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Dooley

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(54) **SCAVENGE PUMP SYSTEM AND METHOD**

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F02C 7/06 (2006.01)

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(58) **Field of Classification Search** 60/39.08; 415/77, 78, 79, 202; 184/6.11
See application file for complete search history.

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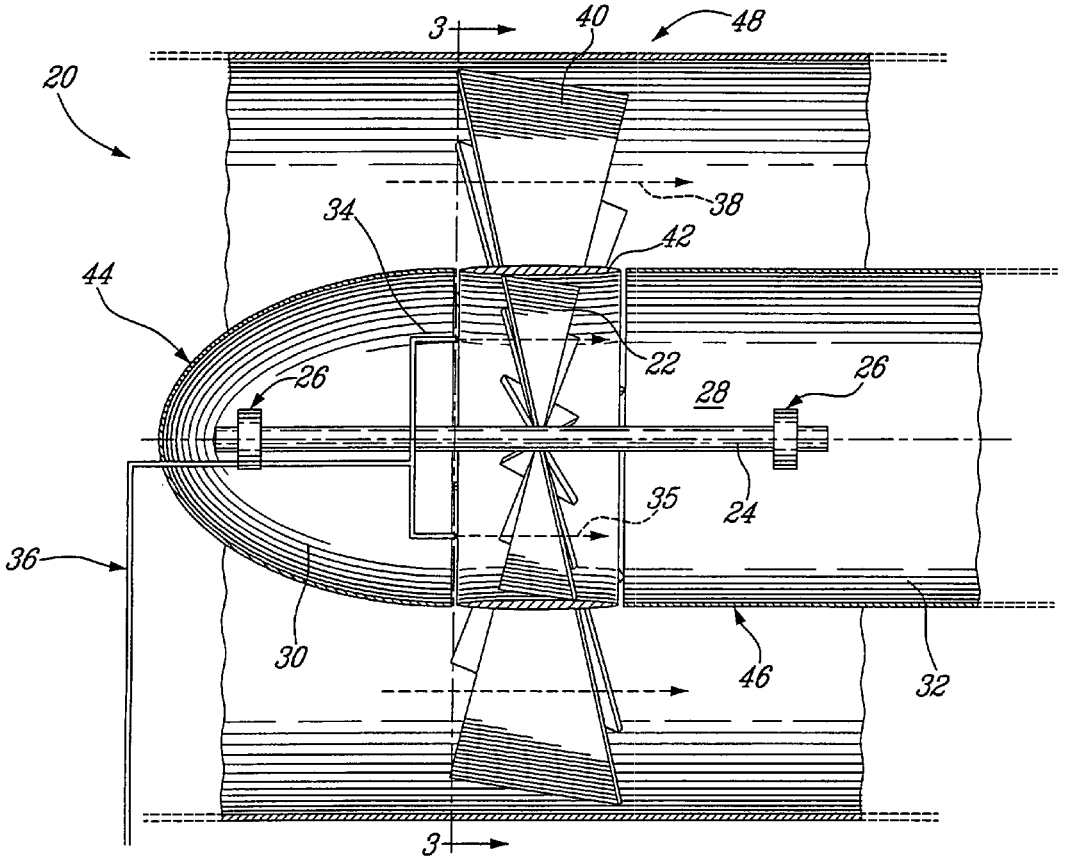
(57) **ABSTRACT**

The pump system extracts motive power from oil in the pressurized oil circuit to power a scavenge pump mounted on a scavenge oil circuit.

4 Claims, 4 Drawing Sheets



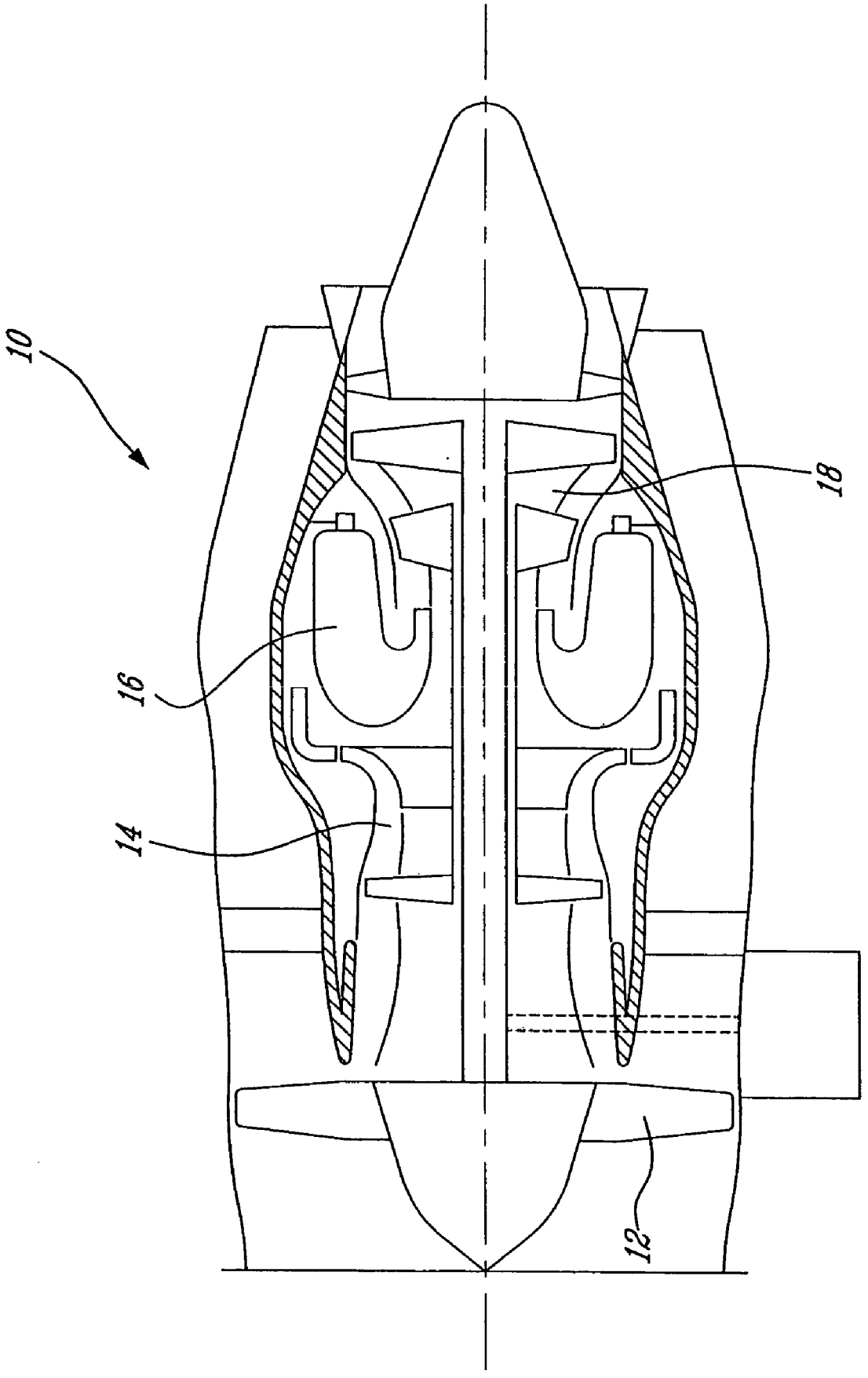


FIG. 1

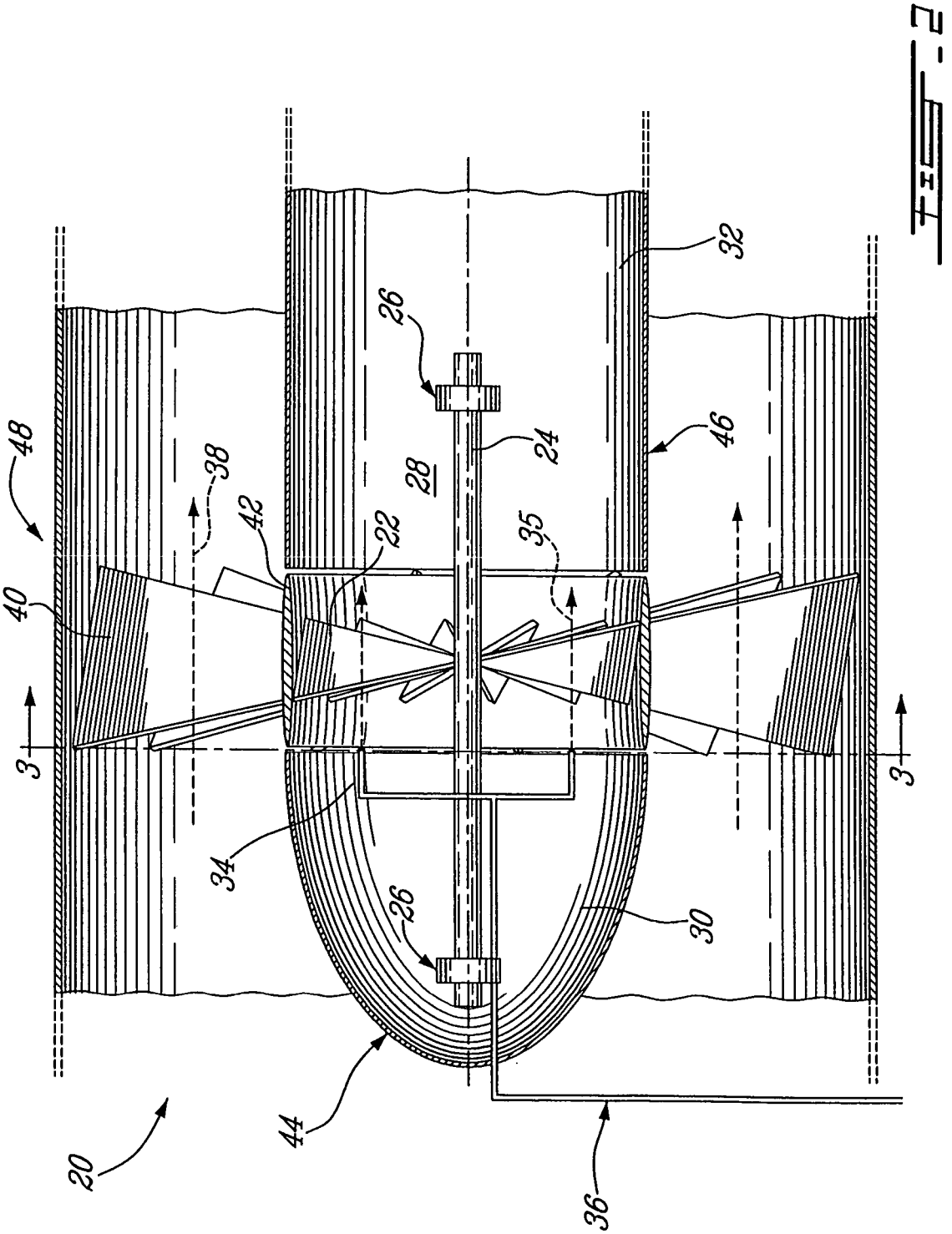


FIG. 2
48
38
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40
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36

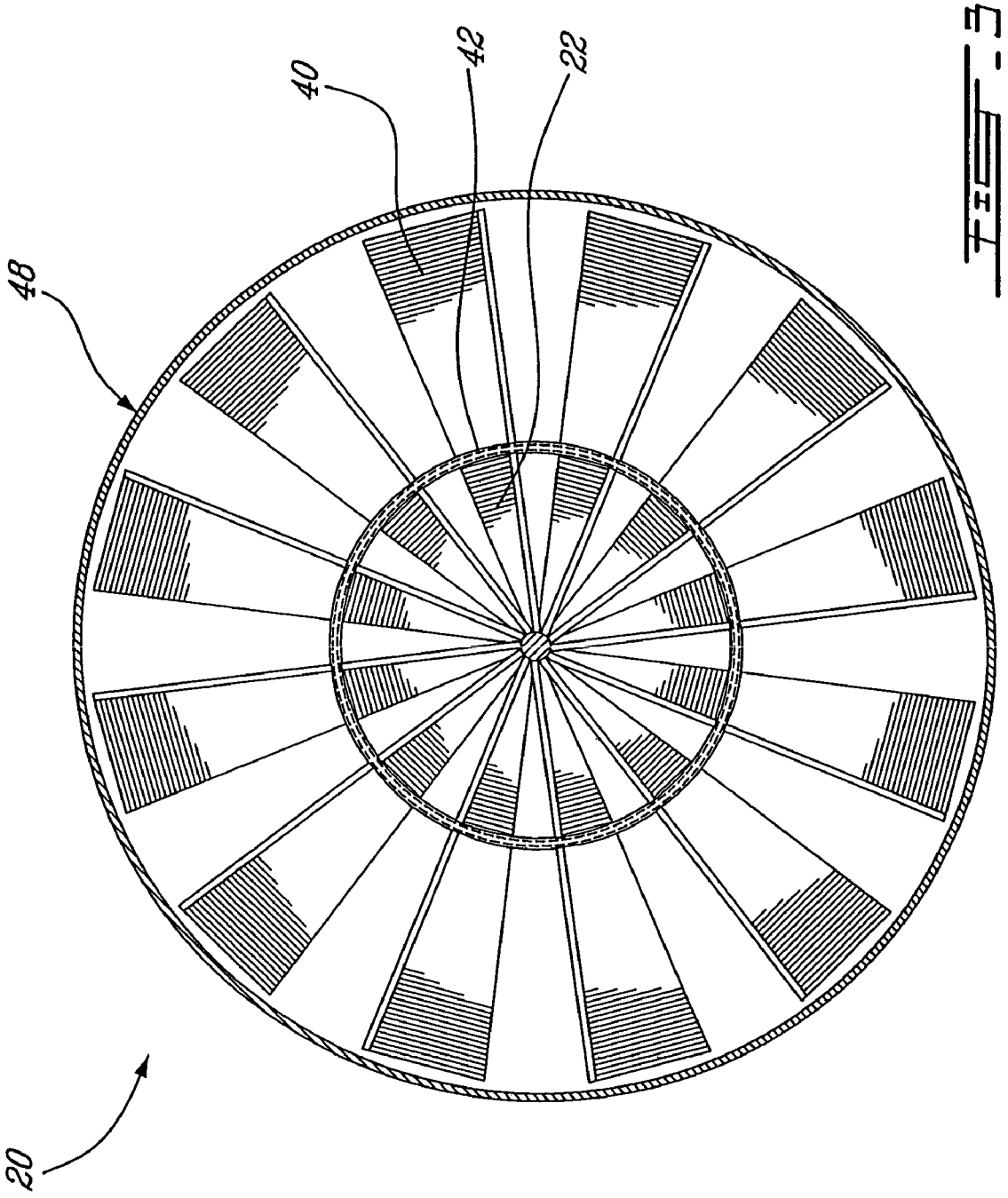

Fig. 3

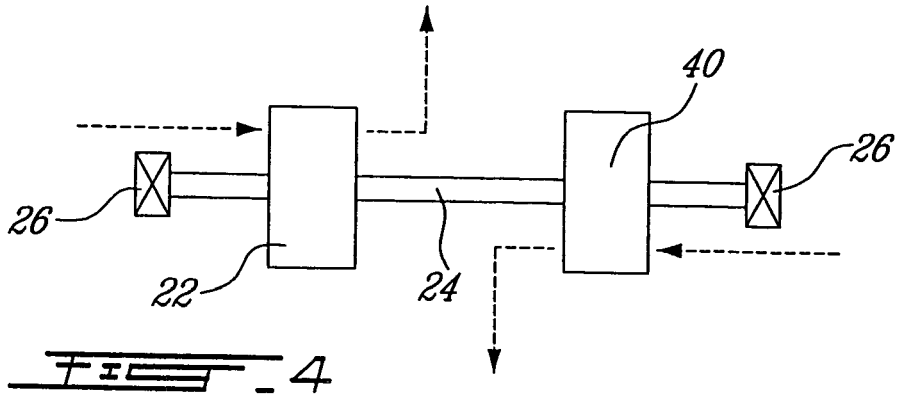

Fig. 4

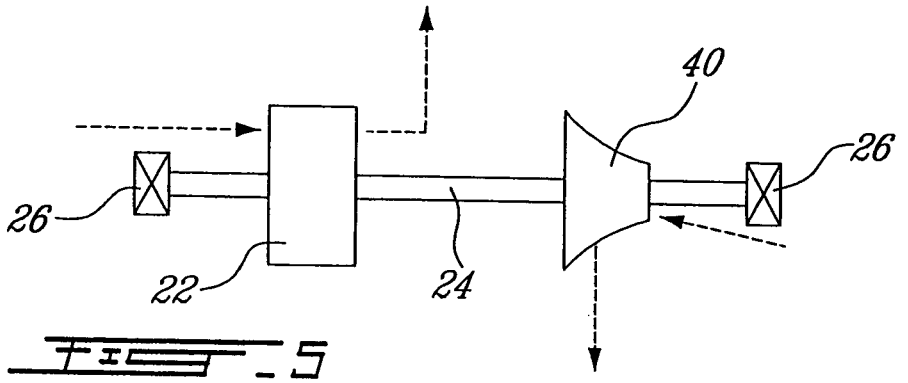

Fig. 5

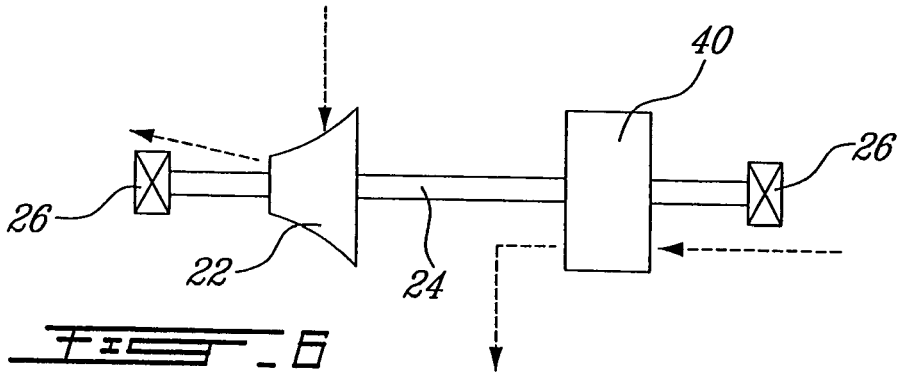

Fig. 6

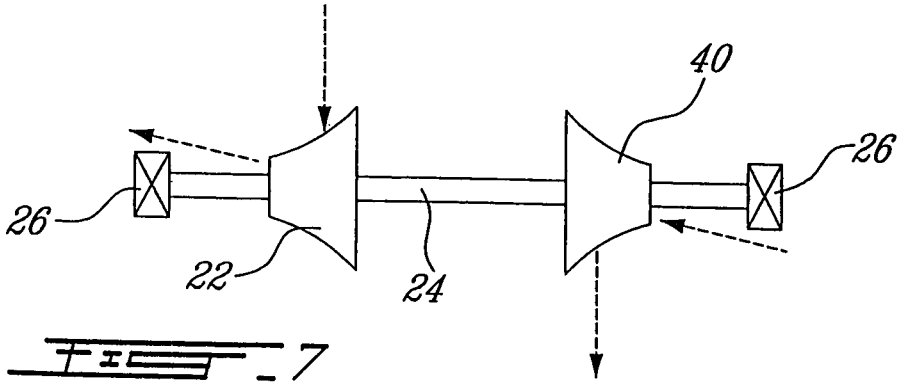

Fig. 7

SCAVENGE PUMP SYSTEM AND METHOD

TECHNICAL FIELD

The invention relates generally to a system for pumping scavenge oil.

BACKGROUND OF THE ART

Scavenge pumps are found in devices which include a lubricating system. These pumps are useful to propel used oil back to an oil sump or tank under certain conditions, for instance when gravity or air pressure is not sufficient to move the used oil. Oil circulating in a scavenge oil circuit, and referred to herein as scavenge oil, is usually a mix of air and oil, which mixture forms a foam-like fluid. Scavenge pumps are often required at remote locations, namely locations that are relatively far from the oil sump or tank. For instance, in the case of a gas turbine engine, a scavenge oil circuit for a bearing cavity at the rear end of the engine may require the use of a scavenge pump. Existing arrangements involving scavenge pumps use mechanical or electrical power to be provided at the remote location where the scavenge pump is located. This external power is supplied by a dedicated external line and it requires appropriate control arrangements, such as a switch or an actuated valve, thereby adding weight and complexity to the device in which the scavenge pump is provided.

SUMMARY OF THE INVENTION

It is therefore an object of this invention to provide an improved scavenge pump system.

In one aspect, there is provided a scavenge pump system comprising: a motor to be mounted on a pressurized oil supply circuit and extracting motive power from oil in the pressurized oil circuit; and a scavenge pump to be mounted on a scavenge oil circuit, the scavenge pump being powered by the motor.

In another aspect, there is provided a scavenge pump system comprising: a turbine adapted to be driven by a pressurized oil supply; and a pump drivingly connected to the turbine, the pump adapted to scavenge oil from an oil scavenge circuit.

In another aspect, there is provided a method of scavenging oil, the method comprising: circulating pressurized oil in a pressurized oil supply circuit; generating rotational power using a flow of the oil in the pressurized oil supply circuit; and rotating a scavenge pump using said rotational power.

Further details on these and other aspects of the present invention will be apparent from the detailed description and figures included below.

DESCRIPTION OF THE DRAWINGS

Reference is now made to the accompanying figures depicting aspects of the present invention, in which:

FIG. **1** is a schematic view of a multi-spool gas turbine engine showing an example of a possible environment in which the system and method can be used;

FIG. **2** is a axial view of an example of a system in accordance with a possible embodiment;

FIG. **3** is a cross-sectional view of the system taken along line III-III in FIG. **2**; and

FIGS. **4** to **7** are schematic views showing different possible configurations of the scavenge pump system.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIG. **1** illustrates an example of a gas turbine engine **10** of a type preferably provided for use in subsonic flight, generally comprising in serial flow communication a fan **12** through which ambient air is propelled, a multistage compressor **14** for pressurizing the air, a combustor **16** in which the compressed air is mixed with fuel and ignited for generating an annular stream of hot combustion gases, and a turbine section **18** for extracting energy from the combustion gases. The gas turbine engine **10** is a device in which scavenge pumps are often used and where the scavenge pump system and the method in accordance with the present invention would be very advantageous.

FIGS. **2** and **3** illustrate an example of a scavenge pump system **20** in accordance with a possible embodiment of the present invention. This scavenge pump system **20** comprises a motor in the form of a turbine **22** that is mounted around a shaft **24** supported between two bearings **26**. The turbine **22** is provided in a chamber **28** having an inlet side **30** and an outlet side **32**. The inlet side **30** is provided with nozzles **34** located in front of the turbine **22**. These nozzles **34** are connected to a pressurized oil supply circuit **36**. This circuit **36** carries the oil to the structure or structures requiring lubrication, such as gears or bearings. Thereafter, the scavenge oil flows back to the oil sump or tank through the scavenge oil circuit **38**.

The turbine **22** is configured and disposed to be driven into rotation by oil flowing out of the nozzles **34**. In use, the nozzles **34** create pressurized oil jets **35** impinging on the blades of the turbine **22** and generating a rotation of the turbine **22** around its shaft **24**. This arrangement allows extracting motive power from the oil and transferring it to the turbine **22** when oil flows in the pressurized oil supply circuit **36**. Oil then flows out of the chamber **28** through the outlet side **32** and it is sent to the structure or structures requiring lubrication.

It should be noted at this stage that in some designs, it is possible to have only a portion of the oil from the pressurized oil supply circuit **36** sent through the turbine **22**. The entire flow of oil may otherwise be used to rotate the turbine **22**.

The scavenge pump system **20** further comprises a scavenge pump **40** mounted on the scavenge oil circuit **38**. The scavenge pump **40** provides the necessary impulse to the scavenge oil to be sent back to oil sump or tank. The scavenge pump **40** is powered by the turbine **22**. This way, the scavenge pump system **20** is autonomous and does not require any external power or any control arrangement since the scavenge pump **40** would need to operate whenever oil flows into the pressurized oil supply circuit **36**.

In the illustrated embodiment, the scavenge pump **40** is connected to the turbine **22** by the fact that it is concentrically mounted on it. Moreover, they are different portions of a same blade. The system **20** is designed so that the pressurized oil supply circuit **36** and the scavenge oil circuit **38** remain independent at this level. An intermediary wall **42** separates the pressurized oil supply circuit **36** and the scavenge oil circuit **38** between the turbine **22** and the scavenge pump **40**. Other internal and external walls **44**, **46**, **48** complete the system **20**.

The above description is meant to be exemplary only, and one skilled in the art will recognize that changes may be made to the embodiments described without departing from the scope of the invention disclosed. For instance, oil flowing in the pressurized oil supply circuit does not necessarily need to flow in the same direction as that of the scavenge oil. The system could be designed so that both are flowing in opposite directions. The scavenge pump **40** and the turbine **22** do not

necessarily have to be directly connected together as illustrated in FIGS. **2** and **3**. The pump **40** and the turbine **22** can be mechanically connected using a shaft, a gear box, a transmission belt, etc. For instance, FIGS. **4-7** show the turbine **22** and the scavenge pump **40** as two adjacent parts on the same shaft **24**. FIG. **4** further shows that the turbine **22** may be an axial turbine and that the pump **40** may be an axial pump, both being mounted back to back in a configuration similar to an automotive supercharger. FIG. **5** shows that the turbine **22** may be an axial turbine and that the pump **40** may be a radial pump. FIG. **6** shows that the turbine **22** may be a radial turbine and that the pump **40** may be an axial pump. FIG. **7** shows that the turbine **22** may be a radial turbine and that the pump **40** may be a radial pump.

Furthermore, the motive power can also be transmitted between the turbine and the scavenge pump using an electrical generator connected to the motor, and an electrical motor connected to the scavenge pump. The motor which is provided on the pressurized oil supply circuit can be any suitable kind of motor to be driven by the pressurized oil, including a motor that is not a turbine. Furthermore, oil flowing in the pressurized oil supply circuit is not necessarily sent back to the oil sump or tank using the scavenge oil circuit associated with the pressurized oil circuit. More than one pressurized oil supply circuit can be present in a device and in some designs, the oil or a portion thereof can flow back through another scavenge oil circuit of the device. The system and method can be used in devices that are not gas turbine engines, although the system and method are particularly useful for gas turbine engines since it allows reducing the weight and the number of parts. Still other modifications of the present invention will be apparent to those skilled in the art, in light of a review of this disclosure.

What is claimed is:

1. A scavenge pump system for scavenging oil from a plurality of bearing chambers of a gas turbine engine, the gas turbine engine having: a compressor; and a turbine driven by hot gas from a combustor, mounted on at least one shaft mounted for rotation about an axis on a plurality of bearings housed in said bearing chambers, the gas turbine engine including an oil supply circuit having a pressurized oil supply conduit to each bearing chamber and an oil scavenge circuit from each bearing chamber, the scavenge pump system comprising: a turbine having an inlet and an outlet each in flow communication with the pressurized oil supply circuit, the turbine being powered to rotate on a turbine shaft in response to pressurized oil flow over the turbine and extracting motive power from the flow of oil through the pressurized oil circuit; and a scavenge pump having an inlet and an outlet each in flow communication with the scavenge oil circuit, the scavenge pump being mechanically connected to and powered by the turbine shaft.

2. The system as defined in claim **1**, wherein the turbine and the scavenge pump are concentrically mounted with reference to a rotation axis of the turbine.

3. The system as defined in claim **2**, wherein the turbine and the scavenge pump are different portions of a same blade, both portions being separated by an intermediary wall.

4. The system as defined in claim **2**, wherein the turbine is selected from the group consisting of: an axial turbine; and a radial turbine, and the scavenge pump is selected from the group consisting of: an axial pump; and a radial pump.

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