

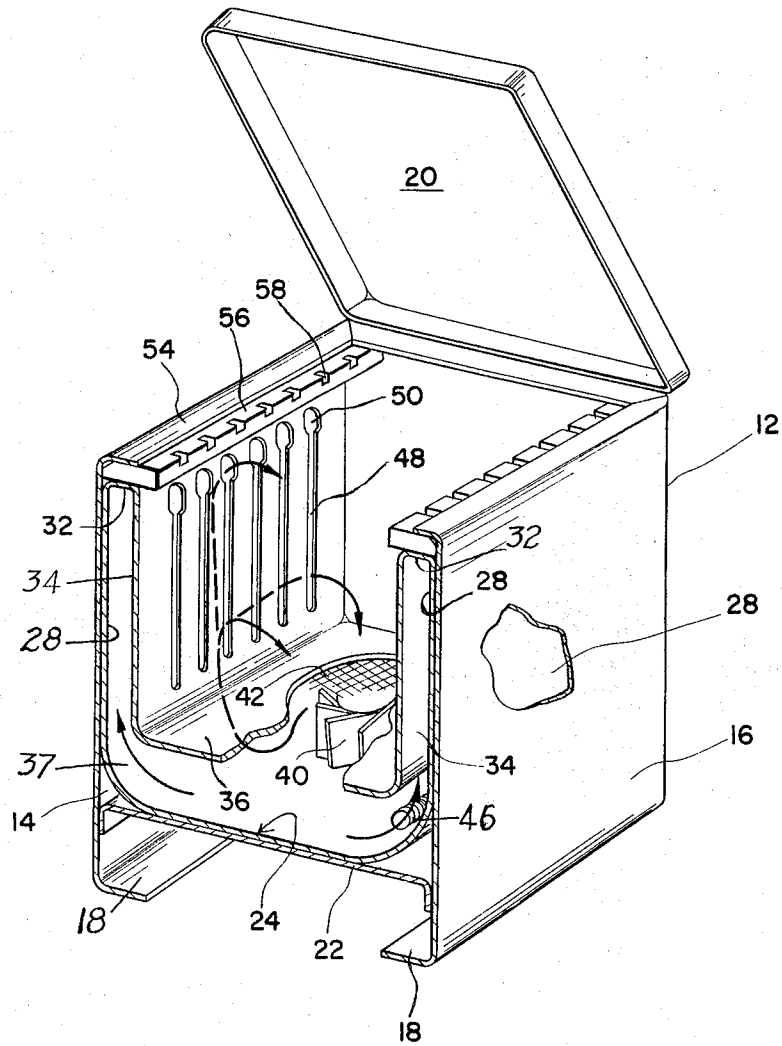
Nov. 22, 1966

H. F. HOPE
DRYING MACHINE

3,286,370

Filed Nov. 29, 1963

3 Sheets-Sheet 1



INVENTOR.
HENRY F. HOPE
BY *Louis Necks*
ATTORNEY

Nov. 22, 1966

H. F. HOPE
DRYING MACHINE

3,286,370

Filed Nov. 29, 1963

3 Sheets-Sheet 2

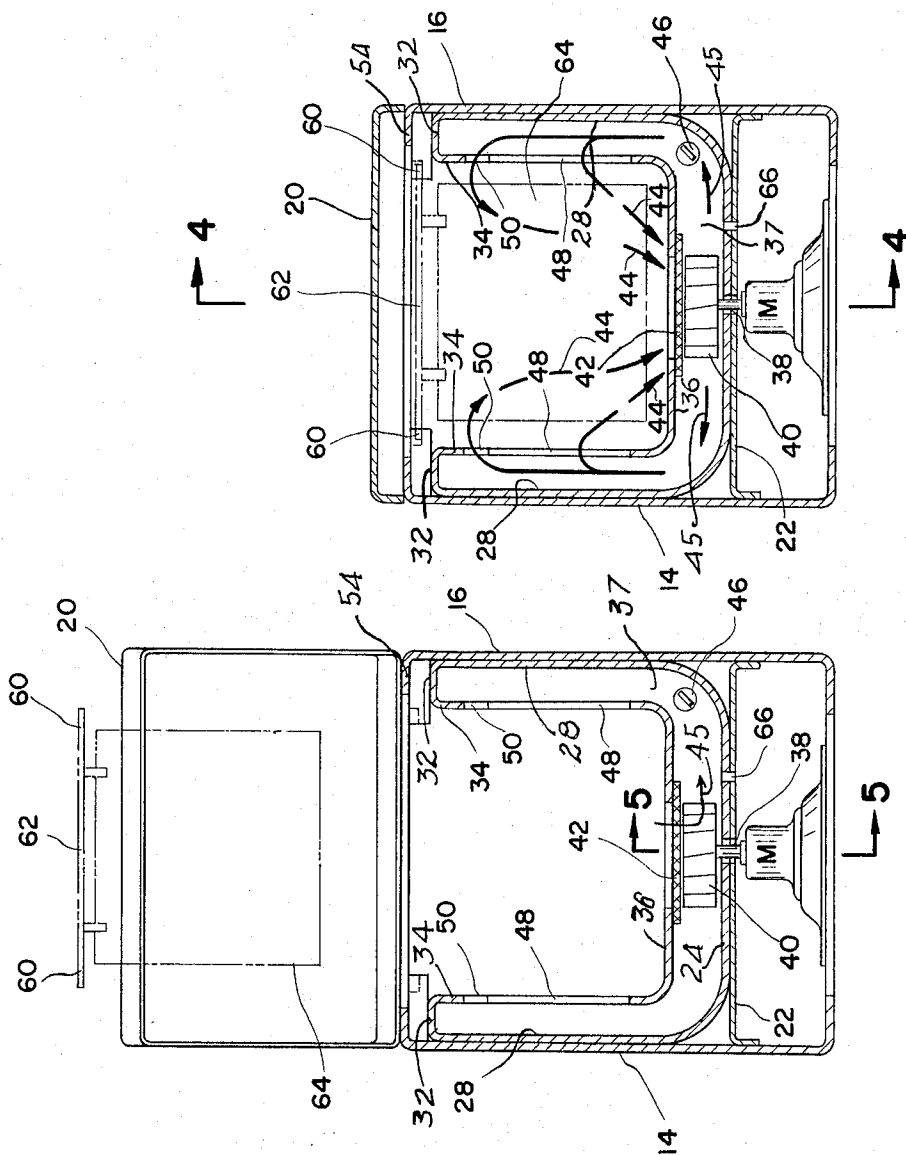


FIG. 3

FIG. 2

INVENTOR
HENRY F. HOPE
BY *Louis Mecho*
ATTORNEY

Nov. 22, 1966

H. F. HOPE
DRYING MACHINE

3,286,370

Filed Nov. 29, 1963

3 Sheets-Sheet 3

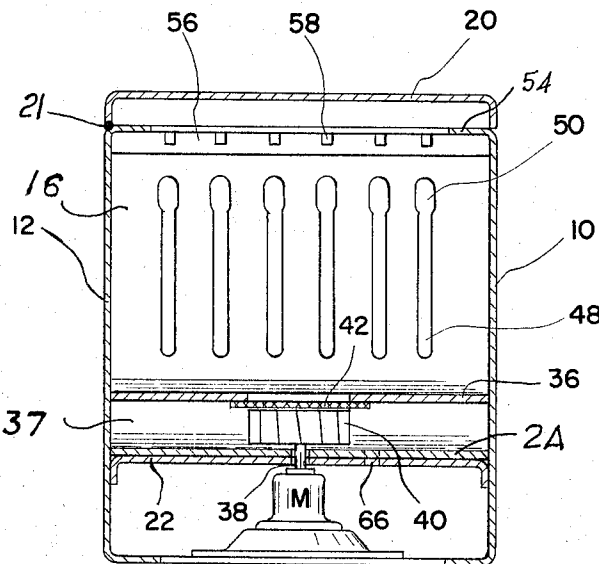


FIG. 4

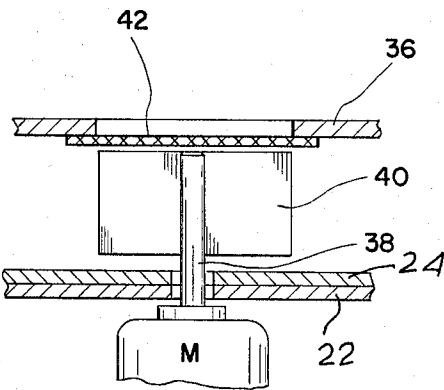


FIG. 5

INVENTOR.
HENRY F. HOPE
BY *Leon Necho*
ATTORNEY

1

3,286,370

DRYING MACHINE

Henry F. Hope, 195 Welsh Road, Huntingdon Valley, Pa.

Filed Nov. 29, 1963, Ser. No. 326,716

4 Claims. (Cl. 34-163)

My invention relates to a drying machine which is especially adapted for drying films.

Partly in order to ascertain whether a film just exposed is satisfactory so that no additional exposures are necessary, and vice versa, and partly because it may be necessary to have the information revealed by the film immediately, whether the X-ray film is of a patient's chest or of a steel casting, it is necessary to dry the film as quickly as possible. But, because X-ray films can not be subjected to a temperature in excess of 120° F., the drying of the film by conventional methods and machines is very slow. In fact, it takes two or three times as long as the developing, fixing and washing operations combined.

It is therefore one object of this invention to produce an improved drying machine whereby the time needed for drying a film is greatly reduced.

A further object is to produce an improved drying machine which is inexpensive to make and simple to operate.

A still further object is to produce a drying machine which is compact and which can be used independently or as an adjunct, of a film developing, fixing and washing machine such, for example, as that disclosed in my copending application Ser. No. 291,015 filed June 27, 1963, entitled, Machine For Processing X-Ray Film or the like, now Patent No. 3,241,473 whereby a machine for carrying out all of the operations referred to can be conveniently used in the high-rent office of a radiologist or in other limited space.

The full nature of the invention will be understood from the following specification and the accompanying drawings in which:

FIG. 1 is a perspective view of a drying machine embodying my invention, the front wall being removed to show details of construction and the cover being shown in the open position.

FIG. 2 is a vertical sectional view showing details of construction and the manner in which an X-ray film is introduced into the drying machine.

FIG. 3 is similar to FIG. 1 but showing the X-ray film in position and illustrating the operation of the machine.

FIG. 4 is a sectional view looking in the direction of line 4-4 on FIG. 3.

FIG. 5 is an enlarged sectional view looking in the direction of line 5-5 on FIG. 2.

The dryer illustrated includes a box-like structure having an outer front wall 10, an outer back wall 12, outer side walls 14 and 16, the lower ends of which are bent in to form legs 18 and a door 20 which is hinged, at 21, to the top edge of back wall 12. The walls referred to coact to form a cabinet for receiving the film to be dried and are thermally and acoustically insulated.

Suitably secured to side walls 14 and 16, and spaced from the floor, is a platform 22 for supporting the bottom, or bight portion 24 of a U-shaped shell the limbs, or side walls, 28 of which abut, and are preferably secured to, outer walls 14 and 16, respectively. The upper ends of walls 28 are bent in to form substantially horizontal ledges 32 and are bent downwardly to form inner side walls 34 which merge to form a false bottom 36 which is spaced from the bight portion 24 to form a compartment 37. Platform 22 is provided with a conventional bearing in which is journaled the shaft 38 of a motor M which drives a centrifugal impeller 40 which is located in com-

2

partment 37 and draws air downwardly through screened opening 42, as shown by arrows 44. The air drawn down by the impeller is propelled in the direction of arrows 45 as so to come in contact with an electric heater 46. As can best be seen from FIGS. 1 and 4, inner side walls 34 are provided with vertical air outlets 48 which terminate in upper enlarged openings 50, the upper ends of outer walls 14 and 16 are bent in to form upper ledges 54 which form a seat for door 20 and which coact with lower ledges 32 to receive and retain strips 56 which are provided with notches 58 for receiving the ends 60 of conventional frames 62 from which the X-ray film 64 is suspended while it is being developed, fixed and dried in the well known manner.

In order to replenish the drying air, the bottom walls 22 and 24 are provided with registering exhaust openings 66 which lead from the compartment 37. Fresh air may be admitted into the dryer through a suitable opening, not shown, or it may leak in around door 20 and ledges 54 which are neither gasketed nor finely machined. In a successfully operating prototype, the dryer cabinet has a volumetric capacity of about eight cubic feet; the impeller has an air translating capacity of about thirty cubic feet per second and exhaust opening 66 has a flow capacity of about four cubic feet a second.

It will be understood that impeller 40 rotates in counter clockwise direction, as viewed in FIG. 1, and that the pitch of the blades of the impeller is such as to draw air downward and to propel it laterally so that the heated air is propelled into the plena formed between walls 28 and 34 and ledges 32, in the direction of the arrows. In practice, I have found that the arrangement of the fan and the provision of large openings 50 coact to produce substantially uniform air volume and velocity over the entire interior of the cabinet. Also I have found that a single heater 46, having the desired heat output and located as shown, produces a substantially uniform temperature over the entire interior of the cabinet.

A film just withdrawn from the wash bath carries bubbles and small droplets of water which cannot be wiped off and which take an inordinate amount of time to dry by evaporation. According to my invention, the volume and velocity of the air impinging on the opposite sides of the film are such as to blow bubbles and drops off the film so that only a thin film of water remains to be dried by evaporation. It will be noted that the air emanates, from opposite directions and impinges horizontally and downwardly on opposite sides of each film so that any drops adhering to the vertical faces of the film will be pushed downwardly. In other words, the kinetic energy of the air blast on a drop is added to the pull of gravity. This is more effective in blowing drops off the surfaces of the film than it would be if the direction of the blast is opposed, or is at an angle to the pull of gravity.

For the sake of brevity, walls 34 and 36 are referred to in the claims as an inner shell and walls 28 and 24 are referred to as an outer shell.

It will be noted that the spaces defined by walls 28, ledges 32, and walls 34 serve as plena which insure an adequate supply of air to the upper portions 50 of slots 48. It will be noted that the air issuing through the left openings 48, 50 at the left side of the cabinet has to act on the adjacent half of the film, only, and that the air issuing from openings 48, 50 at the right side of the cabinet has only to act on the adjacent half of the film. This makes for faster drying because of the limited area on which the streams of drying air issuing from the opposite side openings have to act, and it makes for more uniform drying as distinguished from an arrangement wherein the air impinges on one end, or one side, of a film and must traverse the entire width or length of the film and in

3

which the air will have lost some of its moisture-absorbing capacity before it reaches the opposite end, or side. It will be further noted that the combined lengths of openings 48 and 50 are substantially equal to the height of the film whereby the entire right and left halves of the film will be subjected to the drying air simultaneously, as distinguished from an arrangement wherein the lengths of openings 48 and 50 are materially less than the height of the film. Also, by suspending the films between adjacent slots or nozzles, the air streams delivered from opposite sides of the cabinet will operate on both sides of the film simultaneously. It will be noted that opposing streams of air will meet along the center of the film where their combined force will blow water droplets downwardly off the film and where their combined residual moisture-absorbing capacity will dry the center portion of the film at about the same rate as the outer areas on which the drying air first impinged.

In practice, the X-ray technician keeps constant check and as each film has been developed, fixed and washed, it must be put in the dryer. This means that the door of the dryer will be opened every few seconds or every few minutes. In a conventional dryer, that is, one in which the air is blown straight up (or down, for re-circulation), a considerable amount of heated air will be lost. This is very serious because in addition to the loss of the heated air, the temperature of the developing and fixing fluids will be reduced. This not only results in waste of time and expense but it also adversely affects the film which must be perfect if it is to be of any diagnostic use. According to my invention, the tops of the plena are closed as at 32 so as to deflect the air downwardly into the area of suction. In practice, the door of my dryer can be opened without any loss of air.

What I claim is:

1. A machine for drying X-ray film, or the like, including:

an inner shell having side walls and a bottom wall and having its upper end open,
an outer shell comprising side walls and a bottom wall, means securing said shells together with said side and bottom walls spaced from each other respectively to provide a plenum,
a door for closing the top of said inner shell,
there being an intake opening in the bottom wall of said inner shell,
the area of said intake opening being less than the area of the bottom wall of the inner shell,
a suction fan disposed between the bottom walls of said inner and outer shells, with its suction side registering with said opening and with its pressure side leading to said plenum,
there being air discharge openings in the opposite side walls of the inner shell leading from said plenum to the interior of said inner shell,
a heater near the pressure side of said fan, and
means mounting the object to be dried in the path of flow of air emanating from said discharge openings.

2. A drying machine including

an inner shell having side walls and a bottom wall and having its upper end open,
an enveloping outer shell including side walls and a bottom wall,
means securing said shells together with the side walls and bottom walls of said shells spaced from each other respectively,

4

a door for closing the open, upper end of said inner shell,

a driven impeller between said bottom walls, there being an opening in the bottom wall of said inner shell registering with said impeller whereby said impeller draws air downwardly from said inner shell and propels it into the spaces between the walls of said inner and outer shells,

a heater near the pressure side of said impeller for heating the air,

there being vertical elongated spaced air discharge openings in the opposite side walls of the inner shell extending from near the bottom to near the upper end of said inner shell for discharging the heated air into the interior of said inner shell, the upper ends of said discharge opening being of larger cross section than the remaining portions thereof.

3. A machine for drying a frame-supported object said machine comprising:

an inner shell having vertical side walls and a bottom wall defining a compartment having its top end open, a door for closing said open top end,
an outer shell including vertical side walls and a bottom wall,

means securing said shells with the side and bottom walls thereof spaced from each other, respectively, closure means for closing the top of the spaces between the side walls of the inner and outer shells,

a fluid drying medium impeller below the bottom wall of said inner shell,

there being an opening in the bottom of said inner shell through which said impeller draws the fluid medium and propels it into the spaces between the side walls of said inner shell and the side walls of said outer shell,

a heater in the path of flow of medium propelled by said impeller,

here being spaced openings in the side walls of said inner shell below said closure means for discharging the heated medium into said shell, and

means mounting the object between said openings and means mounting the object between said spaced openings to subject the opposite sides of the object to the drying medium.

4. The structure defined in claim 3 in which the object is an X-ray film and in which said machine includes spaced notches near the top of said inner shell for receiving the opposite ends of the frame which supports said film,

said notches being staggered with respect to the air discharge openings whereby each X-ray film is supported in a plane perpendicular to the said side walls and parallel to planes connecting the air discharge openings in the opposite side walls of said inner shells.

References Cited by the Examiner

UNITED STATES PATENTS

291,722	1/1884	Hale	34—163
1,285,615	11/1918	Canepa et al.	34—225
1,325,044	12/1919	Poggel	34—163 X
1,589,642	6/1926	Harris	34—163

FREDERICK L. MATTESON, JR., *Primary Examiner*.
A. D. HERRMANN, *Assistant Examiner*.