No. 809,185. PATENTED JAN. 2, 1906.

J. F. JOHNSON.

EXPLOSIVE ENGINE.

APPLICATION FILED OCT. 19, 1904.

3 SHEETS—SHEET 1.

Fig. 1.

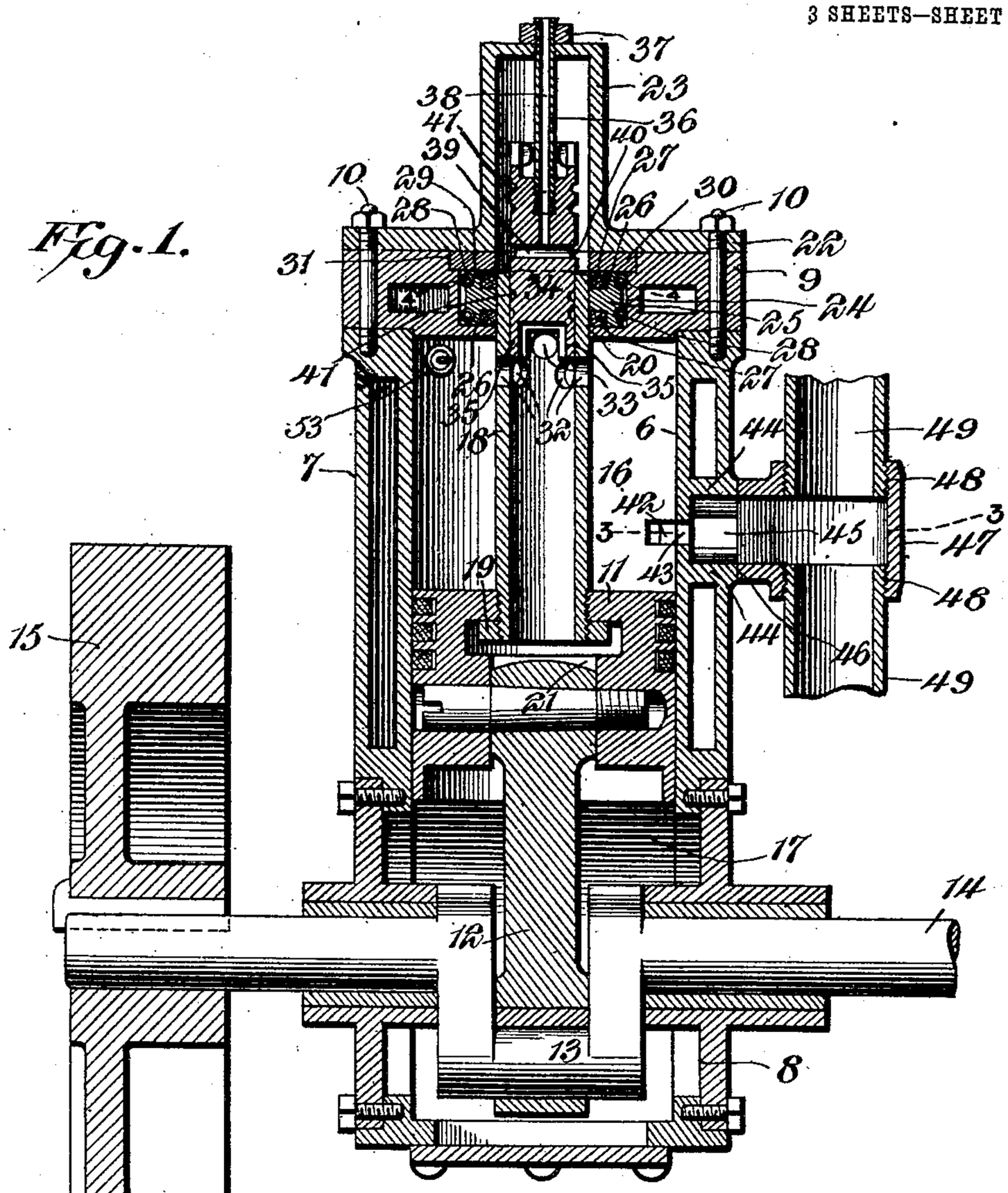
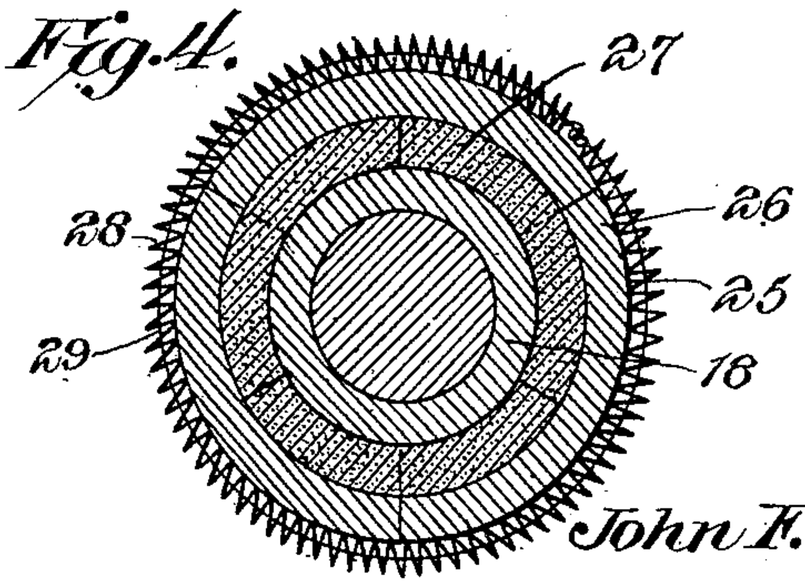


Fig. 4.



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3 SHEETS—SHEET 2.

Fig. 2.

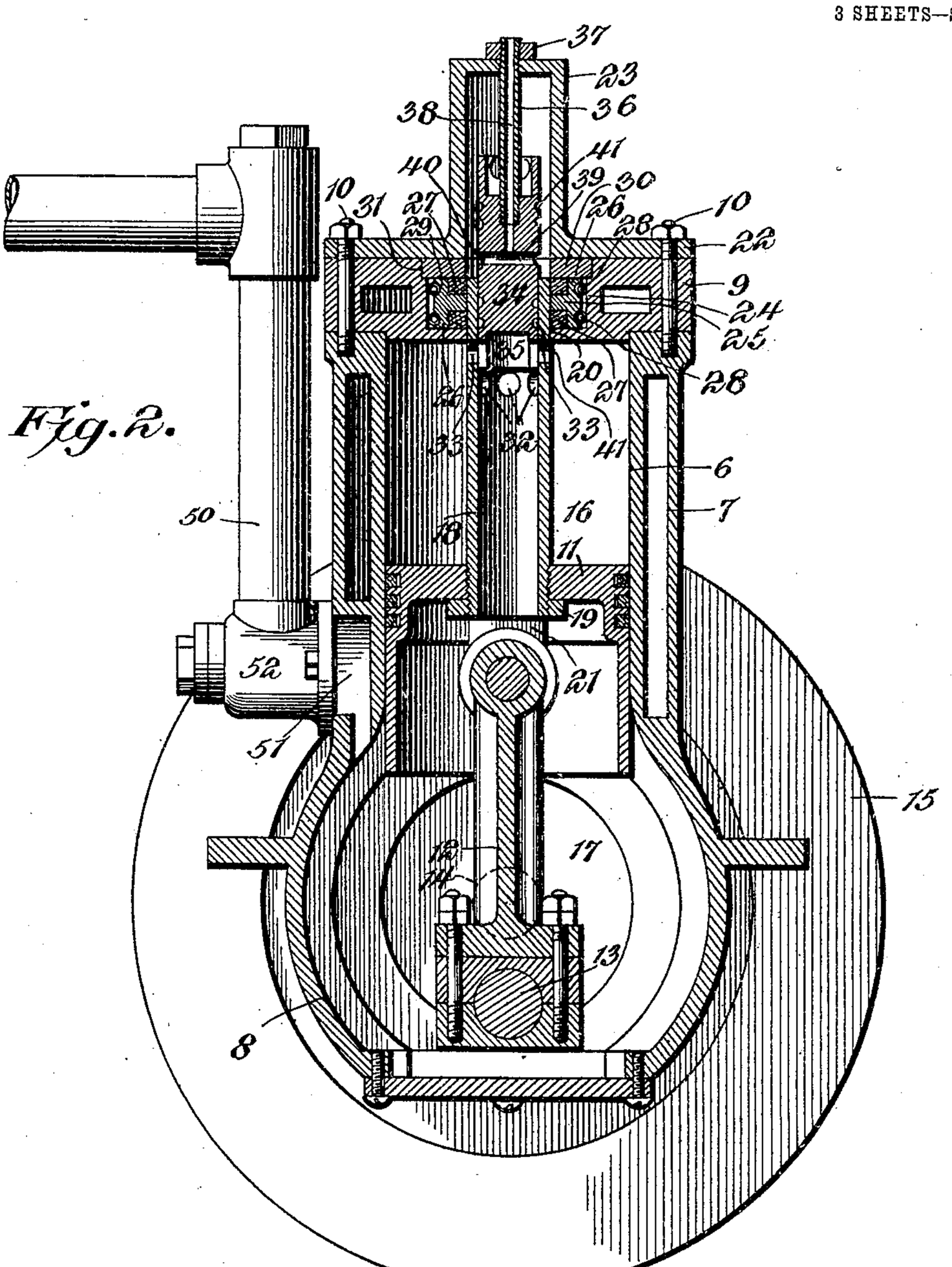
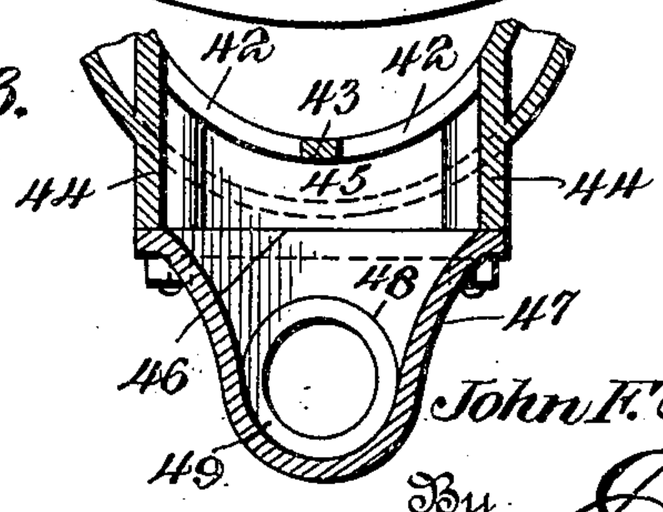


Fig. 3.



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3 SHEETS—SHEET 3.

Fig. 5.

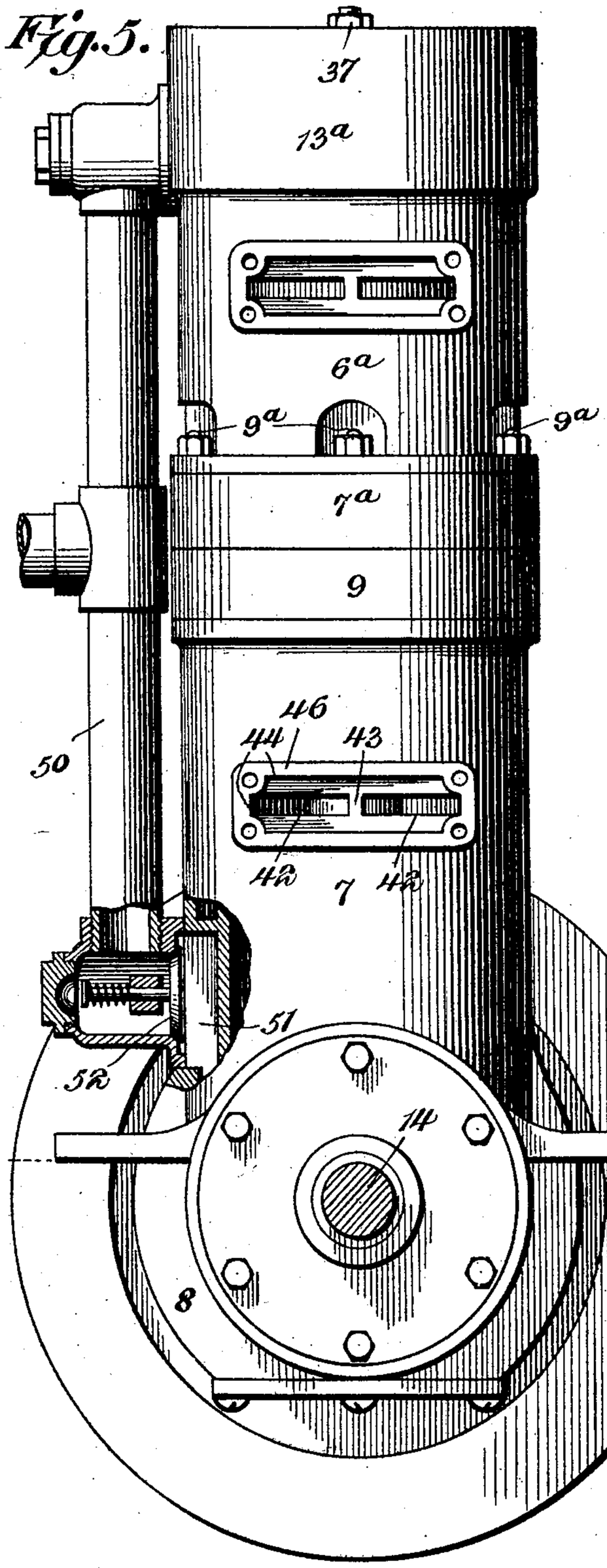
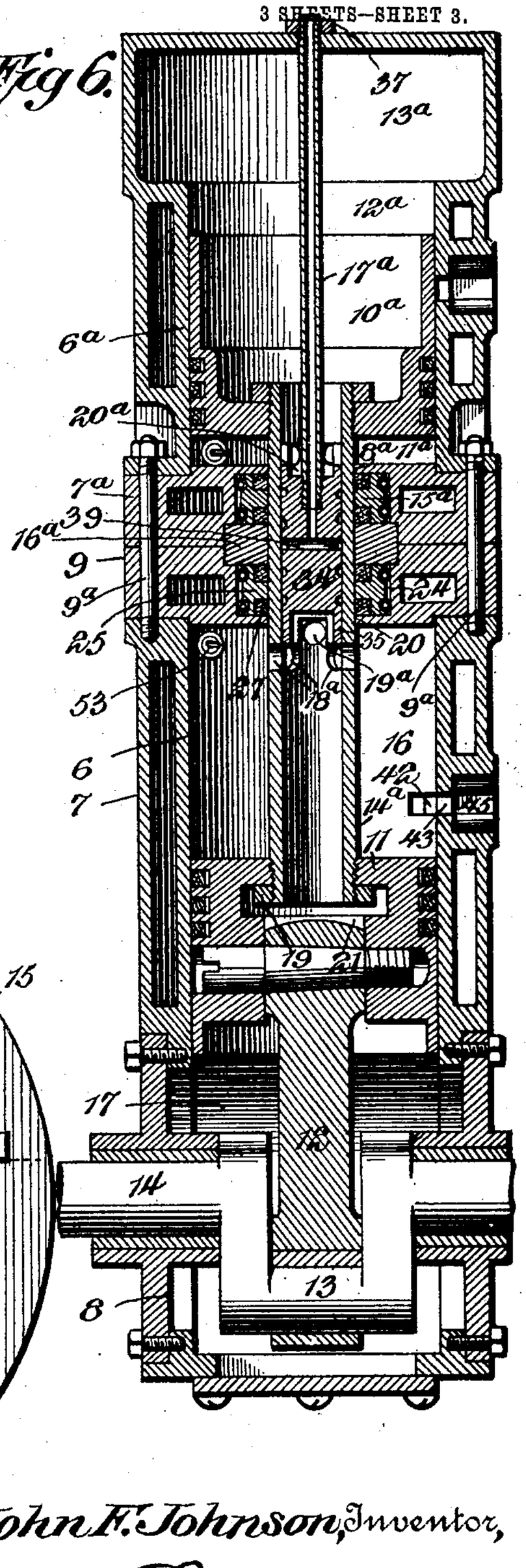


Fig 6.



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UNITED STATES PATENT OFFICE.

JOHN F. JOHNSON, OF CHESTER, PENNSYLVANIA.

EXPLOSIVE-ENGINE.

No. 809,185. Specification of Letters Patent. Patented Jan. 2, 1906.

Application filed October 19, 1904. Serial No. 229,133.

To all whom it may concern:

Be it known that I, JOHN F. JOHNSON, a citizen of the United States, residing at Chester, in the county of Delaware and State of Pennsylvania, have invented a new and useful Explosive-Engine, of which the following is a specification.

This invention has particular reference to explosive-engines of the reciprocatory-piston type.

One of the features of the invention relates to novel means of a simple nature for supplying motive-fluid charges to the engine-cylinder, so that the burned gases will be thoroughly expelled without the loss of any material part of such charges.

Another feature resides in means whereby the power of an engine may be increased by the addition of other motor units without any material alterations in the working parts of the original engine, said additions being substantially duplicates of the original and readily applicable thereto.

A still further feature of importance resides in the combination of a plurality of such power units, whereby the number of parts employed is reduced to a minimum, said parts in certain instances performing double functions, and the cycle-number as a whole is reduced one-half.

In the drawings, Figure 1 is a vertical sectional view through a single-cylinder engine embodying certain of the improvements. Fig. 2 is also a vertical sectional view through said engine, taken at right angles to Fig. 1. Fig. 3 is a detail horizontal sectional view taken on the line 3 3 of Fig. 1 Fig. 4 is a detail sectional view taken on the line 4 4 of Fig. 1. Fig. 5 is a view in elevation of an engine to which a unit has been added and showing two cylinders disposed in tandem relation. Fig. 6 is a vertical sectional view therethrough.

Similar reference-numerals designate corresponding parts in all the figures of the drawings.

Referring first to the simple type of engine illustrated in the first four figures, the cylinder 6 is preferably provided with a water-jacket 7 of suitable construction and has attached to its lower end an inclosed crank-case 8, communicating with the lower end of the cylinder, while a cylinder-head 9 is fastened to the upper end of the cylinder by means of bolts 10. Operating in the cylinder 6 is a reciprocatory piston 11, having a pitman connection 12 with the crank 13 of the engine-shaft 14, said shaft projecting through the opposite sides of the case 8 and carrying the usual fly-wheel 15. The piston 11 thus subdivides the cylinder into an upper explosion-chamber 16 and a lower compression-chamber 17, the latter including the crank-case 8.

The piston 11 carries a tubular extension 18 in the form of a hollow rod threaded into the piston and secured by a jam-nut 19, said extension projecting across the explosion-chamber and having its free end slidably moving in an opening 20, formed in the head 9. The opposite end of the extension or rod is open and communicates with a passage-way 21, formed about the pivoted end of the pitman 12 and opening into the compression-chamber 17, the interior of said extension thus having communication directly with said compression-chamber. For the purpose of covering and protecting the rear end of the tubular extension 18 a cap 22 is secured upon the head 9 by means of the bolts 10 and has a hollow projection 23 alined with the opening 20 of the head and receiving the extension during the reciprocation of the piston. The head 9 is preferably provided with a circular pocket 24, that receives a packing-ring consisting of a circular sectional disk 25, having oppositely-disposed annular flanges 26, that surround suitable sectional packing-washers 27, bearing against the tubular extension 18. The disk 25 and washers 27 are preferably in thirds and have their joints broken, as illustrated in Fig. 4, the whole being bound by compression-springs 28, located in annular seats 29, formed in the flanges 26. A retaining-disk 30 is located over the packing-ring within a seat 31, formed in the outer face of the head 9.

Communication between the interior of the extension 18 and the interior of the explosion-chamber 16 is permitted through sets of ports 32 and 33, the ports 32 being located nearer the piston than the ports 33 and being formed in different sides of the rear portion of the tubular rod, so that they will communicate with the explosion-chamber when the piston is at the forward limit of its stroke. By having one set of ports above the other the tube structure is not weakened nearly as much as if said ports were located side by side or in an annular ring around the

tube. These ports 32 and 33 are controlled by a stationary plunger 34, located in the opening of the cylinder-head and within the tubular extension, the lower end of said plunger having spaced depending projections 35, between which the ports 33 are adapted to pass and which are arranged to cover the ports 32 until said ports 33 are in communication with the explosion-chamber. The result is that the sets of ports 32 and 33 will be brought into communication simultaneously. The plunger 34 is held against reciprocatory movement with the extension by means of a hollow rod 36, threaded at its lower end into said plunger and having a threaded engagement at its upper end with the extension 23 of the cap, being secured by a jam-nut 37. The bore 38 of said rod is extended into the plunger and communicates with a transverse bore 39, which is connected with an annular packing-groove 40, other grooves 41 being located on opposite sides of the groove 40.

The exhaust from the explosion-chamber 16 is provided for by means of spaced ports 42, located in one of the curved walls of the cylinder and separated by a web 43. These ports are surrounded by angularly-disposed walls 44, forming an exhaust-receiving chamber 45 and having outer flat faces 46. Secured to said outer flat faces is a coupling 47, the interior of which constitutes an extension of the chamber 45, said coupling being provided with upper and lower ports 48, the walls of which are threaded to receive exhaust-pipes 49, either or both of which may be used as desired. The exhaust-ports are so located with respect to the piston and extension 18 that said ports are fully uncovered when the inlet-ports 32 and 33 first begin to open. Motive-fluid supply is secured through a suitable pipe 50, having communication through an inlet 51 with the compression-chamber, an inwardly-opening spring-pressed valve 52 being located in said pipe, preferably contiguous to the inlet. Any suitable form of igniter 53 may be employed in the explosion-chamber, the preferred form of the ignition mechanism being, however, fully set forth in a copending application, Serial No. 229,134.

The operation of the engine may be briefly described as follows: Upon the upstroke of the piston a motive-fluid charge is drawn into the compression-chamber through the inlet 51, and upon the return movement of said piston this charge is compressed (the valve 52 being closed) until the ports 32 33 are uncovered. Thereupon the said charge will rush through the extension 18 and the ports 32 into the explosion-chamber. Upon the second upward movement of the piston the charge is compressed in said explosion-chamber, the communication between the same and the compression-chamber being completely cut off by the passage of the ports 32 33 into the head and past the lower end of the plunger. At the proper point the charge now compressed within the explosion-chamber is exploded, thereby driving the piston toward its lower or foremost limit of stroke. This movement compresses a new charge within the compression-chamber, which charge will find its way with considerable force into the explosion-chamber when the ports 32 33 again become uncovered. The new charge will thereupon drive the burned gases from the explosion-chamber through the exhaust-ports and will substantially fill said explosion-chamber; but no material portion has the chance of escape before the piston has again moved rearwardly to close the exhaust-ports and the inlet-ports 32 33.

It will thus be evident that a simple engine is provided having efficient means for delivering charges to the explosion-chamber and wherein there is no danger of back-firing or the return of gases, because of the complete closures afforded the inlet-ports. The exhaust of burned gases is efficiently secured, and the exhaust mechanism has been found to be peculiarly efficient because of the comparatively large space afforded for the free escape of the same.

In order to show how additions may be made to this engine to secure additional power, attention is invited to Fig. 5. The lower cylinder, cylinder-head, packing mechanism, piston, and engine-shaft, together with the exhaust mechanism, is still employed and the same reference-numerals are therefore applied to the same. Another cylinder 6^a is placed upon the original cylinder and has a head 7^a located on the head 9, being provided with a central opening 8^a, alined with the opening 20. The heads are secured to their respective cylinders, and the cylinders are secured to each other by common bolts 9^a, thus fastening said cylinders rigidly in tandem. A piston 10^a, located within the added cylinder 6^a, subdivides the same into an explosion-chamber 11^a and a compression-chamber 12^a, the latter preferably having an enlarged portion 13^a, securing substantially the additional space afforded in the original shaft by the crank-case. The original tubular extension 18 of the piston 11 is supplanted, however, by another tubular rod 14^a, which is secured to both pistons and constitutes the operative connection between them, said tubular connection passing through the alined openings 20 and 8^a, the packing-ring 25 coacting therewith and another similar packing-ring 15^a, located in the head 7^a, also coacting with the connection, the two packing-rings being separated by a disk 16^a. The original plunger 34 is employed, but is held in place by a new rod 17^a, threaded at its lower end into said plunger and having its upper end secured to the upper end of the cylinder 6^a. The tubular connection 14^a has ports 18

and 19ª, corresponding to the original ports 32 33 and similarly coacting with the extensions 35. In this instance, however, the ports 18ª 19ª are movable into the different explosion-chambers 16 and 11ª and past the plunger 34. Said ports, therefore, coact when moving into and out of the explosion-chamber 11ª, with extensions 20ª, formed upon the upper end of the plunger, but in reverse relation to the projections 35—that is to say, the ports 19ª being nearer the piston 10ª than the ports 18ª they must of necessity be covered after they enter the explosion-chamber 11ª until the ports 18ª begin to enter said explosion-chamber. Furthermore, it will be seen that when the ports 18ª 19ª are below the stationary plunger and in the explosion-chamber 16 the compression-chamber 17 is in communication with said explosion-chamber through the lower portion of the tubular connection 14ª and the ports 18ª and 19ª, while when the tubular extension is elevated the upper or outermost compression-chamber 13ª is in communication with the explosion-chamber 11ª through the upper portion of the tubular extension 14ª and the ports 18ª and 19ª. The fuel-inlet to the compression-chamber 12ª is similar to that of the single-acting engine. With this combination the power of the original engine can be readily doubled with the alteration of merely two elements, the tubular extension and the supporting-rod for the plunger. In this way, by the addition of a single power unit a double-acting or single-cycle engine is secured, and the additional power may be supplied without the necessity of discarding the entire original engine. Furthermore, it is to be observed that in the last embodiment the structure is comparatively simple, as there is material economy in the number of parts used. Thus the tubular rod 14ª constitutes the means for connecting the pistons and for supplying fuel from both of the compression-chambers to both of the explosion-chambers.

From the foregoing it is thought that the construction, operation, and many advantages of the herein-described invention will be apparent to those skilled in the art without further description, and it will be understood that various changes in the size, shape, proportion, and minor details of construction may be resorted to without departing from the spirit or sacrificing any of the advantages of the invention.

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

1. In an engine, the combination with a cylinder, of a reciprocatory piston mounted therein, a tubular extension carried by the piston and reciprocating therewith, said extension having a port, means for introducing motive-fluid-supply charges into the extension, a cut-off located within the extension and arranged to close the port thereof, and means for holding the cut-off against reciprocation.

2. In an engine, the combination with a cylinder and compression-chamber, of a piston operating between the same, a tubular extension carried by the piston, said extension projecting into the cylinder, having communication with the chamber and having a port, and a cut-off located in the extension and held against reciprocation therewith, said cut-off being arranged to close the port thereof.

3. In an engine, the combination with a cylinder having a rear wall, of a reciprocatory piston mounted in the cylinder, a tubular motive-fluid inlet extension carried by the piston and having a port contiguous to its rear end, said port being spaced from the rear wall of the cylinder when the piston is at the forward limit of its stroke, and a stationary cut-off plunger located in the extension, said plunger coacting with the port to close the same upon the rearward movement of the piston.

4. In an engine, the combination with a cylinder, of a piston operating therein and having a tubular extension, said extension being provided with ports located at different distances from the piston, and means for simultaneously opening and closing the ports on the reciprocation of the piston.

5. In an engine, the combination with a cylinder, of a piston operating therein and having a tubular extension, said extension being provided in different sides with ports located at different distances from the piston, and means located within the extension for simultaneously opening and closing the ports upon the reciprocation of the piston.

6. In an engine, the combination with a cylinder, of a piston operating therein and having a tubular extension, said extension being provided in different sides with ports located at different distances from the piston, and a stationary plunger located within the extension and having spaced projections that are arranged to cover certain of the ports, other of said ports being movable to points between the projections.

7. In an engine, the combination with a cylinder having a rear wall provided with a socket, of a piston operating in the cylinder and having a tubular extension movable into and out of the socket, said extension having a port movable into and out of the cylinder, a stationary plunger located within the extension, and packing interposed between the plunger and extension and between the rear wall and the extension.

8. In an engine, the combination with a cylinder having a rear wall provided with a socket, of a piston operating in the cylinder and having a tubular extension movable into

and out of the socket, said extension having a port movable into and out of the cylinder, a stationary plunger located within the extension, and a packing-ring located in the rear wall of the cylinder and surrounding the extension, said plunger being also provided with packing-receiving recesses.

9. In an engine, the combination with a cylinder, of a piston operating therein and having a tubular extension provided with ports, a stationary cut-off plunger located within the extension and having an annular packing-recess, and a supporting-rod for the plunger having a passage-way communicating with the annular recess.

10. In an engine, the combination with a cylinder having a compression-chamber at one end, of a piston operating in the cylinder, a tubular extension carried by the piston and having communication with the compression-chamber, said extension being provided with lateral ports located at different distances from the piston, a cut-off plunger located within the extension and having an annular packing-groove, a supporting-rod for holding the plunger against movement with the extension, said rod having a passage-way communicating with the annular groove, and extensions carried by the inner end of the plunger for effecting the closure of certain of the ports.

11. In an engine, the combination with cylinders arranged in tandem, of pistons operating in the cylinders, a connection between the pistons, and means for introducing motive-fluid-supply charges to one of the cylinders through said connection.

12. In an engine, the combination with cylinders arranged in tandem, of pistons operating in the cylinders, a connection between the pistons, and means for successively introducing motive-fluid-supply charges to the cylinders through the said connection.

13. In an engine, the combination with separate sets of cylinders and compression-chambers, of a piston operating in each cylinder and acting upon the motive fluid in each chamber, a tubular connection between the pistons constituting means of communication between each chamber and the coacting cylinder, and means for cutting off said communication.

14. In an engine, the combination with cylinders arranged in tandem, of a compression-chamber formed at the end of the cylinders, pistons operating in each cylinder, a tubular connection between the pistons constituting means of communication between each chamber and its coacting cylinder, and means for cutting off such communication.

15. In an engine, the combination with cylinders disposed in tandem, of pistons operating in the cylinders and subdividing each into an explosion and a compression chamber, a tubular connection between the pistons having communication with both explosion and both compression chambers, and means for cutting off such communication.

16. In an engine, the combination with cylinders located in tandem, of pistons operating in the cylinders and subdividing each into an explosion and a compression chamber, a tubular connection between the pistons having communication with both compression-chambers and ports that open into both explosion-chambers, and means for cutting off the ports.

17. In an engine, the combination with cylinders arranged in tandem, of pistons operating in the cylinders and subdividing each into an inner explosion and an outer compression-chamber, and a tubular extension connecting the pistons and having open ends communicating with both of said outer compression-chambers, said extension projecting through both explosion-chambers and having ports that communicate therewith.

18. In an engine, the combination with cylinders arranged in tandem, of pistons operating in the cylinders and subdividing each into an inner explosion and an outer compression chamber, a tubular rod connecting the pistons and having open ends communicating with both of said compression-chambers, said rod projecting through both of said inner explosion-chambers and having lateral ports communicating therewith, and means for closing the ports.

19. In an engine, the combination with explosion-chambers, of pistons operating therein, and a reciprocatory charge-conducting device having common ports for introducing charges to the different explosion-chambers.

20. In an engine, the combination with explosion-chambers, of pistons operating therein, and a reciprocatory charge-conducting device having a common port movable into communication with different chambers.

21. In an engine, the combination with explosion-chambers, of reciprocatory pistons operating therein, a charge-conducting device carried by the pistons and reciprocating in the different chambers and having a port that is movable into communication with said chambers.

22. In an engine, the combination with explosion-chambers, of pistons operating therein, a charge-conducting device movably extending into the chambers and having a port that is relatively movable into communication with said chambers, and means located within the device and stationary with respect thereto for cutting off communication between the ports and one of the chambers when said port is in communication with the other chamber.

23. In an engine, the combination with explosion-chambers, of a partition-wall separating the same, pistons operating in the chambers, and a tubular connection between

the pistons passing through the wall and having a port movable through said wall into the different explosion-chambers.

24. In an engine, the combination with explosion-chambers, of a partition-wall separating the same, pistons operating in the chambers, and a tubular connection between the pistons passing through the wall and having a port movable through said wall into the different explosion-chambers, said wall constituting means for cutting off communication between the port and one of the chambers when said port is located in the other chamber.

25. In an engine, the combination with explosion-chambers, of pistons operating therein, a tubular charge-conducting device movably extending into the chambers and having a port that is successively movable into communication with said chambers, and a plunger located within the charge-conducting device.

26. In an engine, the combination with cylinders disposed in tandem, of pistons operating in the cylinders, and a tubular connection between the cylinders, said tubular connection having a port movable into the different cylinders upon the reciprocation of the piston.

27. In an engine, the combination with cylinders arranged in tandem, of pistons operating in the cylinders and dividing the same into explosion and compression chambers, a tubular connection between the pistons having communication with the compression-chambers, and a port that is movable into communication with the explosion-chambers.

28. In an engine, the combination with cylinders arranged in tandem, of pistons operating in the cylinders and dividing the same into explosion and compression chambers, a tubular connection between the pistons having communication with the compression-chambers, a port that is movable into communication with the explosion-chambers, and a stationary plunger located within the connection.

29. In an engine, the combination with cylinders arranged in tandem, of a division-wall separating the cylinders, pistons operating in the cylinders and subdividing the same into inner explosion-chambers and outer compression-chambers, a tubular connection between the pistons having open ends communicating with the compression-chambers, said connection having a port movable through the division-wall into the different explosion-chambers, and means located in the connection at the division-wall for cutting off communication between the ends of the connection.

30. In an engine, the combination with a cylinder, of a reciprocatory piston located therein, another cylinder, means for securing the other cylinder in tandem relation upon the first-mentioned cylinder, a reciprocatory piston located in said second cylinder, and means for connecting the pistons.

31. In an engine, the combination with a cylinder having a head provided with an opening, of a reciprocatory piston located in the cylinder, another cylinder having a head provided with an opening, means for securing the other cylinder in tandem relation upon the first-mentioned cylinder with the heads abutted and the openings alined, a reciprocatory piston located in the second cylinder, and means passing through the openings for connecting said pistons.

32. In an engine, the combination with a cylinder, of a removable head for the same having an opening, a reciprocatory piston located in the cylinder, another cylinder, a removable head for said second cylinder having an opening, a reciprocatory piston operating in the second cylinder, common bolts for securing the heads to the cylinders and the cylinders to each other with the openings in the heads alined, and a rod connection between the pistons, said connection passing through the openings.

33. In an engine, the combination with a cylinder having a curved wall and spaced exhaust-openings therein, of outstanding angularly-disposed walls connected to said curved wall on opposite sides of the exhaust-openings and having flat outer faces disposed in substantially the same plane, and an exhaust-pipe coupling secured against said outer flat faces.

In testimony that I claim the foregoing as my own I have hereto affixed my signature in the presence of two witnesses.

JOHN F. JOHNSON.

Witnesses:

JOHN H. SIGGERS,

E. G. SIGGERS.