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S. VAMVAKETIS
PRINTING PLATE MATERIAL

2,741,297

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Fig- 1

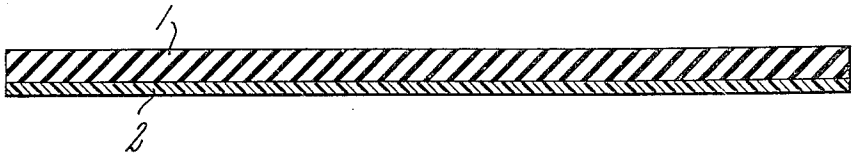


Fig- 3

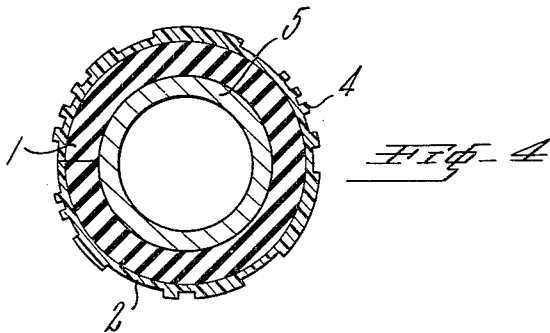
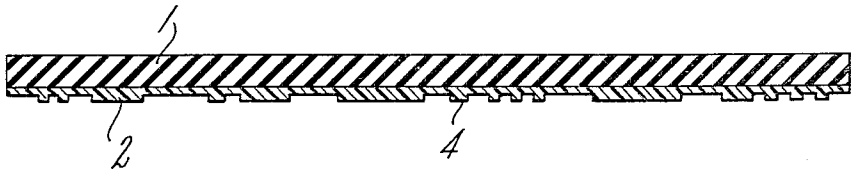
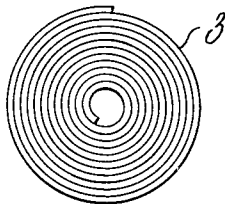


Fig- 2



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2,741,297

PRINTING PLATE MATERIAL

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1 Claim. (Cl. 154—54)

This invention relates to an improved printing plate material, and more particularly it relates to a printing plate material that is adapted for convenient preparation of printing plates having improved characteristics.

The printing plate materials and the printing plates available in accordance with prior art practices have had certain disadvantages. Thus, printing plates made from metals or rigid plastics have lacked the flexibility that would be desirable to permit easy mounting of the plates on the cylinders of the printing press. Also, the lack of resiliency, in addition to the hard surface of these materials, sometimes led to cutting or undesirable embossing of delicate surfaces, such as cellophane, glassine, tissue paper, etc., on which it was desired to print. Furthermore, the handling and storing of the metal or rigid plastic plates required extreme care, since such plates were easily damaged by contact with other hard objects, or when dropped on the floor.

On the other hand, printing plates made from resilient materials do not lend themselves to the reproduction of fine details, as is required in most letterpress work, because of their tendency to deform and spread out under normal printing pressure.

The present invention has for its principal object the amelioration of the foregoing difficulties by provision of a printing plate material which is easily fabricated into a printing plate that has a printing surface capable of accurately reproducing fine detail, but that at the same time is flexible and resilient.

Another object is the provision of a printing plate material which is easily manufactured and can be shipped conveniently in bulk, and stored for relatively long periods without deterioration.

Still a further object of the invention is to provide a printing plate material which the ordinary rubber or plastic printing plate maker can utilize conveniently and efficiently, in its present plate making equipment.

Additional objects and advantages of the invention will be made manifest in the following detailed description, which is intended to be read with reference to the accompanying drawing, wherein:

Fig. 1 is a transverse sectional view of a sheet of printing plate material made in accordance with the invention;

Fig. 2 is a similar view on a smaller scale of the material rolled up for shipment or storage;

Fig. 3 is a view similar to Fig. 1 showing the sheet after fabrication into a printing plate; and,

Fig. 4 is a similar view of the printing plate applied to the cylinder of a printing press.

The invention provides a printing plate material in the form of a laminated sheet constituted essentially of a relatively thick resilient backing sheet of soft rubber in the unvulcanized state, having adhered to one surface a

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relatively thinner layer of a hard but flexible blend of a thermosetting resin with a synthetic rubber. The said thermosetting resin is most preferably a phenolic resin and the said synthetic rubber is most preferably of the type known as nitrile rubber (also known as Buna N, or by such trade names as Hycar or Paracril).

Referring to the drawing, and in particular to Fig. 1, there is shown a sheet of such laminated printing plate material having a soft vulcanizable rubber backing 1, and a facing 2 composed of a hard phenolic resin-nitrile rubber blend. The rubber backing 1 is preferably also made of nitrile rubber for best resistance to the solvents or oils likely to be encountered in printing practice. The soft backing is typically made about 0.03 to 0.4 inch thick, and the hard facing is usually about 0.005 to 0.05 inch thick. The backing is generally made from 3 to 10 times thicker than the facing.

The backing is so compounded, in a manner that will be understood by those skilled in the art of rubber compounding, as to be vulcanizable, at the usual molding temperatures, to a soft vulcanized state, such that the vulcanized material has a Shore hardness within the range from 15 to 70 on the Shore A scale. When using the accelerators and activators commonly used for sulfur vulcanization of nitrile rubber, in the amounts customarily employed, it will generally be found that the backing composition will have the proper hardness when compounded with from 0.5 to 5.0 parts of sulfur, although the skilled rubber compounder will be able to produce the desired hardness with amounts of sulfur outside of this range.

In formulating the tough facing composition, there is employed a soluble, heat-reactive phenolic resin, prepared from phenol and formaldehyde by acid catalysis, such as is described, for example, in U. S. Patent 2,203,206 of Shepard et al. The phenolic resin preferably is modified with from 2 to 10% of cashew nut oil. Such resins are mutually compatible with, or soluble in, the nitrile rubber component, and they are capable of being converted into a relatively infusible, insoluble state by heating in the presence of a curing agent, which is usually a substance capable of yielding formaldehyde, as is well understood by those skilled in the art. With from 20 to 150 parts by weight of such phenolic resin, there is admixed 100 parts of the nitrile rubber to make the tough facing compound. The nitrile rubber may be any suitable rubbery butadiene-acrylonitrile copolymer of commerce containing from 10 to 50% of combined acrylonitrile by weight, and more preferably containing about 20 to 45% of acrylonitrile. The phenolic resin and the nitrile rubber may be blended together by any suitable procedure, such as by mixing together on a rubber mill.

The facing formulation should include an agent capable of promoting the heat-setting of the phenolic resin, such as hexamethylenetetramine in amount of from 4 to 12 parts per 100 parts by weight of resin. Frequently the commercial grades of phenolic resin will already contain a curing agent.

It is also advantageous to include a small amount of sulfur in the mixture, say 1 to 10 parts per 100 parts of rubber, particularly if the mixture contains less than about 50 parts of phenolic resin in 100 parts of nitrile rubber.

Phenolic resin-nitrile rubber blends of this type produce, upon curing at elevated temperatures, a composition which is unusually hard and tough, but still definitely flexible, and having physical properties which are un-

usually well suited for printing. The cured material has a Shore hardness within the range from 65 to 100 on the D scale, but is flexible enough to extend around the cylinder of a printing press.

It is also preferred to employ in the mixture, along with the phenolic resin, a softener or plasticizer, such as a cumarone-indene resin, in amount equal to about ¼ to ½ of the amount of phenolic resin. The mixture may be unfilled, or it may be filled with various materials, such as carbon black.

The following example will illustrate the invention in further detail.

EXAMPLE

Backing compound

Materials:	Parts by weight
Nitrile rubber ¹ -----	100.00
Zinc oxide -----	5.00
Carbon black -----	60.00
Dibutyl phthalate -----	30.00
Antioxidant -----	1.00
Stearic acid -----	2.00
Accelerator -----	1.50
Sulfur -----	1.00
	200.50

¹ A commercial nitrile rubber sold under the trade designation Paracril BJ.

Face compound

Paracril BJ -----	100.00
Phenolic resin ² -----	70.00
Zinc oxide -----	5.00
Carbon black -----	100.00
Stearic acid -----	0.75
Cumarone-indene resin ³ -----	25.00
Antioxidant -----	0.75
Accelerator -----	2.00
Sulfur -----	5.00
	308.50

² A novolac type of cashew nut shell oil modified phenolic resin containing hexamethylenetetramine as a curing agent, sold under the trade designation Durez 12687.

³ A viscous liquid type of resin, sold under the trade designation Cumar AX.

The compounds were mixed on a roll mill and lamination of the two compounds was effected on a calender. The heat and pressure of the calendering operation cause the two layers to become firmly united. The adherence of the two layers is enhanced by the fact that the nitrile rubber constituting the backing layer is also present in the facing layer.

The resulting laminate was 0.125 inch thick, comprising 0.02 inch of facing and 0.105 inch of backing. The laminate was flexible and could easily be rolled up into a roll 3 as shown in Fig. 2, for storage or shipping. To prepare a printing plate from this laminate, a piece of the material was simply cut from the roll 3 to the size of the matrix, which in this case was made of Bakelite and was previously prepared by spraying with a silicone mold release emulsion composition, followed by dusting with fine talc. The piece of laminate was placed on top of the matrix and the assembly was then placed between the platens of a vulcanizing press between thickness bearers to control the thickness of the finished plate. The press was closed to effect a preliminary dwell, during which the material of the plate was pre-heated by contact with the platens, but without being actually compressed. After one minute of such dwell, a platen pressure of about 125 pounds per square inch was applied for about 8 minutes at 307° F. during which time both the backing and the face material became completely cured. The cured plate, having the appearance shown in Fig. 3, with the printing impressions 4 molded in its face, was removed from the matrix, the flash was trimmed off, and

the plate was mounted on the cylindrical roll 5 of a press as shown in Fig. 4. Because of the flexible nature of the laminated plate, there was no difficulty about conforming the plate to the curvature of the plate cylinder. The face of the plate, although hard and smooth, was not brittle. It was found by actual use of such a plate, that the surface was rigid enough to print fine detail. The flexible and resilient rubber backing absorbed practically all of the printing pressure, and at the same time compensated for any irregularities in the printing surface, as well as any unequal printing pressure. Because the plate could be mounted on the press substantially as easily as a rubber plate, the present construction permitted costly "make ready time" to be minimized.

Because the printing plate material made in accordance with the invention takes the form of a sheet material, the storage, shipment and utilization of the material is greatly simplified. Since the surface of the material is not easily damaged, the usual hazards in storing and shipping the plate or the material are substantially eliminated.

The printing plate maker can utilize the material conveniently and efficiently, since the material is fabricated to the prescribed thickness, and the plate maker can simply cut a piece to the required dimensions, place it on the matrix, and apply heat and pressure to form and vulcanize the printing plate. This simple procedure saves time, thereby substantially reducing plate making costs.

The nitrile rubber employed in making the plate has the further advantage of being resistant to acid and solvents.

The use of the present printing plate material is more convenient than the use of resins and the like in granular form. In molding a plate from the latter materials, it was necessary to first spread the granules over the matrix, and then wipe out the excess so that the granules remained only in the crevices of the matrix. Since many matrix designs are intricate, the process of distributing the granules evenly was time consuming, and proved to be very difficult in many cases.

The plates made from the present material are not only capable of printing fine detail with accuracy, but they are unusually long wearing, and retain their ability to print fine detail even after prolonged periods of use.

The soft vulcanizable rubber composition used as the backing material in the present plate can be stored for relatively long periods of time without appreciable change in its vulcanizing characteristics, so that the printer will have no difficulty about fabricating a printing plate from it, even if the material has been on hand for some time. This is true also of the composition used as the facing material, since it remains in the desired heat-curable condition throughout relatively prolonged times in shipment or storage. There is therefore no difficulty about the printing plate material deteriorating during the time elapsed between manufacture of the material and fabrication of the plate.

Having thus described my invention, what I claim and desire to protect by Letters Patent is:

A printing plate laminate comprising a composite flexible sheet constituted of a relatively thick resilient backing layer of soft-vulcanizable nitrile rubber directly heat-laminated on one surface to a contacting surface of a relatively thinner facing layer of a hard but flexible composition comprising a heat-curable blend of 100 parts of nitrile rubber with from 25 to 150 parts of a cashew nut shell oil modified novolac phenol-formaldehyde resin, the said nitrile rubber in each said layer being a copolymer of butadiene and acrylonitrile containing from 10% to 50% of acrylonitrile and the presence of said nitrile rubber in each said layer serving to enhance the adhesion between the layers, the said laminated layers being characterized by the ability to retain without appreciable change their original vulcanizing and curing characteristics throughout relatively prolonged times of shipment and storage, and the said facing layer of the laminate be-

ing capable, when heated to softening and curing temperatures under pressure in contact with a printing matrix bearing fine detail, of taking and retaining the impression of the said matrix and retaining an ability to print said fine detail even after prolonged periods of use, the Shore hardness of the said facing layer in the cured state being within the range from 65 to 100 on the D scale and the laminate at the same time being resilient enough to print on delicate surfaces without damage thereto and flexible enough to conform without difficulty to the curvature of a printing plate cylinder.

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