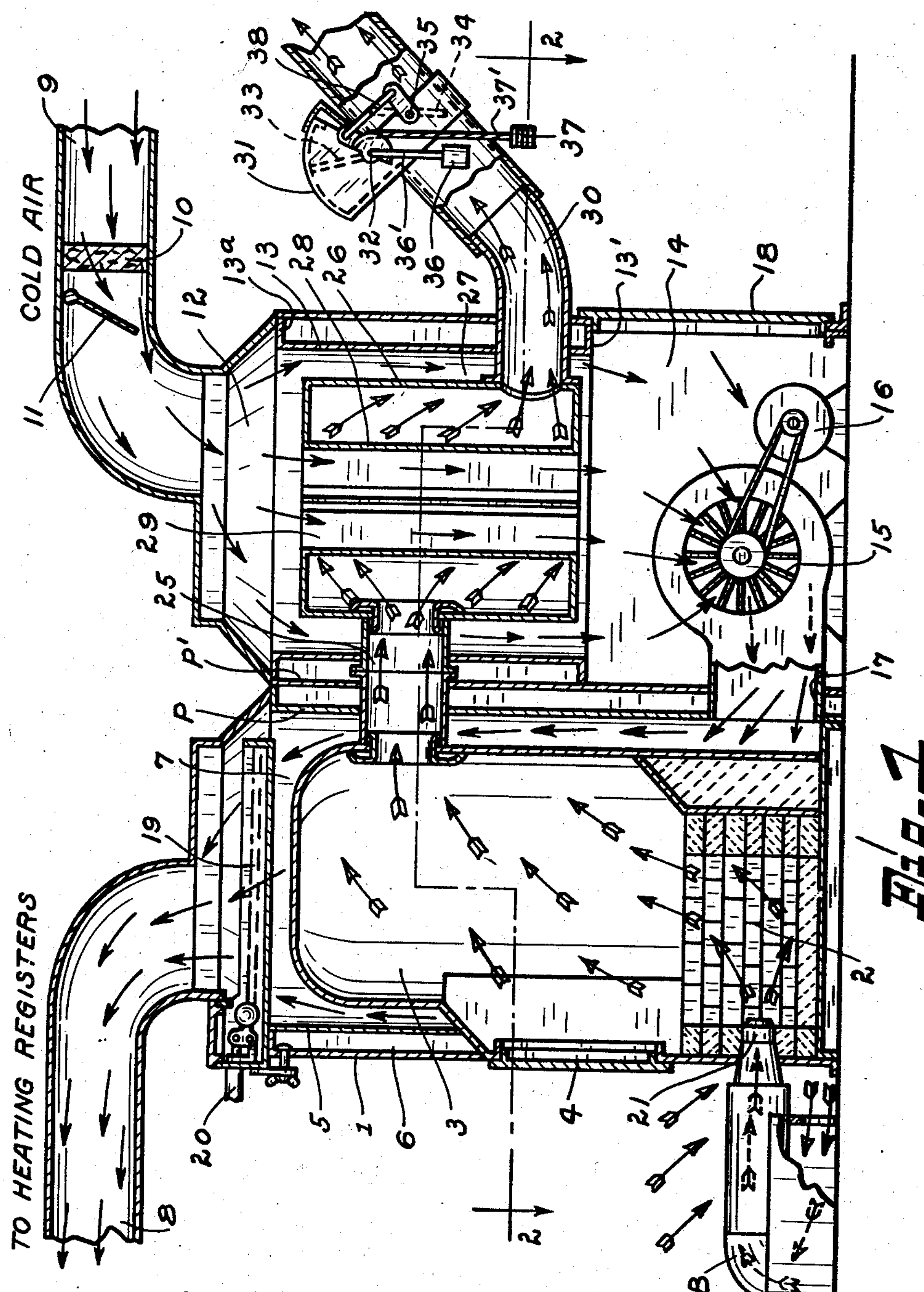
Aug. 19, 1941. D. H. POWERS 2,252,784

HEATING AND AIR CONDITIONING UNIT

Filed Dec. 14, 1938 3 Sheets-Sheet 1



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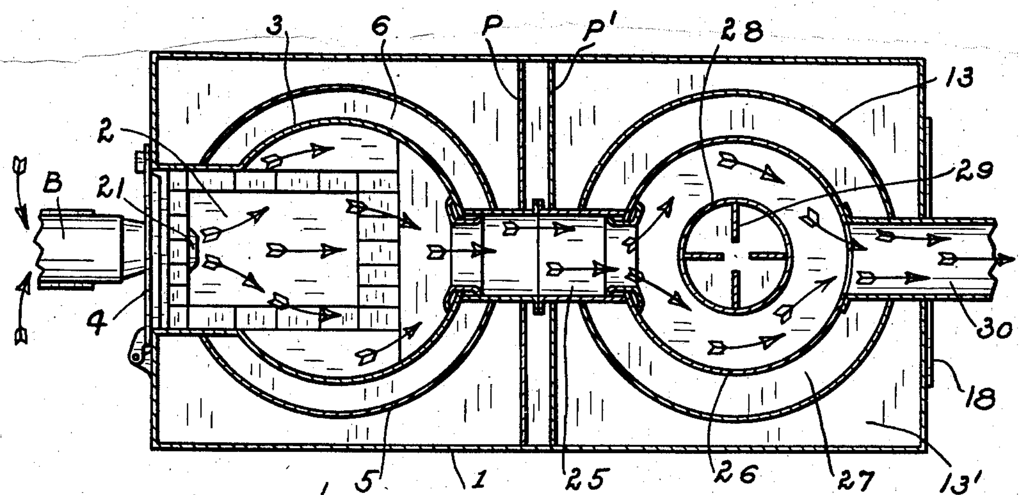

Fig. 2

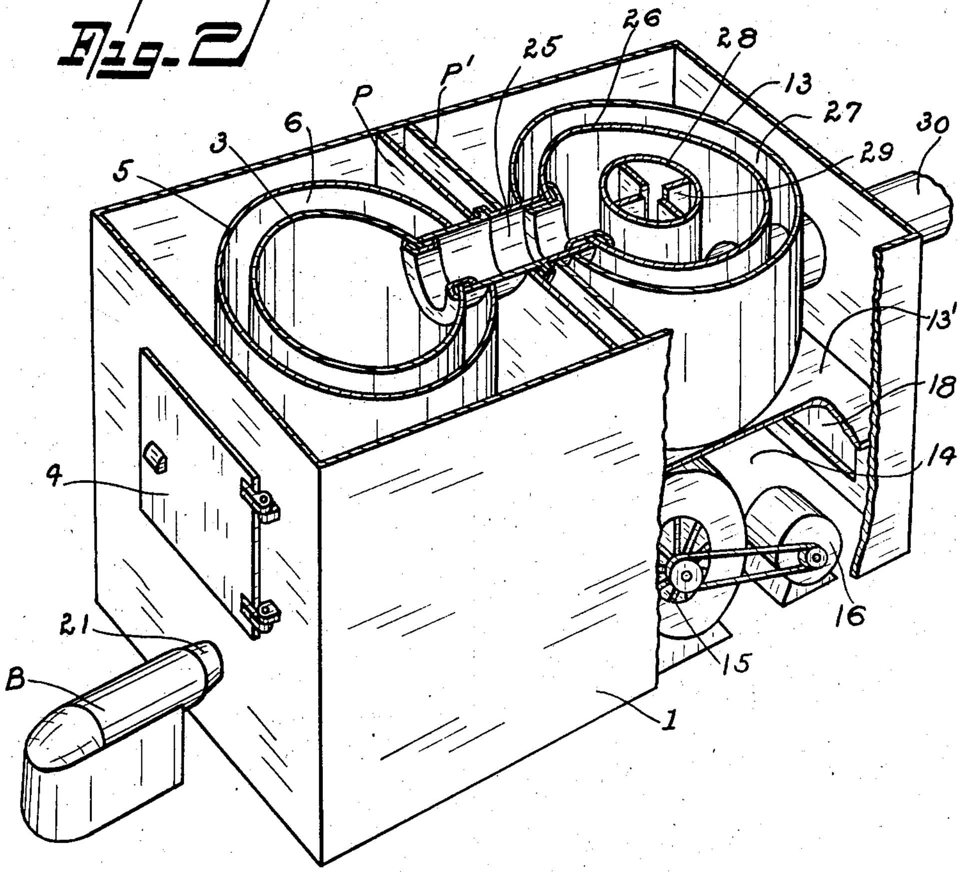

Fig. 3

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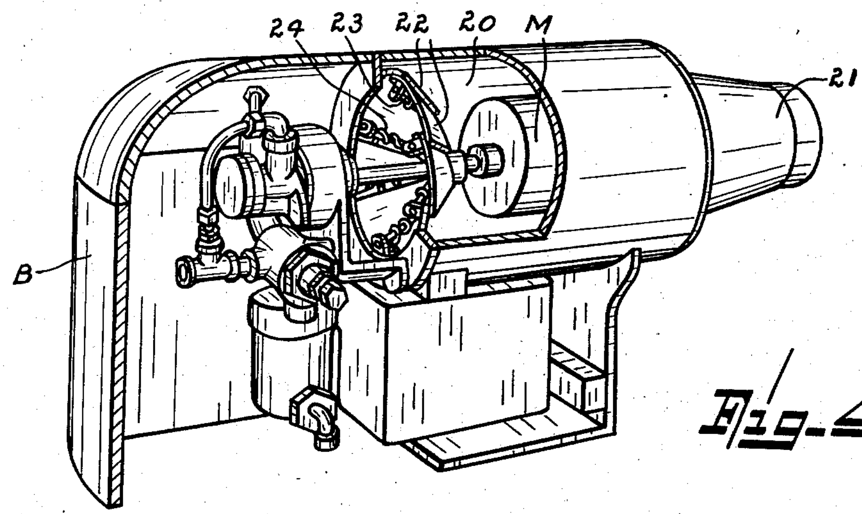

Fig-4

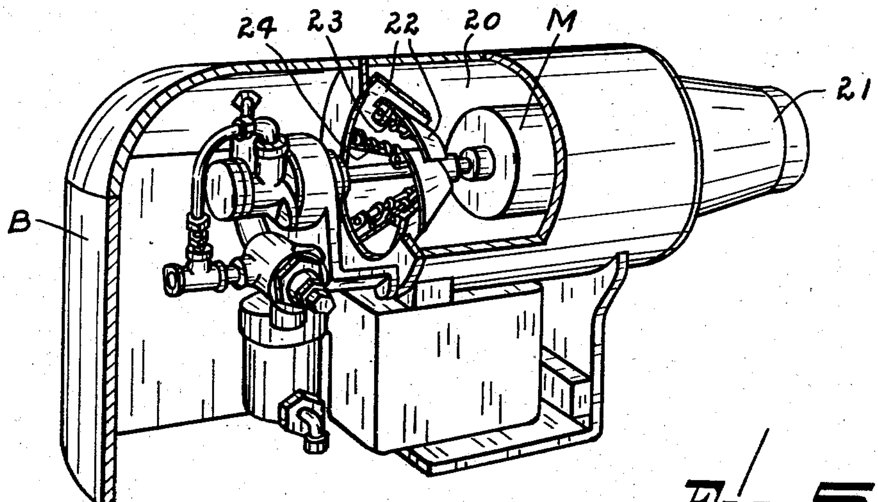

Fig-5

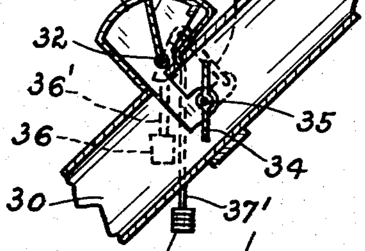

Fig-6

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UNITED STATES PATENT OFFICE

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HEATING AND AIR CONDITIONING UNIT

Donald H. Powers, Tacoma, Wash.

Application December 14, 1938, Serial No. 245,730

2 Claims. (Cl. 126—99)

My present invention relates to an improved heating and air conditioning unit involving the use of a hot air furnace for domestic and other purposes. This application for patent is a continuation in part of applicant's co-pending application Ser. No. 129,251, now Patent No. 2,225,181. The furnace may be of the liquid or gaseous fuel type, and as here illustrated embodies an oil burner to which the supply of fuel air for combustion is fed under pressure, as by a fan, when the furnace is in active operation. During the intermittent intervals when the oil burner, under thermostatic or other suitable automatic control, is inactive, the fan for the fuel air performs the functions of an automatically closed valve which cooperates with a fluid pressure control device in the smoke pipe of the furnace, to seal the interior of the heating units against escape of gases of combustion. In this manner the efficiency of the furnace is greatly enhanced, and the heating elements retain the generated heat within the appliance, even though the oil burner is inactive, with only a minimum loss of heat through the smoke pipe or chimney.

In combination with a main or primary heating chamber for the air I also employ a secondary heating unit or pre-heater, a warm air chamber in communication with the pre-heater and the main or primary hot air chamber, and a differential fluid pressure operated valve or damper is provided, preferably in the cold air intake pipe, for sealing the air chambers against loss of heat, except for the customary outlet of hot air from the main hot air chamber, and to prevent ingress of cold air through the cold air pipe, or a return pipe in the hot air heating system.

In the accompanying drawings I have illustrated one complete example of the physical embodiment of my invention.

Figure 1 is a vertical, longitudinal sectional view of an appliance embodying my invention, the arrows illustrating the flow of air currents from the cold-air intake pipe to the warm air outlet pipe or pipes, and also the travel of the gases of combustion from the oil burner through the smoke pipe to the chimney.

Figure 2 is a horizontal sectional view as at line 2—2 of Figure 1, showing the cabinet which forms an insulation jacket around the heating units of the appliance.

Figure 3 is a perspective view from the front of the appliance, with the upper portion in section, and other parts broken away for convenience of illustration.

Figure 4 is a perspective view enlarged and partly in section showing the oil burner and its fuel-air fan-blower, the burner being inactive and the fan blower performing the functions of a closed valve to prevent transfer of air currents between the interior and the exterior of the furnace.

Figure 5 is a view similar to Figure 4, with the oil burner active and the vanes of the fan-blower open and directing currents of fuel air through the nozzle of the burner to the interior of the furnace.

Figure 6 is a sectional detail view of the counterweighted valves or dampers mounted on and in the smoke pipe as it extends to the chimney or smoke outlet flue, which co-operate with the fuel-air fan blower in sealing the interior of the appliance against escape of gases of combustion during the intervals when the oil burner is inactive.

In carrying out my invention I utilize an enclosing cabinet 1 of rectangular shape as here shown, and which as indicated in Figures 2 and 3 is divided into compartments by two spaced transversely extending interior partitions P and P', so that the cabinet forms a heat insulating jacket about the interior units of the appliance to prevent undue radiation of heat to the interior of the room in which the appliance is located.

In the front compartment of the cabinet is located the furnace proper comprising a brick fire-pot 2 at the bottom of the upright heating or combustion chamber 3 having the usual furnace door 4 and terminating in a dome at its upper end. In Figures 1, 2 and 3, a standard type of oil burner is indicated as a whole by the letter B, with its nozzle 21 projecting through the front wall of the fire-pot to the interior thereof.

The combustion chamber 3 is surrounded by a spaced cylindrical casing 5, which forms an annular air space 6 about the shell 3 of the combustion chamber, and this annular space forms a part of the hot-air outlet chamber 7 extending over the upper end of the combustion chamber. From this hot-air outlet chamber 7, hot air currents flow upwardly and out through one or more hot air pipes 8 which distribute the heat to the usual outlets, as registers, in the various rooms of a house or dwelling.

In combination with the furnace and its hot-air outlet chamber 7 I also employ a secondary heating unit closely associated therewith and located within the rear compartment of the cabinet of the appliance. Cold air is supplied to the top of this secondary heating unit through pipe

9, which may be the return pipe of a domestic hot-air heating system or the pipe may be vented to the atmosphere for a fresh supply of air. In Figure 1 a typical air filter 10 is illustrated in the cold-air pipe, and a suction-opened, pivoted damper or valve 11 is also located in the cold air pipe, which valve automatically swings to closed position against ingress of cold air, when the differential or cold air pressure ceases to hold the valve or damper open.

The cold air pipe 9 furnishes air to be heated to the cold air intake chamber 12 located at the top of the cabinet and fashioned as a dome for the upper portion of an air-heating drum 13, which is of cylindrical shape and mounted within and spaced from the walls of the rear compartment of the cabinet 1.

Within this rear compartment and below the elevated pre-heating drum 13 a warm-air chamber 14 is provided, in which is located a rotary fan, preferably of the low-speed type which comprises a center-intake impeller 15 that is operated by an electric motor 16 preferably located in the impeller compartment or warm air chamber. This warm-air chamber receives air currents from the intake pipe 9 after they have been passed through the secondary heating unit, and the center-intake fan or impeller 15 impels the air currents through its outlet nozzle 17 into the annular heating space forming the lower portion of the main hot air chamber 7 over the furnace. The down draft induced by the impeller from the cold air pipe through the secondary heating unit reduces the pressure at the furnace-side of the damper 11, and the greater pressure against the outer side of the damper causes the latter to swing inwardly to admit air currents. When the impeller is inactive and the pressures at opposite sides of the damper 11 tend to become equalized, the damper automatically closes. In this manner, during the intervals when the oil burner is "off" or inactive, and the impeller 15 is idle, the warm air within the sealed appliance cannot be cooled by ingress of cold air, and the heat from the warm air in the appliance cannot be wasted through this air inlet pipe 9.

As seen in Figure 1 the cylindrical air drum 13 is fashioned with upper and lower exterior annular flanges 13a and 13' that co-act with the cabinet walls and a partition P' to form the insulating jacket about the secondary heating unit, while the impeller-compartment 14, located below this unit, is provided with a door 18, which, like all other portions of the appliance except the hot air outlet pipes, are sealed against waste of heat.

In the upper part of the main heating chamber 7 is located a humidifier or air moistener 19 in the path of the convectional air currents, and the supply of water thereto may be automatically replenished through the pipe 20 under suitable control means.

It will thus be apparent that the impeller 15 located intermediate the cold air pipe and the hot air pipe as well as between the primary heating unit and the secondary heating unit, when in operation induces a down-draft through the cold air chamber and the secondary heating unit into the impeller compartment, and the impeller, under forced draft passes the warm-air currents from the pre-heater to the main hot air chamber 7, from which the hot air is distributed through the hot air outlet pipes 8.

At the front of the furnace or appliance, and within the housing B a suitable oil burner 20 is inclosed, and its nozzle 21 projects through the wall of the fire-box 2 as best seen in Figure 1. Fuel-air for the burner is supplied thereto through a bottom opening of the hood or housing B, and this fuel-air is blown to and through the nozzle under forced draft by means of a specially constructed fan-blower, which not only performs the functions of a fan-blower while the oil burner is active, but also, automatically operates as a valve or closure for the furnace against ingress of air to, and egress of air from, the fire-box, during the intervals of time that the oil burner is inactive.

The oil burner, which is preferably operated by an electric motor M under proper controls, as is also the impeller motor 16 provided with proper controls, are preferably synchronized in their operations, so that they become active and inactive simultaneously.

The fan blower or rotary blower for the fuel-air to the nozzle of the furnace comprises a number of radially projecting vanes 22 mounted on the operating shaft 23, and these vanes are centrifugally "opened" for action by power from the motor M, as in Figure 5, where the fan is blowing a blast of fuel air into the furnace. When the motor M is cut off and the oil burner becomes inactive, springs 23 on pins 24 that are mounted on each vane, automatically return the blades to "closed" position, and in this position the vanes form a cone-shaped or circular valve extending transversely of the cylindrical portion B' of the burner, as in Figure 4. In this closed position the vanes of the fan prevent egress of air from the fire-box and also prevent ingress of air to the fire-box, thus sealing the front end of the furnace against loss of heat, when the oil burner is inactive.

As indicated by the arrows in Figure 1, the gases of combustion pass from the interior of the main combustion chamber 3 through a horizontal pipe or jointed thimble 25 that passes through the furnace wall, the spaced partitions P and P' and an opening in the wall of the chamber 13, into the interior of a cylindrical heating drum 26, closed at top and bottom and mounted concentrically within the air-drum 13, and spaced therein to form an annular down-draft air passage 27 from the cold air intake chamber 12, to the chamber 14.

This heating drum of hot gases of combustion is fashioned with a central concentric sleeve 28 open at top and bottom for passage of down draft air currents, and the interior of the sleeve is fashioned with radial fins or blades 29 for radiating heat to these air currents passing from chamber 12 to chamber 14.

The hot gases of combustion, as indicated by the arrows, pass through the closed gas-drum and around the air-sleeve, and then pass from the lower end of the gas-drum or smoke-drum to the smoke pipe 30, which is connected to this gas drum or radiator 26, extends through sealed openings in the walls of the air drum 13 and the rear wall of the cabinet.

The down-draft air currents passing from chamber 12 are thus heated by contact and radiation from the exterior of the radiator 26, as well as by contact and radiation as they pass through the central sleeve of the radiator 26.

As best seen in Figures 1 and 6 a differential fluid pressure control device for the gases of combustion is mounted in and on the smoke pipe

30, preferably within the room or space in which the appliance is located, which control device co-operates with the fuel-air fan of the furnace, to seal the appliance against escape of hot gases of combustion when the oil burner is inactive. This control device automatically operates under differential fluid pressure from hot gases of combustion at the furnace side of the device, and atmospheric or barometric pressure at the outer side of the control device. The control device includes a hood 31 mounted on the exterior of the smoke pipe 30 and open to the interior of the smoke pipe, as well as to the atmosphere, and at 32 an operating damper 33 is pivoted to swing to open and closed positions within the hood.

Within the smoke pipe a second damper 34 is pivoted at 35 to control the flow of gases of combustion through the smoke pipe. The pivotal movement of the operating damper 33 is counterbalanced by means of two weights 36 and 37, one suspended exterior of and at each side of the smoke pipe 30, by means of wires or links 36′ and 37′ connected with the pivotal support of the operating damper 33. These two dampers 33 and 34 are connected to move synchronously by means of a coupling link or wire indicated at 38 and connected with the pivotal members of the two dampers.

The weights 36 and 37 are set in a predetermined relation in order to counterbalance the two dampers 33 and 34 in closed positions. When the oil burner is ignited and the gases of combustion reach the smoke pipe 30 so that the convectional currents of hot gases enter the hood 31 and impinge against the operating damper 33, these expanded gases overcome the atmospheric pressure on the operating damper 33 and the latter is swung open, carrying with it the control damper 34 to provide draft of the smoke or hot gases to the chimney. When the oil burner is cut off, or rendered inactive and the travel of hot gases or currents of gases of combustion ceases, the gas-pressure within the hood 31 is reduced and the atmospheric pressure at the opposite side of the operating damper swings the latter to closed position. This closing movement of the operating damper also causes the control damper 34 to swing to closed position transversely of the smoke pipe thereby cutting off draft of smoke or hot gases of combustion from the pipe 30 above the damper 34. This closed position of the control damper is not of necessity an air or gas-tight seal, but on the other hand the counterbalanced weights are set in a predetermined relation so that the "closed" position of the control damper permits a minimum venting of the interior of the furnace.

Thus the gases of combustion in the furnace are sealed against escape at the front of the furnace by the air-fan and at the rear by the control device during the intervals that the oil burner is cut off by thermostatic control or other suitable control. These retained gases of combustion, instead of being wasted by draft through the smoke stack or chimney, are utilized for continuing the heating operation after the oil burner has been shut off. The cutting off of access of cold air to the interior of the fire-pot of the furnace permits the furnace to retain its stored heat for a considerable period after the oil burner is cut off. Under these conditions, the air-heating furnace may operate as much as 60% of the time on sealed heat or stored heat within the furnace, resulting in a substantial reduction in the consumption of fuel.

In the various air chambers and air circulation, the plenum system of ventilation is employed in which the air is forced by the impeller 15, and following the convection currents the hot air is displaced from the main hot air chamber 7 by the induction of cold air through the cold air pipe or return pipe 9.

The sealing or retention of the heat, after the oil burner becomes inactive, in the firebox and combustion chamber 3, as well as within the smoke drum or gas drum 26 and connecting parts, prevents any substantial inrush of cold air down through the chimney to the furnace, as well as also preventing the heated air being drawn by convection up through the chimney.

Having thus fully described my invention, what I claim as new and desire to secure by Letters Patent is:

1. In a hot air heating unit, the combination with a furnace having a closed combustion chamber, a fuel burner and means including an intake port for feeding fuel-air to said chamber, a second closed heat-radiating chamber and a flue uniting said chambers for transfer of gases of combustion, and an outlet pipe connected to said second chamber, of means whereby said intake port is closed when the fuel burner becomes inactive, a damper in the outlet pipe, and differential fluid pressure operated means exterior of the pipe whereby said damper is automatically closed when the fuel-burner becomes inactive.

2. In an air heating unit adapted to be sealed for storage of heat, the combination with a furnace having a combustion chamber, an oil-burner, means including an open intake port for feeding fuel-air under pressure to said chamber, a closure for the port, a gas outlet pipe in communication with said chamber and a damper in said pipe, of means whereby said intake port is automatically sealed by the closure when the oil burner becomes inactive, a fluid pressure operated control device mounted adjacent said damper for closing the latter when the oil burner becomes inactive, and operative means connecting said device and the damper.

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