July 1, 1958 J. S. KIRKPATRICK 2,841,082

METHOD OF CURVING MAGNESIUM PRINTING PLATES

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FIG.1.

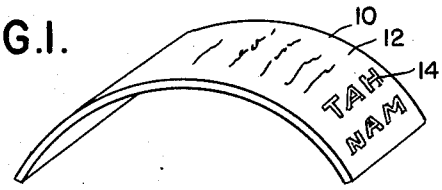


FIG.2.

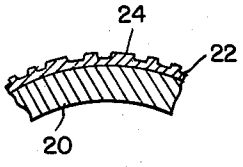
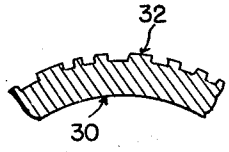


FIG.3.



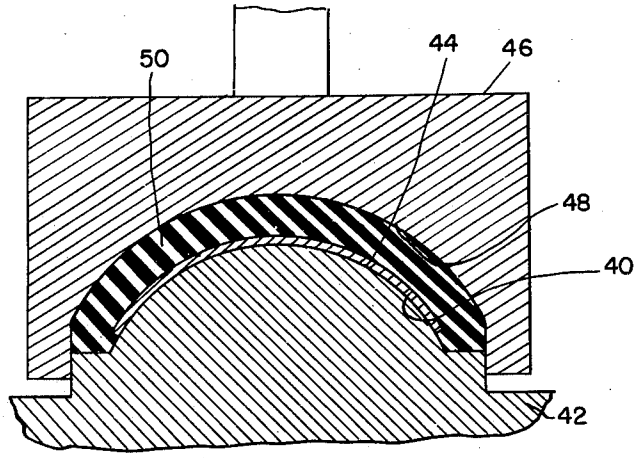


FIG.4.

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METHOD OF CURVING MAGNESIUM PRINTING PLATES

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1 Claim. (Cl. 101—401.1)

The present invention relates to printing plates and methods of producing the same.

It is an object of the present invention to produce printing plates by a novel method in which flat plates are curved to partial cylindrical formation by forming them over a convex cylindrical block by the application of essentially yielding or hydraulic pressure to the opposite side thereof.

It is a further object of the present invention to curve flat printing plates provided with a printing surface at one side thereof by forming them over a convex cylindrically curved block by the application of a yielding or essentially hydraulic pressure to the side of the plate provided with the printing surface.

It is a further object of the present invention to provide printing plates which include a plate formed essentially of magnesium which is heated and formed into cylindrical configuration by the application of a yielding pressure to the convex side of the plate.

It is a further object of the present invention to provide a method of making printing plates which comprises bending plates formed essentially of magnesium into accurate, truly formed cylindrical shape, and thereafter applying a flexible sheet provided with a printing surface to the convex side thereof.

More specifically, it is an object of the present invention to provide a method for bending plates formed essentially of magnesium into a true cylindrical configuration by heating the plates to a temperature of not less than 450 degrees Fahrenheit, and thereafter forming the plates over a rigid convex cylindrical form by the application of a yielding pressure of not less than 1000 pounds per square inch thereto.

Other objects and features of the invention will become apparent as the description proceeds, especially when taken in conjunction with the accompanying drawings, wherein:

Figure 1 is a perspective view of a printing plate as disclosed herein.

Figure 2 is a fragmentary transverse sectional view through a portion of the printing plate showing one modification thereof.

Figure 3 is a vew similar to Figure 2 showing a second embodiment of the invention.

Figure 4 is a simplified diagrammatic sectional view through a press illustrating the manner of forming the plates.

Magnesium plates offer many advantages over plates previously used in the printing industry. From one aspect of the present invention, one of the important advantages of magnesium plates is their extreme lightness as compared to materials previously employed. One of the problems encountered in present day presses is the relatively large centrifugal force set up by high speed press rotation. Obviously, the use of magnesium for curved printing plates on rotary presses will substantially reduce the centrifugal forces developed and will accordingly permit faster press operation.

The foregoing consideration lies whether the final printing plate as used at present is formed substantially completely of magnesium or whether it comprises a magnesium backing having a printing surface applied thereto, such for example as by the adhesion of an electrotype sheet to the convex surface of the curved magnesium plate.

From another point of view, magnesium offers important advantages in the production of printing plates due to the properties of magnesium which make it peculiarly well adapted for engraving of various types. Furthermore, by employing magnesium as the printing plate, it is possible to provide the magnesium plate with a printing surface while the plate is in flat condition, and thereafter bending the plate to a true cylindrical configuration from end to end and from side to side by a method which does not injure the previously produced printing surface.

Referring now to Figure 1 there is illustrated at **10** a curved printing plate composed primarily of magnesium and having an outer convex cylindrical surface **12** which is a printing surface and which bears printing elements indicated at **14**.

Referring now to Figure 2 there is illustrated a portion of a printing plate which may be of the type illustrated in Figure 1. In this case the printing plate comprises a curved backing plate **20** which is composed essentially of magnesium and which is formed to a true cylindrical configuration from end to end and from side to side. Applied to the outer convex surface of the magnesium backing plate is a flexible sheet **22** having a printing surface provided with raised printing elements **24**. The sheet **22** may be an electrotye adhered to the outer convex surface of the magnesium plate **20**.

In Figure 3 there is illustrated a second embodiment of the present invention in which the printing plate is illustrated at **30** and comprises a plate formed essentially of magnesium having an outer convex printing surface **32** in which the high and low points of the printing surface are formed directly on the surface of the magnesium plate. Alternatively, a plate of this type may be produced by initially coating, as by deposition, the surface of the magnesium plate which is to be etched or otherwise formed into a printing surface.

In any case, the production of the true cylindrical curvature of the plate is preferably produced by heating the plate to a temperature of not less than 450 degrees Fahrenheit, and thereafter forming the plate over a cylindrical convex form by the application of pressure. In some cases it may be desirable to form the cylindrical curvature in the printing plate by employing matched male and female cylindrically curved elements, both of which are formed of rigid material. However, in many cases it is preferable to employ a press member having a yieldable material at its work engaging surface and to apply pressure to one surface of the plate through the yieldable material. As best illustrated in Figure 4, a printing plate is illustrated at **40** in a press comprising a form **42** having a cylindrical portion **44**. The press includes a plunger **46** having a recess **48** therein provided with a relatively thick lining of a yieldable material **50** which in the present instance may be rubber. The recess **48** in the plunger **46** is shaped so that as the plunger descends the rubber is effectively trapped so that relatively great pressure may be applied through the rubber to the upper convex surface of the plate **40**. As is well understood, a yieldable material such as rubber when confined as disclosed in Figure 4, operates essentially as a liquid and applies pressure to the upper surface of the plate **40** which is essentially hydraulic in character.

Preferably, the rubber member **50** is so shaped that, after the plate is bent to the configuration illustrated in

Figure 4, pressure is built up in such a way that it is caused to extend progressively outward from the center of the plate **40** toward the ends of the plate.

It is found that a magnesium plate when subjected to pressures of not less than 1000 pounds per square inch and at a temperature of not less than 450 degrees Fahrenheit in the manner disclosed in Figure 4, is formed to a true cylindrical surface from end to end and from side to side, and further, that the plate thus formed retains its exact shape upon removal from the press and cooling.

In a specific case, excellent results have been obtained when the magnesium plate was formed while at a temperature of about 650 degrees Fahrenheit and where pressures of approximately 1300 pounds per square inch were applied.

The method illustrated in Figure 4 is useful in the production of curved backing plates of the type illustrated in Figure 2, but it is particularly useful in the production of curved printing plates formed entirely of magnesium of the type illustrated in Figure 3. In this case where the printing elements are formed in the printing surface of the plate while the plate is in flat condition, the forming of the plate to cylindrical configuration by the application of an essentially hydraulic pressure to the printing surface thereof, does not have any deleterious effect upon the printing surface. As a matter of fact, it is found that the present method of forming printing plates having a previously prepared printing surface has a definite advantage. Experience has indicated that high-light dot areas print better following the curving operation than in the flat condition. This apparently is due to the fact that the smaller high-light dots are depressed more than the larger dots, which is desirable.

While excellent results have been obtained in producing the printing surface on a plate formed essentially of magnesium, in some cases it has been found desirable to deposit copper to a thickness of between .002 and .008 inch by a plating operation on the surface of the magnesium plate which is to be the printing surface.

Prior to the present invention printing plates have been curved by passing them between a set of three rollers so set as to impart the desired cylindrical curvature to the flat plate. This type of plate curving is objectionable from several points of view. In the first place it is impossible to impart curvature to the entering and leaving ends of the plate since it is necessary for the plate to engage three rollers simultaneously to have curvature imparted thereto. Secondly, it is found that plates curved in this manner are not true cylindrical surfaces even throughout their intermediate portions but that instead they are made up of a multiplicity of cords, flat areas, or creases of varying dimensions of curvature. On the contrary, when curved plates are produced by the forming of the plate as disclosed herein, a true cylindrical curvature from end to end and from side to side is produced. Moreover, as applied to the production of curved magnesium plates, the present invention is particularly useful in that it takes full advantage of the inherent properties of magnesium. Thus, magnesium has a relatively high degree of compressibility so that when it is transformed from a flat plate to a cylindrically curved plate compression occurs at the inner concave surface of the plate and accordingly longitudinal stretching at the outer convex surface is minimized in comparison with results obtained with other metals.

Further, the use of magnesium in the present method is particularly useful since it is found that magnesium plates bent under the temperature and pressure conditions as set forth herein have no appreciable tendency to spring or straighten upon release from the press, but instead retain with great accuracy the exact curvature imparted thereto in the press. It is desired to emphasize the fact that the present method of bending printing plates, while particularly useful in the production of magnesium printing plates or magnesium backing plates to be used in composite printing plates, is not limited thereto. It has been found that printing plates of materials other than magnesium gives substanttially improved results when bent by the present method as compared with prior methods. In a specific case it has been found that a printing plate formed essentially of lead and bent by the present method outwore an identical plate bent by the conventional method by a factor of approximately five to one.

Where reference is made herein to magnesium plates or plates composed essentially of magnesium, it is intended to refer to plates including an extremely high percentage of magnesium, as for example, 95% as a minimum. It is not meant to exclude plates which may contain a relatively minor percentage of other materials such for example as zinc. In other words, the detailed composition of the magnesium plates is not important except that the plates shall contain a major proportion of magnesium and at least sufficient magnesium to impart the inherent properties of magnesium to the plate.

The drawings and the foregoing specification constitute a description of the improved printing plates in such full, clear, concise and exact terms as to enable any person skilled in the art to practice the invention, the scope of which is indicated by the appended claim.

What I claim as my invention is:

The method of producing cylindrically curved printing plates composed essentially of hard, dense, homogeneous magnesium which comprises providing a flat magnesium plate with a printing surface at one side thereof, heating the plate to a temperature of at least 450 degrees Fahrenheit, placing the plate against a rigid convex cylindrical forming member with the central portion of the other side of the plate engaging along an intermediate portion of the surface of the member, applying pressure initially to the end portions of the plate to bend the plate generally into conformation with the member, thereafter trapping a yieldable material in contact with the convex printing surface of the plate, applying pressure through the yieldable material of increasing magnitude and progressively outwardly from the central portion of the plate toward the ends thereof, and increasing the pressure applied through the yieldable material to a pressure of a minimum of 1000 pounds per square inch throughout the printing surface of the plate to cause the plate to conform to the rigid convex cylindrical forming member and to retain its shape without springback following release of the pressure.

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