M. R. BILLADO.

COMPRESSED AIR ENGINE.

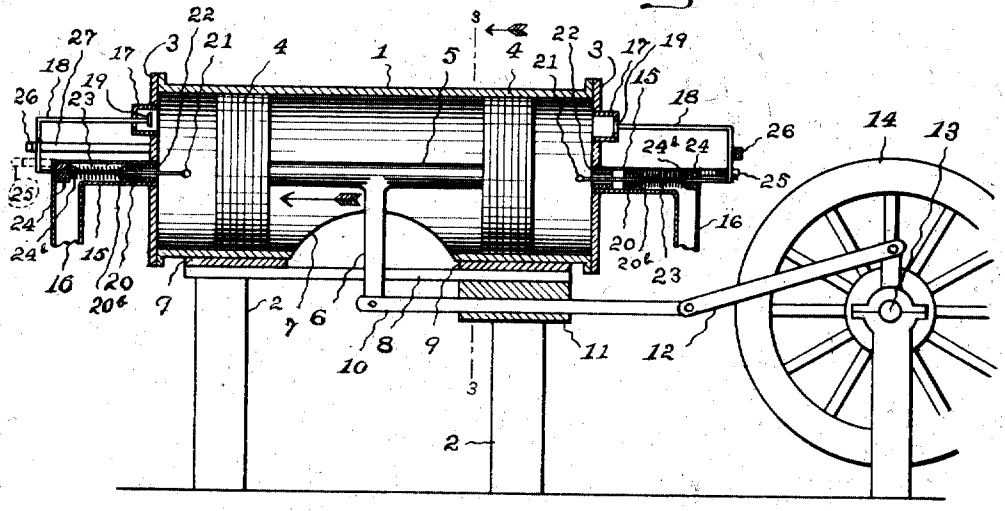
APPLICATION FILED MAY 9, 1918.

1,281,490. Patented Oct. 15, 1918.

Fig. 4.



Fig. 1



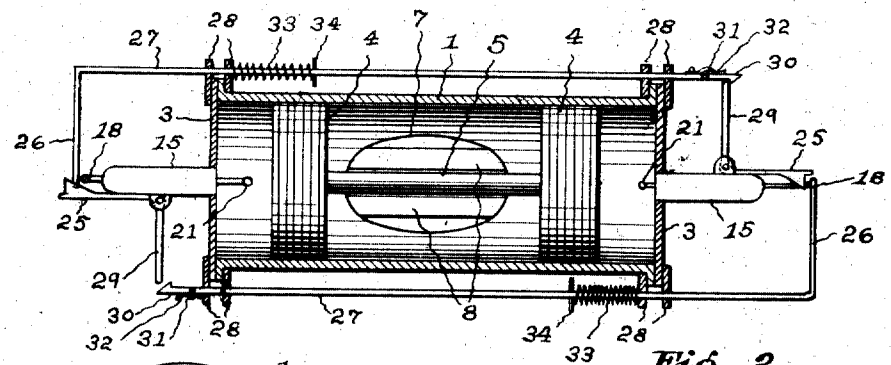


Fig. 2.

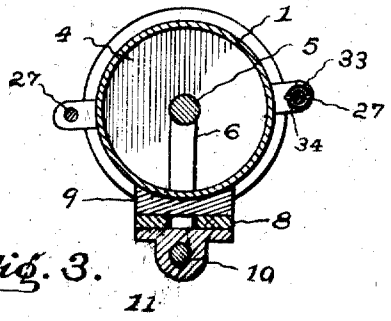


Fig. 3.

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COMPRESSED-AIR ENGINE.

1,281,490. Specification of Letters Patent. Patented Oct. 15, 1918.

Application filed May 9, 1918. Serial No. 233,534.

To all whom it may concern:

Be it known that I, MILO R. BILLADO, a citizen of the United States, residing at Jericho, in the county of Chittenden, State of Vermont, have invented a new and useful Compressed-Air Engine; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

The present invention relates to a compressed air engine, and has for its object to provide a device of this character which embodies novel features of construction whereby the energy of the compressed air can be utilized in the most effective manner to drive a double acting engine.

Further objects of the invention are to provide a compressed air engine which is dependable in its action, which provides in an effective manner for supplying compressed air to the cylinder and exhausting dead air therefrom, and in which the parts are all easily accessible.

With these and other objects in view, the invention consists in certain novel combinations and arrangements of the parts as will more fully appear as the description proceeds, the novel features thereof being pointed out in the appended claims.

For a full understanding of the invention, reference is to be had to the following description and accompanying drawings, in which:—

Figure 1 is a side elevation of a compressed air engine constructed in accordance with the invention with portions broken away and shown in section.

Fig. 2 is a horizontal sectional view through the cylinder.

Fig. 3 is a transverse sectional view on the line 3—3 of Fig. 1.

Fig. 4 is a greatly enlarged transverse sectional view through the air valve and air valve casing.

Corresponding and like parts are referred to in the following description and indicated in all the views of the drawings by the same reference characters.

Referring to the drawings, which illustrate one embodiment of the invention, the numeral 1 designates a cylinder which is preferably arranged in a horizontal position, and which is shown as supported upon the legs 2. Opposite ends of the cylinder are closed by the cylinder heads 3, and a pair of pistons 4 are mounted to reciprocate back and forth within the cylinder, said pistons being rigidly connected by a piston rod 5. An arm 6 projects downwardly from the piston rod 5, extending through an opening 7 in the cylinder and being slidably received between two longitudinal guide bars 8 which extend across the opening, being connected to blocks 9 which are applied to opposite ends of the cylinder at the bottom thereof. The lower end of the arm 6 is connected to a slide 10 which operates through a suitable guide 11 and is connected by a pitman 12 to a crank shaft 13 upon which a fly wheel 14 is mounted. Power can be taken from the crank shaft 3 and utilized for performing any useful work.

A tubular air valve casing 15 communicates with each end of the cylinder 1, being fitted to the center of the recessed cylinder head 3. An air supply pipe 16 communicates laterally with the outer end of each of the air valve casings 15, said pipes leading from any suitable source of supply for compressed air. An exhaust valve casing 17 is applied to each of the cylinder heads 3 immediately above the air valve casing, and a U-shaped frame 18 carries both the exhaust valve 19 and the air valve 20. The two arms of the U-frame 18 are parallel and one of the arms extends through the air valve casing 15 and projects into the end of the cylinder 1 where it terminates in a contact head 21 which is adapted to be engaged by the corresponding piston 4 when the latter reaches the inner limit of its movement and it is necessary to reverse the positions of the valves at the two ends of the cylinder. A valve seat 22 is fitted in the inner end of each of the casings 15 and the air valve 20 is adapted to engage the end of the valve seat, as indicated at the left hand side of Fig. 1, when the supply of compressed air to the cylinder is cut off. The air valve 20, as indicated more clearly by Fig. 4, have a diameter slightly less than the interior diameter of the valve casing, and are provided upon the exterior thereof with longitudinal grooves or depressions 20^a so that the air can always pass freely around the sides thereof when the valve is open. A coil spring 23 is interposed between the rear end of each of the air valves 20 and a guide bushing 24 which is arranged at the rear end of the valve casing, the said bushing and valve being preferably formed with tapered noses

24[b] and 20[b] respectively for engaging the ends of the coil spring and properly centering the same.

The springs 23 normally tend to hold the air valves 20 in a closed position, and when the air valve is closed the corresponding exhaust valve 17 is moved inwardly and opened. When one of the air valves is opened by engagement of the corresponding piston 4 with the contact head 21 of the U-frame 18, the exhaust valve is closed and compressed air admitted to the cylinder end so that the piston will be forced away from the cylinder head. A spring latch 25 is arranged to engage the U-frame 18 when the latter is moved outwardly to open the air valve and close the exhaust valves, the valves being thus locked in this position against the action of the spring 23. When one of the U-frames 18 is thus moved outwardly and engaged by the latch 25, it engages the arm 26 of a slide rod 27 which operates to release the spring latch member 25 at the opposite end of the cylinder, thereby causing the air valve at the other end of the cylinder to be closed and the exhaust valve to be opened. The two slide rods 27 are arranged upon opposite slides of the cylinder, being mounted within guide plates 28 which project from the cylinder, and being arranged at slightly different elevations so that the arms 26 and latch members 25 at the ends of the cylinders will not interfere with each other.

Each of the spring latches 25 is provided at its pivot end with a laterally projecting trip arm 29 which is adapted to be engaged by the hooked nose 30 of the corresponding slide rod 27, said nose being pivoted to the slide rod at 31, and held yieldably in operative position by a suitable spring 32. A coil spring 33 surrounds each of the slide rods 27, being interposed between a transverse pin 34 and one of the guide plates 28, and serving to return the slide rod to its original position as soon as it is released by the return movement of the U-shaped frame 18 with which it coöperates. Upon this return movement of the slide rod the beveled end of the hooked nose 30 will cause the same to engage the free end of the trip arm 29 of the corresponding latch 25. This position of the parts is shown at the right hand end of Fig. 2. Upon the actuation of the slide rod 27 when the pistons 4 have reached the limit of their movement in one direction the hooked nose 30 will coöperate with the trip arm 29 to swing the latch member 25 into inoperative position and release the U-frame 18, after which the trip arm 29 will become disengaged from the hooked nose 30 by reason of the latter being moved beyond the trip arm, and the latch 25 will return to operative position, as indicated at the left hand end of Fig. 2.

In Fig. 1 the air valve 20 at the right hand end of the cylinder is locked in an open position by the corresponding latch 25, while the air valve 20 at the left hand end of the cylinder is held in a closed position by the spring 23, the U-frame 18 thereof having been released. Compressed air is entering the right hand end of the cylinder while dead air is being exhausted from the left hand end of the cylinder, the two pistons moving from right to left, as indicated by the arrow. When the pistons reach the limit of their movement they will engage the contact head 21 of the U-frame 18 at the left hand end of the cylinder and move the same outwardly to open the air valve and close the exhaust valve. This U-frame will be engaged by the spring latch 25 and locked in this position, and as it is moved outwardly it will engage the arm 26 of the slide rod 27 for the air valve at the opposite end of the cylinder, thereby causing the spring latch 25 for the said opposite air valve to be moved into inoperative position and the U-frame 18 at the opposite end of the cylinder released. The position of all of the valves will thus be exactly reversed, so that the pistons will be acted upon by the compressed air and caused to travel in a reverse direction. The operation of the valve mechanism will be repeated and the positions of the valves again reversed when the pistons reach the other limit of their movement. The operation of the engine is thus continuous and each stroke of the pistons is a power stroke.

Having thus described the invention, what I claim as new and desire to secure by Letters Patent, is:—

1. A compressed air engine including a cylinder, a piston movable within the cylinder, a tubular air valve casing projecting from the end of the cylinder, an outwardly opening spring seated air valve therein, a stem projecting inwardly from the valve and terminating in a contact head adapted to be engaged by the piston to open the valve when the piston has reached the limit of its movement in one direction, latch means for locking the valve in an open position, and trip means for releasing the latch means when the piston has reached the limit of its movement in the opposite direction.

2. A compressed air engine including a cylinder, a piston movable within the cylinder, a tubular air valve casing projecting from the end of the cylinder, an outwardly opening spring seated air valve therein, a stem projecting inwardly from the valve and terminating in a contact head adapted to be engaged by the piston when the latter reaches one limit of its movement, an exhaust valve operatively connected to the air valve to be opened when the air valve is closed and closed when the air valve is

opened, a latch for locking the air valve in an open position, and trip means for releasing the latch when the piston has reached the opposite limit of its movement.

3. A compressed air engine including a cylinder, a piston movable within the cylinder, a tubular air valve casing projecting from the end of the cylinder, an outwardly opening spring seated valve therein, an inwardly opening exhaust valve, a U-frame carrying the air valve and exhaust valve and having one end thereof extended into the cylinder and terminating in a contact head adapted to be engaged by the piston to open the air valve when the piston has reached the limit of its movement in one direction, a latch for engagement with the U-frame to lock the air valve in an open position, and trip means for releasing the latch when the piston has reached the limit of its movement in the other direction.

4. A compressed air engine including a cylinder, a piston movable within the cylinder, an outwardly opening spring seated air valve at each end of the cylinder, an inwardly opening exhaust valve at each end of the cylinder, U-frames carrying the air valves and exhaust valves, and formed with extensions which project into the cylinder for engagement with the piston, a latch for engaging each U-frame to hold the corresponding air valve open and exhaust valve closed, and trip means actuated by each U-frame for releasing the latch of the other U-frame.

5. A compressed air engine including a cylinder, a piston movable within the cylinder, an outwardly opening air valve and an inwardly opening exhaust valve at each end of the cylinder, U-frames carrying the air valves and exhaust valves, said U-frames being formed with extensions which project into the ends of the cylinder and terminate in contact heads adapted to be engaged by the piston, latches for engaging the U-frame to lock the corresponding air valve in an open position and the corresponding exhaust valve in a closed position, slide rods extending longitudinally of the cylinder and formed with arms projecting into the paths of the respective U-frames so as to be moved thereby, and means actuated by the slide rods for releasing the before mentioned latches.

6. A compressed air engine including a cylinder, a piston movable within the cylinder, an outwardly opening air valve and an inwardly opening exhaust valve at each end of the cylinder, U-frames carrying the air valves and exhaust valves, said U-frames being formed with extensions which project into the ends of the cylinder and terminate in contact heads adapted to be engaged by the piston, latches for engaging the U-frames to lock the corresponding air valve in an open position and the corresponding exhaust valve in a closed position, trip arms projecting from the latches, slide rods extending longitudinally of the cylinder and provided with arms projecting into the paths of the respective U-frames so that the slide rods will be actuated by the U-frames, and hooked noses upon the slide rods for engaging the lateral arms of the latches to release the latches.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

MILO R. BILLADO.

Witnesses:
J. T. VARNEY,
H. G. HANLEY.