

Dec. 27, 1960

C. H. VON WOLFFRADT

2,966,347

HEATER UNIT

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2 Sheets-Sheet 1

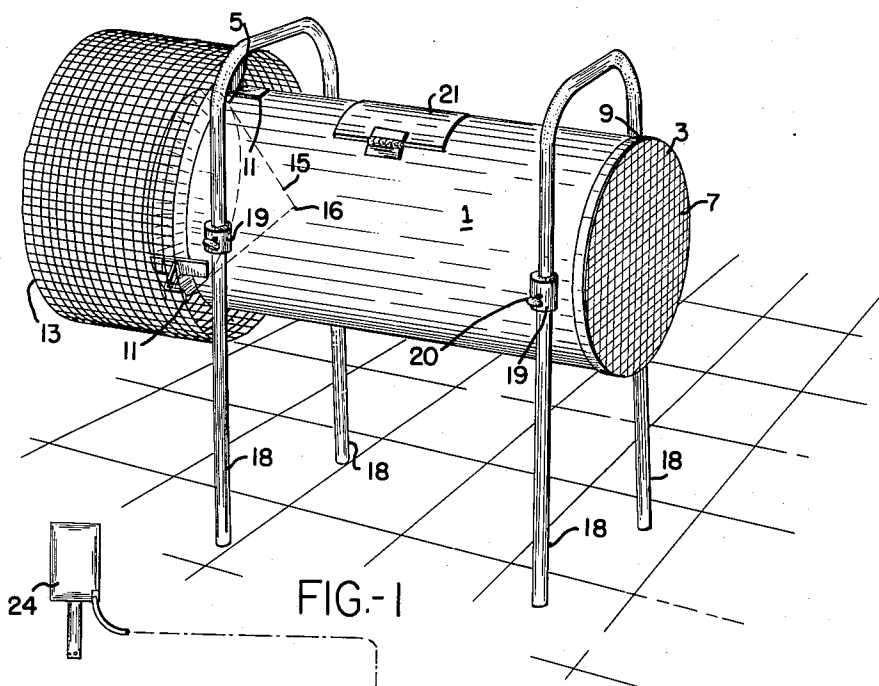


FIG.-1

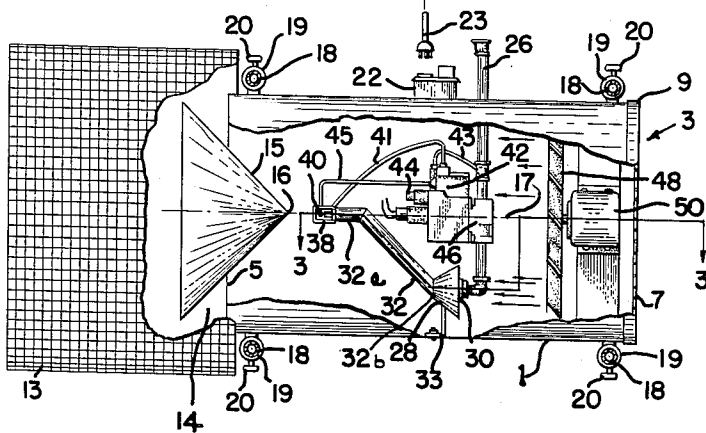


FIG.-2

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2 Sheets-Sheet 2

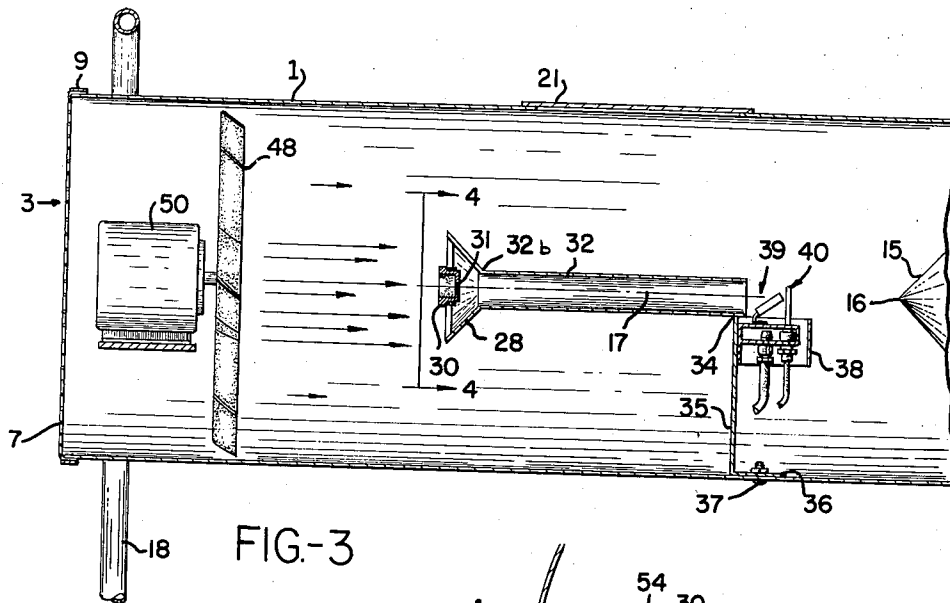


FIG-3

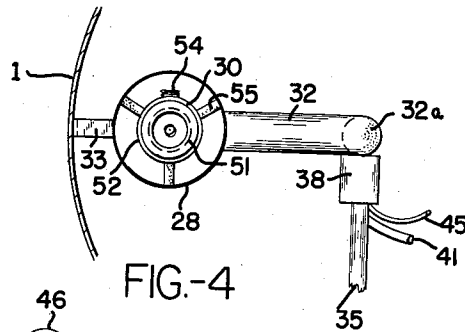


FIG-4

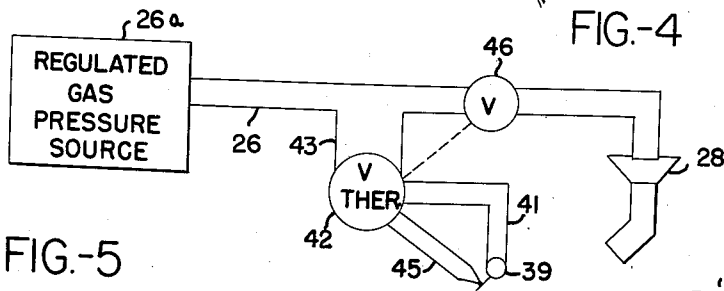


FIG-5

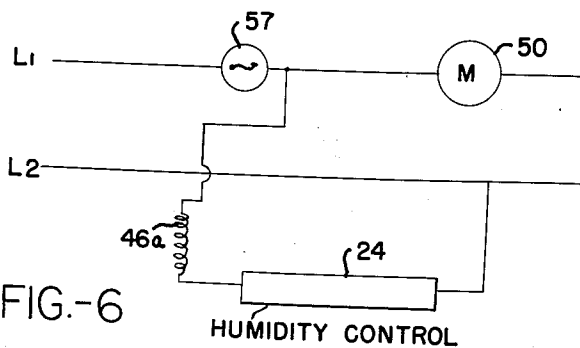


FIG-6

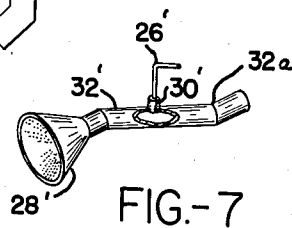


FIG-7

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HEATER UNIT

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5 Claims. (Cl. 263—19)

This invention relates to improvements in gas-fired air heating equipment.

The invention is particularly described in connection with air heater equipment designed for maintaining a humidity condition in stored grain, corn or the like, within safe limits. On damp days such materials though stored within a barn may tend to pick up moisture to such an extent that the material will be destroyed. Further, occasionally the corn, grain or the like may have an excessive moisture content when stored and equipment such as that to be described is effective to bring the humidity content within safe limits. However, as will be clear from the description, the equipment may also be used simply for air heating units.

Economy of manufacture is a primary consideration in air heating equipment. Such equipment commonly employs a Venturi-type construction to provide for the attaining of the combustible air-gas mixture. It is a principle object of this invention to describe an air-gas premixer device which eliminates the necessity for such a Venturi, thereby simplifying manufacturing operations and reducing costs.

It is a further object of the invention to provide the burner conduit which receives the air-gas mixture of such a configuration that the conduit contributes to the mixing of the air and combustible gas.

It is an important object of the invention to provide a novel structural arrangement of gas-fired air-heating equipment.

In the practice of the preferred embodiment of the invention a propeller type fan directs an air flow to an air scoop and burner conduit in combination and into which combination a gas-pressure line opens. The major flow of the air from the fan is well off the axis or the center-line passing through the fan and accordingly the air scoop is itself positioned off the center-line, as is the inlet to the burner conduit. The gas-burner conduit may receive the gas-pressure line directly or the line may terminate in the air scoop outside of the conduit.

The air scoop is carried on the burner conduit which conducts the air-gas mixture to a gas pilot located substantially on the center-line passing through the fan. The pilot is therefore not affected adversely by the fan air flow. The burner conduit itself terminates substantially on the center-line of the fan adjacent the pilot.

The burner conduit end portion which carries the air scoop opens toward the fan outwardly of the center-line passing through the fan and the gas flow from the air scoop to the pilot is sinuous and aids in air-gas mixing. Also the air and gas entering the burner conduit are together impelled against a wall of the conduit to further aid mixing; this is effected by providing an axis of the conduit to extend angularly to the axis of the air scoop.

A simple bent cylindrical tube of substantially uniform diameter throughout its length suitably serves as the burner conduit and forms the air-gas premixer.

The fan, air scoop, gas pressure line conduit and pilot are suitably within a housing having an outlet provided

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with a baffle which itself becomes heated; the air flows to the outlet around the baffle and is heated in the course of movement to the outlet.

Suitably adjacent the exterior of the outlet a screen 5 is mounted which tends to confine the heated air but which itself does not become unduly hot.

The flow of gas to the air scoop-burner conduit combination and the control of the pilot are effected in known manner with standard commercially available valve arrangements. Similarly the humidity sensor, temperature sensor, or the like, which may be employed to exert control of the valving are commercial items.

The invention will be more fully understood by reference to the following detailed description and accompanying drawings wherein:

Figure 1 is a perspective view of a unit constructed in accordance with the invention;

Figure 2 is a plan view, with parts broken away and partially in section, of the structure of Figure 1 associated with a sensor control device;

Figure 3 is an enlarged longitudinal section and fragmentary view taken substantially on line 3—3 of Figure 2;

Figure 4 is a fragmentary view of the structure of Figure 3, particularly illustrating a relationship of the air scoop-gas burner conduit combination and the inlet gas pressure line;

Figure 5 is a diagrammatic view indicating the gaseous flow arrangement;

Figure 6 illustrates the electrical arrangement of the device of invention; and

Figure 7 illustrates a further modification of the relationship of the inlet gas pressure line with the air scoop-gas burner conduit combination.

Referring to the drawings, and initially particularly to Figure 1, the numeral 1 designates a cylindrical longitudinally extending housing having an air inlet 3 and an air outlet 5. This housing is formed in any convenient manner as by welding together longitudinally the adjacent ends of a circularly formed sheet of metal.

The housing 1 at its rearward end is provided with a screen 7 supported on a rim 9 pressed over the inlet end of the housing. The outlet end of the housing is provided with a plurality of brackets 11, preferably three in number, spaced around the periphery of the outlet. These brackets support, externally of the housing and projecting well beyond the outlet end of the housing, a cylindrical screen 13. These brackets 11 also support a baffle in the form of a hollow metallic cone 15 which projects inwardly and outwardly of the housing outlet and defines with the housing a peripheral passage 14 for the flow of gases from the housing to the screen. The apex of this cone is indicated at 16 and it lies on a centerline passing longitudinally through the housing, the center-line being indicated at 17 (Figure 2).

The housing 1 is supported above the ground level by tubular U-shaped supports 18 which pass through collars 19 welded to the housing. The U-shaped supports serve in addition as handles for carrying of the unit. The collars receive therethrough set screws 20 which engage the tubular supports 18 and retain the housing in position. As will be noted from the drawings four sets of collars 19 and four set screws 20 are provided.

The housing 1 is also provided on its upper side with a hinge cover 21 to permit viewing of the interior components of the housing and to provide for lighting of the pilot, illustrated more particularly in Figure 2.

Referring now to Figure 2 the numeral 22 designates a plug-in receptacle, which is adapted to receive plug 23 which is electrically connected in known manner with a humidistat control 24. This control is of conven-

tional design and accordingly is not illustrated in detail. In the utilization of the control, in connection with maintaining the humidity condition, in grain for example, the control is positioned within the mass of stored grain.

Stored grain may usually be dried satisfactorily or may be maintained satisfactorily dry while air humidity is low. However, when the air humidity rises grain not only will not dry by forcing the natural air through the grain, but will sometimes even gain in moisture. The high humidity content of the grain will be sensed by the humidity control device 24 and the necessary signal will be transmitted through the plug 23 to the heater unit. This arrangement will be described more particularly hereinafter.

The numeral 26 (Figure 2) designates the main gas pressure line which extends through an opening (not shown) in the housing and which terminates (Figure 3) within an air scoop 28. A spud 30 having a jet opening 31 (Figure 3) is suitably provided on the extremity of the gas pressure line 26 and is a part thereof. For purposes of achieving vary B.t.u. heat outputs efficiently the unit may be provided with interchangeable spuds having different size openings 31.

The air scoop 28 is provided on an end portion of burner conduit 32, which may be a casting integral with the air scoop. Burner conduit 32 is a cylindrical tube and angles inwardly from adjacent the lateral periphery of the housing 1 and terminates in an axially or center-line projecting portion 32a.

The burner conduit extremity 32b, which receives the air scoop, extends at about a 45° angle to the axis of conduit 32. Viewed somewhat differently, the axis of the burner conduit 32 extends angularly to the axis of the air scoop along which air flows; the axis of end portion 32a extends substantially parallel to the axis of the air scoop.

Thus gases entering the conduit from the scoop are impelled against the tube inner wall, are changed abruptly in direction, and are well mixed.

Figure 7 indicates an alternative arrangement wherein burner conduit 32' receives the spud 30' of the gas pressure line 26' inwardly of the scoop 28'. The single tube bend at 32a' suffices to effect gas-air mixing.

The burner conduit 32 and the air scoop 28 are supported from the housing by a suitable angle bracket 33. Forwardly of the burner conduit portion 32a, and preferably welded to the lower forward edge of the portion 32a at 34, is an angle bracket 35 (Figure 3) having the lower portion 36 thereof secured by a bolt and nut combination 37 to the housing 1. The longer bracket arm is provided with a box-like structure 38 having an open top and bottom and within which there is supported a pilot light structure designated generally at 39 and a thermo-setting element 40.

Gas conduit 41 through pilot valve 42 provides gas under pressure to the pilot. This gas is passed through a branch conduit 43 from the main line 26 to the valve 42. For the purpose of starting the pilot a push-button structure 44 of conventional design is provided. The thermocouple leads are designated at 45 and extend to the valve 42 and control the valve in a customary manner. For example, with the pilot lighted the thermocouple element provides a voltage to maintain the pilot valve 42 in open condition.

Pilot valve 42 is initially opened by pressing the button 44 and maintaining the button pressed until the thermo-setting element has taken over, the usual structure being an electro-magnetic device to maintain the valve open.

The main line valve 46, it may be noted, is connected in a conventional manner with the pilot and is not operable unless the pilot is lighted. A combination pilot and main valve termed "silent gas valve and pilotstat" is available as Model #V41A of the Minneapolis Honeywell Co., Minneapolis, Minn. The valves form no part

of the present invention and accordingly need not be described in greater detail.

The propeller type fan designated at 48 is driven by motor 50 which is mounted in the air inlet 3. This fan 48 as shown has the blades thereof mounted for rotation within the housing about the center-line 17 and produces a considerable volume of air through the housing 1 well off the center-line 17. Preferably for this purpose the fan blades in their rotation closely approach the interior of the housing.

Air flow on the center-line is relatively little and accordingly the pilot 39 is not materially affected by air flow, although it should be noted that the pilot, to some extent, is shielded both by the burner conduit portion 32a and the box 38. Most suitably the fan 48 and the air scoop 28, which opens on the fan, are spaced not greater than one fan diameter apart; preferably the distance is less than one-half a fan diameter, and the scoop may be closely adjacent the fan blade. In general with propane as the fuel it is desirable to have the fan closely adjacent the scoop so that an air-gas ratio by volume of 25:1 may be obtained readily. With natural gas the scoop may be somewhat further from the fan, an air-gas ratio of 10:1 serving the purpose.

The spud 30, which is itself screw threaded on the terminus of the main line 26, is received in a collar 52 and retained by a set screw 54 passing through the collar. The collar is itself supported by a plurality of braces 55 extending from the inner surface of the air scoop 28, as most clearly shown in Figure 4.

In Figure 5 the principal components of the gas flow system are indicated schematically and are shown merely for the sake of completeness. The usual regulated gas pressure source designated 26a provides gas under pressure through conduit 26 to the thermally controlled valve 42 through the conduit portion 43 and then to the pilot 39 through the conduit 41. The thermal element arrangement is designated at 45 as in Figure 2. The thermally controlled valve 42 is interlocked with the main line valve 46 and gas flows through the terminus of the main line into the air scoop 28.

Figure 6 illustrates an electrical arrangement for the operation of the device. Thus current may flow through line L1, fuse 57 through motor 50 and the circuit is completed through L2 for the motor. The humidistat control 24 is provided in series with coil 46a forming a portion of the valve 46, and actuation of the control 24 completes the circuit to open the main line valve 46. As already noted this main line valve is interlocked with the thermally controlled valve 42 which is conventional procedure in gas fired systems.

In operation the pilot light is first lighted in the usual manner by holding button 44 in a depressed condition to permit gas to flow to the pilot. The signal transmitted by the thermal element maintains the valve 42 in the open condition once the pilot is lighted and the thermal element heated.

With the humidistat control device 24 plugged into the receptacle 22 a circuit will be completed through the control valve 46 when the humidity attains a predetermined condition. Valve 46 will accordingly be opened and main line gas pressure causes a flow of gas to the spud 30. The gas issues through the small orifice 31 (Figure 3) into the air scoop, the fan at the same time propels air to the air scoop as indicated by the arrow in Figure 2, and the air mixes with the gas in the scoop. Turbulence is facilitated to some extent by the braces 55 (Figure 4). The mixed air and fuel gas then enter the main body of the burner conduit 32 and in so entering angles towards the center line of the unit at 17. Further, the gases are again angled when entering the conduit portion 32a. This change of direction of fluid flow further enhances the mixing action.

The gas issuing from the open end of burner conduit 32a, which extends toward the apex 16 of the cone 15,

is burned and heat is directed to the cone 15. Air passing down the housing well off the center-line of the housing is heated as it passes between the cone 15 and the burner housing. This air then enters the screen 13 and flows onwardly either to another fan in a permanent conduit installation (not shown) or to the material which is to be supplied with the heated air. When employed in conjunction with another fan the unit of invention is termed a supplemental air heater.

The mixing action at the air scoop 23 is most efficient and entirely eliminates the necessity for a Venturi. This consequently materially reduces the cost since the burner conduit 32a is simply a cylindrical tube provided with a bent portion 32a and carrying rearwardly the scoop 28. Further, in addition to expense the usual Venturi is very much greater in weight than the combination of burner-conduit and air scoop for the same gas-air mixture.

The screen 13 tends to be maintained relatively cool despite contact with the heated gases and when utilized as a supplemental air heater substantially no heated air escapes through the screen. When utilized simply as a heater—that is, when the heated air does not pass to a second fan—air will pass through the screen, but the screen does not become unduly heated and is not dangerous to touch, and is therefore a protection against burning of the hands, for example.

It will be understood that this invention is susceptible to modification in order to adapt it to different usages and conditions and accordingly, it is desired to comprehend such modifications within this invention as may fall within the scope of the appended claims.

What is claimed is:

1. In combination, in air heating equipment, a housing having an air inlet and an air outlet, a propeller type fan in the air inlet, a baffle in the air outlet defining a passage with the housing, a gas burner conduit forwardly of the fan toward the air outlet in the housing having one end opening toward the fan well out on the periphery of the fan and the other end opening toward the baffle in the air outlet, an air scoop on the said one end of the gas burner conduit and also opening toward the fan, a gas pressure line opening into the air scoop-gas burner conduit combination, said gas burner conduit having an axis thereof extending angularly forwardly toward the air outlet and toward a center-line passing through the housing and said burner conduit and terminating at said other end substantially on said center-line.

2. Gas fired air heating equipment comprising a longitudinally extending housing defining a longitudinal axis and having an air inlet and an air outlet; a propeller type fan supported within the air inlet end of the housing; a baffle in the form of a cone supported by the housing extending into the air outlet axially with the apex of the cone projecting toward the air inlet; a pilot burner supported on the longitudinal axis of the housing intermediate the fan and cone; a burner-conduit having one end opening toward the fan well out on the periphery of the fan off the longitudinal axis of the housing and being bent forwardly to provide its other end extending substantially axially of the housing, said other end opening to the pilot burner toward the cone; an air scoop carried on the end of the burner-conduit opening toward the fan, the axis of the air scoop extending substantially parallel to the axis of the housing and angularly to the axis of the burner conduit; and a gas-pressure line opening into the air scoop.

3. Gas fired air heating equipment comprising a longitudinally extending housing defining a longitudinal axis and having an air inlet and an air outlet; a propeller type fan supported within the air inlet end of the housing; a baffle in the form of a cone supported by the housing ex-

tending into the air outlet axially with the apex of the cone projecting toward the air inlet; a pilot burner supported on the longitudinal axis of the housing intermediate the fan and cone; a burner-conduit having one end opening toward the fan well out on the periphery of the fan off the longitudinal axis of the housing and being bent forwardly to provide its other end extending substantially axially of the housing, said other end opening to the pilot burner toward the cone; an air scoop carried on the end of the burner conduit opening toward the fan, the axis of the air scoop extending substantially parallel to the axis of the housing and angularly to the axis of the burner conduit; a gas-pressure line opening into the air scoop; and a screen supported by the housing projecting forwardly of the cone and the air outlet of the housing.

4. Gas fired supplemental air heating equipment comprising: a longitudinally extending housing having forward and rearward open ends, said rearward open end defining an air inlet and said forward open end defining an air outlet, said housing defining a longitudinally extending axis, means supporting the housing above ground level, said means comprising U-shaped supports closed at their upper ends, a cylindrical screen supported by the housing on the forward end of the housing and projecting well forwardly of the housing, a baffle in the form of a cone interiorly of the screen projecting into the housing air outlet and having the cone apex extending toward the air inlet; means supporting a pilot burner in the housing intermediate the cone and fan; a bracket projecting from the housing inwardly toward the housing axis between the pilot light burner and the fan, a burner conduit in the form of a cylindrical tube and having one end thereof supported by the bracket, said burner conduit opening toward the fan well off the axis of the housing and being forwardly of the fan about one-half to one fan diameter; an air scoop carried by the end of the burner conduit opening toward the fan; said burner conduit extending forwardly in the housing angularly toward the pilot burner and being bent to extend axially of the housing and terminating adjacent said pilot burner, a gas-pressure line extending into and opening within said air scoop, and means carried by the air scoop engaging and supporting the gas-pressure line within the air scoop.

5. In gas-fired air heating equipment, a housing having an air inlet and an air outlet, a propeller type fan in the air inlet, a pilot burner substantially on the center-line of the housing between the air inlet and air outlet and forwardly of the fan toward the air outlet, a burner conduit having one open end thereof terminating adjacent the pilot burner and said burner conduit extending rearwardly in the housing angularly toward the periphery of the fan and opening toward the fan well out on the periphery of the fan, an air scoop carried by the end of the burner conduit opening toward the fan, and a gas pressure line opening into said air scoop-gas burner conduit combination.

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