H. F. BOCK.

INTERNAL COMBUSTION ENGINE.

APPLICATION FILED DEC. 20, 1909.

974,853. Patented Nov. 8, 1910.

Fig. 1.

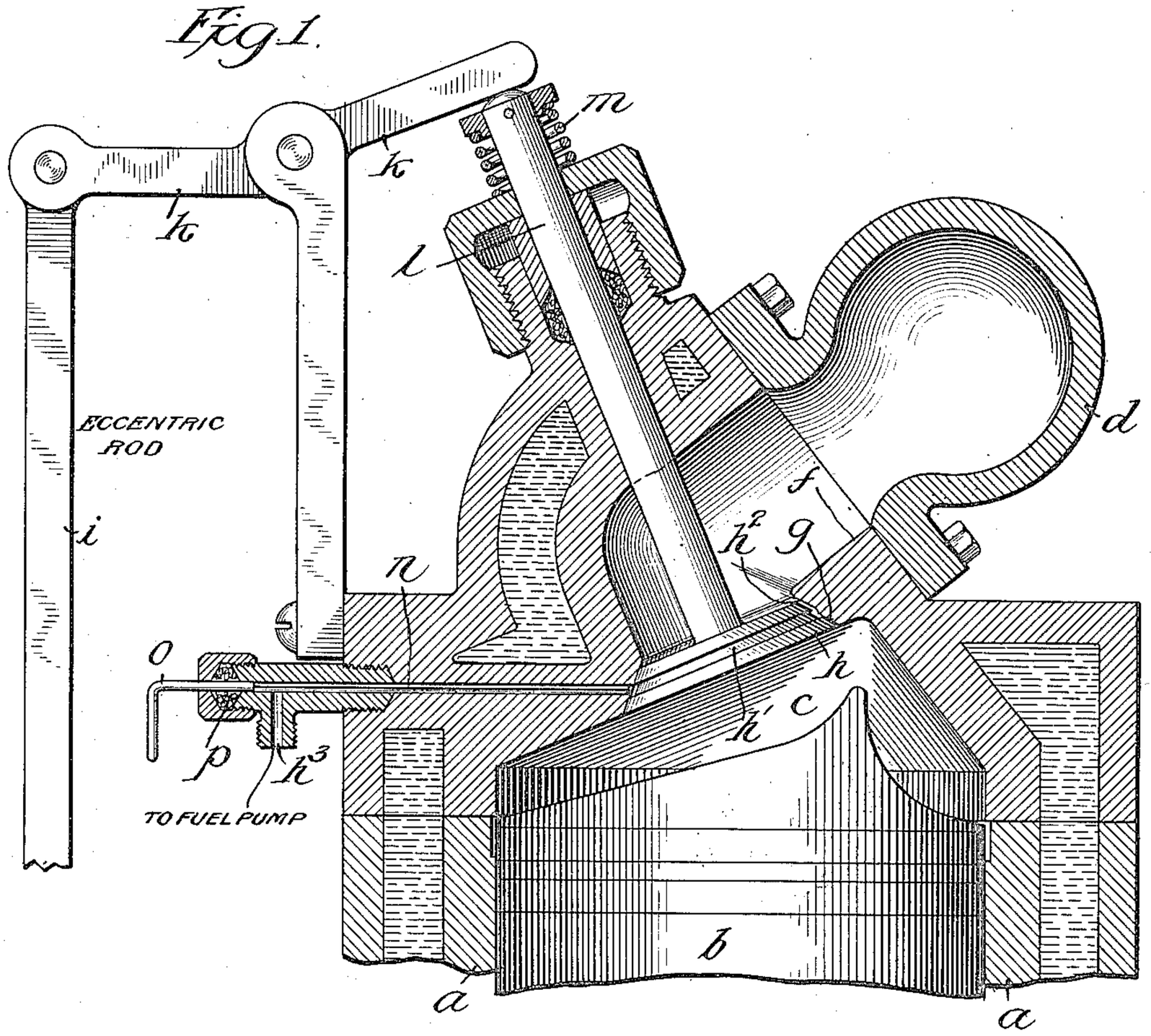


Fig. 2.

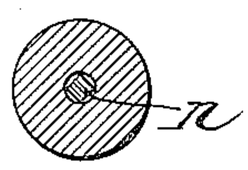
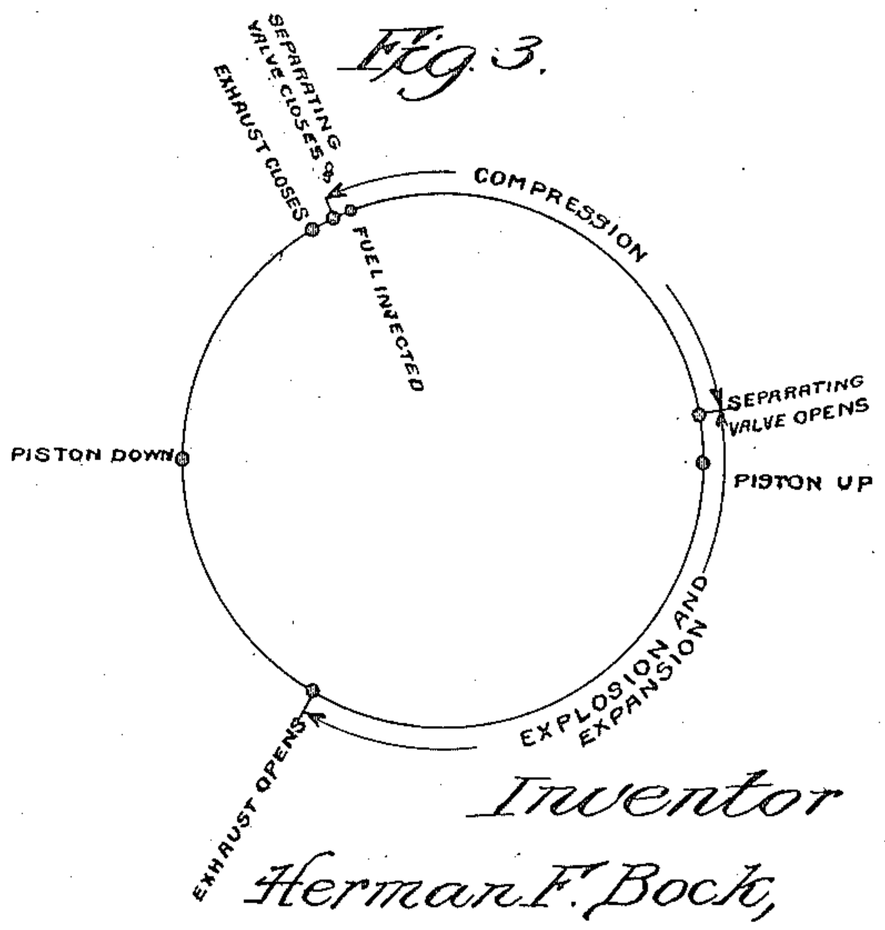


Fig. 3.



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UNITED STATES PATENT OFFICE.

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INTERNAL-COMBUSTION ENGINE.

974,853. Specification of Letters Patent. Patented Nov. 8, 1910.

Application filed December 20, 1909. Serial No. 534,181.

To all whom it may concern:

Be it known that I, HERMAN F. BOCK, citizen of the United States, residing at Antioch, in the county of Lake and State of Illinois, have invented a certain new and useful Improvement in Internal-Combustion Engines, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

My invention relates to internal combustion engines and has for its general object the provision of means for dividing the combustion and expansion chamber into two noncommunicating compartments during the time or part of the time that the piston is in the act of compressing the air, the piston operating in one compartment to effect compression, and the fuel, such as kerosene or other low grade oil, (to which I do not wish to be limited, however), being admitted to the other compartment when such other compartment is out of communication with the compression compartment, this fuel being desirably admitted during compression, but it is to be understood that I do not limit myself to the admission of fuel during compression. When the desired degree of compression of the air in the compression compartment has been attained, the means that is employed to separate the compartments is operated to throw them into free communication, thereby, in effect, establishing a single chamber that constitutes the combustion and expansion chamber. Combustion and expansion is effected when the compression and fuel compartments are thrown into one, the air under compression then having free access throughout the space that initially received the fuel and the fuel having free access to the space in which compression occurred. Hitherto, the combustion space was included within a single chamber nondivisible into compartments, the fuel being admitted thereto during at least a part of the time that compression was being effected, whereby many disadvantages followed which are well recognized by those skilled in the art. Among these disadvantages were the necessity of forcing the fuel into the compression space under high pressure, the imperfect vaporization of the fuel due largely to the fact that it would strike upon and flow down the wall surfaces of the combustion space, and untimely preignition of the fuel. Other disadvantages are so well known as not to require mention.

By means of my invention, the fuel may preferably be admitted to its compartment of the combustion chamber against atmospheric pressure only, there then being required only a few ounces of pressure to force the fuel into its compartment. The fuel may readily be vaporized or atomized before it has opportunity to mingle with the air under compression and is also well heated by the hot wall portions of its compartment of the combustion chamber before this compartment is thrown into communication with the compression compartment so that when the fuel is acted upon by the air under compression, it is in most favorable condition for combustion.

The means which I employ for dividing the combustion chamber into fuel receiving and air compressing compartments resides in a valve that may be operated by engine actuated eccentric mechanism.

I will explain my invention more fully by reference to the accompanying drawing, in which—

Figure 1 is a sectional elevation of so much of an engine structure as is necessary to an understanding of my invention, the balance of the structure being so well known by those skilled in the art as not to require illustration; Fig. 2 is a view in cross section illustrating a novel construction of the structure through which the fuel passes to the fuel compartment; and Fig. 3 is a diagram showing the time relations of the operations of the valve that I have employed for intermittently separating the combustion chamber into two compartments as compared with other operations which are well known.

Like parts are indicated by similar characters of reference in Figs. 1 and 2.

I have illustrated a portion of a two cycle engine but I do not wish to limit the use of my invention thereto. The cylinder *a* is shown only in part, as is also the piston *b* which is shown very close to the upper limit of its stroke, the air being compressed in the space *c* located above the piston, the particular engine being described being a vertical engine, to which, however, the invention is not limited. The space *c* is a part of the combustion and expansion chamber space,

the combustion and expansion chamber also including the hollow ignition ball *d*, to which the invention is not limited, and a hollow extension *f* of the structural portion *d*.

A valve seat *g* is formed in the end of the portion *f* which is nearest the piston *b*, a valve *h* being shown at rest upon this seat in order to separate the portion *c* of the combustion chamber space from the balance of the combustion chamber space contained in the elements *d* and *f*. The valve *h* remains seated thus to divide the combustion chamber into two noncommunicating compartments during the time that the piston *b* is in the act of compressing the air above it as indicated by the diagram, Fig. 3. During the time that the valve *h* is seated, a fuel conveying annular channel *h'* in the valve *h* is in communication at h^2 with the interiors of the portions *d* and *f* and is also in communication with a fuel duct h^3, through which fuel is pumped during the time or during a sufficient portion of the time that the valve *h* is seated, a few ounces of pump pressure upon the fuel being sufficient to force it within the hollow interiors of the portions *d* and *f* through the clearance h^2 in the valve seat *g*. The fuel is thus received within the hollow of the ignition ball *d* and its extension *f* during a time when the air within these portions *d* and *f* is not under compression, ample opportunity being afforded for proper vaporization of the fuel and the proper heating thereof by the parts *d* and *f* which are in a constantly heated condition when the engine is in operation. Since there is no air under compression in the presence of the fuel above the valve *h*, there is no reasonable possibility of untimely ignition. The fuel is well heated during the time that the valve *h* is closed so as to be prepared for thorough intermixture with the air under compression when the valve is opened. When the compression has been completed, the valve *h* is opened by any suitable mechanism which would readily be supplied by those skilled in the art, as for example by an eccentric rod *i* actuated by an engine driven eccentric and in turn operating a lever *k* to press upon the valve stem *l* in opposition to a spring *m* that acts to seat the valve when the lever *k* is moved from the stem by the eccentric.

As indicated in the diagram, the valve *h* may be opened just before the piston reaches the upper limit of its travel, in order that the explosion may occur before the piston reaches the upper limit of its travel, but I do not wish to be limited to particular relative times when the functions of the engine are accomplished.

When the valve *h* opens, the compartments previously separated thereby are merged into one combustion chamber, the air under compression in the space *c* finding access to the fuel receiving space and the fuel in turn finding access to the space *c*, the result being a thorough intermixture of compressed air and fuel due to the violent agitation furnished by the compressed air in rushing through the valve port, and a highly effective combustion of the fuel. The fuel is desirably admitted through a conduit having a cylindrical bore in communication with a supply of fuel which is preferably pumped through said bore, though I do not wish to be limited to the use of pumped fuel. This bore contains a rod *n* which is polygonal in cross section and which terminates in a handle *o* in order that the rod may be revolved, the edges of the polygonal portion of the rod then scraping the cylindrical bore to clean the same. The rod may remain constantly within said bore, since the spaces that intervene between the same and the surface of the bore may be made to be sufficient to convey the fuel. The outer end of the rod is round and passes through a stuffing box *p* to prevent the escape of fuel.

A very important specific characteristic of the invention resides in the provision of a lodging place for the fuel or a portion of the fuel adjacent to the separating valve when said valve is closed. As illustrated in the drawing, this lodging place may be the annular groove *h'* in the valve and the upper surface of the valve adjacent to the valve seat. Under normal conditions, a considerable portion of the fuel is thus held adjacent to the valve port so that when the valve is opened, the air rushing through the valve port from the compression compartment *c* thoroughly atomizes and vaporizes this portion of the fuel.

In operating my engine, there may be slight leakage when the valve is closed, such for example as might be due to a clearance of a thousandth of an inch between the valve and its seat. I therefore do not desire to restrict myself to an engine in which there is absolutely no leakage between the two compartments when the valve is closed.

While I have herein shown and particularly described the preferred embodiment of my invention, I do not wish to be limited to the precise details of construction shown, as changes may readily be made without departing from the spirit of the invention, but,

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

1. An internal combustion engine including a combustion and expansion chamber, means for separating said chamber into distinct compartments when compression occurs and for reëstablishing communication between said compartments when compression has been effected to permit of forcible flow from the compression compartment to the companion compartment, a piston mov-

ing in one of said compartments and serving therein to effect compression while the two compartments are separated, and means for supplying fuel to the other compartment.

2. An internal combustion engine including a combustion and expansion chamber, a valve operated by the engine for separating said chamber into distinct compartments when compression occurs and for reëstablishing communication between said compartments when compression has been effected to permit of forcible flow from the compression compartment to the companion compartment, a piston moving in one of said compartments and serving therein to effect compression while the two compartments are separated, and means for supplying fuel to the other compartment while said compartments are separated by said valve.

3. An internal combustion engine including a combustion and expansion chamber, a valve intermittently operated by the engine for intermittently separating said chamber into distinct compartments in one of which the piston moves, and means for supplying fuel to the other compartment when said chamber is divided into separate compartments by said valve, said valve having a fuel containing channel communicating with the fuel receiving compartment.

4. An internal combustion engine including a combustion and expansion chamber, a valve intermittently operated by the engine for intermittently separating said chamber into distinct compartments in one of which the piston moves, and means for supplying fuel to the other compartment when said chamber is divided into separate compartments by said valve, there being lodging place for the fuel adjacent to the valve and located in the path followed by the air moving from the compression compartment to the fuel compartment.

In witness whereof, I hereunto subscribe my name this 17th day of December A. D. 1909.

HERMAN F. BOCK.

Witnesses:
G. L. Cragg,
R. E. Atherton.