(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 625 629 A1**

(12) EUROPEAN PATENT APPLICATION

(21) Application number: **93201449.1**

(51) Int. Cl.5: **F01D 1/34**, F01D 1/26

(22) Date of filing: **21.05.93**

(43) Date of publication of application:
23.11.94 Bulletin 94/47

(84) Designated Contracting States:
DE ES FR GB IT

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(54) Turbine.

(57) A turbine consisting of a central rotor (20) connected with a shaft (10) and a plurality of annular stators (30,50,70) and annular rotors (40,60). The central rotor (20) is formed as a hollow frustum of right circular cone so that it has an inner side and an outer side wherein a number of curved channels (204,205) are formed. The shaft (10) is axially inserted through the central rotor (20) and rotatably supported by means of at least one thrust bearing. Each annular stator or rotor has an outer side and an inner side wherein a plurality of curved channels (204,205) are formed. The central rotor (20) is sealably mounted in the annular stators or rotors. Driving gas flows through the curved channels (204,205) formed in the central rotor (20) and the curved channels (402,602) formed in the annular stators or rotors so that the central rotor rotates in an opposite direction relative to the annular stators or rotors.

EP 0 625 629 A1

This invention relates to internal combustion engines, particularly to an internal combustion rotary engine which consists of a combustor and a turbine and, particularly, to a turbine.

A rotary engine is known as utilizing a rotor which is enclosed in a chamber and rotated by an expanding ignited gas to convert heat energy into mechanical energy in order to perform work. The motion of the rotor classifies known rotary engines into different types, such as:

(1) Single-rotating engines: a plurality of rotors respectively rotate at a certain angular velocity and the center of its rotation does not move. A typical example is the Malloy engine (United States), which rotor is divided by a number of vanes and rotates eccentrically in the chamber.

(2) Oscillatory-rotating engines: a plurality of rotors respectively rotate about the center of rotating at a varying angular velocity, the chamber volumes change as the rotors come close to one another or away from one another. A typical example is the Kauertz's engine.

(3) Planetary rotating engines: a rotor rotates in a closed chamber which makes a planetary motion. A typical example is Wankel engine which is installed in Mazda sport cars which are manufactured by Toyo Kogyu Co., Ltd. Japan.

However, each of the above-mentioned rotary engines has four strokes during one cycle in the enclosed space: intake, compression, power (or combustion), and exhaust. Apex seals or blades are necessary for separating the four strokes. Motor oil is also necessary for sealing and lubricating interfaces between the rotors and stators. Such a structure solves problems of motion conversion, but, induces disadvantages, e.g., mechanical friction, combustion inefficiency, and-exhaust gas pollution.

It is the purpose of this present invention, therefore, to improve and/or overcome the above-mentioned drawback in the manner set forth in the detailed description of the preferred embodiment.

It is an object of the present invention to provide a turbine which does not use apex seals or dividers, in order to reduce mechanical friction.

It is another object of the present invention to provide a turbine which eliminates motor oil in combustion chambers in order to reduce exhaust pollutants.

It is still another object of this invention to provide a turbine which has an improved mechanical efficiency.

It is still another object of the present invention to provide a turbine consisting of a central rotor connected with a shaft and a plurality of annular stators and annular rotors. The central rotor is formed as a hollow frustum of right circular cone so that it has an inner side and an outer side wherein a number of curved channels are formed. The shaft is axially inserted through the central rotor and rotatably supported by means of two bearings. Each annular stator or rotor has an outer side and an inner side wherein a plurality of curved channels are formed. The central rotor is sealably mounted in the annular stators or rotors. Driving gas, which is the product of the combustion of fuel-and-air mixture, flows through the curved channels formed in the central rotor and the curved channels formed in the annular stators or rotors so that the central rotor rotates in an opposite direction relative to the annular stators or rotors.

In the drawings:

Fig. 1 is an exploded view of an internal combustion engine using a turbine in accordance with a first embodiment of the present invention;

Fig. 2 is a cross-sectional view of the internal combustion engine using the turbine in accordance with a first embodiment of the present invention;

Fig. 3 is a cross-sectional view showing the deployment of channels respectively formed in a central rotor and two annular rotors in accordance with this invention;

Fig. 4 is a cross-sectional view taken along a line 4-4 in Fig. 3 to show the channels formed in a central rotor;

Fig. 5 is a cross-sectional view taken along a line 5-5 in Fig. 3 to show the channels formed in two annular rotors;

Fig. 6 is an exploded view of an internal combustion engine using a turbine in accordance with a second embodiment of the present invention; and

Fig. 7 is a cross-sectional view of the internal combustion engine using the turbine in accordance with a second embodiment of the present invention.

Initially referring to Figures 1 and 2 of the drawings, there is shown an internal combustion engine using a turbine in accordance with the first embodiment of the present invention. In the first embodiment, a turbine is combined with a combustor, however, a combustor can be a separate element from a turbine in accordance with the second embodiment of the present invention.

A central rotor 20 is formed as a frustum and has a hole 208 axially formed therethrough. The central rotor 20 has a substantially conical outer side consisting of two conical faces 201 and 203 and a cylindrical face 202. The conical face 201 is formed at the fore end of the central rotor 20. The cylindrical face 202 is formed at the rear end of the central rotor 20. The conical face 203 is formed at the middle portion of the central rotor 20. The conical face 201 has a more acute angle of slope than that of the conical surface 203.

A number of, e.g., two, series of curved channels are formed in the conical face 203. A first series has several, e.g., three, curved channels 204. A second series has a corresponding number of, i.e., three, curved channels 205. Preferably, each of the curved channels 204 and 205 has a curved form as shown in Figure 3 of the drawings and a U-shaped form as shown in Figure 4. Fore ends of the curved channels 204 are merged into the conical face 201.

Moreover, there are provided a corresponding number of, i.e., two, grooves 206 and 207 circumferentially formed in the outer side of the central rotor 20. The curved channels 204 are communicated with one another by means of the groove 207, so that the pressure in the curved channels 204 can be balanced. The curved channels 205 are communicated with one another by means of the groove 206, so that the pressure in the curved channels 205 can be balanced.

The turbine in accordance with this invention also has at least one annular rotor. In the first embodiment, there are two annular rotors 40 and 60 corresponding to two series of curved channels 204 and 205. Three annular stators 30, 50 and 70 and the annular rotors 40 and 60 are alternatively mounted about the central rotor 20.

The annular rotor 40 has a circular recess formed in a fore end thereof. The annular stator 50 has a circular recess formed in a fore end thereof. The annular rotor 60 has a circular recess formed in a fore end thereof. The exhaust 70 has a circular recess formed in the fore end thereof. Several gaskets 81, 82, 83, and 84 are received in the circular recess formed in the annular rotor 40, the annular stator 50, the annular rotor 60 and the exhaust 70. The gaskets 81, 82, 83 and 84 serve as seals.

A stator 30 serves as a cap and has a plurality of fixing lugs 301 which are mounted to an engine seat (not shown), a tubular portion 302 which receives a bearing 11 for supporting the shaft 10 and three ports 303, 304 and 305 which include at least one intake port and at least one spark plug port. The stator 30 is mounted on the shaft 10 by means of a bearing 11.

An annular stator 50 has a smooth conical inner surface and a plurality of fixing lugs 501 which are mounted to the engine seat (not shown).

An exhaust 70 has an inner side and outer side. A number of, e.g., three, exhaust ports 701 are formed in the outer side of the exhaust 70 and communicated with three exhaust passages 702 formed in the inner side of the exhaust 70.

An annular rotor 40 has an inner side and an outer side. A plurality of curved channels 402 are formed in the inner side of the annular rotor 40 corresponding to the curved channels 204/205 on the central rotor 20. The curved channels 402 are similar to the curved channels 204/205 but are in an opposite direction. There is a groove 401 communicating the curved channels 402 with one another in order to balance pressure in the curved channels 402. A plurality of teeth 603 are formed on the outer side of the annular rotor 40.

The annular rotor 60 is similar to the annular rotor 40 but has a larger diameter. That is, the annular rotor 60 has a groove 601 communicating three curved channels 602 with one another and a plurality of teeth 603.

A hollow shaft 10 has an exit 101 at an end thereof, a plurality of elongated holes 102 in a periphery thereof and an inlet 103 in the periphery thereof near another end thereof. The shaft 10 is inserted through the stator 30, the central rotor 20 and the exhaust 70. The shaft 10 is mounted in the stator 30 and the exhaust 70 by means of two bearings 11 and 12. A flywheel 15, a gear 16 and an encoder 17 are firmly mounted on the hollow shaft 10. The central rotor 20 is enclosed by means of the stator 30, the annular rotor 40, the annular stator 50, the annular rotor 60 and the exhaust 70.

The stator 30 and the conical face 201 form an internal combustion chamber. At least one plug (not shown) is mounted in at least one of the holes 303, 304 and 305. At least one of the holes 303, 304 and 305 serves as an intake port for fuel-and-gas mixture. Thus, the stator 30, the conical face 201 and the spark plug form a combustor.

The internal combustion chamber communicates with the curved channels 204. In the first embodiment, during each revolution of the central rotor 20, there are three relative positions between the central rotor 20, the stator 30, the annular rotor 40, the annular stator 50, the annular rotor 60 and the exhaust 70, so that the curved channels 204 communicate with the curved channels 402 which communicate with the curved channels 205 which communicate with the curved channels 602 which communicate with the exhaust passages 702.

The internal combustion chamber communicates with the fore ends of the curved channels 204. The middle portions of the curved channels 204 is covered by means of the stator 30. The rear end of each of the curved channels 204 communicates with the fore end of a corresponding one of the curved channels 402. The rear end of each of the curved channels 402 communicates with the fore end of a corresponding one of the curved channels 205. The middle portions of the curved channels 205 are covered by means of the annular stator 50. The rear end of each of the curved channels 205 communicates with the fore end of a corresponding one of the curved channels 602. The rear end of each of the curved channels 602 communicates with a corresponding one of the exhaust passages 702.

In each of the above-mentioned positions, a fuel-and-air mixture is drawn into the internal combustion chamber and burnt by means of the spark plug, so that gas expands and flows into the curved channels. The gas will be referred to as driving gas.

Obviously, there must be a timing between the rotation of the central rotor 20 and the ignition of the spark plug. The encoder 17 provides signals in order to monitor the rotation of the central rotor 20.

Additionally referring to Figure 3, the central rotor 20 rotates when the driving gas rushes into the curved channels 204. The annular rotor 40 rotates in an opposite direction to that of the central rotor 20 when the driving gas rushes into the curved channels 402. The rotation of the central rotor 20 is reinforced when the driving gas passes rushes into the curved channels 205. The annular rotor 60 rotates in an opposite direction to that of the central rotor 20 when the driving gas rushes into the curved channels 602. The driving gas is released from the turbine by means of the exhaust passages 702.

As mentioned above, the annular rotors 40 and 60 have teeth 403 and 603. The teeth 403 and 603 can be engaged with gear trains for driving some components, such as an air conditioner or an air compressor.

Additionally referring to Figures 6 and 7 of the drawings, there is shown a turbine in accordance with a second embodiment of the present invention. In the second embodiment, a turbine is formed as an element separate from a combustor (not shown). Fuel-and-air mixture is induced in the combustor wherein fuel is burnt. Gas expands and surges into the turbine by means of pipes, the gas will be referred to as the driving gas. The combustor will not be described in detail as it is well known.

The turbine in accordance with the second embodiment is similar to that in accordance with the first embodiment. However, the exhaust 70 is replaced with a stator 86, the stator 30 is replaced with an exhaust 90.

The stator 86 serves as a cap which encloses the rear end (following the direction implied in Figures 1-5) of the central rotor 20 such that the rear ends of the curved channels 602 communicate with the stator 86. The stator 86 defines a central hole 88 through which the shaft 10 is inserted. The stator 86 is mounted on the shaft 10 by means of the bearing 12. The stator 86 is communicated with the combustor by means of an inlet 89, so that driving gas rushes from the combustor into the stator 86. Thus, the driving gas rotates the central rotor 20 and the annular rotors 60 and 40 as it sequentially passes through the curved channels 602, 205, 402 and 204.

The exhaust 90 is similar to the exhaust 70, but smaller in size. The exhaust 90 has three exhaust passages 92 communicating with the fore ends of the curved channels 204 and three corresponding exhaust ports 94 for releasing exhaust out of the turbine.

In the first and second embodiments, the central rotor 20 is a frustum which is tapered from the rear end toward the fore end. In the first embodiment, driving gas flows from the fore end to the rear end. In the second embodiment, driving gas flows from the rear end to the fore end. However, the central rotor 20 can be shaped as a cylindrical element, i.e., it has the same diameter along the length thereof. Therefore, the annular stators 30 and 50, the annular rotors 40 and 60 and the exhaust substantially have identical sizes.

It is to be understood that even though numerous characteristics and advantages of the present invention have been set forth in the foregoing description, together with details of the structure and function of the invention, the disclosure is illustrative only, and changes may be made in detail, especially in matters of shape, size and arrangement of parts within the principles of the invention to the full extent indicated by the broad general meaning of the terms in which the appended claims are expressed.

Claims

1. A turbine comprising:

a central rotor having an outer side wherein at least one group of curved channels circumferentially-and-axially extend without radially extending therethrough; and

at least one annular rotor enclosing said central rotor and respectively having an inner side wherein a number of curved channels circumferentially-and-axially extend without radially extending therethrough;

when said curved channels formed in said central rotor communicate with said curved channels formed in said at least one annular rotor, a driving gas flow, which is the product of the combustion of fuel-and-air mixture, circumferentially-and-axially passing between said outer surface of said central rotor and said inner surface of said at least one annular rotor for rotating said central rotor and said at least one annular rotor in opposite directions.

2. A turbine comprising:

a central rotor having an outer surface wherein (a) a plurality of first curved channels circumferentially-and-axially extend without radially extending therethrough, each said first curved channel having an inlet for inducing a driving gas flow from a combustor and an outlet and (b) a corresponding number of second curved channels circumferentially-and-axially extend without radially extending therethrough, each said second curved channel having an inlet and an outlet;

a first annular rotor enclosing said central rotor and having an inner surface wherein a corresponding number of curved channel circumferentially-and-axially extend without radially extending therethrough, each said curved channel having an inlet for inducing the driving gas flow from said outlet of a corresponding one of said first channels and an outlet for inducing the driving gas flow to said inlet of a corresponding one of said second channels; and

a second annular rotor enclosing said central rotor and having an inner surface wherein a corresponding number of curved channels circumferentially-and-axially extend without radially extending therethrough, each said curved channel having an inlet for inducing the driving gas flow from said outlet of a corresponding one of said second channels and an outlet for inducing the driving gas flow to an exhaust;

when said first curved channels communicate with said channels formed in said first annular rotor which communicate with said second curved channels which communicate with said channels formed in said second annular rotor, the driving gas flow circumferentially-and-axially passing between said outer side of said central rotor and said inner sides of said annular rotors for rotating said central rotor and said annular rotors in opposite directions.

3. A turbine in accordance with claim 2, wherein said curved channels formed in said annular rotors have opposite configurations relative to said curved channels formed in said central rotor.

4. A turbine in accordance with claim 2, wherein said central rotor is a conical frustum.

5. A turbine in accordance with claim 2, wherein said exhaust is defined in an annular seat hermetically matching said second annular rotor.

6. A turbine in accordance with claim 2, further having a first recess for communicating said first channels with one another.

7. A turbine in accordance with claim 2, further having a second recess for communicating said second channels with one another.

8. A turbine in accordance with claim 2, further having a shaft axially linked to said central rotor.

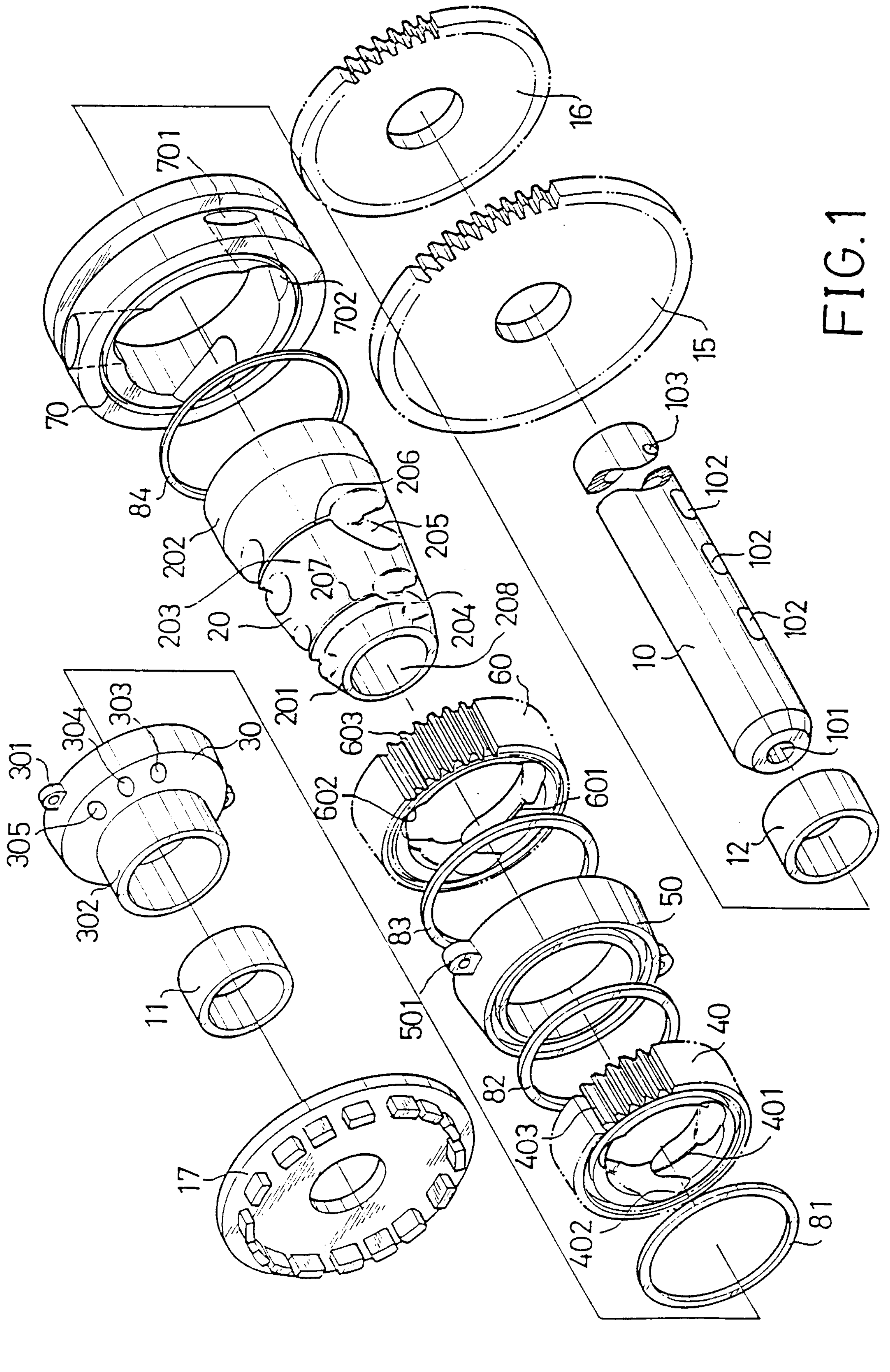
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FIG.1

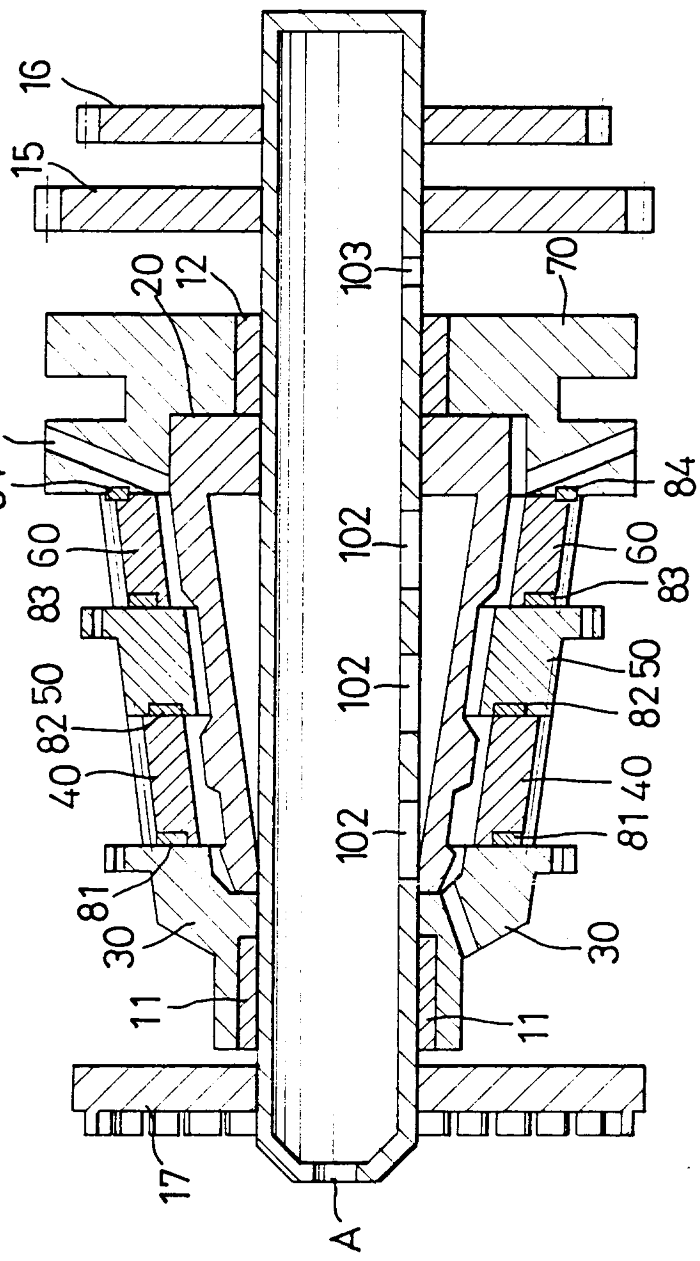

FIG.2

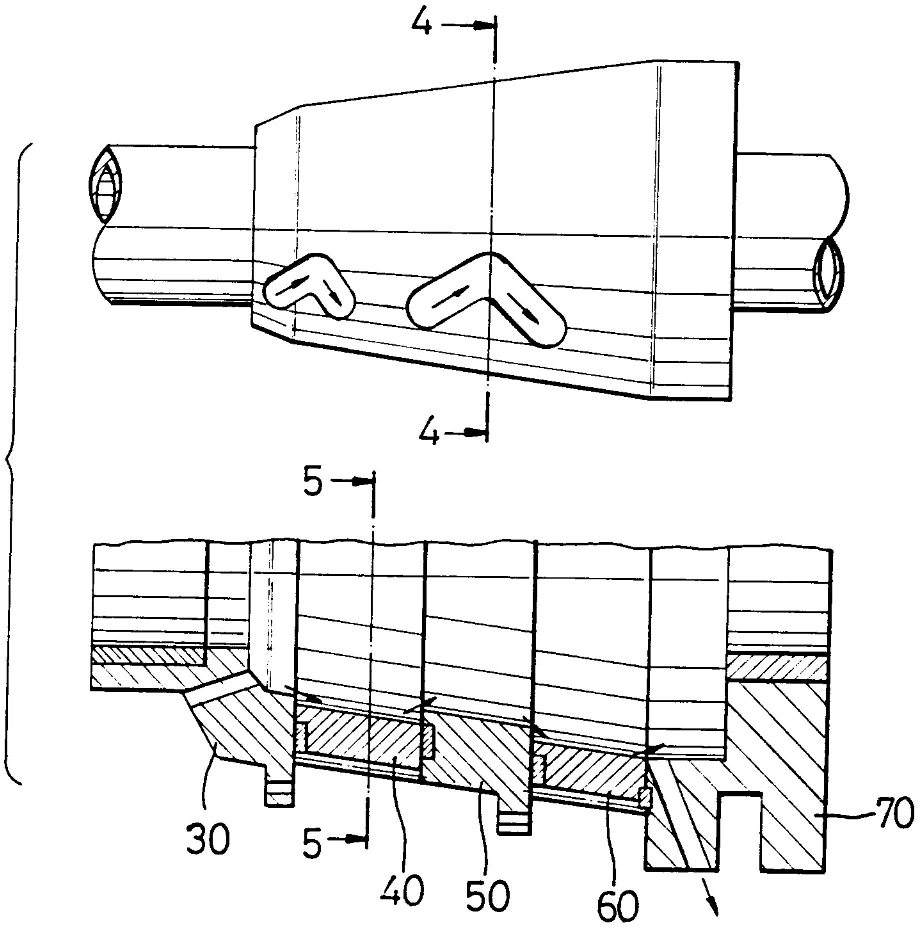

FIG.3

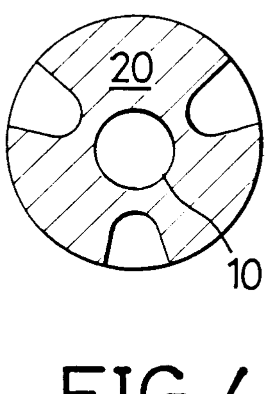

FIG.4

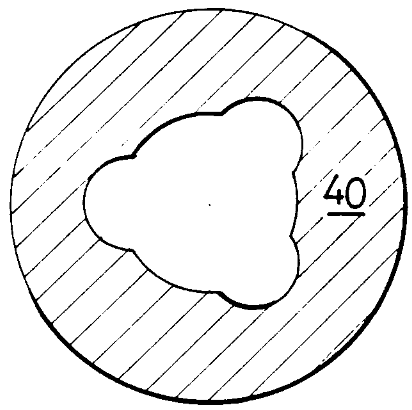

FIG.5

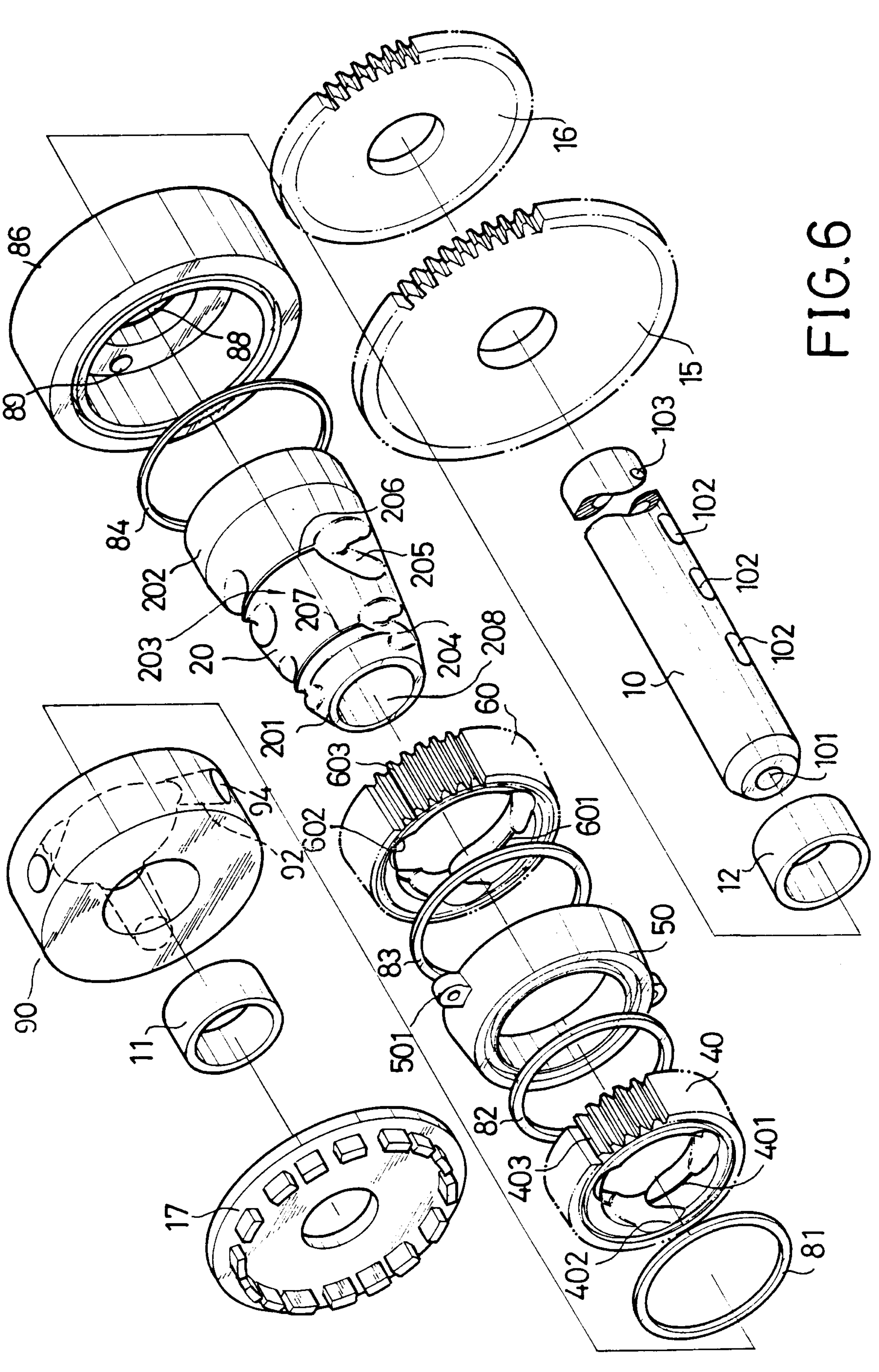
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FIG.6

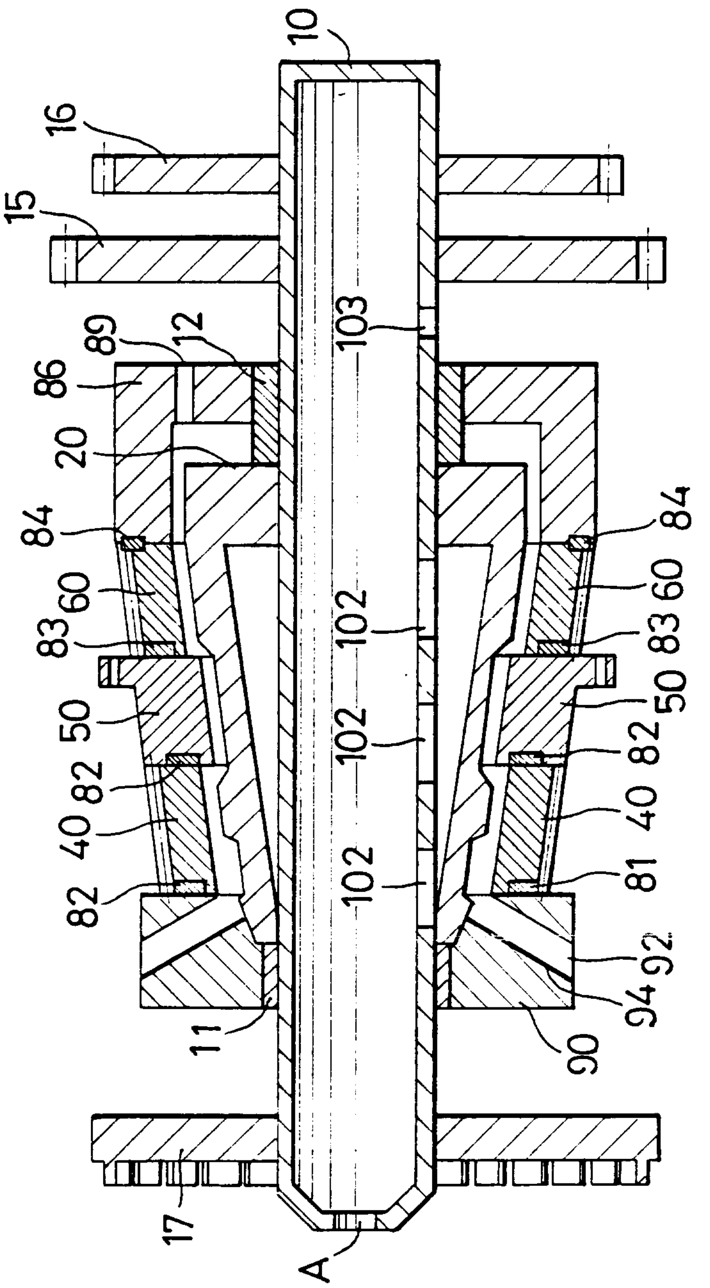

FIG.7

European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 93 20 1449

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
A	GB-A-1 258 986 (KRZYSZCZUK) * page 2, line 22 - line 97; figures 1-3 * ---	1-3,8	F01D1/34 F01D1/26
A	DE-A-1 426 835 (M.A.N.) * page 5, line 24 - page 6, line 8; figure 2 * -----	1,2	

TECHNICAL FIELDS SEARCHED (Int. Cl.5)
F01D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	27 SEPTEMBER 1993	TEERLING J.H.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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