July 11, 1944. J. G. CAPSTAFF 2,353,219

FILM PROCESSING MACHINE

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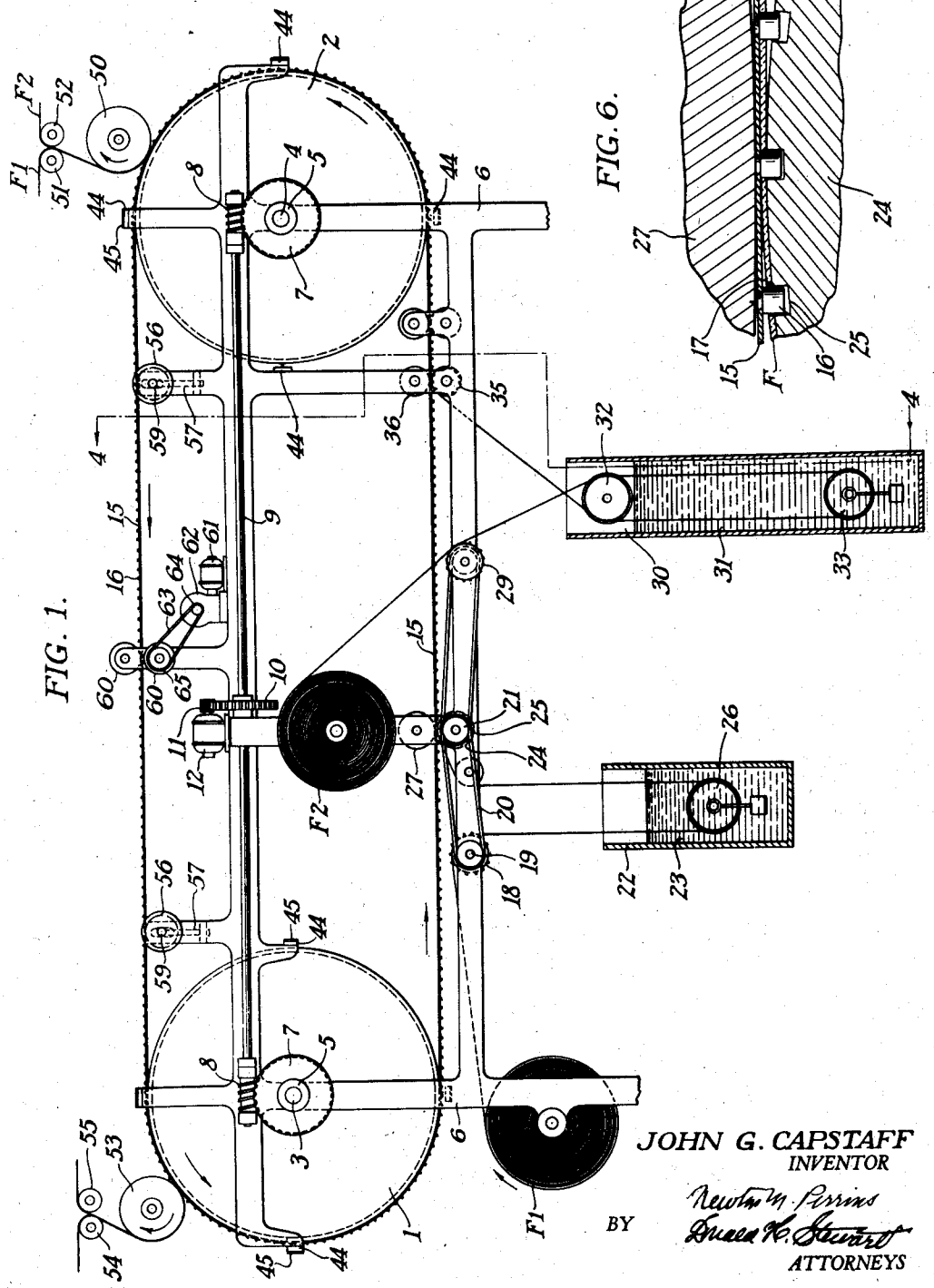


FIG. 1.

FIG. 6.

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FIG. 2.

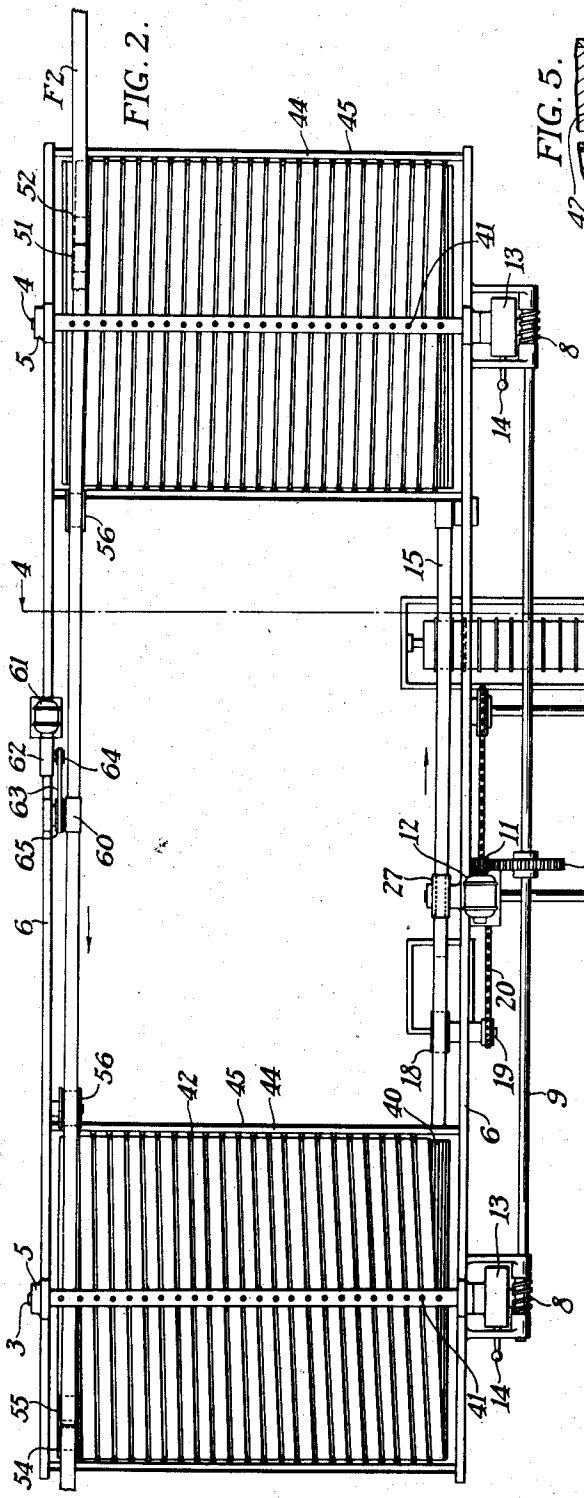


FIG. 5.

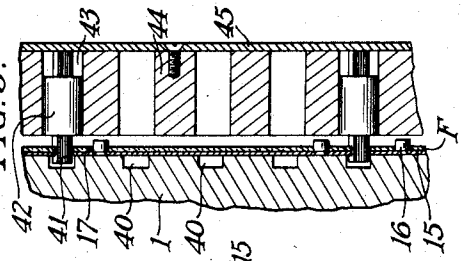
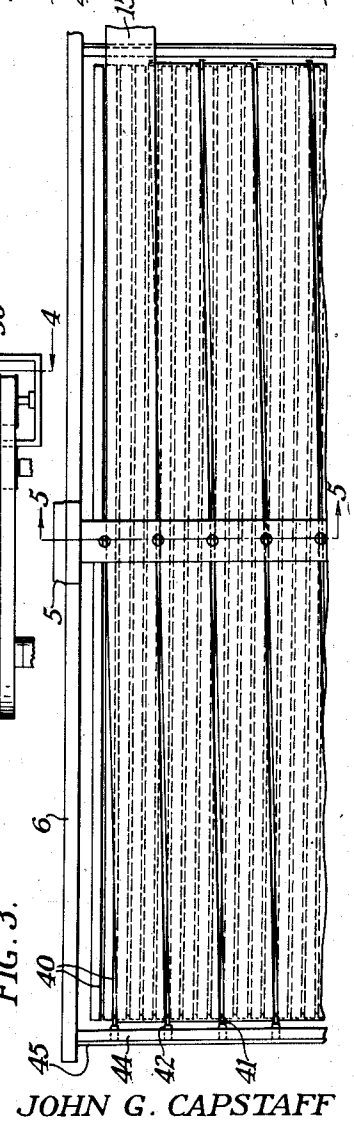


FIG. 3.



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FIG. 4.

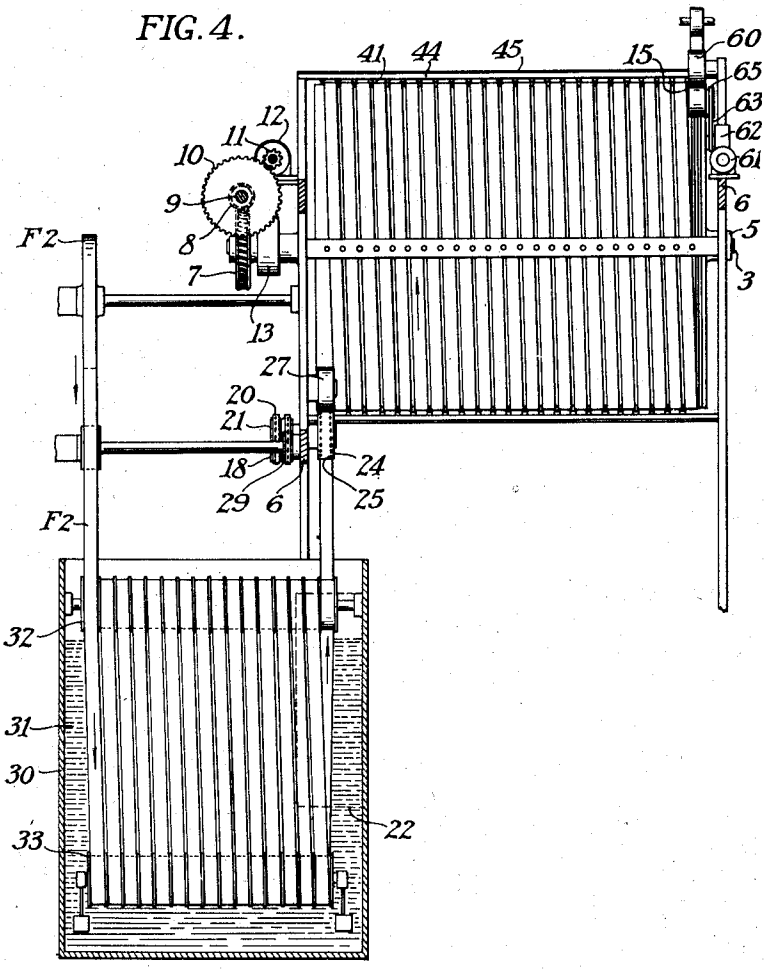
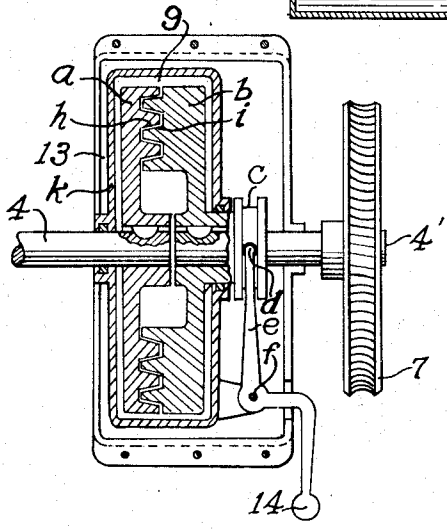


FIG. 7.



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FILM PROCESSING MACHINE

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Application November 6, 1941, Serial No. 418,051

16 Claims. (Cl. 271—2.1)

This invention relates to photography and more particularly to machines for supporting strips of motion picture film for various film processing operations.

One object of my invention is to provide a film guide and support for strips of motion picture film, the film carrying devices being so arranged that the film may be conducted through a long path in a comparatively small space. Another object of my invention is to provide a machine in which the length of the film path can be readily varied to suit the particular conditions under which the film is to be processed. Another object of my invention is to provide a film machine in which a cylinder is used, the cylinder being provided with a means for conducting a film supporting belt through a spiral path about the cylinder. Another object of my invention is to provide a pair of cylinder supports about which a belt carrying the film may be looped and to provide a tendency drive tending to turn the cylinders. Another object of my invention is to provide a belt drive which will require extremely little torque to keep the cylinders turning at the linear speed of the belt. Other objects will appear from the following specification, the novel features being particularly pointed out in the claims at the end thereof.

Coming now to the drawings wherein like reference characters denote like parts throughout:

Fig. 1 is a side elevation of a film processing machine constructed in accordance with and embodying a preferred form of my invention;

Fig. 2 is a top plan view of the machine shown in Fig. 1;

Fig. 3 is an enlarged fragmentary view in elevation of a portion of one of the cylinders;

Fig. 4 is a section taken on line 4—4 of Fig. 1 showing parts of the machine in elevation and parts in section;

Fig. 5 is an enlarged fragmentary section on line 5—5 of Fig. 3;

Fig. 6 is an enlarged fragmentary magnified sectional view through socket wheel 24 and rubber roller 27; and

Fig. 7 is a fragmentary view partially in section and on a magnified scale of a tendency drive as used for driving my machine.

My machine for guiding and supporting long lengths of motion picture film may consist of a belt, preferably somewhat wider than the film, on which the film may be carried through a path which normally extends through a series of loops about a cylinder, although it may also extend between runs of the supporting belt between two cylinders. The belt is preferably an endless one, although if desired belts of the required length may be unreeled from one reel and passed through the machine, after which they may be reeled up at some other station.

Referring now to Figs. 1 and 2, the machine preferably consists of a pair of spaced cylinders 1 and 2, mounted upon shafts 3 and 4, carried by suitable bearings 5 in a frame member 6. The shafts 3 may carry spiral gears 7, meshing with worms 8, carried by a shaft 9, supporting a gear 10, meshing with a pinion 11, driven by the motor 12.

As indicated in Fig. 2, similar housings 13 on the shafts 3 and 4 carrying known types of tendency drives and adjusting handles 14 are for varying these drives. Such drives usually consist of a pair of mating discs having complementary surfaces between which there is an oil layer, and by varying the thickness of this oil layer, as by moving the handles 14, the extent of the drive may be adjusted. Any suitable drive of this nature may be used so that the two cylinders 1 and 2 may normally be driven at a known speed, but these cylinders may be moved either slightly faster or slightly slower than the set speed by a very light force, which in this case may be taken care of by a belt 15 which may convey the film through the desired path. A typical example of such a tendency drive is shown in Patent 1,238,447, Severy, August 28, 1917.

As shown in this patent, the tendency drive may be similar to the drive shown in Fig. 7. This drive may comprise a casing *k* which contains oil. The shaft 4 extends into this casing and carries a plate *a* having formations *h* of annular form thereon which are complementary in shape to the formations *i* on the plate *b* which may be moved axially to and from the plate *a* to change the spacing therebetween. This may be done by means of the grooved portion *c* of the plate which may be engaged by the rollers *d* on an arm *e* pivoted at *f* in the casing. The arm *e* extends outside of the casing so that the handle 14 is in an operative position. By moving this handle the spacing between plates *a* and *b* can be varied so that the tendency drive can be made to drive more or less positively when the worm gear 7 is rotated through the worm 8, shaft 9 and gears 10 and 11 by means of the motor 12.

Since the oil film between the plates *a* and *b* determines the torque transmitted it is a simple matter to adjust these plates so that the cylinders will turn or at least tend to turn at about the same speed, this speed being usually selected to

be at substantially the speed at which the film is positively driven by means of the power drive indicated in Fig. 1. This drive includes the motor 61, a gear reduction 62 belt 63 and the rollers 60. Thus, while the cylinders tend to turn at approximately the desired speed, they may nevertheless vary from this speed at which they tend to turn because of the frictional contact of the loops of belt extending around these drums, the belt being driven at exactly the desired speed.

As indicated in Figs. 5 and 6, the belt 15 may be provided with pins 16 spaced to extend into the usual sprocket apertures 17 of a film F, so that the film or films, as the case may be, will be normally held in a fixed position with respect to the belt.

Film may be drawn from a roll F1, as shown in Fig. 1, by means of a sprocket 18 pivoted at 19 to the frame 6 and driven by means of a chain 20 from a sprocket 21 turned by power at a known speed. Thus, the film F in passing over the sprocket 18 may be fed into a tank 22 containing a treatment solution 23 at the same speed as the speed of movement of the belt 15 because this belt may be moved by a socket wheel 24. This wheel has sockets 25 in its periphery to engage the pins 16 of the belt, as best shown in Fig. 6.

As the film is drawn out of the tank 22 after having passed about a weighted spool 26 it may pass over the socket wheel 24 which may then iron the film or smooth it upon the belt 15. The socket wheel may be backed up by a rubber roller 27 so that, as indicated in Fig. 6, the film may be caused to adhere to the belt 15 by which it will be carried through a predetermined path.

If it is desirable to place a second film upon the belt, the film roll F2 may be supplied with a roll of film which will be fed by a sprocket wheel 29 into a tank 30 of treatment solution 31 where it may be looped about upper rolls 32 and lower rolls 33 through a path of sufficient length to receive the necessary treatment. After passing out of the tank 30 the film may pass over a socket roll 35 against which an ironing roll 36 presses so that the second film may be brought into intimate contact with the first, this being sometimes done to transfer images by imbibition or for other purposes.

One of the features of my invention is the construction of the cylinders 1 and 2 which are alike in that each cylinder as indicated in Figs. 3 and 5 is provided with a means for guiding the belt 15 through a spiral path. This path is maintained in the following manner.

Each drum is provided with a plurality of concentric grooves 40 which are parallel and which extend into the surface of the drum a distance sufficient to receive the flattened end 41 of a pin 42 which may be carried in an aperture 43 of arm 44, the aperture being covered by a removable plate 45, as shown in Fig. 5.

I preferably provide four arms 44 spaced 90° apart about the periphery of each cylinder as best shown in Fig. 1. Each of these arms has a plurality of apertures and these may be made to correspond to the locations of the plurality of grooves 40. By selecting the desired apertures and inserting the pins 42 in the selected apertures a spiral path may be made through which the belt will travel, since it is looped about the cylinder and guided by the flat surfaces 41 of the pins 42.

I prefer to provide each cylinder with four grooves to each width of carrier belt, since it is a convenient number and since it provides a smooth spiral when four arms spaced about the cylinder are used when guiding pins are inserted in every fourth slot. However, the number of grooves and pins used may depend entirely upon the paths required. With the setup shown in Fig. 2, in which the periphery of the cylinder is almost completely covered by the spiral belt, every fourth groove is used as indicated in Fig. 5.

One of the features of my machine is its extreme flexibility in that film can be passed through a path which may vary considerably in length according to the processing needs. For instance, I may, with the setup shown in Fig. 1, apply two films to a belt which is then looped about the cylinder 2 and which may, as indicated in Figs. 1 and 2, be removed from the cylinder 2 by passing the films F1 and F2 from the belt 15 and over a roller 50, and if desired the two films may be separated by passing them over rollers 51 and 52 after which the film may pass to a drier or other suitable piece of apparatus.

It should be noticed that, in passing through the path above described, films F1 and F2 are held closely together on the belt 15 by means of the snubbing action caused by looping the belt 15 with the films F1 and F2 thereof about the cylinder. However, if a longer path should be desired as may be necessary for other types of film processing whether a single or multiple layer be used, the film may continue on from cylinder 2 and may then loop around cylinder 1 in a plurality of loops after which the film may be taken off by a roller 53 and may be passed over one or both of the rollers 54 or 55 when the processing is complete.

The upper reach of the belt 15 may include additional supports for the belt 15 such as the rollers 56, these rollers being supported by the frame member 6 and preferably including adjusting screws 57 by which the axis of the shafts 59 supporting the rolls may be tilted if desired with respect to the shafts 3 and 4 to more readily guide the belt 15.

The belt 15 may be driven at any convenient point, as indicated in Fig. 1, by mechanism to be hereinafter described. Only a very small amount of power is necessary to move the belt because of the tendency drive for the drums 1 and 2 which will always tend to turn the drums sufficiently to overcome friction and at a very slightly greater linear speed than that of the belt. The tendency drive, however, being preferably somewhat less than is necessary to overcome friction of bearings, etc. The balance of the power needed will come from a positive drive of the belt. Such a drive may comprise a pair of rubber covered rollers 66, as shown in Fig. 1, at least one roller being driven by a motor 61 through a reducing gear 62 and chain 63, this chain connecting sprockets 64 to sprocket 65 carried by the lower roller 66. Thus, there is no tendency to distort the belt in use and it may move smoothly and freely through the path defined by the cylinders and pins. The belt is preferably made of metal inert to the processing baths or substantially so, such as stainless steel, Monel metal, or belts having a plating of nickel, silver or other suitable materials. For some purposes the belts may be made of cellulose material such as filtrate or acetate, or in some instances real or artificial rubber may be used in which case metal wires may be used to prevent stretching. Any belt which may be guided through the machine above described and carry

film may be used which will not deleteriously affect the particular processing baths in use at the time.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. A guide and support for processing machines including a cylinder adapted to support a belt, a plurality of annular slots formed in the cylinder, a base for supporting the cylinder, supporting arms carried by the base, spaced about the cylinder and extending axially of the cylinder near the periphery thereof, edge guide members carried by the supporting arms in a pattern forming a spiral and extending into the slots to define a path for said belt lying on said cylinder, and means carried by the supporting arms for mounting the edge guides in selected positions.

2. A guide and support for processing machines including a cylinder adapted to support a belt, a plurality of annular slots formed in the cylinder, a base for supporting the cylinder, supporting arms carried by the base, spaced about the cylinder and extending axially of the cylinder near the periphery thereof, edge guide members carried by the supporting arms in a pattern forming a spiral and extending into selected slots to define a path for the belt lying on said cylinder, said edge guide members comprising rollers, studs carrying the rollers, said studs being carried by the supporting arms.

3. A guide and support for processing machines including a cylinder, adapted to carry a belt, a plurality of annular slots formed in the cylinder, a base for supporting the cylinder, supporting arms carried by the base and extending axially of the cylinder near the periphery thereof and equally spaced about the cylinder, edge guide members carried by the supporting arms in a pattern forming a spiral and extending into the slots to define a path for the belt lying on said cylinder, said edge guides being of a size to clear the walls of the slots while extending into the slots whereby an edge of the belt supported by the cylinder may be guided by the film edge guides.

4. A guide and support for processing machines comprising a cylinder, a film conveying belt partially carried thereby, a plurality of annular slots formed in the cylinder, a base for rotatably supporting the cylinder, supporting arms carried by the base and extending axially of the cylinder near the periphery thereof and equally spaced about the cylinder, equally spaced, edge guide members carried by the supporting arms and extending into the slots, the edge guide members on one supporting arm being positioned in different annular slots from the edge guide members carried by the next adjacent supporting arms to form a spiral path for a film conveying belt lying on said cylinder, said edge guide members being so positioned in the various selected slots to form a path for the film conveying belt supported upon the cylinder.

5. A guide and support for processing machines for treating strips of film of known width comprising a base, a cylinder rotatably mounted on the base, a film conveying belt at least partially carried thereby, a plurality of annular grooves carried by the cylinder and spaced apart a distance considerably less than the width of said film conveying belt, film edge guides of a width less than said grooves, means carried by the base for positioning said edge guides to extend into said grooves, the edge guide members being positioned and arranged to form a spiral path for said film conveying belt looped about and lying at least partially on the cylinder whereby said film conveying belt turning with said cylinder may be guided through the selected path.

6. A guide and support for processing machines for treating strips of film of known width comprising a base, a cylinder rotatably mounted on the base, a film conveying belt carried thereby, a plurality of annular grooves carried by the cylinder and spaced axially thereof, a plurality of supporting arms carried by the base, the number of said arms corresponding to the number of grooves in the cylinder for each width of film conveying belt, and means on said arms for supporting edge guides whereby said guides may be positioned to extend substantially radially into selected grooves to form a path on said cylinder for the film conveying belt.

7. A guide and support for processing machines for treating strips of film of known width comprising a base, a cylinder rotatably mounted on the base, a film conveying belt partially carried thereby, a plurality of annular grooves carried by the cylinder and spaced axially thereof, a plurality of supporting arms carried by the base, the number of said arms corresponding to the number of grooves in the cylinder for each width of belt, and means on said arms for supporting belt edge guides whereby said guides may be positioned to extend substantially radially into selected grooves, the edge guides of each supporting arm clockwise about the cylinder preferably extending into the next adjacent groove to those receiving the edge guides of the next supporting arm counter-clockwise from said supporting arm, whereby a compact spiral path may be defined for the belt.

8. A guide and support for processing machines including a pair of spaced cylinders, a plurality of annular grooves in each cylinder, an endless belt looped about each cylinder in a spiral path, and means for defining the spiral path for the belt on each cylinder comprising supporting arms spaced about each cylinder and carrying edge guides extending into selected annular grooves of each cylinder.

9. A guide and support for processing machines including a pair of spaced cylinders, a plurality of annular grooves in each cylinder, an endless belt looped about each cylinder in a spiral path, and means for defining the spiral path for the belt on each cylinder comprising supporting arms spaced about each cylinder and carrying edge guides extending into selected annular grooves of each cylinder, and means for moving the cylinders and belt.

10. A guide and support for processing machines including a pair of spaced cylinders, a plurality of annular grooves in each cylinder, an endless belt looped about each cylinder in a spiral path, and means for defining the spiral path for the belt on each cylinder comprising edge guides extending into selected annular grooves of each cylinder, and means for moving the cylinders and belt, said means for moving the cylinders including a tendency drive and said means for moving the belt comprising a positive drive.

11. A film guide and support for processing film comprising a long, flexible, endless belt, means for supporting the belt comprising a pair of spaced cylinders including annular slots therein and about which portions of the belt are

looped in a plurality of loops and means included adjacent a cylinder and spaced thereabout for guiding a portion of said belt looped about said cylinder through a spiral path, said means comprising relatively fixed edge guides extending into said slots arranged in a pattern defining the spiral path.

12. A film guide and support for processing film comprising a long, flexible, endless belt, means for supporting the belt comprising a pair of spaced cylinders including annular slots therein and about which portions of the belt are looped in a plurality of loops and means included adjacent a cylinder and spaced thereabout for guiding a portion of said belt looped about said cylinder through a spiral path, said means comprising relatively fixed edge guides extending into said slots and arranged in a pattern defining a desired spiral path, said edge guides being normally out of contact with said cylinder.

13. A film guide and support for processing motion picture film comprising a long, flexible, endless belt, a pair of spaced cylinders about which said belt may be looped in a plurality of loops, a power drive for the belt, and a drive tending to turn said cylinders sufficiently to overcome friction but at such a speed that said cylinders may be driven to a very slight extent by said endless belt.

14. A film guide and support for processing motion picture film comprising a long, flexible, endless belt, a pair of spaced cylinders about which said belt may be looped in a plurality of loops, a power drive for the belt, a tendency drive for the cylinders, and means for adjusting the tendency drive to normally move said cylinders at approximately the speed of the belt, whereby the belt drive may regulate the speed of the tendency driven cylinders.

15. A film guide and support for processing motion picture film comprising a long, flexible belt, a cylinder having a plurality of annular slots therein, means for positively feeding the belt toward the cylinder, a plurality of relatively fixed pins extending into a plurality of selected slots in the cylinder forming a spiral path for the belt thereon, said belt having frictional contact with the cylinder, a tendency drive for the cylinder for resiliently turning the cylinder whereby the speed of said cylinder may be controlled by the frictional contact of the spiral convolutions of the flexible belt passing around said cylinder guided by the fixed pins forming said spiral path and moved by the means for positively feeding the belt toward the cylinder.

16. A film guide and support for processing motion picture film comprising a long, flexible belt, a cylinder having a plurality of annular slots therein, means for positively feeding the belt toward the cylinder, a plurality of relatively fixed pins comprising rods having oppositely disposed parallel belt engaging faces and extending into a plurality of selected slots in the cylinder forming a spiral path for the belt thereon whereby said belt may have material frictional contact with the cylinder, a tendency drive for the cylinder for resiliently turning the cylinder whereby the speed of said cylinder may be controlled by the frictional contact of the spiral convolutions of the flexible belt moved by the means for positively feeding the belt toward the cylinder and passing around said cylinder and guided by the flat faces of the fixed pins forming said spiral path.

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