

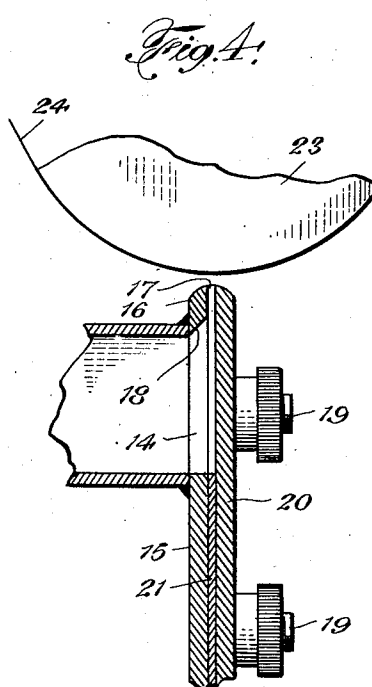
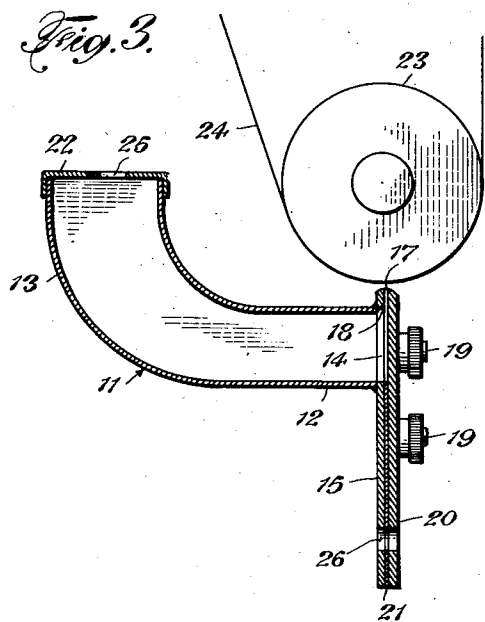
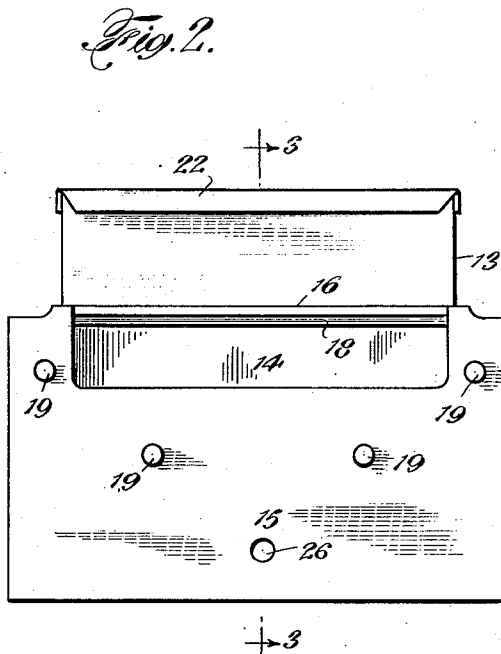
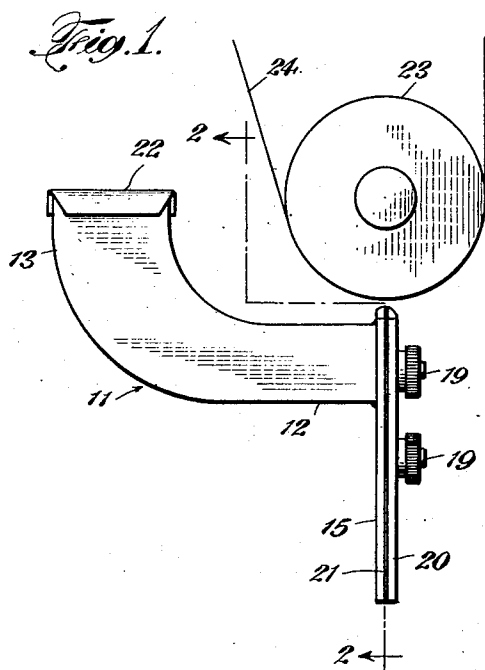
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COATING HEAD

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## COATING HEAD

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This invention relates to coating heads such as are employed for applying a film of a desired substance upon a band of suitable material. More particularly, the invention relates to apparatus for continuously applying a thin, uniform, liquid film upon a moving band or strip of flexible sheet material of indefinite length by capillary attraction.

It is an object of the invention to provide improved apparatus for applying thin liquid coatings to bands of flexible sheet material by capillary attraction. Other objects and advantages of the invention will appear hereinafter.

A preferred embodiment of the invention selected for purposes of illustration and description is shown in the accompanying drawings, in which:

Figure 1 is a side elevation of a coating head constructed according to my invention;

Figure 2 is a front elevation of the coating head with the cover plate 20 removed, being a view taken substantially on the line 2—2 of Figure 1;

Figure 3 is a vertical section through the coating head, including the cover plate, taken substantially on the line 3—3 of Figure 2; and

Figure 4 is a vertical section showing a portion of Figure 3 to enlarged scale, so as to disclose more clearly the orifice upon which the coating meniscus will be formed and the passageway for the coating liquid from the reservoir to the orifice.

It has been suggested heretofore that a film of a desired substance might be applied to a long strip of flexible sheet material by moving the strip in close proximity to a narrow, horizontal, slot-like orifice fed with coating liquid in such manner that an unbroken film of liquid is maintained between the edges defining the orifice and the moving surface which is to be coated. As the strip is moved past the meniscus formed at the narrow slot-like orifice, the strip will be coated by the liquid by capillary attraction.

In coating heads of the prior art it has been proposed to locate the narrow slot-like orifice at the upper edge of a trough which, throughout its depth, has the same or approximately the same shape and horizontal cross section as the orifice. It has been proposed to supply liquid coating material to such a trough from a reservoir through a pipe or pipes connected to the lower part of the trough. Since, with such a construction, the coating liquid must travel a considerable distance lengthwise of the narrow trough to reach all parts of the orifice, the trough

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is made deep, as compared with the width of the orifice, in an attempt to obtain a more or less uniform distribution of the coating liquid throughout the full length of the orifice. However it is difficult or impossible to obtain a uniform flow of liquid through the deep narrow trough to all parts of the orifice. Moreover, the coating substance generally contains a considerable percentage of solid matter, often in a highly evaporable solvent, and there is danger that a deep narrow trough such as has been described may become partially choked or impeded to liquid flow, thus adversely affecting the evenness of the coating applied to the strip. It has even been proposed to employ specially shaped orifice lips in an attempt to secure more uniform coating of the moving strip with the liquid.

According to the present invention the orifice on which the meniscus is formed is located in very close proximity to the reservoir—in effect right in the wall of the reservoir—and the orifice is fed directly from the reservoir uniformly throughout its length with practically no possibility of the orifice becoming clogged or of the liquid flow impeded. There is no need for specially shaped orifice lips.

The coating head of the present invention may be used for applying films of various materials, and on strips of various materials. The coating head is adapted for applying films of liquids made with highly evaporable solvents. Merely as an example, a cellulose acetate strip may be coated with cellulose nitrate by applying a film of an ether and alcohol collodion solution.

Referring to the drawings, a shallow, covered reservoir 11 is provided for the coating liquid, this reservoir being generally L-shaped with the length of the horizontal extension 12 exceeding the height of the vertical portion 13. The horizontal extension 12 is permanently covered. Liquid coating material can be supplied to the reservoir through the top of the vertical portion 13, which is provided with a removable cover 22. This cover is suitably designed to prevent excessive evaporation of solvents used in the preparation of the liquid coating material, while allowing sufficient air to enter the reservoir, as through hole 25, in order to keep the internal pressure constant.

The width of the horizontal extension 12 should be at least equal to the width of the strip which is to be coated and preferably should equal or closely approximate the width of the strip. The end of the horizontal extension 12 is provided with a horizontally elongated opening 14,

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the length of which is at least equal to and desirably is substantially the same as the length of the slot-like orifice on which the meniscus is to be formed. Preferably the horizontally elongated opening 14 will be provided by leaving the entire end of the horizontal extension 12 open, as shown, thus avoiding the formation of corner pockets in the reservoir which might interfere with continuous unimpeded movement of coating liquid from the reservoir to the orifice or might permit partial separation or settlement of the components of the coating liquid.

A flange plate 15 is provided on the end of the horizontal extension 12, surrounding the opening 14 therein. Ordinarily the reservoir 11 will be made of metal, and the flange plate 15 may be secured thereon by soldering or by other suitable method. The flange plate 15 has a straight upper edge 16 which is disposed horizontally when the coating head is in operating position. This horizontal upper edge preferably rises above the horizontal portion 11 of the reservoir only a very short distance and it defines one side of the slot-like orifice 17 on which the meniscus is to be formed. As may be seen in Figures 3 and 4, the lower portion of the edge 16 preferably is beveled adjacent the opening 14, as shown at 18, to provide an unobstructed short passageway of large and tapering cross section from the reservoir 12 right up to the slot-like orifice 17.

The portions of the flange plate 15 extending to the sides and below the opening 14 preferably are provided with screw-headed studs 19 or other suitable fastening means to facilitate securing the cover plate 20 over the opening 14. The lower edge of the flange plate may be utilized for mounting the coating head in its desired operating position, as by means of the hole 26, which permits tilting the head to bring the orifice 17 to the desired horizontal position.

The cover plate 20 desirably matches the flange plate 15 except that it is not provided with any opening corresponding to the opening 14 in the wall of the reservoir 12. The upper edge of the cover plate 20 lies parallel to the upper edge 16 of the flange plate 15, is of the same height, and is separated therefrom slightly to form the narrow slot-like orifice 17. The upper edges of the flange plate and the cover plate desirably are rounded off somewhat as shown.

The separation between the upper edges of the flange plate 15 and the cover plate 20 preferably is obtained by interposing between the plates a thin U-shaped sheet metal element or shim 21 which extends from the top of the flange plate near one end thereof, down one side of the opening 14, along the bottom of the opening, and up along its other side to the top of the flange plate near the other end thereof. This element may be made, for example, of sheet copper and, when pressed between the flange plate and the cover plate by tightening the nuts on the studs 19, will function as a gasket to prevent escape of coating liquid from the opening 14 in the reservoir 11, except upwardly through the slot-like orifice 17.

The width of the orifice 17 may be varied, depending on the nature of the coating liquid and the speed of movement of the band to be coated, by selection of sheet material of suitable thickness for forming the element 21. Also it is possible to decrease the length of the orifice, for coating narrower strips, by increasing the width of the vertical end portions of the element 21.

In practice, the strip of material which is to be coated usually is passed around a roller which

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is located with its axis parallel to the longitudinal edges of the slot-like orifice 17 and with its surface spaced very slightly above the orifice. Such a roller is indicated at 23 on the drawings and 24 designates the strip of flexible material.

When the reservoir 11 is supplied with coating liquid to a level which is approximately the height of the slot-like orifice 17, a meniscus can be formed along the length of the orifice between the longitudinal edges thereof and the strip 24, as by drawing a brush along the orifice 17. When the strip then is moved over the roller 23 at a uniform speed the strip will be coated by capillary attraction with the liquid contained in the reservoir. The moving strip, with its coating, will then be subjected to suitable drying conditions as it passes to a takeup device.

Since the orifice 17 is located practically in the wall of the reservoir 12 so that the reservoir feeds liquid directly to the orifice without having to pass through any intervening long, narrow, or tortuous passageway, and since the reservoir extends the full length of the orifice, coating liquid will be supplied uniformly throughout the length of the orifice, and the moving strip will be coated from edge to edge with a coating of uniform thickness.

The invention herein disclosed may be variously modified and embodied within the scope of the subjoined claims.

I claim:

1. A coating head for applying liquid coatings to the surfaces of long strips of flexible material comprising, in combination, a relatively shallow, covered reservoir having an open end, the length of the open end being at least equal to the width of the strip to be coated, a flange plate provided with an opening corresponding to the opening in the end of the reservoir, said flange plate being affixed to the reservoir surrounding the opening in the end of the reservoir, the flange above the opening being narrow and having a horizontal upper edge, a thin U-shaped sheet metal element adjacent the face of said flange plate and extending from the top of said flange plate near one end thereof, down one side of the opening, along the bottom of the opening, and up its other side to the top of the flange plate near the other end thereof, a flat cover plate for the flanged opening in the end of the reservoir, said cover plate having a horizontal upper edge matching the upper edge of the flanged plate, and means for removably clamping the cover plate against the flanged plate separated only by the U-shaped element to provide a narrow, slot-like, horizontal orifice for the reservoir at the upper edges of said plates.

2. A coating head according to claim 1 including, in combination, means for supporting the surface to be coated in close proximity to said orifice out of contact with the said plates, and means for moving said surface continuously across the orifice while maintaining an unbroken film of liquid between the upper edges of the plates defining the orifice and the surface to be coated.

3. A coating head for applying liquid coatings to the surfaces of long strips of flexible material comprising, in combination, a relatively shallow, covered reservoir having an open end, a flange plate provided with an opening corresponding to the opening in the end of the reservoir, said flange plate being affixed to the reservoir surrounding the opening in the end of the reservoir, said flange plate having a horizontal

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upper edge, a thin U-shaped sheet metal element adjacent the face of said flange plate and extending from the top of said flange plate near one end thereof, down one side of the opening, along the bottom of the opening, and up its other side to the top of the flange plate near the other end thereof, a flat cover plate for the flanged opening in the end of the reservoir, said cover plate having a horizontal upper edge matching the upper edge of the flange plate, means for removably clamping the cover plate against the flange plate separated only by the U-shaped element to provide a narrow, slot-like, horizontal orifice for the reservoir at the upper edges of said plates, and means for supplying coating liquid to the reservoir at a location opposite the open end.

4. A coating head for applying liquid coatings to the surfaces of long strips of flexible material comprising, in combination, a reservoir for the coating liquid having a horizontally disposed extension adjacent its bottom, a horizontally elongated opening in the end of said extension, a flange plate provided with an opening corresponding to the opening in the end of said extension, the flange plate being affixed on the end of said extension surrounding the opening therein, a thin, U-shaped sheet metal element adjacent the face of said flange plate and extending from the top of said flange plate near one end thereof, down one side of the opening, along the bottom of the opening, and up along its other side to the top of the flange plate near the other end thereof, a flat cover plate for the flanged opening in the end of the reservoir, said cover plate having a horizontal upper edge matching the upper edge of the flange plate, and means for removably clamping the cover plate against the flange plate separated only by the U-shaped element to provide a narrow, slot-like, horizontal orifice for the reservoir at the upper edges of said plates.

5. A coating head for applying liquid coat-

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ings to the surfaces of long strips of flexible material comprising, in combination, an L-shaped reservoir for the coating liquid in which the length of the horizontal extension exceeds the height of the vertical portion, an opening in the top of the vertical portion for supplying coating liquid to the reservoir, the enclosing walls of the horizontal extension terminating at and affixed to a flange plate extending outwardly from all walls of the horizontal extension and pierced with an opening corresponding to the smooth inner sides of said walls, the upward extension of the flange plate being sufficient only to give clearance between the body of the reservoir and the strip to be coated, a thin, U-shaped sheet metal element adjacent the face of said flange plate and extending from the top of said flange plate near one end thereof, down one side of the opening, along the bottom of the opening, and up its other side to the top of the flange plate near the other end thereof, a flat cover plate for the flanged opening in the end of the reservoir, said cover plate having a horizontal upper edge matching the upper edge of the flange plate, and means for removably clamping the cover plate against the flange plate separated only by the U-shaped element to provide a narrow, slot-like, horizontal orifice for the reservoir at the upper edges of said plates.

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