

Dec. 22, 1970

C. W. SMOOT

3,548,512

DRYER FOR PHOTOGRAPHIC FILMS OR THE LIKE

Filed July 25, 1969

3 Sheets-Sheet 1

FIG. 1

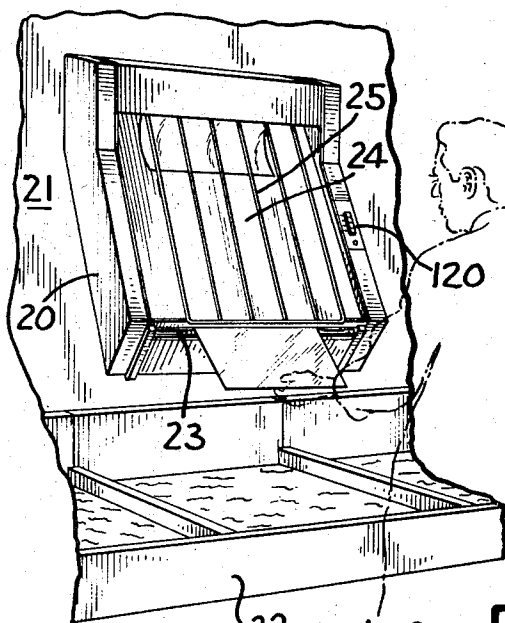


FIG. 7

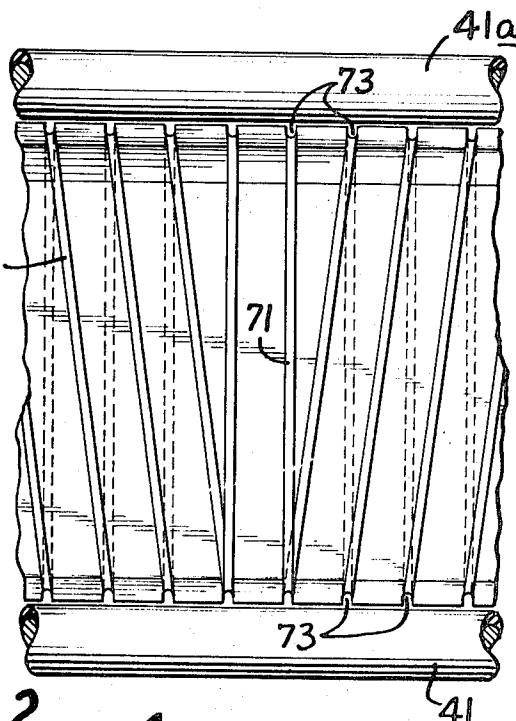
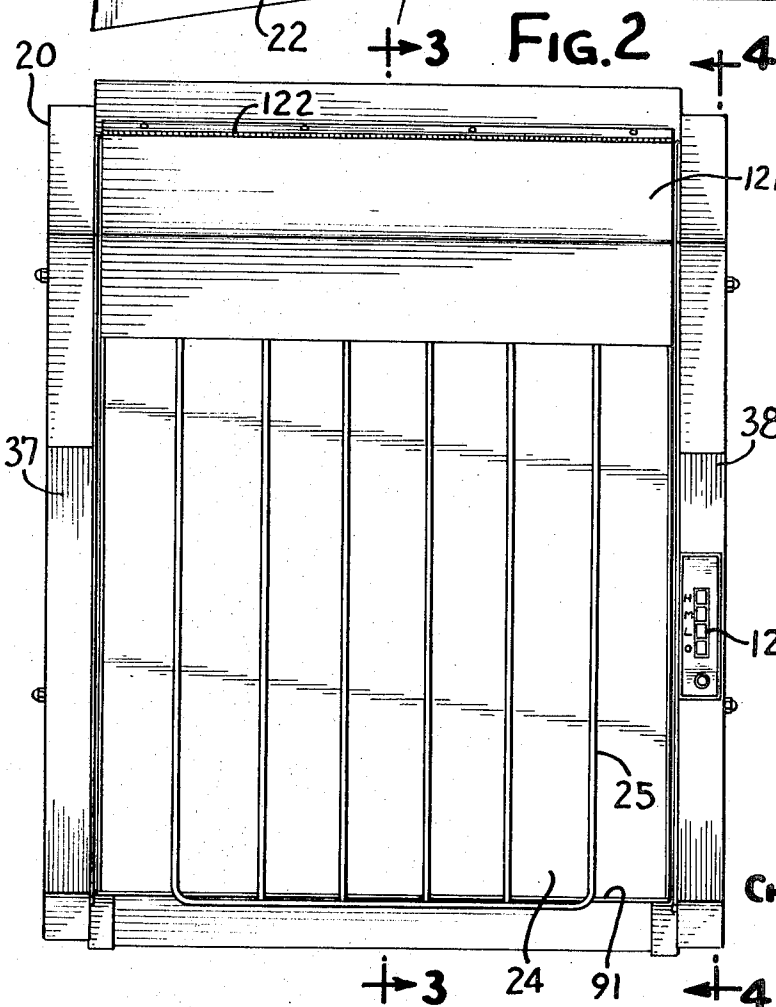
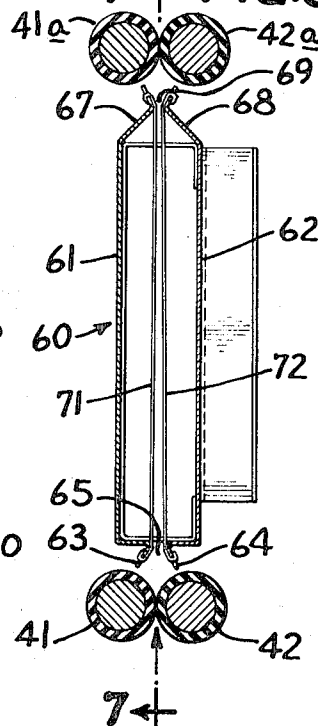


FIG. 6



INVENTOR
CHARLES W. SMOOT
by: Wolfe, Hubbard, Voigt
& Osann
ATTYS.

Dec. 22, 1970

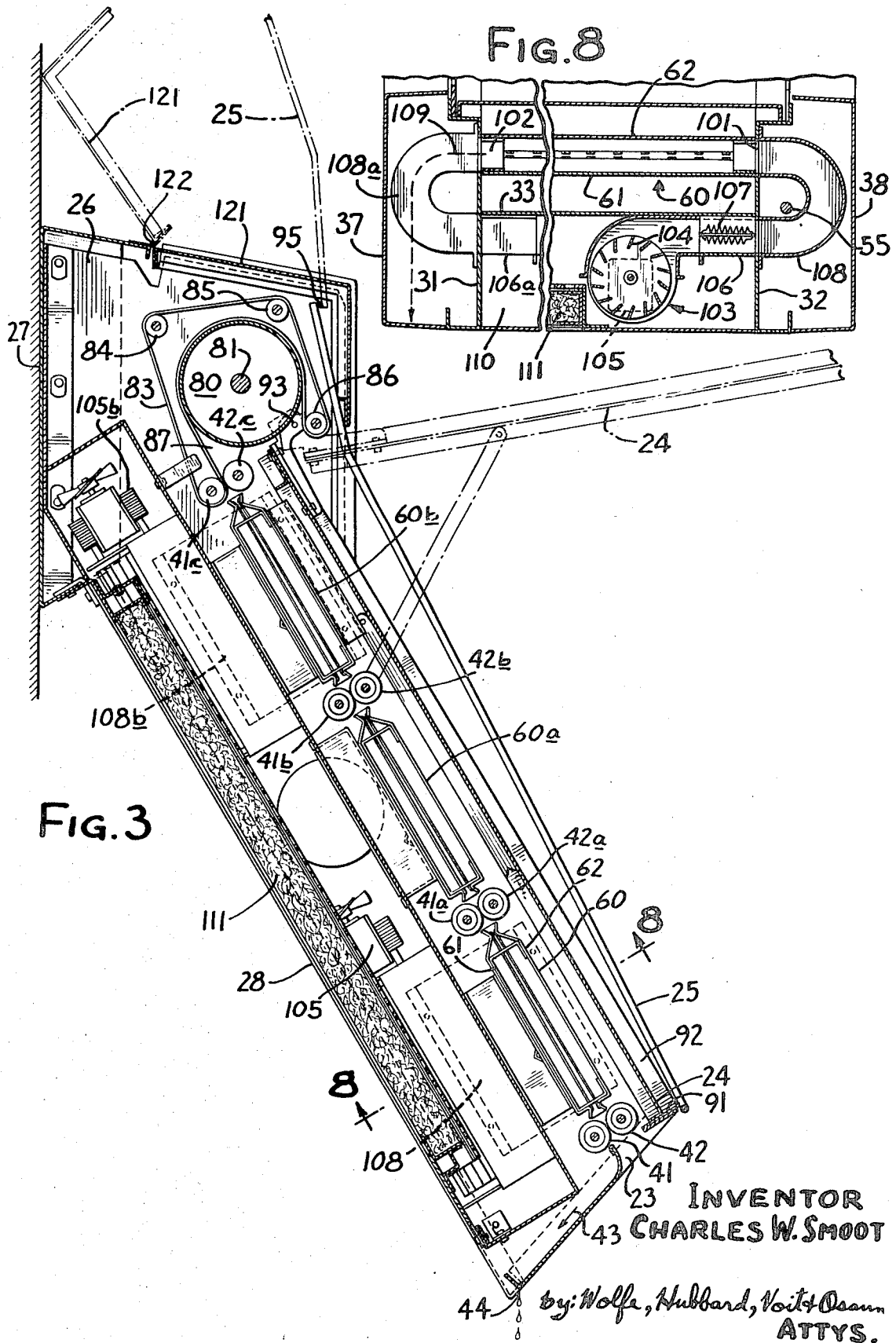
C. W. SMOOT

3,548,512

DRYER FOR PHOTOGRAPHIC FILMS OR THE LIKE

Filed July 25, 1969

3 Sheets-Sheet 2



Dec. 22, 1970

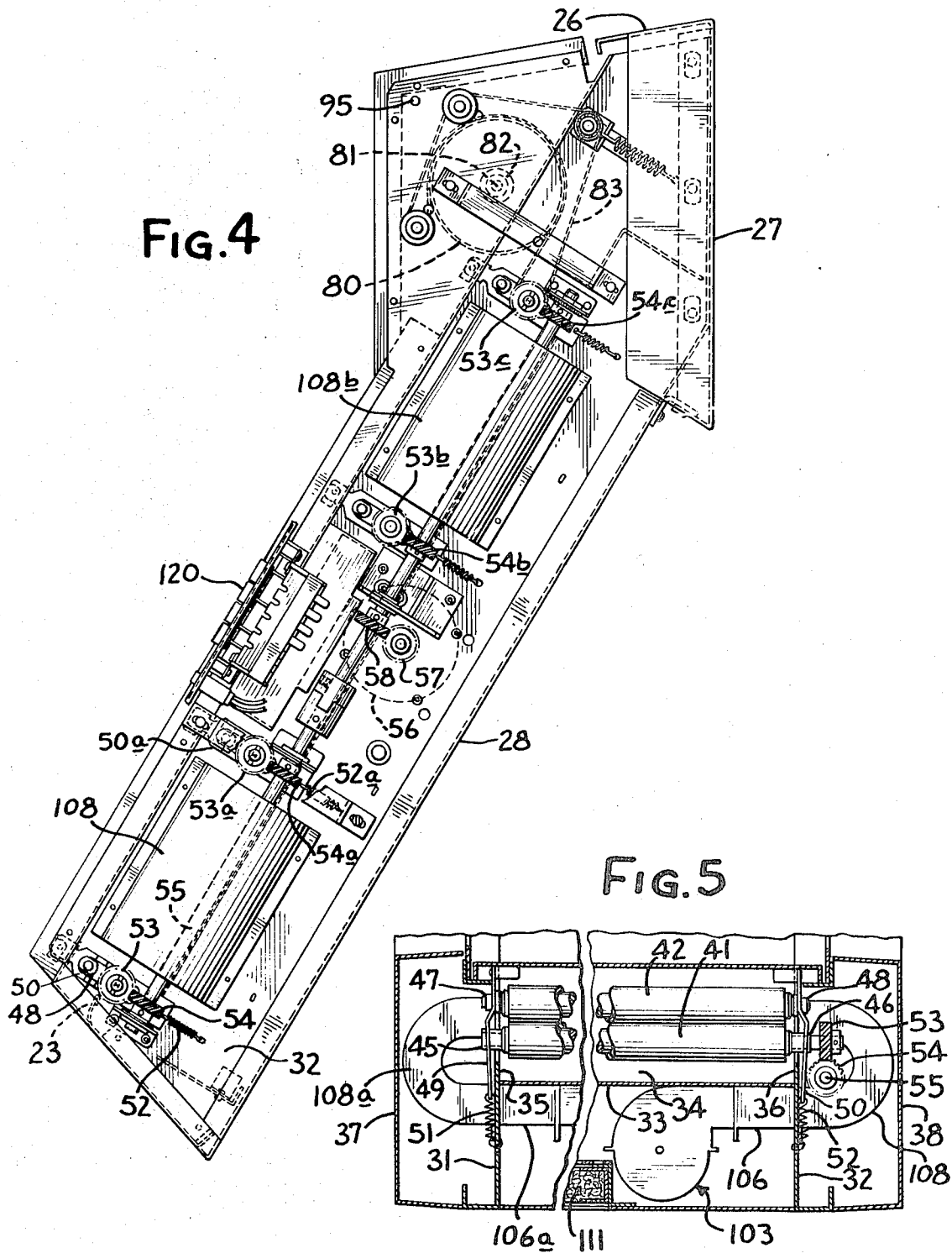
C. W. SMOOT

3,548,512

DRYER FOR PHOTOGRAPHIC FILMS OR THE LIKE

Filed July 25, 1969

3 Sheets-Sheet 3



INVENTOR
CHARLES W. SMOOT

by: Wolfe, Hubbard, Voit & Osann
ATTYS.

1

2

3,548,512

DRYER FOR PHOTOGRAPHIC FILMS OR THE LIKE

Charles W. Smoot, Skokie, Ill., assignor to American Photocopy Equipment Company, Evanston, Ill., a corporation of Illinois

Filed July 25, 1969, Ser. No. 844,978

Int. Cl. F26b 19/00

U.S. Cl. 34—70

8 Claims

ABSTRACT OF THE DISCLOSURE

A dryer for receiving and automatically processing wet films and for discharging them at the face of the dryer in a flat, dry state. The dryer is in the form of a housing which is supported above a sink in a forwardly sloping position having an inlet opening along the lower edge into which the wet films are fed. The films pass through synchronized rollers and a succession of warm air ducts, the initial pair of rollers serving to "squeeze" the excess water back into the sink and with the successive ducts applying warm air to both sides of the film for drying out of the emulsion. The ducts, having lateral openings aligned with the nips of the rollers for passage of the films, are coupled to separate sources of warm air which passes through the ducts endwise at right angles to the direction of film movement. At the top of the machine a film is turned forwardly and downwardly for gravity discharge into a sloping tray at the face of the housing where the dried films are collected behind a guard for removal from time to time. The back portion of the housing forms a plenum having a filter through which fresh air is drawn prior to its heating and discharge through the ducts.

It is an object of the present invention to provide a film dryer which is convenient to use, occupying normally unused space immediately above the sink from which the wet films are taken, which is rapid and thorough in the removal of water droplets and in the subsequent drying of the emulsion, and which is completely safe in its handling of the films and in the low temperature to which the films are subjected, thereby protecting the integrity of the emulsion and maintaining the film backing material flat and undistorted.

It is a general object of the invention to provide a film dryer which is particularly well suited for the drying of large films of the type employed in lithography and X-ray machines, which is simple in construction, which is economical and long lived requiring little or no maintenance. It is, finally, an object to provide a film dryer in which each of the entering films is automatically guided along a predetermined path in order to avoid any condition of hangup or jamming within the machine but which is nevertheless constructed so as to permit prompt individual removal of the ducts for cleaning or other normal maintenance or for removal of any defective film or other foreign object which might be inadvertently fed into the machine. While the dryer is particularly well suited for drying of photographic film, it may be employed in an emergency for the drying of matte prints or other similar sheet material.

Other objects and advantages of the invention will become apparent upon reading the attached detailed description and upon reference to the drawings in which:

FIG. 1 is a perspective view of a dryer constructed in accordance with the invention and supported in position above a sink;

FIG. 2 is a face view of the dryer shown in FIG. 1;

FIG. 3 is a vertical section taken through the dryer along the line 3—3 in FIG. 2;

FIG. 4 is a right-hand elevation of the dryer taken along the line 4—4 in FIG. 2 and with the side panel removed to reveal the driving means;

FIG. 5 is a typical horizontal section taken through the dryer, for example along line 5—5 in FIG. 3;

FIG. 6 is a fragmentary view somewhat enlarged showing one of the ducts and the associated driving rollers;

FIG. 7 is a fragmentary view looking along the line 7—7 in FIG. 6 and showing the internal stringing of cord within the ducts for guidance purposes; and

FIG. 8 is a generally horizontal transverse section taken through a duct system along the line 8—8 in FIG. 3.

While the invention has been described in connection with a preferred embodiment, it will be understood that I do not intend to be limited to the particular embodiment shown but intend on the contrary to cover the various alternative and equivalent constructions falling within the spirit and scope of the invention.

Turning now to the drawings, there is shown in FIG. 1 a film dryer 20 supported on a wall 21 above a sink 22 in which films are washed. The view shows an operator inserting a film into an entry slot 23, following which the film is transported and dried within the machine for discharge in flat, dry form upon a tray 24 having an associated guard 25 which is lifted for removal, from time to time, of the collected dry films.

It is one of the features of the film dryer that while it is of generally rectangular configuration it is, when viewed from the side, as shown in FIG. 3, of dog-leg shape formed of an upper portion 26 having a vertical mounting portion 27 and a forwardly and downwardly extending portion 28. The dryer thus occupies a normally unused space above the sink, making it easy to manually feed films directly from the sink into the entry slot 23 and providing for direct return of the water which is squeezed from the entering films back to the sink through appropriate drain openings.

In accordance with the present invention the housing 20 is formed of a pair of side rails 31, 32 interconnected by a central panel 33 and defining between them a roller and duct compartment 34 having opposed walls 35, 36. The rails 31, 32 are enclosed by removable boxlike covers 37, 38 which form the side walls of the housing and which, upon removal, provide access for purposes of servicing. Extending between the inwardly facing walls 35, 36 is a first pair of rubber covered rollers 41, 42 which serve as inlet or nipping rollers and which, in addition to seizing and transporting the film serve to squeeze from the surface of the film any standing droplets of water, the droplets being gathered and conducted along the bottom surface of the housing in the direction of the arrow 43 for discharge through weep holes 44 along the lower edge. For the purpose of mounting the roller 41, stub shafts at the end thereof are mounted in bearings 45, 46 which are received and held captive in notches formed in the inwardly facing wall members 35, 36. The upper roller 42 of the pair is provided with bearings 47, 48 which are connected through the flat links 49, 50 to respective hold down springs 51, 52. For driving the roller 41, the companion roller 42 being driven by friction, there is fixed to the right-hand end of the roller 41 a helical gear 53 which meshes with a helical drive gear 54 rotatable by a drive shaft 55 coupled to a motor 56 via helical gears 57, 58 (see FIG. 4).

For the purpose of receiving the film from the inlet or squeeze rollers and for subjecting it to a flow of slightly heated air, a duct assembly 60 is provided which is of box shape open at its left and right hand ends and formed of two spaced inwardly facing members 61, 62. These members have respective flared inlet edges 63, 64 for defining a film inlet 65 between them as well as flared outlet edges 67, 68 which define a lateral discharge opening 69 (see

FIG. 6). For the purpose of guiding the film centrally within the duct the portion 61 of the duct may be strung with a pattern of cords 71 (see FIG. 7) while the portion 62 is strung with a pattern of cords 72. The flanges are notched as indicated at 73 (see FIG. 7) to facilitate the stringing, and the cords, which are preferably of fabric covered elastic material, are arranged in a centrally divergent pattern as shown. The inlet opening 65 is preferably somewhat wider than the discharge opening 69 for accurate guidance of the entering and exiting film.

From the duct 60 the film is passed into the alined nip of a pair of rubber covered drive rollers 41a, 42a. Such drive rollers are mounted and driven in the same way as the inlet rollers 41, 42 and corresponding reference numerals have been employed where applicable with the addition of subscript a.

From the rollers 41a, 42a, the film is fed into a second duct assembly arranged in alinement therewith, the assembly, indicated at 60a, being identical with the duct assembly 60 previously described. From the duct assembly 60a the film continues to pass upwardly through rubber covered drive rollers 41b, 42b, also driven from the shaft 55, thence into a third duct assembly 60b which is, again, constructed the same as that described above. Finally, the film is discharged between a pair of drive rollers 41c, 42c, driven from the shaft 55, through suitable helical gearing, which advance the film into engagement with a reversing cylinder 80 having a shaft 81 mounted, at the ends, in suitable bearings 82. Extending partially around the cylinder 80 is a series of endless belts 83 formed of cloth or the like which are trained about idler rollers 84, 85, 86. The cylinder and belts together form an inlet nip 87 which engages the leading edge of the film, the belts being driven by the roller 41c. The film thus passes around the rotating cylinder 80 for discharge forwardly and downwardly at the face of the dryer. The cylinder 80, and its drive belts, together form a means for bending the film through approximately 180°, about a relatively large radius, for convenient discharge at the front of the dryer free of any permanent set.

For receiving the dried films exiting from the cylinder 80, the tray 24 is provided having a lower retaining edge 91, side edges 92, and mounted on a hinge 93 extending along the upper edge. When the tray 90 is in its normal receiving position, the films drop one by one upon the retaining edge 91 where they are held securely by the guard 25 which is in the form of an open framework consisting primarily of spaced vertical members of wire or the like and which is bodily hinged, at a hinge 95, along its upper edge to permit the guard to be swung forwardly and outwardly for retrieval of the dried films. The edge 91 is notched to receive the wires.

Consideration may next be given to the means for flowing heated air through the ducts, taking the duct 60, shown in FIG. 8, as representative. Such duct has an inlet end 101 and an outlet end 102. For the purpose of furnishing air to the inlet end, a blower 103 is provided having an impeller 104 driven by a motor 105. Connected to the outlet of the blower is a section of conduit 106 containing a heater 107. For connecting the heater conduit 106 with the inlet 101 of the duct 60, a U-shaped duct member 108 is provided which extends into the space outside of the side rails 32 and which is enclosed by the cover member 38. After passing along the faces of the film, the spent air, with its included moisture, is directed outwardly as indicated at 109 (FIG. 8) for discharge into the left-hand end space of the housing from whence it is discharged into the room.

It is one of the features of the present construction that each of the duct assemblies has its own source of slightly heated air. Consequently, separate blowers are provided, with separate heaters and separate U-shaped duct sections for each duct. The components associated with the duct assembly 60a are indicated by subscript a and the components associated with the duct assembly 60b carry the subscript b, it being recognized that the "a" and "b" com-

ponents are not shown completely or in detail since they correspond exactly to those employed with duct assembly 60 already described in detail in connection with FIG. 8. The only difference is that the assembly which supplies the central one, 60a, of the ducts, is reversed from right to left so that air passes in alternating directions to even out the temperature distribution across the film.

For furnishing filtered air to all three of the blowers 103, 103a and 103b, a plenum is defined at the back of the housing having a filter, of the furnace type, which covers a portion of the back area. Referring to FIG. 8, this plenum, indicated at 110, and defined by the side rails 31, 32 and panel 33 is enclosed by a replaceable filter 111. This insures that an ample supply of clean filtered air is furnished to all three of the blowers.

It is one of the advantages of the use of separate blowers and separate heaters for each of the duct assemblies that the degree of heat supplied to the film in each of the duct assemblies may be varied depending upon ambient conditions. For example under conditions of low humidity all of the blowers may be operated but the heater 107 associated with the first duct assembly 60 may be turned off. Thus the film, passing into the first stage at substantially the temperature of the wash water, is brought up to room temperature by the flowing air at the time of exit into the second stage. In the second stage the temperature of the film is slightly increased and in the third or final stage the temperature is increased still more while nevertheless keeping it to a safely low level on the order of 105° F. so that there is no possibility of the emulsion being jeopardized or the backing material becoming distorted. If desired the heating elements of the first two ducts may be silenced. By contrast, under conditions of high humidity, all three of the heating elements may be used. Conveniently, the heating elements to be active at any given time may be selected by a series of selector switches 120 (see FIG. 1) located along the right hand edge of the housing.

Because of the alinement of the rollers and duct openings and because of the control of the film within the duct assembly by reason of the pattern of strung cords 71, 72, there is no risk that an ordinary film will become jammed or hung up within the machine. However, for the purpose of periodic maintenance and for facilitating removal of any deformed sheet of film or other foreign object which may be fed into the machine, each of the duct assemblies 60, 60a and 60b is separately removable from its normal nested position between the side rails 31, 32. For access to the duct assemblies the guard 25 and receiving tray 24 may both be swung upwardly about their respective hinge axes to positions shown in dot-dash outline in FIG. 3. Complete upward swing of the guard 25 is facilitated by making a portion of the top surface of the housing, indicated at 121 in FIG. 3, swingable about a hinge 122 into a corresponding upraised position shown by the dot-dash outline.

In a typical usage of the dryer, the dryer is conveniently supported, at 27, on the vertical wall behind the sink but projecting forwardly and downwardly so that the inlet 23 is at convenient hand height above the sink and so that successive films may be fed, one by one, into the inlet 23. All of the rollers, as well as the belts 83 and drum 80 are rotated at precisely the same peripheral speed by coupling all of them to the same drive motor 56 and drive shaft 55. The peripheral speed may, for example, be on the order of 22 inches per minute. While the dryer is especially suited to lithograph films up to a commercial size of, say, twenty by twenty-four inches, it is not limited thereto but can be used for other types of film, for example, X-ray film or for the drying of matte prints or, indeed, any similar sheet material. Occupying unused space above the sink, and with direct return of the squeezed water back to the sink, the device is to be contrasted with conventional dryers which are larger and more expensive and which require counter space and pro-

5

vision for removal of a collected water. It is found that the present device because of its clever yet simple and straightforward design is capable of operating for long periods continuously and without maintenance.

I claim as my invention:

1. A film dryer comprising, in combination, a housing of generally rectangular shape, means for supporting the housing in a forwardly sloping position above a sink, a pair of inlet rollers at the lower edge of the housing, pairs of drive rollers at spaced intervals, ducts interposed between the pairs of rollers, each of said ducts having lateral openings alined with the nips of the rollers, means for driving all of the rollers at the same peripheral speed so that a film fed into the inlet rollers is progressively advanced through the ducts, means including heater and blower means for flowing heated air through the ducts at right angles to the direction of film movement, reversing means in the top portion of the housing for receiving the films and for discharging them forwardly and downwardly, a tray at the front of the housing having guard means for receiving and collecting the films for removal from time to time, the back portion of the housing defining a plenum having a filter through which fresh air is drawn for supplying air to the heater and blower means, and means at the outlets of the ducts for discharging the spent air from the housing.

2. The combination as claimed in claim 1 in which each of the ducts is formed in two sections facing one another to define lateral openings for respective receiving and discharge of the films, the edges having spaced runs of cord extending therebetween and bent into flaring shape for guidance of the films upon entry and discharge as the films pass from one pair of rollers to the next.

3. The combination as claimed in claim 1 in which a separate blower and heating element is provided for each of the ducts to permit silencing of the heaters supplying one or more of the ducts under conditions of low humidity and for operation of all of the heaters under conditions of high humidity.

4. A film dryer comprising in combination a housing of dog-leg configuration having a vertical portion and a forwardly sloping portion, means on the vertical portion for mounting on a wall surface with the housing in position to overhang a sink, a pair of inlet rollers at the lower forward edge of the housing, pairs of drive rollers at spaced intervals therefrom, ducts interposed between the pairs of rollers, each of the ducts having lateral openings alined with the nips of the rollers, means including a blower and heating element for blowing heated air through the ducts from end to end, a tray having a guard mounted on the face of the housing, means including a rotating cylinder at the upper end of the housing for receiving the films and for reversing them for discharge forwardly and downwardly into the tray in dry condition for removal from time to time, means for driving the rollers and cylinder at the same peripheral speed, means including a filter at the back of the housing for furnishing fresh air to the blower and heater means, means for discharging the spent air received from the ducts into the room

6

at a region separated from the plenum, and means for collecting water dripping from the inlet rollers and for conducting it to discharge openings arranged along the lower extreme edge of the housing for return of the water to the sink.

5. A film dryer comprising, in combination, a housing of generally rectangular shape, means for supporting the housing in a forwardly sloping position above the sink, said housing having a pair of side rails defining a central receptacle having inwardly opposed walls, a pair of inlet rollers arranged between the opposed walls at the lower edge of the housing and pairs of drive rollers extending between the walls at spaced intervals therefrom, ducts nested between the walls and interposed between pairs of rollers, each of said ducts having lateral openings alined with the nips of the adjacent pairs of rollers, means including individual blowers and heating elements coupled to the ducts when the ducts are in nested position between the walls for blowing heated air through the ducts from end to end, a tray having a guard mounted on the face of the housing, means including a rotating cylinder at the upper end of the housing for receiving the films and for reversing them for discharge forwardly and downwardly into the tray in dry condition for removal from time to time, and means for driving the rollers and the cylinder at the same peripheral speed.

6. The combination as claimed in claim 5 in which openings are provided in the inwardly facing walls for registering with the ends of the ducts and in which the individual ducts are removable upon raising the tray for cleaning or other maintenance purposes.

7. The combination as claimed in claim 5 in which the tray at the front of the housing overlies the ducts and in which the tray is hinged along its upper edge for upward swinging movement to reveal the ducts for removal of the ducts from between the opposed walls for cleaning or other maintenance purposes.

8. The combination as claimed in claim 5 in which the air flowing in successive ones of the ducts is propelled in opposite directions.

References Cited

UNITED STATES PATENTS

1,085,230	1/1914	Wild et al.	34—70
3,147,090	9/1964	Russell et al.	34—160
3,308,555	3/1967	Kruger	34—155
3,330,189	7/1967	Vil	34—155
3,375,593	4/1968	Fleisher et al.	34—155

FOREIGN PATENTS

605,758 2/1926 France.

CARLTON R. CROYLE, Primary Examiner

H. B. RAMEY, Assistant Examiner

U.S. Cl. X.R.

34—151