United States Patent

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[33] **Germany**
[31] **No. A53258;**

[54] DEVICE FOR FEEDING PHOTOGRAPHIC FILM OR THE LIKE

12 Claims, 5 Drawing Figs.

[52] **U.S. Cl.** 95/94
[51] **Int. Cl.** G03d 3/12
[50] **Field of Search** 95/94R, 94, 89Misc, 89R

[56] **References Cited**

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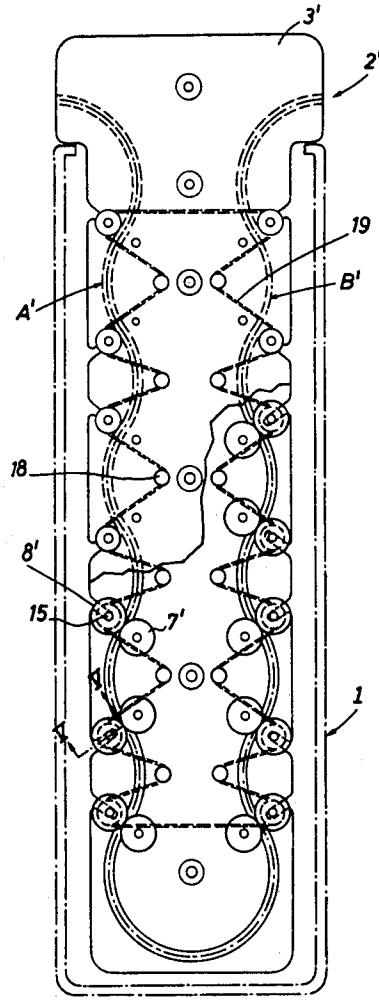
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ABSTRACT: The device for guiding and feeding photographic roll film through a liquid treatment bath comprises two spaced parallel vertical plate-like guides having aligned U-shaped grooves which guide the edges of the film in a U-shaped path having concave sections alternating with convex sections. Pairs of film-advancing rollers are disposed in the regions (turns) between successive sections of the path. The inner roller of each pair is driven by a gear train and the outer roller is biased toward the inner roller. All of the outer rollers can be biased by a single elastic belt or the device may comprise several endless belts, one for each of several clusters of outer rollers.



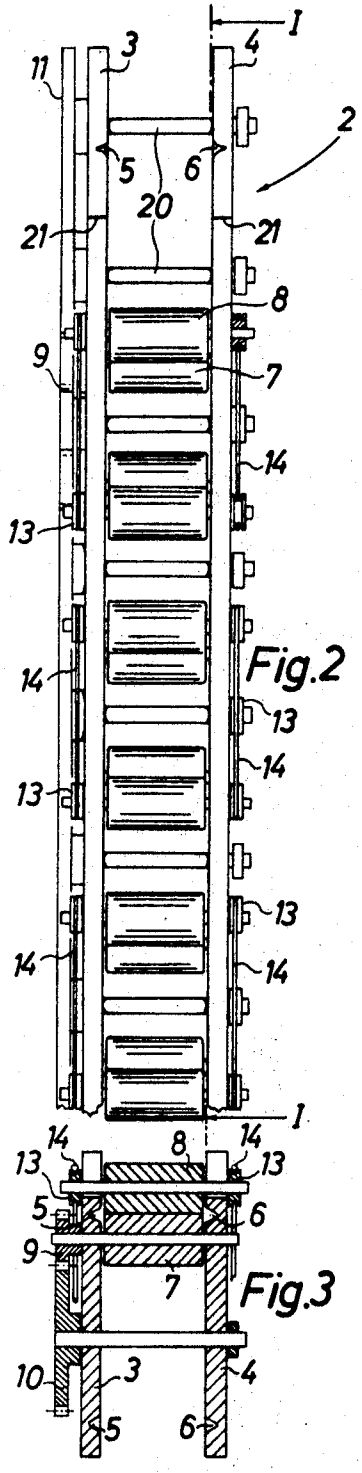
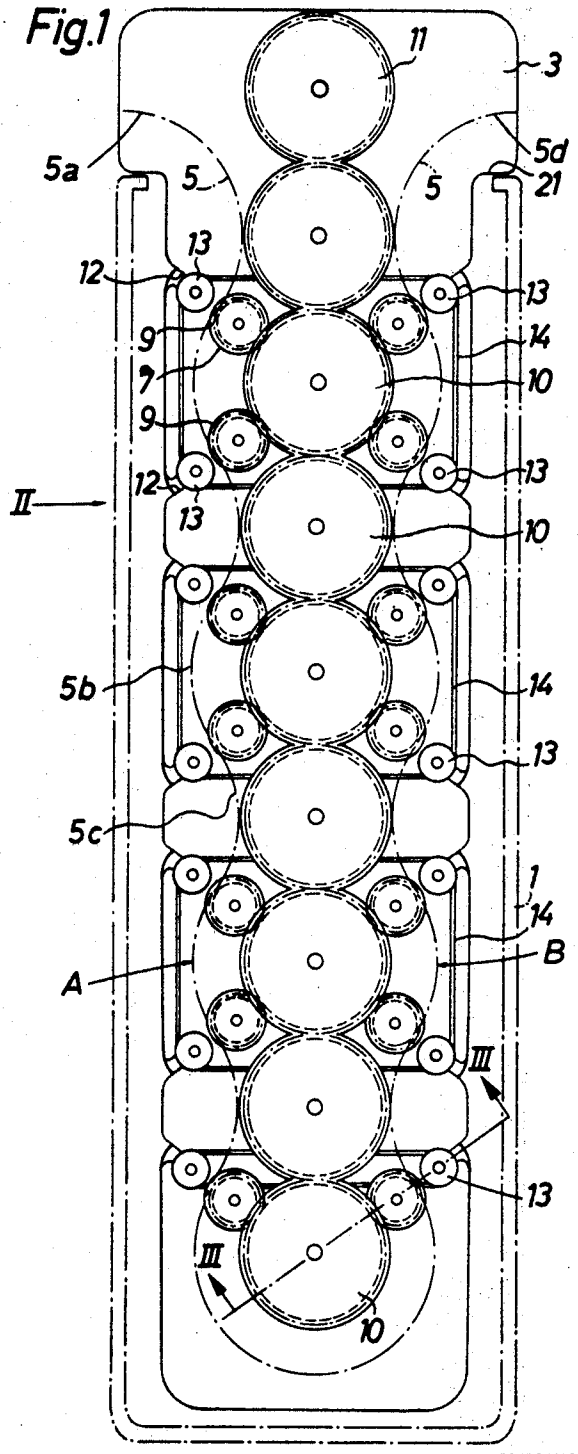


Fig.2

Fig.3

Fig.1



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Fig.4

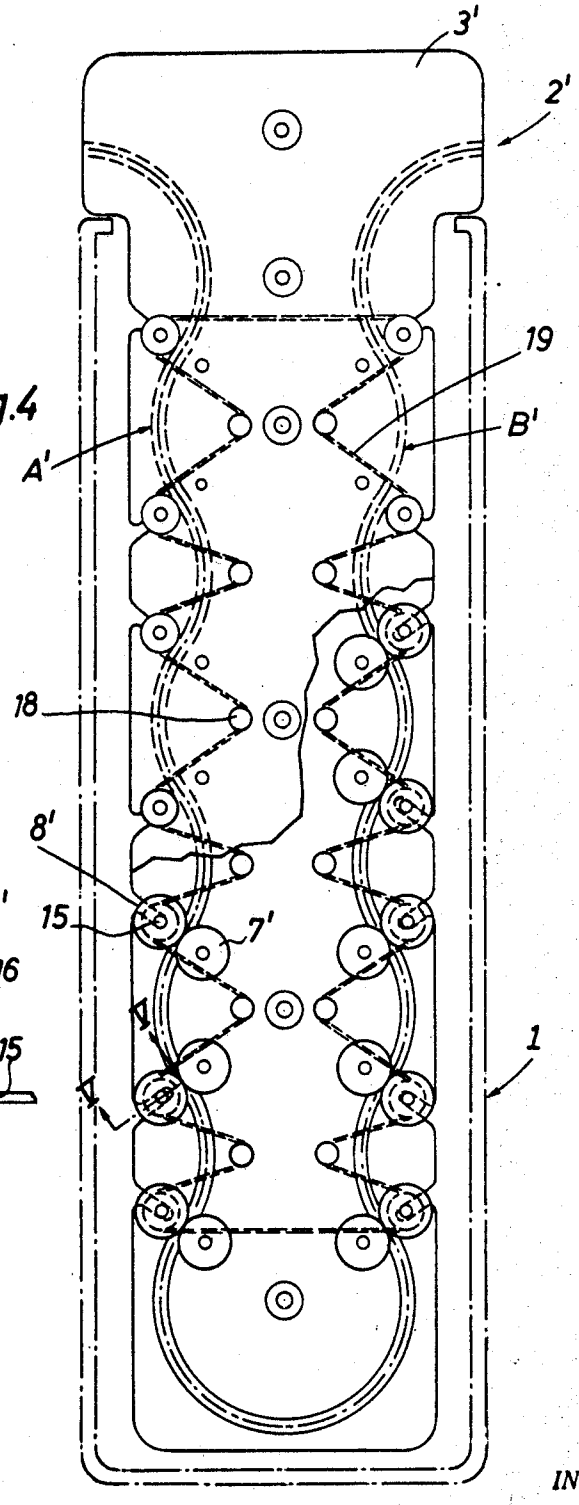
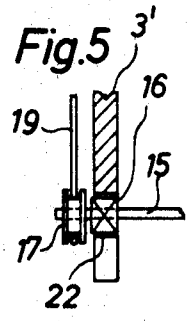


Fig.5



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DEVICE FOR FEEDING PHOTOGRAPHIC FILM OR THE LIKE

BACKGROUND OF THE INVENTION

The present invention relates to an automatic device for feeding and guiding strips of flexible material, particularly for feeding roll film through a treatment bath which may contain a fixer, short-stop, water, hot gas, developer or another medium necessary for processing of exposed but undeveloped film. U.S. patent No. 3,096,701 to Edwards discloses a film feeding device wherein the film is guided in a substantially circular path around the periphery of a driven wheel which is installed in a liquid treatment bath. The edges of the film are guided in notches provided in the inner surfaces of two plates and spaced portions of the film are pressed against the wheel by idler rollers which are biased toward the wheel by elastic bands. A serious drawback of this film feeding device is that the length of the substantially circular path in which the film advances through the bath is too short and that the inner side of the film (namely, that side which faces the periphery of the wheel) is subjected to less effective treatment than the outer side. This is due to the fact that the agitation of treating medium between the film and the wheel is less pronounced than the agitation at the outer side of the film. Therefore, such devices are suitable for treatment of films only one side of which is coated with light-sensitive material. Furthermore, such devices occupy too much room, particularly in relation to the length of the interval during which the film travels about the wheel.

SUMMARY OF THE INVENTION

It is an important object of our invention to provide a novel and improved automatic film guiding and feeding device which occupies relatively little room, which can effect treatment of both sides of the film with the same degree of efficiency, and which is constructed and assembled with a view to utilize, with greater efficiency, the interior of a tank or a like vessel which contains the treatment bath.

Another object of the invention is to provide a film feeding device of the just outlined character wherein the configuration of the path in which the film advances through the bath is such that both sides of the film can be contacted by a fluid which is agitated to the same extent.

A further object of the invention is to provide an automatic device for guiding film through a liquid treatment bath which can handle films having one or both sides coated with material requiring treatment by contact with the bath.

An additional object of the invention is to provide novel film-advancing means which can be used in a film feeding device of the above outlined character.

Briefly outlined, one feature of our invention resides in the provision of an automatic device for feeding strips of flexible material through a treatment bath, particularly for feeding exposed but undeveloped photographic roll film through a liquid treatment bath. The device comprises a pair of preferably plate-like spaced-apart guides having opposed surfaces provided with aligned grooves or notches arranged to receive the edges of a strip and defining an elongated path of other than circular outline comprising a plurality of arcuate sections including concave sections followed by convex sections and vice versa, and pairs of cooperating strip-advancing means provided in the regions between successive sections of the path. Such advancing means preferably include pairs of rollers including a driven inner roller and a yieldable outer roller biased toward the associated driven roller by one or more endless elastic belts or the like.

The path is preferably U-shaped and comprises two elongated legs at least one of which includes a sequence of alternating concave and convex sections. In this way, the interior of a tank for a fixer, developer or other liquid medium which is needed in development of exposed roll film is used with much greater advantage than the interior of a tank wherein the film is guided in a substantially circular path.

The novel features which are considered as characteristic of the invention are set forth in particular in the appended claims. The improved film feeding device itself, however, both as to its construction and its mode of operation, together with additional features and advantages thereof, will be best understood upon perusal of the following detailed description of certain specific embodiments with reference to the accompanying drawing.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a side elevational view of a film feeding device which embodies one form of our invention, with one of the guides and with the outer or idler rollers omitted, the view being taken substantially as seen in the direction of arrows from the line I-I of **FIG.** 2;

FIG. 2 is a fragmentary end elevational view of the film feeding device, substantially as seen in the direction of the arrow II in **FIG.** 1;

FIG. 3 is a section as seen in the direction of arrows from the line III-III of **FIG.** 1;

FIG. 4 is a somewhat schematic side elevational view of a portion of a second film feeding device; and

FIG. 5 is a section as seen in the direction of arrows from the line V-V of **FIG.** 4.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring first to **FIG.** 1, there is shown a tank **1** (indicated by phantom lines) which contains a supply of liquid treatment medium necessary in developing of exposed photographic roll film. The film guiding or feeding device **2** is insertable through the open top of the tank **1** and comprises two spaced-plate like parallel guides **3**, **4** the inner sides of which (namely, those sides which face each other) are provided with aligned grooves **5** and **6** (see also **FIG.** 2). The guides **3**, **4** are held in spaced-apart positions by a plurality of transversely extending spacer elements **20**. Each of the grooves **5**, **6** has a substantially triangular cross-sectional outline to facilitate introduction of roll film into their intake ends (see the intake end **5a** of the groove **5** shown in **FIG.** 1. In the illustrated embodiment, the grooves **5** and **6** define a substantially U-shaped film path whose outline is clearly different from a circular outline. This U-shaped path has two substantially vertically extending legs A, B and a connecting web D. That portion of the groove **5** which extends along the leg A or B comprises a series of concave sections **5b** alternating with convex sections **5c**. The web D of the U-shaped path causes the film to form a single loop in the bottom region of the tank **1**. The configuration of the groove **6** is identical to that of the groove **5**. Thus, it can be said that the elongated U-shaped path for roll film comprises concave sections alternating with convex sections.

The film advancing means comprises pairs of rollers **7**, **8** which are disposed in the regions between the concave and convex sections of the U-shaped path. The intake and discharge ends of this path extend substantially horizontally (see the intake and discharge ends **5a**, **5d** of the groove **5** in **FIG.** 1). The ends of shafts of the rollers **7** are rotatable in bores provided therefor in the guides **3** and **4**, and these rollers **7** are installed at the inner side of the U-shaped path, i.e., between the legs A and B. The shafts of the rollers **7** extend through and beyond the guide **3** and carry pinions **9** which mesh with centrally located driver gears **10**. The gears **10** mesh with each other, and the uppermost gear **10** meshes with a main gear **11** which receives motion from a prime mover, for example, from an electric motor or a transmission (not shown). The prime mover which drives the main gear **11** can be started when the film feeding device **2** is inserted into the tank **1** in such a way that the shoulders **21** of the guides **3**, **4** rest on the top face of the tank.

The outer rollers **8** are idler rollers and their shafts are reciprocably received in slots **12** provided therefor in the guides **3** and **4**. The arrangement is such that each idler roller **8** is movable substantially radially toward and away from the

associated inner roller 7. The end portions of shafts for the idler rollers 8 carry pulleys 13, and an endless elastic biasing belt 14 is trained around clusters of four pulleys 13 in such a way that the idler rollers 8 cooperating with rollers 7 which receive motion from a common gear 10 are biased by a pair of endless belts 14, one at the outer side of each of the guides 3, 4 (see FIGS. 2 and 3).

The diameters of the idler rollers 8 may but need not be identical with those of the rollers 7.

The operation is as follows:

The leading end of an exposed but undeveloped photographic roll film (not shown) whose width exceeds the distance between the inner sides of the guides 3, 4 sufficiently to have its edges properly received in the grooves 5, 6 is introduced into the intake end of the U-shaped path (see the horizontal intake end 5a of the groove 5 in FIG. 1). The film can come from a preceding tank or can be introduced into the film feeding device 2 by an automatic threading unit (or by hand). When the leading end of the film reaches the nip between the first pair of advancing rollers 7, 8, it is entrained by these rollers to advance in the U-shaped path toward the discharge end 5d. Each inner roller 7 is driven by one of the gears 10 and each outer roller 8 receives motion from the associated inner roller or from the film itself. The leading end of the film threads itself between successive pairs of rollers 7, 8 which are disposed at the turns between the concave and convex sections of the path. It will be noted that the rollers 7, 8 are disposed in regions where the path is substantially straight due to transition from a concave section into a convex section or vice versa. This insures that the rollers cannot cause the film edges to jump out of the grooves 5 and 6. Such jumping of film edges is less likely in zones where the film travels between arcuate portions of grooves 5, 6 because a curved portion of film exhibits greater resistance against movement of its edges toward each other. It was found that the grooves 5, 6 and rollers 7, 8 can prevent jumping of film even if the film is fed at a very high speed. The two legs A and B of the path can be placed close to each other so that a relatively narrow but long tank 1 can hold the film for a desired period of time to insure satisfactory treatment of both film surfaces in a relatively small area. The means for agitating the liquid in the tank, both within and without the U-shaped path (if such agitation is necessary), are not shown because their construction forms no part of our invention. The device 2 can be readily lifted out from or inserted into the tank 1. All such parts which are accommodated in the tank consist of a material which can withstand the corrosive or other action of the bath.

FIGS. 4 and 5 illustrate a modified film feeding device 2'. The shaft 15 of each idler roller 8' carries a bearing member 16 and is turnable therein. Each bearing member 16 has two parallel surfaces which are slidable in a slot 22 provided therefor in one of the guides (only guide 3' has been shown in FIG. 5) and each shaft 15 carries a pulley 17 for an endless elastic belt 19. The belt 19 is further trained around deflecting rolls or posts 18 arranged in two vertical lines or rows between the legs A', B' of the U-shaped path. The manner in which the belt 19 is trained around pulleys 17 and deflecting rolls 18 is clearly shown in FIG. 4. The device 2' of FIGS. 4 and 5 uses only two endless belts 19, one adjacent to the outer side of each guide. The driven film advancing rollers are shown at 7'; these rollers cooperate with the idler rollers 8' in the same way as descibed in connection with FIGS. 1 and 3.

Without further analysis, the foregoing will so fully reveal the gist of the present invention that others can, by applying current knowledge, readily adapt it for various applications without omitting features which fairly constitute essential characteristics of the generic and specific aspects of our contribution to the art.

We claim:

1. A device for feeding strips of flexible material, particularly for feeding photographic roll film through a liquid treatment bath, comprising a pair of spaced-apart guides having grooves arranged to receive the edges of a strip and defining an elongated path of other than circular outline, at least the major part of said path consisting of a plurality of arcuate sections including concave sections followed by convex sections and vice versa; and pairs of cooperating strip-advancing means provided at the opposite sides of said path in the regions between successive sections of said path.

2. A device as defined in Claim 1, wherein each pair of advancing means comprises a pair of rollers having substantially parallel axes extending transversely of the direction of strip travel between said guides.

3. A device as defined in Claim 2, wherein said path is U-shaped and comprises two elongated legs at least one of which is composed of a plurality of concave and convex sections.

4. A device as defined in Claim 2, wherein one of each pair of rollers is movable radially of the other roller and wherein said strip-advancing means further comprises means for biasing said one roller toward the other roller of the respective pair of rollers.

5. A device as defined in Claim 4, wherein said biasing means comprises at least one elastic belt.

6. A device as defined in Claim 4, wherein said path is U-shaped and wherein the other roller of each pair of rollers is located at the inner side and the one roller of each pair of rollers is located at the outer side of said path.

7. A device as defined in Claim 6, wherein said guides have registering slots and said one roller of each pair of rollers has end portions reciprocably received in such slots.

8. A device as defined in Claim 7, wherein the end portions of said one roller carry bearings which are slidably fitted into the respective slots.

9. A device as defined in Claim 1, wherein at least one of said guides has a portion which can come to rest on the top of a tank which receives said bath.

10. A device as defined in Claim 1, wherein said guides are disposed in two parallel vertical planes and the length of said path is a multiple of the width therof.

11. A device for feeding strips of flexible material, particularly for feeding photographic roll film through a liquid treatment bath, comprising a pair of spaced-apart guides having grooves arranged to receive the edges of a strip and defining an elongated path of other than circular outline, said path having a plurality of arcuate sections including concave sections followed by convex sections and vice versa; pairs of cooperating strip-advancing means provided at the opposite sides of said path in the regions between successive sections of said path, each pair of said strip-advancing means comprising a pair of rollers having substantially parallel axes extending transversely of the direction of strip travel between said guides and one of each pair of rollers being movable radially of the other roller, said strip-advancing means further comprising means for biasing said one roller toward the other roller of the respective pair of rollers and said biasing means comprising at least one elastic belt; and a set of roller-shaped deflecting means carried by said guides, said one belt being trained around said deflecting means and around a portion of the one roller of each pair of rollers.

12. A device as defined in Claim 11, wherein said path is U-shaped and comprises two elongated legs, said deflecting means being arranged in at least one row between said legs.