

Sept. 16, 1947.

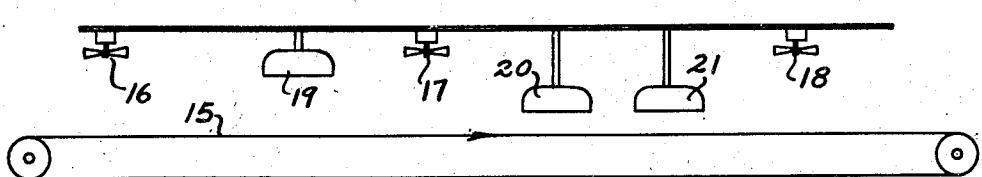
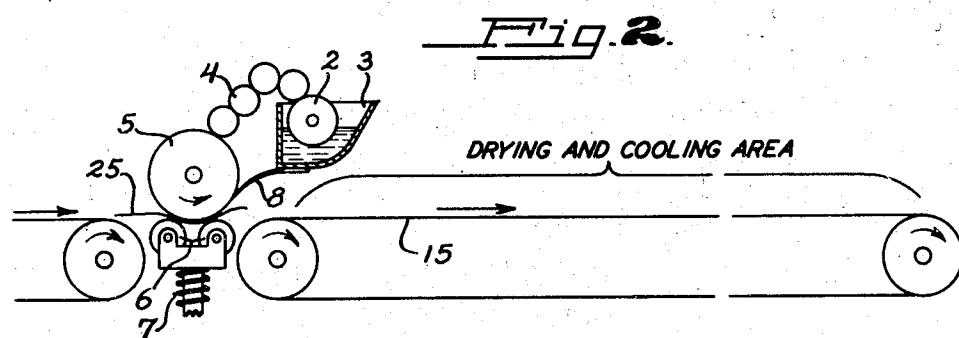
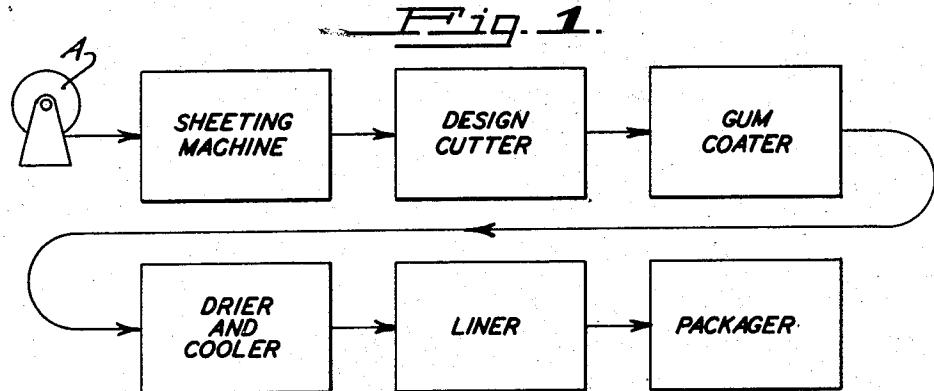
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2,427,447

COMBINED STENCIL SHEET AND LINER

Filed Dec. 6, 1943

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

Fig. 4.

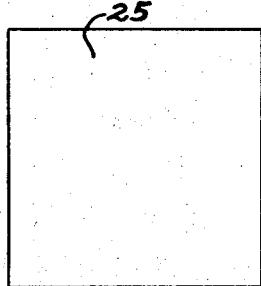


Fig. 5.

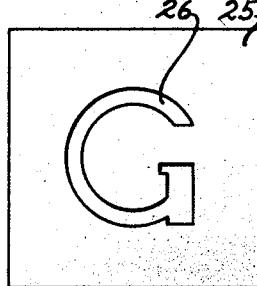


Fig. 6.

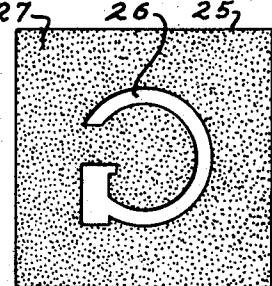


Fig. 7. 28,

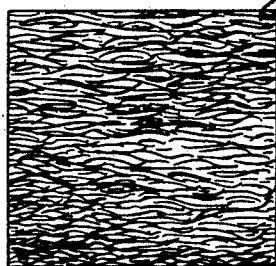


Fig. 8.

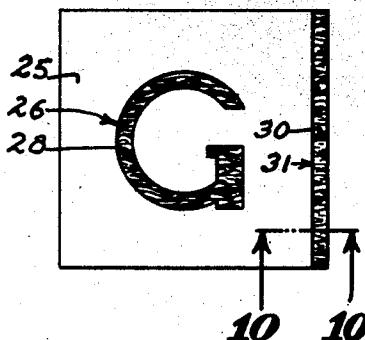


Fig. 10.

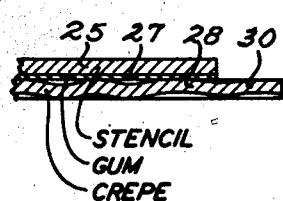


Fig. 9.



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## UNITED STATES PATENT OFFICE

2,427,447

## COMBINED STENCIL SHEET AND LINER

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Application December 6, 1943, Serial No. 513,141

1 Claim. (Cl. 101—128.2)

1

This invention relates to stenciling, and more particularly to improvements in stencils having a permanently tacky, pressure-sensitive, adhesive surface adapted to be positioned on a surface to which a design or lettering is to be applied, and a novel process for manufacturing said stencil.

Stencils, characterized by a permanently tacky adhesive surface, are difficult to manage because of the inherent tendency of the gummed surface to stick to adjacent objects during packaging, transfer, and application. For example, if the stencils were rolled up to form a compact package or were superposed one on the other, the gummed surface would adhere to the ungummed back surface of the stencils. The unprotected gummed surface would dry out after a period of time in storage and impair the useful life of the stencil. Hence a protective cover sheet or liner is used to cover the tacky surface of the stencil sheet. However, where a protective cover or liner is provided for a stencil having a permanently tacky pressure-sensitive surface and then the stencil design is cut therethrough by means of pressure die cutting or stamping, the adhesive is forced into the liner and removal of the liner from the stencil is not only difficult but many times results in damage to the design cutouts.

The objects of the present invention are to improve, generally, stencils and the method of manufacturing them. More specifically, the objects of the invention are to provide a stencil having a protective covering for the permanently tacky adhesive surface, which can be easily and readily removed prior to the application of the stencil to the work surface without danger of damage to the stencil; to provide a stencil having a protective covering for the tacky surface which prevents deterioration of the adhesive material and materially prolongs the useful life of stencils, thereby enabling long storage prior to use; to provide a stencil adapted to be packed compactly for storage and shipment without cohesion of the tacky surface thereof to adjacent stencils or portions of stencils packed therewith; to provide a method of manufacturing stencils at mass production line tempo; and to provide a method of manufacturing stencils which materially reduces the quantity of adhesive cement necessary to treat a given number of stencils than was heretofore the case. Other objects and advantages will become apparent upon reference to the accompanying specification and drawings annexed hereto and forming a part hereof.

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In the drawings, wherein similar characters of reference represent corresponding parts in the several views:

Fig. 1 is a diagrammatic flow sheet of a preferred method of practicing the invention.

Fig. 2 is a diagrammatic showing of a preferred form of gum coater useful in practicing the invention.

Fig. 3 is a diagrammatic showing of the relative positions of fans and drying units.

Fig. 4 is a plan view of a blank stencil sheet.

Fig. 5 is a plan view of a stencil sheet having a design cut-out provided therein.

Fig. 6 is a plan view of the gummed surface 10 of a stencil sheet having a design cut-out provided therein.

Fig. 7 is a plan view of a liner sheet.

Fig. 8 is a plan view of the stencil sheet and attached liner, showing the liner extending beyond a marginal edge of the stencil sheet.

Fig. 9 is a perspective view, illustrating the preferred manner of removal of liner from stencil sheet.

Fig. 10 is an enlarged sectional view, taken on 25 line 10—10 of Fig. 8.

The essence of this invention is the provision of a special protective, disposable covering for the tacky surface of the stencil sheet which can be removed easily from the stencil sheet without damaging the same. The protective covering, hereinafter referred to as the liner, is formed of a heavy creped paper provided with a hard, waxy surface. The liner sheet is characterized by the large number of pronounced ridged rugosities, the longitudinal axes of which lie in substantially a common direction. The creping or crimping of the liner and hard finish thereof are produced during manufacture in varying manners well known in the paper making trade.

In my invention the stencil sheet is usually formed of a low-cost, long-fibred, thirty-pound, kraft paper. The stencil sheets are cut and the desired lettering or stencil design cut-out is cut in the stencil sheet before a permanently tacky, 40 pressure-sensitive adhesive is applied to one surface thereof. Any adhesive having a permanently tacky surface may be utilized in my invention, preferably a rubber base cement having a liquid consistency approximate to that of milk 45 is used.

The rubber base is mixed with a suitable solvent, such as a petroleum or coal tar solvent, which will dry rapidly and yet which flows readily and spreads over the surface of the paper 50 being coated. After application of the viscous

adhesive to the stencil sheet the adhesive is dried so that it presents a permanently tacky, pressure-sensitive surface, the liner sheet is then positioned over the tacky surface of the stencil, and the stencil is then in readiness for packaging and use.

Referring to Fig. 1, there is disclosed a diagrammatic flow sheet, showing the steps in producing my improved stencil. The stencil paper, usually in the form of a roll A, is first sheeted, i. e. cut into sheets of the proper size, in any suitable manner. Then the stencil sheets are die cut, stamped or otherwise provided with the desired lettering or design. One surface of the stencil sheet is then coated with a permanently tacky, pressure-sensitive adhesive. The adhesive is then suitably dried, preferably by infra red ray lamps and power fans, cooled, and a liner sheet positioned over the adhesive surface of the stencil sheet. The stencil sheets, having liners attached, may then be packaged for shipment and use.

Fig. 2 shows a roller coating apparatus suitable for applying an adhesive cement to the stencil sheets. The roller coater comprises a train of rollers, wherein a dipping roller 2 is submerged in an adhesive bath contained in receptacle 3. Driving and distributing rollers 4 form a train to drive the applicator roller 5. Stencil sheets 25 are compressed against the applicator by seating rollers 6, mounted, as at 7, for adjustable compression against the applicator 5, as the said sheets travel between the seating rollers and applicator to be stripped and guided by steel fingers 8 for conveyance on conveying belt 15 under the drying lamps and fans.

Fig. 3 shows the drying area of the conveyor belt 15 which comprises a plurality of fans 16, 17 and 18 positioned perpendicularly to the conveyor belt and a plurality of banks 19, 20 and 21 of infra red ray lamps. A drying area suitable for practicing the present invention comprises about thirty-nine to forty feet of conveyor belt, above which are positioned the fans and drying lamps above noted.

By a plurality of power fans, or other suitable means to impart circulatory movement to the air, and infra red ray lamps arranged in substantially the manner indicated in Fig. 3, I have found an efficient manner of drying and cooling the stencil sheets in readiness for application of the liner, it being remembered that the adhesive is extremely viscous during application thereof to the stencil sheets.

The arrangement of power fans and infra red ray lamps herein illustrated and described has been found practicable with a thirty-nine foot drying area from applicator to packaging, and wherein the conveyor belt travels at a constant speed calculated to subject the wet stencils to the lamps and fans on the average of about twenty minutes.

Fig. 3 shows fan 16 positioned perpendicularly to the belt at a vertical distance from the said belt sufficient to prevent the wet stencils from being blown from their position on the conveyor belt surface. Approximately ten feet from the applicator is positioned the first bank of infra red ray lamps 19 which covers approximately three feet of the conveyor belt. Power fan 17 is spaced from lamps 19 and is suspended at about the same height perpendicularly from the belt as is fan 16. There is a space of approximately ten feet between bank 19 and bank 20, and about two feet between banks 20 and 21. Power fan 18 is spaced from bank 21 and suspended in the

same manner as are fans 16 and 17. There is a space of approximately eight feet from bank 21 to the point where the stencil sheets are provided with the liners. The last mentioned space 5 between bank 21 and the place of liner attachment is to allow the adhesive cement to cool after being subjected to rather high temperatures while under the infra red ray lamps.

I have found that under normal circumstances 10 of humidity, room temperature, and normal viscosity of the adhesive applied to the stencils, the adhesive should be subjected to drying and cooling for approximately twenty minutes, as based on a drying and cooling arrangement herein 15 illustrated. Under varying conditions of room temperature, humidity, adhesive viscosity, and manner of adhesive application to the stencil, the time for drying and cooling may vary from between fourteen and twenty-eight minutes under a drying and cooling arrangement as herein 20 illustrated. By regulating the surface speed of the conveyor belt 15 I can control the time the adhesive is subjected to the drying and cooling apparatus.

25 It is noted that the infra red ray lamp banks are of a conventional type which may be purchased through regular channels of commerce. I have found the lamps made by the Fostoria Company of Ohio to be satisfactory. Each bank 30 houses twenty-four lamps, the interior of the housing or reflector shield being gold-plated.

Bank 19 is vertically spaced from the surface 35 of the conveyor belt approximately two and one-half times the distance of banks 20 and 21 in order that the applied adhesive, which is very viscous immediately after application, will not be damaged by the heat emitted by the first bank 19. As I have above mentioned, the adhesive mixture applied to the stencil by means of 40 the applicator has a fluid consistency approximately that of milk.

For purpose of example, the following adhesive formulae are applicable in coating stencil sheets as herein described:

*Example 1*

Rubber	parts..	100
Fillers	do	40
Resins, (wood rosins, ester gum, etc.)	do	60
Anti-oxidant	1% (of rubber content)	

*Example 2*

Reclaim rubber	parts..	180
Fillers	do	30
Resins (natural or synthetic)	do	65
Anti-oxidant	75% (of rubber content)	

*Example 3*

	Parts	
60 Synthetic rubber	100	
Fillers	100	
Plasticizers	20	
Resins (natural or synthetic)	40	

65 In all of the examples I have set forth, the materials are milled by means of a conventional rubber mill for approximately fifteen minutes. Then the materials are put into a suitable mixture together with conventional rubber solvents, such as petroleum or coal tar solvents, and mixed 70 together to place the adhesive mass in the proper solution. The desired viscosity or fluid consistency may be measured by determination of the solid contents of the adhesive solution. For example, solid contents should range between 75

5%–40% and 95%–60% of solvents, while best results are usually obtained when the solid contents are from 5%–15% and solvent contents between 85%–95%.

A standard Beaumé viscometer may be utilized having readings from 30 to 65 at temperature of 60° Fahrenheit. Probably the normal reading for a proper mixture of the adhesive under normal conditions and circumstances would be 49 Beaumé.

It is pointed out that the above formulae are practicable, but the instant invention may be practiced with many varying adhesive mixtures suitable to produce a pressure-sensitive adhesive, as for example, pressure-sensitive adhesives produced from synthetic resins.

Referring to the novel stencil per se, Fig. 4 illustrates a sheet of stencil paper prior to the design being cut therein. The stencil sheet, generally indicated at 25, is usually a low-cost, long-fibered, light, kraft paper.

Fig. 5 shows the stencil sheet 25 with the cut-out design 26 provided therein.

Fig. 6 shows the stencil sheet 25 provided with a coating of pressure-sensitive adhesive 27. The pressure-sensitive adhesive is applied to one surface only of the stencil sheet by means of the roller applicator, or, if desired, by means of spraying, scraping, or the like.

Fig. 7 shows a liner sheet 28 formed of a heavy, hard-finished, creped or crimped paper, wherein the longitudinal axes of the rugosities lie in a substantially common direction. The liner sheet 28 is preferably slightly larger than the stencil sheet in order to provide a finger-hold to facilitate removal of the stencil sheet therefrom.

The marginal finger-hold is illustrated at 30, in Fig. 8, as extending beyond the edge of stencil sheet 25. Preferably, the liner sheet is cut so that the marginal extension or finger-hold 30 extends beyond the margin of the stencil sheet to present an exposed surface of the said liner wherein the longitudinal axes of the liner rugosities are at right angles to the adjacent overlapped edge 31 of the stencil sheet. In this manner the stencil sheet may be removed easily from the liner in the direction of the axes of the said rugosities, and thereby prevent damage to the design cut-out during removal of the stencil caused by adherence of the delicate portions of the cut-out design to the liner.

Fig. 9 illustrates the manner of removal of the stencil with the "grain" of the liner, that is, the liner is pulled away from the stencil in the direction of the longitudinal axes of the creped or crimped rugosities formed therein.

Fig. 10 shows a sectional view of a stencil sheet and liner attached thereto and illustrates the ridges only of the creped paper in contact

with the adhesive coating on the stencil, the depressions between the ridges being free from contact with the adhesive surface of the stencil. There is less area of surface contact between

5 the adhesive surface of the stencil and liner than is the case when utilizing various other types of liner materials. It is noted that the liner sheet 30 may be utilized as a slip sheet for transferring the stencil sheet on to the work surface in the conventional manner of applying stencil patterns to irregular or sticky work surfaces, and the like.

I have provided a method of manufacturing stencils, whereby large quantities of adhesive material may be saved and whereby a stencil, in readiness for use, is produced having a liner sheet attached for the purposes hereinabove mentioned, which is easy of removal without damage to a more or less fragile stencil design. 15 The dangers of damage to stencils, particularly large stencil sheets having intricate designs provided therein, have in the past been an extremely vexatious problem. The present invention obviates this difficulty.

20 While I have described my invention in more or less detail for purposes of clarity of description, it is understood that modifications and variations may be made within the spirit of the invention and the scope of the appended claim.

30 I claim:

A stencil sheet having a design cut-out provided therein, a pressure-sensitive adhesive provided on one surface of said stencil sheet, and a heavy, hard-finished, creped paper liner positioned over the gummed surface of said stencil sheet in such a manner that a portion of the said liner sheet extends beyond a marginal edge of the said stencil sheet to facilitate removal therefrom, the said creped paper having pronounced rugosities, the longitudinal axes of which lie substantially in a common direction and perpendicular to the extended edge of the liner sheet and which said direction constitutes the line of removal of the stencil sheet from the liner sheet.

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50 The following references are of record in the file of this patent:

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