Nov. 2, 1965 E. ORSHANSKY, JR 3,215,081

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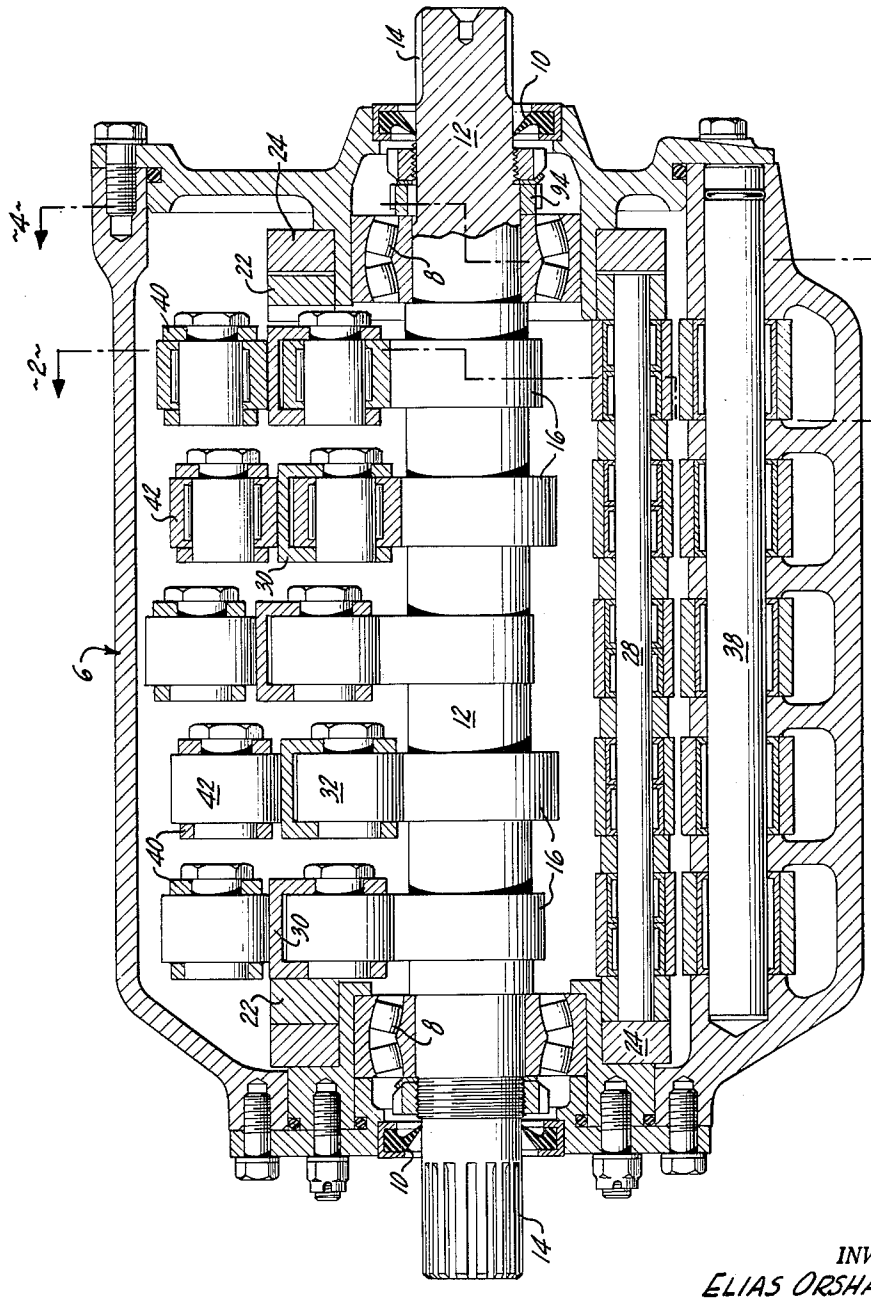


FIG. 1

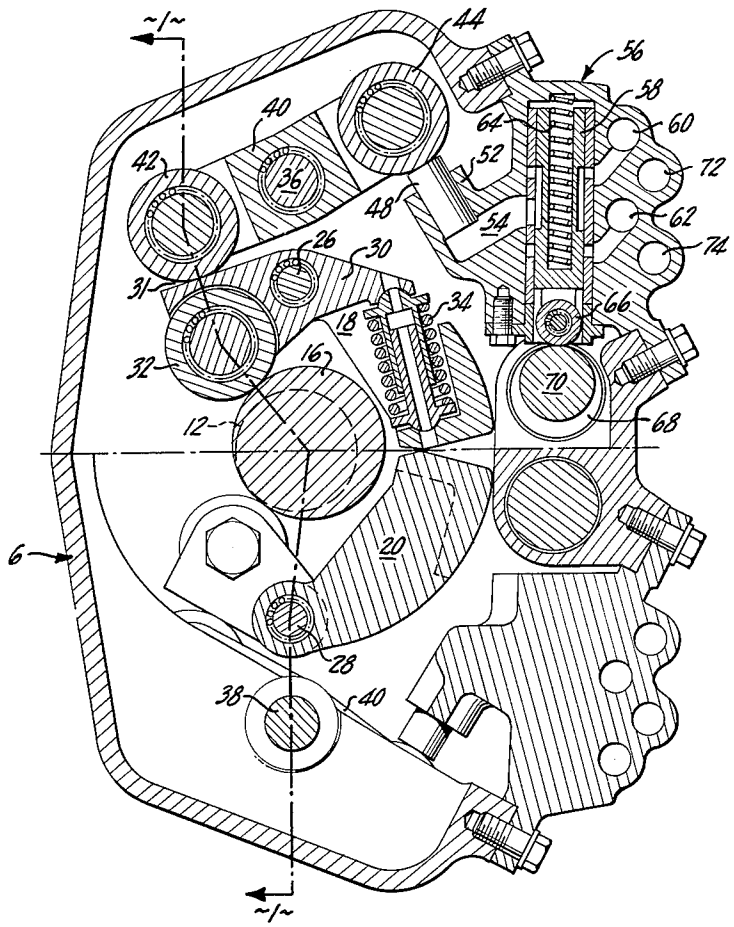
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Fig. 2



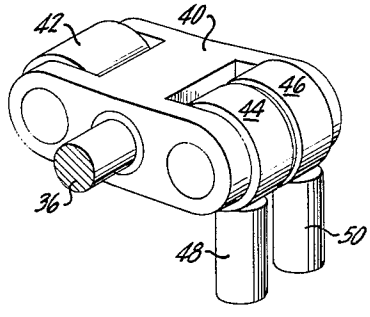


Fig. 3

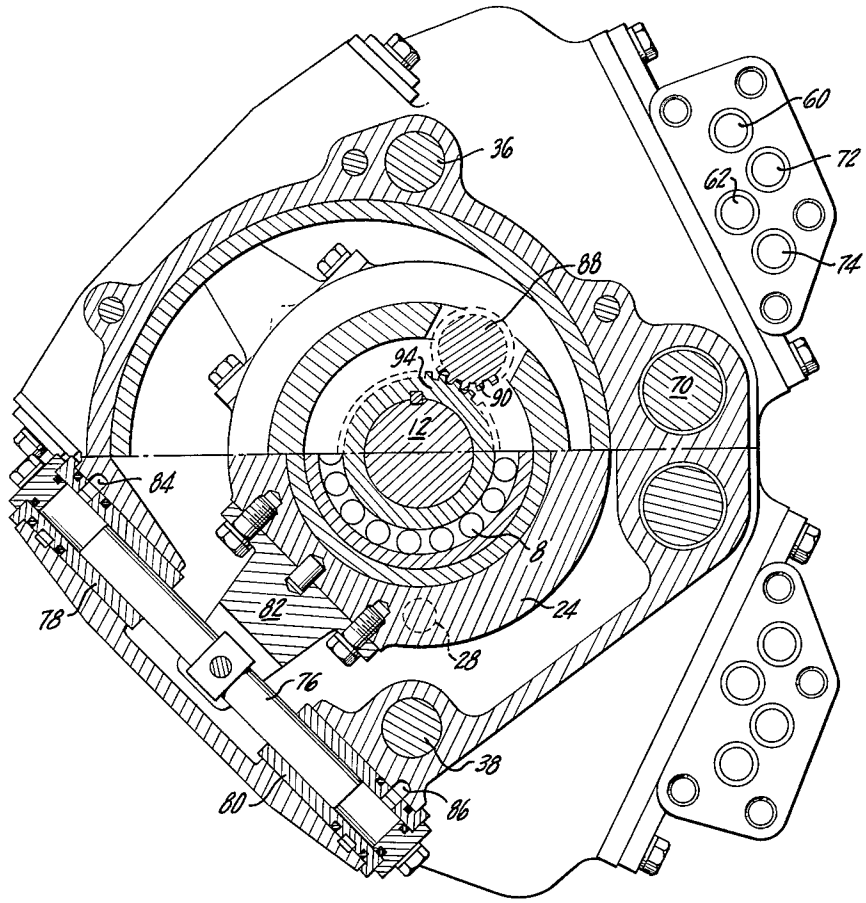
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Fig. 4



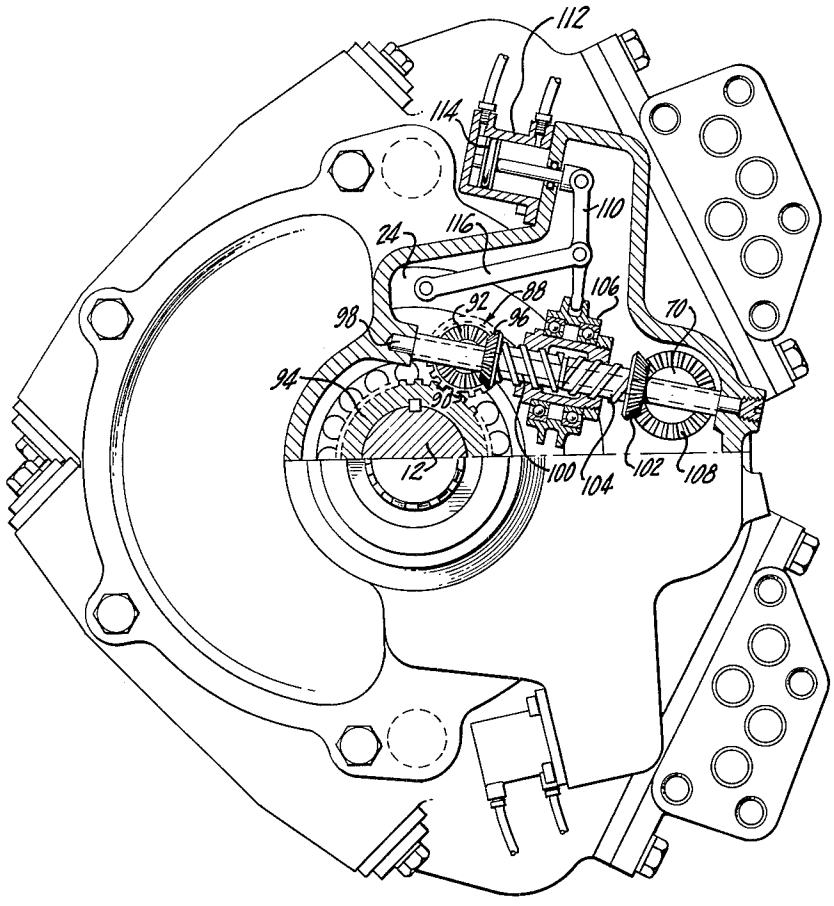
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Fig. 5



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Filed June 26, 1962, Ser. No. 205,432
6 Claims. (Cl. 103—38)

This invention relates to a pump and more particularly relates to a pump suitable for supplying fluid under pressure to the wheel motors of a heavy-duty vehicle, as well as supplying pressurized fluid for actuating various hydraulic equipment on a vehicle.

The pump of the present invention is reversible so that the lines leading to the pump can become pressure or suction lines. Further, the pump is capable of acting as a motor so that the driving engine can be started by pushing the vehicle.

Although the pump of the present invention can be made in various forms, in a preferred embodiment which will be described the pump divides the flow into four channels, one of which can be used for each wheel in a four-wheel vehicle, or for each pair of wheels in eight-wheel drive vehicles. By dividing the flow in this manner, power loss is prevented should one or more of the wheels lose traction or should there be a failure in the lines leading to one or more of the motors. Thus, the pump of the present invention actually acts as four individual pumps.

The four channels of flow are grouped in pairs so that either two channels can be controlled independently of the other two. This is done so that steering may be accomplished in the case of track-laying vehicles and also so that part of the power may be used for operating auxiliary equipment without disturbing the other two channels of the pump output.

Since the flow can be reversed, as well as controlled, in various lines, the motors require no reversing valves, flow dividers or gearing. Further, as will be later apparent, the volume of the pump is variable independently of the speed of the pump, so that varying needs of the motors can be met from a standing start to high speed operation.

In the drawings which form a part of this application:

FIGURE 1 is a sectional view of a pump embodying the present invention on the line 1—1 of FIGURE 2.

FIGURE 2 is a sectional view of the pump on the line 2—2 of FIGURE 1.

FIGURE 3 is an enlarged partial perspective view of a piston drive lever and the associated pistons.

FIGURE 4 is a sectional view taken approximately on the line 4—4 of FIGURE 1.

FIGURE 5 is an end view partially in section showing the method of driving the valve timing cams.

Referring now to the drawings by reference characters, there is shown a casing generally designated 6 having bearings 8 and oil seals 10 at each end thereof supporting a shaft 12 for rotation. Both ends of the shaft are splined as at 14 so that it can be driven by a prime mover, such as a gasoline or diesel engine. The shaft 12 has five cams 16 thereon and each of the cams is adapted to drive a pair of cam rollers, one of which is mounted generally over the cam and one of which is mounted generally under the cam.

Mounted for limited rotation on the same axis as the shaft 12 are a pair of stroke-adjusting cages. Thus, there is an upper stroke-adjusting cage 18 and a lower stroke-adjusting cage 20. The upper stroke-adjusting cage 18 is mounted on the ring bearings 22, while the lower cage is mounted on the ring bearings 24. Each of these cages is capable of an angular adjustment through about 30° and the means for adjusting the cages is set

forth in detail hereinafter. The upper cage supports a link bearing rod 26, while the lower cage has a similar bearing rod 28. Mounted on each of the link bearing rods is a plurality of cam roller links 30, each link pivoting on one of the bearing rods. There is a pair of links for each cam, one of each pair being mounted above and one mounted below each cam. Mounted at one end of each link is a cam roller 32 and at the opposite end of the link a spring 34 pushes upwardly between the link and its supporting cage, holding each roller in contact with its associated cam and preventing chattering. An upper shaft 36 and a lower shaft 38 run the width of the pump and are supported at their respective ends by the casing 12. Mounted on the shafts 36 and 38 are a plurality of piston-actuating links 40, corresponding in number and placement to the cam roller links. One end of each piston-actuating link is provided with a roller 42 which bears against the upper surface of the mating cam roller link as at 31, while the opposite end of each link 40 has a pair of rollers 44 and 46 mounted thereon. Each of the rollers 44 and 46 is in contact with a piston, 48 and 50, respectively, mounted in the cylinders 52. At the bottom of each of the cylinders 52 is a plenum chamber 54 serving one of each of the pairs of cylinders in a bank. The plenum chamber leads to the slide valve assembly generally designated 56, which has a sleeve valve body 58 adapted to slide therein and to connect the chamber 54 with either the line 60 or 62, depending upon its position. A spring 64 biases the valve element downwardly so that the roller 66 of the valve element is held in contact with a cam 68 on the shaft 70. Naturally, the shaft 70 is driven in synchronization with the shaft 12 and the means for driving the shaft 70 and adjusting it relative to the position of the shaft 12 is described in detail hereinafter. It is thus apparent from the foregoing that as the shaft 12 rotates, the link 30 will be caused to reciprocate, which in turn will cause the lever 40 to reciprocate, driving the twenty pistons and causing a pumping action. It will also be apparent that the volume of the pumping action per stroke will be dependent upon the position of the shaft 26 since, as the cage 18 is rotated through its limited travel, it effectively changes the stroke of the pump. In this manner, one revolution of the shaft 12 can cause the full volume of the pump to be displaced, or can result in no pumping action, all dependent upon the position of the cam adjusting cage. It will be understood that the opposite pairs of pistons will be connected to the lines 72 and 74 by valves similar to valve 56 and that either pair of lines will be the pressure lines, depending upon the relative position of the shaft 12 and the shaft 70. Thus, lines 60 and 72 could be the pressure lines, or lines 62 and 74 might be the pressure lines.

The bottom half of the pump has not been described in detail, since it is a mirror image of the upper part of the pump.

In FIGURE 4, the method of actuating the cam-adjusting cages is shown. This comprises an adjusting piston 76 which extends into cylinders 78 and 80. The center portion of piston 76 is connected through arm 82 to one of the cam-adjusting cages, in the case the upper cage 78. Lines 84 and 86 lead to the cylinders 78 and 80, respectively, so that the relative position of the cage can be adjusted by supplying fluid under pressure to either 84 or 86. The method of supplying such control fluid forms no part of the present application, and is shown in my co-pending application Serial No. 187,235, filed April 13, 1962, now Patent No. 3,131,604. It will be understood, of course, that one such piston assembly and actuating arm is supplied for each of the two cages.

In FIGURE 5, the method of driving the valve-timing cam is shown, as well as the method of adjusting the position of the cam for forward or reverse motion, and also for adjusting the position of the cam so that it will be properly synchronized with the piston movement, depending upon the exact position of the adjusting cage. This comprises a gear generally designated **88**, having spur teeth **90** and bevel teeth **92**, the former engaging mating gear **94** mounted on shaft **12**. The latter teeth mesh with a bevel gear **96** which is mounted for rotation on an axle **98** mounted on the framework of the pump, and carries a sleeve **100** having a coarse thread thereon. Near the opposite ends of the shaft a similar gear **102** is mounted for rotation, having a similar sleeve with coarse thread **104** thereon. A threaded coupler **106** couples the two threads together, and since the threads are of opposite hand, the relative position of the gear **96** and the gear **102** is determined by the position of the coupling element **106**. Thus, the gears **96** and **102** generally turn at the same speed, although they can be displaced with respect to each other by 180°, depending upon the exact position of the coupling element. The bevel gear **102** drives a mating bevel gear **108** on the shaft **70**. In this manner, motion is transmitted from the main drive shaft **12** to the cam shaft **70**.

The position of the coupling element is determined by the movement of the arm **110**, and this may be actuated in two different manners. In the first place, a reversing cylinder **112** is supplied so that the coupling element may be moved to substantially one end of its path of travel to the other by means of hydraulic piston **114** to secure a reversed flow of the pump by moving shaft **70** by 180° with respect to shaft **12**. As has been previously mentioned, it is also necessary to slightly adjust the position of the cam shaft relative to the main drive shaft depending upon the position of the adjustable cage. This is accomplished by means of the linkage **116** which connects to ring **24** supporting adjustable cage **18** with the arm **110** as is shown. Thus as the cage is adjusted, the valve timing is adjusted so that the valve will operate in synchronism with the pump. A similar mechanism drives the lower cam shaft but is not illustrated since it again is a mirror image of the structure described.

I claim:

1. A fluid pump having a cam on a shaft, means for rotating said shaft, a cam roller link mounted on an adjustable cage with a roller on said link in contact with said cam, a piston actuating link pivoted near the center thereof with one end of said link in contact with the cam roller link and the other end in contact with a piston, and means for adjusting said cage to change the point of contact between the cam roller link and the piston actuating link whereby the displacement of the pump can be varied.

2. The pump of claim **1** wherein a mechanically actuated valve driven by the shaft is employed, having in combination therewith two fluid lines, and means whereby the valve action may be shifted through 180° so that either of said lines will be the pressure line.

3. The pump of claim **2** wherein means is provided to adjust the valve action whereby the valve action is synchronized with the position of the adjustable cage.

4. The pump of claim **3** wherein a plurality of cams are employed with a plurality of independently adjustable cages, each cage having corresponding cam roller links thereon, each of which drives a pair of pistons with one piston of each pair feeding a first outlet line and the other of said pistons of each pair feeding a second outlet line whereby a plurality of independent outlet lines are provided.

5. The pump of claim **3** wherein five cams are employed with two independently adjustable cages, each cage having five cam roller links thereon, each of which drives a pair of pistons with one piston of each pair feeding a first outlet line and the other of said pistons of each pair feeding a second outlet line whereby four independent outlet lines are provided.

6. The pump of claim **3** wherein a plurality of cams are employed, with a plurality of independently adjustable cages, each cage having corresponding cam roller links thereon, each cam roller link driving at least one piston.

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