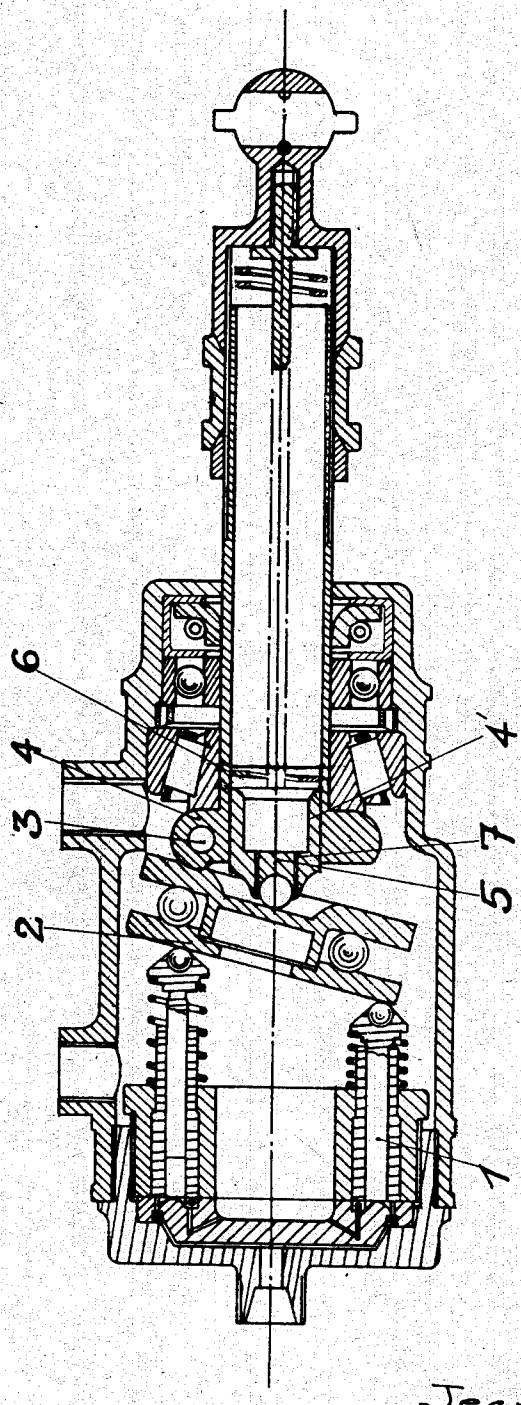
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PUMP

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PUMP

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The present invention relates to pumps of the type generally designated wabble plate pumps, each such pump comprising a plurality of pistons arranged in a circular series with their axes disposed in parallelism, the movements of all pistons of the series being controlled and effected by means of a single cam, the series of pistons and the cam being relatively rotatable about a common axis, which is the axis of the pump.

The single cam is itself pivotally mounted for rocking movement upon a cam-supporting member, which member may be driven to effect rotation of the cam and operation of the pump. The cam is pivotally mounted about an axis disposed in a plane perpendicular to the pump axis and the oscillations or rocking movements of the cam about this axis, in different directions of rotation, are produced by two different means, the resultant of the reactions of the pistons due to back pressure of the delivered liquid on the pistons tending to move the cam into a plane normal to the pump axis, and means being provided for resisting with a substantially constant force rocking movement of the cam produced by increase in the resultant pressure exerted on the cam by the pistons and for rocking said cam in the reverse direction when said resultant pressure of the pistons decreases, the force delivered by said means being imparted to the cam by a pusher or piston-like member positioned on the axis of the pump and mounted for movement along said axis. This pusher or piston-like member may be actuated by hand from outside the pump as well as being normally operative in an automatic manner.

The arrangement thus generally described makes possible the construction of a pump and pressure regulator of efficient type which is very small in size. The fluid delivered by the pump is intended to be transmitted to some fluid pressure operated apparatus and, when the effect of such apparatus is such that the pressure upon the pistons of the pump is increased, these parallel pistons act against the cam with increased force so that the cam is rocked about its pivotal axis, overcoming the action of the means provided for resisting such rocking movement with a substantially constant force. If the resultant of the pressures of the several pistons becomes sufficiently great the cam may be rocked until it is disposed in a plane approximately perpendicular to the axis of the pump. In this extreme position, when the cam is perpendicular to the axis the reciprocatory movements of the pistons are stopped and the pump ceases to deliver liquid.

Pumps of this general type heretofore employed have been found to have certain disadvantages which are chiefly due to the fact that the cam has a tendency to occupy a position in which its plane is normal or perpendicular to the pump axis. When the cam becomes so disposed the yielding means acting against the pusher or piston-like element is compressed and in turn the increase in compression of the spring causes the piston-like element to more strongly bear against the cam.

The principal object of the present invention is to obviate these disturbances. The improved pump is so designed that the contact point between the pusher or piston-like element and the cam travels a relatively short distance even when there is a relatively great angular movement of the cam about its pivotal axis. As the device for yieldably resisting rocking movement of the cam acts at a point relatively close to the pivotal axis of the cam, the spring which constitutes the yielding resistance element of the device, may be very light in weight. The pump of the present invention is characterized in that the pivotal axis about which the cam may rock is disposed in a plane normal to the pump axis and tangent to a circle in said plane which is centered on said pump axis, the radius of said circle being less than the radius of a cylinder which includes the piston axes.

In the accompanying drawing one embodiment of the invention is illustrated, this embodiment being set forth solely by way of example.

In the drawing the several pistons are indicated by the numerals 1 and these pistons are controlled by a cam indicated at 2, pivotally mounted at 3 upon the adjacent end of tubular member 4 which member may also be utilized to drive the cam. Upon that side of the cam remote from the pistons is positioned a pusher or piston-like element 5 which is acted upon by a helical spring 6 and normally urged thereby toward the cam. Each piston is reciprocable within a cylinder, as previously stated, and the inlet, and outlet ports of each cylinder are at that end thereof remote from the head of the associated piston.

Relative rotation of the cam 2 and the tubular member 4 upon which it is mounted, and the circular series of pistons, can be effected by any suitable motor and in the form of the invention illustrated it is more convenient to apply a driving force to the tubular member 4, which is mounted for free rotation in anti-friction bearings as shown. It is evident that the length of stroke of each piston 1 is determined by the inclination of the cam 2 relative to the pump axis and that the inclination of the cam depends upon the magnitude of the forces developed by the pistons acting against one side thereof and that of the yielding means which includes the piston-like device 5 and the elongated spring 6, acting against the opposite side thereof. The inclination of the cam may be adjusted from outside, at any time and without disassembling the pump, by manually or otherwise adjusting

member 4' axially of the tube 4, the member 4' comprising both a closure for the outer end of the tube and an adjustable abutment for the outer end of the spring 6. As previously stated, the axis of the pivot 3 which connects the enlarged end of tubular member 4 to the cam is disposed closer to the pump axis than are the axes of the several pistons 1, the axis of pivot 3 being preferably as close as possible to the pump axis. This arrangement is highly advantageous In the first place, it insures improved pump operation, as compared with previous pumps of this general type and, in addition, it permits a better distribution of the stresses in the pump and also permits the use of a much lighter spring than would otherwise be required.

According to a further feature of the invention the pusher or piston-like element 5 is provided with one or more apertures or channels 7 connecting the space within the tubular member 4 with the space within the housing which encloses the cam and pistons. The pusher or piston-like member 5, therefore, operates as a dash pot and serves to dampen vibration of the cam 2, the dash pot or vibration damping action of member 5 being particularly helpful when the pump includes but a relatively small number of pistons, in which case the force applied against the cam will fluctuate.

Obviously the invention is not limited to the embodiment described and illustrated, which embodiment has been set forth by way of example only.

Having thus described the invention, what is claimed as new and desired to be secured by Letters Patent is:

1. In a wabble plate pump, in combination, a plurality of pump cylinders disposed in a circular series about, and substantially equidistantly from, a pump axis, each cylinder having an associated piston and the several pistons being disposed in parallel relationship to each other and to said axis, a cam disposed transversely of said axis and so as to engage and act upon the heads of the said pistons, a cam supporting member disposed adjacent said cam, said member and said series of cylinders being relatively revoluble about said axis, means pivotally connecting said member and cam whereby the cam and member are constrained to rotate together and the cam is supported for rocking movement about an axis disposed in a plane normal to said pump axis and tangent to a circle in said plane which is centered on said pump axis, the radius of said circle being less than the radius of a cylinder which includes the piston axes, and means for resisting with a substantially constant force rocking movement of the cam produced by increase in the resultant pressure exerted on the cam by the pistons, and for rocking said cam in the reverse direction when said resultant pressure of the pistons decreases.

2. In a wabble plate pump, in combination, a plurality of pump cylinders disposed in a circular series about, and substantially equidistantly from, a pump axis, each cylinder having an associated piston and the several pistons being disposed in parallel relationship to each other and to said axis, a cam disposed transversely of said axis and so as to engage and act upon the heads of the said pistons, an elongated tubular member the axis of which is coincident with the pump axis and one end of which is adjacent said cam, said member being rotatable about said axis, means pivotally connecting said member and cam whereby the cam and member are constrained to rotate together and the cam is supported for rocking movement about an axis disposed in a plane normal to said pump axis and tangent to a circle in said plane which is centered on said pump axis, the radius of said circle being less than the radius of a cylinder which includes the piston axes, and means disposed within and carried by said elongated tubular member for resisting with a substantially constant force rocking movement of the cam produced by increase in the resultant pressure exerted on the cam by the pistons, and for rocking said cam in the reverse direction when said resultant pressure of the pistons decreases.

3. In a wabble plate pump, in combination, a plurality of pump cylinders disposed in a circular series about, and substantially equidistantly from, a pump axis, each cylinder having an associated piston and the several pistons being disposed in parallel relationship to each other and to said axis, a cam disposed transversely of said axis and so as to engage and act upon the heads of the said pistons, a cam supporting member disposed adjacent said cam, said member and said series of cylinders being relatively revoluble about said axis, means pivotally connecting said member and cam whereby the member and cam are constrained to rotate together and the cam is supported for rocking movement about an axis disposed in a plane normal to the pump axis and spaced laterally of said pump axis, and means including a dash pot mounted on said member for resisting, with a yieldably resisting force, rocking movement of the cam produced by increase in the resultant pressure exerted on the cam by the pistons, and for rocking said cam in the reverse direction when said resultant pressure of the pistons decreases.

4. In a wabble plate pump, in combination, a plurality of pump cylinders disposed in a circular series about, and substantially equidistantly from, a pump axis, each cylinder having an associated piston and the several pistons being disposed in parallel relationship to each other and to said axis, a cam disposed transversely of said axis and so as to engage and act upon the heads of the said pistons, an elongated tubular member the axis of which is coincident with the pump axis and one end of which is adjacent said cam, said member and the series of pump cylinders being relatively rotatable about the pump axis, means pivotally connecting the cam to the adjacent end of said tubular member whereby the cam and member are constrained to rotate together and the cam is supported for rocking movement about an axis disposed in a plane normal to the pump axis and spaced laterally of said pump axis, a closure for that end of the tubular member which is remote from the cam, and means disposed within said tubular member for resisting, with a substantially constant force, rocking movement of the cam produced by increase in the resultant pressure exerted on the cam by the pistons and for rocking said cam in the reverse direction when said resultant pressure of the pistons decreases, said last mentioned means including an apertured piston-like element slidably fitting within that end of the tubular member adjacent the cam and comprising with the tubular member and its closure a dash pot, and a spring within said tubular member one end of which bears against said piston-like element and the other against said closure.

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