Aug. 20, 1935. W. W. WILLIAMS 2,012,210

WARM AIR FURNACE

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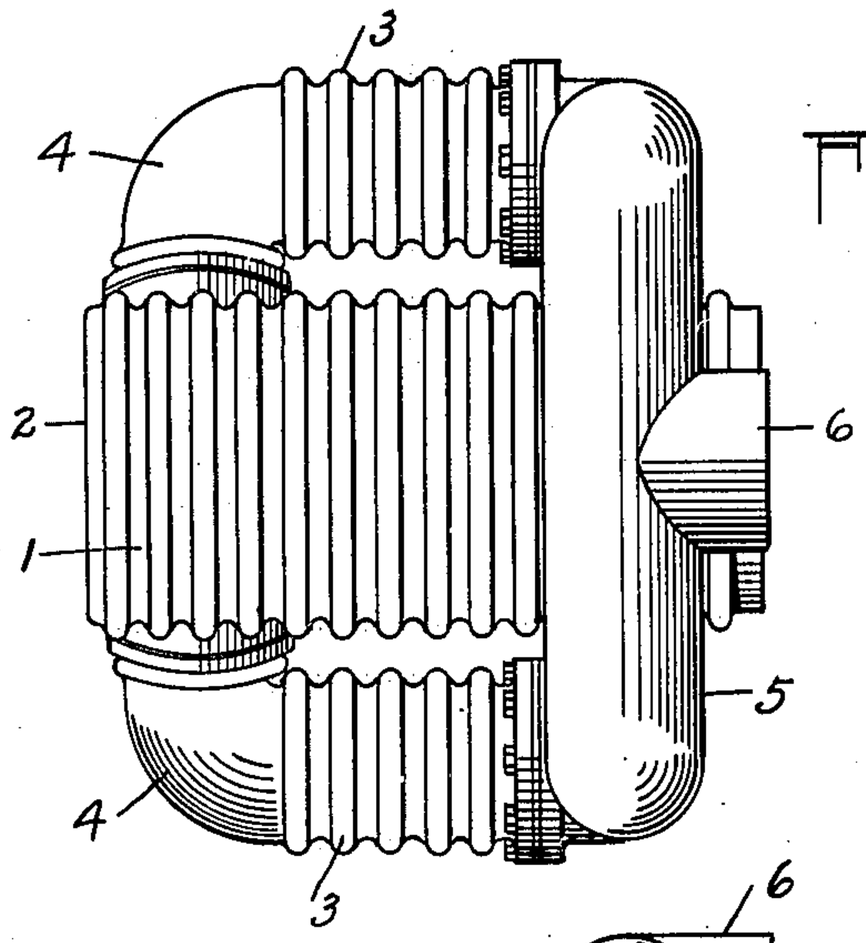

FIG. 1.

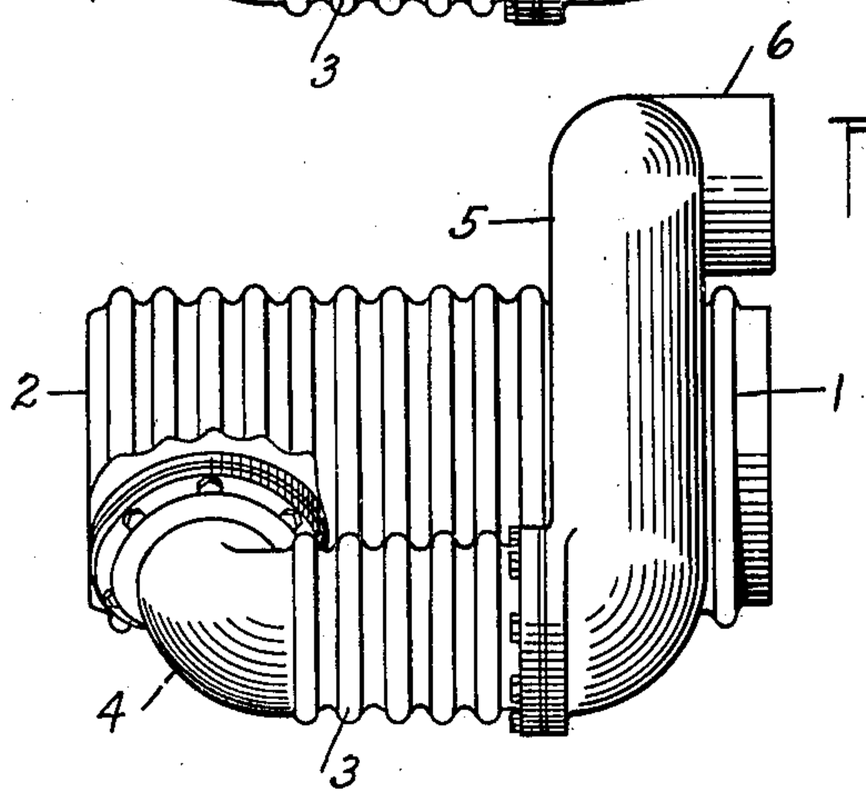

FIG. 2.

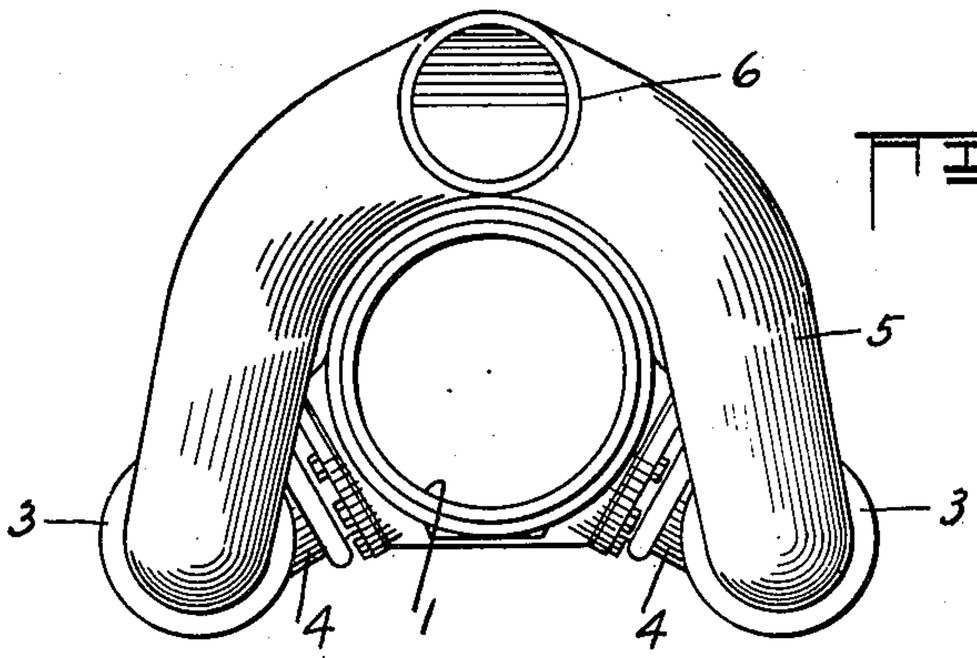

FIG. 3.

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WARM AIR FURNACE

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FIG-4-

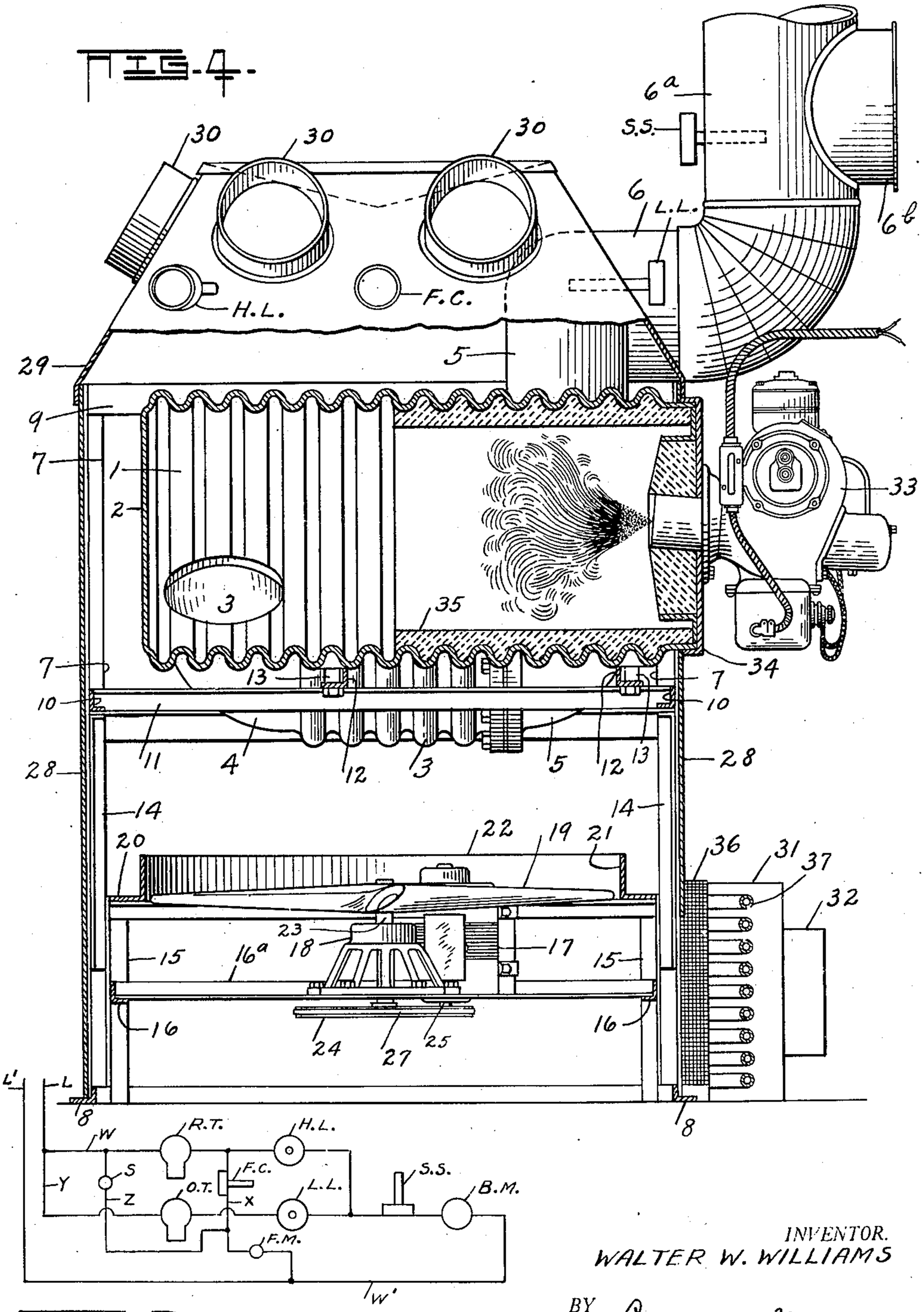

FIG-8-

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WARM AIR FURNACE

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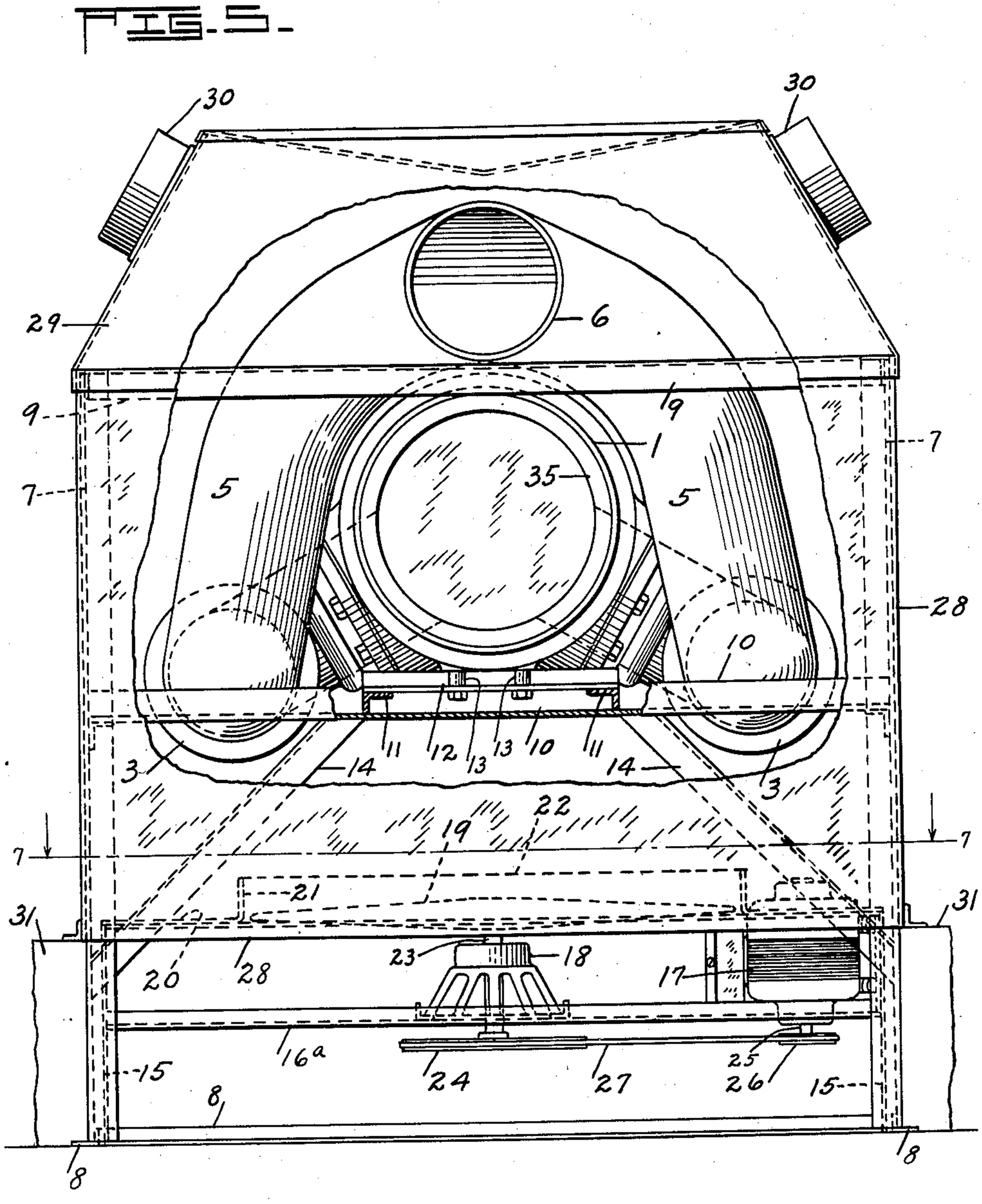
FIG. 5.



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WARM AIR FURNACE

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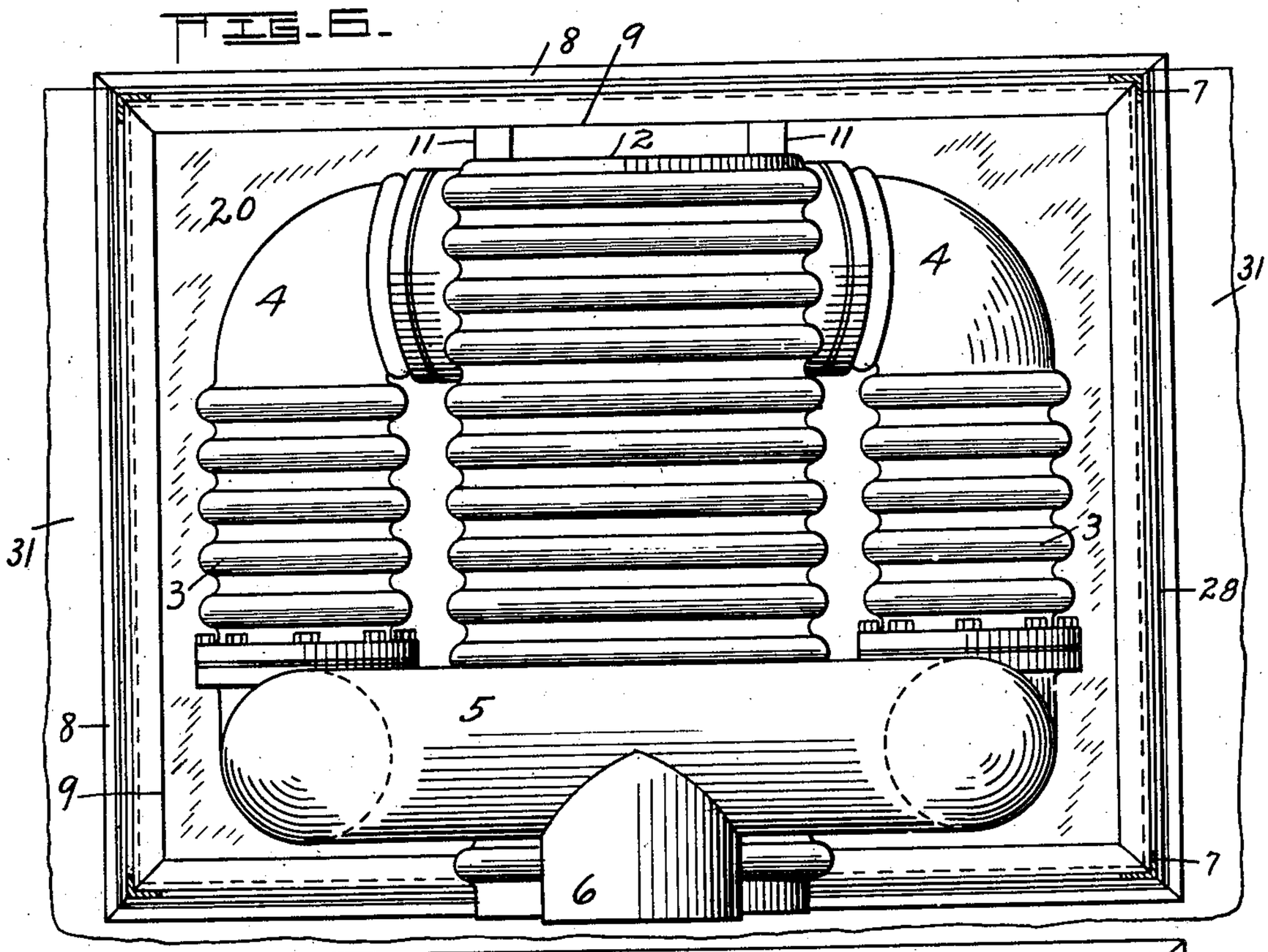
FIG-6-



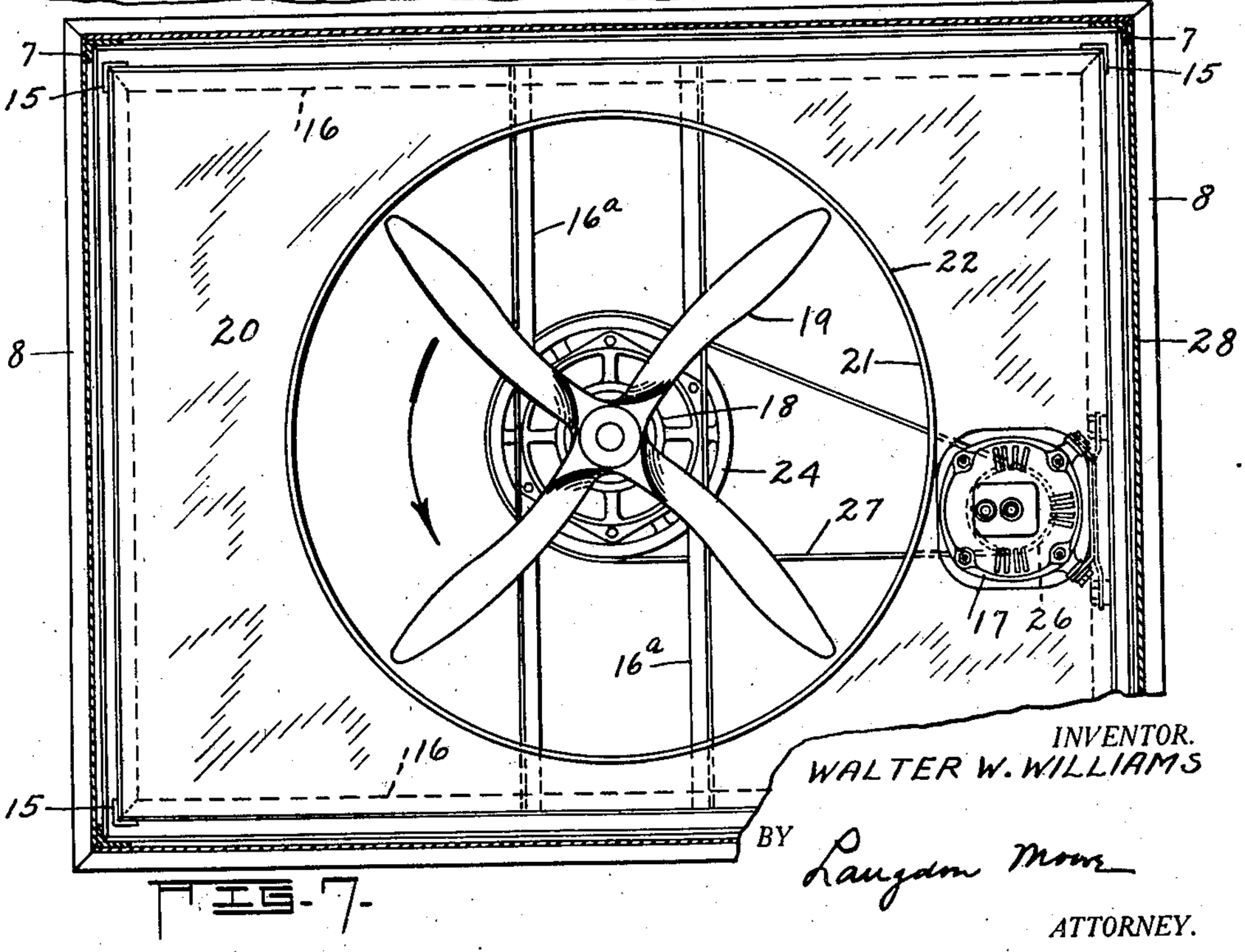


FIG-7-

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UNITED STATES PATENT OFFICE

2,012,210

WARM AIR FURNACE

Walter W. Williams, Bloomington, Ill.

Application December 13, 1933, Serial No. 702,121

5 Claims. (Cl. 126—116)

This invention relates to warm air furnaces and more particularly to the construction and location of the heat generating element within the furnace.

It is an object of this invention to provide a warm air furnace such as commonly used in domestic heating, with a heat generating element particularly adapted for use with fluid fuels and so constructed that the travel of the gases of combustion from the combustion chamber are carried through flues within the furnace and about the combustion chamber to present a large space of heating surface. It is another object of this invention to locate the heat generating element within the casing or walls of the furnace a considerable distance above the bottom of the furnace so that the cool air returning from the heating system or outside air may be admitted at the bottom below the heat generating element, and passing over the increased heating surface thereof, be quickly raised to the proper temperature for passing through the heating system.

The advantages of such a furnace construction are obvious. The elimination of the ashpit section permits free circulation of air over all parts of the heating surface, increasing the efficiency of the furnace by reducing the temperature of the products of combustion passing up the stack to the chimney, and increasing the temperature of the air discharged into the heating ducts of the system. This construction also permits the location of a circulating fan within the furnace below the heat generating element whereby all of the cold air return pipes may be connected to the furnace casing. Heretofore, it has been the practice to locate the fan in a casing outside of the furnace with the cold air return pipes delivering the cold air into the casing and the fan delivering the cold air from the casing through a large duct into the lower part of the furnace, which not only impedes the circulation but consumes considerably more space in the furnace room.

With these and other objects in view, reference is made to the accompanying sheets of drawing which illustrate a preferred embodiment of this invention.

In the drawings:

Figure 1 is a top-plan detail view of the preferred heating element as applied to a warm air furnace in accordance with this invention.

Figure 2 is a view in side elevation of Figure 1.

Figure 3 is an end elevation of Figure 2 looking toward the left.

Figure 4 is a view partly in central vertical section and partly in elevation illustrating the application of this improved heat generating element to a warm air furnace.

Figure 5 is a view in end elevation of Figure 4 with the stack and oil burner removed from the element and the walls of the furnace casing broken away to illustrate the heating element as supported therein.

Figure 6 is a plan view of Figure 5 with the furnace cap above the heating element removed.

Figure 7 is a view in section taken on the line 7—7 of Figure 5 looking in the direction of the arrows.

Figure 8 is a wiring diagram of a preferred system of controls when a fluid fuel burner is used as the source of heat.

It is preferable to construct the heat generating element of cast iron or other material having a high coefficient of heat transmission. The heating element, as contemplated by this invention, comprises a cylindrical combustion chamber 1 open at the one end for the reception of fuel and closed at the other, with two parallel extensions or flues 3 arranged, spaced apart from the cylindrical portion 1, on each side thereof of approximately one-half the diameter of the cylindrical portion and with their center lines arranged in a plane passing below the lower surface of the cylindrical portion 1. The ends of the flues or extension 3 adjacent the closed end 2 of the cylindrical portion 1 are placed in communication with the interior thereof, or combustion chamber, by elbows 4 and the opposite ends of the flues 3 are extended upwardly to pass in spaced relation about the circumference of the cylindrical member 1 in a vertical direction, preferably by means of an integral extension 5 which is provided with a central section 6 extending at right angles thereto above the top of the combustion chamber to form a circular integral annular flanged discharge for the gases of combustion, terminating in line with the open end of the casing, the flange of which is adapted to be connected to the chimneys or stack. The cylindrical portion 1 forming the combustion chamber as well as the parallel portions of the extensions of flues 3 are preferably corrugated, as shown in Figures 1, 2 and 4, to afford greater heating surfaces.

As shown in Figures 4, and 5, the heating element, just above described, is supported within a rectangular casing with the bottom of the cylindrical combustion chamber 1 arranged horizontally and above the transverse center of the casing. The casing includes vertical corner

posts 7 of angle iron construction joined at their base by angle irons 8 with one flange extending in outward direction thereunder and at their tops by angle irons 9 with the upper flange extending inwardly. The corner posts 7 are joined by horizontal braces 10, to impart rigidity to the frame and also to afford a means for supporting the bottom of the cylindrical portion 1, or combustion chamber of the heating element above the vertical center line in the casing. The front and rear braces 10 support parallel supports 11, of angle iron formation, arranged equidistant from the vertical center line of the casing and the vertical plane passing through the axis of the cylindrical portion or combustion chamber of the heating element which is carried on said supports by means of transverse bars 12, preferably of angle iron formation, resting upon the tops of the supports 11 and passing under the cylindrical portion 1 between the extensions 3 thereof. The supports 11 are preferably secured to the lower wall of the cylindrical portion 1, as by spacers and bolts 13, as shown. The frame braces 10 upon which the supports 11 rest are preferably reinforced by the annular bracing members 14 engaging the under side of the braces 10 adjacent the supports 11 and secured to the adjacent corner posts 7.

In the form shown, it is preferable to mount a circulating fan in the space within the casing below the heat generating element. As shown in Figures 4, 5, and 7, it is preferable to mount the fan and motor for driving the fan upon a separate removable frame within the furnace casing, which frame includes corner posts 15 provided with braces 16 intermediate their height for supporting transverse braces 16a supporting the motor 17 and fan bearing 18. It is preferable to employ a four-bladed airplane type propeller 19 for the circulating fan adapted for rotation in a horizontal plane. The upper ends of the corner posts 15 support a closure plate 20 having a central circular opening 21 in the plane of rotation of the propeller blades, provided with an upstanding annular flange 22. As shown, the propeller 19 is mounted upon a vertical shaft 23 passing through and below the bearing 18 mounting a horizontal pulley wheel 24 therebelow. The motor 17 is arranged at one side of the opening 21 with its driving shaft parallel to the propeller shaft 23. The upper end of the motor casing is adapted to pass through the closure plate 20 of the frame and be secured thereto, as shown in Figure 7. The motor shaft 25 extends below the support 16 and is provided with a driving pulley 26 connected by a driving belt 27 to the pulley 24 of the propeller 19.

The frame of the furnace casing is preferably covered by sheet metal plates 28 which cover the entire back of the frame, with the plates on the front and each side terminating a short distance below the closure plate 20 of the fan-supporting frame, the front plate being provided with a circular opening and receiving the open end of the cylindrical casing 1 of the heat generating element. The top of the furnace casing is provided with a customary cap 29 of sheet metal in the form of a truncated cone, with the front side thereof provided with an opening for the passage of the discharge 6 of the heat generating element, as shown in Figure 4. The conical surfaces of the cap 29 are provided with a plurality of outwardly flanged openings 30 adapted to be connected to the hot air carrying ducts of the heating system, not shown. It is preferable to provide about the outside of the furnace casing a continuous casing 31 surrounding the openings at the front and sides and having a plurality of outwardly flanged openings 32 adapted to be connected with the cold air return ducts of the heating system, not shown. The discharge 6 of the heating element is shown in Figure 4 as communicating with the customary stack or smoke-pipe 6a leading to the chimney which, if desired, may be provided with a check draft regulator 6b.

Figure 4 illustrates the application of a fluid fuel burner 33 as the source of fuel although, while this type of burner is preferable, this invention is not limited thereto as any means of feeding fluid fuel to the interior of the cylindrical portion 1, or combustion chamber, of the heating element may be employed as well. In the type illustrated, the fluid fuel burner 33 is supported upon a plate 34 attached to and enclosing the open end of the cylindrical member 1 and the interior of this member, for approximately one-half its length, is provided with a lining 35 of refractory material to form a combustion chamber wherein the fluid fuel is ignited and burns.

As a fluid fuel burner is employed, it is preferable to provide the same with the same type of controls as used with electrically operated and controlled fluid fuel burners and domestic heating purposes. It is also preferable to provide an additional set of controls when such a source of heat is employed, to not only provide additional protection to the heating element but also to maintain a constant temperature therein whenever the temperature outside the building in which the furnace is installed falls below a certain predetermined degree.

Figure 8 illustrates a wiring diagram for accomplishing the above purpose in which L L' indicates the leads from a commercial line or source of electricity; RT indicates a room thermostat of commercial form located in that portion of the building wherein an even predetermined temperature is desired to be maintained; HL indicates a high limit furnace control of commercial construction; LL indicates a low limit furnace control of commercial construction; FC indicates a fan control of commercial construction acting in the same manner as the low limit furnace control. The high limit, low limit, and fan controls act in response to the temperature of the air within the furnace cap 29 and are preferably mounted thereon, as shown in Figure 4. In the wiring diagram, BM indicates the fluid fuel burner motor; FM, the fan motor, such as the motor 17 shown in Figure 4; and OT indicates an outside thermostat of commercial form which is placed outside of the building containing the furnace.

The wire W connects the lead L through the room thermostat and high limit furnace control to one side of the motor BM, the other side of which is connected by the wire W' to the line L'. The fan motor FM is connected by the wire X in parallel to the wires W and W' between room thermostat RT and the high limit furnace control HL through the fan control FC. The wire Y connects the lead L through the outside thermostat OT and low limit furnace control LL to one side of the motor BM, all as shown in the wiring diagram on Figure 8.

The room thermostat is set to close the circuit therethrough when the temperature in the room descends below a predetermined degree. The high limit furnace control is set to open the

circuit therethrough when the temperature of the air within the cap 29 exceeds a predetermined degree. The fan control FC is set to close the circuit therethrough when the temperature within the cap 29 ascends above a predetermined degree. The low limit furnace control LL is set to close the circuit whenever the temperature of the air within the cap 29 descends below a predetermined degree. The outside thermostat OT is set to close the circuit therethrough whenever the temperature outside the building descends below a predetermined degree. By the proper adjustment of these instruments, when the room thermostat calls for heat by closing the circuit thereto and the high limit furnace control is closed, it being set only to open when the temperature actuating the same approaches the danger zone, the circuit is established through the burner BM by way of the wires W and W'. The fan control FC is adjusted to close the circuit through the fan motor when the temperature of the air in the cap 29 exceeds a predetermined low degree whereby the oil burner is allowed to operate when the heating element is cold to raise the element to a predetermined degree before the fan begins the circulation of air thereabout, so that the passage of the cold air will not reduce the effective heating temperature of the element. By setting the outside thermostat to close whenever the temperature outside of the building reaches a predetermined degree, such as 40° F., or descends below that degree, the circuit will be closed therethrough and through the low limit furnace control to the motor, provided the low limit furnace control is closed. The low limit furnace control is regulated to close whenever the temperature of the air circulating through the cap 29 decreases to a predetermined degree such as 150° F. or therebelow. By this arrangement, during cold weather a uniform temperature may be maintained within the heating element when the temperature of the room containing the room thermostat has been satisfied, because the lowering of the temperature within the heating element resulting from normal opening of the room thermostat will automatically, through the low limit furnace control, intermittently operate the burner without the operation of the fan. This increases the efficiency of the furnace because as soon as the room thermostat closes the fan motor circuit, the cool air is passed about a pre-heated heating element.

If desired, the returned cool air, as well as fresh air from the outside of the building, entering the casing 31 through the cold air ducts may be passed through an air filter before being drawn into the air circulating chamber below the heating element by the operation of the fan. An air filter 36, preferably containing spun glass between the wire netting stretched over a frame, of commercial design may be readily employed and may be supported either within the casing of the furnace or removably supported upon the outside thereof within the casing 31. Such an air filter may be either co-extensive with the openings in the sides and front of the casing covering 28, or may be mounted within the circular opening 32 leading through the casing 31 from the outside air, or may be secured over each individual opening 32 in the casing 31, leading from the cold air return ducts. If desired, in summertime when the heating system is idle, an additional circuit may be completed by a wire Z, controlled by switch S located in proximity to the room thermostat, to connect the fan motor to the line L, cutting out the room thermostat and fan control, so that the fan could be independently operated to circulate the air in the rooms in which the hot air ducts of the heating system lead. Furthermore, if it is desired to circulate cold air, a coil of pipe 37 may be arranged within the casing 31 and a refrigerant circulated therethrough from some source of electrical refrigeration placed in operation by the closing of the switch S. It is to be understood that the control for the fluid fuel burner illustrated diagrammatically in Figure 8 includes the customary stack safety switch which is responsive to the combustion conditions of the burner.

What I claim is:

1. A heating element for a warm air furnace including a horizontal cylindrical casing closed at one end and open at the other with oppositely disposed parallel cylindrical extensions therefrom opening into the casing adjacent the closed end and arranged in spaced-apart relation to the exterior of the casing with their respective axes in a plane substantially tangential to the bottom of said casing, with the free ends of said extensions upraised in contiguous relation to the casing to meet at the top thereof and provided with a circular opening above the open end of the casing provided with an annular extension therefrom, terminating in line with the open end of the casing.

2. The structure of claim 1 wherein the horizontal cylindrical casing is corrugated.

3. The structure of claim 1 wherein the horizontal cylindrical casing is corrugated, and wherein the oppositely disposed parallel cylindrical extensions are corrugated.

4. The structure of claim 1 wherein the horizontal cylindrical casing is provided with a refractory lining extending from its open end.

5. The structure of claim 1 wherein the horizontal cylindrical casing is provided with a refractory lining extending from its open end for approximately one-half its length.

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