(No Model.)

H. C. MILLER.

ENGINE.

No. 503,154. Patented Aug. 15, 1893.

Fig. 1

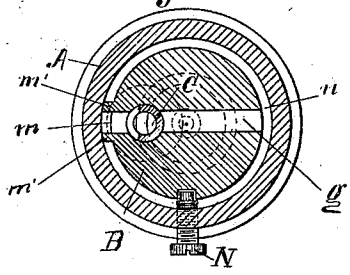


Fig. 3.

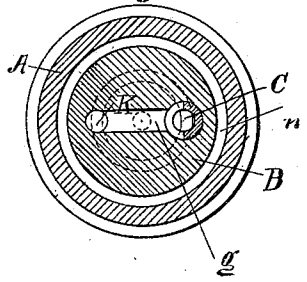


Fig. 5.

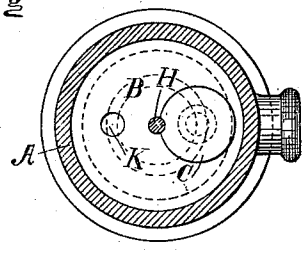


Fig. 2

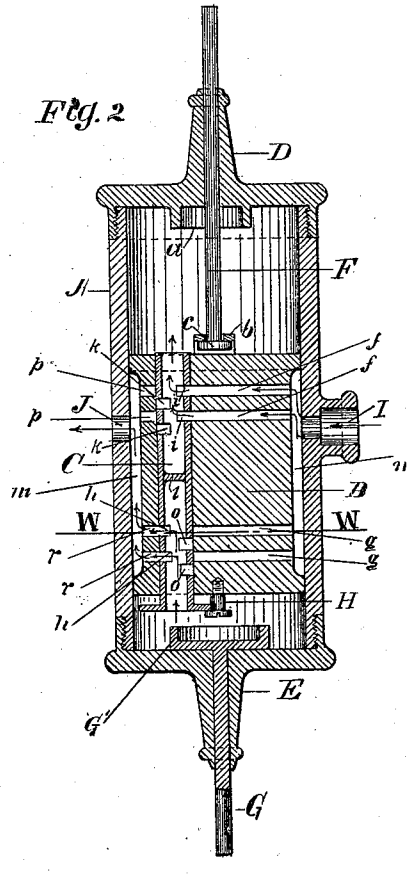


Fig. 6

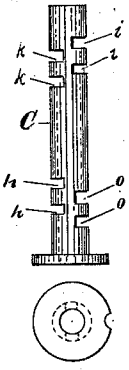


Fig. 7

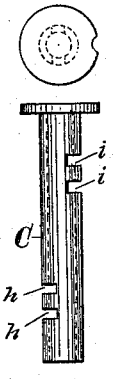
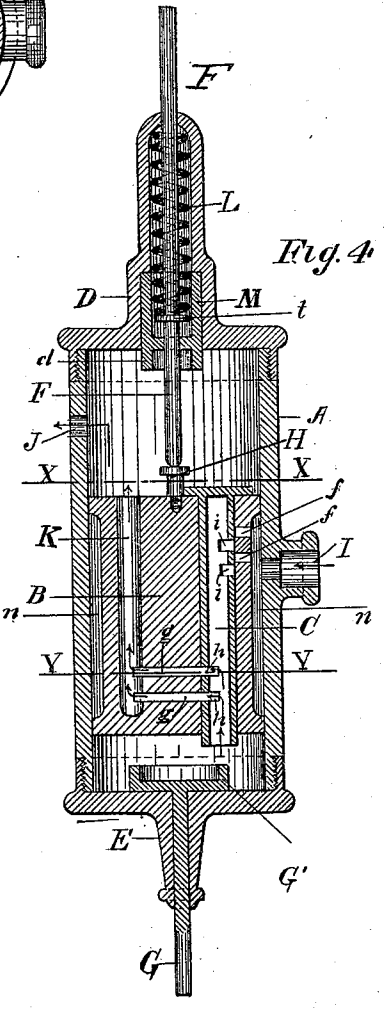


Fig. 4



WITNESSES:

W. H. Crighton

R. S. Robertson

Henry C. Miller INVENTOR

BY Chapin & Denny

his ATTORNEYS.

UNITED STATES PATENT OFFICE.

HENRY C. MILLER, OF FORT WAYNE, INDIANA.

ENGINE.

SPECIFICATION forming part of Letters Patent No. 503,154, dated August 15, 1893.

Application filed December 3, 1892. Serial No. 453,954. (No model.)

To all whom it may concern:

Be it known that I, HENRY C. MILLER, a citizen of the United States, residing at Fort Wayne, in the county of Allen and State of Indiana, have invented certain new and useful Improvements in Engines; and I do hereby declare that the following is a full, clear, and exact description of the invention, which will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, which form part of this specification.

My invention relates to improvements in engines adapted to be operated by compressed air or steam.

The object of my invention is to provide an engine of simple and economical construction, adapted for either double or single action, requiring less power to operate it insuring a quicker action and enabling the operator to readily secure either a longer or shorter stroke than can be secured by any other cylinder of that form now in use.

My object is also to provide an engine of convenient form which can be operated with equal facility by either air or steam.

My invention consists in the novel construction and combination of the several parts, as will be hereinafter set forth and particularly pointed out in the claims.

The object of my invention thus indicated, is accomplished by the mechanism illustrated in the accompanying drawings forming part of this specification, in which similar letters indicate corresponding parts in the several views.

Figure 1 is a transverse section of Fig. 2 on the line W—W. Fig. 2 is a longitudinal vertical section of that form of my invention which is adapted for double action by compressed air or steam. Fig. 3 is a transverse section of Fig. 4 on the line Y—Y. Fig. 4 is a longitudinal vertical section of my invention adapted for single action, and provided with a coil spring for returning the working piston to its normal position. Fig. 5 is a transverse section of Fig. 4 on the line X—X. Fig. 6 is a detail view in elevation and in plan of the valve for my double action form of cylinder. Fig. 7 is a detail view in elevation and in plan of the valve for my single action cylinder.

The cylinder A of suitable size and material, and containing a proper piston chamber, is provided with the cylinder heads D and E, united thereto by a proper threaded connection the said cylinder heads being properly perforated at their center to form a bearing for the piston rod F, and the regulating stem G, as seen in Fig. 2.

The piston head is provided upon its lower surface with a circular flange *a* adapted to drive the valve C into position for the return stroke of the piston B, as seen in Fig. 2. The cylinder head D may also be elongated and provided with a coil spring chamber, as seen in Fig. 4, said chamber having a nipple M properly secured therein, which nipple forms a bearing for the rod F, and is provided with a projecting flange for driving the valve C back into the position seen in Fig. 4. In this spring chamber and encircling the rod F is arranged the coil spring L, of any proper size, strength or tension, and is loosely mounted on said rod, resting on the rigid collar *t* with its upper end impinging against the end of the head D. The cylinder A is also provided with an inlet port I through which compressed air or steam may be properly supplied, said port being preferably located at or near a point midway between the ends thereof, and also an exhaust port J which for the double acting cylinder is preferably arranged diametrically opposite said inlet port, as seen in Fig. 2. For the cylinder shown in Fig. 4, adapted for single action said exhaust port is preferably arranged near the upper end thereof.

In a suitable perforation in the head E of the cylinder A, I arrange the regulating rod G, for regulating the length of the stroke of the piston B, which rod is provided with a circular flange G′ upon its inner end, adapted for driving in the valve C by contact with its flanged top, as seen in Fig. 2 and by contact with the bottom of said valve, in the form shown in Fig. 4. The cylindrical working piston B, adapted for longitudinal play or movement in the cylinder A, is provided with a circular valve chamber extending through its entire length and fitted to contain the cylindrical valve C which is adapted for a limited longitudinal movement therein.

Referring now to Fig. 2, or that form of my invention designed for double action, the valve C is arranged in that portion of the work-

ing piston B opposite to the inlet port I. To the center of the head of piston B is rigidly secured any suitable lug *b* adapted for securely engaging the flange *c* on the rod F. The air space *n* almost entirely surrounding the piston B, is connected with the source of air supply at I, but is shut off from the exhaust port by the flanges *m'*, one upon either side of the groove *m*, as seen in Fig. 1. The air chamber *n* is shut off from the external portion of the piston chamber by the flanged ends of the piston B as seen in Fig. 2. Directly opposite the exhaust port J is provided a longitudinal groove *m* in the side of the piston B, which groove is of such a length that it freely communicates with the exhaust port J in all positions of the piston B when in use. Through the upper part of said piston are provided a suitable number of transverse supply channels *f*, connecting the air chamber *n* with the said valve chamber, and also the transverse exhaust channels *p* in direct line therewith, and connecting the said valve chamber with the exhaust groove *m;* also, through the lower part of said piston are arranged a suitable number of supply channels *g* connecting the air chamber *n* with the said valve chamber, and the exhaust channels *r* arranged in direct line with the channels *g*, and connecting said valve chamber with the exhaust channel *m*.

Referring now to Fig. 4, or that form of my invention designed and adapted for single action, the valve C is arranged in a suitable longitudinal valve chamber in that part of the piston B nearest to and directly opposite the inlet port I. In that part of the piston B diametrically opposite the port I is a longitudinal exhaust channel of proper size, extending from the upper end thereof to a point nearly but not quite to the lower extremity thereof, which channel is connected with said valve chamber by means of the exhaust channels *g*, also seen in Fig. 3. In that form of my invention shown in Fig. 4 the air space or chamber *n* entirely surrounds the piston B, as seen in Figs. 3 and 5. The valve C of Fig. 2 is open at both ends with a partition *l* preferably about midway between the extremities thereof, with a flanged head on its lower end, said flange having on one side a vertical slot, said valve being provided with slots or openings *h*, *i*, *k*, and *o*, as seen in Fig. 6, and adapted for registering with the channels *r*, *f*, *p*, and *g*, respectively by the play of said valve in the said valve chamber. The valve C is limited and regulated in its movement by the set screw H which fits in the slot provided in the flanged top of said valve, and engages therewith, which slot prevents any oscillation of said valve when in motion. The valve C as constructed for use in Fig. 4 has a closed flanged top but is open at the bottom and is provided with the slot *h* and *i*, as seen in Fig. 7, adapted to register in a proper manner with the channels *g* and *f* respectively. To the top of piston B is properly secured the set screw H, Fig. 4, adapted to fit in the slot of the flanged top of valve C, thereby preventing any oscillation thereof in the said valve chamber. The set screw H also forms a support for the conical end of the rod F. A longitudinal slot or groove *v* extends from flange to flange on the outer surface of the piston B, in which slot or groove the set screw N, properly secured in the cylinder A, is adjusted in a proper manner to prevent any oscillation of the piston B when in motion.

The operation of my improved power cylinder thus described is as follows: The compressed air or steam enters the cylinder A through the port I and fills the air space or chamber *n*, and in the double acting cylinder shown in Fig. 2, it is then forced through the upper supply channels *f*, and through the openings *i* into the valve C and thence into the upper part of the cylinder A thereby forcing the piston back as seen in Fig. 2, until the flanged head of said valve by contact with the flange G', is forced down against the end of the piston B, the supply channels *g* during this operation being locked, and the compressed air or steam being thus prevented from passing out of the channels *r*, by the partition *l*, and said air or steam is prevented from entering the groove *m* by the flanges *m'* and *m'*, as seen in Fig. 1. When the valve C is thus driven in by the flange G, the supply channels *f* and *r* will be locked, and the channels *g*, and *p* will be open and will register with the openings *o* and *k* of said valve respectively. Consequently the compressed air or steam contained in the space *n* is forced through the supply channels *g*, and the apertures *o* into the lower part of the valve C, whence it enters the rear end of the cylinder A, thus driving the working piston B on its return movement, while the air or steam in the forward end of said cylinder is exhausted by passing out through the apertures *k*, the channels *p*, the groove *m* and the port J. The length of the stroke of said piston is conveniently regulated by placing the finger on the lower end of the rod G and thereby raising or lowering the same.

The operation of my single acting cylinder above described is as follows: The coil spring L on the rod F rests on the set screw H and normally forces the piston B to the rear end of the cylinder A, the supply channels *f* being locked, and the exhausted air or steam readily passing out through the exhaust channels *h*, the groove K and the port J. But when the piston B is thus forced down by the coil spring L the rear end of the valve C will come in contact with the flange G' forcing said valve forward until its movement is limited by the set screw H, when the apertures *i* of said valve will register with the supply channels *f*, and the exhaust channels *h*, will be locked. The valve C is prevented from any oscillatory movement by the set screw H as before described. The compressed air or steam occupying the chamber *n* will then be

forced through the supply channels *f*, the apertures *i* and out at the bottom of the valve C in to the rear end of the cylinder A, thereby driving the piston B forward in its return movement, compressing the coil spring L until said valve is forced back into its normal position, as seen in Fig. 4, when the exhausted air or steam in the lower extremity of the cylinder A will readily exhaust through the channels *h* and the channel K as above described.

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

1. An engine consisting of the cylinder A provided with a piston chamber, an inlet port I and an exhaust port J, a working piston B adapted for longitudinal movement in said cylinder and having a valve chamber adapted for the valve C, and air chamber *n*, a longitudinal groove *m*, the supply channels *f* and *g* connecting the air space *n* with said valve chamber, the exhaust channels *p* and *r*, leading from said valve chamber to said groove *m*, a longitudinal groove *v* fitted for the adjustment of the set screw N, a lug *b* upon the forward end thereof adapted to secure the rod F, and a set screw H or equivalent device for limiting the play of the valve C in said chamber, a valve C open at both ends and having a partition at or near its center, a flanged top and apertures or slots in its sides adapted to register with the said supply and exhaust channels, and a stroke regulating-rod G, all substantially as set forth and described.

2. A valve C having a suitable flanged top, and a central opening with a partition *l* at or near its center, suitable apertures *i*, *k*, *h* and *o*, adapted to register with the channels *f*, *p*, and *g* respectively, all substantially as described.

3. A power cylinder provided with a piston chamber, inlet and exhaust ports, a working piston adapted for longitudinal movement in said chamber, and having a valve chamber adapted for the valve C, the said piston being provided with an annular surrounding air chamber *n*, and also with proper transverse supply and exhaust channels connecting the air chamber *n* with said valve chamber and with the inlet and exhaust ports, a valve C having a flanged top and apertures or slots in its sides adapted to register with the said supply and exhaust channels, and a stroke regulating-rod G, all substantially as set forth and described.

Signed by me this 30th day of November, 1892.

HENRY C. MILLER.

Witnesses:
WILLIAM D. WILLIAMS,
W. C. MCCOWAN.