METHOD OF AND APPARATUS FOR PRE-REGISTERING PRINTING PLATES

Wendell H. Stickney, Wilbraham, Mass., assignor to Diamond Gardner Corporation, a corporation of Delaware

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This invention relates to methods of and apparatus for preregistering printing plates, particularly with regard to multicolor printing plates.

Traditionally, during the printing operations, wherein a composite impression is made by successively imprinting in exactly the same place from a series of printing plates each of which carries ink of a different primary color, the principal problem encountered is obtaining accurate registration of the several printing plates in order to insure that their impressions will be made exactly in the same place. Generally, such registration is achieved by a preliminary aligning operation in which equidistant reference marks or holes are placed at corresponding points on each of the plates and are so located that they will be in exact registration when the successive impressions are made in the subsequent printing operations. Therefore, the attainment and checking of pre-registration has generally been a cumbersome, expensive and time-consuming operation. Many different systems and many different devices have been proposed for alleviating these difficulties, but none have been entirely satisfactory.

An object of the present invention is to provide new and improved methods of and apparatus for preregistering printing plates.

Another object of the invention is to provide new and improved methods of and apparatus for accurately and rapidly attaining and checking the preregistration of a series of multicolor printing plates.

Other objects and the nature and advantages of the instant invention will be apparent from the following description taken in conjunction with the accompanying drawings, wherein:

Fig. 1 is a side elevational view of the apparatus embodying the invention; with portions thereof shown in section to reveal structural details;

Fig. 2 is a transverse vertical broken section taken along the line 2—2 of Fig. 1; and

Fig. 3 is a plan view of the apparatus embodying the invention.

The apparatus illustrated is designed especially for the preregistration of accurate printing plates of the type employed in rotary printing machines. This apparatus includes a cylinder 10 of the proper size to receive such accurate printing plates on its periphery, where they are mounted temporarily for the preregistration operation, as is best shown in Fig. 2 by a plate 11 mounted thereon. During this operation the position of the cylinder 10 may be adjusted both axially and rotatably between predetermined limits.

In order to facilitate accurate adjustment of the position of the cylinder 10, it is secured to a tubular cylindrical shaft 12, which is journalled slidably at opposite ends thereof in a pair of aligned sleeve bearings 14 mounted in a frame 15. A second shaft 16 extends axially through and is slidably movable within the first shaft 12. Opposite ends of the shaft 16 project beyond the ends of the shaft 12 and beyond the sleeve bearings 14. In fact, in Fig. 1 the righthand end of the shaft 16 has been broken away merely to simplify the drawing, and actually this shaft projects a short distance farther in this direction. A disc 18 secured to the extreme left hand end of the shaft 16, as viewed in Fig. 1, serves as a stop against one of the sleeve bearings 14 when the shaft 16 is shifted axially to the right as far as it will go. Likewise, an annulus or collar 20 mounted slidably on the shaft 16 adjacent to the disc 18 and joined to said disc by a plurality of adjustment screws 22, functions as a stop abutting the tubular shaft 12 when the shaft 16 is at the limit of its movement in this direction. On the righthand end of the shaft 16 a disc 24 and an adjacent annulus or collar 26, corresponding in structure and in function to the disc 18 and the annulus 20, are both threaded onto the shaft 16, and the annulus 26 is rotatably adjustable along the threaded end of the shaft 16 until they have advanced as far as they can go to the left, as viewed in Fig. 1. However, the disc 24 and the annulus 26 may be moved along the shaft 16, and they may be moved relative to each other by means of the adjustment screws 28, in order to adjust the position of the cylinder 10 axially. Likewise, the adjustment screws 22 regulate the relative position of the disc 18 and the annulus 20, for controlling the axial position of the cylinder 10 and any end play thereof.

Rotational limits for the movement of the cylinder 10 are set by means of a swingable bar 30 having an elongated longitudinal slot 32 formed at one end thereof and a generally square aperture 34 extending through the opposite end thereof. The bar 30 is mounted pivotally on a horizontal shaft 36 passing through the aperture 34 and extending between opposite sides of the frame 15. The shaft 36 is journalled within a block 38 which is mounted slidably in the aperture 34 and is slotable longitudinally of the bar 30 by means of an adjustment screw 40. A pin 42 having a retaining head 44 on the outer end thereof projects through the slot 32 and is secured to the cylinder 10 near its periphery at a point generally opposite to that provided for securing printing plates thereon to be preregistered. During such preregistration the cylinder 10 may be rotated for fraction of a revolution alternately in opposite directions to an extent limited by the slotted bar 30. The pin 42 slides from one end to the other of the slot 32 as the bar 30 pivots on the shaft 36 during the rotary motion of the cylinder 10 in each direction. By means of the adjustment screw 40 the bar 30 may be shifted with respect to the shaft 36 to limit the travel of the pin 42 within the slot 32 thereby controlling the limits of the rotary movement of the cylinder 10.

It is necessary to provide adjustments for insuring that the extent of the rotary movement of the cylinder 10 will be the same in each direction. In other words, the rotary limits must be set to stop the cylinder 10 at equal distances on each side of the center point of the printing plates being preregistered thereon. For this purpose, a pair of eccentric bushings 46 are formed in opposite ends of the shaft 36 where these ends pass through the frame 15, and a pair of adjustment screws 48 are threaded into these bushings. By the adjustment of the screws 48 the shaft 36 may be shifted laterally in a very small increment in each direction.

In preregistering a series of multicolor printing plates, or the like, the plates are compared successively in pairs
to be sure that the reference marks or holes are placed at corresponding points on each of the plates. For this purpose, the cylinder 10 is designed to accommodate two of the printing plates side by side on its periphery. The plates are compared by observation through a pair of optical scope viewers 50 mounted on top of the frame 15 a fixed distance apart and directly over the cylinder 10. The viewers 50 are provided internally with the usual cross-hairs (not shown) for making an accurate comparison of corresponding points on the two printing plates.

When the printing plates are provided with screw holes for use in subsequently fastening them to the cylinder of a rotary printing machine, such screw holes are drilled into the plates while they are secured on the cylinder 10, after they have been properly centered thereon. During such drilling, opposite ends of the printing plates, such as the plate 11 (Fig. 2), are secured to the cylinder 10 by means of a pair of clamps 52. These clamps are arranged to hold opposite ends of the printing plates in sliding engagement until they are properly positioned, and then they may be tightened into gripping engagement by means of a plurality of screws 54. Meanwhile, the cylinder 10 is positively prevented from moving axially and rotatably by securing the shaft 12 on which it is mounted by means of a pair of set screws 56 mounted on the sleeve bearings 14. A pair of drill bushings 58 located in the top of the frame 15 and spaced apart a distance equal to the distance between the viewers 50 serve as guides for drilling the reference holes on one edge of the printing plates secured on the cylinder 10. Similarly, a second pair of drill bushings 60 positioned in the top of the frame 15 and spaced apart the same distance, serve as drill guides for the holes on the opposite edge of the printing plates. The cylinder 10 is provided with a plurality of holes 62 on its periphery corresponding to the positions of the bushings 58 and 60, for allowing the drill to penetrate entirely through the printing plates.

Before using the above-described apparatus for preregistering a series of printing plates, the apparatus should be checked to be sure that all the various adjustment screws are properly set, and particularly to have the cylinder 10 properly centered. The disc 24 and the annulus 26 are tightened, and adjustments are made to eliminate any end play of the shafts 12 and 16 on which the cylinder 10 is mounted. The cross-hairs of the viewers 50 should appear coincident with the reference marks (not shown) formed at the midpoints of the two placements or positions provided on the periphery of the cylinder 10 for the reception of a pair of printing plates to be preregistered. Finally, the rotational limits of the cylinder 10 are checked to be certain that it is rotatable equal distances on opposite sides of the center marks.

Printing plates may be preregistered on this apparatus by a rapid, simple, substantially fool-proof method with superior accuracy. First, one printing plate is centered with respect to one of the viewers 50. To do so, the plate is placed on the cylinder 10 and its ends are elastically engaged by the pair of clamps 52. The disc 24 and the annulus or collar 26 are loosened and shifted to the right along the shaft 16 to allow the shaft 12 and the cylinder 10 carried thereon to move axially to the right a distance corresponding approximately to one-half the width of the printing plate 11, until one of the viewers 50 appears in the field of vision of one of the viewers 50, then the cylinder 10 is shifted axially in the opposite direction until the opposite edge of the plate 11 is visible under the same viewer, and the cylinder 10 is moved axially back and forth while adjusting the position of the stop means, until the end of the printing plate 11, as well as the annulus 26, to limit the axial movement of the shaft 12, and if necessary the printing plate is shifted, until it appears accurately centered. Now the disc 24 and the annulus 26 are tightened to prevent any further axial movement of the shaft 12. Then the cylinder 10 is rotated back and forth while viewing one edge of the printing plate 11 and adjustments are made to insure that this plate is not askew and to cause opposite ends of the printing plate to appear in the viewer 50 at the rotational limits of the cylinder 10. Having been thus properly centered, the cylinder 10 is securely clamped to the cylinder 10 by tightening the screws 54 of the clamps 52.

In preparation for the drilling of reference holes in the printing plate, the cylinder 10 is moved to bring the holes 62 therein which are not covered by this printing plate on one side of the cylinder 10 into alignment with the bushings 58 and 60 which are located in the top of the frame 15. A dowel (not shown) may be used to align one of the bushings 58 or 60, as the case may be, with one of the holes 62 on one side of the cylinder 10, while the corresponding bushing on the other side is being used as a guide for drilling a hole through the printing plate. During this drilling operation the set screws 56 are tightened to secure the shaft 12 and the cylinder 10 carried thereon against movement. In this manner holes may be drilled on both sides of the printing plate through the bushings 58 and 60.

Next, a second printing plate (not shown) is mounted beside the drilled first plate on the other half of the cylinder 10, and this plate is centered with respect to the other viewer 50 and clamped in the same manner as was done for the first plate. It is important to have identical corresponding points on the two plates appear on the cross-hairs of the two viewers 50. Reference holes are then drilled in the second plate, using the bushings 58 and 60 as drilling guides, and using a dowel to locate corresponding drilled holes in the first plate. These two drilled printing plates should now be perfect duplicates, thereby being perfectly preregistered. The other plates of the series may then be drilled successively with one of the previously drilled plates for drilling in the same manner, thus preregistering the whole series of printing plates.

It is evident that the above-described apparatus and method provide for the preregistration of printing plates with a minimum of time, expense, preparation and skill on the part of the operator. Yet, a high standard of accuracy exists, and any plate defects can be readily detected. It is also possible to check the cylinders of rotary printing machines on this apparatus. Plate handling is greatly minimized, and the operating procedure is quite simple, with a pair of operating steps required in the whole procedure, the sources of both human and machine errors are greatly reduced.

Although the invention has been described and illustrated with particular reference to the preregistration of curved printing plates made for use on rotary printing machines, it should be understood that the principles of the invention may also be applied advantageously in the case of flat printing plates. In such case the flat plates may be shifted back and forth laterally and axially in the same horizontal plane between predetermined limits. While the invention is especially useful for a series of color printing plates, other types of printing plates may be preregistered thereby with similar success. Furthermore, while it is preferred to form corresponding reference points in the plates by drilling holes therethrough, it is contemplated that such reference points may be formed by other means of marking or otherwise marking the plates.

It will be obvious to those skilled in the art that various changes may be made without departing from the spirit of the invention, and therefore the invention is not limited to what is shown in the drawings and described in the specification, but only as indicated in the appended claims.

Claims:
1. Apparatus for preregistering a series of printing plates, comprising a cylindrical support for receiving on its periphery a pair of printing plates in side-by-side relation, clamping means for securing the plates to the support while permitting adjustments of their position there-
on, a frame in which said support is mounted for normal movement axially and rotatably, means for stopping the axial and rotary movement of the support at predetermined maximum limits, a pair of optical viewers mounted a fixed distance apart on the frame above the positions where the printing plates are clamped, and a pair of guides located on the frame the same distance apart as the viewers for locating corresponding points of reference on the plates.

2. Apparatus for preregistering a series of printing plates, comprising a supporting cylinder for receiving on its periphery a pair of printing plates in side-by-side relation, clamping means for securing the plates to the cylinder while permitting adjustments of their position thereon, an axial shaft secured to the cylinder, a frame slidably supporting the shaft for normal movement axially and rotatably, stop means for limiting the axial movement of the shaft to limit such movement of the cylinder, means for stopping the rotary movement of the cylinder at predetermined maximum limits, a pair of optical viewers mounted a fixed distance apart on the frame above the positions where the printing plates are clamped, and a pair of guides located on the frame the same distance apart as the viewers for locating corresponding points of reference on the plates.

3. Apparatus for preregistering a series of printing plates, comprising a supporting cylinder for receiving on its periphery a pair of printing plates in side-by-side relation, clamping means for securing the plates to the cylinder while permitting adjustments of their position thereon, a shaft extending axially through said cylinder and secured thereto, a frame having a pair of bearings in which said shaft is journaled for rotation and in which said shaft is axially slidable, stop means for limiting the axial movement of the shaft to limit such movement of the cylinder, means for stopping the rotary movement of the cylinder at predetermined maximum limits, a pair of optical viewers mounted a fixed distance apart on the frame above the positions where the printing plates are clamped, and a pair of guides located on the frame the same distance apart as the viewers for locating corresponding points of reference on the plates.

4. Apparatus for preregistering a series of printing plates, comprising a supporting cylinder for receiving on its periphery a pair of printing plates in side-by-side relation, clamping means for securing the plates to the cylinder while permitting adjustments of their position thereon, a shaft extending axially through said cylinder and secured thereto, a frame having a pair of bearings in which said shaft is journaled for rotation and in which said shaft is axially slidable, a pair of adjustable stops mounted at opposite ends of the shaft for limiting its axial movement to limit such movement of the cylinder, stop means linking the cylinder to the frame for halting the rotary movement of the cylinder at predetermined maximum limits equally spaced in opposite directions from the center points of printing plates being preregistered thereon, a pair of optical viewers mounted a fixed distance apart on the frame above the positions where the printing plates are clamped, and a pair of guides located on the frame the same distance apart as the viewers for locating corresponding points of reference on the plates.

5. Apparatus for preregistering a series of printing plates, comprising a supporting cylinder for receiving on its periphery a pair of printing plates in side-by-side relation, clamping means for securing the plates to the cylinder while permitting adjustments of their position thereon, a shaft extending axially through said cylinder and secured thereto, a frame having a pair of sleeve bearings in which said shaft is journaled for rotation and in which said shaft is axially slidable, a pair of adjustable stops mounted at opposite ends of the shaft for limiting its axial movement to limit such movement of the cylinder, a swingable arm pivotally linking the cylinder to the frame for halting the rotary movement of the cylinder at predetermined maximum limits equally spaced in opposite directions from the center points of printing plates being preregistered thereon, a pair of optical viewers mounted a fixed distance apart on the frame above the positions where the printing plates are clamped, and a pair of guides located on the frame the same distance apart as the viewers for locating corresponding points of reference on the plates.

6. Apparatus for preregistering a series of curved printing plates to prepare them for use on a rotary printing machine, comprising a supporting cylinder for receiving on its periphery a pair of printing plates in side-by-side relation, clamping means for securing the plates to the cylinder while permitting adjustments of their position thereon, a shaft extending axially through said cylinder and secured thereto, a frame having a pair of sleeve bearings in which said shaft is journaled for rotation and in which said shaft is axially slidable, a pair of adjustable stops mounted at opposite ends of the shaft for limiting its axial movement to limit such movement of the cylinder, a swingable arm pivotally linking the cylinder to the frame for halting the rotary movement of the cylinder at predetermined maximum limits equally spaced in opposite directions from the center points of printing plates being preregistered thereon, a pair of optical viewers mounted a fixed distance apart on the frame above the positions where the printing plates are clamped, and a pair of guides located on the frame the same distance apart as the viewers for locating corresponding points of reference on the plates.
of adjustable stops mounted at opposite ends of the shaft for limiting its axial movement to limit such movement of the cylinder, a swingable arm mounted pivotally with respect to the frame for linking the cylinder there-to to limit rotary movement of the cylinder at predetermined maximum limits in opposite directions, said arm having at one end thereof an elongated longitudinal slot in which a pintle secured to the cylinder is free to travel back and forth during alternate rotary movement of the cylinder, the other end of said arm having an aperture in which a block is slideable longitudinally of the arm, a shaft journalled in the block and supported by the frame for pivotally mounting this end of the swingable arm, means for adjusting the position of the block within the aperture for controlling the extent of the rotary motion of the cylinder, means for adjusting the mounting of the last-mentioned shaft on the frame to set the rotational limits of the cylinder at equal distances in opposite directions from the center points of printing plates being preregistered thereon, a pair of optical viewers mounted a fixed distance apart on the top of the frame above the positions where the printing plates are clamped, and a pair of guides located on the top of the frame and mounted the same distance apart as the viewers for locating corresponding points of reference on the plates.

9. Apparatus for preregistering a series of curved printing plates to prepare them for use on a rotary printing machine, comprising a supporting cylinder for receiving on its periphery a pair of printing plates in side-by-side relation, clamping means for securing the plates to the cylinder while permitting adjustments of their position thereon in a first shaft on which said cylinder is secured for rotary movement, a frame having a pair of sleeve bearings in which said shaft is journalled for rotation and in which said shaft is axially slideable, a second shaft extending axially through the center of the first shaft and protruding beyond the sleeve bearings, a pair of adjustable stops mounted at opposite ends of the second shaft for limiting its axial movement to limit such movement of the cylinder alternately in opposite directions thereby halting its rotary movement at predetermined maximum limits, a block journalled on the third shaft and mounted slideably in said aperture for movement longitudinally of the arm, means for regulating the position of the block within the aperture thereby to control the extent of the rotary movement of the cylinder alternately in opposite directions thereby halting its rotary movement at predetermined maximum limits, the other end of said arm having an aperture extending through the center of the arm, and mounted in the slot for slidable movement between the opposite ends of the slot during rotary movement of the cylinder alternately in opposite directions thereby halting its rotary movement at predetermined maximum limits, a block journalled on the third shaft and mounted slideably in said aperture for movement longitudinal of the arm, an adjustment screw for regulating the position of the block within the aperture thereby to control the extent of the rotary movement of the cylinder, means for adjusting the position of the third shaft on the frame to set the rotational limits of the cylinder at equal distances in opposite directions from the center points of printing plates being preregistered thereon, a pair of optical viewers mounted a fixed distance apart on the top of the frame above the positions where the printing plates are clamped, a plurality of guides located on the top of the frame and mounted the same distance apart as the viewers for locating corresponding points of reference on the plates, and means for securing the cylinder against movement while the plates thereon are being marked.

11. A method of preregistering a series of printing plates, comprising the steps of centering one of said plates with respect to one of a plurality of marking guides spaced a fixed distance apart, marking said plate with a set of reference marks spaced apart said fixed distance, centering a second one of said plates with respect to a second one of said guides which is spaced said fixed distance from the first-mentioned guide, marking said second plate with a set of reference marks corresponding to and guided by the marks on the first plate, and successively pairing each of the remaining plates with one of the previously marked plates to locate sets of reference marks at corresponding positions thereon.

12. A method of preregistering a series of printing plates, comprising the steps of placing a first one of said plates upon an adjustable support having a plurality of marking guides spaced a fixed distance apart, centering said plate with respect to one of said guides, marking said plate with a set of reference marks spaced apart said fixed distance, placing a second one of said plates on said support adjacent to the first-mentioned plate, centering said second plate with respect to a second one of said guides which is spaced said fixed distance from the first-mentioned guide, marking said second plate with a set of reference marks corresponding to and guided by the marks on the first plate, and successively pairing each of the remaining plates with one of the previously marked plates to locate sets of reference marks at corresponding positions thereon.

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