

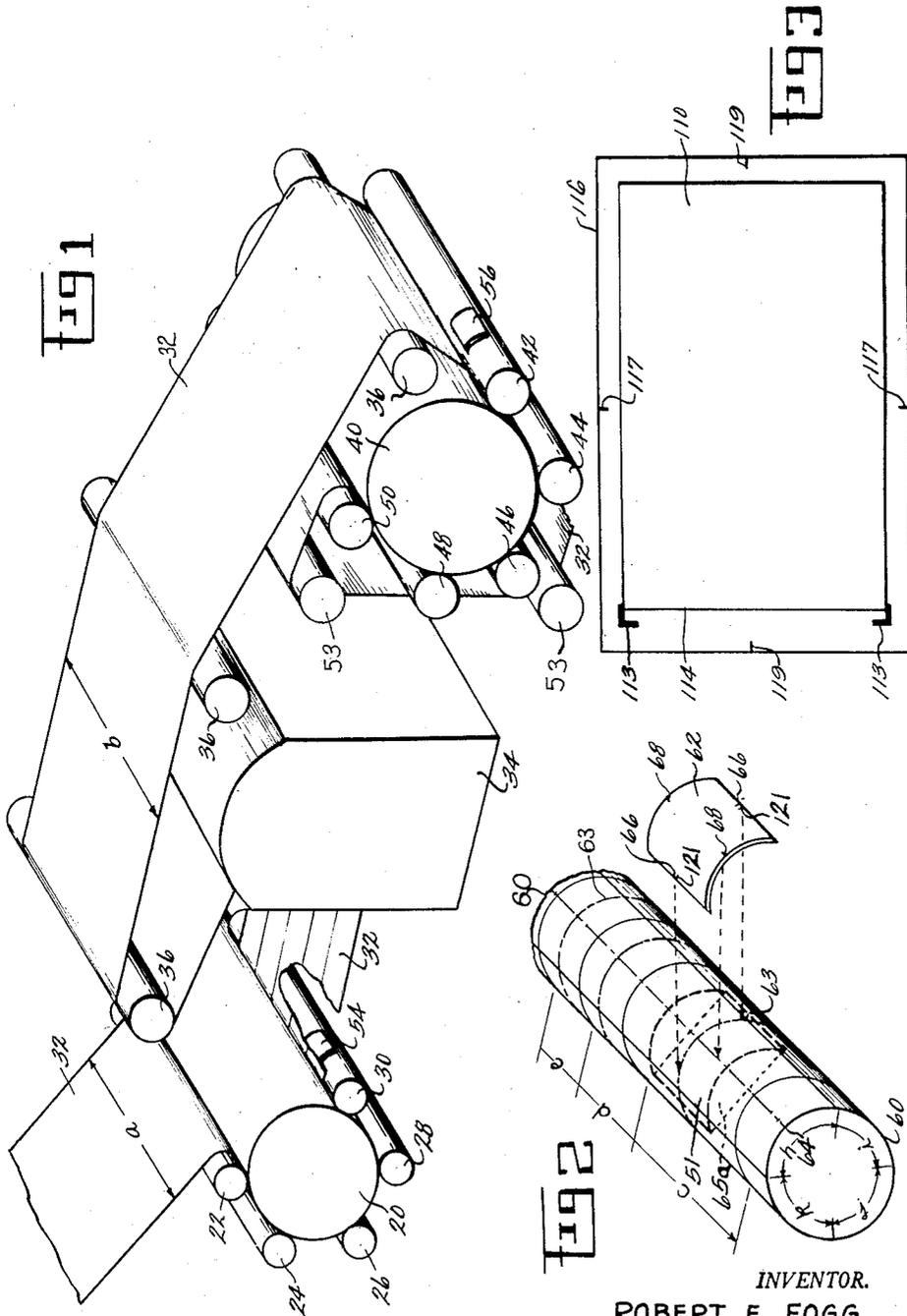
Nov. 11, 1958

R. E. FOGG
METHOD AND APPARATUS FOR LINEUP AND REGISTER
OF PRINTING PLATES

2,859,532

Filed Nov. 19, 1954

5 Sheets-Sheet 1



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HIS ATTORNEYS—

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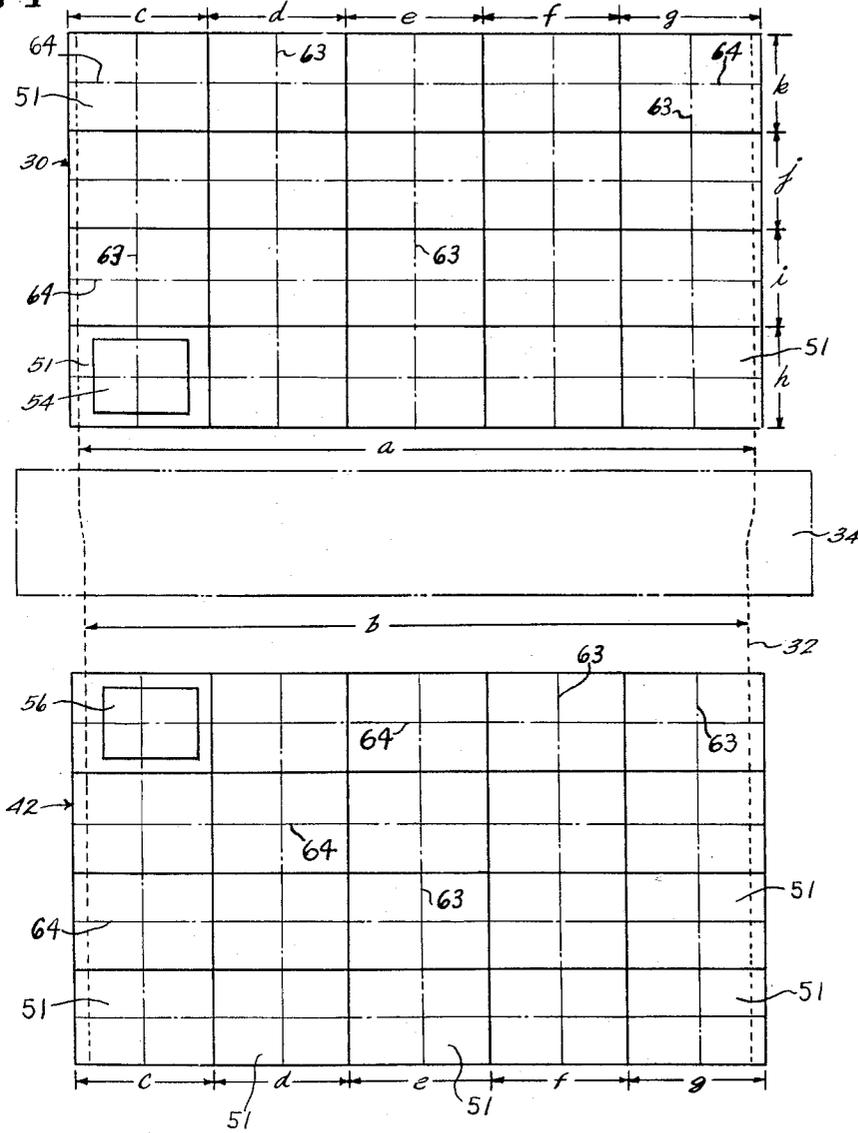
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Fig 4



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Fig 8

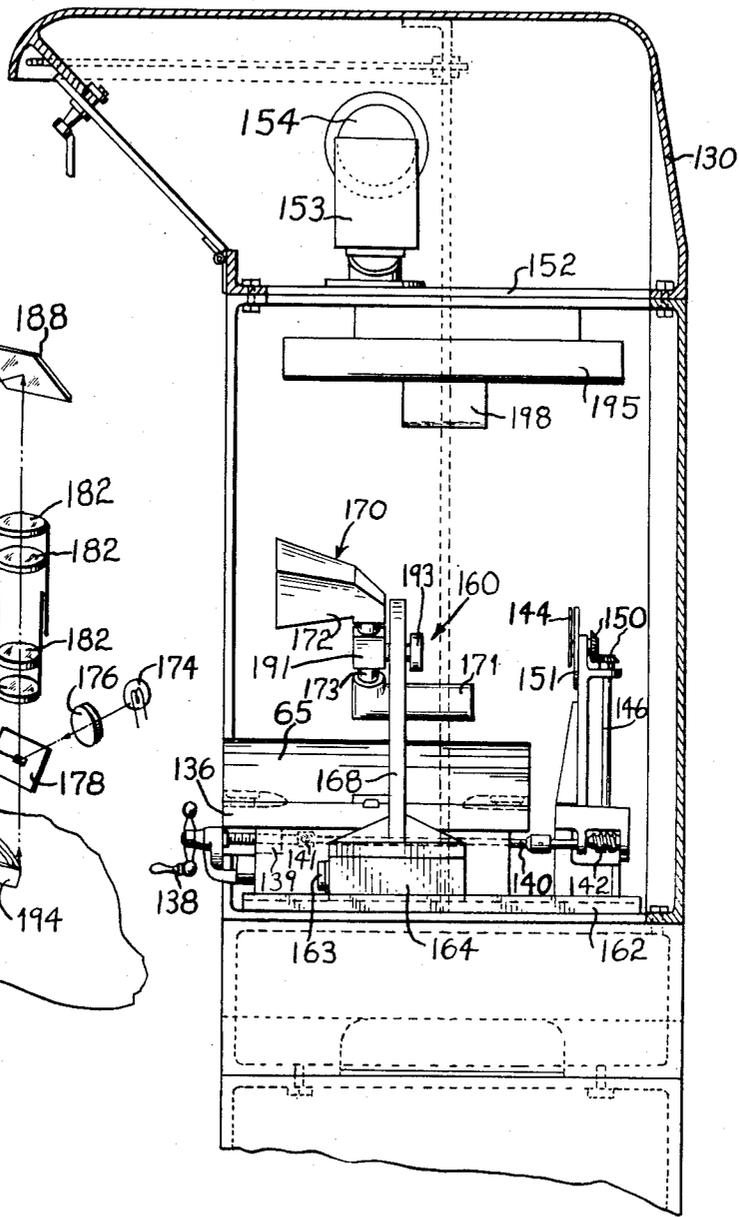
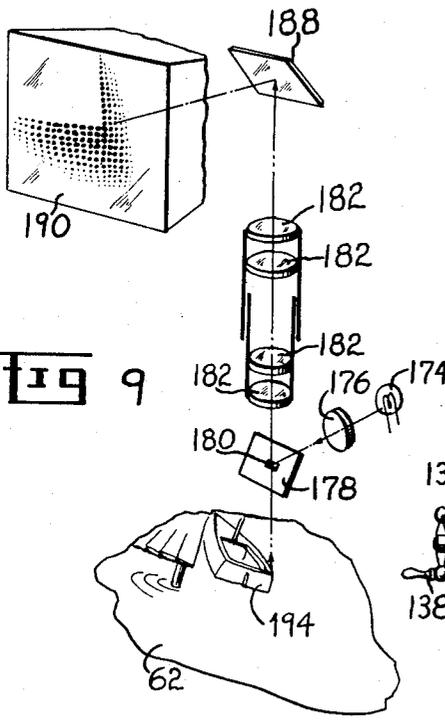


Fig 9



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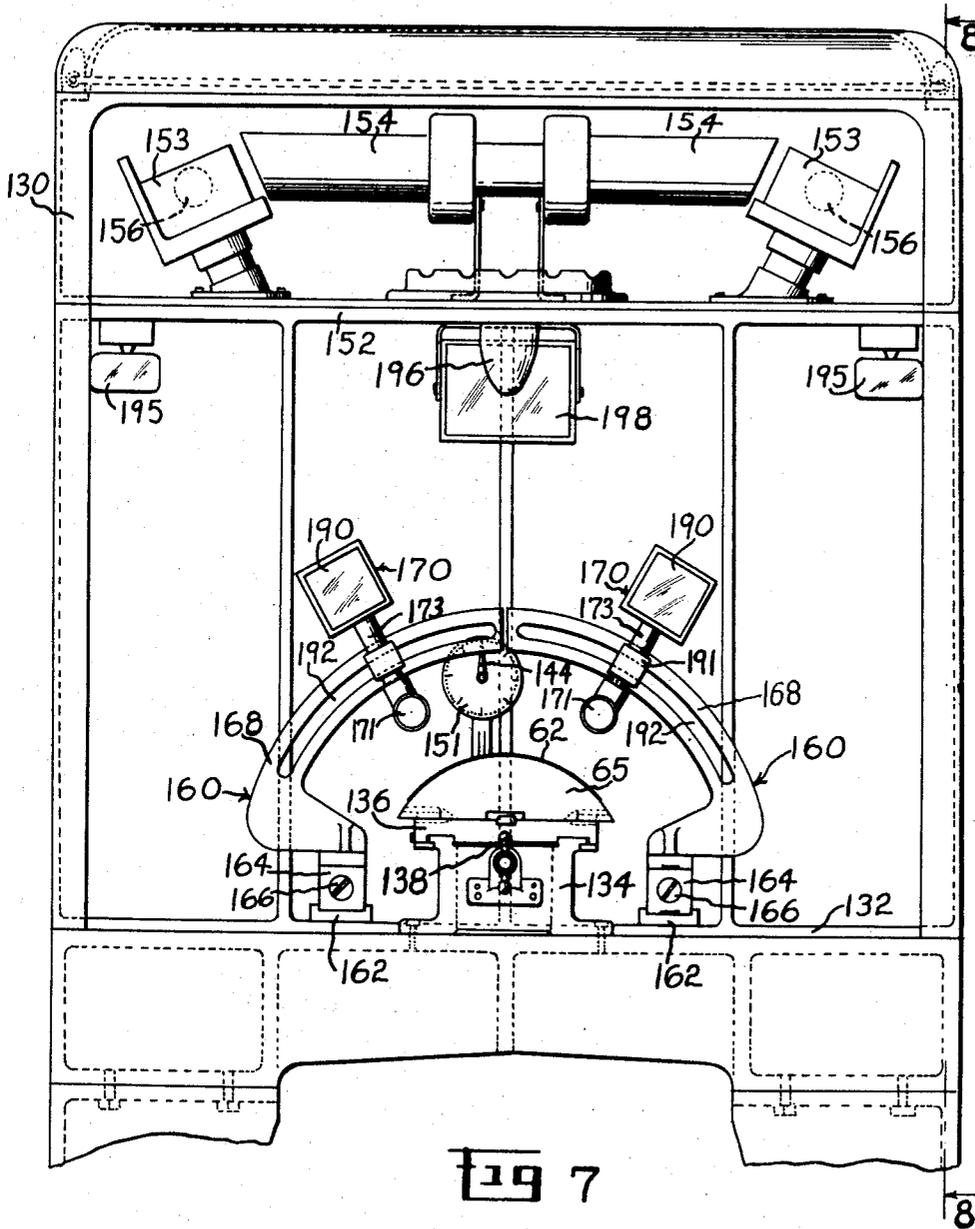
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2,859,532

METHOD AND APPARATUS FOR LINEUP AND REGISTER OF PRINTING PLATES

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Application November 19, 1954, Serial No. 469,936

16 Claims. (Cl. 33—184.5)

This invention relates to a method and apparatus for the lineup and register of printing plates. This invention relates to registering and lineup of plates in the letter press method of printing. However, the invention is not so limited in that the method and apparatus therefor may be used in other methods of printing and in other processes.

In the art of printing, numerous problems have long existed in the make-ready operation of a multi-color press. In such type of printing, it is necessary to impress upon the paper web a plurality of colors in the formation of a printed sheet. Upon a given plate cylinder are mounted a plurality of printing plates, the printing plates of each plate cylinder being adapted to impress a definite color or colors upon the web. After the paper web is printed on the first side, the web is moved through a drying oven; then the web is printed on the second side thereof. Between the time the paper web is printed on the first side thereof and the second side thereof, a shrinkage occurs in the paper web. As a result of this shrinkage of the paper web between the first side impression and the second side impression, various problems arise in the registering and lineup of the plates on both the first side plate cylinders and on the second side plate cylinders.

A great amount of time has been necessary in the past in the make-ready operation in a multi-color printing press. This make-ready operation includes the alignment and register of the printing plates on the plate cylinders so that the first side impressions and the second side impressions are properly positioned on the paper web. In other words, proper backup must be maintained. Also included in the plate positioning problem is the matter of locating the plates of the various cylinders so that proper color register is obtained.

Another problem in this type of printing operation results from the fact that the paper web may not be equal in width to the length of the attachment area of a plate cylinder used in the printing operation. The attachment areas of the plate cylinders of most printing presses are inscribed with markings indicating positions for printing plates. Therefore, if there is a difference between the width of the paper web and the length of the attachment area, this difference must be considered in positioning each printing plate with respect to the indicator markings upon the plate cylinder. This difference must be considered in properly positioning the printing plates on the plate cylinders so that the impressions are correctly positioned upon the paper web.

It is well known in the art of printing that the make-ready operation usually involves a great amount of time. In the past, it has been necessary to have a printing press out of operation during all of the make-ready procedure. Often the time involved in the make-ready operation has been as great as or greater than the time involved in the printing operation.

An object of this invention is to provide a method and an apparatus for the lineup and register of print-

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ing plates which method and apparatus aid in greatly reducing the amount of make-ready time required in the preparation of a printing press for a given printing operation.

5 Another object of this invention is to provide a method and apparatus which determine the proper position of printing plates while the printing press upon which the plates are to be mounted is in operation. Thus, production may proceed during most of the make-ready operation.

10 Another object of the invention is to provide an apparatus for accurately checking original engravings prior to the making of printing plates therefrom.

15 Still another object of the invention is the provision of an apparatus and method for checking various component parts used in flat or curved printing work.

Another object of the invention is to provide a checking apparatus for machine parts and the like.

20 Another object of this invention is to provide a positioning apparatus having a high degree of accuracy.

Other objects and advantages reside in the construction of parts, the combination thereof and the mode of operation, as will become more apparent from the following description.

25 In the drawings, Figure 1 is a perspective view showing a typical multi-color press unit provided with printing cylinders, packing cylinders and drying oven.

Figure 2 is an enlarged perspective view showing a fragment of a typical plate cylinder and a printing plate adapted to be positioned upon a portion of the plate cylinder.

30 Figure 3 shows an enlarged view of a typical master card or indicator card of the apparatus of this invention.

35 Figure 4 is a lay-out view showing a plate cylinder for the first side impression and a plate cylinder for the second side impression laid out in the flat, each cylinder having one printing plate positioned thereon; this view also shows diagrammatically and somewhat exaggerated the manner in which the paper web shrinks during its movement through the dryer oven.

Figure 5 is a front elevational view with parts broken away of a positioning apparatus of this invention.

40 Figure 6 is a sectional view taken substantially on line 6—6 of Figure 5.

45 Figure 7 is a front elevational view showing a preferred modification of the positioning apparatus of this invention, with a portion of the housing therefor broken away.

50 Figure 8 is a sectional view taken substantially on line 8—8 of Figure 7.

Figure 9 is an enlarged diagrammatic exploded view showing the optical system and light means in a scanner unit of this invention.

55 Referring to the drawings in detail, the diagrammatic perspective view of Figure 1 shows a typical multi-color press unit provided with a first side packing cylinder 20 having a plurality of first side plate cylinders 22, 24, 26, 28 and 30. A paper web 32 contacts the first side cylinders and moves into a dryer oven 34. The web 32 moves out of the dryer oven 34 and over a plurality of idler rolls 36. From the idler rolls 36 the web 32 moves to a second side packing cylinder 40 and a plurality of second side plate cylinders 42, 44, 46, 48 and 50. A plurality of idler rolls 53 aid in guiding the web 32 from the second side packing cylinder 40.

60 Before the paper web enters the dryer oven 34, the paper web has a width "a," as shown in Figure 1. When the paper web moves from the dryer oven 34, it has a width "b," which is less than the width "a" due to the fact that a shrinkage of the paper web occurs during the drying operation. In Figure 4 is diagrammatically shown

the manner in which the paper web 32 shrinks in width as the web 32 passes through the dryer oven 34.

As shown in Figures 2 and 4, each of the plate cylinders may be divided into five equal longitudinal portions—*c, d, e, f* and *g*—for the printing of five ribbons. The periphery of each cylinder may be marked in four equal transverse portions—*h, i, j* and *k*. Thus, the arcuate surface of each plate cylinder may be marked in twenty equal rectangular plate attachment sections 51, each section 51 being adapted to receive a printing plate, such as printing plate 54 or 56. Each printing plate must be properly positioned upon its plate attachment section 51 of a plate cylinder in order that proper printing on both sides of the paper web can be accomplished.

A printed portion on the first side of the web 32 must be in alignment with a portion upon the reverse side of the web 32 in order to properly form pages of printed matter; in other words, proper backup must be maintained. Furthermore, each color impression must correctly register with the other color impressions for the same page.

As stated above, in the past it has been necessary to expand a considerable amount of time in the make-ready operation before the printing operation could be commenced. It has been a very difficult problem due to the fact that the positioning of the printing plates, such as printing plates 54 and 56, upon the plate cylinders has been a matter of guesswork and estimation or trial and error. This invention has provided means and a method by which the positioning of the printing plates upon plate cylinders can be done quickly, easily and accurately.

Figure 2 is an enlarged view of a typical plate cylinder 60 similar to any one of the plate cylinders shown in Figure 1. The plate cylinder 60 is adapted to receive printing plates, such as a typical printing plate 62, to be attached thereto. As shown in Figure 4, the arcuate surface of each of the plate cylinders is divided into twenty equal rectangular plate attachment areas or sections 51. Longitudinal centerlines 63 and transverse centerlines 64 are marked through each of the twenty equal attachment sections 51. A printing plate, such as the printing plate 62, is adapted to be positioned upon one of the twenty equal sections 51. Each printing plate 62 is provided with longitudinal center marks 66 and transverse center marks 68.

If the width of the paper web 32 exactly coincided with the position markings for the printing plates upon the plate cylinders, if no shrinkage would occur in the drying process between the first side printing and the second side printing, and if other factors did not influence the positioning of the printing plates upon each of the attachment sections 51 of the plate cylinders, each printing plate would be positioned so that the longitudinal center marks 66 and the transverse center marks 68 of each printing plate would coincide with the longitudinal centerlines 63 and the transverse centerlines 64 respectively of its section 51. However, due to the fact that the width of the paper web is not equal to the length of the attachment section as determined by the positioning inscriptions on the plate cylinder and due to the fact that shrinkage does occur, and other problems are involved, each printing plate must be spaced so that the longitudinal center marks 66 thereof are positioned inwardly or outwardly with respect to the longitudinal center of the plate cylinder. Therefore, the longitudinal center marks of a plate do not necessarily coincide with the longitudinal centerline of the section 51 upon which the plate is positioned.

In this invention a saddle 65 is part of a positioning apparatus 75. The saddle 65 has an arcuate surface which is substantially the same in curvature as the surface of a plate cylinder. As shown in Figure 2, the saddle 65 is similar to a segment 65a (shown in dotted lines) of the cylinder 60. The arcuate surface of the saddle 65 is greater in area than the area of one of the plate attachment areas 51. The positioning apparatus 75 is

used to determine the proper location of a printing plate upon each of the areas 51 of a plate cylinder.

In regard to this invention, it has been learned that a paper web, such as web 32, if approximately 70 inches in width, shrinks about one-fourth to three-eighths of an inch during the drying process between the first and second side printing. Considering that there are five equal spaces *c, d, e, f* and *g* along the length of each of the cylinders, the amount of movement of each printing plate upon the plate cylinder to compensate for web shrinkage may be calculated. For example, it may be determined that the printing plate 56 for the first ribbon position *c* on the second side plate cylinder 42 should be moved inwardly, toward the longitudinal center of the plate cylinder 42, a distance of .187 inch to compensate for the difference between the length of the attachment area of the plate cylinder and the width of the paper web. It may also be determined that further movement of the printing plate 56 of .075 inch is required as compensation for shrinkage of the paper web during the drying process. This makes a total movement of .262 inch of the plate 56 with respect to the longitudinal center of its section 51 of the plate cylinder. It may also be determined that the printing plate 54 for the first ribbon position *c* on the first side plate cylinder 30 must be moved inwardly .187 inch from the longitudinal center of the section 51 in order to compensate for the difference between the width of the paper web 32 and the printing plate positions as shown by the markings or inscriptions on the plate cylinder. After it has been determined the exact amount that each of the printing plates should be moved with respect to the longitudinal centerline of its respective section of a plate cylinder, the positioning apparatus 75 may be used to accurately position each of the printing plates.

The positioning apparatus 75 comprises a base 78 to which is securely mounted a block 82 at the central portion thereof. Adjustably movable upon the block 82 is a carriage member 84 which is slidably secured to the block 82. Firmly attached to the carriage member 84 is the saddle 65, the arcuate surface of which has a radius substantially equal to the radius of curvature of the surface of one of the attachment sections 51 of a plate cylinder.

Also, attached to the base 78 is a bearing bracket 85 which rotatably supports a threaded rod 86 which is threadedly attached to the carriage member 84. An adjustment crank 88 attached to the rod 86 is provided for rotation thereof. Preferably, the rod 86 and the carriage member 84 are provided with fine threads so that adjustment of the carriage member may be made in thousandths of an inch or fractions thereof. Naturally, the adjustment of the carriage member 84 with respect to the block 82 is along the rotational axis of the threaded rod 86. Along one longitudinal edge of the carriage member 84 is a gear rack 90. In meshed relation with the gear rack 90 is a pinion gear 92 provided with a vertical shaft 94. At the upper end of the shaft 94 is a bevel gear 96 cooperating with a bevel gear 98 attached to a horizontal shaft 99, and also attached to the shaft 99 is an indicator finger 100 which rotates about the center of an indicator disc 102. Supporting the disc 102 and the shaft 94 is a support bracket 104. The indicator finger 100 cooperating with the disc 102 thus indicates the movement of the carriage member 84 with respect to the block 82. The disc 102 may be marked in thousandths of an inch or fractions thereof.

Supported by the base 78 are a plurality of vertical legs 105. Attached at the upper end of the legs 105 is a cross support 106 to which is attached a pair of camera and light projector combination units 108. Preferably, each of the camera-projector units 108 has a lens assembly 109, a photo-slide holder 111, and a projector lamp 112 so that the assembly may be used either as a camera or as a projector. However, it is to be understood that

within the purview of this invention, each of the units 108 may be a separate camera replaceable with a projector mounted in precisely the same position and angularly disposed in the same manner as the camera. Each camera-projector unit 108 is provided with a slidable cover 107 so that access to the slide holder 111 is readily available.

A master card or indicator card 110, shown in Figure 3, is placed upon the saddle 65 so that the master card 110 assumes the curvature of the saddle 65. The master card 110 contains folio marks 113, color ad lines 114, and bleed lines 116. The master card may also contain other types of indicia or key markings.

Longitudinal center marks 117 and transverse center marks 119 are aligned with the longitudinal centerline 63 and the transverse centerline 64 respectively of the saddle 65. With the master card 110 so positioned and the indicator finger 100 pointed to zero, a photograph is taken of one-half of the master card with a film slide disposed in each slide holder 111. Naturally, during the photographing, the projector lamp 112 is not energized. The light for taking the pictures may be provided by a light source 115 attached to the cross support 106 or from any other suitable source.

Thus, two pictures are taken, each picture showing one-half of the master card 110 with the dividing line being at the center of the arcuate surface and normal to the arcuate edges thereof. The film slides are then developed. These film slide negatives or other type transparencies are replaced into the proper slide holders 111 and the image of the master card projected therefrom; the image of the master card in its arcuate position, as positioned upon the saddle 65, is thus projected by the light from the lamps 112 of the units 108, as shown in Figure 5. Light rays 120 emanating from each of the units 108 clearly set forth the image of the master card 110 upon the saddle 65.

Before the make-ready process is begun, a chart is compiled showing the distance from the center of each of the sections 51 that the printing plate to be attached thereto must be moved in order to compensate for the various factors involved. As discussed above, some of the factors involved are the difference in width of the paper web as compared to the plate positions indicated by inscriptions on the plate cylinder, and compensation for shrinkage of the paper web which shrinks as it moves through the dryer oven.

As stated above, calculations may be easily made knowing that the paper web shrinks a definite amount as it passes through the dryer oven and knowing the width of the paper web as compared to the length of the plate attachment area of a cylinder as indicated by the plate attachment indicator marks on the cylinder.

The saddle 65 which is firmly attached to the carriage member 84 is properly positioned prior to the placing of a printing plate upon the saddle 65. The saddle is properly positioned by turning the adjustment crank 88, thus moving the carriage member 84 with the saddle 65 attached thereto until the indicator finger 100 cooperating with the indicator disc 102 indicates that the saddle has been moved the total distance calculated for compensation for the factors involved. Thus, the saddle 65 is moved a given distance from the position which it occupied when the pictures of the master card were taken by the units 108. In other words, the saddle 65 is adjustably moved laterally with respect to the camera-projector units 108.

For example, if it is known that the printing plate 62 should be aligned within the area 51 upon the cylinder 60, which it is to occupy, so that the transverse axis of the printing plate 62 should be displaced .262 inch from the longitudinal centerline 63 of the rectangular area 51, the saddle 65 is moved by the crank 88 until the indicator finger 100 reads upon the indicator disc 102 the value of .262. The printing plate 62 is then

placed upon the saddle 65, as shown in Figures 5 and 6.

With light rays 120 projecting the image of the master card 110 from the camera-projector units 108 upon the saddle 65, the printing plate 62 is positioned upon the saddle 65 so that the folio or other indicia of the printing plate 62 coincide precisely with the projected folio marks 113 or other indicia of the master card 110. In the event the printing plate 62 carries no folio, then ad lines or bleed lines may be used to align the printing plate with those portions of the image of the master card projected by the units 108.

After a printing plate, such as plate 62, is properly positioned upon the saddle 65, as described above, a pair of scribe marks, such as scribe marks 121, are placed upon the plate 62. These scribe marks 121 are provided for alignment with the centerline 63 of the section 51 of the plate cylinder 60 upon which the plate 62 is to be located. Thus, it may be understood that an accurate method is provided by which a printing plate may be properly positioned upon a plate cylinder. This method provides means by which the proper position of a printing plate upon a plate cylinder may be determined within $\frac{1}{1000}$ of an inch or closer.

In this invention means are also provided for obtaining proper and accurate color register. In other words, the printing plate 62 may impress the color black upon a given page of material. Other plates provide impressions of one or more colors to the same page. In order to obtain proper register of these colors, it is necessary to accurately position each printing plate for a given page in precisely the same relative position upon its respective section 51 of the plate cylinder. After the first color plate 62 is properly positioned upon the saddle 65 and is scribed with scribe marks 121, then means are employed to indicate the position of the plate 62 upon the saddle 65.

A definite letter or portion of a letter or some other point within the printing plate 62 is aligned with a pointer 122 which is supported by an arm 124 held by a surface block 126. The light source 115 may be used to cast a shadow of the pointer 122 upon a definite point on the plate 62. The surface block 126 and the pointer 122 remain in this precise location while the plate 62 is removed and is replaced upon the saddle 65 by the next succeeding color plate for the same page. The same point on this next succeeding printing plate is then aligned with the pointer 122 so that this next printing plate is disposed precisely at the same location on the saddle 65 as was the printing plate 62. Thus, all of the printing plates positioned on the spaces around the periphery of a cylinder for printing upon substantially the same area of a web may be accurately aligned so that proper color register may be obtained. Furthermore, the impression of the first side printing is accurately aligned with the impression of the second side printing.

A preferred modification of the positioning apparatus of this invention is shown in Figures 7, 8 and 9. A housing 130 encloses the positioning apparatus. Upon a floor 132 is a support block 134 to which is slidably attached a carriage member 136. Rigidly attached to the carriage member 136 is the saddle 65. As stated above, the saddle 65 is substantially identical to a segment 65a of a typical plate cylinder 60. The carriage member 136 is movable by means of a crank 138 which is similar to the crank 88 of the preferred embodiment.

The crank 138 is used to rotate a rod 139 which threadedly engages a projection block 141 of the carriage member 136. Axially attached to the rod 139 at the end thereof is a shaft 140 to which is attached a worm 142 which drives an indicating finger 144. The indicating finger 144 is driven by the worm gear 142 through a shaft 146 and a pair of bevel gears 150, as best shown in Figure 8. A disc scale 151 cooperates with the indicating finger

144 to show the relative position of the saddle 65 with respect to the support block 134.

An upper floor 152 rigidly supports a pair of camera-projector units 153 which are similar to the camera-projector units 108 shown in the first described embodiment. An air blower unit 154 may be used to cool the camera-projector units 153 which may tend to heat considerably when being used as a projector, due to the fact that a lamp 156 within the unit is lighted during the time that the unit is being employed as a projector.

In this preferred modification a scanner assembly is used to accurately indicate the position of printing plates for the purpose of obtaining precise color register. Upon the saddle 65 is positioned a typical printing plate, such as printing plate 62. As discussed above, this printing plate 62 is herein described as being a first printing plate for one side of a given page which is printed upon the paper web 32. After the printing plate 62 is properly positioned upon the saddle 65 by use of light projection from the camera-projector units 153, the printing plate 62 is scribed by means of scribe marks 121, as discussed above, and the printing plate 62 remains in its proper position upon the saddle 65 until this position is indicated and recorded by means of a pair of scanning assemblies 160.

Each scanning assembly 160 is movably carried upon a rail member 162 which is disposed on one side of the support block 134. Each of the rail members 162 extends substantially parallel to the rod member 140. On each rail member 162 is movably positioned a magnetic carrier block 164. This magnetic carrier block 164 may be of a conventional type having a switch 166 which may be employed to rotate a magnetic assembly within the carrier block 164 in order to magnetically secure or release the carrier block 164 upon its rail 162.

Firmly supported upon each carrier block 164 is an arcuate scanner bracket 168. Each scanner bracket 168 extends over the saddle 65 to substantially the center thereof, as shown in Figure 7. Upon each arcuate scanner bracket 168 is adjustably positioned a scanner unit 170. Thus, it is understood that each scanner bracket 168 is movable along the length of the saddle 65 by means of the carrier block 164 upon its respective rail 162. Furthermore, each scanner unit 170 is adjustably movable upon its respective bracket 168 in a direction transverse to the rails 162. The scanner units 170 of the preferred modification replace the pointer assembly having the pointer 122 and the surface block 126 shown in the first described embodiment.

Each of the scanner units 170 may be positioned over a letter or point upon the printing plate 62 positioned upon the saddle 65. A letter or point is chosen which appears upon all of the complementary color plates which together impress a given printed configuration. Each scanner unit 170 is provided with a pair of substantially parallel leg portions 171 and 172 joined by a body portion 173 normal to the legs 171 and 172. The leg portion 172 is tapered, having a lesser cross sectional area at the juncture thereof than at the end thereof.

Within the leg 171 is a light source 174 and a light directing lens 176. The light source 174 emanates light through the lens 176. This light falls upon an inclined mirror 178, mounted at the juncture of the leg 171 and the body 173. The mirror 178 is provided with an aperture or unsilvered portion 180. The inclined mirror 178 directs light downwardly upon the surface of a printing plate, such as the printing plate 62 positioned upon the saddle 65. The aperture 180 within the mirror 178 permits light rays to pass from the surface of the printing plate 62 through a plurality of collimation lenses 182 which are mounted in the body 173. The light rays pass through the collimation lenses 182 and reach a second inclined mirror 188, mounted at the juncture of the body 173 and the leg 172. The mirror 188 directs rays of light to a frosted lens or receiving screen 190 disposed at the end of the leg 172.

By this means a point, such as the corner of a boat 194, which is part of a figure appearing on the printing plate 62, as shown in Figure 9, is lighted by the lamp or light source 174 and light rays are directed upwardly through the collimation lenses 182. A greatly enlarged image of this corner of the boat is thus received upon the frosted lens 190, as clearly shown in Figure 9. Due to the fact that the printing plates are provided with a multiplicity of dot protuberances forming configurations of figures and letters for printing, these protuberances appear as dots in the enlarged image on the frosted lens 190.

By means of a crayon or the like, the image of this corner of the boat may be traced upon the exterior surface of the frosted glass lens 190 so that the pattern remains upon the frosted glass lens even though the printing plate 62 is removed from the saddle 65.

After the image of the corner of the boat is traced upon the frosted lens 190 of one of the scanner units 170, the other scanner unit 170 is lined up with another point or letter on another portion of the arcuate surface of the plate 62. The image of this point or letter is traced upon the frosted lens 190 of the second scanner unit in a manner similar to that described with respect to the first scanner unit. Therefore, the locations of two points are accurately determined for the setting of the other complementary printing plates.

Each of the scanner units 170 is retained by a clamp 191 which is provided with a clamping bolt 193. The bolt 193 extends through a guide slot 192 of the bracket 168. Thus, each scanner unit 170 is adjustably movable upon its bracket 168. An entire scanner bracket 168 may be moved upon its respective rail 162 by means of the carrier blocks 164 which may be magnetically locked in a given position upon the rails 162 as described above. The two arcuate brackets 168 may be joined one to the other at the ends thereof to form one large bracket with two scanning units.

After the printing plate 62 has been aligned by means of the camera-projector units 153 and two points on the surface thereof have been carefully indicated by means of the scanner units 170, the printing plate 62, having been scribed with scribe marks such as scribe marks 121, is removed from the arcuate saddle 65. The next color plate, which cooperates with the plate 62 to provide one side of a page of colored printed material, is placed upon the arcuate saddle 65. This next color plate has the same point or letter thereon such as the boat 194 shown in Figure 9. This corner of the boat in the second color plate is aligned carefully with the first scanner 170 so that the image of this corner of the boat is carefully aligned with the outlines of the corner of the boat which have been marked in crayon on the frosted lens 190, as shown in Figure 9. In other words, the outlines of the corner of the boat 194, drawn in crayon to indicate the position of the corner of the boat as shown by the position of the printing plate 62, are used to align this same corner of the boat appearing upon this second color plate to the same position upon the saddle 65.

The second scanner unit is then used to line up the second point which has been chosen upon the plates. Thus, two points on the second plate are precisely located in the same positions upon the saddle 65 as the same two points upon the plate 62 were positioned. Therefore, the second color plate is precisely positioned in the same location as was the printing plate 62 upon the saddle 65. Then this second color plate is scribed by marks, such as marks 121, to indicate the relative position of this second plate with respect to the longitudinal center marks of the section 51 upon which it is to be positioned.

This same procedure is followed in determining the proper position of all of the color plates which will cooperate with the printing plate 62. After all of the cooperating plates are individually located upon the arcuate saddle 65 and are precisely scribed, the outline of the marking, such as the corner of the boat 194, is erased

from the frosted lens 190. Then another first color plate, such as plate 62, is aligned by means of the camera-projector units and the same procedure is followed in indicating the position thereof by using the scanner assembly as described above.

As shown in Figures 7 and 8, the housing 130 may support a pair of lamp units 195 which are located along the upper side portions of the housing 130 and may be used in the photographing process. Another lamp 196 may be located near the center portion of the housing 130 for use in illuminating the housing 130 when desired. An amber-color light 198 on the like may also be supported by the housing 130 near the center thereof to be used in the developing of a film used with the camera-projector units 153.

In some types of work it may be desired to use light projected from the camera-projector units 153 for both the lineup and register of printing plates. In other types of work it may be desired to employ only scanner units, such as scanner units 170, for checking various industrial operations.

It is to be understood that, within the purview of this invention, other types of guide marks than scribe marks 121 may be used to indicate proper relative positions of printing plates upon the plate cylinders. Also, holes in the plate, or stops, may be used to indicate the proper position of the printing plates.

The method and apparatus of this invention may also be employed for other types of work in the printing art. It may be used in flat plate work as well as in cylinder plate work. The method and apparatus may also be used in the process of pre-register of original engravings for a molding process. The method and apparatus of this invention may also be used in other types of industry than that of printing.

Although the preferred embodiment and modifications of the device have been described, it will be understood that within the purview of this invention various changes may be made in the form, details, proportion and arrangement of parts, the combination thereof and mode of operation, which generally stated consist in a device capable of carrying out the objects set forth, as disclosed and defined in the appended claims.

Having thus described my invention, I claim:

1. A locator apparatus for printing plates comprising support structure, an arcuate saddle having substantially the curvature of a printing plate, the arcuate saddle being longitudinally movable upon the support structure, a pair of projectors attached to the support structure, each of the projectors being positioned for directing rays of light upon one-half of the arcuate saddle, and means for measuring the movement of the arcuate saddle upon the support structure.

2. A locator apparatus for indicating the longitudinal position of an arcuate printing plate upon a printing cylinder, the combination comprising a support structure, a pair of light projectors attached to the support structure in spaced relation one from the other, a cylindrical segment having its arcuate surface facing the projectors movably carried by the support structure, each of the projectors being angularly positioned equidistant from the cylindrical segment so that the center of the projected light rays therefrom lies upon an extension of a radial line of the arcuate segment, each of said projectors being positioned so that the projected light therefrom covers substantially an equal portion of the arcuate surface of the cylindrical segment, means for moving the cylindrical segment so that said segment remains equidistant from each of the projectors, and means for measuring the movement of the cylindrical segment.

3. The method of marking printing plates for proper positioning of the printing plates upon a printing cylinder provided with peripheral centering lines normal to the axis of the cylinder, comprising the steps of positioning an indicator card upon a cylindrical segment having

an arcuate surface substantially identical to the arcuate surface of the printing cylinder, the indicator card being provided with indicator marks for a printing plate, followed by photographing the indicator card positioned upon the cylindrical segment, said photography being done by taking two photographs, each photograph showing one-half of the indicator card, followed by removal of the indicator card from the cylindrical segment and by substituting for the indicator card upon the cylindrical segment a printing plate, followed by projecting transparency photographs of the indicator card by light rays upon the printing plate, the projecting being done from the positions and angles from which the photographs were taken so that the light rays project the images of the card upon the cylindrical segment at a position in which the printing plate should be disposed, followed by positioning the printing plate in such position that said plate coincides with the indicator markings therefor projected by the light rays, followed by scribing the printing plate to indicate its position upon the printing cylinder.

4. A method of determining the position of a printing plate upon a cylinder, the cylinder being provided with peripheral centering lines normal to the longitudinal axis of the cylinder, comprising (a) positioning an indicator card upon a cylindrical segment, said segment being equal to a segment of the cylinder, said indicator card assuming the curvature of the segment, (b) photographing the indicator card positioned upon the cylindrical segment by a camera positioned in two radial positions, each position permitting the camera to photograph one-half of the card, (c) projecting images of the card upon the cylindrical segment, (d) placing a printing plate upon the segment, so that the printing plate coincides with the projected image of the indicator card.

5. In a positioning device for printing plates comprising a base, an arcuate saddle mounted for relative movement with respect to the base, the arcuate saddle being movable along a line normal to a radial line thereof, a support member carried by the base, a pair of projectors carried by the support member, each of said projectors being positioned and aligned upon an extension of a radial line of the arcuate saddle, the two projectors being positioned so that they are together capable of projecting direct light rays upon the entire curved surface of the saddle, means for movement of the saddle, and means connected to the saddle for measuring the movement thereof.

6. In a positioning apparatus for printing plates adapted to be located upon plate cylinders, a base, a saddle movably positioned upon the base, the saddle being equal to a segment of a plate cylinder, means for mounting a plurality of projectors in spaced relation from the saddle, each of the projectors being positioned for directing light rays upon a portion of the saddle, and means for indicating the position of the saddle with respect to the base.

7. The method of locating a printing plate upon a plate cylinder having marks for printing plate alignment comprising the steps of projecting images of indicia upon a segment of a plate cylinder, followed by moving the segment of the plate cylinder with respect to the projected images, followed by positioning the printing plate so that alignment occurs between the projected indicia and the printing plate, followed by marking the position of the printing plate with respect to the segment of a plate cylinder, followed by placing the printing plate upon the plate cylinder in accordance with the marks upon the printing plate and upon the plate cylinder.

8. Apparatus for aligning an arcuate printing plate upon a plate cylinder, said apparatus comprising a base, a plurality of light ray projectors, means extending from the base for supporting the projectors, a segment of a plate cylinder movably positioned upon the base equidistant from each of the projectors, the projectors being

angularly disposed, each projector being aligned upon a radial extension line of the segment so that light rays projected by each projector fall directly upon a portion of the arcuate surface of the segment, an indicator card for a printing plate, each of the projectors being adapted to project an image of a portion of the indicator card, and means for measuring lateral movement of the segment with respect to the projectors.

9. In a method of positioning a printing plate upon a retainer member for a printing operation, the steps of projecting alignment indicia by means of light rays upon a segment of the retainer member, followed by alignment of the printing plate upon the segment of the retainer member with the alignment indicia which is projected upon the segment of the retainer member, followed by indicating the position of the printing plate with respect to the segment of the retainer member.

10. In a method of marking a printing plate for positioning of the printing plate upon a retainer member for a printing operation, the steps of projecting alignment indicia by means of light rays upon a segment of the retainer member, followed by alignment of the printing plate upon the segment of the retainer member with the alignment indicia which is projected upon the segment of the retainer member, followed by scribing the position of the printing plate with respect to the position of the segment of the retainer member.

11. In a method of marking a printing plate for positioning of the printing plate upon a retainer member for a printing operation, the steps of projecting alignment indicia upon a segment of the retainer member, the projecting means being movable laterally with respect to the segment of the retainer member, followed by relative movement between the projecting means and the segment of the retainer member, the relative movement being through a predetermined distance, followed by alignment of the printing plate upon the segment of the retainer member with the alignment indicia which is projected upon the segment of the retainer member, followed by scribing the position of the printing plate with respect to the position of the segment of the retainer member.

12. In a positioning apparatus for printing plates, a support block, a saddle member for retaining a printing plate, the saddle member being movably attached to the support block, a pair of rails, the rails being mounted on opposite sides of the support block, a scanner bracket movable upon the rails, a scanner unit adjustably attached to the scanner bracket, the scanner unit being provided with an optical lens and mirror assembly and an image receiving lens, the optical lens and mirror assembly being adapted to project to the image receiving lens an enlarged image of a portion of a printing plate positioned upon the saddle member.

13. In a positioning apparatus for printing plates, a support block member, a saddle member for retaining a printing plate, said members being movably attached one to the other, a rail member extending adjacent the

support block member, a scanner bracket movable upon the rail member, a scanner unit adjustably attached to the scanner bracket, the scanner unit being provided with a pair of leg portions, one of said leg portions having a lens assembly mounted therein, the other of said leg portions having a receiving lens at the end thereof, there being an inclined mirror at the juncture of the leg portions.

14. In a positioning apparatus for printing plates, the combination comprising a support block, a saddle member for retaining a printing plate, the saddle member being movably attached to the support block, a pair of rail members, one of said rail members being mounted on either side of the support block, a pair of scanner brackets, there being one scanner bracket movably attached to each of said rail members, a pair of scanner units, one of said scanner units being adjustably attached to each of said scanner brackets, each of said scanner units being provided with an optical lens and mirror assembly, each of said scanner units also having an image receiving lens, the optical lens and mirror assembly being adapted to project to the image receiving lens an enlarged image of a portion of a printing plate positioned upon the saddle member.

15. A locator apparatus for printing plates comprising support structure, a saddle having a surface conforming to the surface of a printing plate, the saddle being movable upon the support structure, a plurality of projectors attached to the support structure, each of the projectors being positioned for directing rays of light upon a portion of the saddle, and means for measuring the position of the saddle with respect to the support structure.

16. A method of determining the position of a printing plate upon a holder therefor, comprising (a) positioning an indicator card upon a body having a surface similar to the surface of the holder, said indicator card assuming the shape of the surface of the body, (b) photographing the indicator card positioned upon the body by a camera positioned in spaced relation from the body, (c) projecting an image of the card upon the surface of the body, (d) placing a printing plate upon the body so that the printing plate coincides with the projected image of the indicator card.

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