June 20, 1967 J. F. GULYAS 3,325,993

JET ENGINE

Filed Aug. 11, 1965 5 Sheets-Sheet 1

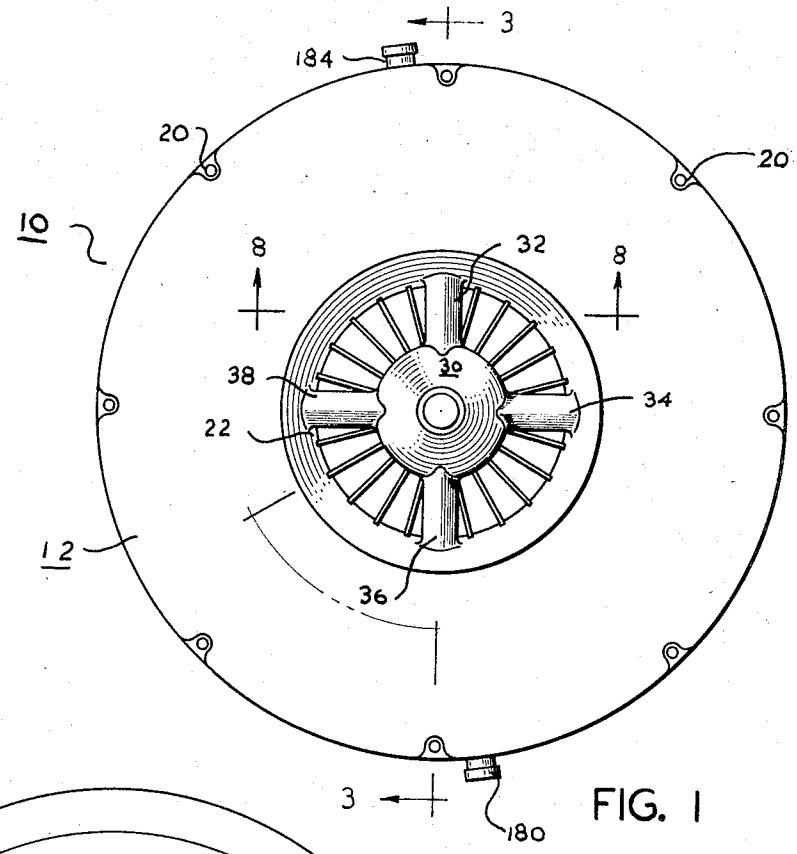

FIG. 1

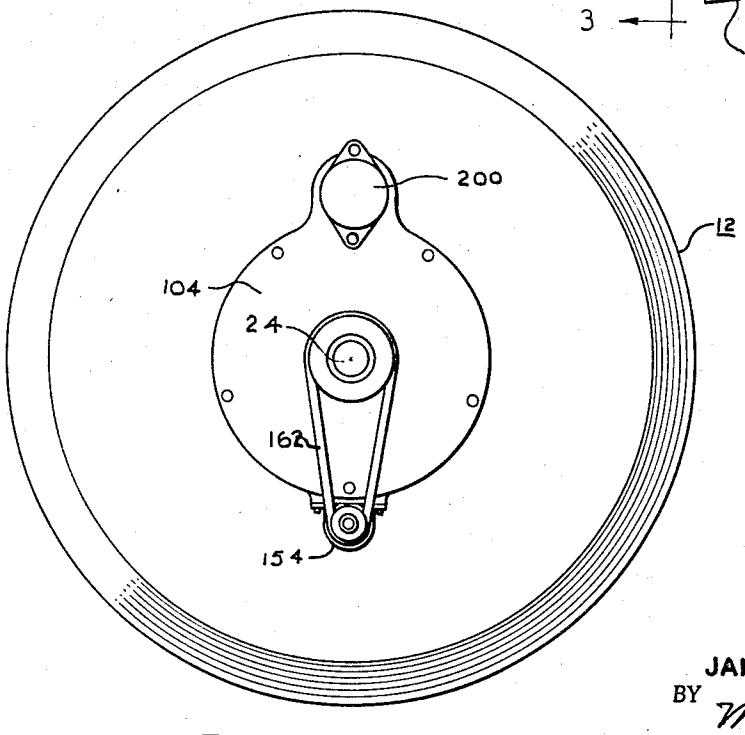

FIG. 2

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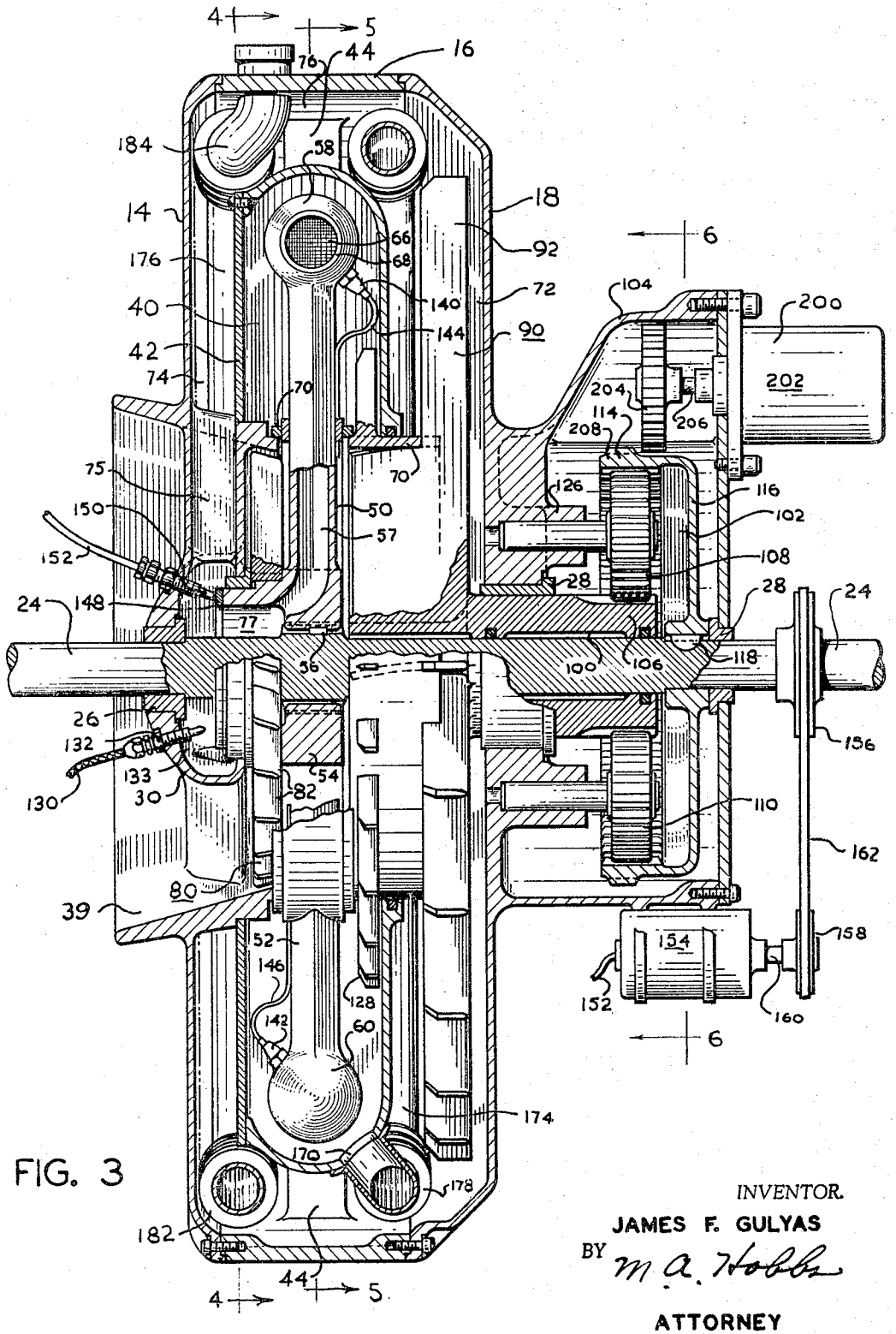

FIG. 3

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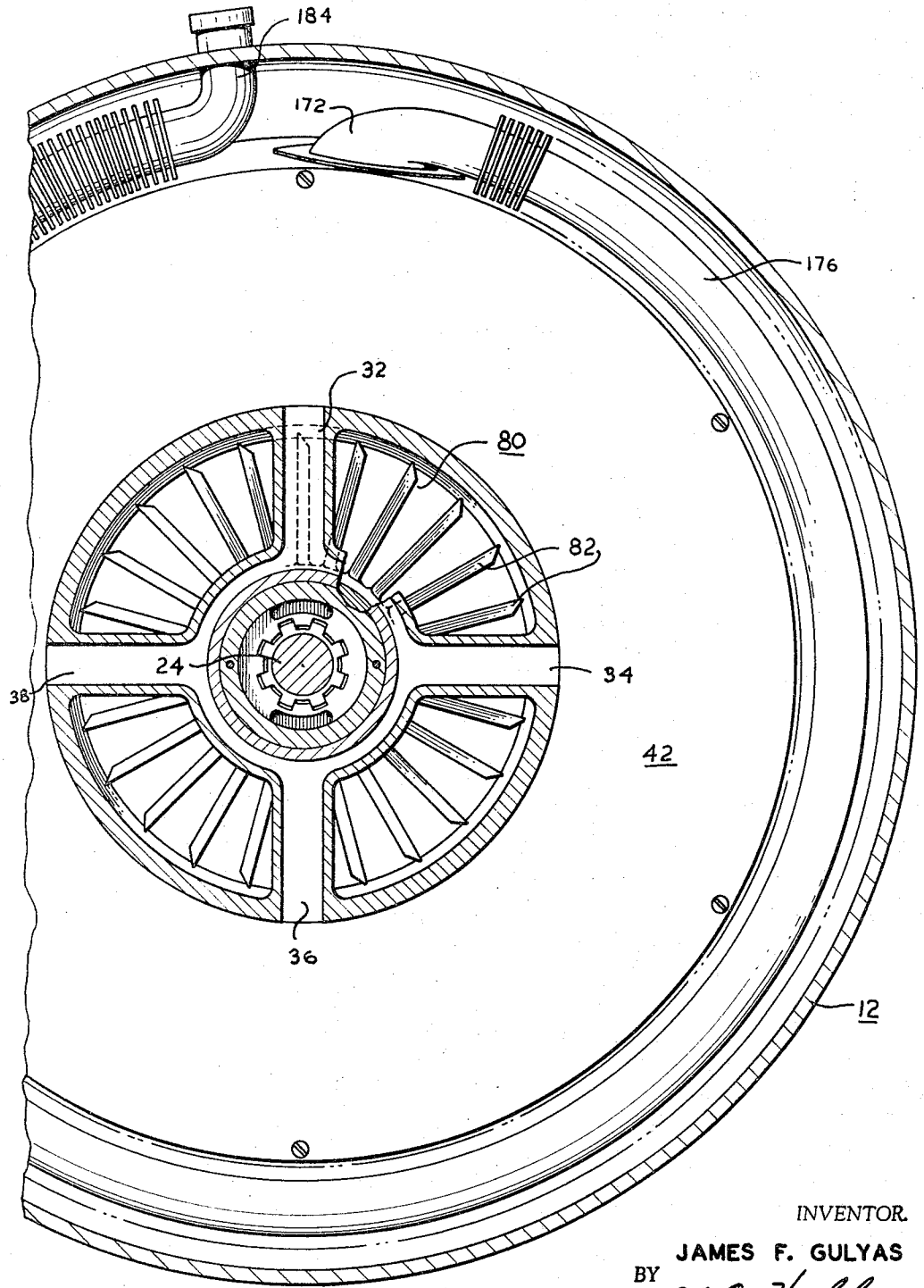

FIG. 4

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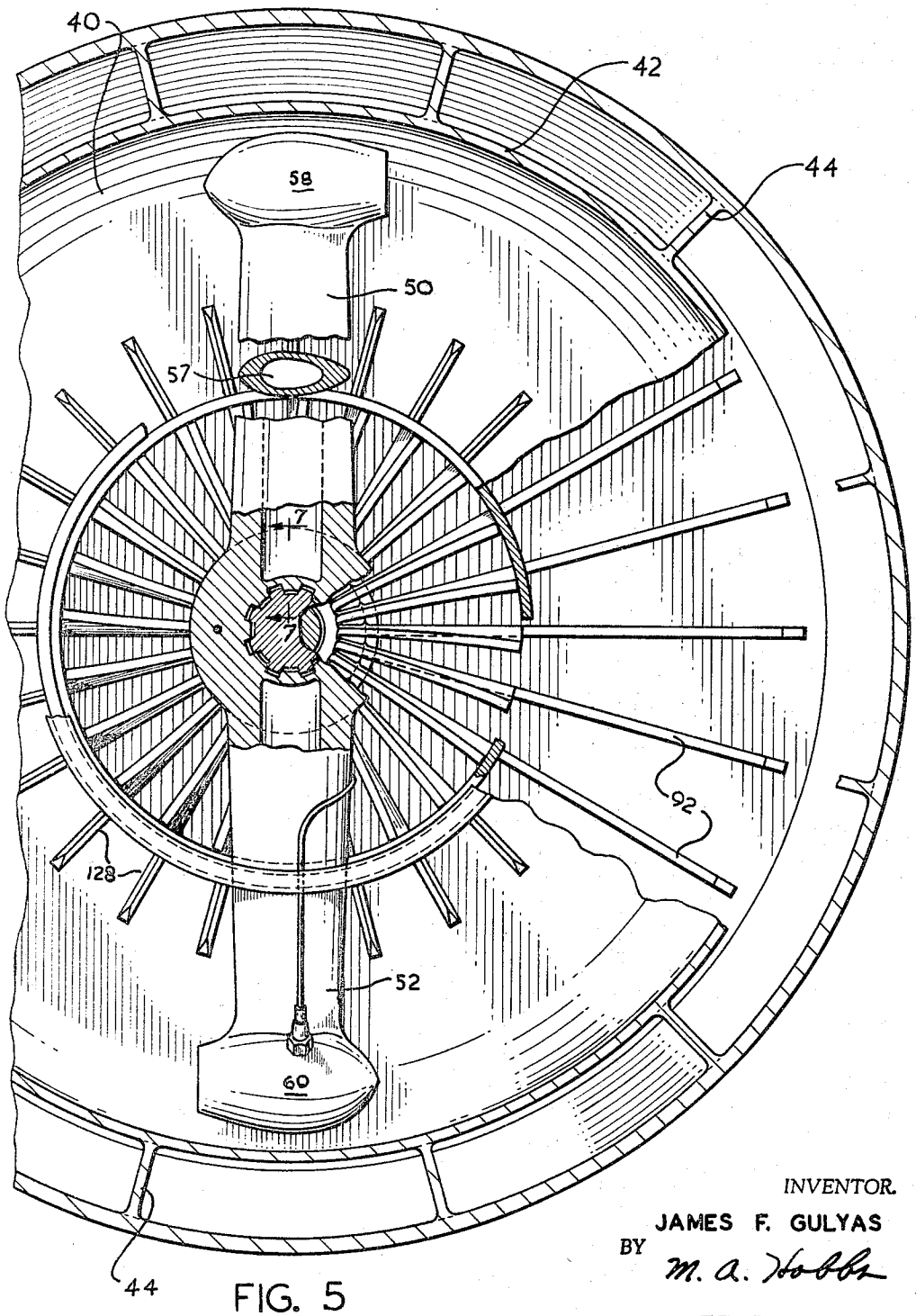

FIG. 5

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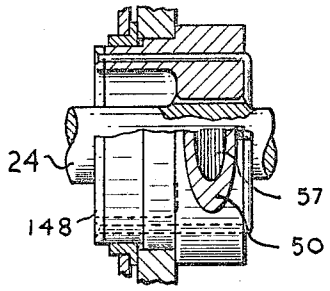

FIG. 7

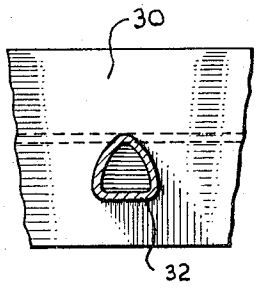

FIG. 8

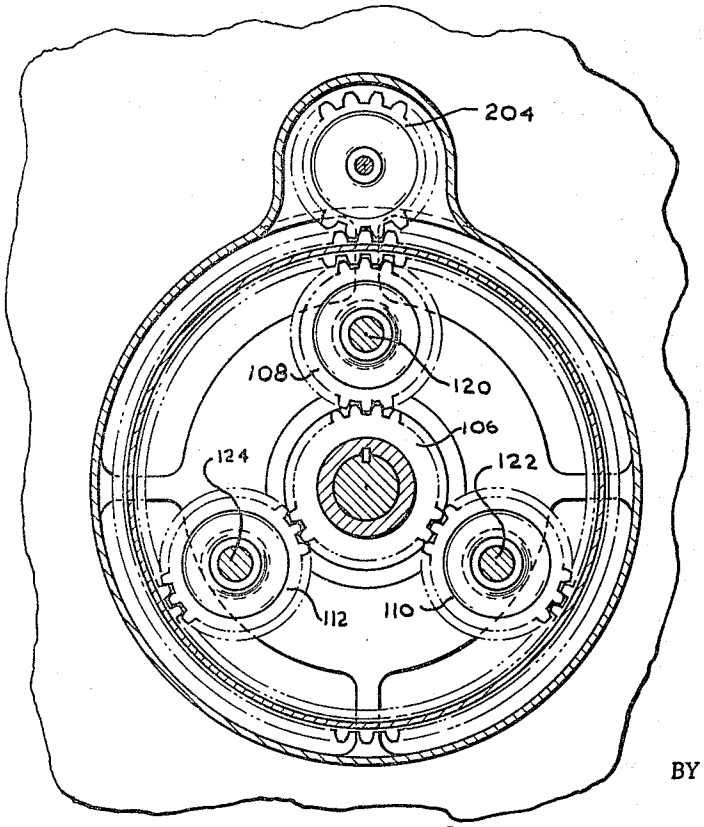

FIG. 6

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3,325,993

Patented June 20, 1967

3,325,993

JET ENGINE

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Filed Aug. 11, 1965, Ser. No. 478,822
5 Claims. (Cl. 60—39.35)

The present invention relates to jet engines and more particularly to a rotary engine driven by internal jet reaction units.

In recent years efforts have been made to develop gas turbine or jet engines for ground vehicles or for stationary industrial use wherein the power developed by jet propulsion units is transferred to a power output shaft either for driving the vehicle or, in case of industrial use, for a machine or some type of equipment. These prior engines have had certain inherent difficulties or drawbacks which render them inefficient and uneconomical to operate and/or inconvenient to install and control, and for land vehicles and industrial use they have had the further and possibly equally as serious disadvantage of creating an exhaust and noise problem which to correct has resulted in less efficient engines and more difficulties in installation and operation. It is therefore one of the principal objects of the present invention to provide a jet engine for land vehicles and industrial use, which completely encloses a plurality of jet propulsion units and which has an air intake in a confined position and a versatile exhaust system which permits the engine to be adapted to convenient locations in a vehicle without sacrificing the efficiency of the engine.

Another object of the invention is to provide a jet engine having internal jets and an air induction system which effectively pressurizes and preheats the incoming air before the fuel has been discharged therein and an effective fuel-air mixture has been formed, and then delivers the mixture thus formed and heated to jet burners, and which utilizes the exhaust gases from the burners to accomplish the preheating operation.

Still another object of the invention is to provide a jet engine of the aforementioned type in which the exhaust system includes a relatively small pipe for carrying the combustion gases from the combustion chamber of the engine through the air intake passage where much of the heat of the combustion gases is dissipated and then for carrying the relatively cool exhaust gases from the engine through the vehicle to a suitable place for discharging them into the atmosphere.

A further object of the invention is to provide a compact, fully operable unit having a power take off shaft for driving a vehicle or other type machine, which can be installed as a unit in a limited, enclosed area and operated safely for extended periods of time and which can conveniently be located with respect to the machinery to be driven and easily connected to the input shaft thereof.

Another object is to provide a rotary jet engine which is relatively simple in basic construction and operation and which can easily be serviced and adjusted to maintain it in optimum operating condition.

Additional objects and advantages of the invention will become apparent from the following description and accompanying drawings, wherein:

FIGURE 1 is a front elevational view of the present jet engine;

FIGURE 2 is a rear view of the present engine;

FIGURE 3 is a vertical cross sectional view of the engine, the section being taken on line 3—3 of FIGURE 1;

FIGURE 4 is a vertical cross sectional view of the engine, the section being taken on line 4—4 of FIGURE 3;

FIGURE 5 is a vertical cross sectional view of the engine, the section being taken on line 5—5 of FIGURE 3;

FIGURE 6 is a vertical cross sectional view of the engine, the section being taken on line 6—6 of FIGURE 3;

FIGURE 7 is a fragmentary plan and cross sectional view of a rotor tube or arm, the section being taken on line 7—7 of FIGURE 5; and

FIGURE 8 is a fragmentary plan and cross sectional view of the engine, the section being taken on line 8—8 of FIGURE 1.

Referring more specifically to the drawings, and to FIGURES 1 and 2 in particular, numeral 10 designates the present jet engine generally, 12 a housing having a front section 14, an intermediate section 16, and a rear section 18 secured together by a plurality of bolts 20 in the periphery of the housing sections. The air intake for the engine is shown at numeral 22 and the shaft for the power output is indicated by numeral 24. A mounting base or supporting structure is required to install the engine in a vehicle, or mount the engine in position for industrial use, this structure not being shown since it would be varied in accordance with requirements for the installation.

Shaft 24 extends axially through the engine and supports most of the rotatable operating parts thereof, the shaft being journalled in bearings 26 and 28, bearing 28 being supported in the housing and bearing 26 being supported by an annular member 30, which in turn is supported by four arms 32, 34, 36 and 38 extending radially from member 30 and joining the front section 14 at the periphery of intake horn 39. A jet chamber 40 formed by walls 42 is disposed in housing 12 and the walls thereof are spaced inwardly from the internal side of the housing walls, thus providing an air passage completely surrounding the jet chamber, as will be more fully explained hereinafter. The walls 42 of chamber 40 are rigidly supported in housing 12 by a plurality of radially extending lugs 44 connected to the external surface of walls 42 and to the internal surface of the housing walls, the lugs being relatively small and spaced from one another so that air may flow freely between them from one side of the housing to the other externally of the jet chamber.

Mounted on shaft 24 in jet chamber 40 are two diametrically opposed radially extending arms 50 and 52 supported by a hub 54 which in turn is keyed to shaft 24 by a spline or a key and key-way 56, so that the shaft and two arms rotate in unison when the engine is in operation. The two arms are provided with an internal passage 57 for delivering the fuel-air mixture from the intake passage, as will be more fully described hereinafter, to the combustion chamber. Mounted on each end of each arm are burners 58 and 60, each burner

consisting of an inner chamber 66 having a discharge opening 68, each of which faces in the same direction, and the fuel-air mixture supplied through passage 57 is discharged into chamber 66 where it burns and discharges the combustion gases through jets of combustion gases through discharge opening 68.

A relatively large annular spaced hub-like member 70 forms a passage connecting the air intake 22 with annular passage 72 in housing 12, and walls 42 of chamber 40, in effect, divide the housing into a second air chamber 74 connected to chamber 72 by the annular passage 76 at the periphery of chamber walls 42, chamber 74 being connected to passages 57 by the hollow interior of radial members 32, 34, 36 and 38, and cylindrical member 30 to which passages 57 are connected by passage 77 as illustrated in FIGURE 3.

The air from intake 22 is propelled by an impeller 80 which is mounted on the hub and driven by the jet arms 50 and 52 and which is provided with a plurality of air propelling vanes 82. The air is driven by the impeller through the hub of the jet arms into chamber 72 where a compressor turbine 90 with a series of radially extending blades 92 compresses the air, forcing it under substantial pressure through annular space 76 into annular chamber 74 from which it is delivered through passages 75 and 77 to arm passages 57, and thence to burners 58 and 60.

The compressor 90 is mounted on a shaft 100 which in turn is journalled on shaft 24 and driven by a planetary gear mechanism 102 disposed in housing extension 104, the planetary mechanism including sun gear 106 and three planetary gears 108, 110 and 112. The sun gear is formed as part of shaft 100 on which teeth are provided on the right hand end thereof as viewed in FIGURE 3. A ring gear 114, against which the planetary gears rotate, encloses the planetary gears and is supported by housing 116 on shaft 24 and is keyed to the shaft by a key and key-way 118. The planetary gears are mounted on respective shafts 120, 122 and 124, supported in bosses 126 in a portion of the housing interconnecting the two sections 12 and 104. With this construction, the force transmitted from the jet arms through shaft 24 is transmitted through the planetary gear arrangement to rotate shaft 100 and compressor 90 at a substantially increased speed over the rotation of shaft 24, thereby causing the compressor 90 to pressurize effectively the air passing through chamber 72 before it is discharged through annular space 76 into chamber 74. The air in passing from the hub 70 of the jet arms passes through the hub and compressor 90 before passing radially outwardly along the space between blades 92. Thus, it is seen that the air on passing from the air horn 39 passes through an impeller 80 and compressor turbine 90 and thence passes under pressure through chamber 74 into passages 77 and 57 to the burners 58 and 60. A ventilator impeller 128 mounted on hub 30 in chamber 40 circulates the combustion gases and assists in expelling them from chamber 40 through the exhaust conduits.

The fuel is supplied through a fuel line 130 to a nozzle 132 and is discharged by the nozzle into chamber 133 where it mixes with the pressurized air passing through the chamber into passages 57 of arms 50 and 52 and thence to burners 58 and 60. The fuel control mechanism for discharging a metered amount of fuel into the air is not shown, and for the purposes of the present invention may be considered conventional. Suitable nozzles for properly atomizing the fuel in the air are well known and are readily available, and since a number of different makes are available, the details of the nozzle, likewise, will not be described in detail herein.

The fuel is initially ignited by an electrical ignition system, consisting of spark plugs 140 and 142 disposed in the sides of burners 58 and 60, respectively, and the electrical current for the two plugs is supplied by a circuit, including wires 144 and 146 and ring contact 148 located in chamber 76 and mounted on hub 70 of the jet arms.

A stationary contact 150 which brushes constantly on the surface of ring contact 148 is connected by a line 152 to a generator 154 or other suitable electrical source. The generator 154 is mounted rigidly on housing 104 and is driven by pulleys 156 and 158 mounted on shaft 24 and shaft 160 of the motor, respectively, and an interconnecting belt 162. After the engine has started and is operating at the proper temperature, the ignition system is no longer needed, since the heat in the burners will sustain continuous combustion so long as proper fuel-air mixture is maintained to the burners.

The combustion gases from burners 58 and 60 are discharged into chamber 40 and pass therefrom through exhaust outlets 170 and 172 to annular pipes 174 and 176, respectively, pipe 174 extending around chamber 72 near the periphery thereof and having a series of closely spaced fins 178 throughout substantially its full length. After making substantially one complete circle around the chamber 72, the pipe passes outwardly through the wall of the housing at connection 180. Pipe 176 likewise extends around chamber 74 near the periphery thereof and has a series of closely spaced fins 182 throughout substantially its full length, and after making substantially one complete circle around chamber 74, the pipe passes outwardly through the wall of the housing at connection 184.

A starting mechanism 200 is preferably provided, and the one shown in the drawings consists of a motor 202 mounted on housing 104 and having a gear 204 mounted on motor shaft 206 for engaging annular starter rack 208 on the periphery of housing 116. The starting mechanism may be similar in construction to the well known and extensively used starters for automotive vehicles, which in this case would cause gear 204 to first engage the gear rack 208 and thereafter automatically be disengaged when the engine starts.

In the operation of the present engine, the burners are started by first engaging the starter 200 and discharging the fuel from line 130 through nozzle 132 into the air flow created by the rotation of both the impeller and compressor by the starter motor 202. The ignition system is turned on, thus providing a spark in ignition plugs 140 and 142, thereby igniting the fuel-air mixture delivered to the respective burners. Once the burners have started firing, they readily become sufficiently warm to sustain combustion without the operation of the ignition system. As the engine continues to operate under its own power, the impeller initially draws the air in from the air intake 22 through the hub 70 of the jet arms and through compressor 90 into chamber 72 where it is compressed and delivered under pressure through annular passage 76 to chamber 74 and radial passages 75 and annular chamber 76 where it is mixed with fuel from nozzle 132. The fuel-air mixture formed in chamber 76 passes through passages 57 to burners 58 and 60 where combustion takes place. The combustion gases pass through openings 68 of the respective burner, causing a reaction moving the arms angularly and thereby causing rotation of shaft 24. The combustion gases pass through exhaust pipes 174 and 176 to the respective outlets 180 and 184.

Rotation of shaft 24 reacts through the planetary gear speed increasing mechanism 102 to rotate shaft 100 at a substantially increased rate of speed which is transmitted to the compressor 90 by compressing the air in chamber 72 in the manner previously described. The engine will continue to operate as long as a satisfactory fuel-air mixture is delivered to the nozzle, and the speed of the engine can be effectively controlled by varying the amount of fuel delivered through the nozzles 132 to the engine. When the operation of the engine is to be stopped, the fuel delivery is discontinued.

One of the important features of the present invention is the heating of the air as it is compressed and delivered through the induction system to the burners. The heating of the air not only increases the effectiveness of the com-

bustion in the burners but also cools the exhaust pipes sufficiently that the pipes after leaving the engine can be placed safely in relatively limited areas. Further, another important feature of the circulation of the air around the combustion chambers and exhaust pipes is the effective cooling of the housing so that the engine can be run safely for extended periods of time in confined areas without becoming overheated. The utilization of the heat created by the engine for the incoming air increases engine economy.

While only one embodiment of the present invention has been described in detail herein, various changes and modifications may be made without departing from the scope of the invention.

I claim:

1. A rotary jet engine comprising outer walls forming a housing having a cylindrical chamber therein, inner walls spaced from said outer walls forming an annular jet chamber, a rotatable shaft mounted in said housing and extending through said chambers in axial alignment therewith, the space between the walls of the two chambers forming an air induction passage, two radially extending arms mounted in said jet chamber on said shaft and having passages extending longitudinally therein, a burner at the outer end of each of said arms communicating with the passages therein, a hub in said jet chamber spaced from said shaft forming an air passage therein, a shaft mounted on said first shaft for rotation relative thereto, a ventilator impeller in said jet chamber concentric with said shaft, a hub spaced from said shaft forming an air passage therein and connected to said second shaft for rotation therewith, an air inlet disposed in one side of said housing and in axial alignment with said shaft and communicating with the passages in said hubs, an impeller in said inlet, a compressor having a plurality of radially disposed blades disposed in the housing externally of said jet chamber and on the side opposite said air inlet and being connected to said second shaft, a member in said air intake forming an annular chamber communicating with the housing chamber and with the passages in said radial arms, a fuel supply jet in said last mentioned chamber for forming a fuel-air mixture for said burners, an ignition plug in each of said burners, an electrical ignition system for said plugs including a ring contact in said last mentioned chamber, two exhaust pipes connected to said jet chamber near the periphery thereof and extending through the housing externally of said jet chamber in a circuitous path for heating the incoming air and then extending to and through the housing walls, fins on said pipes, a planetary drive connecting said first and second shafts to cause said second shaft to rotate at a greater rate of speed than said first shaft, and a power mechanism connected to said second shaft for starting the engine.

2. A rotary jet engine comprising outer walls forming a housing having a cylindrical chamber therein, inner walls spaced from said outer walls forming an annular jet chamber, a rotatable shaft mounted in said housing and extending through said chambers in axial alignment therewith, the space between the walls of the two chambers forming an air induction passage, a plurality of radially extending arms mounted in said jet chamber on said shaft and having passages extending longitudinally therein, a burner at the outer end of each of said arms communicating with the passages therein, a hub in said jet chamber spaced from said shaft forming an air passage therein, a shaft mounted on said first shaft for rotation relative thereto, an air inlet disposed in one side of said housing and in axial alignment with said shaft and communicating with the passages in said hub, an impeller in said inlet, a compressor having a plurality of radially disposed blades disposed in the housing externally of said jet chamber and on the side opposite said air inlet and being connected to said second shaft, a member in said air intake forming an annular chamber communicaitng with the housing chamber and with the passages in said radial arms, a fuel supply jet in said last mentioned chamber for forming a fuel-air mixture for said burners, an ignition plug in each of said burners, an electrical ignition system for said plugs, a plurality of exhaust pipes connected to said jet chamber near the periphery thereof and extending through the housing externally of said jet chamber in a circuitous path for heating the incoming air and then extending to and through the housing walls, and a speed changing device connecting said first and second shafts to cause said second shaft to rotate at a greater rate of speed than said first shaft.

3. A jet engine comprising outer walls forming a housing having a cylindrical chamber therein, inner walls spaced from said outer walls forming an annular jet chamber, a rotatable shaft mounted in said housing and extending through said chambers in axial alignment therewith, the space between the walls of the two chambers forming an air induction passage, a plurality of radially extending arms mounted in said jet chamber on said shaft and having passages extending longitudinally therein, a burner at the outer end of each of said arms communicating with the passages therein, a hub in said jet chamber spaced from said shaft forming an air passage therein, a shaft mounted on said first shaft for rotation relative thereto, an air inlet disposed in one side of said housing and in axial alignment with said shaft and communicating with the passages in said hub, an impeller in said inlet, a compressor disposed in the housing externally of said jet chamber and on the side opposite said air inlet and being connected to said second shaft, a member in said air intake forming an annular chamber communicating with the housing chamber and with the passages in said radial arms, a fuel supply jet in said last mentioned chamber for forming a fuel-air mixture for said burners, an ignition plug in each of said burners, an electrical ignition system for said plugs, an exhaust pipe connected to said jet chamber and extending through the housing externally of said jet chamber to and through the housing walls, and means for driving said second shaft from said first shaft.

4. A jet engine comprising outer walls forming a housing having a cylindrical chamber therein, inner walls spaced from said outer walls forming an annular jet chamber, a rotatable shaft mounted in said housing and extending through said chambers in axial alignment therewith, the space between the walls of the two chambers forming an air induction passage, a plurality of radially extending arms mounted in said jet chamber on said shaft and having passages extending longitudinally therein, a burner at the outer end of each of said arms communicating with the passages therein, a hub in said jet chamber spaced from said shaft forming an air passage therein, a shaft mounted on said first shaft for rotation relative thereto, an air inlet disposed in one side of said housing and in axial alignment with said shaft and communicating with the passages in said hub, a compressor disposed in the housing externally of said jet chamber and on the side opposite said air inlet and being connected to said second shaft, a member in said air intake forming an annular chamber communicating with the housing chamber and with the passages in said radial arms, a fuel supply jet in said last mentioned chamber for forming a fuel-air mixture for said burners, an exhaust pipe connected to said jet chamber and extending through the housing externally of said jet chamber to and through the housing walls, and means for driving said second shaft from said first shaft.

5. In a jet engine comprising outer walls forming a housing having a cylindrical chamber therein, inner walls spaced from said outer walls forming an annular jet chamber, a rotatable shaft mounted in said housing and extending through said chambers in axial alignment therewith, the space between the walls of the two chambers forming an air induction passage, a plurality of radially extending arms mounted in said jet chamber on said shaft

and having passages extending longitudinally therein, a burner at the outer end of each of said arms communicating with the passages therein, a hub in said jet chamber spaced from said shaft forming an air passage therein, a shaft mounted on said first shaft for rotation relative thereto, a ventilator impeller in said jet chamber concentric with said shaft, a hub spaced from said shaft forming an air passage therein and connected to said second shaft for rotation therewith, an air inlet disposed in one side of said housing and in axial alignment with said shafts, a compressor disposed in the housing externally of

said jet chamber and on the side opposite said air inlet and being connected to said second shaft, and means for driving said second shaft from said first shaft.

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