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(54) Rotary Motor

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ABSTRACT OF THE DISCLOSURE

There is provided for use in an internal combustion engine a novel fuel feed or exhaust expulsion system comprising, for each combustion zone or collinear series of zones in the combustion cylinders, a cylindrical chamber running longitudinally in the engine casing adjacent the combustion cylinders, said chamber interconnected with each said cylinder by a first opening extending between said chamber and said cylinder; within said cylindrical chamber, a cylindrical pipe mounted for rotation therein, said pipe having a second opening therein corresponding to each said first opening; and timing means controlling the rotation of said pipe whereby said corresponding openings are periodically in predetermined timed registration; and, in the case of an intake system, means providing fuel mixture to said pipe, and, in the case of an exhaust system, means for removing exhaust gases from said pipe. There is further provided a novel rotary internal combustion engine utilizing the said fuel feed system.

This invention relates to feed and exhaust systems for internal combustion engines and to such engines utilizing those systems.

BACKGROUND OF THE INVENTION

Numerous types of internal combustion engines are known in the prior art. Those of the rotary type generally offer considerable advantage over reciprocating engines by reason of reduced number of moving parts, absence of the need to move the piston arrangement as dead weight in the return stroke, elimination of valves, and other known aspects. These advantages lead to a smoother running engine with a high power to weight ratio.

Within the rotary engine art each new engine design is said to offer advantages over those engines which preceded it. These advantages are achieved by a modification of one or other of the factors affecting the operation of the engine. Thus, while cooperating pairs of rotors are common to most such engines, the configuration of each rotor in the pair shows wide variance from engine to engine. Similarly, the manner of introducing the fuel mixture, of igniting it and of exhausting it all show wide variance. Because of the widely differing combinations of these various factors which arise in specific engine designs, it is often very difficult if not impossible, to determine realistically the advantage of one design over another without actually building and testing the engines. Nonetheless, since very few rotary engines have achieved the objective of commercial success, it is clear that more efficient designs are still required. This is particularly the case at a time when the

energy crisis has dictated a completely new approach to efficiency in energy intensive areas, including that of internal combustion engines. Accordingly, the present invention offers a new and more efficient design in rotary internal combustion engines, and in fuel feed and exhaust systems for such engines.

While rotary engines have various advantages over reciprocating types, as discussed above, technical problems have to a large extent inhibited the large scale adoption of this engine type. As a result, the reciprocating engine still greatly predominates. As a result, there is a constant need to improve the efficiency and reliability of this engine type as well. Accordingly, one aspect of the present invention includes a fuel feed and exhaust system that is equally applicable to rotary and reciprocating engines.

PRIOR ART

While applicant is unaware of any prior art engines which offer a similar combination of elements to the present case, Canadian Patent No. 780,666, granted March 19, 1968, to Dettwiler, does illustrate one specific design utilizing some of the general concepts utilized in particular form in the present case. Thus, for example, Dettwiler uses toothed and gapped rotors and a compressor external to the engine per se.

The present invention provides in an internal combustion engine a fuel feed system or an exhaust expulsion system comprising, for each combustion zone or collinear series of zones in said combustion cylinders, a cylindrical chamber running longitudinally in the engine casing adjacent the combustion cylinders, said chamber

interconnected with each said cylinder by a first opening extending between said chamber and said cylinder; within said cylindrical chamber, a cylindrical pipe mounted for rotation therein, each said pipe having a second opening therein, corresponding to each said first opening, and timing means controlling the rotation of said pipe whereby said corresponding openings are in predetermined times registration; and, in the case of an intake system, means providing fuel mixture to said pipe, and, in the case of an exhaust system, means for removing exhaust gases from said pipe.

In a further embodiment there is provided a rotary internal combustion engine comprising a housing; at least one first cylindrical chamber in said housing; a second cylindrical chamber in said housing parallel to and overlapping radially with each said at least one first chamber; for each said first chamber, a corresponding third cylindrical chamber in said housing parallel to and spaced from said first chamber and interconnected therewith by a first longitudinally extending opening therebetween; for each said first chamber, a corresponding first cylindrical rotor mounted for rotation within said first chamber having at least one tooth extending longitudinally of said rotor; a second cylindrical rotor mounted for rotation within said second chamber and having for each said at least one tooth a corresponding longitudinally extending notch therein; the outer extremity of each said at least one tooth in each said at least one rotor being in sliding sealing contact with the wall of the corresponding said first chamber, the surface of said second cylinder being in sliding sealing contact with the surface of said second

chamber, the surface of each said first rotor being in sliding sealing contact with the surface of said second rotor and each said at least one tooth being adapted to engage in sealing contact with each said corresponding notch; for each said third chamber, a corresponding cylindrical pipe mounted for rotation therein, each said pipe having a second longitudinally extending opening therein, and being so timed in its rotation that said first and second longitudinally extending openings are in registration with each other at a point just after said at least one tooth of a corresponding first rotor has passed said first opening; a source of compressed air and means for supplying said air to each said pipe; means for supplying fuel to each said pipe; ignition means in each said first chamber at a point beyond said opening in the direction of rotation of said first rotor; exhaust means connected with each said first chamber at a point beyond said ignition means in the direction of rotation of said first rotor.

BRIEF DESCRIPTION OF THE DRAWINGS

In drawings which illustrate embodiments of the invention:

Figure 1 is a cross-sectional view through one end of a single rotor engine just prior to injection of fuel;

Figure 2 is a view similar to Figure 1 but just prior to combustion;

Figure 3 is a cross-sectional view through one end of a two rotor embodiment;

Figure 4 is a cross-sectional view through one side of a

three rotor engine, illustrating an auxiliary rotating disc injection system.

DETAILED DESCRIPTION OF THE INVENTION

While the feed and exhaust aspect of the invention is applicable to both rotary and reciprocating engines, for purposes of illustration only a rotary engine has been shown and only the fuel feed aspect has been incorporated in the drawings. The exhaust system is for practical purposes essentially the same as the feed system with the obvious exception that the means for actually delivering the fuel to the pipe and the combustion chambers are not required in the exhaust case.

With reference to the drawings, and considering a single rotor, in Figure 1 the casing 2 encloses the meshing cylindrical chambers 4 and 6 containing respectively the toothed rotor 8 and the gapped stator 10. The intermeshing of chambers 4 and 6 and the diameters of rotor 8 and stator 10 are such that the surface of the rotor and stator form a sealing contact 12 therebetween, as they rotate. As shown, the rotor rotates clockwise and the stator, counterclockwise.

The diameter of rotor 8 is less than that of the chamber 4 so that the tooth 14 on rotor 8 forms a pair of chambers 16 and 18 defined by the tooth 14 and contact line 12. As is known in the art, the gap 20 is provided in the stator 10 in order to accommodate the tooth 14 in its rotation while maintaining the seal 12 between rotor and stator.

Drive is transmitted from the rotor 8 via shaft 22.

The casing 2 is provided with an opening 24 to accommodate

the spark plug 26.

Casing 2 is further provided with the recess 30 which with the casing section 32 forms a further cylindrical chamber 34 to accommodate the feed system 28. The chamber 34 is joined to chamber 4 by the opening 36 in casing 2 which extends the width of chamber 4. The chamber 34 contains therein the rotating pipe 38. Pipe 38 is provided with the slot-like opening 40 which corresponds in length to opening 36 in casing 2. Openings 36 and 40 may be modified in configuration as desired, the slot configuration not being essential. The interior 42 of the pipe 38 is connected to a source of supply of fuel mixture, as, for example, a carburetor.

OPERATION

In operation, as in the usual case of such engines, following the expulsion of exhaust gasses as illustrated in Figure 3 through the exhaust port 43, the continued rotation of rotor and stator form the combustion chamber 44 as shown in Figure 1.

The rotating pipe 38 is driven by a timing belt from shaft 22. Thus continued rotation of rotor 4 brings openings 36 and 40 into registration and the fuel mixture rushes from the interior 42 of pipe 38 into chamber 44. The air component of the fuel mixture is compressed by an external compressor prior to mixture with the fuel.

Continued rotation results in the deregistration of openings 36 and 40 and consequently the closing off of the fuel supply. The mixture in chamber 44 is then ignited.

In the case of multiple rotors coaxially arranged, the pipe 38 would contain a series of staggered openings 40 arranged to register with a corresponding series of openings 36 in the several

rotors in the desired timing sequence.

In the case of multiple combustion zones around a single rotor or multiple rotors arranged in different axes, the latter as illustrated in Figure 3, a separate feed system would preferably be utilized to supply each zone. Where this arrangement also includes coaxial rotors, each collinear series of zones which might result would preferably be fed by a single feed system the pipe 38 of which, as indicated in the preceding paragraph, would be provided with a series of staggered openings 40 arranged to register with a corresponding series of openings 36 in the several rotors in the desired timing sequence.

It will be apparent that the number and arrangement of feed systems is dependent on the desired configuration of combustion zones. Once the latter has been established, the desired feed system can readily be determined.

The exhaust system would function in a similar manner. It will be apparent that rotating feed and exhaust systems having the characteristics described above can be advantageously mounted on a reciprocating engine in order to eliminate the need for valves and associated linkage, and thereby provide for smoother quieter operation.

An additional embodiment of the fuel feed system is illustrated in Figure 4. In this embodiment an injection system is utilized to supplement the system described above and is particularly useful to improve response at times of increased power requirements.

With reference to Figure 4, the distribution disc assembly 46 is interposed between a source of fuel and air mixture 48 and the

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interior 42 of pipe 38. Distribution lines 50 lead from the disc assembly 46 through the interior 42 of pipe 38 to a position adjacent each of the slots 36. The disc assembly contains a rotating distribution disc 52 which distributes fuel mixture in accordance with the required timing sequence to the lines 50 and hence to the combustion chambers. It will be clear that the respective slots in pipe 38 are in this case subject to the same timing sequence as the rotating disc and that the slots 40 in the pipe 38 will be in registration with slots 36 at the appropriate time.

The effect of this arrangement will be to gain advantage from both carburator and fuel injection systems in a hybrid application.

The lines 50 are provided with a series of nozzles or openings 54 adjacent the slots 36 to deliver the fuel mixture directly into the cylinder.

In the preferred case the disc assembly 46 and lines 50 act as a booster to supplement fuel mixture delivered via the interior 42 of pipe 38. That part of the mixture injected via lines 50 will then be required to be at the higher pressure than that part of the mixture entering via interior 42 of pipe 38.

Optionally, for more precise control of fuel intake, valves can be provided to control fuel flow through the slots 36 and 40. The valves are preferably sliding valves.

In the case where the system is utilized to perform an exhaust function, the injection disc assembly 46 is not required nor are the distribution lines 50.

Thus it is apparent that there has been provided in accordance with the invention a feed and exhaust system for internal combustion engines that fully satisfies the objects, aims and advantages set forth above. While the invention has been described in conjunction with specific embodiments thereof, it is evident that many alternatives, modifications and variations will be apparent to those skilled in the art in light of the foregoing description. Accordingly, it is intended to embrace all such alternatives, modifications and variations as fall within the spirit and broad scope of the appended claims.

THE EMBODIMENTS OF THE INVENTION IN WHICH AN EXCLUSIVE PROPERTY OR PRIVILEGE IS CLAIMED ARE DEFINED AS FOLLOWS:

1. In an internal combustion engine a fuel feed system comprising, for each combustion zone or collinear series of zones in the combustion cylinders, a cylindrical chamber running longitudinally in the engine casing adjacent each of the combustion cylinders, said chamber interconnected with respective ones of each said cylinder by corresponding first openings extending between said chamber and said cylinder; within said cylindrical chamber, a corresponding cylindrical pipe mounted for rotation therein, said pipe having a corresponding second opening therein corresponding to each said first opening siad second openings staggered about said pipe, and timing means controlling the rotation of said pipe whereby each pair of said corresponding first and second openings is periodically in predetermined timed registration; according to the firing sequence of the cylinders of the engine; and including a fuel injection system comprising a series of fuel lines leading into said pipe, at least one said line adapted to discharge fuel mixture through each said first opening, and a fuel mixture distribution system for distributing fuel mixture in predetermined timed sequence to each at least one said line.

2. The feed system of claim 1 wherein said fuel mixture distribution system consists of a manifold, a source of fuel mixture under pressure to said manifold, and a rotating disc between said manifold and said at least one said line, said disc having inlet

openings therethrough at radial positions corresponding to the ends of said at least one said line and said disc rotating such that said inlet opening and said corresponding ends are periodically in predetermined timed registration.

3. The feed system of claim 1 wherein said fuel mixture distribution system consists of a manifold, a source of fuel mixture under pressure to said manifold, and a rotating disc between said manifold and said at least one said line, said disc having inlet openings therethrough at radial positions corresponding to the ends of said at least one said line, and said disc rotating such that said inlet openings and said corresponding ends are periodically in predetermined timed registration in predetermined sequence; and wherein said rotating disc is driven in rotation from the engine main shaft and said predetermined timed registrations and predetermined sequences are such that fuel mixture inlet paths are provided in predetermined timed sequence to each said engine cylinder.

4. A feed system of claim 1 including valves in each said first opening, said valves controlled to operate in accordance with said predetermined timed sequence.

5. A rotary internal combustion engine comprising:
a housing;
at least one first cylindrical chamber in said housing;
a second cylindrical chamber in said housing parallel to and

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overlapping radially with each said at least one first chamber;

for each said first chamber, a corresponding third cylindrical chamber in said housing parallel to and spaced from said first chamber and interconnected therewith by a first longitudinally extending opening therebetween;

for each said first chamber, a corresponding first cylindrical rotor mounted for rotation within said first chamber having at least one radially disposed tooth extending longitudinally of said rotor;

a second cylindrical rotor mounted for rotation within said second chamber and having for each said at least one tooth a corresponding longitudinally extending notch therein;

the outer extremity of each said at least one tooth in each said at least one rotor being in sliding sealing contact with the wall of the corresponding said first chamber, the surface of said second rotory being in sliding sealing contact with the surface of said second chamber, the surface of each said first rotor being in sliding sealing contact with the surface of said second rotor and each said at least one tooth being adapted to engage in sealing contact with each said corresponding notch;

for each said third chamber, a corresponding cylindrical pipe mounted for rotation therein, each said pipe having a second longitudinally extending opening therein, and being so timed in its rotation that said first and second longitudinally extending openings are in registration with each other at a point just after said at

least one tooth of a corresponding first rotor has passed said first opening;

means for supplying a fuel and compressed air mixture to each said pipe;

ignition means in each said first chamber at a point beyond said opening in the direction of rotation of said first rotor;

exhaust means connected with each said first chamber at a point beyond said ignition means in the direction of rotation of said first rotor.

6. The engineof claim 5 comprising, in addition, a fuel injection system comprising a series of fuel lines leading into said pipe, at least one said line adapted to discharge fuel mixture through each said first opening, and a fuel mixture distribution system for distributing fuel mixture in predetermined timed sequence to each at least one said line.

7. The engine of claim 5 wherein said means for supplying a fuel and compressed air mixture to said pipe consists of a fuel injection system comprising a series of fuel lines leading into said pipe, at least one said line adapted to discharge fuel mixture through each said first opening and a fuel mixture distribution system for distributing fuel mixture in predetermined timed sequence to each at least one said line.

8. The engine of claim 6 or 7 including valves in each said first opening, said valves controlled to operate in accordance with said predetermined timed sequence.

9. The engine of claim 6 or 7 wherein said fuel mixture distribution system consists of a manifold, a source of fuel mixture under pressure to said manifold, and a rotating disc between said manifold and said at least one said line, said disc having inlet openings therethrough at radial positions corresponding to the ends of said at least one said line and said disc rotating such that said inlet openings and said corresponding ends are periodically in predetermined timed registration.

10. The engine of claim 6 or 7 wherein said fuel mixture distribution system consists of a manifold, a source of fuel mixture under pressure to said manifold, and a rotating disc between said manifold and said at least one said line, said disc having inlet openings therethrough at radial positions corresponding to the ends of said at least one said line, and said disc rotating such that said inlet openings and said corresponding ends are periodically in predetermined timed registration in predetermined sequence; and wherein said rotating disc is driven in rotation from the engine main shaft and said predetermined timed registrations and predetermined sequences are such that fuel mixture inlet paths are provided in predetermined timed sequence to each said engine cylinder.

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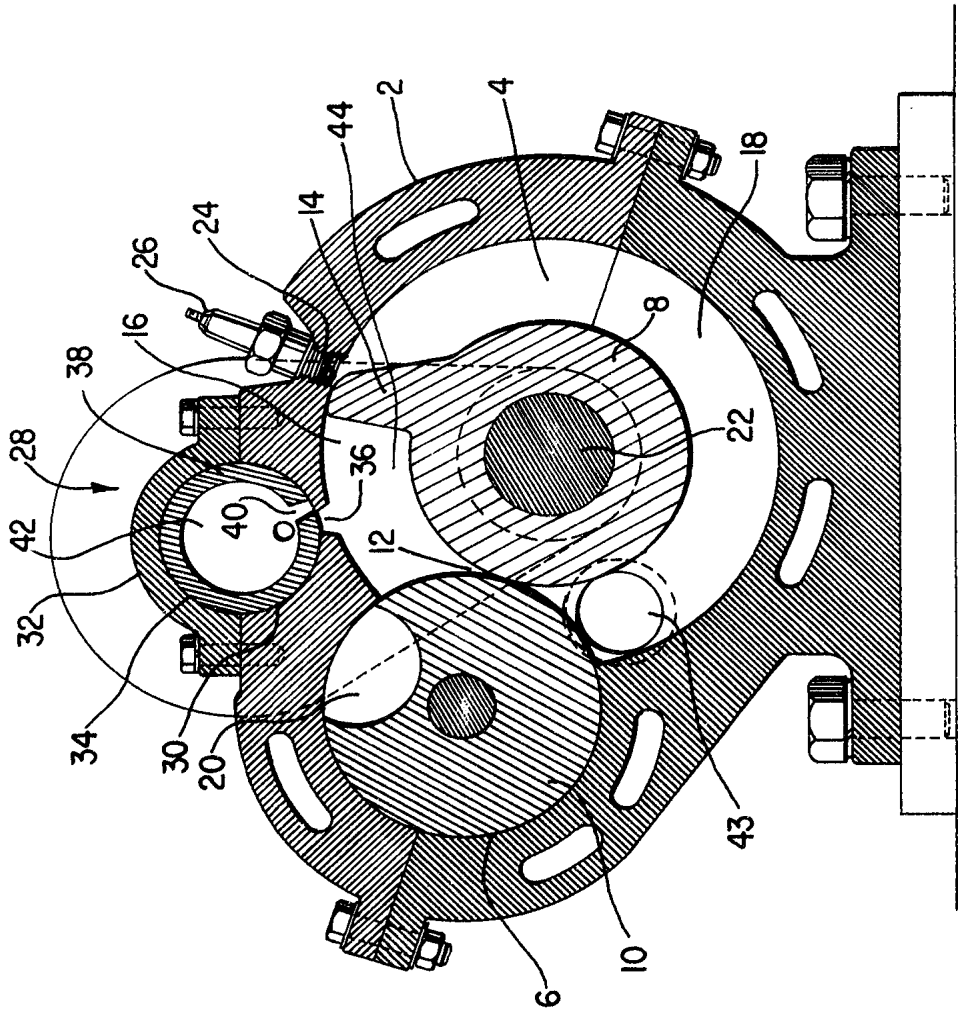

FIG.1

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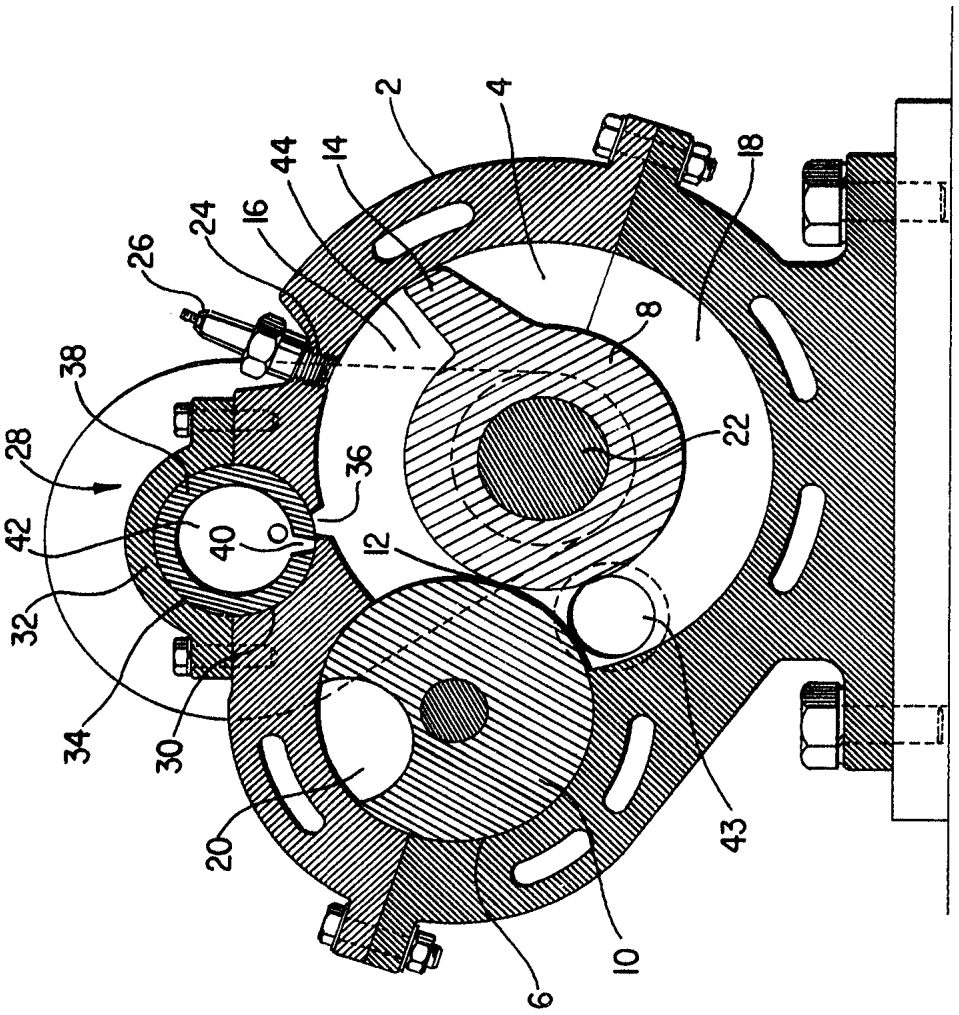

FIG. 2

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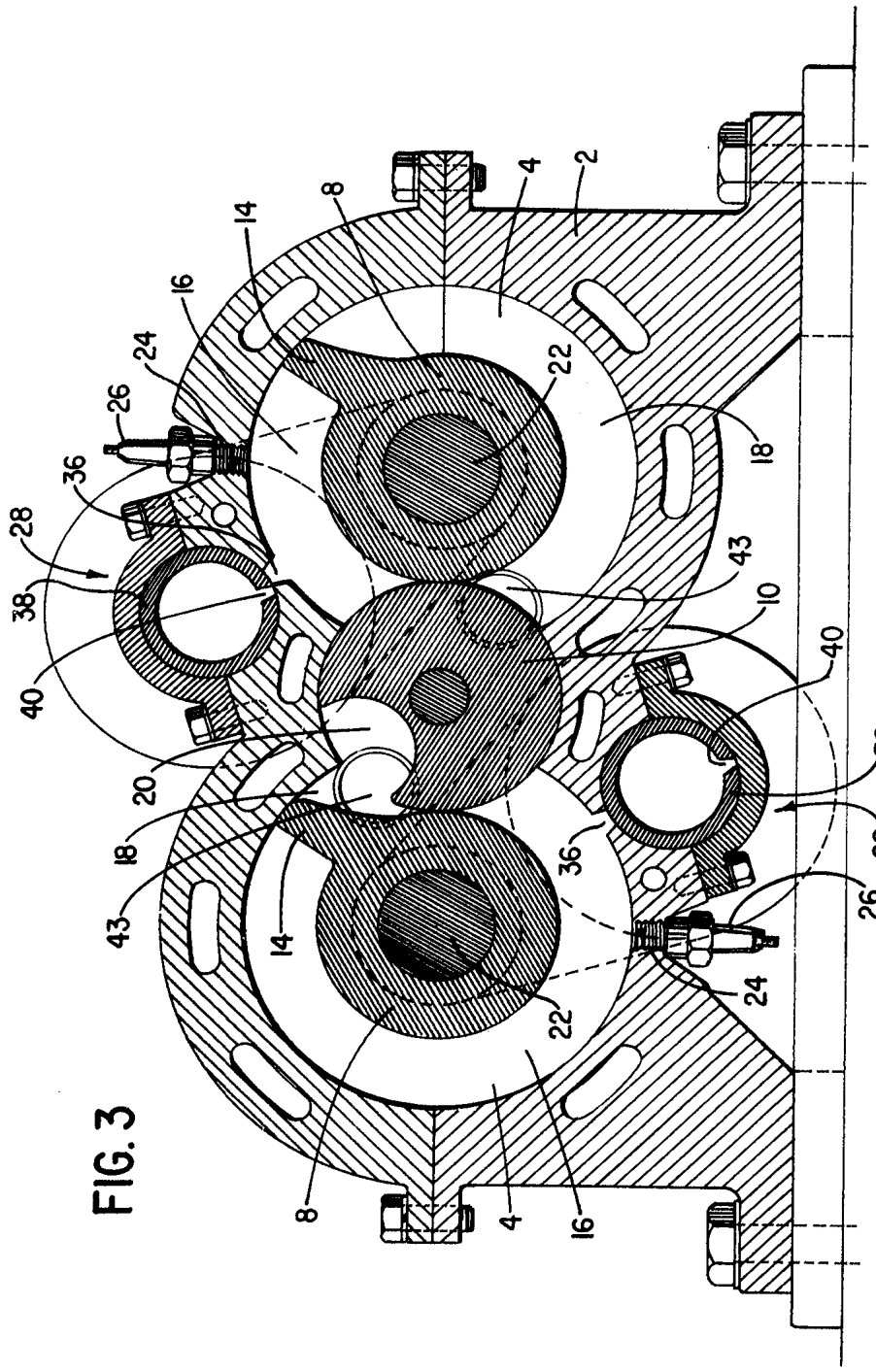

FIG. 3

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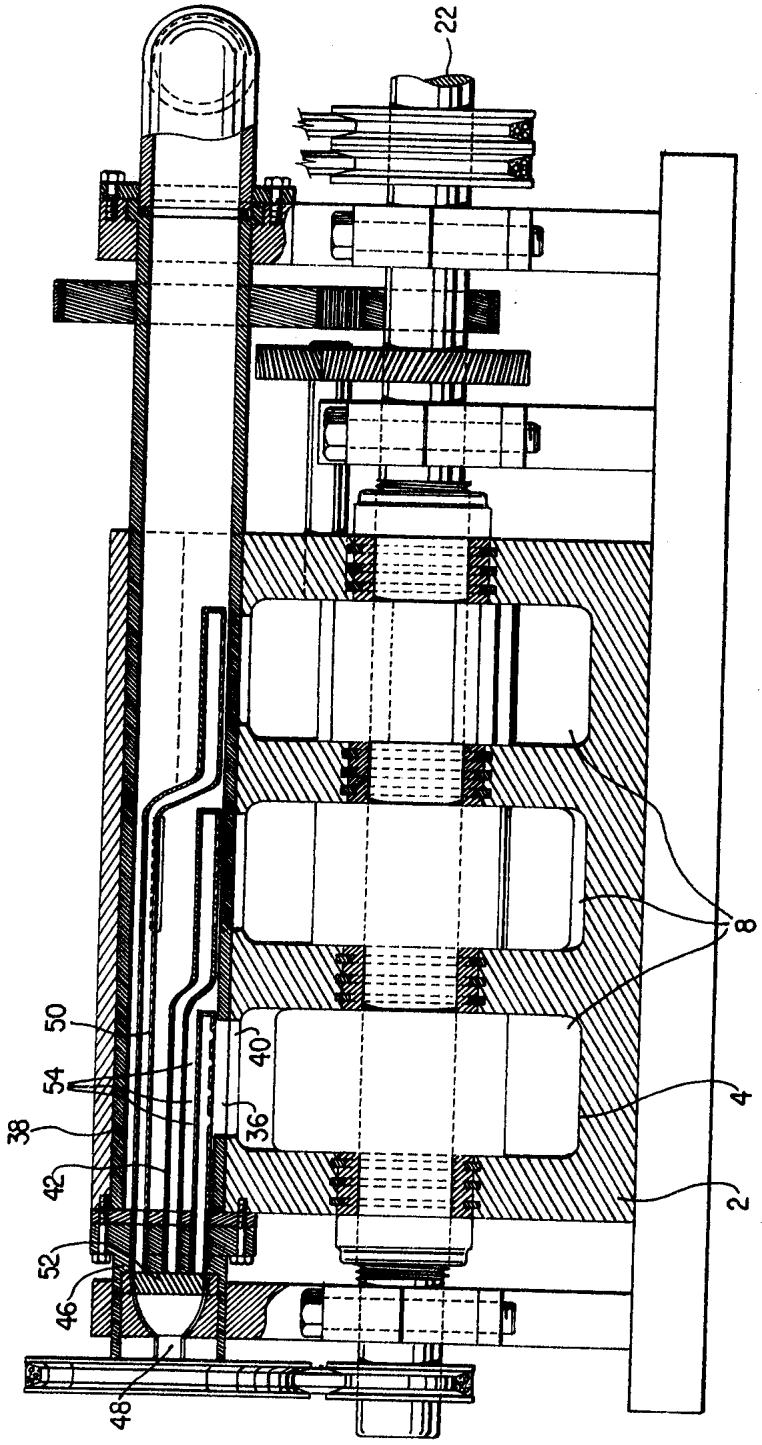

FIG. 4

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