United States Patent [19]

Lytle et al.

[11] **3,882,775**

[45] **May 13, 1975**

[54] **REGISTRATION SYSTEM FOR THIN MAGNETIC PRINTING PLATES**

[75] Inventors: **Gerald H. Lytle; F. John Littleton,** both of Effingham, Ill.

[73] Assignee: **World Color Press, Inc.,** Maryland Heights, Mo.

[22] Filed: **July 2, 1973**

[21] Appl. No.: **375,799**

[52] **U.S. Cl. 101/415.1;** 101/382 MV; 101/DIG. 12

[51] **Int. Cl.** **B41f 27/02;** B41f 13/12

[58] **Field of Search** ..... 101/378, 382 MV, 415.1, 101/DIG. 12

[56] **References Cited**

UNITED STATES PATENTS

1,192,578	7/1916	Sonnenberg	101/415.1
2,226,987	12/1940	Wiegand	101/DIG. 12
2,385,599	9/1945	Ball et al.	101/DIG. 12
2,711,031	6/1955	Kessler	101/DIG. 12
2,793,442	5/1957	Ozga	101/DIG. 12
3,670,646	6/1972	Welch	101/382 MV

FOREIGN PATENTS OR APPLICATIONS

2,010,900	9/1971	Germany	101/407
1,150,830	5/1969	United Kingdom	101/DIG. 12

Primary Examiner—Clyde I. Coughenour
Attorney, Agent, or Firm—Wolfe, Hubbard, Leydig, Voit & Osann, Ltd.

[57] **ABSTRACT**

A registration system for registering a thin magnetic printing plate on a magnetic cylinder, the cylinder having a set of registration pins projecting a short distance from the surface of the cylinder at the corner positions of the plate, the leading and trailing edges of the plate being notched to register with the pins. The first notch is dimensioned to engage both axial and peripheral surfaces on the pin which it engages and the second notch is dimensioned to engage only the peripheral surface of the corresponding pin while providing clearance in both axial directions. The third notch is dimensioned to engage only the axial surfaces of the corresponding pin while providing clearance in the peripheral direction. The fourth notch is dimensioned to provide clearance with the corresponding pin in both the axial and peripheral directions so that the plate is registered on the cylinder accurately, with freedom from buckling, notwithstanding any initial error in the spacing of the notches with respect to the pins and notwithstanding slight changes in the axial and peripheral dimensions of the plate. In accordance with one of the aspects of the invention printing plates are spaced in multiple around the periphery of the cylinder, with leading and trailing edges spaced edge to edge, and with the same pins serving to register adjacent plates. Still further in accordance with the invention pins spaced axially along the printing cylinder are employed to accommodate plates of unit length and width or platess of any multiple of unit length and width, with the notches, or openings, corresponding to the redundant ones of the pins being enlarged to provide pin-clearance in all directions.

1 Claim, 11 Drawing Figures

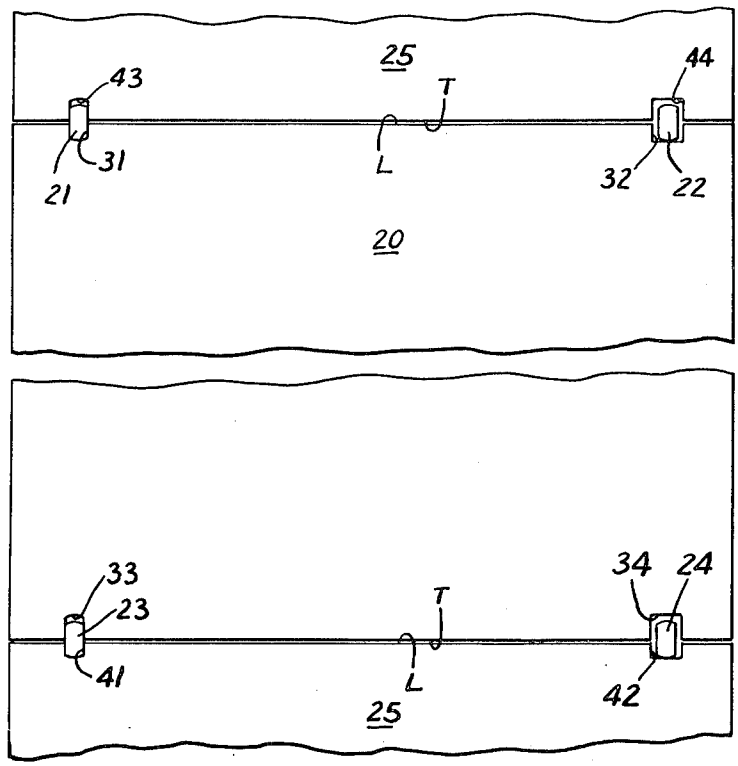


FIG. 1

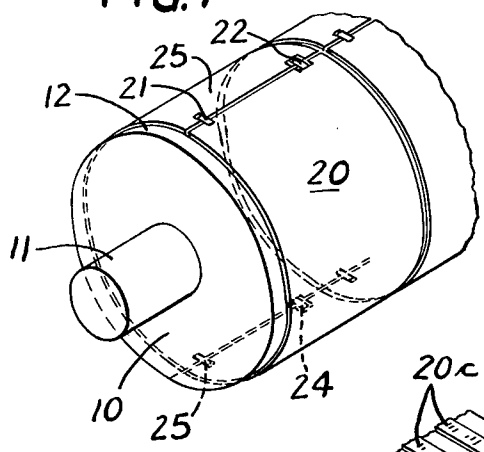


FIG. 2

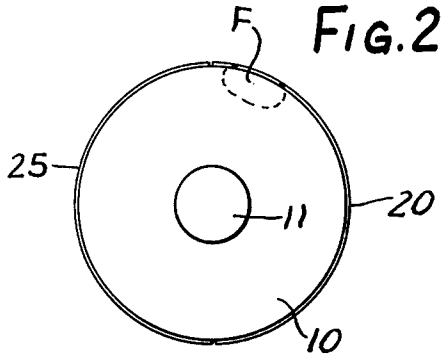


FIG. 3

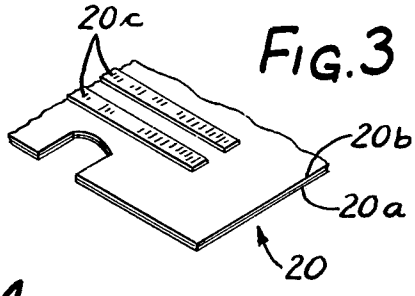


FIG. 4

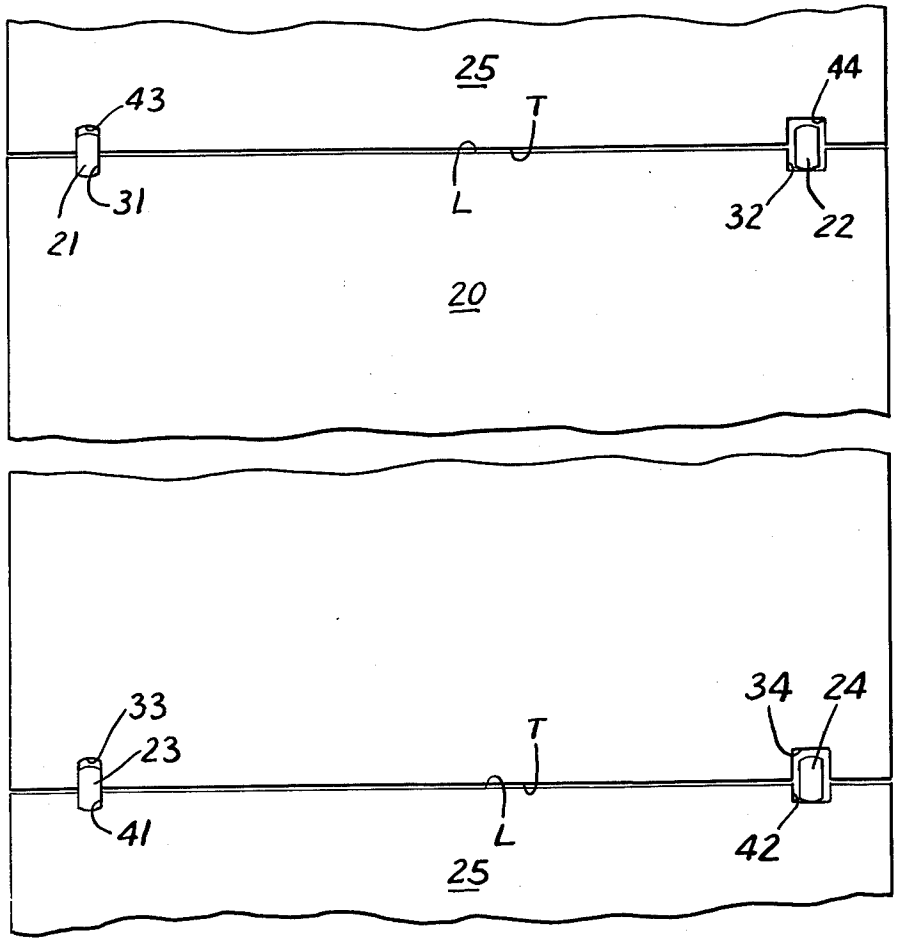


FIG. 5

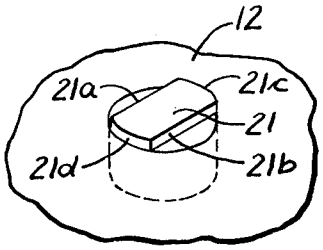


FIG. 7

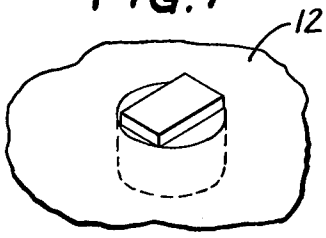


FIG. 6a

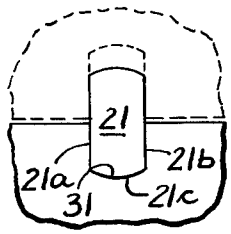
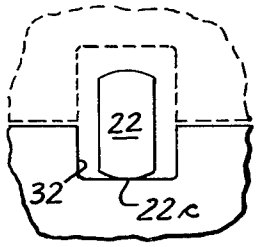


FIG. 6b



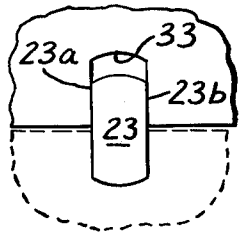


FIG. 6c

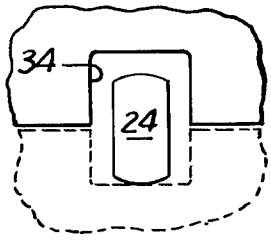
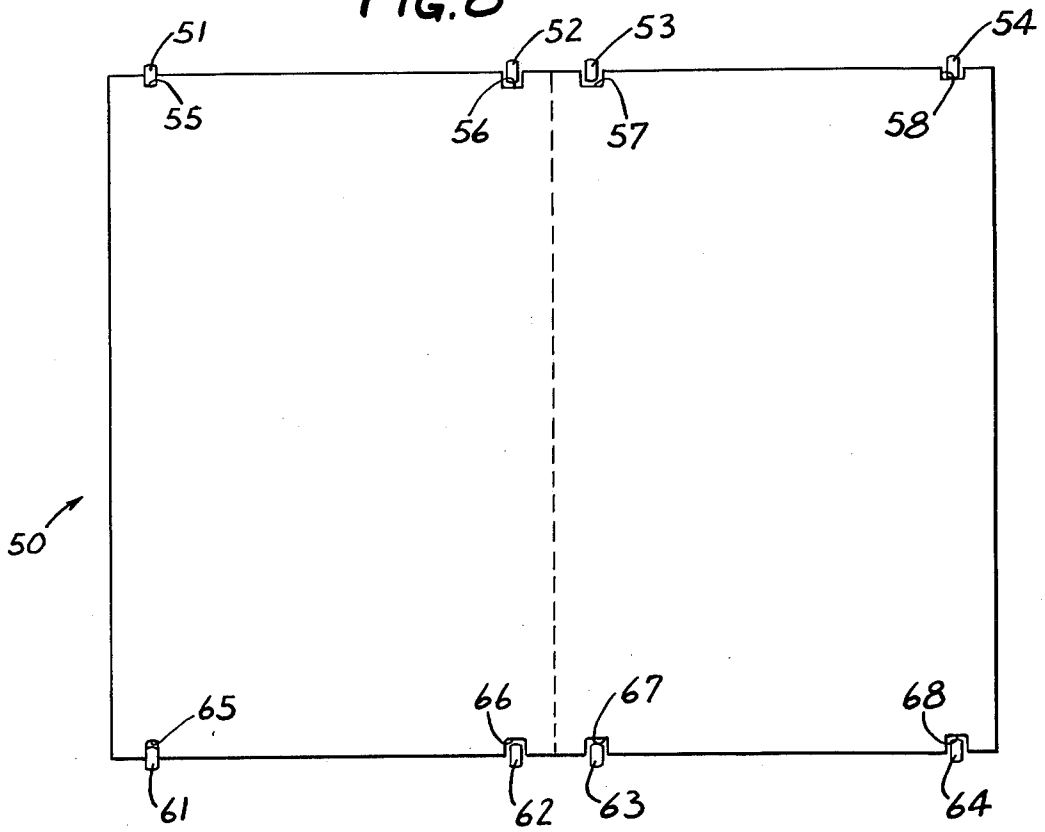


FIG. 6d

FIG. 8



REGISTRATION SYSTEM FOR THIN MAGNETIC PRINTING PLATES

It is known to provide a printing plate having a magnetic backing formed of a thin sheet of soft steel or the like mounted upon a magnetized cylinder and with the backing plate having superimposed layer of nylon with raised type integrally molded thereon. It is also known to provide pins of shallow height which engage openings in the corners of the plate to register the plate on the cylinder, thereby to insure register of the successive printed impressions required in color printing.

While it is possible to punch openings in a plate which have an accurate fit with individual pins, it is difficult to space the openings to conform accurately to the pin center-to-center distance. Where the center-to-center spacing between the openings in the plate is greater than the distance between the pin centers it is impossible for the plate to seat flatly on the cylinder and buckling occurs. On the other hand, where the tolerances are in the opposite direction and the center-to-center distance of the openings is slightly less than the pin spacing, mounting of the plate on the pins is impossible except by filing an enlarged opening which is time consuming and runs the risk of destroying the condition of register.

It is an object of the present invention to provide a registration system for a magnetic printing plate which employs a set of specially shaped notches and which insures easy installation of the plate on the cylinder in a condition of accurate register even though the spacing of the notches does not precisely correspond to the center-to-center spacing of the pins.

It is a further object of the present invention to provide a registration system for registering thin plates in multiple around the periphery of the cylinder and in multiple side by side and which is capable of accommodating oversized plates in even multiples of the unit length or width. It is a more detailed object to provide a registration system for thin magnetic plates in which register pins are shared by adjacent leading and trailing edges and in which the same registering pin performs different registering functions for the two engaged plates.

It is, moreover, an object of the present invention to provide a registration system for a thin magnetic printing plate which is highly accurate and long lived as well as being highly economical.

Other objects and advantages of the invention will become apparent upon reading the attached detailed description and upon reference to the drawings in which:

FIG. **1** is a fragmentary perspective view of a magnetic plate cylinder having printing plates mounted thereon two-around and in multiple in the axial direction.

FIG. **2** is an end view of the plate cylinder of FIG. **1** showing the magnetic field which retains the plate and with the thickness of the plate intentionally exaggerated.

FIG. **3** shows the corner of a typical plate having a notch formed therein, the thickness also exaggerated.

FIG. **4** is a developed view showing a pair of plates arranged peripherally edge to edge with the specially formed notches in register with the pins.

FIG. **5** is an enlarged detail showing one of the pins.

FIGS. **6***a* -**6***d* are fragmentary enlarged views showing the engagement at each of the pins. FIG. **7** shows an alternate pin construction.

FIG. **8** shows a plate having double axial width and the mode of engagement with the pins on the cylinder.

While the invention has been described in connection with certain preferred embodiments, it will be understood that the invention is not to be limited to the particular embodiments shown and that we intend, on the contrary, to cover the various alternative and equivalent construction included within the spirit and scope of the appended claims.

Turning now to the drawings there is shown in FIG. **1** a plate cylinder **10** having a shaft **11** and presenting a smooth magnetized surface **12.** A thin pre-curved magnetic printing plate **20** is mounted upon the surface of the cylinder and located in a registered position by pins **21, 22, 23** and **24.** In the illustrated embodiment plates are mounted "two-around" and the same pins serve, as will be described, to register a second printing plate **25.**

Means are provided in the cylinder for setting up lines of flux F as shown in FIG. **2.** Because of the intimate face-to-face engagement between the presented surface of the cylinder and the undersurface of the plate and the permeability of the magnetic plate, relatively great flux densities may be achieved resulting in secure radial retention even when the cylinder is rotated at high press speeds.

The construction of a typical plate is shown in FIG. **3** where it will be noted that the plate **20** is of composite construction having a magnetic backing sheet **20***a* and a superimposed layer of nylon or the like **20***b* having integrally molded raised type diagrammatically indicated at **20***c*, the sheet **20***a* being of soft steel.

A typical pin construction is shown in FIG. **5** where it will be noted that the pin **21** has a base portion which is anchored in a bore in the surface **12** of the cylinder. The sides of the projecting portion of the pin **21** are flatted so as to produce axially facing flats **21***a*, **21***b*. The pin **21** also has peripherally facing surfaces **21***c*, **21***d* respectively.

In accordance with the present invention notches are formed in the edges of the plate for registering with the pins, each of the notches being differently shaped, or dimensioned, to perform a different registering function. More specifically in accordance with the invention the notch which registers with the pin **21** is dimensioned to intimately engage both the axially facing surfaces of the pin and also a peripherally facing surface. The notch which registers with the pin **22** engages a peripherally facing surface thereon, but is widened to provide clearance with respect to both of the axially facing surfaces. The notch which engages the pin **23** closely embraces the axially facing surfaces but is deepened as to provide clearance in the peripheral direction, while the notch which engages pin **24** provides clearance in all directions.

As shown in the drawings and particularly in FIGS. **4** and FIGS. **6***a* -**6***d*, the notches which register with the pins **21-24** are indicated at **31-34** respectively. In the case of the notch **31,** the notch is dimensioned to closely fit, and bear against, both the axial surfaces **21***a*, **21***b* and the peripheral surface **21***c*. This provides positive plate location in both directions, and pin **21** may be referred to as the "key" or "reference" pin. The notch **32** of the plate has the same depth as the notch **31** so that the notch bears against the peripheral sur-

face 22*c* of the pin, but the notch is made extra wide in both the axial directions.

Turning to the notch **33**, it has a width which is the same as the notch **31** so as to closely embrace the surfaces 23*a*, 23*b* of the pin **23**, but the notch **33** is made extra deep so as to provide peripheral clearance. Finally, the notch **34** is both extra deep and extra wide so as to provide complete clearance with respect to the registering pin **24** in all directions.

It will be apparent, then, that the notch **32**, by reason of the abutting engagement at 22*c* controls the peripheral position of the right-hand end of the plate but, because of the axial clearance, the location of the notch is uncritical to eliminate any possibility of buckling and the plate is incidentally free to expand or contract in the axial direction. As shown at FIG. 6*c*, the sides 23*a*, 23*b* of pin **23** are closely embraced by the notch **33** for close control of axial positioning, but the clearance depth of the notch **33** makes the peripheral spacing between notches **31, 33** non-critical, so that there is no possibility of buckling and with incidental freedom to accommodate any "roll-out" of the plate on the cylinder. Finally, turning to the clearance notch **34** surrounding pin **24**, clearance is provided in all directions so that pin **24** is non-functional as far as plate **20** is concerned but does provide a registering function for the adjacent edge of plate **25**.

The system, although providing a wide range of tolerance in the spacing of the notches is, nevertheless, highly accurate in defining the registered position of the plate, pins **21, 22** cooperating to positively determine the condition of peripheral register while pins **21,** 23 cooperate to establish axial register. The pins moreover insure that the plate is positioned "straight" on the cylinder without any inadvertent skew because of the blocking of the plate against rotation in both the clockwise and counterclockwise directions.

In accorcance with one of the aspects of the present invention the same pins which serve to register the plate **20** are utilized for registration of the adjacent plate, for example, the plate **25** illustrated in FIGS. **1** and **4** but with the pins, in the case of the adjacent plate, providing distinctively different registering functions. Thus, referring to FIG. **4**, the pin **23**, which provides only axial register for the plate **20** is received in notch **41** and fitted to provide both axial and peripheral register for plate **25**. Pin **24**, which has complete clearance with respect to plate **20**, is bottomed in a wide notch **42** to perform a peripheral registering function for plate **25**. Pin **21**, the "key" registering pin for plate **20**, engages a deepened notch **43** on plate **25** so that its function is restricted to providing axial registration. Finally, pin **22** is surrounded by a clearance notch **44** to provide clearance in all directions. It will be apparent to one skilled in the art that the pins may be utilized with such dual functions, using only two pins between adjacent edges, regardless of the number of printing plates "around" the cylinder.

Moreover, while the discussion has had to do with plates of "unit" width, the same pins may be used for registering plates of double, or multiple, unit width, utilizing the pins in the corner positions of the oversized plate for registering purposes while providing clearance notches about the intervening redundant pins. Thus, referring to FIG. **8** there is shown a plate **50** of double width, having pins **51-54** engaged by registering notches **55-58** at the "leading" edge and cooperating with pins **61-64** received in registering notches **65-68** at the "trailing" edge. Notch **55** is the "key" notch, closely fitted to pin **51**, to provide both axial and peripheral register. Notch **58** is shaped to bottom against pin **54** but with axial clearance being provided on both sides of the pin. The remaining notches **56, 57** are enlarged in both directions for clearance purposes.

Turning to the "trailing" edge of the plate, notch **65** is formed to closely embrace pin **61** in the axial direction while providing peripheral clearance. All three of the remaining notches along this edge, indicated at **66-68**, are enlarged in both directions for clearance of pins **62-64**.

Thus while plate **50** is of double unit width it utilizes the same pins for registration purposes as plates of single unit width, and may be substituted therefor with clearance being provided around the redundant pins. Since it is seldom necessary to use plates of greater than double unit width, the pins in the adjacent portion of the cylinder may be peripherally offset or "staggered" with respect to the pins illustrated in FIG. **8**.

Analogously to use of plates which are of multiple width in the axial direction, the present invention contemplates to equal degree, the use of plates of multiple unit length, in which case clearance openings may be provided in the body of the plate for the purpose of accommodating the redundant pins.

While it is preferred, in the case of plates of multiple unit width, to perform the registering function at the pins in corner position, it will be understood that this is not necessary in the practice of the invention and that any two spaced notches at the "leading" edge may perform the functions described above for the notches **55, 58**. Moreover, it is possible to use any of the notches **66-68** to perform the axial registration function of notch **65**.

The particular pin construction illustrated in FIG. **5** has been found to be particularly suited to the invention since it is accurate, highly reliable and economical. The pin projects above the surface of the cylinder to only a shallow height, a height which is less than the thickness of the plate and which preferably exceeds the thickness of the backing member by only a small amount. Thus the pin, in use, is safely recessed and cannot interfere with the printing process. The pins are "flatted" prior to being inserted into a registering bore formed in the surface of the cylinder to insure that the flatting extends all of the way to the surface and preferably a little below it. The pins may be made slightly oversized and cooled by subjecting to dry ice or the like to bring about sufficient shrinkage for easy insertion, with return to normal temperature serving to lock the pin securely in place. As a precaution, and to permit later servicing, each pin may be provided with a central threaded bore for screwing in of a jack screw.

In a practical case the thickness of the magnetic backing may be 0.012 inch and the thickness of the nylon layer may be 0.016 inch. In addition, a thin layer of packing may be employed under the plate having a thickness of, say, 0.010 inch, resulting in a total plate thickness of 0.038 inch. The pin projection to accommodate such a plate is less than this, on the order of 0.025 inch.

If desired, the pins may be doubly flatted as illustrated in FIG. **7** which increases the bearing area at the root of the notch in performing the function of peripheral register.

It might be thought that using a backing of soft steel, with such a small cross section of metal in contact, that difficulty would be experienced with deformation and peening at the edge of the notch, particularly where there is limited "line" engagement at surfaces **21***c*, **21***d*, at the "ends" of the pin. It is found, on the contrary, that the condition of register which is established when the plates are manually installed, by bringing the registering surfaces into engagement, is thereafter positively maintained by the magnetic holding forces, especially in view of the large area which is in intimate contact and the relatively high coefficient of friction between the plate and the surface of the cylinder. In short, once a plate has been installed by being placed in registering contact with the cooperating pins, the pins have completely served their purpose. They are not called upon to resist peripheral or axial forces during the printing operation and are, for practical purposes, nonfunctional during a printing run except, perhaps, during the first few revolutions of the printing cylinder during which "roll-out" of the plate occurs, accompanied by a minute change in the peripheral length of the plate. Extended practical usage has shown no evidence of peening or other notch distortion, using commercially available magnetic cylinders.

While reference has been made above to "leading" and "trailing" edges, this has been done for convenience only and it will be understood that the present registration system is not limited to any particular direction of rotation and that the plate cylinder **10** may be rotated in either direction with equal advantage. Thus the terms "leading" and "trailing" may be considered as interchangeable terms.

The term "notch" has been used throughout and is an important element in the construction particularly where plates are mounted closely edge to edge and where each pin thus provides a dual registering function. However, it will be understood that where only a single plate is to be registered on a set of pins, and the duality is not required, the notches may be "enclosed" without departing from the invention. Moreover, where a single plate is being registered the redundant pin **24** and its notch **34** may, if desired, be omitted.

It will be apparent to one skilled in the art that the invention adequately fulfills the objects set forth above, achieving a high degree of precision of registration without requiring corresponding precision in the center-to-center spacing of the notches and pins. Thus easy "fit" is assured without any necessity for filing or adjusting the notches and with complete freedom from buckling.

What is claimed is:

1. A registration system for accommodating printing plates in multiple around a plate cylinder comprising, in combination, a magnetic cylinder, a plurality of thin plates each having a magnetic backing and superimposed printing surface, each of the plates being of rectangular shape presenting straight axially facing ends and straight peripherally facing leading and trailing edges, the plates being dimensioned so that the leading and trailing edges of adjacent plates are spaced slightly edge to edge on the cylinder to define plate junctions, first and second pins at each junction, the pins being spaced to lie in the corner positions of the adjacent plates, each of the pins being of shallow height presenting flat axially facing surfaces as well as peripherally facing surfaces, the leading and trailing edges of each plate being notched to registeringly accommodate the pins, one of the notches in the leading edge of each plate being dimensioned to engage the two axial surfaces and a peripheral surface on its associated pin and the remaining notch in such edge being dimensioned to engage only a peripheral surface on its associated pin, one of the notches in the trailing edge of each plate being dimensioned to engage only the two axial surfaces of its associated pin while the remaining notch in such edge provides clearance in all directions about its associated pin, the pins all being peripherally elongated and centered on the junctions to extend therefrom equally in both peripheral directions into the edges of the adjacent plates so that each pin while registered in notches of two adjacent plates performs differing functions on behalf of such plates, thereby to achieve register of the plates with freedom from buckling notwithstanding initial error in the spacing of the notches with respect to the pins and notwithstanding slight changes in the axial and peripheral dimensions of the plates occurring incident to a printing run.

* * * * *