March 24, 1964 G. W. BUNGAY 3,125,952

METHOD FOR FORMING COMPOSITE PRINTING PLATES

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Fig. 1

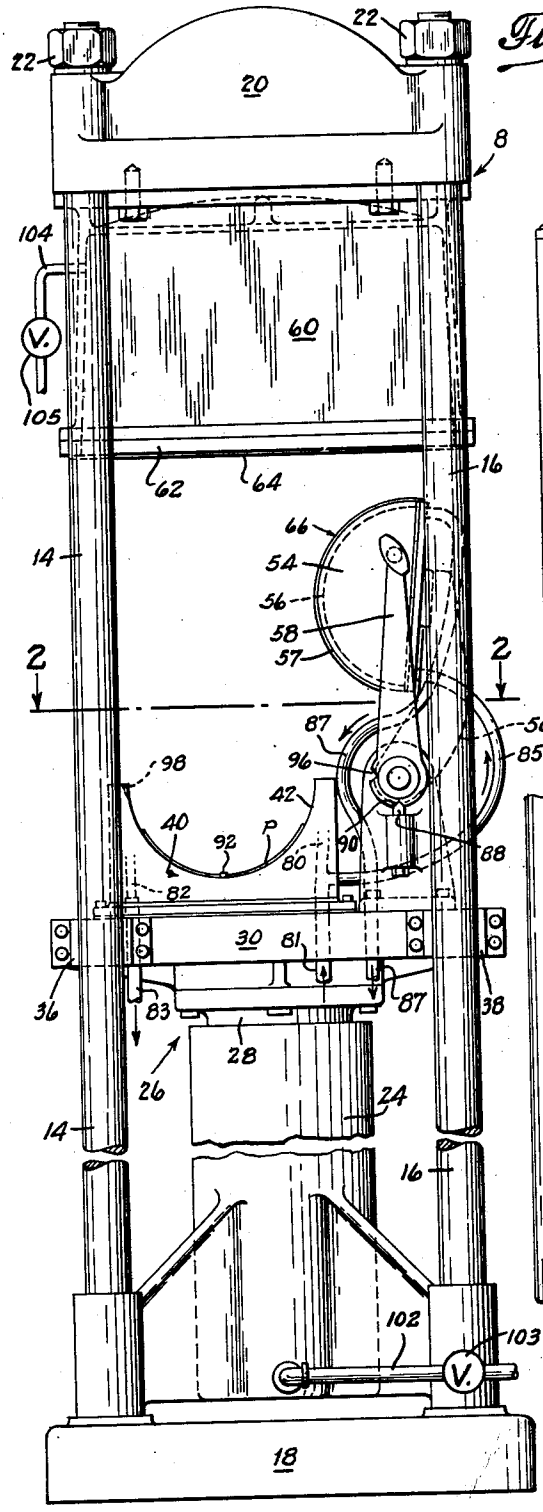


Fig. 2

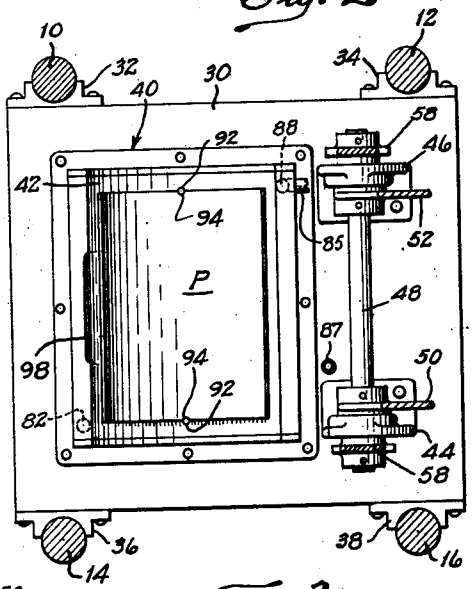
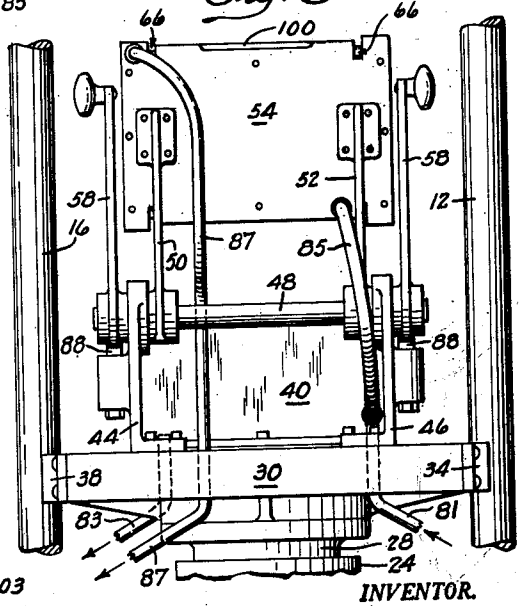


Fig. 3



INVENTOR.
GEORGE W. BUNGAY
BY
Morgan, Finnegan, Durham & Pine
ATTORNEYS.

March 24, 1964 G. W. BUNGAY 3,125,952

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Fig. 4

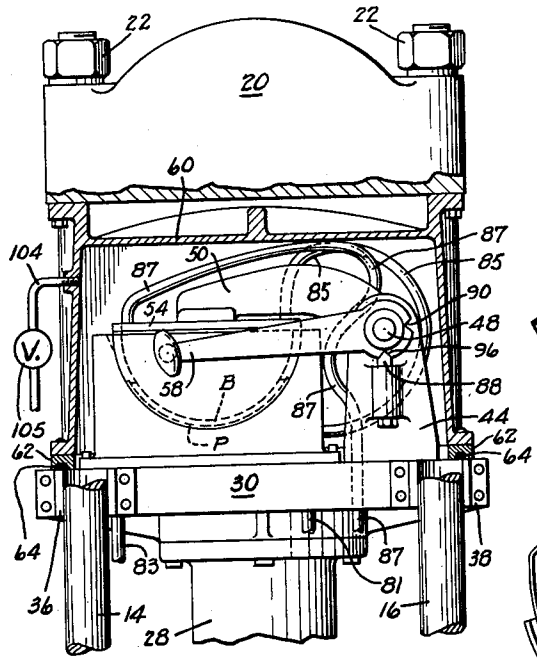


Fig. 13

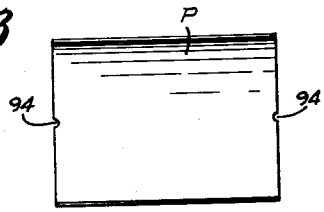


Fig. 14

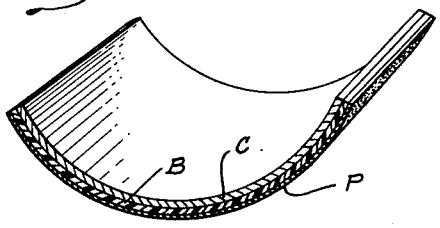


Fig. 7

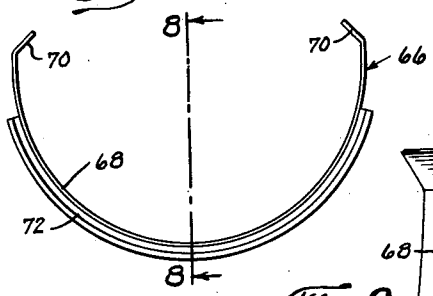


Fig. 10

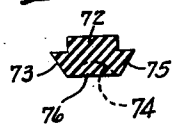


Fig. 5

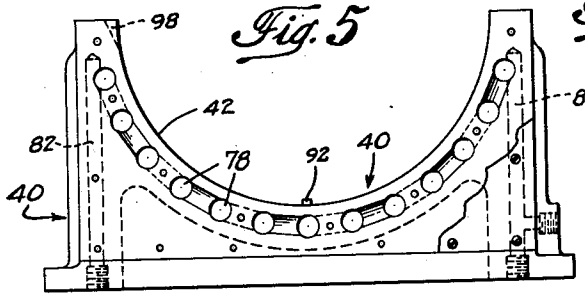


Fig. 8

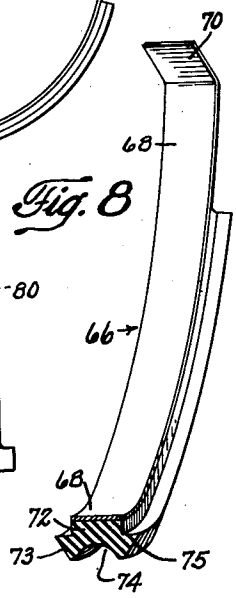


Fig. 9

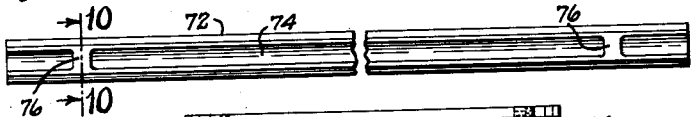
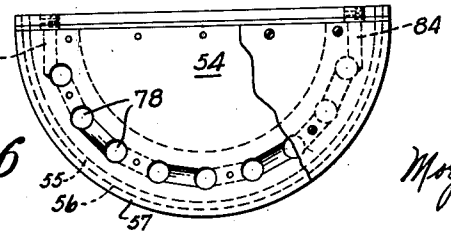


Fig. 6



INVENTOR.
GEORGE W. BUNGAY
BY
Morgan, Finnegan, Durham & Pine
ATTORNEYS.

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METHOD FOR FORMING COMPOSITE PRINTING PLATES

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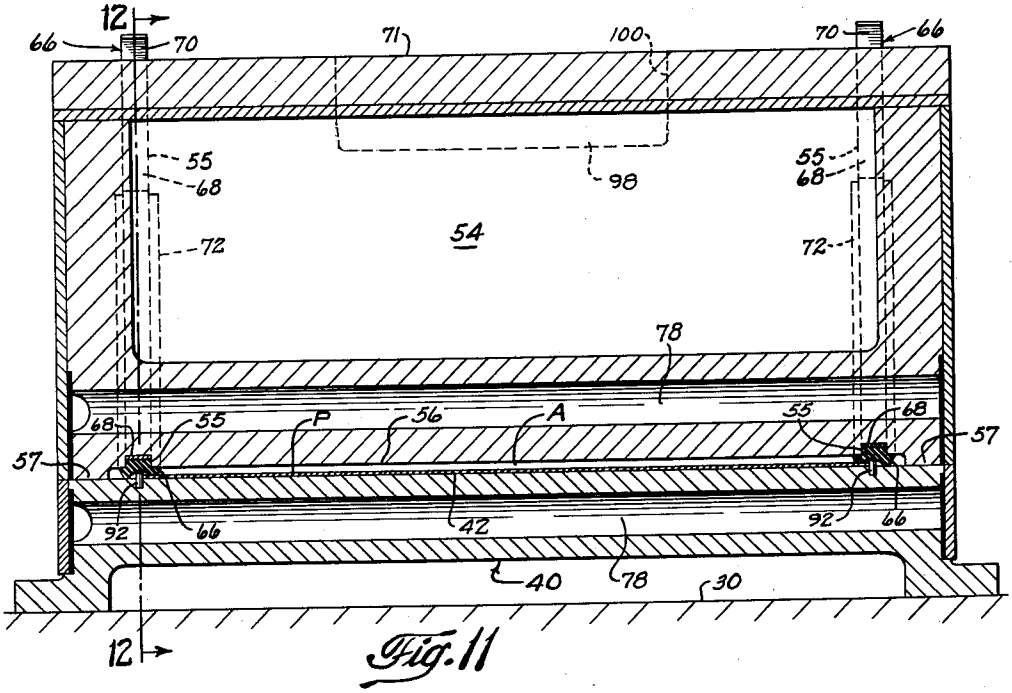


Fig. 11

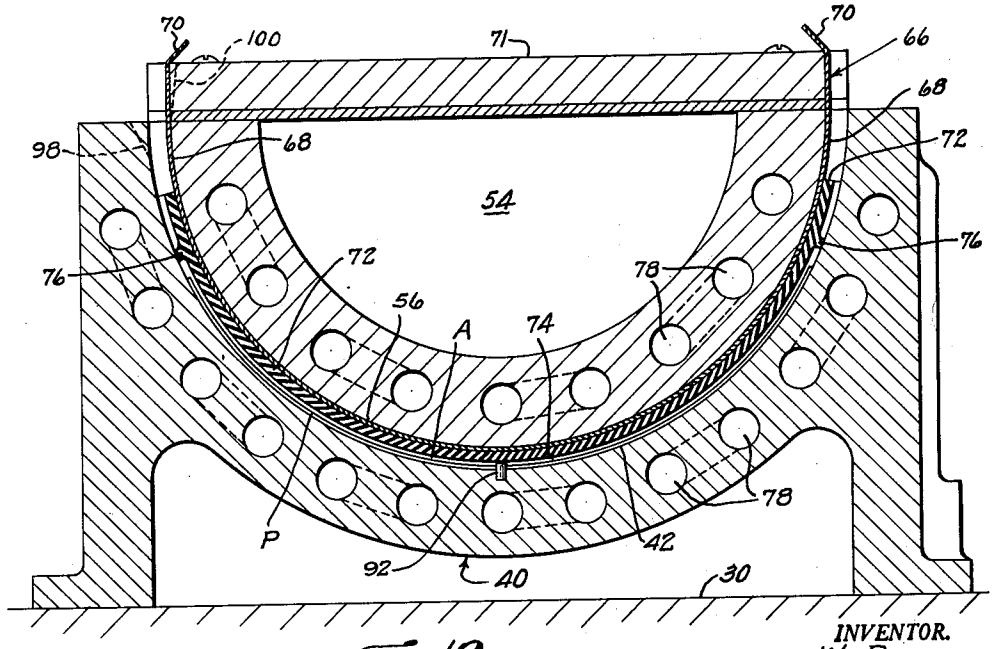


Fig. 12

INVENTOR.
GEORGE W. BUNGAY
BY
Morgan, Finnegan, Durham & Pine
ATTORNEYS.

March 24, 1964 G. W. BUNGAY 3,125,952

METHOD FOR FORMING COMPOSITE PRINTING PLATES

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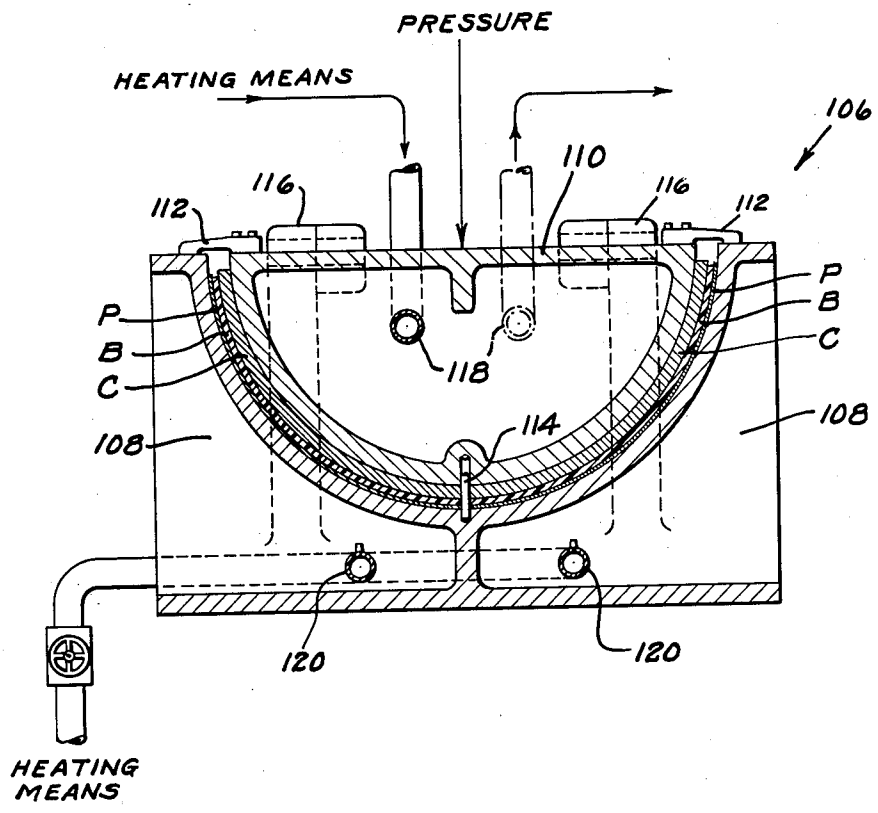


Fig. 15

INVENTOR.
GEORGE W. BUNGAY
BY
Morgan, Finnegan, Durham & Pine
ATTORNEYS.

United States Patent Office 3,125,952 Patented Mar. 24, 1964

3,125,952

METHOD FOR FORMING COMPOSITE PRINTING PLATES

George Waldemar Bungay, New York, N.Y., assignor to Electrographic Corporation, New York, N.Y., a corporation of Delaware

Filed Feb. 14, 1961, Ser. No. 89,280
2 Claims. (Cl. 101—401.1)

The present invention relates to a novel method for producing a composite electrotype printing plate.

Objects and advantages of the invention will be set forth in part hereinafter and in part will be obvious herefrom, or may be learned by practice with the invention, the same being realized and attained by means of the steps, process and apparatus pointed out in the appended claims.

Generally, plates for use on rotary printing presses are formed by adhering a thin, flexible electrotype shell containing the printing character to a metallic backing plate with the back face of the electrotype plate leaded or otherwise filled in. The methods and mechanisms utilized heretofore for forming the laminated plate resulted in plates that were dimensionally inaccurate in thickness. It will be appreciated that with the close tolerances required for high class color registry, a slight deviation in finished thickness of the laminated plate necessitated manual scraping and trimming.

One main source of difficulty heretofore was that the layer of adhesive between the shell and the backing plate was applied unevenly. Another was that the adhesive was dimensionally unstable, exhibiting shrinkage upon hardening.

The present invention is characterized by the use of spaced cooperating die elements between which the electrotype shell is placed. The upper die element is provided with edge seals adapted to seal the space between the dies. A dimensionally stable plastic material such as an epoxy resin is flowed into the space between the dies and against the back of the shell. The entire die structure is then subjected to air pressure which forces the epoxy liquid throughout the entire area between the dies, any untrapped air being vented through the seals. The air pressure is maintained until the liquid has hardened to the desired degree and is dimensionally solidified. This desired hardness is preferable when the epoxy is in semi-cured condition. The conventional curved metallic backing plate is then bonded to the epoxy layer by press means to form a finished composite printing plate within the required tolerances.

In forming the composite plate, the plastic layer is applied to the shell to a slightly greater thickness than in the finished plate. This over-thickness compensates for the pressure applied in bonding the backing plate. By applying a slightly over-thick layer of epoxy, the finished composite plate including the shell, epoxy layer and backing plate is of the desired finished thickness and is ready to proof immediately.

It is therefore an object of the present invention to provide a novel method for forming a composite printing member utilizing a dimensionally stable plastic backing material and fluid pressure to distribute the material evenly to the desired thickness against the back of an electrotype printing plate positioned between two spaced dies.

Another object of this invention is to provide a novel method of forming a composite printing member by flowing a liquid epoxy resin layer against the back of an electrotype printing plate positioned between two spaced dies to a given thickness, applying air pressure thereto to spread the epoxy evenly against the plate until it acquires dimensional stability, interrupting the air pressure when

the epoxy has attained a semi-cured condition, positioning a support plate at the free face of the epoxy layer, subjecting the composite plate to pressure to adhere the plate tto the epoxy, this pressure effecting a reduction in the thickness of the epoxy layer to produce a composite printing plate of desired finished dimensions.

For a more complete understanding of the invention, reference should be had to the accompanying drawings, wherein:

FIG. 1 is a side elevation of the invention with the die elements illustrated in non-cooperative relationship;

FIG. 2 is a sectional plan view taken along line 2—2, FIG. 1;

FIG. 3 is a partial rear view of the mechanism shown in FIG. 1, illustrating the back of the die elements;

FIG. 4 is a side elevation, partly in section, of the air chamber, illustrating the die elements in cooperating relationship therein;

FIG. 5 is a detail view of the female die element;

FIG. 6 is a detail view of the male die element;

FIG. 7 is a side elevation of one of the edge seals;

FIG. 8 is a perspective view, partly in section, of an edge seal taken along line 8—8, FIG. 7;

FIG. 9 is a plan view of the sealing element of an edge seal, illustrating the longitudinal channel formed therein;

FIG. 10 is a secttional view taken along line 10—10, FIG. 9;

FIG. 11 is an enlarged front sectional view illustrating the die elements in cooperating relationship with an electrotype plate therebetween;

FIG. 12 is a side sectional view of the mechanism illustrated in FIG. 11;

FIG. 13 is a plan view of an electrotype printing shell, showing the positioning notches therein;

FIG. 14 is a perspective view, partly in section, of a composite printing member produced in accordance with the present invention; and

FIG. 15 is a cross-sectional side elevation of a suitable support plate mounting mechanism.

Referring to the figures in detail, and especially to FIG. 1, there is illustrated the preferred embodiment of the present invention which includes a frame 8 having four spaced supports 10, 12, 14 and 16 fixed at their lower ends to the four corners of a general rectangular base plate 18. The upper ends of the supports 10–16 are stepped and threaded to support an arched top plate 20 secured in position on supports 10–16 by nuts 22.

Base plate 18 supports the reservoir 24 of a vertically disposed hydraulic lift 26. The free end of the piston 28 of lift 26 has mounted thereon a support plate 30 disposed substantially parallel with base plate 18. Plate 30 is thus adapted to travel on piston 28 vertically in frame 8 between supports 10–16. Corner bearing brackets 32, 34, 36 and 38 on plate 30 assist in maintaining alignment of plate 30 in frame 8 as plate 30 is travelled by piston 28.

The upper surface of support plate 30 has mounted thereon a female die member 40 having a semi-cylindrical concave die face 42 accurately corresponding to the curvature of the finished printing member. Also mounted on plate 30 are a pair of spaced standards 44 and 46 which pivotally support a transverse shaft 48. Fixed to and rotating with shaft 48 are a pair of spaced arms 50 and 52 to which is mounted the cooperating semi-cylindrical male die element 54 having a cylindrical convex face 56 adapted to be received in spaced cooperating parallel relationship with the face 42 of the member 40. Handles 58 fixed to each end of shaft 48 are operated to travel die element 54 into and out of cooperative operating relationship with die element 40. Face 56 has semi-annular ridges or shoulders 57 formed on each side thereof (see FIG. 11). Ridges 57 are effective to maintain dies 40 and 54 in spaced parallel relation with a precise

area A therebetween when the dies are in closed cooperating relationship.

At the top of the frame 8 is an air chamber 60 fixed to the undersurface of top plate 20. Chamber 60 is open at the bottom and adapted to receive therein die elements 40 and 54 in closed cooperating relationship, as shown best in FIG. 4.

Chamber 60 is positioned in frame 8 such that its lower peripheral lip 62 engages the upper surface of support plate 30 at the upper limit of travel thereof on piston 28. Gasket 64 provided on lip 62 effects a sealing of the interior of chamber 60 by engaging the upper face of plate 30 at its uppermost point of travel.

For reasons set forth hereinbelow, each curved side edge of male die 54 is provided with a semi-annular slot 55 adapted to accommodate a sealing member 66. Sealing member 66 includes a flat, elongated resilient metallic element 68 having an angular extension 70 at its ends adapted to snap-fit over the flat surface 71 of die 54. Secured to metallic element 68 is a preferably elastomeric or otherwise resilient sealing unit 72 having inclined edge sections 73 and 75, sealing unit 72 having a generally trapezoidal cross-section with a longitudinal, arcuate channel 74 formed therealong. Channel 74 is interrupted adjacent each end of sealing unit 72 by transverse ribs 76 which provide structural rigidity to unit 72.

To provide suitable temperature control means for the dies, die members 40 and 54 are provided with a plurality of transverse elongated interconnected internal bores 78. Bores 78 in die 40 are connected to a generally vertical inlet bore 80 at one end and an outlet bore 82 at the other end. Bores 80 and 82 are connected in turn to suitable hydraulic lines 81 and 83, respectively. Bores 78 in die 54 are connected at one end by an inlet bore 84 and hydraulic line 85 to bore 80 and at the other end to a suitable outlet bore 86 and outlet line 87. Water, air or other suitable fluid is supplied from line 81 to bore 80 and circulates through dies 40 and 54 by the interconnected bores 78 and hydraulic line 85, the fluid exiting from its associated die 40 and 54 through its respective outlet lines 83 and 87. It will be understood that the temperature of die members 40 and 54 can thus be easily and accurately controlled by controlling the temperature and rate of circulation of the fluid supplied thereto.

In operation, piston 28 is located in its lowermost position of travel through frame 8 and die 54 rotated by the operator to its open, non-operative position. A spring detent member 88 on each standard 44 and 46 cooperates with a suitable notch 90 in its associated handle 58 to maintain die 54 in open position. Preferably, inlet hydraulic line 81 is opened to admit heated fluid, such as water, through dies 40 and 54 to heat them to the desired operating temperature of approximately 200° F.

The operator then positions a conventional curved electrotype printing plate P into position in die 40, as shown in FIG. 1. Plate P is arcuate to conform to the surface of a plate cylinder of a rotary printing press. The printing character is formed on the convex side of plate P which is positioned against face 42. To accurately locate plate P in die 40, a pair of dowel pins 92, one at each side thereof, is provided in die face 42. These pins 92 cooperate with notches 94 formed in the "dead" or unused portion of plate P to precisely center plate P in die 40.

With plate P centered in die 40, seals 66 are positioned in slots 55 in die 54. Handles 48 are then actuated by the operator, against the effect of spring detents 88, to rotate die 54 into spaced cooperating relationship with die 40. In this position, detents 88 engage a second notch 96 in handles 88, maintaining die 54 in operative closed position.

Preferably, dies 40 and 54 are formed with cooperating lip sections 98 and 100, respectively. These lip sections 98, 100 provide an access to the area A between the dies when in closed operative relationship.

With the dies thus closed, the operator pours into the space A, between lips 98 and 100, a liquid form of epoxy resin. It has been found that epoxy resins of the epichlorohydrin bisphenol condensate type, with a hardener such as triethylenetetramine, will provide satisfactory results. It will be understood that the epoxy resins are particularly suitable for use in practicing the invention since such material is dimensionally stable and not subject to severe shrinkage upon curing. By dimensionally stable is meant the characteristic of the epoxy resin to hold the dimensions to which it is poured upon curing thereof.

After the epoxy resin has been poured into place, the hydraulic supply line 102 to lift 26 is opened by actuating a suitable control valve 103 to energize lift 26, raising piston 28 to its uppermost limit of travel. This travels plate 30 with dies 40 and 54 thereon into chamber 60. With dies 40 and 54 sealed therein, the air supply line 104 to chamber 60 is opened by actuating a suitable control valve 105, admitting air under pressure into chamber 60. Preferably, the air pressure in chamber 60 is maintained at approximately 15 p.s.i. This pressure effects even distribution of the fluid epoxy resin throughout the entire area between dies 40 and 54, filling all the voids therebetween. By utilizing air pressure, uniformity is assured over all of the die areas to effect the desired even distribution of the epoxy.

Referring now to FIGS. 11 and 12, the function of seal 66 will be fully set forth. As stated hereinabove, seals 66 are positioned in semi-annular slots 55 provided therefor. In this position, the resilient sealing units 72 of seals 66 have one inclined face 73 exposed to the area A between dies 40 and 54 into which the epoxy resin was poured. The other inclined face 75 is exposed to the air pressure in chamber 60. The function of seal 66 is to permit egress of air entrapped in area A by the fluid epoxy while containing the epoxy itself in area A.

As the air pressure in chamber 60 urges the epoxy into the voids in space A, the entrapped air therein is forced against faces 73 of seals 66, and therepast into longitudinal channel 74. The viscous epoxy fluid, however, is contained by seals 66 in space A. In this manner, the entire of area A is filled with the liquid epoxy resin.

It will be understood that the entrapped air is free to pass into channel 74 since the face 75 of units 72 seals the channel 74 from the air pressure in chamber 60. This permits free egress of entrapped air from space A, ensuring that space A is entirely filled by the fluid epoxy resin.

When sufficient time has elapsed for the fluid epoxy to set into solid semi-cured though tacky form (anywhere from three and one half to four minutes, depending on the particular epoxy composition used), the air supply to chamber 60 is interrupted. The hydraulic pressure in lift 26 is released, permitting piston 28 and its associated mechanism to return to their lowermost position shown in FIG. 1. The operator then rotates die 54 into non-operative position to have access to plate P with its epoxy resin backing B. As described above, the epoxy is allowed to assume solid form and in the exact dimensions of area A. However, it is withdrawn from the dies while its concave surface remote from plate P is still in tacky or adhesive condition.

Plate P with its epoxy backing B in semi-cured condition is then transferred to a press member 106, shown in FIG. 15, which includes a pair of cooperating dies 108 and 110. Die 108 corresponds to the desired outside curvature of the finished printing plate F, while die 110 corresponds to the diameter of the printing cylinder on which the curved printing members are to be mounted. Stops 112 are provided to maintain dies 108 and 110 in exact spaced relationship when closed.

In operation, plate P is positioned against die 108 and aligned therein by dowels 114. A light, strong, curved metallic backing plate C, preferably having its outer face

coated with an adhesive such as liquid epoxy resin, is placed with its outer face against the epoxy backing layer B, dowels **114** aligning plates P and C in press **106**. Temperature control means is provided in the form of longitudinal bores **118**, **120** in dies **110** and **108**, respectively. Bores **118**, **120** are connected to a suitable source of heat, such as a hot water line **119**. The rate of flow of heated media through bores **118**, **120** and the temperature of such media effectively controls the temperature of dies **108** and **110** to the desired degree.

Member **110** is then pivoted about hinges **116** and moved into coaxial cooperating relationship with member **108**, and suitable means (not shown) is provided for pressing member **110** toward member **108** against stops **112** to securely press plate C, backing B and plate P into finished composite plate F. In addition, this press corrects any inaccuracies in the curvature of plate C and eliminates the undulations often found therein.

Since plate C is to be applied to plate P and backing B under pressure to form plate F, backing B is formed to a slightly greater thickness in dies **40** and **54** than the finished thickness thereof in plate F. This oversize compensates for the pressure necessary to adhere plate C resulting in producing a finished plate F to the desired thickness ready for the presses without further trim or scraping.

It will be understood that while the foregoing description has referred to arcuate composite printing plates and method and mechanism for the forming thereof, the teachings thereof can be applied with equal force and effect to flat plates.

What is claimed is:

1. The method of producing curved printing members comprising positioning an arcuate printing plate with a printing face on its convex surface between a pair of

spaced cooperating arcuate dies, filling the area between the dies and against the concave surface of said plate with a fluid plastic material of a first given thickness, enclosing said dies, plate and resin material with a housing, pressurizing the interior of said housing to subject the plastic material to air pressure as it hardens, venting any air trapped by said fluid plastic from said area to effect complete distribution of the plastic material therefrom, interrupting said air pressure before said plastic material has achieved its full hardness, and applying a backing member by pressure directly to said plastic material remote from said printing plate prior to complete hardening of said plastic material to form a composite printing member whereby said plastic material assumes a second smaller given thickness such that the composite printing plate formed thereby is free from irregularities and is within pre-selected tolerance limits.

2. The method as defined in claim 1, including the step of controlling the temperature of the printing plate and the plastic material during hardening of said plastic.

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