

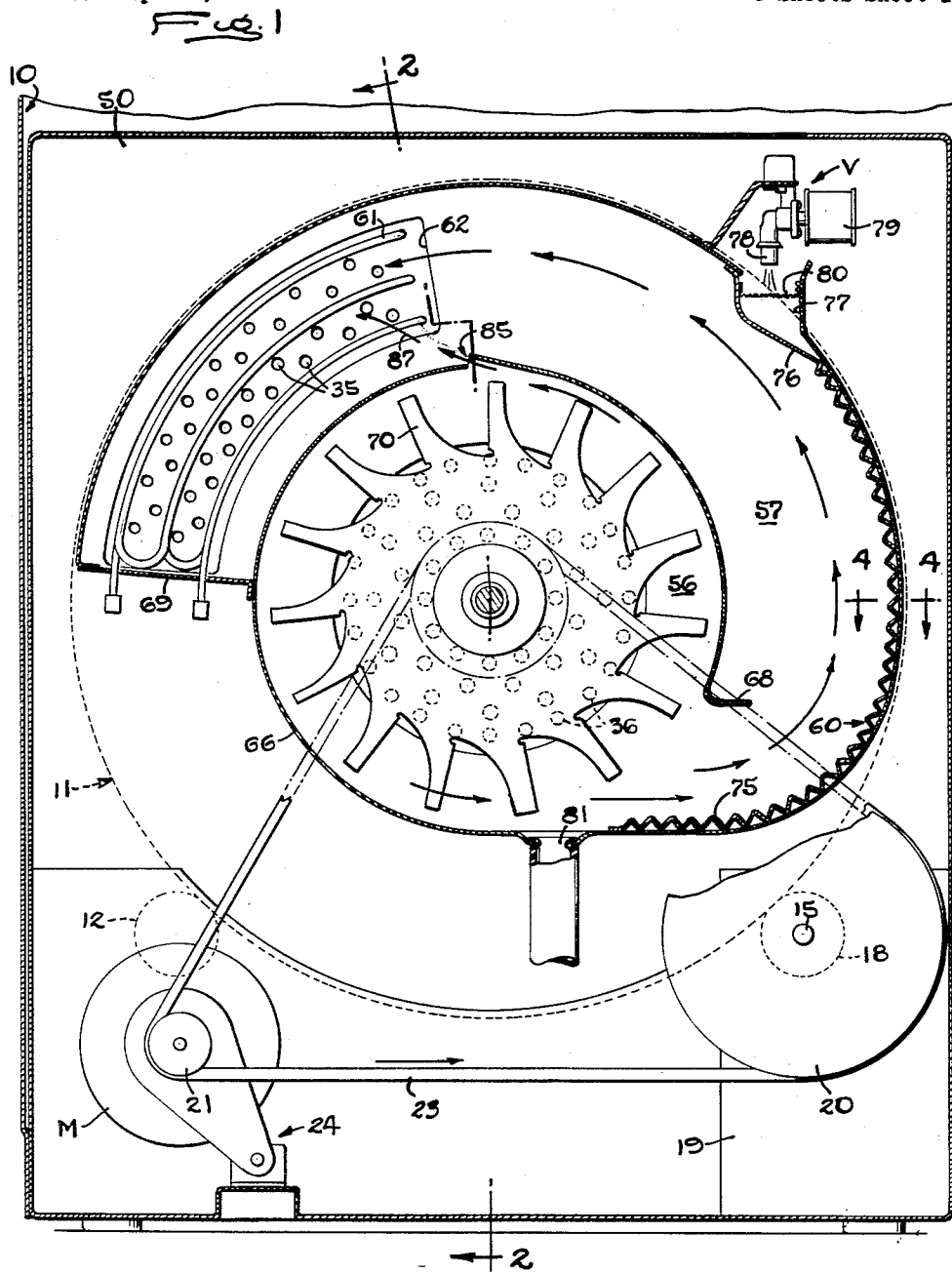
June 14, 1960

C. F. CZECH
LAUNDRY DRYERS

2,940,179

Filed Sept. 4, 1956

3 Sheets-Sheet 1



INVENTOR
Clifford F. Czech
By Carlens, Pitzner, Hubbard & Wolfe
ATTORNEYS

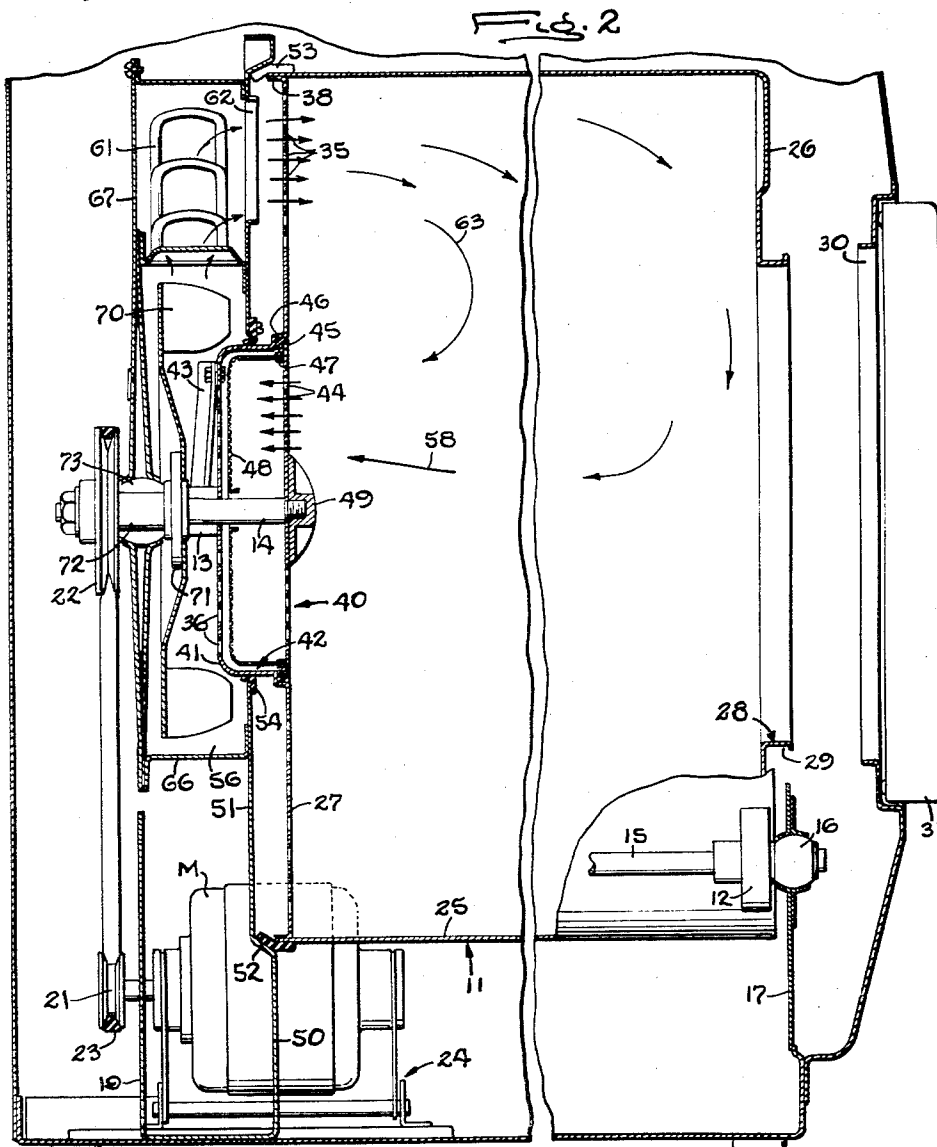
June 14, 1960

C. F. CZECH
LAUNDRY DRYERS

2,940,179

Filed Sept. 4, 1956

3 Sheets-Sheet 2



INVENTOR

Clifford $\equiv$ Czech

By Carlson, Pitzner, Hubbard & Wolfe
ATTORNEYS

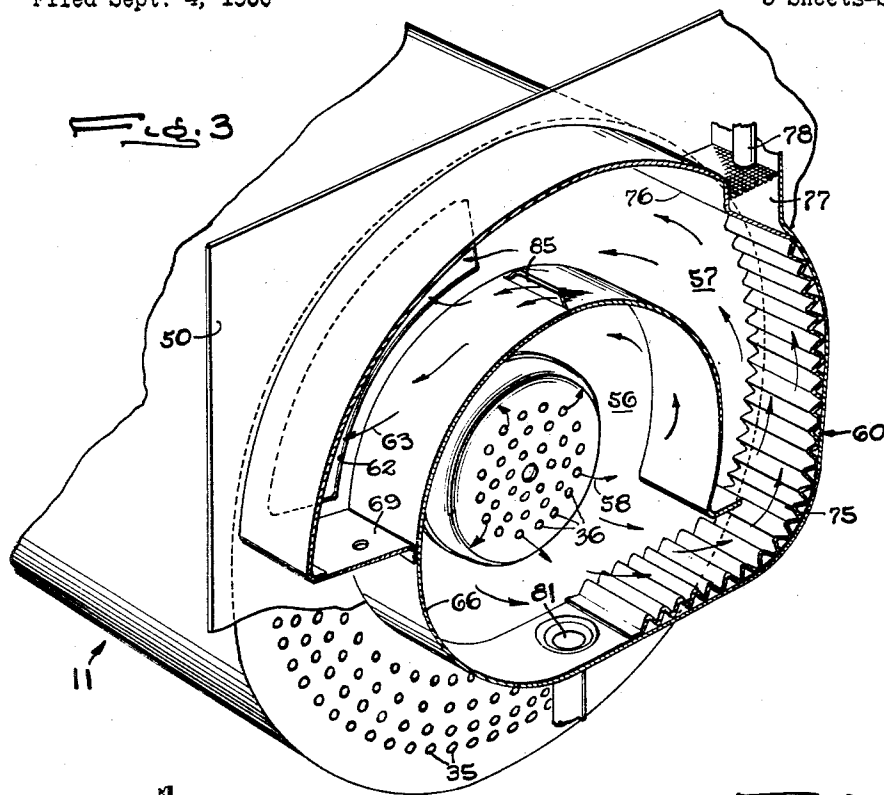
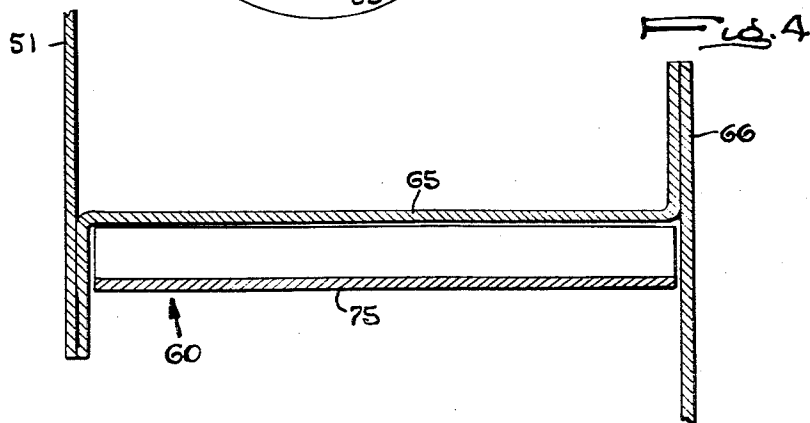
June 14, 1960

C. F. CZECH
LAUNDRY DRYERS

2,940,179

Filed Sept. 4, 1956

3 Sheets-Sheet 3



INVENTOR

Clifford F. Czech
By *Carlson, Pitzner, Hubbard & Wolfe*
ATTORNEYS

1

2,940,179

LAUNDRY DRYERS

Clifford F. Czech, Ripon, Wis., assignor, by mesne assignments, to McGraw-Edison Company, a corporation of Delaware

Filed Sept. 4, 1956, Ser. No. 607,626

13 Claims. (Cl. 34—77)

The invention relates to laundry dryers generally and is more particularly concerned with dryers of the type having a closed air circulating system.

One object of the invention is to simplify the construction and increase the operating efficiency of dryers of the above character.

A more specific object is to provide an efficient and dependable closed circulating system dryer of simple, rugged construction that can be manufactured at relatively low cost.

Another object is to provide a dryer in which only a predetermined portion of the circulating air is passed over a relatively cold condensing surface to reduce its moisture content before it is heated and returned to the drying chamber.

Another object is to provide improved moisture condensing means for laundry dryers.

Still another object is to provide improved means for removing lint from the air circulating in the dryer.

Other objects and advantages of the invention will become apparent from the following detailed description of the preferred embodiment illustrated in the accompanying drawings, in which

Figure 1 is a rear view of a dryer embodying the features of the invention, the rear part of the cabinet and portions of the interior partitioning structure being removed to show details of the air circulating system.

Fig. 2 is a vertical sectional view of the dryer shown in Figure 1.

Fig. 3 is a fragmentary perspective view of the casing structure defining the chamber in which the circulating air is treated to reduce its moisture content and increase its temperature.

Fig. 4 is an enlarged sectional view taken in a plane substantially on the line 4—4 of Fig. 1.

While a preferred form of the invention has been shown, and will be described in detail herein, this is not intended to limit the invention to the particular construction illustrated but the intention is to cover all modifications and adaptations falling within the spirit and scope of the invention as explained in the appended claims.

Referring to Figs. 1 and 2 of the drawings, the dryer selected to illustrate the invention has a generally rectangular cabinet 10 enclosing the operating parts of the appliance, including a cylindrical tumbler or drum 11 which defines the clothes drying chamber. The drum 11 is supported in the cabinet for rotation about a horizontal axis and, in operation, is rotatably driven by a motor M. Support for the drum is provided in this instance by a pair of resilient rolls 12 spaced apart laterally in the cabinet and positioned to engage the periphery of the drum adjacent its forward end. At its rear end the drum is supported by a bearing 13 secured to the rear drum wall and running on a shaft 14 carried by suitable supporting structure in the cabinet to be discussed later.

The drive for the drum 11 in this instance is through

2

one of the rolls 12. As shown in Fig. 2, the driving roll 12 is mounted on a shaft 15 journaled at one end in a bearing 16 carried on a transverse positioning member 17 forming a part of the cabinet 10. At its other end the shaft extends through a bearing 18 (Fig. 1) carried on a vertical panel member 19 provided in the cabinet. The shaft 15 is fitted with a driving pulley 20 alined in a common plane with a pulley 21 on the shaft of the motor M and a pulley 22 journaled on the shaft 14. A V-belt 23 is trained over all three pulleys, the belt being maintained under tension by the weight of the motor which is mounted on a swinging bracket 24 as shown in Fig. 1.

In accordance with one aspect of the invention, the tumbler drum 11 embodies novel features of construction which provide for more efficient circulation of air through the clothes during the drying operation and which further provide for the effective removal of lint from the circulating air. The drum is preferably constructed of sheet metal and, as shown in Fig. 2, comprises a cylindrical peripheral wall 25, a front end wall 26 and a rear end wall 27. To provide for the circulation of the air in a closed circuit, the peripheral wall of the drum is imperforate and the front wall is also imperforate, except for a central access opening 28. The opening 28, in this case, is bordered by a flange 29 and, when the drum is assembled in the cabinet 10, the opening 28 is substantially alined with an opening 30 in the front wall of the cabinet. The latter opening is provided with a hinged door or closure 31. It will be understood that the openings 28 and 30 are dimensioned to permit convenient loading and unloading of the drum. While they have been shown spaced apart in the present instance, it will be understood that a sleeve or liner may be provided, if desired, to prevent articles being placed in or removed from the drum from falling into the cabinets.

To provide for the admission to and exhaust of air from the drum, the back wall 27 is provided with spaced foraminate areas which may be in the form of screened openings or of groups of closely spaced punched holes. One of the foraminate areas is annular and is located adjacent the marginal edge of the wall. As shown, this area is defined by a series of closely spaced punched holes 35 and is related to the other elements of the air circulating system to be described presently so as to constitute the air inlet for the drum.

The other foraminate area, which in this instance constitutes the air outlet for the drum, is preferably roughly circular in form and located centrally of the wall 27, that is, coaxial with the drum. This area is defined by a series of closely spaced punched holes 36. For convenience of assembly the wall member 27 is formed with a marginal flange 38 adapted to fit into the cylindrical wall member 25 as shown.

The end wall member 27 is also formed to provide for the mounting of a lint-screening device or lint trap 40 in a location for effectively removing lint to prevent any accumulation in the air circulating system. For this purpose the central portion of the wall member 27 is offset or pressed outwardly in the form of a cylindrical boss 41 to define a relatively shallow cylindrical recess 42 opening to the interior of the drum. The support bearing 13 is secured to this boss as by radially extending arms 43 which are attached to the wall member by bolts or suitable fastening elements. As will be seen by reference to Fig. 2 of the drawings, the central portion of the boss 41 is formed with a clearance opening for the shaft 14 which extends through the bearing 13 and completely through the lint trap recess 42 with its inner end projecting into the drum.

The lint trap 40, in its preferred form, comprises a circular front plate 44 dimensioned to cover the lint trap

3

recess. As shown in Fig. 2, the plate has a narrow flange around its marginal edge and is fitted with a gasket 45 of rubber or other resilient material adapted to seat in a groove 46 formed around the edge of the recess 42. Fitted into the flange of the cover plate and releasably held in place by a resilient ring 47 is a cup-shaped screen element 48 of fine meshed wire fabric or the like. The ring is suitably attached to the edge of the element 48 and is dimensioned to fit tightly within the flange of the plate. The screen element and the plate 44 are both centrally apertured to accommodate the shaft 14 and a nut 49 threaded on the end of the shaft serves to hold the trap securely in place. The nut is readily accessible through the access openings in the cabinet and drum, thus enabling the trap to be easily removed for cleaning out accumulated lint.

For cooperation with the drum 11 the invention provides a structure defining an air treating chamber or passage completing the closed air circulating path. This structure is characterized by its compact and simple construction and by its high operating efficiency in terms of power consumption. The compactness of the structure, of course, permits substantial reduction in the overall size of the cabinet 10 which, together with the simplicity of construction, materially reduces manufacturing costs. The efficiency of the circulating system is reflected by its ability to remove moisture from a load of clothes with a minimum expenditure of power and in a relatively short time. In addition, the dryer is rendered much more suitable for household use since the discharge of moisture or lint laden air is avoided without resorting to outside venting of the dryer.

As shown in Fig. 2 of the drawings, the cabinet 10 is divided transversely by an upright partitioning member 50, preferably a sheet metal panel, suitably attached to the wall of the cabinet and extending across the rear of the drum 11. A circular section 51 of the partitioning member is formed rearwardly to define an annular shoulder 52 of substantially the same diameter as the drum and coaxial with it. Centrally of the section 51 is an opening dimensioned to receive the boss 41 on the end wall of the drum. A sealing ring 53 on the drum coacting with the shoulder 52 and a sealing ring 54 on the partitioning member coacting with the boss 41 seals the space between the end of the drum and the partitioning member.

Disposed at the rear of the partitioning member and preferably built directly upon it is a structure defining the air treating chamber above mentioned and connected to form a closed circuit with the drum 10. Air withdrawn from the drum is circulated through this chamber and treated to remove a part of the moisture picked up from the contents of the drum and to raise the temperature of the air before returning it to the drum for further drying of the drum contents. In accordance with the invention the air treating chamber is constructed to provide a generally cylindrical fan compartment 56 disposed coaxially of the drum 11 and opening to an elongated passage 57 that has its outlet positioned to register with the air inlet of the drum. The arrangement is such that air enters the compartment 56 from the central portion of the drum through the perforations 36 in the boss 41 after passing through the lint trap 40 as indicated by the arrows 58 in Figs. 2 and 3 of the drawings.

The air drawn into the fan compartment 56, or a predetermined portion of it, is then directed through the passage 57 in which is mounted a condenser 60 and a heater 61. The heated air is returned to the drum by way of an opening 62 in the partitioning member 50 as indicated by the arrows 63 in Figs. 2 and 3. As will be seen by reference to Figs. 1 and 3 of the drawings, the opening 62 is arcuate in form and is positioned to register with the annular series of apertures 35 in the end wall 27 of the drum.

For simplicity and compactness the fan compartment

4

of the air treating chamber is made generally circular and the passage 57 is spirally coiled about the fan space as shown in Figs. 1 and 3. Thus, a chamber of substantial length is obtained, providing ample accommodations for the condenser and the heater, yet occupying a minimum of space in the back of the cabinet. In the exemplary chamber one end wall of the air treating chamber is formed by the partitioning member 50 while the side wall and the internal partitioning dividing the fan compartment from the passage 57 is formed by a single elongated sheet metal strip 66 bent into spiral configuration. An outer cover plate (Fig. 2) closes the other end of the chamber. For convenience of attachment to the end walls the strip 66 may be formed with flanges 67 (Fig. 4) at opposite sides for spot welding or otherwise suitable attachment to the members 50 and 67.

As will be seen by reference to Fig. 1 of the drawings, the passage 57 of the air treating chamber opens at one side of the fan space 56 and extends around that space approximately 270°. The entrance to the passage from the fan compartment is formed by bending the inner end of the strip 66 outwardly as at 68 and locating it in spaced relation to the opposite wall of the passage. The end portion 68 thus, in effect, constitutes a vane for directing the air flow toward the outer wall of the passage. The other end portion 69 of the wall strip 66 is bent inwardly at approximately right angles to abut the adjacent outer face of the wall strip and thus form the end wall for the passage. Preferably, the opening 62 in the partitioning member 50 is located adjacent the closed end of the passage. The heater 61, herein shown as a resistance coil, is supported in the passage adjacent the opening 62 so that the circulating air passes over it on its way to the opening and the tumbler drum.

Circulation of air is maintained through the air treating chamber and tumbler drum by a rotatably driven multi-bladed blower or fan element 70 mounted in the fan compartment 56 of the air treating chamber. As shown in Fig. 2, the fan element has a hub 71 keyed or otherwise non-rotatably fixed on a sleeve 72 which serves as a bearing for the shaft 14 and which, in turn, is journaled in a bearing 73 carried on the cover plate 67. The driving pulley 22 hereinbefore mentioned is keyed to the projecting end of the sleeve element 72.

In the exemplary dryer the condenser 60 is located adjacent the entrance to the passage 57, that is, at its junction with the fan compartment 56 so that the air entering the passage is subject to the cooling action of the condenser. The condenser in its preferred form comprises an elongated strip 75 of sheet metal of substantially the same width as the wall member 66 and disposed in face-to-face contact with such wall member as shown in Figs. 3 and 4. As shown herein, the condenser strip 75 extends upwardly from approximately the lowermost portion of the passage 57 to a point spaced approximately 65° therefrom. The strip is preferably corrugated transversely so as to present a maximum surface area to the air circulating through the passage.

The upper end portion 76 of the strip 75 is generally funnel-shaped and it is disposed below an inlet opening 77 in the outer passage wall. Cooling water is directed through the opening 77 from a nozzle 78 or the like under control of a suitable valve V which may be opened and closed manually or by a solenoid 79. A screen 80 is desirably provided in the opening 77 to prevent the entry of any foreign material.

The water introduced into the air treating chamber through the opening 77 flows down the back of the condenser strip 76 and the adjacent wall of the passage and out through a discharge opening 81 at the lowest point of the passage. The condenser strip is thus maintained at a temperature substantially below that of the air circulating through the passage. Accordingly, as the warm moist air flows over the strip it is cooled and a substantial

5

portion of the moisture in the air condenses on the strip. The condensate flows down the strip and is discharged through the opening 81 along with the cooling water. Any lint escaping through the lint trap 40 will tend to collect on the condensing strip and, of course, will be washed down through the discharge opening with the condensate. The cool dry air continues along the passage and is heated to the temperature required for efficient drying by passing over the heater 61 before entering the tumbler drum 11.

Under ordinary operating conditions the air circulating in the dryer does not become completely saturated with moisture in a single passage through the tumbler drum. I have found that a substantial reduction in the power required for heating purposes can be realized without materially increasing the length of the drying cycle by subjecting only a portion of the circulating air to the action of the condenser. This is particularly effective when the cooled dry air is then thoroughly mixed with the uncooled portion of the air and the entire mass passed over the heater before recirculation through the tumbler drum.

In the improved dryer the by-passing of a portion of the air around the condenser is effected by providing a by-pass opening in the chamber wall 66 at a point between the entrance to the passage 57 and the outlet opening 62 from the passage to the drum. This by-pass opening is conveniently formed by transversely slotting the wall member 66 at the appropriate point and striking out the adjacent portion to form a deflecting hood. The size of the opening 85 may be varied as required by the particular conditions under which the dryer is to be operated. Thus, for ordinary domestic usage, it has been found that satisfactory operation is obtained with an opening dimensioned to by-pass approximately 30% of the circulating air. The air discharged through the opening 85 as indicated by the arrows 87 meets the air stream flowing through the passage in the vicinity of the heater 61. This insures a thorough mixing of the warm and cold air in its passage over the heater and before passing through the opening 62 to the drum.

In the operation of the improved dryer the wet clothes or other fabrics to be dried are loaded into the drum 11 through the access openings 30 and 28 and the door 31 is closed. By operation of a suitable starting switch, the motor M is started and the heater 61 is energized. At the same time the valve V is opened to direct a flow of cooling water over the condenser 60.

Motor M rotates the drum 11 at a rate effective to tumble the load and present the individual pieces to the drying air current in the drum. This air current is maintained by the fan 70 which draws air from the central portion of the drum through the lint trap 40 into the fan compartment 56. Part of the air is discharged from the fan compartment into the passage 57 where it is subject to the action of the condenser 60 to reduce its moisture content. The remainder of the air drawn from the drum is discharged through the by-pass slot 85 to mix with the cooled and dryer air. The entire mass of air then passes over the heater 61 and through the outlet opening 62 and perforations 35 is the drum wall to the interior of the drum. Air circulation is maintained and the tumbler drum operated until the clothes reach the desired degree of dryness.

During operation the moisture condensed from the air by the condenser 60 flows down the strip 75 to the discharge opening 81 through which it is discharged along with the cooling water admitted through the opening 77. The major portion of the lint picked up from the clothes being dried is caught in the lint trap 40 and any that passes through will tend to collect on the condenser strip 75 to be washed down by the condensate into the discharge 81.

When necessary, accumulated lint may be removed from the trap 40 by unscrewing the nut 49 and drawing the trap forwardly through the access opening of the drum. The screen portion of the trap is readily detachable from

6

the perforated front plate 44 since the parts are held together frictionally by the resilient ring 47. The cleaned lint trap is then replaced and secured in place by the nut 49.

It will be apparent from the foregoing that the invention provides a laundry dryer of novel and advantageous construction. The invention provides a simple sturdy structure defining an air treating chamber which is very compact and requires a minimum amount of space in the cabinet. The simplicity of construction and particularly the use of a single narrow sheet metal strip for defining both the fan compartment and the elongated air treating passage materially reduces the cost of manufacture.

The improved dryer is particularly well adapted for household use as discharge of moist air and lint into the room is completely avoided without resorting to outside venting of the dryer. A simple yet efficient condenser makes it possible to maintain continuous circulation of air without interference with proper drying. Power consumption is reduced by subjecting only a portion of the air to the action of the condenser in its circulation through the dryer.

I claim as my invention:

1. In a laundry dryer, in combination, an upright sheet metal partitioning member, an elongated metal strip bent into generally spiral configuration and secured at one edge to one face of said member, a sheet metal cover member secured to the other edge of said strip, said members and said strip defining an air treating chamber comprising a generally circular fan compartment with an elongated passage opening therefrom and spirally coiled about the compartment, said partitioning member having one opening communicating with said compartment and another opening communicating with said passage adjacent the end remote from the compartment, a fan element mounted in said compartment operative to draw air through said one opening and discharge it by way of said passage through said other opening, and a heating element mounted in said passage adjacent said other opening.

2. In a laundry dryer, in combination, an upright sheet metal partitioning member, an elongated metal strip bent into generally spiral configuration and secured at one edge to one face of said member, a sheet metal cover member secured to the other edge of said strip, said members and said strip defining an air treating chamber comprising a generally circular fan compartment with an elongated passage opening therefrom and spirally coiled about the compartment, said partitioning member having one opening communicating with said compartment and another opening communicating with said passage adjacent the end remote from the compartment, a fan element mounted in said compartment operative to draw air through said one opening and discharge it by way of said passage through said other opening, a condenser mounted in said passage adjacent the opening from said compartment, and a heating element mounted in said compartment adjacent said other opening.

3. In a laundry dryer, in combination, an upright sheet metal partitioning member, an elongated metal strip bent into generally spiral configuration and secured at one edge to one face of said member, a sheet metal cover member secured to the other edge of said strip, said members and said strip defining an air treating chamber comprising a generally circular fan compartment with an elongated passage opening therefrom and spirally coiled about the compartment, said partitioning member having one opening communicating with said compartment and another opening communicating with said passage adjacent the end remote from the compartment, a fan element mounted in said compartment operative to draw air through said one opening and discharge it by way of said passage through said other opening, and a corrugated sheet metal strip supported in said passage adjacent its

7

junction with said compartment and in face-to-face contact with the outer wall of the passage, the outer wall of the passage having an opening adjacent the upper end of the corrugated strip for the admission of a stream of water for cooling the strip, said outer wall also having an opening adjacent the lower end of the corrugated strip for the discharge of cooling water and condensate.

4. In a laundry dryer, in combination, a pair of upright flat sheet metal members disposed in spaced parallel relation, an elongated sheet metal strip bent into generally spiral configuration interposed between said members and having its opposite edges secured thereto, said members and said strip defining a generally circular chamber with an elongated passage spirally coiled about it, the inner end of said strip being positioned to define an opening from said compartment to said passage and the other end of the strip being bent over to form the end wall of the passage, one of said members having an air inlet opening into said chamber and an air outlet opening adjacent the end wall of said passage, a transversely corrugated sheet metal strip mounted in face-to-face contact with the portion of said strip defining the outer wall of said passage adjacent the opening from the compartment, and said strip having inlet and discharge openings respectively positioned for directing a stream of cooling water between the upper end of the corrugated strip and the adjacent wall of the passage and for discharging the water adjacent the lower end of the corrugated strip.

5. In a laundry dryer, in combination, an elongated sheet metal strip bent into generally spiral configuration to define a circular compartment opening into an elongated passage spirally coiled about the compartment, sheet metal members secured to opposite edges of said strip to constitute the other walls of the compartment and passage, said strip being transversely slotted to provide for discharge of air into said passage at a point spaced substantially from the junction of the passage with said compartment, one of said members having an inlet opening into said compartment and an outlet opening from said passage, a fan element disposed in said compartment, and bearing means carried by the other of said members rotatably supporting said fan element.

6. A laundry dryer as defined in claim 5 in which a condenser is mounted in the passage between the junction of the passage with the compartment and the slot in the common wall between the passage and the compartment.

7. In a laundry dryer, in combination, an upright sheet metal partitioning member, an elongated metal strip bent into generally spiral configuration and secured at one edge to one face of said member, a sheet metal cover member secured to the other edge of said strip, said members and said strip defining an air treating chamber comprising a generally circular fan compartment with an elongated passage opening therefrom and spirally coiled about the compartment, said partitioning member having one opening communicating with said compartment and another opening communicating with said passage adjacent the end remote from the compartment, a fan element mounted in said compartment operative to draw air through said one opening and discharge it by way of said passage through said other opening, said strip having a transverse slot in the portion separating said compartment from said passage positioned to by-pass a portion of the circulating air from the compartment to the passage adjacent said other opening.

8. In a dryer having a generally cylindrical drying chamber, a wall member adjacent one end of said chamber having a first opening coaxially aligned with the chamber and a second opening spaced laterally of said first opening, means coacting with said wall member to define a generally spiral passage connecting said two openings, a heating element mounted in said passage adjacent said second opening, a condenser mounted in said

8

passage and spaced from said heating element, and blower means mounted adjacent said first opening operative to draw air from the chamber through said first opening, said air returning to the chamber through said second opening, said passage being formed to direct a portion of the incoming air around said condenser and directly to said heating element.

9. In a dryer having a drying chamber closed at one end by a sheet metal wall having spaced openings communicating with the chamber, a sheet metal strip secured to said wall and defining a generally spiral passage connecting said openings, a blower mounted adjacent one opening operative to circulate air through the chamber and passage, a corrugated sheet metal strip disposed adjacent the inner face of said passage intermediate said openings, and means for directing a flow of cold water between said corrugated strip and the adjacent wall of the passage to condition the corrugated strip for condensing moisture from the circulating air, said strip having an opening disposed adjacent the lowest portion of the passage and constituting an outlet for the water.

10. In a laundry dryer, in combination, a cylindrical drum having an end wall formed to provide a shallow cylindrical recess coaxial with the drum, and a lint trap mounted in said recess comprising a generally cylindrical metal plate having a narrow internal flange dimensioned to fit within said recess, a resilient gasket on said flange operative to effect sealing engagement with the end wall of the drum and to retain the plate in closed relation to the recess, a cup-shaped element of fine meshed wire fabric, and a resilient ring mounted on the edge of said element and adapted to fit tightly within the flange of said plate to secure the element to the plate, said plate and the end wall of the drum within said recess being perforated to permit flow of air from the drum through the lint trap.

11. In a clothes dryer, in combination, a cylindrical tumbling drum having an imperforate peripheral wall, a front end wall formed with a central access opening and a perforated rear wall, a boss formed in said rear end wall concentric with the axis of the drum defining a shallow cylindrical recess opening into the drum, a bearing secured to said boss externally of the drum, a shaft extending through said bearing and into the drum for supporting the drum, a lint screening device mounted in said recess, and a nut threaded on said shaft for retaining said device in place.

12. In a clothes dryer, in combination, a cylindrical tumbling drum having an imperforate peripheral wall, a front end wall formed with a central access opening and a perforated rear wall, a boss formed in said rear end wall concentric with the axis of the drum defining a shallow cylindrical recess opening into the drum, a lint screening device removably mounted in said recess, and a perforated cover plate removably mounted in said recess between said screening device and the interior of the drum.

13. In a laundry dryer, in combination, a sheet metal member forming one wall of a drying chamber, said wall member having a generally circular opening to the chamber, a cylindrical drum supported for rotation in said chamber and having one end offset to extend into said opening in the wall member, a rotatably supported shaft extending axially through said opening and operatively connected with said one end of the drum, a sheet metal strip affixed to said wall member externally of the chamber defining a spiral passage centered about said opening, the offset portion of said drum having a series of openings affording communication between the interior of the drum and said passage, a fan mounted on and driven by said shaft to draw air from the chamber into said passage, said passage having an outlet through said wall member for discharging air into said chamber adjacent the periphery of said drum, and a cup shaped screen element mounted in the offset at said one end of

the drum recess, said screen element being operative to trap lint entrained in the air drawn from said drum into said passage.

References Cited in the file of this patent

UNITED STATES PATENTS

1,358,599	White	Nov. 9, 1920
1,981,234	Hetzer	Nov. 20, 1934
2,521,712	Geldhof	Sept. 12, 1950
2,635,354	Geldhof et al.	Apr. 21, 1953
2,645,033	Kling et al.	July 14, 1953
2,648,142	Shapter	Aug. 11, 1953

8

10

2,676,418
2,689,413
2,712,182
2,722,751
2,724,906
2,774,148
2,798,306
2,828,550
2,828,551

1,028,699

Shewmon	Apr. 27, 1954
Kachuck	Sept. 21, 1954
Vetorino	July 5, 1955
Steward	Nov. 8, 1955
Pfleider	Nov. 29, 1955
Worth	Dec. 18, 1956
Reiter	July 9, 1957
Geldhof	Apr. 1, 1958
Conlee	Apr. 1, 1958

FOREIGN PATENTS

France	May 27, 1953
--------	--------------