Dec. 30, 1958 P. E. GELDHOF 2,866,273

CONDENSER PARTICULARLY ADAPTED FOR CLOTHES DRIERS AND THE LIKE

Filed Nov. 13, 1953 6 Sheets-Sheet 1

Fig. 1

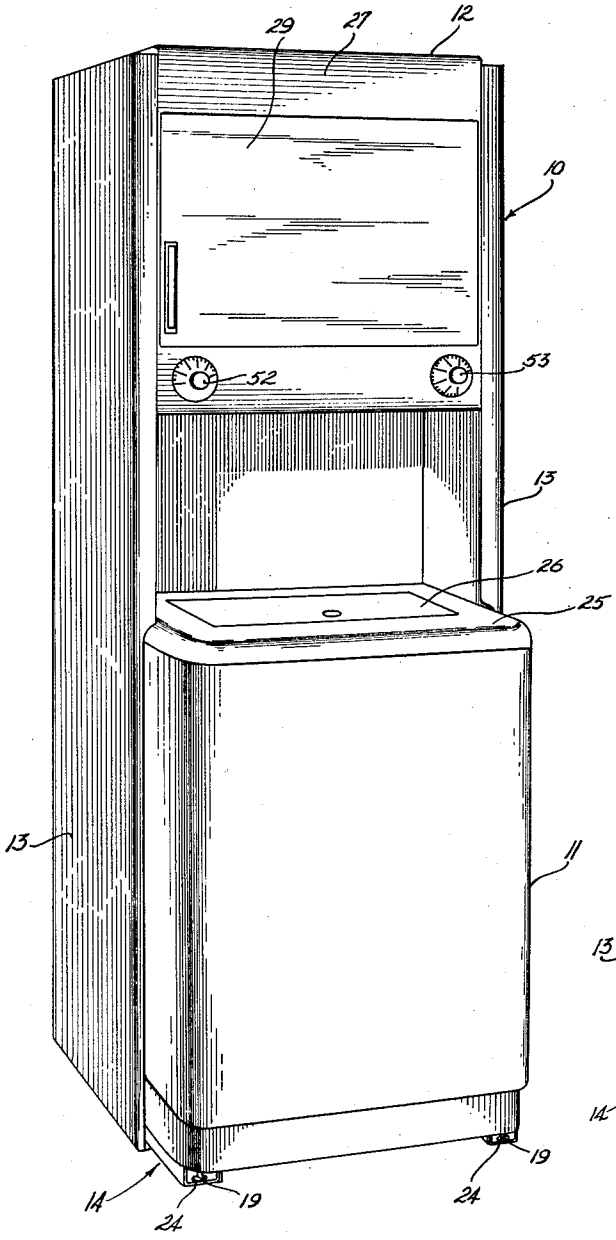


Fig. 2

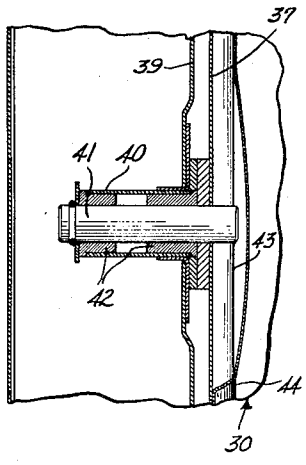
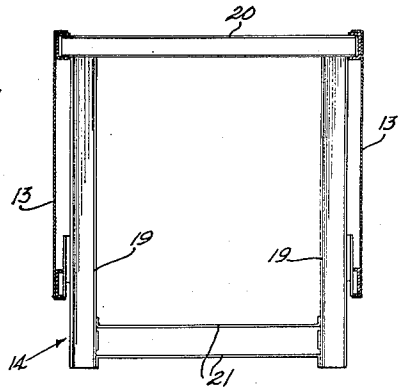


Fig. 9



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by Attys.

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CONDENSER PARTICULARLY ADAPTED FOR CLOTHES DRIERS AND THE LIKE

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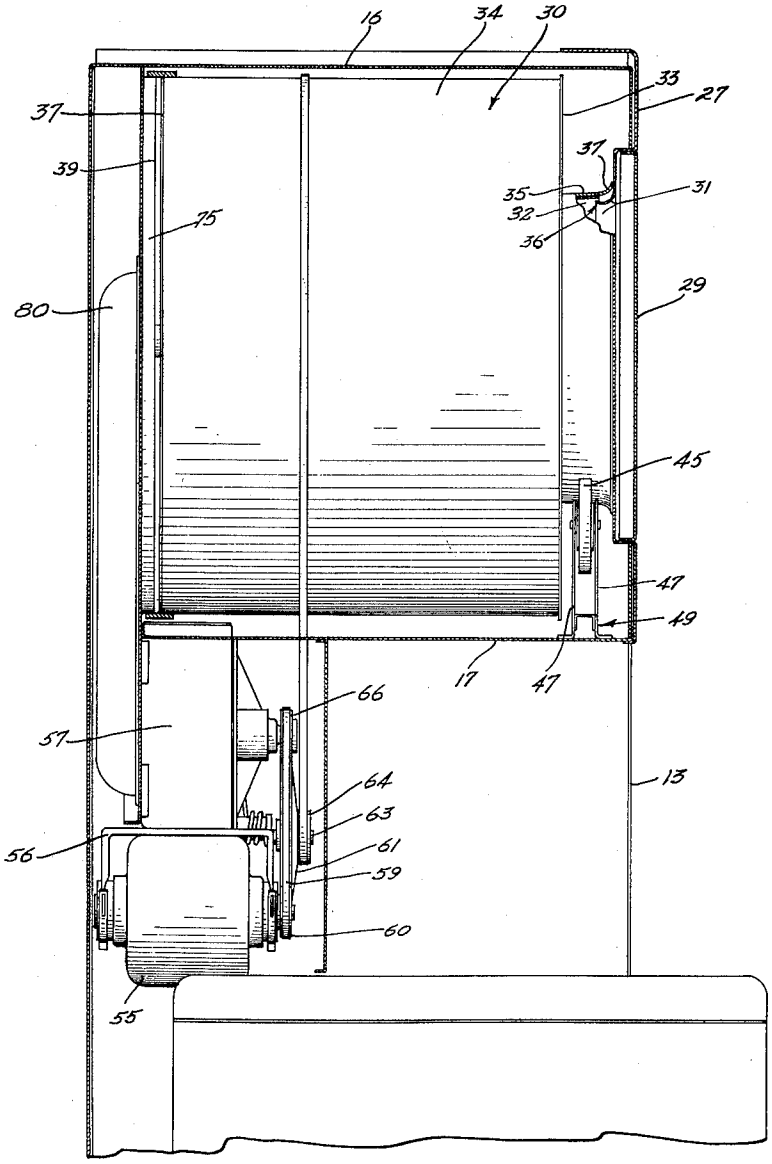
Fig. 3



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Dec. 30, 1958 P. E. GELDHOF 2,866,273

CONDENSER PARTICULARLY ADAPTED FOR CLOTHES DRIERS AND THE LIKE

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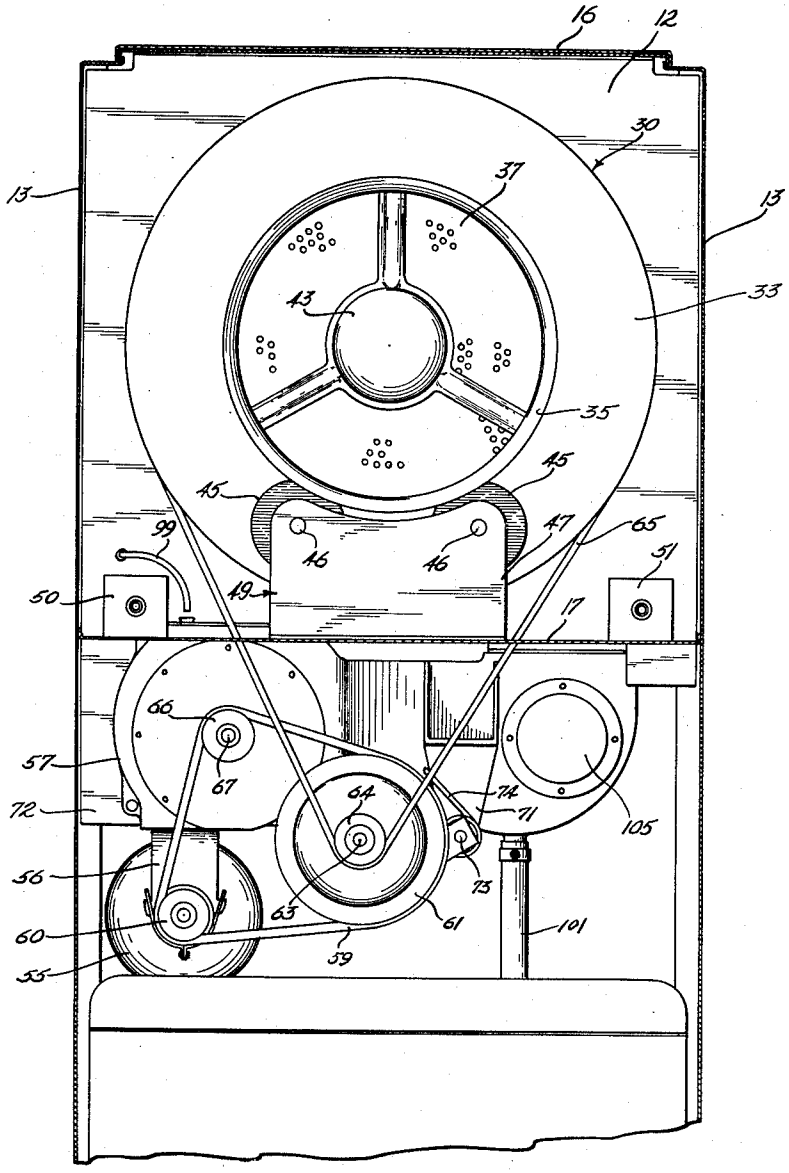
Fig. 4



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CONDENSER PARTICULARLY ADAPTED FOR CLOTHES DRIERS AND THE LIKE

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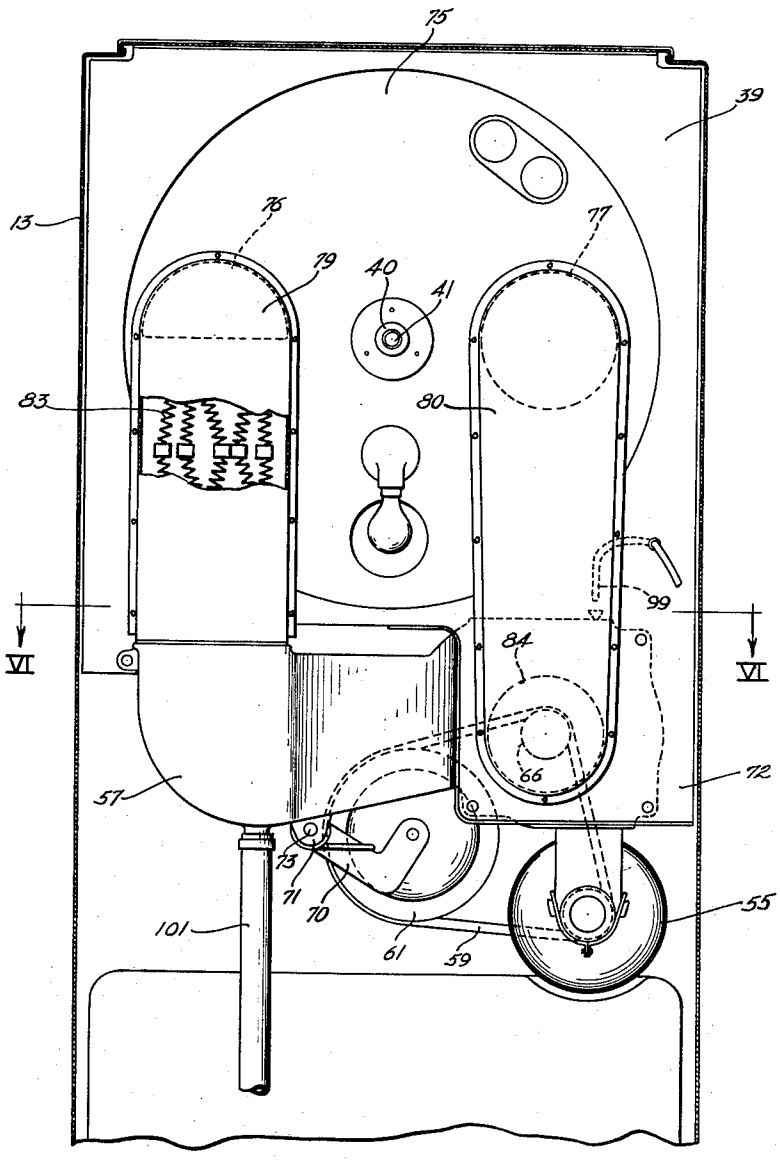
Fig. 5



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CONDENSER PARTICULARLY ADAPTED FOR CLOTHES DRIERS AND THE LIKE

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Fig. 6

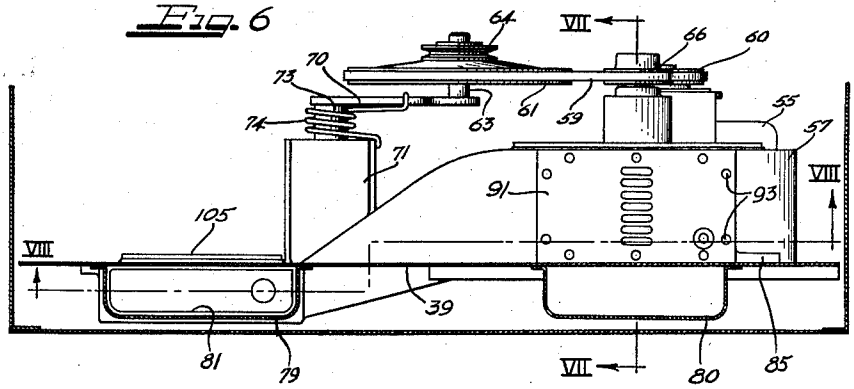
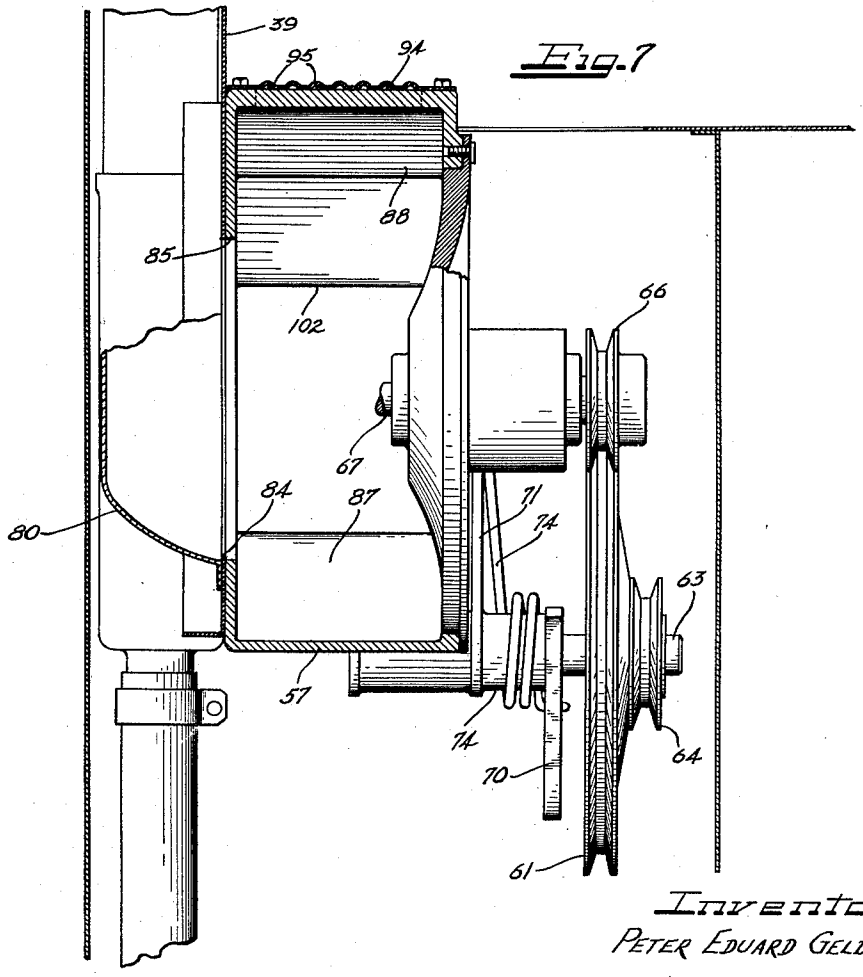


Fig. 7



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Dec. 30, 1958 P. E. GELDHOF 2,866,273

CONDENSER PARTICULARLY ADAPTED FOR CLOTHES DRIERS AND THE LIKE

Filed Nov. 13, 1953 6 Sheets-Sheet 6

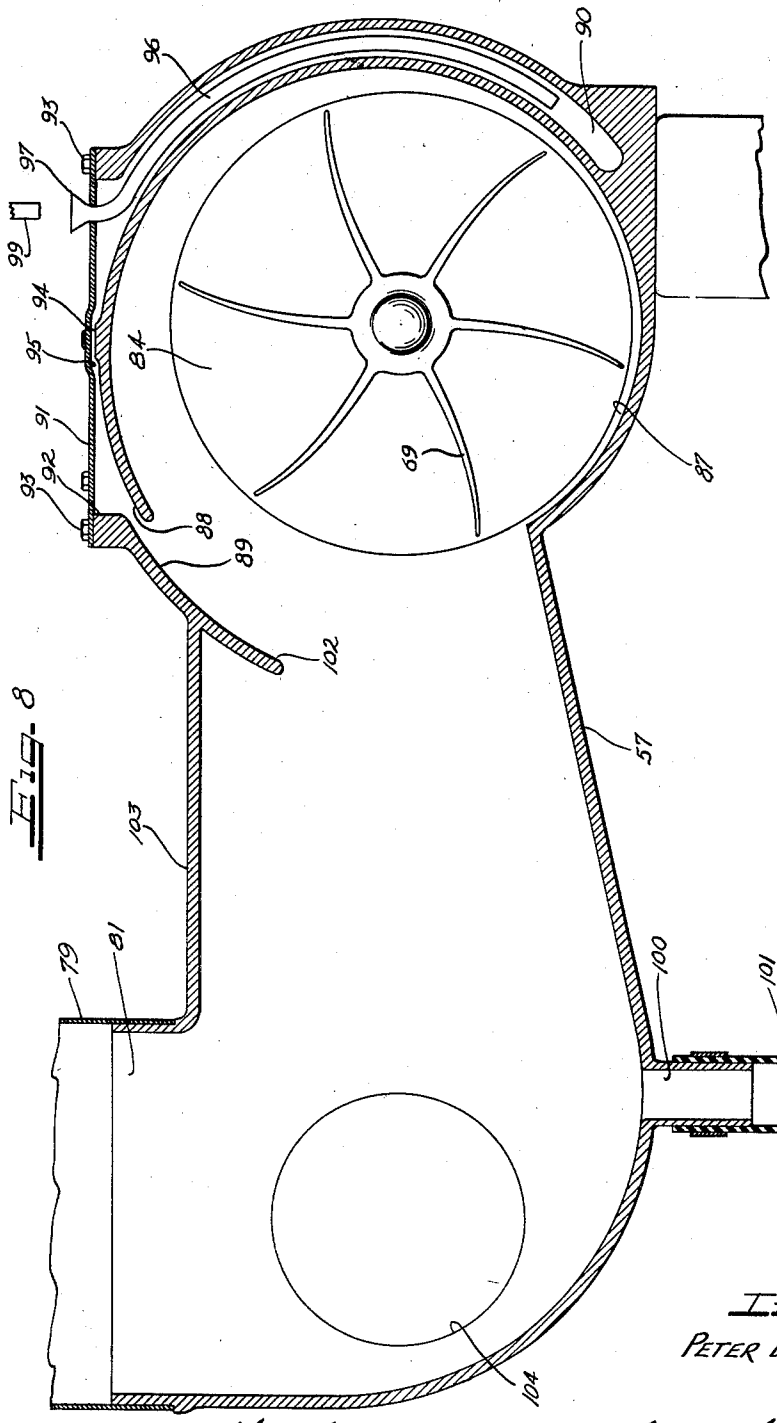

Fig. 8

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United States Patent Office 2,866,273 Patented Dec. 30, 1958

2,866,273

CONDENSER PARTICULARLY ADAPTED FOR CLOTHES DRIERS AND THE LIKE

Peter Eduard Geldhof, Benton Harbor, Mich., assignor, by mesne assignments, to Whirlpool Corporation, a corporation of Delaware

Application November 13, 1953, Serial No. 391,873

10 Claims. (Cl. 34—75)

This invention relates to improvements in laundry condenser particularly adapted for clothes driers and the like.

A principal object of the invention is to provide a simple and efficient condenser for dehumidifying and removing lint from the spent air of a clothes drier and the like.

A further object of my invention is to provide a simplified form of drying machine in which the air is circulated into and out of the drier drum through intake and exhaust ducts, and in which a separate duct having a single blower therein connects the two ducts together for establishing a closed air circulating circuit therein, and has a water screen extending thereacross for condensing spent air.

Still another object of my invention is to provide a new and improved clothes drying machine in which condensation of the spent air is effected by a screen of water circulated by the blower, establishing a circulation of air through the machine.

A still further object of my invention is to provide a novel and improved from of condenser for clothes drying machines of a simplified construction, in which condensing water is drawn by the circulating blower for the machine over the scroll therefor in the form of a cold water screen through which the circulating air passes for condensing the same for draining through the bottom of the condensing duct.

A still further object of my invention is to provide a simplified and improved form of clothes dryer adapted for association with a washing machine, in which heated air is circulated through the drying drum by means of a single suction blower, which also serves to draw a screen of condensing coolant in the path of the air exhausted from the drying drum.

These and other objects of my invention will appear from time to time as the following specification proceeds and with reference to the accompanying drawings wherein:

Figure 1 is a perspective view of a laundry machine constructed in accordance with my invention;

Figure 2 is a fragmentary vertical sectional view taken through the support for the drier drum of the machine shown in Figure 1, showing the bearing support for the shaft therefor;

Figure 3 is a transverse sectional view taken through the portion of the cabinet enclosing the drier drum and drive mechanism therefor, and showing the drier drum drive therefor in side elevation.

Figure 4 is a fragmentary front end view of the upper portion of the machine, with the front wall for the dryer removed, in order to show the support for the front of the dryer drum, and the drive therefor;

Figure 5 is a rear end view of the machine shown in Figure 1 with the rear cover therefor removed;

Figure 6 is a horizontal sectional view taken substantially along line 6—6 of Figure 5;

Figure 7 is a transverse sectional view taken substantially along line 7—7 of Figure 6;

Figure 8 is a sectional view taken substantially along line 8—8 of Figure 6; and

Figure 9 is a horizontal sectional view taken through the cabinet adjacent its base.

In the embodiment of my invention illustrated in the drawings, I have shown a laundry machine comprising a cabinet 10 for two vertically spaced laundry compartments 11 and 12, the lower compartment 11 being shown as a washing compartment, and the upper compartment 12 being shown as a drying compartment.

The cabinet 10 is shown as comprising two parallel side walls 13—13 extending upwardly from a base 14 along the outer sides of the washing compartment 11 and forming the side walls of the drying compartment 12. The side walls 13—13 are shown in Figures 3 and 4 as being connected together at their upper ends by a top wall 16 forming the top of the drying compartment 12 and as being connected together intermediate their ends by a wall 17, forming the bottom of the drying compartment.

The base 14 as shown in Figure 9 as comprising two parallel spaced slide rails 19—19 forming a slidable support for the washing machine 11, and extending beyond the forward end of the side walls 13—13, to accommodate the washing compartment to extend beyond the forward ends of said side walls. The slide rails 19—19 are shown as extending forwardly from a transverse channel 20 extending along the rear of the base 14 and forming the rear margin thereof, and as being connected together adjacent their forward ends by transverse braces 21—21.

The slide rails 19—19 are shown as being upwardly facing channels resting on the ground, the space between said flanges of said channels forming slides for feet 24—24 supporting the washing compartment 11. The slide rails 19—19 thus accommodate ready removal of the washing compartment 11 from the cabinet for inspection or repair.

The washing compartment 11 may contain a well known form of automatic washing machine in which washing is attained by an agitator (not shown) oscillating in a clothes containing basket (not shown), and water is extracted from the clothes by spinning of the clothes container therefor. The washing machine may be of a type shown and described in my joint patent with Luther Ringer No. 2,541,159 which issued on September 5, 1950, and is no part of my present invention so need not herein be shown or described in detail.

The washing compartment 11 as shown as having a top 25 having an upwardly opening top cover 26, affording access to the interior of said washing compartment for the placing of clothes in the clothes containing basket (not shown). The top 25 of the washing compartment is shown as being spaced beneath the bottom wall 17 of the drying compartment 12 a distance sufficient to afford free opening of the cover 26 and free access to the clothes within the washing compartment without interference with the drying compartment. The washing compartment 11 further projects forwardly from the drying compartment and the wall 13 of the cabinet 10 in order to facilitate access to the clothes container without interference from the drying compartment.

The drying compartment 12 is shown as having a front wall 27 forming the front wall of the cabinet 10 having a door 29 hinged thereto to afford access to a clothes drying and tumbling drum 30, through a clothes receiving opening 31. The clothes receiving opening 31 is formed in the front wall 27 and confronts a clothes reeciving opening 32 in a front wall 33 of the drier drum 30.

The drier drum 30 is shown in Figures 3 and 4 as

being a generally cylindrical drum having an imperforate cylindrical wall 34. The front wall 33 has a flange 35 extending therefrom the inner margins of which define the clothes receiving opening 32. The flange 35 is shown as extending along the outside of a stepped inwardly extending flange 36 extending inwardly from the front wall 27 of the drying compartment 12 and defining the clothes receiving opening 32. The flange 35 is sealed to the flange 36 to prevent the escape of air from the front of the dryer drum by a flexible seal 37 (see Figure 3).

The dryer drum 30 also has a rear perforate wall 37, confronting a partition or bulkhead 39 extending across the drying compartment 12, betwen the side walls 13—13 of the cabinet 10 and suitably secured thereto at its ends.

The bulkhead 39 is shown as having a bearing support 40, extending rearwardly therefrom, for supporting a horizontal shaft 41 on spaced bearings 42—42 carried within said bearing support. The horizontal shaft 41 is shown as being mounted at its inner end on a hub 43 of a spider 44, reinforcing the rear perforate wall 37 of the dryer drum 10, and supporting the rear end portion of the dryer drum on the shaft 41, for rotation about a horizontal axis concentric with the center of said dryer drum.

The front end portion of the dryer drum is shown as being supported on two spaced rollers 45—45, which may be anti-friction rollers and are mounted on transverse shafts 46—46, mounted at their outer ends in the parallel side plates 47—47 of a bracket 49. The bracket 49 is shown as being welded or otherwise secured to the top plate 17 and as extending upwardly therefrom. The rollers 45—45 are shown as having supporting engagement with the flange 33 on opposite sides of the center line of the drum 30, to support said dryer drum at its forward end for free rotation and affording free access to the interior of said dryer drum.

The base plate 17 fo the dryer compartment also forms a support for a timer 50, which may control operation of the washing machine, and a timer 51 which may control operation of the dryer. The timers or control switches 50 and 51 may be of well known forms, commonly used to control the operation of washing machines and clothes dryers so are not herein shown or described in detail. The timers 50 and 51 may be operated by knobs 52 and 53 respectively on the outside of the front wall 27 of the drying compartment (Figure 1).

The drier drum 30 is shown as being driven from a motor 55 mounted on a bracket 56 secured to and depending from the bottom of a transverse housing or duct 57 depending from the bottom of the dryer compartment 12 and forming an air duct and condenser for condensing the spent air. The drive from the motor 55 is shown as including a belt 59 trained about a motor pinion 60 and having driving connection with a pulley 61 on a shaft 63. The shaft 63 in turn has a pulley 64 coaxial therewith and driven by the pulley 61. A belt 65 trained about the periphery of the dryer drum 30 is trained about and driven by the pulley 64.

The belt 59 is also trained about a pulley 66 on a shaft 67 for a suction blower 69 (see Figures 4, 7 and 8).

The pulleys 61 and 64 and the shaft 63 are shown as being mounted on a crank arm 70, pivotally mounted on a bracket 71 depending from the housing 57 and forming a take up for the belts 65 and 59. As herein shown, the bracket 71 has a shaft 73 projecting outwardly therefrom, on which the crank or lever arm 70 is mounted. A torsion spring 74 is shown as encircling the shaft 73 and as having abutting engagement with the bracket 71 at one of its ends, and with the crank arm 70 at its opposite end, and as acting in a direction to maintain tension on belts 59 and 65.

The bulkhead 39 is shown as extending across the drying compartment and as having an end portion 72 extending downwardly therefrom along the rear or outside of the housing 57, and as having said housing secured thereto. The bulkhead 39 is also shown as having an inwardly or forwardly recessed portion 75 of substantially the same diameter as the dryer drum 30 and confronting the rear wall of the dryer drum and suitably sealed thereto as by a sealing member extending over the outer margin of said dryer drum. The recessed portion 75 is shown as having two air circulating openings 76 and 77 therein, the opening 76 being an intake opening and having communication with an intake air duct 79. The opening 77 is shown as being an exhaust opening and has communication with an air duct 80, extending downwardly along the back of the bulkhead 39 and along the depending portion 72 thereof.

The intake opening 76 and intake air duct 79 are shown as communicating with the opposite side of the housing 57 from the blower 69. As herein shown the bulk of the housing 57 is in front of the bulkhead 39, and has an offset portion extending along the back of the bulkhead having an upwardly opening duct or passageway 81, about which the lower end portion of the air duct 79 fits. The intake air duct 79 is likewise shown as having a heating element 83 therein, for heating the air delivered by the blower 69 through the interior of the housing 57.

The exhaust air duct 80 is shown as extending downwardly from the exhaust opening 77 in the bulkhead 39 along the front of the depending portion 72 of the bulkhead 39, and as having communication with an opening 84 leading through the depending lower end portion 72 of the bulkhead 39, which opens directly into a rear wall 85 of the housing 57, and forms an intake opening for the suction blower 69 (see Figure 7).

Referring now to the novel form of condensing means of my invention, within the housing 57 and partially surrounding the blower 69, is an arcuate wall portion 87. The arcuate wall portion 87 extends around the blower 69 and diverges therefrom and forms a scroll for the blower which terminates in a lip 88. The lip 88 is spaced in advance of and downwardly from an arcuate inner wall 89 of the housing 57, shown as conforming generally to the form of the lip 88. In the space between the wall 87 and the outer side of the housing 57 and blower 69 is a cavity 90, which may be cored and forms a cavity or jacket 90 for a coolant such as water. The cavity 90 is herein shown as extending outwardly along outer side of the scroll 87 and discharging the coolant, which may be water, along the top of said scroll from the end of the lip 88.

The housing 57 has a rectangular opening 92 above the suction blower 69 and top of the scroll 87, which is closed by cover plate 91, secured to said housing to cover said opening, as by cap screws 93—93. The top portion of the wall 87, forming the scroll for the suction blower 69, is shown as having a flat rib 94 extending thereacross and abutted by the cover plate 91. The cover plate 91 has a plurality of passageways 95—95 extending across the rib 94, and shown as being formed by upset portions of said cover plate, and forming passageways for the passage of coolant thereby along the upper surface of the scroll 87 for discharge from the end of the lip 88.

Within the cavity 90 and conforming to the form thereof is a tube 96 extending through the cover plate 91 to a position adjacent the bottom of said cavity. The outer end of tube 96 is shown as being in the form of a funnel as indicated by reference character 97, to receive water passing from the lower open end of a water tube or pipe 99. The discharge end of the tube 99 is spaced upwardly from the mouth of the funnel 97, to avoid the sucking of the coolant from the cavity 90 upon low pressure conditions in the water system, supplying water to the pipe 99. The pipe 99 may be connected with a source

of water, and may have a valve (not shown), for controlling the flow of water therethrough.

The bottom of the housing **57**, leading from the scroll **87** toward the intake air duct **79**, is shown as sloping downwardly to a drain **100**, having a conduit **101** connected thereto, which may be connected with the sewer, for draining the condensed water and lint directly to the sewer.

The wall **89** is shown as extending generally parallel to the lip **88** and as extending downwardly beneath a top wall **103** of the housing **57**, to form a baffle to deflect the cooling liquid downwardly across the path of air brought into the housing **57** by the blower **69** through the intake duct **79**.

The front wall of the housing **57** is provided with a cleaning opening **104** therein, closed by a closure cap **105** (see Figures 4, 6 and 8) and accommodating the hand or a cleaning tool to enter the housing **57** for cleaning.

As cooling water enters the cavity **90** through the tube **96** and fills said cavity, the cooling water will flow through the passageways **95—95** along the top surface of the scroll **87** and the lip **88**. The blower **69**, being in operation will force the damp spent air containing lint to pass along the under side of the scroll **87** and lip **88** and draw the cooling water over the top of the lip **88** along the wall **89** and baffle **102** downwardly through the spent air brought into the housing of the blower **69**. The cooling water spread over the lip **88** by the passageways **95** will thus form a screen of cold water through which the spent hot moist air from the drier drum passes, resulting in the condensing of the moisture from the spent warm air, and the flow of the condensed moisture downwardly along the bottom wall of the housing **57** into the drain **100**. The screen of cold water therefor washes the spent air exhausted from the dryer, and cools and condenses the same, and removes lint and the like therefrom by the washing process.

The fine screen or stream of cooling water thus forms a condensing medium for the spent moist air as well as a washer and dehumidifier therefor, and due to the width of the stream and the fineness thereof, effects a substantial reduction in the amount of water necessary to effect cleaning and condensation of the spent air over that formerly required.

It may be seen from the foregoing that a simple and improved form of condenser for clothes driers has been provided, in which the duct connecting the exhaust and intake ducts of the dryer drum together in cooperation with the blower scroll and water jacket therefor forms an efficient and simple condenser, and in which the volume of water required for condensing is reduced by spreading the water over a wide area and utilizing the circulating blower to draw a screen of cooling water over the moist, hot spent air.

It will be understood that various modifications and variations of the present invention may be effected without departing from the spirit and scope of the novel concepts thereof.

I claim as my invention:

1. In a condenser particularly adapted for clothes driers having a cabinet having a clothes tumbling drum journaled therein, a closed air circulating and heating system for heating and circulating heated air into and out of said dryer drum, comprising separate intake and exhaust ducts confronting a wall of said dryer drum, a third duct connecting said ducts together at the lower end thereof, a suction blower in said third duct for circulating air through said ducts and tumbling drum, said last mentioned duct having a wide discharge lip across said blower and having means for supplying water to said lip to effect the discharge of a relatively wide stream of water in the path of the air drawn into said duct by said blower, for condensing the spent air from said tumbling drum.

2. In a condenser particularly adapted for clothes driers having, a cabinet, a clothes tumbling drum journaled for rotation within said cabinet, means for rotatably driving said drum, a closed air circulating and heating system for circulating heated air into said drum and withdrawing spent air therefrom, comprising separate intake and exhaust ducts confronting a perforate wall of said drum, a third duct connecting said intake and exhaust ducts together, a suction blower in said third duct having its intake in communication with said exhaust duct and delivering air to said intake duct, a drain for water and lint in said third duct, said third duct having a scroll for said blower extending partially around said blower and over the top thereof and having a cavity for water extending along said scroll, means for admitting cold water into said cavity and overflowing the same over the top of said scroll into the path of said blower to effect the forming of a wide screen of cooling water by the action of said blower for condensing the spent air drawn into said third duct by said blower.

3. In a condenser particularly adaptable for clothes driers, having a cabinet, a clothes tumbling drum journaled within said cabinet, a closed air circulating and heating system for circulating air into and out of said drum comprising separate intake and exhaust ducts having communication with the interior of said drum, a third duct connecting said intake and exhaust ducts together, a drain from said third duct, a suction blower in said third duct for circulating air through said ducts and having its intake in communication with said exhaust duct, a scroll for said blower extending therearound and over the top thereof and having a lip extending across said blower, a cavity for water extending along the outside of said scroll, means for supplying cold water to said cavity and overflowing the same over the top of said scroll, and a baffle deflecting the water discharged over said scroll in the path of the spent air drawn into said third duct by said blower, for cleaning and condensing the spent air.

4. In a condenser particularly adapted for driers for clothes and the like, a cabinet having a clothes tumbling drum rotatably journaled therein, a closed air circulating and heating system for said drum comprising separate intake and exhaust ducts having communication with the interior of said drum, a third duct connecting said intake and exhaust ducts together, a suction blower in said third duct having an intake in communication with said exhaust duct, said third duct having a scroll extending around said blower and over the top thereof, having a discharge lip for the cooling water at the end thereof, said duct also having a cavity for cooling water extending along the outside of said scroll, means for admitting a flow of cooling water to said cavity to flow the water over said lip, restricted passageways extending along the top of said scroll for spreading the water over the top thereof for discharge over said lip in a wide screen, and a baffle spaced from and forming a downward continuation of said lip for baffling the screen of cooling water in the path of the spent air discharged by said blower.

5. In a condenser particularly adapted for driers for clothes and the like, a cabinet having a clothes tumbling drum rotataly mounted and having a perforate rear wall, a bulkhead in said cabinet extending along the rear wall of said drum and having spaced intake and exhaust openings confronting the rear wall of said drier drum, an intake duct extending downwardly along said bulkhead from said intake opening, an exhaust duct extending downwardly along said bulkhead from said exhaust opening, a third duct connecting said intake and exhaust ducts together and having a sloping bottom having a drain leading therefrom, a blower in said third duct having its intake in communication with said exhaust duct, a scroll for said blower extending over the top thereof

and terminating in a discharge lip extending the width of said third duct and spaced from the top thereof, a cavity extending along the outside of said scroll, means for admitting a flow of cooling water to said cavity to fill the same and flow over the top of said lip, and a baffle for deflecting the cooling water from said lip downwardly in the path of the spent air discharged from said blower.

6. In a condenser particularly adapted for driers for clothes and the like, a cabinet, a clothes tumbling dryer drum rotatably mounted within said cabinet and having a rear perforate wall, a bulkhead extending across the rear portion of said cabinet and confronting the rear wall of said clothes tumbling drum, said bulkhead having intake and exhaust openings therein affording passageways to supply and exhaust air from said drum, an intake duct extending upwardly along said bulkhead to said intake opening, an exhaust duct extending downwardly along said bulkhead from said exhaust opening, a third duct connecting said exhaust and intake ducts together at the lower ends thereof, a suction blower in said third duct having its intake in communication with said exhaust duct, said third duct having a sloping bottom and a drain leading therefrom a scroll extending around and upwardly over the top of said blower and terminating in a lip spaced downwardly from the top of said third duct, a cavity for cooling water extending along the outside of said scroll, a tube for cooling water leading downwardly into said cavity, a second tube for supplying a stream of water to said first tube, to fill said cavity and overflow the cooling water over the top of said lip, restrictive passageway means extending over the top of said scroll for spreading the cooling water to flow over the entire extent of said lip, and a baffle spaced from said lip and extending downwardly therefrom for baffling the cooling water to form a water screen in the path of the spent air discharged by said blower.

7. In a condenser particularly adapted to dehumidify and remove lint from the spent air from clothes driers and the like, a duct having intake and outlet openings therein for connection with the exhaust and inlet of a clothes drier, a suction blower in association with one of said openings for drawing spent air into said duct, a scroll for said blower within said duct and extending partially around said blower and over the top thereof and having a cavity for water extending along said scroll, means for admitting cold water into said cavity and overflowing the same over the top of said scroll into the path of said blower to effect the formation of a wide screen of cooling water by the action of said blower for condensing the spent air drawn into said duct by said blower.

8. In a condenser particularly adapted to dehumidify and remove lint from the spent air from a clothes drier and the like, a duct having intake and outlet openings therein for connection with the exhaust and inlet of a clothes drier, a suction blower in said duct having its inlet in communication with one of said openings, a scroll for said blower extending over the top thereof and terminating in a discharge lip extending the width of said duct and spaced inwardly from the top thereof, a cavity extending along the outside of said scroll, means for admitting a flow of cooling water to said cavity to fill the same and flow over the top of said lip, and a baffle spaced from and forming a downward continuation of said lip for baffling the cooling water in the form of a screen in the path of the spent air discharged by said blower.

9. In a condenser particularly adapted to dehumidify and remove lint from the spent air of a clothes drier and the like, a duct having spaced intake and outlet openings therein for connection with the exhaust and inlet of a clothes drier and the like, a drain for water and lint from the bottom of said duct, a suction blower in association with said intake opening for drawing spent air into said duct, a scroll extending around and upwardly over the top of said blower and terminating in a lip extending across the top of said blower, a cavity for cooling water extending along the outside of said scroll, restrictive passageway means extending over the top of said scroll for spreading cooling water to flow over the entire extent of said lip, means for supplying cooling water to said cavity to flow through said restrictive passageway means over said lip, and a baffle spaced from and forming a downward continuation of said lip for baffling the cooling water drawn from said lip by said blower in the form of a screen in the path of the spent air discharged by said blower.

10. A condenser particularly adapted to dehumidify and remove lint from the spent air from a clothes drier and the like and to supply clean air thereto, comprising a duct having intake and outlet openings therein for connection with the exhaust and inlet of a clothes drier, a suction blower in said duct in association with one of said openings for drawing spent air into said duct, a member in said duct, spaced above said blower and terminating in a lip extending across and above said blower, means for supplying water to said member lip to flow over said lip, and a baffle spaced in advance of said member and lip and extending within said duct downwardly along said blower in spaced relation with respect thereto for a portion of the diameter thereof, the space between said baffle and lip forming a passageway for water and said baffle coperating with said lip to baffle the water to form a downwardly falling water screen in the path of the spent hot air discharged by said blower.

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UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 2,866,273

December 30, 1958

Peter Eduard Geldhof

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 1, line 36, for "from" read -- form --; column 2, line 70, for "reeciving" read -- receiving --; column 6, line 22, for "adaptable" read -- adapted --; line 23, after "driers" strike out the comma; line 64, for "rotataly" read -- rotatably --; column 8, line 43, for "coperating" read -- cooperating --.

Signed and sealed this 16th day of June 1959.

(SEAL)
Attest:

KARL H. AXLINE
Attesting Officer

ROBERT C. WATSON
Commissioner of Patents