Oct. 21, 1958 E. J. FREY 2,856,699

CLOTHES DRIER WITH CONDENSER

Filed Aug. 6, 1956 4 Sheets-Sheet 1

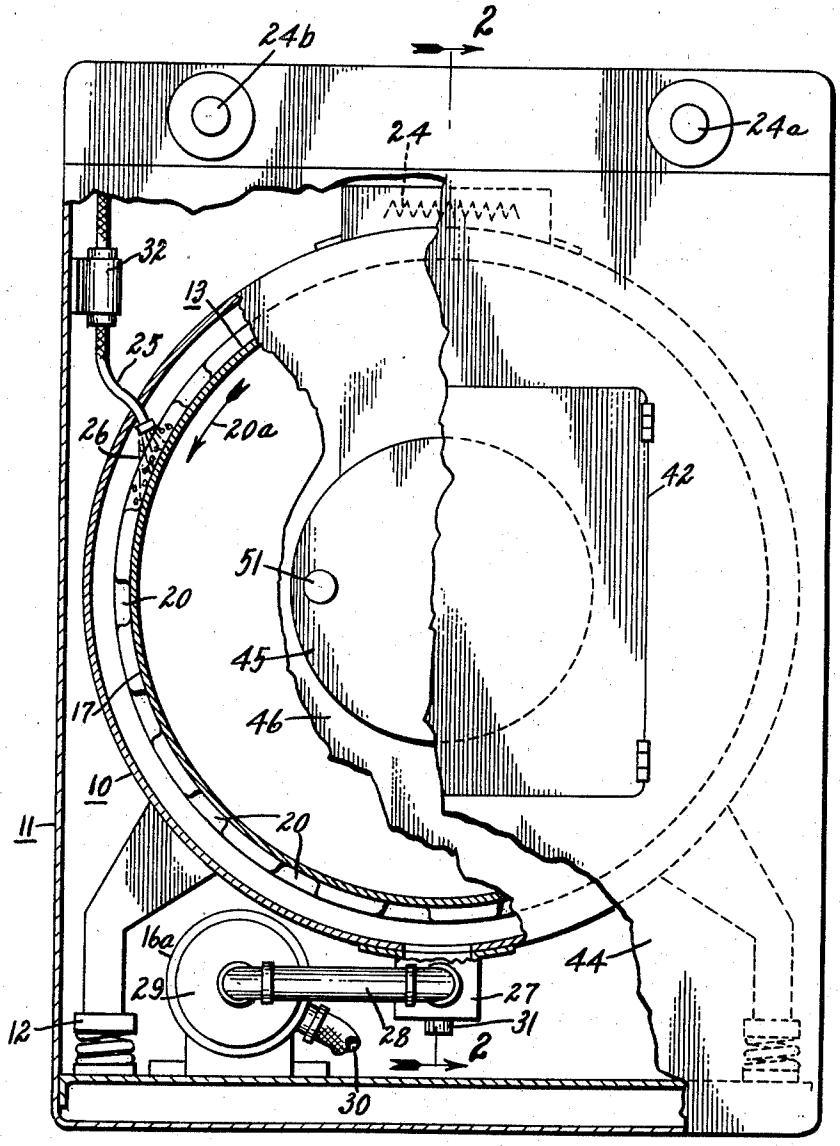

Fig. 1

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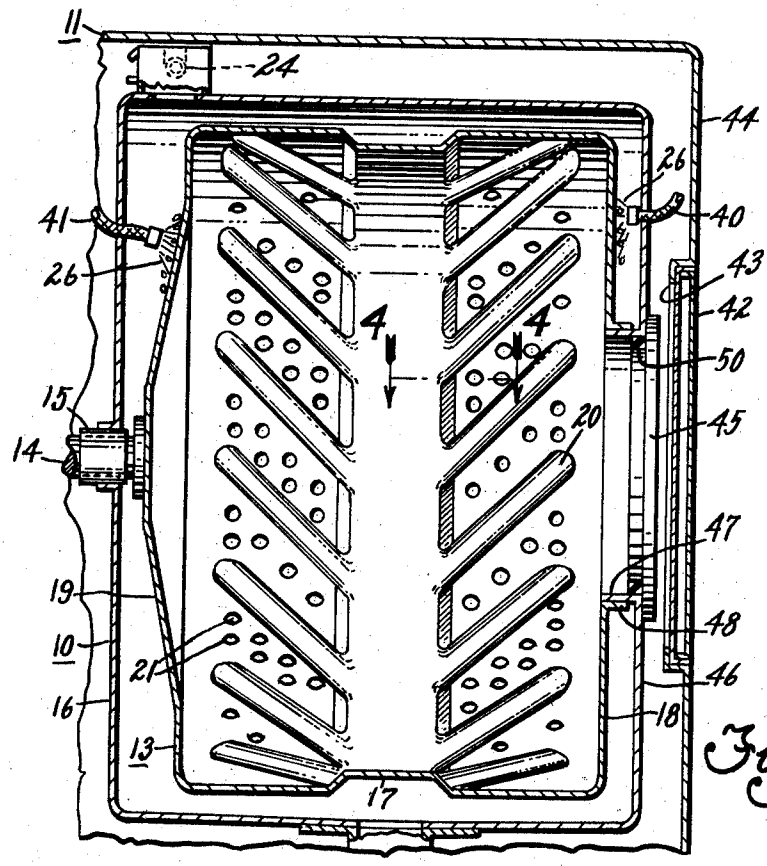

Fig. 2

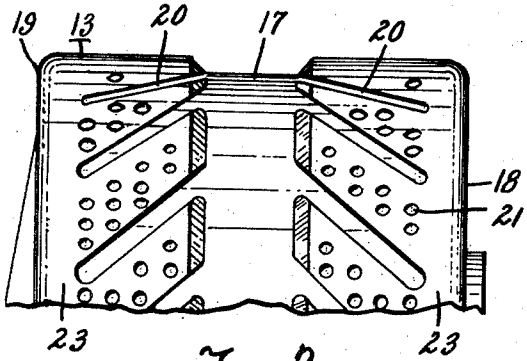

Fig. 3

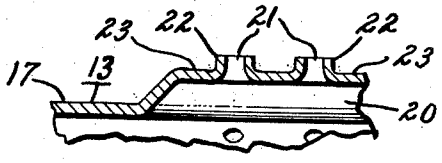

Fig. 4

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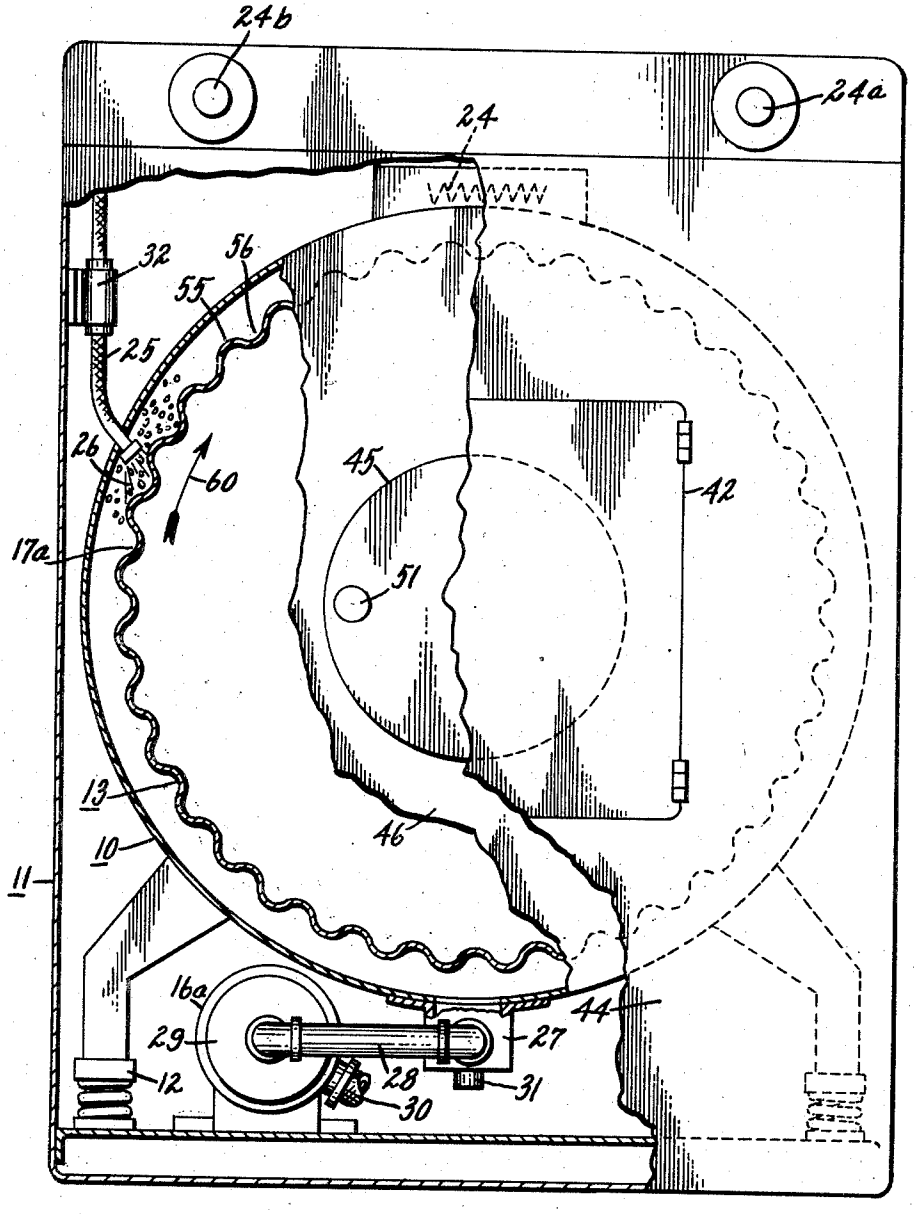

Fig. 5

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CLOTHES DRIER WITH CONDENSER

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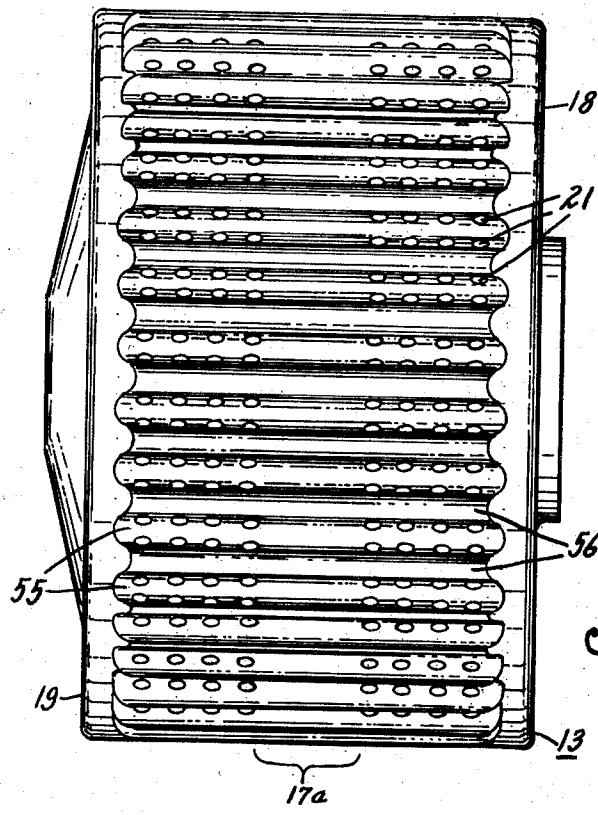

Fig. 6

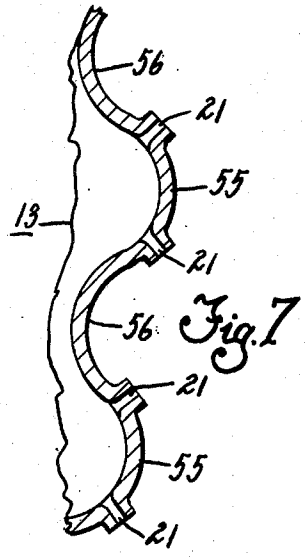

Fig. 7

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2,856,699

CLOTHES DRIER WITH CONDENSER

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Application August 6, 1956, Serial No. 602,342

8 Claims. (Cl. 34—75)

This invention relates to domestic appliances and more particularly to laundry washing and/or drying apparatus.

An object of this invention is to provide an apparatus in which the moisture in damp clothes within a rotating perforated drum is evaporated by the application of heat, and the vapor thus produced is condensed by flowing cooling water on the outside of said drum.

Another object of this invention is to provide a clothes dryer having a perforated drum within which the moisture in damp clothes is evaporated and around which a vapor condensing zone is produced outside said drum by impinging a cold water spray outside said drum between perforations in said drum to produce a condensing spray without the necessity of stationary protecting baffles outside said drum.

Another object of this invention is to provide a clothes dryer with a perforated rotating damp clothes containing drum having an imperforate surface of revolution on the outer surface of which cooling water may flow to condense vapor driven off of said wet clothes.

Another object of this invention is to provide a clothes dryer with a rotating drum having outwardly extruded perforations and having means for flowing and spraying cooling water between said perforations to produce a cooling film or spray outside said drum which is prevented from flowing into said drum by the outward flanges of said perforations.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings wherein a preferred form of the invention is clearly shown.

In the drawings:

Figure 1 is a front view, partly in section, and partly diagrammatic, of an apparatus embodying my invention.

Figure 2 is a vertical cross-section along the line 2—2 of Figure 1.

Figure 3 is a side elevation of a part of the drum shown in Figures 1 and 2.

Figure 4 is an enlarged, broken horizontal cross-section taken along the line 4—4 of Figure 2.

Figure 5 is a view, somewhat similar to Figure 1, showing another embodiment of the invention.

Figure 6 is a side elevation of the drum shown in Figure 5.

Figure 7 is an enlarged vertical cross-section of a portion of the periphery of the drum shown in Figures 5 and 6.

An outer casing or tub **10** conveniently may be mounted within a cabinet **11** by a pedestal or spring mount construction diagrammatically indicated at **12**. A perforated rotatable drum **13** is mounted within the casing **10** by means of a rotatable drive shaft **14** supported by the bearing **15** carried by the rear wall **16** of the tub **10**. A suitable transmission, not shown, such as a belt consturction with or without a single or multiple speed clutch may rotate the shaft **14** and drum **13** from a motor **16***a*. If the machine is a dryer only, the drum is rotated at clothes tumbling speed only. If the machine is a combined washer and dryer, then the drum **13** is rotated at clothes tumbling speeds during the washing and drying operations, and is rotated at centrifugal, moisture extracting speed after the washing or rinsing operations and before the drying operation.

The periphery of the drum **13** is provided with a continuous, imperforate surface of revolution such as the imperforate indented band **17** and/or the imperforate drum end walls **18** and **19**. The band **17** preferably has a plurality of indented branches or grooves **20** which are downwardly slanted on the downwardly rotating side of the drum, as shown in Figure 3, and which are upwardly directed on the upwardly rotating side of the drum, as shown in Figure 2. The drum rotates counterclockwise when viewed from the front as indicated by arrow **20***a*.

The drum **13** has perforations **21** which are outwardly extruded as indicated at **22**, Figure 4 to prevent any inward flow of cooling water flowing on the main outer surface **23** of the drum.

Heating means are provided to heat the damp clothes in the drum and to vaporize the moisture in the clothes. Such heating means may take the form of an electrical resistance **24** at the upper part of the tub **10**. Such heater may be controlled by manually adjustable thermostat **24***a* and timer **24***b* in the usual manner. Any other heating means may be used such as a gas heater or the like, not shown.

Means are provided to flow cooling water on the outside of the drum **13** against the outer surface of the imperforate surface of revolution of drum **13**, such as the band **17**, and/or either of the end walls **18** and **19**. Such means may take the form of a pipe or nozzle **25** which flows or impinges a stream of cooling water **26** against the outer surface of band **17** and/or either of the end walls **18** and **19**. If the band **17** is used, the water which flows on its outer surface is distributed by the downwardly directed grooves **20** (Figure 4) between the outwardly extruded perforations **21**. The stream **26** flows the cooling water on the outside of the downwardly rotating side of the drum. It is not necessary to provide a stationary baffle or the like between the drum **13** and tub **10** to prevent inward flow of cooling water into the drum and to prevent wetting of the clothes. This method of flowing the cooling water prevents such inward flow, and at the same time produces a very efficient condensing action on the vapor driven from the moist clothes.

The cooling water flows down to the bottom of the tub and enters the outlet **27**, outlet pipe **28**, pump **29** and discharge hose **30** leading to a drain or laundry tub. If desired, the outlet **27** may include a solenoid **31** for controlling a drain valve at the outlet, particularly when the machine is used as a combined dryer and washer.

The flow of cooling water at **26** may be controlled by a solenoid valve **32** connected to a suitable cold water supply pipe. The valve construction **32** may also include a hot water connection with a hot water supply pipe, and may include a constant flow construction to insure the proper formation of stream **26** and/or the introduction of the proper amount of wash water under the control of the timer, if the machine is a combined dryer-washer, as is readily understood.

If it is desired alternatively or additionally to flow cooling water on imperforate surfaces of revolution on the end walls **18** and/or **19**, this may be accomplished by alternate or additional pipes **40** and/or **41** under the control of valve **32** or additional or alternate valves, not shown.

If a cabinet **11** is used, a relatively large door **42** may be hinged to the cabinet **11** and cover the relatively large opening **43** in the front wall **44** of the cabinet **11**. A second door **45**, of smaller size, may be hinged to the front wall **46** of the tub **10** and cover the opening **47**, also of

smaller size, in wall **46**. The opening or flange **47** may telescope into the outwardly directed flange or opening **48** in the front wall **18** of drum **13**. The door **45** may be tightly secured and sealed by a suitable flexible seal **50** carried by the tub or door **45** as desired. The door **45** may be provided with a latch **51** for aiding sealing the door **45** to the tub.

In the modification shown in Figures 5, 6 and 7, all of the parts are substantially as previously described in connection with Figures 1 to 4, and some of the parts are marked with similar reference numerals. However, the periphery of the drum is corrugated transversely to form transverse hills **55** and valleys **56**. An imperforate surface of revolution may be formed by an imperforate band **17***a* upon which the stream **26** impinges. In this embodiment, a splashing action takes place where the stream **26** encounters the rotating drum. The drum is rotated clockwise, when viewed from the front, and as indicated by the arrow **60**. The stream **26** may be forcible enough to cause a splashing or spraying action upon its contact with drum **13**. The perforations **21** are outwardly extruded, as in Figures 1 to 4, and that prevents the inward flow of cooling water into the drum. No stationary baffle is required for this.

In the operation, clothes are inserted into the drum **13** of the machine through openings **43**, **47** and **48**. If the machine is solely a dryer, the drum **13** rotates at a clothes tumbling speed by motor **16***a*. The heater **24** is energized and the cooling water valve **32** is opened to produce the cooling water jet **26**. The moisture from the wet or damp clothes which were inserted into the drum is vaporized by the heat from heater **24**. The vapor flows out openings **21** to the space between the drum **13** and tub or casing **10**, where the vapor is condensed by the spray and film of cooling water from stream **26**. The cooling water and condensed vapor flow out through outlet **27** and are discharged through hose **30** to a drain or laundry tub. Such operations may be under the control of the timer and the heater may be thermostatically controlled.

If the machine is a combined washer-dryer, the washing, rinsing and centrifugal water extracting operations may be the same as now well known and under proper automatic controls, and hence are not further described. The drying operation may be performed on the damp clothes in the drum after the washing, rinsing and centrifugal extracting operations substantially as described in the preceding paragraph.

In Figures 1 to 4, the drum receives the cooling stream of water on its downwardly rotating side and the water tends to form a film on the outside of the drum, which is distributed by the band **17** and branches **20** to the outer surface of the drum.

In Figures 5 to 7, the drum receives the cooling stream on the upwardly rotating side of the drum. This action produces a spray in the zone between the drum and tub which is a very efficient vapor condenser. No stationary baffles are required to prevent the inward flow of water into the drum.

While the form of embodiment of the invention as herein disclosed constitutes a preferred form, it is to be understood that other forms might be adopted as may come within the scope of the claims which follow.

What is claimed is as follows:

1. In combination: an outer casing; a perforated generally cylindrical rotatable drum within said casing and having on its cylindrical periphery a continuous imperforate surface of revolution; heating means to heat clothes in said drum; and means to flow cooling water on the cylindrical periphery of said drum against the outer face of said imperforate surface of revolution.

2. In combination: an outer casing; a perforated rotatable drum within said casing, said drum having outwardly extruded perforations to prevent inward flow of water into said drum; heating means to heat clothes in said drum; and means to flow cooling water on the outside of said drum against the surface between the outwardly extruded perforations.

3. In combination: an outer casing; a perforated rotatable drum within said casing and having a continuous imperforate surface of revolution including a continuous imperforate band along the central portion of the periphery of said drum; means to heat clothes in said drum; and means to flow cooling water on the outside of said drum against said continuous imperforate band of said imperforate surface of revolution.

4. In combination: an outer casing; a perforated rotatable drum within said casing and having a continuous imperforate surface of revolution including a continuous imperforate band along the central portion of the periphery of said drum and branches along the periphery of said drum extending toward the ends of said drum; means to heat clothes in said drum; and means to flow cooling water on the outside of said drum against said continuous imperforate band of said imperforate surface of revolution.

5. In combination: an outer casing; a perforated rotatable drum within said casing and having a continuous, corrugated imperforate surface of revolution; heating means to heat clothes in said drum; and means to flow cooling water on the outside of said drum against said imperforate surface of revolution.

6. In combination: an outer casing; a perforated rotatable drum within said casing and having a continuous, corrugated imperforate surfaces of revolution; heating means to heat clothes in said drum; and means to flow cooling water on and splash water from the outside of said continuous, corrugated imperforate surface of revolution.

7. A laundry dryer including a casing, a rotatable clothes container within said casing, means for heating the clothes in said container to evaporate liquid therefrom, means for directing a stream of cooling fluid directly onto the outer surface of said container to condense the evaporated liquid, said casing being provided with a drain outlet for said cooling fluid, said container having external grooving for receiving the cooling fluid and perforations adjacent said grooving through which the evaporated liquid may flow from the clothes to the cooling fluid.

8. A laundry dryer including a casing, a rotatable clothes containing drum having a perforated periphery rotatably mounted within the casing, means for heating the clothes in the drum to evaporate liquid therefrom, means for directing a stream of cooling fluid onto the outer surface of said drum to condense the evaporated liquid, said casing being provided with a drain outlet, said drum having grooving between perforations of its perforated periphery for receiving the cooling fluid.

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