

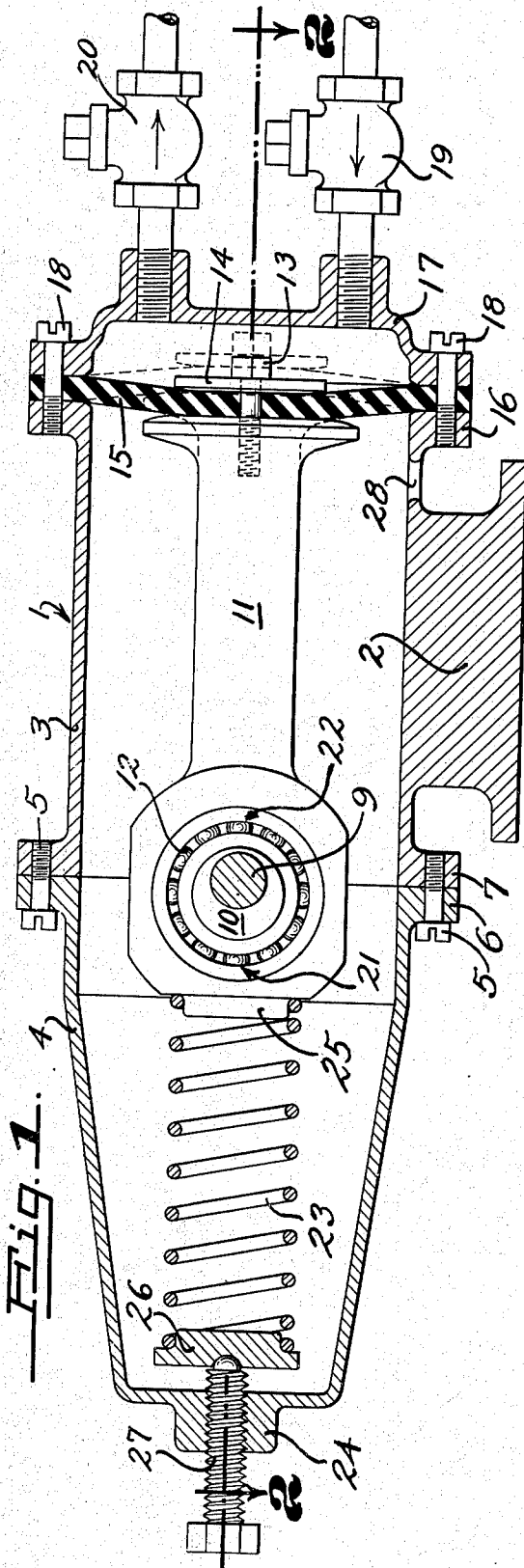
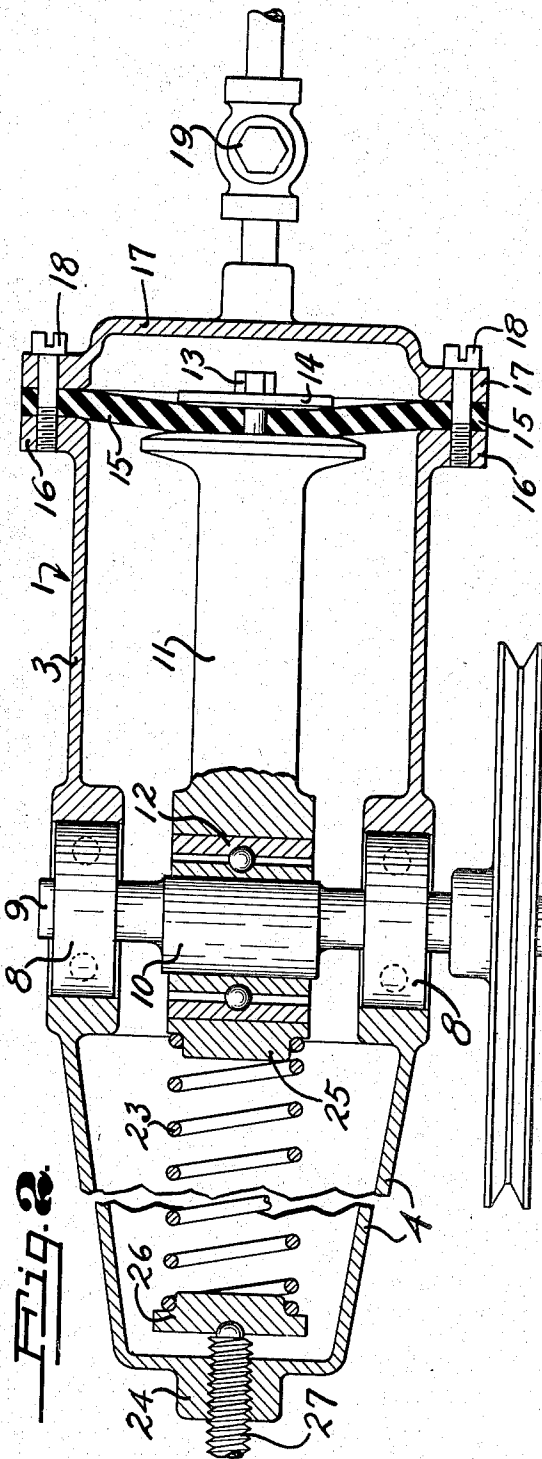
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DIAPHRAGM PUMP

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DIAPHRAGM PUMP

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The present invention relates to improvements in diaphragm pumps, and its principal object is to provide means for equalizing or balancing pressures active on the bearings for driving the pump so as to evenly divide stresses between power and suction strokes.

Diaphragm pumps have certain advantages for pumping a uniform amount of water, or other fluid, at a relatively fast speed of say, five hundred revolutions per minute and a rather short stroke, possibly three-sixteenths of an inch. This gives the pump many rapid pulsations with corresponding changes in direction in the flow of water, which sets up a resistance that is difficult for a bearing to cope with.

It is proposed therefore, in the present invention, to add a spring to the reverse side of the bearing, such spring to be placed under tension during the suction stroke of the pump, and to be released during the power stroke for aiding in the latter, whereby the pressures on the bearing are substantially evenly divided between pressure and suction strokes.

For the purposes of our invention, the pressure absorbed by the spring on the suction stroke of the pump, should not only be equal to substantially one-half of the pressure used on the power stroke, but additionally it should be sufficient to compensate for the so-called shock load inherent in power necessary to overcome the forces of inertia on the change in direction.

It is further proposed, therefore, to provide a spring of the character described, which is adapted to absorb substantially one-half of the pressures used on the power stroke and inherent in shock load.

Further objects and advantages of our invention will appear as the specification proceeds, and the novel features thereof will be fully set forth in the claims hereto appended.

The preferred form of our invention is illustrated in the accompanying drawing, in which:

Figure 1 shows a vertical section through our pump, and

Figure 2, a horizontal section taken along line 2-2 of Figure 1.

While we have shown only the preferred form of our invention, we wish to have it understood that various changes or modifications may be made within the scope of the claims hereto attached without departing from the spirit of the invention.

Referring to the drawing in detail, we show a substantially conventional diaphragm pump 1 comprising a base 2, a cylindrical housing 3 sup-

ported thereon and a tapered housing section 4 attached to the main housing by means of bolts 5 passing through registering flanges 6 and 7.

At the juncture between the housing sections 3 and 4 bearings 8 are provided for the transverse shaft 9 which has a cam 10 located centrally with respect to the housing.

A connecting rod 11 has one end revolvably mounted upon the cam 10, preferably through interposed bearings 12, and the other end of the connecting rod is secured, by any suitable means, such as the bolt 13 and washer 14, upon a diaphragm 15 secured to the end of the housing 3 between a flange 16 on the latter and a pump head 17, by means of bolts 18.

The pump head 17 forms a pump chamber with the diaphragm and is provided with suitable intake and delivery valves 19 and 20.

This pump is intended to operate at high speed, and it is apparent that in normal operation, the bearing 12 interposed between the cam 10 and the connecting rod is subjected to unequal pressures on the suction stroke and the power stroke. The pressure on the suction stroke bearing on the outer section of the bearing indicated at 21 will be comparatively light, whereas the pressure exerted on the inner section 22 of the bearing is relatively strong.

In actual operation, it happens, therefore, that the bearing at 22 wears out much faster than at the opposite side, whereby the life of the bearing is shortened, and the operation of the pump is rendered less efficient.

To overcome this defect, we have thought of substituting a larger bearing, but we found that this not only involves a great deal of more expense, but it makes the arrangement more cumbersome, and sets up considerable vibration.

We prefer, therefore, to effect a balancing of the pressures about the bearing during suction and power strokes, and to thereby give to the pump a smooth and velvety action. This we accomplish by providing a spring 23 between the extreme end of the connecting rod engaging the cam and the end 24 of the tapered section of the housing, the spring being in alignment with the connecting rod and being tensioned to oppose the suction stroke and to aid the compression stroke.

The spring may be mounted in any suitable manner and is here shown as being seated, at one end, around a projection 25, rising from the connecting rod and, at the other end, on a suitable base 26, bearing against screw 27, threaded into the end 24 of section 4.

The tension of the spring 23 may be adjusted by turning the screw 27, and should preferably be such as to substantially absorb one-half of the differential in pressure between the suction and power strokes, so as to substantially balance the pressures on the bearing.

For this purpose, the spring should absorb somewhat more than one-half of the actual pump pressure to take care of additional pressure produced by or inherent in the reversal of movement of the connecting rod.

For instance, when the pump is pumping at a pressure equal of, say; one hundred pounds to the square inch, the spring should be loaded to a pressure of at least fifty pounds, and possibly to seventy-five pounds. The addition of twenty-five pounds would be intended to take up part of the so-called shock load inherent in the reversal in direction of the connecting rod.

As a general rule, we would consider that the spring should carry possibly three-fourths of the static pressure against the diaphragm side of the pump.

The pump housing, as shown, is preferably made in two separable sections for facilitating the assembling of the pump and the spring, and a drain hole 28 is provided near the diaphragm to prevent water from reaching the bearing in case of leaks.

The operation and advantages of the invention will be readily understood from the foregoing description:

On the suction stroke the cam 10 bearing on the portion 21 of the bearing places the spring 23 under tension, and this tension is released when the cam 10 begins the compression stroke, so that during the latter, the spring 23 assumes part of the burden and thereby relieves the section 22 of the bearing to a corresponding degree.

Thus both sides of the bearing will substantially carry the same load and no portion of the bearing will be subjected to excessive wear.

The action of the pump itself is much improved, and becomes smooth and velvety, insuring better and more perfect operation and longer life.

We claim:

1. In a diaphragm pump, a housing having a diaphragm supported in one end thereof, a rotary shaft transversely supported in an intermediate section of a housing and having a cam thereon, an abutment in the other end of the housing, a connecting rod having one end connected to the diaphragm and having an annular bearing on the other end fitted over the cam to gyrate therewith when the cam is rotated for reciprocating the diaphragm, a seat formed on the extreme bearing end of the connecting rod opposite the diaphragm, and a spring having its outer end bearing on the abutment and its inner end bearing on the seat to gyrate with the bearing, the spring serving to equalize pressures on the bearing during compression and suction

strokes and the seat having means for holding the spring end against lateral slipping.

2. In a diaphragm pump, a housing having a diaphragm supported in one end thereof, a rotary shaft transversely supported in an intermediate section of the housing and having a cam thereon, an abutment in the other end of the housing, a connecting rod having one end connected to the diaphragm and having an annular bearing on the other end fitted over the cam to gyrate therewith when the cam is rotated for reciprocating the diaphragm, a seat formed on the extreme bearing end of the connecting rod opposite the diaphragm, and a spring having its outer end bearing on the abutment and its inner end bearing on the seat to gyrate with the bearing, the spring serving to equalize pressures on the bearing during compression and suction strokes, the abutment having means for adjusting the position thereof whereby the tension of the spring may be adjusted and the seat having means for holding the end of the spring against lateral slipping.

3. In a diaphragm pump, a housing having a diaphragm supported in one end thereof, a rotary shaft transversely supported in an intermediate section of the housing and having a cam thereon, an abutment in the other end of the housing, a connecting rod having one end connected to the diaphragm and having an annular bearing on the other end fitted over the cam to gyrate therewith when the cam is rotated for reciprocating the diaphragm, a seat formed on the extreme bearing end of the connecting rod opposite the diaphragm, and a spring having its outer end bearing on the abutment and its inner end bearing on the seat to gyrate with the bearing, the spring serving to equalize pressures on the bearing during compression and suction strokes, the seat having means for holding the end of the spring against lateral slipping and the housing being split transversely in two sections of substantially equal length joined together at the location of the shaft for facilitating the assembling of the pump.

4. A connecting rod for a pump or the like comprising a shank, an annular bearing on one end thereof, an annular, flat seat formed upon the latter end outside the bearing and in a plane at a right angle to the shank, and a central cylindrical projection rising from the end of the shank inside of the seat for defining the inner limit thereof.

5. In combination, a connecting rod for a pump or the like comprising a shank having an annular bearing on one end thereof and having a seat formed upon said end, means for revolving the bearing whereby the end of the shank is made to gyrate, an abutment opposite the seat and a spring mounted between the seat and the abutment and made to gyrate with the shank end for balancing pressures active on the connecting rod.

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