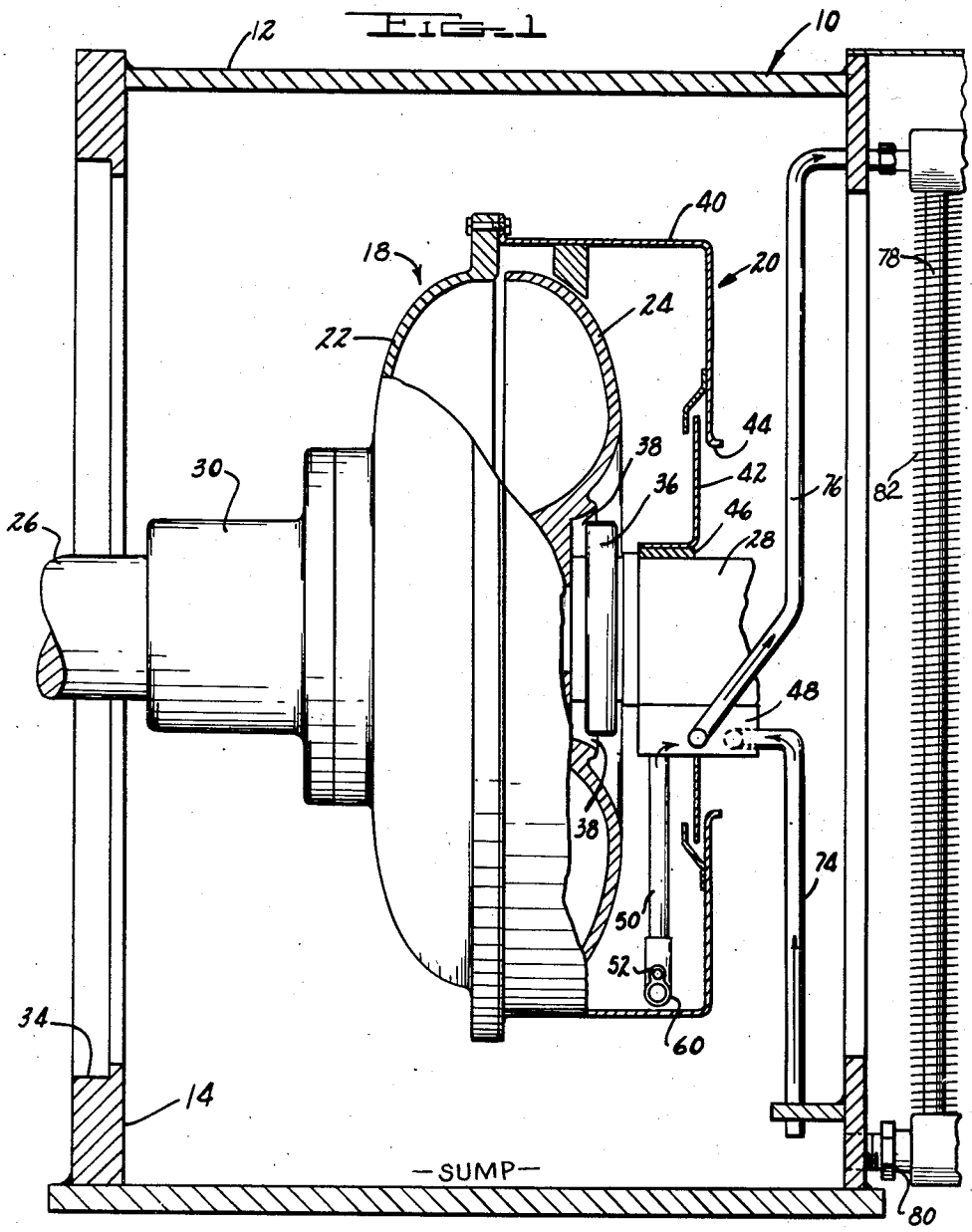
April 22, 1958 J. C. LINSENMEYER 2,831,323

SCOOP AND JET PUMP FLUID REGULATING MEANS FOR FLUID COUPLINGS

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Fig. 1



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FIG. 2

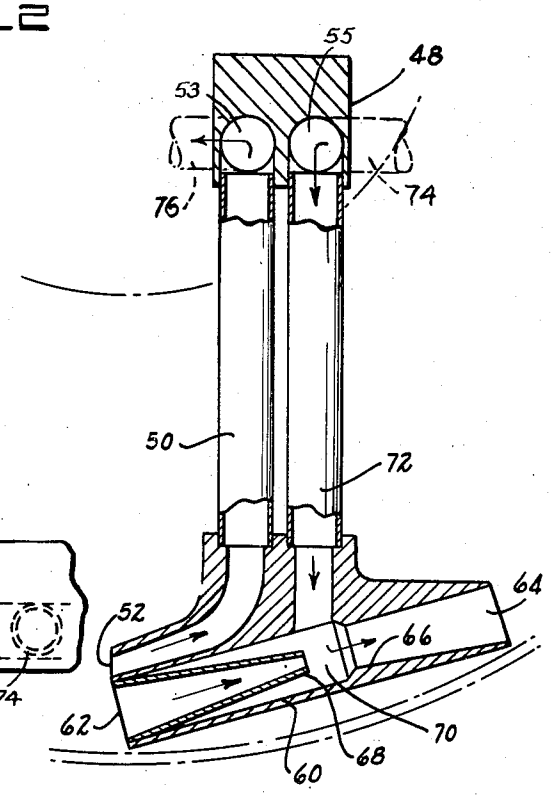
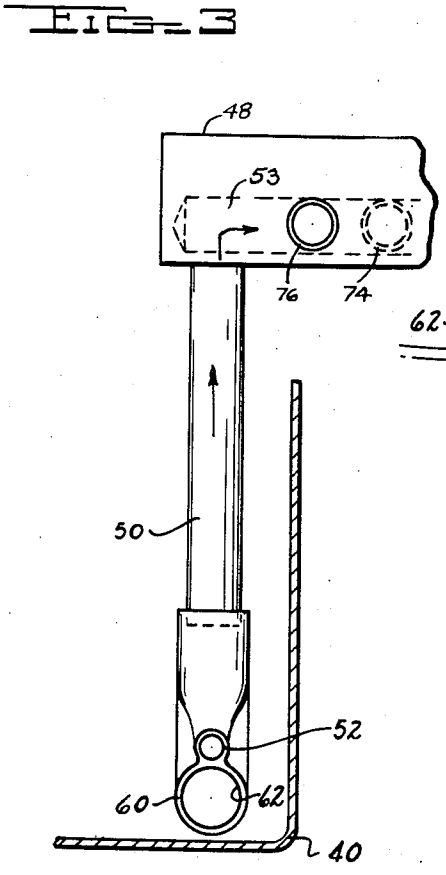


FIG. 3



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Fig. 4

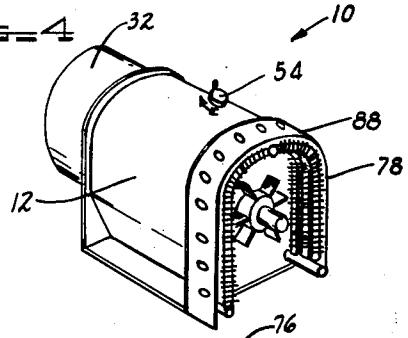
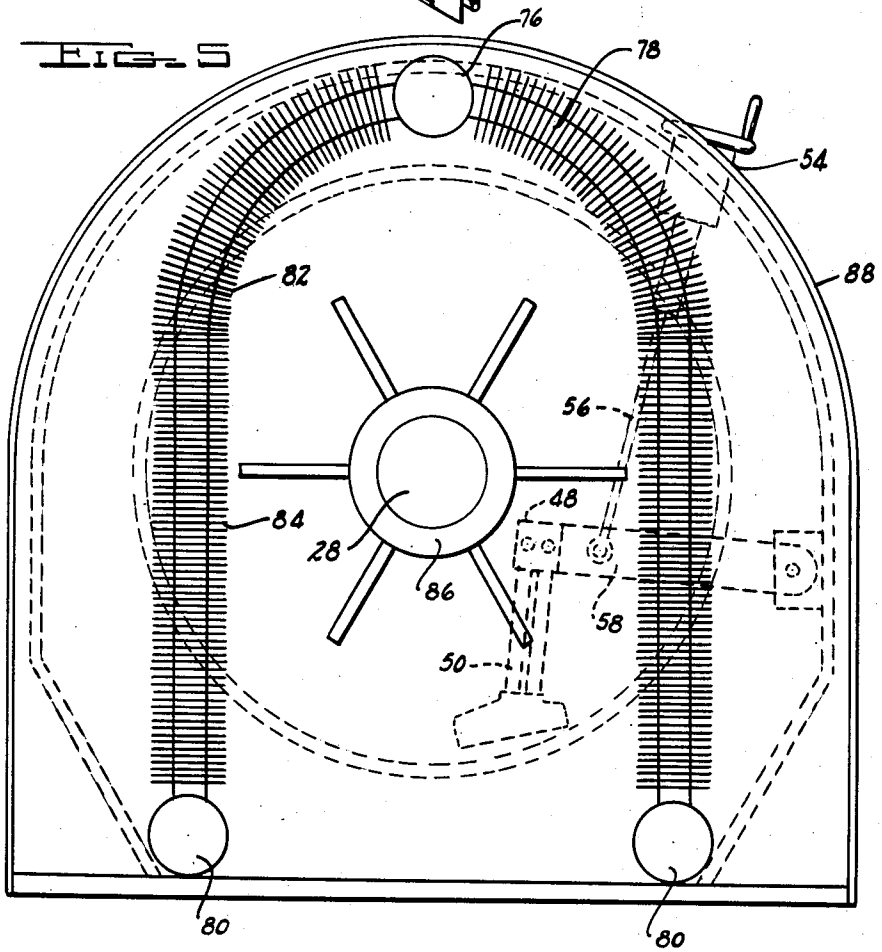


Fig. 5



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SCOOP AND JET PUMP FLUID REGULATING MEANS FOR FLUID COUPLINGS

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7 Claims. (Cl. 60—54)

The present invention relates to a fluid coupling or torque transmitter, and in particular to pump and cooling apparatus used in the working fluid circuit.

It is an object of the present invention to provide a fluid torque transmitter employing a scoop tube for regulating the size of a revolving ring of working fluid in a scoop chamber and thereby the amount of such working fluid in the work chamber, said torque transmitter being constructed and arranged so that energy from working fluid in said revolving ring is utilized for pumping additional working fluid from a reservoir chamber back to said scoop chamber.

It is still another object of the present invention to provide a fluid torque transmitter of the foregoing character where a jet pump is employed in the working circuit for pumping the working fluid from the reservoir chamber to the scoop chamber.

It is still another object of the present invention to provide a fluid torque transmitter of the foregoing character where the jet pump is mounted on the end of the scoop tube so that it will always be immersed in the revolving ring of working fluid when the scoop tube is in its operative position with its mouth engaging the ring to define the inner diameter thereof.

It is still another object of the present invention to provide a fluid torque transmitter employing a scoop tube for regulating the size of a revolving ring of working fluid in a scoop chamber and thereby the amount of such working fluid in the work chamber, said torque transmitter having a pump for returning working fluid from the reservoir chamber to the work chamber, said pump being constructed and arranged to provide an automatic torque-limitation for driven loads by allowing the working fluid to be drawn from the scoop chamber at a more rapid rate when sudden overloads are applied thereby reducing the fluid in the work chamber and limiting the torque that can be transmitted.

Still another object of the present invention is to provide a torque transmitter of the foregoing character which requires a minimum of moving parts and is characterized by its economy in manufacturing and trouble free operation.

It is still another object of the present invention to provide a torque transmitter of the foregoing character which has a simple and efficient cooling system for the working fluid.

Other objects of this invention will appear in the following description and appended claims, reference being had to the accompanying drawings forming a part of this specification wherein like reference characters designate corresponding parts in the several views.

In the drawings:

Figure 1 is a side elevation, partially in section, and with portions removed of one embodiment of the present invention;

Figure 2 is a fragmentary enlarged section of the scoop tube and jet pump employed in the embodiment of Figure 1;

Figure 3 is a front elevation of the scoop tube and jet pump;

Figure 4 is a perspective view of an embodiment of the invention employing a cooling system for the working fluid; and

Figure 5 is an enlarged end elevation of the disclosed embodiment of the invention.

Before explaining the present invention in detail, it is to be understood that the invention is not limited in its application to the details of construction and arrangement of parts illustrated in the accompanying drawings, since the invention is capable of other embodiments and of being practiced or carried out in various ways. Also, it is to be understood that the phraseology or terminology employed herein is for the purpose of description and not of limitation.

Referring now to the drawings, a more detailed description of the invention will be given. The fluid coupling or torque transmitter 10 has a housing 12 forming at the bottom thereof a sump or reservoir chamber 14 for the working fluid.

Positioned within the housing 12 is a work chamber 18 and a scoop chamber 20. The work chamber 18 is formed by the vaned impeller 22 and the vaned runner 24 which are mounted, respectively, on the ends of drive shaft 26 and driven shaft 28. The impeller 22 is connected to drive shaft 26 by means of the hub 30 which is keyed to shaft 26 of motor 32, Figure 4. The end flange of motor 32 will fit into the opening 34 of housing 12 closing the same.

The runner 24 is locked against rotation on driven shaft 28 by means of rod 36 which passes through shaft 28 and the opposite ends thereof seat in radial V-grooves 38 formed in the hub of runner 24.

Connected to the impeller 22 is a casing 40 which encloses the runner 24 and forms the scoop chamber 20. A baffle plate 42 is mounted on shaft 28 to close the shaft opening 44 in casing 40. The baffle plate 42 is stationary in operation and is supported by the shaft bearing 46. Supported against rotation on housing 12 and on one side of shaft 28 and passing through baffle plate 42 is a manifold 48 and a scoop tube 50 having an inlet mouth 52 at its free end. Tube 50 is connected at its upper end with a passage 53 formed in manifold 48. As best seen in Figure 5, the position of scoop tube mouth 52 relative to the periphery of scoop chamber 20 can be varied by turning the screw member 54 which raises or lowers rod 56 pivotally connected to the arm 58 on which manifold 48 and scoop tube 50 are carried.

On the outer free end of scoop tube 50 is a passageway 60 in line with the normal flow of working fluid in scoop chamber 20 so that such fluid will enter at the inlet 62 and be discharged at the outlet 64. The interior of this passageway 60 is constructed and arranged to form a jet pump. Thus, a throat is formed at 66 and a nozzle 68 discharges into the suction or low pressure chamber 70. A conduit 72 extends between the suction chamber 70 and passage 55 formed in manifold 48. A conduit 74 extends between passage 55 and the reservoir chamber 14. As will be explained later, the jet pump operates to draw working fluid from the reservoir chamber 14 through the conduit 72 and out the discharge outlet 64 into the scoop chamber 20 with the working fluid that flows through passageway 60.

The working fluid in the scoop chamber 20 is removed to a desired extent by the action of scoop tube 50 which forms a portion of a passageway including passage 53, conduit 76, cooler 78 and return conduits 80 which discharge into reservoir chamber 14. Where de-

sirable, this passageway may by-pass the cooler 78 and discharge directly into reservoir chamber 14.

The cooler 78 is mounted on the outside of housing 12 and has a plurality of conduits 82 extending between conduits 76 and 80 and surrounding the shaft 28. Radial fins 84 are on conduits for aiding in transferring heat to the surrounding atmosphere. To further assist this process a fan wheel 86 is mounted on the shaft 28. If desired a guard 88 may enclose the finned conduits 82.

In the operation of the illustrated embodiment, let it be assumed that the motor 32 is turning the impeller 22 at a fixed speed and that working fluid is in the work chamber 18, thereby coupling the runner 24 to the impeller 22 and rotating shaft 28. A revolving ring of working fluid will be present in scoop chamber 20, the amount of which will be controlled by the position of the mouth 52 of scoop tube 50. This in turn controls the amount of working fluid in the work chamber 18, and hence, the torque that can be transmitted to shaft 28.

The working fluid that is removed by scoop tube 50 will pass through the cooler, as previously described, and will return to the working fluid reservoir 14.

Working fluid is returned to the scoop chamber by means of the jet pump mounted on the end of the scoop tube 50. The fluid will be sucked through the conduit 74, passage 55, conduit 72 and discharged into the scoop chamber as a fresh supply of cooled working fluid. It will be observed that the jet pump is always immersed in the ring of working fluid while the scoop tube is functioning to control the dimension of the rotating ring of working fluid. In the disclosed embodiment, it is necessary, therefore, that the scoop tube have a greater capacity for withdrawing working liquid than the jet pump has for adding working fluid.

One of the features of this invention is the simplicity of the control and pumping apparatus. The minimum of moving parts are employed thereby avoiding unnecessary wear and ultimate replacement of parts. Furthermore, the cost of making and assembling the parts is relatively low.

Another feature of the invention is the automatic torque-limitation for driven loads. In the event a sudden overload occurs, the working fluid will be drawn out of the scoop chamber into the work chamber. This quick removal of the working fluid from the scoop chamber will have the effect of stopping the prime to the jet pump so that no further replacement of working fluid occurs, and thereby limiting the torque that can be transmitted to the driven equipment.

Still another feature is the unique cooling system that may be employed, if desired. It is to be observed that the cooler also has no parts that can be worn or which will require maintenance, and yet it assures constant air cooling of the finned coils.

Having thus described the invention, I claim:

1. A fluid torque transmitter comprising a drive shaft carrying an impeller, a driven shaft carrying a runner, said impeller and runner being axially aligned and in juxtaposiiton to form a work chamber for the working fluid, a casing connected to said impeller for rotation therewith and defining a scoop chamber in axial alignment and fluid communication with said work chamber to carry a rotating ring of working fluid during operation of said transmitter, a stationary housing enclosing said work chamber and scoop chamber and providing a reservoir chamber for the working fluid, a scoop tube mounted against rotation on said housing and extending into and adjacent the outer periphery of said scoop chamber, the mouth of said scoop tube being disposed opposite to the direction of rotation of said scoop chamber to control the amount of working fluid in said ring and thereby in said work chamber, the discharge end of said scoop tube communicating with a passage for returning working fluid to said reservoir chamber, and a jet pump mounted on said scoop tube outwardly beyond the mouth thereof so that said jet pump will be immersed in the rotating ring of working fluid, the suction side of said jet pump being connected to a conduit extending to said reservoir chamber so that said jet pump will automatically operate to return working fluid to said scoop chamber and thereby to said work chamber during operation of said transmitter.

2. A fluid torque transmitter comprising a drive shaft carrying an impeller, a driven shaft carrying a runner, said impeller and runner being axially aligned and in juxtaposiiton to form a work chamber for the working fluid, a casing connected to said impeller for rotation therewith and defining a scoop chamber in axial alignment and fluid communication with said work chamber to carry a rotating ring of working fluid during operation of said transmitter, a stationary housing enclosing said work chamber and scoop chamber and providing a reservoir chamber for the working fluid, a scoop tube mounted against rotation on said housing and extending into and adjacent the outer periphery of said scoop chamber, the mouth of said scoop tube being disposed opposite to the direction of rotation of said scoop chamber to control the amount of working fluid in said ring and thereby in said work chamber, the discharge end of said scoop tube communicating with a passage for returning working fluid to said reservoir chamber, said scoop tube being adjustable to vary the distance its mouth is from the axis of said scoop chamber so that the quantity of working fluid in the work chamber can be varied, and a jet pump mounted on said scoop tube outwardly beyond the mouth thereof so that said jet pump will be immersed in the rotating ring of working fluid, the suction side of said jet pump being connected to a conduit extending to said reservoir chamber so that said jet pump will automatically operate to return working fluid to said scoop chamber and thereby to said work chamber during operation of said transmitter.

3. A fluid torque transmitter comprising a drive shaft carrying an impeller, a driven shaft carrying a runner, said impeller and runner being axially aligned and in juxtaposition to form a work chamber for the working fluid, a casing connected to said impeller for rotation therewith and defining a scoop chamber in axial alignment and fluid communication with said work chamber to carry a rotating ring of working fluid during operation of said transmitter, a stationary housing enclosing said work chamber and scoop chamber and providing a reservoir chamber for the working fluid, a scoop tube mounted against rotation on said housing and extending into and adjacent the outer periphery of said scoop chamber, the mouth of said scoop tube being disposed opposite to the direction of rotation of said scoop chamber to control the amount of working fluid in said ring and thereby in said work chamber, the discharge end of said scoop tube communicating with a passage for returning working fluid to said reservoir chamber, and a jet pump mounted on said scoop tube outwardly beyond the mouth thereof so that said jet pump will be immersed in the rotating ring of working fluid, the suction side of said jet pump being connected to a conduit extending to said reservoir chamber so that said jet pump will automatically operate to return working fluid to said scoop chamber and thereby to said work chamber during operation of said transmitter, said jet pump having a lesser capacity for transferring working liquid than said scoop tube so that the latter will always control the inner diameter of the rotating ring of working fluid.

4. A fluid torque transmitter comprising a drive shaft carrying an impeller, a driven shaft carrying a runner, said impeller and runner being axially aligned and in juxtaposition to form a work chamber for the working fluid, a casing connected to said impeller for rotation therewith and defining a scoop chamber in axial align-

ment and fluid communication with said work chamber to carry a rotating ring of working fluid during operation of said transmitter, a stationary housing providing a reservoir chamber for the working fluid, a cooling coil on the outside of said housing through which working fluid can be passed, a scoop tube mounted against rotation and extending outwardly to adjacent the outer periphery of said scoop chamber, the mouth of said scoop tube being disposed opposite to the direction of rotation of said scoop chamber to control the amount of working fluid in said ring and thereby in said work chamber, the discharge end of said scoop tube communicating with a passageway leading to the inlet of said cooling coil, another passageway leading from an outlet of said cooling coil to said reservoir chamber, said cooling coil at least partially encircling one of said shafts, a fan mounted on the last named shaft for circulating air over said cooling coil, and a jet pump mounted on said scoop tube outwardly beyond the mouth thereof so that said jet pump will be immersed in the rotating ring of working fluid, the suction side of said jet pump being connected to a conduit extending to said reservoir chamber so that said jet pump will automatically operate to return working fluid to said scoop chamber and thereby to said work chamber during operation of said transmitter.

5. In a fluid torque transmitter the combination comprising driving and driven shafts operatively connected to impeller and runner elements, respectively, and forming a work chamber; means forming a scoop chamber in fluid communication with the work chamber; a scoop tube in said scoop chamber for engaging a rotating ring of working fluid and thereby controlling the amount of working fluid that is present in the work chamber; a jet pump mounted on the fluid-engaging end of said scoop tube beyond the mouth thereof so that said jet pump will always be immersed in said rotating ring of working fluid while the scoop tube is operating; said jet pump having an inlet at one end; an outlet at the other end and a restricted orifice intermediate said ends opening into a low pressure chamber; a passageway terminating in said low pressure chamber and communicating with a working fluid reservoir through which working fluid can flow to said low pressure chamber and from there into said scoop chamber.

6. In a fluid torque transmitter the combination comprising driving and driven shafts operatively coupled to impeller and runner elements, respectively, and forming a work chamber; means forming a scoop chamber in fluid communication with the work chamber; a scoop tube in said scoop chamber for engaging a rotating ring of working fluid and thereby controlling the amount of working fluid that is present in the work chamber; a working fluid reservoir chamber, a passageway for working fluid extending from the fluid ring-engaging mouth of the scoop tube to said reservoir chamber, a second passageway including a jet pump communicating with the rotating ring of working fluid in the scoop chamber for passing working fluid through said jet pump and discharging the fluid back to the scoop chamber; and a third passageway extending between said jet pump and said reservoir chamber for conducting working fluid from said reservoir chamber through said pump and discharging the fluid back to the scoop chamber.

7. In a fluid torque transmitter the combination comprising driving and driven shafts operatively coupled to impeller and runner elements, respectively, and forming a work chamber; means forming a scoop chamber in fluid communication with the work chamber; a scoop tube in said scoop chamber for engaging a rotating ring of working fluid and thereby controlling the amount of working fluid that is present in the work chamber; a working fluid reservoir chamber; a cooler; a passageway for working fluid extending from the fluid ring-engaging mouth of the scoop tube through the cooler to the reservoir chamber; a second passageway including a jet pump communicating with the rotating ring of working fluid in the scoop chamber for passing working fluid through said jet pump and discharging the fluid back to the scoop chamber; and a third passageway extending between said jet pump and said reservoir chamber for pumping working fluid from said reservoir chamber through said pump and discharging the fluid back to the scoop chamber; said cooler having at least one conduit spaced from and surrounding one of said shafts and having radial fins projecting from its surface, and a fan rotatably mounted on said one shaft inward of said conduit for directing cooling air between said fins.

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