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FIG. 1

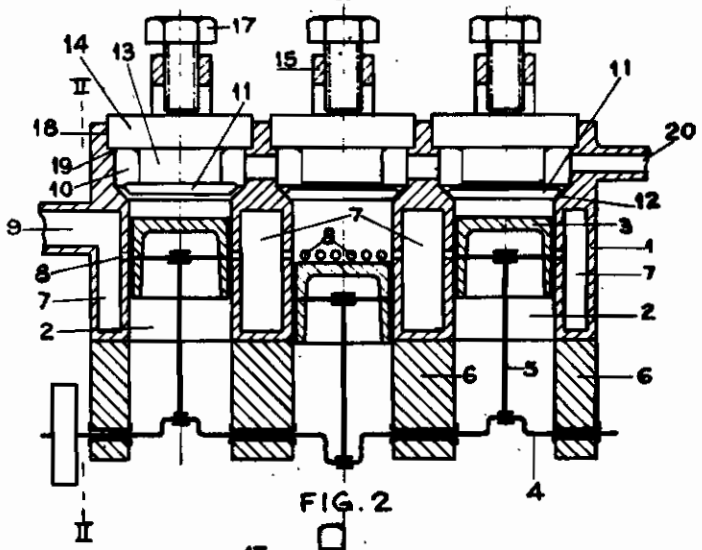


FIG. 2

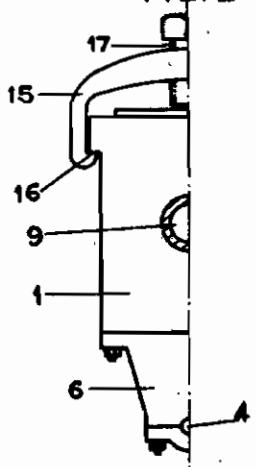
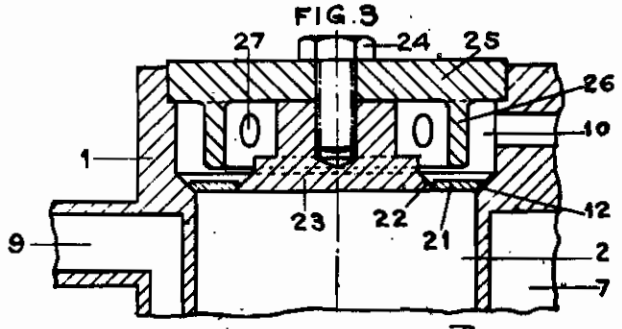


FIG. 3



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ALIEN PROPERTY CUSTODIAN

SINGLE ACTION HIGH SPEED MULTI-CYLINDER PUMPS

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vested in the Alien Property Custodian

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The present invention relates to single action high speed multi-cylinder alternating pumps for liquid and gaseous fluids.

The object of the present invention is to provide a pump of this kind which is better adapted to meet the requirements of practice than similar pumps used for the same purpose up to the present time.

According to an embodiment of the present invention, the pump includes a plurality of cylinders in each of which the fluid inlet ports are arranged in such manner as to be opened by the piston at the end of its admission stroke, and a valve forming the end wall of the cylinder and the diameter of which is equal or nearly equal to that of the cylinder controls the outflow of the fluid into an exhaust chamber common to all the cylinders or to a whole row of cylinders. This valve is so devised as to afford, for a relatively small lift thereof, a large section of flow, which reduces friction and gives a minimum loss of pressure. Furthermore, the valve in question is so devised and arranged as to reduce to a minimum or even to eliminate the piston clearance space.

According to another embodiment of the invention, the valve is of annular shape, the end wall of the cylinder being, in this case, made rigid with the cover of the exhaust chamber or with a fixed intermediate piece.

Preferably, a single crankshaft drives the whole of the pistons of the respective cylinders of the pump and said cylinders may constitute either a single row or a plurality of rows arranged in V-like or star-like fashion around the crankshaft.

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

Preferred embodiments of the present invention will be hereinafter described, with reference to the accompanying drawings, given merely by way of example, and in which:

Fig. 1 is a diagrammatic longitudinal sectional view of a pump made according to a first embodiment;

Fig. 2 shows one half of an end view of the pump, in section on the line II—II of Fig. 1;

Fig. 3 is a partial sectional view of a modification of the pump.

In the drawings, reference character 1 designates the pump body, including three cylinders 2, mounted in line so as to form a row. Each of these cylinders cooperates with a piston 3, and the three pistons are actuated by a crankshaft common to the three cylinders, with the interposition of connecting rods 5. The crankshaft is mounted in bearings provided in four supports 6 fixed to the pump body 1. As a matter of fact, these supports 6 may also be made rigid with the pump body. They can also be connected together by a small surrounding the bearings and the crankshaft, in such manner as to constitute a crankcase.

In the pump body 1, the inlet ports designated by reference character 8 open into a cavity 7 which constituted the tank of fluid to be pumped, for instance oil. Piston 3 opens these ports 8 when it comes to the end of its inlet stroke. Cavity 7 is constantly fed with oil through an aperture 9. In the case of an oil pump the crankshaft of which is located in a wholly closed crankcase, cavity 7 may be in communication with the inside of this crankcase, so that all the moving parts of the structure, such as the crankshaft, the connecting rods, the pistons, and also their joints and their bearings, are immersed in oil.

Above the row of cylinders 2, there is provided an exhaust chamber 10, common to the whole row of cylinders and into which said cylinders open directly.

Between this chamber and each cylinder, there is interposed a valve 11 which constitutes the whole of the end wall of the cylinder. This valve bears upon a seat 12. The lift of this valve is limited by an abutment 13 provided at the lower part of a plug 14. A stirrup-shaped part 15, engaged on the pump body 1 and 16 and provided with a pressure screw 17, keeps said plug 14 in position in a housing 18 provided in the upper wall of the exhaust chamber. This screw 17 makes it possible to apply this plug 14 against a shoulder 19, and the fluidtightness of the joint is insured through any suitable means either conventional or not.

Plug 14 is coaxial with cylinder 2. Its size is sufficient for permitting the insertion and removal of valve 11; and also of the corresponding piston 3.

The weight of valve 11 may be sufficient for bringing it back onto its seat after the outflow of oil or any other fluid from the cylinder. However, a spring may be interposed between valve 11 and abutment 13. For instance, this spring may be a spiral spring housed in a corresponding recess provided in abutment 13 and plug 14. The use of a return device such as a spring may in particular be contemplated when, as a consequence of its position or of other local circum-

stances, the valve has a tendency not to come back onto its seat as exactly and quickly as it may be desirable.

The fluid driven by the pistons into the exhaust chamber 10 escaped from said chamber through a pipe 20, adapted to lead it to the place where it is to be employed.

The lateral walls of the exhaust chamber may, as illustrated by the drawing, be made integral with the pump body 1, but this arrangement is not necessary.

Owing to the features which have just been described, the pump includes a very limited number of mechanical parts in movement. During the inlet stroke of each piston, there is formed, between said piston and the corresponding valve a vacuum which, however, is not complete, due to unavoidable leakage, and which, as soon as ports 6 are uncovered by the piston, produces an inflow of the fluid to be pumped into the cylinder, at a very high speed. The length of the connecting rods may be such that the working face of each piston comes as near as it is desired to the position of rest of the under face of the corresponding valve. The upper position of said working face may even be caused to coincide with this position, which practically eliminated the clearance space.

As the valves are of a diameter as large as possible, a very small lifting movement thereof is sufficient for affording a very large section of flow for the escaping fluid, whereby the exhaust takes with minimum friction and practically without loss of pressure.

For all these reasons, the pump according to my invention is especially well adapted to work at high speed and under high pressure, with a very satisfactory efficiency.

In the modification illustrated by Fig. 3, valve 21 is given the shape of an annulus of relatively small width. The seat of this valve is constituted by a conical surface 12 provided in the pump body as in the embodiment just above described and by another conical surface 22 provided in a head 23 fixed by means of a screw 24 coaxially with the plug which closes the exhaust chamber 10, in such manner that it is possible to arrange valve 21 between head 23 and plug 24 before their assembly.

Fluidtight contact between plug 25 and the pump body 1 is ensured through any suitable means. The assembly of head 23 and plug 25 is preferably effected in such manner as to permit of adjusting the height of said head by modification of the position thereof with respect to the plug.

Plug 25 is provided with an annular abutment 26 which limits the lifting movement of the valve, said abutment being provided with apertures 27 which permit free circulation of the fluid through the exhaust chamber 10.

In the preceding description, it has been supposed, by way of example, that the pump is an oil pump, but the invention can be applied to all fluids, both gaseous and liquid. It goes without saying that, in the case of a compressible fluid, the vacuum that is formed in the cylinders during the admission stroke is not so complete as in the case of a fluid which is not compressible, since any amount of this fluid as may remain in a cylinder after the closing of the valve then expands as the piston is moving away from said valve.

When the fluid to be compressed becomes heated, it suffices to apply cooling means of any suitable type.

Of course, the above described examples have no limitative character and apparatus can be devised which differ from these embodiments while remaining within the scope of the invention.

In particular, a single crankshaft can be used for driving the pistons of several cylinders distributed into a plurality of rows arranged in V-like or star-like fashion about the axis of said crankshaft. Such an arrangement is particularly well adapted to a good balancing of the stresses and of the moments of the moving masses.

On the other hand, it should be noted that the valves shown by the drawings are not provided with special guiding means. As a matter of fact, experience has taught that valves arranged in this manner work perfectly well without the addition of such means. However, this does not exclude the possibility of guiding the valves through any suitable means, when necessary.

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