March 26, 1957 N. B. MEARS 2,786,443

APPARATUS FOR PRODUCING LIGHT-SENSITIVE COATINGS ON METAL SHEETS

Filed Sept. 14, 1953 2 Sheets-Sheet 1

FIG. 1

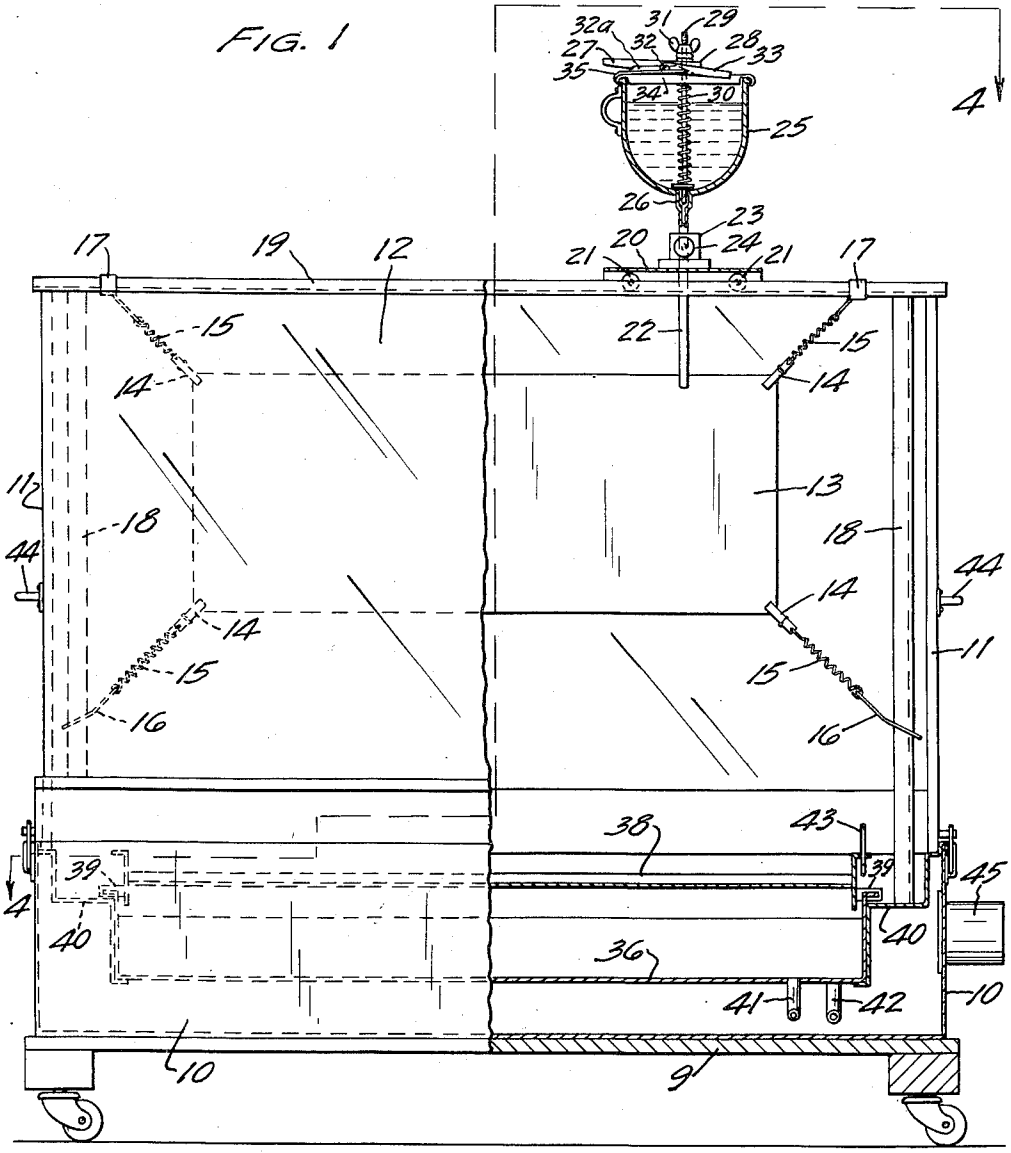


FIG. 2

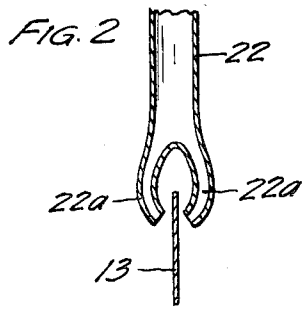
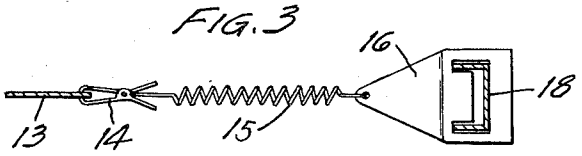


FIG. 3



INVENTOR
NORMAN B. MEARS
BY John E. Thyken
ATTORNEY

March 26, 1957 N. B. MEARS 2,786,443

APPARATUS FOR PRODUCING LIGHT-SENSITIVE COATINGS ON METAL SHEETS

Filed Sept. 14, 1953 2 Sheets-Sheet 2

FIG. 4

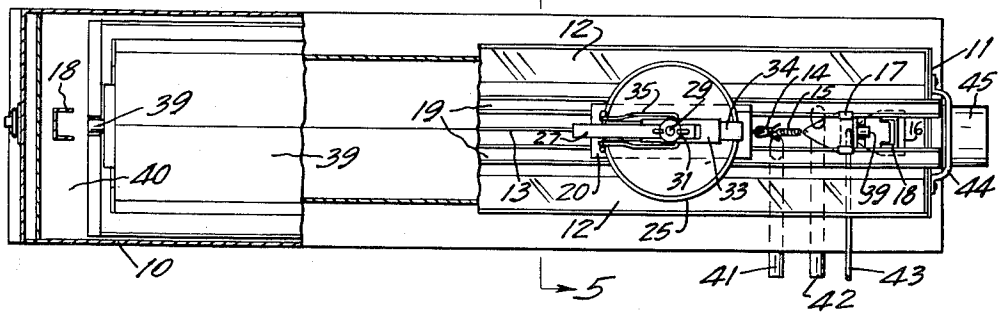


FIG. 5

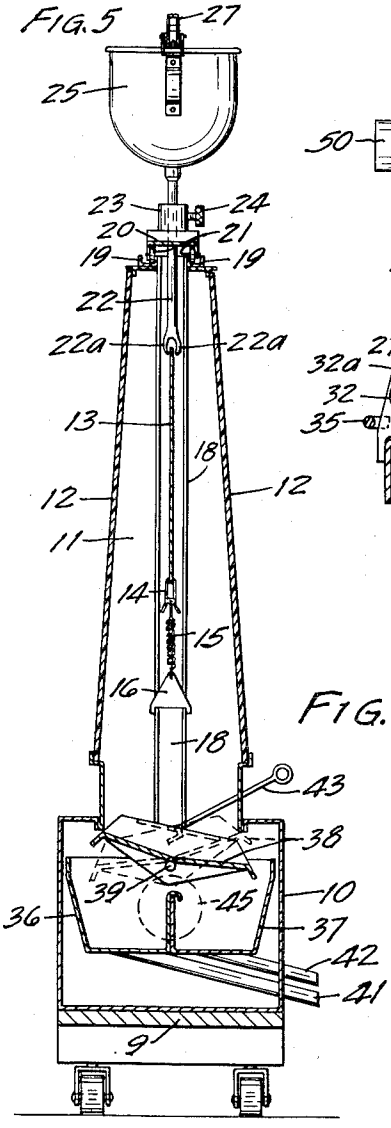


FIG. 6

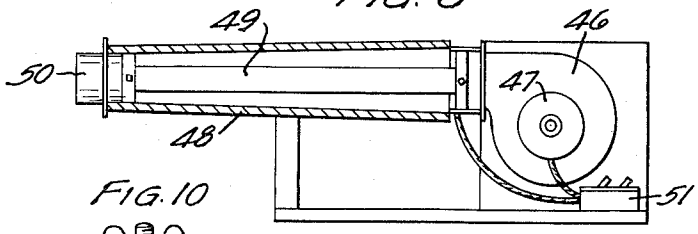


FIG. 10

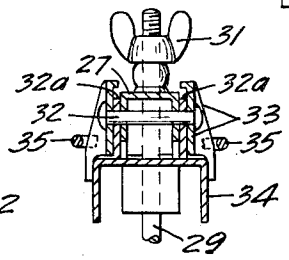


FIG. 7

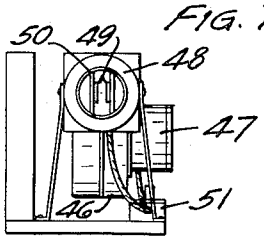


FIG. 8

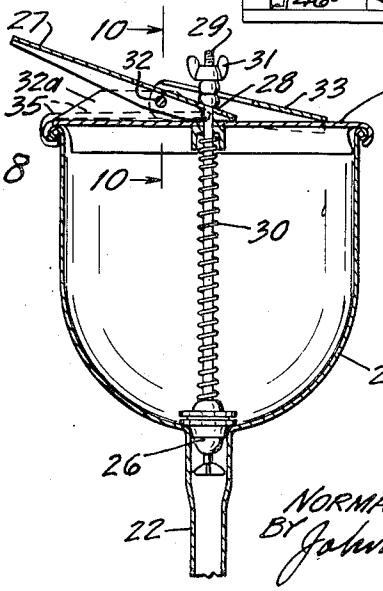
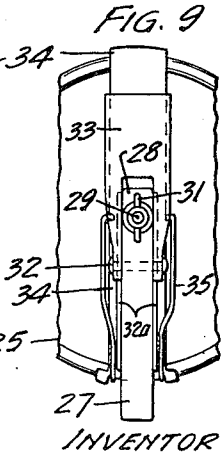


FIG. 9



INVENTOR
NORMAN B. MEARS
BY John E. Stryker
ATTORNEY

United States Patent Office 2,786,443
Patented Mar. 26, 1957

2,786,443

APPARATUS FOR PRODUCING LIGHT-SENSITIVE COATINGS ON METAL SHEETS

Norman B. Mears, St. Paul, Minn., assignor to Buckbee-Mears Company, St. Paul, Minn., a corporation of Minnesota

Application September 14, 1953, Serial No. 379,945

8 Claims. (Cl. 118—316)

This invention relates to apparatus for producing light-sensitive coatings on metal sheets or plates, herein collectively referred to as "blanks" and is particularly adapted for the production of uniform coatings of this character on both faces of thin metal sheets for use in the manufacture of various articles of precision requiring the formation of fine line or dot designs or patterns on the light-sensitive surfaces by photo-printing procedure. Subsequently the photo-printed designs or patterns may be caused to penetrate or perforate the metal sheet by etching procedure or by electrolysis.

It is an object of my invention to provide apparatus of the class described whereby a blank to be coated may be held in a vertical plane and enclosed in a protective casing while the liquid coating material is applied to one or both sides of the blank and then dried.

A further object is to provide in such apparatus improved means for forming a uniform coating on the metal blank or sheet and for drying it while avoiding both handling of the work and contact with the coated surfaces.

My invention also includes certain other novel features of construction which will be more fully pointed out in the following specification and claims.

Referring to the accompanying drawings which illustrate, by way of example and not for the purpose of limitation, a preferred embodiment of my invention:

Figure 1 is a part side elevational view and part vertical sectional view showing my improved apparatus;

Fig. 2 is a fragmentary sectional view through the nozzle tip;

Fig. 3 is a plan view showing one of the sheet holding devices;

Fig. 4 is a part plan view and part sectional view taken on the line 4—4 of Fig. 1;

Fig. 5 is a vertical sectional view taken on the line 5—5 of Fig. 4;

Fig. 6 is a part side elevational view and part sectional view showing the blower and heater;

Fig. 7 is an end elevational view of the blower and heater;

Fig. 8 is a detail sectional view through the reservoir and valve mechanism;

Fig. 9 is a fragmentary plan view of the reservoir and valve, and

Fig. 10 is a section taken on the line 10—10 of Fig. 8.

In the drawing, the numeral 9 indicates an elongated, readily movable base supporting an elongated casing indicated generally by the numeral 10. Extending upward from the casing 10 at each end are fixed end walls 11 and a pair of removable transparent side walls 12 are disposed to enclose a metal sheet 13 to be coated, together with a holder adapted to support the sheet 13 in a substantially vertical plane.

The sheet holder comprises pairs of spring clamps 14 adapted to grip opposite margins of the sheet 13 and connected by tension springs 15 to adjustable anchor members 16 and 17. As shown in Figs. 1 and 3, each of the anchor members 16 is adapted to engage a vertical frame

member 18 and is adjustable along the frame member so that tension may be applied to sheets 13 of various widths and lengths. Extending along the top of the apparatus between the end walls 11 is a guide or track 19 which is engaged by the anchor members 17 to adjustably connect an upper pair of sheet holder members to the frame of the apparatus.

A carriage indicated generally by the numeral 20 is readily movable along the track 19, being supported on pairs of wheels 21 engaging the track members. A nozzle 22 is mounted on the carriage 20 and projects downward therefrom to distribute liquid light-sensitive material along the upper margin of the sheet 13 mounted on the holder members hereinbefore described. The nozzle 22 is adjustable vertically in a bearing 23 mounted on the carriage 20 and may be secured in adjusted positions by means of a set screw 24. As best shown in Fig. 2, the nozzle 22 is formed with a bifurcated lower end having tubular branches 22*a* adapted to direct streams of liquid coating material against opposite sides of the sheet 13 along its upper margin. This margin of the sheet normally extends substantially horizontally in parallel relation to the track 19 so that when the nozzle 22 is moved along on the carriage 20 liquid flowing from the branch nozzle members 22*a* may be distributed along the upper margin of the sheet.

Liquid coating material may be supplied to the nozzle 22 from a reservoir 25 under control of a valve 26. This reservoir is supported on the upper end of the nozzle 22 and the operating mechanism for the valve 26 may comprise a manually operable lever 27 having a perforated end portion 28 arranged to actuate a substantially vertical rod 29 connected to the valve 26. A spring 30 is confined on the rod 29 to bias the valve 26 toward closed position in relation to a port communicating with the upper end of the nozzle 22. The upper end portion of the rod 29 is threaded and is fitted with a wing nut 31 which is operative to control the extent of opening of the valve when the lever 27 is depressed. This lever is pivoted on a pin 32 having bearings in bracket members 32*a* secured to a supporting bar 34. A toggle member 33 is pivoted on the pin 32 and is disposed to actuate a U-shaped spring member 35 to fasten the bar 34 on the reservoir. By raising the free end of the toggle member 33 from its operative position shown in Fig. 1, the member 35 may be freed from engagement with the reservoir and thereby permit the removal of the valve assembly from the reservoir as a unit.

Extending longitudinally within the casing 10 are a pair of troughs 36 and 37 adapted to selectively receive excess liquid which is drained from the lower edge of a sheet 13 mounted in the holder. Pivoted centrally above the troughs 36 and 37 is a baffle 38 for selectively directing the liquid to one or the other of the troughs. The baffle is pivotally supported at its ends on studs 39 having bearings on supporting walls 40 which also support the troughs 36 and 37. Projecting to the exterior of the casing 10 from the trough 37 is a drainage tube 41 and a similar tube 42 provides drainage for the trough 37 so that the excess liquids collected in these troughs may be recovered separately for further use or for discharge to waste. A handle 43 is operatively connected to the baffle 38 so that the latter may be tilted to cause overflow selectively into one or the other of the troughs 36 and 37. The handle 43 projects through an opening in the casing so that it is readily accessible at all times. Handles 44 projecting from the end walls 11 afford means for readily moving the apparatus to and from the site where it is to be used.

Communicating with the casing 10 at one end is an inlet 45 for dry air. When drying air is required, it may be supplied from a blower such as that shown in Figs. 6 and

7. A centrifugal blower of suitable type is contained in a casing 46 and connected to an electric motor 47. From the blower outlet the air passes through a heating tube 48 containing electric heating elements 49 and having a terminal 50 adapted to fit in the pipe 45. Electric switches are provided in a box 51 to control the supply of heat and operation of the motor 47.

Operation

Preparatory to coating a metal sheet, one or both of the removable transparent walls 12 are removed to allow access to the sheet holding members and the sheet 13 to be coated is secured in the holder by attaching the clamps 14 to the margins or corners of the sheet and adjusting the springs and anchor members 16 and 17 so that the sheet 13 is held under tension in a substantially vertical plane in the coating and drying chamber defined by the walls 11 and 12. It is usually desirable as a further preliminary to the application of the light sensitive coating to remove finger prints and other foreign matter from the surfaces of the sheet. This cleaning operation may be performed by the use of a hand spray applied to the surfaces of a sheet and the spray may contain a suitable solvent or cleansing material suited to the purpose. During this cleansing operation the excess liquid material flows from the lower edge of the sheet 13 and is directed by the baffle 38 to one or the other of the troughs 36 or 37. This overflow liquid is usually wasted. After the sheet has been thoroughly cleansed the walls 12 are replaced and the baffle 38 is tilted to direct the excess coating liquid into the second or clean trough. A suitable light-sensitive liquid coating material is charged into the reservoir 25 in further preparation for the coating operation.

To coat the sheet 13 in place in the sheet holder, the upper margin of the sheet is placed between the branches 22*a* of the nozzle and the valve lever 27 is actuated to open the valve 26 with the carriage 20 positioned above one end of the sheet 13. As the liquid coating material starts to flow from the nozzle upon the upper margin of the sheet 13, the operator moves the carriage 20 along the track 19 at a suitable, substantially uniform rate so that the liquid is distributed along the upper margin of the sheet 13 and flows down over both surfaces progressively. In some cases a single traverse of the nozzle along the upper margin is sufficient but ordinarily two or more passes along the margin are desirable to afford a coating of the desired thickness and uniformity. After each pass the excess coating adhering to the lower margin of the sheet 13 may be removed by hand and by the use of a squeegee or sponge. With the walls 12 in place and with the sheet properly coated it may be dried without further handling. This is done by forcing warm dry air in through the conduit 45 so that the air passes upward at opposite sides of the troughs 36 and 37 and then upward over the coated surfaces of the sheet 13 and out at the top of the apparatus between the track members 19. When the coating has been thoroughly dried in this manner, the sheet 13 may be removed from the casing for further processing.

It has been found that by supporting the sheet in a substantially vertical plane while applying the coating material along the upper margin thereof so that it flows downward at both sides, a desirable uniformity in the coating may be obtained quickly and easily. Both faces of the sheet being accessible and easily visible through the treatment, continuous inspection and the necessary manual operations such as the preliminary cleansing and removal of excess coating from the lower margin may be performed readily and without handling the sheet or contacting its main coated surfaces constituting the critical areas to be photo-printed and developed. The surfaces of the sheet are also protected from deposits of airborne dust by the enclosing walls during the coating and subsequent drying operations.

Having described my invention, what I claim as new and desire to protect by Letters Patent is:

1. Apparatus for coating a metal blank having a substantially plane continuous surface to be coated with light-sensitive material comprising, means for supporting said blank in a substantially vertical plane, a nozzle formed to deliver an unbroken continuous low velocity stream of liquid coating material solely upon the upper margin of a blank held by said supporting means, a carrier supporting said nozzle for movement along and in parallel relation to the upper edge of a blank held by said supporting means and means for supplying a liquid light-sensitive material to said nozzle whereby said material may be caused to flow downward uniformly over a surface of said blank while said carrier and nozzle are moved longitudinally of the upper edge of the blank.

2. Apparatus in accordance with claim 1 wherein the nozzle is bifurcated to provide branch outlets adapted to receive the upper margin of said blank between them and formed with openings disposed to deliver streams of liquid solely upon opposite narrow marginal surface areas of the blank extending along said upper margin.

3. Apparatus in accordance with claim 1 wherein said blank supporting means comprise a plurality of clamping members adapted to grip the margins of the blank to be coated at opposite ends thereof, rigid supports spaced from the ends of the blank and spring tension members connecting the clamps to the rigid supports.

4. Apparatus in accordance with claim 1 wherein said means for supplying a liquid light sensitive material to said nozzle comprise a reservoir mounted on said carrier and a manually operable valve for controlling the flow of said material to the nozzle.

5. Apparatus for coating a metal blank having a substantially plane continuous surface to be coated with light-sensitive material comprising, an elongated trough, a substantially horizontal track extending longitudinally above said trough, a nozzle carrier movable along said track, a nozzle depending from said carrier, means for supplying said nozzle with a liquid light-sensitive material at a low gravity head, and a sheet holder adapted to support a metal blank to be coated in a substantially vertical plane below said track and above said trough, said nozzle being formed with an outlet opening disposed to direct an unbroken continuous low velocity stream of said material solely upon the upper margin of a blank supported on said holder and said carrier being movable along said track to cause the nozzle to distribute said material solely along the upper margin of said blank.

6. Apparatus for coating a metal blank having a substantially plane continuous surface to be coated with light-sensitive material comprising, an elongated trough, parallel end walls extending upward adjacent to the ends of said trough, a substantially horizontal track extending longitudinally above said trough and between said end walls, a nozzle carrier movable along said track, a nozzle depending from said carrier, means for supplying said nozzle with liquid light-sensitive material at a low gravity head, a blank holder adapted to support a metal blank to be coated in a substantially vertical plane below said track and above said trough, said nozzle being formed with an outlet opening disposed to direct an unbroken continuous low velocity stream of said material solely upon the upper margin of a blank supported on said holder and said carrier being movable along said track to cause said nozzle to distribute said material solely along the upper margin of said blank and side walls extending between said end walls for enclosing opposite faces of a blank mounted on said holder.

7. Apparatus for coating a metal blank with light-sensitive material comprising, an elongated trough, a substantially horizontal track extending longitudinally above said trough, a nozzle carrier movable along said track, a nozzle depending from said carrier, means for supplying said nozzle with a liquid light-sensitive material, a blank holder

adapted to support a metal blank to be coated in a substantially vertical plane below said track and above said trough, said nozzle being disposed to direct a stream of said material solely upon the upper margin of a blank supported on said holder and said carrier being movable along said track to cause said nozzle to distribute said material solely along the upper margin of said blank, a casing for enclosing a blank held by said holder, said trough being disposed to collect excess coating material flowing from the lower edge of a blank on said holder during the coating and means for supplying drying air to the interior of said casing for drying the coated surfaces of the blank held by said holder.

8. Apparatus for coating a metal blank with light-sensitive material comprising, a casing, a blank supporting means adapted to hold a blank in a substantially vertical plane within said casing, a nozzle having a tip disposed to deliver a stream of liquid coating material solely to the upper margin of a blank so supported within said casing, means for guiding the tip of said nozzle along and in parallel relation to the upper edge of a blank so supported in said casing, means for supply a liquid light-sensitive material to said nozzle, said nozzle being movable along said guide to distribute said material solely along the upper margin of said blank and means for supplying drying air to the interior of said casing whereby the coated blank may be dried while enclosed in said casing.

References Cited in the file of this patent

UNITED STATES PATENTS

1,876,967	Krause et al.	Sept. 13, 1932
2,377,780	Hann	June 5, 1945
2,403,661	Hurley	July 9, 1946
2,489,445	Benzuly	Nov. 29, 1949
2,615,529	Lincoln	Oct. 28, 1952
2,651,287	Turner	Sept. 8, 1953
2,665,698	Robinson	Jan. 12, 1954