June 4, 1963 J. H. WILLIAMS 3,092,000

STEP BY STEP LINEAR FEED MECHANISM FOR PHOTO-TYPE COMPOSING MACHINES

Filed Nov. 20, 1959 13 Sheets-Sheet 1

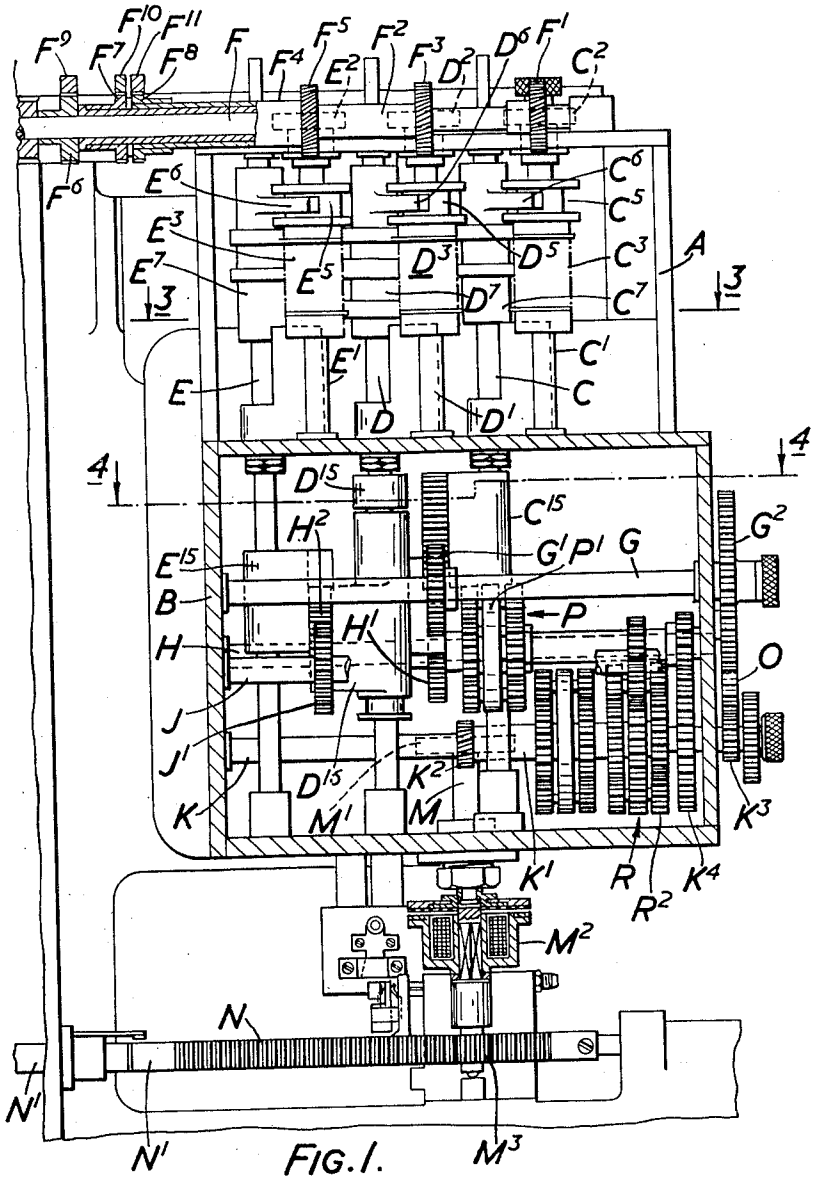


FIG. 1.

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Filed Nov. 20, 1959 13 Sheets-Sheet 2

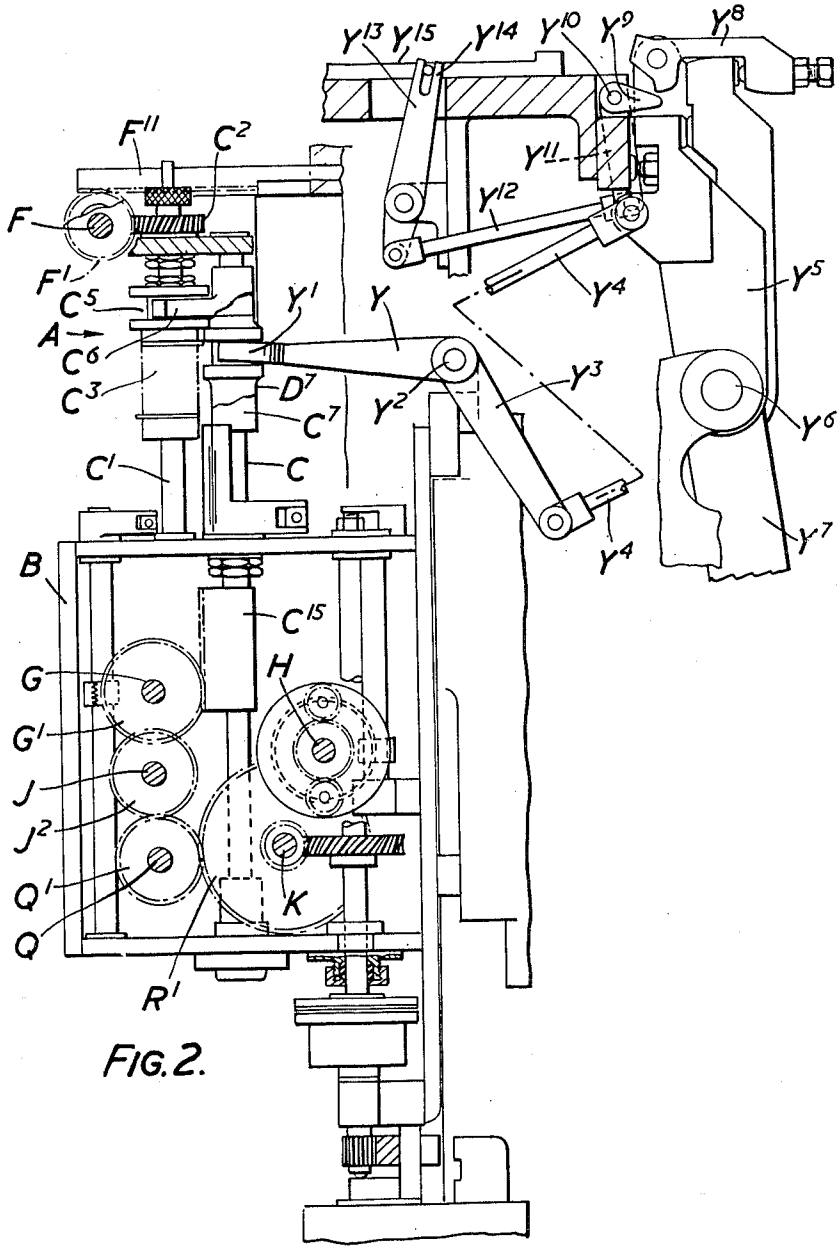


FIG. 2.

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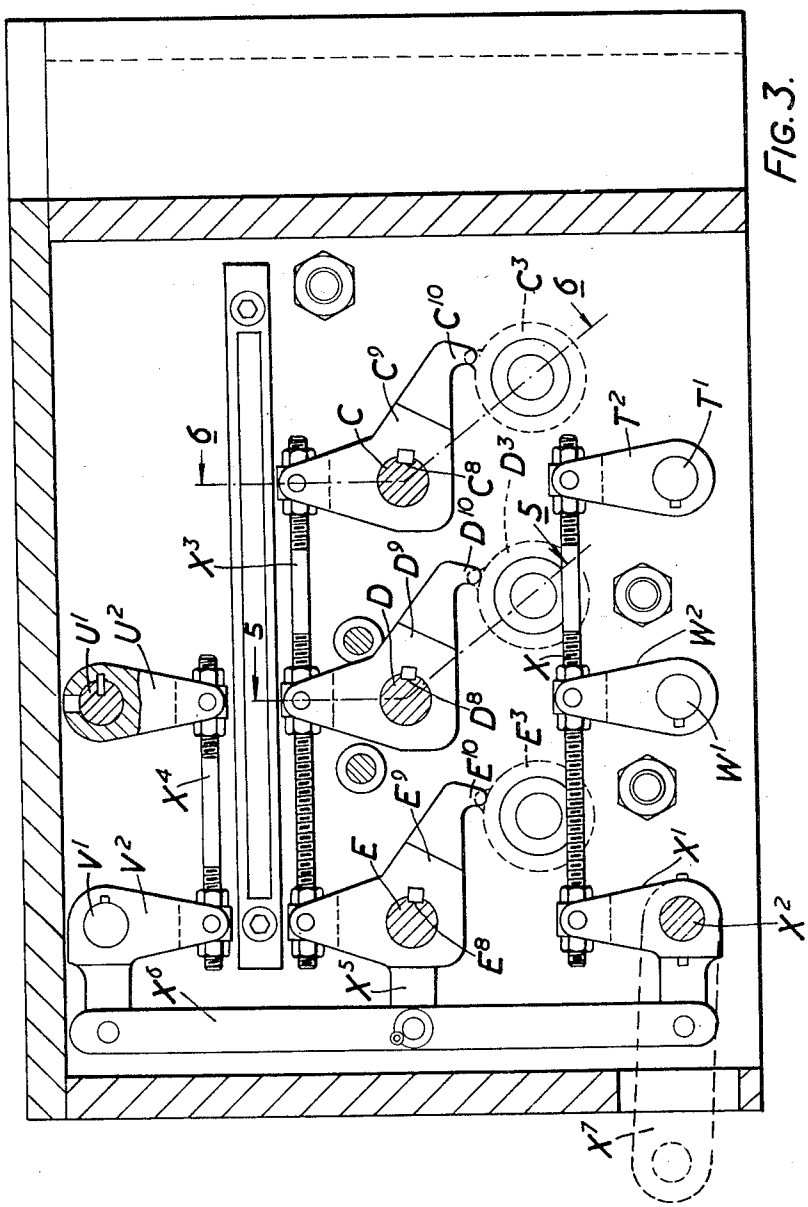
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June 4, 1963 J. H. WILLIAMS 3,092,000

STEP BY STEP LINEAR FEED MECHANISM FOR PHOTO-TYPE COMPOSING MACHINES

Filed Nov. 20, 1959 13 Sheets-Sheet 3

FIG. 3.



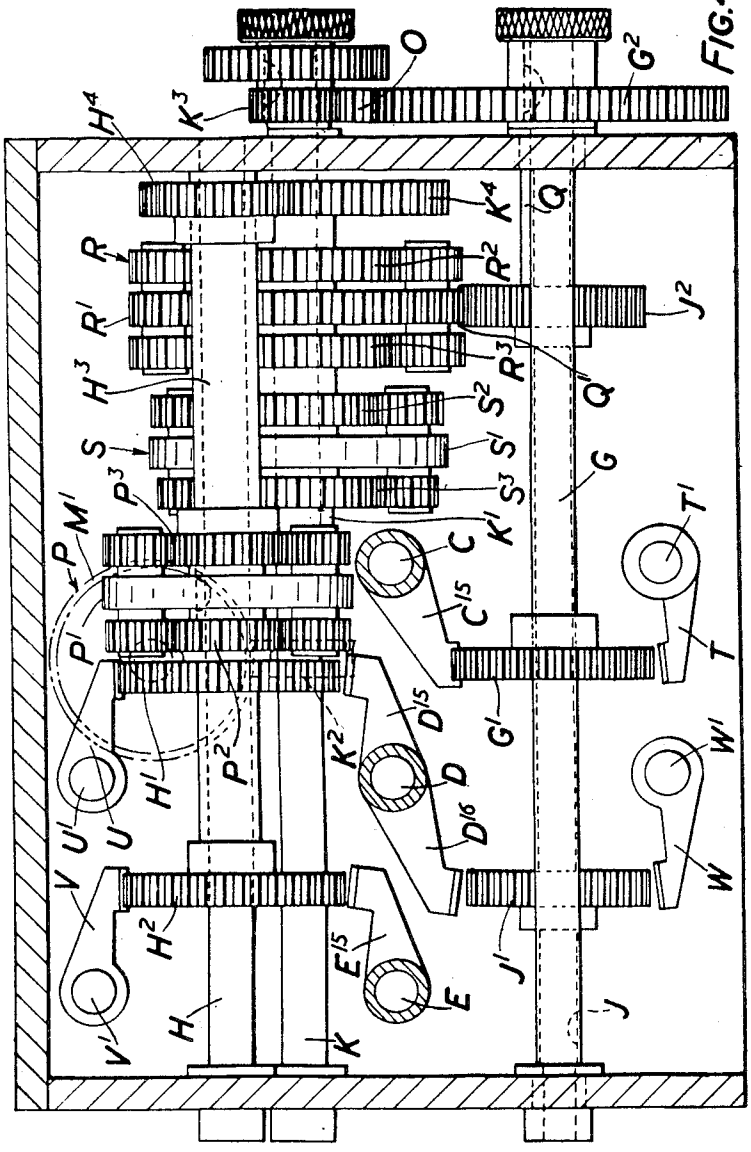
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June 4, 1963 J. H. WILLIAMS 3,092,000

STEP BY STEP LINEAR FEED MECHANISM FOR PHOTO-TYPE COMPOSING MACHINES

Filed Nov. 20, 1959 13 Sheets-Sheet 4

FIG. 4.



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STEP BY STEP LINEAR FEED MECHANISM FOR PHOTO-TYPE COMPOSING MACHINES

Filed Nov. 20, 1959 13 Sheets-Sheet 5

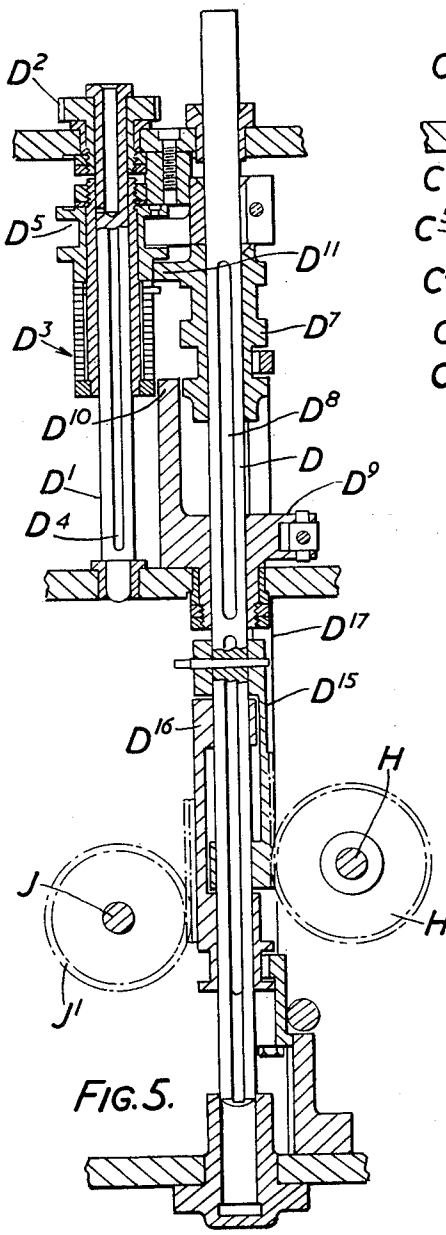


FIG. 5.

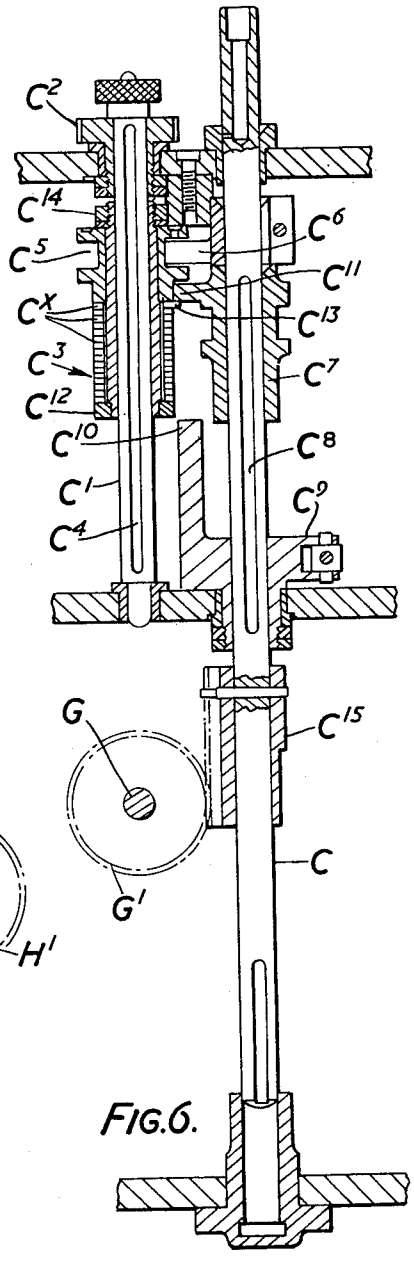


FIG. 6.

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STEP BY STEP LINEAR FEED MECHANISM FOR PHOTO-TYPE COMPOSING MACHINES

Filed Nov. 20, 1959 13 Sheets-Sheet 6

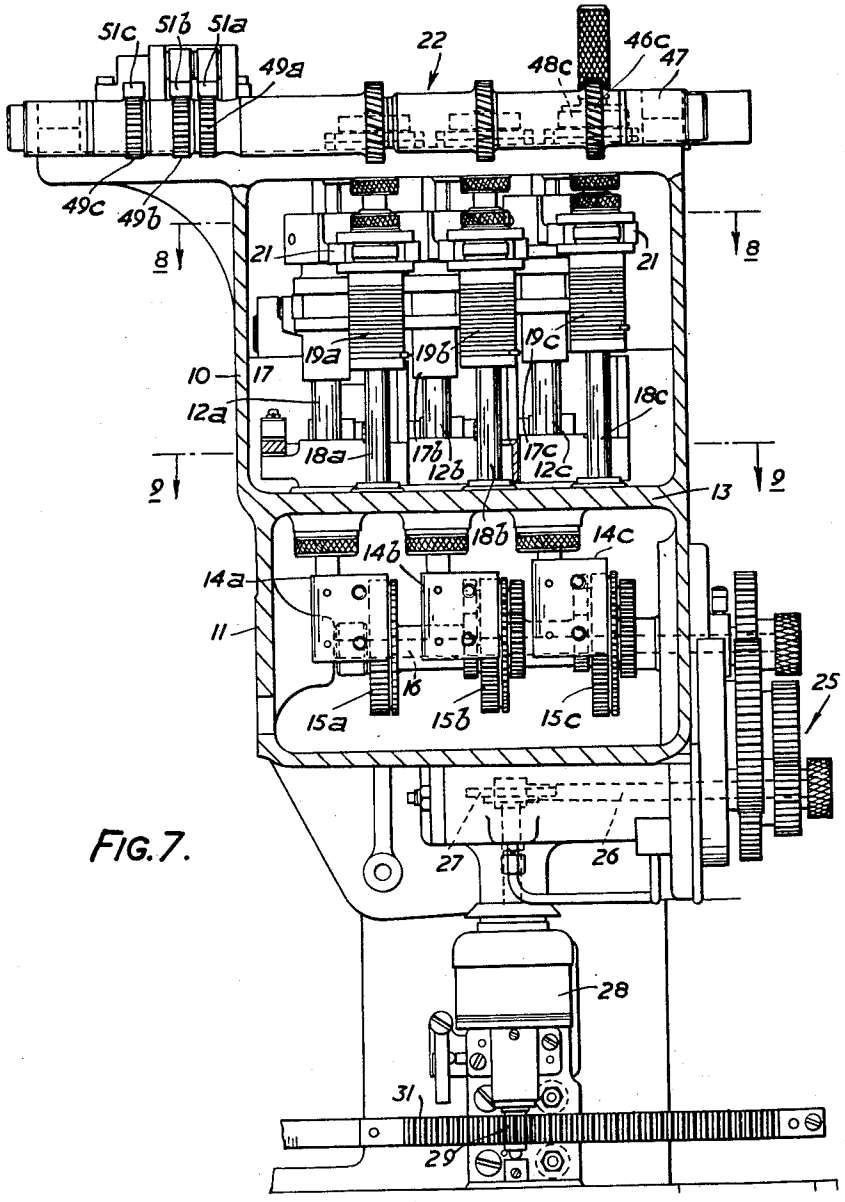


FIG. 7.

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June 4, 1963 J. H. WILLIAMS 3,092,000

STEP BY STEP LINEAR FEED MECHANISM FOR PHOTO-TYPE COMPOSING MACHINES

Filed Nov. 20, 1959 13 Sheets-Sheet 7

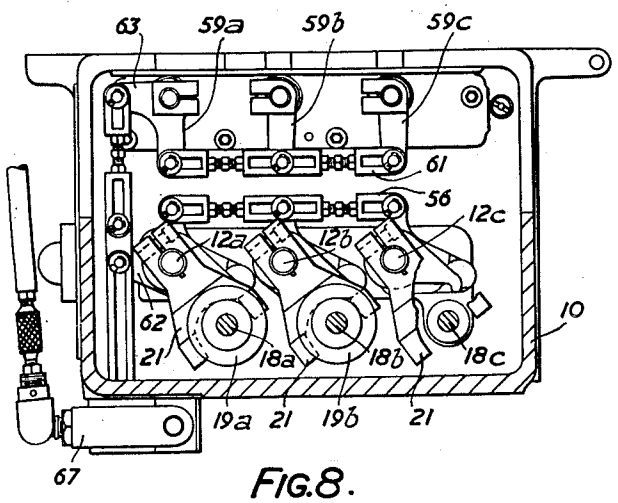


FIG. 8.

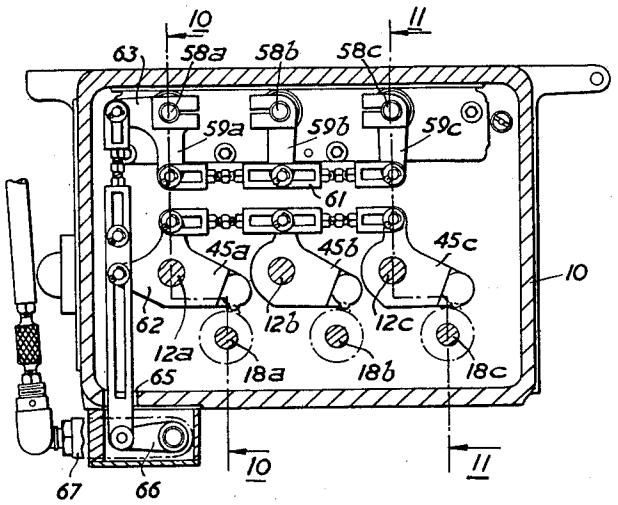


FIG. 9.

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June 4, 1963 J. H. WILLIAMS 3,092,000

STEP BY STEP LINEAR FEED MECHANISM FOR PHOTO-TYPE COMPOSING MACHINES

Filed Nov. 20, 1959 13 Sheets-Sheet 8

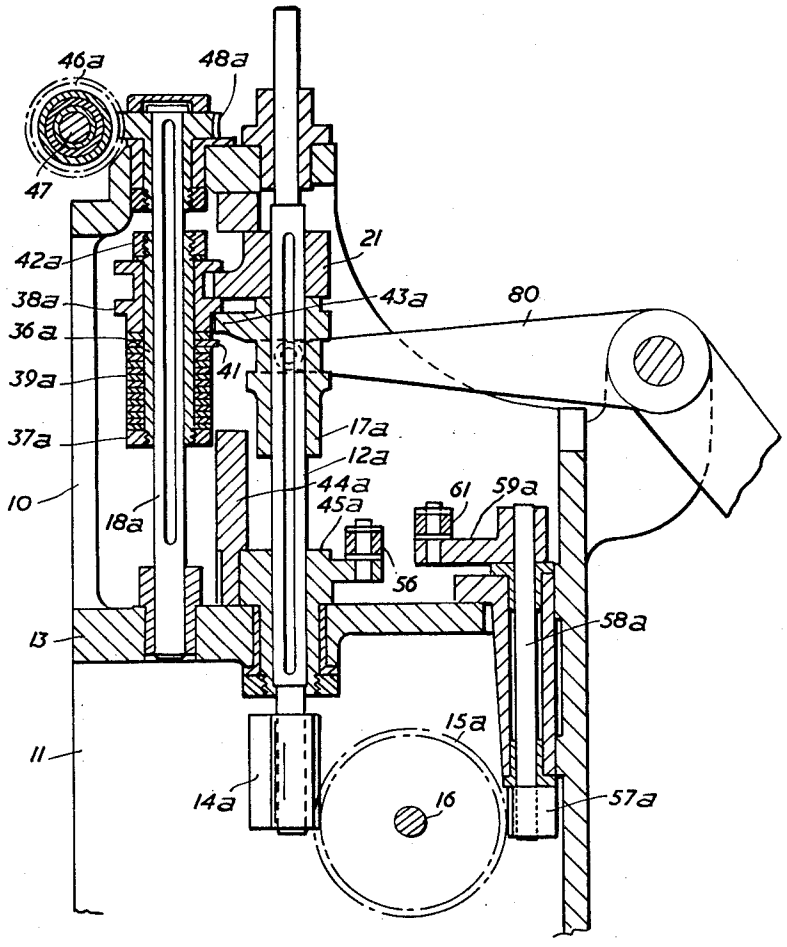


FIG. 10.

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June 4, 1963 J. H. WILLIAMS 3,092,000

STEP BY STEP LINEAR FEED MECHANISM FOR PHOTO-TYPE COMPOSING MACHINES

Filed Nov. 20, 1959 13 Sheets-Sheet 9

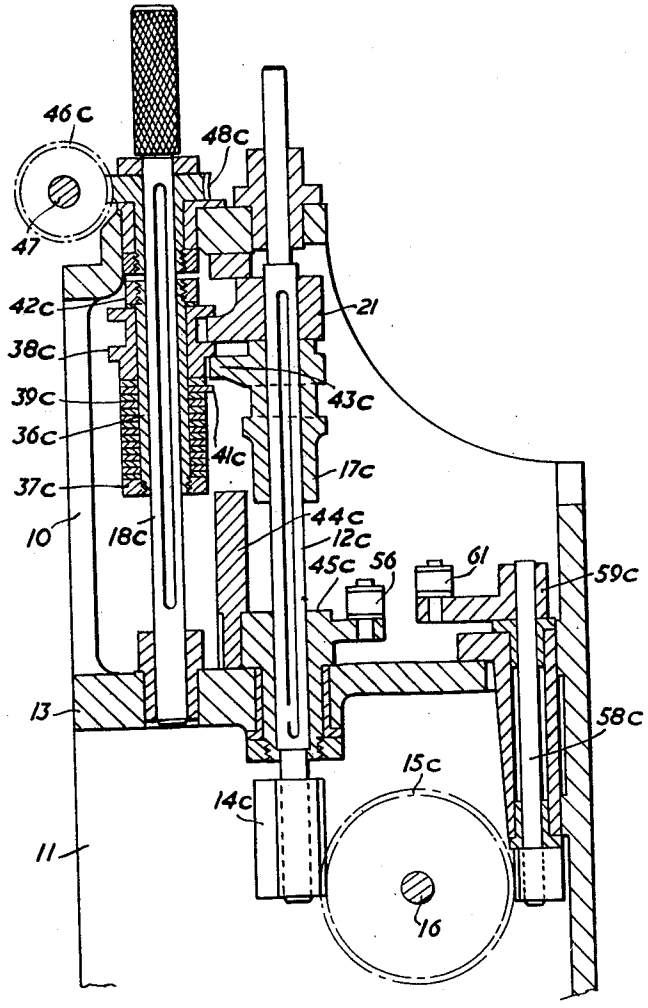


FIG. 11.

INVENTOR
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June 4, 1963 J. H. WILLIAMS 3,092,000

STEP BY STEP LINEAR FEED MECHANISM FOR PHOTO-TYPE COMPOSING MACHINES

Filed Nov. 20, 1959 13 Sheets-Sheet 10

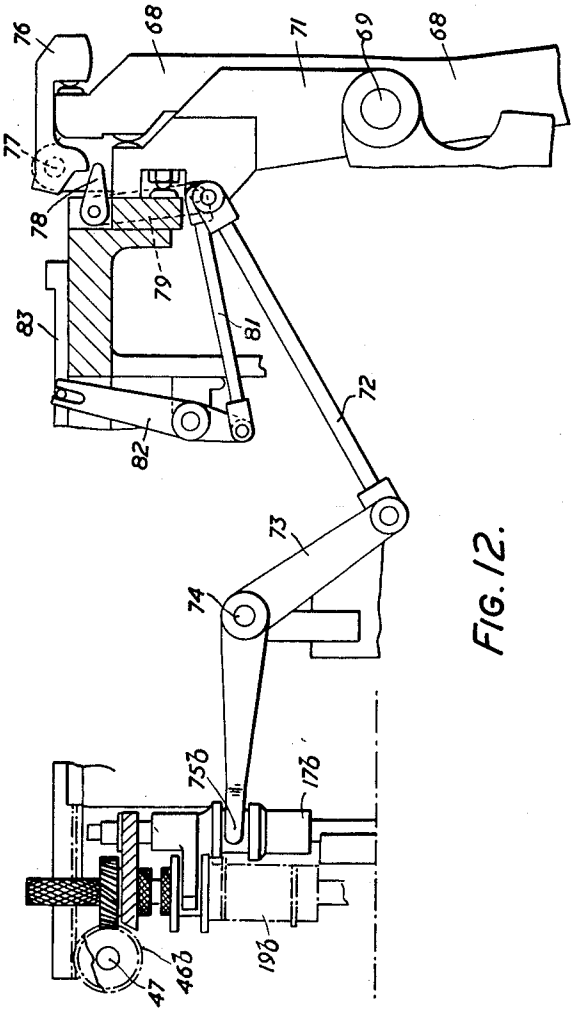


FIG. 12.

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June 4, 1963 J. H. WILLIAMS 3,092,000

STEP BY STEP LINEAR FEED MECHANISM FOR PHOTO-TYPE COMPOSING MACHINES

Filed Nov. 20, 1959 13 Sheets-Sheet 11

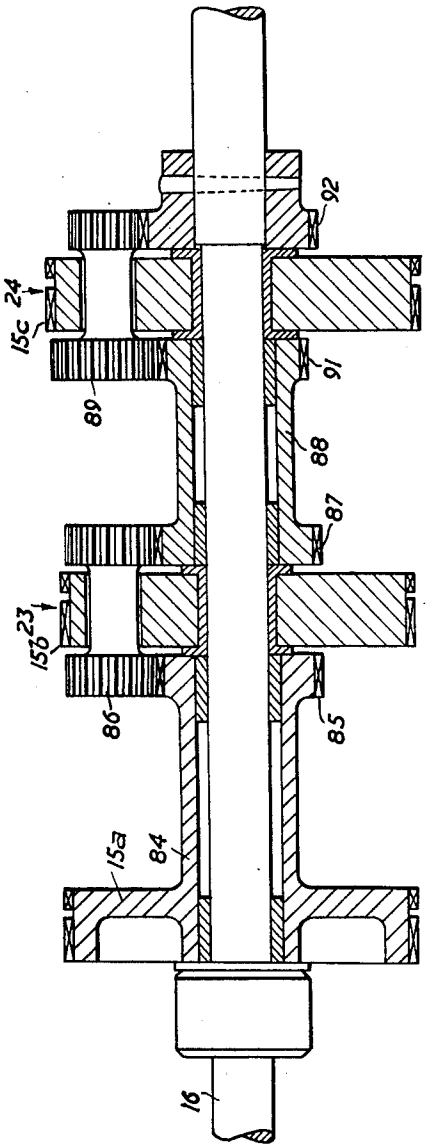


FIG. 13.

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June 4, 1963 J. H. WILLIAMS 3,092,000

STEP BY STEP LINEAR FEED MECHANISM FOR PHOTO-TYPE COMPOSING MACHINES

Filed Nov. 20, 1959 13 Sheets-Sheet 12

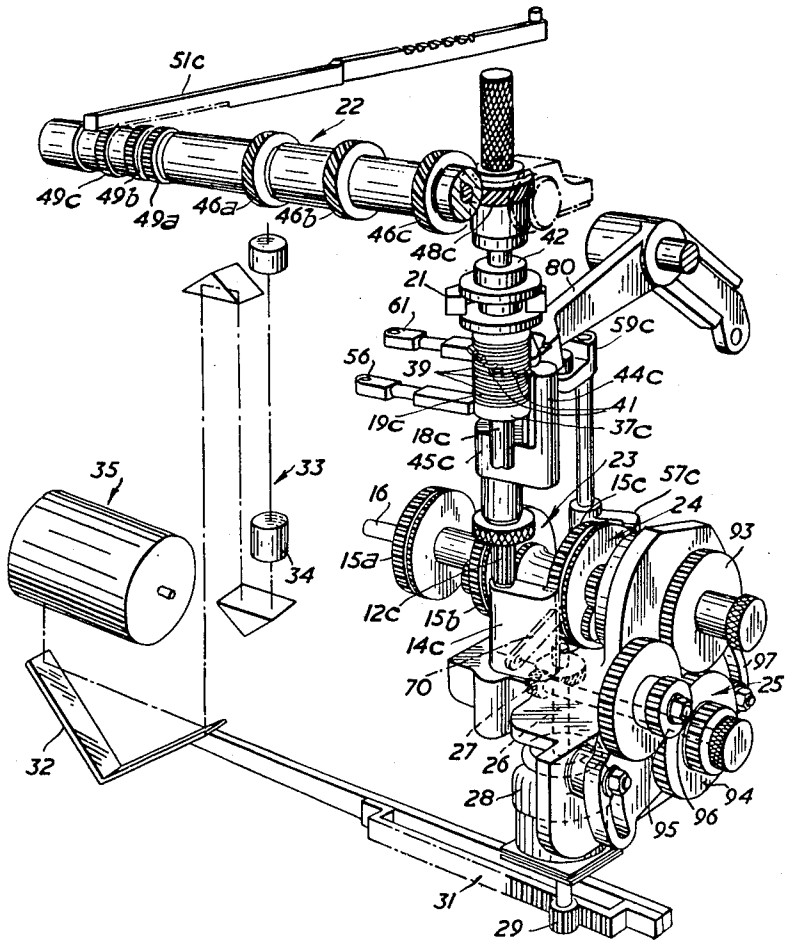


FIG. 14.

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June 4, 1963 J. H. WILLIAMS 3,092,000

STEP BY STEP LINEAR FEED MECHANISM FOR PHOTO-TYPE COMPOSING MACHINES

Filed Nov. 20, 1959 13 Sheets-Sheet 13

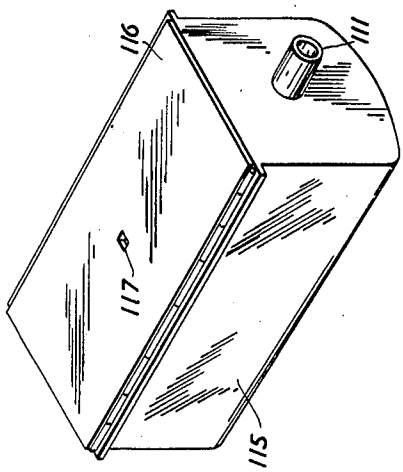


FIG. 17.

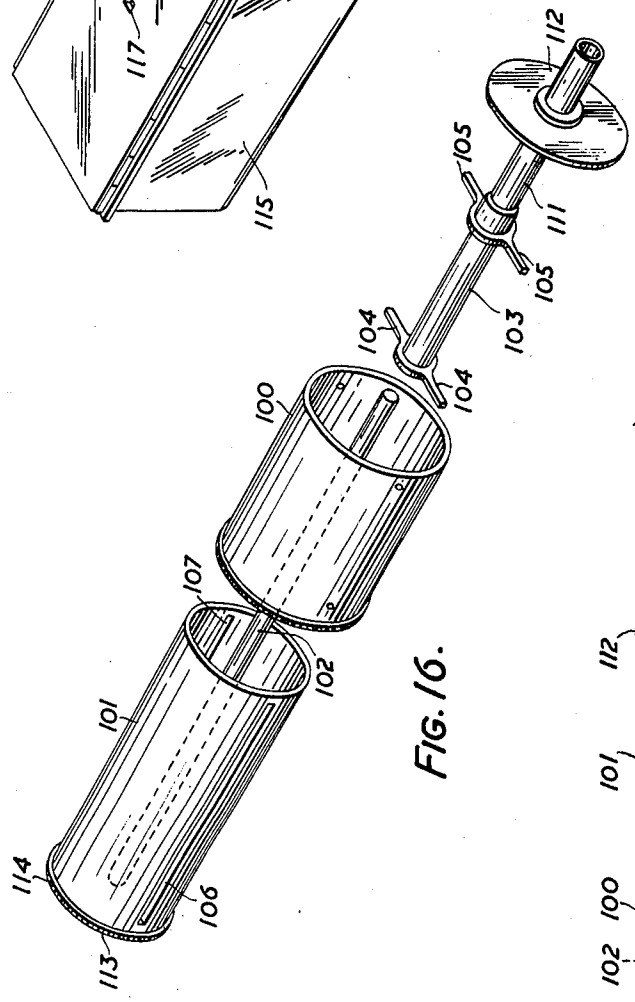


FIG. 16.

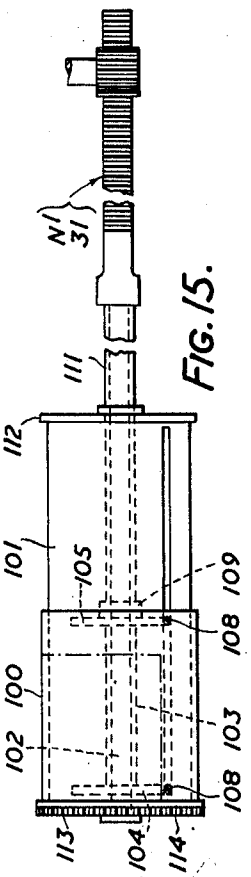


FIG. 15.

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United States Patent Office 3,092,000 Patented June 4, 1963

3,092,000

STEP BY STEP LINEAR FEED MECHANISM FOR PHOTO-TYPE COMPOSING MACHINES

Joseph Henry Williams, Reigate, England, assignor to The Monotype Corporation Limited, Fetter Lane, London, England

Filed Nov. 20, 1959, Ser. No. 854,336
10 Claims. (Cl. 95—4.5)

This application is a continuation-in-part of my application for patent filed October 1, 1956, Serial No. 613,345, now abandoned.

This invention relates to photo-type composing machines. In such machines the matter is composed by photographically projecting character images on to a sensitized sheet, the sheet, or the position of the projected image, being moved step-by-step to produce lines of composition. The length of the steps of movement is determined in accordance with the width of the characters and interword spaces, the width of the latter being variable to enable justification to be effected, that is to bring all the lines to equal lengths.

Thus an essential requirement of such machines is a variable step-by-step feed mechanism operating either a carrier for the sensitized sheet or an image-displacing device such as a pair of relatively inclined mirrors in the optical system of the machine.

In United States Patent No. 2,388,961 there is described a photo-type composing machine in which a frame has located thereon a master plate having transparent characters arranged thereon in rows and columns according to the width of said characters, the said frame being movable in its own plane in two directions at right angles to bring any one character in line with the optical axis of a lens. The carrying frame cooperates with stop pistons actuated by compressed air under the control of a record strip, being moved to a position determined by the stops for the selection of each character as fully described in the patent above referred to. For purposes of explanation, the present invention is described for use with a master plate having fifteen horizontal rows of characters. Normally, there is employed a unit measure system in which the width measure of the widest normal character on the master plate is expressed as eighteen units and the width of the narrowest character is five of such units. The characters are arranged in horizontal rows on the master plate in which all characters in each row have the same width measure and the width measure increases progressively from row to row in the vertical direction.

In the variable step-by-step feed mechanism described in Patent No. 2,388,961, a mirror pair is moved at each step by the engagement of a gripper with a draw-bar attached to the mirror pair, the gripper being moved through a stroke of constant length for each step of movement, but being caused to disengage the draw-bar by coming into contact with an adjustable stop which, by its position, determines the point at which the gripper disengages the draw-bar and so determines the length of the step of movement of the draw-bar. In that mechanism, the adjustable stop is positioned, for each step of movement, by the movement of wedges the positioning of one of which is determined by the signals on the record strip controlling the vertical positioning of the master plate, such signals also controlling the supply of compressed air to actuating cylinders for the wedges. That wedge is thus re-positioned for each working cycle in accordance with the widths of the individual characters or spaces. Other wedges are adjusted once for each line in accordance with justification requirements and rendered operative only when a space is required.

It has been found that the accuracy of a mechanism such as that above briefly described is not sufficient to produce composition of the highest standard, and an object of the present invention is to provide an improved step-by-step feed mechanism giving more accurate control of the character positioning and spacing.

Another object of the invention is to provide a step-by-step feed mechanism in which the feed steps can be changed in length to conform with changes in the point size of the photographically composed characters, and the inter-word spaces can at the same time be increased in true proportion to the character size.

Another object of the invention is to provide, in a photo-type composing machine, means whereby interword spaces can be provided by signals applied to the machine simultaneously with signals determining the initially composed characters of the words following the spaces.

The feed mechanism according to the invention comprises essentially a plurality of feed racks movable through strokes of adjustable length and driving pinions the motions of which are combined by means of differential mechanisms, their combined movements being applied through rack-and-pinion gearing to an output member which moves the mirror pair in the optical system of the machine or the carrier for the sensitized sheet, the feed racks being themselves moved by slide members having fixed strokes, and selector members, actuated under the control of signals on the record strip, being provided to vary the length of the strokes transmitted to the feed racks by the slide members.

The accompanying drawings show, by way of example, some embodiments of the invention.

In the drawings:

FIGURE 1 is a front elevation of one form of mechanism according to the invention, some parts having been omitted for clarity;

FIGURE 2 is an end view of the mechanism shown in FIGURE 1, with some parts omitted;

FIGURE 3 is a sectional plan view taken on the line 3—3 of FIGURE 1;

FIGURE 4 is a sectional plan view taken on the line 4—4 of FIGURE 1 and including some parts omitted from that figure;

FIGURE 5 is a vertical section taken on the line 5—5 of FIGURE 3;

FIGURE 6 is a vertical section taken on the line 6—6 of FIGURE 3;

FIGURE 7 is a front elevation, similar to FIGURE 1, of a modified form of apparatus according to the invention;

FIGURE 8 is a sectional plan taken on the line 8—8 of FIGURE 7;

FIGURE 9 is a sectional plan taken on the line 9—9 of FIGURE 7;

FIGURE 10 is a section, on a larger scale, taken on the line 10—10 of FIGURE 9;

FIGURE 11 is a section, on the same scale as FIGURE 10, taken on the line 11—11 of FIGURE 9;

FIGURE 12 is a side elevation, partly in section, of the upper part of the machine, showing part of the driving mechanism;

FIGURE 13 is a cross section, on an enlarged scale, of the shaft assembly carrying differential gears, parts of which are shown in FIGURE 7;

FIGURE 14 is a persepective view, of parts of the mechanism shown in FIGURES 7 to 12, showing the inter-relation of said parts;

FIGURE 15 is a view in elevation showing a film carrier adapted to be moved for letter spacing by the mechanism according to the invention;

FIGURE 16 is a perspective view showing the parts of the film carrier separated one from another; and

FIGURE 17 is a perspective view of a light-tight box adapted to house the film carrier shown in FIGURES 15 and 16.

The mechanism illustrated in FIGURES 1 to 6 of the drawings is designed for incorporation in a photo-composing machine such as that described in U.S.A. Patent No. 2,388,961 in which a master plate having transparent characters arranged in rows and columns on an opaque background is movable in two directions at right angles so as to place any one of the said characters in line with the optical axis of a lens, a light source being provided from which light is directed through the master plate to the lens. The optical system includes a pair of mirrors inclined at an angle of 90° one to the other, by which the image formed by the lens is deflected through 180° on to a sensitized surface. The spacing of successive characters is effected by displacement, in the direction of the length of the lines of typescript, of the mirror pair, such displacement causing a change in the point at which the incident ray strikes one mirror, and a consequent increase or decrease of the distance between that incident ray and the reflected ray from the other mirror. The amount of displacement of the mirror pair is controlled, as is also the position of the master plate, by signals derived from a record strip, the displacement between successive characters forming a word being determined by a single signal and spacing between words being determined by combining the effect of two signals, one determining a minimum space width and the other an increased width depending on the justification required.

The signals determine the setting of stops governing the movement of setting members which in turn determine the movement of the mirror pair, and also determine the setting of similar stops governing the position of the master plate. The stops are conveniently pneumatically operated, the record strip "signals" being perforations which determine the flow of air for operating the stops. The setting members, as well as the driving parts for the mirror pair, are operated mechanically from a camshaft.

Describing the mechanism generally, means are provided whereby a rack movable in relation to the vertical placement of the carrying frame and master plate, adjusts measuring means in accordance with the space width required by each desired character to be photographed; said rack being arranged to rotate, through skew gears and a shaft, a cylindrical unit width selector member to any of fifteen radial positions in accordance with the frame and record strip, the said selector member being mounted around a vertical shaft to rotate with and slide lengthwise on said vertical shaft. Circular rings of identical thickness each having a radial projection, are built up on the selector unit. The radial projections of the rings are circumferentially arranged upon the selector unit to accord with the radial position of the selector unit and relative to the associated horizontal character row, in such a manner, that when the desired horizontal row is located by the record strip controlled machine, the selector unit is rotated on its shaft to interpose the appropriate radial projection to a gauging position; the vertical positioning of the radial projection being indicative of the required character width. Where the unit width arrangement of fifteen horizontal rows in the frame requires 5, 6, 7, 8, 9, 9, 9, 10, 11, 12, 13, 14, 15 and 18 units characters feed; for the five unit feed, the lowest working ring on the selector unit will have a projection at the first working radial position; for the six unit feed, the second ring will interpose a projection at the second working radial position. The build up is continued until the three nine unit positions are required; to accomplish this, the fifth ring will have an extended projection interposed at the fifth, sixth and seventh working radial positions. For the unrequired sixteen and seventeen units, two rings without projections are placed between the fifteen and eighteen

unit rings which respectively interpose their projections at the fourteenth and fifteenth working radial positions. It will be obvious that many varied frame layouts can be readily accommodated by the easily replaceable, appropriately built up, unit selector.

The required spacing for the character images on the sensitized material is obtained by a lever actuating a lever which displaces the selector member downwardly to bring the radial projection in the gauging position against a fixed stop. As previously explained the radial projection interposed for a five units feed, will be of the lowest projection on the selector unit, and the minimum downward displacement of the selector unit, will be accorded at this radial position. For the eighteen or maximum unit radial positions of the selector the greatest downward movement will be obtained. Feed racks moving with the selector unit, feed the measure in units of the downward displacement of the unit selector member, into a gear system; for, as the measure of eighteen units may vary in different type designs according to whether the characters are relatively narrow or wide, external interchangeable gears are provided to vary the standard units measurement of the units selector member, to a desired ratio for the size and style of type face being composed, and all character feed is transmitted from the interchangeable gears, at the desired ratio, to a differential gear system for summation of the individual character increments.

For purposes of justification, which may be described as the ability to produce horizontal lines of composed matter of equal length throughout a text, the example of the invention as described is fitted with two additional selector members—one coarse selector giving increments of 0.0075", and a fine selector giving increments of 0.0005"—each operating in a similar manner to the unit selector. Justification is controlled by signals produced in the record strip in the following manner; the aggregate unit width of the characters in a line, and a constant unit width for each word space, is automatically subtracted by the record strip perforating machine or keyboard; the remainder is divided by the number of word spaces in the line, and perforations indicating this final figure are incorporated in the record strip at the end of each line to position the coarse and fine selectors for the desired increments to each word space. Where the constant unit addition to each word space by the unit selector is the normal minimum of four units, the unit selector will actually be set at six units, and a two unit subtracting rack actuated by the justification signal, automatically reduces the six unit feed to the desired four units. The signals designating the measure for justification being incorporated in the control strip at the finish of a line of text, the control strip is passed backward through the composing machine and the justification signal is therefore received at the commencement of the line to be composed; in five revolutions of the machine, the air operated piston abutments are used to set the coarse and fine justification selectors to the required inter-word space increment to achieve justification. The coarse and fine justification selectors remain in position until the commencement of the succeeding line of composition, and regulate an identical increment to the differential gears at each space signal in the line to be composed, the unit selector being used to add the required constant unit increment at each space signal.

Referring to the drawings, and particularly, in the first instance, to FIGURES 1, 2 and 3, a selector box A is mounted above a gear-box B, the selector box A containing mechanism which determines the strokes of feed racks in the gear-box B. Three vertical shafts C, D and E, mounted for longitudinal sliding movement and for limited turning movement, extend from the bottom of the gear-box B upwardly through the selector box A, and, adjacent the shafts C, D and E respectively there are mounted, in the selector box A, vertical shafts C^1,

D^1 and E^1 which are rotatable but are held against longitudinal movement. Above the top of the selector box A, the shafts C^1, D^1 and E^1 carry respectively skew gears C^2, D^2 and E^2. A horizontal shaft F, mounted in bearings on the top of the selector box A has directly mounted thereon a skew gear F^1 meshing with the skew gear C^2, a sleeve F^2 rotatably mounted on the shaft F carries a skew gear F^3 meshing with the skew gear D^2, and a second sleeve F^4 rotatably mounted on the sleeve F^2 carries a skew gear F^5 meshing with the skew gear E^2. The shaft F, sleeve F^2 and sleeve F^4 carry respectively pinions F^6, F^7 and F^8 meshing with racks F^9, F^{10} and F^{11} slidable horizontally in guides in the machine frame. The racks F^9, F^{10} and F^{11} are biased rearwardly by any suitable means (not shown) and are moved forwardly in response to the signals derived from the record strip to an extent determined by the stops controlled by said signals, so that such signals produce rotary movement of the shafts C^1, D^1 and E^1 respectively. The rack F^9 is controlled with the master plate frame of the machine so that for any position of the frame in a vertical direction there is a corresponding position of the said rack.

The shafts C^1, D^1 and E^1 have slidably mounted thereon selector members C^3, D^3 and E^3 respectively, the members C^3, D^3 and E^3 being held against rotation on the shafts by keys engaging keyways in the shafts as shown at C^4 and D^4 in FIGURES 5 and 6. Each of the selector members C^3, D^3 and E^3 has a pair of of spaced circumferential flanges defining between them a groove C^5, D^5 or E^5 in which is engaged a fork C^6, D^6 or E^6 clamped to the corresponding shaft C, D or E. Mounted on the shafts C, D and E respectively, below the forks C^6, D^6 and E^6 are slide members C^7, D^7 and E^7, the said slide members having keys (not shown), which engage in keyways C^8, D^8 and E^8 (FIGURE 3) in the shafts C, D and E.

Three rocker members C^9, D^9 and E^9 (see FIGURE 3) are provided with tubular bosses rotatable in bearings in the bottom wall of the selector box A, the shafts C, D and E passing respectively through the bosses of the rockers C^9, D^9 and E^9, and the rockers being provided with keys engaging in the keyways C^8, D^8 and E^8 respectively. The rockers are provided with outstanding abutments C^{10}, D^{10} and E^{10} respectively, the said abutments being vertically aligned with fingers C^{11}, D^{11} and E^{11} projecting from the slide members C^7, D^7 and E^7 respectively, the fingers on the slide members C^7 and D^7 being shown in FIGURES 5 and 6.

The selector members C^3, D^3 and E^3 are all substantially identical and the following description of the member C^3 will suffice to explain their construction. The selector member C^3 (FIGURE 6) is tubular and has an abutment ring C^{12} fixed to its lower end. Between the ring C^{12} and a sleeve bearing the flanges defining the groove C^5, there is mounted a stack of rings C^x each formed with a radial projection C^{13}, the projections being staggered circumferentially. The rings C^x and the sleeve are held in position on the body of the selector member by a nut C^{14}. The projections C^{13} co-operate with the abutment C^{10} and finger C^{11} as hereinafter described.

The parts of the three shafts C, D and E which lie in the gear-box B have fixed to them feed rack members C^{15}, D^{15} and E^{15} (the racks D^{15} and C^{15} being shown in FIGURES 5 and 6) respectively, and the shaft D has a second feed rack member D^{16} slidable but non-rotatable thereon, the feed rack member D^{16} being coupled by a link D^{17} to the slide member D^7 so as to move up and down therewith.

The feed racks C^{15}, D^{15} and E^{15} move up and down with the shafts C, D, and E respectively, the shafts being moved with the selector members C^3, D^3, E^3 due to the engagement of the forks C^6, D^6, E^6 in the grooves C^5, D^5, E^5 and the said selector members have a variable stroke, depending, as hereinafter described, on their rotational positions on the shafts C^1, D^1, E^1 imparted to them by the slide members C^7, D^7, E^7 which have a constant stroke.

Four transverse horizontal shafts are mounted in the gear-box, these shafts being shown at G, H, J and K respectively (see FIGURES 2 and 4). The shaft G has fixed to it a pinion G^1 co-operating with the feed rack member C^{15}, the shaft H has rotatably mounted on it a pinion H^1 co-operating with the feed rack member D^{15} and has also fixed on it a pinion H^2 co-operating with the feed rack member E^{15}, and the shaft J has fixed on it a pinion J^1 co-operating with the feed rack member D^{16}. The shaft K has rotatably mounted on it a sleeve K^1 carrying a skew gear K^2 meshing with a skew gear M^1 on a vertical output shaft M which drives, through a magnetic clutch M^2 (FIGURES 1 and 2), a pinion M^3 meshing with a rack N on a bar N^1 to which is secured the mirror pair of the optical system (outlined in FIGURE 14 not shown). Movements transmitted to the pinions G^1, H^1, H^2 and J by the feed rack members are compounded by differential gears to effect rotation of the shaft K.

The shaft G carries at one end an interchangeable gear wheel G^2 meshing with an idler gear wheel O mounted on an arm adjustable about the shaft K, the idler wheel also meshing with one part of a reversible double pinion K^3 mounted on the shaft K. The shaft K is thus rotated by movement of the shaft G, the movement ratio between them depending on the size of the gear wheel G^2 and on which part of the pinion K^3 is in mesh with the idler gear wheel O. The idler gear wheel O is mounted on a stub axle slidable on the arm to enable it to mesh with either part of the pinion K^3.

The shaft H has keyed to it the planet carrier P^1 of a differential gear P, one sun wheel P^2 of the differential gear P being mounted on a sleeve carrying the pinion H^1, and the other sun wheel P^3 being mounted on another sleeve H^3 also rotatable on the shaft H. A pinion H^4 on the sleeve H^3 meshes with a gear wheel K^4 rotatably mounted on the shaft K.

The shaft J carries, in addition to the pinion J^1, a pinion J^2 which meshes with an idler pinion Q^1 rotatable on a stub shaft Q^2, the idler pinion Q^1 meshing with a gear ring on the planet carrier R^1 of a differential gear R. The planet carrier R^1 is rotatable on the shaft K, one sun wheel R^2 of that differential gear being fast with the gear wheel K^4, and the other sun wheel R^3 being also rotatable on the shaft K. A third differential gear S has its planet carrier S^1 fast with the shaft K, one sun wheel S^2 fast with the sun wheel R^3 of the differential gear R, and the other sun wheel S^3 fixed on the sleeve K^1 which carries the skew gear K^2.

It is, of course, necessary that the shafts G, H, J and K shall have unidirectional rotation, since each step of movement of the mirror pair must be added to the previous steps as the composition of a line progresses, and the feed rack members C^{15}, D^{15}, D^{16} and E^{15} must therefore engage their co-operating pinions only during their movements in one direction. Movement of the pinions when the feed rack members are disengaged therefrom must be prevented. The feed rack members C^{15}, D^{15}, D^{16} and E^{15} are therefore so formed that the teeth thereon can be disengaged from the pinions by angular movement of the said members about the axes of the shafts C, D and E, and locking racks are provided which come into engagement with the pinions when the rack members are disengaged therefrom. As shown in FIGURE 4, a locking rack T co-operates with the pinion G^1, a locking rack U co-operates with the pinion H^1, a locking rack V co-operates with the pinion H^2, and a locking rack W co-operates with the pinion J^1. These locking racks are mounted respectively on vertical shafts T^1, U^1, V^1 and W^1 extending upwardly from the gear-box B into the selector box A. As shown in FIGURE 3, the shafts T^1 and W^1 carry radial arms T^2, W^2 at their upper ends, these arms being pivotally connected to a cou-

pling rod X which is also pivotally connected to one arm of a bell-crank lever X^1 fixed to another vertical shaft X^2. The rocker members C^9, D^9 and E^9 are similarly pivotally connected to a coupling rod X^3, and the two shafts U^1 and V^1 carry respectively a radial arm U^2 and a bell-crank lever Y^2 one arm of which is pivotally connected to a coupling rod X^4 also pivotally connected to the arm U^2. The other arms of the bell-crank levers X^1 and V^2, and a radial arm X^5 integral with the rocker member E^9 are coupled together by a link X^6 pivotally connected to all of them, and an arm X^7 fixed to the shaft X^2, when moved to turn the said shaft, therefore produces simultaneous turning movement of the shafts C, D, E, T^1, U^1, V^1 and W^1, movement in one direction engaging the feed rack members C^{15}, D^{15}, D^{16} and E^{15} with the corresponding pinions and disengaging the locking racks T^1, U^1, V^1 and W^1 from those pinions, whilst movement in the other direction engages the locking racks and disengages the feed rack members. The arm X^7 is moved by means of a cam (not shown) on the main camshaft of the machine.

Each of the slide members C^7, D^7 and E^7 is reciprocated through a fixed stroke by mechanism driven by the main camshaft of the machine (not shown), the said camshaft making one rotation for each step of movement of the mirror pair. The mechanism for reciprocating the slide members D^7 and E^7 is shown in FIGURE 2. An arm Y having a fork Y^1 engaging in a circumferential groove in the slide member D^7, is pivotally mounted at Y^2 and is fast with another arm Y^3 connected by a link Y^4 to a lever Y^5 pivoted at Y^6. A second arm and fork similar to the arm Y and fork Y^1 also fast with the arm Y^3 are provided to operate the slide member E^7. Another lever Y^7, also pivoted at Y^6, has at its lower end a follower engaging a cam on the main camshaft, and its upper end is engaged, when operation of the slide members D^7 and E^7 is to be effected, by a pivoted hook member Y^8 mounted on the lever Y^5. When the hook member Y^8 engages the lever Y^7 the levers Y^5 and Y^7 move together as one. A trip member Y^9, pivoted at Y^{10} on the machine frame, is coupled by an arm Y^{11} and link Y^{12} to a lever Y^{13}, having a forked end Y^{14} engaging a sliding bar Y^{15} which is normally in such a position that the trip member Y^9 is lifted to disengage the hook member Y^8 from the lever Y^7, but is moved in response to a signal when an inter-word or inter-character space is required, to allow the hook member Y^8 to fall and engage the lever Y^7. The mechanism for reciprocating the slide member C^7 is similar to that just described.

The strokes of the feed rack members C^{15}, D^{15} and E^{15} are determined by the signals derived from the record strip in the following manner.

Each photographing cycle of operation of the machine includes one step of movement of the mirror pair, each cycle either adding a character to the line being composed or producing an inter-word space. Assuming that the composition of a word is in progress, and a letter on the master plate is in line with the optical axis of the lens system, this letter is photographed, and the rack F^9 is then operated, with a stroke depending on the width of that letter, to rotate the shaft C^1 and selector member C^3 so as to bring a selected projection C^{13} into a predetermined position about the axis of the shaft C^1. The arm X^7 is then moved to bring the abutment C^{10} and finger C^{11} into vertical alignment with the selected projection C^{13}, and to disengage the feed rack member C^{15} from the pinion G^1. The slide member C^7 is then moved downwardly by an arm similar to the arm Y, the finger C^{11} engaging the selected projection C^{13} and moving the selector member downwardly until that selected projection engages the abutment C^{10}. The distance through which the selector member C^3 is moved thus depends on the position in the stack of rings C^x of the ring C^x bearing the selected projection. The shaft C and feed rack member C^{15} move downwardly with the selector member C^3. When the downward stroke is completed, the arm X^7 is again operated to engage the feed rack member C^{15} with the pinion G^1, to release the locking rack T, and to swing the abutment C^{10} and finger C^{11} clear of the projection C^{13}. The slide member C^7 is then moved upwardly, and, at a point in its stroke depending on the previous downward movement of the selector member C^3, the upper end of the slide member engages an abutment on the shaft C, conveniently, as shown, the boss carrying the fork C^6, and lifts the shaft C through a distance equal to its previous downward movement. During this upward movement the feed rack member C^{15} imparts rotation to the pinion G^1 and shaft G. This cycle of operations is repeated for each letter of the word. At the end of a word, the interword space is determined by a record-strip operated signal applied to the selector member C^3 to produce a predetermined minimum width of space, and a signal applied to the selector members D^3 and E^3 to determine an enlargement of the minimum space in accordance with the justification required for the line of composition. The selector members D^3 and E^3 are set by the racks F^{10} and F^{11} respectively, and the selector C^3 is set by the rack F^9. The trip member Y^9 is moved to release the hook member Y^8 and allow it to engage the lever Y^7, so that all three slide members are operated, and all three feed racks C^{15}, D^{15} and E^{15} are caused to move their respective pinions, the movements of the latter being combined through the differential gears to advance the mirror pair attached to the bar N^1, across the stationary sensitized sheet the correct amount for each blank or inter-word space in a given line of composition to justify that line exactly which is related to the sum of those movements.

The feed rack member D^{16} makes, during each cycle when the slide member D^7 is operated, a fixed stroke which, through the differential gear R, reduces the total movement of the bar N^1. The feed rack member D^{16} and differential gear R enable the machine to be operated by record strips prepared in the manner already described, for use with type-casting machines such as are sold under the registered trademark "Monotype."

By changing the gear wheel C^2 and/or reversing the pinion K^3 so as to provide a different movement ratio between the shafts G and K, the mechanism can be adjusted to suit different type sizes or widths.

The bar N^1 and the mirror pair attached to it are returned at the end of each line of composition to the starting point for the next line by, for example, a cam operated lever acting on a projection on the bar, the lever making a to-and-fro stroke for each return movement and actuating a switch to release and reengage the magnetic clutch M^2 at the beginning and end of its stroke respectively.

The mechanism illustrated in FIGURES 7 to 14 of the accompanying drawings and hereinafter described has many features in common with that described with reference to FIGURES 1 to 6, but is simpler, only three feed racks and two differential mechanisms being included.

Moreover, the mechanism of FIGURES 7 to 14, employing a record strip perforated for any one character size, can produce aliquot reduced or increased sizes of composed matter since the justification stroke varying means provide a justification setting which is proportional to the character width. This is not the case with the mechanism shown in FIGURES 1 to 6, in which the proportion of the justification allowances to the character sizes would be upset by enlargement or reduction.

The mechanism described with reference to FIGURES 1 to 6 employs a record strip which, in conformity with the usual practise, has the signals corresponding to interword spaces provided by a line of holes separate from those corresponding to both adjacent characters, so that the composing machine has to make a complete cycle of movement, corresponding to that for producing a char-

acter, for each inter-word space. The mechanism described with reference to FIGURES 7 to 14 employs a record strip in which the signals corresponding to an inter-word space and to the next-composed character are provided by a single line of holes, thus enabling the casting machine to produce the space and the following character in one cycle of operations.

Referring to FIGURES 7 and 14, a selector box 10 (FIGURE 7) is mounted above a gear-box 11 (FIGURE 7) and three shafts 12^a, 12^b, and 12^c extending substantially vertically through a partition 13 between the selector box and the gear-box carry racks 14^a, 14^b, 14^c at their lower ends to engage respectively with pinions 15^a, 15^b, 15^c on a horizontal shaft 16 in the gear-box. On the parts of the shafts 12^a, 12^b and 12^c which are in the selector box 10 there are slidably mounted slide members 17^a, 17^b, and 17^c respectively which are reciprocated through a constant stroke by levers hereinafter described. Substantially vertical shafts 18^a, 18^b and 18^c in the selector box, adjacent respectively to the shafts 12^a, 12^b and 12^c, carry selector members 19^a, 19^b, and 19^c respectively, each coupled by a forked arm 21 to the corresponding shaft 12^a, 12^b and 12^c, the selector members 19^a, 19^b and 19^c being rotatable with, but slidable on the shafts which carry them to determine, as hereinafter described, the proportion of the stroke of the slide members 17^a, 17^b and 17^c which is transmitted to the respective shafts 12^a, 12^b and 12^c. The shafts carrying the selector members are individually rotatable, by mechanism generally indicated at 22, to adjust the strokes of the shafts 12^a, 12^b and 12^c. The shafts 12^a and 12^b, with their associated parts, have been omitted from FIGURE 14.

The rotations of the pinions 15^a, 15^b and 15^c are combined by differential gears 23 and 24 on the shaft 16 and transmitted to the said shaft, the combined rotation being transmitted through change gears 25 to another horizontal shaft 26 driving through skew gears 27, a clutch 28, and a pinion 29, a rack bar 31 constituting the output member of the mechanism. The rack bar 31, as shown in FIGURE 14 is attached to a mirror pair 32 arranged in the optical system of the machine, which is generally indicated at 33, the mirror pair 32 deflecting character images formed through the medium of a lens 34 on to a sensitized sheet mounted on a drum 35. The optical system and the drum 35 are, of course, enclosed in a light-tight casing.

The movement of the rack bar 31 during the composition of a line of type is unidirectional, and the shaft 16 must therefore be operated unidirectionally by the racks 14^a, 14^b and 14^c. Means are therefore provided, as will be hereinafter described, to swing the said racks into and out of engagement with the pinions, locking racks being provided to hold the pinions against movement when the racks 14^a, 14^b and 14^c, hereinafter called feed racks, are disengaged therefrom.

The selector members 19^a, 19^b and 19^c, with their associated parts, are substantially identical one with another. The following description is common to all of them and refers particularly to FIGURE 11 of the drawings, the corresponding parts in FIGURE 10 being marked with the same reference numerals with the index *a* instead of *c*. Referring to FIGURE 11, the selector member 19^c comprises a tubular body 36^c keyed to the shaft 18^c so as to slide thereon and having an abutment collar 37^c and a sleeve 38^c grooved circumferentially to receive the forked arm 21 there is mounted a stack of rings 39^c each formed with a radial projection 41^c, the projections 41^c being staggered circumferentially. The rings 39^c and the sleeve 38^c are clamped to the body 36^c by a nut 42^c.

The slide member 17^c is formed with a finger 43^c which projects below a shoulder on the sleeve 38^c and co-operates with the radial projections 41^c on the selector member 19^c, the rotation on the selector member bringing one or other of the projections 41^c into the line of movement of the finger 43^c so that as the slide member 17^c reciprocates it transmits a corresponding reciprocating movement to the selector member 19^c, the extent of the movement of the selector member depending on the position in the stack of the particular ring 39^c carrying that projection 41^c. The downward movement of the selector member 19^c is limited by an abutment 44^c carried by a rocker 45^c movable in a horizontal plane about the axis of the shaft 12^c and keyed to the said shaft so that its angular movement moves the feed rack 14^c into and out of engagement with the pinion 15^c.

The rotational movement of the selector member 19^c to the desired position for providing any desired stroke of the feed rack 14^c is effected by a skew gear 46^c carried by a horizontal shaft 47 mounted above the selector box 10 and meshing with a skew gear 48^c on the upper end of the shaft 18^c, the skew gear 46^c rotating as one with a pinion 49^c (FIGURE 7) on the shaft 47 which is in turn rotated by a rack bar 51^c sliding in guides in the machine frame. The rack bar 51^c is biased rearwardly by any suitable means (not shown) and is moved forwardly in response to the character signals from the record strip so that its movement, and the consequent angular position of the selector member 19^c depends on the character signal which in turn varies with the width of the character.

The selector members 19^a and 19^b are similarly controlled by skew gears at the upper ends of the shafts 18^a and 18^b meshing with other skew gears on the shaft 47, the skew gears for the selector member 19^a being shown at 46^a, 48^a in FIGURE 10, these latter skew gears being respectively arranged to rotate as one with pinions 49^a and 49^b engaged by rack bars 51^a and 51^b operated by the justification signals from the record strip. The interconnection between the skew gears on the shaft 47 and the corresponding pinions is provided by mounting each skew gear and its associated pinion on a sleeve and arranging the sleeves one within another.

The rocker 45^c and corresponding rockers 45^a and 45^b associated with the shafts 12^a and 12^b are coupled together, as shown in FIGURES 8 and 9 by a link member 56, and locking racks for each of the three pinions 15^a, 15^b and 15^c (the locking racks 57^a and 57^c being shown in FIGURES 10 and 11 respectively) are mounted on vertical shafts 58^a, 58^b and 58^c carrying rockers 59^a, 59^b and 59^c which are similarly coupled together by a link 61. The rockers 45^a and 59^a are provided respectively with arms 62 and 63, FIGURES 8 and 9, which arms are coupled together by a further link extending through an opening 65 in the front of the gear box and coupled to an arm 66 turning with another arm 67 moved in a predetermined timed relation with the driving means for the slide members 17^a, 17^b and 17^c so as to cause the driving racks 14^a, 14^b and 14^c to engage the pinions 15^a, 15^b and 15^c during upward movement of the slide members and to disengage the feed racks from the pinions, and engage the locking racks 57^a, 57^b and 57^c therewith, during downward movement of the slide members.

Each of the pinions 15^a, 15^b and 15^c also has associated with it a pawl (one of which is shown at 70 in FIGURE 14), urged by gravity into engagement with the pinion and providing a further safeguard against backward rotation.

The drive mechanism for reciprocating the slide members 17^a, 17^b and 17^c is operated by a cam shaft in the machine (not shown) and includes levers which are rocked by cams on the cam shaft. FIGURE 12 shows only the mechanism for reciprocating the slide members 17^a and 17^b, the slide member 17^c being operated by a second similar mechanism embodying slight differences which will be hereinafter described. Referring to FIGURE 7, a lever 68 pivoted at 69 engages at its lower end with a cam on the machine cam shaft, and another lever 71 also pivoted at 69 is releasably coupled to the lever 68 so that the latter lever can move without simul-

taneously moving the lever 71. The lever 71 is connected by a link 72 to a cranked lever 73 pivoted at 74 and provided with forks only one of which is shown at 75^b in FIGURE 12, to engage in circumferential grooves in the slide members 17^a and 17^b. The interconnection of the levers 68 and 71 is effected by a hook arm 76 pivoted at 77 on the lever 71 and adapted to be moved to a position in which it leaves the lever 68 free to move without the lever 71 by a trip member 78 pivoted on the frame and coupled by an arm 79 and a link 81 to a lever 82 having a forked end engaging a pin on a slide bar 83 which is moved by a space signal on the record strip to bring the hook 76 into engagement with the lever 68 thereby ensuring that on only a cycle of the machine during which the space signal is operative the slide members 17^a and 17^b are operated.

The driving mechanism for the slide member 17^c corresponds with that which has just been described, an air operated trip member similar to that just described being provided to disconnect the levers corresponding to the levers 68 and 71 during cycles of the machine when no character is being recorded on the sensitized sheet, for example during cycles at the beginning of each line which produce setting of the justification selectors. The forked lever of this last-mentioned mechanism corresponding to the lever 73 is shown at 80 in FIGURE 14.

The shaft 16, pinions 15^a, 15^b and 15^c, and the differential gears 23 and 24 are shown in detail in FIGURE 9.

The pinion 15^a is fixed on a sleeve 84 rotatable on the shaft 16, the sleeve having also fixed to it a sun wheel 85 forming part of the differential gear 23. The pinion 15^b constitutes the planet carrier of the differential gear 23, the said pinion having journalled in an eccentric hole therein a planet assembly 86 comprising planet wheels meshing respectively with the sun wheel 85 and with another sun wheel 87 fixed on a second sleeve 88 also rotatable on the shaft 16. The pinion 15^b, and also the pinion 15^c which constitutes the planet carrier of the differential gear 24, are both rotatable on the shaft 16, and the pinion 24 carries a planet assembly 89 similar to the planet assembly 86, one planet wheel thereof engaging a sun wheel 91 fixed on the sleeve 88 and the other planet wheel thereof engaging a sun wheel 92 fixed to the shaft 16.

The rotations of the pinions 15^a, 15^b, 15^c are thus combined by the differential gears and applied to the shaft 16 through the pinion 92.

The shaft 16 carries on one end thereof an interchangeable driving wheel 93 (FIGURE 14) of a changeable gear train through which rotation of the shaft 16 is transmitted to the shaft 26. This gear train includes a reversible stepped gear unit 94 mounted on the shaft 26, and an idler gear unit 95 mounted on a stub shaft 96 carried by a plate 97 movable about the axis of the shaft 26 to enable the idler to be brought into mesh with gear wheels 93 of different diameters. Additional driving wheels 93 are provided so that a number of different gear ratios can be provided between the shaft 16 and the shaft 26, by suitable selection of the gears employed.

The main camshaft of the machine, as well as carrying the cams operating the lever 68 and the corresponding lever for reciprocating the slide member 17^c, carries a further cam acting through suitable linkage on the lever 67 to move the rockers 45^a, 45^b, 45^c and the rockers 59^a, 59^b, 59^c in such timed relation to the movements of the slide members that the driving racks 14^a, 14^b, 14^c engage with the pinions 15^a, 15^b and 15^c only during upward movement of the said slide members.

The movements of the rack bars 51^a, 51^b and 51^c are effected by cam-actuated mechanical means similar to those described in Patent No. 2,388,961 for setting the wedges controlling the steps of movement of the mirror pair such means being controlled by the perforations in the record strip which admit air, through holes in an air bar to the cylinders, as is generally described in Patent No. 2,388,961.

Each cycle of operation of the machine includes one step of movement of the mirror pair 32. Assuming that the composition of a word is in progress, and a line of perforations in the record strip has just come on to the air bar, the air passing through the perforations sets the mechanism to determine the position to which the master plate is to be moved, and sets the selector member 19^c to the position for giving a stroke of the feed rack 14^c appropriate to the width of the character. The cam shaft then rotates to move the master plate to the determined position and to move the selector member 19^c downwardly until the selected projection 41^c thereon engages the abutment 44^c. A shutter in the optical system is then operated to expose the character, and the selector member 19^c moves upwardly, the feed rack 14^c rotating the pinion 15^c to transmit a step of movement to the mirror pair 32 through the change gears 25, the skew gears 27 and the rack bar 31. The slide member 17^c makes a full stroke, but the selector member 19^c commences to move only when the finger 43^c engages a projection 41^c, and remains in engagement with the abutment 44^c until the finger 43^c has moved upwardly into engagement with the sleeve 38^a.

The composition of each line is started at the right hand end, so that the characters are added in the opposite direction to that in which they are read, and a justification signal, to determine the width of the inter-word spaces, is applied at the commencement of the composition of each line to position the rack bars 51^a and 51^b so that the combined strokes of the feed racks 14^a and 14^b gives the required inter-word spacing. The line of perforations which includes the character signal for the initially composed letter of each word includes also a space signal which releases the trip member 78, thus coupling together the levers 68 and 71, and thus all the selector members with their feed racks, are moved during the cycle of the machine which produces the initially composed letter, and the movement of the mirror pair 32 is equal to the character width with the space width added thereto.

The rack bar 31 and mirror pair 32 are returned at the end of each line of composition to the starting point for the next line by, for example, a cam-operated lever acting on a projection on the bar, the lever making a to-and-fro stroke for each return movement and actuating a switch in an electric circuit controlling the clutch 28 so as to release the said clutch at the commencement of the return movement and to re-engage it at the end of such movement.

The stroke varying projections 41^b and 41^a on the justification selector members 19^b and 19^a respectively, are arranged to provide increments proportional to those provided by the unit value stroke varying means, 41^c, on selector member 19^c, and the combined output from their associated feed racks 14^c, 14^b and 14^a are passed into differential summation gears 23 and 24, FIGURE 13 and then through the required change gear 25 (FIG. 7) for the width style of the type face being composed; in this manner a record strip, perforated for a specific character size may be used to obtain justified lines of text matter of any other desired character size within the optical limitations of the machine, the length of the line being proportionately increased or decreased accordinto the character size ratio.

The combining of the movements of the mirror pair to provide space for the last-photographed character of a word and the adjacent inter-word space reduces to a substantial extent the time taken to compose a given piece of matter, since the number of inter-word spaces is a substantial fraction of the number of characters, so that the number of cycles of operation is substantially reduced as compared with the number which would be needed if separate cycles were needed for the spaces.

In this embodiment of the invention, the stroke vary-

ing projections 41[a] on the so-called coarse justification selector member 19[a], are arranged to provide from nought to fourteen units of a standard unit feed; the stroke varying projections 41[b] on the so called fine justification selector member 19[b] are arranged to provide from nought to fourteen fifteenths of one standard unit feed; the units selector member 19[c] is arranged to provide from five to eighteen units of a standard unit feed.

The space signal is perforated in the record strip in line with the signal for the last character of each word in the line of text matter. The required space increment signal to achieve justification is perforated in the usual manner at the end of each line of text matter. The record strip is fed backwards into the composing machine, and the justification signal is therefore received at the commencement of a line of text to be composed, the coarse 19[a] and fine 19[b] justification selectors being positioned to the required increment by the master plate frame positioning means, not shown, and record strip controlled air piston abutments, not shown, providing relative movement to the racks 51[a], 51[b] (FIG. 7), and skew gears 46[a] and 46[b] individually connected to said racks by associated sleeve shafts. Where a five and two fifteenths unit word space is required to obtain a desired length of line, the record strip will be perforated at the end of the line to raise the air piston abutments for the six and then three positions, the signals to the composing machine being backward reading, the machine will firstly raise the appropriate air piston abutment for the number three position and both racks 51[a], 51[b] and justification selectors 19[a], 19[b] will pass through the nought and first to the second increment position; in succeeding revolutions of the machine, during which the record strip remains stationary, the air piston abutment for the number six position is raised, and the coarse selector member rack 51[a] with the selector member 19[a] is set to the sixth position, or five unit increments; the fine selector member 19[b] remaining at the two fifteenths unit increment position. The coarse and fine justification selector members remain in this position for the required increment for each word space in the line of text until the justification signal is received for a succeeding line of text. After the justification selectors have been set the record strip moves for the succeeding signals; the unit selector member is appropriately positioned for each character of a word being backwardly composed, and the space signal is received with the initially to be composed character of a word following the space, said space signal tripping the feed racks 14[b] and 14[a] into operation, together with the feed rack 14[c], so that the unit value feed for each word space and the character unit value feed are summated and transmitted through the differential gears then change gears 25 (FIG. 7) to provide the required combined movement of the rack 31 and mirrors 32, FIGURE 14.

In both the embodiments of the invention which have been described herein, the output of the step-by-step feed mechanism has been applied to a mirror pair which was moved to displace the successively produced character images one relative to another and thereby provide the desired spacing between them. As an alternative, the output of the said mechanism may be applied to a carrier for the sensitized material, the movable mirror pair being omitted from the optical system of the machine.

FIGURES 15 to 17 show a film carrier suitable for operation by the output of either of the feed mechanisms described herein.

Referring to those figures, the carrier comprises a drum 100 slidably mounted on a second drum 101 having substantially twice the length of the drum 100. Coaxially mounted in the drum 101 is a spindle 102 on which is slidably mounted a sleeve 103 carrying two pairs of radial arms 104 and 105. The drum 101 is slotted longitudinally at 106 and 107, the slots being diametrally opposite one of the other, and pins or screws 108 passing through the slots 106 and 107 secure the drum 100 to the arms 104, 105 so that the drum 100 is slidable on the drum 101 but is rotatable therewith. The sleeve 103 is connected at 109 to a further co-axial sleeve 111 by a joint providing for relative rotation but no relative axial movement of the two sleeves, and the sleeve 111 is rigidly connected to the rack bar (N^1 of the mechanism shown in FIGURES 1 to 6 or 31 of the mechanism shown in FIGURES 7 to 14) for operation thereby.

The sleeve 111 passes through a removable end plate 112 closing one end of the drum 101, the other end of the drum 101 being closed by an end plate 113 having gear teeth around its periphery at 114 to mesh with a driving gear (not shown) by which the drums are rotatable for line spacing.

The mechanism for effecting rotation forms no part of this invention.

The carrier is housed in a light-tight casing 115 having a hinged lid 116 in which is formed an aperture 117 closable by a shutter (not shown), the said aperture, when the casing 115 is mounted in the composing machine, being aligned with the optical axis of the said machine.

The drum 101 is provided with any suitable means (not shown) for securing a sheet of sensitized material such as photographic film thereto, and it will be apparent that the operation of the step-by-step feed mechanism will bring successive parts of the said sheet into line with the aperture 117 to receive the projected images of the characters on the master plate.

I claim:

1. In a photo-type composing machine in which character images are projected on to a sensitized sheet to form justified lines and including a carrier means for said sensitized sheet and means for directing said images on to said sheet, one of said carrier means and said image directing means constituting a movable member movable step-by-step to position successively projected images side-by-side; the provision of variable step-by-step feed mechanism for moving said movable member, said mechanism comprising an output member, means connecting said output member to said movable member for movement as one therewith, a plurality of slide members, means for reciprocating said slide members with a constant stroke, a plurality of feed racks each reciprocable by one of said slide members, a plurality of selector members one associated with each slide member and the feed rack reciprocated thereby, means connecting said selector member to one of said slide member and feed rack for reciprocation therewith, means on said selector member adjustable to produce variable lost motion between said selector member and the other one of said slide member and feed rack, means for moving said adjustable means, a plurality of pinions one driven by each of said feed racks as the rack moves in one direction, differential mechanisms to combine the movements of the pinions, an output shaft to which the said combined movements are applied, and means for converting rotation of said output shaft intto linear movement of said output member.

2. In a photo-type composing machine in which character images are projected on to a sensitized sheet to form justified lines and including carrier means for said sensitized sheet and means for directing said images on to said sheet, one of said carrier means and said image directing means constituting a movable member movable step-by-step to position successively projected images side-by-side; the provision of variable step-by-step feed mechanism for moving said movable member, said mechanism comprising an output member, means connecting said output member to said movable member for movement as one therewith, a plurality of shafts, means supporting said shafts for longitudinal sliding movement, a slide member slidably mounted on each said shaft, a feed rack fixedly mounted on each of said shafts, means for reciprocating said slide members with a fixed stroke, a plurality of selector members each associated with a slide member and

the feed rack on the same one of said shafts, means connecting said selector member to one of said slide member and feed rack for reciprocation therewith, means on said selector member adjustable to produce variable lost motion between said selector member and the other of said slide member and feed rack, means for moving said adjustable means, a plurality of pinions one driven by each of said feed racks as the rack moves in one direction, differential mechanisms to combine the movements of the pinions, an output shaft to which the said combined movements are applied, and means for converting rotation of said output shaft into linear movement of said output member.

3. In a photo-type composing machine in which character images are projected on to a sensitized sheet to form justified lines and including carrier means for said sensitized sheet and means for directing said images on to said sheet, one of said carrier means and said image directing means constituting a movable member movable step-by-step to position successively projected images side-by-side; the provision of variable step-by-step feed mechanism for moving said movable member said mechanism comprising an output member, means connecting said output member to said movable member for movement as one therewith, a plurality of rack shafts, means supporting said rack shafts for longitudinal sliding movement, a slide member slidably mounted on each rack shaft, a feed rack fixedly mounted on each rack shaft, means for reciprocating said slide members with a fixed stroke, a plurality of selector shafts each parallel and adjacent to a rack shaft, a plurality of selector members each mounted on one of said selector shafts and associated with a slide member and the feed rack on the same one of said rack shafts, means connecting said selector member to one of said slide member and feed rack for reciprocation therewith, means on said selector member adjustable to produce variable lost motion between said selector member and the other of said slide member and feed rack, means for moving said adjustable means, a plurality of pinions one driven by each of said feed racks as the rack moves in one direction, differential mechanisms to combine the movements of the pinions, an output shaft to which the said combined movements are applied, and means for converting rotation of said output shaft into linear movement of said output member.

4. In a phototype composing machine in which character images are projected on to a sensitized sheet to form justified lines and including carrier means for said sensitized sheet and means for directing said images on to said sheet, one of said carrier means and said image directing means constituting a movable member, movable step-by-step to position successively projected images side-by-side; the provision of variable step-by-step feed mechanism for producing movements of said movable member, said mechanism comprising a plurality of feed racks movable in accordance with signals derived from a record strip, pinions rotated by the said racks, and differential mechanisms to combine the movements of the pinions, there being provided, in association with each feed rack, a slide member, means for reciprocating said slide member with a fixed stroke, a selector member coupled to the feed rack for longitudinal movement therewith, a plurality of longitudinally and circumferentially spaced radial projections on said selector member, means for rotating said selector member, and a finger on said slide member with which the spaced radial projections on the selector member are selectively aligned by the rotation of the selector member, so that the stroke of the feed rack is determined by the rotational position of the selector member which is in turn determined by the signals derived from the record strip.

5. In a photo-type composing machine in which character images are projected on to a sensitized sheet to form justified lines and including a carrier means for said sensitized sheet and means for directing said images on to said sheet, one of said carrier means and said image directing means constituting a movable member movable step-by-step to position successively projected images side-by-side; the provision of variable step-by-step feed mechanism for moving said movable member, said mechanism comprising an output member, means connecting said output member to said movable member for movement as one therewith, a plurality of rack shafts, means supporting said rack shafts for longitudinal sliding movement, a slide member slidably mounted on each rack shaft, a feed rack fixedly mounted on each rack shaft, means for reciprocating said slide members with a fixed stroke, a plurality of selector shafts each parallel and adjacent to a rack shaft, a plurality of selector members each mounted on one of the selector shafts, means connecting each of said selector members to one of said feed racks for longitudinal movement therewith, a plurality of longitudinally and circumferentially spaced radial projections on said selector member, means for rotating said selector member, and a finger on said slide member with which the spaced radial projections on the selector member are selectively aligned by rotation of the selector member, so that the stroke of the feed rack is determined by the rotational position of the selector member which is in turn determined by the signals derived from the record strip.

6. A photo-type composing machine according to claim 1, wherein each of the driving means comprises a slide member and means for reciprocating the slide member with a constant stroke, the stroke-varying means controlling lost motion connections between the slide members and the feed racks to vary the proportion of the strokes of the slide members which is transmitted to the racks.

7. A photo-type composing machine according to claim 6, wherein each of the stroke varying means comprises a rotatable selector member having therein a plurality of longitudinally and circumferentially spaced radial projections, the selector member being rotated in accordance with the signals from the record strip to bring a selected one of said projections into position for engagement by a finger on the slide member, the selector member being mounted for longitudinal sliding movement with the feed rack.

8. In a photo-type composing machine in which character images are projected on to a sensitized sheet to form justified lines, the selection and spacing of the characters being determined by signals from a record strip previously produced, by forming holes in the strip, in a keyboard-controlled machine, in accordance with a predetermined code, so that individual characters, inter-word spaces and justification requirements are each represented by appropriately positioned holes in lines across the strip, the provision of mechanism for determining the positions of character images on the sensitized sheet comprising first, second and third racks, first, second and third pinions driven respectively by the first, second and third racks, differential gearing to combine the movements of the pinions, a first driving means to reciprocate the first rack, a second driving means to reciprocate the second and third racks, stroke-varying means for the first rack operable in accordance with character signals on the record strip, stroke-varying means for the second and third racks operable in accordance with justification signals on the record strip, control means actuated by the signals on the record strip to produce actuation of the second driving means only in response to a space signal, and gearing to transmit the combined movements to an output member coupled to image-positioning means in the optical system of the machine, the measurement of inter-word space width being determined solely by the second and third racks so that by providing signals in the record strip to operate all three racks simultaneously the output member is given a single movement corresponding to an inter-word space and the initially composed character of the word following the said space.

9. The mechanism as defined in claim 4 characterized in that the feed racks are fixed to shafts on which the slide members are slideably mounted, the selector members being slideably mounted on shafts parallel and adjacent to the rack shafts and being coupled to the rack shafts for longitudinal movement therewith.

10. The mechanism as defined in claim 4 characterized in that the feed racks are moveable into and out of engagement with the pinions so as to rotate the said pinions only during movement of the feed racks in one direction, and locking racks for holding the pinions against rotation when said feed racks are disengaged therefrom.

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