

March 25, 1952

A. R. CONSTANTINE

2,590,295

CLOTHES DRIER

Filed Jan. 23, 1948

7 Sheets-Sheet 1

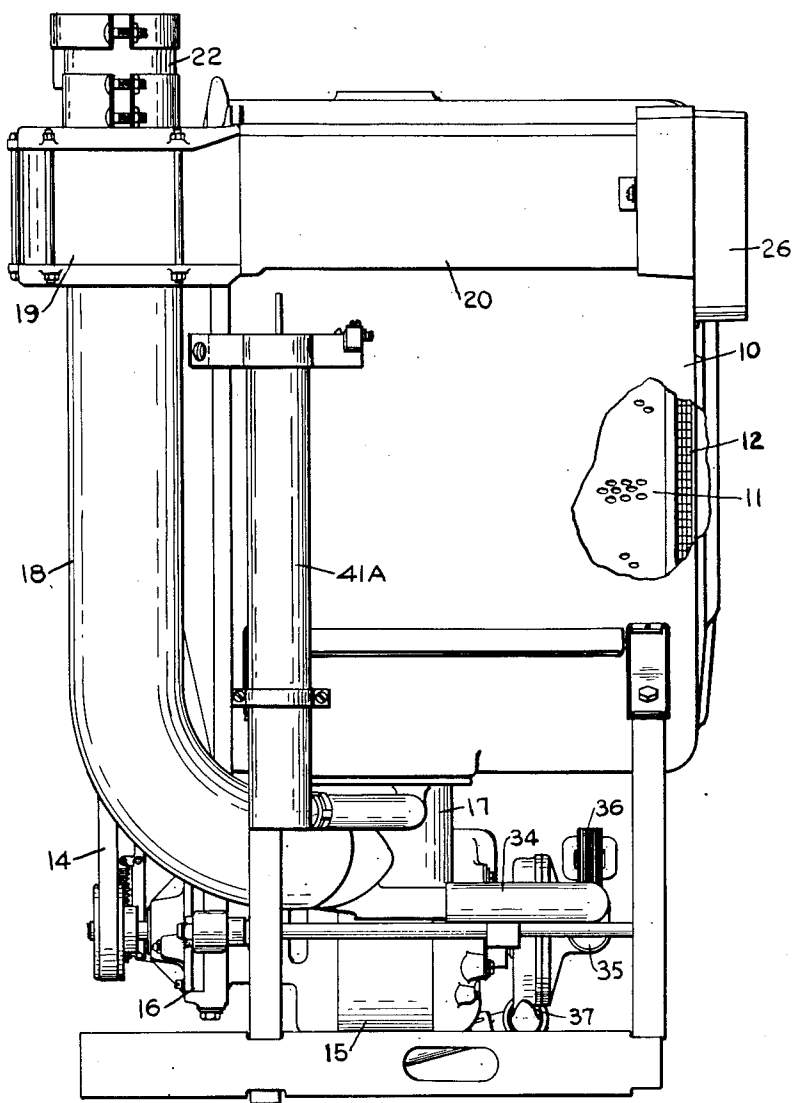


Fig. 1.

INVENTOR.
ARTHUR R. CONSTANTINE.

BY *M. W. Green*
ATTORNEY.

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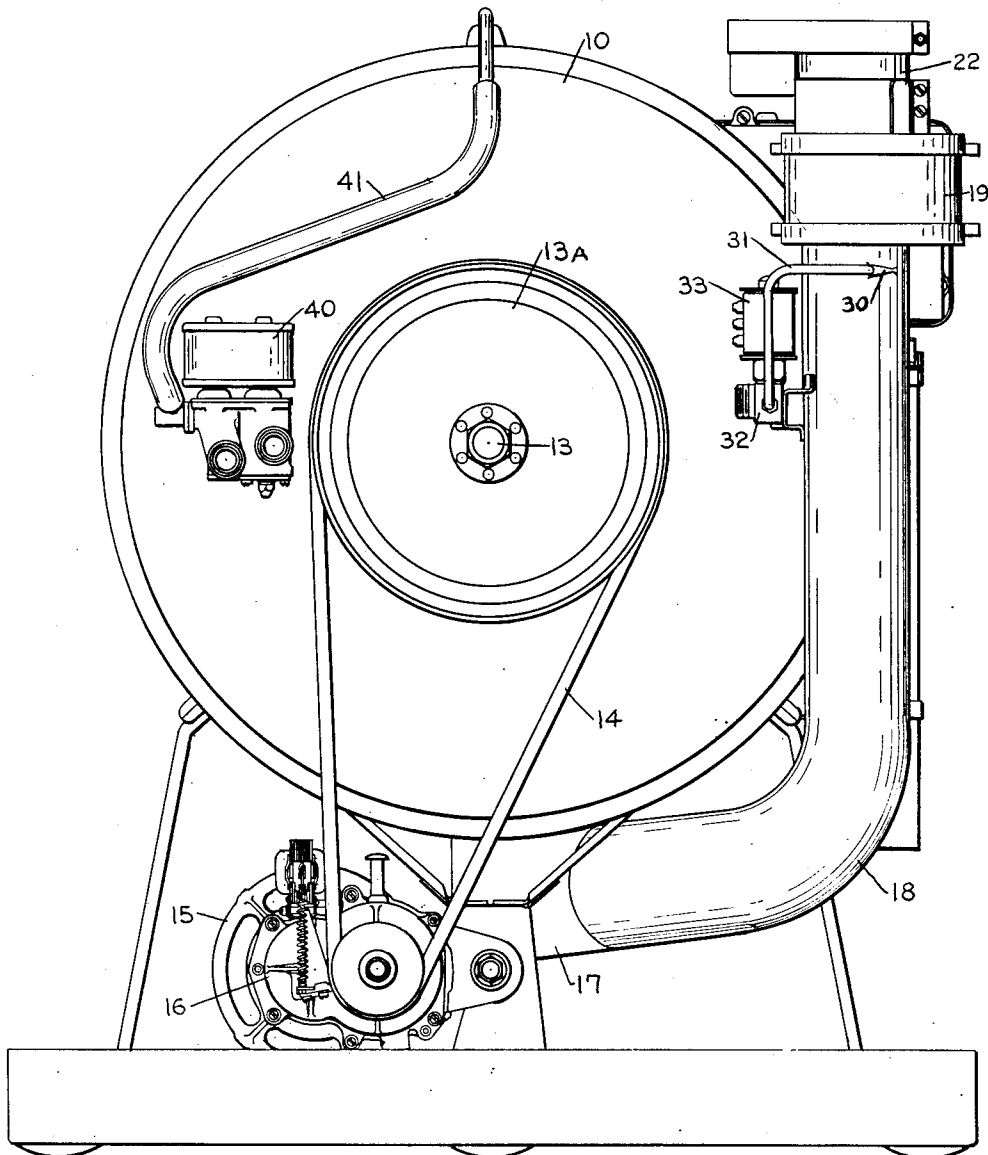


Fig. 2.

INVENTOR.
ARTHUR R. CONSTANTINE
BY *M. H. Green*
ATTORNEY

March 25, 1952

A. R. CONSTANTINE
CLOTHES DRIER

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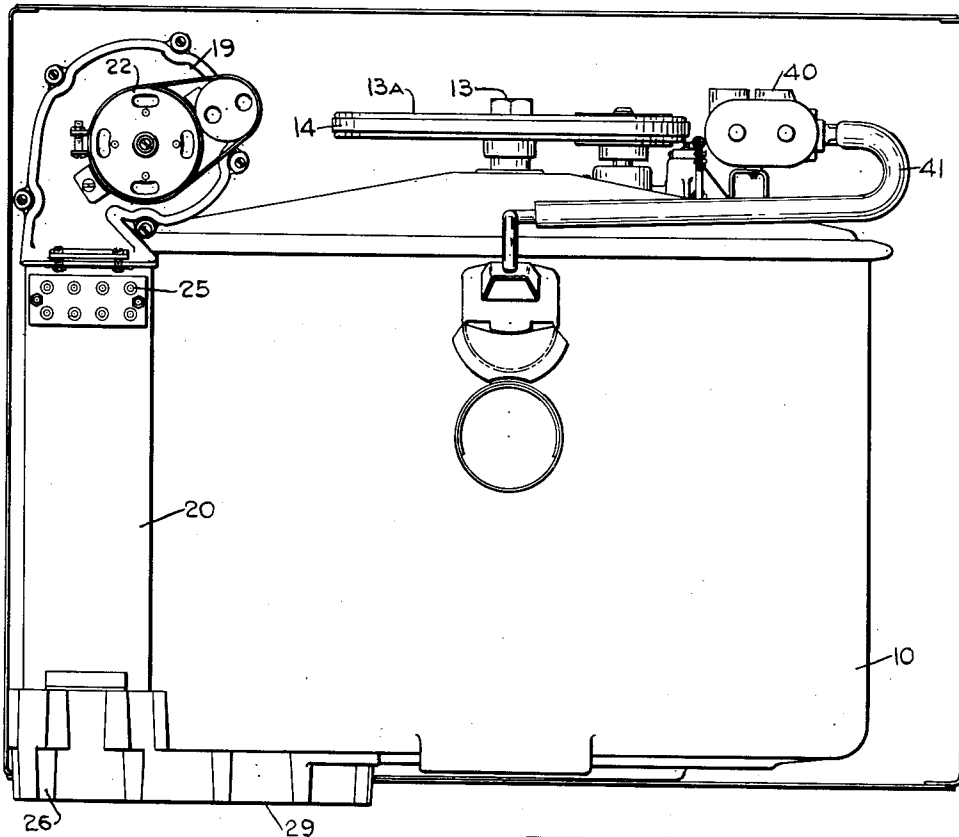


Fig. 4.

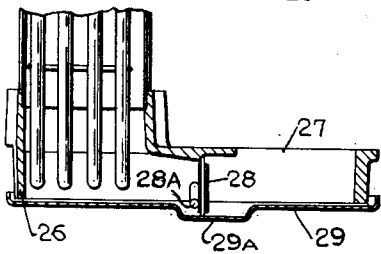


Fig. 5.

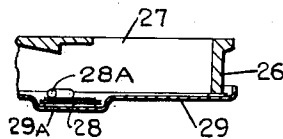


Fig. 6.

INVENTOR.
ARTHUR R. CONSTANTINE.
BY *M. W. Green*
ATTORNEY.

March 25, 1952

A. R. CONSTANTINE

2,590,295

CLOTHES DRIER

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7 Sheets-Sheet 5

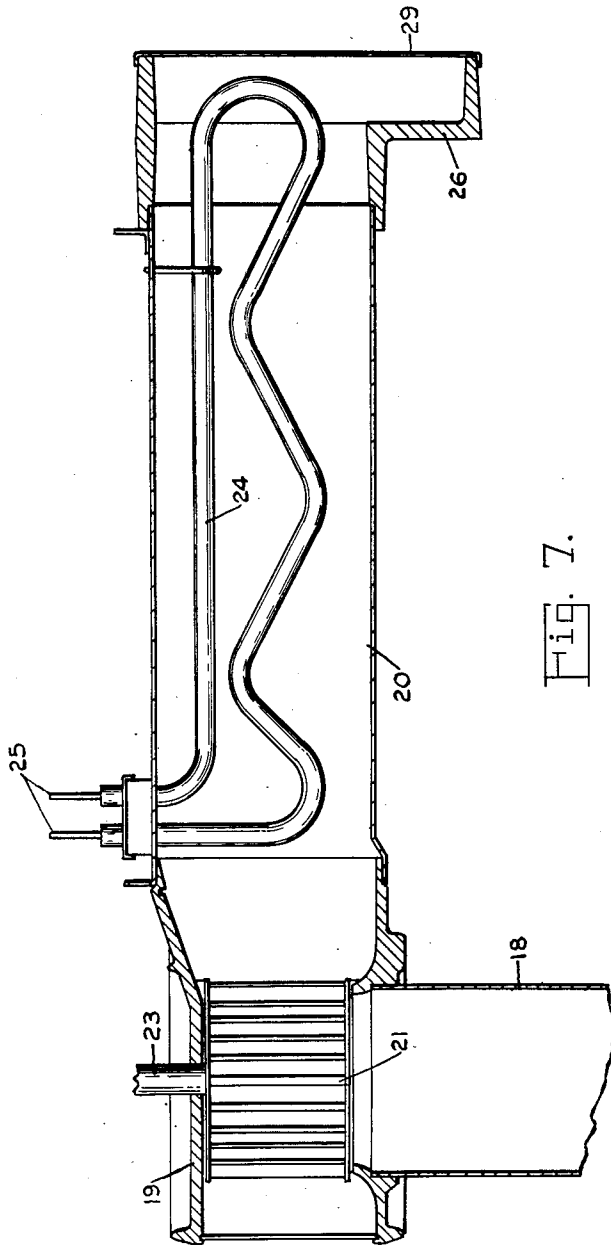


Fig. 7.

INVENTOR.
ARTHUR R. CONSTANTINE.
BY *M. W. Green*
ATTORNEY.

March 25, 1952

A. R. CONSTANTINE

2,590,295

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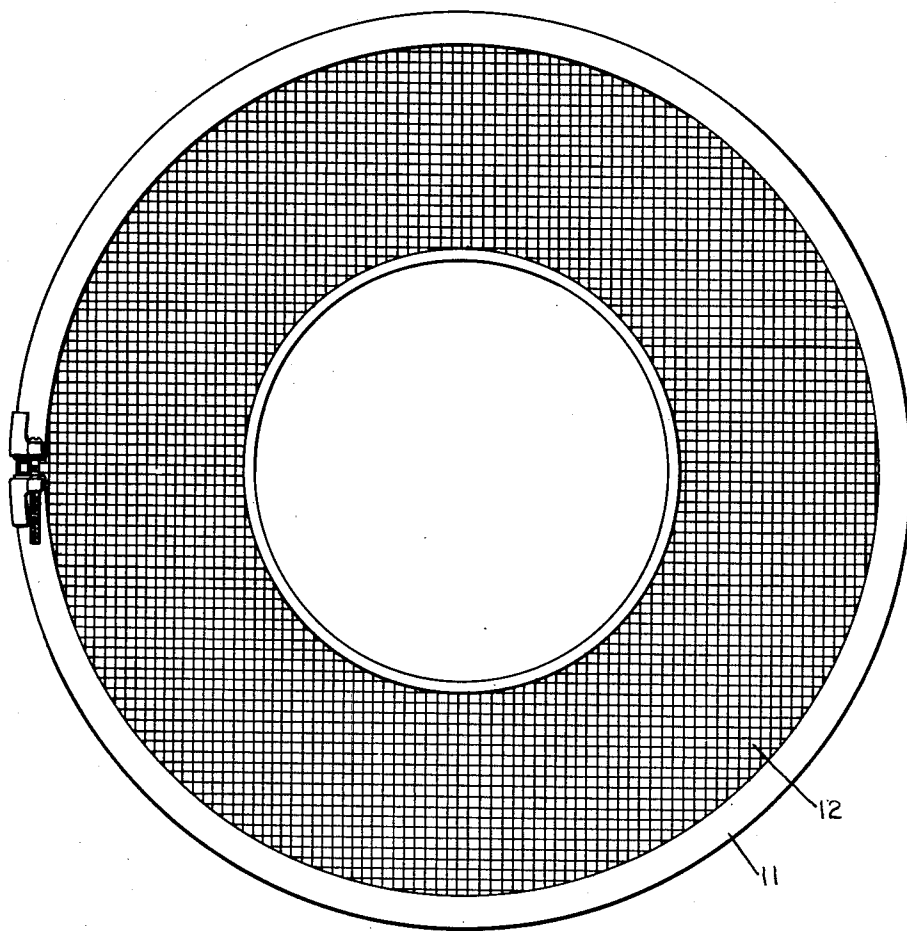


Fig. 8.

INVENTOR.
ARTHUR R. CONSTANTINE.
BY *M. W. Greer*
ATTORNEY.

March 25, 1952

A. R. CONSTANTINE
CLOTHES DRIER

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7 Sheets-Sheet 7

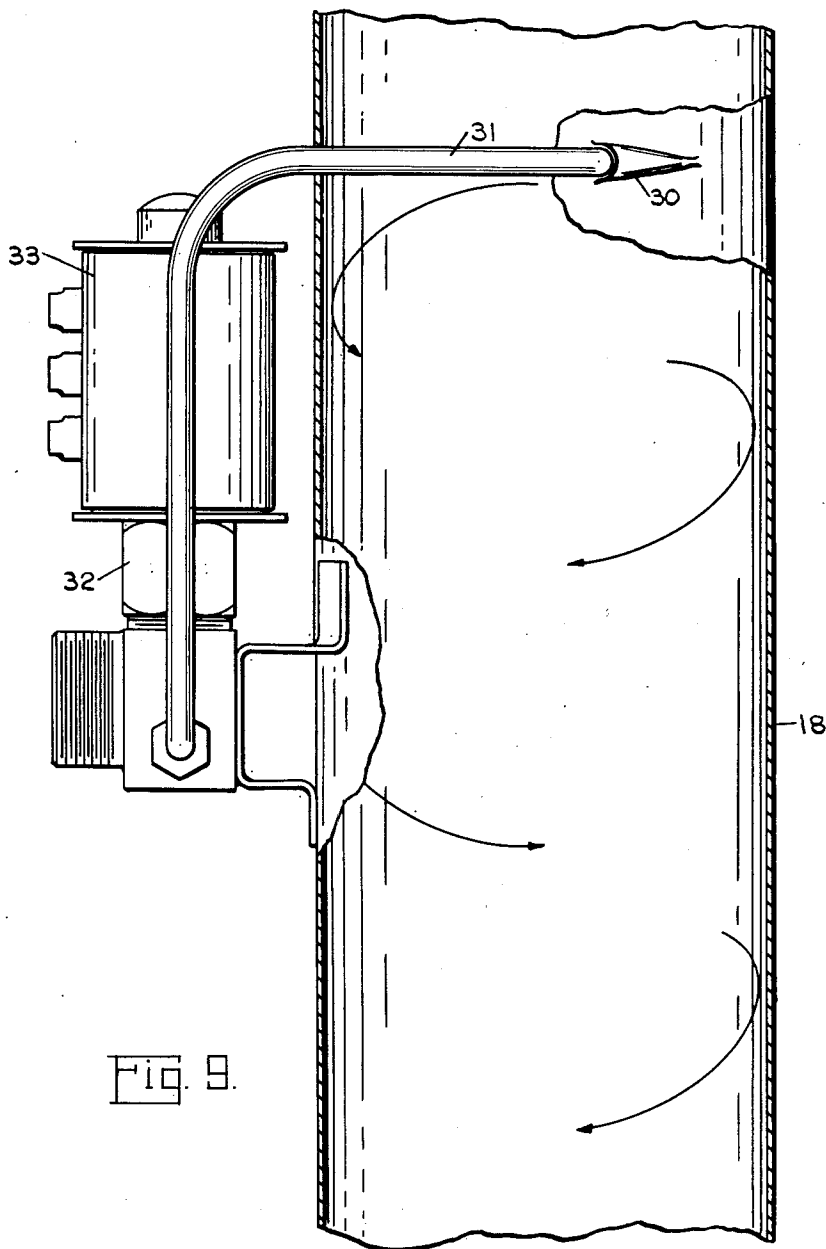


FIG. 9.

INVENTOR.
ARTHUR R. CONSTANTINE,
BY *M. W. Green*
ATTORNEY.

UNITED STATES PATENT OFFICE

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CLOTHES DRIER

Arthur R. Constantine, South Bend, Ind., assignor, by mesne assignments, to Avco Manufacturing Corporation, New York, N. Y., a corporation of Delaware

Application January 23, 1948, Serial No. 3,999

1 Claim. (Cl. 34—75)

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This invention relates generally to mechanism for drying of clothing and other fabrics and is described herein as a drying mechanism capable of drying clothes in the same unit in which they were washed.

It is the primary object of this invention to provide a laundry drying machine with a system for circulating heated air through the tub of the machine in order to effect the drying of the clothes contained in the tub and providing also for condensing moisture and the carrying away of lint from the machine without exhausting moisture and lint into the atmosphere of the room.

It is a further object to provide a machine which is operable separately either as a washing machine or as a drying machine, or which may be used in its combined form to wash and then dry a tub full of clothing.

Another object is to provide a laundry drying machine with a heating element to heat the air in a circulating conduit which air is then circulated through the tub of the machine in order to dry the clothing contained therein and subsequently carried through a condensing portion of the circulating conduit, a circulating element being located between the condensing portion and the heating element portion of the conduit.

Still a further object is to provide a system for condensing moisture and removing lint from the air in the circulatory system of a clothes dryer by exposing the circulating air to a film of water carried on the inner surface of a portion of the circulating conduit.

These and other objects and features of this invention will appear more fully in the detailed description and in the drawings forming a part hereof and wherein:

Figure 1 is a side view of a machine employing the mechanism for drying according to the present invention.

Figure 2 is a rear view of the machine shown in Figure 1.

Figure 3 is a front view of the same machine as shown in Figure 1.

Figure 4 is a top view of the machine.

Figure 5 is a section through the air inlet to the tub with the closure for the opening in position.

Figure 6 is a section showing the opening to the tub with the closure in open position.

Figure 7 is a section through the heater and air conduit above the tub.

Figure 8 is a front view of the clothes cylinder

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showing the screened opening to allow entry of air into the clothes cylinder.

Figure 9 is a section and view showing the condenser tube.

Referring to the drawings, a tub 10 has a clothes cylinder 11 mounted for rotation therein. In this case the clothes cylinder 11 has a perforated outer periphery and a screened or perforated front wall 12 which will allow air to enter therein. The clothes cylinder 11 is mounted for rotation and is supported from its back wall within the tub by means of a shaft 13, and rotated by pulley 13A, belt 14, electric motor 15 and transmission 16. The bottom of the tub is provided with an opening which leads to a sump 17 which connects with a tube 18 of relatively large diameter which is capable of carrying air and which is herein described as a condenser tube 18. The tube 18 is curved from the bottom of the sump 17 in a generally vertical direction and is mounted at the rear of the tub and its top end connects with a central inlet portion of a centrifugal type blower housing 19. Shown particularly in the top view in Figure 4, the blower housing 19 has a tangential outlet into a horizontally positioned conduit 20, the blower inlet and outlet thereby effecting a right angle turn in the path of air travel from the vertical tube 18, Figure 1, to the horizontal conduit 20. The cross section Figure 7 shows the blower housing 19, conduit 20 and a blower wheel 21. This blower wheel 21 is rotated by an electric motor 22, Figures 1, 2, 4, positioned above the blower wheel and driven through a shaft 23. The horizontally positioned conduit 20 has a plurality of electric heating elements 24 supported therein, electrical connections 25 for such heating elements being positioned on the outside of the conduit 20 as shown in Figure 7 and Figure 4. The conduit 20 connects with a connector casting 26 at the front of the machine and the passage is formed around the end of the tub 10 into an inlet opening 27, Figure 5, which is positioned in the front wall of the tub 10 and opens on and into the screened front wall 12 of the clothes cylinder 11. Thus if air is forced by the blower 21 and is carried past the heating element 24 it will be forced into the tub 10 and through the screened front wall 12 of cylinder 11 and onto the clothes to be dried which are tumbling in cylinder 11 during its rotation. As shown by reference to Figures 1 and 2, the vertical condensing tube portion 18 and the horizontal heater conduit portion 20 are connected by the blower housing 19. The

blower housing 19 is of the usual centrifugal type with inlet at the center and with tangential outlet as shown in Figure 4. The arrangement for connection of the vertical tube 18 and the horizontal conduit 20 at substantially right angles to each other is such that the top of conduit 18 connects to the center inlet portion of the housing 19 and the horizontal conduit 20 connects to the tangential outlet of the housing 19 and thus effects the 90° turn in the direction of the air flow. The necessary 90° turn in the conduit system to fit the conduit to the tub is thus accomplished through the blower housing, making it unnecessary to provide this change in direction of flow by special means which would require curved tube sections or other special arrangements requiring extra space and complication of construction with added resistance to air flow.

It may be desirable to provide a means for closing the opening 27 when the machine is used for washing and this may be accomplished as shown in Figures 5 and 6 by means of a hinged door 28 which is integral with a shaft 28A extending through the casting 26 and moveable by a handle 28B. Figure 5 shows the hinged door 28 in a position closing off the conduit 20 and connector casting 26 from the opening 27 into the tub 10 thus preventing washwater from entering conduit 20 during washing operation. Figure 6 shows the door 28 in the open position for drying operation. In order that the door 28 in its open position will not interfere with the free passage of air through connector casting 26, a cover 29 on the connector casting is provided with a depression 29a into which the door 28 fits when in the open position shown in Figure 6. The operation of door 28 may be manual or by suitable automatic mechanical means as desired. With door 28 open there is provision for circulation of air from the bottom of the tub 10 through the sump 17 upward through the condenser tube 18, through the blower wheel 21, through the conduit 20 and over the heating elements 24, through the casting 26 from outlet 27 into the cylinder 11 as previously mentioned.

Near the top of the vertical tube 18 an opening 30 is provided into which a relatively small water tube 31, Figure 9, is inserted, the tube 31 being fed from a water valve 32 connected to water supply under pressure, the valve 32 being preferably of the solenoid operated type as shown, the solenoid being shown at 33 in Figures 9 and 2. As shown particularly in Figure 9 the direction of the inlet 30 and the tube 31 relative to the wall of the condenser tube 18 is such as to cause water to flow around and down the inside of the tube 18, the water flow direction being substantially tangent to the inner wall of tube 18. Thus the water will descend by gravity in the tube 18 following generally the inner wall thereof covering the wall in a thin film or sheet until it reaches the sump 17. As shown in Figure 3 there is a drain 34 which is controlled by drain valve 35 operated by solenoid 36 which on opening of the drain valve 35 will allow the liquid to flow into a continuously rotating pump 37. Thus water injected into the tube 18 and falling by gravity around the inner surface of the tube 18 will eventually be carried out and pumped out the drain by the action of the drain pump 37.

In the operation of the machine the clothes to be dried are carried in the clothes cylinder 11. The clothes may be inserted in the front of the machine through a door opening 38. The machine shown, although it may operate separately

as a dryer, may also be a combination washer and dryer. The drying operation is herein under consideration and the clothes are assumed to be in the condition they normally assume after washing is completed, that is with approximately equal their weight in contained water. The motor 15 is assumed to be in operation to rotate the cylinder 11 at tumbling speed through transmission 16, belt 14 and pulley 13. Suitable electrical circuits actuate the heating elements 24 and also, with electrical current supplied, the motor 22 is in rotation to cause the blower wheel 21 to rotate and thereby set up a circulation of air which passes over the heating elements 24, out the opening 27, and onto the tumbling clothes in the clothes cylinder 11 thereby taking up moisture therefrom. The moisture saturated air then passes out the sump 17 and into the condenser tube 18 and again into the blower 21 and over the heating elements 24 once again. The heated air will take up moisture from the clothes as they tumble by rotation of the clothes cylinder, and after the heated air passes over the clothes, as above described, the air is forced upward through the condenser tube 18. The solenoid 33 is actuated continuously during drying and the water from the tube 31 forms a film on the inner surface of the tube 18 as it travels downward leaving room for passage of air in the center of the tube 18 in an upward direction at the same time that the water is traveling downward. Thus the cooling effect of the water will condense moisture from the vapor laden air coming into tube 18 from the tub 10 and the water film will also take up lint particles which are carried in the air and these lint particles with the condensed moisture will be carried away by the film of water in the condenser tube 18, the water being pumped away from the sump 17 by the pump 37.

Air circulating through the condensing portion of the tube 18 is carried into the heating portion 20 by the blower wheel 21 which is here shown as positioned between the vertical condensing portion of the conduit 18 and the horizontal heating portion of the conduit 20. As mentioned, the horizontal heating portion 20 of the conduit connects directly with the front inlet 27 which inlet is directly in front of the open screened front wall 12 of the rotatable clothes cylinder 11.

The vapor laden air which is drawn from the bottom of the tub through the sump 17 and into the vertical condensing tube 18 will have a major portion of its vapor removed therefrom inasmuch as the film of water on the inner wall of tube 18 is a condensing medium. The central portion of the tube also carries vapor laden air and all of the air flowing in tube 18 is reduced in temperature and because of the drop in temperature the ability of the air to retain moisture is reduced and condensation results. Because of the recirculation forced by continuous operation, the air, having a large portion of the vapor removed therefrom is again heated in the heating region 20 after passing through the blower wheel 21 and thus enabled to take up moisture again as it flows into the clothes cylinder 11.

The collection and carrying away of lint with the condensing water in tube 18 is a major and important feature of the arrangement as the problem of lint disposal is a major one in any clothes dryer. Although the description herein has been confined to the portion of the machine necessary to provide operation as a dryer, the arrangement is particularly adaptable for use as the drying mechanism portion of a combined

washer and dryer, and the mechanism shown includes the tub 10 and the cylinder 11 of a type which may be used in a washing machine of the horizontal axis type. Also the driving motor 15 as shown herein is preferably provided with two speed transmission 16, as previously mentioned. This transmission disclosed herein employs two speeds, one speed for washing and tumble drying, and another higher speed for centrifugal extraction of water following normal washing operation prior to the drying procedure mentioned in this description. The washing machine tub 10 shown is also provided with a water mixing valve 40, a water inlet tube 41 and a float chamber 41A with a suitable switch mounted thereon for controlling liquid level in the tub 10, which are a part of the washing machine apparatus and as such do not form a part of the specific dryer combination disclosed herein. The sump 17 may serve the dual purpose of the sump for the dryer, to carry away condensing water with lint and also serves as the sump for the washing machine. The drain connection and drain valve, and drain pump previously mentioned may be used in the washing operation to carry away the wash water and in the dryer operation to carry away the condensing water.

Suitable automatic controls, or if desired manual controls closing electrical circuits may be used to operate the mechanism shown in this disclosure. The primary purpose of the disclosure however, is not to show automatic operation, but to show the structure and arrangement, together with the operation of the drying mechanism which, it is assumed, is put in operation by provision of suitable electrical connections to the several units to place them in operation for drying: including the driving motor 15, the condensing water solenoid 33, the air circulation motor 22, the electrical heating coils 24 and the drain valve solenoid 36.

It is therefore apparent that although the dryer mechanism has been disclosed as a specific type of machine found practical in operation it is not intended to limit the scope of the invention to the specific embodiment shown herein, or otherwise than by the terms of the appended claim.

I claim:

In a dryer, the combination of a chamber including a cylindrical tub and a rotatable perforate inner clothes tumbling member, said tub having an outlet near the bottom thereof, a conduit communicating with said outlet and having a substantially vertical and elongated cylindrical portion extending outside of said tub from said outlet to a position adjacent the top portion of said tub, water inlet means positioned at said top portion to inject water tangentially onto the inner surface of said vertical portion, a transverse conduit interconnected with said top portion, a heating chamber in said transverse conduit communicating with the interior of said tub and the top of said vertical portion, and air circulating means located between said top portion and said transverse conduit, said circulating means circulating air from said tub outlet through said vertical portion and said heating chamber and thence back into said tub, whereby moisture may be condensed from and lint may be collected from air circulating in said vertical portion of said conduit by contact with the water cooled inner surface thereof.

ARTHUR R. CONSTANTINE.

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