Feb. 27, 1940. A. L. V. C. DEBRIE 2,191,850

FILM DEVELOPING MACHINE

Filed Dec. 13, 1937 2 Sheets-Sheet 1

FIG. 1

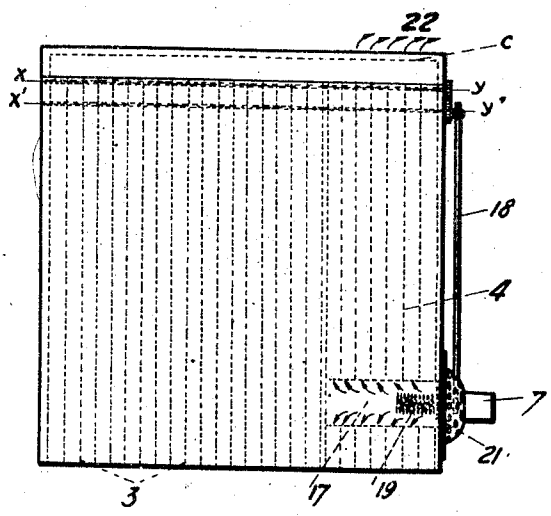


FIG. 5

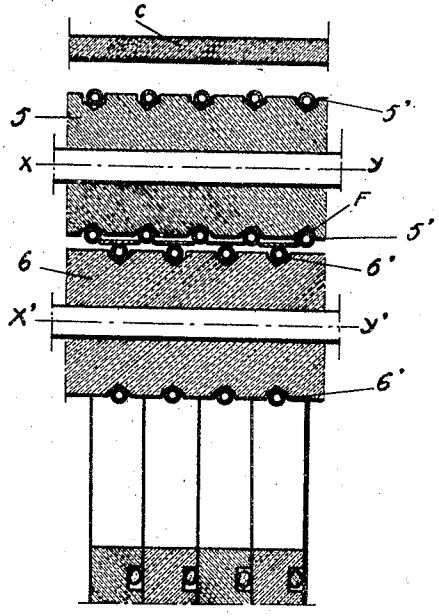


FIG. 2

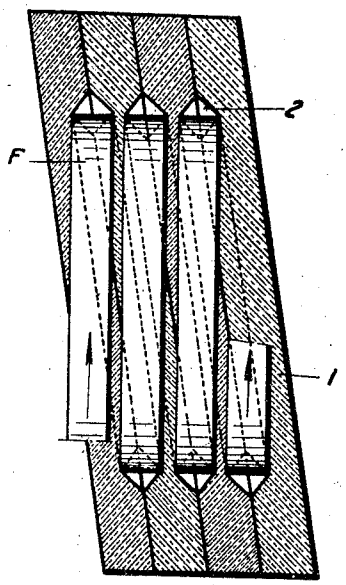


FIG. 6

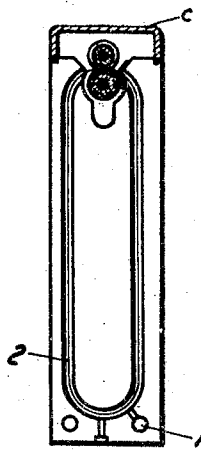
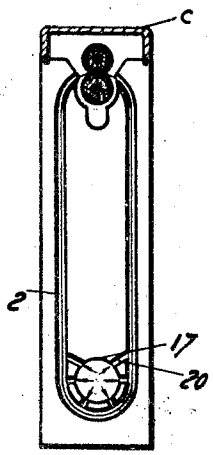


FIG. 7



Inventor
A. L. V. C. Debrie
By E. F. Wenderoth
Atty

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FIG. 3

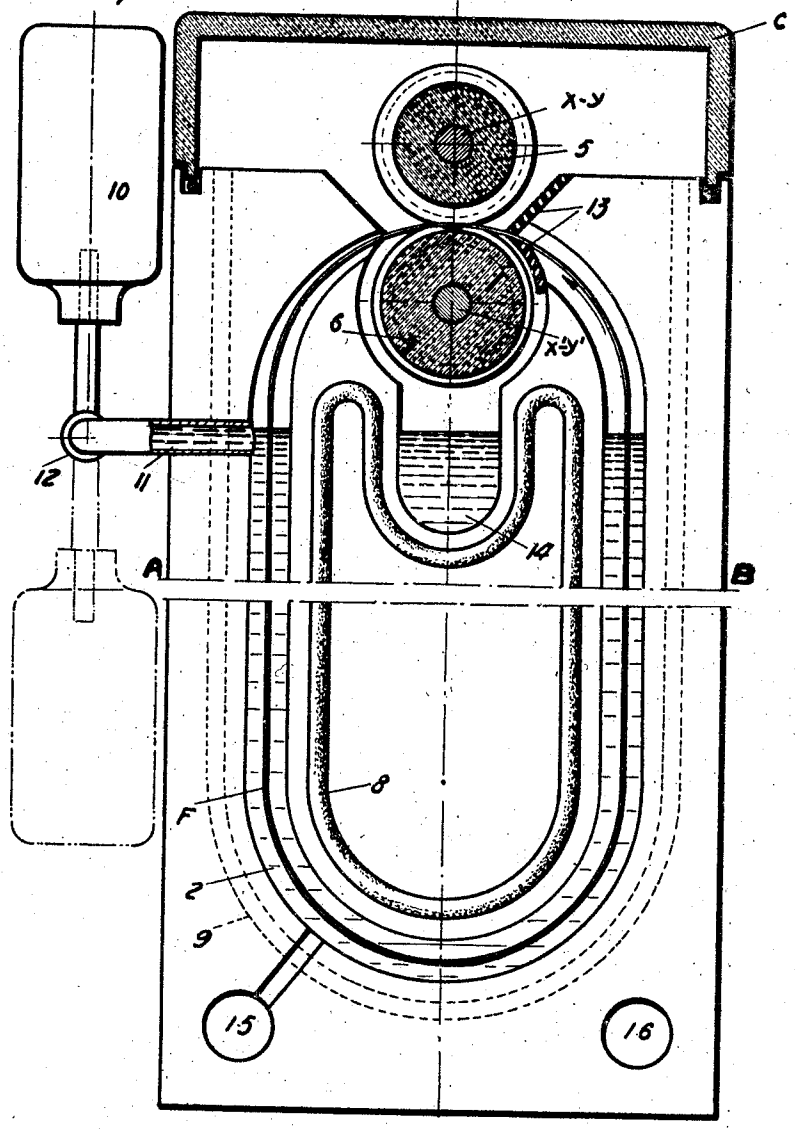
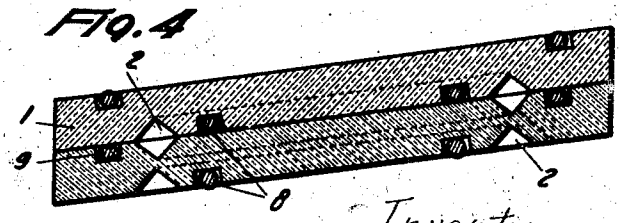


FIG. 4



Inventor
A. L. V. C. Debrie
By E. F. Wenderoth
Atty

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UNITED STATES PATENT OFFICE

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FILM DEVELOPING MACHINE

André Leon Victor Clement Debrie, Paris, France

Application December 13, 1937, Serial No. 179,624
In France December 21, 1936

12 Claims. (Cl. 95—94)

My invention has for its object a machine adapted more particularly for the developing of 16 mm. films, chiefly amateur films; its size is greatly reduced; it may be easily loaded without requiring the preliminary film extension or lead required in the continuously operating machines now in use; its supervision and cleaning are very easy and it may work intermittently without any drawback. Moreover it is easily applicable to the treatment of films through the reversal process.

To achieve this, I cause the film to progress along a helical line inside a series of channels provided in a block of suitable material, constituted by a series of suitably cut elements arranged in liquidtight relationship. The channels are narrow and contain but little treating liquid which latter is drawn along by the film. Suitable means allow renewal of the bath at the entrance of each element while at the outlet, the exhausted bath is removed into suitable collecting means. Lastly the films are seized as they enter the machine and are driven throughout their progress through the latter between two rollers carried on two parallel horizontal shafts at the upper part of the machine. These rollers are preferably of the type described in my copending application No. 83,143 of June 2, 1936.

Different other arrangements covered by my invention will appear in the following description of an exemplification of said invention as shown in appended drawings.

Fig. 1 is a side view of the whole machine.

Fig. 2 is a partly sectional view from above.

Fig. 3 is an elevational view of one of the developing elements.

Fig. 4 is a horizontal cross-section of two such elements arranged side by side, along line A—B of Fig. 3.

Fig. 5 is a fragmentary longitudinal cross-section of the upper part of the machine.

Figs. 6 and 7 are views similar to Fig. 3, at a reduced scale, of a washing and of a drying element.

The machine illustrated is constituted by a series of small parallelipipedic adjacent similar elements or vats 1; said vats, preferably of ebonite or other material resisting the liquids used for developing according to the reversal process, are arranged with a certain oblique shifting of the opposite end surfaces of their breadth. Through the whole arrangement is provided a narrow helical channel 2 forming a passageway for the film F. The said film is submitted in said channel to the developing treatment proper, to washing and to drying. Each element or vat includes a portion of the channel 2 constituted by a U-shaped half groove on either side of the element. The film passing out of one of the higher ends of the groove formed by the two half grooves formed on the adjacent sides of two successive elements, enters the opposite upper end of the groove formed between one of said elements and the next element. The cross-section of these grooves has the shape of a parallelogram one diagonal of which lies in the surface along which the film progresses.

The first vats 3 are intended for the treatment proper, and include a number of washing vats. These first vats are followed by a second group of vats 4 used for drying. The treating liquid, or water, is introduced into the required groove elements through means described hereinafter and the circulation thereof is provided simply by the progression of the film itself in the direction of said progression. The film is driven at the upper part of each element, i. e. through a point of its path lying between two successive elementary grooves 2, where it passes between two smooth rollers, to wit an upper roller 5 and a lower roller 6. The different rollers 5 and 6 may form two single sleeves extending throughout the length of the machine. As shown, they are carried by two superposed horizontal shafts XY, X'Y' arranged in the longitudinal medial plane of the apparatus. These shafts are driven simultaneously by a motor 7 described hereinafter. The rollers 5 and 6 acting frictionally on the film are preferably of the type disclosed in my prior copending above-mentioned application. Fig. 5 shows a multiple roller 5 of this type carrying a series of compressible rings 5' over which the edges of the film loop bear when they come out of the corresponding groove, without the impressed portion of the film coming into contact with said roller. The lower multiple roller 6 is also provided with a series of compressible rings 6' over which bear the inner sides of the different loops which carry no emulsion.

Yielding joints are provided for ensuring water-tightness between the successive elements or vats together with light tightness and protection against air pressure.

For instance, as shown, the front wall of each element carries a packing 8 on the inside of the half-groove provided in said wall while each rear wall carries a packing 9 on the outside of the corresponding half-groove. It is apparent from inspection of Fig. 4 that the joints 8—9 thus interposed between two elements ensure

perfect fluid-tightness to either side of the groove formed between said elements. A cover C closes in a fluidtight manner the whole arrangement of elements together with the driving rollers thereof.

The treating liquid is introduced into the vats used for the development process through a so-called siphoid bottle 10 arranged on the outside of the element and communicating with one end of a half groove through the bore 11. The bottle 10 is adapted to rock around the spherical joint 12 operating as a cock in order to assume as required the position shown in full lines or that shown in dotted lines; when it is in the full line position the liquid bath flows out in conformity with requirements into the groove inside which it progresses under the drving action exerted by the film. The replacement of the bottle is performed easily, the spherical joint 12 forming a cock which closes when the bottle is rocked for removal. The bath cannot pass out of the groove with the film by reason of the provision of a squeegee 13 constituted by two rubber blades adapted to pinch the film between them as it passes out of the machine. Thus the liquid drawn along by the film is constrained to fall into a collecting channel 14, instead of into the vat as usual. This channel 14 collecting the exhausted baths and water passes longitudinally through the assembly of elements so as to collect the excess of developing bath (or of water) from the different squeegees. The amount of liquid thus removed from the bath is automatically compensated for by the fresh bath from the siphoid bottle.

The rinsing of the vats is provided when required by water under pressure flowing through the longitudinal channel 15 at the lower part of the elements, which channel communicates through bores provided with cocks with the different treating grooves.

The grooves serving for the washing of the film are fed with water through another longitudinal duct 16 (Fig. 6) also communicating through bores provided with cocks with the lower portion of the corresponding grooves. To further the outlet of the water, another bore not shown sets the upper part of the outlet end of the grooves of the washing elements in communication with the collecting channel 14, a squeegee being provided if desired for these washing elements as in the case of the treated vats.

Lastly there flows through the drying elements 4 (Figs. 1 and 7) hot air forced into them by the fan 21 controlled by the motor 7 and arranged in the recess 17 provided at the lower part of the elements 4. The motor 7 also controls through the transmission 18 the arrangement of film driving rollers. The air forced through the fan and heated by suitable heating means 19 enters the drying grooves through the bores 20 arranged radially around the recess 17 and passes out of the upper ends of the said grooves into the atmosphere through the ports 22 provided in the cover. It is apparent that the loading is automatic and that the film, seized at its entrance between the rollers driven by the motor, continues its progression through the treating and washing baths and through the drying elements and passes out of the opposite end of the machine. I thus avoid using the nonimpressed extension strip for the film considered heretofore as essential for the threading of the film through the apparatus. By reason of the narrowness of the helical guiding channel, the amount of bath used for each film is very small and this allows without any waste of bath an intermittent use of the apparatus in accordance with requirements.

There may be provided on the apparatus all the usual auxiliary devices such as exposure station, light control station, etc.

Of course the different parts of the machine have been described solely by way of example and their constitution, shape and relative arrangement may be modified in any suitable manner without widening thereby the scope of my invention. I may also omit certain parts or replace them by parts of suitable type while retaining the other parts described or equivalent parts.

What I claim is:

1. A film developing machine comprising a plurality of adjacent blocks in fluidtight contact, one of the cooperating surfaces of any two successive blocks being provided with a loop-shaped groove the ends of which terminate at the upper surface of the corresponding block, at least part of said grooves being adapted to be filled with treating liquid and film feeding and driving means adapted to draw the film out of the outlet end of each groove and to urge it into the inlet end of the following groove.

2. A film developing machine comprising a horizontally elongated mass of material provided with a plurality of loop-shaped grooves substantially perpendicular to the long side of the mass of material, the ends of which open at the upper side of the mass of material and film driving means adapted to draw the film out of the outlet end of one groove and to urge it into the inlet end of the following groove.

3. A film developing machine comprising a plurality of adjacent blocks in fluidtight contact, the cooperating surfaces of any twe successive blocks being provided with complementary loop-shaped grooves the ends of which terminate at the upper surface of the corresponding block and film driving means adapted to draw the film out of the outlet end of one pair of complementary grooves and to urge it into the inlet end of the following pair of complementary grooves.

4. A film developing machine comprising a plurality of adjacent blocks in fluidtight contact, the cooperating surfaces of any two successive blocks being provided with complementary cross-sectionally V-shaped loop-shaped grooves the ends of which terminate at the upper surface of the corresponding block and film driving means adapted to draw the film out of the outlet end of one pair of complementary grooves and to urge it into the inlet end of the following pair of complementary grooves.

5. A film developing machine comprising a plurality of adjacent blocks, one of the cooperating surfaces of each two successive blocks being provided with a loop-shaped grcove the ends of which terminate at the upper surface of the corresponding block, elongated packings arranged between each two successive blocks both on the inside and on the outside of the corresponding groove and film driving means adapted to draw the film out of the outlet end of one groove and to urge it into the inlet end of the following groove.

6. A film developing machine comprising a plurality of adjacent blocks, the cooperating surfaces of any two successive blocks being provided with complementary loop-shaped grooves the ends of which terminate at the upper surface of the corresponding block, elongated packings arranged between each two successive blocks both on the inside and on the outside of the corre-

sponding groove and film driving means adapted to draw the film out of the outlet end of one pair of complementary grooves and to urge it into the inlet end of the following pair of complementary grooves.

7. A film developing machine comprising a plurality of adjacent blocks in fluidtight contact, one of the cooperating surfaces on any two successive blocks being provided with a loop-shaped groove the ends of which terminate at the upper surface of the corresponding block, two horizontal shafts arranged vertically one above the other and overlying the series of blocks, means for driving same and cooperating couples of rollers carried by said shafts respectively, the cooperating rollers of each couple being adapted to feed the film between them as it passes out of one loop into the next.

8. In a film developing machine as claimed in claim 1, means for feeding one groove with a developing liquid and including a liquid containing bottle adapted to rock round a horizontal axis, a cock controlled by the position of said bottle with reference to said horizontal axis and means controlled by the cock and passing through a grooved element for feeding the grooves considered with the liquid in the bottle.

9. In a film-developing machine as claimed in claim 1, a squeegee arranged at the outlet of the film from a liquid containing groove and constituted by two yielding blades facing one another and adapted to bear against either side of the film at its outlet from the groove considered for preventing any liquid from passing out of said groove.

10. In a film developing machine as claimed in claim 1, a squeegee arranged at the outlet of the film from a liquid containing groove and constituted by two yielding blades facing one another and adapted to bear against either side of the film at its outlet from the groove considered for preventing any liquid from passing out of said groove and a longitudinal duct passing throughout the machine adapted to collect the liquid falling off the film under the action of the squeegee.

11. In a film developing machine as claimed in claim 1, a squeegee arranged at the outlet of the film from a liquid containing groove and constituted by two yielding blades facing one another and adapted to bear against either side of the film at its outlet from the groove considered for preventing any liquid from passing out of said groove, a longitudinal duct passing throughout the machine adapted to collect the liquid falling off the film under the action of the squeegee, a longitudinal water duct and means whereby said duct is adapted to feed all the elements with cleansing water.

12. In a film developing machine as claimed in claim 1 the provision of a longitudinal duct adapted to feed at least one groove with water.

ANDRÉ LEON VICTOR CLEMENT DEBRIE.