Dec. 18, 1956 A. B. SAINT-HILAIRE 2,774,327

APPARATUS FOR PRODUCTION OF COATED TAPE

Filed June 28, 1952 3 Sheets-Sheet 1

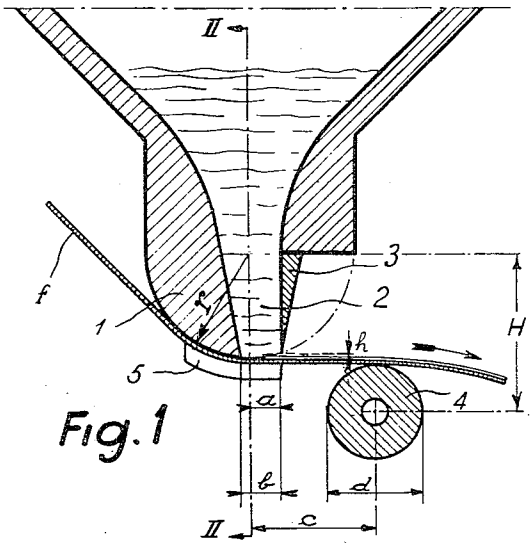
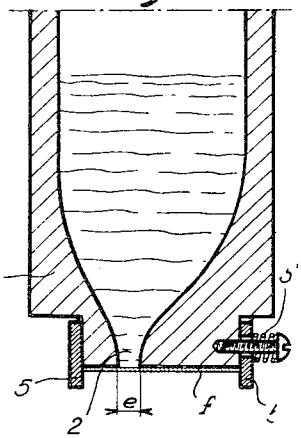


Fig. 1

Fig. 2



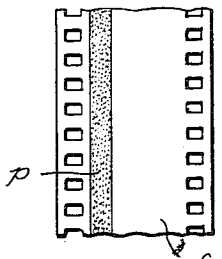


Fig. 3

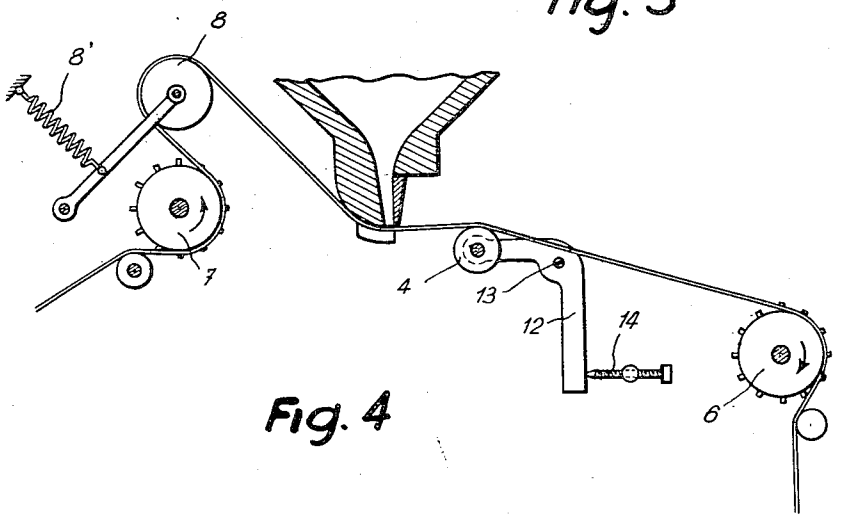


Fig. 4

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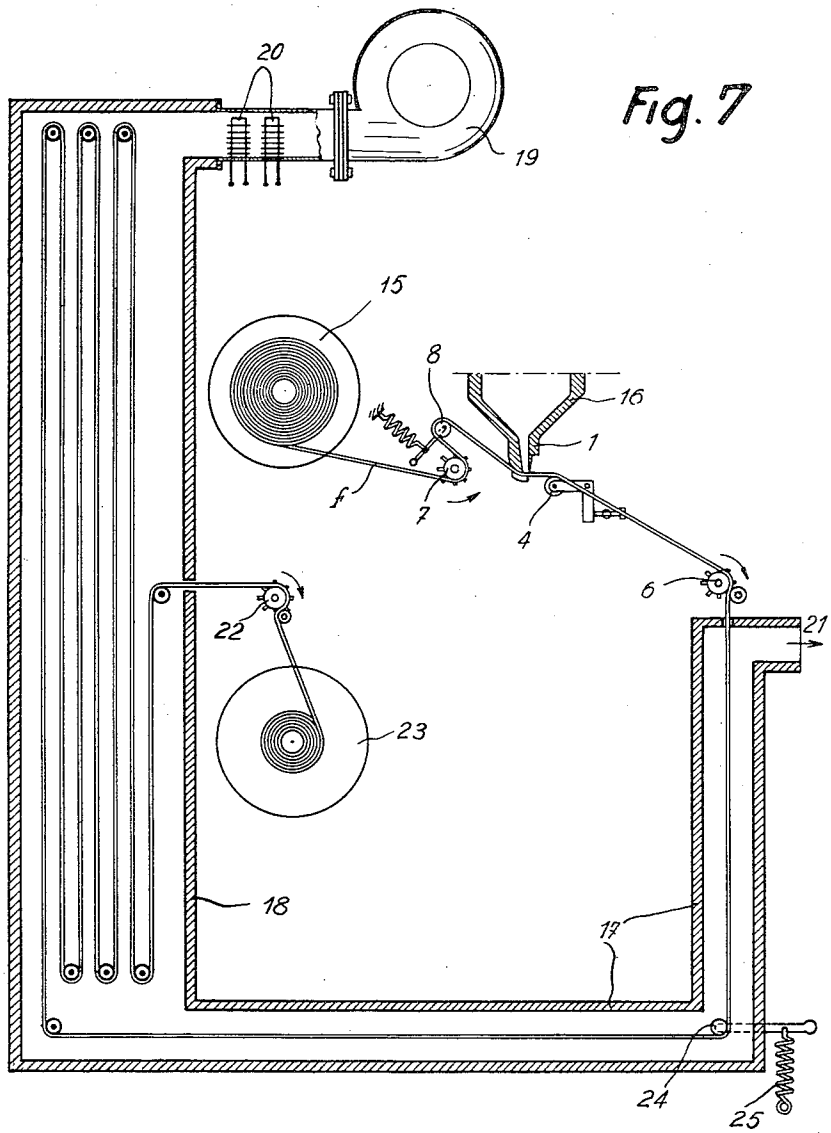
Fig. 7



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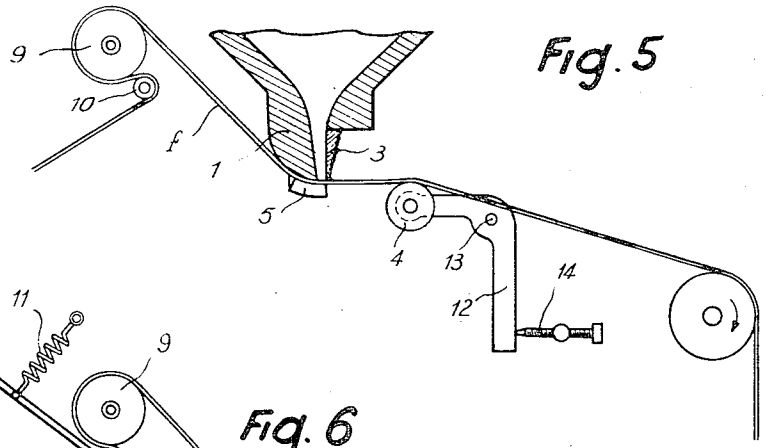

Fig. 5

Fig. 6

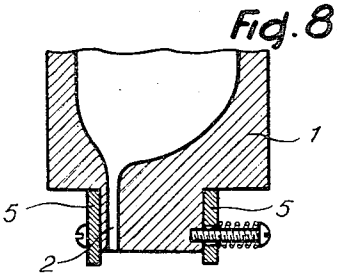

Fig. 8

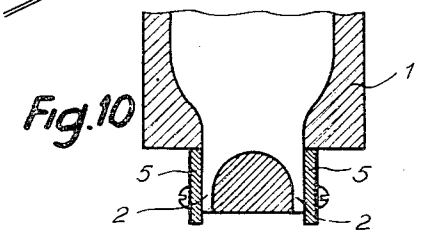

Fig. 10

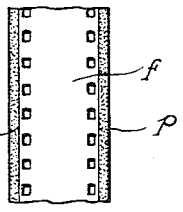

Fig. 11

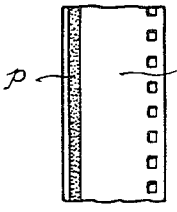

Fig. 9

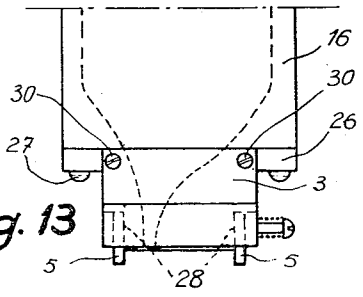

Fig. 13

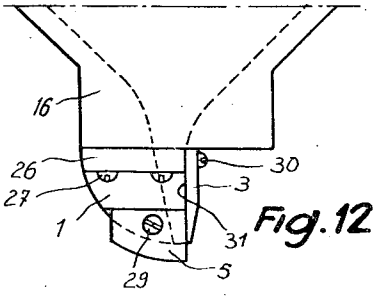

Fig. 12

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Patented Dec. 18, 1956

2,774,327

APPARATUS FOR PRODUCTION OF COATED TAPE

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Application June 28, 1952, Serial No. 296,111
Claims priority, application France July 19, 1951
9 Claims. (Cl. 118—33)

This invention relates to processes and apparatus for depositing a narrow track of a coating substance, on a flexible strip, such as, for example, a magnetic sound track on a moving picture film. The object of the invention is to provide a process and apparatus by which the curvature of such a film, due to the shrinkage of the layer of gelatin which covers the face opposite to that which is to receive the magnetic sound track, may be counteracted so as to present a perfectly flat surface to the coating apparatus, enabling a track of constant width and thickness to be obtained, and by which such a uniform track may be deposited despite changes in the hygrometric conditions, which cause the shrinking of the galatin and consequently the curvature of the film to vary, and changes in the viscosity of the coating medium, as well as variations in the speed of unwinding of the film.

The invention concerns first of all a process for depositing on a supple strip a narrow track of a coating medium, the width of which is comprised between 0.5 mm. and 3 mm. or more, consisting in imparting to the strip the necessary flatness by causing the face of the strip which is to be coated to pass against the tip of a nozzle, which tip is constituted by a cylindrical surface provided, along a generatrix of the said cylindrical surface, with an aperture of constant width, constituting a slit for the passage of the coating medium, the downstream edge of which slit is constituted by the straight edge of a scraper disposed parallel to a generatrix of the said cylindrical surface, in leaving free from any contact near the nozzle the other face of the strip and in causing the strip to leave the said cylindrical surface in a predetermined direction which is tangent to the said surface at a point in the vicinity of the said slit.

The invention concerns also an apparatus for carrying out the process described above, comprising a coating nozzle the tip of which has a cylindrical surface under which and in contact with which the strip to be coated is caused to pass, the lower portion of which cylindrical surface is provided with an aperture of constant width the downstream edge of which is constituted by the straight edge of a scraper parallel to a generatrix of the said cylindrical surface, determining the width of the slit.

Another feature of the invention consists in a cylindrical support, which may be fixed or adapted to turn about its axis, situated downstream of the nozzle, at a small distance therefrom and at a predetermined level which is a function of this distance and of the thickness of the coating to be applied, on which support is resting on its way out the face of the strip on which no track has been deposited.

According to another feature of the invention, the apparatus comprises devices for ensuring that the tension of the strip passing under the nozzle remains constant.

According to yet another feature of the invention,

the width of the film path of said nozzle is limited by two stops adjustable in position, the distance between which, preferably, is equal to that width of the strip to be coated.

Other features and advantages of the present invention will become apparent in the course of the description which follows and an examination of the appended drawings on which there are represented, in the way of examples only, several embodiments of the invention.

In the drawings:

Figure 1 is a diagrammatic section of a coating nozzle forming part of the apparatus of the invention;

Figure 2 is a section along II—II of Figure 1;

Figure 3 is a plan view of a moving picture film coated with a magnetic sound track by means of the nozzle shown in Figures 1 and 2;

Figure 4 is a diagrammatic view, sectional in part, of an arrangement according to the invention, comprising the nozzle shown in Figures 1 and 2;

Figure 5 is a similar view to that of Figure 4, illustrating an alternative embodiment of the invention, to be used when the strip to be coated is not provided with perforations;

Figure 6 is a diagrammatic view of a pressing roller for ensuring a constant tension of the strip in the ararngement shown in Figure 5;

Figure 7 is a sectional elevation showing the arrangement of Figure 5 in connection with a drying arrangement;

Figures 8 and 9 are, respectively, a diagrammatic transverse section of a nozzle similar to that shown in Figures 1 and 2, and a view in plan of a film with a single row of perforations, coated with a magnetic sound track obtained by means of this nozzle;

Figures 10 and 11 are similar views to those of Figures 8 and 9, showing a nozzle with two slits adapted to deposit two magnetic sound tracks simultaneously on a film having two rows of perforations;

Figures 12 and 13 are side and front elevations, respectively, of a nozzle of the model shown in Figures 1 and 2, mounted on the lower portion of a hopper containing the coating medium, shown in more detail.

As shown principally on Figures 1, 2 and 3, a nozzle 1 is used, the tip of which has externally the shape of a portion of a cylindrical surface the axis of which is perpendicular to the direction of travel of the film *f* which is caused to pass under and against the tip of this nozzle in order to receive a magnetic sound track *p* consisting in a deposit of a suitable coating medium issuing through an aperture 2, of suitable constant width *e*, provided along a generatrix of the said cylindrical surface. A doctor blade or scraper 3, the straight-edge of which is, in the embodiment shown in Fig. 1, disposed along a generatrix of this same cylindrical surface, constitutes the downstream edge of the aperture or slit 2.

There may be more than one aperture or slit provided in the tip of the nozzle, when more than one sound track is to be deposited on the same strip, as shown on Figs. 10 and 11.

The distance of this edge from the strip which leaves tangentially the cylindrical surface of the tip of the nozzle determines the thickness *h* of the coating; this distance is easily adjustable, either by the raising or the lowering of a roller 4 situated at a small distance from the nozzle, downstream, or by the raising or lowering of the nozzle itself.

As the strip is in contact with the edges of the coating slit at the moment when it leaves tangentially the cylindrical surface, the width of the track deposited is strictly constant whatever may be the viscosity of the coating medium and the speed of travel of the strip.

The transverse rigidity imparted to the strip by its application against the cylindrical surface enables one to obtain the flatness required for a good coating; the distance h of the edge of the scraper **3** to the strip f leaving tangentially the cylindrical surface, one or two millimetres before the scraper, is in fact practically constant on the whole width of the strip, whatever may be the initial curvature due to the shrinkage of the gelatin.

As the strip does not rest on any counter-support, there is no risk of scratching the under-face of the strip, which is normally coated with a photographic emulsion, whether unexposed or exposed. Moreover, variations in the thickness of the strip could not cause variations in the thickness of the coating, as would happen if the strip passed over a support or a fixed or rotating cylinder placed just under the tip of the nozzle. This latter advantage is a characteristic feature of the process.

The length b of the coating slit is theoretically equal to the distance a between the point of tangency of the strip to the cylindrical surface and the vertical projection on the strip of the edge of the scraper.

$$a=\sqrt{h(2r-h)}$$

which is practically the same as $\sqrt{2rh}$, as h is very small; r is the radius of curvature of the cylindrical surface of the tip of the nozzle and h is the thickness of the coating when moist.

In the case of very narrow tracks, the length b of the coating orifice may be raised to a maximum value of twice a in order to increase the discharge, which otherwise would be insufficient. On the contrary, in the case of very large tracks, one must not give to b a value greater than a.

The radius of curvature of the cylindrical surface of the tip of coating nozzles for magnetic sound tracks on strips 8 mm., 9.5 mm., 16 mm., and 35 mm. width is practically comprised between 10 and 50 mm., but these limits need not be strictly adhered to. The thickness h of the moist coating is of the order of $\frac{1}{10}$ mm.

In order to permit a perfect transverse location of the magnetic track on the strip f, the path of the strip under the nozzle is limited laterally by two stops **5** distant from each other by the exact width of the film. One of these stops may, however, be maintained in position resiliently by the pressure of a spring, such as **5'**.

In order to obtain a uniform deposit with such a nozzle, it is necessary to ensure that the sliding motion of the strip on the cylindrical surface shall be very regular; this is obtained by imparting to the strip a strictly constant tension before its passage against the nozzle.

In the case of a perforated strip (Figs. 3 and 4) pulled by a sprocket drum **6**, a simple manner of achieving this purpose consists in paying out the strip before the nozzle by a sprocket drum **7** having the same peripheric speed as the pulling sprocket drum **6** and to intercalate between the said paying-out drum and the nozzle a tension pulley **8** which maintains the strip under the desired tension by means of a spring **8'** or of a counterweight.

In the case of a strip without perforations (Figs. 5 and 6), the strip is maintained in tension before the nozzle by a drum **9** the spindle of which rotates against a frictional resistance that is uniform, the adhesion of the strip f on the drum **9** being obtained either by the nature itself of the surface of the drum and a winding roller **10** (Fig. 5) or simply by a pressing roller **10'** subjected to the thrust of a spring **11**. The frictional device is a classic model and its sliding motion must be very regular.

After the nozzle, the strip passes over a cylindrical support **4** (Figs. 1, 4 and 5), as a rule rotative, the position of which determines the thickness of the coating: by altering the height of this cylindrical support, one moves away or approaches the strip f from or to the edge of the scraper **3** at the point where the strip leaves tangentially the cylindrical surface.

The distance c (Fig. 1) between the point of tangence

of the strip on the cylindrical surface of the nozzle and its point of tangence on the cylindrical support must be at least equal to a i. e. $\sqrt{2rh}$. For this minimum value, the axle of the cylindrical support is exactly under the edge of the scraper. That said support **4** may satisfactorily answer its purpose, c must not be higher than r. A small value will provide a greater regularity of thickness of the coating and a great value of c will ensure easier adjustment. Practically, c will be close to $\frac{1}{2}$ r.

The diameter d of the cylindrical support will be lower than or equal to $2r$. The maximum value $2r$ is the maximum diameter it is possible to give to d when $c=a$ that the film may not be jammed between the cylinder and the support. Practically, d will be close to c.

In order to be able to adjust the level of this cylindrical support **4**, it may be mounted on a bent lever **12**, adapted to pivot about an axis **13** (Figs. 4 and 5); the adjusting screw **14** allows it to be displaced vertically with the desired precision.

The above arrangement is particularly employed in the following cases:

Deposit of a track of 0.6 to 0.9 mm. in width, externally of the perforations, on one side or on both sides of a film of 16 mm. (Fig. 11).

Deposit of a track of 0.6 to 1.5 mm. in width, externally of the perforations, on one side or on both sides of a film of 35 mm. (Fig. 11).

Deposit of a track of 0.6 to 1 mm. on one side or on both sides of a film of 9.6 mm.

Deposit of a track of 0.5 to 0.9 mm. on the perforated side of a film of 6 mm.

Deposit of a track of width comprised between 2 and 3 mm. on the location of the optical track, on a film of standard width 35 mm. (Fig. 3).

Deposit of a track of width comprised between 2 and 3 mm. on the location of the optical track, on a film of 16 mm. with one row of perforations (Fig. 9).

The examples given above are not at all limitative, the process according to the invention making possible the deposit of tracks of any width or the simultaneous deposit of tracks of same or different widths, as well on moving picture films as on the strips in plastic material or paper, whether perforated or not.

Fig. 10 represents the section of a nozzle for the deposit of two tracks of 0.8 mm., externally of the perforations, on a film of 16 mm. (Fig. 11) and Fig. 8 represents the section of a nozzle for the deposit of a track of 2.5 mm. on the location of the optical track of a film of 16 mm. with one row of perforations (Fig. 9).

On Fig. 7 there is represented, in the way of example, a complete apparatus for the deposit of magnetic sound tracks on moving picture film. It comprises:

A reel **15** on which is wound the film f to be coated,

A tension regulating device, constituted, in the case of perforated films, by the paying-out sprocket drum **7** and the tension roller **8**,

The nozzle **1**, as described above, surmounted with a hopper **16** of sufficient capacity for depositing a track of the required width along the whole film,

The roller **4**, fixed or rotative, situated at a small distance from the nozzle, downstream thereof, and permitting the adjustment of the thickness of the coating to be deposited,

The pulling sprocket drum **6**,

A drier constituted first by a passage **17** and then by an air-heated chamber **18**, in which the film follows a sinuous path so as to remain in the heated air the time necessary to dry the coating,

A fan **19** which blows air, heated by ribbed heating elements **20** through the chamber **18** and issuing at **21** at the end of the passage **17** situated near the pulling drum **6**,

A paying-out drum **22** pulling the film through the drier before it is wound on the receiving spool **23**,

A tension roller **24** permitting the tension of the film

to be maintained constant while it travels between the first paying-out drum **6** and the second paying-out drum **22**, by means of a spring **23**.

Figs. 12 and 13 represent in greater detail the manner in which the coating nozzle may be constructed and fixed on the hopper **16**.

The nozzle **1** is secured on the lower portion of the vertical hopper **16** by means of a strap **26** and screws **27**, for example; the outlet of the hopper corresponds practically in dimensions to the inlet orifice of the nozzle. The nozzle comprises also lateral bearing surfaces **28** for securing the guiding stops by means of screws **29**, for example. The doctor blade **3** is secured by means of screws **30**, for example, on a vertical surface **31** constituting the downstream wall of the nozzle. Owing to this arrangement, it is easy to change the nozzle **1**, the doctor blade **3** or the lateral guides **5** in case of wear or damage or when a different type of film is to be treated.

It will be clear to those skilled in this art that the method and apparatus described are by way of illustration and that the practice of the invention lends itself readily to useful modifications in both instances.

I claim:

1. An apparatus for depositing a sound track on a flexible film, comprising a nozzle a part of which is shaped externally according to a cylindrical surface, and provided with at least one slit along a part of said cylindrical surface, the upstream edge of said slit being substantially coincident with the generatrix of said cylindrical surface situated at a location where said film leaves said cylindrical surface tangentially thereto, while the downstream edge of said slit is constituted by the lower edge of a scraper situated on the extension of said cylindrical surface at a predetermined distance from the line from which said film leaves said cylindrical part, so that said lower edge of said scraper is situated at a level above the path of travel followed by said film from the line at which said film leaves said cylindrical part, means for advancing the film past the nozzle, and means for causing the film to pass over and in contact with a substantial portion of the cylindrical surface immediately upstream of the slit.

2. An apparatus as claimed in claim 1, in which is provided a cylindrical support for the film, situated at a predetermined distance from said slit, in the direction of motion of said film, the contact line of said film with said support being situated at a level lower than the level of said lower edge of the scraper, said level of said support being adjusted so as to insure a predetermined thickness of the track applied on the upper face of said film.

3. An apparatus as claimed in claim 1, in which is provided a fixed cylindrical support for the film, situated at a predetermined distance from said slit, in the direction of motion of said film, the contact line of said film with said support being situated at a level lower than the level of said lower edge, said level of said support being adjusted so as to insure a predetermined thickness of the track applied on the upper face of said film.

4. An apparatus as claimed in claim 1, in which is provided a rotary cylindrical support for the film, situated at a predetermined distance from said slit, in the direction of motion of said film, the contact line of said film with said support being situated at a level lower than the level of said lower edge, said level of said support being adjusted so as to ensure a predetermined thickness of the track applied on the upper face of said film.

5. An apparatus as claimed in claim 1, in which is provided a cylindrical support for the film, the position of which is adjustable relative to the nozzle and which is situated at a predetermined distance from said slit, in the direction of motion of said film, the contact line of said film with said support being situated at a level lower than the level of said lower edge, said level of said support being adjusted so as to ensure a predetermined thickness of the track applied on the upper face of said film.

6. An apparatus as claimed in claim 1, including a device for applying a constant tension to the film passing against said cylindrical surface of said nozzle.

7. An apparatus as claimed in claim 1, including a device for applying a constant tension to the film passing against said cylindrical surface of said nozzle, said device comprising a paying-out sprocket drum followed by a tension roller, said device being disposed before said nozzle.

8. An apparatus as claimed in claim 1, including a device for applying a constant tension to the film passing against said cylindrical surface of said nozzle, said device comprising a paying-out drum provided with a brake adapted to exert a uniform braking action thereto.

9. An apparatus as claimed in claim 1, including a support for the film, said support being situated at a predetermined distance from said slit and at a level which is adjusted relative to the lower edge of said scraper so as insure a predetermined thickness of the track applied on the upper face of said film, a device for applying a constant tension to the film, and a drying chamber in which the film follows a devious path of sufficient length to dry the track on said film.

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