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J. MERCIER

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PUMP

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Fig. 1

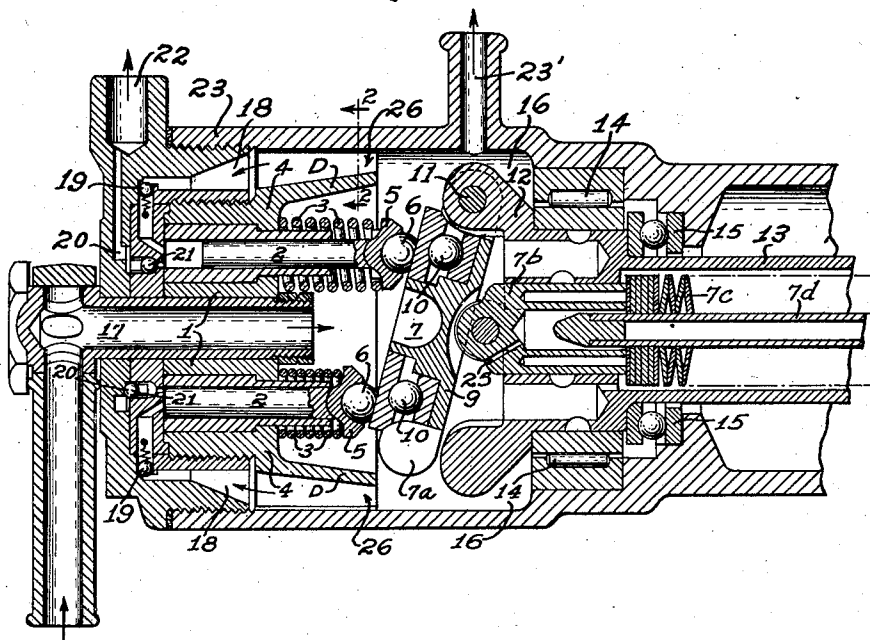


Fig. 2

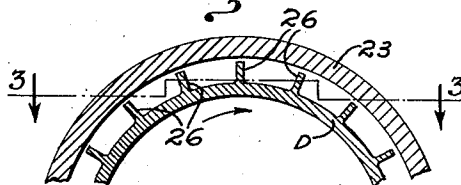
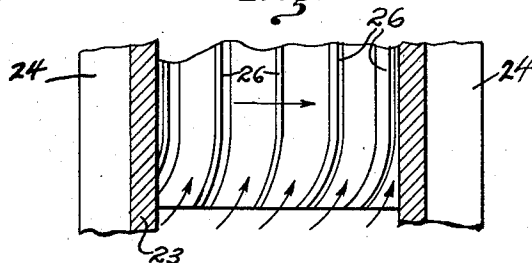


Fig. 3



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UNITED STATES PATENT OFFICE

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7 Claims. (Cl. 103—5)

The present invention relates to pumps for liquids, more especially for use on aircraft.

A pump of the considered type is shown in my French Patent 809,826. Pumps of this type when used on aircraft do not work satisfactorily when the oil to be pumped becomes cold and consequently less fluid. The suction exerted by the plungers may then become insufficient and this disturbance is particularly inconvenient if the low temperatures are accompanied by a drop of the atmospheric pressure. This drawback can be obviated according to the invention by utilizing the centrifugal force exerted by the rotating parts of the pump.

According to the invention the liquid to be supplied to the pump is introduced into the central part. The aforesaid force there produces a suction effect which facilitates the arrival of liquid. Under the action of the same force the liquid is carried to the periphery. The pressure exerted on the liquid, thus, rises from the center towards the wall of the casing. The liquid to be fed to the cylinders is isolated at the point of highest pressure and from there conducted into the individual feed channel of each cylinder.

For that purpose I have found it advantageous to provide an annular wall disposed at a short distance from the wall of the casing, and reaching up to a point immediately adjacent the turning parts of the pump. I thus create a peripheral groove into which the oil is forced and from which it is withdrawn near the bottom into the feed channels of the individual cylinders.

However, the same purpose can be obtained by leading the feed channels of the cylinders up to a point adjacent the turning parts of the pump.

This structure insures regular supply of liquid to the cylinders and facilitates restarting of the pump after a period of idleness.

A pump of this kind includes a plurality of parallel pistons, preferably disposed along generatrices of a circular cylinder, and actuated by means of a rotating cam. This cam is mounted to oscillate with respect to a piece, intended to give it its rotary movement, about an axis perpendicular to the axis of rotation of said cam with respect to said piece. The oscillations of the cam about said axis of rotation are produced, in the direction which tends to reduce the inclination of the cam, by the reaction of the pistons resulting from the action of the liquid that is discharged and of the return springs, and, in the opposed direction, which tends to increase the inclination of the cam, by the action of a sliding push-piece parallel to the axis of revolu-

tion, said push-piece bearing against the cam and being subjected to the thrust of an elastic device.

Therefore, this pump ensures an automatic regulation of the discharge pressure, since the inclination of the cam depends upon the value of said pressure. For a given maximum value of this discharge pressure, the cam is at right angles to the axis of revolution and no liquid is any longer discharged by the pump.

In the pumps of the known type, the inlet and outlet conduits or channels were provided at one end of the pump and they were directly connected with the ends of the cylinders containing the pistons. Now, this arrangement, although it gave very satisfactory results under ordinary working conditions, has been found to be insufficient in the case of very high working speeds of the pump, and especially when re-starting a pump which has been stopped for a certain time. This is due to the fact that the space located beyond the pistons ends and which contains the cam is, in this latter case, nearly empty and must be connected, on the one hand, to a special conduit serving to ensure the restarting, and, on the other hand, to the conduits or channels through which the inflow of fluid to the cylinders takes place.

The general object of the present invention is to provide a pump of the type above mentioned which is better adapted to meet the requirements practice than the pumps of the same type made up to this time, and, in particular, which is simpler to construct.

A more specific object of the invention is to provide a pump of this type which eliminates the inconvenience of providing a special re-starting device.

Still another object of the invention is to provide a pump of this type working in a perfectly smooth and regular manner.

According to an essential feature of the present invention, the supply conduit or conduits of the pump open directly into the space containing the cam and located beyond the piston heads, and the particular and individual inlet conduits or channels provided for each cylinder respectively open into the peripheral zone of the above mentioned space surrounding the cam.

It will be readily understood that in the case of a very quick rotation of the parts contained in the space surrounding the cam, there is produced, under the effect of the centrifugal force resulting from this rotation, an extra-pressure in the above mentioned peripheral zone. If the

cylinders are fed with fluid coming from this zone, two advantages are obtained:

(a) First, the feed remains always perfectly regular, and

(b) Re-starting becomes an easy operation, automatically obtained without any special device, owing to the above mentioned pressure, which is established as soon as the parts of the pump are started rotating.

Other features of the present invention will result from the following detailed description of specific embodiments thereof.

A preferred embodiment of the present invention will be hereinafter described, with reference to the accompanying drawing, given merely by way of example, and in which:

Figure 1 is an axial sectional view of a pump of the type above mentioned made according to the invention. Fig. 2 is a cross-sectional view taken on line 2—2 of Fig. 1 and Fig. 3 is a detail sectional view taken on line 3—3 of Fig. 2.

In the embodiment of the invention shown by the drawing, the pump includes a plurality of cylinders 1, in which are slidably mounted pistons 2 subjected to the action of return springs 3 bearing on the one hand against the block 4 in which the cylinders are provided, and, on the other hand, against pieces 5 belonging to the pistons. These pistons 5 carry the balls 6, flattened on one side, which bear on a cam 7. This cam includes two plates 8 and 9, which are capable of rolling with respect to each other, owing to the provision of ball bearings 10. Plate 9 is pivoted at 11 to a lateral piece 12, carried by a tube 13 which is caused to rotate about the axis of the apparatus by means of any suitable motor, not shown. This tube is mounted on bearings 14 and 15. The plate 9 is normally forced outward from its pivotal support 11 by a piston 7b slidably mounted on a shaft 7d and pressed outwardly by a spring and clutch arrangement 7c.

The space 16 which surrounds the piston heads and cam 7 communicates, through tube or conduit 17 with any suitable supply. The individual feed of each cylinder 1 is obtained through a circular groove or channel 18 provided in block 4, formed by the wall of the casing and an annular wall D disposed close to said wall of the casing and having its upper end adjacent the turning parts of the pump and connected through channels 19 with the ends of the respective cylinders 1.

Channel 20, provided with check valves 21 connects the ends of the respective cylinders 1 with the discharge 22.

The operation of the pump above described is as follows:

As a rule it is identical to that of the pump described in the above mentioned French patent. Tube 13, brought in rotation and driven by any suitable motor, rotates cam 8—9, the inclination of which is variable according to the pressure of the fluid fed by the pump.

The fluid is in space 16 surrounded by the casing 26, to which it is fed through tube 17. It is driven in rotation and under the effect of the centrifugal force it is expelled into the peripheral zone of space 16 which is in communication with channels or grooves 18. An extra-pressure is produced in the zone in question and it is clear that, under these conditions, cylinders 1 are fed with fluid under a given pressure. Furthermore, when the pump is being restarted after having been stopped for a more or less considerable period of time, the rotation of the elements present in space 16 produces an overpressure in the

vicinity of conduits 18, which ensures a correct restarting, which is a very interesting result obtained without any special device.

In view of ensuring a sufficient pressure at the inlet check valves, it is preferable to incline the inlet conduits, taking of course into account the direction of revolution of the pump. Also, I may make these conduits with the shape of blades, especially at the inlet end thereof.

The end portion 7a of the cam may be made of the shape of the blades of a turbine, which further drives the liquid toward the periphery. The cam 7 is rotated by the tube 13 which is supported on bearings 14 and 15. Thus the blade portion 7A and the end portion of the tube 13 on which the cam is mounted will rotate with a turbine effect to drive the liquid to the inner periphery of the housing filling the space 16.

I further provide a supplementary conduit 23', preferably of relatively small section, which connects the zone of overpressure with the ordinary oil or analogous reservoir. This ensures an intensive circulation of the liquid in the casing.

Blades 24 may also be provided on the outer surface of the pump body and they further improve the cooling.

An orifice 25, of small cross section, may be provided in the push piece acting on cam 7, so as to deaden the oscillations produced by the reciprocating movement of this push piece. The rotation of the cam and revolving head is utilized for turbine action. One or more blades may be added on the periphery of the cam to enhance turbine action. The turbine action creates a suction effect at the center of the cam which draws fluid into the pump. This fluid is carried to the periphery of cam and accumulated under pressure in chamber 16. Thence, part of the fluid is expelled through port (or ports) 23'; another part of the fluid feeds the cylinders.

If the fluid at the periphery were not separated from the fluid arriving through tube 17 it would mix or circulate within the casing and thus lose its pressure. This would defeat the purpose of the invention which is to facilitate the intake of the fluid through tube 17 by suction and feeding of fluid to the cylinders under pressure. Screen D isolates feeding fluid, adjacent to the point of highest pressure (16), from the rest of the fluid in pump, so that the centrifugal pressure developed forces fluid through channels 18 into cylinders 1.

To avoid loss of charge when fluid is forced down through an annular groove 26, curved blades as shown in Figs. 2 and 3, may be provided to guide the fluid.

The suction force in the center of the swash plate (9) and the expulsion of part of the fluid through port or ports 23' is of great advantage since it insures a constant flow of fluid through the pump even after the swash plate is concentric, so that no pumping is effected. This circulation of liquid cools the pump which might otherwise become overheated, or retain sufficient heat in the fluid in the reservoir in case of aircraft where frequently the pump must operate under extreme cold.

The introduction of fluid under pressure into the channels leading to the cylinders facilitates restarting of the pump and makes it possible in some cases to omit spring 3.

In a general manner, while I have, in the above description, disclosed what I deem to be practical and efficient embodiments of the present invention, it should be well understood that I do

not wish to be limited thereto as there might be changes made in the arrangement, disposition and form of the parts without departing from the principle of the present invention as comprehended within the scope of the appended claims.

What I claim is:

1. A pump which comprises a pump casing, a plurality of cylinders arranged in circular series around the longitudinal axis of said casing in one portion thereof, a piston associated with each cylinder and extending into said casing, a revolving head journaled in the other portion of said casing, a cam carried by said revolving head and contacting the heads of said pistons, said cam being, at least in its normal position, inclined with respect to said axis, means for supplying fluid to the central portion of said casing at a point distant from the periphery thereof, a circular wall close to the periphery of said casing extending axially from a point adjacent said cam to the opposite end of said cylinders and forming a peripheral groove along the periphery of said casing, a conduit extending from each said cylinder to said groove and means to discharge fluid from said cylinders through at least one second discharge port in said casing.

2. A pump which comprises a pump casing, a plurality of cylinders arranged in circular series around the longitudinal axis of said casing in one portion of said casing, a piston associated with each cylinder and extending into said casing, a revolving head journaled in the other portion of said casing, a cam carried by said revolving head and contacting the heads of said pistons, said cam being, at least in its normal position, inclined with respect to said axis, means for supplying fluid to the central portion of said casing at a point distant from the periphery thereof, at least one discharge port in said casing adjacent said cam, a circular wall close to the periphery of said casing extending axially from a point adjacent said cam to the opposite end of said cylinders and forming a peripheral groove along the periphery of said casing, a conduit extending from each said cylinder to said groove and means to discharge fluid from said cylinders through at least one second discharge port in said casing.

3. A pump which comprises a pump casing, a plurality of cylinders arranged in circular series around the longitudinal axis of said casing in one portion of said casing, a piston associated with each cylinder and extending into said casing, a revolving head journaled in the other portion of said casing, a cam carried by said revolving head and contacting the heads of said pistons, said cam being, at least in its normal position, inclined with respect to said axis, means

for supplying fluid to the central portion of said casing at a point distant from the periphery thereof, a conduit extending between each of said cylinders and a point adjacent the periphery of said cam and means to discharge fluid from said cylinders.

4. A pump according to claim 3, in which said conduits are inclined in a direction opposed to the rotary flow of fluid engendered by the rotation of said cam.

5. In a device of the character described, the combination with a source of fluid of a series of fluid receiving chambers disposed in parallelism at equal distances from a common axis, booster means rotatable about said common axis for feeding fluid from said source to said chambers at a pressure greater than that at which the fluid is taken from said source, and a cam means in said chambers for increasing the pressure of said fluid while said cam remains in an eccentric position during rotation and for automatically stopping the increase of said fluid pressure when a predetermined maximum pressure forces said cam to be positioned in a concentric position during rotation.

6. In a device of the character described, the combination with a source of fluid of a series of fluid receiving chambers disposed in parallelism at equal distances from a common axis, booster means rotatable about said common axis for feeding fluid from said source to said chambers at a pressure greater than that at which the fluid is taken from said source, and means in said chambers for increasing the pressure of said fluid and means for automatically stopping the increase of said fluid pressure when a predetermined maximum pressure is attained.

7. A pump which comprises a pump casing, a plurality of cylinders arranged in circular series around the longitudinal axis of said casing in one portion thereof, a piston associated with each cylinder and extending into said casing, a revolving head journaled in another portion of said casing, a cam carried by said revolving head and contacting the heads of said pistons, said cam being, at least in its normal position, inclined with respect to said axis, means for supplying fluid to the central portion of said casing at a point distant from the periphery thereof, at least one discharge port in said casing adjacent said cam, further means to conduct part of said fluid from points adjacent the periphery of said cam to said cylinders, further means to discharge it therefrom through at least one second discharge port in said casing, and at least one blade secured to the periphery of said cam to increase its turbine action.

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