Jan. 5, 1954 C. K. HEASLEY 2,664,818

STENCIL AND BACKING UNIT

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Fig. 1

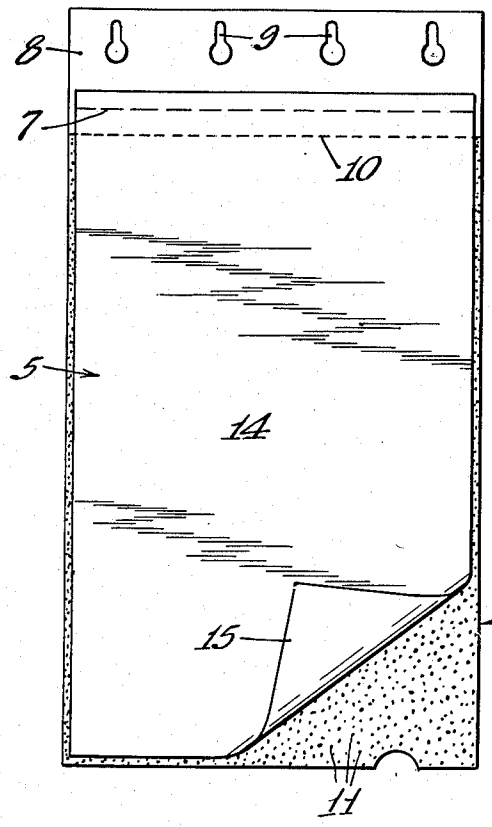


Fig. 2

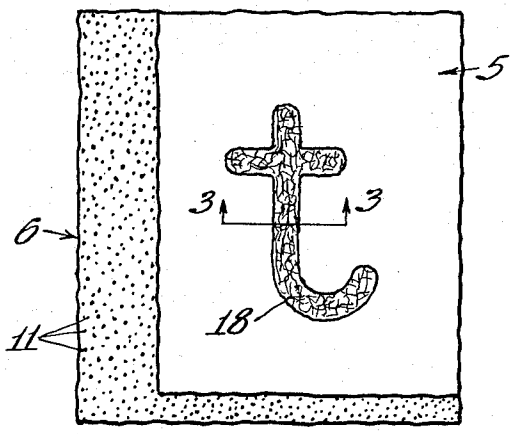


Fig. 3

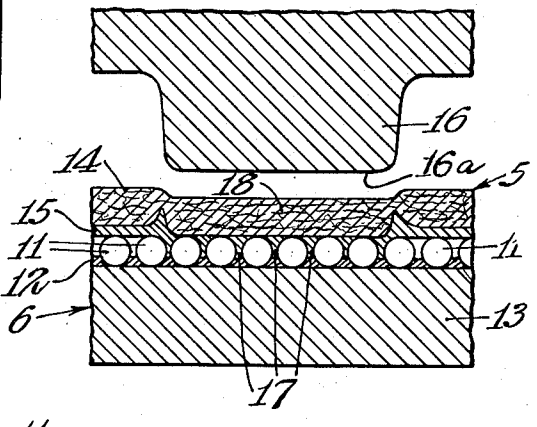
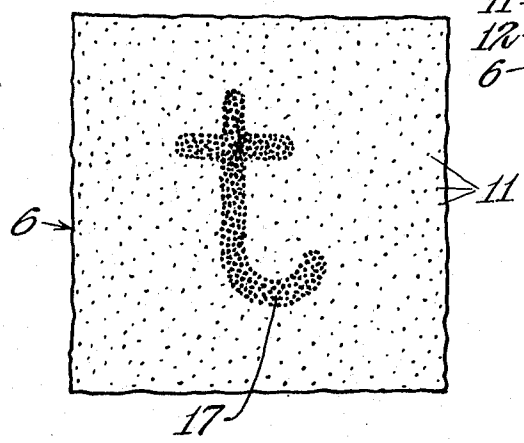


Fig. 4



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STENCIL AND BACKING UNIT

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6 Claims. (Cl. 101—128.2)

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This invention relates to the art of forming stencils such as those used in duplicator machines and particularly to a stencil and composite backing sheet wherein a surface composed of a multiplicity of minute, substantially spherical protuberances affords a substantially uniformly level but discontinuous support for the stencil during the typing and other stencilizing operations.

Most of the commercial stencil sheets for use in duplicator machines have been composed of thin tissue paper, such as Yoshino, coated with a wax or other pressure displaceable composition to render them impervious to ink. During the stencilizing of such sheets it has been customary to place a cushion of tissue paper, either plain or coated, in contact with the back face of the sheet and to back the cushion in turn with a smooth, hard surfaced film or sheet of paper. The group of sheets thus arranged is placed in a typewriter which is operated to cause the type to strike the stencil sheet and thereby dislodge the wax or other ink-impervious substance from the areas of the impressions. From these areas the ink-impervious substance is either displaced laterally or is caused to adhere to the cushion, leaving the stencil characters permeable to ink.

By the present invention I obviate a number of difficulties which are attendant upon the use of such backing materials. Due to the relatively irregular fibrous consistency of the cushion sheet the resulting stencil characters are not uniformly clear and the quality of the work subsequently performed by the duplicator machine through the stencil is also relatively irregular. There is also a tendency for the type to cut through the fibers of the stencil sheet where there is a continuous, relatively hard surfaced backing, thus completely separating the areas bounded by the closed loops of characters such as *a, e, o,* etc. The wax or other coating for stencils of this kind is usually dyed a dark color and enough of the displaced colored material remains on the areas of the impressions to make the stencil characters poorly legible until after the cushion carrying the dislodged material has been separated from the stencil sheet. Consequently the stencil is not easily legible for proof-reading without removal from the typewriter and this makes it relatively difficult to correct errors. Further difficulties are sometimes encountered when it is attempted to write or draw with a stylus on the stencil sheet because of the softness of both this sheet and the cushion tissue.

It is an object of the present invention to provide a stencil with an improved backing in which a multiplicity of substantially uniform, smoothly

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rounded segments are utilized to support the sheet during the stencilizing operation.

A particular object is to produce more clearly defined stencil characters by providing a stencil backing having directly opposed to each type face a multiplicity of substantially uniformly spaced, smooth, spheroidal protuberances in contact with the stencil sheet and having recesses between the several protuberances into which all of the pressure-displaceable, ink-impervious material from the stencil will pass readily in the stencilizing operation.

Another object is to provide a stencil backing of such durable character that it may be used a large number of times, having durable, smooth, spheroidal glass or vitreous protuberances from which the wax or other substance displaced from the stencil sheet may be readily removed by the application of a solvent.

A further object is to provide a stencil backing from which sufficient light is reflected through the porous areas of the impressions to render the stencil characters easily legible without separation of the stencil sheet from the backing.

Other objects are to provide a stencil backing which minimizes the cutting of the stencil fibers, minimizes damage to the type during the cutting operation, facilitates free-hand writing and drawing on the stencil sheet and affords a durable, permanent record of the document reproduced on the stencil.

My composite backing has a facing composed of a single layer of hard, globular particles of substantially uniform size. These particles are securely bonded individually to a flexible backing by a suitable adhesive. To insure an adequate bond the adhesive is carefully selected for its resistance to impact as well as its adhesion to the particles and backing sheet. Care is exercised to submerge each spheroidal particle in the adhesive to a depth not exceeding one-half its diameter and preferably between 30% and 50% of its diameter. This affords recesses of adequate capacity between the protruding segments to receive the wax or other material dislodged from the stencil. It will thus be evident that a large number of the recesses extend beneath the overhanging peripheries of the spheroidal particles. The facing layer is preferably composed of particles of one of the smaller sizes, for example, bead sizes No. 15 to No. 19. Equivalent average particle diameters are approximately as follows:

Bead size:	Diameter in microns
15	.58
17	.43
19	.24

Facing particles of these sizes, ranging from approximately .001 inch to .003 inch, are particularly adapted for use where the stencilizing is to be performed on a typewriter having type faces ranging from about .01 to .015 of an inch in width.

Excellent results have been obtained by forming the globular particles for my purpose from a lime soda glass, such as that commonly used in the manufacture of glass containers and window panes. Other materials having suitable surface qualities and adequate resistance to crushing for my purpose are metals, metal alloys, ceramic material and synthetic resins. As the support or backing for the globular particles a paper may be used, such as wood pulp or rope paper of twenty pound or heavier weight, a seventy pound paper being preferred for use with most wax coated stencil sheets. It will be understood that such weight designation represents the weight of a ream of the paper, i. e., 480 sheets of size 24 inches by 36 inches. Other materials which may be substituted for the paper backing are sheets of rubber or rubber derivative or a suitable synthetic resin film.

Where the composite sheet is to be used with a stencil sheet impregnated with a wax or other material of dark color, I provide either a backing or an adhesive containing a white pigment or of a light color and I use clear or light colored glass or white particles as a facing, thus affording maximum contrast between the dark wax or other substance displaced and the backing to which such substance adheres. A dark backing or dark adhesive is supplied for use with white or light tinted stencil sheets. This improves the legibility of the stencil characters when read against the backing for the detection of errors and also the legibility of the characters on the backing when the latter is used as a permanent record sheet.

The adhesive may comprise a suitable glue or a rubber or synthetic elastomer composition, or a thermo-setting synthetic resin, such as phenol-aldehydes, urea-formaldehyde, melamine aldehyde, thio urea-formaldehyde, alkyd resins, etc., or mixtures of such resins or a suitable thermoplastic resin. Most highly plasticized resins and unmodified starches have insufficient bonding strength for my purposes. The adhesive must be chemically inert with respect to the stencil sheet with which it may be in contact for long periods of time.

In cases where the backing is to be used repeatedly its components comprising the supporting sheet, adhesive and globular particles must be chemically inert with respect to the solvents that may be used in removing the wax or other deposits from previous stenciling operations. For example, with wax coated stencils ether or alcohol may be applied to the glass sphere coated backing to remove deposits of wax therefrom and in this case the adhesive bond and supporting sheet or film must be inert to these solvents.

My improved stencil backing material may be prepared by either of several known methods which have been employed in the manufacture of coated abrasive material. For example, the solid globular particles may be dropped upon a flexible backing upon which there is a surface coating of a suitable adhesive of the requisite thickness and the excess particles may then be removed. As the next step, before the adhesive has set, the coated web may be passed between accurately spaced nip rolls which level the tops of the globular particles and submerge them to the required depth in the adhesive. After the adhesive has set a second or sizing coat may be spread over the particles in order to more firmly secure them to the flexible backing or to impart a surface which will increase the tendency of the displaced stencil material to adhere to the face of the backing. The sizing coat may be applied by means of a roll partially immersed and revolving in a pan of sizing material and contacting with the coated surface of the web, or by spraying with a sizing solution, or by any other suitable means.

Other methods of applying solid particles to a backing which may be adapted to the manufacture of my composite stencil backing are those described generally in Carlton Patent No. 2,318,570. Such methods are particularly adapted to secure uniform spacing of the particles by reason of the dispersing action resulting from the electrical charges imposed upon the particles. To accurately level the tops of all particles and to submerge their lower portions to the required depth in adhesive the freshly coated web may then be passed beneath a nip roll which is accurately spaced from another machine element in contact with the flexible backing so that the spacing of these machine elements corresponds to the overall thickness of the product. Finally the globular particles are retained at this controlled depth in the adhesive and with their tops uniformly level during the setting of the adhesive.

Where, as is usually the case, closely spaced points for contact with the stencil are desirable, care is taken to crowd the particles together leaving only a thin film of adhesive between their adjoining peripheries. The resulting product possesses the highest degree of uniformity because the number of points of contact afforded by the protruding spherical segments over a given area is determined by the accurate grading of the particles themselves for size.

To illustrate an exemplary embodiment of the invention, and not to limit it, reference is had to the accompanying drawing in which:

Figure 1 is a plan view showing my improved stencil sheet and backing unit;

Fig. 2 is a magnified plan view showing a fragmentary portion of the stencil sheet and backing on which a type impression has been made;

Fig. 3 is a further magnified section taken on the line 3—3 of Fig. 2 and illustrating the cooperative relationship between the stencil and backing, as well as preferred details of the backing, and

Fig. 4 is a fragmentary plan view showing a fragment of the face of the backing on which wax or other ink-impervious material from a stencil has been impressed by a type, also on an enlarged scale.

In the drawing a stencil sheet, indicated generally by the numeral 5, is shown in assembled relation to my improved backing, indicated generally by the numeral 6. These elements may be joined together in the usual manner by a narrow band of adhesive 7 extending along the upper margin of the sheet 5, in spaced relation to the upper edge of the backing 6, thereby leaving a margin 8 of the backing 6 which projects to facilitate the fastening of the stencil sheet to its support in the duplicator machine. Keyhole shaped perforations 9 in the margin 8 are provided to receive lugs on the cylinder or other stencil supporting element of the machine. To

facilitate the necessary separation of the impression part of the backing 6 from its margin 8 a line of perforations 10 is formed therein below and adjacent to the band of adhesive 7.

As shown in detail in Fig. 3, my improved backing sheet has a facing composed of a single layer of minute, spheroidal particles 11 which are secured by means of a coat of adhesive 12 to a flexible supporting sheet 13. As hereinbefore described, the particles 11 preferably comprise minute spherical or spheroidal glass particles of substantially uniform size, substantially uniformly distributed to afford a level but discontinuous surface for contact with the stencil sheet 5. Each of these particles is submerged in the adhesive 12 to a depth of from 30% to 50% of its diameter so that recesses are provided between their protruding segments of sufficient capacity to receive all of the ink-impervious coating material that is to be displaced from the stencil sheet 5 over the areas of the impressions. The stencil sheet 5 has a tissue paper base 14, composed of long fibers and coated on its face adjacent the particles 11 with an ink impervious material 15 which may be a wax, a mixture of waxes or other suitable pressure displaceable substance.

To prepare the stencil sheet 5 to duplicate typewritten matter the assembly comprising this sheet and the backing 6, shown in Fig. 1, is placed on the platen of a typewriter as for ordinary typing and, with the inking mechanism inoperative, the machine is operated in the usual manner to type the subject-matter on the uncoated face of the stencil sheet. During this operation the keys apply sufficient pressure upon the areas of the type characters to displace the ink-impervious material 15 from the fibrous base 14 into the recesses between the protruding segments of the spherical particles 11. This is illustrated in detail in Fig. 3 wherein a fragmentary portion of a type is indicated at 16 in cross section and greatly magnified. A face 16*a* of the type is shown withdrawn slightly from the area of the impression and is representative of the width, usually .01 to .015 inch, of the ordinary type faces approximately to the same scale as that of the backing 6 which is also shown in this view. Pressure thus applied causes the coating material 15 to be displaced into the recesses between the globular particles 11, as indicated at 17, leaving the fibrous stencil area 18 pervious to ink. In Fig. 2 this pervious area 18 of one of the type characters, viz.: the letter *t*, is shown in plan view and in Fig. 4 the displaced material 17 is indicated on the sphere coated backing sheet 6.

Uniformly well defined stencil characters are obtained by reason of the fact that the ink-impervious material is allowed to escape from the entire area of each impression into the uniformly distributed recesses of adequate capacity between the rounded protuberances of the facing particles. This will be understood when it is considered that the face 16*a* of each type character is opposed by a large number of minute, smoothly rounded protuberances which support the fibers of the stencil base 14 without cutting them, while directing the displaced material 15 into the immediately adjoining recesses. Damage to the typewriter keys is prevented not only by the cushioning effect of the stencil material but also by the smooth, non-abrasive character of the protuberances and the large number of them which oppose each type face.

My improved backing coacts with the stencil sheet in a similar manner to produce clearly defined, pervious areas when the impressions are made by a stylus, as in free hand writing and drawing on the sheet 5. In this case the smoothly rounded, hard surfaced, protuberances formed by the particles 11 afford a support which allows the stylus to glide smoothly over the stencil without severing or detrimentally disturbing the fibers comprising the base 14.

As long as the backing remains in contact with the stencil the work thereon is clearly legible by reason of the fact that my preferred transparent glass particles are excellent reflectors of light which coact with the white or light colored backing to illuminate the pervious areas formed by the impressions, notwithstanding the presence of the network of fibers remaining in these areas. Moreover, legibility is improved even when the spheroidal particles are composed of opaque material of a color which contrasts with that of the stencil sheet because the smoothly rounded protuberances deflect the displaced wax into the adjoining recesses which are uniformly distributed and have sufficient capacity to insure exposure of the tops of the particles in contact with the fibrous network of the stencil. Consequently proof-reading and the making of corrections without removing the stencil and backing from the typewriter is facilitated by the present invention.

The displacement of the wax or other ink-impervious substance into the recesses of the backing 6 is so uniform and complete that this product is adapted to constitute a clearly legible, permanent record of the subject-matter impressed on the stencil. It is more durable than most record papers and ordinary rubbing of the sphere coated face does not remove or otherwise affect the legibility of the impressed deposits. In the event that the backing is not needed as a permanent record, a substantial saving in the cost of the duplicating may be effected by repeated use of the same sphere coated backing sheet. To remove previous deposits it is only necessary to apply a solvent for the wax or other deposited substance by suitable means such as a cloth or brush. Such cleaning is greatly facilitated where the surface to be cleaned is composed of my preferred, smooth, spheroidal protuberances of glass or of other globular particles which are similarly devoid of abrasive points and edges.

The discontinuous nature of the surface of my improved stencil backing affords a multitude of minute recesses between the adjacent spherical particles and when the stencil sheet is hit by the type face or otherwise impressed as by a stylus these recesses serve to accommodate the fibers of the stencil sheet and to prevent the cutting of these fibers, thus eliminating the cutting out of closed loops of characters such as the letter "O," which is one of the above noted defects of the prior constructions utilizing a smooth backing sheet. Accordingly the use of my improved stencil backing not only results in improved stencils when used with stencil sheets of special long fiber tissue paper, but also make possible the use as a stencil sheet of less expensive tissue paper with shorter fibers which would not be satisfactory for use with the smooth continuous surfaces of the backing sheets previously used.

What I claim is:

1. In combination, a stencil sheet upon which pervious areas may be formed by the application of pressure and without perforating the sheet

and a backing for said sheet comprising a multiplicity of minute globular particles of substantially uniform size having rounded segments protruding in contact with said sheet and in spaced relation to each other, a flexible support for said particles and an adhesive bonding said particles to said support, said particles being submerged in the adhesive to a depth not exceeding one-half their diameters.

2. In combination, a stencil sheet upon which pervious areas may be formed by the application of pressure and a backing for said sheet comprising a multiplicity of minute globular, glass particles having rounded segments protruding in contact with said sheet and in spaced relation to each other, affording a substantially level but discontinuous supporting surface for said stencil sheet, a flexible support for said particles and an adhesive bonding said particles to said support.

3. In combination, a stencil sheet upon which pervious areas may be formed by the application of pressure and a backing for said sheet comprising a single layer of substantially spherical particles of substantially uniform size, the diameters of which do not exceed .003 inch and each having a rounded segment protruding in contact with the stencil sheet, affording a substantially level but discontinuous supporting surface for said stencil sheet, a flexible support for said particles and an adhesive bonding said particles to said support.

4. In combination, a stencil sheet composed of a fibrous base carrying pressure-displaceable coating and a backing for said sheet comprising a single compact layer of spheroidal particles of substantially uniform size having smooth, rounded segments protruding in contact with said sheet, affording a substantially level but discontinuous supporting surface for said stencil sheet, the diameters of said particles being not larger than .003 inch, a flexible support for said particles and an adhesive bonding said particles to said support and submerging them to a depth not exceeding one-half their diameters, the space between protruding segments of said particles

being adapted to receive the coating displaced from said sheet by stencilizing pressure.

5. In combination, a stencil sheet composed of a fibrous base carrying a coating of pressure-displaceable wax and a backing for said sheet comprising a single compact layer of spheroidal glass particles of substantially uniform size, each having a smooth, rounded segment protruding in contact with the wax coated surface of said sheet, a flexible support for said particles and an adhesive bonding said particles to said support and submerging them to a depth of from 30% to 50% of their diameters, the space between protruding segments of said particles having capacity sufficient to contain all of the wax displaced from said sheet by stencilizing pressure.

6. A stencil sheet assembly comprising a type and stylus impressible stencil sheet having a base tissue of interlaced fibres impregnated with a pressure-displaceable coating, and a backing for said stencil sheet having one surface formed by a layer of small, hard, elastic bodies set in spaced relation in a plastically deformable adhesive, said bodies having rounded projections adapted to contact the stencil sheet and defining interspaces for reception of the fibres and of coating material expressed during stencilization.

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