HEATING MEANS FOR COMBINATION WASHER-DRYER


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9 Claims. (Cl. 68—12)

The present invention relates to improvements in laundering machines and especially to automatic home laundering machines of the combination type wherein both laundering and drying are automatically completed within the same machine and the fabrics or clothes are subjected to a complete operation and are completely laundered and dried.

A laundering machine of the preferred type in which the present invention may be embodied includes a laundering cylinder or drum which defines a laundering zone therein in which the clothes are subjected to a washing and a drying action. The machine is preferably self-contained and controlled by a pre-settable sequential time controlled device provided with cam controlled electrical switches for operating the various functional elements in their proper sequence and for the desired length of time to complete the laundering operation.

In a machine of the type shown in the drawings to illustrate the invention, fabrics or clothes are subjected to a washing action within the laundering zone such as by rotating the drum at a tumbling speed and directing a stream of water against the fabrics therein with the fabrics tumbling and impacting against the solid non-liquid interior of the drum to aid in loosening the soils from the wetted fibers of the fabrics. The drum is perforated for the escape of washing liquid and beneath the drum is positioned a washing liquid tank with a drum wrapper furnishing sloping side walls of the tank. A gas burner is located beneath the tank to heat the liquid therein and apply heat to the sloping walls leading to the tank. An air conduit means directs a flow of air along the combustion chamber, in which the burner is located, up through a flue and into a transverse duct or heater box and then axially through the laundering drum and up axially across the top of the drum through a lint tube where a fan draws the air out of the machine. The flow of air is controlled by a damper in the lint tube so that a reduced flow of air will pass through the drum during the washing operation to aid in supporting combustion and to heat the laundering zone for increasing the temperature of the stream of water and of the clothes as they are impacted against the inside of the drum. During the drying operation, an increased flow of air is passed through the drum for evaporating the moisture and drying the fabrics therein.

It is an object of the present invention to provide an improved laundering machine which is automatically operated by a pre-settable sequential time control and which automatically performs both a laundering and a drying operation performing both operations in an improved manner.

Another object of the invention is to provide improved apparatus for laundering fabrics in a laundering zone wherein the fabrics are subjected to a stream of liquid and are impacted against the non-liquid surface in a laundering zone in which the air is heated to a temperature greater than the washing liquid.

Another object of the invention is to provide a laundering machine in which a continual flow of heated air passes through the laundering zone during the washing operation.

A further object of the invention is to provide an improved arrangement for heating laundering liquid to be applied to fabrics in a laundering zone and wherein the liquid can escape from the laundering zone and is rapidly heated as it escapes.

A further object of the invention is to provide an improved heating means for washing liquid and wherein a single heating means serves to heat the washing fluid both directly and indirectly wherein the same heating means is used for heating drying air during the drying portion of the laundering operation.

A further object of the invention is to provide a laundering machine utilizing a flow of heated air wherein an improved flow path for the heated air is defined through the machine.

A still further object of the invention is to provide an improved laundering machine for laundering fabrics wherein a flow of heated air is utilized during both washing and drying operation and wherein an improved means is provided to control the flow of air and whereby a full flow is utilized during a drying period and a reduced flow is employed during a washing period of operation.

Other objects and advantages will become more apparent throughout the teachings of the principles of the invention in connection with the disclosures of the preferred embodiment in the specification, claims and drawings, in which:

Figure 1 is a side elevational view of a laundering machine shown somewhat diagrammatically and with the cabinet removed from the machine to generally illustrate the location of the combustion chamber and the path of flow of air through the machine;

Figure 2 is a front elevational view shown somewhat diagrammatically and illustrating the machine of Figure 1;

Figure 3 is a front elevational view of the laundry machine with a front inspection panel of the cabinet removed to illustrate the mechanism within the cabinet, the drawing showing only the lower part of the machine;

Figure 4 is a side elevational view of the laundry machine with the portions of the cabinet and other elements removed for clarity illustrating the combustion zone of the machine;

Figure 5 is a rear elevational view of a machine with the cabinet and other elements broken away or removed to better show the details of construction of the rear end; and

Figure 6 is an enlarged detailed elevational view of a damper for controlling the flow of air through a lint tube on the machine.

Figures 1 and 2 illustrate somewhat diagrammatically the overall arrangement of the machine elements and show the location of many of the salient elements which embody the principles of the invention. The machine includes a cabinet 10 which normally surrounds the working parts of the machine, but which is broken away for clarity of the drawing. Rotatably supported within the cabinet for rotation about a horizontal axis is a laundering cylinder or drum 12 which defines a laundering zone 14 therein in which the washing and drying functions are performed. Although other forms of laundering apparatus may be employed, the laundering drum 12 is rotated throughout the laundering and drying operation at a tumbling speed, being driven by a pulley 16 secured to its supporting shaft 18. Of course, the drum rotates at centrifuging speed during fluid extraction.

As will be further described in connection with the drawings which show greater detail of the structure in
Figures 4, 5, and 6, the drum is perforated for the escape of washing liquid and the liquid precipitates downwardly to be captured in a liquid tank 20 which is positioned directly below the drum 12 and which has a wrap-around bottom 22 that extends upwardly in angular sides 24 and 25 to receive the washing liquid.

The liquid in the tank 20 is heated by a burner 26 located in a combustion zone 28. This burner forms a unit heat supply for heating the liquid in the tank 20, for heating the air which is passed through the laundering zone 14 during the washing operation, and for heating the air which passes through the laundering zone 14 during the drying operation.

For these operations, the air is directed through an air conduit means defining a path of flow for optimum laundering results. The path includes the combustion chamber 28 with the air entering the front of the machine where the burner is mounted. The air flows axially to the back of the machine, reverses itself and again flows axially through the laundering zone 14, and again reverses itself to flow axially along the lint tube 30 to the back of the machine where it enters the fan scroll 32 and is discharged through the discharge opening 34.

Two stages of air flow are utilized by the machine as controlled by a flow control damper 36 mounted in the lint tube 30.

As to the more specific details of construction, the cabinet 10, as shown in Figures 3, 4 and 5 is supported at its four corners by legs 40, 42 and 44, which may be adjustable in order to level the cabinet. As illustrated in Figure 5, the horizontal drum or cylinder 12 is supported on vertical supports 45 and 47 at the rear of the machine carrying a cross beam 49 in which is carried a bearing for rotationally journalling the shaft 18 supporting the drum.

According to the operation of the preferred embodiment, the drum is rotated at a speed throughout the washing operation whereby the articles will fall to impact against the inside of the cylinder. The drum driving pulley 16 is driven by a V-belt 46 passing over the V-pulley 16. The belt 46 is driven by a V-pulley 48 secured to an idler shaft 50. The idler shaft is driven by a driving pulley 52, with the pulleys 48 and 52 being secured to the shaft so as to rotate with each other.

The driving pulley 52 is driven by a belt 54 which in turn passes over and is driven by an output pulley 56 of a variable speed controller pulley assembly 58. The input pulley of the assembly is pulley 60 which is driven by a belt 62 passing over a drive pulley 64 of a drive motor 66. The speed control pulley assembly 58 has a central shaft 68, the position of which controls the drive ratio through the pulley assembly in order to eventually control the speed of rotation of the drum 12.

As illustrated in Fig. 1, within the fan scroll 32 is a fan 70 mounted on a rotatably supported shaft 72. The shaft and fan 70 are driven by a pulley 74 which is driven by a belt 76, as illustrated in Fig. 5. A belt tightening pulley 78 is used to maintain the proper driving tension of the belt 76. The belt is driven by a pulley 80 mounted on a drive shaft 82 of the motor 66.

The aforesaid mechanism will rotate the drum 16 at the correct speeds during the washing and the air drying operation. With the use of the variable speed control 58, the drum may be rotated at higher speeds at the end of a washing operation for spin-drying the fabrics therein to centrifugally extract the washing or rinse liquid in preparation for the air drying operation.

The washing operation within the laundering zone is preferably performed by directing a stream of water against the fabrics therein by a nozzle 84 (Figure 3) supplied with washing liquid under pressure through a washing liquid line 86. Liquid is supplied by a pump P shown diagrammatically and connected to the tank 20. As the drum 12 rotates, the stream or spray of washing liquid issuing from the nozzle 84 engages the fabrics to wet the fibers and loosen the soil particles. As the drum continues to rotate and carries the fabrics upwards, with the drum rotating in the direction indicated by an arrow 88, the fabrics will tumble downwardly to impact against the solid non-liquid inner surface of the drum 12. Inasmuch as the drum 12 is perforated, and the liquid level in the tank 20 is maintained beneath the drum 12, there will be a solid surface for impacting the clothes. This impacting will flex the fibers aiding in loosenig the soils therefrom for an improved laundering operation. The nozzle 84 will be located at one end of the drum to be directed across the drum to engage the fabrics therein. In accordance with the present invention, the air in the laundering zone 14 within the drum 12 is at a temperature greater than the washing liquid and will flow relatively slowly axially through the drum. This air is heated by the burner 26 which is also provided for heating the washing liquid in the tank 20 and for heating the air used for drying the fabrics within the laundering zone 14.

As illustrated in Fig. 3, the burner is preferably fired with a combustible gas which is admitted to the machine through a supply pipe 90. The gas, after entering the machine, flows through a main shut-off valve 92 and a pressure regulating valve 94 before reaching the burner 26. The nozzle 98 is located at one end of the drum to direct the gas across the drum 12 to engage the fabrics therein. In accordance with the present invention, the air introduced to the burner 26 which is also provided for heating the washing liquid in the tank 20 and for heating the air used for drying the fabrics within the laundering zone 14.

The burner 26 is supplied with a combustible fuel and is ignited at a burner end 108 to heat the gases that flow through the combustion chamber 28. The air flowing through the combustion chamber enters at a front end 112a of the chamber and flows axially rearwardly to leave through an exit 112b at the rear of the chamber. Positioned to project vertically upwardly at the rear of the chamber and at the front of the opening 112b is a deflector plate or flame target 114, Figs. 1 and 4. The flame target 114 concentrates the heat within the combustion chamber 28 and prevents the direct flow of burning gases up through the flue 106 where they might enter the laundering zone 14. The combustion chamber 28 is insulated on its outer side by insulated bottom and side walls 107 and 109 respectively.

The burner 26, extending into the combustion chamber 28, thus heats the washing liquid directly in the tank 20 and the tank bottom which is preferably of sheet metal, transmits heat so that the inclined bottom sloping extensions 24 and 25 will heat the bottom of the liquid therein and allow the liquid therein to be heated throughout. The inclined bottom sloping extensions 24 and 25 will be extended upwardly to integral with vertical side walls 110 and 111, and with the inclined walls 24 and 25. These complete the tank wrapper which extends along the bottom and upwardly along the sides of the cylindrical drum. Tank end walls, shown generally at 115 and 117 in Figure 1, extend across the end of the wrap-around tank body to enclose the water or liquid in the tank. Thus, during operation of the laundering machine, when a stream of water is being directed against the fabrics in the drum 12, the water escapes downwardly through the perforated drum 12 passing into the tank.
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20 and spraying through the opening of the drum against the heated walls 24, 25, 110 and 111 of the wrap-around tank. This increases the speed and effectiveness of heating the liquid.

In a domestic laundry machine, such as the type shown, the liquid commonly used is water with a soap or detergent used in the water during the laundering operation, and with a clear water used during rinsing operations. Water can be admitted cold to the drum to be heated in the tank 20, but preferably is admitted hot from a household hot water supply line and the temperature is increased to an optimum laundering temperature, as determined by the thermostat 87, which controls the operation of the burner 26.

The air passing through the machine flows axially through the combustion zone 28 out through the opening 112b at the back of the zone, up through the flue 106 and into a heater box or transverse duct 116 which is illustrated in Figures 1 and 2 as rectangular in shape and extending across the rear of the machine. As illustrated in Figs. 1, 2, 4, and 5, the flue 106 is rectangular in cross section and passes air through an opening 118 into the heater box. The air flows across the heater box to its opposite end where it is provided with a rectangular opening 120 through which the air discharges heated air into the laundering zone 14. The air passes through a back end wall 121 of the drum 12, which may have an annular arrangement of enlarged perforations for the free passage of air at the radius which is aligned with the opening 120.

The air then flows axially through the laundering zone 14 following the path indicated by the articulated arrows 122.

The forward end of the drum is flared outwardly at 124 to form an opening 126 for loading and removing the fabrics or clothes being laundered. The outwardly flared portion 124 is surrounded by an annular ring 130 which leads into an inwardly tapered perforated wall 132 of annular shape through which the air flows as it leaves the Laundering zone 14. Facing the wall 132 is an imperforated wall 134 which faces the front of the machine and surrounds the opening 126 through which access to the drum is afforded.

Thus, perforated wall 132 and imperforate wall 134 with an outside wall 135 define an annular air flow channel 136 through which air passes; upwardly into the duct 138 to flow rearwardly through the lint tube 30.

Air is drawn through the lint tube by the fan 70 which is located at the rear end of the machine and draws the air from the air flow system to discharge into the discharge opening 34.

The flow of air through the air conduit means which defines the aforementioned path of air flow, moves at two levels. The first level is a relatively low rate of air flow that occurs during the washing operation. The second level is an increased rate of flow which occurs during the air drying operation. The flow in the present instance, is controlled by a flow damper 36, shown schematically in Fig. 1, and shown in detail in Fig. 6.

The damper plate 36 is mounted on trunnions 140 and 142, which are pivotally mounted at the sides of the lint tube 30. The damper 36 is shown in its closed position in Fig. 6, which will be referred to as a first position and is the position which it assumes during the washing period. The damper is made so as to be somewhat smaller than the cross section of the tube 30 to provide an air flow space 144 between the outer edge of the damper and the inner surface of the tube. The air flow quantity is such to allow sufficient air for proper combustion of the gases in the combustion zone 28, but to prevent a cooling off of the liquid tank 20 and the combustion chamber 28 during the washing period.

The flow of air, however, maintains an increased temperature in the laundering zone 14 and causes the stream of water from nozzle 84 to flow through the increased temperature and the fabrics to tumble through the increased temperature as they are impacted on the solid inner surface of the drum 12.

The damper 36 is pivoted upwardly to a substantially horizontal position to fully open the lint tube 30 in its second drying position. The damper is moved to this second position during the drying period for the machine. To pivot the damper, the rod 146 which forms the trunnions 140 and 142 is bent at right angles to form an arm 148 at the end of trunnion 142. To this arm is connected a tension spring 150 which continually urges the damper 36 to open position. A core 152 of an electrically energizable solenoid 154 is connected to an extension arm 156 connected to the trunnion arm 148. When the solenoid is energized, the core withdraws into the solenoid to pull downwardly on the trunnion arm 148 and move the damper 36 to closed position. When the solenoid is deenergized, the spring 150 takes over and pulls the damper to open position. Thus, with failure of electrical circuit, the damper will move to open position.

The solenoid has electrical leads 155 which are connected to a switch in the presettable sequential time control mechanism 100 to cause the damper 36 to be operated at the proper time during the sequence of operations that complete the cycle of operation of the machine.

In operation, fabrics, usually in the form of clothes to be laundered, are placed within the drum 12 through the opening 126 into the laundering zone 14. The drum 12 rotates at a slow speed while a stream of water is directed against the fabrics by a nozzle 84, Fig. 3. The clothes are carried upwardly with the drum and drop down to be impacted against the rigid non-liquid inner surface of the drum for the washing operation.

During the washing operation, the burner 26 is heating the water in the tank 20 which is pumped through the nozzle 84 via a line 86 by the pump 71 which withdraws water from the tank 20.

In addition to heating the water in the tank, the burner 26 heats the air which flows through the combustion zone 28, up the flue 106, through the transverse duct or heater box 116 and axially through the laundering zone 14, up the duct 138 at the front end of the machine rearwardly through the lint tube 30. The flow of air through this air path is controlled by the air flow damper 36, which reduces the flow of air to a level to prevent cooling the water of the tank 20 but to utilize the heat of the burned gases for heating the stream of water and the fabrics as they are impacted, during the washing operation. During the drying operation, the damper 36 is opened for a full flow of air to utilize the heated gases for drying of the fabrics.

Thus, it will be seen that we have provided an improved combination washing and drying machine which meets the objectives hereinbefore set forth. The apparatus of the invention is well adapted to use in a combination machine automatically controlled by a presettable sequential time control device. The machine is illustrated as being well suited to use as a domestic automatic laundry machine and can be operated by the housewife through a complete cycle of operations without attention. The clothes will be placed in the machine and the time control operator started and the machine will automatically progress through its functions, stopping itself when the clothes have been completely laundered and are ready to dry.

The features of the machine of the invention enable controlling the temperature of the washing fluid and obtaining an optimum operating temperature for an improved washing operation. Also, the utilization of the hot burned gases which are originally used for heating the water in the tank effect an economy in that the gases
are passed through the laundering zone and are used for heating the sprayed stream of water and the clothes during their impacted treatment. The path of gas flow is such that a substantial amount of heat is retained within the cabinet before the gases are discharged to atmosphere. Further, a single heating means is utilized for the various heating functions.

We have, in the drawings and specification, presented a detailed disclosure of the preferred embodiments of our invention, but it is to be understood that we do not intend to limit the invention to the specific form disclosed and intend to cover all modifications, changes and alternative constructions falling within the scope of the principles taught by our invention.

We claim as our invention:

1. A combination laundry machine for washing and drying operations comprising a chamber defining a laundering zone wherein articles may be subjected to a washing operation during a first operational period and subjected to a drying operation during a second operational period, an air conduit means defining a path of air flow through the laundering zone, flow control means for controlling the flow of air through the conduit means and operative to selectively create a first reduced flow quantity during the washing operation and a second increased flow quantity during the drying operation, a heater associated with the air conduit for increasing the temperature of air flowing through said zone, and a pre-settable sequential time control means determining the time period to move through the laundering zone during the washing period and the second flow quantity during the drying period.

2. A laundering machine for washing articles comprising a washing and drying chamber wherein articles may be subjected to a laundering operation, a liquid container for washing liquid to be applied to the articles during laundering, means defining a combustion zone, a burner located in the combustion zone in heat-transferring relationship to the liquid container, conduit means defining a continuous open air flow path through the combustion zone and through the washing and drying chamber, and a fan positioned to move air through the combustion zone, conduit means and washing and drying chamber to aid in support of combustion to heat the liquid for laundering, and whereby the heated air will transfer heat to the liquid and the articles in the washing and drying chamber during the washing of the articles and the articles during the drying thereof.

3. In combination in a laundering machine or the like, a container defining a treating zone wherein articles are subjected to a flow of hot gas during washing and drying operations performed therein, a continuously open conduit means defining a flow path through the treating zone, a heater positioned to increase the temperature of the air flowing through the conduit means, means forcing air through the conduit means, and a time operated valve in the conduit means movable between a second position wherein a substantial flow of air is obtained during the drying operation and a first position wherein a reduced flow is obtained but the conduit is not completely closed whereby air flow through the container continues during the washing operation.

4. A combination laundry machine for washing and drying operations comprising a chamber defining a laundering zone wherein articles may be subjected to a washing operation during a first operational period and subjected to a drying operation during a second operational period, a continuously open air conduit means defining a path of air flow through the laundering zone, a damper in the air conduit movable between a second position wherein a large flow volume is obtained during the drying operation and a first position wherein a reduced flow is obtained during the washing operation whereby the temperatures of the washing fluid and articles are increased, a heater associated with the air conduit for increasing the temperature of air flowing through said conduit, and means operatively connected with theduration of the washing and drying operations to move the damper to the first position during washing operations and to the second position during drying operations.

5. A laundering machine for washing articles comprising a chamber defining a laundering zone wherein articles may be subjected to a laundering operation, a liquid container for washing liquid to be applied to the articles during laundering, means for directing a stream of liquid from the liquid container into the washing chamber during a washing period with the stream being terminated during a drying period, air conduit and movable means combined to drive heated air through the washing chamber during the laundering period, flow control means in the conduit having a first operating condition wherein the flow through the conduit is limited during the washing period and a second operating condition wherein an increased flow is obtained during the drying period, a positioner operatively connected to heat the air flow through the conduit means, andsequential control means placing the flow control means in the first operating condition during the laundering period to increase the temperature of the washing fluid and the articles being laundered and in the second operating condition during the drying period.

6. A combination laundry machine for washing and drying articles comprising a laundering chamber defining a laundering zone wherein articles are subjected to a washing operation by a washing fluid during a first operational period and subjected to a drying operation during a second operational period, an air conduit means connected to define a flow path of air through the laundering zone, a flow controlling air valve means in the conduit operable between a first position wherein the flow of air is restricted but the conduit means is not completely closed during the washing operation and a second position wherein the conduit means is opened during the drying operation, an electrically controlled motor means connected to the air valve operative to control the position of the air valve, a heater positioner to increase the temperature of the air flow through the air conduit means, and a pre-settable sequential time control operatively connected to the motor means whereby the air valve will be moved to the first position during the first washing operational period whereby the flow of air through the machine will be limited and the temperature of the washing fluid and articles is increased and to the second position during the second drying operational period whereby an increased flow of air will be permitted.

7. A combination laundry machine for washing and drying fabric articles comprising in combination a cabinet for enclosing operating mechanism, a rotatable horizontal drum within the cabinet having draining perforations in the outer wall and having openings at the ends for the flow of air, a tank positioned beneath the drum to contain laundering liquid beneath and out of contact with the drum, said tank having a bottom extending upwardly and outwardly below the drum whereby liquid precipitating downwardly from the drum is received by the tank bottom, a gas burner positioned in a combustion zone within the cabinet beneath the tank bottom to heat the liquid in the tank and heat said bottom, a first conduit means extending upwardly within the cabinet from the combustion zone to conduct air upwardly from beneath the tank into a first open end of the drum, a second conduit means positioned at the second open end of the drum and directing a flow of air from inside of the drum upwardly above the drum, a third conduit means leading along the top of the drum from the second end to the first end, an air flow control damper in the third conduit and movable between a first position
wherein the flow of air through said conduits is reduced during the washing operation and a second position wherein the flow through said conduits is increased during the drying operation, means for continually moving the air through said conduits during both the washing and drying operations, nozzle means positioned to direct a stream of water against articles being washed within said drum during a washing period wherein washing liquid engages the articles during a washing operation and drains downwardly through said drum drainage perforations with heated air passing through the moist fabric articles, said stream being terminated during a drying period, and means for positioning said damper in said first position during said washing period and for positioning the damper in said second position during said drying period.

9. A laundering machine for washing and drying fabrics comprising in combination a cabinet for a housing operating mechanism, a horizontal drum supported within the cabinet and having perforations in the outer surface with an opening in the front end of the drum for loading the drum with articles to be washed and an air receiving opening in the rear end of the drum, means for driving the drum in rotation, a tank positioned within the cabinet below the drum and having a wrap-around bottom containing liquid beneath the drum and extending upwardly beneath the sides of the drum to catch liquid discharged through the perforations in the drum, a gas burner positioned in a combustion zone beneath the tank within the cabinet, a first conduit extending upwardly at the rear of the cabinet from the combustion zone into the rear opening in the drum, a second conduit extending upwardly from the front end of the drum to the top of the cabinet, means defining air flow openings around the front drum opening, collecting means directing air from said opening to said second conduit, a third conduit extending along the top of the cabinet and connected to receive air from the second conduit, a fan at the rear of the cabinet connected to the third conduit to draw air through said conduits and through said combustion zone and said drum during both the washing and drying operations, a damper within said third conduit movable between a first position of reduced air flow during washing and a second position of increased flow during drying, means for moving the damper into the first position during a washing operation and into the second position during a drying operation, and nozzle means positioned to spray a stream of water against the articles being laundered within the tub during the washing operation.

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