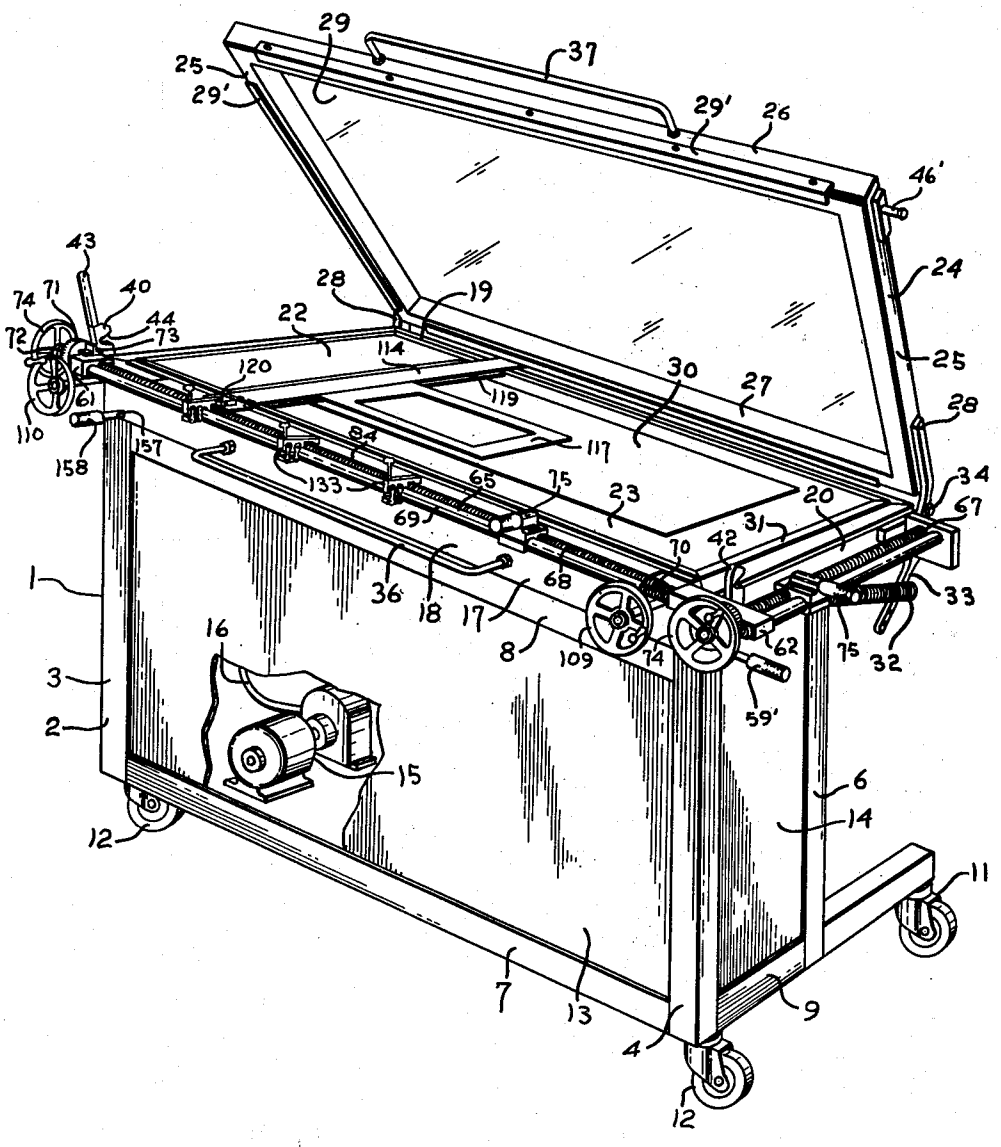
Sept. 8, 1964 C. K. HULEN 3,147,683

PHOTOGRAPHIC PRINTING APPARATUS

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Fig. 1.



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PHOTOGRAPHIC PRINTING APPARATUS

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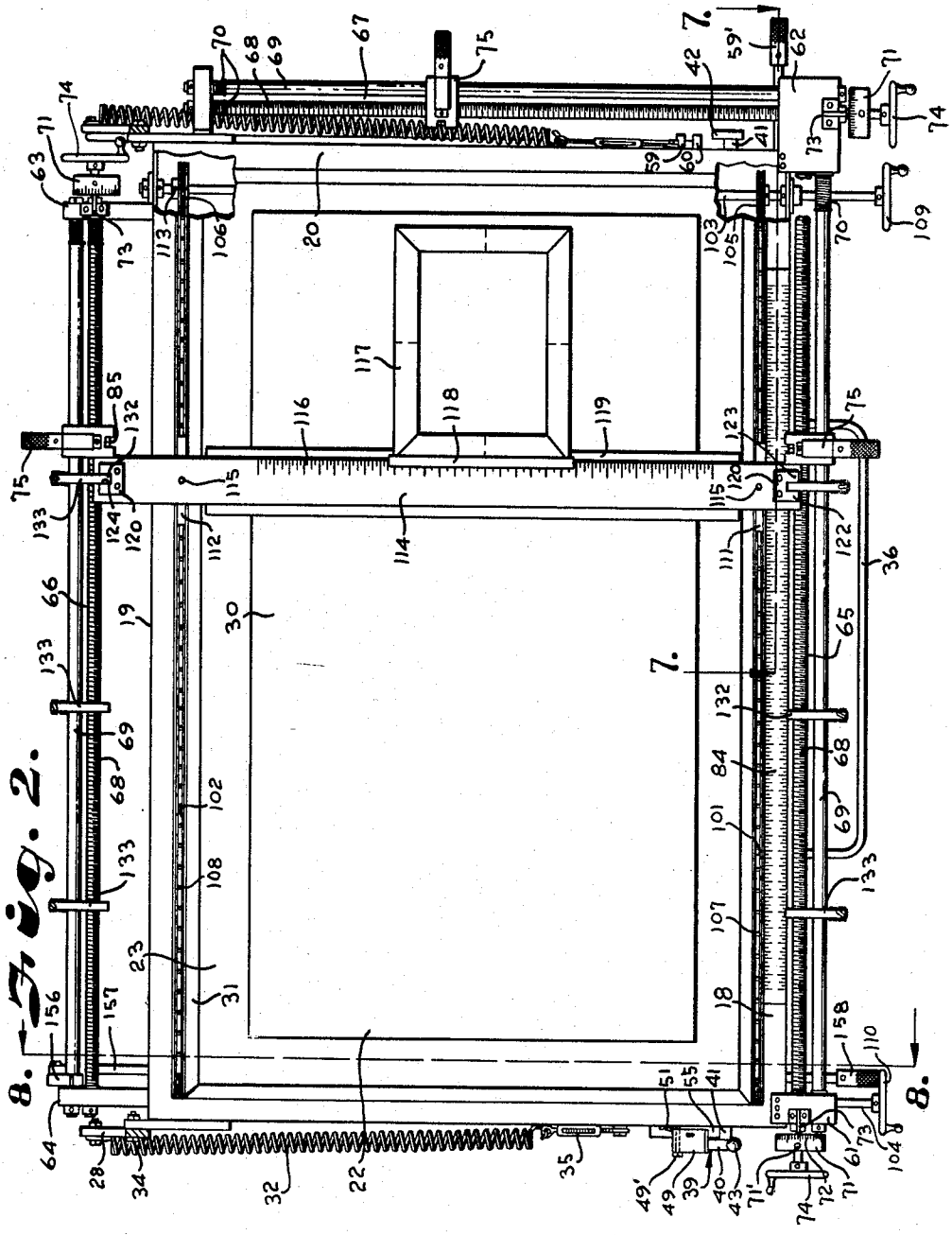


Fig. 2.

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PHOTOGRAPHIC PRINTING APPARATUS

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Fig. 3.

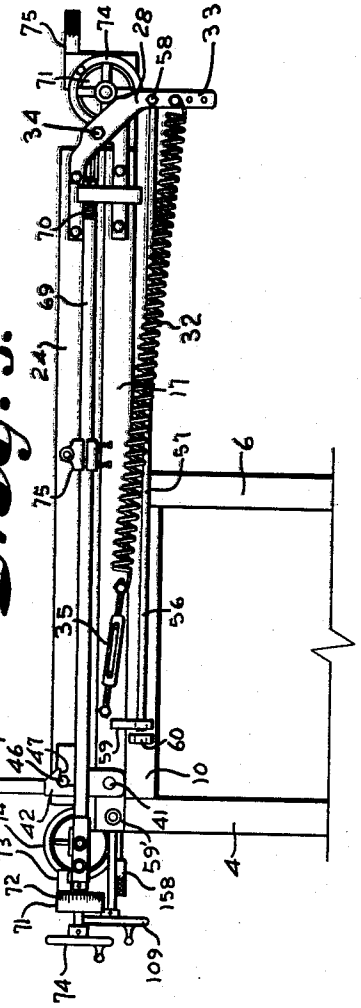


Fig. 4.

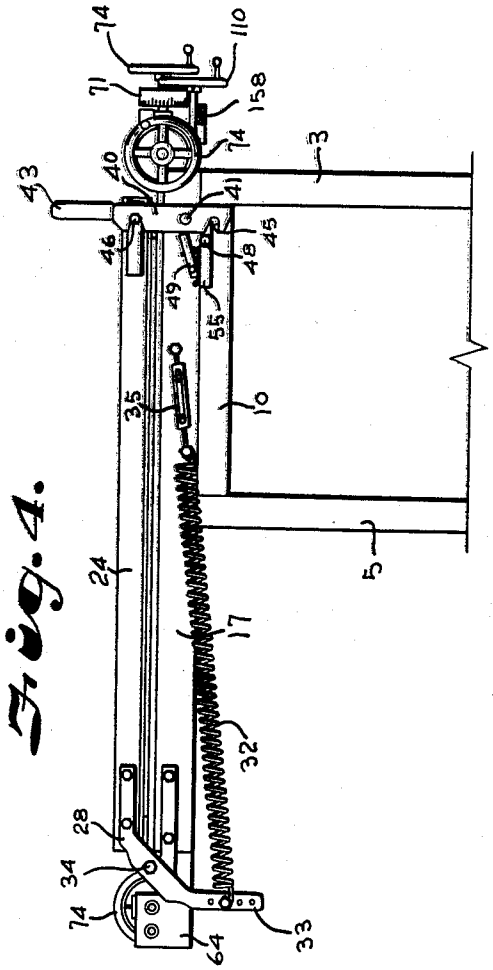
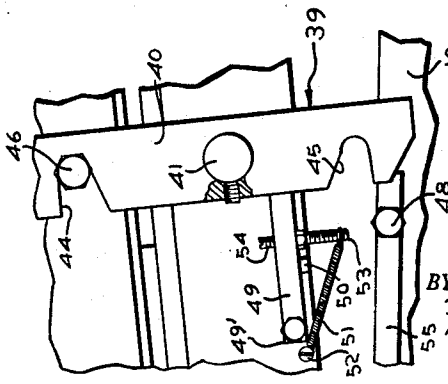


Fig. 9.



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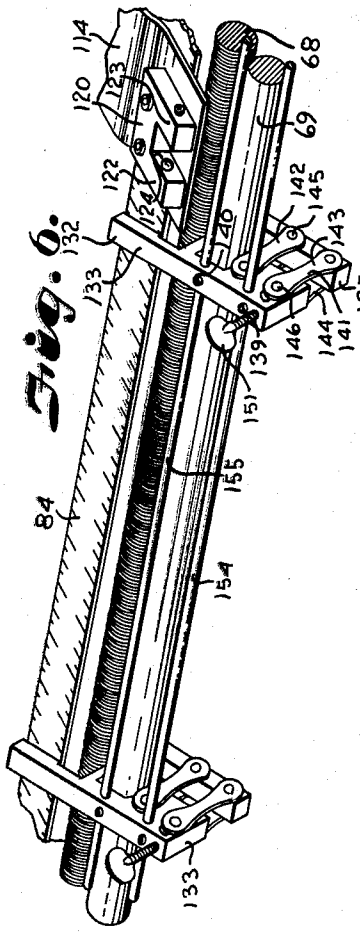


Fig. 6.

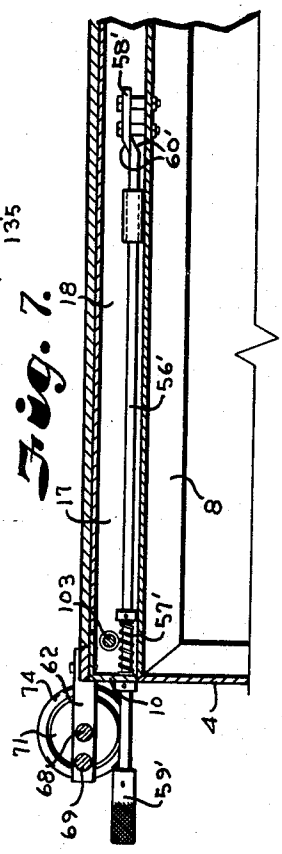


Fig. 7.

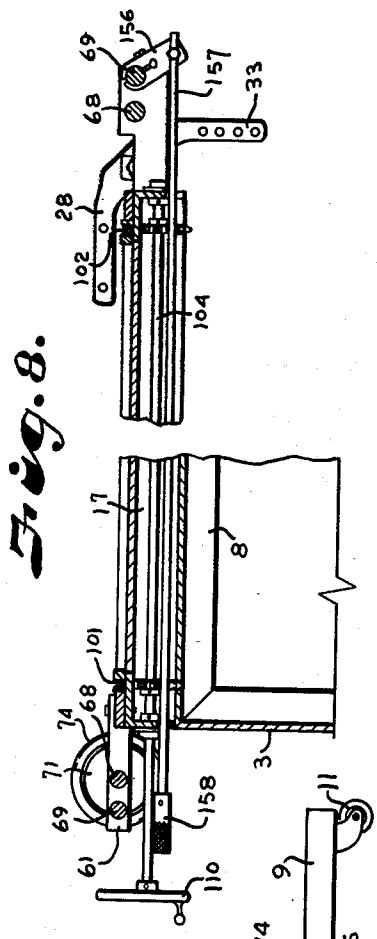


Fig. 8.

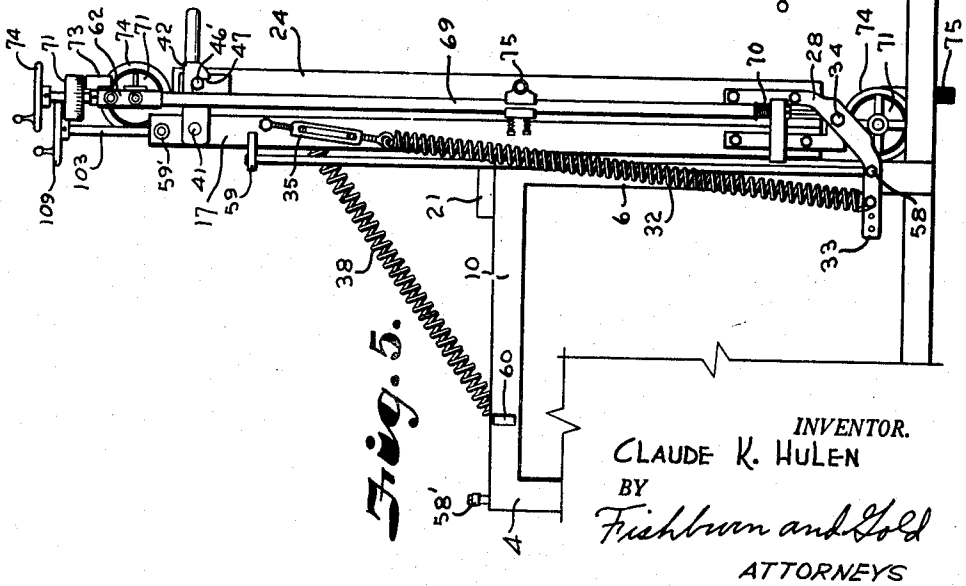


Fig. 5.

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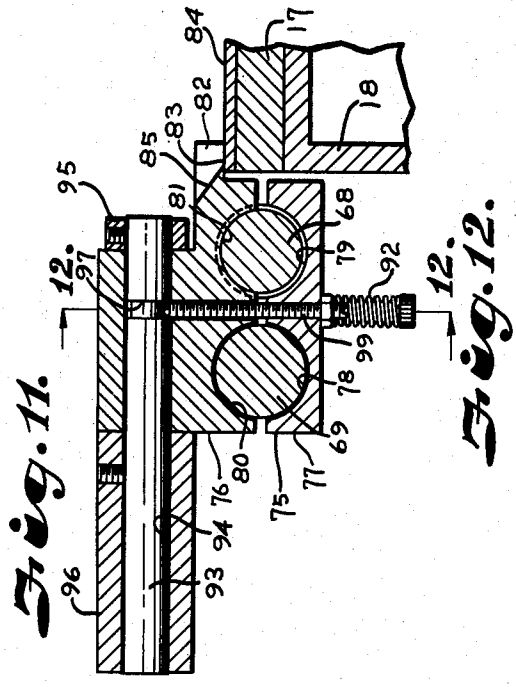


Fig. 11.

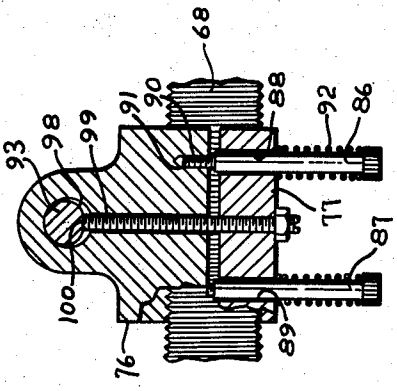


Fig. 12.

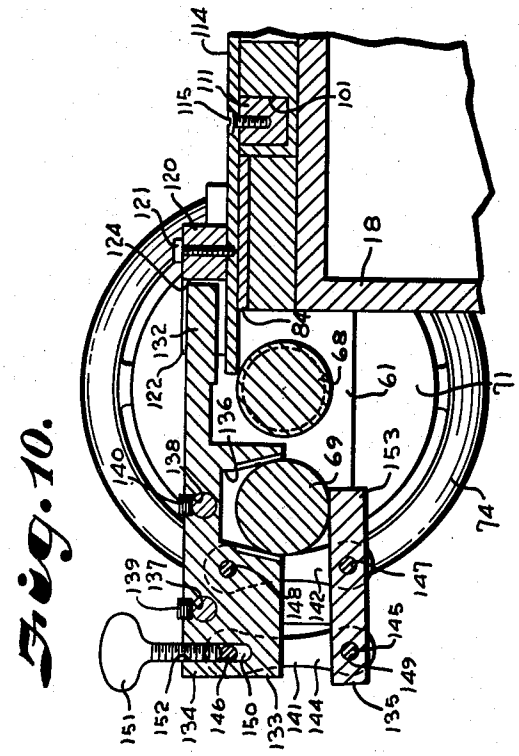


Fig. 10.

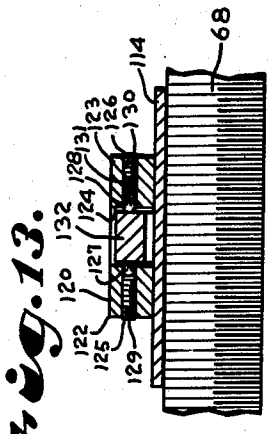


Fig. 13.

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United States Patent Office 3,147,683 Patented Sept. 8, 1964

3,147,683

PHOTOGRAPHIC PRINTING APPARATUS

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Filed Oct. 5, 1961, Ser. No. 143,113
9 Claims. (Cl. 95—73)

This invention relates to photographic printing apparatus used in the graphic arts industry, and more particularly to improvements in apparatus of a type which may be referred to as "step and repeat vacuum frames."

In the graphic arts industry, the process known as step and repeat printing involves the use of a negative from which is printed on a lithographic plate or the like a number of duplicate images in accurately spaced relationship. The accurate spacing of such images is an essential requirement since, when transferred by the well known process to a printing plate which is used to print multiple copies, such spacing determines the position of the image on the finished printed matter. Likewise, in color printing where a series of plates are made from color separation negatives or positives or a separate plate for each printing color made by any suitable process, each image must be spaced and located precisely with respect to other plates to provide proper color registry.

In practicing step and repeat printing with known apparatus, a lithographic or sensitized plate with the negative accurately positioned thereon is supported on a rubber blanket which is impervious to air. The blanket, plate and negative are covered by a sheet of transparent glass or the like which forms a chamber with the blanket from which air may be evacuated to hold the negative and plate tightly against the glass sheet. Prior to exposure by suitable lighting means, the portions of the lithographic plate which are intended to remain unexposed are suitably masked. The printing frame of the apparatus may be pivotally mounted on trunnions or the like whereby positioning or layout can be conveniently accomplished on a substantially horizontal surface while exposure is conveniently effected with the sensitized plate in a vertical position. Graduated scales are usually provided as an aid in locating the negative on the plate but accuracy and repeatability of placement have heretofore been dependent upon very tedious and time-consuming steps. Also, existing apparatus of this type is prone to damage for failure to lock the glass sheet in place prior to tilting to exposing position.

The principal objects of the present invention are to provide improvements in step and repeat vacuum frame printing apparatus by incorporating position indicating stop members which are selectively engageable with accurate lead screws for determining the position of the negative with respect to the composing table with greater speed, accuracy and repeatability than was heretofore possible; to provide a plurality of locating stop members adapted to engage a straight edge extending across the printing frame for repeatably determining the proper relative position thereof; to provide such locating stop members which are easily removable from the apparatus and replaceable thereon without destroying the spaced relationship therebetween; to provide a safety lock latch assembly which prevents the cover frame from being accidentally disengaged from the printing frame when the apparatus is in the vertical or exposing position; to provide balance springs for minimizing operator effort required in tilting the printing frame; to provide safety lock apparatus which prevents the tilting of the printing frame when the cover is not secured thereto; to provide apparatus for conveniently disengaging from the straight edge locating stop members positioned in the rear of the machine while the operator is standing in the front of the machine; to provide a vacuum frame printing apparatus having accurate lead screws located both forwardly and rearwardly of the device for accurately positioning a straight edge member extending across the composing blanket; and to provide such an apparatus which is simple in construction and highly efficient and reliable in use with locating members which are quickly and accurately moved and positioned for precise results.

Other objects and advantages of this invention will become apparent from the following description taken in connection with the accompanying drawings wherein are set forth by way of illustration and example certain embodiments of this invention.

FIG. 1 is a perspective view of the vacuum photographic printing apparatus embodying the features of the present invention.

FIG. 2 is a top view of the apparatus with the cover frame removed therefrom.

FIG. 3 is a fragmentary view in elevation showing one side of the apparatus.

FIG. 4 is a fragmentary view in elevation showing the opposite side of the apparatus from that shown in FIG. 3.

FIG. 5 is a fragmentary view in elevation of one side of the apparatus showing the printing frame in vertical exposing position.

FIG. 6 is a fragmentary perspective view on an enlarged scale showing a pair of locating stop members rotated out of straight edge engaging position.

FIG. 7 is a fragmentary sectional view taken on the line 7—7, FIG. 2, showing the locking device for maintaining the printing frame against the base in working or layout position.

FIG. 8 is a sectional view taken on the line 8—8, FIG. 2, particularly showing the rear locating stop member rotating device.

FIG. 9 is a fragmentary view on an enlarged scale showing portions of the safety lock latch assembly.

FIG. 10 is a fragmentary sectional view on an enlarged scale showing details of a locating stop member.

FIG. 11 is a fragmentary sectional view on an enlarged scale showing details of a position indicating stop member.

FIG. 12 is a fragmentary sectional view taken on the line 12—12, FIG. 11, showing further details of the position indicating stop member.

FIG. 13 is a fragmentary sectional view on an enlarged scale showing details of the straight edge member.

Referring to the drawings in more detail:

1 designates a vacuum photographic printing apparatus comprising a mobile supporting base 2 having a pair of forward spaced upstanding legs 3 and 4 and a pair of rear spaced upstanding legs 5 and 6 respectively spaced from the forward legs 3 and 4. Cross support members 7, 8, 9 and 10 are suitably joined to the legs 3, 4, 5 and 6, forming a rigid upstanding structure. The cross support members 9 extend rearwardly of the supporting base 2 to provide a mounting for rear wheels or casters 11 which are spaced a considerable disstance rearwardly of the front wheels or casters 12 forming an extensive wheel base for apparatus stability. Suitable panels 13 and 14 enclose the open areas between the respective rear legs and cross support members to provide a pleasing and finished appearance to the apparatus. The supporting base 2 has a suitable vacuum pump 15 operatively and conventionally connected by means of a hose 16 to a printing frame 17 described hereinafter.

The printing frame 17 is of rectangular shape and comprises a forward frame member 18, a rear frame member 19 and spaced side members 20, all preferably of angular cross section and suitably joined at the ends thereof to form a rigid structure. The printing frame 17 is pivotally mounted intermediate the side members 20 respectively to the upper portions of the rear base legs 5 and

6 on trunnion receivers 21 preferably welded to the supporting base 2. The pivotal mounting of the printing frame 17 permits pivotal or rotational movement thereof from a generally horizontal layout or working position such as illustrated in FIG. 1 to a vertical or exposing position as illustrated in FIG. 5. The printing frame members 18, 19 and 20 define a framed portion 22 within which a suitable rubber blanket 23 is supported in an exposed planar condition. The rubber blanket 23 is of a suitable type which is impervious to air whereby a vacuum may be created thereabove as will be more apparent hereinafter.

A cover frame 24 is formed from side members 25, a front member 26 and a rear member 27 into a rectangular shape of substantially the same outside dimensions as the printing frame 17. The cover frame 24 is hinged to the printing frame 17 by means of hinges 28 respectively located on the side members 20 and 25 adjacent the rear members 19 and 27. The cover frame 24 is thereby adapted for selective pivotal movement toward and away from the printing frame 17, as best illustrated in FIG. 1. A transparent glass sheet 29 is supported against the cover frame 24 by elongated brackets 29' and is adapted to selectively cover and uncover the blanket 23 upon pivotal movement of the cover frame 24 with respect to the printing frame 17. The glass sheet 29 is impervious to air but permits the transmission of light therethrough and serves to form a surface against which intimate contact between a negative (not shown) and a sensitized sheet or lithographic plate 30 may be maintained. A suitable sealing member 31 is slightly raised above the upper surfaces of the printing frame members 18, 19 and 20 whereby the glass sheet 29 comes into intimate contact therewith to define an enclosed chamber between the glass sheet 29 and the blanket 23 from which air may be exhausted by the vacuum pump 15 to urge the lithographic plate 30 and overlying negative (not shown) tightly against the glass sheet 29.

The glass sheet 29, due to its great weight, renders the cover frame 24 very difficult and awkward to raise and lower without aid. To alleviate this situation, elongated tension springs 32 are connected at one end thereof to a leg 33 extending downwardly from the hinges 28 and adapted to act as a lever for rotating the hinge 28 about trunnions or pivots 34 to aid in controlling the opening and closing of the cover frame 24. The other end of the tension springs 32 are respectively connected to turnbuckles 35 secured to the printing frame side members for anchoring the springs 32 and providing means for adjusting the tension thereof. It is noted that the springs 32 aid both in the raising and lowering of the cover frame 24 by reducing the effective weight thereof which must be manipulated by the apparatus operator. Suitable handles 36 and 37 are respectively secured to the forward frame member 18 of the printing frame 17, and the front member 26 of the cover frame 24 to offer convenient grasping means for the operator in separating and closing the printing frame and cover frame and for rotating or pivoting the printing frame to a vertical or exposing position.

Elongated tension springs 38 are suitably connected between the printing frame 17 and the supporting base 2 to aid the operator in rotating the printing frame 17 between the exposing or vertical position and the working or substantially horizontal position. It is noted that the springs 32 and 38 are independent of each other, the springs 32 only effecting the pivoting of the printing frame with respect to the cover frame, the springs 38 controlling the pivoting of the printing frame 17 and cover frame 24 as a unit.

The springs 32 are normally adjusted by the turnbuckles 35 so that the cover frame 24 is maintainable, through the tension of the springs 32, in an upwardly tilted position, as illustrated in FIG. 1, to provide the operator with free access to the blanket 23. In order to positively retain the cover frame 24 in closed position with respect to the printing frame 17, a latch assembly generally indicated 39 cooperates therebetween. The latch assembly 39 is comprised of a latch bar 40 fixed to a shaft 41 extending through and rotatably mounted on the printing frame 17 at the forward portion of the side members 20. The end of the shaft 41 which is opposite from the latch bar 40 supports a latch bar 42 fixed thereto and adapted to pivot or rotate with the shaft 41 and the latch bar 40. The latch bar 40 terminates at the upper end thereof in a handle 43 adapted to be grasped by the operator for simultaneously pivoting the latch bars 40 and 42. The latch bar 40 has an upper notch 44 spaced above the fulcrum point or connection with the shaft 41 and a lower notch 45 spaced below the connection with the shaft 41. A lug 46 is fixed to the cover frame 24 and is adapted to engage with the upper notch 44 when the cover frame 24 is closed against the printing frame 17 and the handle 43 urged toward the rear thereof. The latch bar 42 has a notch 47 therein which is adapted to engage with a lug 46' fixed to the cover frame 24 on the opposite side thereof from the lug 46. The rearward rotation or pivoting of the latch bar 40 also causes a rearward pivoting or rotation of the latch bar 42 whereby when the cover frame 24 is closed against the printing frame 17 the notches 44 and 47 will respectively engage with the lugs 46 and 46' for securing the cover frame and printing frame in closed and sealed relation. A lug 48 is fixed to the supporting base 2 on one of the cross support members 10 and is adapted to be engaged with the lower notch 45 for securing the printing frame 17 against the base 2 in a horizontal or working position. The lug 48 is so positioned with respect to the latch bar 40 that the pivoting or rotation thereof will simultaneously disengage one of the lugs 46 and 48 while engaging the other of the lugs 46 and 48. The latch bar 40 is unable to engage both lugs simultaneously and also is unable to disengage both lugs simultaneously so long as the cover frame 24 is closed upon the printing frame 17 to maintain the proximity of the lug 46.

A keeper bar 49 is pivotally mounted at one end 49' thereof to the side member 20 in operative relation to the latch bar 40. The keeper bar 49 is permitted to rotate upwardly or counterclockwise from the position thereof illustrated in FIG. 9, but is prevented from rotating clockwise or downwardly from said illustrated position by a suitable lug or stop 50. The keeper bar 49 is resiliently urged to pivot in a clockwise direction as illustrated in FIG. 9 by means of a suitable tension spring 51 fixed at one end thereof to an anchor screw 52 located slightly rearwardly and downwardly of the pivotally mounted end 49'. The other end of the spring 51 is secured to the lower terminus 53 of a threaded rod 54 threadedly engaged with the keeper bar 49 and adapted to be downwardly adjusted in displacement with respect thereto. A bar or stop 55 is fixed to the supporting base 2 and extends outwardly from one of the cross support members 10 a distance less than the lug 48. The bar or stop 55 is adapted to make contact with the lower terminus 53 of the threaded rod 54 to urge the keeper bar 49 upwardly or counterclockwise from the position illustrated in FIG. 9 when the printing frame 17 is brought into contact with the base 2, FIG. 4.

By way of explanation, when the latch bar 40 is engaged with the lug 46 to maintain the cover frame 24 in closed relation against the printing frame 17, the latch bar 40 is in a non-interfering position with respect to the keeper bar 49 whereby the extension spring 51 rotates same against the stop 50, thus forming a wedge or lock preventing the latch bar 40 from being accidentally pivoted or rotated so as to disengage the lug 46. This prevents the cover frame 24 from accidentally pivoting away or separating from the printing frame 17 when the apparatus is in the exposing or vertical position, as illustrated in FIG. 5. Such a separation would probably cause breakage of the glass sheet 29, a warpage of various ap-

paratus frame members or other severe damage to the apparatus. When the printing frame 17 is returned to the horizontal or working position, as illustrated in FIG. 4, the keeper bar 49 is automatically rotated away from a wedging position with respect to the latch bar 40 permitting the cover frame 24 to be released to provide access to the blanket 23 while simultaneously locking the printing frame 17 against the base 2 to prevent an accidental pivoting thereof away from the base 2.

Since it is possible to pivot the latch bar 40 out of engagement with the lug 48 after the cover frame 24 has been raised, an auxiliary locking member designated 56 is provided for preventing an accidental pivoting or rotation of the printing frame in the event that the disengagement of the latch bar 40 from the lug 48 occurs. The locking member 56 comprises a bar 57 pivotally connected at one end thereof to the leg 33 at 58 and at the other end thereof slidably retained in a guide bearing 59 secured to the printing frame 17. A lug 60 is fixed to the base 2 and contains a bore axially aligned with the rod 57. When the printing frame is closed against the base 2 and the cover frame 24 is raised, as illustrated in FIG. 1, the rod 57 slides into the lug 60 and thus positively prevents any pivoting or rotation of the printing frame 17 away from the base 2 so long as the cover frame 24 is raised.

To prevent the accidental rotation of the printing frame even after the locking of cover frame 24 to the printing frame 17, a rod 56′ is longitudinally slidably mounted in the printing frame 17 and is resiliently urged by a spring 57′ toward and into engagement with a keeper 58′ secured to the supporting base 2. A handle 59′ within convenient reach of the operator permits the rod 56′ to be urged longitudinally against the spring 57′ to disengage the rod 56′ from the keeper 58′ to release the printing frame 17 for rotation to the exposing position. The mating or engaging portions of the keeper 58′ and rod 56′ are mutually slanted at 60′ for automatic engagement when the printing frame 17 is returned to the working position.

Bearing members 61, 62, 63 and 64 are secured to the printing frame 17 respectively adjacent each corner thereof. Pairs of laterally spaced parallel locating shafts designated 65, 66 and 67 are rotatably mounted in the bearing members 61, 62, 63 and 64 respectively adjacent the forward frame member 18, the rear frame member 19 and one of the side members 20 and respectively extend parallel thereto. The inner shaft 68 of each of said pairs of shafts 65, 66 and 67 is threaded substantially over the entire length thereof and positioned between the outer shaft 69 of said pairs of shafts 65, 66 and 67, and the printing frame 17. Each of the shafts 68 and 69 are urged against a respective bearing block by suitable resilient members, in the illustrated example, springs 70. The springs 70 function to insure that there is no longitudinal free play in the shafts 68 and 69 for reasons which will become apparent hereinafter. A dial member 71 is mounted on one end of each of the threaded or inner shafts 68 and has graduations 72 thereon registrable with an indicator 73 fixed on the respective bearing block whereby when the shaft 68 is turned by a hand wheel 74 fixed thereto the graduations 72 will indicate the amount of linear movement of a positioned indicating stop member 75 relative to the printing frame 17. The graduations 72 and the threads on the shafts 68 are preferably such that the linear movement of the position indicating stop members 75 are indicated in thousandths of an inch. Suitable locking devices, in the illustrated example, set screws 71′, permit the release of the dial members 71 to rotate with respect to the shafts 68 for resetting the dial member graduations to a particular rotational position of the shafts 68.

One position indicating stop member 75 is associated with each of said pairs of locating shafts 65, 66 and 67 and comprises an upper portion 76 and a lower portion 77. The lower portion 77 has a pair of parallel semi-circular troughs 78 and 79 extending thereacross and laterally spaced and sized for sliding engagement with and along the shafts 68 and 69 of a pair of shafts. The position indicating stop member upper portion 76 has a pair of parallel semi-circular troughs 80 and 81 extending thereacross and adapted to oppose the lower portion troughs 78 and 79 respectively. The upper portion trough 81 has threads therein adapted to mate with the threaded shaft 68 by which the stop member 75 is urged along the shafts 68 and 69 by the rotation of the shaft 68 with the hand wheel 74. The indicating stop member 75 has a lip 82 adapted to extend over the respective edge 83 of the printing frame 17.

A horizontally extending graduated scale 84 is secured to the printing frame 17 along the forward frame member 18 and registers with the lip 82. An indicator 85 on the lip 82 enables the position of the stop member 75 to be determined with respect to the graduated scale 84.

A pair of guides 86 and 87 slidably extend through bores 88 and 89 in the lower portion 77 of the position indicating stop members 75 and terminate in threaded tips 90 engaging in suitable threaded bores 91 in the upper portion 76. The guides 86 and 87 permit the lower portion 77 to move toward and away from the upper portion 76 while maintaining the respective troughs 78 and 79 in opposed relation to the troughs 80 and 81. Helical springs 92 surround the guides 86 and 87 and resiliently urge the lower portion 77 toward the upper portion 76. A shaft 93 is journalled in a longitudinal bore 94 extending through the upper portion 76 and is restricted from longitudinal movement with respect thereto by means of a collar 95 fixed to one end thereof and a knurled handle 96 fixed on the other end thereof. The shaft 93 has an eccentrically turned slot or cut-out portion 97 forming a cam surface 98. An elongated screw 99 is threadedly engaged in the lower portion 77 but slidably engaged in the upper portion 76, and the upper end 100 thereof is maintained in contact with the cam surface 98 by the helical springs 92. It is apparent that the rotation of the handle 96 will cause the upper and lower portions 76 and 77 of the stop member 75 to selectively separate to disenagage the threads in the trough 81 from the threads on the shaft 68 whereby the stop member 75 becomes freely slidable along the shafts 68 and 69.

Forward trackway 101 and rear trackway 102 are respectively parallel to each other and extend adjacent and parallel to the forward frame member 18 and the rear frame member 19. A pair of spaced parallel sprocket supporting shafts 103 and 104 are rotatably mounted on and extend through the printing frame 17 and extend respectively parallel to and adjacent the printing frame side members 20. A pair of spaced sprocket wheels 105 and 106 are fixed to each of said shafts 103 and 104 respectively adjacent opposite ends of the trackways 101 and 102. Roller chains 107 and 108 are movably supported in the respective trackways 101 and 102 and engage the respective sprocket wheels 105 and 106. The forward ends of the shafts 103 and 104 have respectively fixed thereto hand wheels 109 and 110 by which the sprocket wheels 105 and 106 may be simultaneously rotated on both the shafts 103 and 104 to simultaneously move the chains 107 and 108 in the trackways 101 and 102. Carriages 111 and 112 are respectively slidable in the trackways 101 and 102 and are connected in a suitable manner to the respective chains 107 and 108 for movement of the carriages therewith upon rotation of the sprocket supporting shafts 103 and 104. The carriages 111 and 112 are adjusted to be accurately opposed to each other by rotating a selected set of sprocket wheels 105 or 106 with respect to both the shafts 103 and 104 and subsequently locking the adjusted set of sprocket wheels to the respective shafts by suitable means, in the illustrated example, set screws 113.

A straight edge member 114 extends parallel to the printing frame side members 20 and is secured adjacent each end thereof to the carriages 111 and 112 by suitable

means, in the illustrated example, screws 115. The straight edge member 114 has suitable graduations or a scale 116 thereon to indicate the position of a negative holder 117 with respect thereto. The negative holder 117 is removably secured to the straight edge 114 by a length of adhesive tape 118. The negative holder 117 is preferably fabricated of a thin metal such as sheet aluminum and is held to very close tolerances in dimension for reasons apparent hereinafter. A thin metal backing strip 119 is secured to the under side of the straight edge member 114 by suitable means such as adhesive or adhesive tape and extends laterally therefrom to offer a smooth surface on which the negative holder 17 may slide adjacent the scale 116.

A bifurcated block 120 is secured to each end of the straight edge member 114, in the illustrated example, by screws 121. Each of the blocks 120 is shaped to form a pair of legs 122 and 123 which are spaced apart to define an outwardly and upwardly open slot 124. The legs 122 and 123 have mutually aligned laterally extending threaded bores 125 and 126 extending respectively therethrough and communicating with the slot 124. The bores 125 and 126 are slightly deformed adjacent the slot 124 so as to permit balls 127 and 128 respectively to partially extend into the slot 124 but be prevented from falling thereinto from the bores. The bore 125 is threaded and contains a suitable screw 129 engaged therewith and contacting the ball 127 to provide a positive location therefor. The bore 126 is also threaded and contains a screw 130 engaged therewith, but spaced from the ball 128. A resilient member or spring 131 is positioned between the screw 130 and the ball 128 and resiliently urges the ball 128 toward the slot 124. It is to be realized that the forwardly extending tongue 132 of a locating stop member described hereinafter may be easily and positively located with respect to the block 120 by entering same between the balls 127 and 128, the spring 131 urging the ball 128 thereagainst to prevent play and the ball 127 providing a locating stop.

A plurality of elongated locating stop members 133 each comprise an upper section 134 and a lower section 135. The upper section 134 has a transverse outwardly tapering downwardly opening notch 136 intermediate the ends thereof and adapted to engage the outer or unthreaded shaft 69 of said respective pairs of locating shafts 65, 66 and 67. The upper section 134 has a pair of spaced transverse rod receiving bores 137 and 138 with set screws 139 and 140 respectively extendable thereinto for a purpose explained hereinafter.

A pair of substantially parallel links 141 and 142 are respectively pivotally mounted on the upper section 134 and lower section 135 of the locating stop members 133 in a manner now described. The links 141 and 142 are each formed of a pair of parallel spaced side sections 143 and 144 joined by shafts 145 and 146 extending therebetween. The shafts 145 and 146 of the front link 142 are pivotally extended through bores 147 and 148 respectively transversely extending through the lower section 135 and upper section 134. The bore 148 is located adjacent the notch 136. The shaft 145 of the rear link 141 extends through a bore 149 extending transversely through the lower section 135 and spaced rearwardly of the bore 147. The shaft 146 of the link 141 extends transversely through a vertically elongated slot 150 extending laterally or transversely through the upper section 134 and spaced rearwardly of the bore 148 the same distance that the bore 149 is spaced rearwardly of the bore 147. It is thus apparent that the links 141 and 142 maintain the lower section 135 in a particular relationship with respect to the upper section 134 whereby the lower section 135 is permitted to swing forwardly and rearwardly of the upper section 134 with a rocking movement about the shaft 145 of the link 142 permitted within restricted limits by the freedom of movement of the shaft 146 in the slot 150.

A wing bolt 151 is engaged in a threaded bore 152 extending vertically into the upper section 134 and communicating with the transversely extending slot 150. The wing bolt 151 is adapted to engage with the shaft 146 to urge same downwardly with respect to said slot and thereby force the lower section 135 to pivot counterclockwise about the shaft 145 of the link 142, as illustrated in FIG. 10. The rotation of the lower section 135 by the wing bolt 151 causes a forward extension 153 of the lower section 135 to move upwardly whereby when the lower section 135 is swung forwardly locating the forward extension 153 beneath the notch 136 and the outer shaft 69 is located therebetween, the forward extension 153 urges the shaft 69 into the notch 136 causing the locating stop member 133 to be rigidly clamped to the shaft 69, FIG. 10. If it is desired to release the locating stop member 133 from the shaft 69, the wing bolt 151 is rotated in the direction permitting the shaft 146 to move upwardly with respect to the slot 150 which removes the pressure of the forward extension 153 from the shaft 69 and permits the lower section 135 to be swung rearwardly of the upper section 134 completely removing all obstruction from the lower portion of the shaft 69 and permitting the locating stop member 133 to be removed upwardly therefrom.

When the locating stop member 133 is located in a desired position along the shaft 69 (by procedure described hereafter) and clamped thereto, the straight edge member 114, by means of the blocks 120 on the respective ends thereof, may be positively located with respect to the locating stop members 133. The stop members 133 when clamped to the shaft 69 of the shaft pairs 65 and 66 are rotatable therewith whereby the tongues 132 move upwardly of the printing frame 17, permitting the blocks 120 to be slid thereunder approximately aligning the slots 124 therewith. By then rotating the shaft 69 in the opposite direction, the tongues 132 are entered into the slots 124 and laterally adjust themselves with respect thereto by means of the cooperating balls 127 and 128. The exact positions corresponding to the positions of the locating stop members 133 on the shafts 69 are thus imparted to the straight edge member 114.

If it is desired to maintain a particular relationship more permanently between a plurality of locating stop members 133, a pair of rods 154 and 155 may be extended through the respective bores 137 and 138 and locked therein by means of the set screws 139 and 140 prior to the release of the respective locating stop members 133 from the shaft 69. The locating stop members may thus be removed from the apparatus to permit the set-up of another job and subsequently replaced thereon without losing the proper spatial relationship with respect to each other.

As noted above, the locating stop members 133 may be maintained upon both the shaft pairs 65 and 66. The locating stop members on the front shaft pair 65 can be easily rotated by merely grasping the tongue 132 and pulling same upwardly of the printing frame 17, however, such a manual rotation of the shaft 69 of the rear shaft pair 66 would be inconvenient since it would necessitate the operator's movement to the rear of the apparatus. To facilitate the rotation of the shaft 69 of the rear shaft pair 66, a collar or link 156 is secured adjacent one end of said shaft 69 of the rear shaft pair 66. The link 156 is pivotally connected to a rod 157 which extends forwardly of the printing frame 17 and terminates in a handle 158 within convenient reach of the operator standing near the front of the apparatus. A longitudinal displacement of the rod 157 by pulling and pushing of the handle 158 will cause the shaft 69 of the rear shaft pair 66 to rotate for displacing the tongues 132 from and into the respective slot 124 in the manner described above.

The operation of the vacuum photographic printing apparatus 1 is generally as follows:

A lithographic or sensitized plate 30 is placed in a

desired position on the blanket 23 and fixed thereagainst by any suitable means, for example, adhesive tape. A negative (not shown) is taped to the negative holder 117 and the negative holder 117 is abutted against the scale 116 on the straight edge member 114. The straight edge member 114 is then moved toward the side shaft pair 67 by rotating a hand wheel 109 or 110 until the negative holder 117 extends over the edge of the printing frame 17 a distance sufficient to engage the side of a position indicating stop member 75 engaged with the shaft pair 67. It is noted that the position indicating stop members 75 on the shaft pairs 65 and 66 must be moved to the right from the position indicated in FIG. 2 in order for the straight edge 114 to enter the above-described position. The position indicating stop member 75 on the shaft pair 67 may then be moved by rotating the respective hand wheel 74 to bring the position indicating stop member 75 into engagement with a selected edge of the negative holder 117. The position indicated by the dial member 71 associated with the shaft pair 67 may then be noted or, if desired, reset to zero for the purpose of accurately relocating the negative holder 117 longitudinally with respect to the straight edge 114. It is noted that the rough position of the negative holder 117 with respect to the straight edge member 114 is obtained by reference to the scale 116 and the exact position located by reference to the position indicating stop member 75 on the shaft pair 67. Thus, after first setting the negative holder 117 with respect to the position indicating stop member 75 on the shaft pair 67, the negative holder 117 may be subsequently accurately placed in any position longitudinally of the straight edge member 114 by reference to the number of turns or fraction of turns of the respective hand wheel 74.

In locating the negative holder 117 transversely or laterally of the printing frame 17, the printing frame 17 is first moved to a desired position on the lithographic plate 30 by means of a hand wheel 109 or 110. The position indicating stop members 75 on the shaft pairs 65 and 66 are then moved either by releasing and sliding or by rotating the respective threaded shaft 68 to a position in mutual alignment and respectively abutting one edge of the straight edge member 114, FIG. 2. The respective dial members 71 of the shaft pairs 65 and 66 may then be set to zero without further rotating the threaded shafts 68 in order to provide positive location defining settings. Any lateral position of the negative holder 117 with respect to the printing frame 17 may then be obtained by roughly locating the straight edge member 114 laterally of the printing frame 17 by reference to the graduated scale 84 and then locating the exact desired position by moving the position indicating stop members 75 thereagainst and referring to the respective dial members 71 as verniers. When the straight edge member 114 is in a desired position, a locating stop member 133 may be inserted at opposite ends thereof into the slots 124 of the blocks 120 and locked on the shafts 69. This may be repeated for providing accurate multiple positions, as indicated in FIG. 2. The locating stop members 133 may then be used to repeatably locate the straight edge member 114 into accurately known positions without the need for referring to the position indicating stop members 75 on the shaft pairs 65 and 66. As noted above, the relationship between various locating stop members 133 may be maintained even after removing same from the shafts 69 by using parallel rods 154 and 155 extending therethrough and locked into position, FIG. 6.

It is thus apparent that I have provided safely operating apparatus for step and repeat printing by which accurate spacing of the negative can be obtained and repeated with less effort and greater speed and accuracy than has heretofore been obtainable.

It is to be understood that while I have illustrated and described certain embodiments of my invention, it is not to be limited to the specific form or arrangement of parts herein described and shown except insofar as such limitations are included in the claims.

What I claim and desire to secure by Letters Patent is:

1. A photographic printing apparatus comprising, a supporting base, a printing frame pivotally mounted on said base for pivotal movement from a generally horizontal working position to a vertical exposing position, a cover frame hinged to said printing frame for selective pivotal movement toward and away from said printing frame, a transparent sheet supported by said cover frame and adapted to selectively cover and uncover said printing frame upon pivotal movement of said cover frame with respect to said printing frame, a latch bar pivotally mounted to said printing frame and having an upper and a lower notch therein, a lug fixed to said cover frame and engageable with said upper notch for securing said cover frame and said printing frame in closed relation, a lug fixed to said base and engageable with said lower notch for securing said printing frame against said base in working position, said latch bar being adapted to disengage one of said lugs when engaging the other of said lugs, a keeper bar pivotally mounted at one end thereof to said printing frame, the other end of said keeper bar being adjacent said latch bar, said keeper bar being movable in one direction to engage said other end with said latch bar only when said latch bar is engaged with said cover frame lug to prevent said latch bar from rotating to disengage said cover frame lug, stop means on said printing frame limiting movement of the keeper bar in said one direction, means on said supporting base for engaging said keeper bar to swing same out of engagement with said latch bar as said printing frame is moved to working position, and means biasing said keeper bar into engagement with said latch bar when said printing frame is pivoted away from working position.

2. Layout apparatus comprising, a supporting base, a rectangular printing frame having a forward frame member and a rear frame member and spaced side members, bearing members secured to said printing frame, at least one locating shaft rotatably mounted in said bearing members and extending parallel to and along said forward frame member, a straight edge member extending parallel to said printing frame side members, a block member secured to the forward end of said straight edge member, said block member having an upwardly open slot therein, said block member having a laterally extending bore communicating with one side of said slot, a ball member movable in said bore and adapted to partially extend into said slot, a plurality of locating stop members adapted to be removably secured to said shaft, each of said locating stop members having a tongue thereon adapted to engage in said slot upon rotation of said shaft, and means biasing said ball member to extend into said slot to engage said tongue and urge same toward the other side of said slot.

3. A photographic printing apparatus comprising, a supporting base, a rectangular printing frame having a forward frame member and a rear frame member and spaced side members, bearing members secured to said printing frame, at least one locating shaft rotatably mounted in said bearing members and extending respectively parallel to and along said forward frame member and said rear frame member, a straight edge member extending parallel to said printing frame side members, a block member secured to each end of said straight edge member, each of said block members having an upwardly open slot therein, said block members having aligned laterally extending threaded bores therethrough communicating with said slots, balls in said bores and adapted to partially extend into said slots, an adjusting screw in one of said bores in each of said block members and contacting the respective ball, an adjusting screw in the other bore in each of said block members and spaced from the respective ball, a resilient compression spring between said latter adjusting screw and ball, and a plu-

rality of locating stop members adapted to be removably secured to said shafts, each of said locating stop members having a tongue thereon adapted to engage in one of said slots upon rotation of a respective shaft.

4. A photographic printing apparatus comprising, a supporting base, a rectangular printing frame having a forward frame member and a rear frame member and spaced side members, bearing members secured to said printing frame, pairs of laterally spaced parallel locating shafts rotatably mounted in said bearing members and extending respectively parallel to and along said forward frame member and said rear frame member, one shaft of each of said respective pairs of locating shafts being threaded and positioned between the other shaft of said respective pairs of locating shafts and said printing frame, a straight edge member extending parallel to said printing frame side members, means for moving said straight edge member laterally of said printing frame while maintaining same extending parallel to said printing frame side members, a bifurcated block secured to each end of said straight edge member, each of said bifurcated blocks having a pair of legs defining an upwardly open slot, said legs having aligned laterally extending threaded bores therethrough communicating with said slots, balls in said bores and adapted to partially extend into said slots, an adjusting screw in one of said bores in each of said blocks and contacting the respective ball, an adjusting screw in the other bore in each of said blocks and spaced from the respective ball, a resilient compression spring between said latter adjusting screw and ball, and a plurality of locating stop members adapted to be removably secured to the other shaft of said pairs of laterally spaced parallel locating shafts and having a tongue thereon adapted to engage in one of said slots.

5. Layout apparatus comprising, a supporting base, a rectangular printing frame having a forward frame member and a rear frame member and spaced side members, bearing members secured to said printing frame, at least one locating shaft rotatably mounted in said bearing members and extending parallel to and along said forward frame member, a straight edge member extending parallel to said printing frame side members, a block member secured to the forward end of said straight edge member, said block member having an upwardly open slot therein, said block member having a laterally extending bore communicating with one side of said slot, a ball member movable in said bore and adapted to partially extend into said slot, a plurality of locating stop members adapted to be removably secured to said shaft, each of said locating stop members having a tongue thereon adapted to engage in said slot upon rotation of said shaft, means biasing said ball member to extend into said slot to engage said tongue and urge same toward the other side of said slot, said locating stop members each comprising an upper section and a lower section, said upper section having a transverse outwardly tapering downwardly opening notch intermediate the ends thereof and adapted to engage said shaft, a front and a rear link extending in spaced substantially parallel relation between said locating stop member upper and lower sections, said front link being pivotally mounted at upper and lower ends thereof to said latter named sections, said rear link being pivotally mounted at the lower end thereof to said lower section, a vertically elongated opening extending transversely through said locating stop member upper section, said rear link at the upper end thereof being retained in said opening and adapted to translate vertically therein, and a member extending into said opening and adapted to contact and adjustably urge said rear link downwardly thereof, said locating stop member lower section having a forward extension adapted to contact the under side of said shaft whereby said locating stop member lower section is adapted to selectively swing forwardly supported by said links for engagement with said outer shaft and said forward extension urged thereagainst to removably fix said locating stop member in a desired location on said shaft.

6. The apparatus of claim 5 wherein said upper section has a pair of spaced transverse parallel rod receiving bores and set screws adapted to extend into said rod receiving bores whereby said locating stop members may be maintained in fixed spaced relation.

7. Layout apparatus comprising, a supporting base, a printing frame having a frame member, bearing members secured to said printing frame, at least one pair of laterally spaced parallel locating shafts rotatably mounted in said bearing members and extending respectively parallel to said printing frame member, one shaft of said pair of locating shafts being threaded and positioned between the other shaft of said pair of locating shafts and said printing frame, a position indicating stop member associated with said pair of locating shafts, said position indicating stop member comprising, an upper portion and a lower portion, said lower portion having a pair of parallel semi-cylindrical troughs extending thereacross and laterally spaced for sliding engagement along said pair of said locating shafts, said indicating stop member upper portion having a pair of parallel semi-cylindrical troughs extending thereacross and adapted to oppose said lower portion troughs, one of said indicating stop member upper portion troughs having threads therein adapted to mate with the threaded shaft of said pair of locating shafts, guide means on one of said upper and lower portions and slidably engaged with the other for maintaining said troughs in opposed relation, means biasing said upper and lower portions toward each other, means mounted on one of said upper and lower portions and operative with the other for selectively separating said upper and lower portions to disengage the threads in said trough from said shaft threads whereby said indicating stop member is selectively freely slidable along said pair of locating shafts, and means for rotating said threaded shaft for moving said position indicating stop member longitudinally of said shaft when the threads in said upper portion are engaged with the threaded shaft.

8. The apparatus of claim 7 including a graduated scale having an edge extending along said printing frame adjacent said frame member, said indicating stop member upper portion having a lip adapted to extend over said edge of said graduated scale, and indicating means on said lip whereby the relative position of said indicating stop member is readable on said scale.

9. The apparatus of claim 7 wherein the means for separating said upper and lower portions consists of a shaft rotatably mounted in said upper portion and having a handle portion extending therefrom oppositely from the printing frame, a cam on said shaft, and a rod fixed on said lower portion and engaged by said cam in response to rotation of the shaft to effect separation movement of said upper and lower portions.

References Cited in the file of this patent

UNITED STATES PATENTS

1,552,817	Boedicker	Sept. 8, 1925
2,210,726	Mazzocco	Aug. 6, 1940
2,614,469	Hillmer	Oct. 21, 1952
2,713,294	Padgett	July 19, 1955
2,957,400	Sussin	Oct. 25, 1960