J. E. PFEFFER.

PRESSURE FLUID MOTOR.

APPLICATION FILED MAY 29, 1918.

**1,400,236.**

**Patented Dec. 13, 1921.**

2 SHEETS—SHEET 1.

Fig. 1

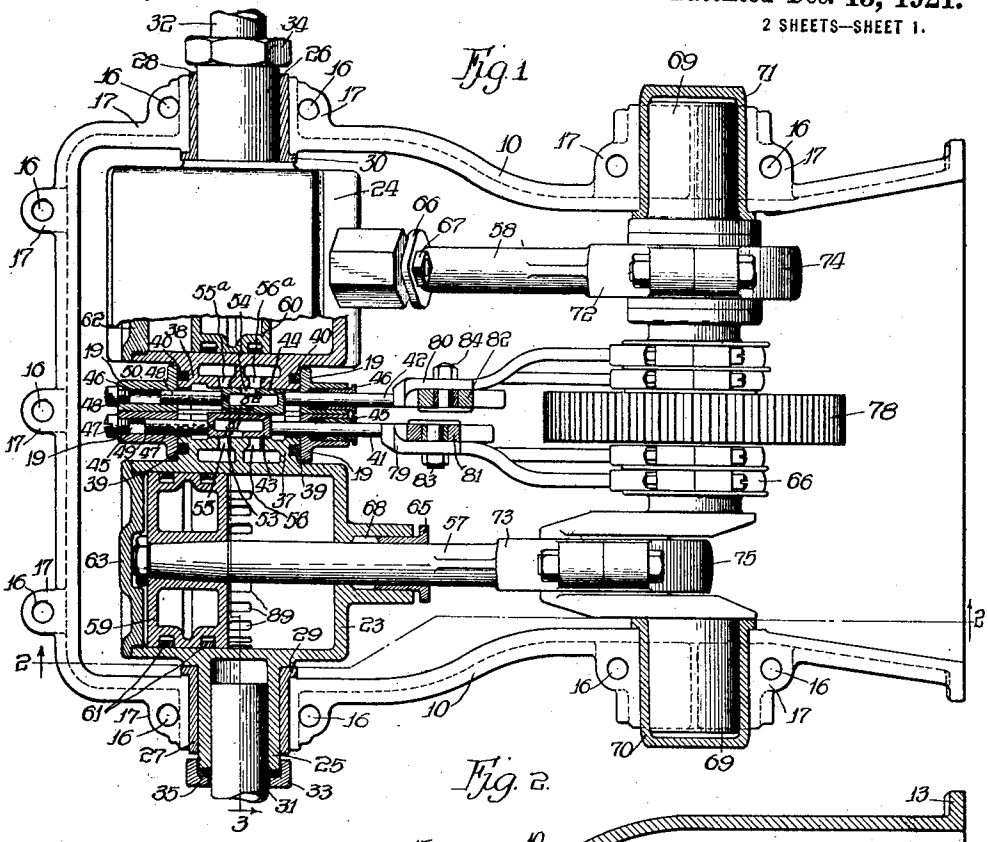
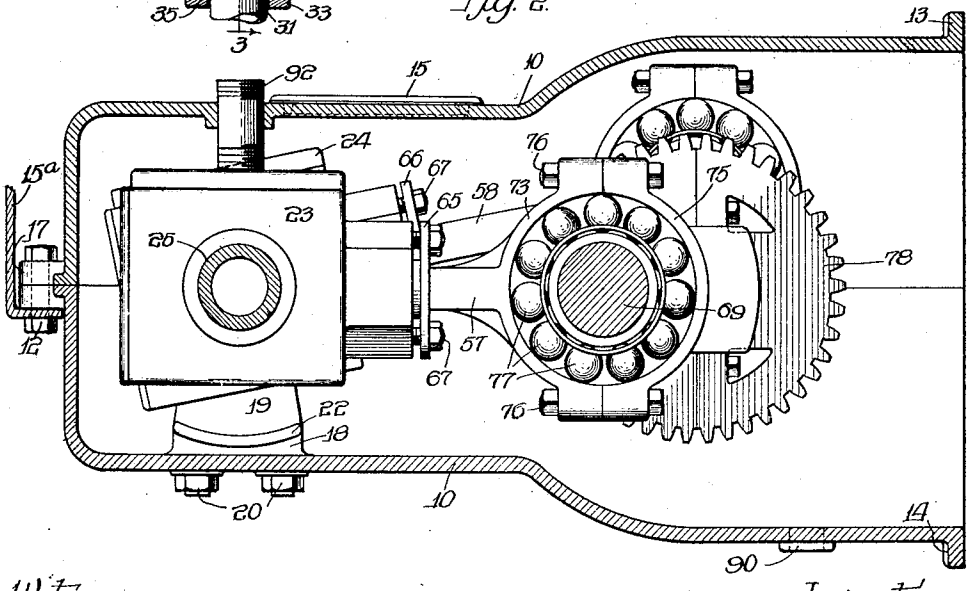


Fig. 2.



Witnesses:

Fred C. Dixon

Milton F. Miller

Inventor:

John E. Pfeffer

By Williamson & Hinkley

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2 SHEETS—SHEET 2.

Fig. 3.

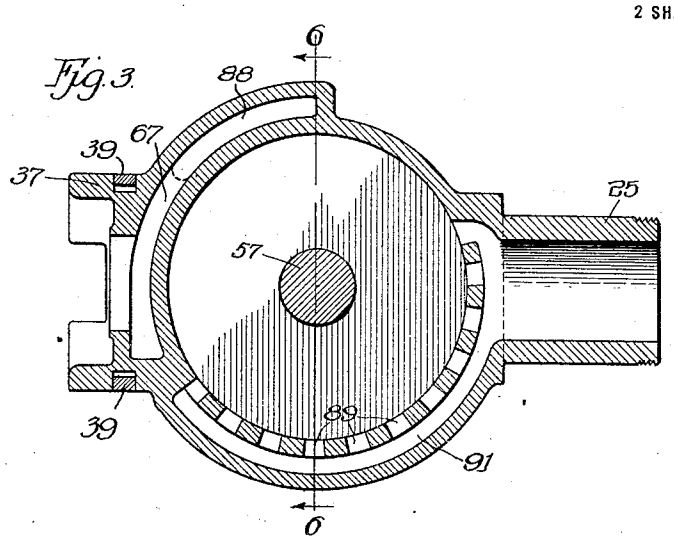



Fig. 4.

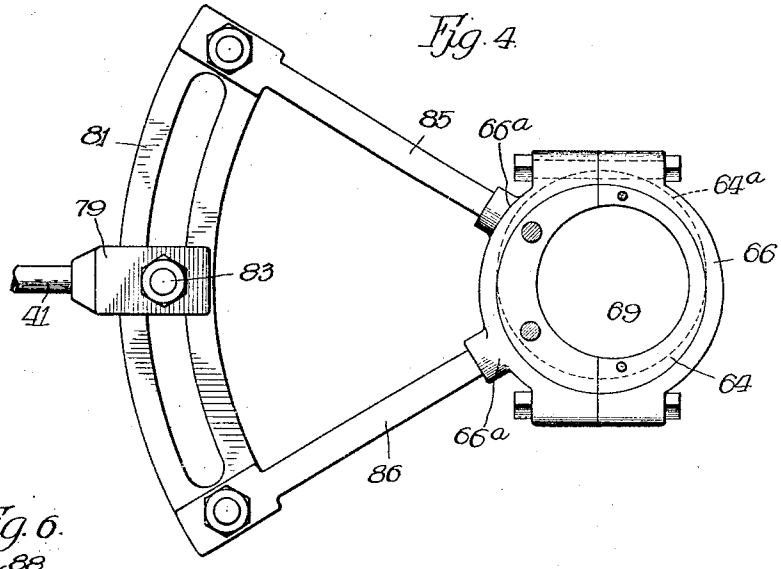
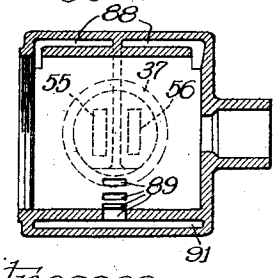



Fig. 6.



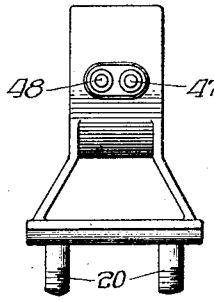




Fig. 5.

Witnesses:

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# UNITED STATES PATENT OFFICE.

JOHN EDWARD PFEFFER, OF CHICAGO, ILLINOIS.

## PRESSURE-FLUID MOTOR.

1,400,236. Specification of Letters Patent. Patented Dec. 13, 1921.

Application filed May 29, 1918. Serial No. 237,209.

*To all whom it may concern:*

Be it known that I, JOHN EDWARD PFEFFER, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Pressure-Fluid Motors, of which the following is a specification.

This invention relates to motors or engines employing steam or other expansible pressure fluid as the motive power thereof, and has for its object to provide certain new and useful improvements in the type of motors or engines which employ oscillatory cylinders, whereby a simplified power connection may be employed between the piston and the crank shaft, and simplified valve operating mechanism may be employed. In this connection my invention obviates the employment of the usual cross-head and pivotal rod connections, and I am also enabled to provide simple and compact valve actuating mechanism, all of which especially adapts the engine or motor for use on motor vehicles or in any other place where it is desirable to have an engine working in a small and as compact space as possible.

Another object of the invention is the provision of a power unit which is simple and efficient in operation and which will get the utmost amount of power from a minimum amount of steam.

These and other objects of the invention will be more fully and better understood by reference to the accompanying drawings and in which—

Figure 1 is a plan view partially in section of an engine or motor embodying the features of the present invention;

Fig. 2 is a vertical sectional view of the motor on lines 2—2 of Fig. 1;

Fig. 3 is a sectional view of the motor through one of the cylinders on line 3—3 of Fig. 1;

Fig. 4 is a side elevation of the valve operating mechanism;

Fig. 5 is an end elevation of the steam or valve chest of my invention; and

Fig. 6 is a sectional view on line 6—6 of Fig. 3 showing the intake and exhaust ports.

Referring now specifically to the drawings and in which like reference characters refer to like parts throughout, I provide a case or housing 10 within which the power unit is mounted and having suitable connections 13 and 14 by means of which the housing can be secured to the axle housing of a vehicle. The housing 10 on its upper side has secured thereto a hand-hole 15 and can be suspended from the vehicle at its rear by means of a connecting strap $15^a$ or any other portion desired and in any manner desired. The housing 10 comprises two sections, an upper and lower, secured together by means of bolts such as 12 passing through holes 16 formed in ears or projections 17 along the marginal edges of each of the sections of the housing 10. Suitable journal bearing openings hereinafter described, are also provided in the housing or casing. Mounted upon a suitable base 18 formed integrally with the case 10 is a valve or steam chest 19 and held securely in position by means of bolts 20, 20, the top of the base 18 being curved slightly and the base 22 of the valve chest 19 also being curved to conform to the shape of the base 18. Mounted within the chamber formed by the case 10 I provide a pair of steam cylinders 23 and 24, each of said cylinders on its outside having a hollow integral projection 25 and 26 suitably mounted within bearings 27 and 28, the bearings 27 and 28 fitting snugly within suitable openings in the casing 10 and each of said bearings having an annular shoulder 29 and 30 for engagement against the inner wall of the casing 10 so as to be held firmly in position. Exhaust pipes 31 and 32 leading to any desired point away from the cylinders are located within the hollow projections 25 and 26 and serve to carry away the exhaust steam or gases from the cylinders, as hereinafter described. In threaded engagement with the outer ends of the hollow projections 25 and 26 I provide nuts 33 and 34 with suitable packing such as 35 interposed between the ends of the projections 25 and 26 and the said nuts so as to provide a steam tight joint. Each of the cylinders 23 and 24 on its inner side has a circular head or projection 37 and 38 which fits into corresponding openings in the steam or valve chest 19 so as to allow each of the cylinders 23 and 24 to oscillate while the steam or valve chest 19 remains in

a stationary position with respect to the cylinders. Encircling the heads 37 and 28 in suitable grooves and between the bearing surfaces of the said heads and the steam chest 19 is a pair of ordinary expansive piston rings 39 and 40 so as to prevent any leakage of steam in the bearing joint between the cylinders and steam chest. Suitably mounted within the valve chest 19 and upon valve stems 41 and 42 is a pair of slide valves 43 and 44, the valve rods 41 and 42 being mounted within suitable guideways with bushings 45 and 46 secured to the valve chest and packed in the usual manner to prevent steam from escaping around the valve stems 41 and 42. Secured to each of the valves 43 and 44 and extending rearwardly is a pair of valve stems 47 and 48 working within circular guideways 45 and 46 the guideways being closed by threaded nuts 47 and 48. Passageways 49 and 50 extend longitudinally of the valve rods 47 and 48 to allow the escape of any steam from the rear closed portion of the guideways 45 and 46. The valves 43 and 44 are mounted so that they reciprocate against each other on their inner faces, the outer faces being in contact with the cylinders 23 and 24 respectively, the flat surfaces of the cylinders affording valve seats for the valves 43 and 44. This arrangement in effect makes the valves of the balanced type and avoids the friction produced between the valve and the cylinder in the ordinary type of slide valve by the pressure of the steam upon the valves. The valves 43 and 44 have vertical openings 51, 52, extending therethrough with transverse communicating ports 53, 54, respectively extending through their outside walls to allow steam to pass into the cylinders through intake ports 55 and 56 and $55^a$ and $56^a$ provided in each of the cylinders. Each of said cylinders 23 and 24 has a reciprocating piston located therein, the said pistons comprising piston rods 57, 58, to which are secured piston heads 59, 60, in any manner desired. Piston rings 61, 61, fit around the piston heads in the usual manner to insure tight fitting of the piston heads and prevent leakage of steam. Cylinder heads 62, 63, in threaded engagement with the cylinders are mounted upon the cylinders in the usual manner. Bushings 65, 66, secured to the cylinders by means of bolts 67, 67, hold the packing 68 surrounding the piston rods in position and afford tight joints preventing leakage of steam around the piston rods.

A crank shaft 69 extends transversely of the case 10 at its front portion and is mounted at its ends within journal bearings 70, 71, in any suitable manner. The piston rods 57 and 58 at their front ends are secured directly to the crank shaft 69 by means of any suitable connection, but preferably as shown in the drawing, the piston rods having enlarged portions or heads 72, 73, integral therewith. Straps 74 and 75 secured to the head portions of the pistons by means of bolts 76, 76, hold the pistons securely in engagement with the crank shaft. Ball bearings 77 are interposed between the crank shaft 69 and the bearing surface of each of the piston rods. A suitable gear wheel 78 is mounted upon the crank shaft 69 so that it will mesh with the transmission gear of an ordinary vehicle such as an automobile or truck, the power of the engine thus being transmitted to the vehicle.

The valve rods 41 and 42 have heads at their front ends 79, 80, secured thereto in any suitable manner, the heads 79 and 80 being held in operative relation with links 81 and 82 by means of bolts 83 and 84, the connection being such that an oscillating movement of the links can take place, one of such links and connections being illustrated in Fig. 4. The links are connected at each of their ends by rods such as 85 and 86 which are in turn secured by means of a head portion $66^a$ and straps 66 to eccentrics 64 and $64^a$ mounted upon the crank shaft 69 in any suitable manner, one of the eccentrics being turned in advance of the other in the usual manner so as to give an oscillating or rocking movement to the links 81 and 82. In the walls of the cylinders I provide passages 67 extending circumferentially of the cylinder for a short distance and communicating with another passage 88 extending longitudinally of the cylinders to the ends thereof and through which steam is admitted to the cylinders under control of the valves 43 and 44 and through the intake ports 55 and 56 and $55^a$ and $56^a$ in the cylinders. The steam is thus carried for a short distance circumferentially around the cylinders, this arrangement of the ports enabling me to position the cylinders more compactly and secure a closer and better arrangement of the ports. Located centrally of each cylinder I provide a plurality of exhaust ports 89, which communicate with a passage 91 in the walls of the cylinders and which extend circumferentially around the cylinder and lead to the exhaust pipe 31 and 32. It will be thus understood that as the cylinder head reaches a point toward the end of each stroke the exhaust ports are uncovered and a free passage afforded for the escape of the steam to the atmosphere or to a condenser. A steam supply pipe 92 extends through the top of the housing 10 and connects with the steam or valve chest 19. An opening 90 is provided in the bottom of the case 10 in order that drainage of the case may be made.

It will also be understood that by providing a stationary steam or valve chest

within which the valves reciprocate in a horizontal plane exactly at right angles to the vertical plane of the crank shaft coupled with the oscillation of the cylinders the action of the valves in cutting off the steam is very much quickened and "wire drawing" of the steam is thus avoided. I am thus able to use the steam expansively to a greater degree by reason of the quick action of the valves in cutting off the steam at any particular point in the stroke of the pistons. It will be understood that by the use of the valve actuating mechanism which I show and describe, the admission of the steam to the cylinders may be controlled, and that the steam through the cylinders may be cut off at any point desired, thus securing the benefit of the expansive power of the steam to a greater extent than if the steam were allowed to flow into the cylinders for the full length of the stroke of the piston.

It will also be noted that the pistons are connected to the crank shaft at right angles with respect to each other and are entirely separate and independent of each other, as far as their working is concerned. And it will be further understood that any number of cylinders can be coupled up in the same manner as the pair of cylinders which I have illustrated and described in order to provide a working unit of any size desired.

While I have described more or less precisely the details of construction, I do not wish to be understood as limiting myself thereto, as I contemplate changes in form and the proportion of parts and the substitution of equivalents as circumstances may suggest or render expedient without departing from the spirit or scope of my invention.

I claim:

1. A motor comprising a crank shaft, an oscillating cylinder having a piston and a direct connection between the piston and a crank of the crank shaft, a stationary pressure fluid chest supported independently of the cylinder and provided with a circular socket opening into the chest, the cylinder having an external cylindrical boss mounted to oscillate in the socket and provided with an inlet port, a slide valve mounted in the chest in coöperative relation with the inlet port and working in the general direction of the reciprocating movement of the piston, and valve actuating means, the passage of pressure fluid through the inlet port being controlled by the joint movements of the cylinder and the valve.

2. A motor comprising a crank shaft, an oscillating cylinder having a piston and a direct connection between the piston and a crank of the crank shaft, a stationary pressure fluid chest supported independently of the cylinder and provided with a circular socket opening into the chest, the cylinder having an external cylindrical boss mounted to oscillate in the socket and provided with an inlet port, a slide valve mounted in the chest in coöperative relation with the inlet port and working in the general direction of the reciprocating movement of the piston, and valve actuating means, the passage of pressure fluid through the inlet port being controlled by the joint movements of the cylinder and the valve, the cylinder being provided with an exhaust port controlled by the piston.

3. A motor comprising a crank shaft having a pair of cranks, a pair of oscillatory cylinders provided with pistons having direct connections with the respective cranks, a stationary pressure fluid chest located between the cylinders and provided at opposite sides with circular sockets, each cylinder having a circular boss rotatably mounted within the adjacent socket of the steam chest and provided with an inlet port, a pair of slide valves mounted in the chest in coöperative relation with the inlet ports of the respective cylinders and in mutual slidable engagement, said valves working in the general direction of movement of the pistons, and valve actuating means associated with the crank shaft, the passage of pressure fluid through the ports being controlled by the joint movements of the cylinder and the respective valves.

4. A motor comprising a crank shaft having a pair of cranks, a pair of oscillatory cylinders provided with pistons having direct connections with the respective cranks, a stationary pressure fluid chest located between the cylinders and provided at opposite sides with circular sockets, each cylinder having a circular boss rotatably mounted within the adjacent socket of the chest and provided with an inlet port, a pair of slide valves mounted in the chest in coöperative relation with the inlet ports of the respective cylinders and in mutual slidable engagement, said valves working in the general direction of movement of the pistons, and valve actuating means associated with the crank shaft, the passage of pressure fluid through the ports being controlled by the joint movements of the cylinders and the respective valves, each cylinder being provided at its outer side with a hollow trunnion and an exhaust port leading into said trunnion, the exhaust port being controlled by the piston, and a bearing for each of said trunnions.

5. A motor comprising a crank shaft, an oscillatory cylinder provided at opposite sides with trunnions, one of the trunnions having an inlet port, the other trunnion being hollow and constituting an exhaust port, a bearing for said hollow trunnion, a sta-

tionary pressure fluid chest having a socket receiving the trunnion having the inlet port and constituting a bearing for said trunnion, a slide valve mounted in the chest and controlling the inlet port and working in the general direction of movement of the piston, and valve actuating means associated with the crank shaft, the passage of pressure fluid through the inlet port being controlled by the joint movements of the cylinder and the valve.

Signed at Chicago, Illinois, this 25th day of May, 1918.

JOHN EDWARD PFEFFER.