April 16, 1963 L. S. KUNETKA 3,085,507

RUBBER PRINTING PLATE WITH BUILT-IN CURVATURE

Filed Aug. 24, 1962 2 Sheets-Sheet 1

Fig. 1.

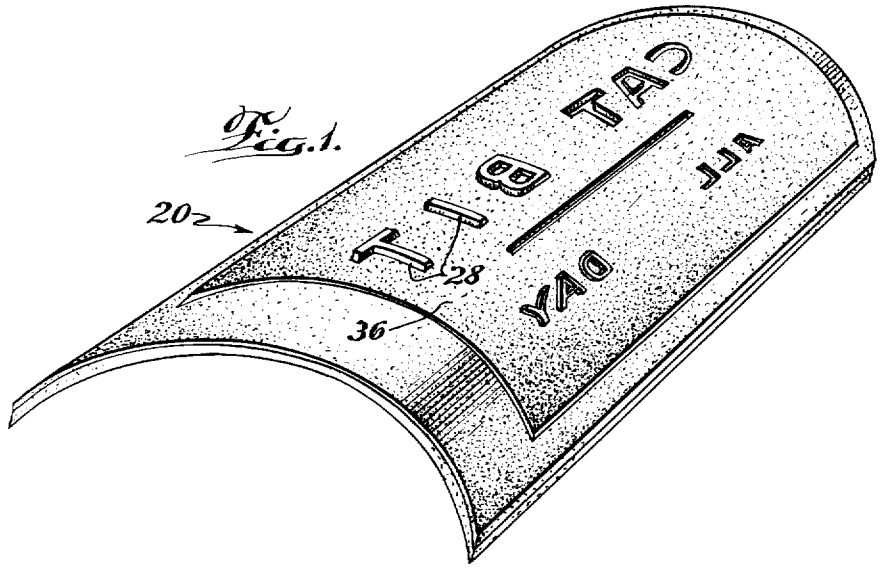


Fig. 2.

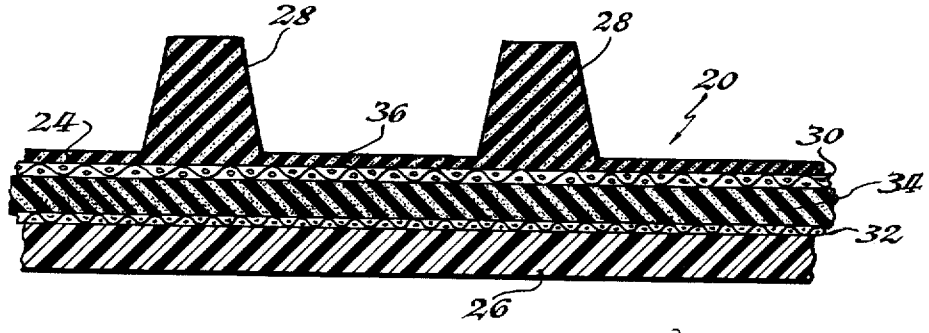


Fig. 4.

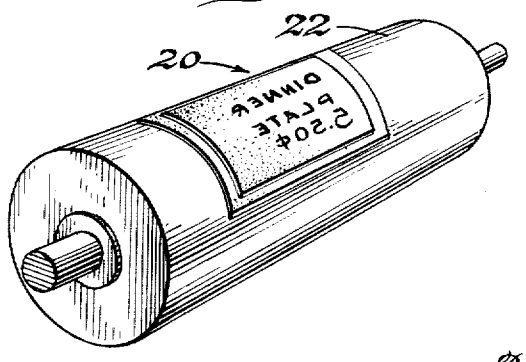
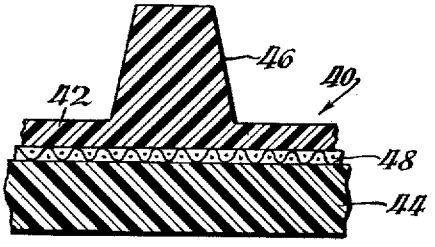


Fig. 3.



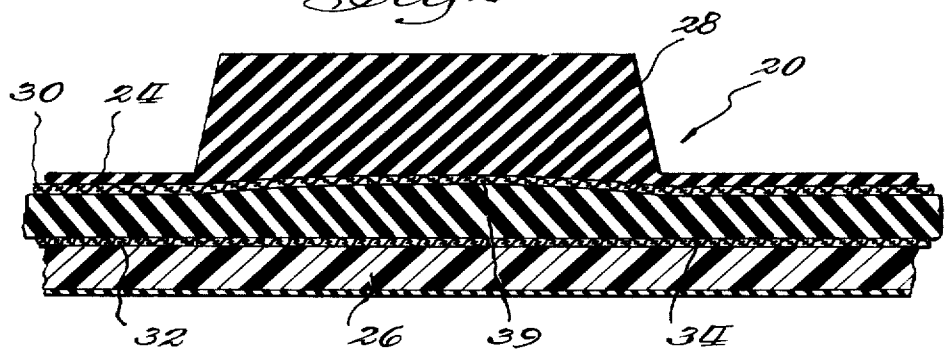
Inventor:
Lawrence S. Kunetka
By Silverman, Mullin & Cass
Attorneys.

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RUBBER PRINTING PLATE WITH BUILT-IN CURVATURE

Filed Aug. 24, 1962 2 Sheets-Sheet 2

Fig. 6.



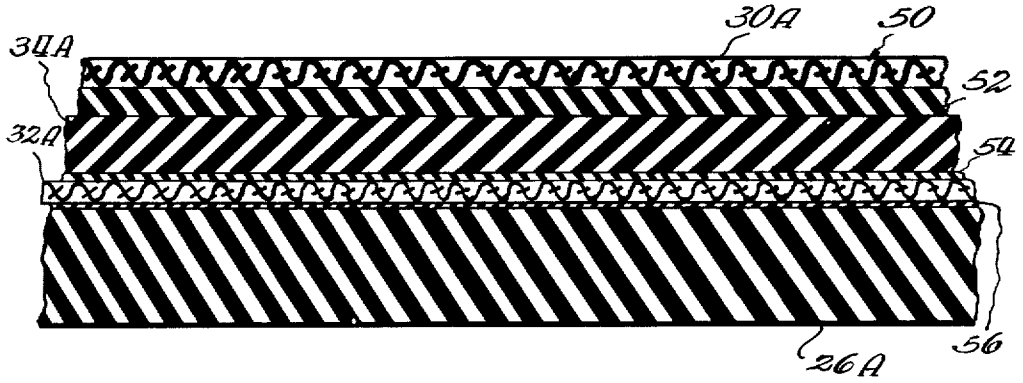


Fig. 5

Inventor
Lawrence S. Kunetka
By Silverman, Mullin, Cass & Kaufman
Attorneys

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RUBBER PRINTING PLATE WITH BUILT-IN CURVATURE

Lawrence S. Kunetka, 900 Lake Shore Drive, Chicago, Ill.

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16 Claims. (Cl. 101—379)

This invention relates generally to printing plates and more particularly, relates to an improved rubber printing plate for printing on corrugated fiberboard, said printing plate having a built-in curvature corresponding substantially to the curvature of the roll or cylinder of the printing press on which the printing plate is mounted. Additionally, said invention provides a novel base or backing member for the printing surfaces of a printing plate having such a preset curvature.

This is a continuation-in-part of my co-pending application, Serial No. 181,522, filed March 22, 1962, now abandoned.

Printing on corrugated board such as is used extensively in the manufacture of cartons and boxes, is done substantially universally by means of direct printing from a rubber die or rubber printing plate. The rubber printer plates customarily are made with the desired type face either in relief or reversed or both, and then mounted on the curved cylinder of a rotary printing machine, for instance. Heretofore, such rubber printing plates have been formed as flat members. In the mounting of such flat rubber printing plates on the curved cylinders of the press, undesirable stretching and distortion of the plates occurs which gives rise to images reproduced by the direct printing on the corrugated board which are irregular and disproportionate in size. Further, in conforming the flat printing plate to the curved cylinder, the rubber plate is bent and stretched to a degree tending to weaken the same, especially in the light of the treatment to which the printing plate normally is subjected during the printing procedure. The stretching of the printing plate also results in cupping of the type face characters thereby contributing to distorted imprints. Since the surface of the fiberboard to which the imprints are applied is corrugated in texture and has surface areas unsupported from below between flutes, the complexity of the problems encountered in making a suitable rubber printing plate is increased. Also, the bent flat plate has a normal bias, against any forced bending thereof so that it tends to return to a flat condition. After being mounted for some time, the edges of the plate curl and the body thereof tends to cup in shape. Because of such normal bias in flat plates, heavy staples commonly were used to secure the printing plate on the printing cylinder.

Prior attempts to provide a rubber printing plate for printing on corrugated fiberboard generally have been unsuccessful in solving the problems alluded to hereinabove. One attempt has been to form the rubber printing plate during the molding thereof by using rubber materials of different durometer characteristics. However, such attempts have been completely unsuccessful especially, where the type face of the printing plate is reversed to type in relief. This form of printing surface is known as "solid." In such instances, the relative thickness of the body of rubber material in which the reverse type faces were formed caused the rubber printing plate to curve in a direction opposite to the curvature desired in order to permit mounting of the same on a printing roll. Consequently, although the problems have been recognized and there has been a longfelt need for solution of the aforementioned problems, no successful attempts heretofore have been made in this regard.

Accordingly, a major object of the invention is to provide a rubber printing plate having a built-in curvature so as substantially to conform to the curvature of the printing roll upon which it is to be secured which substantially eliminates all of the problems hereinabove enumerated.

Another object of the invention is to provide a rubber printing plate having a built-in curvature which is universally suitable both for rubber printing plates having type faces in relief and reversed, that is to say, having a so-called solid printing surface in which the intelligence is recessed in the printing surface of the printing plate.

Another object of the invention is to provide a curved printing plate of the character described, which utilizes different hardnesses of rubber on the top and bottom surfaces of the printing plate, the upper surface of the printing plate which includes the type face being made from a layer or lamination of rubber of lower durometer hardness such that, in the vulcanization process, the lower surface or base of the plate will shrink to provide a curl in the printing plate whereby a built-in curvature is obtained which will conform to the curvature of the printing cylinder.

Another object of the invention is to provide a curved printing plate of the character described which includes a top layer and bottom layer of different durometer hardness, said bottom layer of rubber being substantially thicker than the upper layer of rubber.

Another object of the invention is to provide a rubber printing plate of the character described in which embodiment of the invention, layers of non-shrinkable and shrinkable sheet material such as fibrous glass and canvas, respectively, are sandwiched between the top and bottom layers of rubber.

Another object of the invention is to provide a novel base or flexible backing structure for the rubber printing surfaces of a printing plate of the character described, said structure comprising a composite panel of layers of uncured rubber and selected sheet members which are secured together so that the composite panel can be shipped and storaged as a separate article to be used, as needed, by manufacturers of rubber printing plates. The manufacturers of such rubber printing plates are engaged, usually, for special printing jobs for which the printing plate is to be made. In manufacturing the printing plate, the composite panel embodying the invention is made available in his inventory for final molding of the printing plates, to fill his orders.

Other objects of the invention reside in providing a rubber printing plate of the character described which is economical to manufacture, which is easy to secure on a printing cylinder, which substantially eliminates distortion of the lettering in the printing face of the printing plate notwithstanding the built-in curvature thereof, and which is durable, long-lasting and strong and which eliminates cupping in the solid areas of the printing surface.

The foregoing and other objects of the invention will become apparent from the ensuing disclosure in which a preferred embodiment has been described in detail in the specification and illustrated in the accompanying drawing. It is contemplated that minor variations in the structure, proportion, size and arrangement of parts thereof may occur to the skilled artisan without departing from the scope of sacrificing any of the advantages of the invention.

In the drawings:

FIG. 1 is a perspective view of a preferred embodiment of the rubber printing plate embodying the invention. FIG. 2 is a fragmentary sectional view taken through the printing plate of FIG. 1.

FIG. 3 is a fragmentary enlarged sectional view through a printing plate representing an unsuccessful attempt to adapt prior structures to the production of curved printing plates.

FIG. 4 is a perspective view showing the printing plate embodying the invention secured on a printing cylinder.

FIG. 5 is a fragmentary sectional view greatly enlarged taken through a composite backing structure in accordance with the invention.

FIG. 6 is a greatly enlarged fragmentary type of the sectional view taken through a type of the rubber printing plate embodying the invention, and exaggerated to show details.

Referring now to the drawings, in FIG. 1, the reference character **20** identifies generally one embodiment of the rubber printing plate forming the invention. The printing plate **20** may be seen to have a normally arcuate configuration providing a curvature therefor which enables the printing plate easily and readily to conform generally to the curvature of a printing cylinder **22**, such as shown in FIG. 4. Thus, upon securing the printing plate **20** to a printing cylinder **22**, there is not required any stretching or radical bending of the rubber printing plate **20** as is the general occurrence in the case of flat printing plates heretofore employed.

Referring to FIG. 2, in the manufacture of the printing plate **20**, there is provided a flexible printing surface by means of a layer **24** of rubber and a base layer or lamination **26** also formed of rubber. The layer or lamination **24** carries the type **28** which may be cut, molded or otherwise formed by a technique without critical application to the herein invention. Sandwiched between the top layer **24** and the base or bottom layer **26** of the printing plate are a pre-shrunk or non-shrinking sheet member **30** preferably of fibrous glass material, a sheet **32** of suitable fabric such as canvas capable of shrinking and a layer **34** interposed between the sheets **30** and **32**. As seen in FIG. 2, the pre-shrunk or non-shrinking sheet **30** is located next adjacent the top layer **24** while the shrinkable fabric sheet **32** is located next adjacent the base or bottom layer **26**.

Either synthetic or natural rubber materials may be employed in making the printing plate **20** with cognizance being taken of the type of ink which will be used in the printing process. Where the printing inks have an oil base, it will be necessary to use a rubber material which is resistant to such inks. Natural rubber ordinarily will be attacked by printing ink having an oil base. On the other hand, where the printing inks have an alcohol or water base, the printing plate can be formed of natural rubber.

In the manufacture of the printing plates, the top layer **24** is comprised of a rubber material of from 20 to 50 durometer hardness. The base or bottom layer **26** is comprised of a rubber material having a durometer hardness of from 70 to 90. The layer **34** of rubber between sheets **30** and **32** has a durometer hardness of approximately 70. These durometer hardness values are based upon the Shore durometer scale. The vulcanization of the several layers to form the printing plate is carried out at approximately 317° Fahrenheit, or without any critical pressures or temperatures required and known techniques are followed. Because of the different durometer hardnesses and thicknesses of the layers **24** and **26**, during vulcanization, the base layer **26** will shrink more than the top layer **24** thereby causing an upward curling or arching of the printing plate. Also, the sheet member **32** will shrink more than member **30** further to cause the desired arcuate formation of the plate **20**. Upon complete curing, the printing plate is removed from the vulcanizing equipment as an arcuate rubber printing plate or one having a pre-set or built-in curvature therein shown in FIG. 1. Also, during vulcanization, the rubber enters the interstices of sheets **30** and **32** to bond to them.

Referring to FIG. 6, there is illustrated a phenomenon believed to occur in the finished printing plate **20**. As a result of the vulcanizing procedure in which the sheet member **30**, preferably of fibrous glass, does not shrink, said member **30** is forced into layer **24** of rubber which forms the flexible printing surface. There may occur some compression of the rubber of layer **24** adjacent said member **30**, especially in the portions of said rubber layer **24** subtending type **28**. In any event, the sheet member **30** assumes an upwardly arched or bowed configuration indicated at **39** which has a slightly greater radius of curvature than the radius molded into curvature of the printing plate **20**. Thus, the member **30** may be likened to a sheet member having a permanent seat in the same general direction of curvature of the plate **20**. It is believed that the non-shrinkable, non-elastic character of the fibrous glass sheet **30** enables such slight displacement in adjacent portions of rubber layer **24** so that the sheet **30** can be placed in this condition of permanent curved set adjacent the printing surfaces of the slate **20** and assist to maintain the preset curved condition of the printing surface of the plate **20**. Note that none of the other layers **26**, **32** and **34** experience the same phenomenon in the completed plate **20**.

Of further consequence in this structure, is the relationship between the dimensions of the several layers one relative to the other and relative to the overall thickness of the resulting plate **20**. The total thickness of the printing plate **20** from the crown of type **28** to the bottom surface of layer **26**, was approximately .255 inch plus or minus .005 inch. The height of the type **28** above the upper surface **36** of layer **24**, was approximately .150 inch. The layer **24** was approximately .010 inch thick, whereas the layer **26** was approximately .045 inch thick. Both the sheets **30** and **32** were approximately .010 inch thick and the rubber layer **34** was approximately .030 inch thick. Thus, the bottom layer **26** was thicker than the top layer **24** excluding the thickness of the type face **28**. The greater thickness of the bottom layer **26** in addition to the greater durometer hardness of the rubber of layer **26** was instrumental in obtaining a fixed curvature in the plate **20** after vulcanization was completed.

Referring to FIG. 3, there is illustrated a fragmentary portion in section, of a molded rubber printing plate **40** which has an upper layer of soft rubber **42**, a bottom layer **44** of harder durometer rubber and a reinforcing sheet member **48** of glass fabric bonded therein. The single layer **48** of glass fabric has been used by others in making rubber printing plates, but not the thick (¼ inch) plates required for printing on yieldable materials, such as corrugated board. Where a thick plate is made using the structure of FIG. 3, although in some instances curvature was achieved because of the greater degree of shrinkage of the harder rubber layer **44**, the results after molding were not reliable. In many cases, the plates were flat when removed from the vulcanizing apparatus, and in other instances, especially where the printing surface was solid, such plates curved in the wrong direction. The use of the two lamina comprising the shrinkable and non-shrinkable elements **32** and **30** are essential for reliability and a guaranteed proper curvature with every kind of printing surface.

Referring to FIG. 5, there is shown a base member designated generally by the reference character **50** for making a printing plate **20**. In referring to member **50** as a base or backing member, it is intended to connote a carrier for the rubber printing face **24—28** of the plate **20**. In other words, the rubber layer **24** with the type **28** integrally formed thereon is laminated to the member **50** in the process of making plate **20**, as previously described. Thus, the member **50** is considered a separate article of manufacture adapted to be used as a base or carrier for the printing surfaces of a rubber printing plate and can be supplied as such to producers of the rubber printing plates.

The member **50** is a composite structure or assemblage of sheet materials and supplied as such. The sheet member **30A** is formed of a non-shrinkable material, such as fibrous glass approximately .008 to .010 inch thick and is located to form one outer face of assemblage **50**. The

fibrous glass sheet **30A** is attached to a sheet of uncured rubber **34A** by a layer of rubber cement **52**. The cement layer **52** is approximately .010 inch thick. The uncured sheet **34A** is approximately .020 inch thick and is of approximately 70 durometer hardness. A synthetic rubber such as Buna-N is used. The rubber cement layer **52** can be omitted from the assemblage in the manufacture of many kinds of printing plates, in which case, the combined thickness of sheet **30A** and sheet **34A** will be .030 inch.

The uncured rubber **34A** is adhesively secured by a layer of rubber cement **54** to a sheet of shrinkable fabric **32A** which, in turn, is secured by rubber cement **56** to the uncured rubber sheet **26A**. The sheet **32A** comprises a canvas material such as a Duck canvas No. 11 formed of cotton and approximately .006 inch thick, although this dimension may vary. The cement layers **54** and **56** are approximately .002 inch thick. The uncured rubber layer **26A** is approximately .040 inch thick and of 70–90 durometer hardness and forms the opposite outer face of the assemblage **50**.

The assemblage **50** can be supplied as a separate structure or even with a sheet of uncured rubber secured on sheet **30A** which will form the printing surface **24—28** of the printing plate **20** when vulcanized. For instance, the assemblage **50** can have another layer of rubber approximately .187 inch thick which will form the rubber layer **24** and type **28** of the plate.

It should be appreciated that the demarcation of layers of sheet material from which the plate **20** is formed, as seen in FIG. 2 is for purpose of description. Under conditions of vulcanization, the clear demarcation between rubber layers would not be discernible if plate **20** were cut through by a sharp instrument. However, in the assemblage **50**, which is prior to curing to form plate **20**, such distinct layers of materials is discernible.

The actual manner of mounting the curved printing plate **20** or **40** on a printing roll or cylinder **22** is of no concern in this invention. The range of durometer hardnesses set forth for the various rubber layers of the printing plate embodying the invention, enables the fabricator to provide suitably curved printing plates for printing rolls of normal 32, 42, or 52 inches presently used in the printing industry. Although it is advantageous to obtain a complete confirmation of the curvature of the printing plate to the curvature of the printing roll, it will be appreciated that slight discrepancies therebetween will have little or any adverse consequence since the printing plate already provided with the built-in curvature need not be bent or stretched to any significant degree sufficient to distort the type faces thereof. Consequently, the manufacturer need only make the printing plates in accordance with the invention with a normal curvature which can be expected to satisfy all of the printing rolls or cylinders in use.

Of considerable advantage herein is the fact that the curved plate **20** has a normal condition which does not resist the curvature thereof. For instance, in a flat printing plate stretched and bent to conform to a printing cylinder, the resilient plate will be based to return to a flat condition. Thus, after being mounted on the cylinder for some time, the edges curl and the body portions of the plate tend to cup. Also, it can be appreciated that the mounting of a normally flat printing plate on a cylinder is difficult, including providing suitable means for securing the flat plate on the cylinder.

It is believed the invention has been described in sufficient detail to enable the skilled artisan to understand and practice the same. The invention has been defined in the appended claims in language intended to be liberally construed commensurate with the contribution made to the arts and sciences by the inventor.

I claim:

1. In a rubber printing plate having a rubber printing surface of predetermined durometer hardness for printing directly on corrugated board or the like; the herein invention comprising, a carrier structure for said rubber printing surface comprising, a unitary assemblage having a bottom rubber layer of substantially greater durometer hardness than said printing surface, a top sheet of a relatively non-shrinkable fabric-like material, a shrinkable fabric sheet, and a rubber bonding layer interposed between said fabric sheets with said shrinkable fabric sheet next adjacent said bottom rubber layer, said carrier having a sheet of rubber of said predetermined hardness laminated to said top sheet by conventional vulcanizing procedures to produce said printing surface with said carrier preset in an arcuate configuration and said printing surface substantially free of distortion.

2. A flexible molded printing plate adapted to be mounted on a printing cylinder of a rotary printing machine for direct imprinting on corrugated paperboard or the like and having a normally arcuate cross section for enabling the plate to be conformed to said cylinder curvature in mounting with a minimum of distortion of the printing surface, said plate comprising a laminated molded member having a base rubber layer and a top rubber layer, with the printing intelligence molded into the top layer, a pair of fabric sheet elements embedded in said plate bonded together and sandwiched between the top and base rubber layers, one element being formed of a material which is flat prior to molding and which will shrink appreciably during the molding, and the second element being formed of a material which is flat prior to molding and which will not shrink appreciably during the molding of the plate, the second element being the upper of the two and closest to the top rubber layer.

3. A printing plate as described is claim 2 in which the first fabric sheet element is canvas and the second is fibrous glass material.

4. A printing plate as described in claim 2 in which the top rubber layer is of a durometer substantially less than that of the base layer.

5. A printing plate as described in claim 2 in which the top rubber layer is formed of a durometer hardness between 20 and 50 and the base layer is formed of a durometer hardness between 70 and 90.

6. A printing plate as described in claim 2 in which the base layer is much thicker than the top layer exclusive of the printing areas.

7. A printing plate as described in claim 2 in which there is a third rubber layer between said fabric sheet elements to provide the bonding between them.

8. A printing plate as described in claim 7 in which the base and third layers of rubber are of substantially greater durometer hardness than that of the top layer.

9. A flexible printing plate adapted to be secured on the cylinder of a rotary printing machine for direct printing on corrugated paperboard or the like comprising, a normally arcuate laminated rubber member having a top printing surface having protruding printing areas and a base, said printing surface and base being formed of layers of cured rubber of different durometer hardness with the base being of greater durometer hardness and substantially thicker than the layer of said printing surface exclusive of said printing areas, two sheets of fabric and a third rubber layer between said sheets, one sheet being a non-shrinking fabric material laminated to said printing surface layer and the second sheet being a shrinkable fabric material laminated to said base layer.

10. A plate as claimed in claim 9 in which said printing surface layer is from 20 to 50 durometer hardness and said base layer is from 70 to 90 durometer hardness.

11. A plate as claimed in claim 10 in which said third layer is approximately 70 durometer hardness.

12. In a rubber printing plate having a rubber printing surface for printing on corrugated board or the like; the herein invention comprising, a carrier structure for said

rubber printing surface comprising, a unitary assemblage having a bottom rubber layer of substantially greater durometer hardness than said printing surface, a top sheet of a relatively non-shrinkable fabric-like material, a second rubber layer and a shrinkable fabric sheet, said second rubber layer being interposed between said fabric sheets with said shrinkable fabric sheet next adjacent said bottom rubber layer, said carrier having a sheet of rubber laminated to said top sheet by conventional vulcanizing procedures to produce said printing plate with said carrier preset in an arcuate configuration and said printing surface substantially free of distortion, said bottom layer being a greater durometer hardness and thicker than said second rubber layer.

13. The invention as described in claim 12 in which said top sheet comprises fibrous glass material and said base layer is formed of rubber of 70–90 durometer hardness.

14. The invention as described in claim 13 in which said second rubber layer is of approximately 70 durometer hardness.

15. A carrier structure for incorporation as an integral part of a normally curved vulcanized rubber printing plate having a type-bearing surface suitable for printing directly on corrugated paperboard or the like; said carrier structure comprising, a stacked assemblage including, first and second sheets of uncured rubber and first and second sheets of fabric material in alternated arrangement with said first fabric sheet at the top end and said first rubber sheet at the bottom end of the assemblage, said first sheet of rubber being substantially thicker and of greater durometer hardness than the second sheet of rubber, said first fabric sheet being of non-shrinkable material and said second fabric sheet being of a shrinkable material, said first sheet of fabric adapted to have a rubber printing surface laminated thereover in forming the printing plate in which said surface is formed of rubber of lesser durometer hardness than said first rubber sheet.

16. A carrier structure for use in the manufacture of a rubber printing plate having a rubber printing surface of predetermined hardness suitable for printing directly on corrugated board or the like and which carrier structure is incorporated as an integral part of the finally vulcanized printing plate: said carrier structure comprising, a laminated assemblage including, a sheet of uncured rubber, a first fabric sheet of shrinkable material overlying said sheet of uncured rubber, a second sheet of non-shrinkable fabric overlying the first fabric sheet and there being a bonding layer of a vulcanizable material between said fabric sheets, said second sheet of fabric adapted to have a rubber printing layer which is of lesser durometer hardness than said sheet of uncured rubber laminated thereover in forming the printing plate.

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