

June 9, 1942.

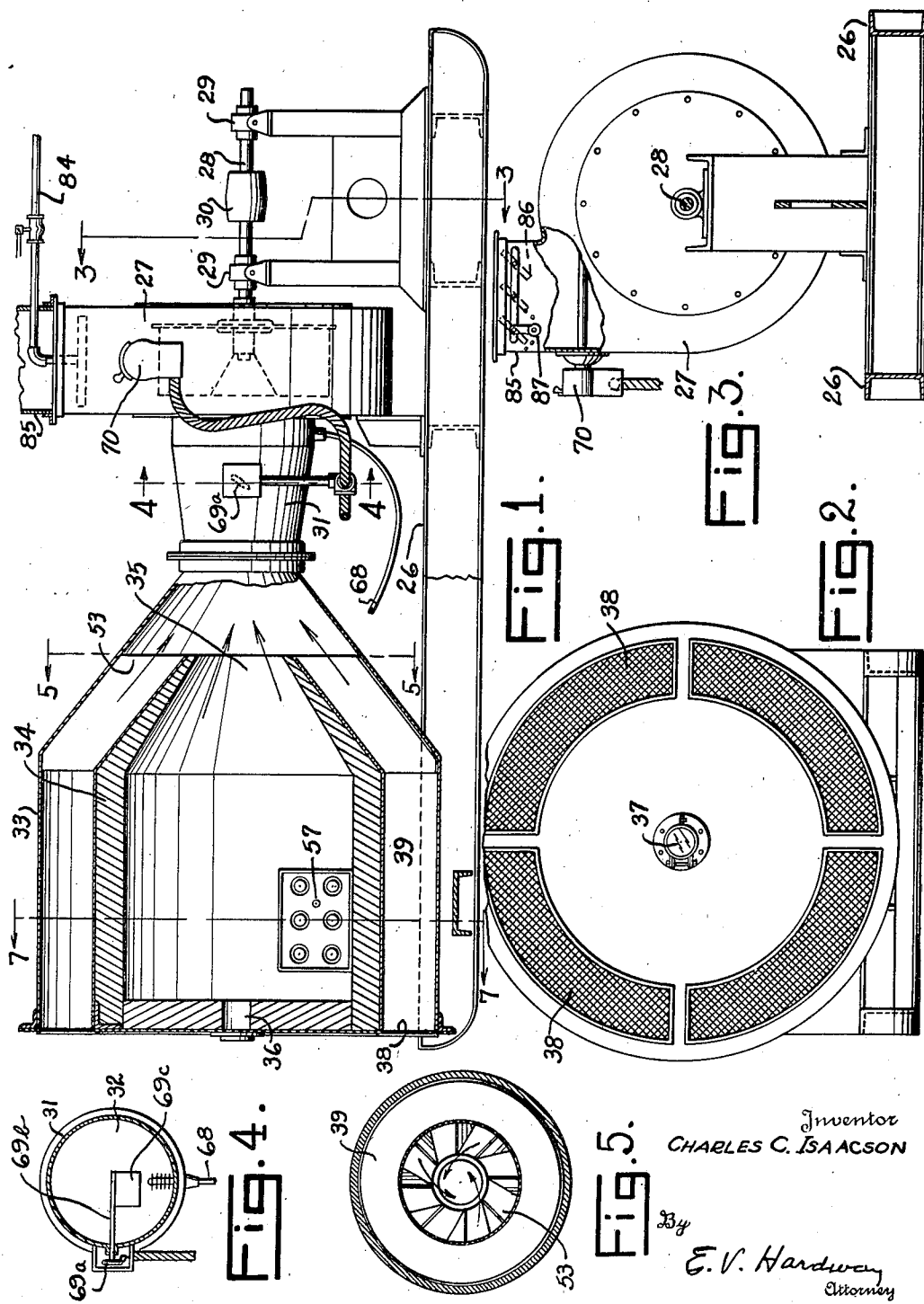
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2,285,718

AIR HEATER

Filed Aug. 15, 1939

2 Sheets-Sheet 1



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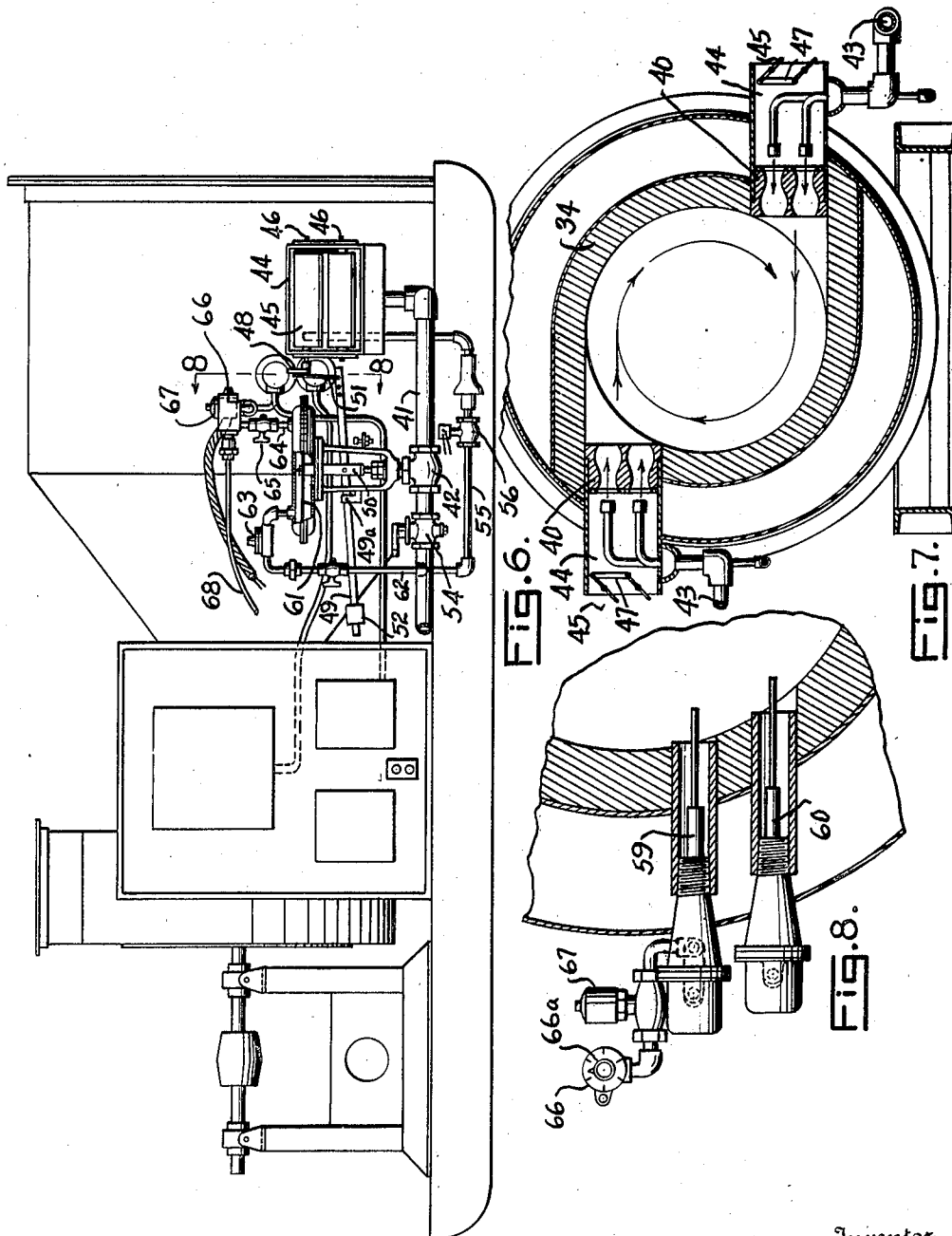
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UNITED STATES PATENT OFFICE

2,285,718

AIR HEATER

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Application August 15, 1939, Serial No. 290,213

1 Claim. (Cl. 263—19)

This invention relates to an air heater.

An object of the invention is to provide an air heater of the character described specially designed for use in drying cotton which is tendered to the cotton gin before it is sufficiently dry to be efficiently ginned. The heater, however, is adaptable for general use in heating air wherever it may be desired.

Another object of the invention is to provide a heater of the character described whereby the amount and temperature of the air may be easily varied so as to adapt the heater to the requirements to be met depending on the state of the cotton to be dried.

It is a further object of the invention to provide an air heater which is of a unitary structure all mounted on skids for easy handling and mounting.

It is a further object of the invention to provide an air heating unit which is so designed as to conduce to the complete combustion of the fuel within the furnace chamber thus conducting to economy in fuel consumption eliminating fire hazards and fumes and as a result eliminating discoloration of the cotton being dried.

A further feature of the invention resides in the provision of an air heater embodying a novel type of furnace having circular walls and enclosed within an outer shell spaced from the furnace proper thus causing the outside or supplemental air to circulate through the space between the shell and the furnace walls to preheat said air as well as to keep the walls cool thus in effect insulating the furnace, provision being made for mixing the supplemental air and the hot air from the furnace only after combustion has been completed in the furnace, the supplemental air and the hot air from the furnace being mixed and mingled in a mixing chamber provided for the purpose.

It is a still further object of the invention to provide an air heater of the character described wherein the burners are mounted tangential to the furnace walls so that the flame follows a spiralled course around the furnace walls toward the mixing chamber. The course of the flame varies depending on the velocity of the air current. Upon increase of the current velocity the centrifugal force will be correspondingly increased thus increasing the period of combustion automatically and conducting to a more efficient combustion of the fuel.

With the above and other objects in view the invention has particular relation to certain novel features of construction, operation and arrange-

ment of parts, an example of which is given in this specification and illustrated in the accompanying drawings, wherein:

Figure 1 shows a side elevation of the heater, partly in section.

Figure 2 shows a rear elevation.

Figure 3 shows a cross-sectional view taken on the line 3—3 of Figure 1.

Figure 4 shows a cross-sectional view taken through the mixing chamber.

Figure 5 shows a cross-sectional view taken on the line 5—5 of Figure 1.

Figure 6 shows a side view as viewed from the side opposite that shown in Figure 1.

Figure 7 shows a cross-sectional view taken on the line 7—7 of Figure 1, and

Figure 8 shows an enlarged, fragmentary, sectional view taken on the line 8—8 of Figure 6.

Referring to Figure 1 the numerals 26 designate the spaced skids whereon there is mounted a suction fan, or blower, 27, which discharges its air directly into the pipe 22. The fan impeller is mounted on and driven by a suitable shaft 28 rotatable in the bearings 29 and driven in any suitable manner as through the pulley 30.

A tubular housing 31 enters one side of the fan casing and encloses a mixing chamber 32 wherein the hot air from the furnace and the supplemental air are thoroughly mixed. There is an outer jacket 33 whose outer end is preferably cylindrical and whose inner end converges toward and merges into the outer end of the housing 31 as shown in Figure 1 thus forming a Venturi passageway for the hot air as it enters and passes through the mixing chamber. Within the outer jacket 33 and spaced therefrom there is a furnace 34 which is shaped to conform to the shape of the outer jacket, its outer end being approximately cylindrical and its inner end converging toward the mixing chamber and having an opening 35 into said mixing chamber. This furnace is lined with suitable radiant material and its outer end is closed and provided with a sight opening 36 which may be closed by a door 37 formed with transparent material. The outer end of the jacket is formed with arcuate screens 38 opposite the space between the jacket and furnace for the inlet of supplemental air which passes inwardly through the said space around the furnace designated by the numeral 39 in Figures 1 and 5. The jacket, furnace and fan 27 form a unitary structure on the skids.

The furnace is equipped with the inside burners as 40, 40. These burners are so arranged that the flame will be emitted in an approxi-

mately tangential direction with respect to the inside wall of the furnace as shown in Figure 7 so that the flame will travel, not only forwardly but also in a spiralled direction about the furnace walls. The burners are supplied with gas through the main gas pipe 41 which is equipped with a main control valve 42 and which branches into the branch pipes 43, 43, one going to each of the burners. Any type of burners may be employed but it is preferable to use that type of burner shown and which is more accurately described in United States Patent No. 2,136,449, issued on the 15th day of November, 1938. Each burner has the air inlet passageway 44 for the inlet of air to support combustion. These air inlets 44 may be opened, partially opened, or closed by the shutters 45 which are mounted on the transverse shafts 46 and which are connected by the links 47 to move in unison. One of the shafts 46 is extended and mounted on said extended end there is a crank arm 48. A control lever 49 is pivotally connected at an intermediate point to the valve stem 50 of the control valve 42. One end of this lever 49 is connected, by the link 51, to the free end of the arm 48 and its other end carries a weight 52 normally tending to open the valve 42. The lever 49 is pivoted to a fixed support at the point 49a, between the stem 50 and the weight 52. Accordingly, as the valve 42 moves toward closed position to reduce the supply of fuel to the burners, the shutters 45 will be correspondingly closed to reduce the supply of air to the furnace and as the valve 42 is moved toward open position, the shutters 45 will be correspondingly opened to increase the supply of air to the burners. The air and fuel within the furnace will therefore be retained at the required ratio to insure efficient combustion. Supplemental air will pass in directly through the screens 38 and will be heated by the furnace and will at the same time form an insulation for the furnace walls to prevent sudden variations in the temperature thereof. This supplemental air will move on into the mixing chamber 32 moving past the baffles 53 which are spaced apart and are arranged across the space 39 adjacent the mixing chamber. They are spiralled in such a direction that the supplemental air will move in the direction indicated by the arrows in Figure 5 which is the reverse of the direction of the hot air emerging from the furnace, to the end that the currents of air will be moving in opposite directions conducing to a thorough mixing of the two in the mixing chamber. The temperature of the air emerging from the furnace will thus be reduced in the mixing chamber and will always be of a temperature below the ignition point of the lint cotton to the end that there will be no danger of igniting the lint; and the gas is substantially consumed in the furnace, so that the lint will not be liable to become ignited and will not be discolored by high temperature or by unconsumed gas.

The main gas pipe 41 is equipped with a shut off valve 54 located out beyond the control valve 42 whereby the supply of gas may be completely cut off and connected into the main gas pipe 41 out beyond the shut off valve 54 there is a pilot gas line 55 which is controlled by an electrically operable control valve 56 and which branches and terminates in nozzles as 57 through which a sufficient supply of gas is supplied to sustain the pilot flames 58. Suitably anchored to the furnace walls and extended into the fur-

nace there is a spark electrode 59, and the flame control electrode 60 as shown in Figure 8.

The amount of gas going to the furnace is varied according to the temperature of the furnace by controlling the valve 42 in a conventional manner as shown in Figures 6 and 8 and as hereinafter described. Mounted above the valve 42 is a control unit which includes a diaphragm 61 which is connected to the valve stem 50 and exposed to the atmosphere on the lower side thereof. Leading from the main gas line 41, out beyond the valve 54 and connected into the diaphragm housing is a branch gas line 62 having a pressure regulating valve 63 therein and connected into the diaphragm housing so that gas pressure is exerted on the upper face of the diaphragm 61. The gas pressure therefore forces the diaphragm 61 and stem 50 downwardly to close the valve 42. This downward movement of the valve stem 50 is resisted by the weight 52 on the arm 48 which weight tends to maintain the valve in open position. In order to allow the valve 42 to open, gas pressure above the diaphragm must be relieved through a bypass connection 64 which is automatically controlled as hereinafter described. Also controlling the bypass line is a manually operable valve 65. The end of the bypass line 64 terminates in the housing of the spark electrode 59, and gas is allowed to pass through the bypass connection and housing into the furnace. The automatic controls for the bypass line comprise a thermostatic valve 66 which is adapted to be manually adjusted for various temperatures; and the control further comprises an electromagnetic valve 67. The construction of the thermostat valve is not shown, but is of conventional construction, comprising a bellows having a valve connected thereto, the seat with which the valve cooperates being movable by the manual control 66a to thereby vary the relative position of the valve to the valve seat. The valve 42 controlling the burners is yieldably maintained in open position by the weight 52 acting on the lever and link hereinbefore described. In order to turn on the main burners, gas must be released from above the diaphragm 61 through the thermostatic valve 66 and electromagnetic valve 67 discharging into the furnace around the electric spark electrode, the gas being then burned in the furnace. It can be seen that the position of the valve 42 is changed by varying the pressure above the diaphragm 61 by means of the thermostatic valve 66, therefore, the main valve is also turned off if the temperature in the furnace rises too high, by this thermostatic valve. In order to shut down the furnace the electromagnetic valve 67 is closed, thereby building up pressure above the diaphragm and shutting off the valve 42. There will be no gas flowing into the furnace through the bypass connection 64 when the furnace is shut down as the electromagnetic valve 67 is also closed.

It is contemplated that the furnace operation will be completely automatic, the electrical circuit and control being of conventional construction, which construction is shown in Figures 6 and 8.

The heater, as hereinabove indicated, has been particularly designed for use in drying cotton preparatory to ginning the same. However it is to be noted that cotton to be ginned requires a certain amount of moisture. If the cotton is too dry, when ginned, the grade of cotton

will be lowered during the ginning process. Ordinarily the moisture content of lint cotton must exceed twelve (12%) per cent by weight in order to necessitate the subjecting of the cotton to the drying process. If the moisture content of the cotton is substantially below said twelve per cent, it is desirable, in order not to injure the cotton in ginning to increase the moisture content. For that purpose a water pipe 84, leading from a suitable source and controllable by a suitable valve, leads into the discharge end of the fan housing 27, as shown in Figure 1. It may terminate in a spray nozzle within said housing if desired. The water may be sprayed into the hot air carrying the lint cotton in sufficient quantity to impart the desired moisture to the cotton. The water will be immediately vaporized so that the moisture will reach the cotton in the form of a pipe 22 as indicated in Figure 10. This discharge end is equipped with conventional shutters 86, as shown in Figure 3, which may be manually operated, or set, by means of an external crank 87 so as to control the discharge of the heated air.

The drawings and description are illustrative merely, while the broad principle of the invention will be defined by the appended claim.

What I claim is:

A heater comprising a fan casing, a tubular housing entering one side of the fan casing and enclosing a mixing chamber, an outer jacket

5 end converges toward and merges into the outer end of the housing forming a Venturi passageway, a furnace lined with radiant material and located within, and spaced from, the jacket and shaped to conform to the shape of the jacket with its outer end approximately cylindrical and closed and its inner end converging toward but spaced from the mixing chamber and having an inner end opening directed toward the mixing chamber, the outer jacket having its outer end substantially open around the furnace, said jacket, furnace, housing and casing forming a unitary structure, a burner arranged in the outer end of the furnace to emit a flame substantially tangent to the inside wall of the furnace, means in the fan casing for creating an air current through said passageway around the furnace and through the mixing chamber to protect the walls of the furnace against sudden variations in temperature, said air current creating a suction in the furnace whereby the air passing inwardly through the passageway will be caused to follow a spiral course about the furnace and the flame will be caused to follow a spiral course around the furnace walls toward the furnace outlet, the passageway about the furnace, and the furnace outlet merging adjacent the outer end of the housing to cause a mixture of the air with the fuel and a reduction of the temperature below the ignition point.

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