

Dec. 5, 1944.

C. I. MacNEIL

2,364,301

HYDRAULIC APPARATUS

Filed July 16, 1941

2 Sheets-Sheet 1

Fig. 1.

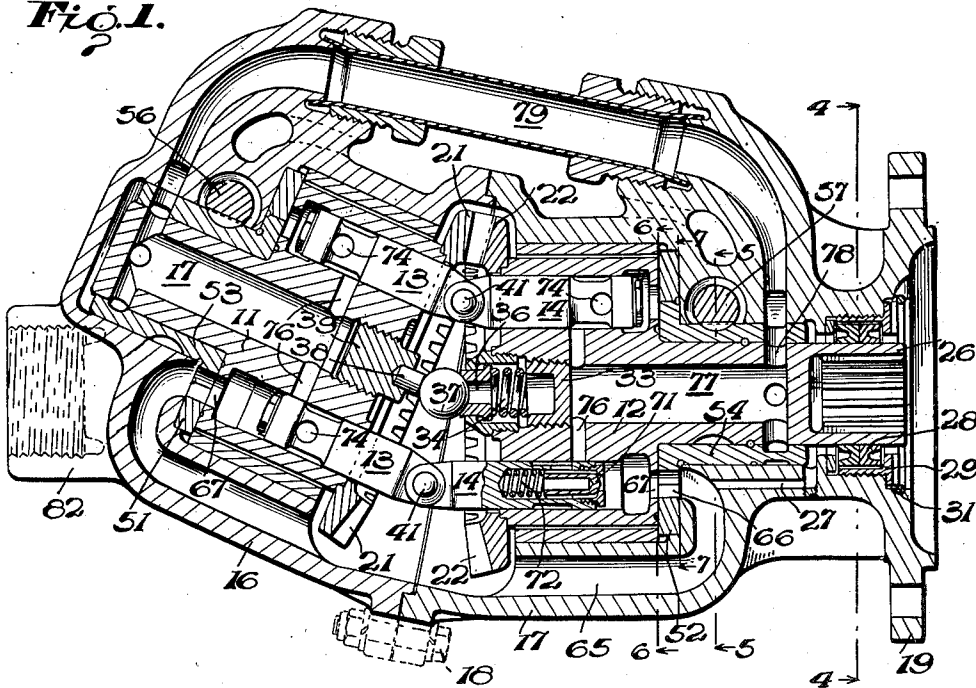
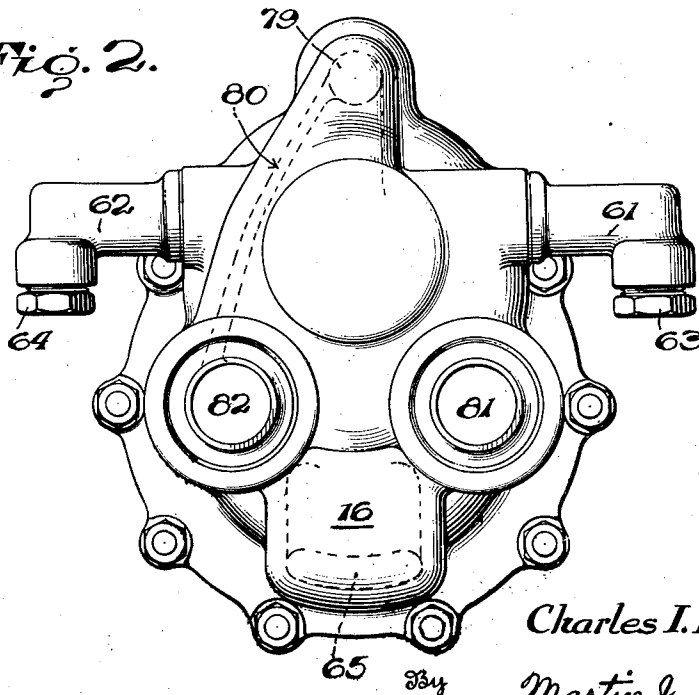


Fig. 2.



Inventor

Charles I. MacNeil.

Martin J. Finnegan.
Attorney

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C. I. MacNEIL

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FIG. 3.

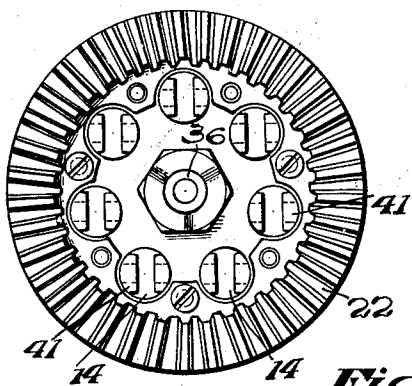


FIG. 4.

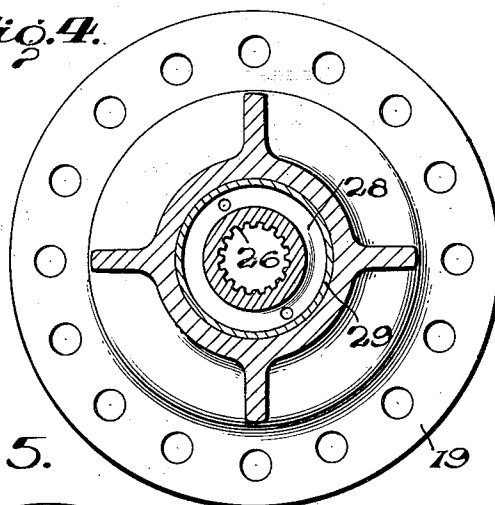


FIG. 5.

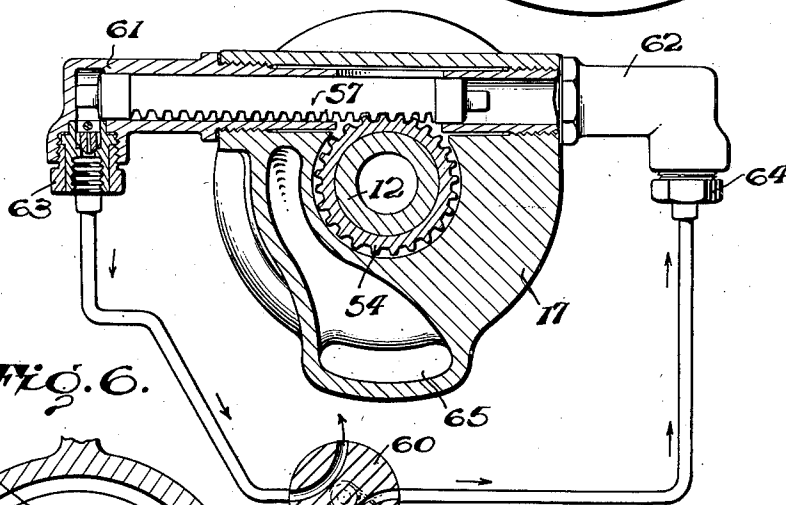


FIG. 6.

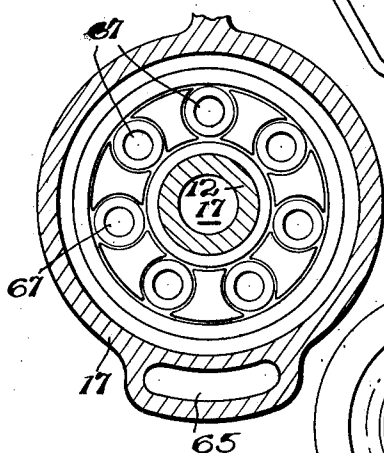
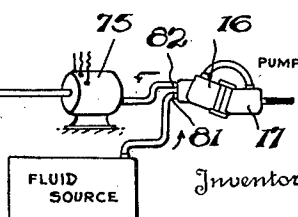
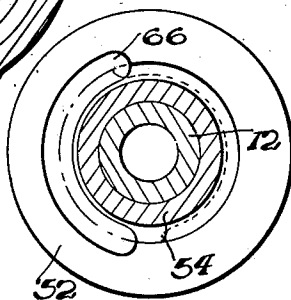


FIG. 7.



Inventor
Charles I. MacNeil.
By
Martin J. Finnegan.
Attorney

UNITED STATES PATENT OFFICE

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HYDRAULIC APPARATUS

Charles I. MacNeil, Glen Ridge, N. J., assignor to
Bendix Aviation Corporation, South Bend,
Ind., a corporation of Delaware

Application July 16, 1941, Serial No. 402,698

2 Claims. (Cl. 103—162)

This invention relates to pumps, and particularly to pumps of the multiple piston class.

The invention is illustrated in the accompanying drawings as embodied in a pump of the "angle" type comprising two cylinder blocks rotatably mounted at an angle to each other, with an end of each block adjacent to an end of the other and with angular pistons arranged one end of each piston in a cylinder in one block and the other end in a cylinder in the other block; but the only limitations as to type are those that are specifically recited in the appended claims.

An object of the invention is to provide a hydraulic system including a variable displacement pump, and further including novel means for automatically varying the displacement of the pump in accordance with operating requirements.

Another object is to provide a pump having a novel flow-directing valve system.

Another object is to provide a variable displacement pump having novel means for varying the fluid intake and thus controlling the displacement.

In pumps of the angle type (except for the special case of right-angled disposition) it has been customary to employ a centrally disposed universal joint connecting means for transmitting the drive from the driving to the driven block.

Another object of the present invention is to provide novel driving means for an oblique-angled pump, which novel driving means does not require resort to universal driving means at the intersecting axes of rotation.

Another object is to provide an oblique-angled pump in which the only element disposed at the intersecting axes of rotation is a spherical bearing member which registers with spherical seats on the driving and driven assemblies for the purpose of facilitating the maintenance of true-running relationship therebetween, but without constituting a driving connection therebetween.

Another object is to provide an oblique-angled pump having novel connecting means between the respective pairs of inter-connected pistons, or pumping elements.

Another object is to provide a novel oblique-angled pump having peripherally disposed driving means between the two cylinder blocks.

These and other objects of the invention will become apparent from inspection of the following specification when read with reference to the accompanying drawings wherein is illustrated the preferred embodiment of the invention. It is to be expressly understood, however, that the draw-

ings are for the purpose of illustration only, and are not designed as a definition of the limits of the invention, reference being had to the appended claims for this purpose.

In the drawings:

Fig. 1 is a longitudinal sectional view of a device embodying the invention;

Fig. 2 is an end view, from the left of Fig. 1;

Fig. 3 is a transverse view at the plane of intersection of the driving and driven axes;

Figs. 4, 6 and 7 are transverse views along lines 4—4, 6—6, and 7—7, respectively, of Fig. 1; and

Fig. 5 is a schematic picture of the novel system of pump intake control, with certain parts shown as they appear when sectioned along line 5—5 of Fig. 1.

In the drawings two rotary cylinder blocks 11 and 12, at oblique angles to each other and containing the ends of a plurality of pistons 13 and 14, respectively, are rotatably supported within the casing sections 16 and 17; said casing sections being joined as indicated at 18, and the section 17 having a flange 19 for mounting the entire device on a suitable support (not shown). Integrated with blocks 11 and 12 are bevel gears 21 and 22, respectively, having meshing relationship, as shown, wherefore rotation of driving block 12 is communicated to driven block 11 in a novel manner. To receive the drive-shaft 10 (see Fig. 5) block 12 terminates in a splined socket 26, to the outer surface of which lubricant is fed by way of duct 27, and retained by the action of sealing rings 28, retainer nut 29, and retainer wire 31 (Fig. 1).

At its inner end block 12 is centrally counter-bored and tapped to receive a pair of tapered nuts 32 and 33 which coact with a spring 34 and an annular, slidable ball-seat 36 to resiliently maintain the ball 37 in rolling engagement with centering pin 38 of the driven block assembly 11; the parts 38 and 34 being pre-settable by adjusting the parts 39 and 33, respectively. The pivot pins 41 connecting the apertured piston ends are another novel feature, and permit automatic shifting of the individual piston angles to reduce friction as between piston and piston bore surfaces.

The novel flow controlling valve system includes a pair of rotatable, ported valve plates 51 and 52 having hubs 53 and 54, respectively, in the form of gears in mesh with racks 56 and 57, respectively; the latter (see Fig. 5 for the details of one of these) having their ends formed as integral pistons reciprocable in cylindrical units 61 and 62 disposed transversely of each housing

section 16 and 17. Each of the units 61 and 62 has a valve assembly (see 63 and 64) at its outer end to control application of pressure for rectilinear movement of the racks and consequent rotation of the valves 51 and 52, associated therewith, whenever the four-way valve 60 (see Fig. 5) is shifted from the neutral (no-flow) position by governor operated lever 70. Each valve 51, 52 has an arcuate port (see 66, Fig. 7) registrable with the ports 67 in the blocks 11 and 12, the said ports 67 being so located as to provide access of fluid to the piston-receiving bores. Since every rotational shift of valves 51, 52 will change the angular position of the arcuate ports 66, such rotational shifting varies the timing of the registry of ports 67 therewith, and thus determines the amount of fluid pumped by each piston 13, 14 on each stroke; it being understood that the amount pumped depends upon the linear position of each piston in its bore, as of the moment when its port 67 registers with the port in the valve 51, or 52, as the case may be. In this manner the delivery volume of the pump is controlled.

The fluid entering the parallel bores of each block acts upon the tubular valves contained within the pistons 13, 14 (see valve 71 within the cross-sectioned piston 14 of Fig. 1) and is effective to lift said valves 71 from their respective seats, against the yielding opposition of the associated springs, of which spring 72 is typical. The fluid thus passing the valves 71 emerges from the pistons by way of lateral ports 74, and thus becomes free to reach the outlet fitting 82; the path from ports 74 to 82 being as follows: radial ports 76 (of blocks 11, 12) central passages 77, radial passages 78, and connecting conduit 79. From connecting conduit 79 the fluid passes to outlet port 82 of outlet conduit 80. Alongside outlet port 82 is the inlet port 81, leading to lower chamber 65, from which the incoming fluid passes to ports 66, heretofore described.

If the pump 16, 17 is used to drive a constant displacement hydraulic motor 75 (see Fig. 5), the amount of oil displaced by the pump will determine the speed of the constant displacement motor. Should we desire the hydraulic motor to drive an alternator at constant speed so as to obtain constant frequency, we would need to equip the motor with a governor which would control the speed of the motor to, let us say, 4000 R. P. M. Should the motor tend to slow down for reason of increased load, or more likely because of lowering of the driving speed of the hydraulic pump, the governor 55 on the motor would then cause oil to flow in the circuit which includes fittings 63 and 64 and valve 60, to act upon pistons 56, 57 in such a direction as to increase displacement of the hydraulic pump. Conversely, should the

speed at which the hydraulic pump is driven, increase, which would normally increase the amount of oil coming from the pump, this in turn would tend to increase the speed of the hydraulic motor. The governor would then shift valve 60 in the opposite direction, thus causing a flow of oil through fittings 63 and 64 in the opposite direction so as to move pistons 56, 57 in such a direction as to decrease the displacement of the pump.

Should it be desired to use the pump in a constant pressure system, this can be done by providing one side of each piston 56, 57 with a spring, and connecting the output pressure of the pump to the proper side of pistons 56, 57 in such a manner that should the pressure increase it would move the pistons 56, 57 against these springs and rotate the valves 51, 52 so that the displacement of the pump would be decreased. Conversely, should the pressure output of the pump decrease, the loss in hydraulic pressure on one side of each piston 56, 57 would cause these springs to move said pistons in such a manner as to increase the displacement of the pump.

What is claimed is:

1. In a hydraulic system including a pump chamber, a pumping element therein, means for driving said pumping element, a fluid reservoir, means controlling admission of fluid from said reservoir to said pump chamber, said means comprising a pair of relatively movable valve elements operating to connect said reservoir with said pump chamber at a predetermined time in relation to the movement of said pumping element, and pressure responsive means for shifting one of said valve elements in relation to the other to vary the time of fluid admission to said pump chamber at different positions of said pumping element.

2. In a hydraulic system including a pump chamber, a pumping element therein, means for driving said pumping element, a fluid reservoir, means controlling admission of fluid from said reservoir to said pump chamber, said means comprising a pair of relatively movable valve elements operating to connect said reservoir with said pump chamber at a predetermined time in relation to the movement of said pumping element, pressure responsive means for shifting one of said valve elements in relation to the other to vary the time of fluid admission to said pump chamber at different positions of said pumping element, said last-named means comprising gear teeth integrated with said shiftable valve element, a rack in mesh with said gear teeth, a cylinder enclosing said rack, and means for admitting fluid to said cylinder to cause movement of said rack.

CHARLES I. MACNEIL.