April 30, 1963 H. LIBBERTON 3,087,423

PRINTING PLATE

Filed Dec. 12, 1960 2 Sheets-Sheet 1

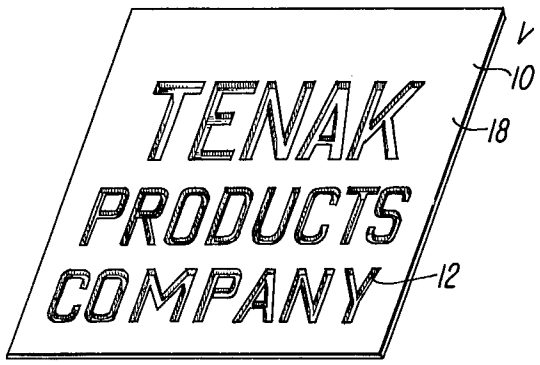


FIG. 1

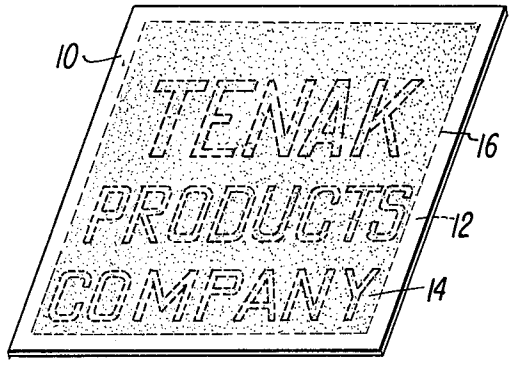


FIG. 2

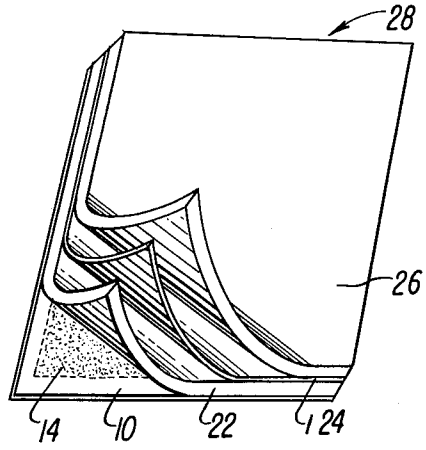


FIG. 4

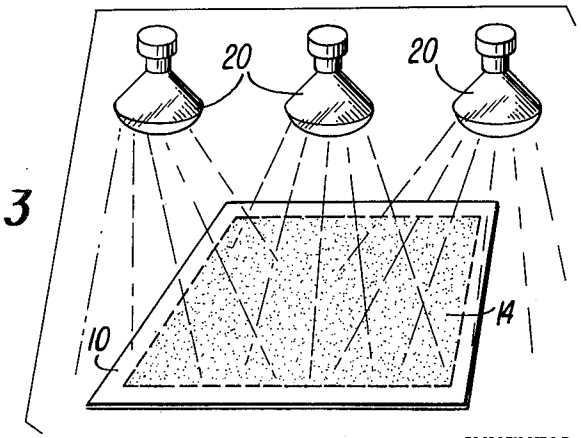


FIG. 3

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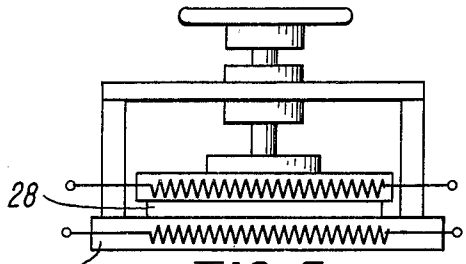


FIG. 5



FIG. 6

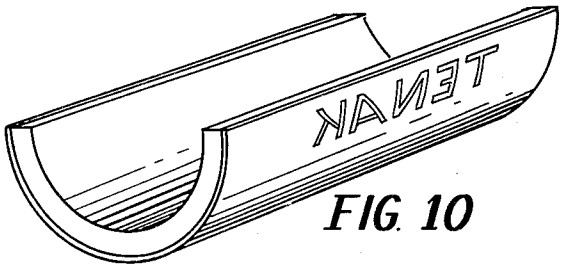


FIG. 10

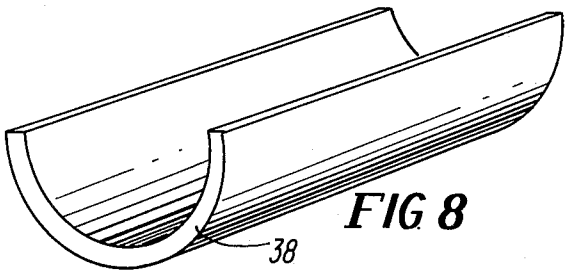


FIG. 8

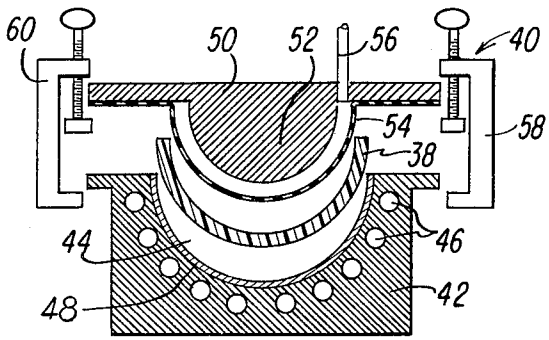


FIG. 9

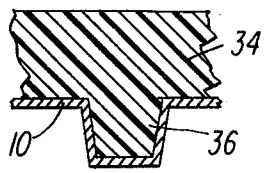


FIG. 7

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3,087,423

PRINTING PLATE

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6 Claims. (Cl. 101—401.1)

This invention relates in general to the art of printing. More particularly, it relates to a method of making plastic backed electrotype printing plates and to plates so produced.

In the printing industry an electrotype shell is conventionally made by first molding into either a thermoplastic sheet, wax or lead the pattern from which the electrotype is to be made. Upon this mold a layer of copper or copper and nickel is electro-deposited to a thickness of about .010", thereby forming an electrotype shell. To give rigidity and strength to the shell, the back is first turned and then a heavy metal backing is joined thereto. The backing metal, called electrotype metal, generally consists of about 3% tin, 3% antimony, and about 94% lead and is applied to the shell at approximately 600° F. Often the high temperatures required in applying the lead base metal induces considerable distortion of the shell which must later be corrected by skilled workmen called "finishers." This is a very laborious operation.

The lead-tin-antimony backing produces a very heavy printing plate which is undesirable either in flat bed or rotary printing. Thus, when such plates are used in a rotary press, the attendant great weight is a serious handicap to faster running speeds. In the case where the plate on one side of the roll has a large amount of solid printing area and the one on the opposite side of the cylinder a relatively small amount, the roll is caused to "whip" even at slower speeds.

Attempts have been made to reduce weight of the electrotype plates used in the rotary printing by substituting a considerable amount of aluminum for part of the plate or by backing up the shell with various plastic materials in lieu of the heavy metal alloy, but none of these solutions has been really satisfactory. The ordinary plastic materials, although ideally suited by their weight, possess certain objectionable physical characteristics. These plastic materials are applied to an electrotype shell at an elevated temperature and possess a tendency to shrink upon cooling. This results in a warped plate or one with a bow, i.e., more than the desired curvature, and this is exactly what a printer does not want. A plate which is a little too concave is useable because it can be pulled down with nails or hooks but a plate which is a little too convex is not useable at all.

Another troublesome characteristic of the prior plastic materials used for backing electrotypes is the tendency of the plastic to cold-flow under pressure. It is known that the addition of fillers to the plastic compositions helps to reduce the problem of cold flow and shrinkage of the plastics, but the usual fillers, such as clay, asbestos, mica, and the like, are not acceptable either because of their cost or because of their dulling effect on the tools used later to rout and finish the electrotype plate.

Problems other than those that relate to the characteristics of the plastic materials themselves are encountered when using thermoplastic resinous materials as a backing for an electrotype shell. More particularly, it is important that the recesses in the back of the metal shell be completely filled with the backing material so as to prevent breakdown of the printing face during operation of the press. Simply pressing a slab of plastic material against the back of the electrotype shell does not insure that all of the recesses therein will be solidly filled because of the tendency to trap gaseous material, particularly when

an adhesive is used to bond the plastic backing to the shell.

Having in mind the shortcomings of prior electrotype printing plates and processes of making the same, it is an important object of this invention to provide an electrotype printing plate which is not warped or bowed due to shrinkage of the backing and which is backed with a moldable thermoplastic resinous material which shows no objectionable tendency to cold-flow under pressure.

Another object of the invention is to provide a method for making an electrotype printing plate having such a backing of moldable thermoplastic resinous material.

Still another object is to provide a method for making a curved electrotype printing plate having such a backing of moldable thermoplastic resinous material.

Yet another object is to provide an electrotype printing plate having a backing of thermoplastic resinous material which is free of subsurface defects.

Other objects will appear hereinafter.

It has been found that the foregoing objects are accomplished by backing electrotype shells with thermoplastic resinous compositions comprising a vinyl resin base and also including at least about 5% of wood flour, by weight, based on the total weight of the composition. The preferred vinyl resins are the polymers of vinyl chloride, particularly the homopolymer and copolymers of vinyl chloride and vinyl acetate, which may be used either alone or in various combinations. Preferably, the amount of wood flour used is in the range from about 5% to about 40%, by weight, based on the total weight of the composition. Additives commonly included in vinyl resin compositions, such as plasticizers, stabilizers, anti-oxidants, mold release agents and the like, are preferably included in the compositions of the present invention to improve their characteristics in ways which are well known to those skilled in the art.

It is desirable that the thermoplastic backing should adhere tightly to the shell and since many of the foregoing compositions do not form a sufficiently strong bond to the shell when applied directly thereto, it is preferable to secure the backing to the shell with an adhesive. There are many adhesives which are well known to possess the property of providing a good bond between metals and vinyl resins and any of these may be used in accordance with the present invention. One such suitable adhesive is the phenolic-elastomer composition sold by the B. F. Goodrich Company under the trademark "Pliobond."

Although it is desirable to apply the thermoplastic backing material to the electrotype shell in the form of a sheet or slab, it has been found that when this procedure is followed and particularly if an adhesive is used as above described, there is a tendency to trap air or other gaseous material between the shell and the backing material so that portions of the printing surface are not adequately supported by the backing.

This defect is avoided, however, by first applying a layer of powdered resinous material to the back of the shell, over the adhesive layer if an adhesive is used, in a quantity sufficient to fill up the recesses therein and cover the surface of the shell. This powdered resinous material is most conveniently provided by grinding a portion of the same material to be used in the sheet or slab portion of the backing as above described although it need not necessarily have the same composition as the sheet or slab backing and may be any of the vinyl resin materials above described and need not contain the wood flour filler.

Preferably, the powdered resinous material to be applied to the back of the shell is ground to a fineness which will pass through a 40 mesh sieve and it is easily

distributed on the back of the shell through an ordinary hand sieve so that the recesses are readily filled and the back of the shell is covered. Following this step it is desirable, although not esssential except when the shell is to be backed up in a curved cavity, to heat the powdered resinous material on the shell sufficiently to cause the particles to coalesce and the body of coalesced material to adhere to the shell directly or through the previously applied adhesive layer. The need for this step in backing shells in curved cavities will be readily apparent. If an attempt were made to curve the shell, the loose powder would, of course, fall off.

While the powder may be heated by any desired means in order to coalesce it, it has been found to be very convenient to put the shell with the powder on it under infrared lamps which quickly heat the powder to the temperature required to cause it to coalesce. However, particularly when the powder is to be heated by this means, it is desirable to include in the resinous composition of which the powder is formed a small amount of carbon black, for example, approximately 2%, by weight, based on the total weight of the composition. The addition of the carbon black serves to improve the heat absorbing qualities of the powder so that it will coalesce within a relatively short time under the infrared lamps. It may be noted that the carbon black may also be included in the sheet or slab backing so that it is not necessary when the carbon black is used to formulate different compositions for the powder and the sheet. After the assembly of the sheet and coalesced powder has cooled, it may be backed immediately with the sheet or slab which forms the main portion of the backing or may be set aside for later curving operations or flat casting.

The resinous material from which the sheet or slab backing is to be formed after it has been formulated in a suitable mixer, such as a Banbury mixer, is mixed therein at elevated temperature, for example, at 275° to 300° F. for a period of time of the order of 10 minutes. It is then removed and further mixed on a conventional two roll rubber mill from which it is transferred to a calender and sheeted out to the desired thickness which will depend upon the requirements for the finished electrotype printing plate but in general ranges from about 0.175" to 0.325".

For the purpose of applying the sheet so formed to a shell as a backing for a flat printing plate, the shell, preferably after it has been coated with adhesive and has had applied thereto the above described layer of coalesced powdered resinous material, may be placed in a conventional molding press having platens suitably heated by steam, electricity, or any other desired means to a temperature of the order of 300° F. The sheet of the resinous material formed as above descibed is then placed over the shell. Preferably, the exposed face of the resinous sheet material is then covered with a sheet of release paper, i.e., a paper which will not adhere to the resinous material, and a solid rubber blanket is laid over the sheet of release paper, the solid rubber blanket preferably being about ¼" thick and having a hardness of about 50 to 60 Shore durometer. Pressure is then applied to this assembly, for example, at about 50 to 80 pounds to the square inch and held for about 5 minutes, for example. The assembly may then be transferred to a cold press and held under pressure therein for a short time, about 3 minutes. Upon removing the assembly from this press, it will be found that a perfect electrotype printing plate has been provided which is ready for use when it has been shaved, trimmed, and routed in the usual way.

The sheet backing is applied in much the same way in forming curved printing plates except that a special type of press is required which is provided with a cavity and cooperating saddle of the desired curvature and which, preferably, may also be both heated and cooled. The shell, preferably prepared as above described for flat

casting, is placed into the cavity and held to the desired curvature by suitable means, such as with the aid of small pieces of adhesive tape. A sheet of the above described resinous backing material which has previously been heated, curved, and cooled to approximately the same curvature as that of the cavity is placed on the shell and the curved saddle is then lowered and locked into position.

One suitable press of this type is provided along its circumference with a rubber bag which can be inflated with air from behind. In this particular press the heating and cooling are provided by coring the cavity for steam and water and when the saddle is in position, the steam is turned into the cavity to provide the desired elevated temperature, generally of the order of 300° F. depending upon the particular resinous composition of which the backing is formed and at the same time air pressure is applied to the bag, for example, at about 10 pounds per square inch.

While the heating time in this press may be varied, according to one suitable cycle the assembly is preheated under the conditions above described for about 5 minutes, after which the pressure is increased to about 50 to 80 pounds to the square inch and held for about 2 minutes. The steam is then shut off and cold water is run into the cavity. The cooling time varies depending upon the temperature of the cooling water but in general about 3 minutes is usually sufficient. The air pressure is now shut off and the saddle removed and the completed plate is ready to be shaved, trimmed and routed and used in printing.

No hand finishing of the plate is necessary since the printing surface conforms perfectly to the highly polished surface of the cavity into which it was molded. If treatment is required, this can be arranged for before molding with standard overlays. Any required variation in the printing height will be perfectly reflected in the final surface.

In order that the invention may be better understood, reference is made to the accompanying drawings which form a part of this specification in which:

FIGURE 1 is a view in perspective of an electrotype shell with the back or non-printing surface uppermost;

FIGURE 2 is a view of the same shell after the recesses have been filled and the surface covered with powered resinous material as above described;

FIGURE 3 is a view of the same shell in position under the infra red lamps to coalesce the powder;

FIGURE 4 is a view of the assembly including the shell and backing sheet or slab ready for insertion into the molding press;

FIGURE 5 is a view of this assembly in the molding press, being pressed to secure the backing to the shell;

FIGURE 6 is a view in perspective of the completed backed printing plate;

FIGURE 7 is an enlarged view in cross section on the line 7—7 in FIGURE 6;

FIGURE 8 is a view in perspective of a sheet of the plastic backing material which has been precurved for use in forming a curved printing plate;

FIGURE 9 is a view in central vertical cross section through a press suitable for applying the backing in forming curved printing plates; and

FIGURE 10 is a view in perspective of a finished backed curved electrotype printing plate.

Referring first to FIGURE 1, it will be seen that there is shown therein the usual eletcrotype shell **10** carrying an impression of printing matter thereon and having the usual recesses **12** on its rear face which are complementary to the raised printing characters on the printing face. FIGURE 2 shows the same shell **10** after a layer of powdered resinous material **14** has been applied over its rear face to fill the cavities **12** indicated therein in dotted lines and cover the rear face. Preferably, as indicated in this figure, after the powder has been applied,

all four edges of the shell for about ¼" in as indicated at **16** are wiped clean of the powder to prevent any powder being knocked off unintentionally later.

Referring back to FIGURE 1, it is pointed out that when an adhesive is used according to the preferred procedure, a layer of a suitable adhesive as above described is applied over the entire rear face **18** of the shell as shown in FIGURE 1 prior to applying the layer **14** of the powder. When an adhesive, such as the "Pliobond" adhesive above mentioned, is used, the layer of adhesive is allowed to dry before the powder is applied.

As previously set forth, the layer of powder **14** is preferably heated to coalesce the particles and cause them to adhere to the shell before applying the sheet backing. An arrangement for carrying out this operation is illustrated in FIGURE 3. As shown in this figure, the shell **10** with the layer of powder **14** thereon is placed under a bank of infrared lamps **20**. By way of illustration, it has been found that a bank of such lamps of 375 watts each positioned about 10½" from the layer of powder will heat it sufficiently to produce the desired coalescence in a period of about 2 minutes when the powdered material contains a suitable amount of carbon black as above set forth. After the powder on the shell has been heated and coalesced, the assembly is preferably allowed to cool, after which the remainder of the backing may be applied immediately or at some later time as desired.

Although the assembly of this shell with the backing sheet is ordinarily accomplished in a molding press, the molding assembly for convenience in illustration is shown separately in FIGURE 4. In this figure the lowermost layer is the shell **10** with the coalesced powder **14** thereon. Over this is laid a sheet **22** of the resinous backing material to be applied to the shell to back it and form a printing plate. Over this backing a sheet of release paper **24** is placed to prevent a rubber blanket **26**, which is placed above it, from sticking to the backing material **22** during molding. FIGURE 5 shows the assembly designated generally **28** in FIGURE 4 positioned in a conventional molding press **30** and being heated and pressed to apply the backing **22** to the shell **10** and form the desired printing plate.

As indicated above, after the assembly has been heated and pressed in the press **30** to the desired extent, it is removed therefrom and placed in a cold press which is not shown because it may be substantially identical with the press **30** except that the platens are cooled instead of being heated. When the assembly has been suitably cooled in this cold press, it is removed therefrom and it will be found that the desired printing plate **32** shown in FIGURE 6 has been formed. As shown in FIGURE 7, the backing material **34** covers the entire rear face of the shell to provide the desired backing and also fills the recesses behind the printing characters as indicated at **36** to prevent the plate from breaking down during printing.

FIGURE 8 shows a sheet **38** of the plastic backing material which has been heated and curved to substantially the curvature desired in a finished curved printing plate and then cooled preparatory to applying it as a backing to an electrotype shell in the press illustrated in FIGURE 9. The press designated generally **40**, which is shown in FIGURE 9 and which has been described briefly hereinbefore, includes a cavity member **42** having a semi-cylindrical cavity **44** therein, the curvature of the surface of which is substantially that desired on the printing surface of the printing plate. It is cored as indicated at **46** for steam and cold water to be supplied from sources not shown.

Arranged in the cavity **44** in a position to be backed is an electrotype shell **48** preferably prepared as previously described by the application of a layer of adhesive and a layer of coalesced powdered resinous material. For convenience in illustration, the elements of the press and molding assembly are shown in exploded relation, the

sheet **38** of precurved resinous backing material being shown immediately above the shell **48**. Above this sheet **38** the saddle member **50** is shown ready to be lowered into molding position, the saddle portion **52** of which has a curvature similar to that of cavity **44** except that the diameter is slightly smaller for obvious reasons.

Positioned about the circumference of the saddle portion **52** is an inflatable rubber bag **54** which can be inflated with air from the rear through the line **56**. To back the shell **48** the plastic backing **38** is moved down into position against the shell and the saddle member **50** is lowered into position to engage the backing **38** and clamped into this position by clamps such as clamps **58** and **60**. With the assembly of the shell **48** and backing **38** so positioned in this press **40**, the cycle of heating, pressing, and cooling previously described is carried out, after which the press is opened and the backed curved printing plate shown in FIGURE 10 is removed therefrom and after shaving, trimming, and routing is ready to be used in printing.

As indicated in the above description, a variety of vinyl resins, particularly vinyl chloride polymer resins, may be used in accordance with the present invention and suitably formulated with various resin additives in addition to the wood flour and carbon black above described. A preferred formulation for the backing sheet or slab as well as the powdered resinous material is as follows:

	Lbs.
Copolymers containing approximately 87% polyvinyl chloride and 13% polyvinyl acetate and sold under the trademark "Vinylite VYHH"	112
Polyvinyl chloride	48
Dioctyl phthalate as a plasticizer	3
Basic lead carbonate as a stabilizer	8
Calcium stearate as an anti-oxidant and mold release agent	2
Fine wood flour	24
Carbon black	4
Total	201

The advantages of the present invention will be apparent in large part from the foregoing description. An electrotype printing plate is provided which is much lighter in weight than the conventional plates backed with electrotype metal. This reduces the load on the printing press and permits much higher running speeds in rotary printing. The lightness in weight is achieved, moreover, without sacrifice in the other characteristics of the plate. The backing material is so formulated that it does not cause the plate to warp or bow as do other light weight backing materials heretofore proposed, such as other plastic or resinous compositions. Lastly, a method of backing, both flat and curved plates, is provided which ensures that the backing will adhere tightly to the shell and completely fill the recesses therein so as to firmly support the printing elements on the plate.

It is apparent that many widely different embodiments of this invention may be made without departing from the spirit and scope thereof and, therefore, this invention is not intended to be limited except as indicated in the appended claims.

I claim:

1. A method of making an electrotype printing plate which comprises the steps of applying a layer of a powdered material comprising a vinyl resin base to the back of an electrotype shell in a quantity sufficient to fill up the recesses therein and cover the surface of the shell, said powdered material including an amount of wood flour equal to at least about 5% of the total weight of the powder, heating the said powder so applied to coalesce the particles therein and molding a sheet of resinous material against said layer at a temperature and under a pressure which unites said sheet and coalesced layer and conforms said united material throughout to the rear face of

said shell, the said sheet comprising a vinyl resin base and including an amount of wood flour equal to at least about 5% of the total weight of the sheet.

2. A method as described in claim 1 in which prior to applying the powder to the back of the electrotype shell the said back is coated with a layer of an adhesive for the shell and material of which the powder is formed.

3. A method as described in claim 1 in which the said powdered material contains a substantial amount of carbon black and is heated to coalesce it by exposing it to infra-red radiation.

4. A method as described in claim 2 in which the powder and sheet materials each contain from about 5% to about 40%, by weight, of wood flour based on the total weight of the composition.

5. A method as described in claim 2 in which the vinyl resins in the powder and sheet are vinyl chloride polymers.

6. A method of making a curved electrotype printing plate which comprises the steps of applying a layer of adhesive over the back of an electrotype shell, then applying over said adhesive a layer of powdered material comprising a vinyl chloride polymer resin base in a quantity sufficient to fill up the recesses in the shell and cover the surface thereof, said powdered material including an amount of wood flour equal to from about 5% to about 40% of the total weight of the powder, heating the said powder so applied to coalesce the particles therein, then

curving the shell to substantially the curvature desired in the printing plate, separately curving to substantially the same curvature a sheet of material comprising a vinyl chloride polymer resin base and including an amount of wood flour equal to from about 5% to about 40% of the total weight of the sheet, and molding said curved sheet against said layer of coalesced material at a temperature and under a pressure which unites said sheet and coalesced layer and conforms said united material throughout to the rear face of said shell.

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