J. H. D. BEAUCAGE.

EXPLOSIVE ENGINE.

APPLICATION FILED DEC. 14, 1911.

1,055,120.

Patented Mar. 4, 1913.

2 SHEETS—SHEET 1.

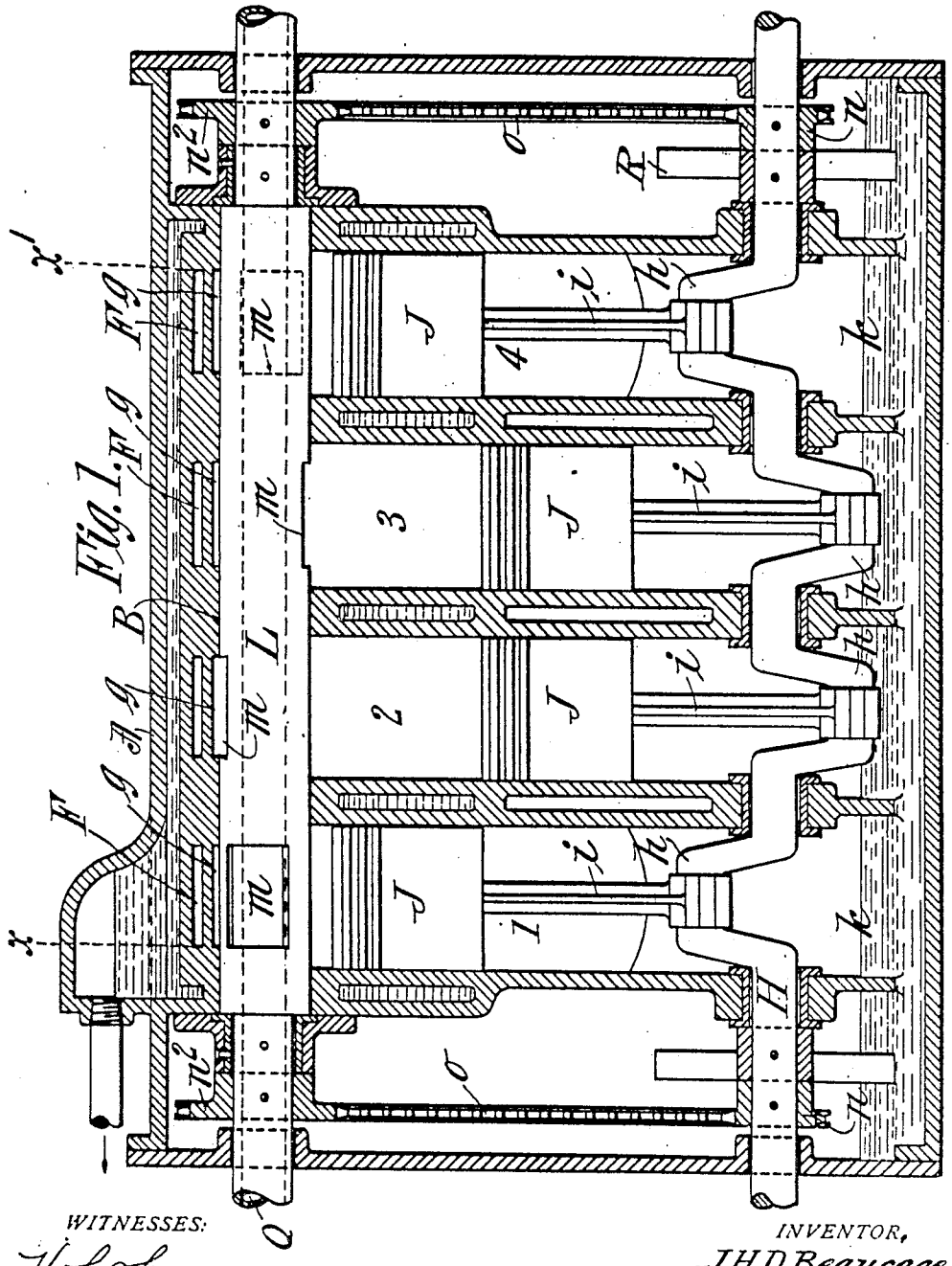

Fig. 1.

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2 SHEETS—SHEET 2.

Fig. 2.

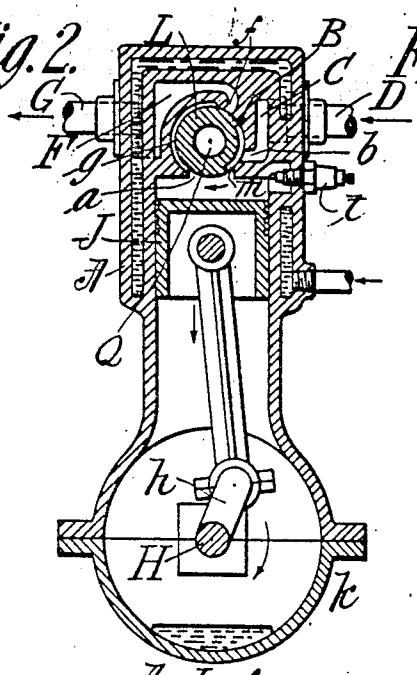


Fig. 3.

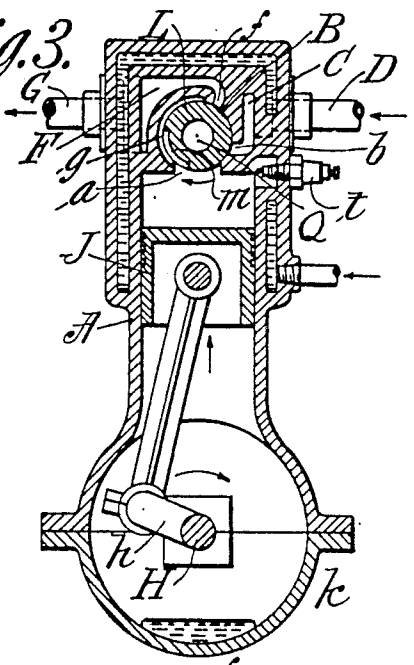


Fig. 4.

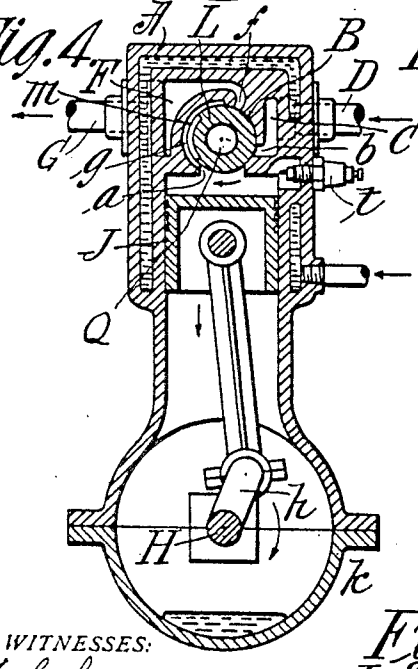


Fig. 5.

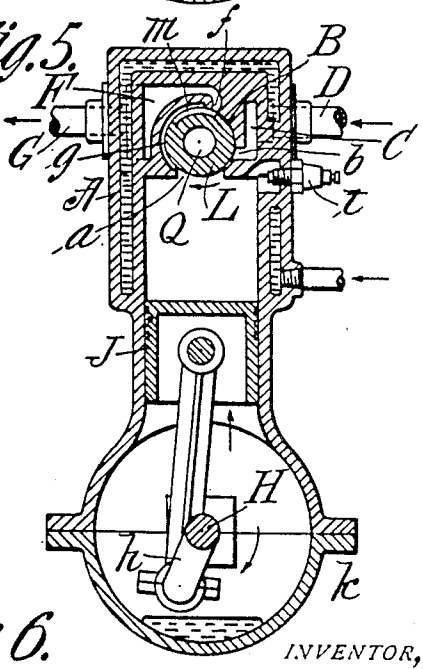
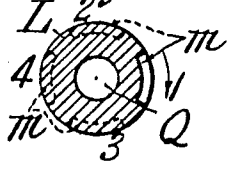


Fig. 6.



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EXPLOSIVE-ENGINE.

1,055,120. Specification of Letters Patent. Patented Mar. 4, 1913.

Application filed December 14, 1911. Serial No. 665,598.

To all whom it may concern:

Be it known that I, JOSEPH H. D. BEAUCAGE, a citizen of the United States of America, and resident of Pittsfield, in the county of Berkshire and State of Massachusetts, have invented certain new and useful Improvements in Explosive-Engines, of which the following is a full, clear, and exact description.

The object of this invention which relates to explosive gas engines is to provide such improved and simplified arrangements that a single member constitutes the means for controlling both the ingress of the liquid or gaseous fuel into the cylinder, and the discharge or exhaust of the dead gas therefrom.

A further object is to so construct an engine comprising a plurality of cylinders that a single shaft-like member, driven from the engine shaft and running at a proper relative speed thereto serves as the ingress and exhaust controlling means for all of the cylinders.

A further object is to produce an explosive gas engine of the four cycle type at extremely low cost and also one in which there is lessened liability of its becoming deranged or out of adjustment.

The invention is described in conjunction with the accompanying drawings and is set forth in the claims.

In the drawings:—Figure 1 is a central vertical sectional view through a four cycle engine constructed in accordance with this invention, such engine in the present instance being one having four cylinders. Fig. 2 is a vertical cross sectional view taken axially through any one of the cylinders showing the valve for such cylinder and the piston thereof as in the intake position. Fig. 3 is a view similar to Fig. 2 but showing the arrangements of the parts in the compression stroke of the piston. Fig. 4 is a similar cross sectional view showing the parts as in condition for ignition, and Fig. 5 is a similar view but showing the parts in the position for exhaust. Fig. 6 is a cross sectional and diagrammatic view indicating the relative arrangement of the recesses in the shaft valve and also the succession of their coöperative actions with the inlet ports.

In the drawings, A represents the engine body or casing having a plurality of cylinders here represented as four in number, and indicated by the numerals 1, 2, 3 and 4,—the same being made by casting with suitable coring not only for the cylinders but for the features comprised in the body beyond the ends of the cylinders forming prominent parts of this invention and to be hereinafter particularly described.

The engine body has a bore B therein located beyond the ends of the cylinders and having its axial line at right angles to the parallel axes of all of the cylinders; and from the said bore openings *a* are formed within the body transversely relatively to said bore connecting the latter with the upper ends of the cylinders. The body has a narrow and closed intake chamber C therein extending longitudinally thereof which has a length corresponding to the distance between the dotted lines x, x' in Fig. 1; and from this common intake chamber with which the gasolene and air supply conduit D is connected, ports *b* individually corresponding to the several cylinders lead to communication with the aforementioned bore. The engine body also has in its upper portion and more or less nearly opposite the inclosed intake chamber C an exhaust chamber F, the length of which is uniform with that of the chamber C and from which chamber F lead exhaust ports *f* corresponding to the respective cylinders, which ports terminate in communication with the bore B. The intake and exhaust ports *b* and *f* for each cylinder as well as the cylinder and bore-connecting openings *a* are so located that they would be centrally intersected by a plane transverse of the engine body coincident with the axis of the respective cylinders with which these ports and openings correspond.

G represents an exhaust conduit leading from the common exhaust chamber F with which the several exhaust ports *f* connect.

The engine body above the cylinders and within its portion forming the wall of the aforementioned bore B has arc shaped channels *g* extending from communication with the transverse cylinder connecting openings *a* to proximity with, but slightly separated from, the exhaust ports *f*.

H represents the engine shaft having cranks A provided as usual for multiple cylinder gasolene engines.

J J represent pistons in the respective cylinders, and *i i* represent pitman rods connecting the pistons with the cranks of the engine shaft,—which shaft with its cranks are inclosed in the crank case *k*.

The distance between the intake and exhaust ports *b* and *f* is fractional of the circumference or circular wall of the bore B, that is in the present instance, in which there are four cylinders, such distance of separation of the ports is approximately one-fourth of the circular extent of the wall of said bore.

The valve device which controls the ingress and exhaust for all of the cylinders consists of a cylindrical bar or shaft-like part L closely fitted in the aforesaid bore but free to rotate therein, the same having suitable end bearings therefor in the engine body. This shaft has recesses *m* therein which extend but fractional of its circumference at different portions of its length corresponding to the regions of the aforementioned intake and exhaust ports *b* and *f* as well as the channels *g* and the bore and cylinder connecting openings *a*. These valve recesses *m* which are at different parts of the length of the shaft-like member L have their locations at different places around the body of such shaft like valve so that they will in proper succession register with the sets of ports, channels and openings appurtenant to each cylinder; and in accordance with the practice of four-cycle explosive engine construction, the shaft-like valve L is caused to rotate half as fast as the engine shaft H through any manifest mechanical means.

In the present instance the engine shaft has a sprocket wheel *n* affixed thereon, while the shaft valve L has a sprocket wheel n^2 twice the diameter of the one *n*,—the sprocket chain *o* running around both sprocket wheels.

To follow the operation of the engine so far as the action of a single cylinder thereof is concerned, reference may be had to Figs. 2 to 5 inclusive: In Fig. 2 it is seen that at the time the piston is at its upper position for intake the shaft-valve recess *m* forms a duct or way for communication between the intake port *b* and the bore and cylinder opening *a* so that as the piston recedes in the chamber *a* full charge may be taken in,—the means of exhaust at this time being closed. In Fig. 3, the piston being understood as proceeding on its upstroke for compression, the shaft valve recess *m* has such a position that the communication between the intake port and the cylinder and exhaust port is closed. In Fig. 4 the valve is shown as having slightly farther rotated, but still insufficiently far as to open connection between either the intake or exhaust ports with the cylinder,—the conditions here being such as established at the time of ignition. Fig. 5 represents the relative position of the parts following ignition when the piston has been driven to the limit of its working stroke, and the conditions are established for the exhaust of the dead gases from the cylinder,—it here being seen that the shaft valve recess *m* forms communication between the channel *g* (which is at all times open to the cylinder by reason of its having connection with the opening *a*) and the exhaust port *f* for the cylinder under consideration; and the length of the arc shaped recess *m* is such as to leave the passageway open for the exhaust until such recess *m*, under the turning of the shaft-valve, derives a position for opening communication between the intake port and the cylinder for a fresh explosive charge.

The valve recesses *m* appurtenant to the respective cylinders and located at different places along the length of the shaft-valve, furthermore, have their locations relatively the one to another at different places around the circumference of the shaft-valve so as to secure the operations in the several cylinders in proper relative times; and the arrangement of this engine as the same has been designed by me is such that the ignition (as insured by the spark plugs *t* having wiring and generator connections and operating in conjunction with a timer, not shown, but all as usual) will take place in cylinder 1 followed by the firing in cylinder 2, the ignition in cylinder 4 next transpiring after which the explosive action occurs in cylinder 3, this operation being repeated time and time again. Such succession of operations need not, however, be adhered to; and the invention is not limited to an engine of any particular number of cylinders, as the idea of means hereinabove described in conjunction with the illustrations provided may be adapted to engines having any number of cylinders within reasonable range, requirement of changes therefor being those of detail and of a character manifest to any designer skilled in the art to which this invention pertains.

The shaft valve is shown as having a passage Q axially therethrough from end to end, the object of which is to provide a means for the cooling of the shaft by atmospheric air, a current of which under the running of the shaft will be induced through the valve device.

The engine shaft is shown as having on portions thereof endwise beyond the cranks, but within the inclosed crank case and adjacent the lower sprocket wheel and the sprocket chain a revoluble member which may be in the form of a disk or fan wheel R which is operative, under the running of the engine to carry oil from the body thereof in the lower part of the crank case for distribution in an upward direction so that

more or less of such oil thrown in the form of a spray will go onto the chain for the effective lubrication of the latter and the sprocket wheels around which the chain runs.

I claim:—

1. In an explosive engine, an engine body comprising a plurality of cylinders, and having a bore therein beyond the ends of the cylinders and at right angles to the axis of the latter, and having openings transversely connecting said bore with the ends of the cylinders, said body having ingress ports corresponding to respective cylinders, leading to said bore, having exhaust ports corresponding to the cylinders leading to the bore, and having channels in the wall of the bore extending from communication with the transverse cylinder-connecting opening to proximity with, but separated from, the exhaust ports, the cylinder pistons, the engine shaft having cranks, and the cylinder pistons and connections between the cylinders and cranks, a valve device for all the cylinders, consisting of a shaft fitted in said bore and having recesses therein extending but fractionally at its circumference at different portions of its length corresponding to the regions of the said ports to alternately establish communication between the ingress ports and the cylinders and the cylinders and the exhaust ports, and means for rotating said shaft-valve at half the speed of the engine shaft.

2. In an explosive engine, an engine body comprising a cylinder, and having a bore therein beyond the end of the cylinder and at right angles to the axis of the latter, and having an opening transversely connecting said bore with the end of the cylinder, said body having an ingress port leading to said bore, having exhaust ports leading to the bore, and having a channel in the wall of the bore extending from communication with the transverse cylinder and bore connecting opening to proximity with, but separated from, the exhaust port, the cylinder piston, the engine shaft having a crank, the cylinder piston and a connection between the cylinder and crank, a valve device for the cylinder consisting of a cylindrical member fitted in said bore and having a recess therein extending but fractionally of its circumference, and located adjacent the said ports to alternately establish communication between the ingress port and the cylinder and the exhaust port and the cylinder, and means for rotating said shaft valve at half the speed of the engine shaft.

3. In an explosive engine, an engine body comprising a plurality of cylinders, having a bore therein beyond the ends of the cylinders and at right angles to the axis of the latter, and having openings transversely connecting said bore with the ends of the cylinders, said body having a chamber therein extending longitudinally thereof and having ingress ports corresponding to the respective cylinders, leading from said intake chamber to said bore, having an exhaust chamber therein extending longitudinally thereof and having exhaust ports corresponding to the cylinders leading from said exhaust chamber to the bore, and having channels in the wall of the bore extending from communication with the transverse cylinder-connecting openings to proximity with, but separated from, the exhaust ports, the cylinder pistons, the engine shaft having cranks, and the cylinder pistons and connections between the cylinders and cranks, a valve device for all the cylinders, consisting of a shaft fitted in said bore and having recesses therein extending but fractionally of its circumference at different portions of its length corresponding to the regions of the said ports to alternately establish communication between the ingress ports and the cylinders and the cylinders and the exhaust ports, and means for rotating said shaft-valve at half the speed of the engine shaft.

4. In an explosive engine, an engine body comprising a plurality of cylinders, and having a bore therein beyond the ends of the cylinders and at right angles to the axis of the latter, and having openings transversely connecting said bore with the ends of the cylinders, said body having ingress ports corresponding to respective cylinders, leading to said bore, having exhaust ports corresponding to the cylinders leading to the bore, and having channels in the wall of the bore extending from communication with the transverse cylinder-connecting openings to proximity with, but separated from, the exhaust ports, the cylinder pistons, the engine shaft having cranks, and the cylinder pistons and connections between the cylinders and cranks, a valve device for all the cylinders, consisting of a shaft fitted in said bore and having recesses therein extending but fractionally of its circumference, at different portions of its length corresponding to the regions of the said ports to alternately establish communication between the ingress ports and the cylinders and the cylinders and the exhaust ports, the respective valve recesses having their locations at different places around the body of the valve, and means for rotating said shaft valve at half the speed of the engine shaft.

5. In an explosive engine, an engine body comprising a plurality of cylinders, and having a bore therein beyond the ends of the cylinders and at right angles to the axis of the latter, and having openings transversely connecting said bore with the ends of the cylinders, said body having ingress

ports corresponding to respective cylinders, leading to said bore, having exhaust ports corresponding to the cylinders leading to the bore, and having channels in the wall of the bore extending from communication with the transverse cylinder-connecting opening to proximity with, but separated from, the exhaust ports, the cylinder pistons, the engine shaft having cranks, and the cylinder pistons and connections between the cylinders and cranks, a valve device for all the cylinders, consisting of a shaft fitted in said bore and having recesses therein extending but fractionally of its circumference, at different portions of its length corresponding to the regions of the said ports, to alternately establish communication between the ingress ports and the cylinders and the cylinders and the exhaust ports, and also having a passage extending from end to end therethrough for the cooling of such shaft-valve, and means for rotating said shaft-valve at half the speed of the engine shaft.

6. A gas engine comprising an explosive cylinder, providing a piston chamber and formed with a valve bore directly communicating with said chamber, the walls of said valve bore being formed with radial intake and exhaust passages communicating with the valve bore, and a self cooling valve consisting of a shaft having an arcuate recess in its face adapted to alternately establish communication between either of the passages and the piston chamber, one of the said walls having an exhaust chamber leading from said exhaust passage, to the piston chamber.

Signed by me at Springfield, Mass., in presence of two subscribing witnesses.

JOSEPH H. DANIEL BEAUCAGE.

Witnesses:
WM. S. BELLOWS,
G. R. DRISCOLL.