

May 15, 1945.

E. F. TETZLAFF ET AL

2,376,207

DRIER FOR PHOTOGRAPHIC MATERIAL

Filed Aug. 21, 1943

2 Sheets-Sheet 1

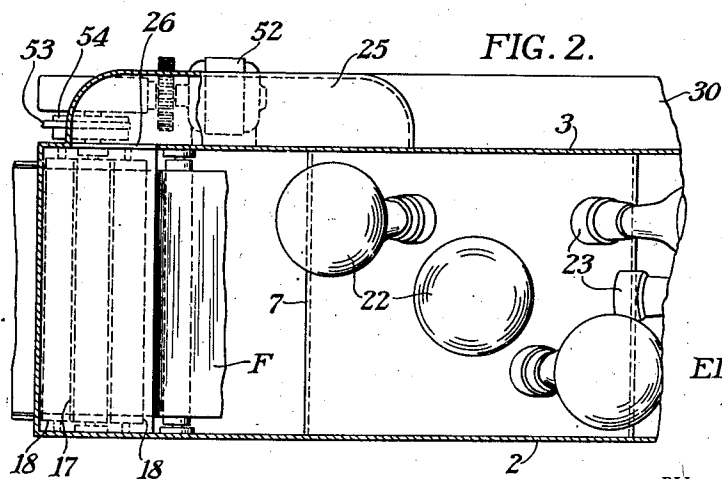
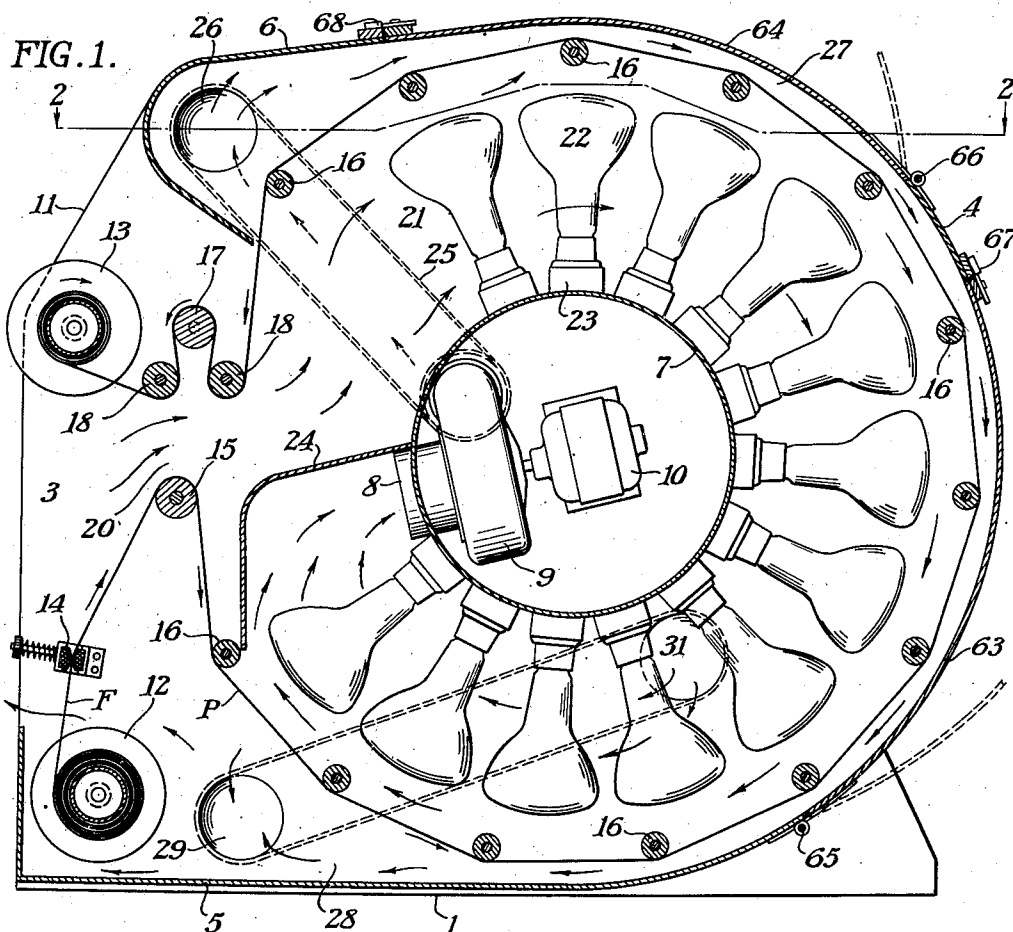
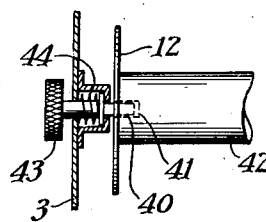


FIG. 3.



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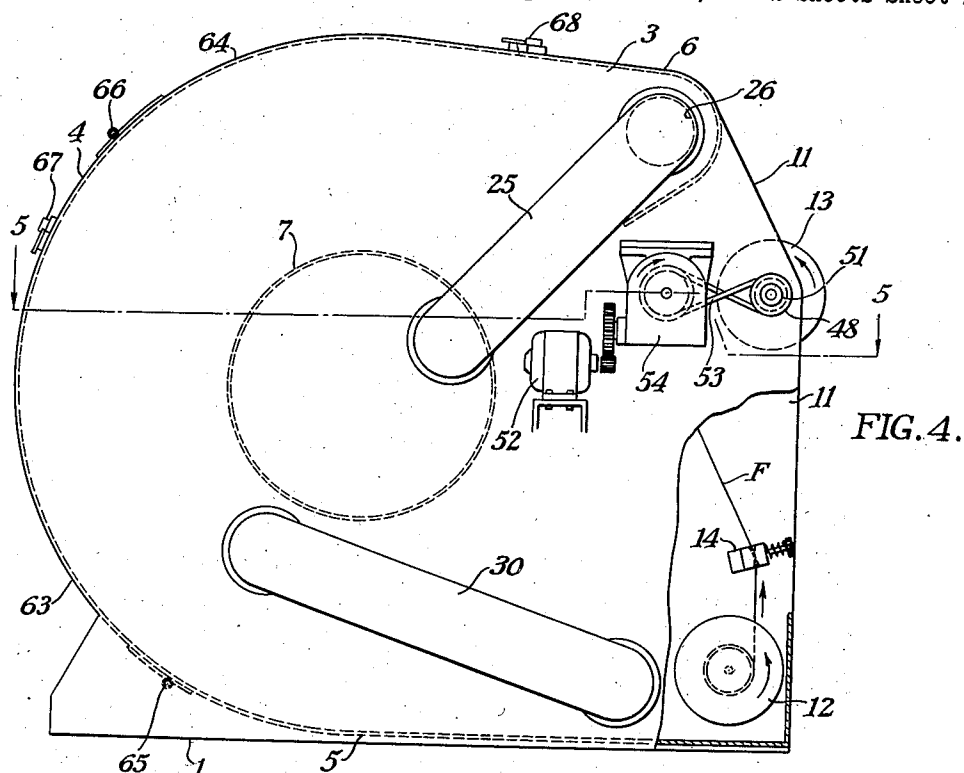
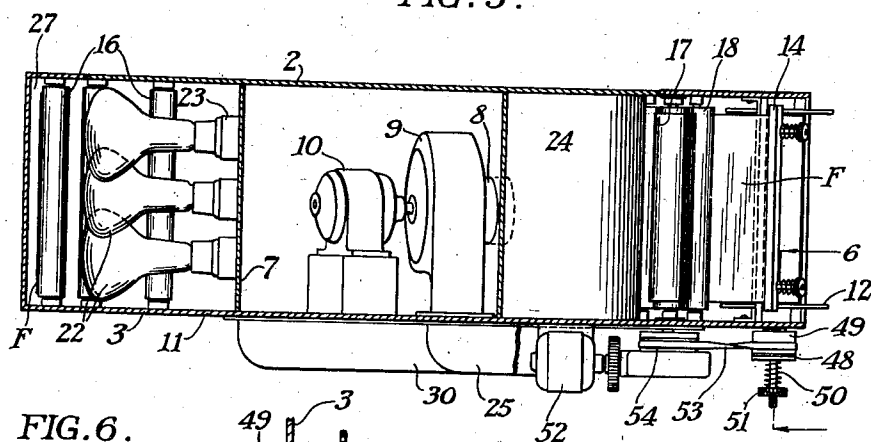


FIG. 5.



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DRIER FOR PHOTOGRAPHIC MATERIAL

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3 Claims. (Cl. 34—155)

This invention relates to driers and more particularly to driers suitable for photographic uses. One object of our invention is to provide a small lightweight drier which can readily be transported and which is suitable for drying long bands of processed photographic film such as are commonly used in aerial cameras. Another object of our invention is to provide a drier which will dry strip material passing through the drier only once. Another object of our invention is to provide a drier in which the material to be dried in itself forms a partition dividing the drier into inner and outer air ducts through which air may be circulated. Still another object of our invention is to provide a drier in which a plurality of heating elements are used for heating the drying air, these heating elements being also adapted to dry the strip material by means of radiant heat. A still further object of our invention is to provide a drier in which a roll of film can be readily threaded so that by passing through a suitable path through the drier, the film or other strip material may be wound up in a dry condition. Other objects will appear from the following specification, the novelty being particularly pointed out in the claims at the end thereof.

Coming now to the drawings in which like reference characters denote like parts throughout.

Fig. 1 is a part section and part side elevation of a typical drier constructed in accordance with and embodying a preferred form of our invention.

Fig. 2 is a fragmentary section view taken on line 2—2 of Fig. 1.

Fig. 3 is a sectional view, parts being shown in elevation of one of the film spool supporting devices.

Fig. 4 is a side elevation partially broken away and part in section showing a reverse side of our improved drier from the showing of Fig. 1.

Fig. 5 is a section taken on line 5—5 of Fig. 4; and

Fig. 6 is a somewhat enlarged fragmentary section view taken on line 6—6 of Fig. 5.

Many drying machines have been designed for rapidly drying photographic material such as long bands of photographic film or paper coated on one or both sides with a photographic light-sensitive emulsion. Such material is ordinarily rather difficult to handle because the light-sensitive emulsion is generally applied in the form of a gelatinous layer which is readily susceptible to abrasion, particularly after it has passed through

the various film processing baths and when it is still soft and wet.

It has been particularly desirable to provide a comparatively small lightweight portable drier for use in field developing stations of the Army or Navy and we have endeavored to provide a machine which is extremely compact, relatively light in weight, and a machine which has a high drying capacity, particularly for army work. Obviously such a machine is not limited to this type work and it may also be used for drying material other than photographic.

Since our machine is primarily intended for drying aerial film, we will use the term film in the following specification and claims to denote strip material having an emulsion layer thereon regardless of whether this layer is coated on a nitrocellulose base, a paper base, a cellulose acetate base, or any other type of suitable support.

Our drying machine consists of a casing having inner and outer air ducts through which a relatively large quantity of heated air is rapidly circulated, the inner and outer air ducts being formed in effect on each side of the strip material or film which is to be dried so that the material itself forms the partition between the inner and outer air ducts.

As indicated in Fig. 1 the drier may consist of a base 1 from which a casing extends upwardly, this casing consisting of side plates 2 and 3 and a generally curved wall 4 which is partially cylindrical in shape but which extends off parallel to the bottom over an area 5 and extends more or less tangentially at 6 from the top curved portion of the wall 4.

There is a second inner curved wall 7 which is cylindrical in shape and this inner wall supports an air intake pipe 8 leading to a blower 9 operated by means of a motor 10.

The walls 2 and 3 are open on one side 11 for the reception of the supply spool 12 and the take-up spool 13. The side walls 2 and 3 also support a squeegee 14 which will remove surface moisture from the film strip F as it moves from the supply spool 12 over the guide roller 15 into a roughly circular path P which is defined by a plurality of rollers 16 mounted just inside of the outer wall 4. The rollers 16 turn freely and are preferably made of wood and after the strip material F has passed over the last guide roller 16 it is looped about a driven roller 17 and guide rollers 18 which hold a sufficient length of the dry film about the roller 17 to enable this roller to pull the film about the rollers 16 and from the supply spool 12.

After passing from the guide roller 18 the film may be wound up upon the take-up spool 13 in a dry condition.

Since there is an open space 20 between the guide rollers 15 and 18 the drying air may be drawn in through this opening 20 so that it may pass through an inner air duct 21 which lies between the curved inner wall 7 and the film F passing over the rollers 16. There are a plurality of relatively high wattage lamps 22 mounted in suitable sockets 23 carried by the curved wall 7. As indicated in Figs. 1 and 2 these lamps may conveniently be placed radially of the wall 7 so they extend substantially across the inner air duct. Thus the air passing in through the entrance 20 passes about these lamps and becomes heated thereby in passing through the inner air duct 21 which terminates when the air is deflected by partition 24 into the pipe 8 leading to the blower 9. It might be pointed out that the film F is of somewhat less width than the length of the rollers 16 and that therefore a certain amount of air may pass between the side walls 2 and 3 and the lateral edges of the film. This leakage, however, is so slight in comparison with the total quantity of air circulated through the drier that it does not materially affect the operation of the machine.

After the air has passed through the inner air duct 21 and passes through the pipe 8 into the blower 9 an air duct 25 on the back of the side plate 3 conducts the air to the entrance 26 of the outer air duct 27, this outer air duct being formed by the generally curved wall 4 and the film F passing over the rollers 16. The opening 26 is at one end of the air duct 27 and the air is circulated through this outer air duct until the larger portion of the air comes to the opposite end 28 where a large portion of the air will be recirculated by passing into the entrance 29 of a duct 30 having an opening 31 in the inner air duct as best shown in Fig. 1. Quite a little air from the outer air duct may pass out of the drier and around the wet roll of film on the supply spool 12. However, by recirculating a substantial amount of the heated air, this air, together with the fresh air drawn in through the opening 20, supplies an adequate flow of air which is heated and circulated about both sides of the film.

It should be noticed that the air on both sides of the film is passing in a counter current with respect to the movement of the film, that is, while the film passes in a counter-clockwise direction with respect to Fig. 1 the flow of air in both the inner air duct 21 and the outer air duct 27 moves in a generally clockwise direction so that it flows rapidly across both surfaces of the film being dried. It should also be noticed that the temperature of the circulating air is lowest as it comes in contact with the dried end of the film, and as it passes through the inner air duct 21 and about the lamps 22 the temperature increases as the air passes in a clockwise direction through the drier.

The heat generated by the lamps 22 is sufficient to raise the temperature of the air quite rapidly, but our arrangement of lamps is such that a material portion of the drying takes place by means of the radiant heat of these lamps.

The supply spool 12 of film is carried on a pair of trunnions 40 similar to the one shown in Fig. 3. These trunnions normally project into suitable apertures 41 in the core 42 of the spool 12 and they may be withdrawn by means of the

handle 43 by drawing the handle outwardly and compressing the spring 44. This type of spool support can be easily and rapidly operated.

The take-up film spool 13 is mounted in the same way except that as shown in Fig. 6 this spool support is provided with a winding key web 45 in the form of a flat plate which extends into the spool slot 46 of the hub 47 so that when the clutch plate 48 is turned by the power driven clutch base 49 the winding key will be turned to wind convolutions of film thereon. The tension of this clutch can be altered by changing the tension on the spring 50 by means of the screw knob 51 so that the right degree of power may be applied to the take-up spool to permit this clutch to slip slightly. The reason for slipping this clutch is that a motor 52 which drives the driven member 49 through the belt 53 from a pulley 54 also drives the power driven roller 17 which draws the film through the drier. Thus while the roller 17 may be driven at a constant speed, the take-up spool may vary slightly in speed through the slip clutch drive to compensate for the varying diameter of the film convolutions being wound upon the take-up spool.

The operation of our device is extremely simple. A wet roll of film 12 may be placed on the supporting pins 40 and the end of the film is threaded through the squeegee 14 over the roll 15 and about the roller 16. To facilitate this threading operation the wall 4 is provided with two or more doors 63 and 64, which may be hinged at 65 and 66 so that when the release latches 67 and 68 are operated these doors can be swung outwardly to facilitate the threading operation.

After drawing the film around the rollers 16 and looping it about the power driven roller 17 and the guide rolls 18 the end may be attached to the take-up spool 13. The machine may then be started, the lamps 22 being turned on at the same time the blower motor 10 and the drying motor 52 are placed in operation so that as the film starts to move the air will start to circulate about the lamps 13 and the film will be quickly dried as it passes through the path P. If desired, the film can remain stationary for a few moments before starting the motor 52 to start the film drying more rapidly. However, we prefer to have the machine heated up by circulating air around the lamps 22 before film is put into the machine because this insures a more rapid initial heating and causes the film to drive evenly throughout its length.

As the power driven roller 17 continued to turn it will wind all of the film from the supply spool 12 and will draw this film about the roller 16, finally winding the dried film upon the take-up roller 13. This spool or roller can then be removed and replaced by an empty spool to which a freshly treated damp film may be attached. The drying operation can be rapidly accomplished in passing the film once through the machine, the time varying in accordance with the humidity of the atmosphere.

While we have described a preferred form of our drier, it is to be understood that the inventive idea may be carried out in a number of different ways. This application is therefore not to be limited to the exact details described but is intended to cover all such variations and modifications as may come within the scope of the appended claims.

What we claim is:

1. A drier for photographic material compris-

ing a base, a housing carried thereby and including an outer curved wall, an inner curved wall, a blower mounted inside the inner curved wall, a plurality of rollers spaced from the outer wall and adapted to support strip material to form in effect an inner and an outer air duct with the inner and outer curved walls, means for drawing air into the inner air duct, means leading from the inner air duct to deflect air therein to said blower and from said blower to the outer air duct, and means leading from the outer air duct and spaced from the air inlet to by pass circulating air to said inner air duct, and heating elements spaced about the inner curved wall and extending into the inner air duct for heating the circulating air therein, whereby material to be dried passing through a path defined by said rollers may be dried by the circulating heated air passing through the inner and outer air ducts.

2. A drier for photographic material comprising a base, a housing carried thereby and including an outer curved wall, an inner curved wall, a blower mounted inside the inner curved wall, a plurality of rollers spaced from the outer wall and adapted to support strip material to form in effect an inner and an outer air duct with the inner and outer curved walls, means for drawing air into the inner air duct, means leading from the inner air duct to deflect air therein to said blower and from said blower to the outer air duct, and means leading from the outer air duct spaced from the air inlet to by pass circulating air to said inner air duct and heating elements spaced radially about the inner curved wall in the path of circulating air therein to heat said air, said heating elements being positioned adja-

cent the rollers over which the photographic material to be dried passes, whereby said material may be dried by direct radiant heat and the air warmed by the heating elements.

3. A drier for photographic strip material comprising, in combination, a frame, a housing carried thereby, a pair of spool supports mounted on the housing for carrying a supply and a take-up spool of strip material, means tending to turn the take-up spool, to move strip material in one direction, a plurality of rotatably mounted rollers carried by the housing and spaced to form a generally circular path for the strip material, said housing including a curved outer wall of a generally circular shape and spaced from the rollers whereby strip material carried by the rollers may, with said curved outer wall form an outer air duct, an inner circular wall forming with the strip material an inner air duct, a plurality of reflector lamp heating elements mounted on the inner circular wall, in close proximity to the strip material, a blower for drawing air into the inner duct of the housing from between the supply and take-up spools in a counter direction to that of the movement of the strip material, an additional air duct including the said blower for circulating air from the inner to the outer air duct, means connecting the inner and outer air ducts for recirculating at least a part of the air from the outer air duct to the inner air duct, whereby strip material drawn by the take-up about the plurality of rollers may be dried by the radiant heat and by the circulated warm air.

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