(No Model.) 3 Sheets—Sheet 1.

F. R. CORNWALL.

ENGINE.

No. 551,366. Patented Dec. 17, 1895.

Fig. 1.

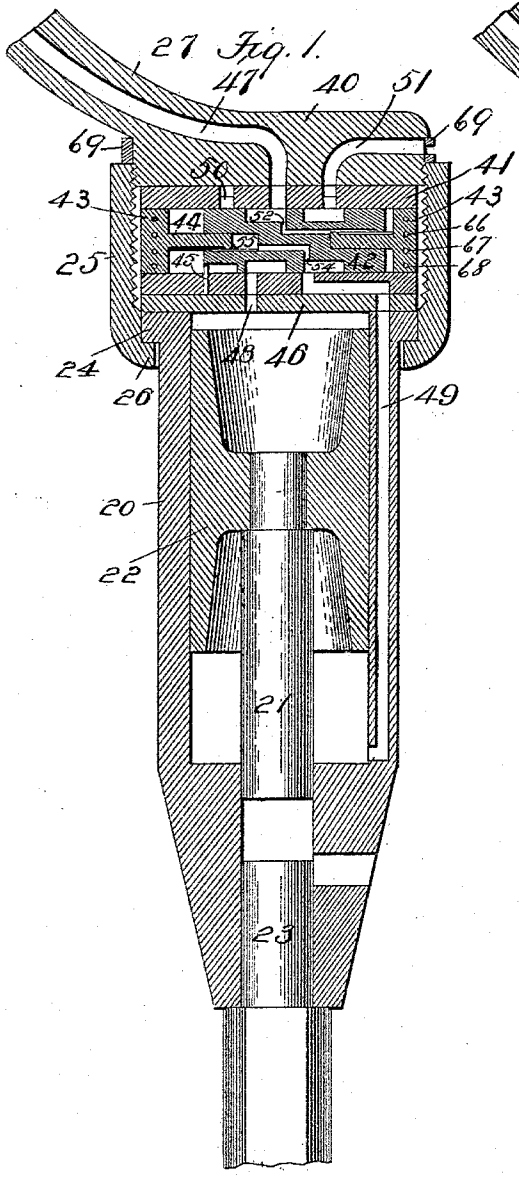
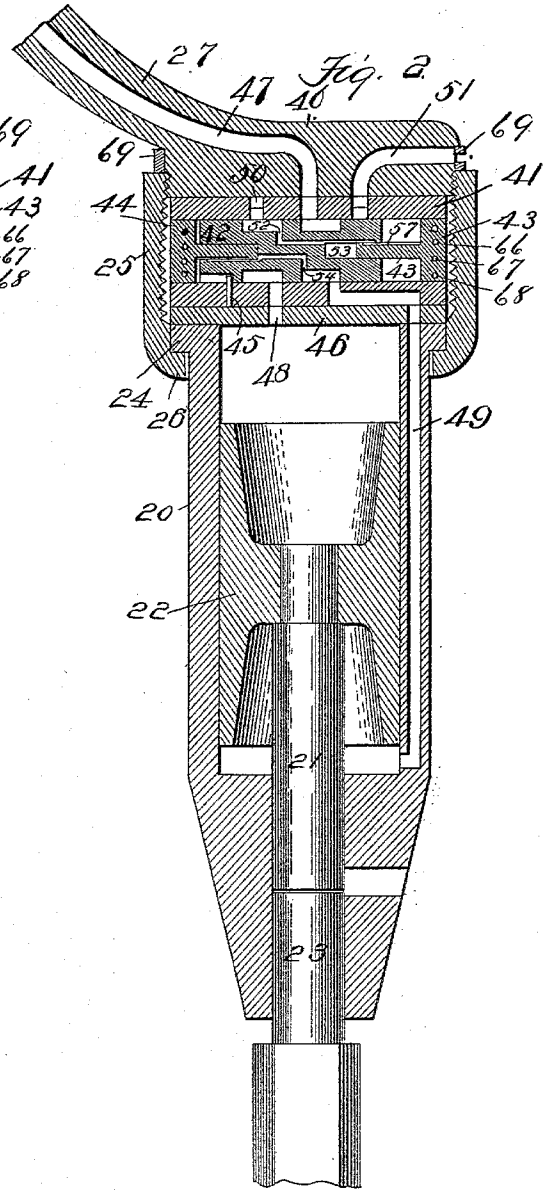


Fig. 2.



Witnesses:
Hugh K. Wagner.
Alfred Kuhn.

Inventor:
Frederick R. Cornwall

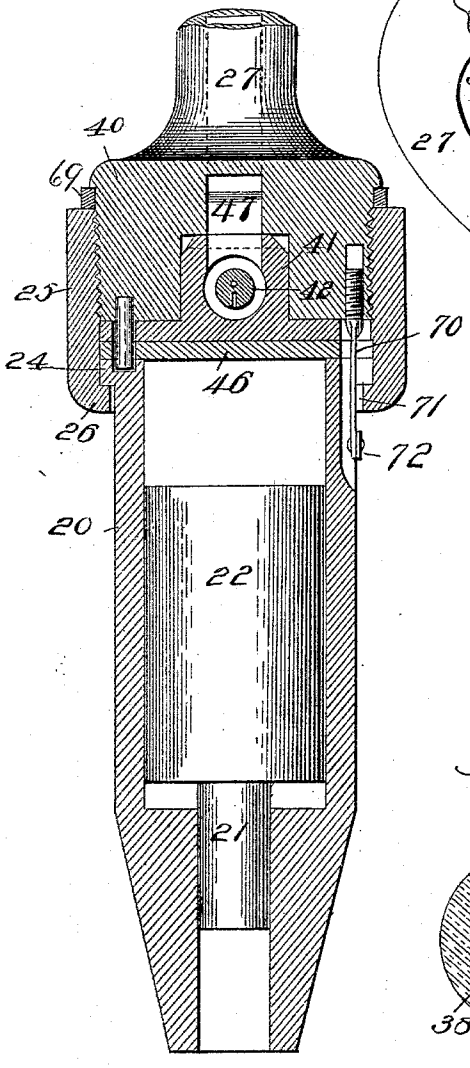
(No Model.) 3 Sheets—Sheet 2.

F. R. CORNWALL.

ENGINE.

No. 551,366. Patented Dec. 17, 1895.

Fig. 3.



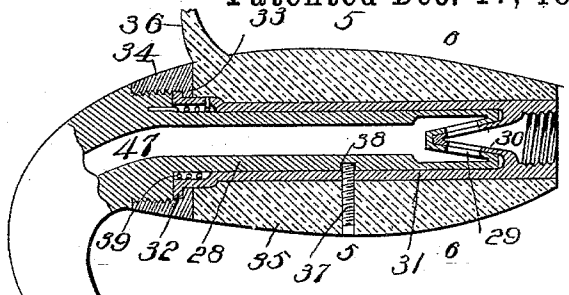


Fig. 4.

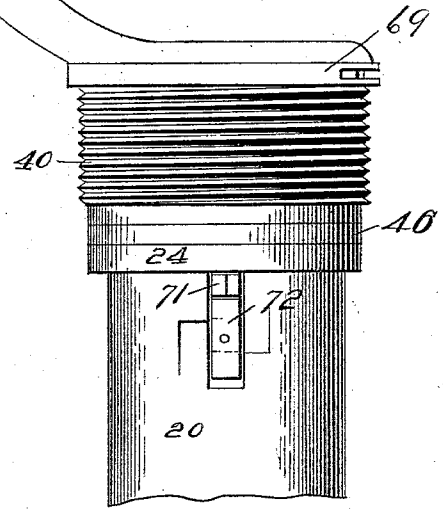


Fig. 5.

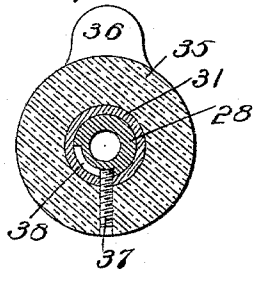
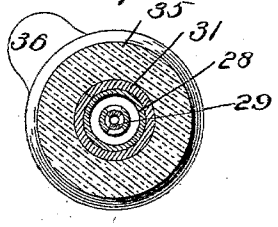


Fig. 6.



Witnesses
Hugh K. Wagner
Alfred Kuhn

Inventor
Frederick R. Cornwall

(No Model.) 3 Sheets—Sheet 3.

F. R. CORNWALL.

ENGINE.

No. 551,366. Patented Dec. 17, 1895.

Fig. 7

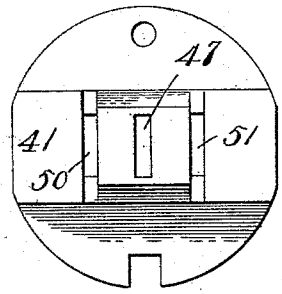


Fig. 8.

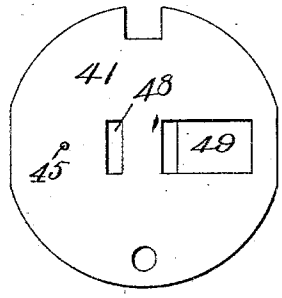


Fig. 9

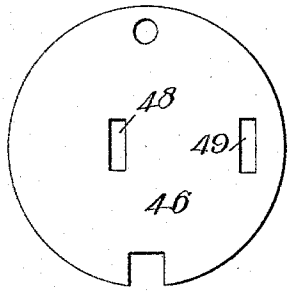


Fig. 10

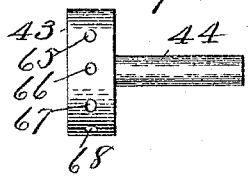


Fig. 11

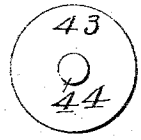


Fig. 12

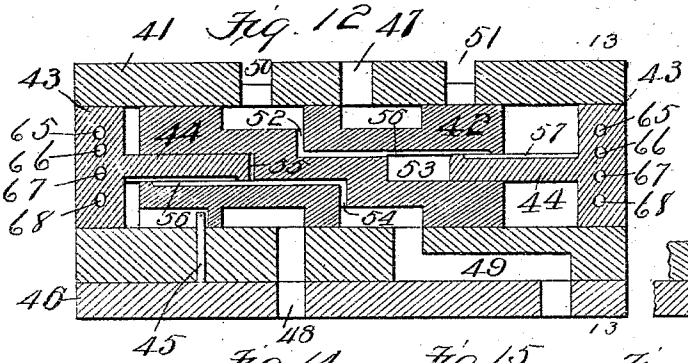


Fig. 13

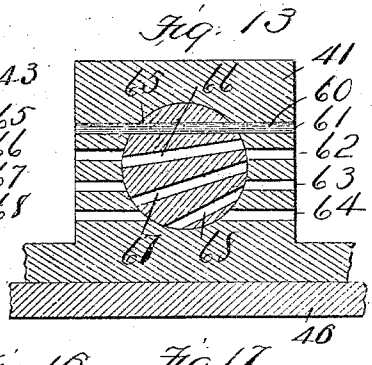


Fig. 14

Fig. 15

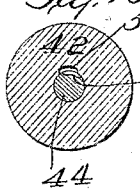


Fig. 16

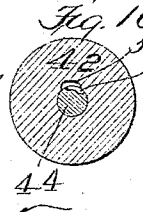
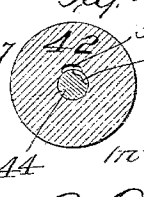


Fig. 17.



Witnesses:
Hugh K. Wagner.
Alfred Kuhn.

Inventor
Frederick R. Cornwall.

UNITED STATES PATENT OFFICE.

FREDERICK R. CORNWALL, OF ST. LOUIS, MISSOURI, ASSIGNOR TO PIERRE CHOUTEAU, OF SAME PLACE.

ENGINE.

SPECIFICATION forming part of Letters Patent No. 551,366, dated December 17, 1895.

Application filed July 29, 1895. Serial No. 557,469. (No model.)

To all whom it may concern:

Be it known that I, FREDERICK R. CORNWALL, a citizen of the United States, residing at the city of St. Louis, State of Missouri, have invented a certain new and useful Improvement in Engines, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming part of this specification, wherein—

Figures 1 and 2 are vertical sectional views of my improved engine. Fig. 3 is a similar view, but at right angles to the section of Figs. 1 and 2. Fig. 4 is a sectional view through the handle, also showing part of the cylinder in side elevation. Fig. 5 is a cross-sectional view through the handle on line 5 5, Fig. 4. Fig. 6 is a cross-sectional view through the handle on line 6 6, Fig. 4. Fig. 7 is a top plan view of the valve-casing. Fig. 8 is a bottom plan view of the same. Fig. 9 is a plan view of the cylinder-head. Fig. 10 is an elevational view of the valve-casing cylinder-head. Fig. 11 is an end view of the same. Fig. 12 is an enlarged view of the valve-casing and valve. Fig. 13 is a cross-sectional view of the valve-casing and its cylinder-head, taken on the line 13 13, Fig. 12. Figs. 14, 15, 16, and 17 are diagrammatical views taken through one of the valve-heads and cylinder-head stem, illustrating the manner of controlling the motive fluid which throws the valve or permits it to be thrown.

This invention relates to a new and useful improvement in engines of that class which are adapted to be run by compressed air as a motive fluid, in the front end of the cylinder of which is inserted a tool-shank, receiving impacting blows from the piston. These types of engines, or the engines designed for boiler-calking, stone-cutting, carving, &c., such as shown in the accompanying drawings, have generally been divided into several classes, according to the characteristics of each. One class is known as the "valveless" engine, in which the piston controls itself, and no controlling or distributing valve for the piston is necessary. Another class has present the controlling-valve, which admits and exhausts the motive fluid from each end of the piston, causing it to reciprocate, the piston in turn controlling the position of the valve by admitting and exhausting the motive fluid at its ends. Still another type is found in the adaptation of an ordinary cut-off to a pneumatic tool. These engines have present a controlling-valve for the piston, the piston controlling the position of the valve by some train of mechanism in which lost motion or play is an essential feature. In both the second and third classes the distribution of the motive fluid depends upon the position of the piston to throw the valve, and upon the position of the valve to impart motion to or reverse the motion of the piston. The primary object of an engine in any of these classes in which the piston delivers impacting-blows upon a tool is to obtain such a speed or rapidity of stroke, together with power, that the tool will make practically a continuous cut, the motion of both piston and tool amounting almost to vibration. This being true, the type of engine described in the first class is eminently satisfactory, saving the objection that it is impossible to start the engine when in certain of its positions, such as "dead-center." The types described in the second and third classes must necessarily run at a slower speed than the valveless engines by reason of the necessity of throwing two moving parts alternately. Consequently their effectiveness is lessened in proportion.

The object of this present invention is to construct an engine in which is employed a controlling-valve for the piston, said valve being self-controlled and movable independently of the piston. Combined with this fundamental object, other conditions are present and provided for and new features of construction are employed, all as will hereinafter be described, and afterward pointed out in the claims.

In the drawings, 20 indicates a cylinder, the front end of which is formed with a reduced bore, in which is inserted the stem 21 on piston 22, which co-operates with the shank of a tool 23 by delivering impacting-blows thereupon as the piston reciprocates. The construction of these parts, however, is unimportant, as there are many different forms of cylinders, bores, pistons, and tools, all of which are well known.

Formed at or near the upper end of cylinder 20 is an annular ring or flange 24, with

which co-operates a collar or coupling-sleeve 25, said collar being formed with an internal flange 26 at its lower end which fits under ring 24, and being interiorly screw-threaded, as shown, to receive and hold in position the head or handle-base which clamps the valve-casing and cylinder-head in position. The handle-base or "head," as it is sometimes called, with which the collar engages, has projecting from its upper portion a handle-shank 27, which terminates in a core 28. (See Fig. 4.) Through this core and shank is formed an inlet-port for the motive fluid, which port leads into the valve-casing, as will hereinafter be described. The outer end of the core is provided with a valve-seat 29, with which co-operates a valve 30 arranged on a sleeve 31, mounted on the core. This sleeve 31 extends out beyond the core and is provided with means for the attachment of a supply-pipe for the motive fluid. (Not shown.) The inner end of the sleeve is formed with a flange 32, which abuts against a shoulder on the handle-shank, with which flange engages an inwardly-projecting flange 33 of ring 34, which is mounted upon the handle-shank. If desired, means may be provided for locking this ring in a fixed or an adjusted position.

35 indicates a hand-grasp mounted upon the sleeve 31, which hand-grasp is preferably provided or formed with a projection 36 at its inner end. The function of this projection 36 is to prevent the hand of the operator from slipping either longitudinally or circumferentially, the hand-grasp at the same time serving as an index to the position of the valve.

The hand-grasp 35 is secured against longitudinal and rotary movement on the sleeve by a screw 37, which passes through said parts and into a circumferential groove 38 in core 28, (see Fig. 5,) said screw also serving to limit the rotary movement of the handle-grasp and sleeve on the core, and determine the full-open or full-closed position of the valve 30. To normally keep the valve closed, I provide a torsion-spring 39, one end of which engages the handle-shank and the other end the sleeve 30, upon which valve 29 is arranged.

By the above construction the operator is enabled to control the amount of motive fluid admitted to the engine by a slight turn of the hand, no occasion being required for the use of any particular finger to perform this office.

The handle-base, which I have indicated as 40 in the drawings, is formed with a transverse groove in its lower face, which receives the valve-casing 41, in which is mounted a three-headed valve 42. The ends of the valve-chamber are closed by rotary adjustable heads 43, which have arranged thereon stems 44, extending into recesses or seats in the ends of the valve. To prevent the valve from rotating in its movement, I extend a pin or projection 45 up into a groove formed on its face, as shown in Figs. 1 and 2. 46 indicates the cylinder-head.

The valve-casing, handle-base and cylinder-head have several registering ports, and in referring to said ports I will not specify the parts through which they are formed, but will refer to them as leading to or from the valve-chamber.

The inlet-port 47 is, as before stated, formed through the handle and extends down into the valve-chamber at about a midway position, where it is controlled by the central head of the valve, passing from one side to the other of said inlet-port and directing the motive fluid on top or beneath the piston. As shown in Fig. 1 the motive fluid passes to the left of the central head of the valve, and is directed on top of the piston through port 48. During the downstroke of the piston the fluid therebeneath is being exhausted through port 49, between the central and right-hand heads of the valve and out through the exhaust-port 51. This operation is obvious, as is also the reverse movement of the piston, as shown in Fig. 2, in which the valve has moved to the left, and its central head is now directing the motive fluid from port 47 to the right thereof and through port 49 to beneath the piston. The fluid above the piston is being exhausted by passing through port 48, auxiliary exhaust-port 50, and exhaust-port 51 to the exterior. This "auxiliary" exhaust-port 50 is made by grooving the valve-casing across its top and along its side edges, as shown in Figs. 3 and 7, which conducts the exhaust taken from two points to a common point (port 51). This manner of conducting off the exhaust through a common port is accomplished in a very simple manner and occasions very little extra labor, as the work is all open and the handle-base forms the remaining walls for the ports. In this connection I might add that this same manner of forming ports may be advantageously employed in port 49 between the valve-casing and head 46, as shown in Figs. 1, 2, 8, and 11.

From the above it will be noted that the piston is controlled by the valve moving from one end of its chamber to the other, and but a single port 49 is necessary in the cylinder, whereas in other constructions two or more ports are generally necessary in the cylinder. It will also be noted that ports 48 and 49 are constantly open, inlet-port 47 is closed for a short time only and that when the central head is passing and the exhaust-ports 50 and 51 are alternately opened and closed.

I have referred to the movement of the valve, and I will now describe how such movement is effected. The valve is formed with two ports 52 and 54, 52 leading from a point to the left of the central head to a seat 53 in the right-hand end of the valve, and 54 leading from a point to the right of the central head to a seat 55 in the left-hand end of the valve. Seats 53 and 55 are each provided

with a side groove 56, which runs nearly to the outer end of the valve, leaving the exposed end of the valve solid, except for the circular opening forming the seat. The stems 44 on the rotatably adjustable heads 43 are likewise provided with a groove 57, which runs nearly their entire length, leaving the ends circular and unmutilated. In order to regulate the area of the opening formed by the registering grooves 56 and 57, I provide means on the heads 43 for locking them in a rotary adjustable position. This means is best illustrated in Fig. 13, where the valve-casing is formed with a series of aligned openings 61, 62, 63, and 64, while the head 43 is provided with a number of openings 65, 66, 67, and 68, arranged at different angles to each other, and being adapted to register with the several openings in the valve-casing, as 65 will form a straight opening through valve-casing and head in connection with aligned openings 61. 66 will register in the same manner with 62, 67 with 63, and 68 with 64. As shown in Fig. 13, a pin 60 passes through openings 61 and 65, and the valve-head and its stem are locked in this position, which is a full-open position, the valve being prevented from rotation by the pin or projection 45. This position will permit the valve to be thrown quickly by the sudden admission or exhaust of the air at its ends. If it is desired to throw the valve slightly slower, pin 60 is removed, the head and stem rotated, and the pin inserted in the next opening 62, when opening 66 registers therewith. The movement of the valve may be further retarded by placing the pin in openings 63 and 67, or the admission and exhaust may be considerably choked by rotating the head and stem, as shown in Fig. 17, and placing the pin in openings 64 and 68. It may be desirable to so rotate the stems that the relations of their grooves to the co-operating groove in the valve will be different at each end of the valve, and in this manner the valve will move quicker in one direction. The object of this is to cushion the piston on its upstroke by cutting off the motive fluid therebeneath quickly, and when the piston starts on its downstroke to throw on a full head of motive fluid for a longer time, which is accomplished by the valve taking a longer time to move from the position it occupies when directing the motive fluid on top of the piston.

The operation of the valve is as follows: Assuming the parts to be in the position shown in Fig. 1, the motive fluid entering the valve-chamber through port 47 will pass through port 48 on top of the piston. At the same time the motive fluid will pass through port 52 in the valve and enter the valve-chamber at the right-hand end, filling the same and forcing the valve to the left quickly or slowly, as the case may be, depending upon the size of the opening controlled by the stem 44. The fluid beneath the piston is being exhausted through ports 49 and 51, and the fluid at the left-hand end of the valve is being exhausted through seat 55, port 54, and port 51. As the valve is thrown to the left, the momentum and expansion of the fluid carrying it past dead-center, the fluid will be directed beneath the piston, and to the left-hand end of the valve, the fluid above the piston exhausting through port 49 and exhaust-ports 50 and 51 and the fluid at the right-hand end of the valve exhausting through seat 53, port 52, and ports 50 and 51.

It may be desirable in some instances to control the exhaust, and to do this I mount upon the handle-base 40 a slotted ring 69, which is held in place by the collar 25, which, by registering the slot with exhaust-port 51, will permit a free escape, said escape, however, being choked or entirely cut off by moving the ring around the handle-base.

In order to lock the handle-base, collar and associate parts to the cylinder, to prevent movement between them, I mount in the lower end of the handle-base a yielding piece 70, which is preferably screwed up into the bottom of the handle-base. This piece 70 is formed with teeth 71, which co-operate with teeth on the interior periphery of the inturned flange 26 of collar 25, the cylinder 20 and its ring 24 being cut away to permit this. On the lower end of this piece 70 I pivot a cross-piece 72, which is adapted to be turned at an angle to the groove in the cylinder, and rest upon the side edges of the groove, where it holds the piece 70 and teeth 71 under tension, the strain being to force the teeth into tighter engagement with the flange 26.

I am aware that many minor changes in the construction, arrangement, and combination of the several parts of my invention may be made and substituted for those herein shown and described without in the least departing from the nature and principle of my invention.

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

1. The combination with the cylinder, of a piston arranged therein, a valve chamber, ports leading from the valve chamber to or near the ends of the piston chamber, and a valve located in said valve chamber for controlling said ports, said valve being self-thrown, and so constructed as to co-operate with means arranged in its chamber for controlling the speed of the valve; substantially as described.

2. The combination with the cylinder, of a piston arranged therein, a valve-chamber, ports which lead from the valve-chamber to or near the ends of the piston-chamber, a valve for controlling said ports, said valve being formed with ports whereby it is self-operated, and means located within the valve chamber which co-operate with the valve, to control its speed; substantially as described.

3. The combination with a piston, of a controlling valve therefor, which is movable in-

dependently of the piston, said valve in its movement alternately directing and exhausting the motive fluid above and below the piston, and ports formed in said valve, for conducting and exhausting the motive fluid to and from the ends of the valve chamber, substantially as described.

4. In an engine, the combination with the cylinder formed with a ring at or near its upper end, of a cylinder-head for the cylinder, a handle base for holding the cylinder-head in position, a handle on said handle-base, through which is formed an inlet port for the engine, a rotary hand-grasp on the handle for controlling the inlet port, and a coupling sleeve or collar formed with an inturned flange to engage the ring on the cylinder, said collar also engaging the handle-base and head; substantially as described.

5. In an engine, the combination with the cylinder having a ring formed thereon near its upper end, of a cylinder-head forming the end wall of the piston-chamber, a handle-base for holding said head in position, a handle on said base through which is formed an inlet port for the motive fluid and a rotary hand-grasp on the handle for actuating a throttle-valve and controlling the inlet port; substantially as described.

6. In an engine, the combination with the cylinder, of a handle secured thereto, said handle being formed with an inlet port for the motive fluid, a rotary throttle valve for controlling the passage of the motive fluid through the handle, and a rotary grasping portion for said handle, which grasping portion operates the throttle valve, substantially as described.

7. In an engine, the combination with the cylinder, of a handle secured thereto, through which handle is formed an inlet-port for the motive-fluid, a rotatable hand-grasp on said handle, and a throttle-valve for the motive-fluid, which is controlled by said hand-grasp; substantially as described.

8. In an engine, the combination with the cylinder of a handle secured thereto, said handle being formed with a core, through which passes the motive-fluid for the engine, a throttle valve for controlling said passage and a rotary sleeve mounted on said core, which sleeve, by rotation, operates the throttle valve; substantially as described.

9. In an engine, the combination with the cylinder of a handle secured thereto, said handle being formed with an inlet-port for the motive fluid, a rotary sleeve forming the hand-grasp of the handle, a throttle-valve operated by said rotary sleeve, which throttle-valve controls the passage of motive-fluid to the engine, and means on the rotary sleeve for the attachment of a supply-pipe for the motive-fluid; substantially as described.

10. In an engine, the combination with the handle, which is secured thereto, and through which is formed an inlet-port for the motive-fluid, of a rotary hand-grasp on the handle, a throttle-valve for controlling the passage of the motive-fluid through the hand-grasp, which valve is operated by the rotary hand-grasp, and means for limiting the rotary movement of said hand-grasp; substantially as described.

11. In an engine, the combination with the cylinder, of a handle secured thereto, through which handle is formed an inlet-port for the motive fluid, a throttle-valve for controlling the passage of motive-fluid through the handle, a rotary sleeve forming a hand-grasp, for operating said valve, and a projection 36 on said handle; substantially as described.

12. In an engine, the combination with the cylinder of a handle secured thereto, through which handle is formed an inlet port for the motive fluid, a throttle valve arranged in the handle, a rotatable sleeve forming the hand grasp for the handle, which sleeve operates the throttle valve, means for limiting the rotary movement of said sleeve, and means for returning the sleeve to a normal position in which the throttle valve is closed, substantially as described.

13. The combination with the core 28 formed with a valve-seat in its end, of a sleeve 31 mounted thereon and formed with a valve 30, which co-operates with the valve-seat, a collar 34 for holding the sleeve in place, a hand-grasp 35, and a screw 37, which secures the hand-grasp to the sleeve, and passing into a groove in the core, limits the rotary movement of the parts; substantially as described.

14. In an engine, the combination with the cylinder, of a handle secured thereto, through which is formed the inlet-port, of a core formed on the handle, a sleeve mounted on the core, said sleeve being formed with a flange 32 at its end, a collar 34 formed with a flange 33 for engaging the sleeve flange and retaining the sleeve on the core, a torsion-spring for returning the sleeve to a normal position, a hand-grasp mounted on the sleeve, and a throttle valve which is actuated by the rotary movement of said parts; substantially as described.

15. In an engine, the combination with a cylinder, of a valve-casing arranged thereon, a valve located in the casing, rotary adjustable heads for said casing, and means which cooperate with the valve upon the rotation of the heads, to control the speed of the valve, substantially as described.

16. In an engine, the combination with a cylinder, of a valve-casing arranged thereon, a valve within the casing, rotary adjustable heads on said casing, and means, whereby upon the rotary adjustment of said heads, the speed of the valve is regulated, substantially as described.

17. In an engine, the combination with the cylinder, of a cylinder-head, a valve-casing, fitting against the cylinder-head, a handle-base fitting against the valve casing, and a coupling-sleeve connecting the handle-base to the cylinder and clamping the interposed parts in position; substantially as described.

18. The combination with the valve-casing, of adjustable heads provided with inwardly projecting grooved stems, and a valve within the casing which is so formed as to co-operate with the grooves on the stems on the adjustable heads; substantially as described.

19. The combination with the valve-casing of a valve located therein, and formed with grooved recesses in its ends, to which lead ports, and grooved stems which project into said recesses; substantially as described.

20. The combination with the valve-casing, of a valve located therein and formed with seats in its ends to which lead ports, of adjustable heads for the valve-casing, and stems on said heads, which enter into the valve-seats and control the movement of the valve; substantially as described.

21. The combination with a valve-casing, of a three-headed valve located therein, grooved recesses in the ends of said valve, ports leading to said recesses, rotary adjustable heads for the valve-casing, and grooved stems on said heads, which project into the recesses in the valve; substantially as described.

22. The combination with a valve-casing, of an inlet-port leading thereinto, a three headed valve located in the valve-casing, the central head of which controls the inlet-port, while the two end-heads control the exhaust-ports, and two constantly open ports in the casing between the central and two end heads; substantially as described.

23. The combination with a valve-casing, of an inlet-port leading thereinto, a three-headed valve located in the valve-casing, the central head of which passes from side to side of the inlet port, exhaust-ports, which are controlled by the two end-heads, and ports leading from the valve-casing which are constantly open; substantially as described.

24. The combination with a valve-casing, of a non-rotary valve located therein, rotary adjustable heads in said casing, means for locking the heads in an adjusted position, and stems on said heads which co-operate with seats in the valve to control the admission and exhaust of the motive-fluid at each end of the valve; substantially as described.

25. The combination with a valve-casing, of a non-rotary valve located therein, rotary adjustable heads in said casing, means for locking the heads in an adjusted position, and stems formed with grooves in their sides, which stems project into seats in the valve, the grooves in the stems co-operating with similar grooves in the valve seats; substantially as described.

26. The combination with the handle-base, of a valve-casing which projects thereinto, an inlet-port formed through the handle-base and leading into the valve-casing, and an exhaust-port leading from the valve-casing into a groove or chamber, located between the valve-casing and handle-base; substantially as described.

27. The combination with the handle-base, of a valve-casing which projects thereinto, an inlet-port formed through the handle-base and leading into the valve-casing, exhaust-ports leading from the valve-casing into a groove or grooves, located between the valve-casing and handle-base, said grooves being connected and led out through the handle-base; substantially as described.

28. The combination with the cylinder, formed with a ring thereon, near its upper end, of a collar operating with said ring, a handle-base with which said collar also co-operates, and a yielding projection fixedly mounted in the handle-base for engaging teeth on the inturned flange of the collar; substantially as described.

29. The combination with the cylinder, formed with a ring thereon, of a handle-base, a collar for connecting said parts together, said collar being formed with an inturned-flange which co-operates with the ring on the cylinder, a yielding spring piece fixedly mounted in the handle-base and engaging the flange of the collar, and means for holding said yielding piece constantly under tension when in operation; substantially as described.

30. The combination with the cylinder, handle-base, and collar, of means for locking said parts against rotary movement, said means comprising a fixed yielding spring mounted in the handle-base and engaging the collar, and having means for co-operating with the cylinder to lock the spring in its engaged position; substantially as described.

31. The herein described lock, comprising a spring portion provided with teeth, and a pivoted portion mounted on the spring portion for locking it in place; substantially as described.

32. The herein described lock, comprising a spring portion provided with teeth, and a pivoted-portion mounted on the spring-portion for holding it under tension; substantially as described.

33. In an engine the combination with a cylinder formed with a flange near its upper end, a collar formed with an in-turned flange to engage the cylinder flange, a valve casing, a handle base upon which the collar is threaded, said handle base holding the valve-casing in position, and a ring mounted on the handle base and held in position by said collar, said ring being slotted or formed with an opening to control the exhaust, substantially as described.

In testimony whereof I hereunto affix my signature, in presence of two witnesses, this 23d day of July, 1895.

FREDERICK R. CORNWALL.

Witnesses:
HUGH K. WAGNER,
ALFRED HUHN.