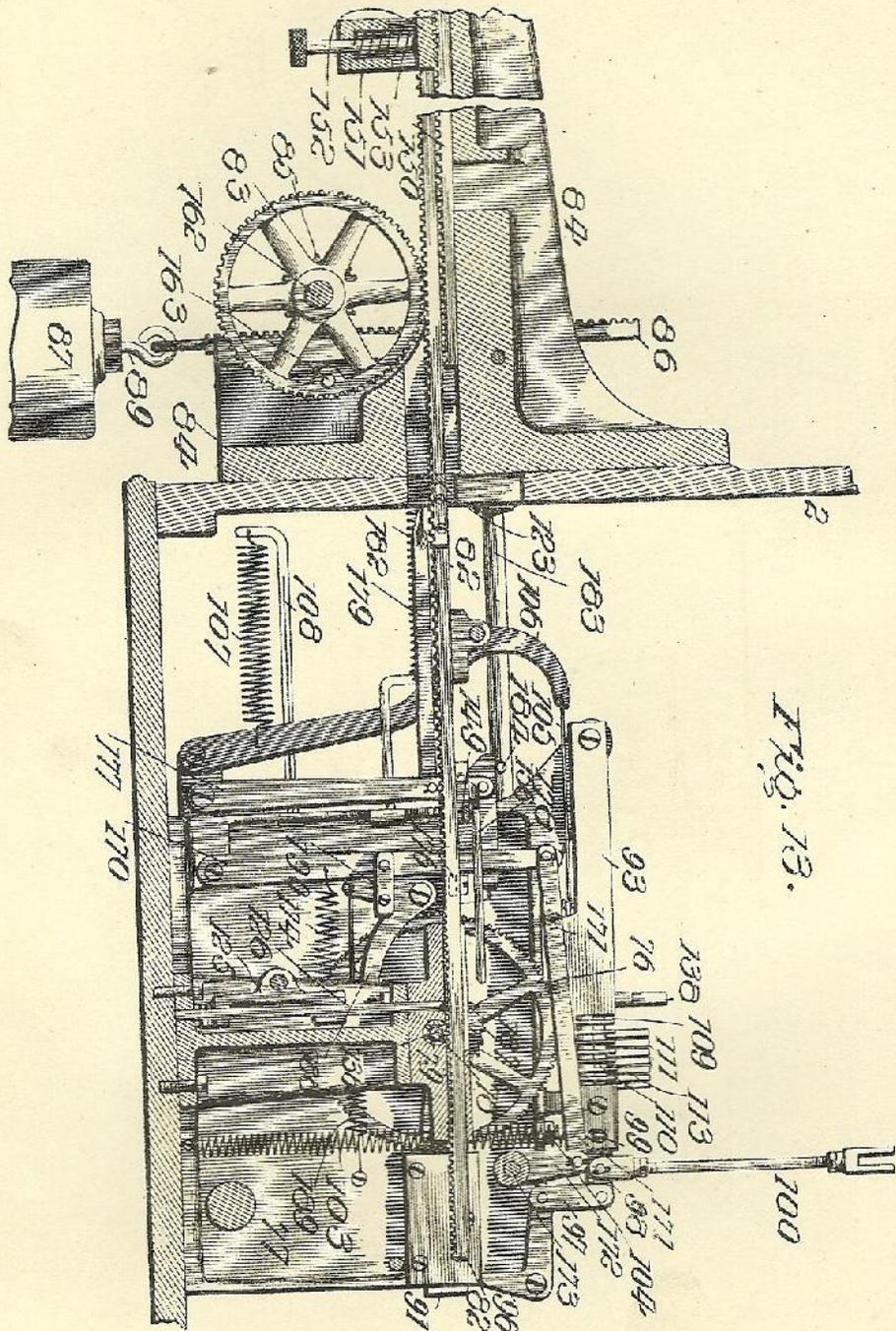


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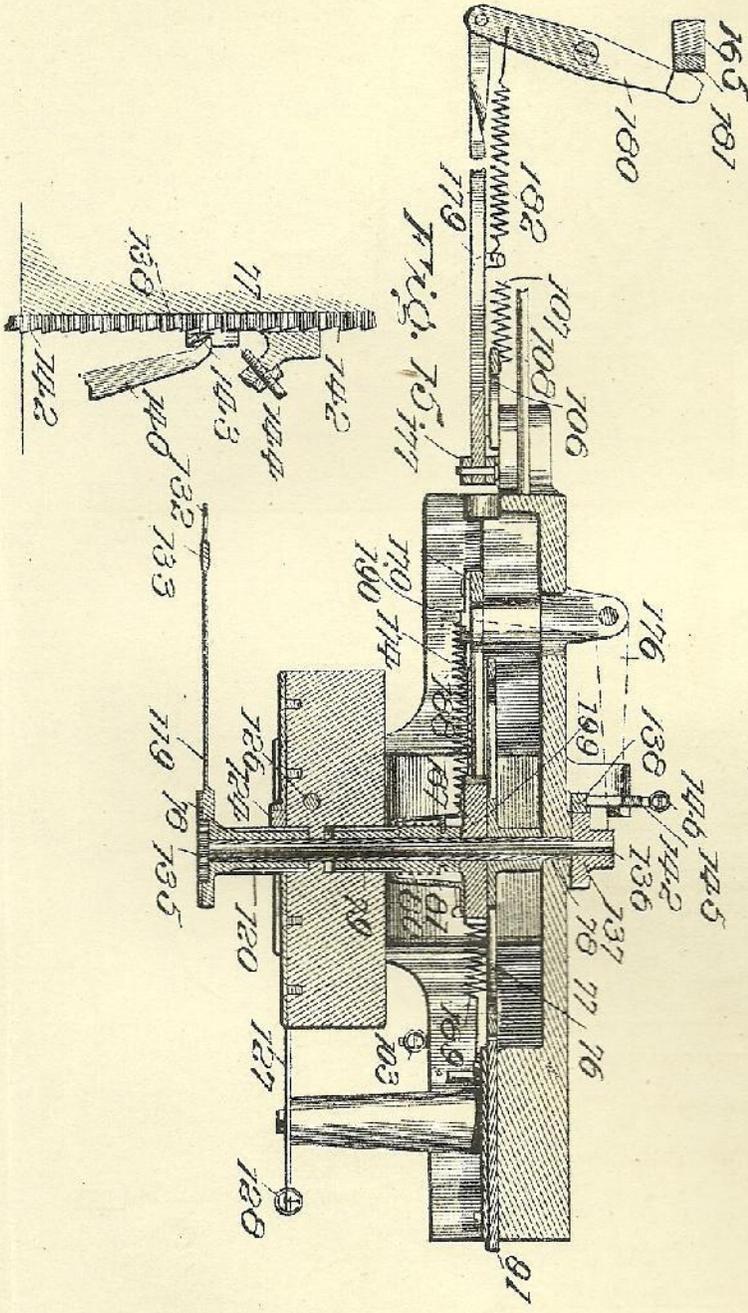
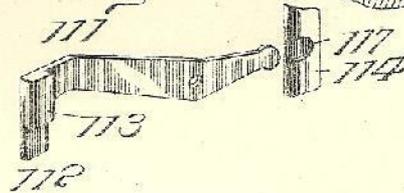
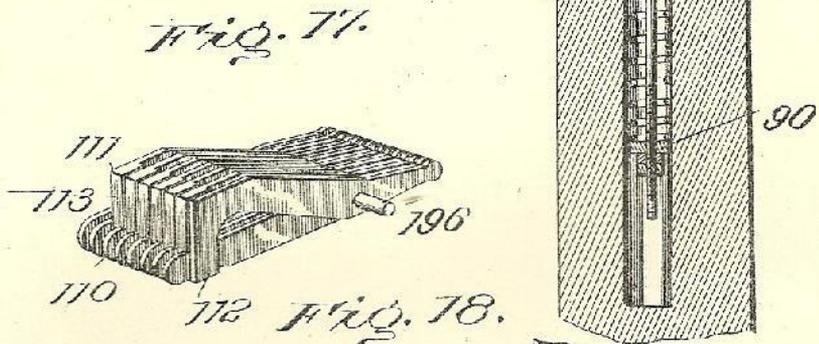
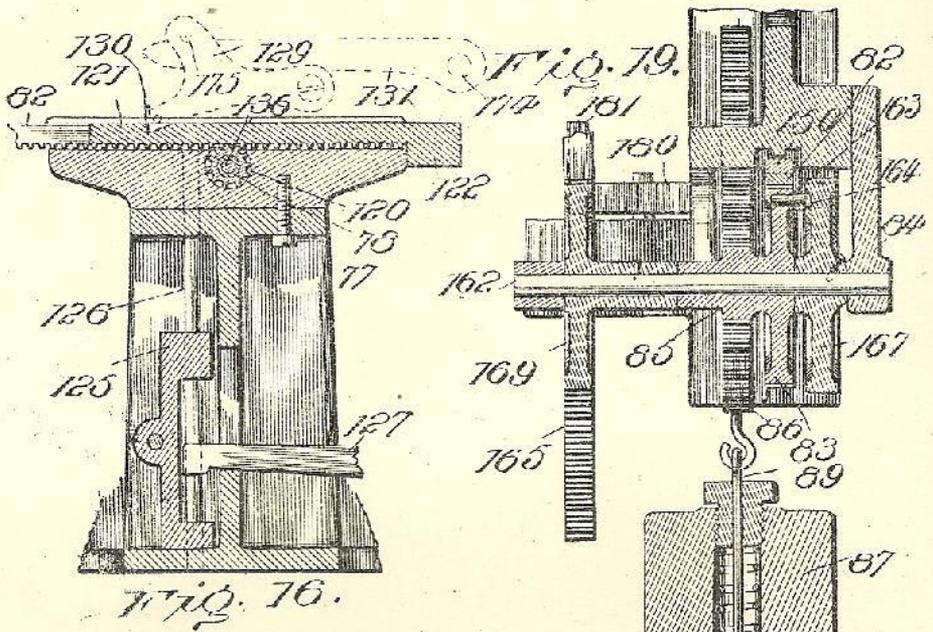


FIG. 14.

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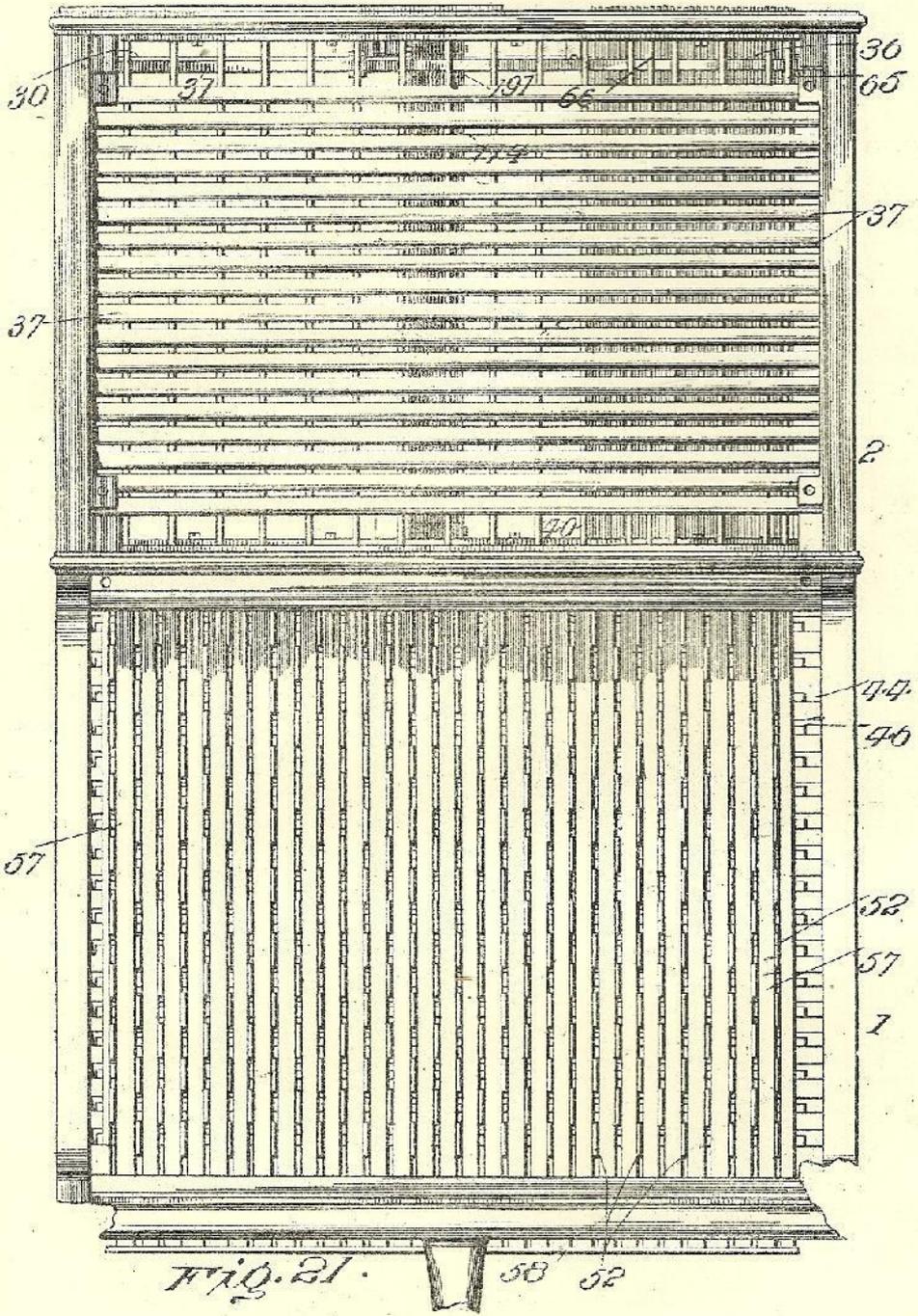
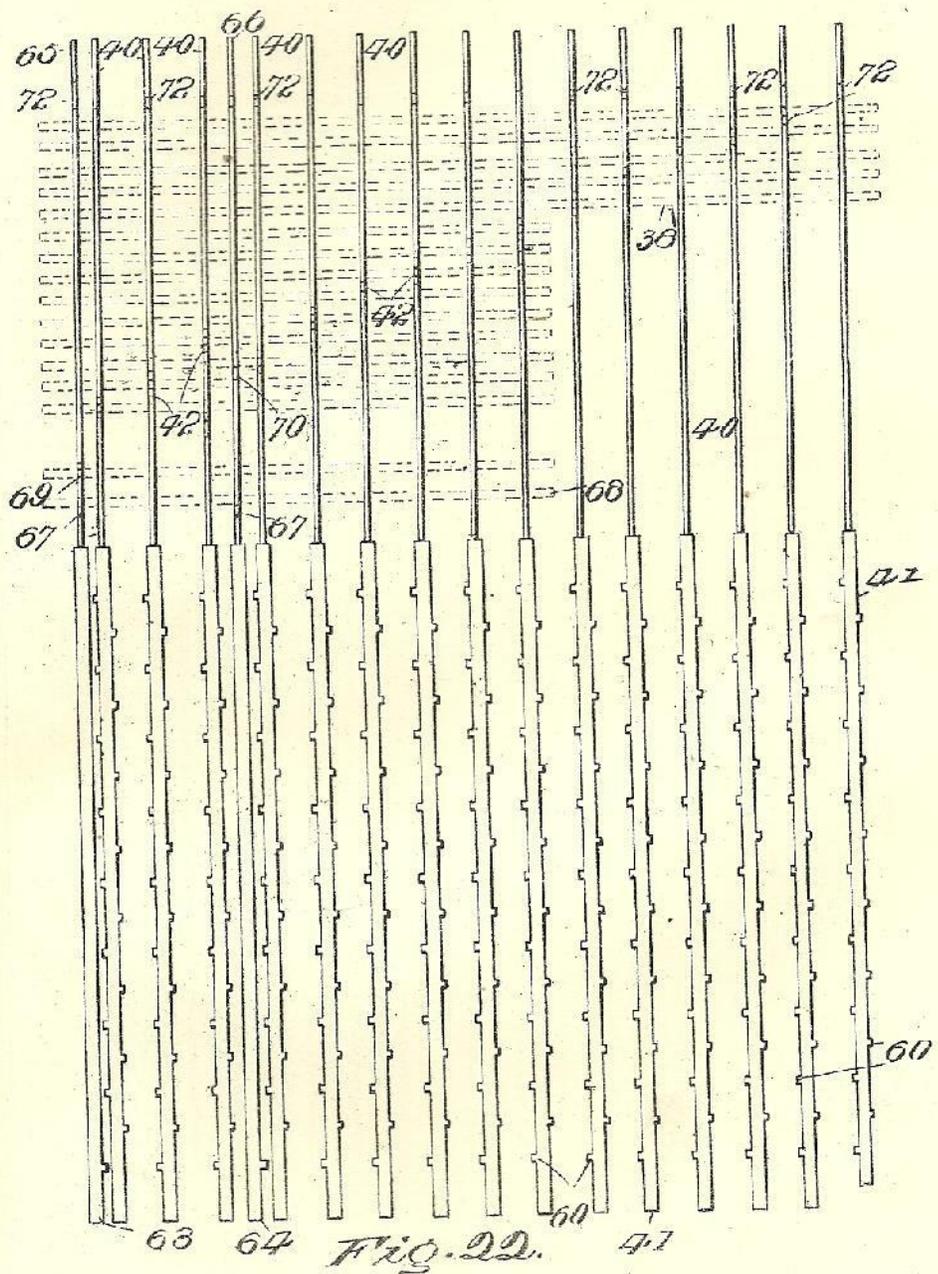
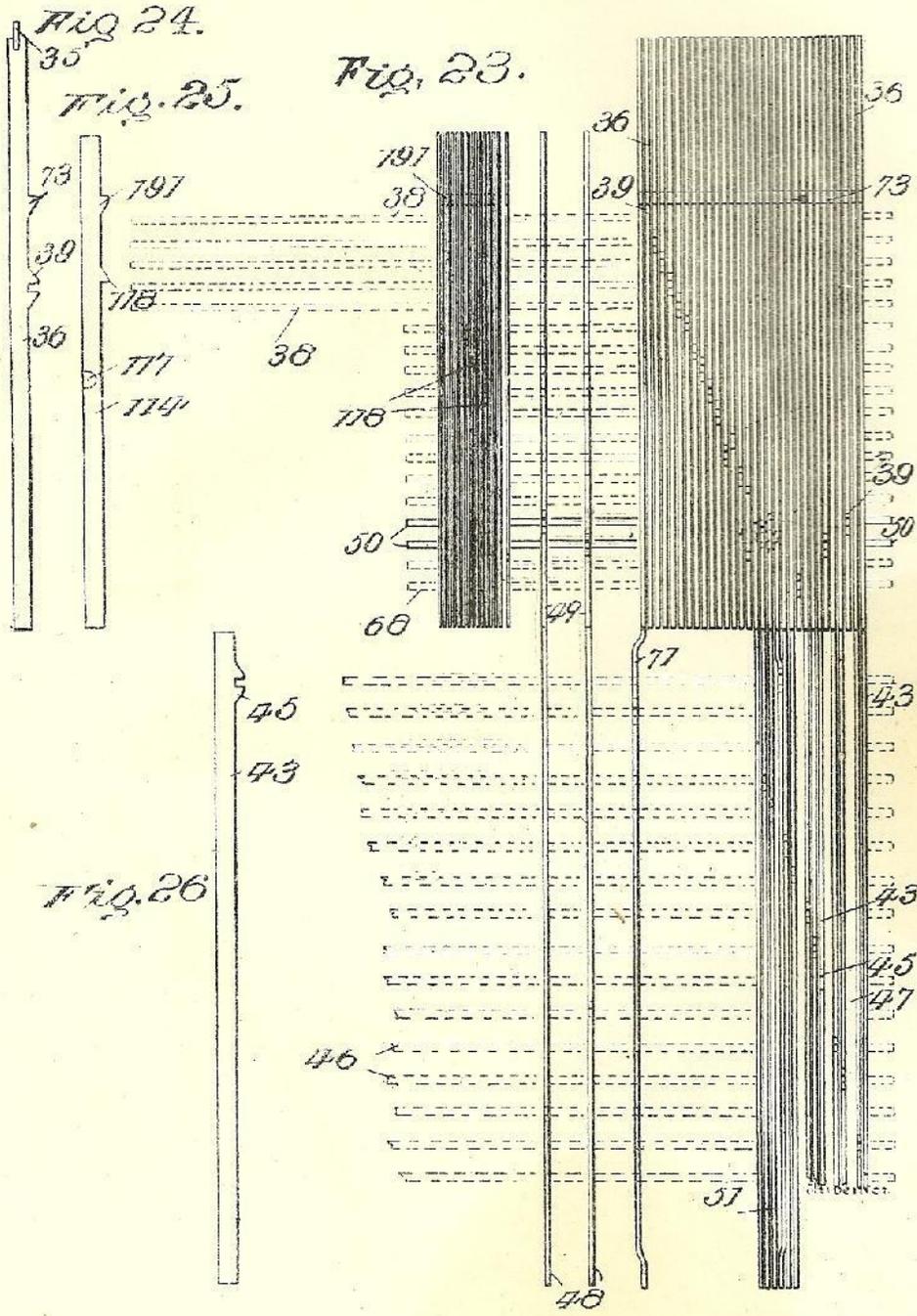
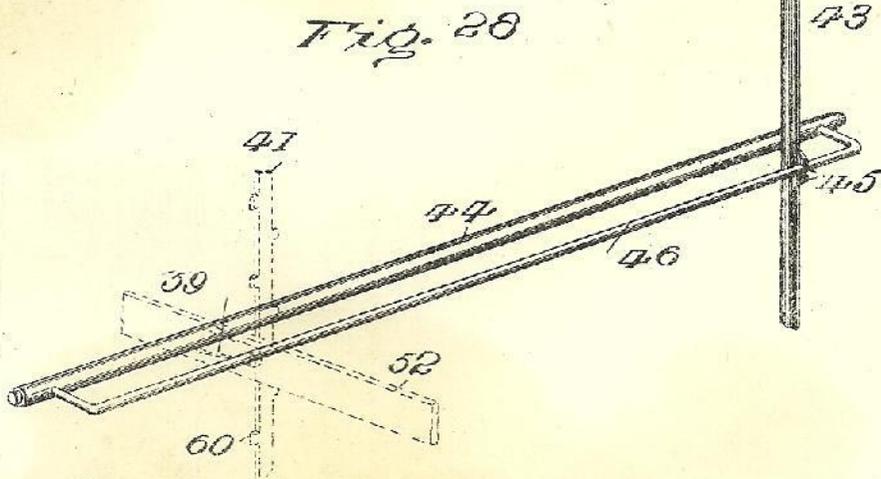
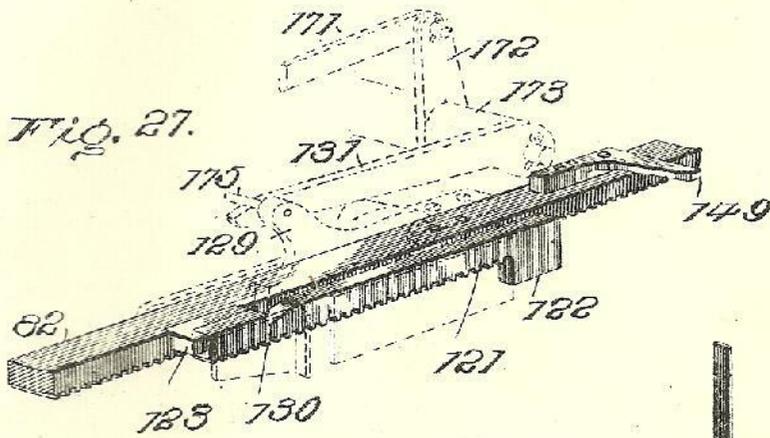


FIG. 21.



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