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AUTO-ROTATIVE COMBUSTION HEATER

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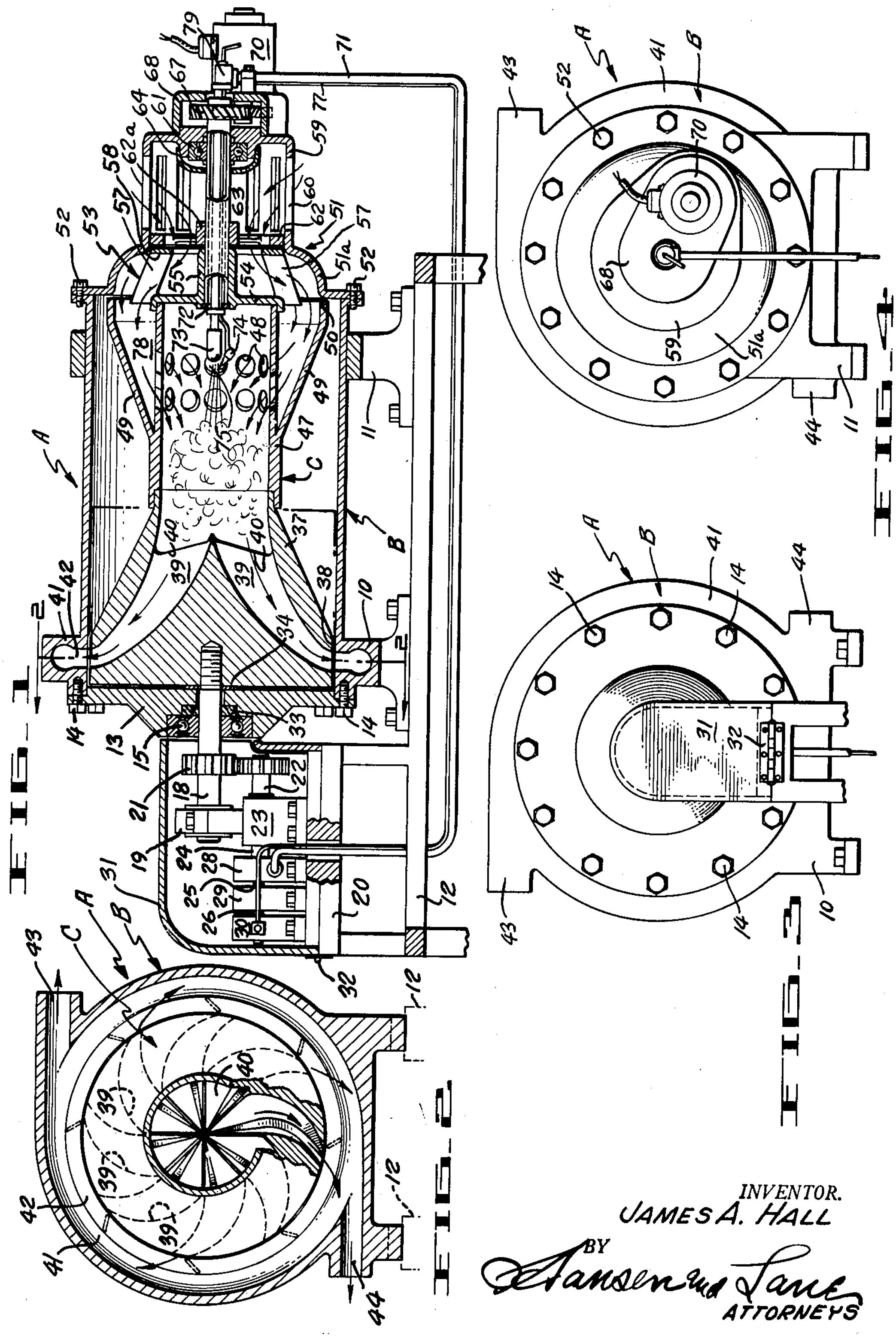

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AUTO-ROTATIVE COMBUSTION HEATER

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The present invention relates to heating apparatus, and pertains more particularly to a heater for burning liquid fuel which uses a portion of the energy generated by the combustion of the fuel for turning a rotor which operates the device.

Much of the mechanized equipment which is stored and used out of doors in the colder parts of the world, such as the Arctic and subarctic zones, requires preheating before it can be placed in operation. Various types of heating equipment for this and other purposes have been devised for heating such mechanism preparatory to starting it. In addition to the heating equipment itself, however, it usually is necessary to have available electric current and an electrically energized blower or a blower driven by an auxiliary gasoline engine in order to induce a flow of heated air or other fluid to desired areas of the mechanism.

The present invention contemplates the provision of an oil burning heater which will use a portion of the energy of combustion of the fuel to drive a rotor which in turn is used to drive the fuel feed mechanism and to distribute the heated exhaust gases.

The invention also provides a simple heating unit having a single rotary element which is propelled by the substantially tangential exit of the gases of combustion from the combustion chamber and which is provided with means for drawing in air of combustion at the opposite end of the combustion chamber from the outlet.

It also is an object of the invention to provide an oil burning heater which will burn fuel oil efficiently and which will employ a portion of the energy generated by the combustion of the fuel to drive the rotor and also the accessory mechanism for operating the burner.

These and other objects and advantages of the invention will be apparent from the following description and the accompanying drawings, wherein:

Fig. 1 is a longitudinal, sectional, somewhat diagrammatic view of a heater embodying the present invention.

Fig. 2 is a transverse, sectional view taken along line 2—2 of Fig. 1.

Fig. 3 is a lefthand end elevational view of the mechanism shown in Fig. 1.

Fig. 4 is a righthand end elevational view of the mechanism shown in Fig. 1.

Referring first to the form of the invention shown in Fig. 1, a heater A consists generally of a cylindrical housing B and a rotor C. The housing B is supported on standards **10** and **11**, mounted on a supporting base structure **12**. An end closure plate **13** is mounted in sealing relation transversely across the lefthand end of the housing B as shown in Fig. 1 and is secured in position thereon by cap screws **14**. A ball bearing **15** is mounted in a seat provided therefor centrally of the end plate **13** and a rotor shaft **18** is journaled in this bearing and in a second bearing **19** mounted coaxially therewith on a platform **20** provided on the base **12**. The rotor shaft **18** is screwed into a threaded axial opening in the rotor C. A gear train **21** provides driving

connection between the rotor shaft **18** and a countershaft **22** journaled in a bearing **23**. The countershaft **22** has driving connection by means of conventional co-axial flexible couplings **24**, **25** and **26** with a fuel pump **28** a magneto **29** and a governor **30**. These units are housed in an enclosure **31** mounted by a hinge **32** on the base platform **20**.

A sealing ring **33** of a conventional type is mounted axially inwardly of the bearing **15**, and a second sealing gasket **34** is provided around the rotor shaft **18** and is interposed between the housing end closure plate **13** and the lefthand end of the rotor C.

The rotor C comprises a spirally ported discharge head portion **37** of generally truncated conical shape with a cylindrical portion **38**. The portion **38** has a freely rotatable fit within the lefthand end of the rotor housing B as shown in Fig. 1.

A plurality of symmetrically arranged spiral exhaust passages **39** are provided in the rotor portion **37**. The intake ends **40** of these passages are at the righthand end of the rotor portion **37** and are directed substantially axially thereof as shown in Fig. 1, while their discharge ends are arranged peripherally of the cylindrical portion **38** and are directed substantially tangentially thereof as shown in Fig. 2.

An exhaust collector ring **41** is provided circumferentially around an annular slotted exhaust discharge passage **42** in the housing B to receive the exhaust gases discharged from the spiral exhaust passages **39** and to conduct these gases circumferentially around the collector ring **41** to exhaust outlets **43** and **44**.

Connected coaxially to the righthand end of the rotor portion **37** as shown in Fig. 1 is a cylindrical combustion chamber **47** having a plurality of air intake openings **48** arranged in two circumferential rows around the righthand end portion thereof. An outwardly flaring skirt **49** of generally truncated conical configuration is provided coaxially of the cylindrical combustion chamber to enclose the perforated righthand portion thereof. The righthand terminal edge **50** of this enclosing skirt portion as shown in Fig. 1 is positioned to rotate closely adjacent a domed impeller and air intake housing **51** which is secured by cap screws **52**, to the righthand end of the rotor housing B.

An impeller **53** comprises a head portion **54** secured as by welding to the righthand end of the cylindrical combustion chamber **47**. A hollow rotor support shaft **55** is formed integrally with the head portion **54** and is co-axial with the lefthand rotor shaft **18** and with the combustion chamber **47**. A plurality of impeller vanes **57** are secured peripherally about the head portion **54** and to a ring **58** spaced to the right from the head portion **54** and co-axial therewith.

The domed impeller and air intake housing **51** has a cylindrical air intake chamber **59** formed integrally and co-axially therewith, as shown in Fig. 1. A plurality of longitudinally extending slotted air intake openings **60** are provided peripherally of the air intake chamber **59**. A ball bearing **61** is mounted in a seat provided therefor in the righthand end of the air intake chamber **59** and this bearing is co-axial with the other rotor support bearings mentioned previously herein. An annular outer flange **62***a* of a spider **62** extends radially inwardly from the outer or righthand end of the domed impeller housing portion **51***a*. The hub **63** of the spider **62** provides an additional bearing for the tubular rotor shaft **55**. A dust cap **64** is mounted to shield the ball bearing **61**. A train of gears **67** is mounted in a housing **68** enclosing a portion of the outer or righthand end of the air intake chamber **59**. This gear train **67** provides driving connection between the tubular rotor shaft **55** and the shaft **69** of an electric motor **70** for pre-rotation for the heater rotor B prior to the attainment of an auto-rotative condition thereof.

A fuel inlet pipe 71 is mounted non-rotatively axially within the tubular rotor shaft 55 and is provided on its inner or lefthand entrance to the shaft 55 with a rotary gas tight seal 72. A nozzle 73 is mounted on the pipe 71 within the combustion chamber 47 to discharge a spray of liquid fuel interiorly of the combustion chamber.

An ignition electrode 74 is mounted on the fuel inlet pipe 71 with its sparking points 75 located within the zone of fuel discharge of the nozzle 73. Insulated conductors (not shown) for conducting high tension current to the electrode 74 are mounted in a conventional manner in a casing 77 alongside the fuel inlet pipe 71 and within the bore of the hollow rotor shaft 55. These conductors to the electrode 74 may be encased in a conventional insulating casing 77 (Fig. 1) and connected to the high tension magneto 30 to provide the necessary interrupted high voltage current to produce a spark across the ignition points 75.

Upon rotation of the rotor C by the electric motor 70 to initiate combustion in the chamber 47, the impeller 53 draws air through the intake slots 60 and discharges this air centrifugally into the domed impeller casing portion 51*a*. Thence the air is directed by the curved wall of the impeller casing portion 51*a* into the converging chamber 78 between the perforated righthand portion of the combustion chamber 47 as shown in Fig. 1 and the truncated conical skirt 49. The convergence of the walls of the chamber 78 causes the air from the impeller to flow radially inwardly through the holes 48 into the combustion chamber 47. When the rotor attains sufficient rotative speed to provide a suitable flow of air through the combustion chamber and outwardly through the exhaust outlets 43 and 44, fuel under pressure from the pump 28 is admitted by opening the fuel valve 79 to the nozzle 73. As the fuel is sprayed from the nozzle 73 it is ignited by the spark across the points 75 of the ignition electrode 74 produced by the rotation of the magneto 30. The gases of combustion pass from the combustion chamber outwardly through the spiral passages 39 wherein the rotation of the rotor during prerotation tends to create a negative pressure by conventional impeller action. Since combustion of the fuel-air mixture greatly increases its volume, the discharge of this increased amount of gas from the substantially tangentially disposed outer ends of the spiral passages 39 tends to drive the rotor C in accordance with well known principles of action and reaction. It will be noted in Figs. 1 and 2 that the passages 39 taper toward their discharge ends which is for the purpose of increasing the velocity of the gases as they approach the discharge end of the passages in accordance with well known gaseous flow principles.

The high velocity tangential discharge of the gases of combustion from the outer ends of the passages 39 produces a torque on the rotor C which causes it to continue its rotation. By controlling the amount of fuel and air admitted to the combustion chamber 47, the volume of hot exhaust gases discharged through the passages 39 may be controlled within close limits. For this purpose the governor 29 may be adjusted in a well known manner to control the fuel flow from the pump 28 as required.

From the exhaust discharge outlets 43 and 44, the hot exhaust gases may be conveyed by suitable hoses or ducts (not shown) to a zone of application such as a chilled airplane, tank or automobile engine.

While I have illustrated and described a preferred embodiment of the present invention, it will be understood however, that various changes and modifications may be made in the details thereof without departing from the spirit and scope of the invention as set forth in the appended claims.

Having thus described the invention, what I claim as new and desire to protect by Letters Patent is defined in the following claims.

I claim:

1. A self propelled continuous flame internal combustion heater comprising a housing, a rotor mounted for rotation within said housing, one end of said rotor having a relatively small combustion chamber therein, a discharge head of larger diameter than said combustion chamber mounted on the other end of said rotor, a plurality of exhaust passages in said discharge head opening at one end thereof into the combustion chamber adjacent the axis thereof and opening at the other end thereof to discharge peripherally about the rotor head, the discharge ends of said passages being directed at an acute angle in a predetermined rotative direction, said housing having an annular discharge passage formed therein surrounding the discharge ends of said exhaust passages, an impeller mounted co-axially on the rotor at the opposite end thereof from said discharge passages, a tapered skirt of truncated conical shape mounted co-axially on the combustion chamber end of the rotor to surround the combustion chamber and provide a forwardly tapering air inlet passage, the combustion chamber walls interiorly of said skirt having a plurality of air inlet holes therein, said housing having an air intake portion surrounding said impeller and formed to direct air discharged by the impeller into and through the tapered air inlet passage and through the air inlet holes into the combustion chamber, a fuel nozzle mounted to discharge a spray of fuel into the incoming air within said combustion chamber, spark means mounted in the zone of fuel discharge from said nozzle, and means for energizing said spark means to ignite the fuel-air mixture within the combustion chamber.

2. A self propelled, continuous flame internal combustion heater comprising a housing, a rotor mounted for rotation within said housing, said rotor having a combustion chamber formed in one end thereof, a discharge head mounted on the other end of said rotor, said head having a plurality of exhaust passages formed therein to open from the combustion chamber and an opening at the other end thereof to discharge peripherally about the rotor head, the walls of the discharge ends of said passages being directed at an acute angle in a predetermined rotative direction, an impeller mounted co-axially on the rotor at the opposite end thereof from said discharge passages, a skirt mounted co-axially on the combustion chamber end of the rotor to surround the combustion chamber to provide an air inlet passage, the combustion chamber walls interiorly of said jacket having a plurality of air inlet holes therein, an air intake housing surrounding said impeller and formed to direct air discharged by the impeller into and through the air inlet passage and through the air inlet holes into the combustion chamber, a fuel nozzle mounted to discharge a spray of fuel into the incoming air within said combustion chamber, and ignition means mounted in the zone of fuel discharge from said nozzle.

References Cited in the file of this patent

UNITED STATES PATENTS

2,364,458	McCollum	Dec. 5, 1944
2,414,829	McCollum	Jan. 28, 1947
2,414,830	McCollum	Jan. 28, 1947
2,415,064	McCollum	Jan. 28, 1947
2,439,717	Cooke	Apr. 13, 1948