March 3, 1942. J. P. GLASBY, JR 2,275,358

AIR CONDITIONING DEVICE

Original Filed April 2, 1936 2 Sheets-Sheet 1

FIG.1.

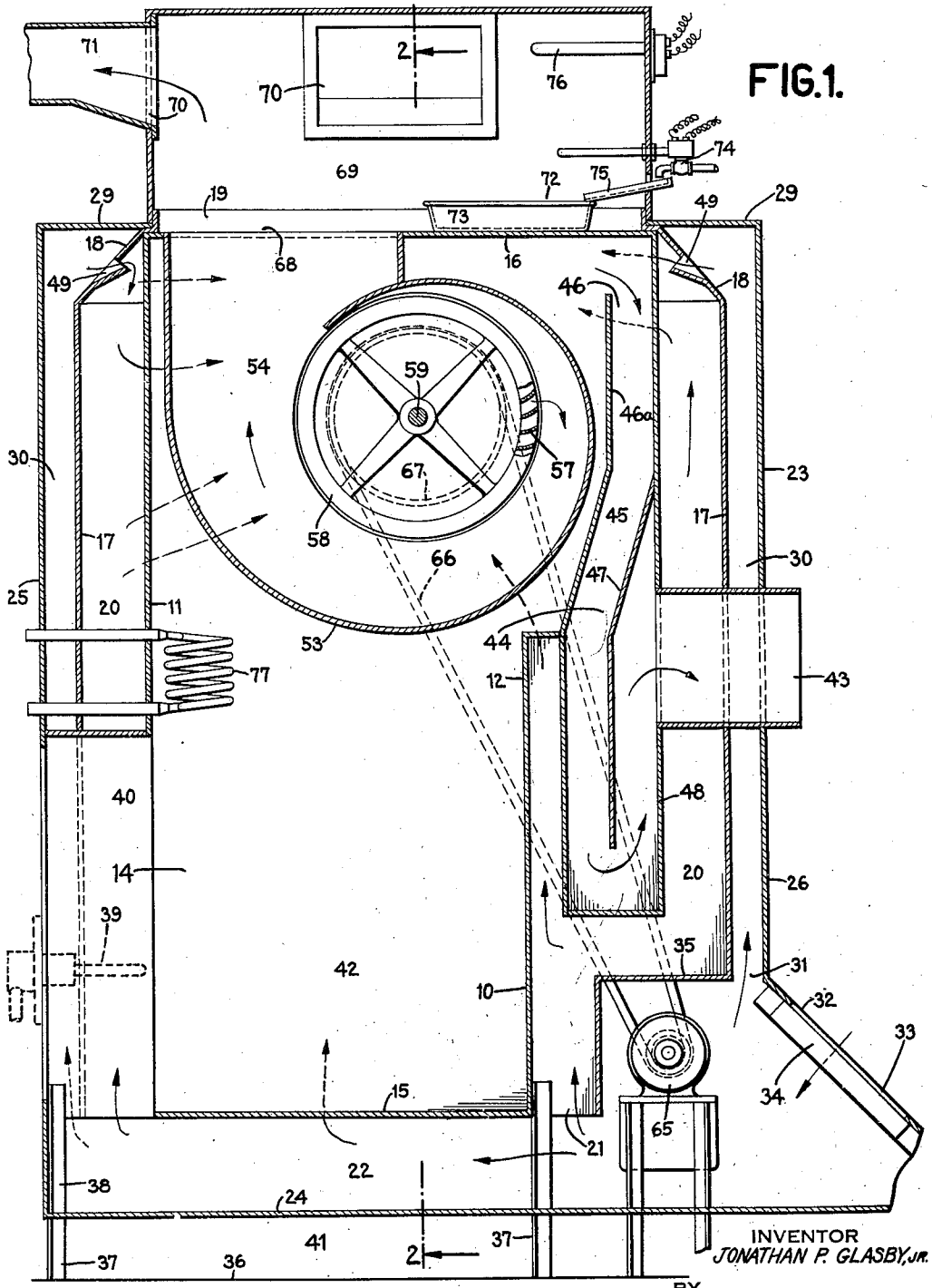

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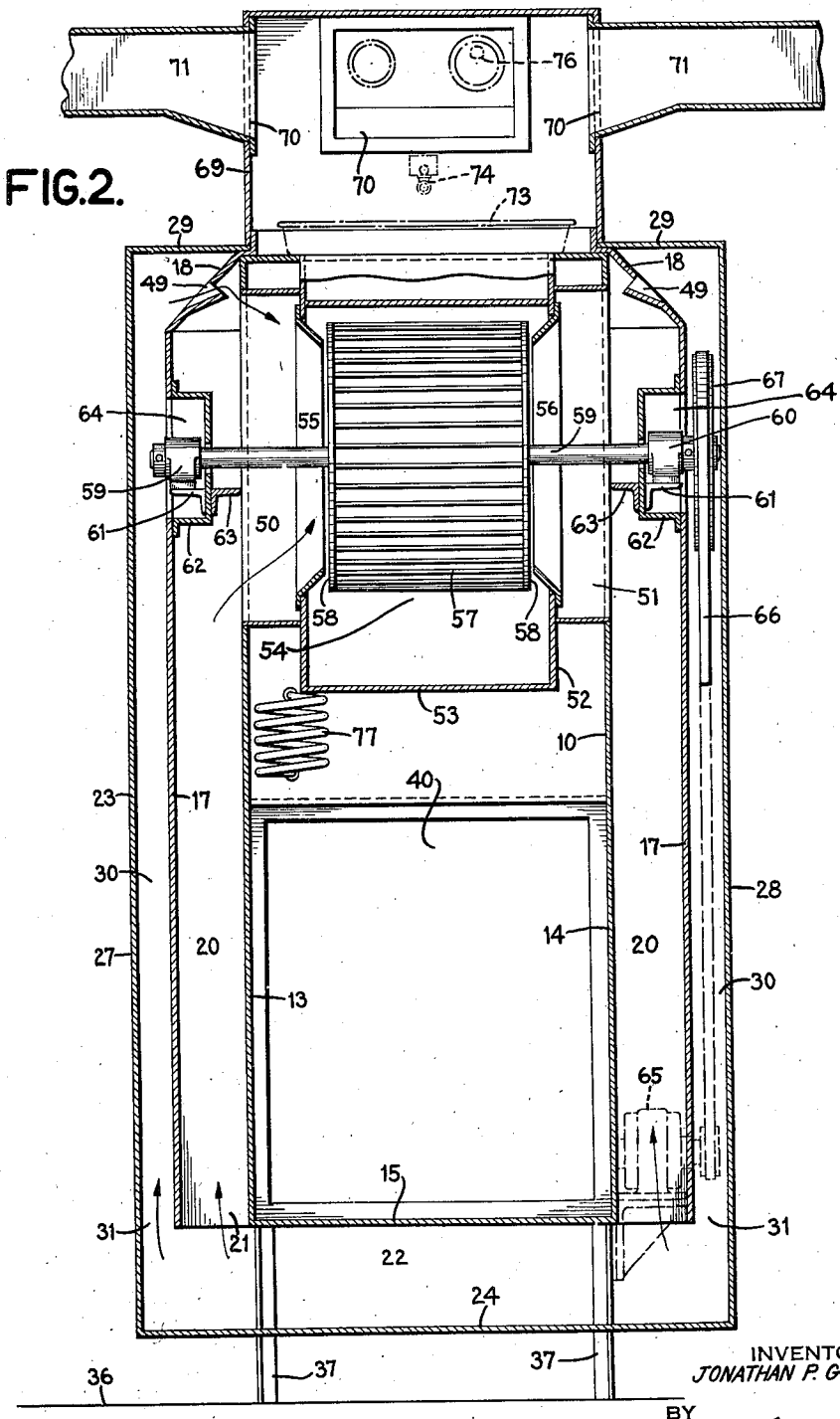
FIG.2.



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UNITED STATES PATENT OFFICE

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AIR CONDITIONING DEVICE

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Application April 2, 1936, Serial No. 72,302
Renewed October 18, 1939

10 Claims. (Cl. 126—110)

The invention relates to an air conditioning device of the type in which air withdrawn from the rooms of a building is filtered, preheated, then finally heated, humidified and returned to the rooms as part of a circulatory air heating system.

The primary object of the invention is to provide an improved, more compact and incidentally more pleasing appearance to an air conditioning device than similar devices now known. Incidental to this general object, the invention features a compact construction of relatively small over-all demensions, and which will provide for a more efficient distribution of heating surface within a compact space than has been possible heretofore with devices of correspondingly small cubical dimensions.

One means by which this objective is attained is by locating the fan in the discharge end of the air heating conduit formed in part by the fan scroll and which in turn is located in the path of the products of combustion and thus in the hottest portion of the conduit which contains the hot burning gases leading off from the combustion zone. Preferably the fan is located just above the combustion zone.

Still another object of the invention and featuring economy in operation is the utilization of a fan of relatively large capacity which is capable of being driven from an electric motor of relatively small horse power and so disposing the fan in the air conduit that it will draw the air through the filters and through the passages forming part of the heat exchange rather than by following the usual practice of forcing the air over the heating unit, and according to this invention, utilizing the pressure side of the fan to sweep the clean, heated air along the intensely heated fan scroll as the air heated by contact therewith is discharged into the outlet conduits or ducts leading to the rooms to be heated.

While the present disclosure features the locating of the fan in the hottest part of the air conduit, the disclosure contemplates the locating of the motor or other power means for driving the fan, and as much as possible of the fan mechanism, in an outer space at least partially insulated from the heating effect of the gas conduit and preferably in a relatively cold portion of the air conduit.

Various other objects and advantages of the invention will be in part obvious from an inspection of the accompanying drawings and in part will be more fully set forth in the following particular description of one form of the device embodying the invention, and the invention also consists in certain new and novel features of construction and a combination of parts hereinafter set forth and claimed.

In the accompanying drawings:

Fig. 1 is a view in vertical section taken from front to rear of a preferred embodiment of the invention; and

Fig. 2 is a similar view substantially at right angles to the showing in Fig. 1 and taken on the plane indicated by the line 2–2 of Fig. 1 looking in the direction indicated by the arrows.

In the drawings there is shown a main or inner metallic casing 10 of somewhat rectangular form and including a front wall 11, a stepped rear wall 12, side walls 13 and 14, bottom 15 and top 16, all integrally welded following conventional practice in this respect. Encircling the front, rear and side walls is an intermediate shell 17 having its upper end bent inwardly as shown at 18 and terminating in an upstanding outer flange 19 which overlaps the casing top 16 and thus provides a support for the hanging shell 17. The shell 17 is spaced from the upstanding walls of the main casing to form therebetween a relatively wide annular inner warmed air conduit 20 with its lower end 21 opened to a bottom cold air chamber 22 hereinafter described.

The construction thus far described is enclosed in an outer metallic jacket 23 which includes a bottom 24, front wall 25, rear wall 26, side walls 27 and 28 and top 29. In lieu of bottom 24, to reduce the height of the heater where desired, the side walls may rest directly on the floor of the room. The jacketing shell 23 is spaced slightly from the intermediate shell 16 to form therebetween an outer heat insulating air jacket 30 also open at its lower end 31 to the bottom cold air chamber 22. The air flowing through chamber 30 is relatively cold. The rear wall 23 as shown in Fig. 1 is inclined downwardly and outwardly as shown at 32 and is provided with an opening 33 which communicates with the rooms through the duct system forming no part of this disclosure and from which relatively cold air is admitted into the bottom cold air chamber 22. Filters 34 extend across the opening 33 and are thus located at the intake end of the air heating system herein disclosed. The air chamber 22 as particularly noted in Fig. 1 is formed between jacket bottom 24, the casing bottom 15 and an off-set extension 35 forming the lower portion of the intermediate shell at the rear of the device.

It is herein suggested that the device as a whole be spaced above the floor 36 by means of legs 37 which preferably extend through the bottom 24 of the jacket to support the more rugged

casing 10. Other legs 38 may be additionally employed particularly at the front side of the device to support burner 39, door frame 40 and other usual structural parts at the front of the device. In this way the casing of the device is spaced as a whole above the floor and provides therebetween a floor air space 41 which tends to air insulate the device from the floor and is of particular advantage in those locations where the floor is subject to flooding or dampness.

The interior of the casing 10 is designed to provide a combustion space 42 in one portion, say the lower portion thereof, and thus forms one end of a burning gas conduit, the opposite end of which terminates in a smoke flue 43 which extends from the rear wall 12 outwardly through the shell 17 and jacket wall 26 as shown at the right hand side of Fig. 1. Between the combustion chamber 42 and the smoke flue 43 is located a heat exchange 44 which includes a tortuous heat conduit 45 leading from a gas intake 46 at the upper portion of the interior of the casing 10 and discharging into the smoke flue 43. This conduit is formed in part by a pair of upstanding metal walls 46a and 47, the latter of which depends from the portion of the rear wall just above the smoke flue and intrudes into a box-like casing 48 formed in part by the rear wall 12 of the casing. The casing 48 intrudes into the inner cold air conduit 20 at the rear of the device and is located above the overhanging wall 35 of the intermediate shell. It is appreciated from examining Fig. 1 that the inner cold air conduit 20 in the portion thereof at the rear of the device surrounds, and thus forms part of, the heat exchange 44 and that the air admitted through the opening 33 is preheated not only by contact with the walls of the heat exchange but is also heated on all sides of the casing by its contact with the several walls of the main casing. The intermediate shell 17 is provided at its inbent portion 18 with a plurality of vent openings 49 placing the outer air jacketing space 30 in communication with the conduit 20 adjacent their upper ends.

The opposite side walls 13 and 14 of the casing as shown in Fig. 2 are provided with aligned openings outlined by annular frames 50 and 51 leading to the fan structure hereinafter described.

Positioned in that part of the main casing 10 remote from the part 42 and shown as above the combustion chamber 42 is a metal box-like partition 52, the bottom of which forms a fan scroll 53 and which partition 52 divides the other portion of the casing interior into a fan containing cochleate chamber 54 and the balance into a hot burning gas passageway leading to the gas intake at 46. Opposite sides of the box-like member 52 are provided with conical rings 55 and 56 which form the suction intake openings to offset the sides of the fan 57 and through which air is drawn from the cold air conduits into the fan through the frames 50 and 51. Fan 57 includes a cylindrical drum frame 58. The fan shaft 59 extends from opposite ends of the frame 58 through the rings 55 and 56 and through the frame 50 and 51 as particularly shown in Fig. 2. The outer ends of the shaft are supported in bearings 59 and 60 in turn supported from brackets 61 secured to a containing casing 62 and which in turn is supported from a structural part of the furnace, part of which is shown by the angular member 63. The housing casing 62 for the shaft bearings is secured to the intermediate shell 16 and associated bearings 59 and 60 are exposed through opening 64 in the shell so that they are contained in the outer cold air jacketing space or conduit 30. The fan is driven from an electric motor 65 also contained in the outer cold air conduit and connected by means of belt 66 to drive pulley 67 at one end of the fan shaft.

The pressure outlet 68 from the fan casing 53 opens through the casing top 16 and discharges into the interior of a rectangular dome or plenum chamber 69 mounted on top of a casing 10 and specifically shown to fit about the flange 19 and engage the top of the outlining jacket. The dome is provided with several air discharge ports 70 leading into conduits 71 which pass to the several rooms as is usual in devices of this character. The dome 69 is shown to contain several cooperating mechanisms, such, for instance, as the humidifier 72 with evaporating pan 73, thermostatically controlled valve 74 for discharging water onto an incline 75 which discharges into the pan 73. There is also disclosed thermostat 76 for controlling the circuit which includes the motor 65 and within the casing is shown a hot water copper coil 77, all these parts forming no particular part of the present invention.

In operation it will be understood that air is admitted through the opening 33 and is drawn through the filters 34 and passes as indicated by the arrows upwardly into both the inner and outer cold air conduits and from both of which conduits the air is drawn by the fan into the interior of the same along the line of its axis indicated by the fan shaft. It will thus be seen that the air is drawn by suction effect through the filters and past the several heat exchange walls and is eventually drawn into the fan space through its opposite open sides. From the fan it is whirled under pressure against the sides and particularly against the scroll portion of the fan casing during which action the air is heated by direct contact with the intensely hot fan scroll and is eventually discharged out through the outlet 68 through the dome and into the duct system leading to the rooms.

Referring to the hot gas flow it will be seen that these gases originate in the combustion chamber 42, pass under, around and up past the fan scroll 53, pass to the upper portion of the casing 16 and then are turned downwardly into the heat conduit 45, under-passing the wall 47 and eventually are discharged from the device into the smoke flue heating the air thereabout in its passage out of the device.

By means of a device of this character, it is possible by proper designing of heat exchange to abstract practically all of the heat from the burning gases before they are eventually discharged. There is particularly featured in this disclosure the heating of the fan scroll in the path of the products of combustion, and in the illustrated embodiment, just above the combustion zone, so that the air receives its maximum amount of heat and heat at maximum temperature at the point where it as about to be discharged from the heating apparatus.

The present disclosure also features the utilization of a more or less dead air jacket surrounding the inner, relatively cold conduit but which as a matter of fact is only comparatively cold with reference to the hotter part of the conduit at the top of the casing and within the fan casing. This insulating air jacket is designed to take the place

of the more expensive heat insulating walls in general use in such constructions.

What is claimed is:

1. In an air conditioning device, in combination, a combustion chamber, rectangular in cross-section having a top wall and a bottom wall and formed in the upper portion thereof with an outlet for the products of combustion, a cochleate passage in the upper portion of said combustion chamber extending substantially across the combustion chamber from side to side, the outlet of said cochleate passage being disposed in the top wall of the combustion chamber and said passage being disposed in the path of the products of combustion, an inner casing of rectangular cross-section defining an inner air chamber surrounding said combustion chamber and in spaced relation thereto, an inlet of said cohcleate passage being formed at each side in the side wall of the combustion chamber and opening into said inner air chamber, an outer casing of rectangular cross-section comprising a bottom and enclosing, in spaced relation, the combustion chamber and the inner casing and defining an outer air chamber, a centrifugal fan in said cochleate passage having a fan shaft, bearings for said fan shaft disposed in the inner casing in the path of the air entering the inlets of the cochleate passage, said inner casing being formed with passages at the top and bottom to conduct air from the outer air chamber into the inner air chamber and an air inlet in the lower portion of the outer casing.

2. In an air conditioning device, in combination, a combustion chamber, rectangular in cross-section having a top wall and a bottom wall and formed in the upper portion thereof with an outlet for the products of combustion, a cochleate passage in the upper portion of said combustion chamber extending substantially across the combustion chamber from side to side, the outlet of said cochleate passage being disposed in the top wall of the combustion chamber and said passage being disposed in the path of the products of combustion, an inner casing of rectangular cross-section defining an inner air chamber surrounding said combustion chamber and in spaced relation thereto, an inlet of said cochleate passage being formed at each side in the side wall of the combustion chamber and opening into said inner air chamber, an outer casing of rectangular cross-section comprising a bottom and enclosing, in spaced relation, the combustion chamber and the inner casing and defining an outer air chamber, a centrifugal fan in said cochleate passage having a fan shaft, bearings for said fan shaft disposed in the inner casing in the path of the air entering the inlets of the cochleate passage, said inner casing being formed with passages at the top and bottom to conduct air from the outer air chamber into the inner air chamber, an air inlet in the lower portion of the outer casing, an end of the fan shaft extending within the outer air chamber, a motor in the flow of air entering the air chambers and operative connections between the motor and the fan shaft end disposed in an air passage.

3. In an air conditioning device, in combination, a combustion chamber, rectangular in cross-section having a top wall and a bottom wall and formed in the upper portion thereof with an outlet for the products of combustion, a cochleate passage in the upper portion of said combustion chamber extending substantially across the combustion chamber from side to side, the outlet of said cochleate passage being disposed in the top wall of the combustion chamber and said passage being disposed in the path of the products of combustion, an inner casing of rectangular cross-section defining an inner air chamber surrounding said combustion chamber and in spaced relation thereto, an inlet of said cochleate passage being formed at each side in the side wall of the combustion chamber and opening into said inner air chamber, an outer casing of rectangular cross-section comprising a bottom and enclosing, in spaced relation, the combustion chamber and the inner casing and defining an outer air chamber, a centrifugal fan in said cochleate passage having a fan shaft, bearings for said fan shaft disposed in the inner casing in the path of the air entering the inlets of the cochleate passage, said inner casing being formed with passages at the top and bottom to conduct air from the outer air chamber into the inner air chamber, an air inlet in the lower portion of the outer casing and a plenum chamber disposed on the top wall of the combustion chamber formed with air outlets and receiving air directly from the outlet of the cochleate passage.

4. In an air conditioning device, in combination, a combustion chamber, rectangular in cross-section having a top wall and a bottom wall and formed in the upper portion thereof with an outlet for the products of combustion, a cochleate passage in the upper portion of said combustion chamber extending substantially across the combustion chamber from side to side, the outlet of said cochleate passage being disposed in the top wall of the combustion chamber and said passage being disposed in the path of the products of combustion, an inner casing of rectangular cross-section defining an inner air chamber surrounding said combustion chamber and in spaced relation thereto, an inlet of said cochleate passage being formed at each side in the side wall of the combustion chamber and opening into said inner air chamber, an outer casing of rectangular cross-section comprising a bottom and enclosing, in spaced relation, the combustion chamber and the inner casing and defining an outer air chamber, a centrifugal fan in said cochleate passage having a fan shaft, bearings for said fan shaft disposed in the inner casing in the path of the air entering the inlets of the cochleate passage, said inner casing being formed with passages at the top and bottom to conduct air from the outer air chamber into the inner air chamber, an air inlet in the lower portion of the outer casing, a plenum chamber disposed on the top wall of the combustion chamber formed with air outlets and receiving air directly from the outlet of the cochleate passage and an air humidifier in the plenum chamber.

5. In an air conditioning device, in combination, a combustion chamber, rectangular in cross-section having a top wall and a bottom wall and formed in the upper portion thereof with an outlet for the products of combustion, a cochleate passage in the upper portion of said combustion chamber extending substantially across the combustion chamber from side to side, the outlet of said cochleate passage being disposed in the top wall of the combustion chamber and said passage being disposed in the path of the products of combustion, an inner casing of rectangular cross-section defining an inner air chamber surrounding said combustion chamber and in spaced relation thereto, an inlet of said cochleate passage being formed at each side in the side wall of the combustion chamber and opening into said inner air

chamber, an outer casing of rectangular cross-section comprising a bottom and enclosing, in spaced relation, the combustion chamber and the inner casing and defining an outer air chamber, a centrifugal fan in said cochleate passage having a fan shaft, bearings for said fan shaft disposed in the inner casing in the path of the air entering the inlets of the cochleate passage, said inner casing being formed with passages at the top and bottom to conduct air from the outer air chamber into the inner air chamber, an air inlet in the lower portion of the outer casing and a conduit for the products of combustion extending from the outlet therefor in heat exchange relation with at least one of the air chambers.

6. In an air conditioning device, in combination, an outer casing, an inner casing therewithin and defining an outer air chamber therebetween, a combustion chamber within the inner casing forming with the inner casing, an inner air chamber, means to conduct air to the lower part of the outer air chamber and to the lower part of the inner air chamber, means to conduct air from the upper portion of the outer casing only to the upper portion of the inner casing, said combustion chamber being formed in the upper portion thereof with an outlet for the products of combustion, a cochleate passage in the upper portion of said combustion chamber extending substantially across the combustion chamber, the outlet of said cochleate passage being disposed in the upper portion of the combustion chamber and the wall of said passage being disposed in the path of the products of combustion, an inlet of said cochleate passage being formed in the side wall of the combustion chamber and opening only into said inner air chamber to receive air therefrom and a fan in said cochleate passage to draw air from the inner air chamber through said inlet into said cochleate passage.

7. In an air conditioning device, in combination, a combustion chamber, rectangular in cross-section having a top wall and a bottom wall and formed in the upper portion thereof with an outlet for the products of combustion, a cochleate passage in the upper portion of said combustion chamber extending substantially across the combustion chamber from side to side, the outlet of said cochleate passage being disposed in the top wall of the combustion chamber and said passage being disposed in the path of the products of combustion, an inner casing of rectangular cross-section defining an inner air chamber surrounding said combustion chamber and in spaced relation thereto, an inlet of said cochleate passage being formed at each side in the side wall of the combustion chamber and opening into said inner air chamber, an outer casing of rectangular cross-section comprising a bottom and enclosing, in spaced relation, the combustion chamber and the inner casing and defining an outer air chamber, a centrifugal fan in said cochleate passage having a fan shaft, bearings for said fan shaft disposed in the inner casing in the path of the air entering the inlets of the cochleate passage, said inner casing being formed with passages at the top and bottom to conduct air from the outer air chamber into the inner air chamber and an air inlet in the lower portion of the outer casing.

8. In an air conditioning device, in combination, a combustion chamber, rectangular in cross-section having a top wall and a bottom wall and formed in the upper portion thereof with an outlet for the products of combustion and in the lower portion of a side wall with an opening, a chamber in communicating relation with the combustion chamber through said last named opening, a source of heat in the last named chamber, a cochleate passage in the upper portion of said combustion chamber extending substantially across the combustion chamber from side to side, the outlet of said cochleate passage being disposed in the top wall of the combustion chamber and said passage being disposed in the path of the products of combustion, an inner casing of rectangular cross-section defining an inner air chamber surrounding said combustion chamber and chamber containing said source of heat and in spaced relation thereto, an inlet of said cochleate passage being formed at each side in the side wall of the combustion chamber and opening into said inner air chamber, an outer casing enclosing, in spaced relation, the combustion chamber and the inner casing and defining an outer air chamber, a centrifugal fan in said cochleate passage having a fan shaft, bearings for said fan shaft disposed in one of said chambers in the path of the air moving to the inlets of the cochleate passage, said inner casing being formed with passages at the top and bottom to conduct air from the outer air chamber into the inner air chamber and an air inlet in the outer casing.

9. In an air conditioning device, in combination, a combustion chamber substantially rectangular in cross-section formed in the upper portion thereof with an outlet for the products of combustion, a cochleate passage in the upper portion of said combustion chamber extending substantially across the combustion chamber from side to side but terminating in spaced relation to the respective sides, the outlet of said cochleate passage being disposed in the upper portion of the combustion chamber and said cochleate passage being disposed in the path of the products of combustion, a casing defining an air chamber surrounding said combustion chamber and in spaced relation thereto, inlets of said cochleate passage being formed in the side walls thereof, inlets formed in the opposite sides of the combustion chamber in the upper portion thereof and in register with the inlets of the cochleate passage, conduits connecting said inlets respectively whereby products of combustion may impinge upon the sides of the cochleate passage and said conduits for heat exchange relationship with the air passing therethrough, a centrifugal fan in said cochleate passage and an air inlet in a lower portion of the casing whereby air is drawn by the fan through said air inlet and upwardly over the outer surface of said combustion chamber to the inlets and conduits leading to the cochleate passage.

10. In an air conditioning furnace, in combination, a combustion chamber, a fuel burner in one end portion thereof, said combustion chamber being formed in an opposite end portion thereof with an outlet for the products of combustion, a cochleate passage in the combustion chamber extending across the combustion chamber intermediate the fuel burner and the said outlet for products of combustion and so spaced from the fuel burner that only products of combustion strike the wall of the cochleate passage, air inlets for the cochleate passage formed in the wall of the combustion chamber and facing in opposite directions, a fan in the cochleate passage registering with each air inlet, a casing surround-

ing the combustion chamber in such spaced relation thereto that air passing between the casing and the combustion chamber is brought in heat exchange relationship with the combustion chamber and said casing being formed with an inlet adjacent that end portion of the combustion chamber containing the fuel burner whereby air upon entering said air inlet first passes in heat exchange relationship over that portion of the combustion chamber adjacent the fuel burner before being drawn through the inlets for the cochleate passage.

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