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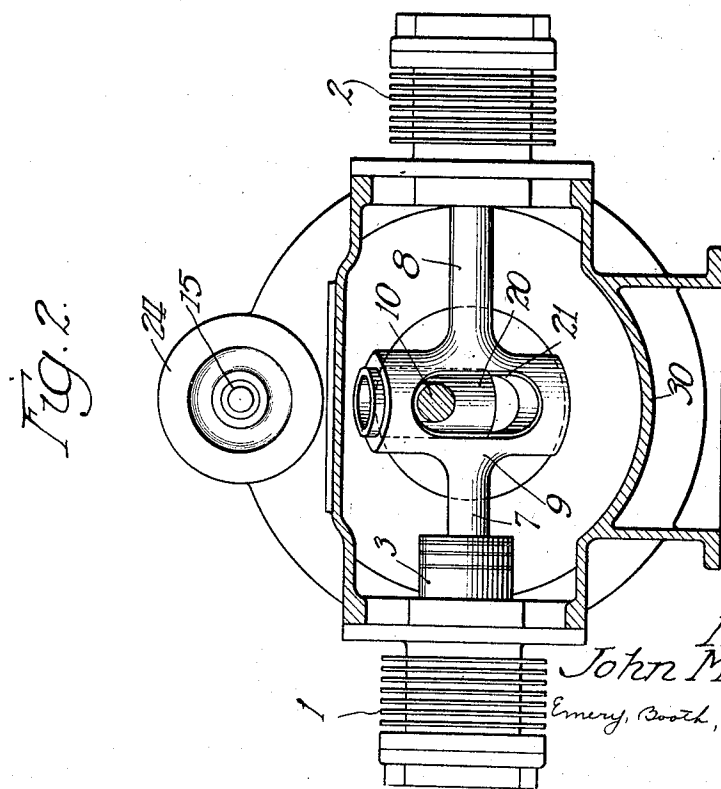
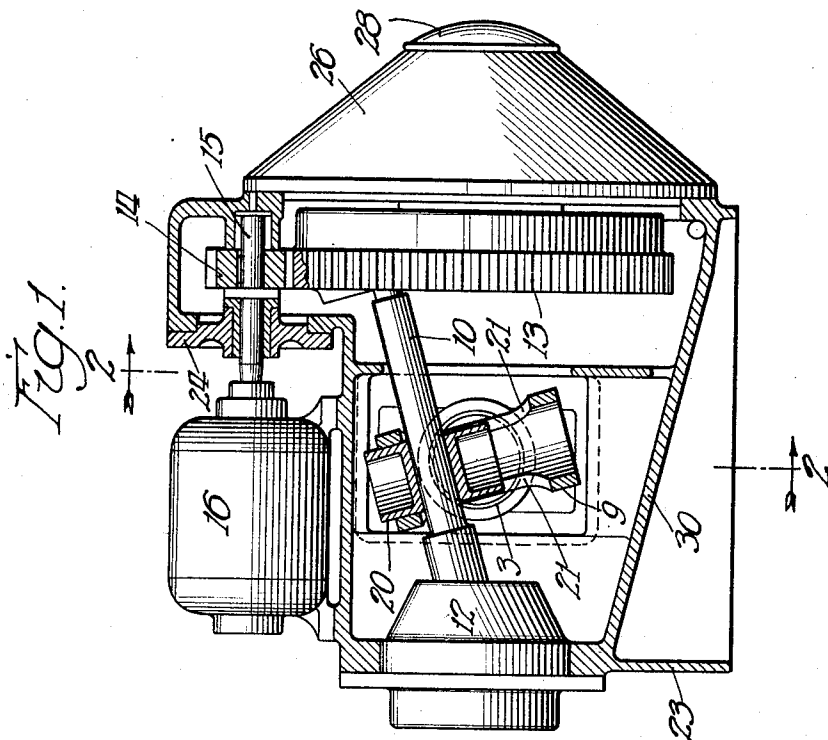
J. M. BUTLER

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PUMPING APPARATUS

Filed May 14, 1926

2 Sheets-Sheet 1



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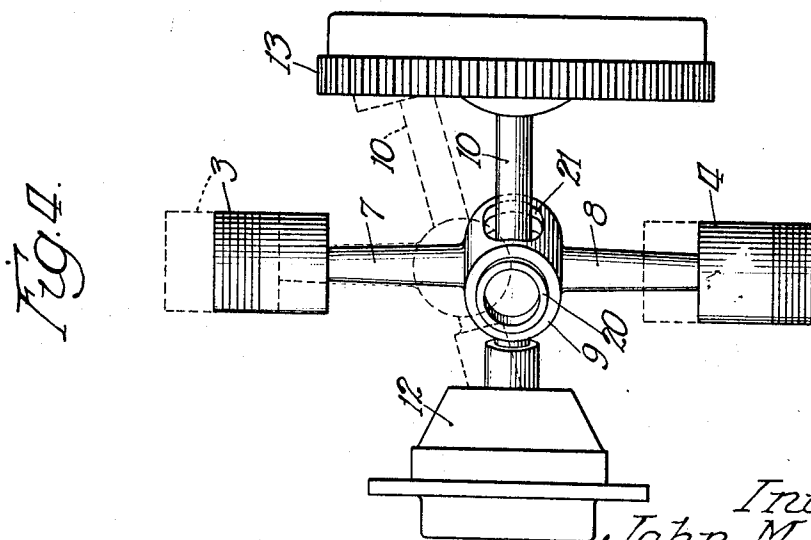
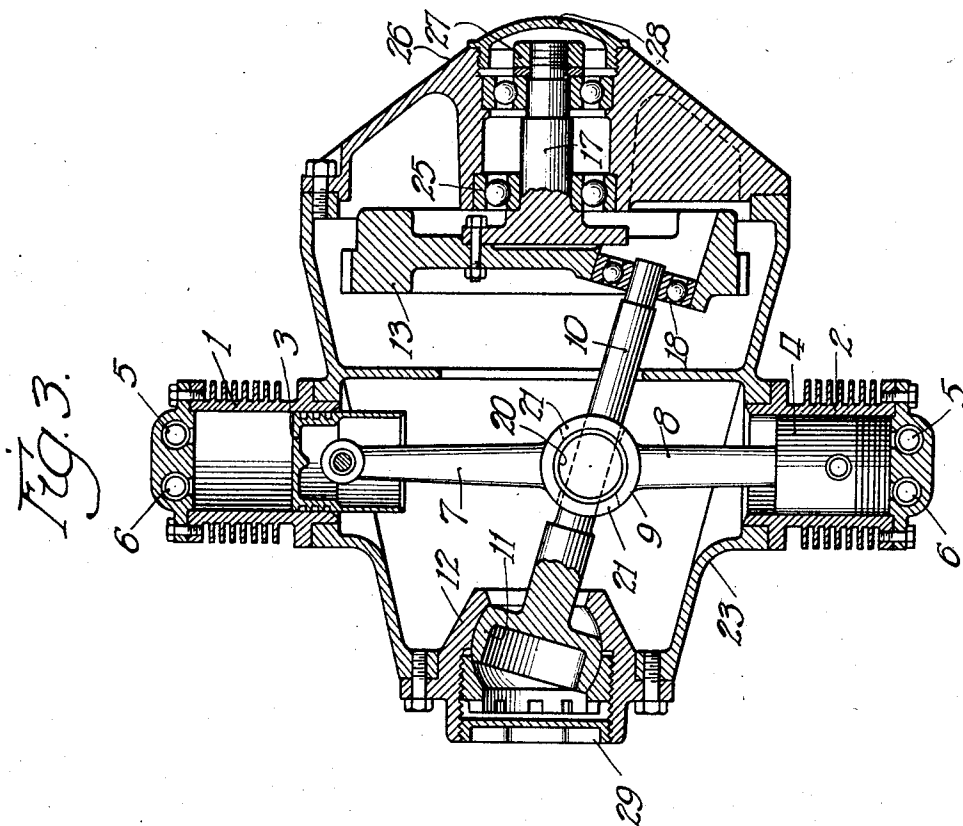
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2 Sheets-Sheet 2



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PUMPING APPARATUS

Application filed May 14, 1926. Serial No. 109,011.

The object of the present invention is to provide an improved pumping apparatus of an efficient and practicable type.

An illustrative embodiment of the invention is shown in the annexed drawings in which:

Fig. 1 is a view of the illustrative apparatus partly in vertical section and partly in side elevation, the section being taken transversely of the pump cylinders.

Fig. 2 is a sectional elevation taken on the line 2-2 of Fig. 1 looking in the direction of the arrow.

Fig. 3 is a horizontal sectional view of the illustrative apparatus.

Fig. 4 is a plan view of the operating parts shown in Fig. 3; illustrating a different position thereof and also indicating another position by dotted lines.

The illustrative apparatus comprises oppositely arranged pumps connected with a common operating means between the pumps. In this instance single acting plunger pumps of the air-compressor type are shown. The respective pump cylinders are designated in the drawings by the reference numerals 1 and 2. The pistons or plungers working in said cylinders are designated by the numerals 3 and 4. Inlet and outlet passages to and from each of the pump cylinders are indicated at 5 and 6 (Fig. 3), said passages being shown in this instance as located in the cylinder heads, as is frequently customary in air compressor pumps. It will be understood that said passages are controlled by any suitable check valves or the like. For instance, if the apparatus is to be used as an air compressor, the inlet passages 5 communicating with the atmosphere would be provided with inwardly opening check valves to permit indrawing of air during the reverse strokes of the pistons, while the outlet passages 6 communicating with an air storage tank would be provided with outwardly opening check valves to permit the air in the pump cylinders to be forced into the tank during the working or compression strokes of the pistons. If the apparatus were used as a vacuum pump, the passages 5 would be connected with the tank or chamber to be

exhausted, while the passages 6 would discharge to the atmosphere, said passages being respectively controlled by check valves as before mentioned.

The pump cylinders and pistons of the two pumps are arranged in line, and the pistons are connected through the rods 7 and 8 with a reciprocating member or cross head 9 rigid with said connecting rods. Thus the pistons or plungers are reciprocated simultaneously, these actions being in opposition in the sense that the working or compression stroke of one piston occurs during the reverse or intake stroke of the other piston. In view of a rotative or turning movement which is imparted to the piston or plungers during their reciprocation, as presently to be explained, the cylinders and plungers of the two pumps should be in accurate axial alignment.

Referring to the intermediate operating means, the cross head 9 is operated to reciprocate the pump plungers by a lever 10. This lever, which extends transversely of the connected pump plungers, is fulcrumed in such manner as to permit the power end of the lever to be revolved in a circular orbit, so that the lever is bodily revolved about the axis of said orbit and thereby in its movement describes a cone. In this instance the fulcrum of the lever is provided by a ball type head 11 fitted in an appropriate bearing in member 12, thus allowing the necessary universal movement of the lever to permit it being swung around as indicated.

A rotary driver for the lever is represented in the drawings by the drive wheel 13, which in this instance is a gear wheel driven by pinion 14 on shaft 15 from an electric motor 16. Said drive wheel 13 is shown mounted on a stub shaft or axle 17 (Fig. 3). The lever 10 is inclined to said stub shaft or axle, or in other words the lever 10 is arranged at an inclination to the axis of the rotary driver 13. The power end of the lever is rotatably connected with or journaled in a bearing 18 in said driver 13, offset from the axis to provide a suitable crank throw for revolving the lever 10.

An operative connection between the re-

volving lever 10 and the cross head 9, for reciprocating the cross head and pump plungers while allowing the lever to move as aforesaid, is provided by means now to be described. The cross head 9 is constructed to provide a substantially tubular guideway for a cylindrical member 20, which is rotatably and slidably fitted in said guideway. It will be observed that the axis of said guideway and movable member 20 is transverse of the axis of the pump cylinders, and also transverse of the lever 10. The lever 10 extends transversely through and is slidable and rotatable in said member 20, which as shown in Fig. 1 may be of substantially H-shape form in cross section and transversely bored to receive the lever 10. The opposite side walls of the cross head 9 are shown provided with openings 21 to accommodate the movements of the lever 10.

In operation, as the drive wheel 13 is rotated by the motor, the lever 10 is revolved or swung around so as to describe a cone as aforesaid, thereby causing the member 20 to travel in an orbit and reciprocate the pump plungers, said member 20 sliding transversely of the axis of the pump cylinders as the lever 10 moves to opposite sides of said axis. In the case of the specific apparatus illustrated, as viewed in Figs. 1 and 2, the member 20 may be said to slide up and down in the cross head 9 as the lever 10 moves above and below the center line of the pump cylinders. Now as the lever 10 in its revolving movement is continually changing its angular relation to the cross head and pump plungers, it follows that the member 20 will likewise follow the angular positions of the lever. As the revolutions of the lever carry it to and from opposite sides of the axis of the drive wheel, the member 20 will rotate or turn to and fro in the cross head. And as the lever moves to and from positions above and below the axis of the drive wheel, the up and down motion of the member 20 will be accompanied by a tilting or rocking of said member about a shifting axis at right angles to the axis of the lever and at right angles to the center line of said member 20. This causes a lateral rocking of the cross head from one side to the other as the cross head is reciprocated, thereby turning the pump plungers during their reciprocation.

The means above described exemplifies a construction wherein the pump plungers are reciprocated by the transversely arranged inclined revolving lever through a connection of a universal movement type, and more particularly through a connection including a rocking and shifting member to accommodate the peculiar movement of the lever. It also exemplifies a construction wherein the pump plungers are reciprocated by said lever in such manner as to cause the plungers to turn during their reciprocation. This is

an advantageous matter, since it reduces frictional resistance. It is much easier to insert a body into a hole or to move a plunger or piston back and forth in its cylinder if the movement be accompanied by a relative rotative or turning movement. With the illustrative apparatus there is a continuous turning movement of the pistons or plungers. If a pencil or marker be held stationary against one of the plungers, the mark described on the plunger will be an elongated ellipse, indicating the turning movement. Of course this is of advantage in reducing the power required to operate the pump.

An apparatus of the character described is highly efficient and practicable, and is well adapted for air compressing and vacuum producing work. The reduction of frictional resistance through the turning of the reciprocating plungers importantly contributes to the production of a type of air compressor or vacuum pump which may be operated by a motor of comparatively small horsepower. The further advantage is obtained that there is no lateral thrust exerted by the pump plungers, thus obviating resistance from any such cause as well as reducing wear. There are no dead centers to be overcome, and no large fly wheel is required for balancing purposes. Moreover, the application of power through the means described secures a power advantage through leverage.

It will be observed, among other items of advantage, that the application of power is greatest where needed, i. e. at the completion of the compression or working strokes of the plungers or pistons. As the plungers reverse their strokes, the lever 10 moves across the longitudinal center axis of the plungers; so that, as the plungers approach the limits of their strokes (where the resistance resulting from air compression is greatest), the lever is approaching said axis and thus pushing directly behind the plungers.

If desired, the rotative movement of the pump plungers may be utilized to control the admission of air to the cylinders by means of lateral cylinder ports and grooves in the plungers adapted to register with said ports during the reverse strokes and to control the discharge of air through cylinder ports adapted to register with grooves in the plungers on the working strokes.

Attention is invited to the simplicity and compactness of the illustrated apparatus. The operating mechanism is shown mounted in and enclosed by a housing 23, constructed as a frame casting, to opposite sides of which the cylinders 1 and 2 are affixed. On the flat top of this housing the motor 16 may be mounted (Fig. 1). The motor shaft or shaft 15 driven by the motor extends through a removable head 24 on an extension from the frame casting, permitting the motor shaft with its pinion 14 to be readily assembled.

Shaft 15 has bearings at opposite sides of the pinion 14. As shown in Fig. 3 the drive wheel 13 may be affixed to a flange on the stub shaft or axle 17, the latter being journaled in bearings 25 supported in a member 26 affixed to the main frame casting. The assembly of the stub shaft 17 and its bearings 25 is secured by a nut 27, while the bore of the member 26 containing the stub shaft and bearings is closed by a removable cap 28. Said bearings 25 and also the bearing 18 for the lever 10 in the drive wheel 13 are of the type comprising concentric race rings and interposed balls or rollers, reducing friction and promoting easy running of the apparatus. The member 12 containing the bearings for the ball-headed fulcrum 11 of the lever 10 is shown secured to the end of the frame casting opposite the drive wheel, and is provided with a removable cap 29. As shown in Figs. 1 and 2, the frame casting may have an inclined bottom 30. Oil for lubricating may be contained in the frame housing and splashed to the operating parts by the rotating driver or gear wheel 13.

Obviously the present invention is not limited to the particular embodiment herein shown and described. The details of construction and arrangement may be variously modified. Moreover different features of the invention may be advantageously used in various different combinations and sub-combinations.

What I claim is:

1. In an apparatus of the class described, the mechanical motion comprising a revolving lever inclined to the axis about which it revolves, a member reciprocating in a line transverse of said axis, and connecting means between said lever and member having up and down, rocking and turning movements.

2. As an element of said apparatus, the exteriorly cylindrical member to fit slidably and rotatably in the tubular cross head, said member being generally H-shaped in central longitudinal section and having a central transverse cylindrical bore to receive a cylindrical lever.

3. A device of the class described having, in combination, a member reciprocating in a straight line comprising alined rods and a connecting cross head; a rotating driver; a wabbling lever arranged transversely of the connected rods at an inclination to the driver axis and connected to and operated by said driver to revolve about said axis in a conical path; and a connection between said lever and cross head for reciprocating the same in a straight line while allowing the said revolution of the inclined lever in said conical path.

4. A device of the class described having, in combination, a member reciprocating in a straight line comprising alined rods and a connecting cross head; a rotating driver; a

wabbling lever arranged transversely of the connected rods at an inclination to the driver axis and connected to and operated by said driver to revolve about said axis in a conical path; and a connection between said lever and cross head for reciprocating the same in a straight line while rocking the same to turn the rods as they reciprocate.

5. A device of the class described having, in combination, a member reciprocating in a straight line comprising alined rods and a connecting cross head; a rotating driver; a wabbling lever arranged transversely of the connected rods at an inclination to the driver axis and connected to and operated by said driver to revolve about said axis in a conical path; and a connection between said lever and cross head for reciprocating the same in a straight line while rocking the same to turn the rods as they reciprocate, said connection including a member having a rocking, turning and axial movement, in which the lever is slidable and rotatable, the axis of said last mentioned member being transverse of the axis of the connected rods.

6. A device of the class described embodying a reciprocating member having a tubular cross head providing a guide the axis of which is transverse of the line of reciprocation; a member slidably and rotatably fitted in said guide; and a wabbling lever arranged transversely of the guide and slidably and rotatably fitted in said last mentioned member; the said cross head having openings extending longitudinally of its own axis to accommodate the movements of said lever.

7. In a device of the class described, the mechanical motion comprising a revolving lever inclined to the axis about which it revolves, a member reciprocating in a straight line transverse of said axis, and connecting means for reciprocating and laterally rocking said member by the operation of said lever.

8. In a device of the class described, the mechanical motion comprising a revolving lever inclined to the axis about which it revolves, a member reciprocating in a straight line transverse of said axis, and connecting means accommodating the said motion of said lever for reciprocating said member by said lever.

In testimony whereof, I have signed my name to this specification.

JOHN M. BUTLER.