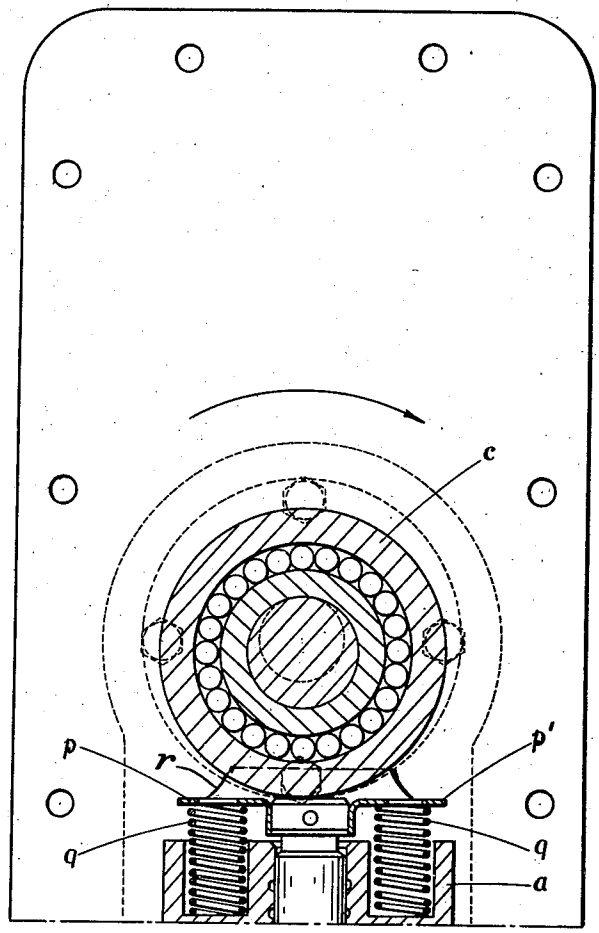
Oct. 22, 1940. J. M. TOWLER ET AL 2,218,927

RECIPROCATING RAM PUMP

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Fig. 1.



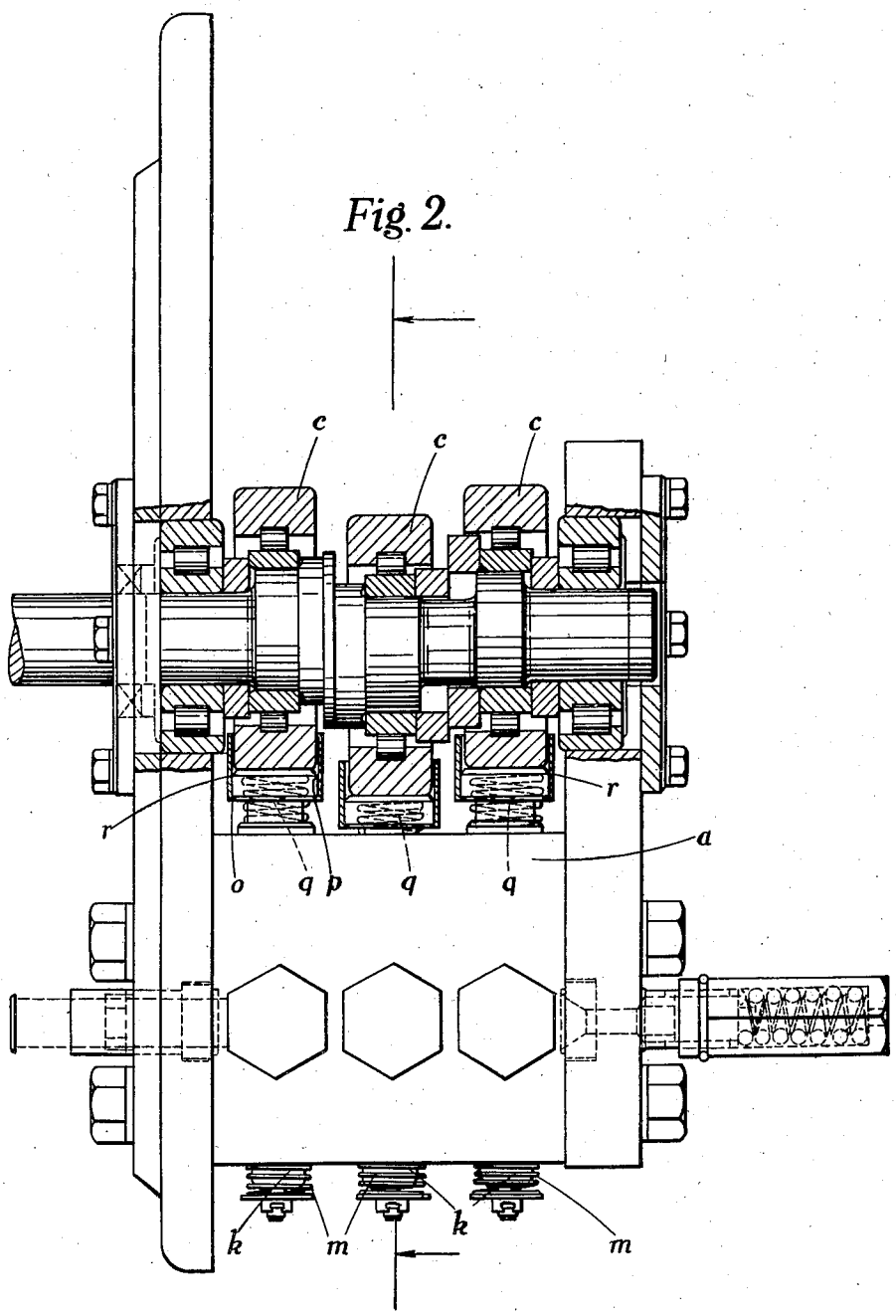
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Fig. 2.



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RECIPROCATING RAM PUMP

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Application July 23, 1938, Serial No. 220,968
In Great Britain March 19, 1937

3 Claims. (Cl. 74—50)

This invention is concerned essentially with reciprocating ram pumps of the kind having a plurality of independent rams and in which the discharge stroke is imparted to each ram by means comprising a ball or roller bearing for each ram mounted directly upon a circular eccentric portion of a driving shaft, the outer ring of said bearing contacting with the outer end of the ram.

In pumps of the above type the outer ring of the ball or roller bearing rolls across the face of the ram end due to the eccentric motion of the circular eccentric portion on which it is mounted and such motion in time causes the ram end to become slightly concave through wear. This concavity of the ram end may also, through wear, cause the outer surface or periphery of the outer ring of the eccentrically mounted bearing to become cambered.

We have discovered that wear on the ram end and on the periphery of the outer ring of the bearing may, to a very large extent, be obviated in pumps of the kind specified above by preventing the rams from turning or rotating and this prevention of rotation in pumps having independent rams therefore constitutes the primary feature of the present invention.

We have also discovered that by preventing the rams from turning or rotating we are also enabled to counteract offset loads on the rams. In pumps of the type with which this invention is concerned the rams are liable to be subjected to two sets of offset loads, one set acting in a direction substantially parallel to the axis of the eccentric shaft and produced by misalignment between the ram and the eccentric bearing and the other set acting substantially at right angles to the first load and produced by the movement of the eccentric bearing across and in contact with the end of the ram.

The first of the abovementioned offset loads may be partially or wholly counteracted by cambering either the periphery of the outer ring of each eccentrically mounted bearing or the contacting ram end. If such cambering is resorted to without also preventing the rams from turning, such turning will destroy the line contact between the ram end and the surface of the ball or roller bearing in the same way as such line contact is destroyed by the turning of a ram the end of which has become concave through wear.

To reduce the offset load due to the eccentric motion of the bearing, the axis of the eccentric shaft is offset to one side of the axes of the rams so that throughout each discharge stroke the eccentric bearing makes contact with its ram at a point as close as possible to the central axis of the ram. By this means the offset load on the ram during each discharge stroke is greatly reduced. Offset load on the return or suction stroke is, of course, unimportant and may be neglected.

Alternatively the offset load due to the above cause may be reduced by suitably sloping the ram end.

The present invention contemplates the use of any suitable means for preventing the rams from rotating. For example each ram end may be provided with a cross head having spaced flanges to engage the sides of an associated ball or roller bearing. Or a groove or slot may be cut across each ram end of slightly greater width than the bearing and of such a depth that its sides reside on opposite sides of the associated bearing. Turning of the rams may also be prevented by making the ends of the rams square or providing the rams with opposing and abutting flat faces.

In order that the invention may be clearly understood and carried into effect one embodiment of the same will now be described, by way of example, by aid of the accompanying drawings in which:

Fig. 1 is a part transverse section through a portion of a pump showing the use of a light metal crosshead on the ram for preventing the same from turning and an offset eccentric shaft to counteract offset loads due to the eccentric motion of the bearing.

Fig. 2 is a similar view of a complete pump taken at right angles to Fig. 1.

In the example illustrated in Figs. 1 and 2 of the drawings the rams are prevented from rotating by providing each ram end with a light metal cross head *p*. Each crosshead is pinned or otherwise secured to the outer end of its ram and is formed or otherwise provided with lateral wings *p'* to form bearers for the ram return springs *q* and spaced flanges *r* to engage the sides of the eccentric ring *c*. The convexity of the ram ends or surfaces of the outer rings of the eccentric bearings being in the region of a few thousandths of an inch only, is incapable of being illustrated.

In lieu of the crosshead illustrated in Figs. 1 and 2, the rotation of the rams may be prevented by cutting a groove or slot across each ram end of slightly greater width than the outer ring of the eccentric bearing *c* and of such a depth that the sides of the groove or slot reside on either

side of the eccentric ring and thus prevent the ram from rotating.

A similar result may be obtained by making the ends of the rams square, one face thereof either engaging a flat guide surface attached to the pump body, or in the case of a multi-ram pump, engaging the corresponding face of the adjacent ram end and so on throughout the series of rams.

To reduce offset load due to misalignment between the rams and the eccentric bearings the ends of the rams or the peripheries of the outer rings of the bearings may be cambered or made convex such cambering or convexity being very slight, for example, in the region of a few thousandths of an inch so that the line of contact between the ram end and the contacting surface of the outer ring of the associated bearing is not seriously reduced. This will also reduce wear on the contacting surfaces.

The offset load on the discharge stroke due to the eccentric motion of the eccentric bearings as they move across and in contact with the ram ends may be rendered almost negligible by offsetting the eccentric shaft in relation to the rams so that their respective axes are out of alignment in the manner illustrated in Fig. 1, of the drawings.

If this offsetting is effected in proper relation to the direction of rotation of the eccentric shaft the thrust of each eccentric on its ram will take place on or very close to the axial centre of the ram throughout each discharge stroke and in consequence any offset load there may be is reduced to such an extent as to be almost negligible. With such offsetting it is, of course, necessary that the eccentric shaft shall always be rotated in one direction. The amount of offset may be equivalent to half the throw of the eccentric on one side of the centre line of the ram when looking at the end of the eccentric shaft.

The improvements herein described may, with advantage, be incorporated in a pump according to our co-pending application No. 146,038.

What we claim is:

1. In a pump assembly, a casing having a plurality of bores, rams reciprocable in said bores for pumping fluid through said casing, each of said rams having a cambered end, a series of eccentrics, each of which contacts the cambered end of a ram, a rotatable shaft mounting said eccentrics, a cross-head mounted on each ram adjacent the cambered end thereof, wings extending laterally of said cross-heads and compression springs mounted in said casing laterally of the axis of the respective rams and bearing against said wings, the springs associated with the respective rams being compressible as the latter are displaced in their discharge stroke by the cooperating eccentrics, and being expansible for returning the ram to original position after each discharge stroke.

2. In a pump assembly, a casing having a plurality of bores, rams reciprocable in said bores for pumping fluid through said casing, each of said rams having a cambered end, a series of eccentrics, each of which contacts the cambered end of a ram, a rotatable shaft mounting said eccentrics, a cross-head mounted on each ram adjacent the cambered end thereof, flanges on said cross-heads engageable with the opposite sides of the eccentrics opposing the ram carrying the same, wings extending laterally of said cross-heads and compression springs mounted in said casing laterally of the axis of each of the respective rams and bearing against said wings, the springs associated with the respective rams being compressible as the latter are displaced in their discharge stroke by the cooperating eccentrics, and being expansible for returning the ram to original position after each discharge stroke.

3. In a pump assembly, a casing having a fluid chamber and inlet and discharge ports leading therefrom, a series of bores, rams reciprocable in said bores, each of said rams having a cambered contact end, a rotatable shaft having a series of spaced eccentrics, each of which contacts the cambered end of an opposing ram for driving the same, a pair of springs mounted on the casing laterally of the axis of each ram and diametrically opposite to one another with respect to said ram axis, a cross-head mounted on each ram adjacent the cambered end thereof, said cross-head having flanges engageable with the opposite sides of the eccentric opposing the ram carrying the same and having wings extending laterally and engageable with the springs associated with each ram, said springs being compressible against the casing by the wings of the cross-heads as the rams are displaced in their discharge stroke by their associated eccentrics, and being expansible against the cross-head for displacing the ram carrying the same after each discharge stroke.

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