Oct. 17, 1967 G. S. BRAZNELL ETAL 3,347,162

PRINTING PLATES

Filed Dec. 21, 1964

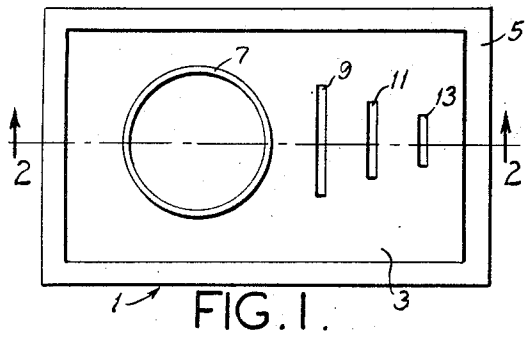

FIG. 1.

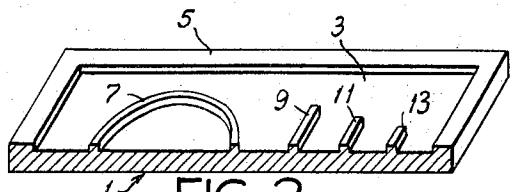

FIG. 2.

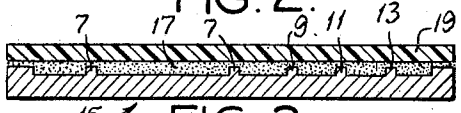

FIG. 3.

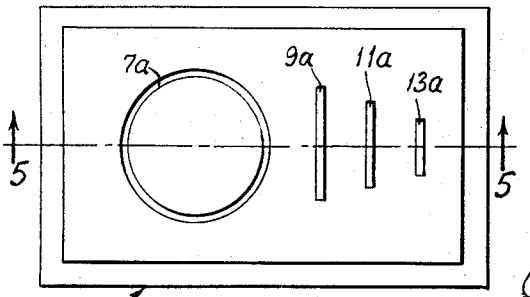

FIG. 4.

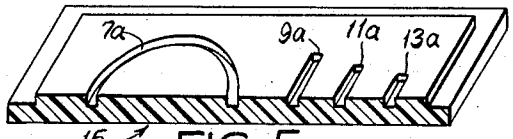

FIG. 5.

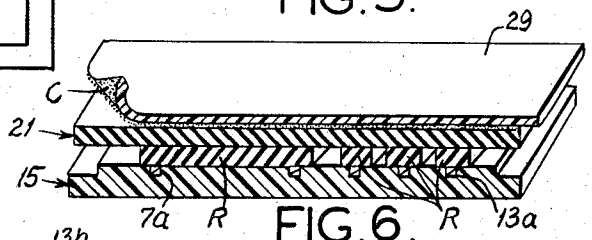

FIG. 6.

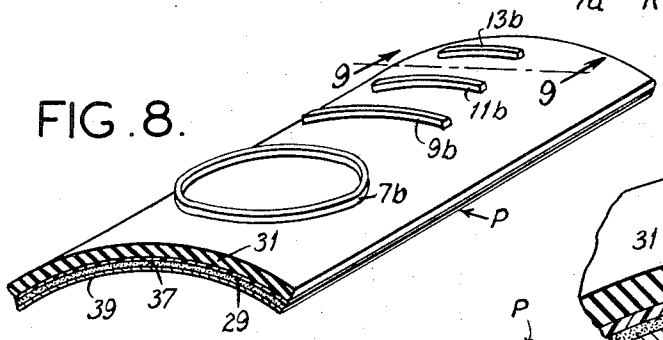

FIG. 8.

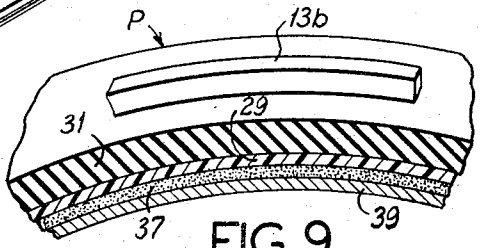

FIG. 9.

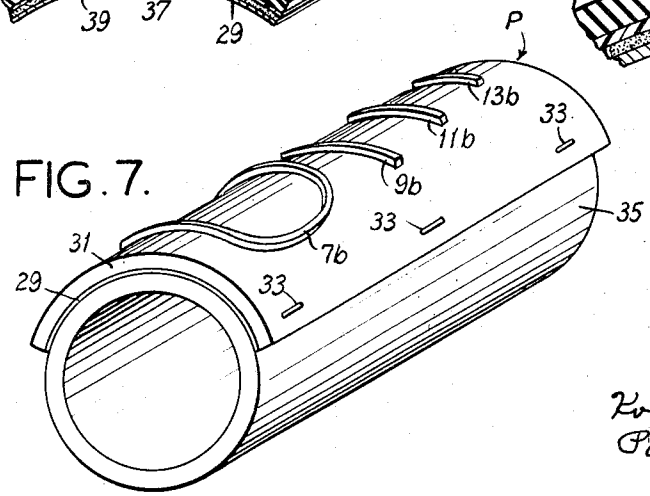

FIG. 7.

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PRINTING PLATES

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8 Claims. (Cl. 101—376)

This invention relates to printing plates, more particularly to a flexible preshaped rubber printing plate and a method of making the same.

The invention is particularly concerned with flexible rubber printing plates (i.e., rubber plates having on one face thereof a pattern in relief of the matter which is to be printed by means of the plate) such as are mounted on a cylinder of a printing press. Heretofore, such plates have been conventionally made flat, and hence they do not conform to the curvature of the surface of the printing press cylinder to which they are applied. They tend to spring back to their normal flat condition, and this causes considerable problems in printing operations. There have been previous attempts to form rubber printing plates with a built-in curvature, but these have contemplated such concepts as use of layers of different materials and shrink characteristics, and have involved various complications.

Accordingly, among the several objects of this invention may be noted the provision of a method of making a flexible rubber printing plate which is preshaped to facilitate mounting on a printing press cylinder; the provision of a method of making a rubber printing plate having built-in curvature using conventional printing plate materials; the provision of a method of making such a plate which is dimensionally stable; the provision of a method of making such a plate in which a rubber layer and a flexible dimensionally stable backing therefor are shaped in a single, simple, economical operation; and the provision of a printing plate so made which is both flexible and preshaped to a curved configuration. Other objects and features will be in part apparent and in part pointed out hereinafter.

The invention accordingly comprises the constructions and methods hereinafter described, the scope of the invention being indicated in the following claims.

In the accompanying drawings in which one of various possible embodiments of the invention is illustrated,

FIG. 1 is a plan of a so-called master metal engraving;

FIG. 2 is a perspective in half section on line 2—2 of FIG. 1;

FIG. 3 is a section showing how a so-called matrix is made using the master engraving;

FIG. 4 is a plan of the matrix;

FIG. 5 is a perspective in half section on line 5—5 of FIG. 4;

FIG. 6 is a view like FIG. 5 showing the formation of rubber printing plate in accordance with this invention, using the matrix of FIGS. 4 and 5;

FIG. 7 is a perspective showing the molded printing plate on a shaping mandrel;

FIG. 8 is a perspective showing the printing plate removed from the mandrel, and having "sticky-back" applied thereto on its concave back face; and

FIG. 9 is a fragmentary perspective in section of the FIG. 8 plate with the "sticky-back" on its back face.

Referring first to FIGS. 1 and 2 of the drawings, there is indicated at 1 what is referred to as a master engraving. As shown, this consists of a rectangular metal plate, for example, which has one face routed out as indicated at 3 to provide a desired printing pattern in relief, and a peripheral retaining wall 5 all around the plate For purposes of simplified illustration, the printing pattern is shown as comprising a ring 7 and three bars 9, 11, 13 The master engraving is made in well-known conventional manner. It is used to make a matrix 15. It will be understood that the master engraving 1 may consist of a hard rubber plate instead of a metal plate.

As shown in FIG. 3, the matrix 15 is made using master engraving 1 in conventional manner by packing a thermosetting resin powder as indicated at 17 into the routed cavity 3 in the master engraving, and covering the faces of peripheral wall 5 and printing pattern 7, 9, 11, 13 with this powder to a predetermined depth. The powder may be a phenol-formaldehyde resin powder such as sold under the trade designation "Bakelite" conventionally used for making such matrices. A plate 19 of thermosetting resin is applied over the powder. This plate may be a plate of phenol-formaldehyde resin such as sold under the trade designation "Bakelite" conventionally used for making such matrices. It will be understood that a parting compound will usually be applied to the master engraving to enable the matrix to be stripped from the engraving. Heat and pressure are applied to set and cure the resin powder and bond it to plate 19, thereby to form matrix 15 having impressions in reverse of relief of the printing pattern 7, 9, 11, 13. The impressions or cavities in the matrix 15 are respectively designated 7*a*, 9*a*, 11*a* and 13*a*. FIGS. 4 and 5 show the matrix 15 stripped from the master engraving 1. It will be understood that matrix 15 may be made using a Bakelite plate instead of powder.

As shown in FIG. 6, strips of unvulcanized rubber R are placed over the cavities 7*a*, 9*a*, 11*a* and 13*a* in the matrix 15. A rubber sheet 21 is applied over these strips. This sheet 21 is a plain rubber sheet, without any fabric or other reinforcement therein. A suitable parting material is applied to the matrix prior to the application of rubber R and sheet 21. The rubber used at R and in sheet 21 may have a durometer in the range from 20–80, for example.

At 29 in FIG. 6 is indicated a backing sheet of dimensionally stable plastic material, use of a sheet of polyethylene terephthalate such as that sold by E. I. du Pont de Nemours & Co. under the trade name Mylar being presently preferred. This is a nonwoven material. It is preliminarily prepared with a coating C on one face of a thermoplastic adhesive. This adhesive may be, for example, one having a solids content of pigment-reinforced synthetic rubber and synthetic resin with methyl ethyl ketone as a solvent, such as that sold under the trade name Pliobond 20 by the Chemical Division of The Goodyear Tire & Rubber Company of Akron, Ohio. This particular adhesive contains 20% solids and 80% methyl ethyl ketone. The adhesive is coated on the Mylar sheet (it may be simply brushed on) and allowed to dry.

The adhesive-coated Mylar sheet 29 is placed over the rubber sheet 21 with the adhesive-coated side of the Mylar sheet contacting the rubber sheet. Then, the assembly of the matrix 15, rubber R, rubber sheet 21 and the

adhesive-coated Mylar sheet is placed in a vulcanizing press, and heat and pressure applied. This simultaneously causes filling of the cavities *7a*, *9a*, *11a* and *13a* in the matrix **15** with rubber from strips R, bonding of the rubber in the cavities with rubber sheet **21**, bonding of sheet **21** to backing sheet **29**, and vulcanization of the rubber, and results in the formation of the composite plate shown in FIGS. 7–9 and designated in its entirety by reference character P. As appears in FIGS. 7–9, composite plate P comprises rubber layer **31** backed by Mylar layer **29**, with a printing pattern in relief on the face of the rubber layer comprising ring *7b* and bars *9b*, *11b* and *13b*. The rubber layer **31** is strongly bonded to the dimensionally stable Mylar backing layer **29** and is practically impossible to peel off.

Immediately upon taking the matrix **15** and plate P out of the press, and while the plate P is still hot, it is stripped from matrix **15** and immediately attached by fasteners **33** (such as staples) to a forming mandrel **35**, as shown in FIG. 7. These fasteners hold the plate under restraint. Mandrel **35**, as shown, is cylindrical in shape since plate P is ultimately to be used on a cylinder of a printing press. The plate is attached to the mandrel with the edges thereof which will extend axially across the printing press cylinder extending axially across the mandrel. The printing surface of plate P faces away from the mandrel and is generally convex in shape while attached to the mandrel. Any suitable cylindrical object may be used as the mandrel. We have found it convenient to use fiber tubes such as are used as forms for pouring cylindric concrete columns.

In a typical operation as above described, the plate P when taken from the press, stripped from the matrix and applied to the mandrel is at a temperature of about 305° F. to 313° F. (the vulcanization temperature of the rubber). The plate, while held in curved condition on the surface of the mandrel, is allowed to cool to room temperature, or it may be positively cooled by putting it in a refrigerator or spraying cold water on it while on the mandrel.

After the plate has cooled, the staples **33** are removed and the plate is taken off the mandrel. As a result of cooling in curved condition on the mandrel, the plate acquires a definite arcuate shape as shown in FIGS. 8 and 9. The radius of curvature of the finished plate is somewhat larger than the radius of curvature of the surface of the mandrel due to a tendency of the plate to recover its original flat shape to some extent. This is taken into account in selecting the mandrel to be used. For example, when the radius of curvature of the finished plate P is to be about seven and one-half inches (to conform to a printing press cylinder having about a fifteen inch diameter), then a mandrel having a radius of curvature of about three and one-half inches is used. While plate P springs back to some extent after removal from the mandrel, it still retains an arcuate shape so that it conforms to the shape of a printing press cylinder when mounted on it, and has no tendency to spring back to a flat condition as in the case of prior flat rubber printing plates when mounted on a cylinder. The reason for the retention of curvature is not fully understood, but we have observed that allowing the plate to cool while in curved condition on the mandrel definitely imparts a built-in curvature to the plate.

The finished curved plate P is adapted to be mounted on a cylinder as by means of sticky-back **37** (see FIGS. 8 and 9) applied to the Mylar backing **29**. "Sticky-back" is a sheet of pressure-sensitive adhesive material which is adhesive on both faces covered with a protective sheet **39**. The latter is peeled off for adhering the plate to the cylinder. It will also be understood that a number of plates P may be adhered by the sticky-back to a Mylar carrier sheet, the latter being wrapped taut around a printing press cylinder. In either case, the plate P, having a built-in curvature corresponding generally to the curvature of the printing press cylinder, has no tendency to spring away from the cylinder and remains firmly affixed by the sticky-back in its proper position on the cylinder. It will be understood that a number of plates P may be adhered by a suitable adhesive to a Mylar carrier sheet instead of by sticky-back, and it is also within the purview of the invention initially to mold a number of rubber plates directly to a Mylar carrier sheet in a vulcanizing press, the carrier sheet in the latter case constituting the dimensionally stable backing layer for all the plates molded thereon and bonded thereto. In the latter case, the carrier sheet with the rubber plates bonded thereto would be curved around a forming mandrel to give it a built-in curvature adapted to that of the printing press cylinder on which it is to be used.

It will be understood that the principles of the invention as above described are applicable to producing curved made-ready printing plates which are formed to provide for pressure differentiation between various printing areas on the plate requiring different printing pressures in a manner similar to that disclosed in Braznell et al. U.S. Patent 3,103,168.

In view of the above, it will be seen that the several objects of the invention are achieved and other advantageous results attained.

As various changes could be made in the above constructions and methods without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

What is claimed is:

1. The method of making a flexible rubber printing plate with a built-in curvature and having on the printing face thereof a printing pattern in relief, comprising applying unvulcanized rubber over a matrix having an impression of said pattern in reverse of relief, applying over said rubber a sheet of relatively thin flexible dimensionally stable backing material having a coating of thermoplastic adhesive on its face contacting the rubber, applying heat and pressure to simultaneously cause the rubber to fill the impression in the matrix, to vulcanize the rubber, and to effect permanent bonding of the rubber to the backing sheet, stripping the resulting backed rubber printing plate from the matrix and, immediately upon being stripped and while it is still hot from the said heating and pressure-applying step, forming it to a curved configuration, and effecting cooling of the plate while holding it under restraint in said curved configuration.

2. The method of claim **1** wherein the plate is formed to said curved configuration and held therein during cooling by applying the plate while hot to a forming mandrel and removably securing it on said mandrel with the backing sheet against the mandrel.

3. The method of claim **2** wherein the plate is to be applied to a cylinder of a printing press, and the mandrel has a cylindrical surface having a radius of curvature less than the radius of the printing press cylinder, the plate being applied to the mandrel with the edges thereof which are to extend axially of the printing press cylinder extending axially of the mandrel.

4. The method of claim **1** wherein the backing sheet is a sheet of polyethylene terephthalate.

5. The method of claim **4** wherein the plate is formed to said curved configuration and held therein during cooling by applying the plate while hot to a forming mandrel and removably securing it on said mandrel with the backing sheet against the mandrel.

6. The method of claim **5** wherein the plate is to be applied to a cylinder of a printing press, and the mandrel has a cylindrical surface having a radius of curvature less than the radius of the printing press cylinder, the plate being applied to the mandrel with the edges thereof which

are to extend axially of the printing press cylinder extending axially of the mandrel.

7. A printing plate for mounting on a cylinder of a printing press, said plate consisting only of two layers, one of said layers being a flexible rubber layer and the other being a backing layer of a dimensionally stable flexible nonwoven sheet plastic material, said layers being interfacially bonded, said rubber layer having a printing pattern in relief on its exposed face, said plate, in its unstressed condition prior to applicaton to a cylinder having a curvature generally corresponding to that of the cylinder with the printing pattern on the convex face of the plate.

8. A printing plate as set forth in claim 7 wherein said sheet plastic material is polyethylene terephthalate.

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