

Jan. 28, 1947.

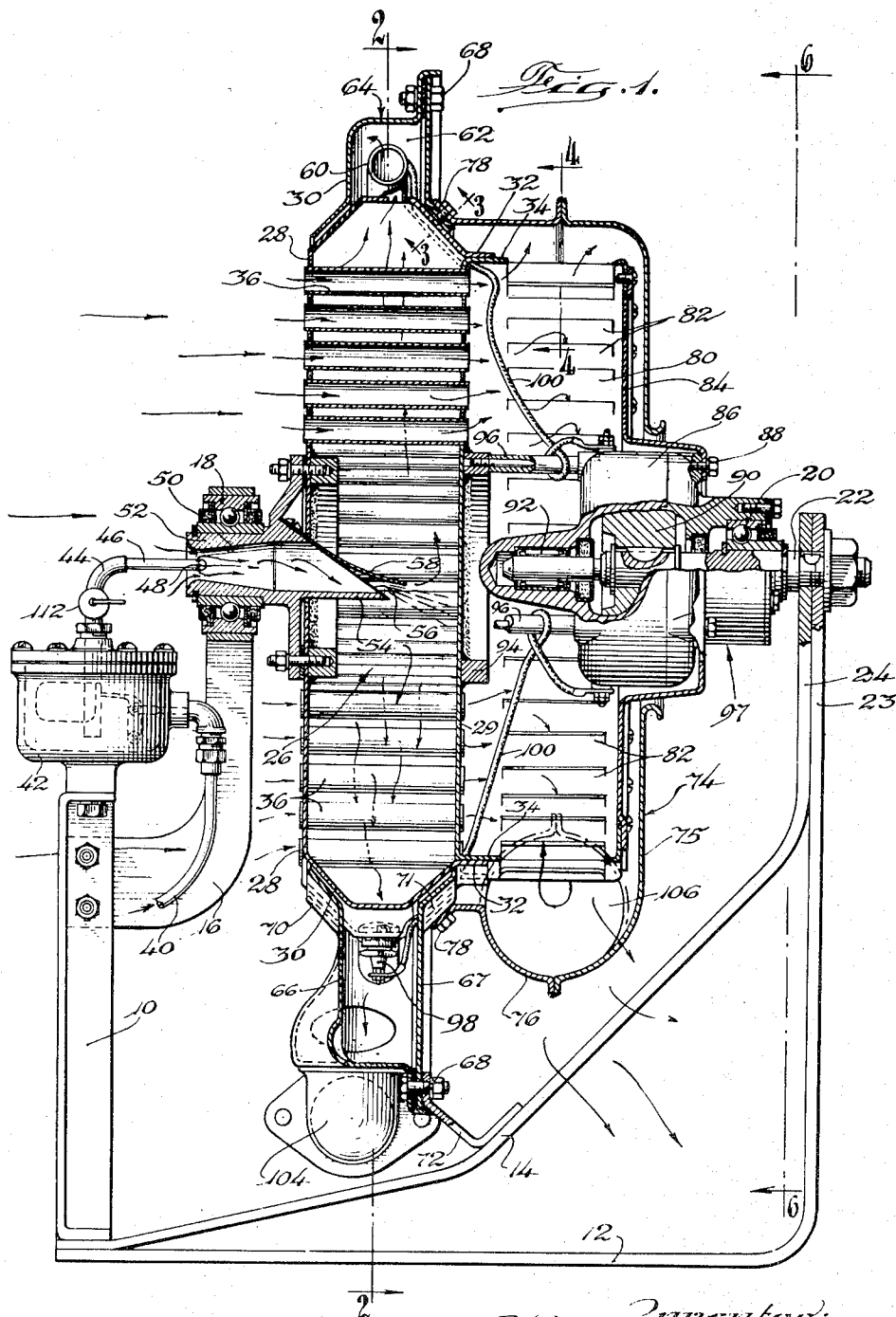
H. J. DE N. McCOLLUM

2,414,829

HEATING APPARATUS

Filed July 30, 1943

4 Sheets-Sheet 1



Inventor:
Henry J. De N. McCollum
By William, Bradbury & Hinkle,
Attorneys

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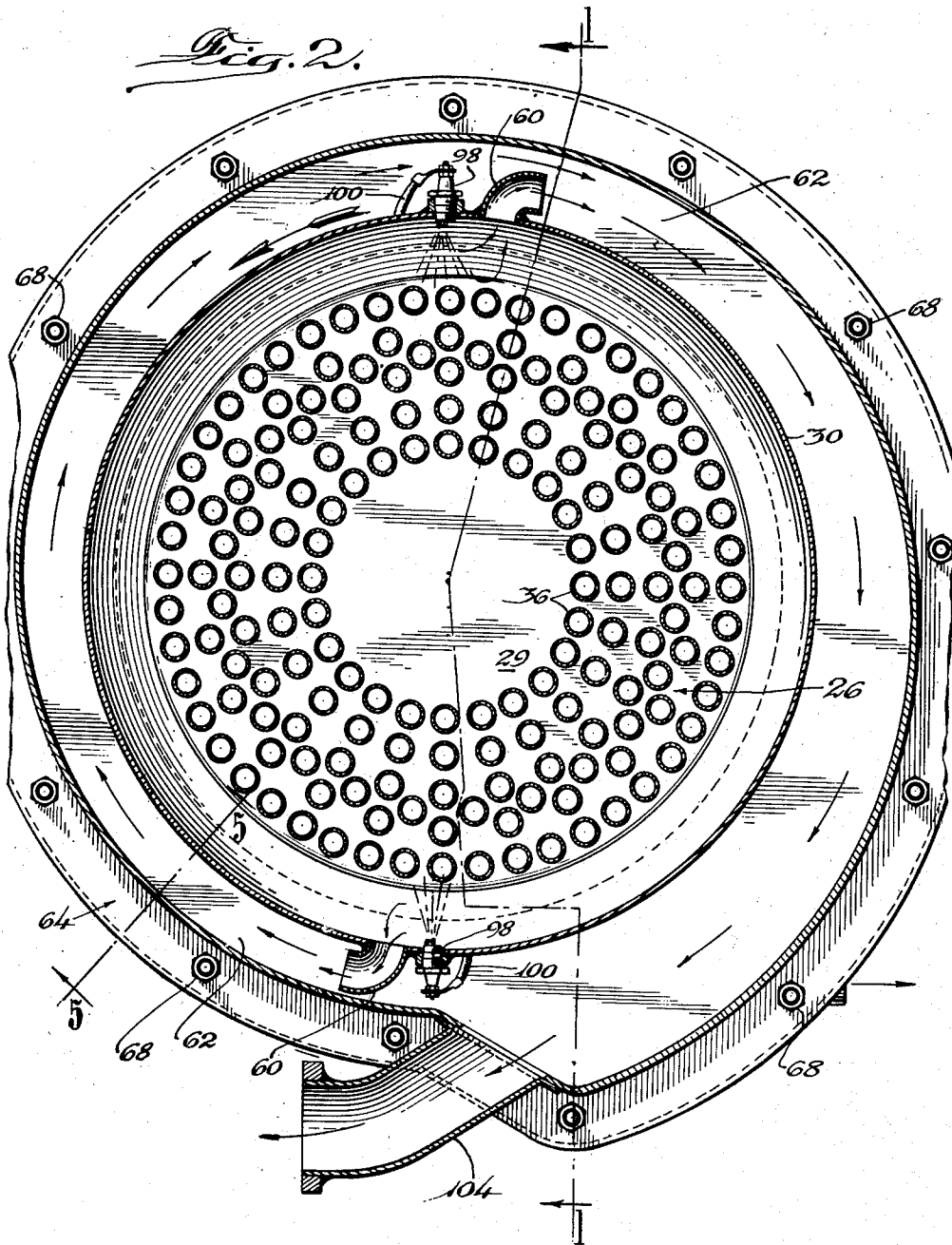
H. J. DE N. McCOLLUM

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4 Sheets-Sheet 2



Inventor:
Henry J. De N. McCollum
By *Williams, Bradbury & Thibault*
Attorneys.

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H. J. DE N. McCOLLUM

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Fig. 3.

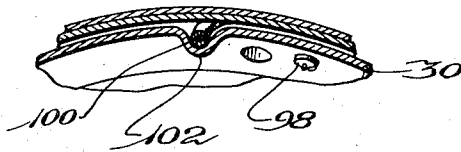


Fig. 4.

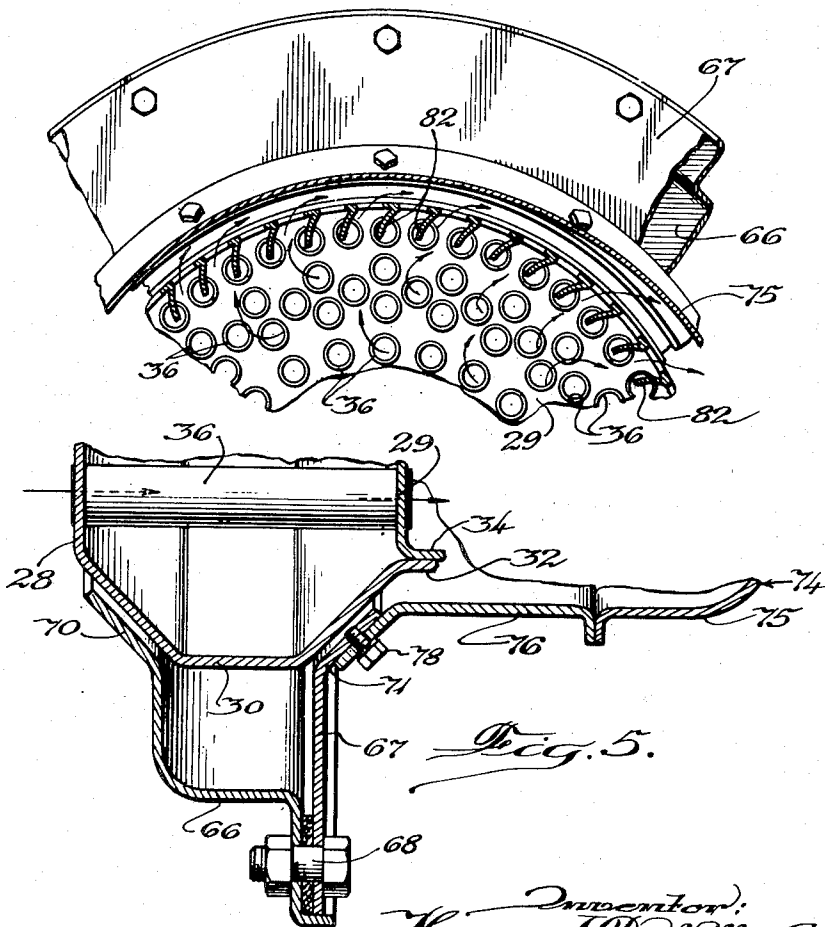


Fig. 5.

Inventor:
Henry J. De N. McCollum
By *Williams, Graham & Hubbs*
Attorneys.

Jan. 28, 1947.

H. J. DE N. McCOLLUM

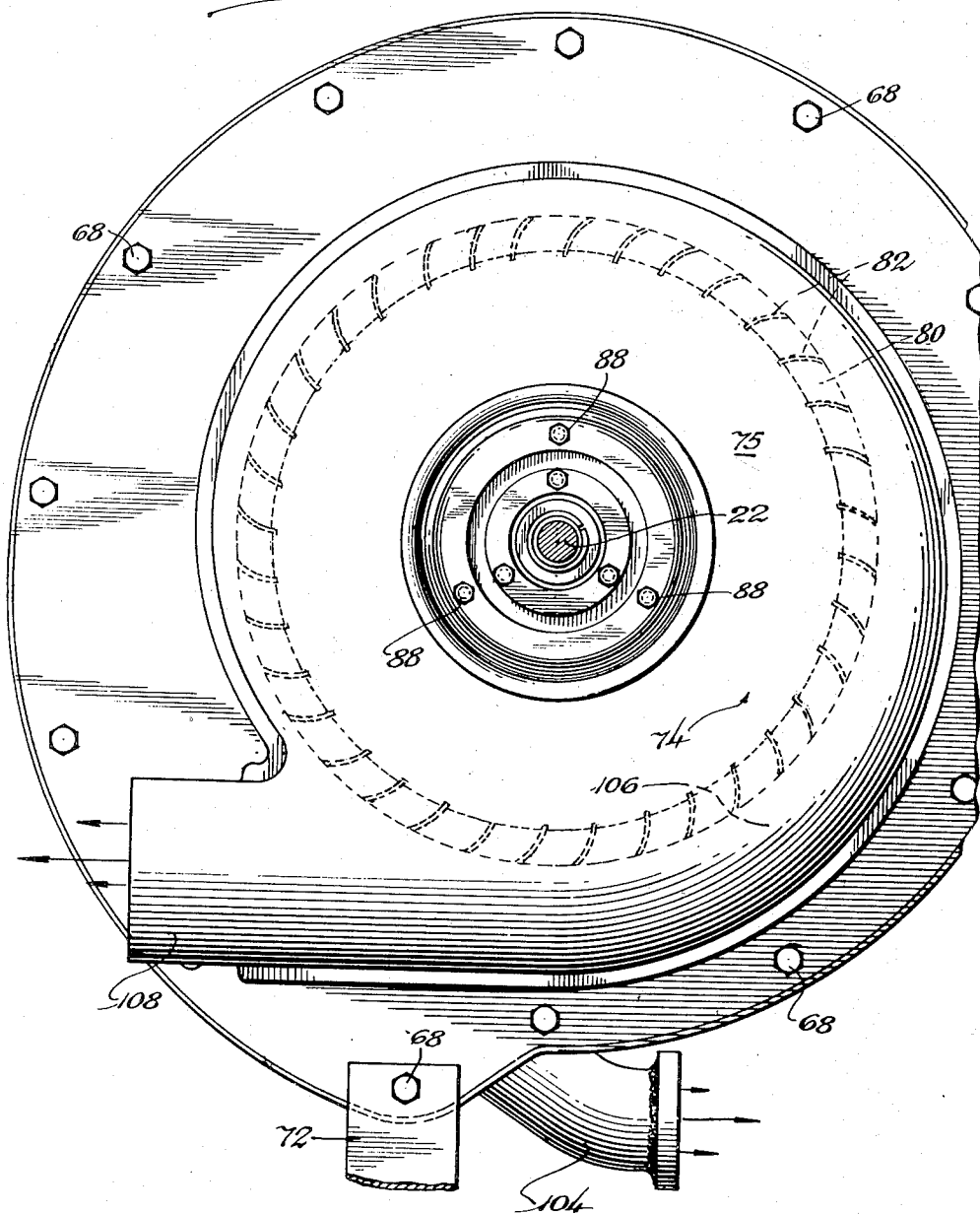
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Fig. 6.



Inventor:
Henry J. De N. McCollum
By Williams, Bradbury & Knicker,
Attorneys.

UNITED STATES PATENT OFFICE

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HEATING APPARATUS

Henry J. DeN. McCollum, Chicago, Ill.; Thelma McCollum, executrix of said Henry J. DeN. McCollum, deceased, assignor to Stewart-Warner Corporation, Chicago, Ill., a corporation of Virginia

Application July 30, 1943, Serial No. 496,813

2 Claims. (Cl. 126-110)

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My invention relates generally to heating apparatus, and more particularly to unit heaters.

It is an object of my invention to provide an improved heating apparatus which will be operable to supply a blast of heated ventilating air without the necessity of providing an external source of power.

A further object is to provide an internal combustion heating apparatus in which a portion of the energy of combustion causing the expansion of the products of combustion is utilized to draw the fuel mixture to the combustion chamber and to force ventilating air through the apparatus.

A further object is to provide an improved internal combustion type heater incorporating electrical ignition means, and a generator for supplying current to the ignition means.

A further object is to provide an improved heating apparatus which is automatic in operation, simple in construction, and compact, and which may be economically manufactured.

Other objects will appear from the following description, reference being had to the accompanying drawings, in which:

Fig. 1 is a generally vertical sectional view taken on the line 1-1 of Fig. 2;

Fig. 2 is a transverse sectional view taken on the line 2-2 of Fig. 1;

Figs. 3 and 4 are fragmentary sectional views taken on the lines 3-3 and 4-4 of Fig. 1;

Fig. 5 is a fragmentary sectional view taken on the line 5-5 of Fig. 2; and

Fig. 6 is a view taken on the line 6-6 of Fig. 1, being substantially an end elevational view of the apparatus.

The heating apparatus is mounted on a suitable fabricated supporting frame comprising a pedestal 10, base 12, and a reinforcing bar 14. A bracket 16, bolted to the pedestal 10, is provided for the support of an antifriction bearing assembly 18. A similar antifriction bearing assembly 20 has its inner ring secured to a shaft 22, which is non-rotatably secured to the up-right portions 23, 24 of the frame.

A combustion chamber 26 is formed by a pair of heads 28, 29, the head 28 being formed integrally with a peripheral wall 30, the terminal flange 32 of which may be welded or brazed to a peripheral flange 34 on the head 29.

A plurality of tubes 36 have their ends welded or otherwise suitably secured in the heads 28 and 29 and form a heat exchanger having passageways for the flow of ventilating air through the combustion chamber, effecting the transfer of heat from the products of combustion in the

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combustion chamber to the ventilating air to be heated.

Liquid fuel for combustion in the heating apparatus is supplied through a conduit 40 to a float bowl 42 mounted on the pedestal 10. The liquid fuel is drawn from the float bowl 42 through a tube 44 terminating in a jet nozzle 46. Jet openings 48 near the end of the nozzle 46 are located substantially at the throat of a Venturi-shaped passageway 50 formed in an inlet fitting 52, which is secured to the inner race of the antifriction bearing assembly 18. The fitting 52 is suitably secured to the combustion chamber head 28 and has a beveled portion 54 extending into the central portion of the combustion chamber 26. The beveled surface 56 of the portion 54 forms a seat for a reed type check valve 58, which is thin and highly flexible and resilient, so that it will readily flex away from its seat to permit flow of combustible mixture from the Venturi passageway 54 into the combustion chamber upon small differential pressures upon the opposite sides thereof.

Referring to Figs. 1 and 2, a plurality of reaction nozzles 60 are provided on the peripheral wall 30, these nozzles discharging products of combustion from the combustion chamber 26 into a space 62 formed by a casing or collector 64, preferably of sheet metal construction and comprising stampings 66 and 67 secured to each other by bolts 68. The stampings 66 and 67 have flaring flanged portions 70 and 71, respectively, which lie closely adjacent the complementary surfaces of the peripheral wall 30, there being merely sufficient clearance between these parts to permit free rotation of the combustion chamber assembly relative to the collector casing 64. The casing 64 is suitably secured to the supporting framework as by one or more brackets 72.

A blower housing 74, preferably in the form of two stampings 75 and 76, which may be welded together, is secured to the flange 71 of the housing 64 in any suitable manner, as by cap screws 78. A "Sirocco" type blower impeller 80 having blades 82, may be formed integrally with the flange 34 of the head 29, as shown in Fig. 1, or may be suitably secured thereto. In any event, the head 29 forms one side wall of the impeller, the other side wall being provided by a stamping 84, which is conformed to embrace the rotor 86 of a high tension alternator, being secured thereto by cap screws 88. The central stator 90 of the high tension alternator is keyed to the shaft 22, the shaft having a reduced diameter exten-

sion projecting into a needle bearing assembly 92 carried by the rotor 86. The rotor 86 is secured to a reinforcing ring 94 by the cap screws 88, these screws extending through suitable spacing posts 96, which are secured to the rotor 86. The rotor has a hub portion 97.

The output of the alternator is supplied to a pair of spark plugs 98, which are threaded in suitable sockets welded to the peripheral wall 30 (Fig. 2), the connection being in series through suitably insulated conductors 100. The conductors 100, as best shown in Fig. 3, pass between the peripheral wall 30 and the complementally shaped flange portion 71 of the part 67, the wall 30 being provided with suitable indented grooves 102 to receive the wires 100. The passageway 62 is of involute or scroll shape and terminates in an outlet fitting 104, which may be connected to any suitable space for disposal of the products of combustion.

The blower housing 74 provides an involute or scroll-shaped passageway 106, which terminates in an outlet duct 108, which may be connected by any suitable duct system to the space to which heated ventilating air is to be supplied.

From the foregoing, it will be seen that the collector casing 64 and housing 74 are stationary, while the combustion chamber assembly and blower impeller, together with the rotor 86 of the alternator, are rotatable, the rotating portion of the assembly being supported upon the bearings 18 and 20.

In using the apparatus, the rotating assembly is initially rotated, as by means of a pull cord wrapped about the hub 97 of the rotor 86. Upon such initial rotation of the parts, the combustion chamber casing with the tubes 36 extending axially thereacross will operate in the manner of a centrifugal blower to create a partial vacuum in the center thereof which will be effective to draw a combustible mixture of fuel and air into the central portion of the combustion chamber through the check valve 58. As soon as the combustion chamber is substantially filled with a combustible mixture, the mixture reaching the spark plugs 98, which are continuously emitting sparks, is ignited, producing an explosion, whereupon the products of combustion are expelled at high velocity from the reaction nozzles 60 into the scroll-shaped passageway 62. The reaction of the products of combustion emitted from the nozzles 60 accelerates the counterclockwise (Fig. 2) rotation of the parts thereby effecting the discharge of the products of combustion from the combustion chamber and causing the induction of a fresh charge into the combustion chamber. As soon as the products of combustion are substantially discharged from the combustion chamber, the fresh supply of combustible mixture will again reach the spark plugs 98 and ignition will again take place to cause a repetition of the foregoing cycle.

As the speed of rotation of the rotary assembly increases, the blower impeller 80 will become increasingly effective to draw fresh air through the tubes 36, wherein the air will become heated, and the heated air will be discharged by the blower through the scroll passageway 106 and outlet duct 108 to the space to be heated.

The apparatus will thus be effective to generate, by means of the alternator, the high tension current necessary for ignition and at the same time provide the means for securing the induction of the combustible mixture, the discharge of the products of combustion, and the

circulation of ventilating air through the heat exchanger formed by the tubes 36. Since the tubes 36 pass directly through the combustion chamber in which burning takes place, and in which there is continuous radial outward flow, the heat transfer is very efficient. The ventilating air blower is of sufficient capacity to cause rapid flow through the heat exchanger tubes 36 and thus prevent overheating of the latter. The rotating assembly will rotate at a speed determined by the rate at which the combustion chamber may be purged of the products of combustion and supplied with a fresh charge, by the torque necessary to be applied to rotate the ventilating air blower, and by the frictional resistance of the air and bearings, as well as by the negligible power required to drive the alternator. Since the retarding torques are mainly the result of air friction, and since such torques vary as an exponential power of the speed of rotation, it will be clear that the apparatus is self-governing as to its speed of rotation. Due to the rotary moment of inertia of the rotating assembly, the fact that the propelling torque is intermittent will not materially affect the uniformity of speed of rotation.

It will also be apparent that there are no spark timing problems involved, since the spark plugs are substantially continuously energized and are effective to ignite the mixture whenever the combustion chamber becomes filled with a combustible mixture. The timing of the explosions thus is in effect automatically controlled.

When it is desired to stop the apparatus, the supply of fuel may be shut off by any suitable valve mechanism, such as a stop cock 112 (Fig. 1) in the conduit 44 which supplies the fuel to the nozzle 46.

The broader subject matter disclosed in this application is claimed in the copending application of Henry J. DeN. McCollum, Serial No. 508,169, filed October 29, 1943.

While I have shown and described a particular embodiment of my invention, it will be apparent to those skilled in the art that numerous modifications and variations may be made therein without departing from the underlying principles of the invention. I therefore, desire, by the following claims, to include within the scope of my invention all such modifications and variations whereby substantially the results of my invention may be obtained by the use of substantially the same or equivalent means.

I claim:

1. In an apparatus of the class described, the combination of a support, a collector for products of combustion and a blower housing carried by said support, a rotary assembly comprising a combustion chamber casing surrounded by said collector, means for supplying a combustible mixture to the combustion chamber comprising an induction tube centrally located with respect to the combustion chamber casing and terminating within the combustion chamber in a valve seat, a resilient flexible reed type valve provided for engagement with the seat to prevent the discharge of products of combustion through the induction tube, a plurality of reaction nozzles carried by the combustion chamber casing for effecting the discharge of products therefrom into said collector, heat exchange means providing passageways extending through the combustion chamber and into the space within the blower housing, means including a blower impeller rotatable with said casing and operable to cause the flow of ventilating air through the passageways in the

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heat exchanger and to force the air thus heated to a space to be heated, and electrical ignition means operating substantially continuously to ignite the combustible mixture in the combustion chamber.

2. The combination set forth in claim 1, in which the induction tube includes a Venturi-

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shaped passageway rotating with the combustion chamber casing and there is provided a stationary fuel jet nozzle projecting into the Venturi-shaped passageway substantially to the throat of the latter.

HENRY J. DeN. McCOLLUM.