Aug. 6, 1940. D. V. MAZZOCCO 2,210,726

PHOTOCOMPOSING MACHINE

Filed June 2, 1939 6 Sheets-Sheet 1

Fig. 1.

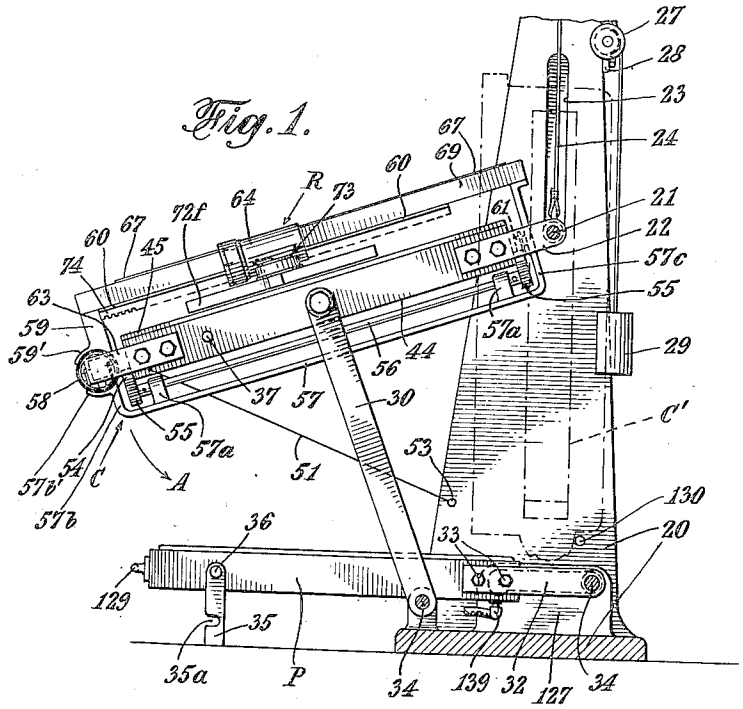
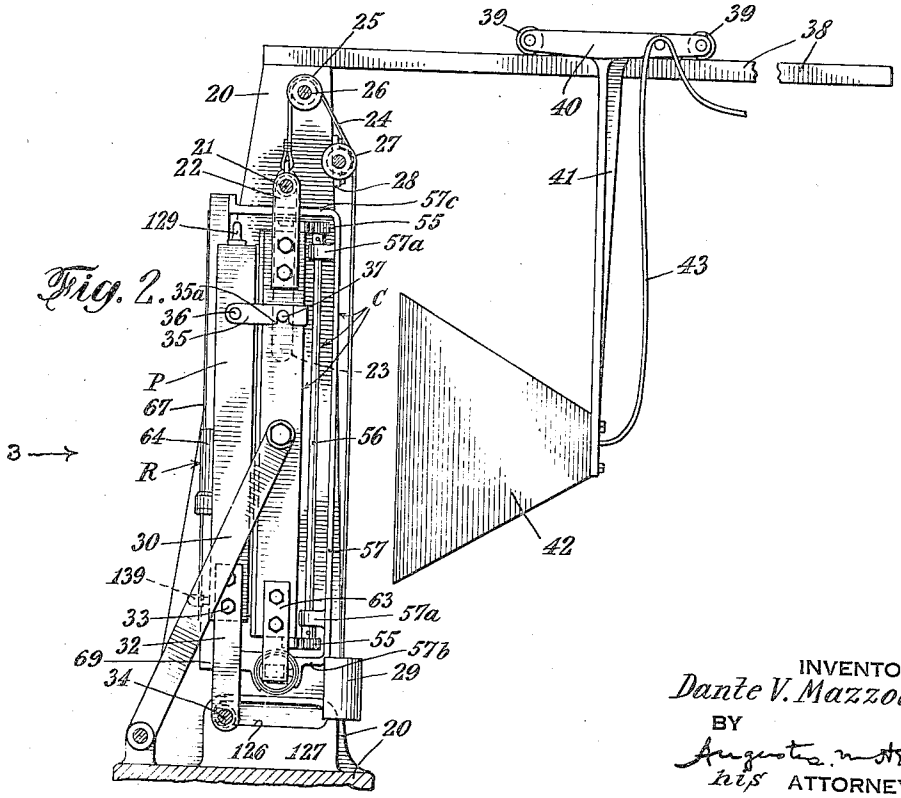


Fig. 2.



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2,210,726

PHOTOCOMPOSING MACHINE

Filed June 2, 1939

6 Sheets-Sheet 2

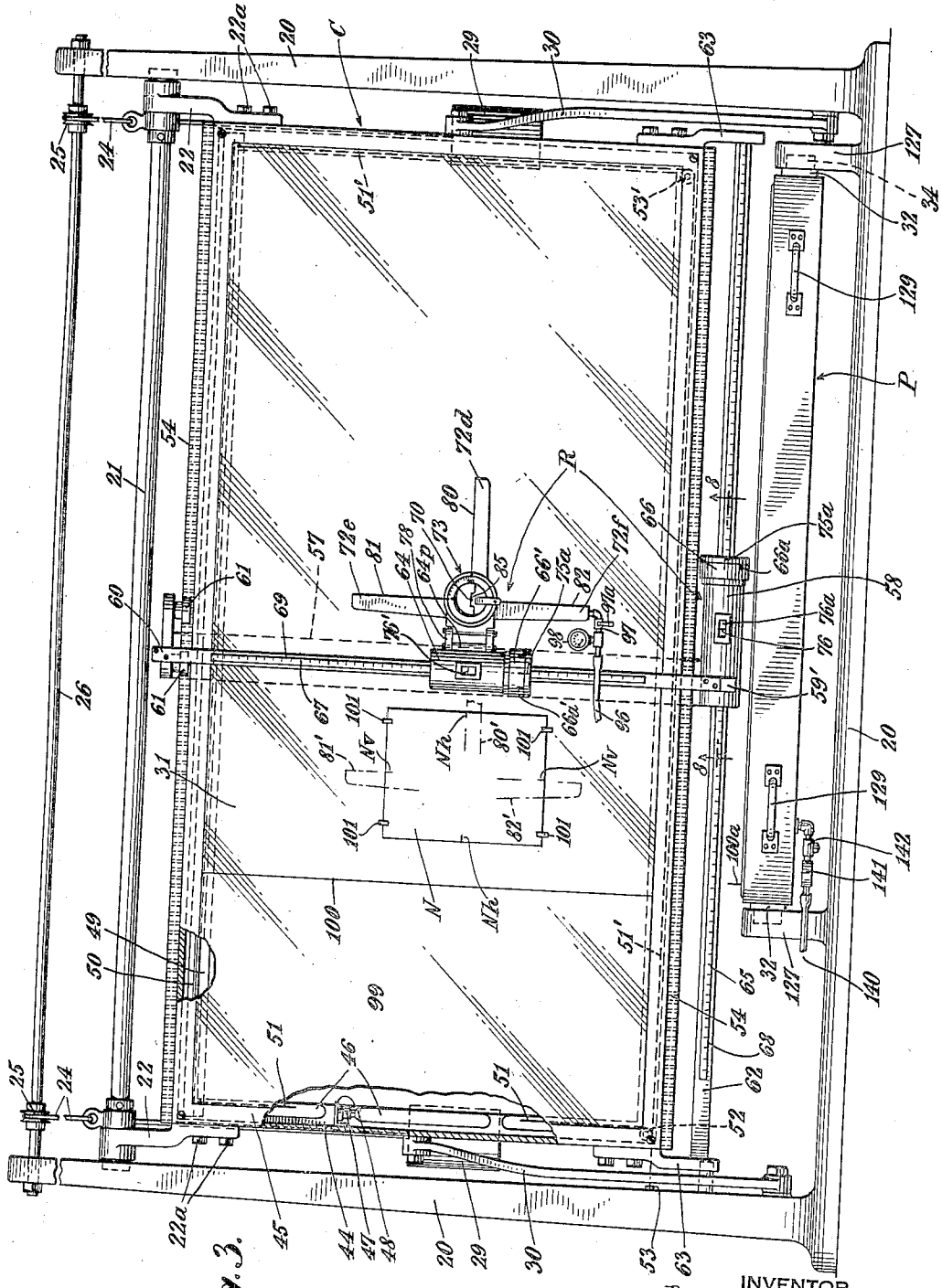


Fig. 3.

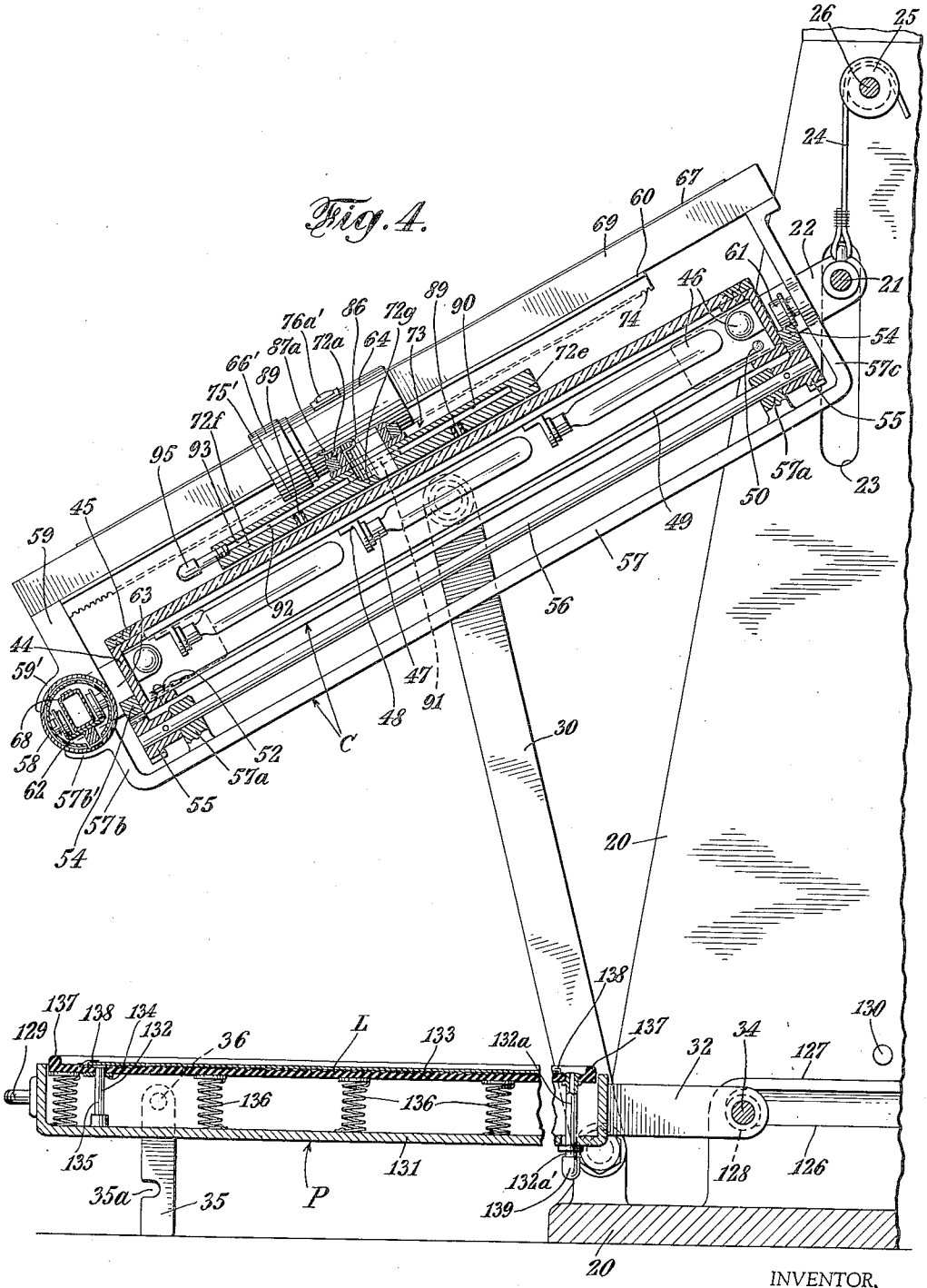
INVENTOR,
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Aug. 6, 1940. D. V. MAZZOCCO 2,210,726

PHOTOCOMPOSING MACHINE

Filed June 2, 1939 6 Sheets-Sheet 3

Fig. 4.



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Aug. 6, 1940. D. V. MAZZOCCO 2,210,726

PHOTOCOMPOSING MACHINE

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Fig. 5.

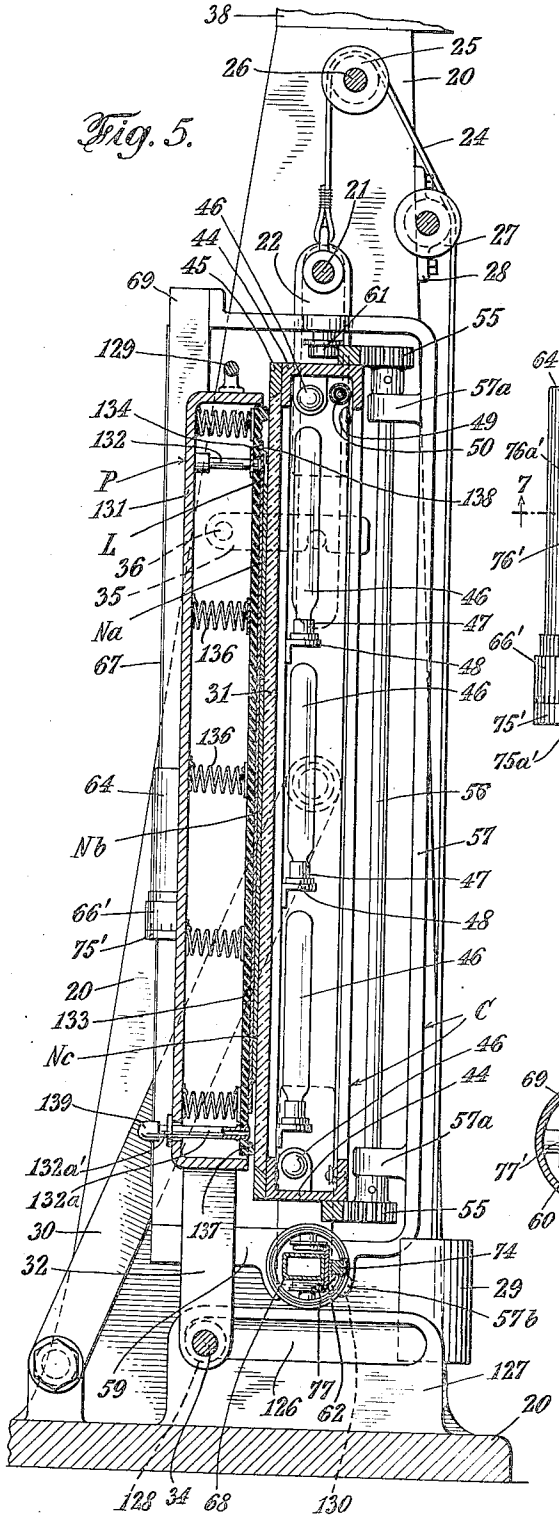


Fig. 6.

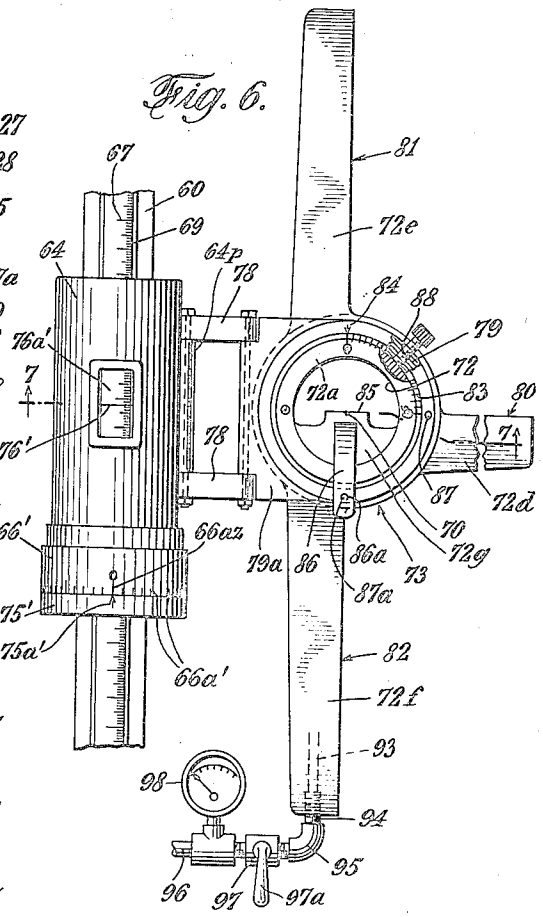
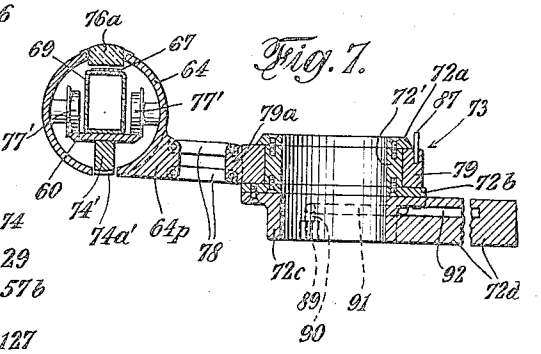


Fig. 7.



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Aug. 6, 1940. D. V. MAZZOCCO 2,210,726

PHOTOCOMPOSING MACHINE

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Fig. 8.

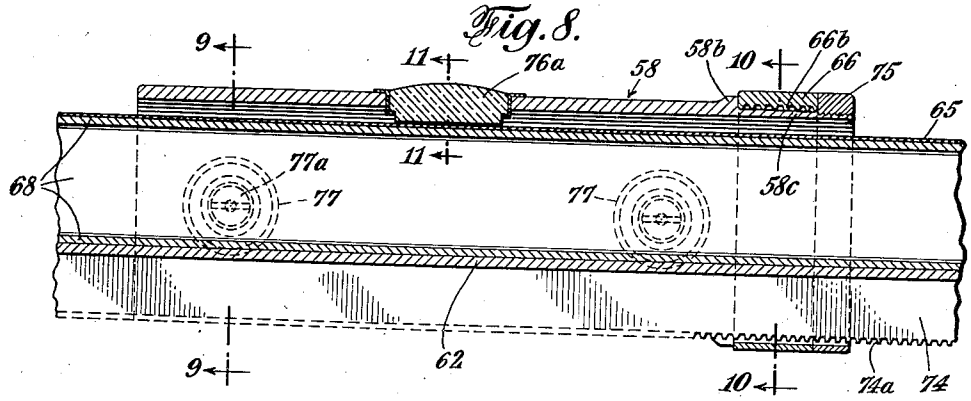


Fig. 9.

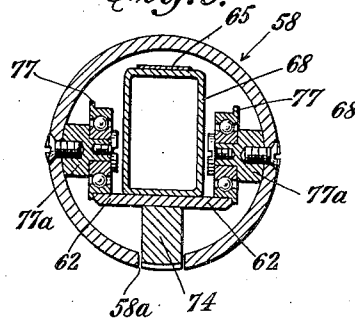


Fig. 11.

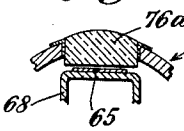
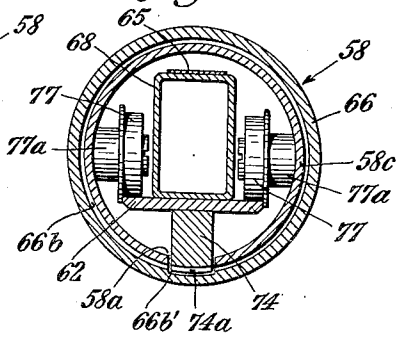


Fig. 10.



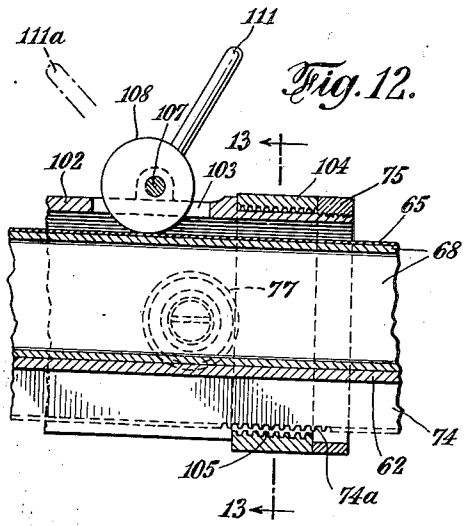
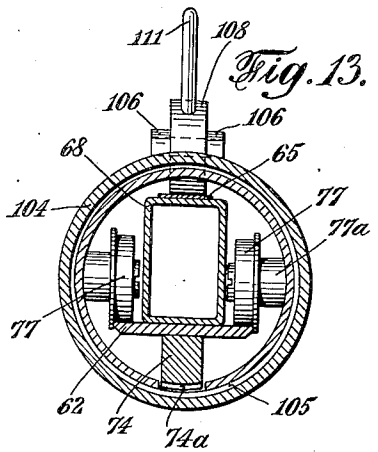


Fig. 12.

Fig. 13.



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Aug. 6, 1940. D. V. MAZZOCCO 2,210,726

PHOTOCOMPOSING MACHINE

Filed June 2, 1939 6 Sheets-Sheet 6

Fig. 16.

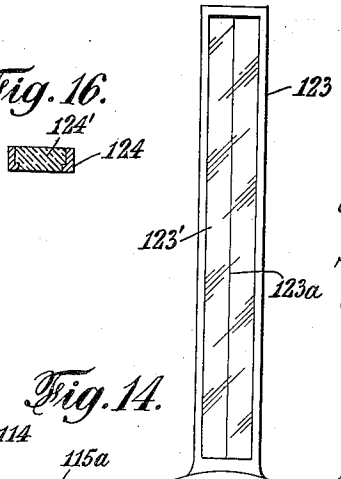


Fig. 17.

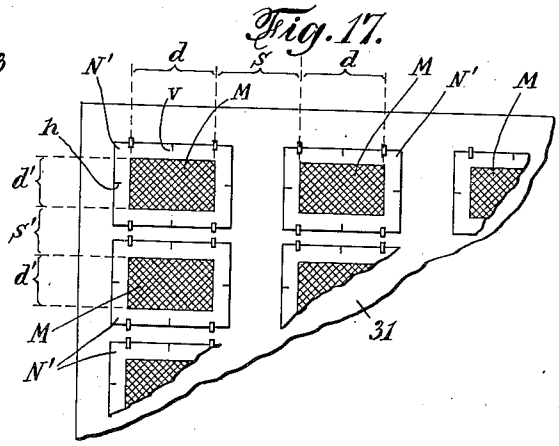


Fig. 14.

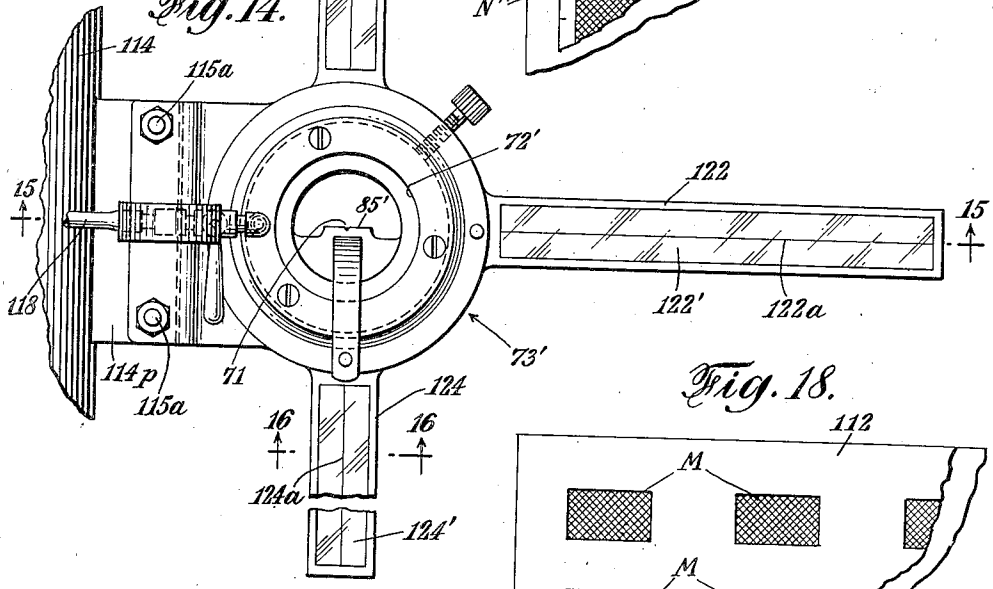


Fig. 18.

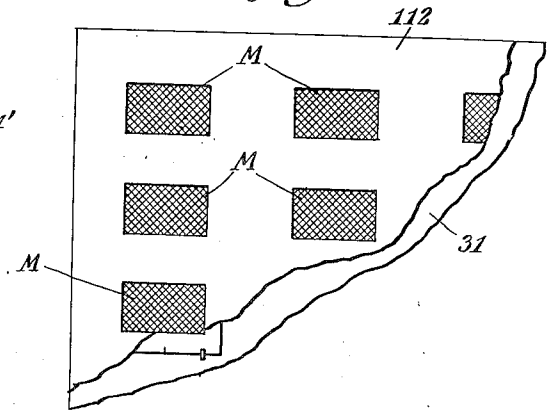
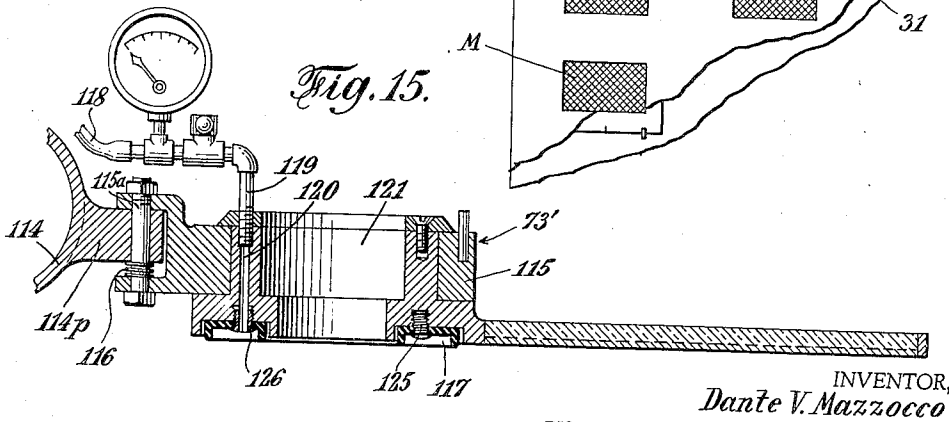


Fig. 15.



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Patented Aug. 6, 1940

2,210,726

UNITED STATES PATENT OFFICE

2,210,726

PHOTOCOMPOSING MACHINE

Dante V. Mazzocco, New York, N. Y.

Application June 2, 1939, Serial No. 277,023

9 Claims. (Cl. 95—76)

This invention relates to lay-out and photocomposing apparatus, at present largely used in preparing press-plates for photolithographic printing presses.

The invention provides, in one broad aspect thereof, a new type of lay-out table or machine having many practical and important advantages, especially when employed for lay-out composing of negatives in preparation for the photocomposing thereof on a press-plate, or for "pencil" lay-out in preparation for a lay-out composing.

In this connection, the invention provides a lay-out machine for a plurality of different or like negatives all to be photoprinted or photocomposed on a common press-plate, but a machine of such type that there is eliminated an enormous amount of hand-labor previously required for effecting precise registration of the negatives and for maintenance of such registration, and at the same time a machine such that certain things can be accomplished therewith which cannot be done with any other so-called lay-out machine of which I am aware. Certain of these new capabilities will be explained hereinafter.

As is usual, the lay-out machine of the present invention incorporates a pane of clear glass or other suitable transpicuous carrier to which the registered negatives are to be secured for the subsequent photocomposing operation; and certain of the features of the invention have to do with improved means for handling a negative while being registered on and secured to said carrier; a novel form of negative-registering means constituting a permanently inbuilt part of the lay-out machine; and improved means for resetting of the registering means in certain steps in terms of the calibrations thereon.

The invention also provides, in another aspect thereof, a broadly new kind of lay-out and photocomposing apparatus. This new apparatus is essentially a single apparatus, including a lay-out machine of novel type as one subdivision or unit thereof, and a structure including elements of a photocomposing machine as another subdivision or unit thereof, and wherein said two units are positionable relative to each other for cooperation to provide a photocomposing machine. According to prior practice, an establishment engaged in the business of preparing press-plates as above, has required a plant equipment in the nature of a system comprising a number of different machines or devices, in addition to the photocomposing machine, and with said machines and devices having to be used repeatedly and in conjunction with each other to insure registration of the various negatives and proper mounting of them on the transpicuous carrier, preparatory to photocomposing said negatives on one press-plate, as for single-color work, or on a plurality of press-plates, as for multi-color work, in the photocomposing machine. The necessity previously existing of having to make use of said machines and devices in aid of negative registration has been responsible for much of the time and hand-labor factors which have heretofore made the preparation of press-plates so relatively costly.

Reverting to the aspect of the invention as regards the provision of a new and valuable lay-out machine as such, the features of such lay-out machine as mentioned briefly above, and others, make for extreme speed in pencil or other lay-out, and in lay-out composition, in that said time and hand-labor cost-factors are thereby cut down to mere fractions of those previously required; yet negative registration is effected in such manner as to predetermine that that absolute color registry essential to the finest multicolor photolithographic printing will be obtained in the press, and that repeat-unit negatives will be located so exactly on a press-plate as to insure that when a sheet of paper or the like printed from said plate is later machine cut, such cuttings will have uniform margins and each cutting will have its edges perfectly aligned with the printing (for example, a lithographed label) thereon.

In the aspect of the invention as providing a single apparatus for both lay-out composing, and photocomposing, a feature thereof is that the two aforesaid subdivisions or units thereof can be permanently operatively connected, as by the use of connecting means including inbuilt pivotal mountings, for quick setting up to an arrangement of said units in one relation, for pencil lay-out or for lay-out composing, or for arrangement in another relation, to provide a photocomposing machine relative to a press-plate; even when, according to the invention as preferably carried out, the units are such that, with one of them providing a mount for the press-plate, the other unit not only mounts the transpicuous carrier for the negatives, but also includes, as an inbuilt part thereof, the registering means for the negatives.

Another feature of the present invention is the provision of two units, one a lay-out machine, and the other a combination of parts

which is cooperant with said lay-out machine to provide a photocomposing machine, which are so connected or connectible that, during pencil lay-out or during lay-out composing of negatives, on the transpicuous carrier, the unit equipped with that carrier is in accessible and particularly convenient location for the task then in hand, and, during use of the apparatus as a photocomposing machine relative to a press-plate, the two units are easily brought together to cause the negatives on the carrier to lie properly against the press-plate.

Another feature of the invention is the provision of an improved vacuum-frame means, in that it is carried by the press-plate-mounting unit, and the operative make up thereof is contributed to by both units during photocomposing, and in that it otherwise incorporates novel and advantageous elements.

Another feature of the invention, as the same is preferably carried out, to provide a combined lay-out and photocomposing machine, is an arrangement of the parts such that when the apparatus is set up for use as a photocomposing machine, the press-plate and the transpicuous negative-carrier are substantially vertical—an arrangement which conserves space, and makes not only for ease and quickness in handling the apparatus in all phases of its operation, but also for simplicity of construction throughout.

Another feature of the invention, considered especially as providing a new type of lay-out machine, is a means for permitting a negative to be registered in an inclined position; that is, so that the negative is registered, as by reference to its usual horizontal and vertical lines or markings by the aid of which it is ordinarily registered, with said markings extended at any oblique angle desired to the 90°-related travel-lines of the two independently movable carriages or bridges commonly forming the main parts of a favored type of previous negative-registering apparatus,—although two bridges need not form parts of the new registering means of the present invention.

Another feature of the invention is the provision of a lay-out machine, and one especially useful for pencil lay-out, in which a means is provided whereby a single straight-edge is so carried by the registering means of the invention that said edge can be used for the making of both the horizontal and vertical strokes of a cross-mark to be inscribed to have its strokes-intersection set a datum point for the particular location of a particular negative, as on a transpicuous carrier or on a press-plate.

The practical importance of the features of the invention hereinabove briefly explained will be appreciated by reference to U. S. patent to me, No. 1,885,532, dated November 1, 1932, for a photocomposing machine having some time-saving advantages in that it incorporates an in-built transpicuous negative-carrier; No. 2,031,221, dated February 18, 1936, for a separate negative registering apparatus required because said photocomposing machine is constructed as above-described—from which patent, especially, may be gained a full appreciation of the number of painstaking and time-consuming steps required, pursuant thereto, in regard to each of a plurality of negatives to be photocomposed on a single press-plate; and No. 1,946,539, dated February 13, 1934, for a vacuum frame designed to overcome difficulties otherwise encountered even in employing such a separate registering apparatus and such a separate photocomposing machine as are disclosed in the first two of said patents.

The invention, however, has other features and advantages which will become apparent or be pointed out hereinafter.

A now favored form of apparatus according to the invention is shown in the accompanying drawings, but merely by way of illustration, to show that one now preferred of the many possible embodiments of the invention.

In said drawings:

Fig. 1 is a side elevational view, partially broken away at the top, showing said apparatus, in full lines, in negative registering or photocomposing condition—with the unit for mounting the transpicuous carrier substantially horizontal but with somewhat of a downward inclination for maximum convenience of the photocomposer, and with the unit for mounting the press-plate down near and substantially parallel with the floor.

Fig. 2 is a view similar to Fig. 1, but showing the complete apparatus, with now both said units vertical and brought together to place the negatives on the carrier of one unit flatwise against the press-plate on the other unit—this view also showing a preferred type of hood and support for the source of illumination for photo-printing the negatives onto the press-plate.

Fig. 3 is what may be called a front elevational view of the unit mounting the transpicuous carrier, being a view looking in the direction of the arrow 3 of Fig. 2 at the unit shown to the right in Fig. 2, with the other unit, that shown to the left in Fig. 2, swung out of the way as in Fig. 1—the parts being shown in Fig. 3 on a somewhat enlarged scale.

Fig. 4 is a still more enlarged detail view, showing both units, arranged as in Fig. 1, in transverse vertical section.

Fig. 5 is a view similar to Fig. 4, showing said units brought together to establish a photo-printing machine as in Fig. 2; this view being a complete transverse vertical section through the machine.

Fig. 6 is a fragmentary detail view, in top plan, on an enlarged scale, showing parts of the registering means as is seen in Fig. 3.

Fig. 7 is a sectional view, taken substantially on the line 7—7 of Fig. 6.

Fig. 8 is a sectional view, taken substantially on the line 8—8 of Fig. 3.

Fig. 9 is a sectional view, taken substantially on the line 9—9 of Fig. 8.

Fig. 10 is a sectional view, taken substantially on the line 10—10 of Fig. 8.

Fig. 11 is a sectional view, taken substantially on the line 11—11 of Fig. 8.

Fig. 12 illustrates a modification of the registering means, as to the parts shown best in Figs. 8 and 10; this view being a sectional one taken on a line similar to that on which Fig. 8 is taken.

Fig. 13 is a sectional view, taken substantially on the line 13—13 of Fig. 12.

Fig. 14 is a view similar to Fig. 6, but illustrating a modification of a feature of the registering means involving a vacum gripper for a negative to hold it in registered position while being secured to the transpicuous carrier.

Fig. 15 is a sectional view, taken on the line 15—15 of Fig. 14.

Fig. 16 is a view taken on the line 16—16 of Fig. 14 and also showing parts in section.

Fig. 17 is a schematic or diagrammatic view which will be helpful in explaining some of the

unique and time-saving capabilities of the new apparatus.

Fig. 18 is a view similar to Fig. 17, likewise helpful in the same connection.

In an adaptation of the invention as exemplified in these drawings, the invention provides, so far as the aforesaid registering means is concerned, a means for locating one or more photographic negatives, that is, for positioning them with extreme accuracy, on a support in the form of a clear pane of glass or other suitable transpicuous material, of a kind such that after mounting the negatives on said support the latter can be used in a photocomposing operation, i. e., for actinic or photochemical transfer of the images on the negatives to the sensitized surface of a metal press-plate for use in a lithographic printing-press.

Where, as is usually the case, said carrier is to have a plurality of negatives positioned thereon and secured thereto prior to the photocomposing operation, each negative must be separately and very precisely thus registered, and secured in its registered position, before the next negative is thus registered and secured; and the registering means is used for this, first in regard to one negative and then in regard to another. Where plural-negative work is multi-color work, a number of press-plates must be made in this way, equal to the number of separate color printings to occur in the printing-press; and each of these plates must be made by a photocomposing operation involving the use of a different carrier. Each of these carriers must have mounted thereon the same negatives, except that, as to the different press-plates, the negatives are of different color values; and the corresponding negatives on the different carriers must be in identical positions, respectively. It will thus be apparent that extreme accuracy is necessary in the location of a negative relative to its carrier as well as to the printing plate, and particularly so with reference to the other negatives of the same series which have different color values and which must be printed in absolute register in order to obtain perfect results.

The negative registering operations just outlined are exemplary of what is meant in the art by lay-out composition.

In plural-negative work, in which work lay-out composition forms an important part,—whether identical negatives are employed all over the carrier (as in label printing, or other repeat-unit work), or different negatives are thus employed (as to have each printing-press impression of maximum usefulness, for a given size of press-plate),—an advisable if not essential preparatory task is to lay out, as by pencil or scriber markings over a press-plate or a surface corresponding in area to the surface of the press-plate, the desired arrangement of the negatives.

This preparatory work is what is meant by pencil lay-out as that expression has been used herein. The performance of this work is facilitated, indeed really made possible in the right way for the first time, by the present invention, by virtue of special devices to be later described in detail. By the use of the apparatus of the present invention, and now reference is made more especially to the invention considered in its aspect as providing a lay-out machine, the negatives can be arranged over a suitable surface, as that within an area over a sheet of paper, with such area of the same size and shape as the press-plate, and in a way such that the best possible lay-out is had, and so as to obtain an absolutely accurate and checked record of the datum points, relative to the press-plate area, for insuring the exact location of the different negatives on the carrier. When these datum points have been checked they can be entered in a log-book, or the like, in terms of abscissae and ordinates, of numerical-value designations corresponding to points along lines of horizontal and vertical calibrations carried by the registering means—as to each negative an abscissa and an ordinate appropriate, respectively, to horizontal and vertical line-markings on the negative. It may also be added that, in making a pencil lay-out extreme accuracy can be insured if, instead of inscribing line-markings as references for datum points on the area over which the lay out is being made, reference points be inscribed, the location of each of which is the intersection of the vertical and horizontal lines of a cross-mark; an advantage which, as already mentioned, is afforded by the present invention.

Referring now to the exemplifying structures illustrated in the accompanying drawings, and particularly to Figs. 1 and 2, for a first general understanding of a preferred embodiment of the apparatus for photocomposing as well as lay-out composition and pencil lay-out, the unit comprising the mount for the transpicuous carrier and having the registering means as an inbuilt part thereof is designated generally by the letter C; the registering means is indicated generally by the letter R; and the unit, which coacts with the unit C in photocomposing, and which mounts the press-plate, is designated generally by the letter P.

At 20 is indicated a main casting (see particularly Fig. 3), on which the unit C is pivotally suspended, as from a horizontal shaft 21, and by means of brackets 22 on the unit. The opposite ends of this shaft ride in vertical slots 23 (Fig. 1), so that the unit C can be raised and lowered as well as swung. So that substantially only friction has to be overcome in rearranging the unit C from the position of Fig. 1 to that of Fig. 2, and vice versa, cables 24 are connected to the shaft 21, pass over pulleys 25 on a common support 26, thence over pulleys 27 on a horizontal bar 28, and at suitable points beyond the last named pulleys hang counterweights 29. The unit C, at its opposite sides is connected to pads carried by the two side uprights of the casting 20 (these pads shown best in Fig. 3), by like side-links 30. There is no necessity for pin and slot-connections between a link 30 and either of its points of support; as the parts are so designed that in rearranging the unit C from the position of Fig. 1 to that of Fig. 2, thereby riding the ends of the shaft 21 up all along the length of the slots 23, the upper end of each link 30 traverses an arcuate path. When the unit C is as in Fig. 1 it is firmly stabilized in that position, by its own weight, by virtue of its manner of mounting as just explained. With the unit C thus arranged, its upper surface, carrying the transpicuous sheet 31 (see Fig. 3), which constitutes the carrier for the registered negatives, and which sheet will be hereinafter called the carrier 31, is in a plane at somewhat of an angle to the horizontal, as shown in Fig. 1; thus making for facility of use of the unit C for lay-out composition and pencil lay-out. The unit P is then well out of the way, as shown in Fig. 1; being horizontal and down near the floor, with its outer end well in toward the casting 20. The unit P when thus arranged

is supported at its inner end by brackets 32, one such on each end of the apparatus. These brackets are secured by bolts 33 to the unit P and are pivotally hung on a horizontal rod 34 mounted on casting 20. The unit P is supported at its outer end, when positioned as in Fig. 1, by legs 35 pivoted on the unit as at 36.

When the unit P is arranged as in Fig. 2, that is, is swung up to vertical position as there shown (which upswing is effected after the unit C has first been rearranged from the position of Fig. 1 to that of Fig. 2, by swinging its lower end in the direction of the arrow A of Fig. 1 while raising the shaft 21 incidental to descent of the counterweights 29 from the positions shown in Fig. 1 to those shown in Fig. 2), the two units are interlocked, and both thereby held to such positions that the carrier 31 is in a vertical plane, by utilizing the legs 35 as coupling arms for the two units, by virtue of engagement of a notch 35*a* of an arm with a lock-pin 37 of a pair of such pins offset from each of the sides of the unit C.

Horizontally and rearwardly extended from the top of casting 20 is a trackway as indicated at 38, for taking the wheels or rollers 39 of a trolley-carriage 40 having a pendent member 41 suspending at its lower end a light distributing hood 42, open at its larger end located to the left in Fig. 2, and there provided with a light diffusing glass pane or the like (not shown), and for containing a source of artificial illumination rendered operative for a photocomposing operation. Such source (not shown) is conveniently a high-wattage electric illuminator, served by wires in a cable 43.

The Apparatus for Lay-Out Composing or Pencil Lay-Out

This, as above stated, comprises, aside from its supporting parts, the unit C, for mounting the carrier 31, and the registering means R forming a permanently inbuilt part of the unit C.

The unit C.—Referring to Figs. 1, 3, 4 and 5, this unit has a main structure in the form of a quadrilateral open frame 44, to which the brackets 22 are bolted as at 22*a*. Secured to the side of this frame, which is uppermost in Figs. 1 and 4, is a holder 45 for the carrier or glass sheet 31, also in the form of a quadrilateral frame, but one uniplanar except where bevelled as shown in Figs. 4 and 5 to interfit with bevelled edges of the glass sheet 31 as there illustrated.

As will be noted from Fig. 3, the dimension of the unit C is greater, lengthwise of the apparatus, that is, along the length of the bottom web of main casting 20, than the unit P for carrying the press-plate, so that the area of the glass sheet 31, to the left in this view, is present as an addition to the area of this sheet required for lay-out composition, and purposes which will be explained later.

For use when the unit C is employed for certain of said purposes, means are provided for illuminating the glass sheet 31 from the inner side thereof.

Said illuminating means is shown as in the form of a plurality of electric light bulbs 46 which run all around the glass sheet 31 but beyond the working area of the latter, that is, under the holder 45. These lamps are in sockets 47 carried on brackets 48 attached to the main frame 44 and are supplied with current from any suitable circuit connections not shown. The lamps are readily replaceable by way of the underside of the main frame 44, which is open at its underside, except when there closed by an opaque curtain 49. This curtain, which is of a white or other light color on its side facing the glass sheet 31, when the curtain is stretched as in Fig. 4 (and not rolled up as in Fig. 5 as for photocomposition), is part of a means for rendering the illuminating means constituted by the bulbs 46 of real assistance in employing the unit C for lay-out composition and for pencil lay-out, while at the same time avoiding the necessity of having a frosted or merely translucent but not transparent sheet instead of the glass sheet 31. If the curtain were dispensed with, and a translucent yet transparent glass sheet were required for lay-out composition and pencil lay-out, a clear glass sheet would have to be substituted each time the apparatus was used for photocomposition by arrangement thereof as in Fig. 1.

The curtain 49 is wound on a roller marked 50 in Fig. 4, of the spring-roller type, say an ordinary Hartshorn roller, so that when released it will be automatically rolled up by the spring means within the roller, but so that when pulled it can be unwound from the roller. To the opposite sides of the curtain or shade 49, as shown in Fig. 3, are attached cords 51 and 51'. The cord 51 passes over a pulley 52 (see also Fig. 4), and thence through a suitable hole in the side of the main frame 44 of the unit C, to the adjacent upright of the main casting 20, where it is tied to a stud-button 53 (see also Fig. 1). The cord 51', after passing around a pulley 53', extends to the holder 52, and thence through said hole, and to said stud-button, to which it is tied.

With the parts arranged as in Fig. 1, the cords 51 and 51' are both taut; and the design of the parts is such that, automatically, when the parts are arranged as in Fig. 1, the shade 49 is drawn out to close the bottom of the main frame 44, as in Figs. 1 and 4, and when the parts are arranged as in Fig. 2, the pull on the said cords is relieved to allow the curtain to be rolled up as in Fig. 5.

The registering means.—Referring in this connection primarily to Figs. 3 through 16, and first to Figs. 3, 4 and 5, the registering means R, as above stated, is permanently operatively carried by the unit C. Along each of its upper and lower edges which run lengthwise of the apparatus the main frame 44 of the unit C has secured thereto a rack 54. These racks have teeth for meshing with pinions 55 tight on a common shaft 56 journalled in bosses 57*a* upstanding from the bar-like bottom band of a transverse cradle 57 (Figs. 3 and 4). Cradle 57 has two upstanding portions 57*b* and 57*c* at opposite ends of said band, so that, all as best seen in Fig. 4, the cradle is of irregular U-shape in side elevation. The shorter one, 57*b*, of said portions, is shaped as a claw 57*b*' having an arcuate seat by way of which the claw is suitably fixed to the bottom of a barrel 58. A similar claw 59', on the bottom of a post 59, is fixed to the top of said barrel. A saddle-bar 60, parallel with the bottom band of the cradle, but overlying the glass sheet 31, is secured at its opposite ends to the upper ends of post 59 and the portion 57*c* of the cradle.

The parts just described constitute a carriage for movement back and forth horizontally along the length of the glass sheet 31, with the axis of the barrel 58, which is generally cylindrical, always parallel to the direction of movement of the carriage and with the saddle-bar 60 extended perpendicular to such direction of travel. This saddle-bar will hereinafter be called the bridge

60. The bridge 60 is mounted for such movement, not merely by the racks 54 and pinions 55, but also by guiding means for precisely holding the plane of the top surface of bridge 60 parallel with the top surface of the glass sheet 31. This means here comprises the top of the rack 54 which is remote from the barrel 58, machined carefully to constitute a track, and a flanged roller 61 engaging said track as shown at the upper right in Fig. 4 (this roller journalled on the portion 57c of the cradle 57) and roller-and-track means within the barrel 58 to be described below, under the italicized heading "Roller-and-track means of the registration adjustment means."

Suffice it to say at this point that the roller-and-track means just mentioned is provided in part by elements within the barrel 58 and in part by a bridge 62 similar to the bridge 60, except that the bridge 62 is a bridge fixed relative to the glass sheet 31, being suitably secured at its opposite ends to brackets 63 carried by the main frame 44 of the unit C as best shown in Fig. 3.

Mounted on the traveling bridge 60 is a barrel 64, structurally similar to the barrel 58, and for movement along the bridge 60 in the same manner as the barrel 58 is movable along the fixed bridge 62; all as will later be made clear.

A feature of the invention is a registering means in which there is only one travelling carriage. In the structure being described, it will be noted that only one travelling bridge, or true bridge, is required, to wit, the bridge 60, but nevertheless movable elements are present, e. g., the barrels 58 and 64, which, as will later be seen, adequately and more than adequately, take the place of the two travelling carriages provided by my aforesaid Patent No. 1,885,532.

The barrel 58 is employed for registering horizontally displaced datum points ascertained and set for the registration of a negative, as the negative shown at N in Fig. 3, and the barrel 64 is employed for registering vertically displaced datum points ascertained and set also for the registration of such negative—the bridges 60 and 62 being always perpendicular to each other, regardless of the positions of either or both of the barrels on their bridges.

These datum points, in a way to be explained, are "registered" by correlation between suitable line-markings on the negative, as the horizontal line-markings indicated at N*h* on the negative N of Fig. 3, and the vertical line-markings indicated at N*v* on said negative, with suitable calibrations arranged along lines fixed relative to the bridges 62 and 60, respectively. Such calibrations are shown in Fig. 3, those of the bridge 60 being, as to main or "rough" elements, arranged along a straight line extended longitudinally of the bridge, at 65, and, as to "fine-adjustment" elements, in a circular line 66*a* about the periphery of a collar 66 rotatable on the barrel 58. Similar calibrations 67 and 66*a'*, respectively, are carried by the bridge 60 and a collar 66' rotatable on the barrel 64.

The calibrations 65 and 67 are on the tops of bars 68 and 69, respectively on the bridges 62 and 60. Said bars are preferably rectangular in cross-section, are of the same shape and size in transverse dimensions, and both are hollow, as shown in the case of the bridge 62 in Fig. 4, for lightness.

It will be understood that in lay-out composing each photographic plate (usually of the film type), herein called for convenience the negative, is to be moved to, for securement at, a definite predetermined position on the glass sheet 31, and that upon the precision with which this positioning, or "registration," takes place, depends the accuracy of the work. This position is determined with respect to directions which extend at 90° to each other, and therefore it is most practical to move the negative first to its position-determinant in one direction and then to its position-determinant in a direction exactly 90° thereto. Also, it is most practical to set the parts first definitely for negative-positioning in one of these directions, and then definitely set the parts for negative-positioning in the other direction at 90° to the first-named direction.

A supervisor for negative registration is carried by the barrel 64 on the travelling bridge 60; a preferred form of which supervisor, and one also including a transporting and holding means for the negative of the vacuum-cup type, is shown in detail, as to one modification thereof in Figs. 6 and 7, and as to another modification thereof in Figs. 14 and 15. Such supervisor, hereinafter discussed in detail, as to structure as well as operable capabilities, under the italicized heating "lay-out supervisor," is fixed to the barrel 64 in such way, that is, with its possible movements relative to said barrel so limited, as to insure that a point on the supervisor, that of a minute notch 70 in Fig. 6 and of a similar notch 71 in Fig. 14, can always be brought directly upon any precisely determined point over the glass sheet 31, by some one or more of the following movements, to wit, an axial movement of the barrel 64 along the travelling bridge 60, a rotational movement of the collar 66' of said barrel on the latter, a movement of the bridge 60 relative to the fixed bridge 62 resulting from an axial movement of the barrel 58 along said fixed bridge, and a rotational movement of the collar 66 on the barrel 58.

The notches 70 and 71 are desirably minute and carefully formed. Such a notch is preferably V-shaped, with its vertex-adjacent sides slightly rounded to a tiny radius, that of a very sharp pencil, for pencil lay-out, and in such manner that the axis of the pencil point, with the pencil manually held vertical, is precisely at the centre of rotation of a ring (72 in Fig. 6; 72' in Fig. 14) forming a calibrations-carrying element of what will be called the protractor device (marked generally 73 in Fig. 6; and 73' in Fig. 14) of the supervisor.

Registration adjustment means.—Reference in this connection should particularly be had to Figs. 3, 4, 8, 9 and 10.

These views show that part of the registration adjustment means associated with the fixed bridge 62 and the calibrated collar 66 rotatable on the barrel 58 on said bridge. A description of this part of said means can also serve as a description of that part of said means associated with the travelling bridge 60 and the calibrated collar 66' on the barrel 64 on said bridge; as these two parts of the registration adjustment means are identical.

Secured to the underside of the fixed bridge 62 is a rack-bar 74.

Along its bottom the barrel 58 longitudinally thereof is slotted parallel with its axis as indicated at 58*a* in Fig. 9, through which slot extends the toothed underside of the rack-bar 74.

At one end the barrel 58 is reduced in external diameter, to provide a shoulder marked 58*b* in Fig. 8, and a cylindrical reduced extension 58*c*

on which is rotationally mounted the calibrated collar 66, said extension 58c at its free end being threaded for the screwing up thereon of an internally threaded ring or nut 75. This nut carries an index 75a (Fig. 3) to cooperate with the calibrations 66a of the collar 66. Any suitable means can be provided for holding the nut 75 precisely in position to avoid loosening thereof, yet always to maintain the collar 66 freely turnable in precisely its appointed plane transverse to the barrel.

Also, for instance as shown in my aforesaid Patent No. 1,885,532, there may be provided any suitable means for temporarily clamping the collar 66 against rotation on the barrel 58, so that the fine adjustment obtained by the calibrations last mentioned may be protected against casual or accidental disturbance, and any suitable means for temporarily clamping the barrel 58 in any set position of the same relative to the calibrations 65.

A feature of the invention, as to these last mentioned calibrations, is an index carried by the barrel 58 which makes for compactness of arrangement, and particularly for very convenient yet accurate readings. This index is a hair-line, marked 76 in Fig. 6, and carried, as best shown in Figs. 8 and 9, by a magnifying lens 76a, set in an opening in the top of barrel 58.

The structure including the barrel 58 and the parts carried thereby surround bridge 62 and rack-bar 74 secured thereto. The collar 66 has an internal thread 66b (Figs. 8 and 10), formed for cooperative meshing engagement with the teeth 74a formed on the rack-bar 74, which teeth are of screw-thread formation in the present embodiment of the invention. In order to fulfill their desired functions the thread 66b and teeth 74a preferably have gradually sloping sides such for example as in the Acme type thread. The thread 66a is a mutilated or interrupted one, there being a slot 66b' (Fig. 10) through the collar 66; which slot is aligned with the slot 58a of the barrel 58, as shown in Fig. 9, when the collar 66 is in normal or "zero" adjustment on the barrel, as shown in Figs. 8, 10 and 3. Then the index 75a is as in the view last-mentioned, that is, is in line with the topmost one of the calibrations 66a on the collar 66. In this connection, see Fig. 6, wherein parts exactly like those just referred to, but associated with the barrel 64 instead of the barrel 58, are shown on a larger scale and are given the same reference characters except for the addition of primes. Note in Fig. 6, the index 75a' on the nut 75' is aligned with the "zero" calibration 66az of the calibrations 66a' on the collar 66'; and the index 76' of the barrel 64 is absolutely in line with one of the calibrations of the line 67 thereof. Conveniently, the calibrations 65 and 69, on the bridges 60 and 62 respectively, are numbered, through say "1," "2," "3," etc., as are the calibrations 66a and 66a' on the collars 66 and 66', respectively; but these numberings are not shown in the drawings to keep them as clear as possible. If there be assumed to be eight of the major calibrations in the series 66a or 66a' thereon on the collars 66 and 66', these major calibrations spaced equidistant around the collar, and if the pitch of the screw teeth on the rack-bar 75a (Figs. 8 and 10) and of the teeth 74a' on the rack-bar 74' (Fig. 7) be assumed to be ⅛", when the collar 66 or 66' is rotated a radial distance equal to the distance between two of said major calibrations thereon, a point on any given tooth of the associated rack-bar will advance 1/64", which latter increment of distance represents the finest adjustment provided in the mechanism herein illustratively shown; it being distinctly understood, however, that it is in the contemplation of the invention that by varying the pitch of the threads and the distance between calibrations 66a and 66a', any desired common fraction or decimal fraction of increments of movement may be provided, as will be obvious to those skilled in the art, as in the fine-adjustment means of my aforesaid Patent No. 1,885,532.

Roller-and-track means of the registration adjustment means.—The barrels 58 and 64 are axially movable along their respective bridges 62 and 60 very easily, as in my aforesaid Patent No. 1,885,532, and without the necessity of the motive means usually employed prior to the teachings of said patent. Otherwise stated, the traveling bridge 60 can be moved back and forth freely by hand, in a direction perpendicular to its length, and the barrel 64 thereon, constituting the other and complementary traveller, can be similarly moved in a direction perpendicular to the direction of travel of the bridge 60.

The means for attaining these ends is similar in regard to both the barrels 58 and 64. Such means for the barrel 58 will only be described—in which connection reference is now made to Figs. 8 and 10. The view last named is here alluded to, particularly, not only because it shows in end elevation the parts shown in side elevation in Fig. 8, but because it brings out the fact that, in order to have endwise movement of the barrel 58 along the length of the bridge, 60, sleeved thereby, the collar 66 must be in "zero" position, that is, the collar must be so angularly set on the barrel that the teeth of the rack-bar 74 are out of mesh with the thread 66b of the collar by virtue of the fact that the toothed underside of the rack-bar is now in the slot 66b' which interrupts said thread along a line parallel with the axis of the helix which defines the thread. In the present embodiment of the invention, the means mentioned at the beginning of the second preceding paragraph comprises, as to its track component, the nicely machined upper and side surfaces of the fixed bridge 62, and, as to its rollers, a wheel set here including forward and rearward pairs of flanged wheels 77 which, mounted on blocks 77a within the barrel 58, are provided with frictionless bearings, such, for example, as the ball-bearings shown.

Lay-out supervisor of the negative registering means.—Referring to Figs. 3, 6 and 7, the barrel 64 has offset therefrom a projection 64p, to which are pivoted the ends of four links 78 the other ends of which links are pivoted to an extension 79a from a collar 79 sleeving the ring 72 of the protractor 73. As shown, these links are duplicates, and are a parallel-link group, and so allow the flat bottom surface 73' of the protractor 73 to be raised and lowered while maintaining such surface always parallel with the upper surface of the glass sheet 31—as, for example, to handle in one case say a thinner negative on film, and at another time a thicker negative on glass.

The ring 72 is a built-up structure, including, as seen in Fig. 7, a ring proper 72' within and of the same axial dimension as the collar 79, a cap-ring 72a, and a lower portion made up of an annulus 72b and a bottom member 72c having radially offset therefrom three arms 72d, 72e and 72f. Each of these arms has a straight-edge, marked respectively, in Fig. 6, 80, 81 and 82.

Calibrations 83, in terms of degrees of angles, are carried by the top of the cap-plate 72*a*, which latter rotates with the ring 72; and a cooperant fixed index 84 is carried by the top of collar 79. The calibrations 83 are shown as measuring from 0 to 90 degrees, the latter reading being one representative of the fact that the arm 72*d* is at right angles to the line of extension of the travelling bridge 60. The calibrations 83 are in an arcuate line concentric with the point of notch 70. This notch is intermediate the ends of a straight-edge 85, extended parallel with the straight-edge 80, and carried by a block 72*g* integral with the bottom member 72*c* of the ring structure. Impositively to hold the protractor arms at either the 0 or 90 degrees reading, a leaf-spring 86 is secured at its end adjacent to notch 70 to the block 72*g* (see Fig. 4); and the other end of said spring has an opening, marked 86*a* in Fig. 6, for acting as a temporary keeper for the upper end of a pin 87 or 87*a* set in the collar 79. Similarly to hold the protractor arms at intermediate angular readings a set-screw 88 having a knurled head is threaded through a tapped hole in the collar 79, and adapted when screwed up to bear at its inner end against the ring structure.

Vacuum-type negative holder.—This feature of the invention here shown as carried by the protractor is further shown as incorporating sucker-mouths arranged at suitable points lengthwise of and along the undersides of the arms 72*d*, 72*e* and 72*f* (compare Fig. 4). One such mouth for the arm 72*e* is indicated in Figs. 4 and 7 at 89, served by a conduit 90 within said arm; which conduit is a branch from a conduit 91 running around the interior of the bottom member 72*c* of the ring structure 72. Said conduit 91, having another branch 92 therefrom within the arm 72*d*, is itself a branch from a conduit 93 within the arm 72*f*. This last named conduit extends all the way to the outer end of this arm, and there, by a nipple 94 and an elbow 95, is connected with a line 96 from a suitable air-exhaust means not shown. The line 96 has interposed therein a shut-off cock 97 and a vacuum gage 98.

Operation

Leaving for a later point herein a consideration of the modification of Figs. 12 and 13 (in lieu of the structure of Figs. 8 through 10) and of the modification of Figs. 14 through 16 (in lieu of the structure of Figs. 6 and 7), the operation of the negative registering means when constructed as already described will now be given with reference to some of its manifold uses, and to an extent such that it will be clearly understood and appreciated by those skilled in the art how the invention may be employed in all of its useful aspects, when the illustrated apparatus is arranged as in Fig. 1, for lay-out composing or pencil lay-out. First, as to lay-out composing: Assume that it is desired to register on the glass sheet 31 a plurality of negatives in various positions on said sheet to correspond precisely with positions over the sensitized surface of a press-plate. Assume, also, for example, that the negatives are of such size and the images carried thereon are of such character that the predetermined registration positions thereof, to take three only of such negatives, are, respectively, 15¼", 30¼", and 45¼" in a direction longitudinally of the apparatus, that is, lengthwise of the fixed bridge 62, and that their predetermined registration positions are, respectively 6¾", 12¾" and 18¾", in the transverse direction, that is, lengthwise of the travelling bridge 60.

As has already been mentioned, the glass sheet 31 is longer than the press-plate; that is, the glass sheet 31 has a surplus or work-place area marked 99 in Fig. 3, and located to the left of the line 100. Compare in this view the placement of this line relative to the line 100*a* on the unit P, the latter line representing the left-hand edge of the press-plate when properly mounted on the unit P. Glance at this point at Fig. 5, wherein the press-plate is shown at L; the edge thereof just referred to being the edge which is vertical in Fig. 5 but remote from the observer. In Fig. 5, it may also incidentally be remarked at this point, three negatives of the various negatives which are to be properly registered on and secured to the glass sheet 31 before the parts are arranged as in Fig. 5 (and Fig. 2) for photocomposition, are indicated at N*a*, N*b* and N*c*. Assume for convenience, that these three negatives are the ones whose abscissae and ordinate determinants are those numerically expressed hereinabove.

Reverting now to Figs. 1 and 3, and particularly the latter, each and every one of the negatives to be registered on and secured to the glass sheet 31 for a single photocomposing operation, are successively thus registered and secured, in the manner now to be described in connection with the negative N of Fig. 3.

Assume that this negative has the registration determinants of, horizontal, 30¼", and vertical, 12¾". By travel of the barrel 58 along the fixed bridge 62, the travelling bridge 60 is moved to within the work-place area 99, at any convenient point thereon, and the negative is registered with the protractor 73 by shifting the negative manually over the glass sheet 31 until the line-markings N*v* are precisely aligned with the straight-edges 81 and 82, and until at the same time the right-hand line marking N*h* is precisely aligned with the straight-edge 80. It is not necessary, particularly in the earlier stages of a multi-negative lay-out composing, to register a negative with the protractor as just described, in the work-place area 99, but it is recommended because it has been found very convenient and time saving in many cases.

Then, by means of the line 96, the vacuum-cup means on the bottom of the protractor 73 is exhausted and is thereby rendered effective to grip securely the upper surface of the negative.

The further steps are very simple and quickly performed. The barrel 58 is moved to that one of the calibrations 65 corresponding to 30", and the collar 66 is rotated to align the index 75*a* with that one of the calibrations 66*a* corresponding to ¼". The barrel 64 is moved to that one of the calibrations 67 corresponding to 12", and the collar 66' is rotated to align the index 75*a*' with that one of the calibrations 66*a*' corresponding to $\frac{3}{16}$".

Now the negative N is precisely registered at the position shown in Fig. 3, and with its emulsion-free side flat down against the glass sheet 31; in which latter connection note again the parallel links 78 of Figs. 6 and 7. The protractor arms are now disposed as indicated in dot and dash lines at 80', 81' and 82' in Fig. 3.

With the negative N thus positioned it is secured to the glass sheet 31 by application of Scotch-tape or other suitable means 101 according to a practice familiar in the art.

The vacuum grip on the negative N is now re-

leased, in any convenient way, as by adjustment of the handle 97*a* of the cock 97, which latter can be of the type wherein the handle in one position opens the conduit 93 of Fig. 6 to the atmosphere and shuts off connection with the line 96, and in another position closes the port last referred to and connects said conduit with the line 96.

In the same way as above described, each of the negatives to be successively registered on and secured to the glass sheet 31 are handled, preferably in the work-place area 99 of Fig. 3 and then at its actual location on the main area of the glass sheet.

If a negative is to be registered with the line-markings N*h* or N*v* at an oblique angle, that is, at an angle to the lines of axial travel of both barrels 58 and 64, that data will be in the log-book entries covering the particular lay-out composition being done. Assume that this data gives the same vertical and horizontal determinants, as given last hereinabove, plus an azimuth notation for the horizontal line-markings N*h* on the negative to signify that they are downwardly inclined toward notch 70 at an angle of 7 degrees to the straight-edge 80; this angle translated, into terms of the calibrations 33, being given by a log-book notation, of, for instance, N*h*—3° (note Fig. 6).

The procedure would be exactly as already explained for the negative N, except that, with the barrel 64 in the work-place area 99 at Fig. 3, the protractor arms would first be swung until the index 84 of Fig. 6 is aligned with that one of the calibrations 83 corresponding to 3 degrees, and then the negative would be shifted about on the glass sheet 31 until the line-markings N*v* on the negative and the right-hand line-marking N*h* thereon were precisely aligned with the straight-edges 81, 82 and 80, respectively. And then the other steps would be performed as above.

The same glass sheet 31 is used repeatedly, for single color as well as multi-color press-plates. But there is no necessity for the curtains or screens previously invariably employed, for blocking out and protecting the sensitized surface of the press-plate from extraneous light on portions thereof. There is but one registering operation, and one securing operation, as to each negative for a particular press-plate. The glass sheet is covered all over with the largest possible number of negatives ever intended to have their images actinically transferred to a press-plate, before that press-plate need be exposed to light which would affect its sensitized surface. Only one registration of a negative is required, and solely in regard to a single transpicuous carrier, and immediately that registration is effected the negative is in position to be secured to, and is directly secured to, said carrier, the glass sheet 31.

One more important utility of the new registering means should be specially mentioned. This is its use in those many cases where a press-plate is to carry as many photoprinted images as possible, as in preparing press-plates for label printing, in either single color or multi-color work. Here the negatives for any single press-plate are all duplicates, so that the press-plate in both directions is really a regular pattern made up of identical repeat units extending in both said directions, but with each such unit an image actinically transferred from a different negative. Particularly time saving is the utility of the invention in this regard, especially when the modification of Figs. 12 and 13 is a feature of the apparatus. The time saving advantage is further augmented, and reductions in total press-plate cost and in the number of printing-press operations required, are made possible, when the teachings of Figs. 17 and 18 are availed of.

Referring in this connection first to Figs. 12 and 13, the parts having reference characters corresponding to those of Figs. 8, 9 and 10, are identical with the parts last referred to; these parts being the bridge 62, the rack-bar 74, its teeth 74*a*, the hollow bar 68 and the calibrations 65 thereon, the wheels 76 and the nut 75. The barrel, marked 102, is exactly like the barrel 58, except for opening 103 in the barrel 102; and the collar 104 is exactly like the collar 66, except for the fact that the thread 105 thereof, corresponding to the thread 58*c* of Fig. 8, is an uninterrupted one, that is, there is provided no such slot as the slot 58*a* of Fig. 10. The inner diameter of the collar 104, at the land of the thread 105, however, is such that when the parts of Figs. 12 and 13, now under consideration, are arranged as shown, the teeth of rack-bar 74 are out of mesh with the thread 105, due to the action of gravity on the barrel 102, now permitted because cam-including support means for the barrel are in an arrangement to allow this. This support means is at the opening 103, and comprises a pair of bosses 106 carrying a stub-shaft 107 on which is secured a cam 108. A handle 111 is projected from the cam.

When the handle 111 is as shown, the teeth 74*a* and the thread 105 are out of mesh, and the barrel 102, regardless of the angular setting of the collar 104 thereon, can be given an endwise movement along the bridge 62; so that if the collar has previously been set say to 5/64", and if say the barrel is set relative to the calibrations 65 at 35", on moving the barrel endwisely until the barrels index shows it is set at 45", the actual setting of the barrel will not be 45 5/64".

When the handle 111 is thrown to the position indicated in Fig. 12 at 111*a*, the cam 108 causes the barrel to be elevated relative to the bridge 62 to an extent to cause meshing of the teeth 74*a* and the thread 75. This allows the collar 104 to be angularly set for any desired "fine" adjustment; either to establish that one referred to in the paragraph immediately preceding, or to allow the apparatus to be used as though it had incorporated therein the barrels 58 and 64, instead of, at the location of the former, the structure of Figs. 12 and 13, and at the location of the latter, a structure identical with that of Figs. 12 and 13. A somewhat similar means, but one of more complicated nature than that shown here in Figs. 12 and 13, is a feature of my aforesaid Patent No. 1,885,532. The value of a structure like that of Fig. 12 or 13, or an equivalent, is very important, for minimizing the naturally great hand-labor contribution to total cost, in many lines of work, as, for instance, in preparing a press-plate for label printing. In this connection refer back to the last clause of the fourth paragraph of this specification. In most if not all cases, both the horizontal and vertical locus-data for a succession of labels to be arranged in a straight line could be expressed in terms of one of the calibrations 65 or one of the calibrations 69, plus in each case the same fractional increment, as C 3/16", and C' 3/16", and C'' 3/16", etc., where C is one of the calibrations 65 or 69, C' is another of such calibrations, and C'' is still another, with C'' representing the same incre-

ment over C' as the latter represents over C. In any such case, only one preliminary angular setting of the collar on one barrel or of the collars on both barrels, would be required, in order to register all the negatives on the glass sheet **31**. Once said collar or collars were thus set, the handle **111** would be thrown to its position **111a**, and remain there until, by longitudinal setting of the barrels only, relative to each negative, all the latter were registered on and secured to the glass sheet **31**.

Referring now to Figs. 17 and 18, these illustrate various capabilities of the invention, one of which is particularly useful in label or similar repeat-unit work. In this last regard the advantages are that not only is time saved, but a considerable economy results from reducing the number of press-plates required for any given job, with a corresponding reduction in the number of times the printing-press must operate for that job. For the economy last referred to, it is great in proportion to the relative number of negatives which can at one time be placed on the glass sheet **31** for actinic transfer to the press-plate regardless of the number of times the carrier with a properly placed group of negatives coacts with the press-plate in photocomposition.

In both Figs. 17 and 18, a portion of the glass sheet **31** is shown, the negatives are indicated at N', and their images to be photocomposed on the press-plate are marked M. It will be noted that the area of an image M is considerably smaller than that of its negative N' as the horizontal and vertical registration markings *h* and *v* must be well removed from the image M to avoid obscuration from the latter.

Figs. 17 and 18 illustrate an extreme case, that is, where the labels are to be printed with all images M immediately adjoining both lengthwise and widthwise of the press-plate, and, extreme economy is possible. In such case the negatives will be placed on the glass sheet **31** in four groups; one group being assembled as such on the glass sheet, then being photocomposed on the press-plate as such group, then being redisposed on the glass sheet to set up the second group, then being photocomposed on the same press-plate as such group; and so on.

Fig. 17 illustrates one group disposition for one photocomposing operation; and Fig. 18 illustrates a mask **112** employed during that photocomposing operation. This mask, which can be of opaque paper or the like, has cut-outs **113** which match the images M of the particular group of negatives then to be photocomposed as such group on the press-plate.

The negatives N' are first grouped, for the first photocomposing operation, say, as shown in Fig. 17, that is, with the horizontal spacings *s* between the images M of each two adjoining negatives in a horizontal line, each equal to the horizontal dimension *d* of said image, and with each vertical spacing *s'* between said images of each two adjoining negatives in a vertical line equal to the vertical dimension *d'* of said image.

The other three required groupings of the negative N' on the same glass sheet **31**, for photocomposing on the same press-plate, are, as will now be understood, groupings thereof such that in one case the spacings *s* will be kept as before but the images M will be in horizontal rows aligned with the spacings *s'*, in another case the spacings *s'* will be kept as shown but the images will be in vertical rows in line with the braces *d*, and in the other case the spacings *s'* will be kept as shown but the images will be in vertical rows in line with the spacings *s*. The three masks used, respectively, in the three groupings last referred to, will of course have cut-outs like the cut-outs **113** but in location appropriate to the varying lay-outs of the different groupings.

Referring to Figs. 14 and 15, there is here shown a modification of the structure principally shown in Figs. 6 and 7, which has certain features now preferred, especially for the extremely accurate work required in connection with pencil lay-out. These features will be described in a moment, in connection with the remarks immediately following.

Pencil lay-out.—In employing the unit C and the registering means R for this work, the ease and quickness of manipulation of the parts, and the special capabilities thereof, as above to some extent outlined, are all present.

The recommended procedure is to lay a paper sheet, of about the same size as that of the glass sheet **31**, over the latter, and attach the paper sheet to the glass sheet by Scotch-tape or the like. To take, for instance, the case ordinarily giving greatest difficulty in pencil lay-out, that involving the lay-out of different negatives, and negatives of different sizes, with some to be arranged with their registration markings parallel to the lines of extension of the bridges **60** and **62** and others to have these markings oblique relative to the said bridges, the negatives are spread on the paper sheet and shifted about until the best possible arrangement thereof is ascertained. It may often be helpful, during this work, to attach one or more of the negatives to key positions or otherwise temporarily anchor them against accidental shift, and this can be readily done by the use of Scotch-tape or the like. It is recommended that all the negatives be thus temporarily secured to the paper sheet, to avoid accidental shift of any thereof, after they are finally arranged exactly as desired. With the negatives thus secured in place, pencil marks are made on the sheet of paper to make a permanent record of the determinants for their positions; so that later, from these marks, and by the use of the registering means, readings from the latter may be taken for entry in the pages of the log-book appropriate to the job in hand.

In pencil lay-out particularly, the ideal type of mark to employ is one giving a datum point as the intersection of two lines one perpendicular to the other, that is, a cross-mark. Indeed, this type of position-datum may be said to be almost an essential for fine and accurate work; due to the fact that hydroscopically or otherwise, a negative at one time may be of one size, and at another time it may have shrunk or expanded to another size. Merely relying on straight line position-data leads to trouble, in the sense that shrinkage or expanse of the negative, or variation in distances between straight-line marks on the negative and straight-line boundaries of the image parallel to such marks, may be present but not detected.

By the present invention, and for the first time in the art so far as I am aware, cross-mark position determinants can be employed, and in the manner which will now be explained.

With the arm **72d** of the protractor arranged as in Fig. 6, the horizontal bar of a cross-mark to be made is inscribed by giving a short stroke of a pencil along the straight-edge **85**. The vertical bar of said cross-mark is made by mov-

ing the barrel 64 a trifle in one direction or the other along the bridge 60, then placing the pencil point in the notch 70, and then moving the barrel a slight distance in the opposite direction, and with it a pencil while the latter is held substantially vertical with its point in the notch 70. A short straight pencil line at any desired oblique angle can be inscribed by properly angularly setting the protractor, so that the straight-edge 85 extends at that angle,—but, as aforesaid, with notch 70 always marking the point along the straight-edge 85 which is at a locus defined by the calibration readings of the barrels 58 and 64 and their collars 66 and 66'. The complementary short straight pencil line, to provide a cross-mark inclined at an oblique angle can be made with the utmost accuracy by resetting the protractor to the proper angle, by aid of the calibrations 83 to dispose the straight-edge 81 or 82 as a guide for the making of said complementary line.

Coming now to the structure shown in Figs. 14 through 16, at 114 is shown a barrel for the travelling bridge 60 which is exactly like the barrel 64 except that, instead of the projection 64*p* on the latter, there is a projection 114*p*. The chief difference between the means supported by the projection 114*p*, and the means (Figs. 6 and 7) supported by the projection 64*p*, is that a fixed collar 115, corresponding to the collar 79 in Figs. 6 and 7, is shaped to have a bifurcation for taking the projection 114*p*; the coupling of these parts is by a pair of bolts 115*a*, each sleeve by an expansible coil-spring 116 as illustrated; the vacuum-cup gripper means for the negative is an annular one 117 wholly within the lower central portion of the protractor device; the line for exhausting the air from the cup 117 includes a flexible tube 118 and leads by a nipple 119 into a conduit 120 extending down through a ring-structure 121 into said cup; and the three protractor arms, 122, 123 and 124, have clear-glass main portions 122', 123' and 124' each provided with an etched or otherwise suitably marked hair-line 122*a*, 123*a* or 124*a*, The annular vacuum-cup 117 is of some suitable material as of soft rubber, and is secured in place by one or more screws 125, as well as by a screw 126 which has a central bore constituting a prolongation of the conduit 120 which opens into the vacuum-cup 117. The hair-lines 122*a*, 123*a*, and 124*a*, parallel with the straight-edges along the opposite sides of the respective arms 122, 123 and 124, are so placed that the hair-line 122*a* is aligned with the straight-edge 85', while the hair-lines 123*a* and 124*a*, aligned with each other, are also aligned with the center point of the notch 71.

Transparent protractor arms, and these hair-lines thereon, are facilitative of extremely accurate registration, particularly in lay-out composition. The mounting of the collar 115 on the barrel 114, by the mounts 115*a* and 116, allows the bottom of the protractor device to accommodate itself exactly to the thickness of a negative, whether on film or glass. By placing the vacuum-cup means within the main central portion of the protractor device the clear-glasses 122, 123 and 124 are all of equal visibility all over.

The apparatus as a photocomposing machine.—This set up, as above stated, comprises the entire apparatus rearranged as in Fig. 2. Incidental to this rearrangement, as already explained, the curtain 49 is automatically rolled up, as in Fig. 5. Before redisposing the parts to arrange the units C and P as in the view last named, the registering means R is stored in non-interferant position by moving the barrel 64 well into the work-space area 99. The use of such area for this purpose is one of the principal reasons why its provision is considered one of the important features of the invention.

Just before taking up herein a detailed description of the unit C under the italicized heading thus entitled, the manner of transformation of the apparatus from the lay-out composing and pencil lay-out machine of Fig. 1, into the photocomposing machine of Fig. 2, was briefly explained,—except that no allusion was made to the means for facilitating quick reversal of the unit P from the position shown in Fig. 4 (and Fig. 1) to that shown in Fig. 5.

The unit P is brought to the last mentioned position by endwise horizontal slide, before being swung up to vertical overlap of the unit C, when the apparatus is to be set up as a photocomposing machine.

In this last connection, and now reference is made to Figs. 1 through 5, the horizontal rod 34 which by way of the brackets 32 connects the unit P with the main casting 20, passes through a pair of aligned horizontal slots 126 cut through bosses 127 integrally upstanding from the floor-plate of casting 20. These slots have slightly rounded depressions 128 at their bottom forward ends, to act as self-setting fulcrums in view of the weight of the unit P, when that unit, by means of its front handles 129, is manually to be raised to vertical position, to set up the apparatus as a photocomposing machine, following rearrangement of the unit C from the position shown in Figs. 1 and 4 to that shown in Figs. 2 and 5, that is, following disposition of the unit C as in Fig. 3 (except for resetting of the registration means R so that its barrel 64 is still within the work-space area 99 of the glass sheet 31, as hereinabove explained). When said unit C is thus vertically disposed it is steadied in such position by engagement with a stop-pin 130.

As will be understood, these operations are performed in a room lighted only by such illumination as will not actinically affect the sensitized surface of press-plate L, as, of course, this press-plate must be mounted on the unit P before bringing the parts to the condition shown in Figs. 1 and 4.

With the parts arranged as in Figs. 2 and 5, the light for making the exposure for actinic transfer of the images of the negatives on the glass sheet 31 to the sensitized surface of the press-plate L proceeds from the hood 40, thence through the glass sheet 31, thence through the negatives (as those shown at N*a*, N*b* and N*c* in Fig. 5) on said glass sheet, and thence directly to the sensitized surface of the press-plate.

The negatives, attached to the glass sheet 31 with their emulsion-sides remote from said sheet, all as above explained, should be held, as is well appreciated in the art, in the most flatwise intimate contact with the sensitized surface of the press-plate L during the photocomposing operation. The most practicable way so far found to insure this result, as is also well known in the art, is to employ negative air pressure for the purpose.

A feature of the invention is a novel means for utilizing a partial vacuum in this connection, to wit, a means of the kind known in the art as a vacuum-frame means, but one characterized by its incorporation in the press-plate carrier,

here the unit P. Moreover this vacuum-frame means, in the embodiment registered, is also the means for holding the press-plate in that position which it must occupy during photocomposing on order to have a predetermined areal relation between the press-plate L and the glass sheet 31.

Exemplifications of the means just referred to are best shown in Figs. 4 and 5, to which reference is now made. The unit P is here in the form of a large shallow box 131 of quadrilateral outline. Upstanding within this box, near its four corners, are four posts. The post marked 132*a*, shown at the right in Fig. 4, is tubular from end to end, and the others marked 132 are solid. A blanket 133 of rubber or other suitable soft and resiliently flexible material is spread taut over the top of the box 131 by anchorage to the tops of the four posts 132 and 132*a*, in any suitable way, as by shaping each post 132, as shown, to include a button-top 134 and an annular shelf 135 therebelow and a similar shaping of the post 132*a*. Within the box 131, at suitable intervals over the space within the four posts 132 and 132*a*, the blanket is supported by yielding upward thrusts against its underside as by coil-springs 136, each suitably anchored at one end to the box and at the other end to the blanket as indicated. Running all around the blanket is an uninterrupted framing-wall portion or flange 137.

When the parts are arranged as in Figs. 2 and 5, following mounting of the press-plate L on the blanket as shown, and in carefully registered position on the unit P relative to the calibrations on the bridges 60 and 62 of the registering means R of the unit C, and while secured in that position by application to it of Scotch-tape strips as indicated at 138,—this blanket and its flange, which latter heightwisely is compressible, provide, with the glass sheet 31 of the unit C, the vacuum-frame for the photocomposing operation.

To exhaust the air from within such frame means are shown which include the hollow post 132*a*. Referring in this connection to Figs. 4 and 3, the post 132*a* is prolonged beyond the box 131 as a nipple 132*a'* leading to an elbow 139, and thence to a vacuum pulling line 140, which line has interposed thereon an air pressure gage 141 and a control cock 142.

While the invention has been described in one of its aspects as providing a photocomposing machine, it is to be understood that the invention is not to be limited to such machine, and that an image or depiction of any kind, whether of reading matter or a pictorial subject can be, if a photographically established one, either a negative or a positive. It is, therefore, to be understood that the expressions "photocomposing" and "negative" imported into the claims are to be considered as words of description and are not to be construed as limiting the claims in any way contrary to what has just been said. It will be obvious to those skilled in the art, after understanding my invention as embodied in the illustrative structure shown in the accompanying drawings, that various changes and modifications may be made therein, without departing from the spirit and true scope of my invention. Parts of the improvements may be used without others. The scope of protection contemplated is to be taken from the appended claims, interpreted as broadly as is consistent with the prior art.

I claim:

1. In a photocomposing machine of the kind incorporating a press-plate support, a second support for carrying a negative and including a frame and means for closing the frame opening including a transpicuous sheet, said second support being pivotally mounted so that it may be swung to bring said sheet parallel to the press-plate and to interpose a negative on the second support between said sheet and said plate, or swung away from the press-plate to extend substantially horizontal,—the combination of a calibrated means having relatively movable parts for giving readings indicative of determining points in different portions of said sheet for the location of a different negative in each such sheet portion, said sheet being of an area at least as large as said press-plate and being so placed on the second support relative to the placement of said plate on the press-plate support that when the two supports are arranged as first described all portions of the press-plate are within the bounds of said sheet, said calibrated means including a fixed bridge, a sleeve on and movable along said fixed bridge, a movable bridge fixed to said sleeve and extending at right angles to said fixed bridge, and a second sleeve on and movable along said movable bridge; means permanently mounting said fixed bridge on said frame to dispose said bridge and the sleeve thereon beyond the limits of said sheet, said means itself being wholly beyond said limits; guiding means for said movable bridge including trackways for the opposite ends of said bridge; and means including said trackways permanently mounting said movable bridge on said frame, said means being wholly beyond the limits of said sheet, and said trackways being sufficiently extended beyond an end of said sheet along said frame to allow said movable bridge and the sleeve thereon to be disposed on the frame so as to be clear of the press plate with the parts arranged as first described.

2. A photocomposing machine comprising, in combination, a support for a press-plate; a second support; a transpicuous sheet on said second support for serving as a negative support during photographic transfer of a negative image to the press-plate, said sheet of an expanse at least substantially equal to that of the press-plate, to permit said transfer to the press-plate simultaneously of all the images to be transferred to said plate; means for coupling said supports in readiness for said transfer; and calibrated means for facilitating precise positioning on said sheet of all the negatives whose images are to be transferred to the press-plate, but for permitting said sheet and the press-plate to be brought close together for said transfer, said means including a plurality of parts some of which are permanently mounted on said second support beyond the bounds of that part of said sheet corresponding to the total area of the press-plate, and some of which are permanently interlocked with but movable relative to said mounted parts, there being operative connections between said movable parts and said mounted parts whereby said movable parts can be moved to facilitate negative positioning or moved to a location beyond said bounds.

3. A photocomposing machine as in claim 1, in which said frame is interiorly hollowed out beyond the limits of said sheet; there is a means for illuminating said sheet from the underside thereof, said means in the hollowed out portion of the frame; there is a curtain movable to close over the entirety of the frame opening below its hollowed out portion, said curtain also being

movable to uncover the entirety of the frame opening below its hollowed out portion; and there is a means, responsive to relative movement between the two supports, for moving the curtain to close the frame opening when the two supports are relatively moved to dispose them as first described, and for moving the curtain to uncover the frame opening when the second support is moved to extend substantially horizontal.

4. A photocomposing machine as in claim 1, including a hollow box having an opening in its bottom; means movably mounting said box on the sleeve on the movable bridge and including an operative connection permitting said box to be lowered toward and raised from said sheet; and means for exhausting the air from the box to cause its said opening to act suction-cup fashion relative to a negative on said sheet with the box lowered to have its opening engage the upper surface of said negative.

5. A photocomposing machine as in claim 1, in which the sleeve on the movable bridge has a lateral extension; said machine further including a ring, means mounting the ring on said extension for rotation about an axis perpendicular to the plane of said sheet, a bar having a straight-edge fixed on said extension with said edge extending parallel with the length of the movable bridge and so positioned that a prolongation of said edge intersects said axis, and a second bar having a straight-edge and fixed to and projecting from said ring with said edge intersecting, in a prolongation thereof, said axis.

6. A photocomposing machine as in claim 1, in which the sleeve on the movable bridge has a lateral extension; said machine further including a ring, means mounting the ring on said extension for rotation about an axis perpendicular to the plane of said sheet, a bar having a straight-edge fixed on said extension with said edge extending parallel with the length of the movable bridge and so positioned that a prolongation of said edge intersects said axis, and a member carried by the ring and extending across the opening therethrough and having a straight edge intersecting said axis and interrupted by an indentation marking said intersection whereby the center of said indentation is included in said prolongation.

7. A photocomposing machine as in claim 1, in which the sleeve on the movable bridge has a lateral extension; said machine further including a ring, means mounting the ring on said extension for rotation about an axis perpendicular to the plane of said sheet, and a bar having a straight-edge fixed on said extension with said edge extending parallel with the length of the movable bridge and so positioned that a prolongation of said edge intersects said axis, said ring having the opening therethrough partially bounded by a straight-edge intersecting said axis.

8. A photocomposing machine as in claim 1, in which the sleeve on the movable bridge has a lateral extension; said machine further including a ring, means mounting the ring on said extension for rotation about an axis perpendicular to the plane of said sheet, a bar having a straight-edge fixed on said extension with said edge extending parallel with the length of the movable bridge and so positioned that a prolongation of said edge intersects said axis, a second bar fixed to and projecting from said ring and having a straight-edge a prolongation of which intersects said axis, and a straight-edge carried by said ring within its opening, said edge aligned with the straight-edge of said second bar.

9. In a photocomposing apparatus of the kind including a transpicuous sheet on which one or more negatives are to be secured in precisely determined positions, and a negative positioning means for use with said sheet having a first bridge extended in one direction and carrying a screw-threaded rack, and a second bridge carrying a similar rack, said second bridge carried by the first bridge for movement in a direction parallel to the line of extension of the first bridge, said second bridge carrying a sleeve surrounding the rack of the first bridge and having an internal thread for meshing with the teeth of said rack, and said second bridge having on its own rack a similar sleeve, said negative positioning means being also of the kind wherein said sleeves are interiorly longitudinally slotted across their threads so that in each sleeve is a recess established by said slot whereby on rotating the sleeve to a certain position the associated rack is positioned in said recess to permit non-spiral movement of said sleeve lengthwise of said rack, —the improved construction for such a rack and sleeve which is characterized by a mounting means for holding the sleeve on the rack including as heretofore the rack teeth and said thread in the sleeve where uninterrupted by said recess, but also including a means for bodily moving the sleeve in a direction at right angles to its length to separate its thread from the teeth of the rack when the angular setting of the sleeve on the rack is other than said certain position, thereby to permit the sleeve to be given a new position along the length of the rack without changing the angular setting of the sleeve on the rack.

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