June 28, 1966 A. H. GRAY 3,257,944

METHOD OF PRODUCING PRINTING PLATES

Filed July 12, 1962

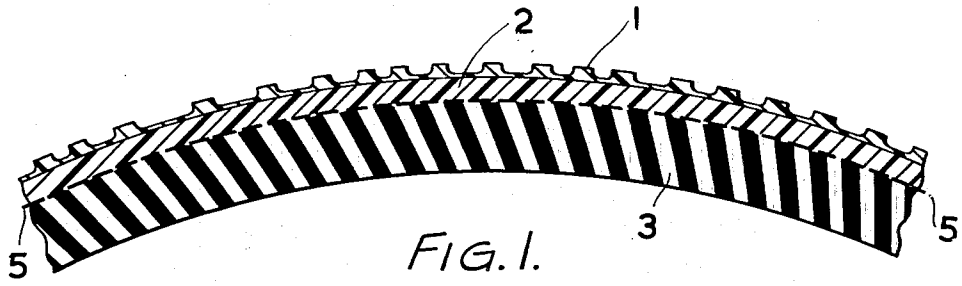


FIG. 1.



FIG. 2.

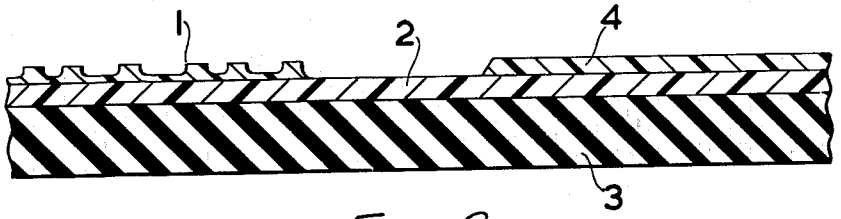


FIG. 3.

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United States Patent Office 3,257,944 Patented June 28, 1966

3,257,944

METHOD OF PRODUCING PRINTING PLATES

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Filed July 12, 1962, Ser. No. 209,351
Claims priority, application Great Britain, June 23, 1959, 21,569/59
2 Claims. (Cl. 101—401.1)

This invention relates to a printing plate for use in printing processes utilizing a raised image and to a method of producing such a plate. The invention is a continuation-in-part of that described in the specification of my now abandoned application Serial No. 37,104, filed June 20, 1960, entitled "A Method of Producing Printing Plates."

The printing plate described in this application has been evolved more especially to meet the special requirements of rotary printing presses and produce fine quality with great economy. Fine quality printing has hitherto been confined almost entirely to the relatively slow-running machines printing from a flat forme. The plates, which are the subject of this invention, provide the means of producing fine quality printing from rotary presses, hitherto impossible, thus making available the high productivity of the rotary press to the enormous range of work which such machines were previously incapable of printing.

Rotary presses require special plates, unlike machines printing from a flat forme where the original type may be used. Previously rotary plates have required a considerable amount of press preparation time. The special construction of this plate enables it to conform precisely to the periphery of the rotary cylinder thus reducing press preparation time (known in the trade as registering and make ready).

The plate is manufactured at a low cost, almost as low as the cheapest possible printing plate. Because rotary presses require special printing plates the manufacturing cost of plates is an important factor in the economics of rotary press use. The low cost of plate manufacture combined with the low press preparation time produces economies which enable the rotary press to be used for very much shorter runs than has been possible previously. It will be seen, therefore, that plates made according to this invention produce fine quality printing from rotary presses with great economy and enable the enormous advantages of the rotary press to be used for a great range of printed matter hitherto entirely restricted to slow running flat presses.

The plate has a very long printing life which together with the great improvement in printing quality also makes it valuable for long and very long run work. Although these plates are intended for rotary presses, and have been designed to meet the requirements of the rotary, they are just as easily used in the flat plane and may so be used if required.

In order to obtain satisfactory performance of any kind of printing press utilizing a raised image, it is essential that there is conformity exactly, or as near exactly as possible, between the surface of the printing image and that part of the printing press supporting the printing medium, that is to say, the bed and type or plates in a flat bed machine or the plates of any kind and the mounting cylinder on a rotary press.

A printing plate which is suitable for printing accurately on all kinds of paper, including rough papers, must be capable of withstanding the necessary printing pressures without noticeable distortion of the printing surface. It should also be capable of transferring a wide range of printing inks from rollers to paper.

Attachment of the plates to the cylinder should be accomplished simply and in perfect register with short press standing time.

Metal printing plates have long been used on rotary presses but poor printing quality or economic disadvantages severely limit their application. Due to poor characteristics of flexibility (accurate curving), it is a known fact that it is almost impossible to cause the surface of the printing image to conform exactly to the periphery of the mounting cylinder.

Curved stereos and electrotypes for rotary printing are well established in their respective spheres, but both fall a long way short of fulfilling all the requirements of the ideal. The stereo is capable of reproducing only a limited range of printing, and then of a quality well below the requirements of many. Text printing, although satisfactory for some purposes, is not first class, and half-tone reproduction is limited to the coarser screens. Plate-making, which requires some special plant for each size of press cylinder, cannot maintain a high degree of accuracy, and the fit on the press cylinder is far from complete. Failings in quality are, however, not so characteristic of the electrotype which, if carefully made, is capable of producing good results. But, being rigid, it suffers much the same physical disabilities as the stereo. If, through irregular plate thickness or imperfect fit on the cylinder, accurate "height-to-paper" over the whole forme is not obtained, then "make-ready" must be resorted to in order to correct the deficiencies. Extra costs of this kind, added to expensive plate-making, create high starting costs which can only be recovered from the savings of high speed. Therefore, although deficiencies in printing quality can largely be overcome by using electrotypes, a high minimum run is required for economic operation. For these reasons the curved electrotype and stereo are only suitable for particular kinds of printing, well out of the range of most printers.

One great disadvantage from which plates made from metal or even of synthetic resinous materials suffer, and the one which gives most trouble, is the physical displacement of the material during bending. When such a plate is bent, stresses of opposite characteristic are applied to the face and back. The outer surface is subjected to an extension strain and the inner to a compression, causing displacement in the body of the plate. As the elasticity of the material responds to these forces two important changes take place. Some elongation of the outer or printing face occurs, while a compressional stress is built up on the other side. Whether curving is effected with the plate in a heated or cold condition, some extension of the image occurs and irregularities are created on the underside, due to bunching of the compressed material. Such irregularities adversely affect plate thickness and constitute the major cause of extra press preparation time.

Natural or synthetic rubber or like material plates are also known and these conform well to the mounting cylinder periphery and allow the printing surface to follow well the same shape. Such rubber or like plates however are readily deformed when subjected to required printing pressures. This deformation occurs mainly in the printing image, thus rendering them useless for any good printing reproduction; furthermore such plates are incapable of reproducing the fine detail.

Again it has been proposed to use plastic or synthetic resinous material sheets for the printing plates, but materials of the above nature that are sufficiently rigid to withstand required printing pressures do not readily conform, and allow the printing surface to conform, to the shape of the cylinder in a rotary printing press. Such materials, on the other hand, that do readily and exactly conform do not have the rigidity of surface fully to resist deformation of the printing image, when subjected to the

required printing pressures. One such known plastic material printing plate for use in a flat-bed printing press comprises a facing of a vinyl resin or ethylene base resin which is secured to a rubber base or body essentially by an adhesive or cement, for example, an acid degenerated rubber in a solvent solution; such a plate however, in the main suffers from the above drawbacks and the essential use of an adhesive or cement leads, on attempted use of the plate or an attempt to curve such a plate to fit onto the cylinder of a rotary press, to disruption between the plastic material facing or printing surface and the rubber base.

The desire amongst printers to use rotary presses is great and growing, but this has been thwarted hitherto by the restriction in quality of printing so obtained and the high cost of press preparation and plate manufacture. One of the objects of this invention is to provide a printing plate for use on rotary presses which will produce fine quality printing with low press preparation costs and low manufacturing costs.

Another object of this invention is to provide a printing plate, which, although primarily for use in a rotary printing press, can also be used on a flat-bed press and which will not include any of the disadvantages referred to above.

Yet another object of this invention is to provide a printing plate, the printing image of which will conform exactly, or as near as exactly as possible, to the cylinder of a rotary printing press or bed in a flatbed machine and which also has the requisite amount of flexibility to allow the plate to curve to conform to the surface of its supporting cylinder, whilst being relatively cheap and simple to manufacture.

Other objects to be achieved by this invention will become apparent from the following description of the invention.

It must be appreciated that a printing plate utilizing a raised image must be of sufficient thickness to provide the necessary degree of relief in the printing surface and have a body thickness suitable to support the printing and non-printing areas. If, for instance, the degree of relief between printing and non-printing areas be 0.040" and the minimum support for the non-printing area be 0.040", then the minimum plate thickness will amount to 0.080".

I have found that, by utilizing rubber, or a similar substance, for the body of the printing plate and a harder synthetic resinous or plastic material for the printing surface and fusing the two materials together in the absence of any adhesive, it is possible to achieve suitable resistance to distortion of the printing image and yet retain full conformity of the plate.

The materials selected for the printing surface of the plate must be capable firstly of producing a plate which will perform on the printing press as described above and secondly, of faithfully reproducing the printed image during manufacture, whatever be the process chosen.

The plate made according to this invention and hereinafter described has a very hard printing surface capable of withstanding, without noticeable distortion, the required printing pressures for all kinds of printing paper. It has a high level of printing ink receptivity providing the required degree of ink transfer. It is impervious to most chemicals and solutions used in printing inks and washing solvents.

The construction of the plate is such that material displaced when curved is equally distributed, leaving the thickness level of the plate unimpared and allowing the printing surface to conform accurately to the shape of the cylinder on which the plate is mounted. A resilient base aids pressure distribution during printing.

The procedure used in manufacture causes the selected materials to fuse together producing a plate which is a homogeneous mass without resorting to the use of any intervening adhesive. In this way the materials, or layers of construction, become inseparable, rendering the plate capable of withstanding the strains imposed in continued printing on high speed rotary presses.

According to this invention, broadly speaking a printing plate comprises a rubber base and a layer of synthetic plastic material fused to the base in the absence of any intervening adhesive.

The rubber base is preferably a synthetic rubber and preferably consists of uncured nitrile rubber material which fuses readily with the synthetic plastic sheet under suitable temperature and pressure conditions.

Preferably the synthetic plastic material used to produce the printing surface is a flexible thermoplastic synthetic resinous material based on vinyl-chloride vinyl-acetate copolymer resins, although a polyvinyl resin may be used.

Such materials may be used to provide a preformed sheet which can be fused, in the absence of any intervening adhesive, to a synthetic rubber base; alternatively, and in order to obtain an even harder printing surface for the plate, a thinner preformed sheet of synthetic plastic material may be used backed by the rubber base; in this alternative, instead of placing the said synthetic plastic sheet in direct contact with the mould to produce the printing surface, the mould is dusted with a synthetic resinous powder, which is again a vinyl-chloride vinyl-acetate resin and when the assembly of the mould, powder, preformed sheet and base is placed in the press, the said materials are formed into the plate, the powder fusing naturally to the preformed synthetic plastic sheet, which in turn fuses with the synthetic rubber base.

The thermoplastic synthetic resinous material used as a preformed sheet to provide the printing surface is preferably either that known in the trade as "VR150" or "VB168," which were referred to in the specification of my application Serial No. 37,104 as they were then known in the trade as "VX150" and "VX168" respectively. The synthetic resinous powder used alternatively for the printing surface is a vinyl-powder or vinyl-chloride resin known in the trade as "VYNS–3," whilst the intervening thin preformed sheet of synthetic plastic material is preferably polyvinyl-chloride known in the trade as "Vitrone AZKK."

In certain circumstances, for example, in order to prevent shrinkage of the synthetic plastic material and synthetic rubber base, a control cloth, for example, of cotton or linen may be inserted between the said plastic material and base prior to the fusing of the materials.

When it is desired to provide a printing plate for printing text pages only, the plate preferably comprises a printing surface of a vinyl-powder such as "VYNS–3" which is dusted into the mould and covered with a preformed sheet of polyvinyl-chloride, such as that known as "Vitrone AZZK," which is then covered with the synthetic rubber base for fusing together. A printing plate for half-tone illustrations or solid prints preferably comprises a preformed sheet of "VR150" material fused directly to the uncured nitrile rubber base. In certain circumstances, however, it will be appreciated that it may be necessary to print from one plate mixed half-tone and text and in these circumstances the printing plate may comprise over the text portion a printing surface of "VYNS–3" material, the half-tone printing surface being formed of "VR150" and between the said printing surfaces and the nitrile rubber base is interposed a preformed sheet of polyvinyl-chloride "Vitrone AZZK."

Three forms of printing plate according to the present invention are illustrated in section in the accompanying drawing, FIGURE 1 showing the plate in curved state for use in a rotary press, FIGURES 2 and 3 showing other plates in flat condition before curving.

Referring to FIGURE 1, there is shown a printing plate mainly for printing text pages only. The printing surface 1 consists of a thermoplastic synthetic resinous powder "VYNS–3" based on vinyl-chloride vinyl-acetate

copolymer resins. If desired, the powder may be dissolved and used as a paste or liquid. When, however, used in powder form, a sufficient quantity of powder is applied to fill all the indentations of the area of application in the mould together with a thin layer over the immediate adjoining areas, the powder preferably being pressed into the indentations, for example, using one ounce of powder per 150 sq. inches of plate. The powder is then covered by a separating sheet **2** of thermoplastic synthetic resinous material "Vitrone AZZK" which has sufficient flow properties to enable the required pressure to be applied to obtain fusing with the printing surface and with an uncured nitrile rubber base **3** placed over the separating sheet.

Referring to FIGURE 2, there is shown a plate which is suitable for half-tone or solid prints and in this plate there is provided a preformed sheet **4** of synthetic resinous material "VR150" fused directly to the uncured nitrile rubber base **3**.

Referring to FIGURE 3, when it is desired to print material which contains half-tone and text, the text portion of the printing surface is again "VYNS–3" whilst the half-tone area of the printing plate is "VR150." The printing surfaces **1** and **4** respectively are separated from the uncured nitrile base **3** by an intermediate layer **2** of vinyl-chloride vinyl-acetate resin "Vitrone AZZK."

In making a plate as shown in any of the FIGURES of the accompanying drawing, use is preferably made of a rigid matrix of thermo-setting material which is formed by moulding the original type or illustration forme. Standard materials available to the trade and their appropriate moulding procedures are adequate; the matrix, however, it preferably treated with a release agent to prevent adhesion of the printing plate with the matrix during manufacture. Suitable release agents are finely dusted french chalk or a graphite spirit solution.

The synthetic resinous material, whether it be a preformed sheet such as "VR150" or powdered material "VYNS–3," is inserted in the mould; to obtain the desired hardness of printing surface whilst retaining the necessary amount of flexibility, said printing surface material should be restricted to the raised portion and a very thin layer of the plate. The second layer **2** of synthetic material, "Vitrone AZKK," when used, is placed on and in contact with the printing layer **1**, and the base material **3** is then placed in position in contact with the layer **2**, as shown in FIGURES 1 and 3. If a second layer of synthetic material is not used, the printing layer **4** is placed in contact with the base material **3** as shown in FIGURE 2.

The manufacture of the plate is completed by applying the correct amount of heat and pressure to the assembly of matrix and materials and allowing same to set under pressure. Such operations may be executed in a press having heated top and bottom platens. The cooling and setting of the plate under pressure will best be carried out in production by transferring the assembly to a second press.

The actual pressures and temperatures used will depend upon the material selected. For the preferred materials designated above for the printing surface, and for the intermediate layer **2** when used, a temperature of approximately 150° C. at a pressure of approximately 500 lbs. per square inch of the matrix area will be found satisfactory. If a separate cooling press is employed, its temperature should not be too low, otherwise over-rapid cooling will take place. A convenient temperature is approximately 30° C.

Even application of pressure over the whole matrix area during manufacture is important. The use of a restriction frame of correct height surrounding the mould has been found useful in maintaining even pressure and restricting the flow of material to prevent undesired over-spill.

The timing of pressure temperature and application is critical with some materials; in this connection, it has been found convenient to place the matrix assembly between two plates of quarter inch metal to prevent over-rapid build up of temperature in the assembled material. This also assists the handling of the assembly into, and between, the presses. The use of a sheet of polished foil between the exposed material and the upper metal plate of the assembly will prevent the material adhering to the metal plate. The foil itself is easily removed from the printing plate at a later stage.

The minimum time the assembly should remain in the hot press during manufacture will also depend on materials chosen. For the said preferred materials, a time of approximately 10 minutes is required. This allows sufficient time for the surface materials to flow into the mould, making contact at all points, and to fuse with one another and with the base material and for the vulcanizing of the rubber to be completed. It has been found advantageous to open the press after approximately 30 seconds to assist in releasing trapped air or gases. Prior to this a pressure some 20% lower than the full moulding pressure may be used. The press should only be open for a sufficient time, for example one or two seconds, to allow trapped gases or air to escape, and then closed with full moulding pressure applied.

It has been found that when using the vinyl powder such as "VYNS–3" for the printing surface and the preformed sheet of polyvinyl-chloride "Vitrone AZZK," satisfactory results can be obtained by using a range of temperatures between 140°–160° C. If, however, a temperature below 140°, for example, 130° C. is used, it is necessary considerably to increase the time through which the materials are in the press and this time may have to be increased up to 20 minutes. All things considered, the most satisfactory range is between 140° and 155° C. The satisfactory range of pressures for producing the plate is between 450 lbs. per square inch of mould area to 1,120 lbs.

For producing the printing plate for half-tone illustrations or solid prints using a sheet of "VR150," the temperature range is preferably between 145° and 155° C. and the pressure in the press between 560 and 1120 lbs. per square inch.

If one utilizes for the last mentioned plate polyvinyl-chloride "Vitrone AZZK" in place of "VR150," the range of temperatures for the top plate of the mould is between 155° and 165° C. and for the bottom platen 165° and 175° C., with pressures of 500–700 lbs. per square inch, the time factor being the same although in certain circumstances the time may be reduced to 8 minutes.

When it is desired to make the plate for a mixed half-tone text plate the figures given above for both pressures and temperatures may be employed although it is preferred to use temperatures and pressures at the lower end of the scale.

When the manufactured plate has cooled and is set it may be removed from the press and stripped from the matrix. If required the plate can be reduced to a standard thickness by grinding the exposed part of the body portion. Such grinding has a secondary and important advantage in that any irregularities introduced at any stage in the plate may be removed.

For some purposes it may be desirable to improve the dimensional stability of the printing plate. This can be achieved by the insertion of a suitable material capable of resisting shrinkage or expansion. Cotton or linen cloth having an open weave have been found most suitable, but other mesh materials, such as fibre glass or metal wire, may be used. This control sheet should be placed as near to the printing surface as possible. It has been found convenient to place it between the second layer of sheet material and the base of the plate as shown at **5** in FIGURE 1.

An alternative method of making the plates may be

used in which heat and pressure are applied to the materials using equipment other than a press having heated top and bottom platens. For instance a machine using the centrifugal principle in which the matrix and the materials are placed and the latter heated appropriately, the pressure being supplied through centrifugal form by rotation. Where such alternative equipment is used, preferred temperature, pressure and timing may be altered to suit the requirements of the machine. The principle however remains the same and the object will still be to produce a plate as herein described.

An alternative way of producing the printing image on the printing surface may consist in projecting the image required through a negative, photographically or otherwise produced, onto the polymerised printing surface material for example the vinyl-chloride vinyl-acetate copolymer resin. The exposed printing surface material is then etched or washed with water to remove unexposed portions of the said surface to provide the raised image. The material used in forming such an image is fused with the flexible base material to form a flexible plate having a structure similar to that described above and the same advantages as those obtained when using a matrix in lieu of photographic exposure.

The fusing of the flexible base with the etched or washout printing surface may be effected before the printing surface is formed or subsequent to that forming. In this case also, the finished plate may be subjected to back grinding to obtain a standard thickness as previously described.

The flexible printing plates as hereinbefore described can be mounted directly onto the press cylinder or can be fixed to segments and subsequently mounted on the press cylinder; the preferred method is to fix the plates to an attachment sheet away from the press and mount the complete sheet of plates on the press cylinder. This preferred method is made possible through flexibility of the printing plate and reduces press standing time, improving the output of the press and enhancing its economic operation. To secure the plate to an attachment sheet, the back of each printing plate may be treated with an adhesive for fixing to a metal or other thin attachment sheet. Each plate is placed in its correct position on the sheet and then fixed firmly in contact with the attachment sheet. Accurate positioning known as registering may be obtained by using a grid. This can take the form of superimposed frame with wire or threads to indicate the position; alternatively, a ruled grid can be used on the attachment sheet, or under it if the latter be transparent, whilst other known methods such as the use of an optical device, can be employed.

Plates are fixed in correct position and register to the attachment sheet in advance of press requirements. When mounted on the press the sheet is fixed mechanically and drawn tightly around the press cylinder. After removal from the press on completion of printing, the whole attachment sheet complete with plates may be stored for subsequent reprinting if desired; alternatively the plates may be removed from the attachment sheet and stored separately.

It is to be appreciated that the printing plate made in accordance with this invention needs no prior preparation of the constituent components before commencement of manufacture of said printing plate, which can thus be performed immediately on requirement.

What I claim is:

1. A method of making a printing plate comprising the steps of placing in a mould, forming a printing plate matrix, a printing surface layer component consisting essentially of thermoplastic vinyl-chloride vinyl-acetate copolymer resins in powder form free of nitrile rubber; placing a preformed thermoplastic sheet component consisting essentially of vinyl-chloride vinyl-acetate copolymer resins free of nitrile rubber in direct contact with said printing surface layer component; placing a base layer component of uncured nitrile rubber in direct contact with said preformed sheet component; and subjecting said components to heat within the range 140° C.–160° C. and pressure within the range 450 pounds per square inch–1120 pounds per square inch in the absence of any adhesive between contacting components, and thereby fusing said components directly together.

2. A method of making a printing plate comprising the steps of placing in a mould having a printing plate matrix a composite printing surface layer component having in part a preformed sheet of thermoplastic material consisting essentially of vinyl-chloride vinyl-acetate copolymer resins free of nitrile rubber and in part a layer of thermoplastic material consisting essentially of vinyl-chloride vinyl-acetate copolymer resins in powdered form free of nitrile rubber; relatively placing a preformed sheet component of thermoplastic material consisting essentially of vinyl-chloride vinyl-acetate copolymer resins free of nitrile rubber in direct contact with said composite printing surface layer component; relatively placing a base component of uncured nitrile rubber in direct contact with said preformed sheet component; and subjecting said directly contacting components to heat within the temperature range 140° C.–160° C. and pressure within the range 450 pounds per square inch–1120 pounds per square inch in the absence of any adhesive between contacting components, and thereby fusing said components directly together.

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