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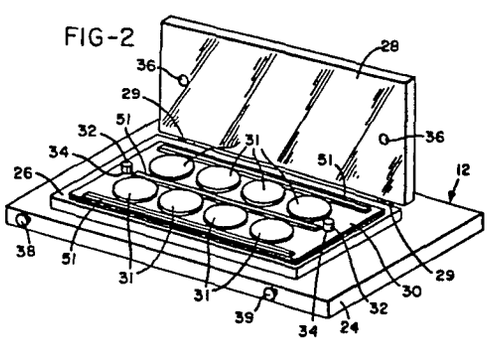
(54) **Method for making decorative emblems having an ultrathin coating of plastic.**

(57) The invention relates to a method for making decorative emblems, plaques, and panels, having an ultrathin coating of plastics material.

In one embodiment, the coating is provided by flow coating a clear, fluent plastics material onto the surface of a decorated substrate (31). The coated substrate is then pressed between surfaces of a pressure fixture (12) to produce the ultrathin coating. The upper surface (28) of the pressure fixture is smooth and does not stick to the plastics material so that no imperfections are introduced into the finished coating. After curing, the coated substrate is then formed by cutting and trimming operations into a finished emblem, plaque, or panel.

FIG-2



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METHOD FOR MAKING DECORATIVE EMBLEMS HAVING AN ULTRATHIN COATING OF PLASTIC

The present invention relates to a method for making decorative emblems, plaques, panels, and the like which have a cured plastic layer over a decorative surface, and more particularly to a method of flow coating a fluent plastic material onto a decorative substrate and applying pressure to yield an ultrathin coating.

Decorative plaques and emblems are widely used throughout a number of industries, including the appliance and automotive fields. In the past, a colored vitreous frit was flowed into a bronze substrate and fired at 676,7°C (1250°F). The glass-like vitreous enamel served to beautify the product and protect the decorative substrate from weathering should the plaque or emblem be exposed to the environment. However, such materials and techniques have become prohibitively expensive today. Alternative materials and processes are required which can produce a high gloss, non-yellowing, tough, weather-resistant coated emblem or plaque which can withstand the harsh environment an automotive exterior is subjected to and yet are low in cost.

Today, plastics are primarily used for producing such plaques and emblems. For example, in Loew, U.S. patent No. 3,654,062, there is disclosed a process for injection molding a decorative Mylar facing sheet over a vinyl plastic body. The plaque is coated with a layer of protective varnish on the outer surface of the facing sheet. Gits, U.S. patent No. 3,246,066, is similar in that male and female

molds are used to form a cavity into which a decorative foil is placed and into which a clear plastic material is injected. Prior to injecting a clear plastic material against the front face of the foil, the foil is precoated. Other molding processes such as compression molding (either one or two shot) are also well known in the art. See, for example, U. S. patents No. 2,244,565; 2,294,865; 2,931,119; 3,075,249; and 3,114,597.

Waugh, U. S. patent No. 4,100,010, discloses a process for producing decorative emblems in which a viscous plastic material is cast onto individual decorative foil shapes to form a meniscus. This meniscus when cured gives a lens effect to the top surface of the foil shape. However, a problem with that process is that despite an ability to vary the size and shape, it is not practical to later conform the as-cast emblems to nonplanar surfaces. Additionally, since the emblems are individually cast, the manufacturing process can be too time consuming and costly for some purposes.

In copending application Serial No. 054,548, filed July 5, 1979, and assigned to us, there is disclosed a flow coating process for producing decorative emblems or plaques. A viscous clear plastic material is flow coated onto a decorative substrate through a plurality of nozzle applicators, cured, and then the substrate is stamped or cut into individual emblems. However, even this process produces a relatively thickly coated substrate. Accordingly, the need still exists in the art for a process for producing a tough, weather-resistant decorative emblem having an ultrathin coating which is inexpensive to manufacture and can be easily formed to different three-dimentional shapes if desired.

The present invention meets that need by utilizing a flow coating process to apply a viscous, clear plastic material to a decorative substrate and then applying pressure to the substrate to form an ultrathin yet tough coated layer. Of course, the use of pressure by a flat surface against a cast plastic material is per se known. For example, Frankenthal, U. S. patent No. 2,294,865, teaches a process of molding decorated plaques under pressure. Holden, U. S. patent No. 2,459,279, coats plywood surfaces by casting a resinous material onto a platen and then pressing the platen against the plywood substrate. The resinous material has to be at least partially polymerized or "jelled" prior to being brought into contact with the substrate.

Likewise, flow coating per se is also known in a number of different art areas. Waugh, U. S. patent No. 4,092,953, discloses a process for flow coating glass containers. See also Suzuki patent No. 3,953,626. Other examples include U. S. patents No. 3,875,893 to Riley et al and 3,431,889 to Fraatz which both disclose the use of multiple orifice applicators to lay down a film of material onto a flat surface. Hansen, U. S. patent No. 3,725,112, also mentions flow coating as one possible method for producing a protective, low-glare, uniformly textured coating on a substrate such as wood, steel, hardboard, aluminum, and the like. But Waugh, Suzuki, Fraatz, Hansen, and Riley do not relate to emblem or plaque manufacturing processes where a clear plastic is applied to a decorative substrate.

Therefore, the need still exists for a method for coating an ultrathin layer of a clear plastic material onto a decorative substrate to produce emblems and plaques which are both inexpensive to make and tough and weather resistant.

The present invention permits the manufacture of decorative emblems and plaques having even thinner coatings of clear plastic material than the process disclosed in copending U.S. application Serial No. 054,548. The process of the present invention results in an ultrathin coating which is attractive, flexible, tough, and weather resistant and yet permits substantial savings in materials costs due to the small amount of coating material required. Using the process of the present invention, it is possible to deposit the plastic on the decorative substrate uniformly to a thickness of as little as 0.1 to 0.2mm and yet produce an attractive and weather resistant emblem.

According to one aspect of the present invention, decorative emblems, plaques, and panels are produced by providing a substrate having a series of decorative designs applied to its top surface and flow coating a clear, viscous, fluent plastic material over the top surface of the substrate to form a relatively uniform coating at least 0.1mm (0.004 inches) thick. Substantially uniform pressure is then applied to the coated substrate to reduce the thickness of the coating to 0.1 to 0.2mm (0.004 to 0.008 inches) followed by curing and hardening the plastic material while maintaining pressure upon it. The pressure is then released, and individual emblems, plaques, or panels are formed by cutting the substrate contiguous with each design of the series of designs.

The substrate upon which the fluent plastic is coated may be a plastic foil such as a vinyl or Mylar foil, a metal foil, or a plastic laminated metal foil. For example, the substrate may be an aluminum foil 0.2 to 1.0mm thick, preferably 0.3 to 0.4mm thick. The foil substrate is decorated with

an appropriate design or series of designs. For example, if a foil sheet or a substantial part of it is to be used as a panel with a minumum amount of trimming after being coated, a single design might be used. More commonly, a series of designs in the form of individual emblems or plaque shapes will be applied to the foil sheet. With a metal foil, the series of designs is preferably applied by silk screen or lithographic printing then the design is enhanced by embossing select areas although other means for forming the decorative designs may also be used.

Likewise, it is desirable to prime the top surface of the substrate prior to printing. Any suitable primer may be used such as a silane primer. The decorated and primed substrate is then loaded onto a hinged pressure fixture. The fixture has a flat lower portion onto which the substrate is positioned and an upper portion which is a highly polished metal plate or a metal plate faced with a non-stick material such as polytetrafluoroethylene or silicone rubber. The upper and lower portions of the fixture are mounted on a base and are hinged in "clamshell" fashion so that as the upper portion is closed, any excess coating material on the substrate is forced to flow uniformly across the substrate.

After the primed substrate has been loaded onto the open pressure fixture, the fixture is transferred to a casting station. At this station, a predetermined amount of a fluent curable plastic material is flow coated onto the substrate.

The plastic is preferably a fluent polyurethane of two component parts (polyol and isocyanate) which are mixed immediately prior to the coating and cure upon heating. A polyurethane of this type is disclosed in Waugh, U.S. Patent No. 4,100,010. In

formulating the particular plastic composition from among those disclosed in the copending application, it is important to use a catalyst which results in a somewhat slow curing time in order to allow the flow coated liquid plastic to flow to its full extent before curing is accomplished.

Likewise, the polyurethane may be compounded from among the components listed in that patent as is known to give a more flexible cured plastic. As long as the bond to the substrate remains strong, it is desirable in this invention to have a somewhat flexible plastic coat so that the emblem, plaque, or panel may be conformed. For example, some decorative automobile panels are applied to a curved surface. With the present invention, it is possible to conform the cured plastic coated panel to that surface.

After casting, the pressure fixture is closed and pressure applied. In closing the fixture, care must be taken that no air is entrapped. Thus, a slow and smooth closing motion is preferred. The pressure may be applied uniformly over the entire surface of the substrate and plastic to produce an ultrathin coating or there may be stops located either on the fixture itself or embossed on the substrate to limit the downward movement of the fixture and produce a controlled but somewhat thicker coating.

The pressure required may range from as little as 0.7 Kg/cm^2 for flat substrates which have not been appreciably warped during embossing to up to 7.0 Kg/cm^2. Curing is accomplished by heating the fixture, directly or indirectly, for a predetermined period of time. A suitable method of curing has been found to be heating the fixtures in

an oven maintained at 82-110°C. for from 15 to 30 minutes.

After curing, the coating substrate is cooled and removed from the pressure fixture. It may at this stage be further processed by cutting, trimming, and forming. When individual emblem or plaque shapes are contained on the single sheet, they are stamped out by a cutting die around the particular emblem or plaque shape. It has been found that complex geometric contours can be imparted to a substrate which has an ultrathin coating. The contours can be formed prior to cutting, during cutting using a combined cut and form tool, or after cutting.

Accordingly, it is an object of the present invention to provide a method of making decorative emblems, plaques, and the like which have an ultrathin cured plastic layer over a decorative surface. This and other objects and advantages of the invention will become apparent from the following description, the accompanying drawings, and the appended claims.

In order that the invention may be more readily understood, reference will now be made to the accompanying drawings in which:

Fig. 1 is a schematic diagram of the preferred process steps for carrying out the method of the present invention;

Fig. 2 is a perspective view of the pressure fixture used in the practice of the present invention; and

Fig. 3 is a view illustrating the coating nozzle arrangement for performing the method of the present invention.

The coating process of this invention may be performed on apparatus illustrated schematically

in Fig. 1. As shown in that figure, a decorated and/or embossed sheet is placed at loading station 10 onto an open pressure fixture 12 situated on conveyor 14. From loading station 10, the sheet is advanced to casting station 16 where a casting head (see Fig. 3) in the form of a multiple orifice nozzle or nozzles flow coats measured amounts of a fluent plastic material, such as a fluent polyurethane, onto the upper surface of the sheet.

After casting, the upper surface of pressure fixture 12 is closed and supplemental pressure is applied by the use of additional clamps at station 18. This clamping action squeezes out any excess plastic and results in a smooth, ultra-thin coating of plastic on the decorated sheet. The plastic is cured while being maintained in a clamped and level position by conveying the pressure fixtures through a curing oven 20. Oven 20 may contain any suitable source of heat which is capable of maintaining the ambient air temperature inside the oven at 82-110°C. The speed of conveyor 14 is such that the pressure fixtures 12 are in oven 20 for from 15 to 30 minutes. After curing, the pressure fixtures are opened at station 22 and the coated sheets unloaded. From there, the sheets may be sent to a conventional stamping or die cutting operation to produce individual finished emblems, plaques, or panels.

Various substrates can be utilized to form the decorated emblems and the like of the present invention. For example, the substrate may be a plastic foil such as vinyl or Mylar foil, a metal foil, or a plastic metal foil laminate. To prepare the substrate for decoration and/or embossing, it is first cleaned, cut to size, and pierced for accurate registration in subsequent handling steps. In a

preferred embodiment, an aluminum foil of from 0.2 to 1.0mm thick, and preferably 0.3 to 0.4mm, is utilized as the substrate. Generally, the sheets are sized so that they can be formed into a multiplicity of individual emblems or the like. It is desirable to prime the substrate with a silane compound before printing to enhance the adherence of the printed decoration thereto. As an example, a mixture of an approximately 6% polyvinyl butyrate (Butvar B-90 from the Monsanto Chemical Co.), up to 3.4% silane (Dow 6020, 6040, or 6075 from Dow Corning Corp.) which are respectively 3-(2-amino-ethylamine) propyltrimethoxy silane, glycidoxypropyltrimethoxysilane, and vinyltriacetoxysilane), approximately 1% of an epoxy resin (Araldite 6005 from Ciba-Geigy Corp.) approximately 3.4% of an aqueous solution of chromic and phosphoric acids, and approximately 0.01% of a colorant (Tinopal SFG from Geigy Chemical Co.) in a solvent such as 36% n-butanol or isobutanol and 64% acetone may be used. Other known silane primers may also be used. These primers may be applied by spraying, dipping, or roller-coating followed by drying or baking to remove the solvent.

The primed substrate is then decorated with designs and/or letters by known silk-screen printing techniques. Optionally, the substrate may be embossed to enhance certain design features. Typically, such embossments are approximately 0.15mm deep.

The decorated and embossed substrates are then loaded onto individual pressure fixtures 12 at loading station 10 in preparation for the casting stage of the process. As best shown in Fig. 2, pressure fixture 12 has a base 24, a flat lower plate 26, and an upper plate 28 attached to the

lower plate by means of hinges 29. Decorated substrate 30, having a plurality of individual designs indicated by 31, and an optional embossed downstop 51, is positioned on pegs 32 lower plate 26 through holes 34 punched or drilled therein for that purpose. This insures that the substrate is accurately aligned when passing under the casting head. Upper plate 28 also has a pair of clearance holes 36 therein positioned to be aligned over pegs 32 when the plate is closed onto lower plate 26. Optional embossed downstop 51 serves to control the downward movement of plate 28 and produces a coating of controlled thickness.

Upper plate 28 has a highly polished surface so that it will not impart any texture or surface imperfections to the coating. Alternatively, the plate may be coated with a smooth nonstick surface such as polytetrafluoroethylene or silicone rubber. Upper plate 28 is constructed so that as it closes, excess coating material will be forced to flow in a uniform direction across the face of the substrate. The closing motion should be slow and smooth to prevent any air from being entrapped. When completely closed, upper plate 28 is parallel to lower plate 26 resulting in a uniform coating on substrate 30. Optional embossments on the substrate or on the fixture itself aid in maintaining the plates parallel by supporting the applied pressure plate over the surface of the substrate.

Base 24, onto which plates 26 and 28 are mounted, is adapted to be attached to conveyor 14 and maintain the substrates in alignment at each station. As the base moves along conveyor 14 toward casting station 16, a first actuator 38, which can be a projecting metal stud, passes a predetermined

location and activates the casting operation by activating a magnetic sensor or proximity switch. The passage of a second actuator 39 past the same location reactuates a sensor or switch and terminates the flow of casting material.

While a continuous conveyor-type arrangement is preferred, it is also possible to utilize a system in which the substrate remains stationary and the casting head, upper plate, heat source, etc. are moved serially into and out of placement over the stationary substrate.

As shown in Fig. 3, casting head 40 has a nozzle 42 having a plurality of orifices shown as tubes 44 arrayed across the face of substrate 30. The nozzle is fed a supply of fluent plastic such as a liquid polyurethane. Preferred is a mixture of "A" and "B" components of the type disclosed in Waugh, U.S. Patent No. 4,100,010. Basically, that mixture is one of a polyether polyol component ("A"), which may be a difunctional, trifunctional and/or tetrafunctional polypropylene glycol containing a suitable catalyst, and a diisocyanate component ("B") such as an aliphatic diisocyanate. A catalyst such as a lead material is used since it promotes a slow cure at room temperature so as to allow time for full flow of the liquid polyurethane before setting. As stated in the above-mentioned Waugh patent which is specifically incorporated herein by reference, an example of the diisocyanate is Hylene W from E. I. dePont de Nemours and Co., and the polyether polyol may be one or more of the Pluracol materials (P-410 or TP-440) from BASF Wyandotte. It may also be a polyether-polyester polyol combination, use of the polyester polyol making the cured polyurethane more flexible. The ratio of components A:B is preferably from 50-60%

"A" to from 50-40% "B". A polyester polyol or polylactone polyol could be used in place of the polyether polyol.

The mixture of "A" or "B" components of this type cures, through catalytic action, under heat such as produced by infrared radiation. Accordingly, this type of arrangement will be disclosed as the preferred embodiment; although, single component, photocurable, polyurethanes of known types could also be used.

Tanks (not shown) store the "A" and "B" material separately prior to mixing, then, feeding to supply line 46 for nozzle 42. Fitting 48 connects multiple orifice nozzle 42 to supply line 46.

The number of tubes 44 and the spacing between the tubes in an individual nozzle will vary in dependence on the width of the portion of the substrate to be coated. It has been found that the use of between 10 and 26 tubes, spaced apart approximately 2.5 to 3.25mm produce an even coating of plastic material across the face of the substrate. The tubes preferably have a 0.56mm I.D. and a 1.0mm O.D. spacer bar 50 holds the tubes 44 spaced apart at desired distances, preferably 2.5mm.

As shown, the casting head 40 is in a fixed position while the substrate tracks beneath it on conveyor 14. Obviously, this arrangement may be modified even within the contents of a conveyor type system to provide for a moving casting head tracking over a temporarily fixed position substrate.

As the fluent plastic material is laid down, it flows over the substrate to complete the coverage of the surface. A uniform thickness of plastic results. The speed of conveyor movement and coating rate for the plastic depend upon the area to

be covered, the number of tubes needed, and the viscosity of the fluent plastic. Generally, however, it is possible to adjust easily these variables in order to achieve a coating of the thickness desired. Ultimately, the final coated thickness will be only about 0.1 to 0.2mm. This thickness may be varied by varying the hinge clearance and spacing of the plates, by providing shims which maintain a slight spacing between plates or by embossments on substrate. Preferably, the amount of fluent plastic coated onto the substrate at the casting station is slightly in excess of the amount required to produce such a thickness, with excess material being squeezed out during the clamping operation.

After casting, the pressure fixture 12 is closed and clamped at station 18. The pressure required may vary depending upon the particular substrate utilized and whether any significant warpage occurred during a preliminary embossing operation. It has been found that from between 0.7 and 7.0 Kg/cm^2 applied to the pressure fixture by means of external clamps is sufficient to produce the flat level surface necessary for a uniform coating. As explained above, the construction of the pressure fixture is such that the upper and lower plates remain parallel during clamping with the embossments on substrate 30 providing support for the upper plate.

The coated substrate is cured by passing it through a heated oven 20. As shown, the oven is elongated and the speed of conveyor 14 is regulated to produce a dwell time sufficient for a complete cure. It has been found that an ambient air temperature in the oven of from about 82 to 110°C. and a

dwell time of from about 15 to 30 minutes produces a complete cure.

The cured, coated substrate is then unclamped and unloaded from pressure fixture 12 at station 22 and is ready for further processing steps. These steps may include cutting, forming, and trimming operations to form individual emblems, plaques, or panels. An adhesive layer and release liner may also be applied to the back of the substrate at this time.

After individual emblems have been formed, they may be adhesively applied into or onto the intended surface of an automobile or appliance. They may also be placed in a retaining frame which is used to affix the emblem onto a surface. Since the finished product has an ultrathin coating and the fluent plastic material may be compounded as described above to give a somewhat flexible coating when cured, forming operations other than merely die cutting may be undertaken. The emblem, and more often panels, may be conformed to nonplanar surfaces as long as the degree of bending for the conformity required is not too severe.

While the method described herein constitutes a preferred embodiment of the invention, it is to be understood that the invention is not limited to this precise method, and that changes may be made therein without departing from the scope of the invention as defined in the appended claims.

CLAIMS

1. A method for producing decorative emblems, plaques, and panels comprising the steps of:

(a) providing a substrate (31) having a series of decorative designs applied to its top surface,

(b) flow coating a clear, viscous, fluent plastic material onto said top surface of said substrate while maintaining said substrate in a flat and horizontal orientation in an amount sufficient to form a layer at least 0.1mm thick, said plastic material being sufficiently slow curing that it will flow over the surface of said substrate to form a relatively uniform coating,

(c) applying substantially uniform pressure to said coating to reduce its thickness to about 0.1 to 0.2mm,

(d) curing and hardening said plastic material while maintaining pressure and a flat and horizontal orientation to produce a uniformly coated substrate, and

(e) releasing the applied pressure and stamping emblems, plaques, or panels out of said substrate having cured plastic material thereon by cutting contiguous with each individual design of said series of designs.

2. A method as claimed in claim 1 including the steps of loading said substrate onto a hinged pressure fixture (12) having a smooth upper platen (28) prior to flow coating and then, after flow coating said plastic material onto said substrate, applying pressure to said substrate by closing said hinged pressure fixture (12) onto the coated substrate (31) and applying clamps to said hinged pressure fixture (12).

3. A method as claimed in claim 2 in which said upper platen (28) is coated with a material which does not stick to said plastic material.

4. A method as claimed in claim 3 in which from 0.7 to 7.0 Kg/cm^2 pressure is applied to said coated substrate.

5. A method as claimed in claim 1 in which said plastic material is cured by heat of convection.

6. A method as claimed in claim 5 in which said plastic material is cured by exposing said pressure fixture to a temperature of 82-110°C. for 15 to 30 minutes.

FIG-1

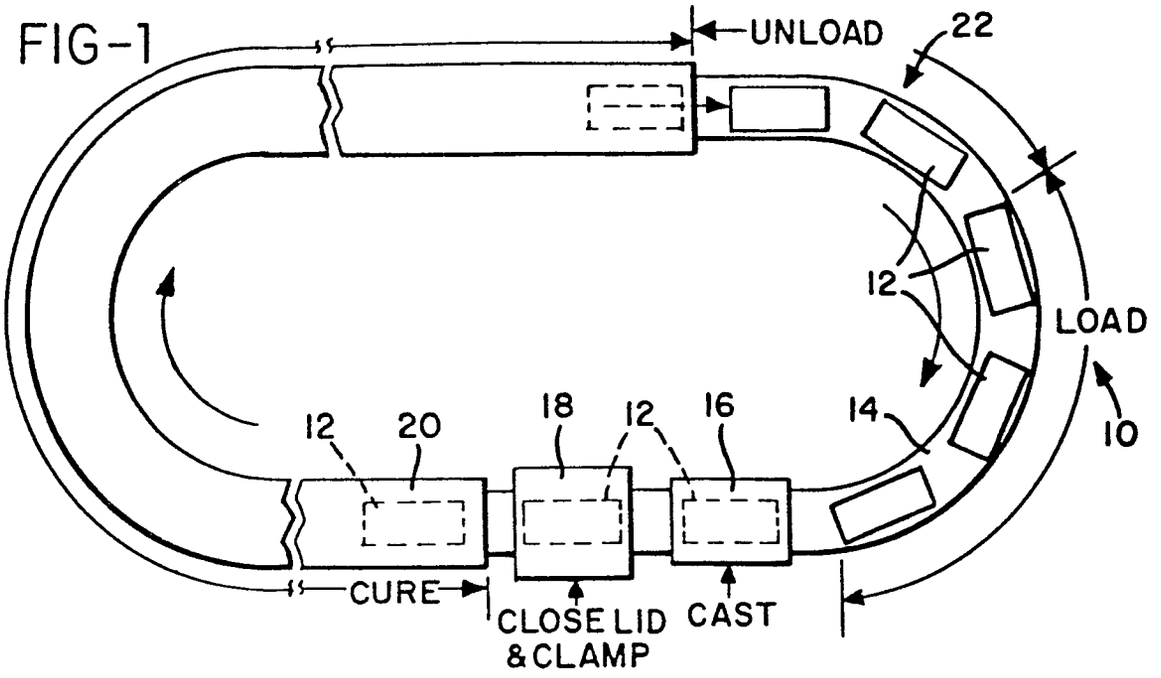


FIG-2

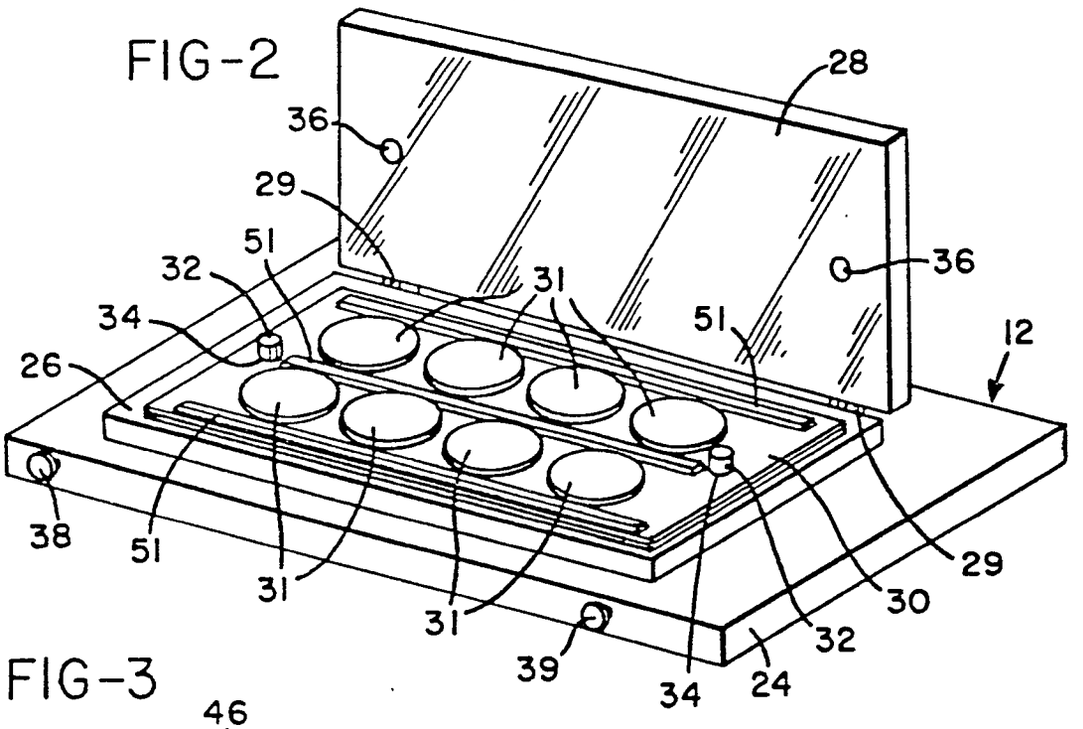
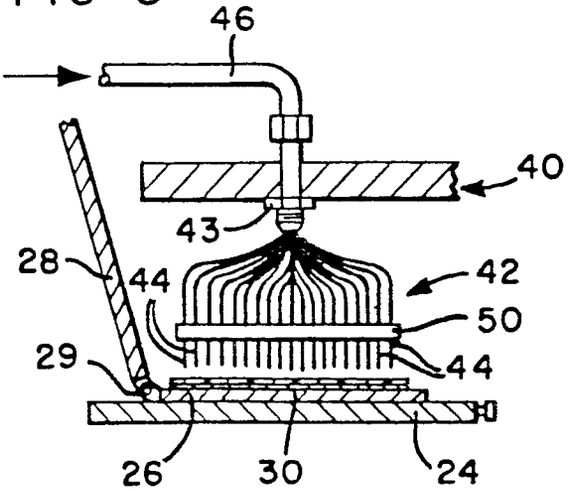


FIG-3



European Patent Office

EUROPEAN SEARCH REPORT

Application number
EP 80 30 3854

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim
	AU - B - 462 224 (JOHN-PETER BRYN-JULF THAMS) * claims 1 and 14; examples * ---	1-3
P	EP - A - 0 005 376 (THE D.L. AULD COMPANY) * the whole document * ---	1
	US - E - 19 549 (L.C. BYCK et al.) * page 1, left-hand column, lines 20-41; right-hand column, lines 42-48 and 54 and 55 * ---	1,2
	DE - A - 2 731 081 (THE D.L. AULD COMPANY) * claim 1; page 5, lines 4-10 * ---	1
D	US - A - 4 100 010 (R.E. WAUGH) * claim 1 *	1

CLASSIFICATION OF THE APPLICATION (Int. Cl.³)

B 44 C 1/20
B 05 D 1/30
3/12

TECHNICAL FIELDS SEARCHED (Int. Cl.³)

B 44 C 1/20
B 05 D 1/30
B 44 D 2/00
B 05 D 3/12
B 05 D 5/06
B 44 F 11/06
B 44 F 11/00

CATEGORY OF CITED DOCUMENTS

X: particularly relevant
A: technological background
O: non-written disclosure
P: intermediate document
T: theory or principle underlying the invention
E: conflicting application
D: document cited in the application
L: citation for other reasons

&: member of the same patent family, corresponding document

X The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	12.02.1981	CECCHINI