

March 25, 1958

H. LIPSIOUS

2,827,727

EXPANDABLE BEADED DECORATIVE PRINTING

Filed April 19, 1956

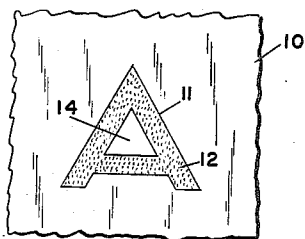


FIG. 1.

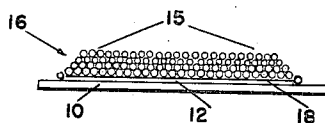


FIG. 2.

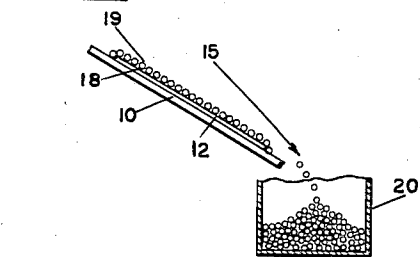


FIG. 3.

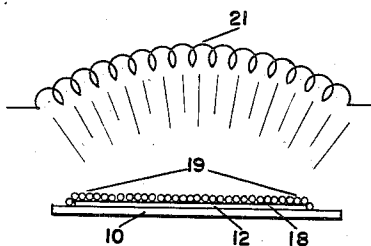


FIG. 4.

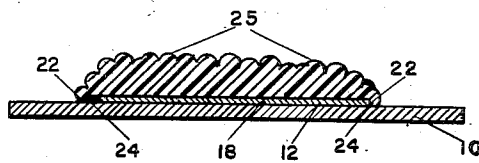


FIG. 5.

INVENTOR.
HERBERT LIPSIOUS.

BY *F. R. Jenkins*
ATTORNEY.

1

2,827,727

EXPANDABLE BEADED DECORATIVE PRINTING

Herbert Lipsius, Brooklyn, N. Y.

Application April 19, 1956, Serial No. 579,350

7 Claims. (Cl. 41—24)

This invention relates to decorative printing such as for greeting cards but it will become apparent herein-after that greeting cards are only one example to which the invention is applicable.

In the graphic arts it is often desirable to have a design or printed matter stand out physically in relief. With special equipment, thin stock to carry the design may be embossed. When thicker stock is to be used embossing is too expensive except for a few specified uses. It has been proposed to applique cut out letters when much relief is desired. This too, has been found too expensive for general usage. A small amount of relief is obtained by engraved printing and so-called imitation engraving or thermographic raised printing wherein a fine fusible dust is applied to wet ink and is subsequently melted so that the dust particles coalesce and form a smooth but only slightly raised surface.

I have also proposed in my co-pending application, Serial Number 569,131, filed March 2, 1956 to lightly adhere glitter particles, sometimes beads, to paper stock and then dust the beads with raised printing powder and fuse the powder to adhere the beads together. This procedure can hardly ever give heights of more than three bead diameters and the greater the bead diameter, the more difficult the adhesion of the bead to the stock, and the greater the decrease in flexibility.

To overcome the objections above mentioned and obtain relief of the order of $\frac{1}{16}$ inch and more I adhere expandable or puffable beads to stock in the intended design or printing and then expand the beads.

Expandable or puffable free-flowing spherical beads are known commercial products. They are generally made from thermoplastics in which is incorporated an expanding or puffing agent which causes the bead to expand when heated. Such expandable compositions are described in United States Patent No. 2,681,321, issued June 15, 1954. They are described in detail in "New expanded plastics," *Plastics (London)* 17, 313, November 1952, and in "Pop-corn plastic," *Modern Plastics* 31, 190 (May 1954). One such plastic in bead form is sold by Koppers Company, Inc., Pittsburgh, Penna., under the name "Dylite" the body of which is polystyrene, and can be expanded to about 30 times its original volume by heating for about a half a minute at about 225° F. In my invention actual temperature need not be known for it is by far much easier merely to observe the expansion, regulate the heater to avoid scorching the paper and determine how long the beads must be heated to get the desirable expansion.

In the accompanying drawing showing, by way of example, one of many possible embodiments of the invention,

Figure 1 shows stock with adhesive applied in the form of an intended design;

Figure 2 shows stock and design covered with an excess of beads;

Figure 3 shows the removal of excess beads;

Figure 4 shows adhered beads subjected to heat, and

2

Figure 5 shows roughly the form assumed by the expanded beads.

For an example:

In carrying out my invention, adhesive 12 is applied to a sheet of stock 10 to form a design 11 as shown in Figure 1. The adhesive may be applied in any known manner, such as hand painting, stenciling as by silk screens, transfer from glue pots etc., so as to leave a wet or tacky surface.

While the surface of the adhesive is still wet or tacky a quantity of heat expandable spherical beads is applied to the surface 18 of the adhesive and the beads may pile up in a mound 16 as shown in Figure 2. The result is that the beads are secured to the adhesive in substantially a monolayer 19. By tilting the stock 10 substantially all the beads other than those of the monolayer will easily roll off and the excess caught in a vessel or trough 20 for reuse. The excess beads roll off even though the design is closed to leave an open space 14 (Figure 1) since the height of the adhesive is only a few thousandths of an inch thick, and the monolayer can hold back very few beads unless the angle of tilt is very slight. In practice, the normal movement of the stock is enough to dislodge any unadhered beads.

Spherical beads even in sizes down to about 80 mesh readily roll on most printing stock. This is in contrast to the action of flat surfaced glitter particles and thermographic raised printing powders which are held by a suction bond and must be removed by strong vacuum cleansing or some form of sweeping action.

The monolayer of beads adhered to the stock is then subjected to heat, as under a radiant heater 21, where the beads begin to expand somewhat as shown in Figure 4. After expansion the beads appear somewhat as in Figure 5. It is to be noted that the beads expand laterally to form marginal portions 22 which overreach the side edges 24 of the adhesive. This overhang is usually over $\frac{1}{16}$ inch on each side. The puffed up mound 25 of expanded beads is in fact not dense but contains microscopical small voids which render the expanded beads non-transparent and substantially opaque. The beads of course should not become truly melted so that surface tension of molten plastic would smooth out the surface of the mound 25. Moreover substantial melting of the plastic of the beads would permit loss of the expanding or puffing agent. As pointed out above, observation of the expansion or puffing up of the beads during the process is sufficient to indicate the degree of heating necessary.

Lateral expansion of the beads to form the overhanging portions is beneficial in several ways other than the reduction in number of beads required to cover a given area. One benefit is that the expanded beads cover films of adhesive that are liable to extend beyond the intended limits and which are so thin that the films are not effective for adhering beads. These films would become sticky, if glue is used, in the presence of moisture. Secondly, it is difficult to obtain an adhesive which will not be noticeable on the stock either due to difference in color or gloss.

Hence a minimum number of types of adhesives for a variety of stock colors and finishes is permissible and off-color cheap adhesives can be generally used. Thirdly, many adhesives which discolor with age and/or under heat (as is here required) yet are otherwise suitable may be used.

It will be realized that by my use of expandable beads complete coverage of the adhesive area in general is not necessary in the body of the design. This is important since silk screens may become plugged at points or the adhesive layer may not have been applied uniformly. If under such circumstances a few beads do not stick to the intended area, the lateral expansion will fill these spots.

Where lateral expansion is uninhibited it usually occurs at a faster rate than vertical expansion.

Since the lateral expansion is uninhibited, and the beads unsecured tend to expand spherically, the marginal portions of the puffed mound assume a lacy edge boundary.

As a specific example of my invention I apply fish glue which is thermosetting as the adhesive to paper stock, preferably through a silk screen. Those skilled in the art can easily determine the required viscosity of glue for a given screen.

The wet glue is then covered substantially completely with a layer of free flowing heat expandable spherical polystyrene beads of about 50 mesh. Beads having a bulk density of about 0.5 g./cc. and expandable at about 225° F. to a bulk density of about 0.025 g./cc. are satisfactory. The beads used were "Dylite" beads supplied by the Koppers Company as mentioned above, understood to be essentially polystyrene in which a highly volatile liquid is occluded, the liquid having little tendency to dissolve the polystyrene. The specific liquid was not known, but liquids used as expanding agents include such materials as petroleum ether and methanol. However, the composition of the expanding agent is of minor import since it is generally apparently non-reactive with the adhesive, ink or paper.

As one skilled in the art of printing, I have had no difficulty in obtaining satisfactory polystyrene beads when only physical properties are specified.

Preferably an excess of beads is spread over the glue, and stock, and the stock tilted to allow unadhered beads to roll off. Bead sizes of from 20 to 80 mesh are generally satisfactory.

After the beads are adhered by the glue the beads are heated for several seconds to expand same, but of course the heat treatment must not damage the stock. Ordinary stock is not damaged at temperatures necessary to expand beads normally expandable at 225° F.

While radiant heating from above is satisfactory, the stock with beads thereon may be disposed on a hot-plate or passed over a naked flame or even subjected to hot gases to expand the beads.

Sudden chilling of the hot beads is undesirable lest they tend to collapse. However the heating and cooling of the beads present no greater difficulties than are met with in conventional thermoplastic raised printing processes in allowance for variations in paper stocks and ink.

The invention claimed is:

1. A process for making greeting cards and the like bearing relief effects in design comprising applying a thermosetting adhesive compatible with polystyrene to card stock in the shape of a design; then applying solid free flowing polystyrene thermoplastic beads thermally puffable to a volume many fold over their pre-puffed size

to the adhesive in a substantially even layer thereon, and then applying heat to the beads sufficiently to puff up the beads and withdrawing the heat before the puffed beads melt, to form a relief design having laterally extended marginal portions of irregular lace-like appearance.

2. A process as claimed in claim 1, said adhesive being fish glue.

3. A decorative article comprising a sheet of paper stock; an adhesive on the stock in the shape of a design; and a relief design in the form of a substantially integral mound secured to the stock by the adhesive, said mound being of polystyrene thermoplastic material having irregular round bumps substantially all over the surface and lateral edge portions of the mound, the mound being substantially uniform throughout the interior but having a large number of microscopic voids to render the plastic opaque, said lateral edge portions projecting laterally past the adhesive in all zones thereof.

4. An article as claimed in claim 3 said adhesive being a thermosetting adhesive.

5. A process for producing relief effects in design comprising applying a thermosetting adhesive compatible with polystyrene to paper and in the shape of a design; then applying solid free flowing polystyrene thermoplastic beads thermally puffable to a volume many fold over their pre-puffed size to the adhesive in a substantially even layer thereon, and then applying heat to the beads sufficiently to puff up the beads and expand the beads laterally and withdrawing the heat before the puffed beads melt to leave a mound of puffed beads having closely spaced bumps protruding from the mound and paper in substantially all directions from the latter.

6. A process as claimed in claim 5 said beads being of between 20 and 80 mesh before being puffed.

7. An article as claimed in claim 3 the mound having a bulk density of the order of 0.025 g. per cc.

References Cited in the file of this patent

UNITED STATES PATENTS

1,739,492	Berndt et al.	Dec. 17, 1929
2,153,755	Higgins	Apr. 11, 1939
2,582,132	Kaphan	Jan. 8, 1952
2,644,883	Schoenherr	July 7, 1953
2,744,291	Stastny et al.	May 8, 1956

FOREIGN PATENTS

576,389	Germany	May 10, 1933
670,230	Great Britain	Apr. 16, 1952

OTHER REFERENCES

Plastic World, "Foaming-agent . . . polystyrene beads," page 4, March 1954.