

April 30, 1963

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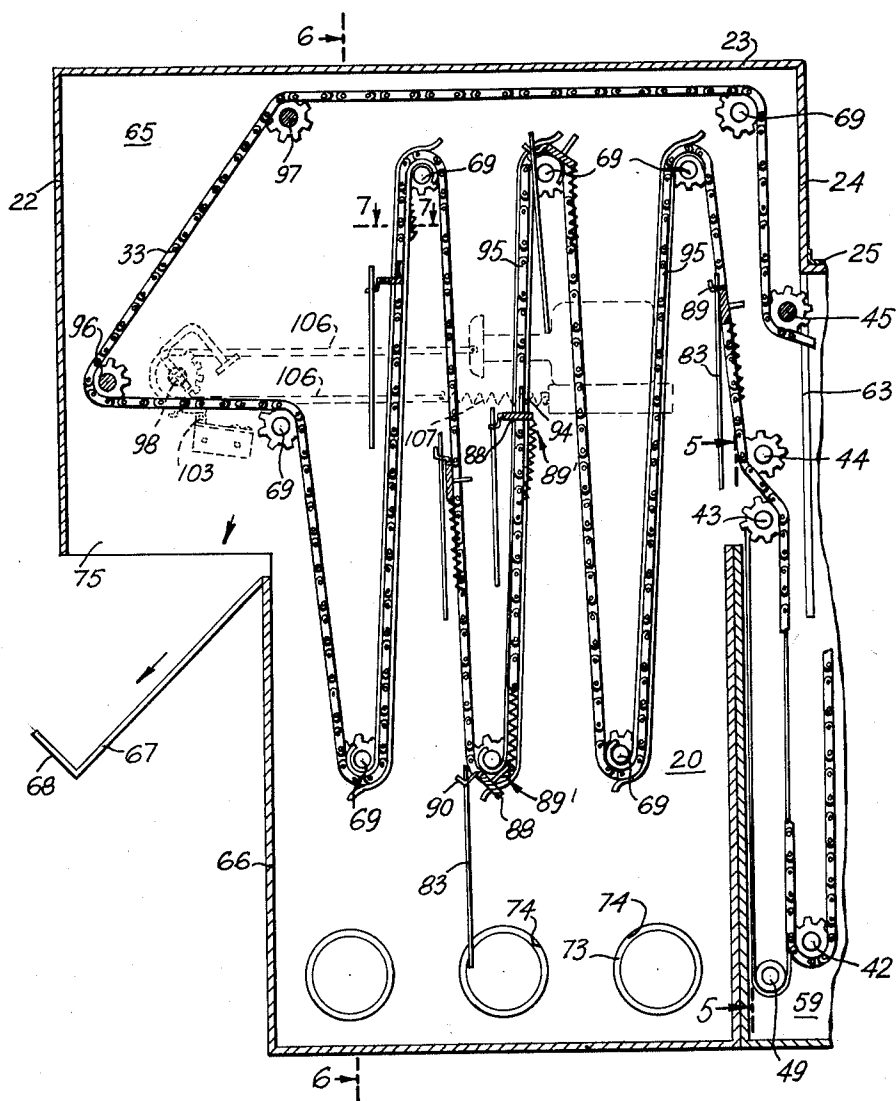
3,087,406

FILM TREATING APPARATUS

Filed June 30, 1960

6 Sheets-Sheet 1

FIG. 1A.



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Filed June 30, 1960

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FIG. 1B.

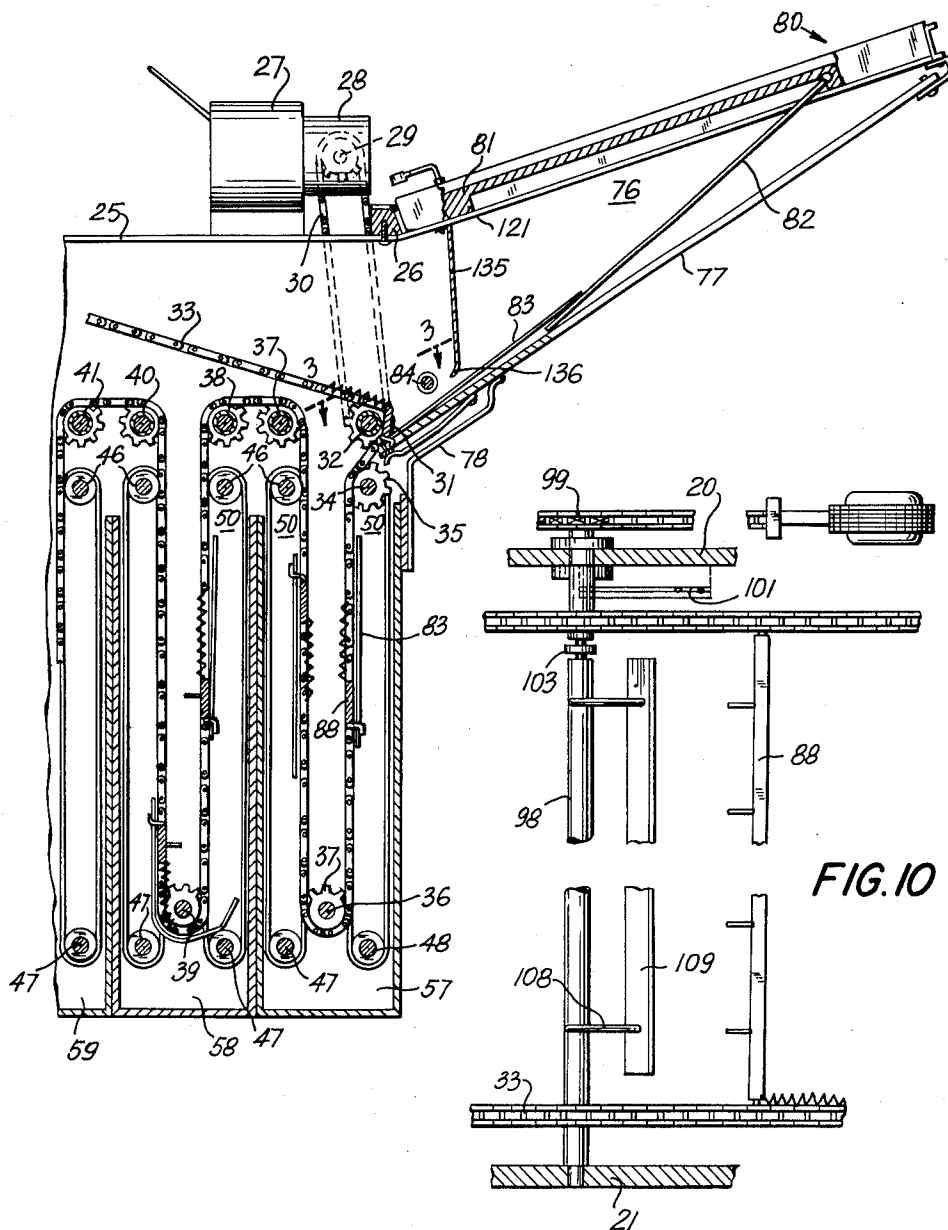


FIG. 10

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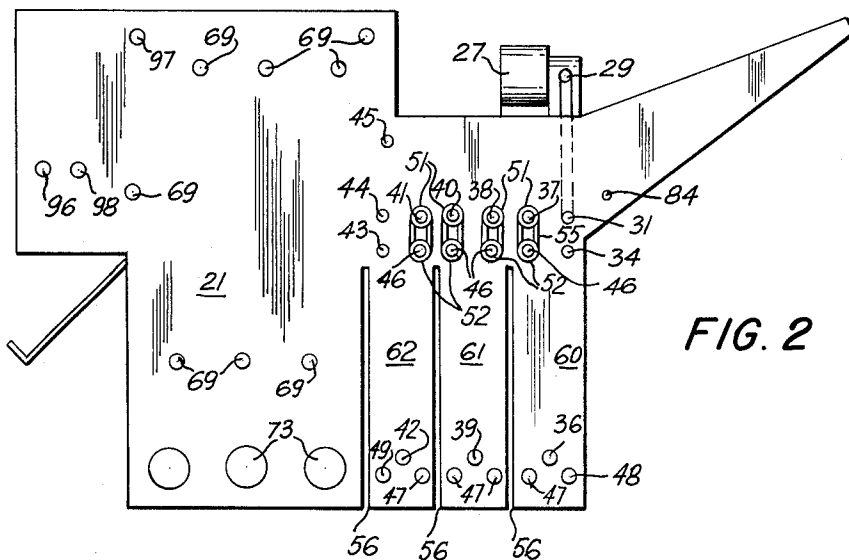


FIG. 2

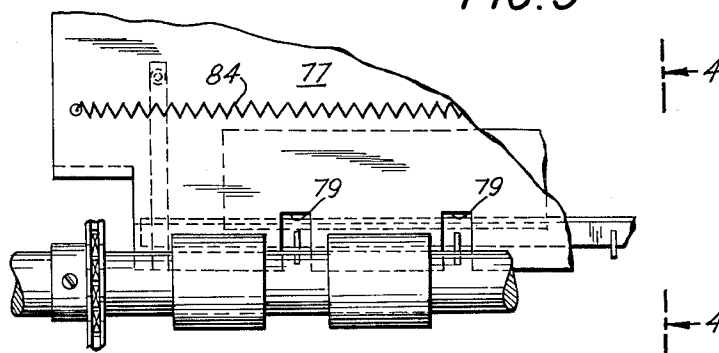


FIG. 3

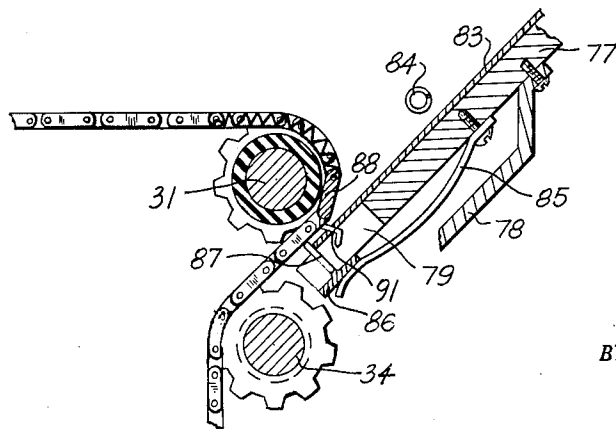


FIG. 4

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FIG. 5

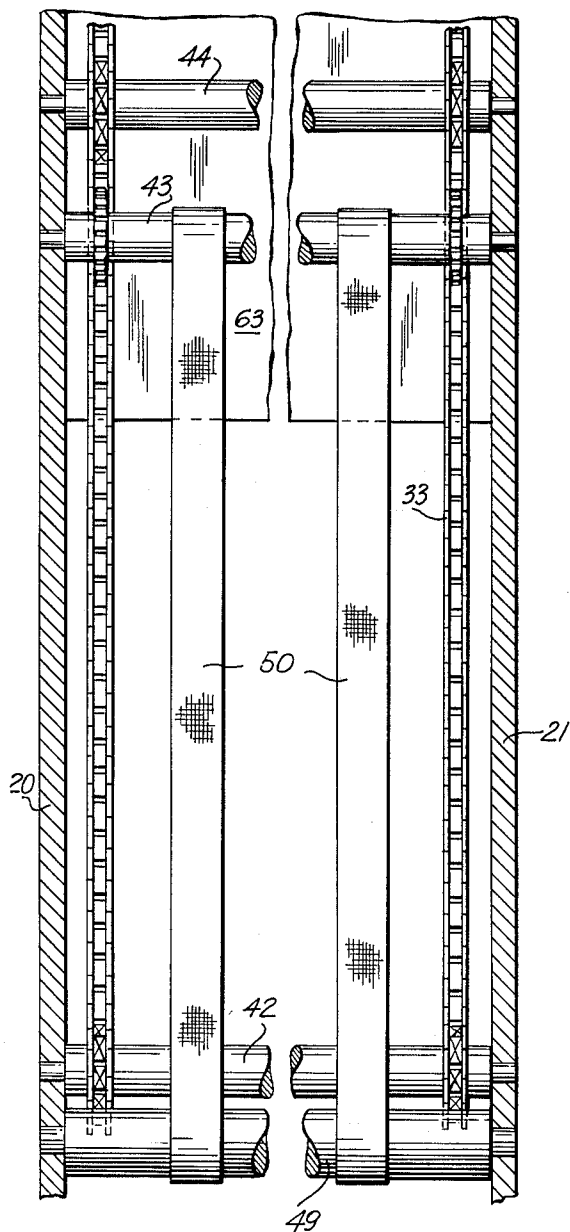
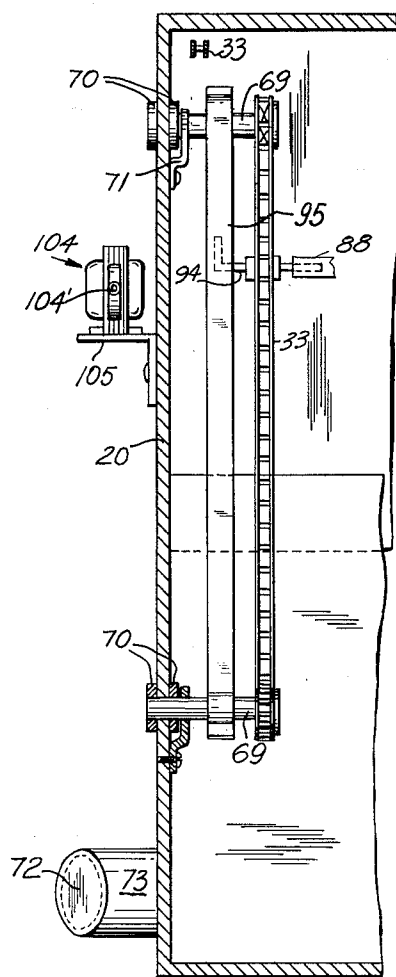


FIG. 6



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Filed June 30, 1960

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FIG. 7

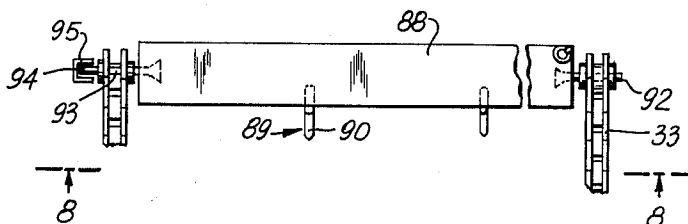


FIG. 8

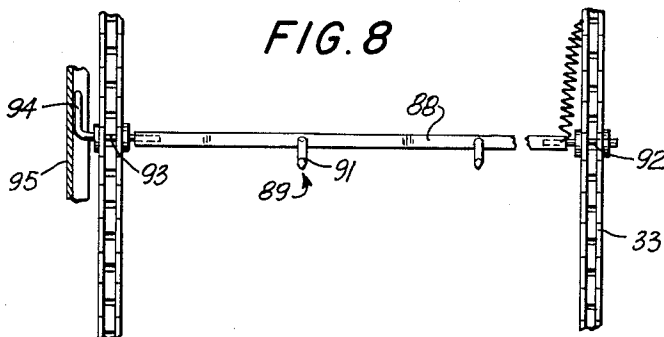
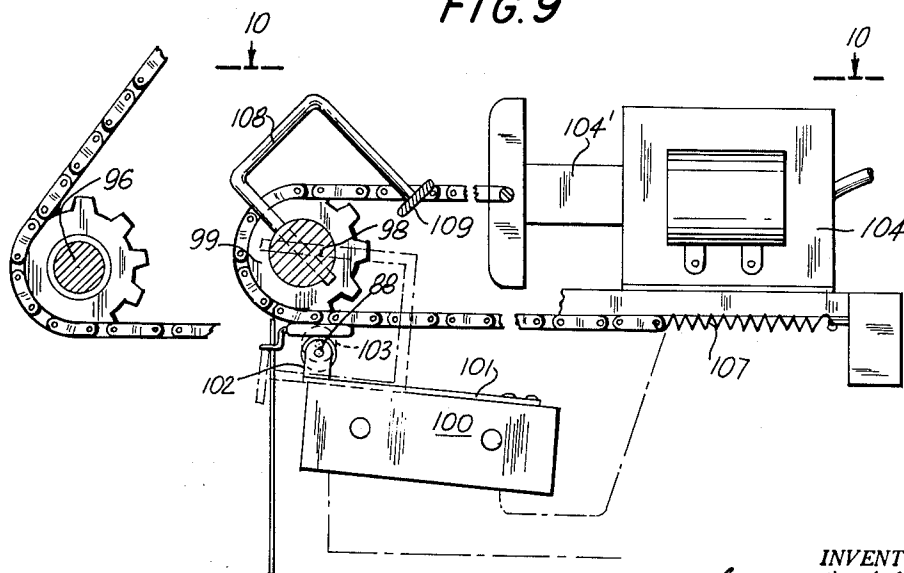


FIG. 9



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FILM TREATING APPARATUS

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Filed June 30, 1960, Ser. No. 40,000

7 Claims. (Cl. 95-94)

The present invention relates to film treating apparatus. More particularly, the present invention relates to apparatus of the type which is used for treating film such as X-ray film.

In conventional apparatus of this type it is necessary to engage the film so as to hold it and while holding it move the film through a series of treating tanks as well as to dry the film after its treatment, so that a dry developed film will result. Several problems are present in the conventional structures of this type. Thus, there has as yet been no satisfactory solution to the problem of properly engaging and holding the film while it moves through the treating apparatus. Moreover, the conventional apparatus of this type is not yet fully automatic so that several operations are required to be manually performed at the present time. Furthermore, the cassettes which carry the film come in different sizes, and extremely complex structures are provided at the present time for supporting the cassettes of different sizes in a proper light-tight manner so that the film can be released from the cassette to be treated.

One of the objects of the present invention is to provide a structure which is capable of automatically treating a film from the time it leaves the cassette to the time the dry fully developed film is received.

Another object of the present invention is to provide in an apparatus of this type a structure which will engage and carry the film in a perfectly reliable secure manner while at the same time permitting easy removal of the film from the treating apparatus.

It is also an object of the present invention to provide a film supporting structure for engaging and carrying the film through the apparatus in a fully automatic manner.

An additional object of the present invention is to provide a structure of the above type with an adjustable cassette supporting assembly which is extremely simple in its construction as well as in its operation and which is reliable to the fullest extent.

It is also an object of the present invention to provide a structure capable of accomplishing all of the above objects and at the same time composed of simple rugged elements which are very reliable in operation.

With the above objects in view the invention includes in a film treating apparatus an elongated bar having a pair of opposed side faces and a pair of opposed longitudinal edges each of which extends between the side faces. A plurality of film-engaging pins are fixed to and extend from one of the edges of the bar, these pins being distributed along this one edge, and each of the pins has an L-shaped portion one leg of which terminates in the tip of the pin and the other leg of which extends substantially perpendicular to the opposed side faces of the bar. A moving means cooperates with this bar for moving it along a path which will cause its pins to pierce through a film adjacent an edge thereof so that the pins serve to engage and carry the film, this moving means moving the bar with the film supported from the pins of the bar through the treating apparatus, which is to say through a series of treating tanks as well as through a drying chamber. As the bar approaches the end of the drying chamber a stripper means according to the present invention is automatically actuated and acts in a fully automatic manner to strip the film from the pins, the film then dropping automatically onto a receiving member

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which positions the film where it can conveniently be taken away from the apparatus in dry, fully developed condition. Moreover, the structure of the invention includes an adjustable cassette supporting means which is easily adjustable to be accommodated to cassettes of any size and which supports the cassettes in a fully light-tight manner permitting the film to be released from the cassette so as to be treated with the apparatus which receives the film from the cassette.

The novel features which are considered as characteristic for the invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and its method of operation, together with additional objects and advantages thereof, will be best understood from the following description of specific embodiments when read in connection with the accompanying drawings, in which:

FIGS. 1A and 1B are a sectional vertical side elevation of a structure according to the present invention;

FIG. 2 is a side elevation of the structure of FIG. 1 as seen from the exterior of one of the side walls thereof;

FIG. 3 is a fragmentary plan view taken along line 3—3 of FIG. 1 in the direction of the arrows;

FIG. 4 is a fragmentary sectional view taken along line 4—4 of FIG. 3 in the direction of the arrows;

FIG. 5 is a transverse view of part of the structure of FIG. 1 taken along line 5—5 of FIG. 1 in the direction of the arrows;

FIG. 6 is a second transverse section showing fragmentarily part of the structure of FIG. 1, FIG. 6 being taken along line 6—6 of FIG. 1 in the direction of the arrows;

FIG. 7 is a fragmentary sectional plan taken along line 7—7 of FIG. 1 in the direction of the arrows;

FIG. 8 is a view of the structure of FIG. 7 taken along line 8—8 of FIG. 7 in the direction of the arrows;

FIG. 9 is a fragmentary side elevation of the stripper means of the invention;

FIG. 10 is a fragmentary plan view illustrating the stripper means of the invention;

FIG. 11 is a top plan view of the adjustable cassette supporting structure of the invention;

FIG. 12 is a sectional elevation taken along line 12—12 of FIG. 11 in the direction of the arrows;

FIG. 13 is a sectional plan taken along line 13—13 of FIG. 12 in the direction of the arrows; and

FIG. 14 diagrammatically illustrates another embodiment of a cable means which is used to maintain a pair of members of the cassette supporting structure parallel to each other while moving them automatically toward and away from each other upon movement of one of the members.

Referring now to the drawings, the structure of the invention includes a frame composed in part of a pair of spaced, parallel, identical, and aligned side walls 20 and 21. The side wall 20 is shown in FIG. 1 as it appears from the interior of the apparatus, while the side wall 21 is shown in FIG. 2 as it appears from the exterior of the apparatus. As was pointed out above, these side walls are parallel to and identical with each other, as well as aligned with each other. An end wall 22 extends between and is connected to the side walls 20 and 21 at the left ends thereof, as viewed in FIGS. 1 and 2, and a top wall 23 is fixed to and extends along the upper left portions of the walls 20 and 21. From the right end of the top wall 23 a wall 24 extends downwardly and is fixed to the pair of walls 20 and 21, and then a wall 25 extends along the upper edge of the walls 20 and 21 adjacent their right ends, as viewed in FIGS. 1 and 2. The side walls 20 and 21 have substantially triangular portions which extend to the right, as viewed in FIGS. 1 and 2, beyond the elongated member 26 which is fixed to the wall 25

at its right end, as viewed in FIG. 2. A motor 27 which can be connected to any suitable source of current, as, for example, a wall plug in a room, is carried by the wall 25 and serves to drive the entire apparatus. Thus, the motor 27 forms a unit with a gear reduction 28 which serves to drive a sprocket wheel 29 which serves to drive an endless chain 30, this chain also passing around a second sprocket wheel which is located at the exterior of the apparatus at the side of the wall 20 which is not visible in FIG. 1. This latter sprocket wheel is fixed to the shaft 31 which carries within the apparatus a sprocket wheel 32 for rotation therewith, and this shaft 31 extends completely across the space between the walls 20 and 21 and is supported by these walls for rotary movement. Adjacent to the wall 21 within the interior of the apparatus the shaft 31 carries a second sprocket wheel identical with the sprocket wheel 32, and a pair of endless flexible members in the form of chains 33 are guided over the pair of sprockets 32 which are carried by the shaft 31 so that in this way the endless chains 33 are driven whenever the motor 27 is energized.

The pair of walls 20 and 21 also serve to rotatably support a shaft 34 which is identical with the shaft 31 and located substantially beneath the latter, and this shaft 34 carries within the interior of the apparatus a pair of sprockets 35 which are fixed to the shaft 34 for rotation therewith and which are respectively located beneath the pair of sprockets 32, the pair of chains 33 being guided over the sprockets 34 in the manner shown most clearly in FIG. 1. The ends of the shafts 31 and 34 are shown in FIG. 2.

The pair of walls 20 and 21 also support for rotation about its axis a horizontal shaft 36 which fixedly carries within the space between the walls 20 and 21, respectively adjacent to these walls, a pair of sprockets 37 around which the chains 33 are guided in the manner shown in FIG. 1. All of the sprockets which guide the chains 33 are respectively located in the same vertical planes as these chains 33, these vertical planes being parallel to and located just inside of the pair of walls 20 and 21, respectively. The several shafts, such as the shafts 31 and 36 are prevented from moving axially as by having reduced end portions which are respectively turnable in the openings formed in the walls 20 and 21 for supporting these shafts. In the same way that the shafts 31, 34 and 36 are carried by the walls 20 and 21, these walls also carry the shafts 37, 38, 39, 40, 41, 42, 43, and 44, as well as a shaft 45, and all of these shafts carry sprockets along which the chains 33 are guided in the manner shown in FIG. 1. The shaft 45 carries a pair of sprockets from which the chains 33 move to the pair of sprockets 32, as is evident from FIG. 1. In addition the walls 20 and 21 rotatably support a plurality of horizontal shafts 46 which are respectively located beneath and adjacent to the shafts 37, 38, 40 and 41 and also these walls rotatably support a plurality of lower shafts 47 which are respectively located beneath the shafts 46. In addition there is a shaft 48 located beneath the shaft 34, and a shaft 49 located beneath a shaft 43. The shafts 43, 46, 34, 47, 48, and 49 all serve to support endless belts made of a mesh which is of a material which is not influenced by the particular treating liquids in which these endless belts are located, as will be pointed out below. Thus, FIG. 5 shows the pair of endless mesh belts 50 which extend around and frictionally engage the shafts 43 and 49, FIG. 5 also showing how these shafts extend across and are carried by the walls 20 and 21. The pairs of shafts formed by each upper shaft 46 and the shaft 47 therebeneath are also provided with endless belts 50 in the same way as the shafts 43 and 49, as is apparent from FIG. 1. In addition, the shafts 34 and 48 support endless mesh belts 50 identical with those illustrated in FIG. 5, and as is apparent from FIG. 5 these endless belts 50 are located at a substantial distance from the sprocket wheels which are carried by the shafts 34, 43, 36, 39, and 42.

The shafts 37, 38, 40 and 41 extend beyond the wall 21 at the exterior of the apparatus (FIG. 2), and at the exterior of the wall 21 these shafts 37, 38, 40 and 41 fixedly carry pulleys 51, respectively. Also, the shafts 46 which are respectively located directly beneath the shafts 37, 38, 40 and 41 respectively carry pulleys 52 which are fixed to the shafts 46 for rotation therewith, respectively, and these pulleys 52 are respectively located in the same vertical planes as the pulleys 51. A series of endless belts 53 extend around and frictionally engage each pair of pulleys 51 and 52, as indicated in FIG. 2, so that in this way the rotation of the shafts 37, 38, 40 and 41 are respectively transmitted to the shafts 46, the several belts 50 which engage the shafts 46 serving to transmit the rotary movement of these shafts 46 to the shafts 47, respectively. Of course, the shaft 34 is directly driven from the chains through the sprocket 35, and the mesh belts 50 which pass around the shaft 34 serve to transmit the drive to the shaft 48, while the shaft 43 also carries sprocket wheels engaged by the endless chains 33, and the endless belts 50 which pass around the shaft 43 serve to transmit rotation from the shaft 43 to the shaft 49. In this way all of the belts 50 move with the above transmission which transmits the drive from the single motor 27. It will be seen that with this arrangement, where the sprocket 29 turns in a clockwise direction, as viewed in FIG. 1, the sprocket 32 will also turn in a clockwise direction, and the endless chain 33 will serve to turn the sprocket 35 in a counterclockwise direction, so that the endless chains 33 move downwardly from the sprocket 34, and the left runs of the belts 50 which extend around the shafts 34 and 48 also move downwardly with the chains 33, the several parts of the transmission having such sizes that the downwardly moving runs of the right belts 50 of FIG. 1 move downwardly at the same speed as the portions of the chains 33 which move downwardly from the shaft 34. The chains pass around the sprockets 37 and turn them in a clockwise direction, as viewed in FIG. 1, and then the chains 33 move upwardly to the sprockets carried by the shaft 37 to turn the latter and the sprockets in a counterclockwise direction. It will be seen that because of the counterclockwise turning of the shaft 37, the pulley 51 carried thereby will also turn in a counterclockwise direction, as viewed in FIG. 2, and thus the pulley 52 will be turned in the same direction to cause the shaft 46 which is beneath the shaft 37 to turn in a counterclockwise direction, so that the right runs of the belts 50 which are on the shafts 46 and 47 located beneath the shaft 37 will move upwardly, and of course the speed is such that these runs of these belts 50 move upwardly at the same speed that the chain moves upwardly from the shaft 36 to the shaft 37. In the same way, it will be seen that all of the several belts 50 are turned with the structure shown in FIGS. 1 and 2 in a direction and at a speed which will cause the runs of the several belts 50 to move in the same direction and at the same speed as the portions of the chains 33 which they are located closest to, and the reason for this arrangement will appear from a description below.

The walls 20 and 21 are each formed with a series of upwardly directed notches 56, as shown for the wall 21 in FIG. 2, and, as is apparent from FIG. 1, these notches are adapted to receive the walls of tanks 57, 58, and 59 as is apparent from FIG. 1, so that the pair of wall portions 60 extend into the tank 57, the pair of wall portions 61 extend into the tank 58, and the pair of wall portions 62 extend into the tank 59. The walls of the tanks 57—59 fill the notches 56, and of course with this arrangement the several shafts 47 together with the shafts 36, 48, 39, 42, and 49 are immersed in the tanks adjacent the bottom thereof. The tank 57 contains a developer solution, while the tank 58 contains a hypo solution, and the tank 59 simply contains water for washing the film. The pair of walls 20 and 21 fixedly carry

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a transverse wall portion 63 shown in FIG. 5. At its upper portion, which is not shown in FIG. 5, the wall 63 is formed with suitable openings through which the chains 33 and portions of the sprocket wheels carried by the shaft 45 can freely extend. This wall 63 by extending downwardly into the tank 59 to an elevation beneath the surface of the water in this tank contributes to the light-tightness of the portion of the apparatus which is to the right of the wall 63, as viewed within FIG. 1, so that there is no possibility for any light reaching the film during its passage through the tanks 57 and 58 in a manner described below.

To the left of the tank 59, as viewed in FIG. 1, the pair of walls 20 and 21 as well as the walls 22—24 define a drying chamber 65. At their left ends a wall 66 extends across and is connected to the walls 20 and 21, and the wall 66 fixedly carries a receiving plate 67 on which the dried, developed film is deposited in a manner described below, a wall 68 being fixed to and extending upwardly from the wall 67 at the lower edge of the latter to prevent film from sliding off the wall 67. The only part of the apparatus which is open is the part which is located just to the right of the wall 22 at the lower edge thereof extending from this wall 22 over the wall 67 up to the wall 66, and this opening is sufficient for the film to leave the apparatus without permitting any light to enter into the apparatus in a manner which can disturb the treatment of the film undesirably.

In the drying chamber 65 the shafts which serve to guide the chains 63 do not extend across this chamber but instead are in the form of stub shafts 69 (FIG. 6) which pass through suitable openings in the walls 20 and 21 and which carry collars 70 which serve to prevent axial movement of the stub shafts. The stub shafts 69 which are supported for rotation by the wall 20 are respectively coaxial with a corresponding series of stub shafts carried by the wall 21, and all of these stub shafts carry sprockets so that the chains continue from the shaft 44 in a zig-zag path through the drying chamber 65 in the manner shown in FIG. 1, the chains passing from the upper right pair of stub shafts 69 and the sprockets carried thereby, shown in FIG. 1, down to the sprockets carried by the shaft 45 so as to continue along the endless path illustrated in FIG. 1. In order to securely support stub shafts 69, each of them passes through an opening of a bracket 71 (FIG. 6) which is fixed to the particular side wall 20 or 21. As a result of the use of these stub shafts 69, the drying chamber 65 is provided with a free open space between these shafts permitting the film to move through this free open space while the film remains in a substantially vertical position, as will be apparent from the description below. From any suitable source of hot air, the hot air is delivered to a manifold 72 (FIG. 6) in the form of a header communicating with a series of ducts 73 which are fixed fluid-tightly to the wall 20 in alignment with openings 74 thereof (FIG. 1) so that in this way hot air is supplied to the interior of the chamber 65 for drying film therein, this hot air rising upwardly in the chamber and leaving the same through the opening 75 which is located just to the right of the wall 2 at the lower end thereof, as pointed out above.

The triangular portions 76 of the walls 20 and 21 which extend to the right beyond the member 26, as pointed out above and as viewed in FIG. 1, are interconnected at their bottom edges by an inclined support 77 which is inclined at such an angle that the film will slide by gravity downwardly along the upper surface of the supporting plate 77 to the left, as viewed in FIG. 1. The upper edges of the wall portion 76 serve to carry an adjustable cassette-supporting structure as described below. The wall 77 is fixed adjacent its lower left end to an angle plate 78 which overlaps the upper right end portion of the tank 57 to preserve the light-tightness at this

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point, as is apparent from FIG. 1. The wall 77 is shown in a partial plan view in FIG. 3 from which it is evident that this wall is formed at its lower edge with a series of notches 79 for a purpose described below.

A cassette supporting assembly 80 which is described in detail below supports the cassette 81 shown in FIG. 1 in a light-tight manner, and then in a manner described below the door 82 of the cassette is permitted to drop so that it engages the wall 77 in the manner shown in FIG. 1, and thus the sheet of film 83 which is to be treated simply slides by gravity down to the position indicated in FIG. 1. An elongated coil spring 84 is fixed at its opposite ends to the plate or wall 77 adjacent its opposite side edges, and this coil spring 84 loosely engages the plate 77 so that the film easily slides beneath the coil spring 84 during downward movement of the film 83. This spring 84 simply guarantees that the film will remain directly next to the plate 77.

A pair of leaf springs 85 (FIG. 4) are fixed to the underside of the plate 77 adjacent the lower edge thereof, and the outer free end of these leaf springs 85 are fixed as by soldering or welding to an elongated bar 86 which carries a plurality of stop pins 87 which respectively extend upwardly through the gaps 79 in the manner shown most clearly in FIGS. 3 and 4. The film 83 can slide down until its lower edge engages these stop pins 87, and the springs 85 are relatively weak so that only a very slight force is required to move the film over the pins 87 and the latter will yield by moving downwardly in opposition to the springs 85 so as to permit the film to pass.

In accordance with the present invention the chains 33 carry a film engaging means which will engage and move the film in such a way that it is carried faultlessly through the entire apparatus without any possibility of improper holding of the film while it is being treated. This film engaging means of the invention is shown in various positions in FIG. 1 and is illustrated most clearly in FIGS. 7 and 8. The film engaging means of the invention includes a bar 88 which is shown in section in FIG. 4. This bar 88, as is evident from FIG. 4, has a pair of opposed side faces as well as a pair of opposed longitudinal edges extending between these side faces. A plurality of film-engaging pins 89 are fixed to and extend from one of these side edges of the bar 88, and as is particularly apparent from FIG. 4, each of the pins 89 includes a substantially L-shaped portion one leg 90 of which terminates in the outer tip of the pin 89 and the leg 91 of which extends substantially perpendicularly with respect to the opposed side faces of the bar 88. The bar 88 fixedly carries at its right end, as viewed in FIG. 7, a pin 92 which extends beyond the right end of the bar 88 through a pair of links of the right chain 33 of FIG. 7 to interconnect this pair of links as well as to connect the bar 88 to the chain 33 shown at the right of FIG. 7 for turning movement around the axis of the pin 92, and this bar 88 fixedly carries at its left end a pin 93 extending through a pair of links of the chain 33 shown at the left in FIG. 7 so as to interconnect this pair of links and so as to support the bar 88 for rotary movement around the axis of the pin 93, the portion of the pin 93 which extends through the pair of links of the left chain 33 of FIG. 7 being coaxial with the pin 92 so that in this way the bar 88 is fixed to the chain 33 for movement therewith while extending cross-wise of the space between the walls 20 and 21 and at the same time the bar 88 is turnable around the common axis of the pins 92 and 93. The pin 93 differs from the pin 92 in that at its outer end which is located beyond the chain 33 the pin 93 has a lever arm 94 shown most clearly in FIG. 8, for a purpose described below.

A spring 89' (FIG. 1) is hooked at one end through an opening in the bar 88 shown at the upper right portion of the bar 88 in FIG. 7, and the other end of the spring 89' is hooked onto one of the links of the right chain 33

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of FIG. 7, so that this spring tends to yieldably hold the bar 88 in a position where the opposed side faces of the bar 88 are parallel to a plane which includes the pair of chains 33.

The manner in which the bar 88 and the pins 89 connected thereto operate is shown most clearly in FIGS. 1 and 4. The pins 89 have the same distribution as the gaps 79 of the plate 77 so that when the shaft 31 turns in a clockwise direction, as pointed out above, the bar 88 just before reaching the position indicated in FIG. 4 will also turn in a clockwise direction around the axis of the bar 31, as viewed in FIG. 4, due to the movement of the chains 33 by the sprockets 32 which are fixedly carried by the bar 31. Thus, assuming that a film 83 rests in readiness on the plate 77 in engagement with the stop pins 87, as the bar 88 approaches the position indicated in FIG. 4, the legs 90 will engage and pierce through the film adjacent to its lower edge, and then during the continued turning of the shaft 31 the bar 88 will move to the position indicated in FIG. 4 where the legs 91 slip through the openings of the film formed by the legs 90, and thus the film is in engagement with the legs 91 of the film engaging means 88, 89. Due to this automatic engagement of the film 83 with the legs 91, the film is very securely held by the film engaging means while being engaged by the latter in a purely automatic manner and there is no danger of undesirable disengagement of the film.

As the bar 88 advances downwardly from the position indicated in FIG. 4 in a counterclockwise direction around the axis of the shaft 34, the film is necessarily carried along with the pins 89 on the legs 91 thereof and of course the pins 87 yield so as to allow the film to pass, the film simply riding over the shaft 34 between the sprocket wheels 35. As the film moves down into the tank 57 to be treated by the developer therein the belts 50 guarantee that the film will remain at all times in a position trailing the pins 89. In this way the film engaging means 88, 89 moves along the path determined by the endless chains 33 successively into and out of each of the tanks 57—59 with the film trailing the pins 89 at all times so that the film is very securely held, and at the same time the belts 50 serve to keep the trailing film confined in the area created by the belt courses, thus preventing excessive bending of the film or falling of the film against the tank walls.

Thus, the film will finally emerge from the tank 59 and it will only be necessary to dry the film in the chamber 65. In this chamber the chains are guided over sprockets which are supported by stub shafts so that while the bar 88 moves along the path determined by the chains 33 the film can move freely through the space between the stub shafts and there are no belts 50 to guarantee that the film is guided and maintained in a position always trailing the pins 89.

In order to properly support the film in the drying chamber 65 to which hot air is delivered from the header 72 in the manner described above, a structure is provided to guarantee that the legs 90 of the pins 89 never are directed downwardly in the chamber 65. Thus, at each run of the chain 33 which is next to the wall 20 and which moves downwardly as viewed in FIG. 1, there is located a guide channel 95. As may be seen from FIGS. 1, 6, 7 and 8, each run of the chain 33 shown in FIG. 1 which moves downwardly in the chamber 65 has a guide channel 95 in alignment with itself. Each of these channels is curved at its top end so that it rests on one of the shafts 69 and at its bottom end so as to extend around more than 180° of a lower stub shaft 69 and in this way the channels are securely mounted on the stub shaft 69 between the sprocket wheels carried thereby and the wall 20. The ends of the channels are flared outwardly as shown most clearly in FIG. 1 so as to guide the lever arm 94 of the pin 93 into each channel. Thus, as the bar 88 and pins 89 approach the upper right hand stub

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shaft 69 shown in FIG. 1, the film 83 will simply hang down from the pins 89 in the manner indicated in FIG. 1 to be dried in the drying chamber 65. As the bar 88 moves with the chains 33 around the axis of the upper right hand stub shaft 69 of FIG. 1, the lever 94 will enter into the right channel 95 of FIG. 1 so that during movement of the bar 88 downwardly from the upper right hand stub shaft 69 of FIG. 1 to the lower right hand stub shaft 69 of FIG. 1, the channel will cooperate with the lever 94 to turn the latter and the bar 88 therewith to a position where the bar 88 has its upper and lower side faces extending substantially horizontally so that as a result of the legs 90 of the pins 89 will also extend horizontally at this time and the film will thus securely hang from these pins since the legs 90 thereof do not have their outer tips pointed downwardly. The position which the bar 88 takes during cooperation of the lever 94 with one of the channels 95 is shown clearly in FIG. 1 at the intermediate channel 95, and the manner in which the bar 88 moves around a lower stub shaft 69 is indicated very clearly at the intermediate lower stub shaft 69 of FIG. 1. Thus, while the bar 88 moves up and down along the zig-zag path in the chamber 65 the film simply hangs freely from the pins 89 so as to guarantee that it remains in the drying chamber 65 for a period of time sufficient to dry the film to the desired extent, and after passing around the lower left hand stub shaft 69 shown in FIG. 1, the film moves with the chain upwardly to the last pair of stub shafts 69 to be guided by the sprockets thereof for movement in a horizontal direction to the left toward the shaft 96 which again extends completely across the space between the walls 20 and 21, the chains then moving from the sprockets which turn with the shaft 96 up to the sprockets which turn with the shaft 97 which also extends completely across the space between the walls 20 and 21, these shafts 96 and 97 being identical with any of the sprocket carrying shafts such as shafts 31 or 37.

According to a further feature of the present invention, a stripper means is provided for automatically stripping the film from the pins 89 when the film is over the wall 67 so that the film will simply fall through the opening 75 onto the wall 67 where it can be picked up by the operator. This stripper means includes a rotary shaft 98 which carries at the exterior of the wall 20 a sprocket 99. The structure of the stripper means shown most clearly in FIGS. 1, 9, and 10. Thus, as may be seen from FIG. 10 the shaft 96 extends through the walls 20 and 21 to be supported by these walls for rotary movement. As is apparent particularly from FIGS. 1 and 9 the chains 33 pass freely beneath the shaft 99. The stripper means includes an electrical switch 100 which is carried by the wall 20 on the inner surface thereof, and this switch 100 includes an elongated actuating arm 101 which is springy and which terminates in a bifurcated portion 102 supporting a roller 103 for rotary movement. This roller 103 is at such an elevation that it will be engaged by the left end portion of the bar 88, as viewed in FIG. 10, as this bar 88 approaches the shaft 96. Thus, when the bar 88 has almost reached a position where it is directly beneath the shaft 96, this bar will engage the roller 103 to act on the arm 101 so as to close the switch 100. This switch 100 is located in the electrical circuit of a solenoid 104 which is carried by the wall 20 on a bracket 105 at the exterior of the wall 20 so that when the switch 100 is automatically closed by the bar 88 the solenoid 104 is energized. The armature 104' of the solenoid 104 is connected to one end of a chain 196 which is guided around the sprocket 99 carried by the shaft 98 and the exterior of the wall 20, and the lower portion of the chain 106 is connected to a coil spring 107 whose right end, as viewed in FIGS. 1 and 9 is hooked onto a stationary eye which is carried by any stationary member such as a member fixed to the bracket 105. When the solenoid is energized the armature 104' will suddenly move to the

right, as viewed in FIGS. 1 and 9, and this will result in clockwise turning of the shaft 98, as viewed in FIGS. 1 and 9. The shaft 98 fixedly carries a pair of U-shaped members 108 one of which is shown most clearly in FIG. 9, one leg of each of the U-shaped members 108 extending through and being fixed to the shaft 98 for rotary movement therewith. At the free ends of the other legs of the U-shaped members 108 there is located a stripper bar 109 which extends substantially parallel to the shaft 98. The dimensions of this assembly are such that when the solenoid is energized so that the shaft 98 turns in a clockwise direction, as viewed in FIG. 9, the U-shaped members 108 and a stripper bar 109 will turn from the solid to the dotted line position indicated in FIG. 9. As a result the bar 109 will sharply engage the film closely adjacent to the horizontally extending legs 90 of the pins 89 and the result is that the stripper bar 109 will strip the film 83 from the pins 89 so that the film will simply fall onto the plate 67, and now the bar 88 will simply continue to move with the chains 33 so that the bar 88 will again become located in the position indicated in FIG. 4 to repeat the above operations with another film.

Of course, as soon as the bar 88 moves beyond the roller 103, the arm 101 due to its springy nature will move up to the position where the switch 100 is opened, so that now the spring 107 will contract and return the stripper means to the solid line position thereof indicated in FIG. 9.

Although only one bar 88 and pins 89 fixed thereto has been described above and shown in various positions in FIG. 1, it is of course possible to arrange more than one of these film-engaging means of the invention at suitable intervals along the chains 33.

The details of the cassette supporting means 80 of the present invention are shown in FIGS. 11-14. Referring to FIG. 11, it will be seen that the cassette supporting means 80 includes a rectangular frame 110 which supports a pair of elongated members 111 for movement toward and away from each other as well as a member 112 for movement toward and away from the stationary frame member 113. A suitable light-tight fabric 114 which is pleated so that it can be expanded and contracted is connected along one edge to the right bar 111 of FIG. 11 and at its opposed edge to the frame 110 so that as the right bar 111 of FIG. 11 moves to the left and right as viewed in FIG. 11, the fabric 114 will maintain the space between the right bar 111 and the right end of the frame 110 of FIG. 11 light-tight. This fabric 114 may be of the same type as that used for camera bellows. In the same way a light-tight fabric 115 pleated and of the same material of the fabric 114 is connected to the left member 111 and to the left end of the frame 110, and also a section of fabric 116 of the same material as the fabric sections 114 and 115 is connected to the bar 112 to extend between the latter and the part 117 of the frame 110 so as to maintain light-tightness between the bar 112 and the bar 117.

As is particularly apparent from FIG. 12, the bar 117 is of a substantially inverted T cross section, and the same is true to the bar 113, and the bars 111 are of a similar cross section. The bar 112 carries a handle 118 and adjacent the handle an angle iron 119 having an upwardly directed web 120 (FIG. 11). Thus, it is possible to place a cassette on the bars 111 with the upwardly directed webs of these bars 111 engaging the side edges of the cassette, and the bar 112 can be manually moved by the handle 118 until the web 120 engages another edge of the cassette, the remaining edge of the cassette engaging the upwardly directed web of the bar 113. The upwardly directed web of the bar 113 is formed adjacent its lower end with an opening through which extends an arm 121 of a substantially Z-shaped member whose upper end forms a handle 122, with the intermediate leg of this member passing between the web of the bar 113 and a strap 123 fixed to this web of the bar 113 so that in this way it is possible for the operator to turn the handle

122 to place the leg 121 in a position where it will extend beneath the door 82 of the cassette (FIG. 1) to retain this door in its closed position until the operator turns the handle 122 to turn the leg 121 away from the cassette door which now can fall so as to release the film in the manner describe above. Due to the adjustable movement of the bars 111 and the bar 112 it is possible to quickly and easily adapt the cassette holding means 80 to any size cassette while at the same time maintaining perfect light-tightness, and of course the element 122 will be available to the operator for manually releasing the film whenever desired.

The bars 113 and 117 of the frame 110 are formed with elongated grooves in which the ends of the bars 111 are guided for sliding movement, and the fabric sections 114 and 115 also extend along these grooves and are fixed at their outer ends to the right and left portions of the frame 110, as viewed in FIG. 11. In this way the bars 111 are guided for movement toward and away from each other. In order to guarantee that movement of one of the bars 111 will result in automatic movement of the other bar 111 toward and away from the bar 111 which is manually moved, these bars are fixed to cables in the manner as shown in FIG. 13. Thus, the outer ends of the bars 111 are slotted to permit passage of the endless cables 125 and 126. The bars 117 and 113 fixedly carry guide pins 127 around which the endless cables 125 and 126 are guided in the manner shown in FIG. 13, and these cables pass freely through the slotted end portions of the bars 111. The bars 111 fixedly carry pins 128 which serve to fix these bars 111 to the cables in the manner shown in FIG. 13. For example, the cables may be placed over the openings which receive the pins 128 and then these pins may be driven into these openings so as to clamp the cables to the bars 111 in this manner. As is apparent from FIG. 13, due to the connections of the bars 111 with the cables 125 and 126 and due to the fact that these cables are crossed movement of one bar 111 will result in equal and opposite movement of the other bar 111 so that these bars are automatically centered with respect to the frame 110 while being easily moved so as to be adapted to any desired size of cassette.

Instead of an arrangement where a pair of cables 125 and 126 are used, the arrangement shown in FIG. 14 may be used where as is diagrammatically illustrated the bars 111 are fixed to a single cable 129 threaded around the pins 127 as well as a pair of pins 130 which are of somewhat different construction in that they are stepped as shown to provide different pin portions around which different parts of the cable 129 are guided. The pins 130 are carried in the same way as the left pins 127 of FIG. 13, and of course the right pins 127 of FIG. 14 are carried in the same way as the right pins 127 of FIG. 13. Thus, the cables in any event are guided in the same grooves which accommodate the ends of the bars 111, the portion of the cable 129 which passes between the pins 130 being accommodated in the groove which receives the left end of the light-tight fabric section 115 of FIG. 11. As may be seen from FIG. 14, due to the manner in which the cable passes around the several guide pins 127 and 130 and the connection of the cable with the bars 111, movement of one of the bars 111 toward or away from the other will result in equal and opposite movement of the other bar 111. A similar arrangement of cable and guide pins may be connected with the bar 112 to maintain the latter at all times perpendicular to bars 111.

As is shown most clearly in FIG. 12, each of the bars 111 is formed with an elongated slot 131 passing through and extending from the bar 117, and the bar 112 extends through the pair of slots 131 so that the bar 112 is itself supported by the bars 111 for movement toward and away from the bar 113. This bar 112 extends completely through the slots 131 and has its ends located in the grooves of the right and left bars of the frame 110, as viewed in FIG. 11. The bar 112 extends beneath the

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fabric sections 114 and 115, and the fabric section 116 is coextensive with the bar 112 and also extends through the grooves 131, this fabric section 116 being located beneath the fabric sections 114 and 115 and having its end distant from the bar 112 fixed to the bar 117 and the portions of the bars 111 which extend into the groove of the bar 117.

The bar 113 of the frame 110 carries an elongated hinge 133 one plate of which is fixed to the bar 113 and the other plate of which is screwed onto the member 26, as indicated in FIG. 1, so that the entire cassette supporting means 80 can be turned upwardly from the position shown in FIG. 1 around the axis of the hinge to give free access to the upper surface of the plate 77 when desired. In addition, a sheet of metal or the like 135 (FIG. 1) is fixed to bar 113 of the frame 110 and extends downwardly therefrom and terminates in a curved edge 136 located adjacent the plate 77, as indicated in FIG. 1, so that the film 83 sliding from the door 82 will be guided by the plate 135 and the particular edge 136 to move along the plate 77 directly next to the latter and then beneath the spring 84 until the lower edge of the pin engages the stop pins 87.

Of course, as soon as a film has been developed the cassette from which the film was derived can be removed very quickly and easily simply upon retraction by the operator of the bar 112 so as to give access to the upper right edge of the cassette which can now be removed and replaced by a different cassette which rests in the above-described manner on the bars 111 between the upwardly directed webs thereof, and these bars 111 are quickly and easily moved so that they are accommodated to the particular width of the cassette. The arm 121 is beneath the door of the cassette to prevent the door from falling until this arm 121 is turned by the operator in the manner described above, and with the cassette in this position the operator by engaging the handle 118 moves the web 120 into engagement with the cassette so that in this way perfect light-tightness all around the cassette is assured before the door 82 is dropped so as to provide the next film which is to be developed by the apparatus.

It will be seen that the above-described structure only requires the operator to place a cassette on the cassette-supporting means 80 and release the film. Thereafter all of the operations take place in a fully automatic manner so that the fully developed and dry film can be picked up from the plate 67, and in fact after the operator releases the film to be developed no further attention need be paid to the machine which operates fully automatically and is driven only from the single motor 27 as was pointed out above.

It will be understood that each of the elements described above, or two or more together, may also find a useful application in other types of film handling apparatus differing from the types described above.

While the invention has been illustrated and described as embodied in apparatus for handling X-ray film, it is not intended to be limited to the details shown, since various modifications and structural changes may be made without departing in any way from the spirit of the present invention.

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 that, from the standpoint of prior art, fairly constitute essential characteristics of the generic or specific aspects of this invention and, therefore, such adaptations should and are intended to be comprehended within the meaning and range of equivalence of the following claims.

What is claimed as new and desired to be secured by Letters Patent is:

1. In a film treating apparatus, in combination, a support for supporting a sheet of film or the like in readiness to be transported beyond the support, said support being formed with a plurality of gaps all of which are located

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beneath portions of the film adjacent an edge thereof; an elongated bar having a pair of opposed side faces and a pair of opposed longitudinally extending edges each of which extends between said side faces; moving means carrying said bar for moving the same along a path where one of said longitudinal edges approaches closely adjacent to the edge of the film adjacent which said gaps of said support are located; and a plurality of substantially L-shaped pins carried by said one longitudinal edge of said bar with the L-shaped portion of each pin having one leg which terminates in the tip of the pin and another leg which extends perpendicularly with respect to the side faces of the bar, said moving means moving the bar along a path where said bar describes part of a cylinder and where first said one legs of said L-shaped portions pierce and move through the film at points displaced from the path of movement of said bar and then the continued circular movement of said bar moves the other legs of the L-shaped portions into the film openings formed by said one legs so that the film will be supported by said other legs of said L-shaped portions, said bar acting through said other legs of said L-shaped portions on said one legs thereof for pressing the tips of said one legs against and through the film to pierce the latter and form said openings during the initial engagement of said pins with the film, the continued movement of said bar and pins by said moving means moving the film away from said support.

2. In a film treating apparatus as recited in claim 1, all of said pins being identical and aligned with each other.

3. In a film treating apparatus, in combination, an elongated bar having a pair of opposed side faces and a pair of opposed edges each of which extends between said side faces longitudinally of said bar; a plurality of pins distributed along, fixed to, and extending from one of said edges, each of said pins having an L-shaped portion provided with one leg which terminates in the tip of the pin and another leg which extends substantially perpendicularly with respect to the side faces of said bar; moving means cooperating with said bar for moving the same along a predetermined path at least part of which is horizontal, said moving means moving said bar along said horizontal part of said path with said side faces of said bar located in substantially horizontal planes, respectively, and with said one legs of said L-shaped portions of said pins also extending substantially horizontally, so that a film supported by said one legs of said pins will hang downwardly therefrom; and stripper means automatically actuated by said bar as it moves along said horizontal part of said path for stripping the film from said pins automatically, said stripper means including a rotary stripper member having a flat film-engaging face of substantial area and adapted to be turned across said path to a position beneath and adjacent to said one legs of said pins while moving in the same direction as said pins so as to engage the film over a substantial area thereof with said flat film-engaging faces from behind and push it, without tearing, from said pins, solenoid means for turning said stripper member, and switch means actuated by said bar and connected electrically with said solenoid means for actuating the latter to turn said stripper member from an idle position to a stripping position where it engages and strips the film from said pins.

4. In a film treating apparatus, in combination, a series of treating tanks located adjacent each other in a predetermined sequence and means forming a drying chamber located after and immediately adjacent to the series of tanks; an elongated bar; moving means cooperating with said bar for moving the same in succession through the series of tanks and then through the drying chamber; a plurality of pins carried by said bar and extending therefrom; support means located adjacent the first of the series of tanks for supporting a film to be treated in a position where it will be engaged by said pins to be carried by the

latter with said bar through the series of tanks and then through the drying chamber; stripper means located along the path of movement of the bar after the latter has moved through a predetermined portion at least of the drying chamber to strip the film from said pins; and adjustable, light-tight means located over said support means for supporting a cassette in a position where a film to be treated can be delivered from said cassette to said support means in readiness to be engaged by said pins.

5. Cassette support means for supporting a cassette from which film is to be removed for development, said cassette support means including a substantially rectangular frame; a pair of parallel members supported by said frame for movement toward and away from each other so that the distance between said parallel members can be regulated to the size of a cassette with said parallel members engaging the sides of the cassette; means interconnecting said parallel members and compelling them to move simultaneously through equal distances in opposite directions; and a third member perpendicular to and in the same plane as said parallel members for engaging an edge of the cassette perpendicular to the sides thereof which are engaged by said parallel members for holding the cassette against an edge of the frame; and means connected to said members and frame for preventing light from passing around the cassette.

6. Cassette support means for supporting a cassette from which film is to be removed for development, said cassette support means including a substantially rectangular frame; a pair of parallel members supported by said frame for movement toward and away from each other so that the distance between said parallel members can be regulated to the size of a cassette with said parallel members engaging the sides of the cassette; a third member perpendicular to and in the same plane as said parallel members for engaging an edge of the cassette perpendicular to the sides thereof which are engaged by said parallel members for holding the cassette against an edge of the frame; means connected to said members and frame for preventing light from passing around the cassette; and means cooperating with said parallel members for maintaining the same parallel to each other at

all times while they move toward and away from each other so as to be accommodated to the size of the particular cassette.

7. In a film treating apparatus, in combination, a pair of elongated endless flexible members; means supporting said members spaced from each other respectively in parallel planes with said members respectively extending along paths which are identical with and aligned with each other so that said endless members are movable along said paths, said paths having a series of substantially vertical portions along which said flexible members alternately move up and down; an elongated bar extending between said endless members and being carried thereby for movement therewith and for turning movement about an axis which extends longitudinally through said bar, said bar having at at least one end an elongated lever extending therefrom; a plurality of film-piercing pins carried by and extending from said bar at a longitudinal portion thereof and adapted to carry film unless the pins have a certain attitude where the film can fall from the pins; and guide means located in the path of movement of said lever for engaging the latter and turning said bar with respect to said axis for positioning said pins in an attitude where film carried thereby will not fall therefrom.

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