

No. 702,601.

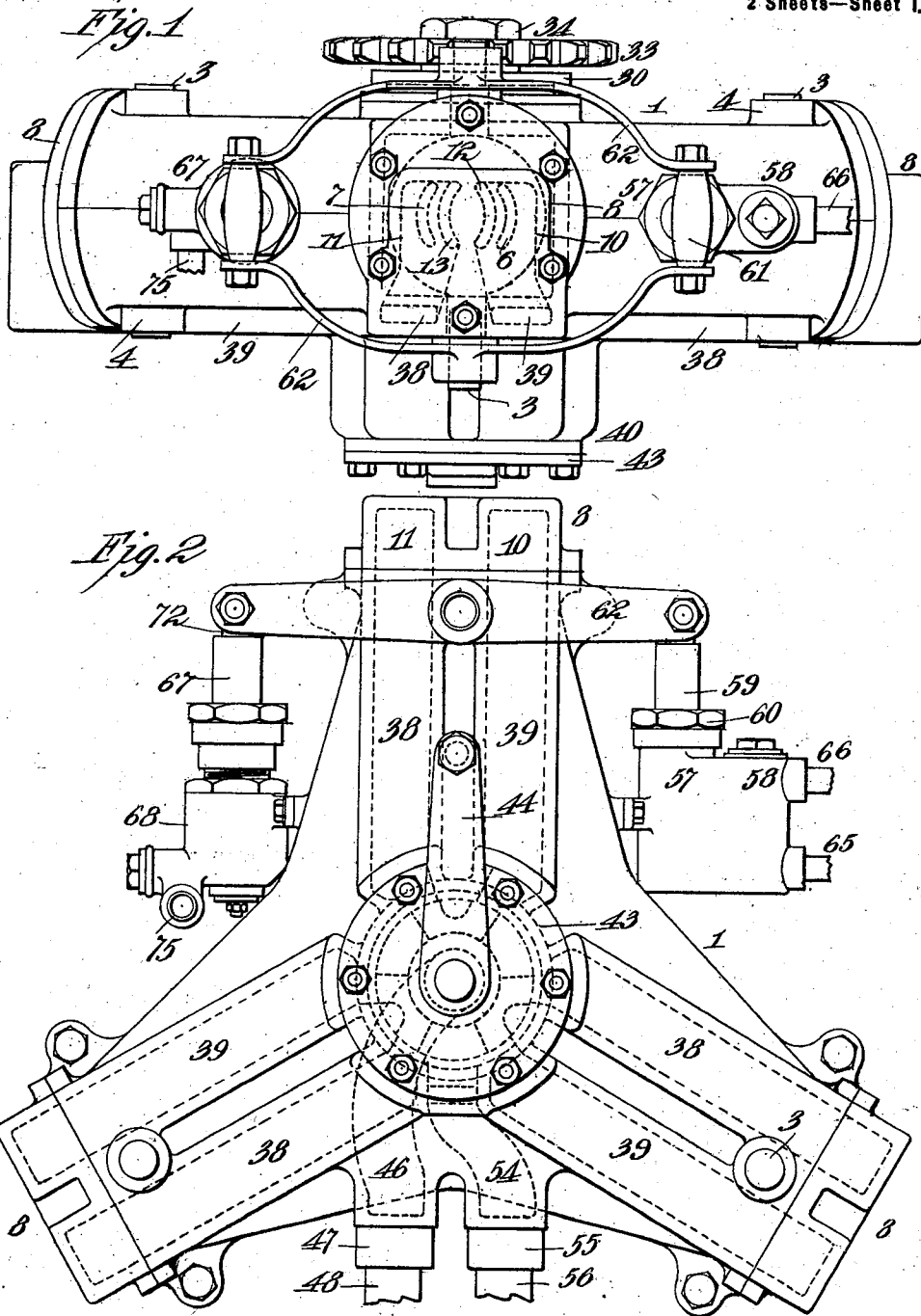
Patented June 17, 1902.

A. C. SMITH.
FLUID PRESSURE ENGINE.

(Application filed July 24, 1901.)

(No Model.)

2 Sheets—Sheet 1.



Witnesses:
Archibald Gray Pease
Isabel M. McIntosh

Inventor
A. Columbus Smith
by *Hyman Edmunds & Co.*
Att'ys.

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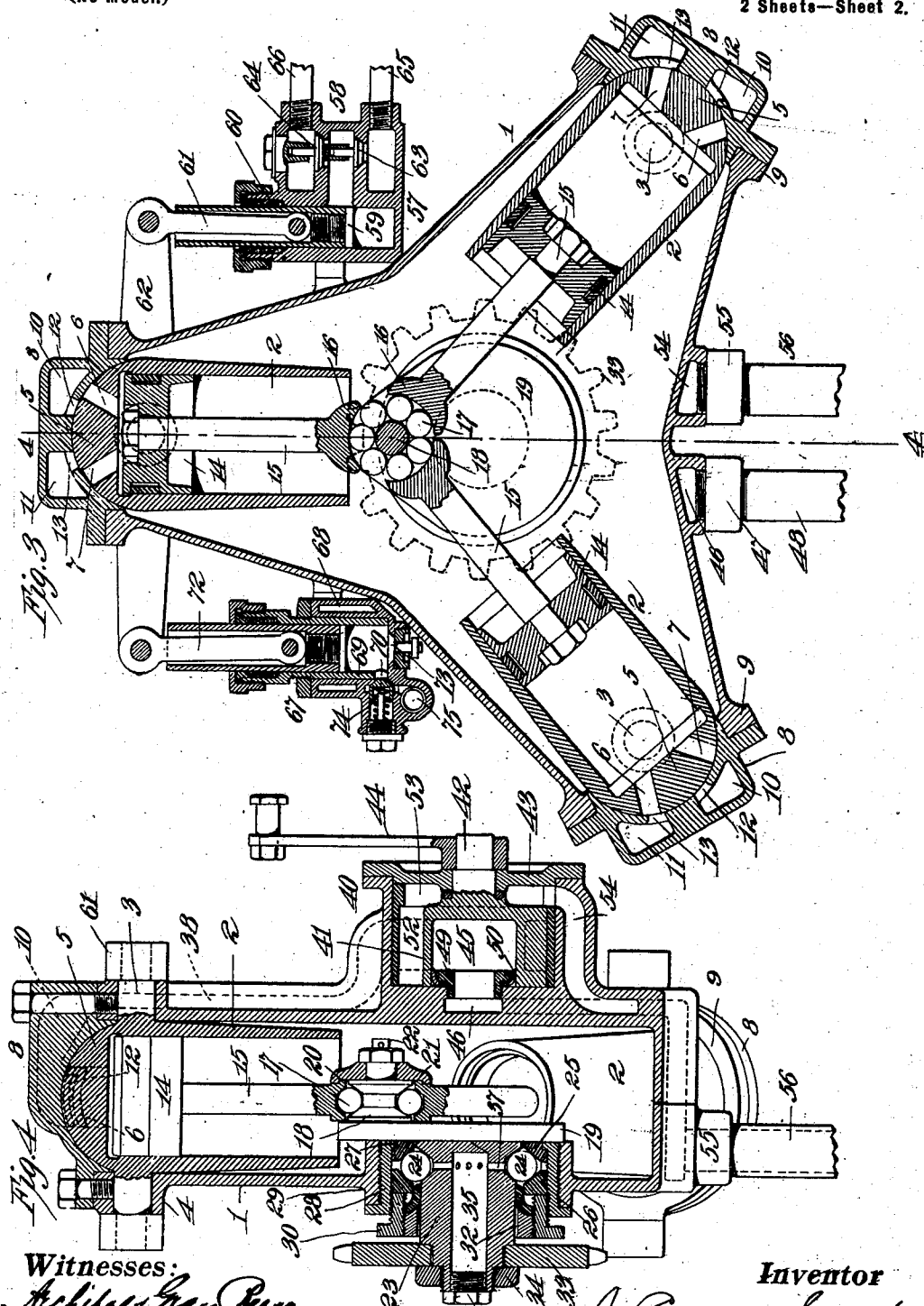
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Witnesses:

Archibald Haynes
Seabel M. Intosh

Inventor

A. Columbus Smith
by *Lyer Edmund*

Att'ys.

UNITED STATES PATENT OFFICE.

AMOUR COLUMBUS SMITH, OF NEW YORK, N. Y., ASSIGNOR TO EDWARD S. JAFFRAY, TRUSTEE, OF IRVINGTON, NEW YORK.

FLUID-PRESSURE ENGINE.

SPECIFICATION forming part of Letters Patent No. 702,601, dated June 17, 1902.

Application filed July 24, 1901. Serial No. 69,527. (No model.)

To all whom it may concern:

Be it known that I, AMOUR COLUMBUS SMITH, a citizen of the United States, residing in the borough of Manhattan, in the city and State of New York, have invented a certain new and useful Improvement in Fluid-Pressure Engines, of which the following is a specification.

My invention relates to improvements in fluid-pressure engines which are designed especially for use in connection with steam-automobiles, but which may be employed in many other arts and with other fluid-pressures, such as compressed air, carbonic-acid gas, &c.

My object is to provide a very simple, compact, and efficient engine for the purpose. When used, as is preferred, as the operating-motor of a steam-automobile, the invention also contemplates the employment of an auxiliary feed-water pump and an air-compressing pump, one or both, the former supplying water to the boiler and the latter furnishing compressed air to the gasoline-tank.

In order that the invention may be better understood, attention is directed to the accompanying drawings, forming a part of this specification, and in which—

Figure 1 is a plan view; Fig. 2, a side elevation; Fig. 3, a vertical sectional view, and Fig. 4 a section on the line 4 4 of Fig. 3.

In all of the above views corresponding parts are represented by the same numerals of reference.

My invention comprises generally an inclosed casing 1, preferably cast as thin as possible consistent with the necessary strength and made of any suitable metal. Mounted within the casing 1 are pressure-cylinders 2 of any suitable number and dimensions. Preferably three cylinders are employed, in which case the casing will partake of the approximately triangular form in side elevation which is illustrated; but obviously more or less cylinders may be employed, the casing being correspondingly modified to accommodate them. Each cylinder 2 is mounted on trunnions 3 3, taking in bearings 4 in the casing, whereby the cylinders may oscillate in operation. The end of each cylinder is formed with an integral rounded head 5, as shown,

having two ports 6 and 7 therein. Coöperating with the rounded end of each cylinder is a cap 8, constituting a valve-chamber, the cylinder itself performing the function of a valve in operation, as will be explained. Each cap 8 is bolted or otherwise secured to a flange 9, formed on the casing 1. The caps 8 are formed each with two separated chambers 10 and 11 therein, from which lead ports 12 and 13. The port 6 of each cylinder coöperates with the port 12, and the port 7 of each cylinder coöperates with the port 13 of the corresponding cap. Working in each cylinder 2 is a suitably-packed piston 14, from which extends a rod 15. The piston-rods are formed with enlarged heads 16 at their inner ends, which heads are provided with curved grooves, with which coöperate the antifriction-balls 17. These balls work within a grooved wrist-pin 18, secured to the face of a disk 19. Each of the piston-rods is provided near its lower end with a shoulder or offset 20, and over these shoulders engages the flanged cap 21, which is carried on a pin 22, extending out from the wrist-pin 18. The crank-disk 19 is fast to the main shaft 23, which is supported by antifriction-balls 24. These balls work between inclined rings 25 and 26, which form the ways in which the balls rotate. The ring 25 bears against a shoulder 27 on an adjusting-sleeve 28, threaded into a seat 29, cast with one of the side members of the casing 1. The ring 26 is mounted within the sleeve 28 and is adjusted by means of a sleeve 30, threaded into the sleeve 28. A packing 31 is interposed between the shaft 23 and the sleeve 30, which packing is held in place by a sleeve 32, threaded into the sleeve 30. Preferably the threads on the sleeves 28 and 30 oppose each other, one being right-handed and the other being left-handed, so that by turning said sleeves in the same direction the rings 25 and 26 may be adjusted toward or away from each other to take up wear between said rings and the balls 24 or to relieve any cramping between such moving parts. Carried by the shaft 23 is a sprocket-wheel 33, preferably screwed in place and held in position by a jam-nut 34. The shaft 23 is provided with a chamber therein, closed by a screw-cap 36. A series

of perforations 37 extend from the chamber 35 to the groove in the shaft, as shown, so that by placing within the chamber 35 a suitable semisolid lubricant the latter will be permitted to pass through the channels 37 to lubricate the balls 24 in use.

Connecting with the chambers 10 and 11 in the caps 8 are steam-passages 38 and 39, respectively, which lead to a controlling-chamber 40, cast with the casing 1 in line with the shaft 23. The steam-passages 38 and 39 may be cast with the casing, or they may be separate pipes, preferably the former, in which case the joint between said passages and the caps 8 will be closed or broken when the caps are applied in place or are removed for any purpose. Mounted in the chamber 40 is a controlling-valve 41, having a stem 42, mounted in a bearing formed in a cap 43 and having a lever 44 secured to its outer end and by means of which the valve may be operated. The valve 41 is provided with a central chamber 45, with which a steam-passage 46 connects, said passage being formed in the casing 1 and extending to a coupling 47, to which a pipe 48 may be secured. The steam-passage 46 leads through a nipple 49, which extends within the chamber 45, and interposed between said nipple and the valve 41 is a packing 50, as shown in Fig. 4. Extending through the body of the valve 41 are ports 51, which are adapted to be brought into line simultaneously with the inner ends of the passages 38 and 39, as may be desired. The valve is also provided with pockets 52, which are caused to register with the steam-passages 38 and 39. It will be understood that by shifting the lever 44 all the pockets 52 may be caused to register with the steam-passages 38 and all the steam-passages 39 simultaneously caused to register with the steam-passages 39, or vice versa. The pockets 52 connect with the space 53 between the valve and the cap 43, and leading out of the steam-space 53 is a passage 54, connected with a nipple 55, from which a pipe 56 may lead.

Steam or other fluid pressure may be supplied to the pipe 48 or 56, as may be desired, the other pipe being employed for the exhaust. As an example I will in describing the operation refer to the introduction of steam by the pipe 56 to the steam-space 53, the exhaust being effected through the passage 46 from the center of the valve; but obviously the reverse arrangement may be adopted.

When the improved motor is employed, as is preferable, for the operation of small steam-automobiles, I make use of a cooperating water and air pump for supplying feed-water to the boiler and furnishing compressed air to the gasoline-tank, respectively. To this end I secure at one side of the casing 1 a water-pump 57, comprising a cylinder, with a valve-casing 58 at one side thereof. Working in the cylinder is a plunger 59, which passes up through a stuffing-box 60. The

plunger is operated by a rod 61, connected to arms 62, which arms are secured to the trunnions 3 of one of the cylinders—for example, the upper one. The valve-chamber 58 is provided with an admission-valve 63 and an exhaust-valve 64 of the ordinary puppet type, whereby water will be forced from a suction-pipe 65 through a discharge-pipe 66 into the boiler or elsewhere. The arms 62 are preferably bent toward each other at their ends, so as to constitute a yoke, which does not add to the space occupied by the motor and which is readily accessible for the purposes of repair.

The air-pump comprises a casing 67, having, preferably, a water-jacket 68, by which it may be cooled by circulating water, (for example, from the pump 57,) and mounted within said casing is a cylindrical sleeve 69, having a port 70 at its bottom. Working within the sleeve is a plunger 71, operated from a rod 72, connected with the other end of the yoke-arms 62. At the bottom of the casing 67 is an admission-valve 73 and a spring-pressed discharge-valve 74 for permitting discharge of air to take place through the port 70 to the exit-pipe 75.

The operation is as follows: The controlling-valve being in the position shown in Fig. 2, the steam-pockets 52 will be in an intermediate position between the passages 38 and 39, and in consequence no steam can pass to the cylinders, so that the motor will be at rest. By moving the controlling-lever 44 to the right in Fig. 2 all the steam-pockets 52 will be brought to registration with the steam-passages 38, while the exhaust-passages 51 will register with the exhaust-passages 39. Steam will therefore be supplied, for example, to all the chambers 8 of the valve-casing.

Referring to Fig. 3, it will be seen that the uppermost cylinder is in an intermediate position, the piston thereof being retracted to its farthest extent. The cylinder at the right will be oscillated by the piston-rod thereof, as will be obvious, and the port 7 will register with the port 13 from the pocket 8, admitting steam to said cylinder to further propel its piston outwardly to carry the uppermost cylinder from its vertical position and bring the port 7 thereof into registration with the port 13, whereby the uppermost cylinder will become operative. The cylinder at the left has been moved to the other position, and its piston is moving toward the rear end of the cylinder. The port 6 of this cylinder registers with the port 12, as shown, so that an exhaust can take place through the steam-passage 39 thereof, thence through the steam-passage 51 of the controlling-valve and passage 46. Thus it will be seen that the oscillation of the cylinders controls the admission and exhaust of steam therefrom. If instead of moving the controlling-lever 44 to the right it were moved to the left, the steam-pockets 52 would be brought into registration with the steam-passages 39 and the steam-passages 51

would be caused to register with the passages 38, in which case steam would be admitted to the chambers 10 of the valve-casings and the cylinder at the left would become operative
5 to start the rotation of the shaft 23 in the opposite direction. Thus the lever 44 controls the starting and stopping, as well as the direction of rotation, of the engine-shaft. Said valve also operates as a throttle to control the
10 speed, it being obvious that it may be moved to only slightly disclose the steam-pockets 52. As the uppermost cylinder in Fig. 3 oscillates the yoke 62 will be correspondingly oscillated, and the air and water pumps will be operated
15 in the usual way.

Since single-acting cylinders are used, the thrust between the wrist-pin 18 and the pistons will be always taken up by the antifriction-balls 17, the operative stroke of each piston being inwardly against the balls and on the reverse stroke the piston being forced outwardly by the engagement of the antifriction-balls with its lower end.

It will be seen that my improved engine is
25 very simple in construction, it can be made very light, it is portable, it is efficient in operation, and its several parts can be readily reached for purposes of repair. In case of wear between the outer ends of the cylinders and the valve-casings the latter may be removed and readily repacked.

Having now described my invention, what I claim as new, and desire to secure by Letters Patent, is as follows:

35 1. In a fluid-pressure motor, the combination of a casing, a plurality of cylinders mounted to oscillate in said casing, a main shaft, a crank on the shaft, pistons in the cylinders connected to said crank, a valve-casing co-
40 operating with the outer end of each cylinder, ports in the cylinder end and in each of said casings, two closed passages leading to each valve-casing, all of said passages connecting with a centrally-mounted chamber, a
45 hollow controlling-valve in said chamber, a plurality of pockets in the face of said valve, a plurality of passages extending through said valve to its hollow center, a nipple mounted in the hollow center of said valve, a packing
50 between said nipple and the valve, and a passage leading from said nipple, substantially as set forth.

2. In a fluid-pressure motor, the combination of a casing, a plurality of cylinders in
55 said casing, a piston in each cylinder, a piston-rod connected to each piston, a main shaft, a crank on the shaft, a wrist-pin on the crank connected with all the pistons, a series of antifriction-balls supporting the main shaft,
60 two inclined rings forming a track for said balls, a sleeve threaded into the casing for adjusting one of said rings, and a sleeve threaded into said sleeve for adjusting the other of said rings, substantially as set forth.

3. In a fluid-pressure motor, the combination of a casing, a plurality of cylinders in
65 said casing, a piston in each cylinder, a piston-rod connected to each piston, a main shaft, a crank on the shaft, a wrist-pin on the crank connected with all the pistons, a series of an-
70 tifriction-balls supporting the main shaft, two inclined rings forming a track for said balls, a sleeve threaded into the casing for adjusting one of said rings, and a sleeve threaded into said sleeve for adjusting the
75 other of said rings, the threads of both of said sleeves being oppositely cut, substantially as set forth.

4. In a fluid-pressure motor, the combination of a casing, a plurality of cylinders in
80 said casing, a piston in each cylinder, a piston-rod connected to each piston, a main shaft, a crank on the shaft, a wrist-pin on the crank connected with all the pistons, a series of antifriction-balls supporting the main
85 shaft, two inclined rings forming a track for said balls, a sleeve threaded into the casing for adjusting one of said rings, a sleeve threaded into said sleeve for adjusting the other of said rings, and a packing between
90 the second sleeve and the shaft, substantially as set forth.

5. In a fluid-pressure motor, the combination of a casing, a plurality of cylinders in
95 said casing, a piston in each cylinder, a piston-rod connected to each piston, a main shaft, a crank on the shaft, a wrist-pin on the crank connected with all the pistons, a series of antifriction-balls supporting the main
100 shaft, two inclined rings forming a track for said balls, a sleeve threaded into the casing for adjusting one of said rings, a sleeve threaded into said sleeve for adjusting the other of said rings, a packing between the
105 second sleeve and the shaft, and a ring engaging the second sleeve for holding said packing in place, substantially as set forth.

6. In a fluid-pressure motor of the class described, the combination of a casing, a cylinder therein mounted in trunnions and ar-
110 ranged to oscillate, a yoke straddling the cylinder and connected to each of said trunnions, and a pump operated from said yoke, substantially as set forth.

7. In a fluid-pressure motor of the class de-
115 scribed, the combination of a casing, a cylinder therein mounted in trunnions and arranged to oscillate, a yoke straddling the cylinder and connected at its center to each of said trunnions, and two pumps operated from
120 the ends of said yoke, substantially as set forth.

This specification signed and witnessed this 20th day of July, 1901.

AMOUR COLUMBUS SMITH.

Witnesses:

JNO. ROBT. TAYLOR,
ARCHIBALD GRAY REESE.