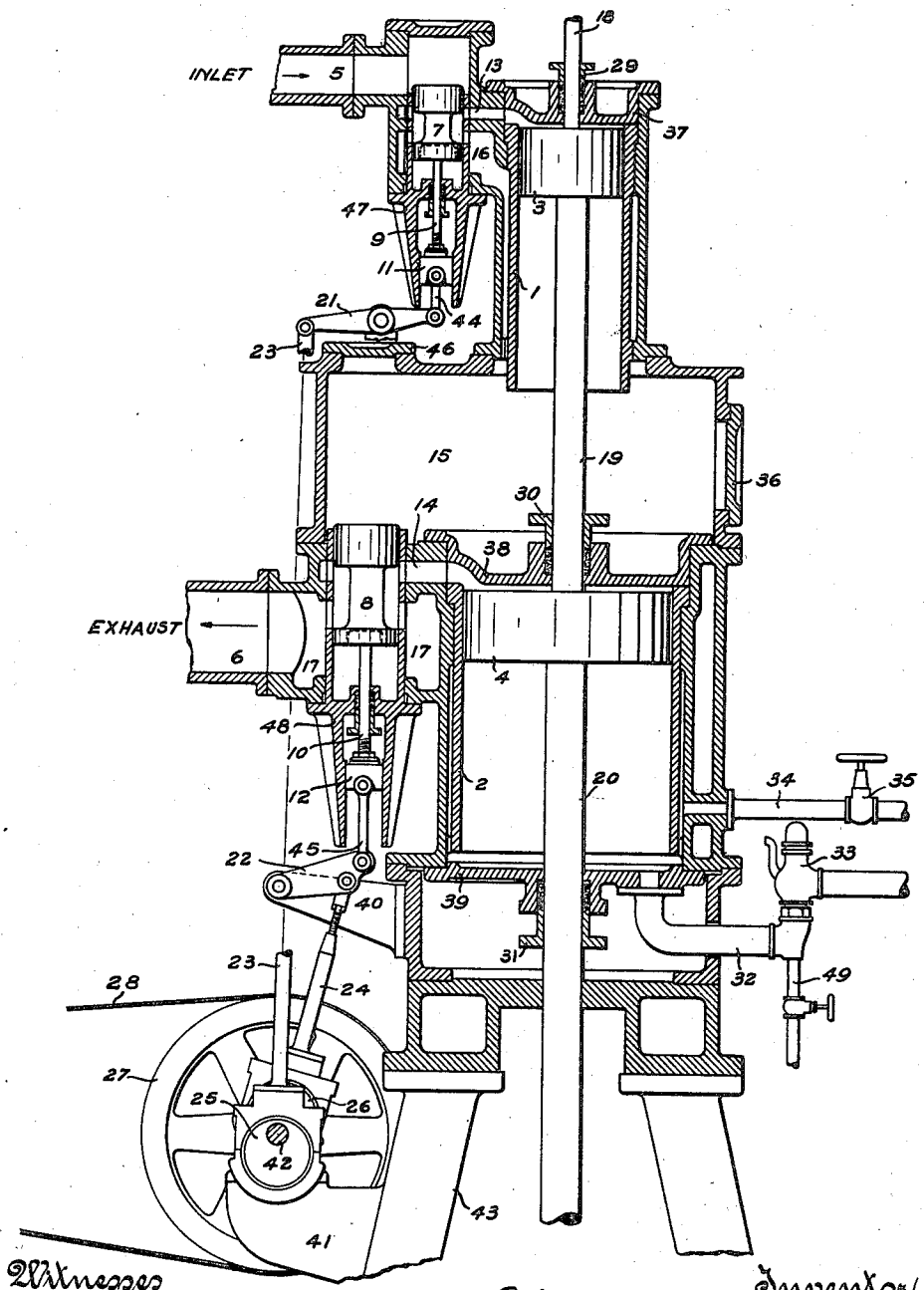
J. F. M. PATITZ.

FLUID OPERATED ENGINE.

APPLICATION FILED MAR. 24, 1913.

1,160,445. Patented Nov. 16, 1915.




Witnesses

Robt. E. Hall.

W. H. Lieber.

Inventor

J. F. M. Patitz

By G. F. Dellwin

Attorney

# UNITED STATES PATENT OFFICE.

JOHANN F. M. PATITZ, OF MILWAUKEE, WISCONSIN, ASSIGNOR TO ALLIS-CHALMERS MANUFACTURING COMPANY, OF MILWAUKEE, WISCONSIN, A CORPORATION OF DELAWARE.

## FLUID-OPERATED ENGINE.

1,160,445. Specification of Letters Patent. Patented Nov. 16, 1915.

Application filed March 24, 1913. Serial No. 757,260.

*To all whom it may concern:*

Be it known that I, JOHANN F. M. PATITZ, a citizen of the United States, residing at Milwaukee, in the county of Milwaukee and State of Wiscontin, have invented a certain new and useful Improvement in Fluid-Operated Engines, of which the following is a specification.

This invention relates to improvements in the construction of fluid operated engines especially applicable for actuating ore stamps, power hammers and similar devices.

An object of the invention is to provide a fluid operated engine especially adapted for actuating ore stamps and like apparatus, which is simple in construction and efficient in operation.

Another object is to provide an engine in which the operating fluid is utilized to the best advantage in a series of cylinders, to cause the striking member actuated by the fluid operated pistons to deliver the most effective and powerful blows.

Still another object is to provide simple and controllable means for quickly and effectively returning the actuating piston and the striking member of the device after the delivery of each blow.

A clear conception of an embodiment of the invention may be had by referring to the drawing accompanying and forming a part of this specification, in which like reference characters designate the same part.

The single figure of the drawing discloses a transverse vertical section through the cylinders and valve casings of a fluid pressure operated engine.

The fluid pressure operated engine as disclosed in the drawing, consists essentially of an upper high pressure cylinder 1, an intermediate receiver 15, and a lower low pressure cylinder 2 arranged in tandem and supported upon the main cylinder supporting frame 43. The cylinder 1 is provided at its upper end with a high pressure cylinder head 37 and has its lower end communicating directly with the receiver 15. The cylinder 2 is provided with an upper low pressure cylinder head 38 and a lower low pressure cylinder head 39. The intermediate receiver 15 is provided with a manhole 36 and a removable cover 46 which permit inspection of the interior of the receiver 15, and through either of which low pressure operating fluid may be admitted directly from any available source, if desired.

The high pressure piston 3 is reciprocable within the cylinder 1 and has an upwardly extending tail-rod 18 which passes through the upper high pressure cylinder head 37. The low pressure piston 4 is reciprocable within the cylinder 2 and is rigidly connected to the high pressure piston 3 by means of the intermediate piston rod 19. The low pressure piston 4 is connected with a striking member, ore stamp, power hammer, pile driver, or other apparatus which it is adapted to actuate, by means of the main piston rod 20. The joint between the tail-rod 18 and the cylinder head 37 is packed by means of a stuffing box 29. The joint between the intermediate piston rod 19 and the cylinder head 38 is packed by means of a stuffing box 30. The joint between the lower cylinder head 39 and the main piston rod 20 is packed by means of a stuffing box 31.

The high pressure combined inlet and discharge valve 7 is of the piston type and controls the admission of operating fluid from the main high pressure inlet 5 through the common high pressure inlet and discharge port 13 to the interior of the upper high pressure piston chamber. This valve 7 also controls the discharge of fluid from the upper high pressure piston chamber to the receiver through the port 13 and high pressure discharge port 16. The high pressure valve 7 has a downwardly extending valve rod 9 which carries a crosshead 11 at its lower end. The crosshead 11 is reciprocable in guides 47 which, as disclosed, are formed in one with the valve casing bushing. The crosshead 11 is connected with one end of the high pressure valve actuating lever 21 by means of a valve crosshead connection 44. The mid portion of the valve actuating lever 21 is fulcrumed to a stationary pivot, while the opposite overhanging end of the lever 21 is connected with the high pressure valve actuating eccentric 25 by means of an actuating eccentric connection 23. The high pressure valve actuating eccentric 25 is fixed to the main valve actuating shaft 42, which is rotatably supported in suitable bearings carried by the stationary bracket 41. Rotation is imparted to the shaft 42 by means of a combined flywheel and driving pulley 27 which receives its rotary motion from a

suitable valve actuating motor through a belt 28.

The low pressure combined inlet and discharge valve 8 is of the piston type and controls the admission of fluid under pressure from the receiver 15 through the common low pressure inlet and discharge port 14 to the upper piston chamber of the low pressure cylinder 2. The low pressure valve 8 also controls the discharge of fluid from within the low pressure cylinder 2 through the port 14 to the low pressure discharge chamber 17. The low pressure discharge chamber 17 connects with the exhaust pipe 6 through suitable ports, and when using steam as an actuating fluid, the exhaust pipe 6 is preferably connected with a condenser or other similar reduced pressure source. The low pressure valve 8 has a downwardly extending valve rod 10 which carries a crosshead 12 at its lower end. The crosshead 12 is reciprocable in guides 48 which, as disclosed, are formed integral with the low pressure valve casing bushing. The crosshead 12 is connected with the low pressure valve actuating lever 22 by means of a valve crosshead connection 45. The valve actuating lever 22 is pivoted to the stationary actuating lever support 40 and is connected with the low pressure valve actuating eccentric 26 by means of an eccentric connecting rod 24. The low pressure valve actuating eccentric 26 is fixed to the main valve actuating shaft 42.

The lower piston chamber of the low pressure cylinder 2 is provided with a fluid pressure inlet pipe 34 which is controllable by means of a suitable valve 35, which may be either of the automatic or manually controllable type. The extreme lower end of the lower piston chamber of the low pressure cylinder 2 is provided with a low pressure discharge pipe 32 in which a pressure relief valve 33 is located. The pressure relief valve 33 may also be either automatically or manually controllable. The drain pipe 49 is connected with the pipe 32 at any convenient point and serves to remove water of condensation which may collect in the pipe 32.

During the operation of the engine, high pressure steam from any suitable source such as a boiler, is admitted to the high pressure valve chamber through the inlet pipe 5. Although the operating fluid will be designated as steam, it should be understood that it is not intended to be limited to the use of steam and that any desired operating fluid, such as compressed air, might be substituted therefor. As the high pressure valve 7 is moved, by the continuous rotation of the main valve actuating shaft 42, to its lowermost position, the inlet pipe 5 is brought into direct communication with the high pressure inlet ports 13, thus admitting high pressure steam directly to the upper piston chamber of the cylinder 1. This admission of the high pressure steam to the upper end of the piston 3 causes the piston 3, due to the expansion of the steam, to move downwardly within the cylinder 1. When sufficient steam for one working stroke of the piston 3, has been admitted from the inlet 5, the valve actuating mechanism gradually raises the valve 7, closing off communication between the inlet pipe 5 and the port 13, and confining the steam in the upper high pressure piston chamber. As the end of the working stroke of the piston 3 is reached, the valve 7 in its upward travel gradually establishes communication between the port 13 and the high pressure discharge port 16. This communication between the upper high pressure piston chamber and the receiver is maintained during the entire upward travel of the piston 3 within the cylinder 1 on its return stroke, so that the expanded low pressure steam from within the upper piston chamber of the high pressure cylinder 1 is forced through the port 13 and high pressure discharge port 16 directly to the intermediate receiver 15.

When the low pressure valve 8 is moved into its lowermost position by the rotation of the main valve actuating shaft 42, communication to the upper low pressure piston chamber from the receiver 15 is established through the port 14. Steam is then admitted at receiver pressure, to the upper piston chamber of the low pressure cylinder 2 and forces the low pressure piston 4 downwardly. The admission of the low pressure steam from the receiver 15 to the upper piston chamber of the low pressure cylinder 2, is simultaneous with the admission of high pressure steam to the upper piston chamber of the high pressure piston 1, thus combining the downward impulses upon the individual pistons 3 and 4 which are transmitted as a single powerful impulse to the main piston rod 20. As the low pressure valve 8 is gradually raised by means of its actuating mechanism, the supply of low pressure steam from the receiver is cut off and the steam confined in the upper low pressure piston chamber expands until the end of the working stroke is reached. At the end of the working stroke of the pistons, the port 14 is brought into communication with the low pressure discharge chamber 17 by the continued upward movement of the valve 8, thus permitting withdrawal of the exhaust steam through the exhaust pipe 6 to the condenser. The exhaust of steam from the upper piston chamber of the low pressure cylinder 2 is simultaneous with the exhaust of steam from the upper piston chamber of the high pressure cylinder 1 to the receiver 15.

As the actuating eccentrics 25, 26, are adjustable upon the main valve actuating shaft 43, the time of the opening and closing of the valves 7, 8, may be readily varied to suit any desired conditions. It is, however, desirable at all times to have the impulses transmitted to the pistons 3, 4, simultaneous as well as to have the exhaust from the upper piston chambers of each of the cylinders 1, 2, likewise simultaneous.

The lower piston chamber of the cylinder 2 is kept constantly under a definite predetermined steam pressure, with the piston in its uppermost position. The pressure of the steam confined within the lower piston chamber of the cylinder 2 is controllable by means of the valve 35 which, as heretofore stated, may be either manually or automatically controllable. If for any reason, such as leakage of steam at a higher pressure past the low pressure piston 4, the pressure within the confined lower piston chamber of the cylinder 2 becomes excessive, the overpressure is discharged either automatically or manually by means of a suitable overpressure discharge valve 33. Any water of condensation or other undesirable liquid which may accumulate within the lower piston chamber of the cylinder 2 may be discharged, either continuously or at intervals, through a suitable drain pipe 49.

As the pistons 3, 4, are forced downwardly during the working stroke, by the admission of steam to the chambers above them, the steam confined in the lower low pressure piston chamber is compressed and forms a cushion for the low pressure piston at the end of its downward stroke. As the steam from the upper piston chambers is exhausted at the end of the working stroke, the steam compressed within the lower pressure piston chamber automatically expands and exerts an upward pressure upon the large area at the lower end of the low pressure piston 4. During the downward travel of the piston 3, the steam confined within the receiver 15 which is open to the lower high pressure piston surface, is also compressed a slight amount, but the expansive effect of this steam on the return stroke, due to such compression, is negligible, since the pressures on opposite sides of the piston 3 quickly equalize when the port 13 is brought into communication with the high pressure discharge port 16 by means of the valve 7. The only urging means which is effective in returning the pistons 3, 4, to their uppermost positions, is the pressure underneath the low pressure piston 4, caused by the prior compression of the steam confined within the lower low pressure piston chamber during the working stroke. Since the upper low pressure piston chamber is in communication with the condenser at the time the steam confined within the lower low pressure piston chamber is expanding, the actual pressure acting to raise the pistons 3 and 4 and the elements connected therewith, is the difference between the absolute total pressures acting upon the upper and lower surfaces of the low pressure piston 4. This pressure, it has been found in practice, is sufficient to very quickly return the pistons 3 and 4 to their uppermost position. The elastic means for returning the pistons to their uppermost positions need not necessarily be a steam cushion, as any other means effecting the same result might be substituted without departing from the scope of the present invention.

It should be noted that various arrangements for maintaining the desired quantity of steam within the lower piston chamber of the low pressure cylinder 2 may be introduced without departing from the scope of this invention. The simplest arrangement for maintaining this pressure at the desired value has been selected in order to avoid obscurity in description of the invention.

It should be understood that it is not desired to be limited to the exact details of construction shown and described, for obvious modifications will occur to a person skilled in the art.

It is claimed and desired to secure by Letters Patent,—

1. In combination, a high pressure piston, means for controlling admission and release of high pressure fluid to and from the upper face of said piston, a receiver for the fluid exhausted from above said piston, said receiver being in open communication with the lower face of said piston at all times, a low pressure piston, means for controlling admission and release of low pressure fluid to and from the upper face of said low pressure piston, and means for establishing an elastic cushion adjacent the lower face of said lower piston for moving said pistons during release of fluid from the upper faces thereof.

2. In combination, a high pressure piston, a low pressure piston, a connection between said pistons, means for simultaneously controlling admission and release of high and low pressure fluid to and from corresponding faces of the respective pistons, a receiver for fluid exhausted from said high pressure piston and admitted to said low pressure piston, and means for establishing an elastic cushion adjacent a face of said low pressure piston for moving said pistons during release of fluid from the corresponding faces thereof, said cushion constituting the sole effective means for moving said pistons during release of fluid from said corresponding faces.

3. In combination, a high pressure piston, a low pressure piston, a connection between said pistons, means for simultaneously ad-

mitting high and low pressure fluid to corresponding faces of the respective pistons, means for subsequently substantially balancing the pressures on opposed faces of said high pressure piston, and means for establishing an elastic cushion adjacent a face of said low pressure piston for moving said piston during the balancing of pressures on said high pressure piston.

4. In combination, a high pressure piston having substantially equal areas on opposite faces thereof, a low pressure piston, a connection between said pistons, means for simultaneously admitting fluid under pressure to corresponding faces of said pistons, means for subsequently substantially equalizing the pressures on opposite faces of said high pressure piston, and means for establishing an elastic cushion adjacent a face of said low pressure piston for moving said pistons during the equalization of pressures on said high pressure piston.

In testimony whereof, the signature of the inventor is affixed hereto in the presence of two witnesses.

JOHANN F. M. PATITZ.

Witnesses:
W. H. LIEBER,
G. F. DE WEIN.