Oct. 3, 1961 A. H. ABDOO 3,002,290

DRUM-TYPE PRINT DRYERS

Filed Sept. 28, 1959 3 Sheets-Sheet 1

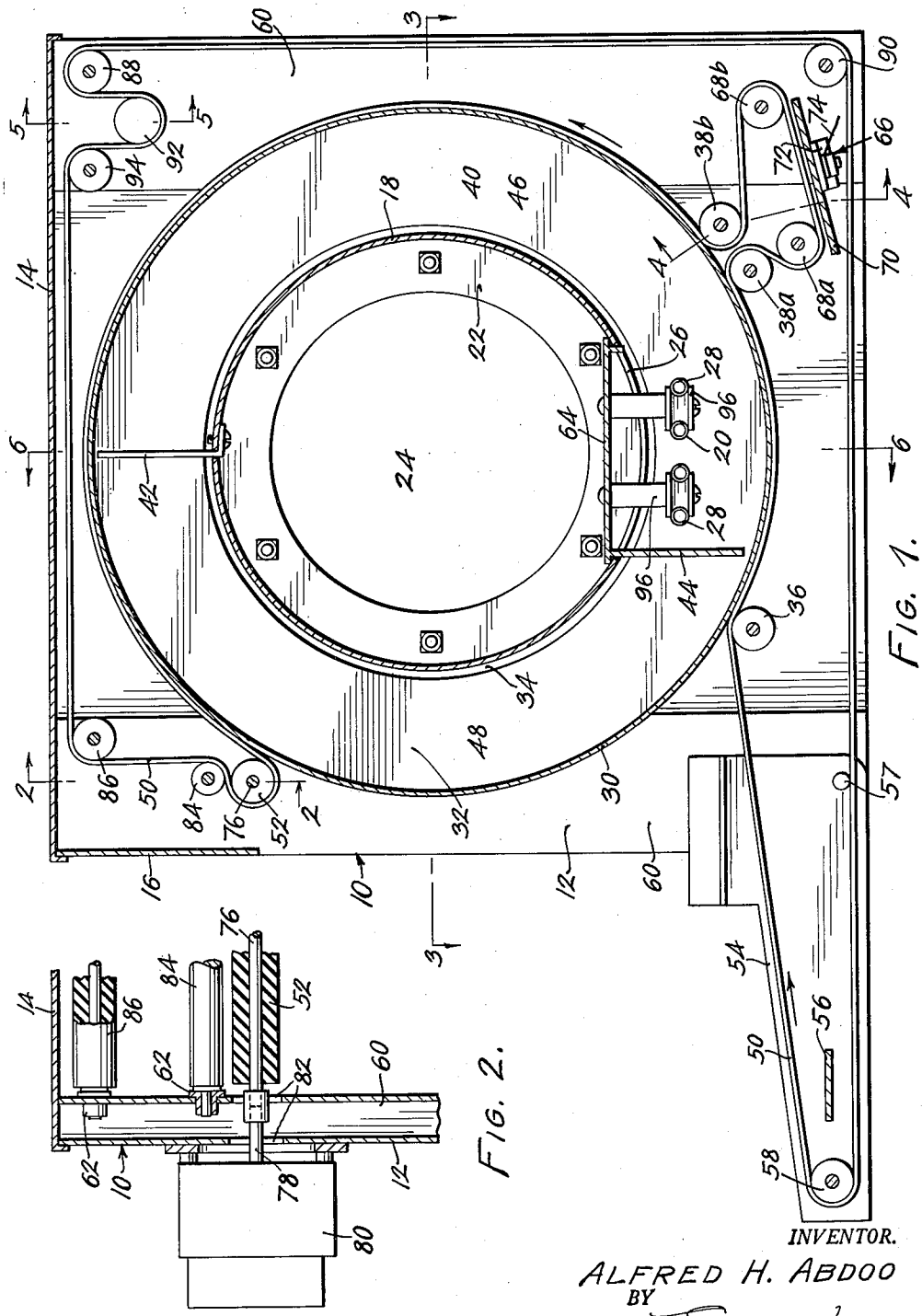

FIG. 1.

FIG. 2.

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DRUM-TYPE PRINT DRYERS

Filed Sept. 28, 1959 3 Sheets-Sheet 2

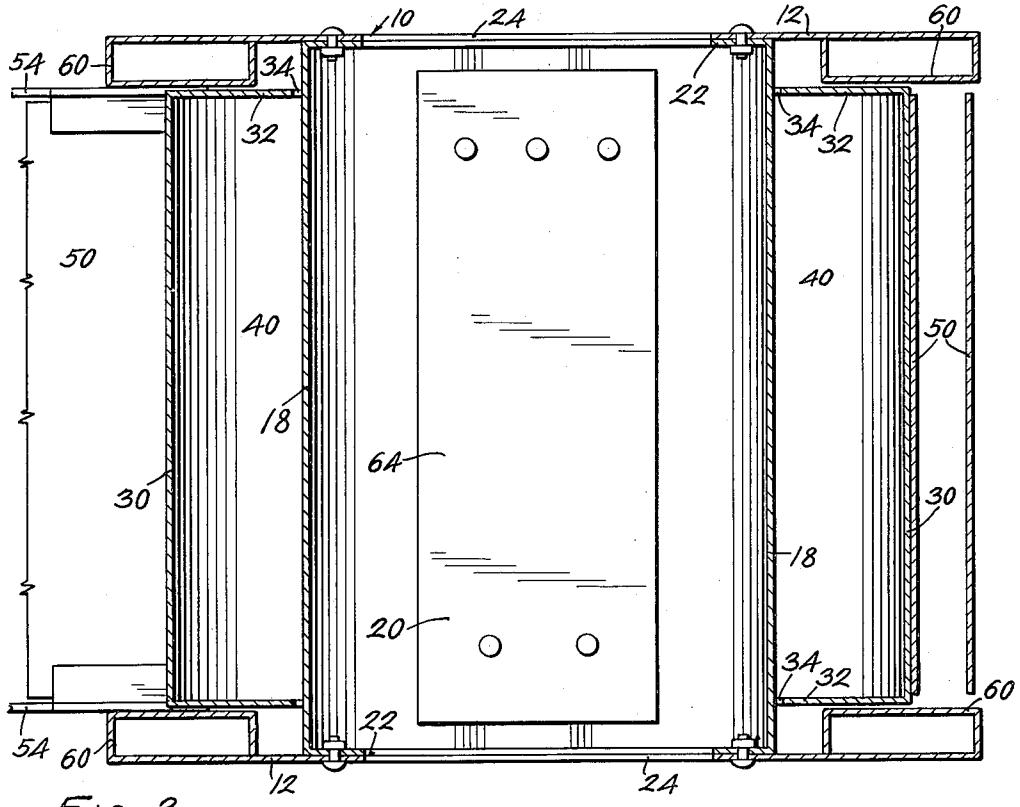

FIG. 3.

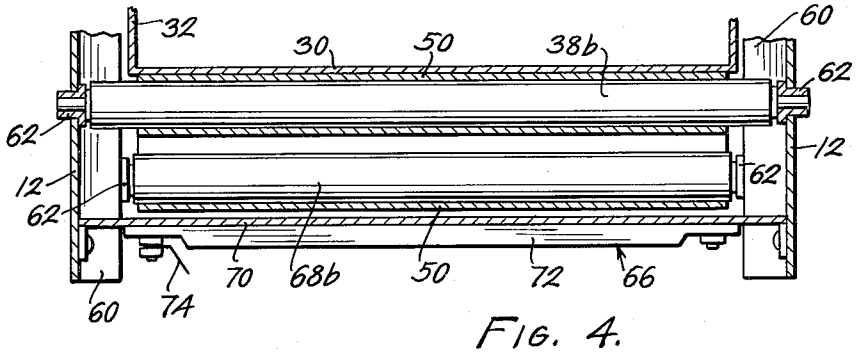

FIG. 4.

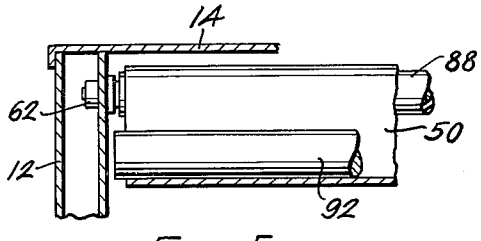

FIG. 5.

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DRUM-TYPE PRINT DRYERS

Filed Sept. 28, 1959 3 Sheets-Sheet 3

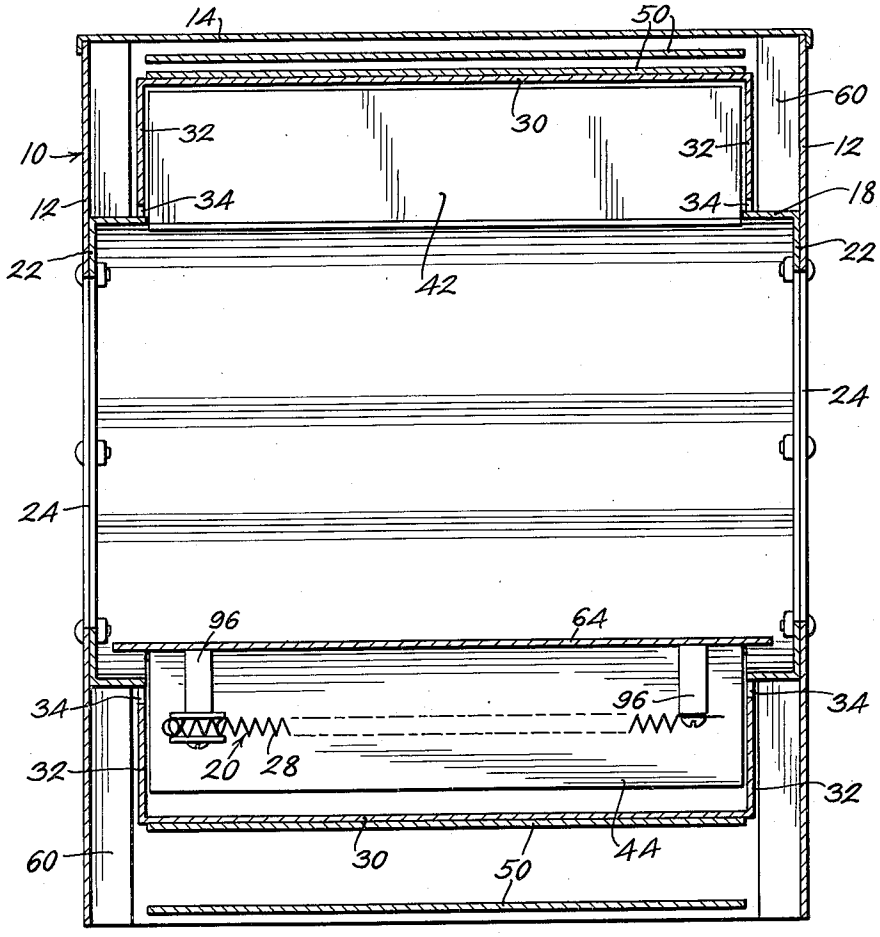

FIG. 6.

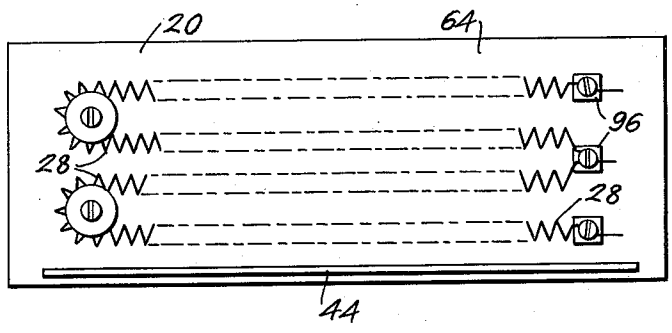

FIG. 7

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DRUM-TYPE PRINT DRYERS

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11 Claims. (Cl. 34—123)

This invention relates to photographic print dryers and, more specifically, to print dryers of the rotating-drum type.

Commercial photographers, photography studios and print processing establishments require print-drying apparatus of a type designed to handle a considerable number of prints in a relatively short period of time for efficient operation. Most of the print dryers for this purpose are of the rotating-drum type into which the wet prints can be fed continuously and are dried as they move around the drum. These units are quite expensive and only a very few of them are capable of handling in excess of one-hundred 8 x 10 prints per hour. Unfortunately, this volume is seldom adequate for purposes of even a moderate commercial operation.

Several factors are responsible for the deficiencies found in the present drum-type print dryers insofar as the limited number of prints they can handle is concerned. First of all, most of the print dryers of this type utilize a continuous canvas belt that moves with the drum and holds the prints pressed against the heated surface thereof. As the prints are introduced into the dryer, they are quite wet which causes the belt to become soaked with water; therefore, the belt must move around the hot surface of the drum slowly enough to dry out before it picks up a new series of wet prints.

The prior art attempts to solve this problem and speed up the drying operation have taken several forms. One of the most common is to pass the endless belt across a separate belt-drying heater located adjacent the point on the circumference of the drum where the dry prints are discharged. Also, extra-long belts are often used with complex roller systems adapted to air-dry the belt before it is returned to the drum. In the more expensive dryers, combinations of both of the aforementioned belt-drying systems are often used.

Quite analogous to the problem is the fact that as the belt becomes saturated with water, it prevents the prints from drying out properly thus again requiring the use of a relatively slow-turning drum. Of course, the use of a drum with an extra-large surface provides a partial solution to the problem of print-drying capacity; however, this approach can become quite expensive due to the increased capacity of the heaters, etc. that must be used with an oversize drum.

Secondly, some print-dryer manufacturers have attempted to increase the capacity of their units by heating all surfaces of the drum so that both the prints and belt are in substantially continuous contact with a heated area. While this solution undoubtedly improves the print-drying capacity of the unit to some extent, it produces another undesirable result that is largely eliminated through the use of zone-heating; namely, that of water-spotting of the prints as the droplets on the wet face thereof contact the hot surface of the drum. Blisters or water spots on the face of the print are more apt to form when the dryer is used to produce glossy prints as opposed to matte prints.

It is, therefore, the principal object of the present invention to provide a novel and improved rotating drum-type dryer for photographic prints and the like.

A second objective is to provide a print-dryer of the type aforementioned which includes an externally-located strip heater unit positioned adjacent the point at which the wet prints are introduced and adapted to dry both

the prints and canvas belt as they pass across the face thereof.

Another objective of the invention is the provision of a dryer unit that includes high-intensity zone heating adapted to dry the belt and prints quite rapidly, and yet, without scorching the latter due to the short period in close proximity thereto.

Still another object of the invention is to provide a unit of the class described in which the drum includes a cooling zone located between the high-intensity heating zone and the position when the wet prints are introduced that allows the drum to cool thus preventing water-spots or blisters on the face of the print.

A further objective of the instant invention is the provision of a rotating-drum dryer in which the canvas belt leaves the surface of the drum and passes over a belt-heater at a point where the prints are still wet enough to adhere to the surface of the drum without being held in contact therewith by the belt.

Additional objects are to provide a photographic print dryer that is simple to operate, relatively inexpensive, one capable of handling both matte and glossy prints, a unit that can be used to dry prints of varying sizes and weights, and a device of the class described that has almost half-again the print-drying capacity of the other commercially-available print dryers with a drum of the same width irrespective of its diameter.

Other objects will be in part apparent and in part pointed out specifically hereinafter in connection with the description of the drawings that follows, and in which:

FIGURE 1 is a view showing the rotating drum-type print dryer of the present invention in longitudinal section;

FIGURE 2 is a fragmentary section taken along line 2—2 of FIGURE 1 showing the drive roller for the canvas belt and the associated idler-roller assembly;

FIGURE 3 is a section taken along line 3—3 of FIGURE 1, portions of which have been broken away to conserve space, showing the main resistance heating element of the dryer that is located inside the drum;

FIGURE 4 is a fragmentary section taken along line 4—4 of FIGURE 1 showing the strip heater used to both dry the belt and the outer surface of the wet prints soon after they enter the dryer;

FIGURE 5 is a fragmentary section taken along line 5—5 of FIGURE 1 illustrating the idler-roller assembly and belt-tightening roller used therewith to take up slack in the canvas belt;

FIGURE 6 is a vertical section taken along line 6—6 of FIGURE 1 showing the construction of the drum along with the location of the stationary baffles that divide the latter into heating and cooling zones; and,

FIGURE 7 is a bottom plan view showing the details of the main high-intensity resistance heating element located inside the drum.

Referring now to the drawings, and in particular to FIGURE 1 thereof for a detailed description of the drum-type print dryer of the present invention, it will be seen to include a housing that has been indicated in a general way by numeral 10 having spaced substantially parallel side panels 12, a removable cover 14, a partial front wall 16, and a hollow cylindrical element 18 that supports the main heater 20 and interconnects the side panels. Hollow cylindrical element 18 is open at both ends and includes an inturned annular flange 22 that is bolted or otherwise attached to the side panels 12 in alignment with a corresponding opening 24 provided in the latter. An opening 26 is also provided in the bottom of element 18 of a shape and size adapted to receive the main heater 20 in supporting relation such that the resistance heating elements 28 thereof are positioned exteriorly.

A highly-polished chrome-steel drum 30 having partial-

ly enclosed ends 32 defining an opening 34 adapted to loosely receive element 18 is supported on a front roller 36 and a rear pair of rollers 38 for independent relative rotational movement around said hollow cylindrical element 18 and main heater 20. These rollers 36 and 38 are journalled for rotation between the side panels 12 in position to support the lower half of the drum in spaced substantially parallel relation on opposite sides of a vertical plane passing through the axis of rotation thereof. The partially enclosed ends 32 of the drum cooperate with the continuous cylindrical surface thereof and with element 18 to define an annular chamber 40 which is divided by upper and lower baffles 42 and 44, respectively, into a heating zone 46 located generally on the rear half of the unit and a cooling zone 48 on the front half thereof.

At this point it should be mentioned that at least the cylindrical surface of drum 30 is preferably formed from highly-polished chrome-steel which is known in the trade as a "ferrotype" plate or tin. When a photographic print of the proper type is placed face-down on such a polished sheet, it attains a "glossy" surface. To produce a so-called "matte" print, on the other hand, the paper is placed face-up on the polished surface. This procedure is, of course, quite old in the art and forms no part of the present invention.

Now, rotation of the drum 30 is accomplished by means of an endless canvas belt 50 which encircles a major segment of the drum and is reeved over a series of idler rollers and a drive roller 52, all of which will be described in detail presently in connection with the remaining figures of the drawing. That portion of housing or cabinet 10 that is beneath partial front wall 16 is open to receive the wet prints which are laid on top of belt 50 as it moves toward the drum. For this purpose, the side panels 12 of the cabinet are provided with forwardly extending wings 54 that are attached to the latter and are maintained in fixed spaced relation to one another by a brace 56 connected therebetween. In the specific form shown, pins 57 depend from the side panels adjacent the front edges thereof and provide means for pivotally attaching the wings thereto so that this assembly can be folded into the open front of the housing when not in use. An idler roller 58 is journalled for rotation between the wings 54 adjacent the front or free ends thereof. The belt 50 passes around the front of this idler as it enters the housing for movement around the drum.

In connection with FIGURES 1 and 3 of the drawings, it can be seen that the side panels 12 of the housing 10 are bent to provide integrally-formed box-like portions 60 extending vertically along both the front and rear margins. The double-walls defined by these box-like portions provide means adapted to strengthen the housing and also to enclose and support several of the roller shaft bearings that have been identified by numeral 62. Also, these box-like portions 60 project inwardly from the side panels as shown to provide guide means adapted to center the drum and belt within the housing and in relation to cylindrical element 18.

In addition, FIGURES 1 and 3 show the plate 64 of the main heater 20 from which the resistance heating elements 28 are suspended along with baffle 44. This plate is attached to the inner cylindrical surface of element 18 over opening 26 therein and performs the secondary function of reflecting the heat from resistance elements 28 onto the inside of drum 30. Note that heater 20 is located in the heating zone 46 of annular chamber 40 adjacent the print when the wet prints enter the dryer.

FIGURES 1 and 4 best show the location and construction of the strip-heater assembly, that has been identified in a general way by numeral 66, and which will be seen mounted in the rear end of the housing 10 between the side panels 12 thereof. This heater assembly 66 is located externally of the drum 30 adjacent, but underneath, the rear pair of idler rollers 38 that help support said drum. A second pair of idler rollers 68 are journalled for rotation in spaced substantially parallel relation to one another underneath the first-mentioned pair 38 but above the leading and trailing edges of heated plate 70 that forms a part of the strip heater assembly. The heating element 72 of the assembly is attached to the underside of plate 70 and is connected to a suitable source of electrical energy by a conductor 74. The endless canvas belt 50 moves in the direction of the arrows in FIGURE 1 from idler 58, over front idler 36 into contact with the outer cylindrical surface of drum 30, around the rear side of lead roller 38*a* of the first pair where it leaves the drum having traversed the lower portion thereof, thence underneath the lead roller 68*a* of the second pair of idlers located adjacent the leading edge of plate 70 which forms a part of the strip heater assembly 66, around the following roller 68*b* of the second pair of idlers after traversing the heated surface of the strip heater assembly, and finally around the front of the following idler 38*b* of the first pair where it returns once again to the surface of drum 30. Several important features of the instant print dryer should be mentioned specifically in connection with the aforementioned phase of the complete drying cycle.

First of all, the prints enter the dryer by being placed on belt 50 between idler rollers 58 and 36, at which point they are the wettest having just been taken from the wash water. As these wet prints pass over roller 36, the weight of drum 30 resting thereon performs a "squeegee" or "wringer" action adapted to remove some of the excess water while spreading the remainder out into a thin relatively uniform film. Almost immediately thereafter, the prints which are still quite wet, pass underneath baffle 44 and enter the heating zone 46 of the annular chamber 40. At this point, the prints are subjected to intense, but localized, heat from the main heater 20 which, if the prints were dryer, would be sufficient to scorch or blister them. Also, due to the highly-localized position of heater 20 at the head of the heating zone 46, the prints pass out of the intense heat before they are dry enough to scorch.

Now, while the prints still retain sufficient moisture to adhere by themselves to the polished surface of drum 30, the belt 50 which has picked up a substantial amount of water from the prints, is carried away from the surface of the drum and across strip heater assembly 66 that functions to dry it out before returning it again to the drum. At the same time, the prints are exposed to the heat of the strip heater assembly as they pass between the first pair of rollers 38 out of contact with the wet belt. Accordingly, as the prints and belt leave idler 38*b* and again come into face-to-face contact with one another, they have both dried out substantially due to their passage in close proximity to heater assembly 66. Thus, as the belt and prints move toward the end of the heating zone 46 that terminates at upper baffle 42, they are thoroughly dried even at the more moderate temperatures that exist on the surface of the drum as it moves away from the main heater 20.

When the prints and belt pass baffle 42, the surface of the drum begins to cool rapidly as it enters the cooling zone 48 of the annular chamber. At this point the prints are completely dry and are freed to drop into a suitable receiver (not shown) as the belt leaves the drum to pass around drum roller 52. The surface of the drum as it passes under roller 52 becomes uncovered and open to the atmosphere through the open front and of the housing which further cools it prior to receiving another wet print. This passage of the drum surface through the cooling zone 48, a portion of which time it is uncovered and cooled by convection currents, enables it to pick up wet prints without danger of blistering or water spotting them.

An examination of FIGURES 1 and 2 will reveal that the shaft 76 of the drive roller 52 is connected in co-

axial relation to the shaft 78 of a small low-speed electric motor 80 mounted on the outside of the housing 10. Suitable openings 82 arranged in aligned relation to one another are provided in the side panels 12 of the housing 10 adapted to receive the motor shaft and drive roller shaft for rotational movement. As the drive roller 52 is turned by motor 80 in a clockwise direction as viewed in FIGURE 1, it moves the belt 50 in the direction of the arrows found in the same figure thus turning the drum counterclockwise as by engaging approximately three-fourths of its cylindrical surface.

Idler roller 84 is journalled for rotation between the side panels of the housing in spaced substantially parallel relation to the drive roller 52 and immediately above the latter. Similar idler rollers 86, 88 and 90 are journalled for rotation in the top front, top rear and bottom rear corners, respectively, of the housing as shown in FIGURE 1. The belt 50 is reeved from the underside of drive roller 52 around the rear face of idler 84, over the top of idler 86, along the top of the housing and over idler 88, down the rear of the cabinet and forwardly along the bottom thereof to idler 58 after passing around roller 90. Thus, the belt moves rearwardly through the open front end of the housing, along the bottom of the drum, off the drum and over the strip heater assembly, back onto the drum for movement up the rear thereof and forwardly across the top to the drive roller, up to the top and rearwardly again underneath the cover, thence down the back and forwardly again along the bottom to the point of beginning.

Canvas belts of the type used in the print dryer of the present invention to turn the drum and hold the prints against the hot surface thereof have a tendency to shrink or expand depending upon their moisture content. Accordingly, some type of self-adjusting means is preferably provided to take up any slack that develops in the belt. The belt-tightener used in the instant print dryer has been identified by reference numeral 92 and can best be seen in FIGURES 1 and 5 to which reference will now be had. An idler roller 94 is journalled for rotation between the side panels in spaced relation ahead of idler 88 but in parallel relation thereto. The belt-tightener 92 comprises a rather heavy unsupported roller laid on that portion of the belt that extends between idler 94 and 88. As slack develops in the belt, the weight of roller 92 causes an underslung fold to develop between idler 94 and 88 thus maintaining the belt tight against the drum.

Finally, the particular construction of the main heater 20 will be described in connection with FIGURES 1, 6 and 7. Ceramic insulators 96 are attached to the underside of reflector plate 64 and are interconnected by an elongated loosely-wound coil of wire of the type commonly used to form resistance heating elements 28. Of course, these resistance elements 28 of the main heater are electrically connected by a suitable conductor to a source of electrical energy. As already mentioned, the heat developed by heater 20 on the outside surface of drum 30 can be considerably more intense than that ordinarily used in a drum-type print dryer because of the localized nature thereof and the fact that the source is positioned at the head of the heating zone 46 where the prints and belt are the wettest. The same heat intensity directed against another area of the drum or the entire cylindrical surface thereof would most certainly scorch the prints. Also, it would prevent the drum from cooling sufficiently during its passage through the cooling zone 48 to stop the prints from blistering or water-spotting. As it is, the instant dryer is capable of handling nearly one hundred fifty 8 x 10 prints per hour which is almost one and one-half times the capacity of other commercially-available dryers with drums of the same width even though of greater diameter.

Having thus described the several useful and novel features of the drum-type photographic print dryer of the present invention, it will be apparent that the several worthwhile objectives for which it was designed have been achieved. Although but a single specific embodiment of the invention has been illustrated and described in connection with the accompanying drawings, I realize that certain changes and modifications therein may occur to those skilled in the art within the broad teaching found herein; hence, it is my intention that the scope of protection afforded hereby shall be limited only insofar as said limitations are expressly set forth in the appended claims.

What is claimed is:

1. In a drum-type dryer for photographic prints and the like, a housing having spaced side panels, a hollow cylindrical element interconnecting said side panels extending transversely therebetween, a first idler roller journalled for rotation between the side panels near the bottom front of the housing, a second idler roller journalled for rotation in spaced substantially parallel relation to the rear of the first idler roller, said first and second idler rollers being spaced substantially the same distance from the axis of the hollow cylindrical element and on opposite sides thereof, a hollow drum having a substantially cylindrical polished outer surface supported on the first and second idler rollers in coaxial relation thereto and peripherally spaced from and coaxial with the cylindrical element for independent relative rotational movement therearound, said drum having end walls cooperating with the cylindrical surfaces of the drum and element interconnecting the side panels to define an annular chamber therebetween, a main resistance heating unit depending from the hollow cylindrical element and extending into the annular chamber at a point adjacent the first idler roller, a first baffle plate located in fixed position within the annular chamber immediately in front of the main heating unit, a second baffle plate located in fixed position in the top of the annular chamber cooperating with the first baffle plate to divide said chamber into a heating zone containing the main heater and a cooling zone, a drive roller journalled for rotation between the side panels at the top front of the housing adjacent the drum, drive means operatively connected to the drive roller for rotating same, a third idler roller journalled for rotation between the side panels in spaced substantially parallel relation to the rear of the second idler roller in tangential contact with the cylindrical surface of the drum, a secondary heating unit mounted in spaced substantially parallel relation beneath the second and third idler rollers, a fourth idler roller journalled for rotation adjacent the upper surface of the secondary heater in spaced substantially parallel relation beneath the second and third idler rollers, a fifth idler roller journalled for rotation between the side panels at the top rear of the housing, a sixth idler roller journalled for rotation between the side panels at the bottom rear of the housing behind and underneath the secondary heater unit, a seventh idler roller journalled for rotation in substantially parallel relation to the first idler roller spaced to the front thereof, and an endless canvas belt threaded between the first idler roller and the drum, over the second idler roller and around the underside of the fourth idler roller in position to be dryed by the secondary heating unit as it leaves the cylindrical surface of the drum, over the third idler roller and around the drum to the drive roller, around the underside of the drive roller and rearwardly over the top of the fifth idler roller, thence downwardly around the sixth idler roller and forwardly to the seventh idler roller, and finally around the front of the seventh idler roller to the beginning.

2. The drum-type dryer as set forth in claim 1 in which, the fourth idler roller is located adjacent the leading edge of the secondary heating unit, an eighth idler

roller is journalled for rotation in substantially parallel relation to the fourth idler roller in spaced relation to the rear thereof and adjacent the following edge of the secondary heating unit, and the belt is threaded from the fourth idler roller around the rear of the eighth idler roller before passing over the third idler roller.

3. The drum-type print dryer as set forth in claim 1 in which, the front of the housing is open to the atmosphere, the cooling zone of the annular chamber is located at the front of the dryer, and the first idler roller and drive roller are spaced apart to provide an area on the front of the drum over which the belt does not pass and is open to the atmosphere for the dissipation of heat from within the cooling diameter.

4. The drum-type print dryer as set forth in claim 1 in which, a ninth idler roller is journalled for rotation between the side panels in parallel relation to the drive roller spaced upwardly and rearwardly therefrom, a tenth idler roller is journalled for rotation between the side panels in the top front of the housing, and the belt passes from the drive roller across the back of the ninth idler and around the front of the tenth idler to the fifth idler.

5. The drum-type print dryer as set forth in claim 1 in which, an eleventh idler is journalled for rotation between the side panels in spaced substantially parallel relation to the fifth idler roller, and belt-tightening means comprising an elongate relatively heavy cylindrical element is freely supported on the belt between the fifth and eleventh idler rollers.

6. The drum-type print dryer as set forth in claim 1 in which, a pair of wings are pivotally attached to the base of the side panels in position to extend forwardly therefrom in spaced relation to one another, the seventh idler roller is journalled for rotation between the wings, and the wings and seventh idler roller are foldable into the open front of the housing.

7. The drum-type print dryer as set forth in claim 2 in which, an eleventh idler is journalled for rotation between the side panels in spaced substantially parallel relation to the fifth idler roller, and belt-tightening means

comprising an elongate relatively heavy cylindrical element is freely supported on the belt between the fifth and eleventh idler rollers.

8. The drum-type print dryer as set forth in claim 2 in which, a pair of wings are pivotally attached to the base of the side panels in position to extend forwardly therefrom in spaced relation to one another, the seventh idler roller is journalled for rotation between the wings, and the wings and seventh idler roller are foldable into the open front of the housing.

9. The drum-type print dryer as set forth in claim 3 in which, an eleventh idler is journalled for rotation between the side panels in spaced substantially parallel relation to the fifth idler roller, and belt-tightening means comprising an elongate relatively heavy cylindrical element is freely supported on the belt between the fifth and eleventh idler rollers.

10. The drum-type print dryer as set forth in claim 3 in which, a pair of wings are pivotally attached to the base of the side panels in position to extend forwardly therefrom in spaced relation to one another, the seventh idler roller is journalled for rotation between the wings, and the wings and seventh idler roller are foldable into the open front of the housing.

11. The drum-type print dryer as set forth in claim 5 in which, a pair of wings are pivotally attached to the base of the side panels in position to extend forwardly therefrom in spaced relation to one another, the seventh idler roller is journalled for rotation between the wings, and the wings and seventh idler roller are foldable into the open front of the housing.

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