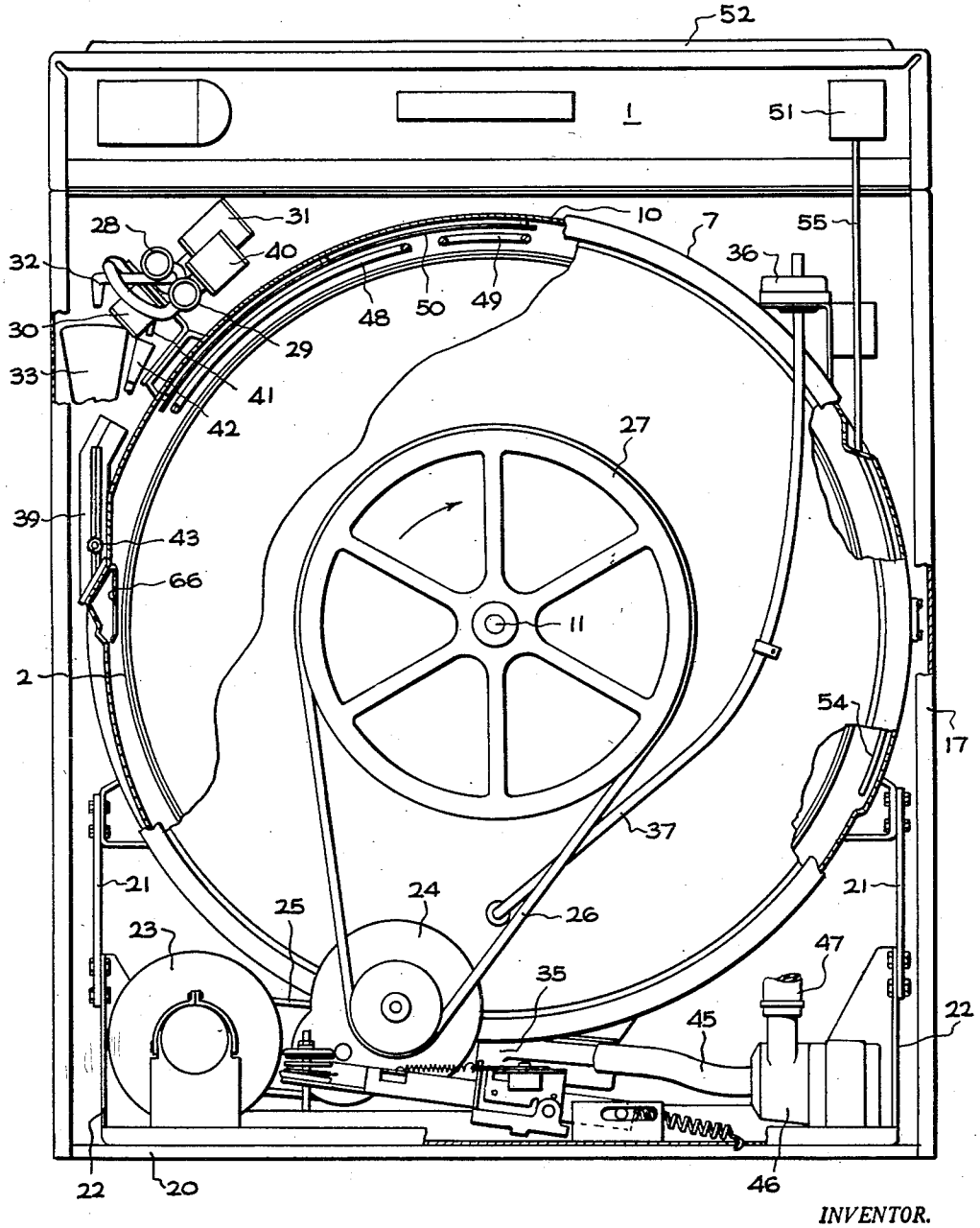
July 23, 1957 W. J. RACZYNSKI 2,800,008

VENTING ARRANGEMENT FOR CLOTHES DRYERS AND COMBINATION WASHER-DRYERS

Filed Oct. 6, 1955 4 Sheets-Sheet 1

FIG. 1



INVENTOR.
WALTER J. RACZYNSKI

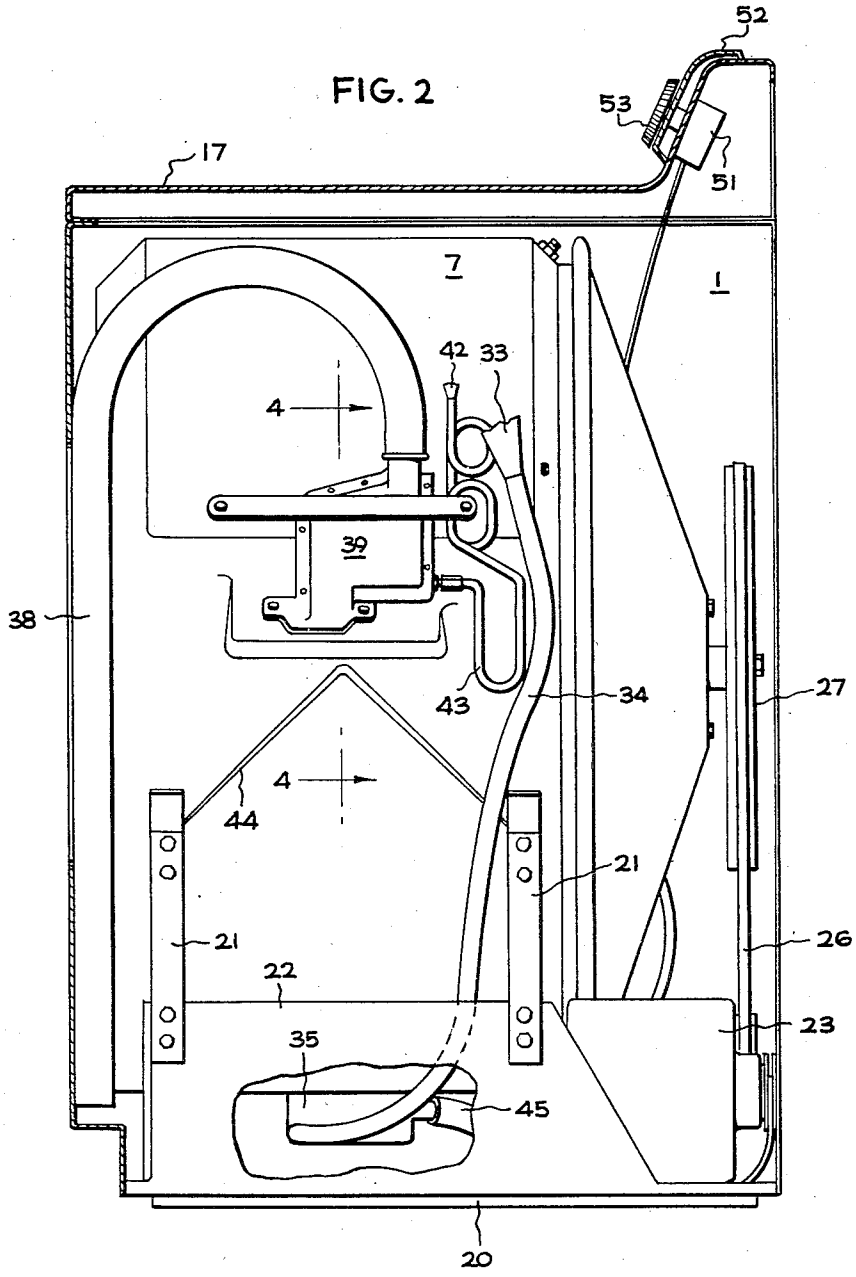
BY Harry F. Manbeck, Jr.
HIS ATTORNEY

July 23, 1957 W. J. RACZYNSKI 2,800,008

VENTING ARRANGEMENT FOR CLOTHES DRYERS AND COMBINATION WASHER-DRYERS

Filed Oct. 6, 1955 4 Sheets-Sheet 2

FIG. 2



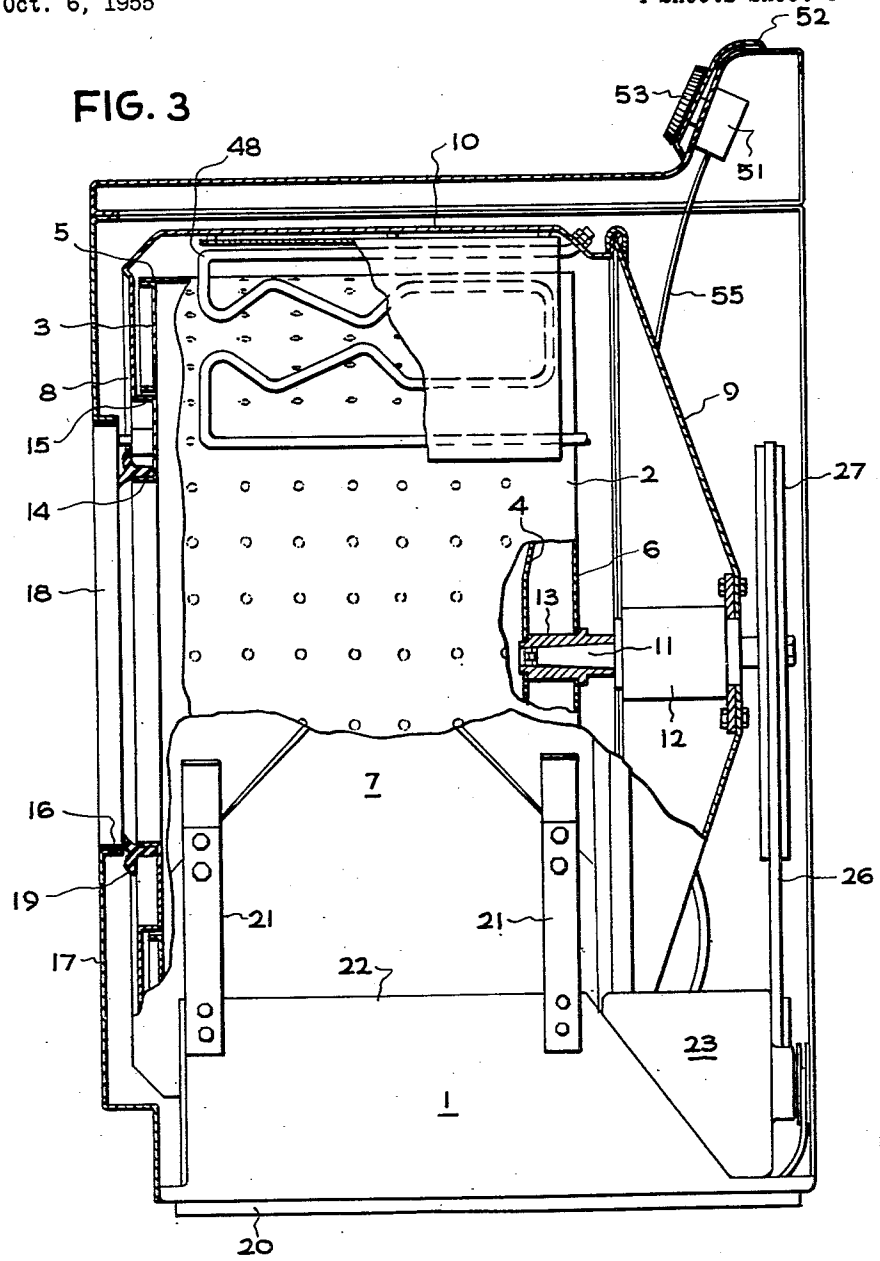
INVENTOR.
WALTER J. RACZYNSKI
BY Harry F. Manbeck, Jr.
HIS ATTORNEY

July 23, 1957 W. J. RACZYNSKI 2,800,008

VENTING ARRANGEMENT FOR CLOTHES DRYERS AND COMBINATION WASHER-DRYERS

Filed Oct. 6, 1955 4 Sheets-Sheet 3

FIG. 3



INVENTOR.
WALTER J. RACZYNSKI
BY Harry F. Manbeck, Jr.
HIS ATTORNEY

July 23, 1957 W. J. RACZYNSKI 2,800,008

VENTING ARRANGEMENT FOR CLOTHES DRYERS AND COMBINATION WASHER-DRYERS

Filed Oct. 6, 1955 4 Sheets-Sheet 4

FIG. 6

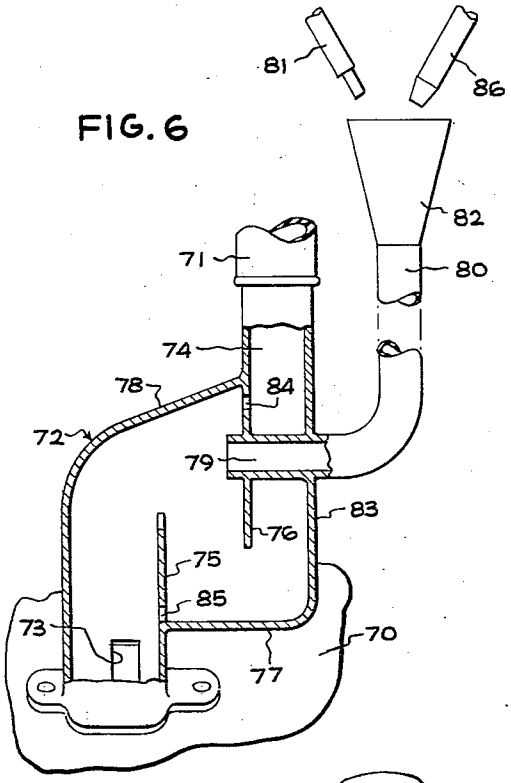


FIG. 5

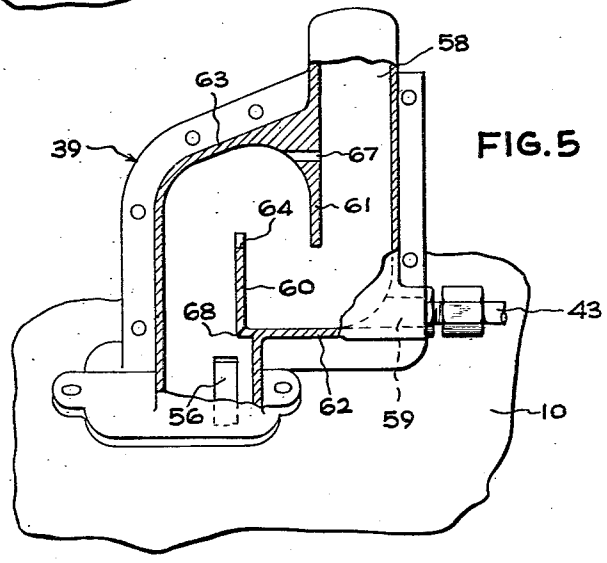
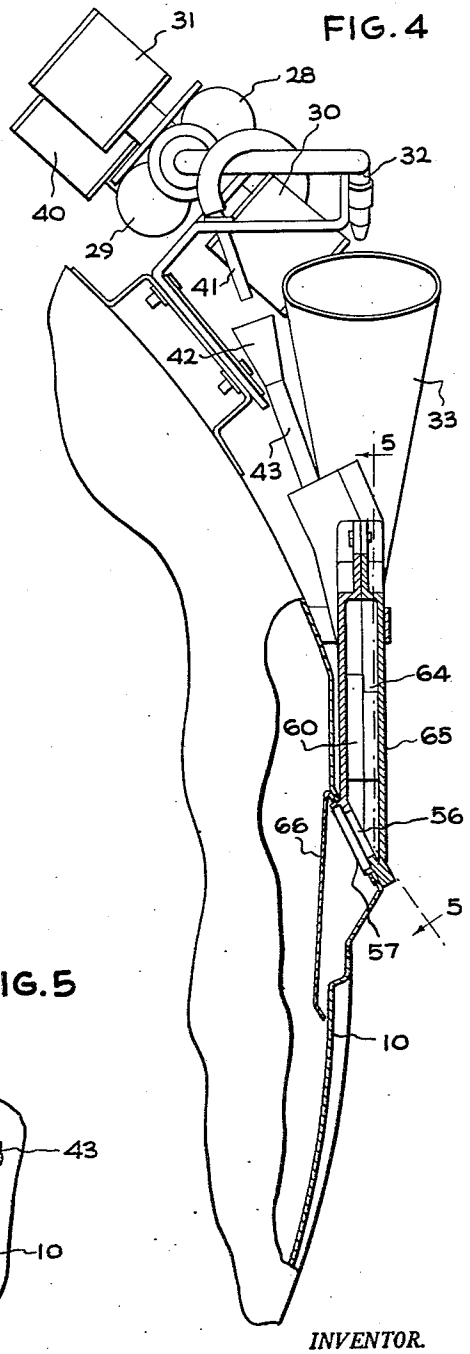


FIG. 4



INVENTOR.
WALTER J. RACZYNSKI
BY Harry F. Manbeck, Jr.
HIS ATTORNEY

United States Patent Office 2,800,008 Patented July 23, 1957

2,800,008

VENTING ARRANGEMENT FOR CLOTHES DRYERS AND COMBINATION WASHER-DRYERS

Walter J. Raczynski, Louisville, Ky., assignor to General Electric Company, a corporation of New York

Application October 6, 1955, Serial No. 538,891

12 Claims. (Cl. 68—19)

My invention relates to clothes dryers and combination washer-dryers in which the clothes basket is enclosed within an imperforate tub, and more particularly to such machines wherein a plate or wall within the tub is cooled by cold water during the drying operation to condense the moisture extracted from the clothes.

In these laundry machines it is desirable that the tub be sealed off from the surrounding room during the drying operation so that steam cannot escape into the room. If the tub is vented to the room, steam will escape through the vent and may condense to form puddles. However, if the drying operation is interrupted and the machine door opened briefly, it is then desirable that the tub be vented temporarily when the machine door is again closed. The opening of the door allows a considerable quantity of hot air to escape from the machine, which air is replaced by relatively cool air from the room. When the door is closed and the machine placed back in operation, the cold air comes into contact with the heated surfaces within the machine and expands very rapidly. To avoid building up undesirable pressure within the tub and perhaps damaging it, the tub should be vented during this period to allow the air to escape as it expands. But once the expanded air has escaped, the vent means should be closed to seal off the tub again and prevent the escape of steam as the drying operation continues.

In a combination washer-dryer the additional problem is introduced that the vent means should be continuously open during the washing operation. The open vent means allow air to escape from the tub as it is filled with water, and also allow air to enter the tub as the water is drained from it. In machines wherein the water level is controlled by a hydrostatic pressure device, it is particularly important that the displaced air be able to escape freely as the tub is filled. Otherwise, a pressure greater than atmospheric may be created within the tub causing the pressure device to respond at water levels lower than those desired. A continuously open vent is also needed in order to allow the escape of suds if the operator mistakenly should add far too much detergent or washing agent at the beginning of the washing operation.

It is an object of my invention to provide a new and improved venting arrangement suitable for clothes dryers and combination washer-dryers, which arrangement is normally sealed off during the drying operation but which vents the tub to the surrounding room whenever the drying operation is interrupted.

Another object of my invention is to provide such a venting operation in which the seal over the venting means during the normal drying operation is formed by the water entering the tub for moisture condensation purposes.

A further object of my invention is to provide a venting operation of this type for combination washer-dryers, which continuously vents the tub during the washing operation.

In carrying out my invention I provide a laundry machine having a clothes basket rotatable about a non-vertical axis. The basket is enclosed by an imperforate tub and heating means are provided for heating the clothes in the basket to extract moisture therefrom. A water line is included for supplying water to the tub for cooling a wall to condense the moisture extracted from the clothes, and a vent tube is provided for venting the tub to the surrounding atmosphere. By my invention a single trap element is mounted on the tub for connecting both the vent tube and the water line to the interior of the tub. The trap element has a tub opening leading into the tub, a vent opening connected to the vent tube and a water opening connected to the water line. The trap element further includes wall means for creating a water seal therein between the tub opening and the vent opening when water is flowing therethrough for condensing moisture extracted from the clothes. This water seal formed between the tub opening and the vent opening effectively closes off the tub from the vent tube and thus prevents the escape of steam through the vent tube during the drying operation. The seal is drained away, however, by suitable passageway means provided in the vent trap whenever the drying operation is interrupted or terminated. When the drying operation is interrupted or terminated, the flow of condenser water is shut off and thereby the passageway means is enabled to drain the seal. This results in the tub being vented through the trap to the tube to allow the escape of expanding air when the drying operation is again resumed.

When the venting arrangement is utilized in a combination washer-dryer, the trap element and the water supply means are so arranged that no water seal is formed in the trap element during the filling of the tub for washing purposes. Rather the seal is formed therein only when the condenser water is supplied to the machine during the drying operation. This result can be accomplished by supplying the wash water to the tub through a different inlet than the trap element. Alternately and in accordance with an additional aspect of my invention, it can be accomplished by arranging the trap element to pass both the wash water and the condenser water into the tub, with the trap element being so constructed that a water seal is formed therein only when the water is flowing at a low rate suitable for condensing moisture and not when flowing at a higher rate suitable for filling the tub for washing.

The features of my invention which I believe to be novel are pointed out with particularity in the appended claims. My invention itself however may be best understood by reference to the following description taken in conjunction with the accompanying drawings in which:

Fig. 1 is a rear elevational view of a combination washer-dryer embodying my invention in one form thereof, certain surfaces of the view being broken away to illustrate details of the machine;

Fig. 2 is a side elevational view of the machine of Fig. 1 with the side panel removed;

Fig. 3 is a side elevational view of the machine with certain surfaces broken away and partially in section in order better to illustrate details;

Fig. 4 is a view taken on the line 4—4 of Fig. 2;

Fig. 5 is a sectional view taken on the line 5—5 of Fig. 4 showing details of the trap element included in the machine; and

Fig. 6 is a sectional view similar to Fig. 5 but illustrating an alternate embodiment of my invention.

Referring now to the drawings I have shown therein a domestic laundry machine 1 comprising a combination washer and dryer. The machine 1 is of the horizontal axis type, that is it includes a clothes basket 2 which is

rotatable about a generally horizontal axis. The basket 2 includes front and rear walls 3 and 4 and a connecting side or outer wall 5 (see Fig. 3). The outer wall 5 is cylindrical in shape and is provided with a plurality of perforations or holes as shown. The rear wall 4 is reinforced by a suitable plate 6.

The cylindrical basket 2 is mounted within an imperforate tub structure 7 which encloses it on all sides. The tub 7 includes a front wall 8, a rear wall 9 and a connecting side or outer wall 10. In my preferred embodiment the outer wall 10 is generally cylindrical in shape and has the same center as the cylindrical wall 5 of the basket 2. The basket is rotatably supported from the tub structure by a horizontally extending shaft 11 which is mounted in an elongated bearing 12 hung from the rear wall 9 of the tub structure. The shaft 11 as well as supporting the basket also serves as a means for turning it during the operation of the machine. The basket is mounted on the shaft by an internally tapered hub 13 which is secured centrally of the basket rear wall and the reinforcing plate 6. The tub and the basket are provided respectively with openings 14 and 15 in the front wall thereof, which are aligned with a door opening 16 in the front wall of the appearance cabinet 17 which surrounds the tub. A hinged door 18 mounted on the appearance cabinet seals against a gasket 19 around the tub opening 14 to close off the tub during operation of the machine.

The tub structure 6 and the appearance cabinet 17 are both mounted on a suitable base structure 20 at the base of the machine. The tub specifically is supported therefrom by means of a plurality of arms or brackets 21 which are mounted on upstanding plates 22 fixedly attached to the base. The appearance cabinet may be welded to the base or otherwise suitably attached thereto. In addition to the tub and the appearance cabinet the base 20 also mounts the basket drive means. The drive means comprise a motor 23 and a multi-speed transmission assembly 24 (see Fig. 1). The motor 23 drives the transmission assembly 24 by means of a belt 25 and the transmission assembly in turn drives the basket through a belt 26. The belt 26 specifically turns a basket drive pulley 27 which is mounted on the outer end of the basket drive shaft 11. The transmission assembly 24 is shiftable between two different gear ratios so that the basket may be driven at one speed for tumbling clothes and at a second or higher speed for centrifugally extracting water from the clothes. The means whereby the transmission is shifted between the lower and higher speeds preferably comprises a solenoid actuated plunger (not shown).

As mentioned above the machine 1 comprises a combination washer and dryer. That is it proceeds through a cycle of operations first washing, rinsing and damp drying the clothes and then, if desired, completely or fluff drying the clothes. The clothes basket is driven at its lower speed both for washing the clothes and for tumbling them during the drying operation. It is driven at its higher speed for extracting both wash and rinse water from them by centrifugal extraction. The machine during its sequence of operations is under the control of a suitable timer operated sequence control which energizes and de-energizes the various electrical components of the machine in predetermined sequence. Since the sequence control forms no part of the present invention it will not be described herein. However, a sequence control and circuit suitable for use in the illustrated machine are described and claimed in the copending application of Walter E. Gray, Jr., S. N. 512,612 filed June 2, 1955, and assigned to the same assignee as the present invention.

The machine 1 is provided with suitable water supply means whereby either hot water or a mixture of hot and cold water may be supplied to the tub 7 for washing and rinsing purposes. The water supply means includes connections or lines 28 and 29 through which hot and cold water are supplied respectively. A valve controlled by a solenoid 30 admits hot water to the machine and a valve controlled by an opposed solenoid 31 admits cold water to the machine (see Figs. 1 and 4). The hot and cold water valves under the control of solenoids 30 and 31 discharge through a common outlet conduit 32. From the conduit 32 the water passes through a suitable air gap into a funnel 33. The funnel 33 discharges into a line 34 which leads to a sump 35 which is mounted at the bottom of the tub structure and communicates with the interior thereof (see Fig. 2). The break or air gap provided by funnel 33 makes it impossible for water to be siphoned from the machine to contaminate the incoming water supply.

In the illustrated machine a pressure actuated or hydrostatic sensing device 36 controls both the water solenoids 30 and 31 to produce the proper water level in the machine during the washing operation. This sensing device is connected to the interior of the tub by a suitable line 37, and it will be understood that any suitable device of this type may be utilized. Further it will be understood that the sensing device controls the water solenoids only when suitable circuits are closed by the timer operated sequence control. The water level in the tub during the washing operation is such that the lower portion of the basket is covered whereby the basket dips continually into the water as it rotates.

As water is admitted into the machine for washing or rinsing purposes through the line 34 and the sump 35, it displaces the air already in the machine. The air escapes from the machine through a vent hose 38 which is connected to the interior of the tub through a trap element 39 (see Fig. 2). This venting arrangement including the trap 39 forms an important aspect of my invention and will be more fully described hereinafter. During the washing and rinsing operations the air may pass freely through the trap element 39 whereby the tub is continuously vented to the surrounding room through the trap element and the vent tube 38.

The illustrated machine is of the type which uses a cold wall condenser during the drying cycle for condensing the moisture extracted from the clothes. A portion of the outer wall 10 of the tub 7 comprises this condenser and it is cooled by flowing cold water over it. The condenser water is admitted to the machine through an additional solenoid actuated valve controlled by a solenoid 40. The solenoid 40 is energized by the sequence control during the drying operation so that the valve controlled by it passes water at a slow rate sufficient to cool the tub wall for condensing the moisture extracted from the clothes. As shown, the condenser water valve discharges through a separate conduit 41 into a funnel 42 and the air gap between conduit 41 and funnel 42 prevents supply line contamination.

From funnel 42 the condenser water flows through a line 43 (Fig. 2) into the element 39. The condenser water flows through the trap element 39 into the tub and in doing so forms a liquid seal therein whereby air cannot escape from the tub through the vent hose 38 during the drying cycle. If however the drying operation is interrupted and the flow of condenser water stopped, this liquid seal is quickly drained off so that the tub is vented to the surrounding room by the vent hose. The novel arrangement of the trap 39 whereby these results are effected is more fully described hereinafter. It will be noted that the condenser water line 43 leading to the trap includes two full turns and a deep U-bend to prevent suds from being blown into the funnel 42 if an over-suds condition should occur during the washing cycle of the machine 1. Also, the turns and the U-bend prevent the escape of moist expanding air through the line 43 and the funnel 42 when the door is opened briefly and then reclosed during the drying operation.

The condenser water flowing slowly into the tub 7 through the trap 39 is spread over the side of the tub by an inverted V-shaped bead 44 formed on the tub wall 10 directly below the trap. The condenser water being

so spread out cools a substantial portion of the area of the tub wall **10** whereby there is provided a large cool surface for condensing the moisture extracted from the clothes.

The wash and rinse water used during the washing portion of the operation and the condenser water and the moisture extracted from the clothes during the drying operation are discharged from the machine through the sump **35**. A discharge hose **45** leads from the sump to a pump **46** which is connected to the household drain by a flexible conduit **47** (Fig. 1). The pump **46** is energized at suitable times to drain the dirty wash and rinse water from the machine and is continually energized during the drying cycle. It will be noted (Fig. 2) that the discharge hose **45** is connected to sump **35** at a higher level than the wash water inlet or fill line **34**. Specifically the wash water line **34** is connected to the sump adjacent its bottom and the discharge hose **45** is connected thereto adjacent its top. Thus throughout the entire operation of the machine, even when the drain pump is running as during the drain periods of the wash cycle and during the drying cycle, a liquid pool or seal is maintained over the end of the fill line **34**. This prevents the blowing out of suds through the line **34** and the funnel **33** if an over-suds condition occurs during the washing operation, and also prevents the escape of steam through the line and the funnel during the drying operation. Further, if the door should be briefly opened during the drying operation so that cool air enters the machine, the pool in the sump will prevent the escape of this air through the fill line **34**, as it expands. This avoids the introduction of a relatively large quantity of moist air to the interior of the cabinet.

To warm the wash water during the washing portion of the cycle and also in order to heat the clothes during the drying portion of the cycle, there is provided in the machine a heater assembly including two heaters **48** and **49**. These heaters are mounted within the upper portion of the tub **7** so that when energized they heat the basket **2**. The heating units are preferably of the sheathed type in which a resistance wire is maintained in spaced relationship within an outer sheath by a highly compressed, granulated, heat conducting, electrically insulated compound such as magnesium oxide. Such heating elements are sold under the trademark of "Calrod" and are available commercially. When the heaters are energized during the washing cycle, they heat the water by first heating the basket. Then as the basket dips into the wash water at the bottom of the tub, it in turn heats the water. In other words, the rotating basket serves as an effective heat transfer means between the heating elements and the water or other washing liquid. When the heaters are energized during the drying cycles, the heat transferred to the basket is then passed on to the clothes to cause vapor migration out of the clothes. Since the outer cylindrical shell **5** of the basket is perforated, some of the heat from the heating elements passes directly to the clothes by radiation during the drying cycle. A heat reflector **50** is positioned between the heating elements **48** and **49** and the wall **10** of the tub to prevent direct radiation from the heating elements to the tub.

During the drying cycle the heaters **48** and **49** are under the control of a hydraulic type thermostat **51** which is mounted in the backsplasher **52** of the appearance cabinet **17**. Preferably the thermostat **51** not only controls the energization of the heaters but is also so connected with the sequence control that it is effective to control the duration of the drying cycle itself. A suitable circuit for accomplishing such control is shown in the aforesaid Gray application Serial No. 512,612.

The thermostat **51** may be of any suitable hydraulic type but preferably is of the expansible bellows type. As shown, it includes a manually adjustable control knob **53** whereby its response may be varied. The thermostat **51** is actuated by means of a temperature sensing element **54** which is positioned within the tub **7** adjacent the basket **2** (see Fig. 1). The sensing element is connected to the thermostat by means of a suitable hydraulic line **55**.

Referring now to Figs. 4 and 5 I have shown therein my improved venting arrangement whereby the tub **7** is continuously vented to the surrounding room during the washing operation but is substantially sealed off from the room during the drying operation. As is shown in Fig. 5 the trap element **39** comprises a hollow member having three openings or holes into its interior. At its bottom the trap is provided with an opening **56** which communicates with the interior of the tub **7** through an aligned opening **57** in the tub wall. In its roof the trap element is provided with a second opening **58** which leads into the vent hose **38**; and in its right hand side (as viewed in Fig. 5) the trap element includes a third opening **59** which is connected to the condenser water line **43** by a suitable fitting.

Within the trap element **39** there are provided two spaced apart walls **60** and **61**. The wall **60** is an upstanding wall extending upwardly from the lower wall **62** of the trap and the wall **61** is a depending wall extending downwardly from the roof **63** of the trap. The two walls **60** and **61** together with the outer walls of the trap form an S-shaped passageway between the tub opening **56** and the vent opening **58**. Thus any air escaping from the tub flows through a generally S-shaped path in proceeding through the trap from the tub **7** to the vent hose **38**.

As shown in Fig. 5 the condenser water opening **59** is on the same side of the upstanding wall **60** as the vent opening **58**. The result of this arrangement is that a liquid seal is formed within the trap preventing direct communication between the tub opening **56** and the vent opening **58** during the drying cycle when condenser water is flowing through the trap. When condenser water is introduced through the line **43**, the upstanding wall **60** acts as a weir or dam forming a pool of water behind it. The wall **60** is sufficiently high that the pool of water formed behind it covers the lower end of the depending wall **61**. With the end of the wall **61** covered by the liquid pool, a liquid seal is formed with the trap between the tub opening **56** and the vent opening **58** so that the S-shaped passageway through the trap is blocked off.

With regard to the top of the upstanding wall **60** it will be understood that it could be higher than the bottom of the depending wall **61** across its entire width in order to form the liquid pool or seal covering the lower end of the depending wall. In the illustrated embodiment, however, the wall **60** includes a downward step indicated at **64** which is only as high as the bottom of the depending wall. This step **64** is formed in the wall **60** to cause the water overflowing the wall **60** to pass downwardly along the outer wall **65** of the trap. Even in the region of the step though, the liquid pool still covers the end of the depending wall **61**. The reason for causing the water to flow downwardly along the outer wall **65** of the trap is that it then enters the tub closely along the wall **10** thereof above the V bead **44**. As a result it is spread effectively by the V bead. A depending plate **66** extending downwardly in front of the tub opening **57** prevents the water from splashing onto the rotating basket **2** and also aids somewhat in spreading the water over the tub wall.

When the pool of condenser water is formed behind the upstanding wall **60** during the drying cycle, the steam and moisture laden air within the tub **2** cannot pass directly out through the trap and the vent tube **38** due to the liquid seal formed by the pool. Thus the escape of steam and the formation of puddles beneath the end of the vent tube is prevented. As the air within the tub does however expand somewhat as the machine heats up during drying, a restricted by-pass is provided around the liquid seal in order to prevent pressure from being

built up within the machine. Specifically there is provided within the trap 39 a restricted passageway 67 through the depending wall 61. This passageway 67 is normally effective to by-pass enough of the expanding air around the liquid seal to prevent a pressure build up. However, due to the restriction offered by the passageway the moisture or steam contained in the air is condensed out to a very considerable degree so that it does not escape into the room. In other words the moisture in the air flowing through passageway 67 condenses out as the air passes therethrough, and flows downwardly into the liquid pool in the trap element.

If a sufficiently rapid expansion of the air should occur as the machine heats up so that the restricted passageway 67 cannot pass all of it to the vent, the air then bubbles through the liquid seal. The cold water however condenses out a substantial amount of the moisture in the air as it bubbles therethrough and thus prevents the escape of an undesirable amount of moisture or steam through the vent tube. Due to the accompanying increased pressure within the machine, the water level on the right hand side of the depending wall 61 (as viewed in Fig. 5) rises above its normal height which is approximately even with the top of upstanding wall 60. The water level on the right hand side of 61 may even rise as high as or higher than the bleed hole 67. This provides a relatively long length of water through which the escaping air or steam must pass, and as a result a substantial amount of the water vapor is removed from the air. However, it will be understood that this bubbling through of the liquid seal occurs only upon a very rapid expansion of the air. The relief or restricted passageway 67 is normally sufficient to handle the flow of air as the heaters are energized to bring the machine up to a suitable temperature for drying.

In this embodiment means are provided whereby the liquid seal in the trap element is drained very quickly whenever the flow of condenser water ceases. The means whereby the seal is broken comprises a passageway or hole 68 through the base of the upstanding wall 60. The passageway 68 has a flow capacity of less than the normal flow rate through the condenser water line 43, and thus it cannot drain the pool 60 so long as the normal flow of condenser water continues. However whenever the condenser water valve is shut off, the passageway 68 is effective to drain the pool and thus break the liquid seal.

It is of course important that the liquid seal be broken after the drying operation is completed in order that the tub will be continuously vented to the surrounding room during the next washing operation. Also it is desirable that the liquid seal be drained when a temporary interruption occurs in the drying operation itself. For example, it is expected that in a domestic machine of the type illustrated the operator may from time to time open the door 18 during the drying cycle. As a result of the door being opened a large quantity of cold air is introduced into the machine. Then when the door is again closed, this air expands very rapidly as it comes into contact with the heated surfaces of the machine. Unless the liquid seal is drained while the door is opened, the result would be that the rapidly expanding air would blow the liquid seal right out through the vent tube.

Thus, in the illustrated machine suitable circuit means are provided whereby the condenser water valve is shut as soon as the door is opened. This shuts off the supply through the line 43 and the pool forming the liquid seal within the trap drains quite rapidly through the passageway 68. In a preferred machine the trap element has been so arranged that the pool is drained in approximately four seconds after the door is opened. When the operator recloses the door, there is thus no liquid pool within the trap element 39. As a result the cold air admitted through the door while it was open may escape through the trap element and the vent tube as it expands rapidly due to contact with the heated surfaces within the tub. Once the machine is placed back in operation it takes some time for the liquid seal to be formed again behind the wall 60, whereby a sufficient period is allowed for the passage of the rapidly expanding air out through the vent. The circuit whereby the condenser water valve is shut off when the door is opened forms no part of the present invention and thus will not be described herein. It will be understood that any suitable circuit may be used, for example the circuit described in the aforesaid Gray application S. N. 512,612. With that preferred circuit, basket rotation as well as condenser water flow is stopped when the door is opened.

From the above it will be seen that I have provided an improved venting arrangement suitable for use either with a clothes dryer or a combination washer-dryer. By my invention the vent is effectively sealed off during the normal drying operation so that steam cannot escape into the room. However, the bypass passageway around the liquid seal allows sufficient air to escape to avoid the building up of pressure within the tub. Also, due to the drain means included in the trap, the liquid seal is quickly drained off whenever the condenser water flow is interrupted. This system is particularly applicable to a combination washer-dryer since in addition to providing the desired venting effects during the drying operation, it also provides for a continuous venting of the tub during the washing operation. Since there is no condenser water flowing during the washing operation, no seal is formed within the trap element.

Referring now to Fig. 6, I have shown therein an alternate embodiment of my invention. In this embodiment the tub 70 of a combination washer-dryer is vented to the surrounding room by means of a vent hose 71 which communicates with the tub through a trap element 72. The trap element comprises a hollow member having an opening 73 at the base thereof which opens into the interior of the tub, and an opening 74 at the top thereof which connects with the vent hose. Within the trap element there are provided spaced apart upstanding and depending walls 75 and 76 which together with the outer walls of the element form an S-shaped passageway between the tub opening 73 and the vent opening 74. The upstanding wall 75 is secured to the bottom wall 77 of the trap element and extends upwardly past the lower end of the depending wall 76. The depending wall 76 extends downwardly from the top wall or roof 78 of the trap element.

During the drying operation of the machine including the tub 70 a liquid seal is formed within the trap element blocking off the S-shaped passageway and interrupting the flow of air between the tub opening 73 and the vent opening 74. This liquid seal is formed by means of the water which is introduced to the tub 70 for moisture condensation purposes. This condenser water is introduced into the tub through the trap 72 and its tub opening 73 and it will be understood that the water cools a wall of the tub for moisture condensation purposes in the same manner as in the first described embodiment.

The trap element includes a third opening 79 for the introduction of the condenser water thereto. The opening 79 comprises a horizontally extending tube or conduit which is connected to a water line 80. Condenser water is fed into the line 80 from a suitable valve controlled water connection 81 which discharges into a funnel 82 connected to the top of the line 80. An air gap between the line 81 and the funnel 82 prevents contamination of the incoming water line.

The inlet water tube or conduit 79 extends through the side wall 83 of the trap element and also through the depending wall 76 within the element. The tube 79 however terminates short of the upstanding wall 75. When water is introduced into the line 80 from the supply 81 at a suitable rate for cooling a wall of the tub 70 for moisture condensation purposes, it flows at such a rate that when it is discharged from the tube 79 it falls short

of the upstanding wall 75. In other words as the condenser water flows out of the tube 79, it drops behind the upstanding wall 75. As a result a pool of water is formed behind the wall 75 which covers the lower end of the depending wall 76. This pool thus forms a liquid seal breaking the S-shaped air path between the tub opening 73 and the vent opening 74. As a result moisture laden air and/or steam cannot normally escape from the tub into the vent tube and the room during the drying operation.

In order, however, to allow air to escape as the heaters are first energized and the machine brought up to temperature, a restricted passage 84 is provided in the wall 76. The passage 84 bypasses the liquid pool or seal formed behind the wall 75. This passage allows a metered amount of air to escape from the tub to the vent as the machine heats up and thereby prevents a dangerous pressure from being created within the machine. The air in passing through the restricted passageway 84 tends to lose some of its moisture. In other words enough moisture condenses out and falls into the liquid pool that puddles are not formed at the bottom of the vent hose. If the expansion of the air occurs so rapidly that the passageway 84 can not accommodate the necessary flow, in that case there is some bubbling of the air through the liquid seal and out the tube 71. As the air bubbles through the liquid seal, however, the cold water condenses the moisture in the air whereby there is no considerable moisture discharge from the machine.

In order to drain the pool whenever the condenser water ceases flowing, a drain passageway 85 is provided in the upstanding wall 75. This drain passageway has a flow capacity of less than the normal flow rate of condenser water into the machine. The passageway is thereby ineffective to drain the pool so long as the condenser water flow continues. However, as soon as the condenser water flow ceases, the drain 85 thereupon drains the water seal and opens the S-shaped passageway between the vent opening 74 and the tub opening 73. This drain feature of course provides that the seal will be drain at the end of the drying cycle. Also, it provides that the seal is drained if the drying cycle should be temporarily interrupted as by the opening of the machine door. As in the first embodiment it is contemplated that the condenser water flow will be automatically interrupted by suitable means whenever the machine door is opened.

In the embodiment of Fig. 6 the trap element 72 in addition to serving as a vent means and as a condenser water inlet during the drying operation also serves as the main water inlet for wash and rinse water. The wash and rinse water is discharged into the funnel 82 at the top of the line 80 from a connection 86 which is connected to suitable hot and cold water valves. An air gap between the conduit 86 and the funnel 82 prevents contamination of the incoming water line. When water is discharged from the connection 86 for filling the machine, it enters the line 80 and is discharged from the tube 79 into the vent trap 72. The water is however discharged from the line 86 at such a flow rate that when it leaves the tube 79, it flows completely over the top of the upstanding wall 75. In other words its velocity as it leaves the tube 79 is such that it passes completely over the wall 75 and does not form a pool behind it. As a result no water seal is formed behind the wall 75 during the supplying of wash and rinse water to the machine whereby the S-shaped passageway to the vent tube 71 remains continuously open. Also, the tub opening 73 is large enough that air may escape from the tub at the same time as the wash and rinse water is admitted thereto. Thus even though the wash and rinse water is passed through it, the trap element 72 continuously vents the tub to the vent hose 71 during the filling operation. During the washing operation itself there is of course no water flowing through the line 80 and the tube 79 at all whereby the tub is continuously vented to the tube 71.

My alternate venting arrangement is thereby effective to provide the same results as the first described venting arrangement. It continuously vents the tub during the washing operation and during the supplying of wash and rinse water to the tub; and it provides a water seal over the vent during the normal drying operation while condenser water is flowing. Also, it effects a quick breaking of the water seal if the condenser water flow should be interrupted for any reason.

It will be understood of course that the combination washer-dryer on which the trap element 72 is mounted is generally similar to the machine 1 except for the arrangement of the vent and the water supply means. The remaining components of the washer-dryer, such as the basket drive means, the heating means, the drain means, etc., have therefore not been shown in Fig. 6 since it is believed that their operation may be readily understood by reference to the similar components of the machine 1.

While in accordance with the patent statutes I have described what at present are considered to be the preferred embodiments of my invention, it will be obvious to those skilled in the art that various changes and modifications may be made therein without departing from my invention and I, therefore, aim in the appended claims to cover all such changes and modifications as fall within the true spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. In a laundry machine, a clothes basket, an imperforate tub enclosing said basket, heating means for heating the clothes in said basket to extract moisture therefrom, a water line for supplying water to said tub for condensing the moisture extracted from said clothes, a vent tube for venting said tub to the surrounding atmosphere, and a single trap element mounted on said tub for connecting said vent tube and said water line to the interior of said tub, said trap element having a tub opening leading into said tub, a vent opening connected to said vent tube and a water opening connected to said water line, and including wall means for forming a water seal therein between said tub opening and said vent opening when the condenser water is flowing therethrough for condensing moisture in said tub, and passageway means for draining said seal upon the interruption of the flow.

2. In a laundry machine, a clothes basket, an imperforate tub enclosing said basket, heating means for heating the clothes in said basket to extract moisture therefrom, a condenser water line for supplying water to said tub at a predetermined rate for condensing the moisture extracted from said clothes, a vent tube for venting said tub to the surrounding atmosphere, and a single trap element mounted on said tub for connecting both said vent tube and said condenser water line to the interior of said tub, said trap element having a tub opening leading into said tub, a vent opening connected to said vent tube and a condenser water opening connected to said condenser water line, and including wall means for forming a water seal therein between said tub opening and said vent opening during the flow of the condenser water through said element, thereby to prevent steam from escaping from said tub, and means including a drain passageway for draining said water seal upon interruption of the condenser water flow, said drain passageway having a flow capacity of less than the flow through said condenser water line.

3. In a laundry machine, a clothes basket, an imperforate tub enclosing said basket, heating means for heating the clothes in said basket to extract moisture therefrom, a condenser water line for admitting water to said tub for condensing the moisture extracted from said clothes, a vent tube for venting said tub to the surrounding atmosphere, and a single trap element mounted on said tub for connecting both said vent tube and said condenser water inlet to the interior of said tub, said trap element having a tub opening leading

into said tub, a vent opening connected to said vent tube and a condenser water opening connected to said condenser water line, said trap element including in the interior thereof spaced apart upstanding and depending walls forming an S-shaped passageway between said tub opening and said vent opening, said condenser water opening being disposed on the same side of said upstanding wall as said vent opening, whereby a pool of water is collected behind said upstanding wall during the flow of condenser water, said pool covering the lower end of said depending wall and thereby forming a liquid seal between said hub opening and said vent opening, and a drain passageway through said upstanding wall having a flow capacity of less than the flow through said condenser water line for draining said pool upon the interruption of condenser water flow.

4. The combination of claim 3 including a restricted passageway in the upper portion of said depending wall bypassing said liquid seal and providing limited communication between said tub opening and said vent opening during the continuance of said liquid seal.

5. In a machine for both washing and drying clothes, a clothes basket, an imperforate tub enclosing said basket, a water line for supplying water to said tub, heating means for heating the clothes in said tub to extract moisture therefrom for clothes drying, said line supplying water at a first predetermined rate of flow to fill said tub for washing clothes and at a second predetermined rate of flow for condensing the moisture extracted from said clothes, a vent tube for venting said tub to the surrounding atmosphere, and a single trap element mounted on said tub for connecting both said vent tube and said water line to the interior of said tub, said trap element having a tub opening leading into said tub, a vent opening connected to said vent tube, and a water opening connected to said water line, and said trap element including wall means for forming a liquid seal between said tub opening and said vent opening when said water is flowing through said trap element at said second rate of flow during clothes drying, said wall means being ineffective to form said seal when said water is flowing through said trap element at said first rate of flow to fill said tub, and passageway means for draining said seal upon the interruption of the flow at said second rate.

6. In a machine for both washing and drying clothes, a clothes basket, an imperforate tub enclosing said basket, a water inlet line for supplying water to said tub for washing clothes, means connecting said line to said tub, heating means for heating the clothes in said basket during the drying operation of said machine to extract moisture therefrom, a condenser water line for admitting water to said tub for condensing the moisture extracted from said clothes, a vent tube for venting said tub to the surrounding atmosphere, and a single trap element mounted on said tub for connecting both said vent tube and said condenser water line to the interior of said tub, said trap element having a tub opening leading into said tub, a vent opening connected to said vent tube and a condenser water opening connected to said condenser water line, and said trap element including wall means for forming a water seal therein between said tub opening and said vent opening during the flow of condenser water through said element, thereby to prevent steam from escaping from said tub during said drying operation, and means including a drain passageway for draining the seal upon interruption of the condenser water flow.

7. The combination of claim 6 including a sump at the bottom of said tub for connecting said water inlet line to said tub, and a water discharge line connected to said sump for discharging water from said tub, said discharge line being connected to said sump at a higher level than said water inlet line, whereby a liquid seal is maintained over said water inlet line during both the washing and the drying operations of said machine.

8. In a machine for both washing and drying clothes, a clothes basket, an imperforate tub enclosing said basket, an inlet water line for supplying water to said tub for washing clothes, means connecting said inlet water line to said tub, heating means for heating the clothes in said basket during the drying operation to extract moisture therefrom, a condenser water line for admitting water to said tub for condensing the moisture extracted from said clothes during the drying operation, a vent tube for venting said tub to the surrounding atmosphere, and a single trap element mounted on said tub for connecting both said vent tube and said condenser water line to the interior of said tub, said trap element having a tub opening leading into said tub, a vent opening connected to said vent tube, and a condenser water opening connected to said condenser water line, and said trap element including wall means for forming a water seal therein between said tub opening and said vent opening during the flow of condenser water through said element, said wall means including a restricted passageway by-passing said water seal to provide limited communication between said tub opening and said vent opening during the continuance of said seal, and means including a drain passageway for draining said water seal upon interruption of the condenser water flow.

9. In a machine for both washing and drying clothes, a clothes basket, an imperforate tub enclosing said basket, a water inlet line for supplying water to said tub for washing clothes, means connecting said water inlet line to said tub, heating means for heating the clothes in said basket during the drying operation of said machine to extract moisture therefrom, a condenser water line for admitting water to said tub during said drying operation for condensing the moisture extracted from said clothes, a vent tube for venting said tub to the surrounding atmosphere, and a single trap element mounted on said tub for connecting both said vent tube and said condenser water line to the interior of said tub, said trap element having a tub opening leading into said tub, a vent opening connected to said vent tube and a condenser water opening connected to said condenser water line, and said trap element including in the interior thereof spaced apart upstanding and depending walls forming an S-shaped passageway between said tub opening and said vent opening, said condenser water opening being disposed on the same side of said upstanding wall as said vent opening, whereby a pool of water is collected behind said upstanding wall during the flow of condenser water covering the lower end of said depending wall and forming a liquid seal between said opening tub and said vent opening, and a drain passageway through said upstanding wall for draining said pool upon the interruption of said condenser water flow.

10. The combination of claim 9 wherein said depending wall includes a restricted passageway in the upper portion thereof providing limited communication between said tub opening and said vent opening during the continuance of said liquid seal.

11. The combination of claim 9 including a sump at the base of said tub for connecting said water inlet line to said tub, and a water discharge line connected to said sump for discharging water from said tub, said discharge line being connected to said sump at a higher level than said water inlet line, whereby a liquid seal is maintained over said water inlet line during both the washing and the drying operations of said machine.

12. In a machine for both washing and drying clothes, a clothes basket, an imperforate tub enclosing said basket, a water inlet line for supplying water at a first predetermined rate of flow to fill said tub for washing clothes and at a second predetermined rate of flow for condensing the moisture extracted from the clothes during the drying operation, heating means for heating the clothes within

said basket during the drying operation to extract moisture therefrom, a vent tube for venting said tub to the surrounding atmosphere, and a single trap element mounted on said tub for connecting both said vent tube and said water line to the interior of said tub, said trap element having a tub opening leading into said tub, a vent opening connected to said vent tube and a water opening connected to said water line, and said trap element including in the interior thereof spaced apart upstanding and depending walls forming an S-shaped passageway between said tub opening and said vent opening, said water opening being disposed on the same side of said upstanding wall as said vent opening and comprising a conduit extending into said trap element, said conduit discharging behind said upstanding wall when water is flowing through said inlet line at said second rate of flow for condensing moisture, whereby a pool is collected behind said upstanding wall during said drying operation covering the lower end of said depending wall and forming a water seal between said tub opening and said vent opening, said trap element including a drain passageway for draining said pool when the flow of condenser water is interrupted, and said conduit discharging over said upstanding wall when said water is flowing through said inlet line at said first rate of flow for filling said tub for the washing of clothes, whereby said tub opening and said vent opening remain in communication with no seal therebetween during the filling of said tub.

References Cited in the file of this patent

UNITED STATES PATENTS

1,235,641	Berry	Aug. 7, 1917
2,619,825	Rosenkraus	Dec. 2, 1952