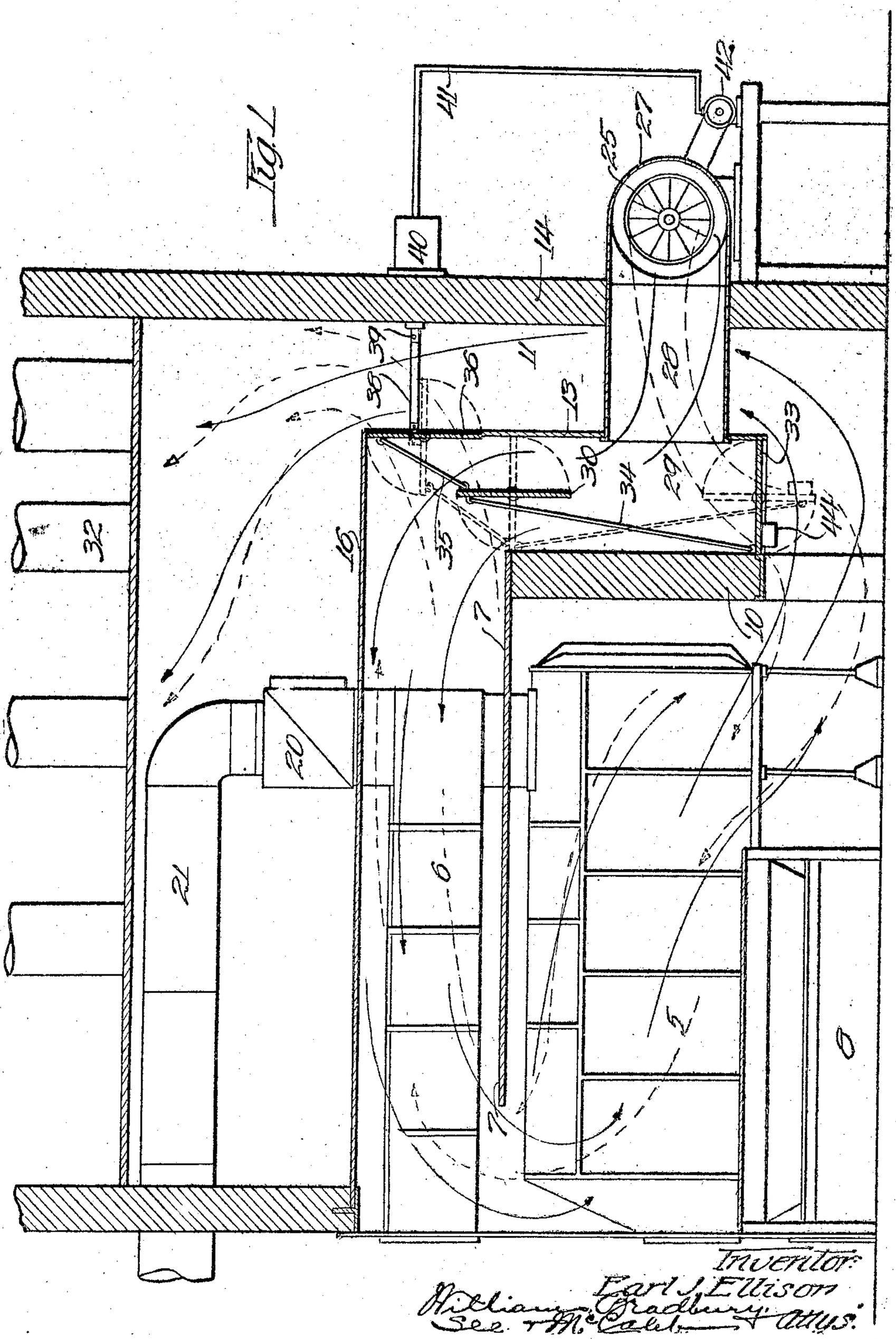
Jan. 2, 1923.

1,440,867

E. J. ELLISON.
AIR HEATER.
FILED FEB. 2, 1921.

3 SHEETS-SHEET 1

Fig 1.



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3 SHEETS-SHEET 2

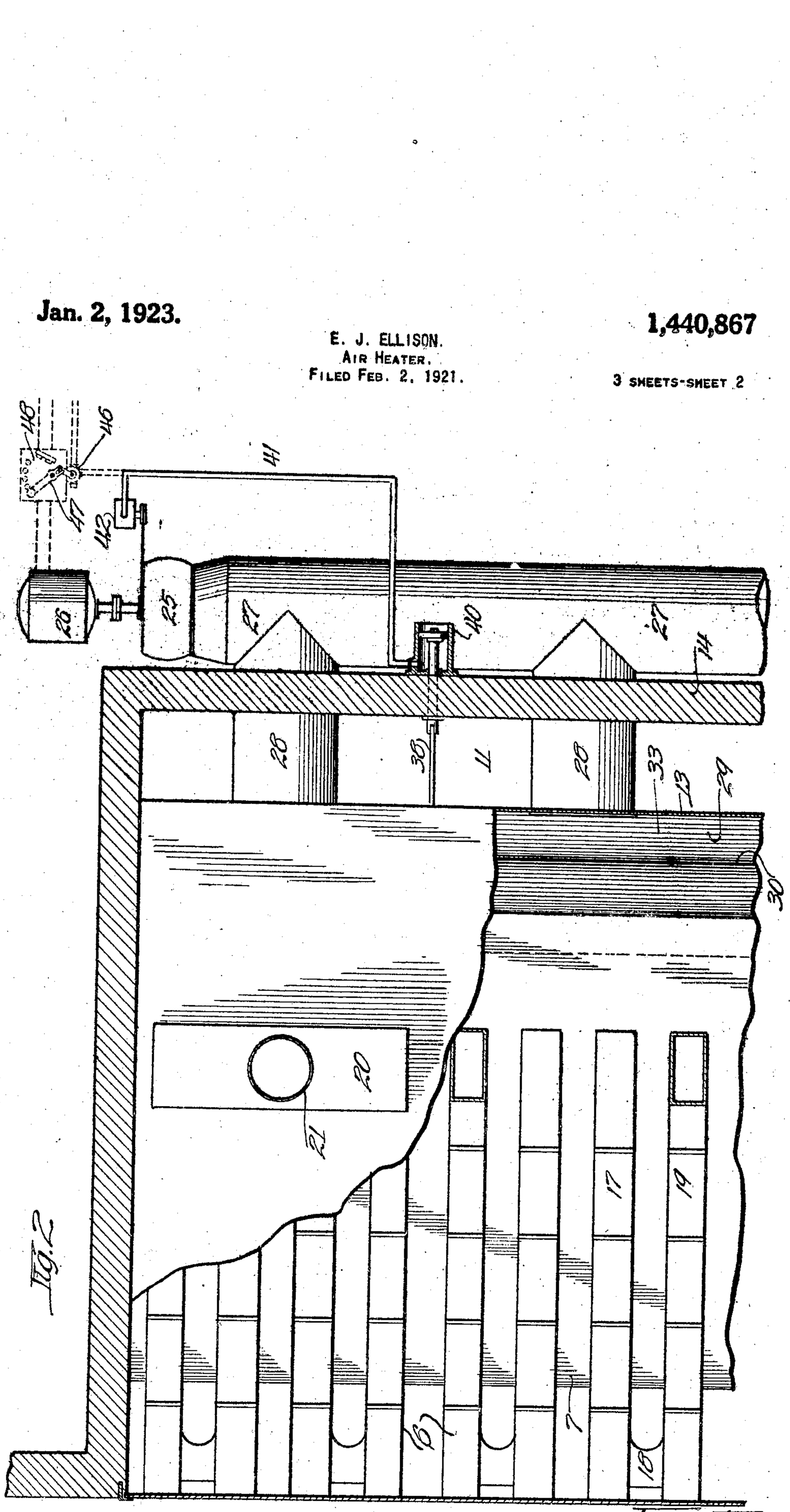

Fig. 2

Inventor:
Earl J. Ellison
Gilliam, Bradbury
See & McCaleb Attys

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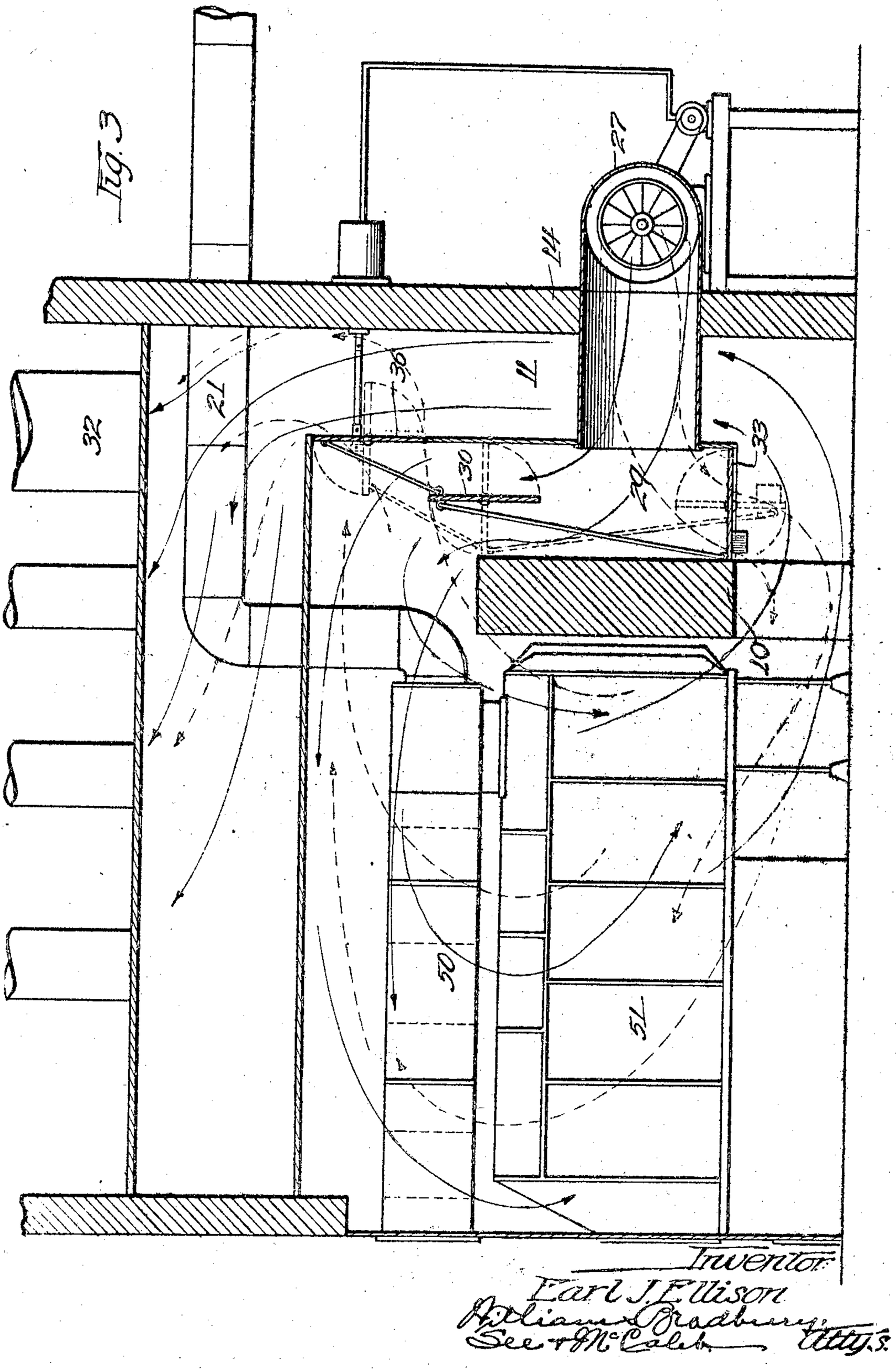
3 SHEETS-SHEET 3

Fig. 3



Inventor:
Earl J. Ellison
William Bradbury
See & McCaleb
Attys.

Patented Jan. 2, 1923. 1,440,867

UNITED STATES PATENT OFFICE.

EARL J. ELLISON, OF MAYWOOD, ILLINOIS, ASSIGNOR, BY MESNE ASSIGNMENTS, TO THE XXTH CENTURY HEATING & VENTILATING CO., OF AKRON, OHIO, A CORPORATION OF OHIO.

AIR HEATER.

Application filed February 2, 1921. Serial No. 441,746.

To all whom it may concern:

Be it known that I, EARL J. ELLISON, a citizen of the United States, and resident of Maywood, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Air Heaters, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

My invention relates to air heaters for heating and ventilating, high temperature drying and dehydrating purposes. My invention relates more particularly to devices for controlling the flow of air past the heat radiating surfaces of such furnaces and to the automatic means of controlling such devices.

One object of my invention is to provide means for reversing the flow of air to be heated under forced feed and gravity feed conditions. It is well understood that an air heater operates more efficiently when the cold air first impinges upon the cooler portions of the radiating surfaces because under these conditions a greater proportion of the heat may be extracted from the radiating surfaces than where the air which impinges upon the cooler radiating surfaces has been previously heated by contact with the radiating surfaces of higher temperature. Air furnaces are not ordinarily arranged for the impingement of air upon the radiating surfaces in this more efficient order because this order ordinarily requires a flow of air which is oposite to the natural gravity flow created by the heat of the air within heater. In accordance with my invention, however, when the air is caused to flow through the heater by gravity at such times as the pressure flow may be temporarily cut off, dampers are automatically changed so that the air to be heated reverses its direction of flow through the heater and follows the less efficient direction of gravity flow.

A further object of my invention resides in the particular arrangement of parts which divides the usual warm air chamber into two compartments to facilitate the flow of air in alternate directions in a simple and efficient manner.

A still further object of my invention resides in the automatic means for controlling the damper positions to bring about the reversal of air flowing through the heater.

Still further objects of my invention will appear from the following detailed description and the appended claims.

My invention is illustrated in the accompanying drawings, in which—

Figure 1 is a vertical section through a battery of heaters of the horizontal air flow type, described in my co-pending application, Serial No. 424,019 filed November 15, 1920.

Figure 2 is a plan, partially in section of the heater of Figure 1.

Figure 3 is a vertical section through a heater of the vertical air flow type illustrating the application of my invention thereto.

Throughout the drawings like characters have been used to designate similar parts in the various views.

Referring more specifically to Figure 1, the heater therein illustrated comprises a fire box 5 having side walls, rear wall and top sections formed with radiating fins for heating the air which impinges upon them in its passage either to or from the radiator section 6 located above the fire box. This radiator section is separated from the fire box by a baffle plate 7 which extends throughout an entire battery of heaters and serves to cause the air to assume horizontal travel along the fire box section and along the radiator section in alternate directions.

When heaters of this character are arranged in a battery, the ash pits 8 are preferably connected into a single chamber. The various heaters may be separated by partitions to facilitate repairs on individual heaters while other heaters are in operation or they may be assembled in continuous chambers extending throughout the length of the battery of heaters.

In accordance with the embodiment of Figure 1, a rear wall 10 constitutes a primary separation between the heater sections and the so-called warm air chamber 11; a second rear wall 13 is interposed between the wall 10 and the rear wall 14 of the warm air chamber, dividing the rear portion of the warm air chamber into two vertical compartments for the purpose to be more fully hereinafter set forth. The top of the partition 13 is connected to a horizontal partition 16 which acts to direct the flow of air horizontally along the radiator sections 6.

The burned and burning gases flow from the rear of the fire box 5 into the inner pair

of horizontal radiating sections 17 where they travel to the forward end of the furnace and are conducted through the cross-overs 18 to the outer radiator sections 19 in which they return to the smoke box 20 from which they pass off through the flue 21. From this flow of gases, it will be seen that the furnace fire box 5 is subjected to the highest temperature, whereas the radiating sections 17 and 19 receive the burned gases after a considerable portion of the heat has been absorbed by the metal of the heater.

In order to direct air under forced feed first upon the radiator sections, and later upon the walls of the fire box, I provide a suitable fan 25 driven by motor 26 and directing air into an induction tube 27 for delivery to each of the several heaters of the battery. When the dampers are in the position shown in solid lines in Figure 1, air passes through the branch conduit 28 into the chamber 29 on the forward side of the partition 13. The air then passes the open damper 30 and follows the course of the solid arrows, passing into the warm air chamber through the opening 31 under the wall 10. From the lower part of the warm air chamber 11, the air passes up between the walls 13 and 14 to the upper spaces where it is carried to its final destination through conduits similar to 32. A damper 33 is arranged under the conditions named, to close the passage between the chamber 29 and the lower portion of the warm air chamber 11, this damper being connected by a rod 34 with the damper 30, which, in turn, is connected by means of a rod 35 with a damper 36 which, under the conditions named, closes an opening between the chamber 29 and the upper part of the warm air chamber 11. This series of dampers all connected together is controlled through a link 38 and piston rod 39 by a piston arranged within a cylinder 40 operated by compressed air through a conduit 41 and compressor 42 or other means hereinafter described so that whenever the motor 26 is in operation sufficient air pressure will be maintained in the cylinder 40 to hold the dampers in the condition just described.

Whenever the fan motor ceases to operate and the air is cut off from the conduit 41, the dampers automatically move to their alternate positions shown in dotted lines in Figure 1. This movement is preferably accomplished by overbalancing the train of dampers as by a weight 44 carried by one of the dampers. When the air pressure is relieved from conduit 41 and these dampers assume the positions indicated by dotted lines, the flow of air over the radiating surfaces of the heater reverses its direction taking the path illustrated by the dotted arrows. Under these conditions, the air passes from the induction conduit 28 into the chamber 29 thence horizontally and upwardly toward the front of the heater and again horizontally rearwardly along the radiator sections 6 and out into the warm air chamber 11 past the now open damper 36. Under these conditions, the air impinges the hotter portions of the heater first and therefore extracts the heat from the radiating surfaces with somewhat slightly less efficiency than under forced-feed operation.

In some installations compressed air is available without the use of a separate compressor such as 42 and in this case an automatically operating three way valve, such as illustrated in dotted lines at 46, Figure 2, may be connected in the air line and operated by the handle of the usual automatic circuit breaker electrically connected in the blower motor circuit. In accordance with this illustration, when the electric circuit for the motor is interrupted either at the main switch or through some failure of the electric supply, the automatic circuit breaker arm 47 moves away from its retaining magnet 48 thus causing a partial rotation of the valve 46 which is arranged under these conditions to cut off the compressed air supply and open the atmospheric vent. When the air supply is thus cut off, the dampers assume their alternate position, the air from behind the piston then escaping through the vent in the three way valve.

In Figure 3 the flow of air into the warm air chamber is exactly the same as described in connection with Figures 1 and 2, the only difference being that the flow of air over the radiating surfaces of this furnace is in a vertical direction. The air under forced feeding conditions impinges first upon the radiator sections 50 and then upon the fire box sections 51 and under gravity flow conditions reverses and impinges upon the fire box sections 51 and then upon the radiator sections 50.

Although I have shown and described my invention with respect to certain specific structures, it is to be understood that modifications of these structures may be made without departing from the spirit and scope of my invention.

What I claim is:—

1. In a heater, the combination with a warm air chamber, of a partition dividing the warm air chamber into two compartments, a means for directing the flow of air through one of said compartments in one direction which is opposite to the natural gravity flow of air in that compartment, and an automatic means for shifting the first-named means to direct the flow of air through said compartment in the direction of the natural gravity flow of air in said compartment.

2. In a heater, the combination with radiating sections, of an induction passage and

an eduction passage, dampers for directing the flow of air from the induction passage to the eduction passage, either with or against the natural gravity flow of air over said radiating sections dependent upon whether or not the air is fed to the induction passage under pressure.

3. In a heater, the combination with radiating sections, of a warm air chamber permanently connected with the lower portion of the chamber containing said radiating sections, a fresh air induction passage, means connecting said induction passage with the top of the chamber containing said radiating sections whereby air may be forced to flow over said radiating sections in the direction opposite to the natural gravity flow of air thereover, a means to close the path for air between the induction passage and the top of the chamber containing the radiating sections and to open a communication between the induction passage and the lower portion of the chamber containing the radiating sections, and further means to open a connection between the upper part of the chamber containing the radiating sections and said warm air chamber in order to permit air to flow from the induction passage into the warm air chamber by gravity.

4. In a heater, the combination with a radiating section chamber, of a fresh air induction pipe, a warm air chamber, means for directing air from the induction pipe to the warm air chamber through either of two paths and three co-operating dampers for controlling the passage through said paths, one of said dampers controlling the connection between the induction passage and the upper portion of said radiating section chamber, another of said dampers controlling the connection between the upper portion of said radiating section chamber and the warm air chamber and the third of said dampers controlling the connection between the induction passage and the lower portion of the radiating section chamber, said dampers being interconnected so that when the first-mentioned damper is opened, the second and third mentioned dampers are closed, and when the first-mentioned damper is closed, the second and third mentioned dampers are opened, whereby the flow of air through the radiating section chamber may be reversed.

5. In a heater, the combination with a radiating section chamber, of a fresh air induction pipe, a warm air chamber, means for directing air from the induction pipe to the warm air chamber through either of two paths and three co-operating dampers for controlling the passage through said paths, one of said dampers controlling the connection between the induction passage and the upper portion of said radiating section chamber, another of said dampers controlling the connection between the upper portion of said radiating section chamber and the warm air chamber and the third of said dampers controlling the connection between the induction passage and the lower portion of the radiating section chamber, said dampers being interconnected so that when the first-mentioned damper is opened, the second and third mentioned dampers are closed, and when the first-mentioned damper is closed, the second and third mentioned dampers are opened, whereby the flow of air through the radiating section chamber may be reversed, means for forcing air into the induction passage and automatic means for opening the first-named damper when the air forcing means is in operation and for closing the first-mentioned damper whenever the air forcing means is out of operation.

In witness whereof, I hereunto subscribe my name this 26th day of January, 1921.

EARL J. ELLISON.

Witnesses:

EDNA V. GUSTAFSON,

E. J. BOURGEOIS.