

July 18, 1939.

H. MOORE ET AL

2,166,873

DRIVING MECHANISM

Filed Dec. 20, 1937

3 Sheets-Sheet 1

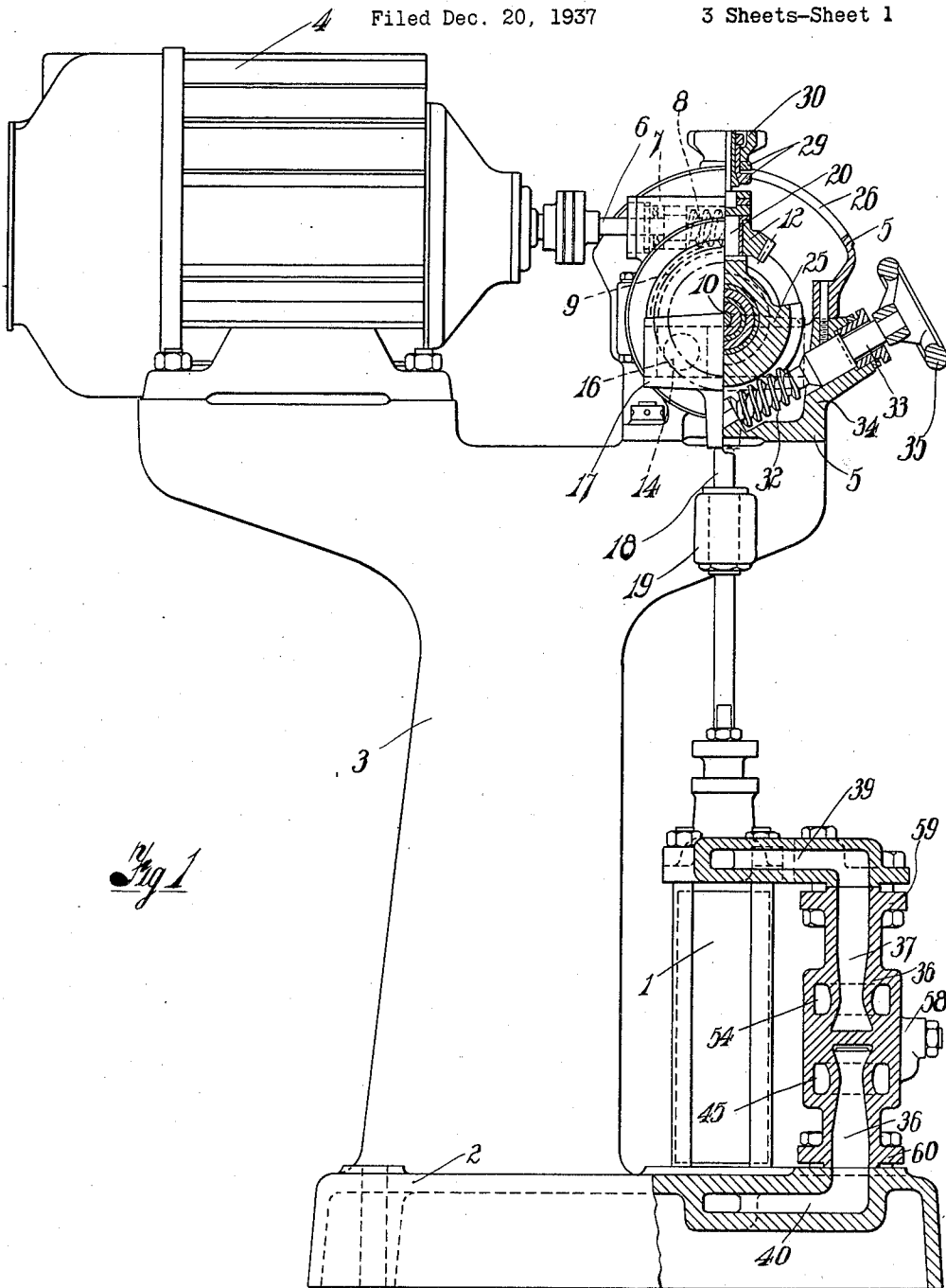


Fig 1

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3 Sheets-Sheet 2

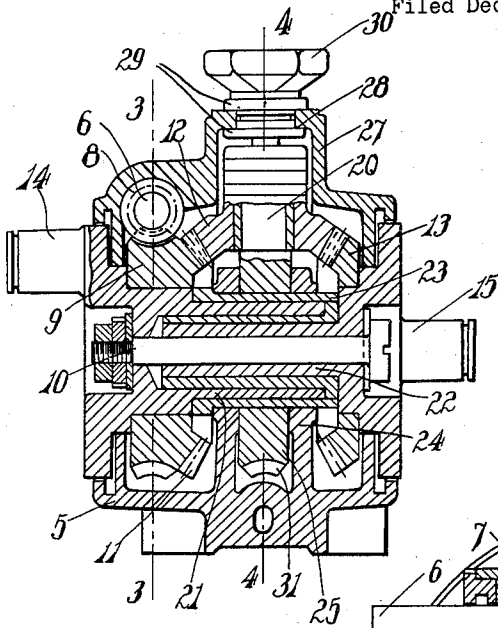


Fig. 2

Fig. 3

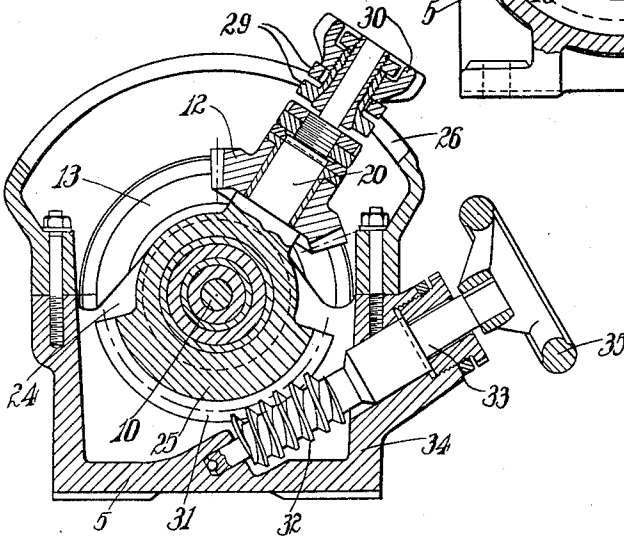
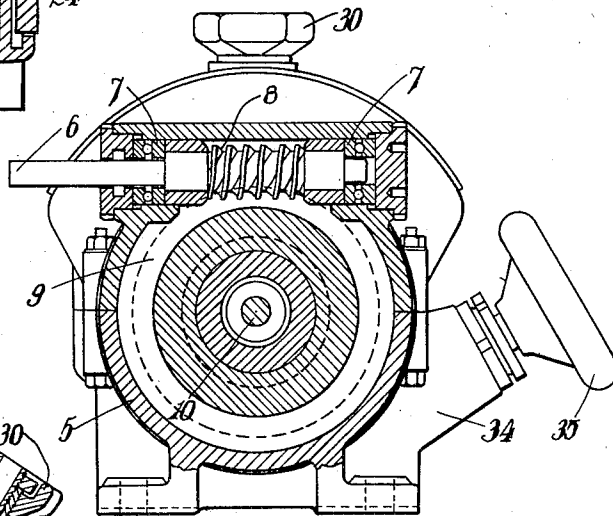


Fig. 4

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3 Sheets-Sheet 3

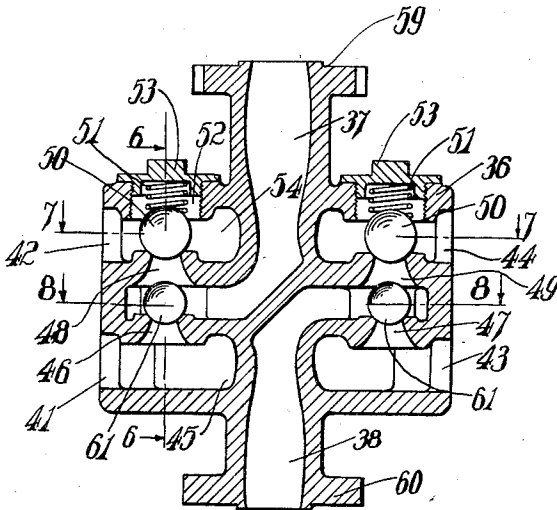


Fig 5

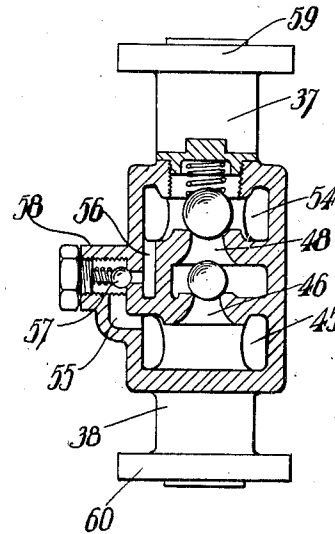


Fig 6

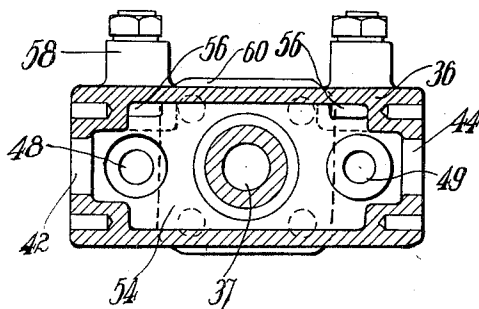


Fig 7

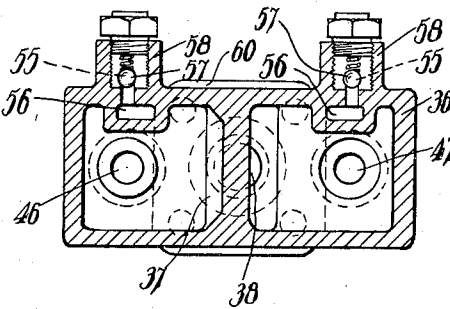


Fig 8

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DRIVING MECHANISM

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3 Claims. (Cl. 74—395)

This invention relates to reciprocating piston or plunger pumps of the kind wherein two pistons are driven through differential or other gearing arranged so that the piston phase relationship can be varied for the purpose of varying the capacity of the pump.

The object of the present invention is to provide improvements in pumps of the kind above described such improvements being directed more particularly towards the means for adjusting the piston phase relationship and for controlling the passage of fluid through the cylinders in all positions of adjustment of the pistons.

According to the invention a reciprocating plunger pump of the kind referred to is provided wherein two pump cylinders and inlet and discharge valves therefor are mounted in the lower portion of a framework which also supports an operating motor and a driving gear to which the pump piston rods are connected, the said driving gear consisting of a differential bevel gear, one element of which is capable of adjustment through an arcuate path to alter the piston phase relationship by adjusting mechanism mounted in a stationary portion of the framework.

In carrying the invention into effect according to one form a reciprocating plunger pump is provided comprising a framework, two pump cylinders mounted in said framework, a valve chest mounted in said framework and communicating with the upper and lower ends of said cylinders, inlet and discharge ports in said valve chest, an operating motor and driving gear mounted in the upper portion of said framework, said driving gear comprising a worm drive from the motor, a differential bevel gear connected to the pump pistons and an arcuately adjustable bevel pinion controlled by a worm adjusting mechanism located in a stationary portion of the said framework.

Reference will now be made to the accompanying drawings which illustrate by way of example a pump constructed according to the invention and in which:

Fig. 1 is a side elevation partly in section,

Fig. 2 is a sectional elevation of the driving gear,

Fig. 3 is a sectional elevation taken on the line 3—3 of Fig. 2,

Fig. 4 is a sectional elevation taken on the line 4—4 of Fig. 2,

Fig. 5 is a sectional elevation of the valve chest of the pump,

Fig. 6 is a sectional elevation of the valve chest taken on the line 6—6 of Fig. 5,

Fig. 7 is a sectional plan of the valve chest taken on the line 7—7 of Fig. 5 and

Fig. 8 is a sectional plan of the valve chest taken on the line 8—8 of Fig. 5.

In the construction illustrated pump cylinders 1 are supported upon the base plate 2 of a framework 3 the upper portion of which supports an operating motor 4 and the differential mechanism for operating the pump piston, this mechanism being disposed within a housing 5 into which extends an extension of the motor shaft 6 which extension is supported in bearings 7 between which it is formed with a driving worm (see Fig. 3) engaging a worm wheel 9 rotatable about a shaft 10 mounted within the housing 5. Formed integral with the worm wheel 9 is a bevel gear 11 meshing with a bevel pinion 12 which in turn meshes with a bevel gear 13 also rotatable about the shaft 10.

The worm wheel 9 and bevel wheel 13 carry crank pins 14 and 15 which carry blocks 16 slidably mounted in slotted bars 17 each of which is fixed to the upper end of one of the pump piston rods 18 which reciprocate vertically in guides 19 fixed to the frame 3.

To enable the capacity of the pump to be varied the bevel pinion 12 is mounted so that it can be adjusted in position through an arcuate path by hand around the shaft 10. During such adjustment the gear wheel 11 is held stationary if the pump is at rest and if the pump is operative is held by engagement of the worm 8 and worm wheel 9 from following the adjusting movement imparted to the pinion 12. Thus angular adjustment of the spindle 20 on which the pinion 12 is mounted will also cause movement of the gear wheel 13 relatively to the gear wheel 11 and consequent advance of the crank 15 to vary the phase relationship of the two pump pistons.

The bevel gear wheels 11 and 13 are mounted respectively upon concentric sleeves 21 and 22 freely rotatable about the shaft 10 and within a sleeve 23 carried in brackets 24 extending upwardly from the base of the housing 5. Between the brackets 24 is mounted a quadrant 25 freely movable around the sleeve 23 and carrying the inner end of the spindle 20. The outer end of the spindle projects through an arcuate slot 26 formed in an extension 27 of the housing 5, the inwardly directed flanged edges 28 of the said slot being engaged between flanges 29 formed around the spindle 20 and movable relatively thereto by operating a lock nut 30, slackening of which permits adjustment of the spindle as hereinafter described.

The quadrant 25 has worm teeth 31 formed around part of its periphery and engaging a worm 32 formed on a spindle 33 which is mounted in a socket 34 formed in the housing 5 and provided at its outer end with a hand wheel 35 for manual operation. This spindle 33 is mounted so as to be capable of rotary movement only so that when rotated in either direction rotational movement is imparted to the quadrant 25 to move the spindle 20 and pinion 12 away from the position shown in Fig. 1 to that shown in Fig. 4 for example. In order that the position of the spindle 20 can be accurately adjusted to give a predetermined variation in the pump capacity the edges of the arcuate slot 26 can be marked with a scale with which co-operates an indication formed on the outer flange 29.

The base plate 2 (Fig. 1) also supports a valve chest 36 which is illustrated in detail in Figs. 5, 6, 7 and 8. This valve chest has passages 37 and 38 which communicate respectively with a port 39 opening into the upper ends of both cylinders and a port 40 opening into the lower ends of said cylinders (see Fig. 1).

The valve chest has four ports 41, 42, 43 and 44 (see Fig. 5) the inlet ports 41 and 43 being connected together and the discharge ports 42 and 44 also being connected together. The ports 41 and 43 communicate with an annular space 45 which surrounds the passage 38 and communicates through ports 46 and 47, normally closed by ball valves 61, with the inner ends of the passages 37 and 38, this arrangement enabling either or both of the ports 41 and 43 to be used for the supply of fluid. Above the ports 46 and 47 are two further ports 48 and 49 normally closed by ball valves 50. When necessary, as for example, when pumping into a vacuum the ball valves 50 may be normally held on their seatings which surround the ports 48 and 49 by springs 51 disposed in valve chambers 52 closed by detachable caps 53. The ball valves control the admission of fluid under pressure to an annular space 54 surrounding the passage 37 and communicating with the discharge ports 42 and 44 either or both of which may thus be used for the discharge of fluid under pressure.

The annular spaces 45 and 54 communicate through passages 55 and 56 respectively (Fig. 6) with safety valves 57 disposed in valve housings 58 formed in one wall of the valve chest so that in the event of an excess pressure the discharge side is connected to the suction side.

In the construction illustrated the bottom port or channel 40 by which the passage 38 communicates with the lower ends of both cylinders (see Fig. 1) is shown as forming an integral part of the base plate 2 but it is to be understood that where, for example, the pump is designed to deal with corrosive fluids the unit enclosing the port 40 may be formed separately and be detachably mounted within the base 2. The valve chest 36 is secured in position between the elements 39 and 40 by means of flanges 59 and 60 formed on the ends of the passages 37 and 38 which may

thus be bolted to flanges on the elements 39 and 40 as shown in Fig. 1.

In the operation of the pump above described the phase relation of the pump pistons may be first adjusted by operating the hand wheel 35 and the motor 4 is started. It is important to note, however, that a principal advantage of the invention is that the adjustment in the piston phase relationship can be effected while the pump is in operation. As the pump pistons reciprocate, fluid is drawn by suction through the inlet ports 41 and 43 or either of them if only one is in use, this operation continuing until the annular spaces 45 and 54, the passages 37 and 38, ports 39 and 40 and the cylinders 1 are filled with fluid which entering at normal pressure has its pressure increased by the action of the pistons. This increase in pressure causes displacement of the ball valves 50 and discharge of fluid through either or both ports 42 and 44. It is to be noted that all four ports 41, 42, 43 and 44 may be in use simultaneously or one inlet and one discharge port only may be employed, for example, ports 41 and 42, ports 43 and 44, ports 42 and 43 or ports 41 and 44.

We claim:

1. Driving mechanism of the type described, comprising a gear housing having two end walls, two crank discs respectively mounted coaxially in said end walls, a crank pin fixed to each of said crank discs and projecting from said crank discs externally of said housing, a sleeve projecting inwardly from one of said discs, a sleeve projecting inwardly from the other of said discs, said sleeves being in telescopic relation with one another, spaced bearing supports fixed within said housing and supporting said sleeves at spaced points located between said discs, an adjustable support mounted on said sleeves between said bearing supports and rotatably adjustable on said sleeves, a toothed wheel fixed to each of said discs, a toothed wheel mounted on said adjustable support and meshing with said toothed wheels fixed to said discs, adjusting mechanism for said adjustable support mounted on said housing, a worm wheel fixed to one of said crank discs within said housing, a driving shaft journaled in said housing, and a worm fixed to said driving shaft and meshing with said worm wheel.

2. Driving mechanism according to claim 1 wherein said adjusting mechanism consists of an adjusting spindle journaled in said housing and having an external operating wheel, and a worm fixed to said adjusting spindle and meshing with worm teeth formed on said adjustable support.

3. Driving mechanism according to claim 1, wherein said housing has an arcuate slot therein, and including a spindle for said toothed wheel on said adjustable support, said spindle projecting through said arcuate slot in the housing, and manually operable fixing means for clamping said spindle in adjusted position relatively to said housing.

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