

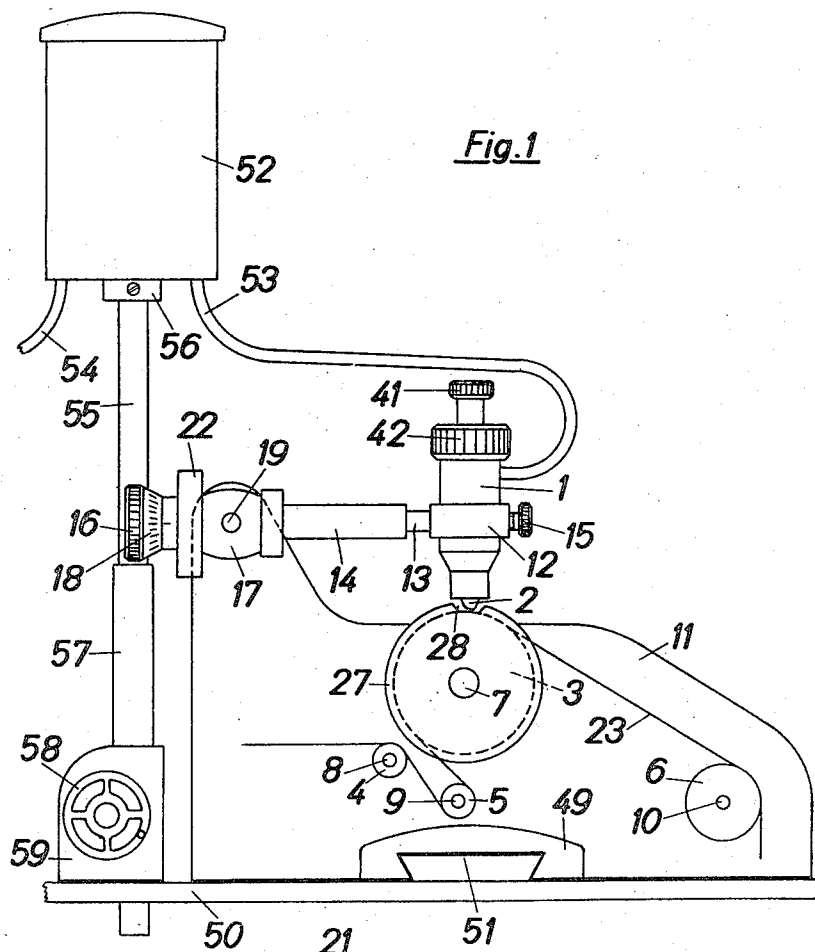
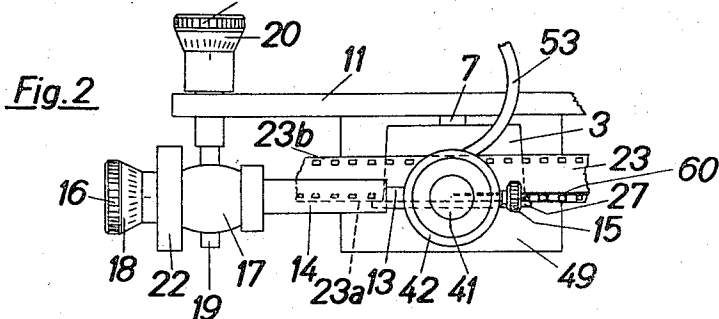
March 24, 1959

F. BIEDERMANN ET AL
STRIP COATING APPARATUS

2,878,779

Filed Aug. 10, 1955

3 Sheets-Sheet 1



INVENTORS
Friedrich Biedermann
BY Franz Jakob
Fritz Rau
Connolly and Hutz
ATTORNEYS

March 24, 1959

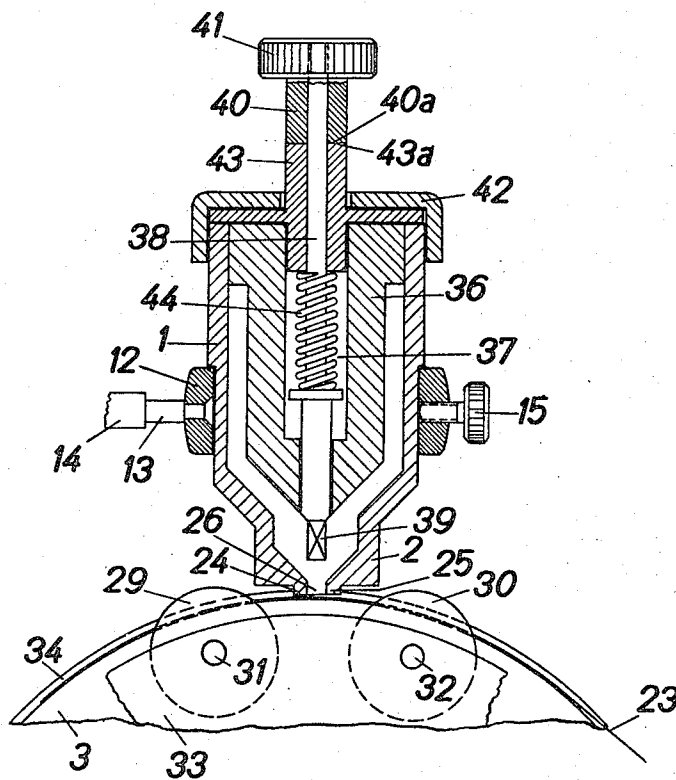
F. BIEDERMANN ET AL
STRIP COATING APPARATUS

2,878,779

Filed Aug. 10, 1955

3 Sheets-Sheet 2

Fig. 3



INVENTORS
Friedrich Biedermann
BY Franz Jakob
Fritz Rau
Connolly and Hutz
ATTORNEYS

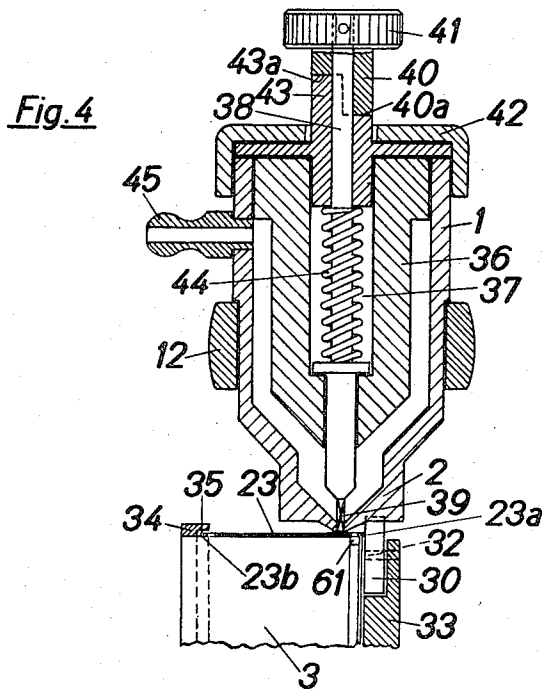
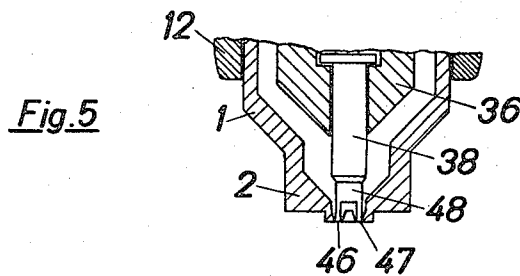
March 24, 1959

F. BIEDERMANN ET AL
STRIP COATING APPARATUS

2,878,779

Filed Aug. 10, 1955

3 Sheets-Sheet 3



INVENTORS

Friedrich Biedermann

BY Franz Jakob

Fritz Rau

Connolly and Hutz
ATTORNEYS

1

2,878,779

STRIP COATING APPARATUS

Friedrich Biedermann, Munich-Unterhaching, and Franz Jakob and Fritz Rau, Munich, Germany, assignors to AGFA Aktiengesellschaft

Application August 10, 1955, Serial No. 527,575

Claims priority, application Germany September 3, 1954

15 Claims. (Cl. 118—412)

This invention relates to apparatus for applying a coating to a moving strip, and more particularly to apparatus for depositing a coating on a moving strip by means of a nozzle.

Coating apparatus is used for depositing magnetic sound tracks on a strip of film. Magnetizable particles are dispersed in a liquid containing a binding agent, and are dispensed through a nozzle.

Apparatus for applying a liquid containing a magnetite dispersion to strips are known. More particularly, it has been proposed to pass the strip to be coated in close contact over a rotating roller which is partially immersed in a tank filled with magnetite dispersion. The dispersion adhering to the roller is thereby transferred to the strip. Furthermore, it is known to apply the magnetite dispersion to the passing strip through a deposition chute.

The use of coating nozzles in the manufacture of magnetic sound tracks on motion picture films has also been proposed. In this case the film to be coated is passed under the lower edge of a fixed nozzle. Moreover, it has been proposed to pass the film at the coating point over a fixed or revolving roller and to locate the depositing device at a distance above the film.

For reproducible production of a desired thickness of the magnetite layer to be deposited on the film, the first two devices mentioned above particularly require considerable mechanical precision. Whereas, a device utilizing a nozzle under which the film is passed without being supported at the coating point has the disadvantage that the film to be coated rests with the whole of its width on the lower edge of the coating nozzle, which involves the risk of the image areas of the film being scratched when it is pulled past the nozzle. Moreover, it is impossible to adjust the distance of the magnetic sound track from the edges of the film at will when one and the same nozzle is used so that a separate nozzle is needed for each desired distance of the sound track from the edge of the film. Even the location of the depositing device at a distance above the film to be coated, which is supported at the coating point by a roller, requires a great deal of mechanical precision if it is desired to vary the thickness of the coating. Furthermore, difficulties arise when the film strip has been spliced.

In contradistinction from these known devices the present invention provides a coating apparatus which is particularly suitable for producing magnetic sound tracks constituted of magnetizable particles incorporated in a liquid containing a binding agent. This liquid is applied through a nozzle to a strip, particularly a film strip. The present apparatus is characterized in that the coating head including the nozzle is movably mounted to freely ride upon the strip at the coating point, at which point the strip passes over a curved surface which may be a roller. The nozzle portion of the coating head rides upon the strip at a part of the nozzle facing the approaching film strip, more particularly at its side facing the direction from which the film approaches. The coating device or nozzle is also mounted in a manner to permit the distance be-

2

tween its side facing the outgoing film strip and the strip to be coated to be adjusted. To this end the nozzle is adapted to be movable on the periphery of the film-supporting roller. Furthermore, it is movable across the direction of travel of the strip and pivotable about the axis of a holding arm. These movements of the nozzle are performed with the aid of rotatable members provided with graduated scales. The position of the nozzle may be thereby universally adjusted.

The novel features and advantages of the present invention will become apparent to one skilled in art from a reading of the following description in conjunction with the accompanying drawings in which:

Fig. 1 shows in front elevation an embodiment of this invention;

Fig. 2 is a plan view of parts of the apparatus, shown in Fig. 1;

Fig. 3 is a longitudinal section through the coating head, shown in Figs. 1 and 2, showing also a modified form of guiding means for the film to be coated;

Fig. 4 is a transverse section corresponding to Fig. 3; and

Fig. 5 shows in transverse section components of a modified head having a nozzle with two orifices.

Referring to Figs. 1 and 2 of the drawings, the coating apparatus shown has a coating head 1 with nozzle 2, a film-supporting roller 3 and film guide and drive rollers 4, 5, and 6. The rollers 3, 4, 5, 6 revolve about spindles 7, 8, 9, 10 on a plate 11.

The head 1 is removably mounted in a ring clamp 12, which is attached to a telescopic part 13 of an arm 14, and can be fixed in position by means of a clamping screw 15. The extent to which the part 13 projects from the arm 14 is controlled by a knurled knob 16, in conjunction with a known type of gearing inside a housing 17, and is indicated on a scale 18. The whole of the described holding and control device for the head 1 can be pivoted about a shaft 19 having a bearing in the plate 11 and is likewise adapted for telescopic movement by means of a knurled knob 21 provided with a scale 20. This allows the head 1 to be displaced parallel to the spindle 7 of the film-supporting roller 3. In addition the arm 14 with the telescopic part 13, the ring clamp 12 and the head 1 can be turned about the longitudinal axis of the arm 14, and this turning can be adjusted and arrested by means of a knurled ring 22 which likewise has a scale (knurl and scale not shown).

In the operative position of the head 1 its nozzle 2 rests or rides freely on a film strip 23 to be coated, which in Figs. 1, 2 and 3 travels from left to right (the magazines for the uncoated and the coated film are not shown). At the coating point the film strip 23 is guided over and supported by the roller 3. Since, owing to deformations produced in the perforated area of the film in the course of the perforating operation, the film is not perfectly flat in the perforated area; the film-supporting roller is provided in the zone where the perforations pass over it with an annular groove 61 (Fig. 4) as wide as or wider than these perforations. In this manner the object is achieved that the portion of the film area where the coated sound track is to be produced rests firmly on the film-supporting roller.

The nozzle 2 is not positioned exactly vertically above the center of spindle 7 of the roller 3 but is set off peripherally (see Fig. 3) by a variable amount in the direction of travel of the coated film so that only that side 24 of an orifice 26 of the nozzle 2 which faces the approaching film touches the film strip 23. The edge of the side 24 of the nozzle orifice which rests on the film strip 23 is so narrow that it does not touch the photographic images on the film when a sound track 60 (Fig. 2) is produced on the film at the conventional distance therefrom. To protect the marginal portions of the film strip 23 against

scratching, the afore-mentioned nozzle edge 24 is slightly rounded off.

Instead of the edge of the side 24 of the nozzle orifice which faces the approaching film, another part closely adjacent to the nozzle orifice 26 and integral with, or attached to, the nozzle 2 may be provided to rest or ride on the film strip 23.

The contact pressure of the head 1 on the film strip is reduced by the knob 16 and the knurled ring 22, which act as counterweights and can be adjusted to the optimum value in reference to deposition of the coating by suitably distributing their weight. The contact pressure of the head can also be reduced by means of a spring (not shown) arranged about the shaft 19 and acting on the arm 14.

The thickness of the coating 60 deposited on the film strip is determined by the distance of the film withdrawal side 25 of the nozzle orifice 26 from the film strip 23 and can be established and varied in a simple manner by suitably moving the head 1 with the nozzle 2 along the periphery of the roller 3 by operating the knob 16. The further away the nozzle orifice 26 is from the vertical line of symmetry of the roller 3 in the direction in which the coated film strip travels, the greater is the distance of the non-contact-making nozzle side 25 from the film strip 23 traveling over the roller 3 and consequently the thicker is the deposited coating 60. Variations in the thickness of the film base have practically no effect upon the thickness of the magnetite layer produced.

Instead of adjusting the thickness of the coating by means of the afore-mentioned peripheral displacement of the nozzle 2, this could be done by turning or tilting the head 1, and with it the nozzle 2, about the axis of a pivot provided, for example, in the clamp ring 12 and located parallel to the spindle 7.

Furthermore, the distance of the magnetite coating to be deposited on the film strip 23 from the edges of the film strip can be adjusted by turning the knob 21. In the example shown in Fig. 2, a sound track 60 is being produced between the film perforations and the image area.

To insure that the film passes the coating point rectilinearly, a guide flange 27 may be rigidly attached to the fixed spindle 7 of the roller 3 parallel to the latter, see Figs. 1 and 2. This guide flange has a diameter slightly greater than that of the roller 3 and is recessed at 28 to enable the head 1 to move unhindered throughout the area of its adjustment. While traveling over the roller 3 the film strip 23 rests with its edge 23a against the guide disc 27 both in front of and behind the coating point so that it is accurately guided at the coating point. Close contact between the film strip 23 and the guide roller 27 can be promoted by making the roller 3 slightly conical or tapering it with its larger diameter adjacent said flange. The illustration of this feature shown in Fig. 2 is exaggerated for the sake of clarity.

In a further embodiment of the invention shown in Figs. 3 and 4, the guide disc 27 is replaced by a disc 33 having guide rollers or discs 29 and 30 provided in front of and behind the coating point which are respectively rotatable about fixed spindles 31 and 32 in the disc 33. Disc 33 is likewise rigidly attached to the spindle 7 of the roller 3 and does not participate in the rotation of the roller 3. The rollers 29, 30 are set in rotation by the edge 23a of the film strip 23 which moves in frictional contact with them.

To achieve even closer contact between the film strip 23 and the guide rollers 29, 30 a ring 34 with an annular rabbet 35 may be attached to that side of the curved surface of the roller 3 opposite to the film edge to be coated (see Fig. 4). The rabbet 35 together with the working surface of the roller 3 forms an annular groove which is parallel to said surface. The distance between the guide rollers 29, 30 and the ring 34 is made very slightly smaller than the width of the film strip 23, so that the

latter runs on to and off the roller 3 with a slight transverse compression. This causes film strip edge 23a to press against the guide rollers 29, 30. In the gap between the rollers 29 and 30, however, its other edge 23b can expand into the groove at 35 so that at the coating point it is free from transverse compression. In this case the roller 3 is not conical. Obviously the ring 34 may form an integral part of the roller 3, if desired.

Details of the head 1 are shown in Figs. 3 and 4. It is of funnel shape. Its constricted lower end carries the nozzle 2 and is shown inserted in the clamp ring 12. Inside the head 1 there is provided a guide member 36 in whose co-axial bore 37 is a pin 38 which is adapted to rotate and to be moved axially. At the point of the pin 38 there is a plunger 39 the cross-section of which corresponds to the nozzle orifice 26 and which is located inside the orifice before the beginning of the coating act and keeps it closed (see Fig. 4). The head of the pin 38 carries a rotatable member 40 with a knob 41 rigidly attached thereto. The rotatable member 40 is stepped and, when the nozzle orifice 26 is closed, it is in engagement with a mating stepped fixed guide member 43 which protrudes through a lid 42 of the head 1. When at the beginning of the coating act the knob 41 is withdrawn, the pin 38 is moved upwards against the action of a spring 44 so that the orifice 26 of the nozzle is freed and the magnetite dispersion introduced through the inlet coupling 45 into the interior of the head 1 can be discharged through the said orifice. The pin 38 is maintained in the raised position by turning the knob 41 through 180° about its longitudinal axis so that the flat 40a of the member 40 comes to rest on the flat 43a of the member 43 (see Fig. 3).

The cross-section of the nozzle orifice 26 is advantageously rectangular, but it may also be of other, for example round or oval, shape.

In order to enable the simultaneous deposition of two adjacent magnetic sound tracks, the nozzle 2 of the head 1 may be provided with two orifices 46, 47 (Fig. 5). In such a case the plunger 48 is bifurcated to close the two nozzle orifices simultaneously. In a similar manner the nozzle 2 may also have more than two orifices.

The plate 11, which forms a structural unit with the coating device described above, is attached to a slotted guide member 49 which engages and slides on a correspondingly shaped dove-tailed rail 51 attached to a baseplate 50. This arrangement makes it possible for the coating unit to be easily replaced by another unit, for example by one which is proportioned for a different film width. The spindle 10 of the film transport roller 6 can be coupled at the rear of the plate 11 by means of a conventional clutch, not illustrated, with a film drive mechanism for the coating apparatus (not shown).

The baseplate 50 may be used to mount a plurality of coating units according to the invention, arranged consecutively in the film transport path, for the purpose of producing one or more magnetite coatings on each edge of the film strip 23. These coatings may be used either for sound projection over several sound channels (stereophonic film) or for recording additional signals. When only one sound track is to be used for the sound recording, it might tend to cause the two edges of the film to wind unevenly on to the reel. A second unit may, therefore, be used to deposit a compensating track on the other edge of the film to cause the film to wind evenly. In such a second unit (not shown in the drawings) the guide disc 27, or the guide rollers 29, 30, may differ from those shown in the drawings in that they are located to contact that edge of the film strip 23 which is adjacent the plate 11.

For all coating units a common storage tank 52 is provided to supply the magnetite dispersion to be used. This tank is connected with the individual heads 1 by means of hoses 53, 54 attached to inlet couplings 45. The storage tank 52 is removably supported on a plate

5

56 on a column 55. The column 55 can be moved up and down in a sleeve 57 by means of a gearing provided inside a housing 59 by operating a handwheel 58. When the column 55 is moved downwardly, it can partially penetrate an opening in the baseplate 50 of the work table. By vertical displacement of the storage tank 57, the discharge velocity of the magnetite dispersion from the nozzle 2 can be controlled and kept constant irrespective of the quantity of the dispersion contained in the tank 52.

Apparatus in accordance with this invention has the advantage that the coating nozzle always occupies a definite, adjustable position in relation to the strip to be coated. Owing to the fact that the nozzle is adapted for movement on the periphery of the film-supporting roller, the distance which separates the nozzle side, which faces away from the coating point and does not rest on the strip, from this strip can be adjusted at will. The thickness of the coating to be deposited can be accordingly adjusted with ease. When the film-supporting roller is of a sufficiently large diameter, very little mechanical precision is required for this purpose. The provision for moving the nozzle transversely enables the coating fluid, for example the magnetite dispersion, to be deposited on the strip at any desired distance from the edges of the strip. When sound tracks are being cast on motion picture films, the image areas are safe from scratching because the nozzle does not touch them.

The strip is transported extremely accurately in a straight line so that the distance between the deposited coating and a reference edge of the coated strip remains constant over the whole length of the strip. The combination of the component parts of the device in a structural unit and the resulting easy interchangeability of the unit, as well as the provision of several such coating units in the path of the strip, make the uses of this invention widely applicable. Thus, for example, one and the same machine may be used for coating films of different width. More particularly, 8 mm., 16 mm., and 35 mm. films can be provided with one or more magnetic sound tracks. The coating may be deposited, on the emulsion side, or on the back, prior or subsequent to the photographic development of the film. The magnetite layer may be produced in known manner between the film perforations and the film edges, or between the perforations and the image areas (frames). When the film has only unilateral perforations, the sound track can be produced along the nonperforated edge of the film.

What is claimed is:

1. An apparatus for applying a liquid coating upon a moving strip parallel to the direction of movement of said strip, comprising a dispensing device for said liquid, said dispensing device including a strip support arranged at one side of the path of movement of said strip and having a convexly curved surface over which said strip passes thereby causing said strip to travel along a curved path of movement, a coating head with a nozzle for depositing said liquid upon said strip, the radius of curvature of said convexly curved surface being very large relative to the width of said nozzle in the direction of movement of said strip, said coating head being attached to a pivotable mounting arm and being arranged at the side of the path of movement of said strip opposite to said strip support so that said coating head rests yieldably upon said moving strip with the side of said nozzle adjacent the approaching portion of said moving strip being in contact with said strip at a convexly curved portion of its path of movement and the other side of said nozzle being maintained out of contact with said strip with a predetermined distance provided between the part of said nozzle adjacent the withdrawing portion of said moving strip and the surface of said strip, and means for shifting said coating head with said nozzle tangentially along said convexly curved portion of said strip for varying said predetermined distance between

6

said part of said nozzle adjacent the withdrawing portion of said moving strip and its surface while said part of said nozzle adjacent the approaching portion of said strip is maintained in contact with said strip whereby the thickness of the deposited coating is precisely varied.

2. The apparatus comprising the combination set forth in claim 1 wherein said strip support includes a rotating roller.

3. The apparatus comprising the combination set forth in claim 2 wherein said roller includes a peripheral groove which is wide enough to cause imperforated portion of a perforated strip to lie flat upon said roller.

4. The apparatus comprising the combination set forth in claim 2 wherein said guide means includes guide discs rotatably mounted with portions of their faces in contact with the edge of said moving strip, said guide discs being positioned before and after said coating point, and said guide means includes means for pressing said strip into contact with said guide discs.

5. The apparatus comprising the combination set forth in claim 4 wherein said pressing means is comprised of means for applying a transverse compressing force to said strip.

6. The apparatus comprising the combination set forth in claim 1 wherein said part of the nozzle which contacts said strip is rounded.

7. The apparatus comprising the combination set forth in claim 1 wherein said nozzle forms part of a replaceable coating head, a clamp is mounted upon said pivotable mounting arm, and said replaceable coating head is secured within said clamp.

8. The apparatus comprising the combination set forth in claim 1 wherein said pivotable mounting arm includes means for controlling the contact pressure between said nozzle and said strip.

9. The apparatus comprising the combination set forth in claim 8 wherein said means for controlling said contact pressure is comprised of a counter weight which is adjustably connected to said pivotable mounting arm for counterbalancing the weight of said coating head.

10. The apparatus comprising the combination set forth in claim 1 wherein said support means for the nozzle includes means for adjusting the position of the nozzle in the direction perpendicular to the direction of movement of said strip.

11. The apparatus comprising the combination set forth in claim 1 wherein said nozzle comprises an element having two outlet openings whose sides are constructed and arranged in the manner set forth in claim 1 for depositing a plurality of coating stripes upon said strip.

12. The apparatus comprising the combination set forth in claim 7 wherein said coating head with said nozzle and said support means, said guide means supporting said strip, and strip drive and guide rollers form a unit which is detachable from the remainder of the apparatus.

13. The apparatus comprising the combination set forth in claim 1 in combination with a storage tank connected to said dispensing device to supply said liquid thereto, and vertically adjustable means supporting said tank to allow a constant flow of liquid to be maintained irrespective of the quantity of liquid contained in said tank.

14. An apparatus for applying a liquid coating upon a moving strip parallel to the direction of movement of said strip, comprising a dispensing device for said liquid, said dispensing device including a strip support arranged at one side of the path of movement of said strip and having a convexly curved surface over which said strip passes thereby causing said strip to travel along a curved path of movement, a coating head with a nozzle for depositing said liquid upon said strip, the radius of curvature of said convexly curved surface being very large relative to the width of said nozzle in the direction of movement of said strip, said coating head being attached to a pivotable mounting arm and being arranged at the

7

side of the path of movement of said strip opposite to said strip support so that said coating head rests yieldably upon said moving strip with the side of said nozzle adjacent the approaching portion of said moving strip being in contact with said strip at a convexly curved portion of its path of movement and the other side of said nozzle being maintained out of contact with said strip with a predetermined distance provided between the part of said nozzle adjacent the withdrawing portion of said moving strip and the surface of said strip, and means for shifting said coating head with said nozzle tangentially along said convexly curved portion of said strip for varying said predetermined distance between said part of said nozzle adjacent the withdrawing portion of said moving strip and its surface while said part of said nozzle adjacent the approaching portion of said strip is maintained in contact with said strip whereby the thickness of the deposited coating is precisely varied, said strip support including a rotating roller, the part of said nozzle contacting said moving strip including an opening through which said liquid is dispensed, the diameter of said roller being large relative to the size of said opening, said roller having a tapering surface, guide means being provided upon said roller, said guide means including a guide flange, and the larger diameter of said tapering surface being adjacent said flange to promote contact between said strip and said guide flange.

15. An apparatus for applying a liquid coating upon a moving strip parallel to the direction of movement of said strip, comprising a dispensing device for said liquid, said dispensing device including a strip support arranged at one side of the path of movement of said strip and having a convexly curved surface over which said strip passes thereby causing said strip to travel along a curved path of movement, a coating head with a nozzle for depositing said liquid upon said strip, the radius of curvature of said convexly curved surface being very large relative to the width of said nozzle in the direction of movement of said strip, said coating head being attached to a pivotable mounting arm and being arranged at the side of the path of movement of said strip opposite to said strip support so that said coating head rests yieldably upon said moving strip with the side of said nozzle adjacent the approaching portion of said moving strip

8

being in contact with said strip at a convexly curved portion of its path of movement and the other side of said nozzle being maintained out of contact with said strip with a predetermined distance provided between the part of said nozzle adjacent the withdrawing portion of said moving strip and the surface of said strip, means for shifting said coating head with said nozzle tangentially along said convexly curved portion of said strip for varying said predetermined distance between said part of said nozzle adjacent the withdrawing portion of said moving strip and its surface while said part of said nozzle adjacent the approaching portion of said strip is maintained in contact with said strip whereby the thickness of the deposited coating is precisely varied, said strip support including a rotating roller, the part of said nozzle contacting said moving strip including an opening through which said liquid is dispensed, the diameter of said roller being large relative to the size of said opening, said guide means including guide discs rotatably mounted with portions of their faces in contact with the edge of said moving strip, said guide discs being positioned before and after said coating point, said guide means including means for pressing said strip into contact with said guide discs, said pressing means is comprised of means for applying a transverse compressing force to said strip, and said pressing means is comprised of a ring including an annular rabbet forming an annular groove opposite said guide discs.

References Cited in the file of this patent

UNITED STATES PATENTS

596,905	McCoy	Jan. 4, 1898
2,144,263	Lane	Jan. 17, 1939
2,328,183	Barrett	Aug. 31, 1943
2,700,954	Speed et al.	Feb. 1, 1955
2,700,955	Speed et al.	Feb. 1, 1955
2,703,066	Speed et al.	Mar. 1, 1955
2,714,363	Speed et al.	Aug. 2, 1955
2,727,881	Nerin	Sept. 1, 1954

FOREIGN PATENTS

714,881	Great Britain	Sept. 1, 1954
---------	---------------	---------------