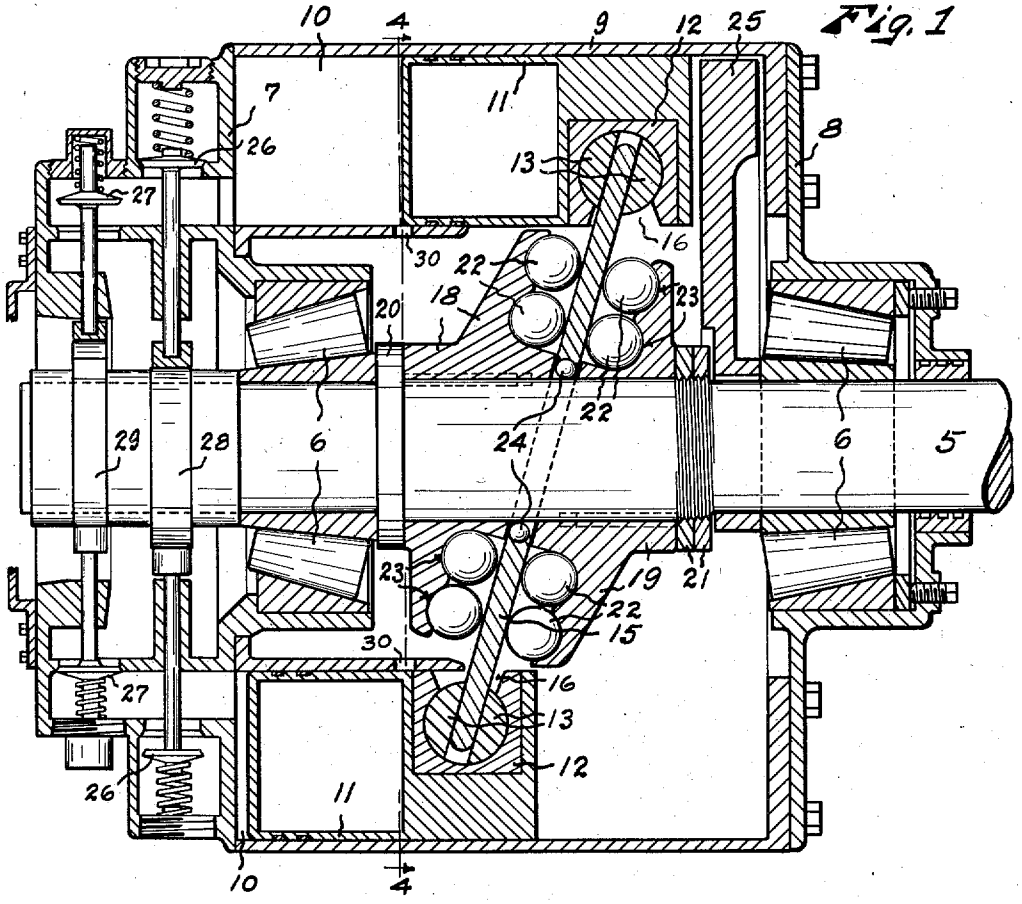
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ENGINE

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Fig. 1



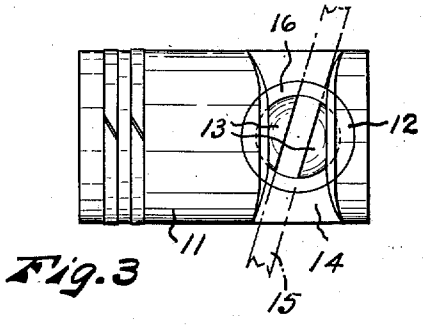


Fig. 3

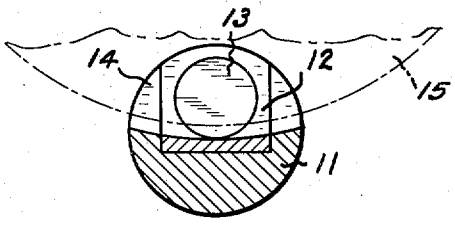


Fig. 2

INVENTOR
Edgar U.G. Reagan
BY
Fred C Matheny
ATTORNEY

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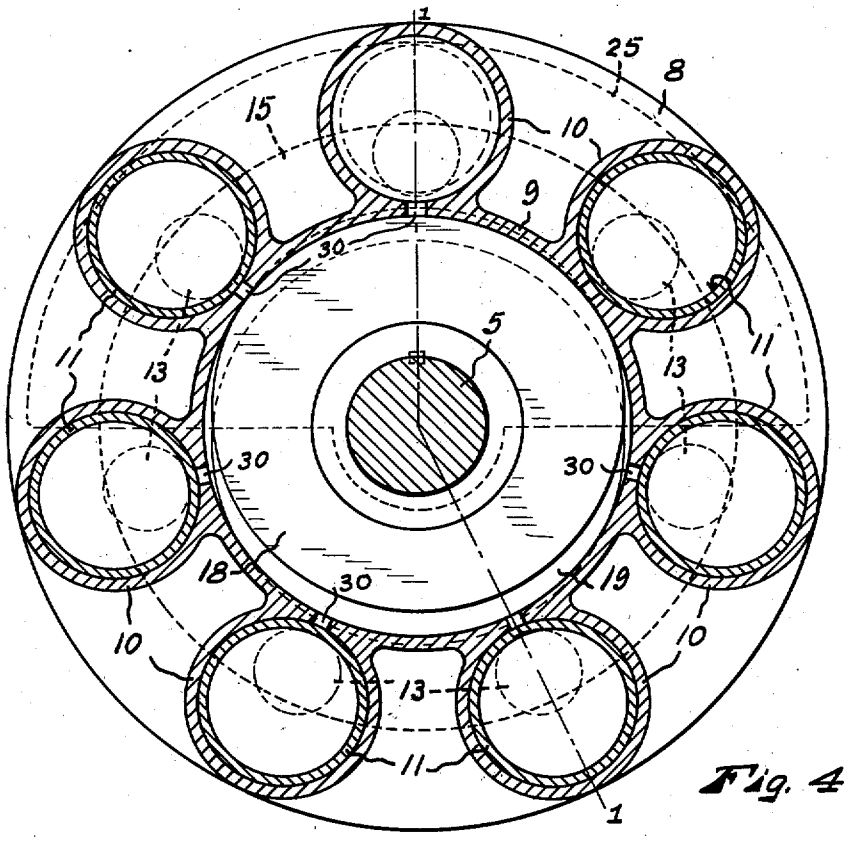


Fig. 4

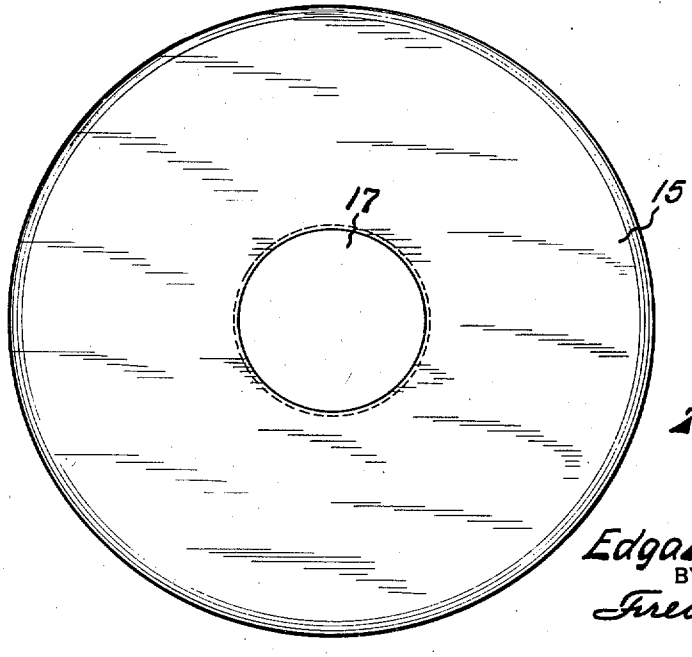


Fig. 5

INVENTOR
Edgar U.G. Reagan
BY
Fred C. Matheny
ATTORNEY

Patented Oct. 30, 1934

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ENGINE

Edgar U. G. Reagan, Detroit, Mich., assignor of one-half to Clarence F. Harvey and one-fourth to George E. Hawley, both of Detroit, Mich.

Application August 20, 1927, Serial No. 214,268

12 Claims. (Cl. 74—60)

My invention relates to improvements in engines of the so called wabbler type, in which the cylinders are arranged parallel with the main engine shaft and the power is transmitted from the pistons to the shaft by means of a disc or spider which is connected with the pistons and with the shaft and is inclined at other than right angles relative to the shaft.

The object of my invention is to provide an engine of this type embodying a floating disc for transmitting the thrust of the pistons to the shaft in the form of a torque which tends to turn said shaft, the connection between the disc and the main shaft leaving the shaft free to rotate without rotating the disc, and the periphery of the disc being slidably connected with the pistons in such a manner as to receive the piston thrust and yet permit the required relative movement between the disc and the pistons as the pistons reciprocate and impart a wabbling movement to the disc.

Another object is to provide efficient counterbalancing means for eliminating vibration in an engine of this type.

Further objects are to simplify the construction and increase the efficiency of the means for connecting the pistons with the main shaft in an engine of this type, and to improve the engine generally and render the same more compact and stronger in construction, and more efficient in operation.

Other and more specific objects will be apparent from the following description taken in connection with the accompanying drawings.

The invention is herein disclosed as embodied in a steam engine but is equally well adapted for use in connection with an internal combustion engine.

In the accompanying drawings, Figure 1 is a longitudinal sectional view, on broken line 1—1, of Fig. 3, of an engine constructed in accordance with my invention.

Fig. 2 is a detached sectional view through one of the pistons.

Fig. 3 is an elevation of one of the pistons.

Fig. 4 is a cross section on broken line 4—4 of Fig. 1.

Fig. 5 is a detached elevation of the driving disc embodied in the invention.

Referring to the drawings, throughout which like reference numerals designate like parts, 5 designates a main engine shaft that is journaled in suitable bearings 6 which are supported in frame plates 7 and 8 respectively. The frame plates 7 and 8 constitute the two ends of a motor housing and are secured to the ends of a block 9 in which are formed, a plurality of cylinders 10 that are arranged parallel with the axis of the shaft 5 and are equidistantly spaced around said shaft. In the drawings I have shown seven cylinders but obviously a greater or less number may be used.

A piston 11 is mounted for reciprocation within each cylinder 10. The forward end of each piston 11 is recessed for the reception of a cylindrical block 12 which supports the two halves 13 of a ball type bearing member. The pistons are slotted as at 14 to afford clearance for the periphery of a floating disc 15 by which power is transmitted from the pistons to the shaft 5. The cylindrical blocks 12 are also cut away as at 16 to afford clearance for said disc. The periphery of the disc 15 passes slidably between the ball type bearing members 13 which form a universal bearing between the piston and the disc. The disc 15 has a hole 17 in its center through which the shaft 5 passes and said disc is inclined at other than right angles to the axis of the shaft and is disposed between two inclined hub members 18 and 19 that are fixedly and non-rotatably mounted on the shaft 5. A collar 20 supports the outer end of the hub 18 and nuts 21 adjustably support the outer end of the hub 19. Anti-friction bearings 22 are provided on both sides of the disc 15 between said disc and the adjacent hub members 18 and 19. These bearings 22 are shown as balls disposed in races 23 in the inclined surfaces of the hub members 18 and 19 but obviously roller bearings may be used in substantially the same way. The bearings 22 may be tightened by adjusting the nuts 21.

Ball bearings 24 are preferably disposed between the shaft 5 and the surrounding portion of the disc 15 at the location of the hole 17.

To counterbalance the thrust and inertia of the pistons on their power stroke and to eliminate a vibration which is otherwise set up in an engine of this type a counterweight or balancer 25 is preferably provided on the shaft 5. This counterweight may be in the form of a segment of a disc, as shown or it may be a complete disc made heavier on one side. Inlet valves 26 and exhaust valves 27 are provided at the head ends of the cylinders. These valves may be operated by cams 28 and 29 respectively on the main shaft 5. The specific form of these valves and cams is not material to the present application and the valves and cams are not herein described in detail. The valves are necessarily timed to open in the proper sequence to admit steam to succes-

sive cylinders and to permit the exhaust of successive cylinders as the shaft 5 rotates and the cams may be made to permit the engine to be reversed. When this invention is embodied in an internal combustion engine the valve arrangement will necessarily be different but the method of transmitting power from the pistons to the main shaft, which is the essence of this invention, will be the same.

In the operation of this engine steam will be admitted to successive cylinders just after the pistons have reached the rearmost position in their stroke thereby moving the pistons forward one after another and producing a thrust on an inclined portion of the disc 15 that will tend to turn the shaft 5. This pressure may continue throughout slightly less than one half of one complete revolution. While the pressure is being exerted on one side, the pistons on the opposite side are moving rearwardly and are exhausting. Just before each piston reaches the outermost limit of its power stroke it begins to uncover a small opening 30 through which some steam may exhaust, this steam carries oil with it for lubricating the working parts of the engine after a manner commonly known as the "uniflow" in connection with steam engines. The small opening 30 is quickly closed by the return movement of the piston the remainder of the steam exhausting past the valve 27 as the piston moves toward the rear end of the cylinder. While the pistons in one semi-circular quadrant are moving outwardly on their power stroke those in the opposite semi-circular quadrant are moving rearwardly on the exhaust stroke.

The pressure exerted against the disc 15 on the power stroke of the pistons will be transmitted to the inclined bearings 22 and will produce a torque which will tend to turn the shaft 5 in the well known manner common to engines of this type.

The disc 15 does not rotate with the shaft 5 and is not fixed relative to the pistons 11. Said disc being, in effect, free to float may turn slowly as the shaft 5 rotates at high speed but said disc will not rotate fast enough to attain a high peripheral speed or to cause the same to wear appreciably in the bearing members 13. The thrust of the pistons against the disc 15 is all taken by the split balls 13 which have very little oscillation in the blocks and which slide the necessary small amount on the disc 15 but are subject to very slight wear. The thrust of the disc 15 against the hub members 18 and 19 is taken by the balls 22 which are at a considerable distance from the axis of the shaft and are ample to withstand the wear and strain to which they are subjected.

The foregoing description and accompanying drawings clearly disclose a preferred embodiment of my invention but it will be understood that this disclosure is merely illustrative and that such changes in this engine may be resorted to as are within the scope and spirit of the following claims.

I claim:

1. In an engine of the class described, a shaft, a plurality of cylinders arranged around said shaft parallel therewith and spaced therefrom, pistons in said cylinders, and means including an inclined floating metal wabbler disc having engagement with the pistons and having sliding means bearing on its sides and connected with the shaft for transmitting the thrust of the pistons as a torque to the shaft.

2. In an engine of the class described, a shaft, a plurality of cylinders arranged around said shaft parallel therewith, pistons reciprocable in said cylinders in directions parallel to the axis of the shaft, and means for transmitting the thrust of the pistons as a torque to the shaft, said means including an inclined floating wabbler disc with a solid peripheral portion slidably engaged by said pistons and a central opening affording clearance for said shaft, the faces of said disc adjacent said opening being flat to coact with bearing means on the shaft.

3. In an engine of the class described, a shaft, a plurality of cylinders arranged around said shaft parallel therewith and in spaced relation therefrom, pistons reciprocable in said cylinders, and means for transmitting the thrust of the pistons as a torque to the shaft, said means including an inclined wabbler disc with a solid peripheral portion slidable through the outer ends of said pistons and having toward its center, an opening affording clearance for the shaft, the faces of said disc adjacent said opening being plane and flat, bearing flanges mounted in inclined positions on the shaft on opposite sides of the said disc and antifriction bearings between said flanges and the sides of said disc.

4. In an engine of the class described, a shaft, a plurality of cylinders arranged around said shaft parallel therewith, pistons reciprocable in said cylinders, means on said shaft affording two spaced apart bearings extending around the shaft and disposed in a plane that is inclined at other than right angles to the shaft, and an inclined floating wabbler disc rotatably supported between said bearings and having a central opening to clear said shaft, the peripheral portion of said wabbler disc being solid and having slidable connection with said pistons.

5. In an engine of the class described, a shaft, an engine housing, a plurality of cylinders arranged around the shaft parallel therewith, pistons reciprocable in said cylinders, hubs on said shaft affording two spaced apart bearing races that are inclined at other than right angles to the shaft, anti-friction bearings in said races, and an inclined floating wabbler disc extending between said anti-friction bearings and rotatably supported by said anti-friction bearings and having a central opening to clear said shaft, the pistons being slotted and the periphery of said wabbler disc passing loosely and slidably through said slots.

6. The apparatus as described in claim 5 in which spherical bearings are provided in the pistons and the periphery of the wabbler disc is slidable through said spherical bearings.

7. In an engine of the class described, a shaft, a plurality of cylinders arranged around said shaft parallel therewith, pistons in said cylinders, means including a flat inclined floating wabbler disc having relatively rotatable engagement with the pistons and with the shaft for transmitting the thrust of the pistons as a torque to the shaft and a counterweight secured to the shaft for counterbalancing the vibrations produced by said pistons.

8. In an engine of the class described, a rotatable shaft, a plurality of pistons positioned thereabout and a disc rotatable relative to said shaft and pistons for effecting their interconnection.

9. In an engine of the class described, a rotatable shaft, a plurality of reciprocable pistons positioned thereabout, a disc rotatable relative to said shaft and pistons for changing a force in

translation of the pistons to one in rotation of the shaft.

10. In an engine of the class described, a rotatable shaft, a plurality of pistons positioned thereabout, a disc rotatable relative to said shaft and pistons for effecting their interconnection, raceways fixed to said shaft, and ball bearings in engagement with both sides of the disc and said raceways.

11. In an engine of the class described, a rotatable shaft, a plurality of pistons positioned thereabout, a disc rotatable relative to said shaft and pistons for effecting their interconnection, raceways fixed in angular relation to said shaft and ball bearings in engagement with both sides of the disc and a side of said raceways.

12. In an engine of the class described, a rotatable shaft, a plurality of pistons positioned thereabout, a disc rotatable relative to said shaft and pistons for effecting their interconnection, raceways fixed in angular relation to said shaft, ball bearings in engagement with both sides of said disc and a side of said raceways, and bearing members associated with said pistons for receiving the edge of the disc.

EDGAR U. G. REAGAN.

CERTIFICATE OF CORRECTION.

Patent No. 1,978,762. October 30, 1934.

EDGAR U. G. REAGAN.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 2, line 72, claim 1, strike out the word "sliding" and insert the same after "having" in line 71, of said claim; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 18th day of December, A. D. 1934.

Leslie Frazer

(Seal) Acting Commissioner of Patents.

translation of the pistons to one in rotation of the shaft.

10. In an engine of the class described, a rotatable shaft, a plurality of pistons positioned thereabout, a disc rotatable relative to said shaft and pistons for effecting their interconnection, raceways fixed to said shaft, and ball bearings in engagement with both sides of the disc and said raceways.

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