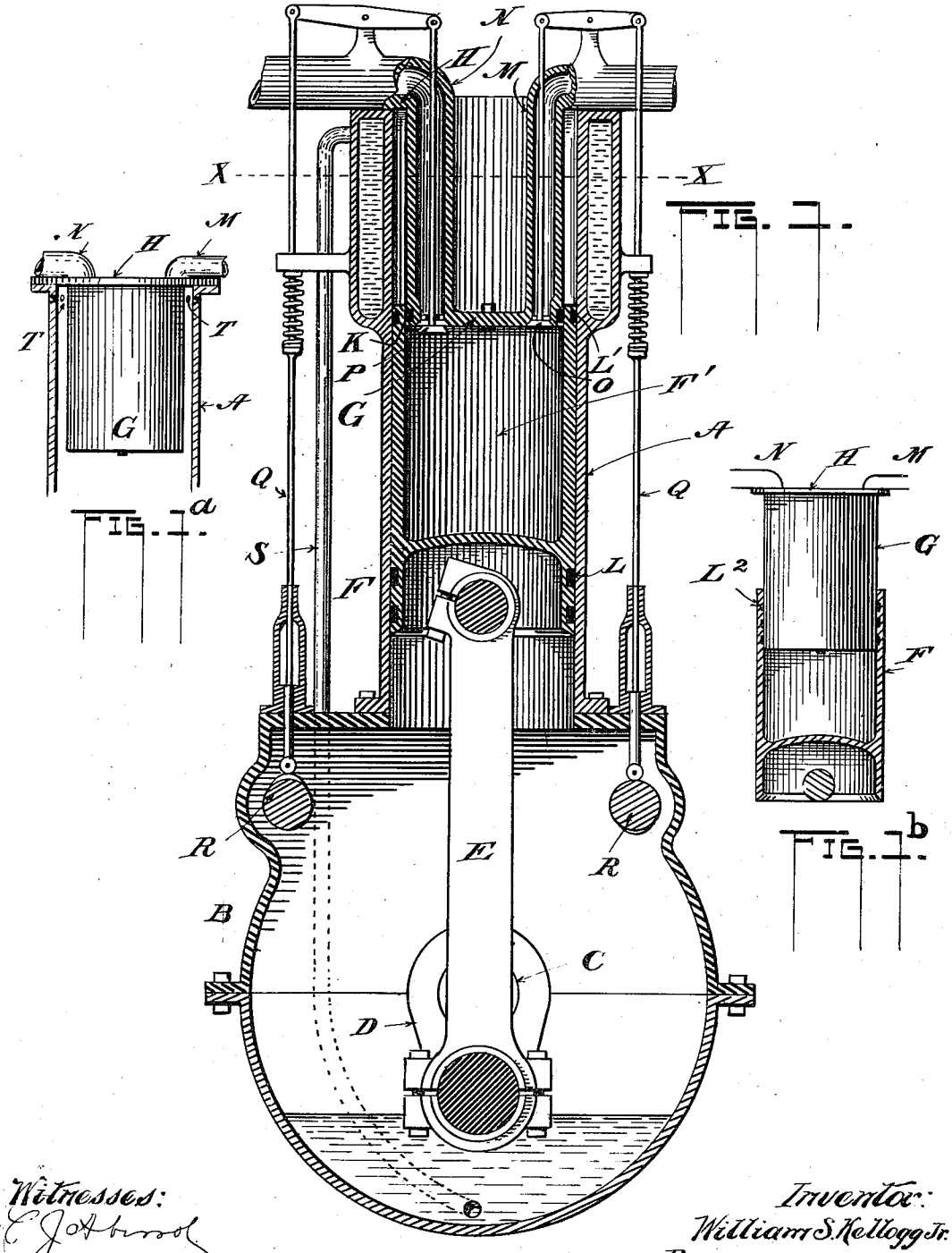
W. S. KELLOGG, Jr.

GAS EXPLOSION ENGINE.

APPLICATION FILED JAN. 22, 1907.

950,155. Patented Feb. 22, 1910.

3 SHEETS—SHEET 1.



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3 SHEETS—SHEET 2.

FIG. 2.

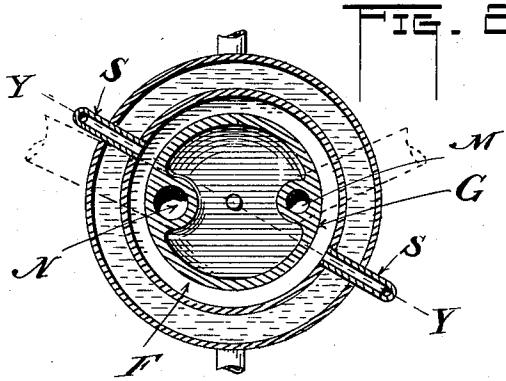


FIG. 3.

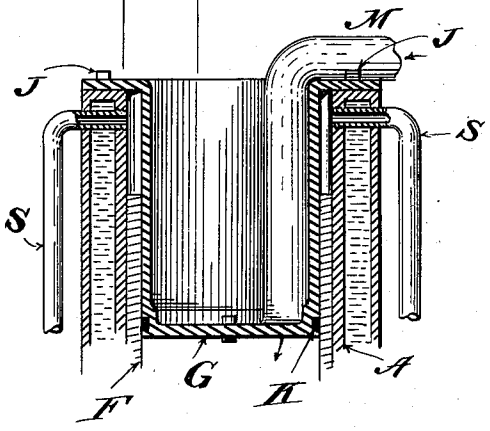
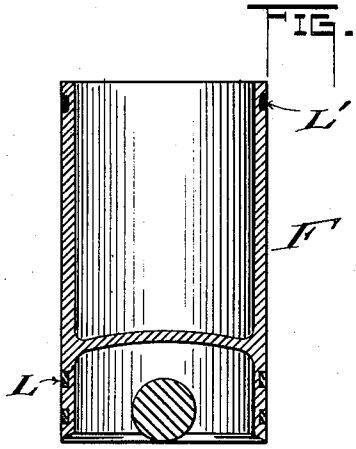


FIG. 4.



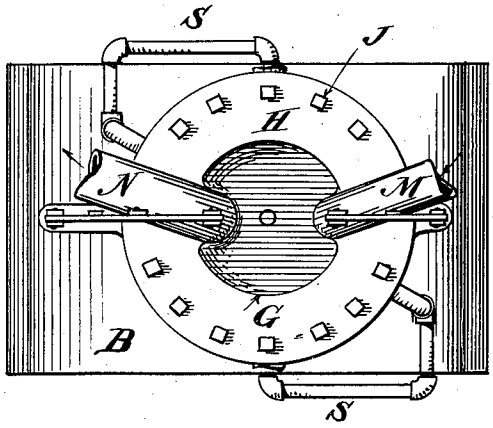


FIG. 5.

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3 SHEETS—SHEET 3.

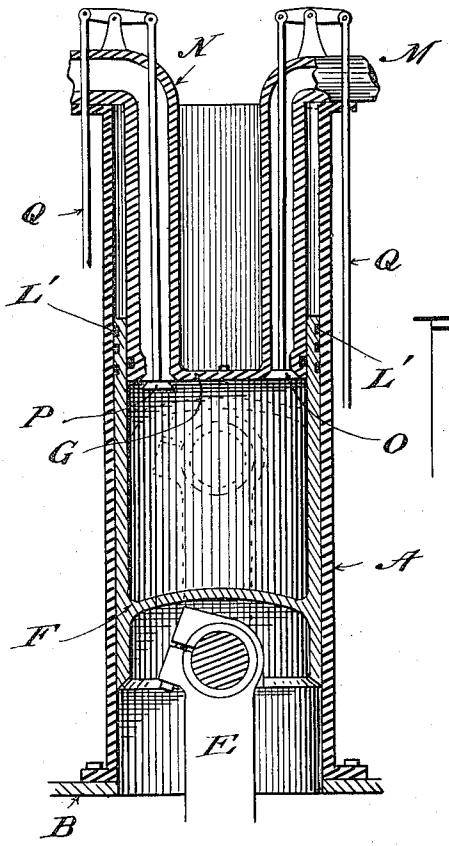

FIG. 6.

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UNITED STATES PATENT OFFICE.

WILLIAM S. KELLOGG, JR., OF PEORIA, ILLINOIS.

GAS EXPLOSION-ENGINE.

950,155. Specification of Letters Patent. Patented Feb. 22, 1910.

Application filed January 22, 1907. Serial No. 353,418.

To all whom it may concern:

Be it known that I, WILLIAM S. KELLOGG, Jr., citizen of the United States, residing at Peoria, in the county of Peoria and State of Illinois, have invented certain new and useful Improvements in Gas Explosion-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.

This invention pertains to gas explosion engines.

It has for one of its objects to produce an engine of the gas explosion type whose cylinder and piston cannot become excessively heated.

A further object is to construct an engine in which the burned gases are prevented as much as possible from reaching the contacting or working surfaces of the piston and cylinder.

A further object is to provide in a gas explosion engine a structure in which the working surfaces of the piston and cylinder are kept free of all abrading or cutting substances that may enter the explosion chamber or that may be created therein.

A still further object of the invention is to invert the piston of the common form of gas explosion engines and use the cavity thereof in which to both compress and ignite the gases.

The invention also relates to certain details of construction by which to obtain certain advantageous results to be pointed out herein.

In the ordinary type of gas engines, as is well known, the burning gases by contacting with the wearing surfaces of the piston and cylinder heat these members to a very high degree rendering it necessary to employ a cooling agent, usually a water jacket, in order to keep the heat down to a reasonably low point. The reasons for thus holding the heat in check are too well known to require lengthy explanation, one important reason, however, is that the intense heat generated by the explosions burns the lubricating oil and thus carbonizes it, thus forming a grit which is very injurious to the wearing surfaces of the cylinder and piston. The extent of cutting and abrading of this material is so great as to make it necessary to bore out the cylinder from time to time and replace the piston by a new one or to provide for placing it in proper condition for further use.

In my engine the gases are kept away from the metal wearing surfaces when in working contact there being some distance between these surfaces and the explosion chamber so that the lubricant employed between the said surfaces cannot become carbonized by the heat of explosion, and, in addition, the lubricant cannot collect dust particles or carbonized matter entered into or created in said explosion chamber.

In the drawings presented herewith, Figure 1 is a sectional elevation of my new type of engine. Fig. 1ª is a side elevation of the cylinder-head reduced in size from that shown in Fig. 1, showing the cylinder in section. Fig. 1ᵇ is an elevation of parts of the engine showing slight modifications. Fig. 2 is a horizontal section of the engine on line X X, Fig. 1. Fig. 3 is a vertical section of a portion of the engine on line Y Y, Fig. 2. Fig. 4 is a vertical section of the piston. Fig. 5 is plan of the engine. Fig. 6 is a sectional elevation of a portion of the engine in a slightly modified form.

A indicates the engine cylinder mounted upon a crank-case B.

C is the shaft of the engine supported in the crank-case or by any other method ordinarily employed.

D is the crank, and E the connecting rod.

F is the piston of substantially the same form as those in common use although peculiar in the respect that its position is inverted from that of other engines so that its cavity F′, within which the connecting rod is usually pivoted, is presented for the reception of the gas and serves as both the compression and the explosion chamber, the other end of the piston having proper attachment to the said connecting-rod E.

Extending downward into the cylinder is a hollow cylinder-head G, as shown, whose outer diameter is substantially equal to that of the cavity of the piston thus leaving an annular recess between it and the cylinder wall, and the amount of downward extension within the piston is a little less than the depth of the piston-cavity leaving a space within the latter for holding gas. The cylinder-head thus constructed and positioned is provided at its top with a flange H by means of which it is secured to the top of the cylinder as by suitable bolts J, Figs. 3 and 5. The piston is bored out and the

surface of the cylinder head is turned off true to fit therein. The cylinder is also bored out as usual so that the piston will snugly work between it and the head G within the annular space described. A packing-ring K is provided at the lower extremity of the cylinder-head and similar rings L are provided at the bottom of the piston, which, as will be noted are positioned below the piston cavity and thus away from the intense heat, though I prefer to place the rings at the top of the piston as indicated at L′ in Figs. 1 and 6 and similar rings may also be carried on the inside of the piston as at L^2 in Fig. 1^b. In placing the rings at the top of the piston they are kept entirely away from the vicinity of the explosion chamber.

By my peculiar form of engine the explosions are confined within the piston cavity entirely, the wearing surfaces between the cylinder and piston being remote from and out of reach of the gases. The heat conveyed to the wearing surfaces is only by conduction through the metals and the cooling by air currents is sufficient to prevent over heating at those parts.

Oil placed within the cavity F′ for lubricating the piston and cylinder-head surfaces when carbonized by the heat of the burning gases, is prevented entering the cylinder proper by the packing rings L^2 in the piston or the rings K in the said cylinder-head of which, however, there may be more than one if desired and the gases are likewise prevented from entering. The carbonized matter is retained entirely within the piston and can be removed therefrom at long intervals by removing the head of the cylinder or by other more simple means.

At M is the inlet pipe for conducting gas into the explosion chamber down into and through the cylinder-head and N is the exhaust pipe leading from the latter, these pipes being controlled by valves O and P respectively operated through spring held rods Q and cam-shafts R all of which is common, in one form or another, in explosion engines and not fully described herein for that reason. The pipes or conduits just described may be screwed into the head G or may be cast therewith these being removed from the engine along with the head it being only necessary to disconnect the valve mechanism so as to allow this to be accomplished. However, in the event of an accident and gas enters the annular space or the carbonized material finds its way thereto I have provided a ring L′ in the piston as in Fig. 1, several of them being shown in Fig. 6, whereby the gas or abrading matter cannot pass down between the cylinder and said piston.

Since there is no pressure upon the cylinder as in other types of engines the metal thereof can be made thin as compared with the thickness of the wall of the piston, so that it can be easily kept cool. My construction provides also for cooling the cylinder both inside and out and the heat is conducted away from the piston by contact with the cooled cylinder. In the common form of engine the cylinder receives the greatest amount of heat because it forms the explosion chamber and has the largest surface, while in my engine the inverted piston receives the bulk of the heat which is conveyed away by the continuously cooled cylinder. Also the head of the piston in this case is inside the engine and takes part of the heat of the explosions but the actual wearing surfaces are far removed therefrom and remain at a safe temperature. An advantage arises in carrying the gas inlet pipe O through the heated cylinder-head in that said pipe is kept hot and the vapor passing therethrough cannot therefore condense and thereby reduce the amount of gas necessary for the explosion. Since the limb of the piston occupies the space between the cylinder and its head at the time the explosion occurs, very little heat can be communicated thereto, and the only heat contacting with the limb is the hot gas as it expands and which on the return stroke is expelled there being but a short interval between the explosion and expulsion of the gas.

My engine has an exceedingly large cooling area by reason of its peculiar construction and by having the piston of the form shown and described I am enabled to keep all wearing surfaces out of direct contact with the burned or burning gases and thus provide an engine of long life and of great efficiency. It is not the intention in using gas engines to keep their cylinders cold or cool the use of the word "cool" in gas engine practice being a comparative term. An engine that is hot is much more efficient than a cool one, but the only desire is that the heat shall not become a detriment for the reason already stated so that some sort of so-called "cooling" means must be used. Although I have illustrated a water jacket in one of the figures in connection with my engine, I need not employ it since, as already explained, I am enabled to cool it by mere circulation of air.

At S S are two pipes connecting the top of the cylinder with lower part of the oil containing crank-case. The movements of the piston within the space at the top of the cylinder alternately raises oil into the piston-space in the cylinder and then expels it thereby keeping the piston and cylinder perfectly lubricated while also gaining by the cooling effect that the oil may impart. It being understood that the pipes are filled with the oil in any way found most convenient so that its action can be maintained

by the piston as described. These pipes also prevent the forming of a vacuum within the piston-space or compression of the air therein as will be understood. Even though the pipes merely admitted air to the space a great advantage would be gained by the cooling effect upon the metals and in fact this may be done also by providing a series of openings through which the air could be drawn and expelled for the cooling purposes as indicated in Fig. 1ª at T.

I am aware of several engines of the gas explosion type that are constructed somewhat after the manner of mine. In one or two of these the piston travels in an annular space between the cylinder and the cylinder head, and this annular space constitutes the explosion chamber, the expansion of the burning gases acting upon the end of the piston. Since the cylinder aids in forming this explosion chamber the wearing surface between the piston and said cylinder receives the carbonized substances so detrimental to engines of this type as I have hereinbefore brought out.

In my engine the cylinder is exposed to the cooling action of the outside air, as shown in Fig. 1, and as constructed, the piston is in intimate working contact with it so that its heat is readily conducted away.

I am not aware of a tubular cylinder-head extending with the cylinder and within the piston after the manner of mine and having the gas inlet and exhaust passage carried therethrough and which holds the burning gases within the piston as the explosion chamber, and whose body serves to convey away the heat from the interior of the engine. Neither am I apprised of an engine whose cylinder-head is bodily removable in order to reach the explosion chamber or piston cavity.

Having pointed out the differences between my engine and others of which I am aware, I claim:

1. In a gas explosion engine the combination of a cylinder partially air cooled, a water jacket surrounding part of said cylinder, a piston having a single cavity to constitute both the compression and the ignition chamber, a cylinder-head depending into the piston cavity to close the same and provided with a cavity open to the outer air, a packing-ring carried by the cylinder-head adjacent to the inner surface of the piston, a packing ring carried by the outer surface of the piston next to the wall of the cylinder, a gas inlet conduit extending through the said depending cylinder-head and opening into the piston cavity an exhaust conduit also opening through said head into the piston cavity, valves to govern the openings of the conduits, and means to positively operate said valves.

2. In a gas explosion engine, a cylinder; a piston therein of tubular form open at one end and closed at its other end and constituting an explosion chamber, the piston having slidable contact throughout its length with the cylinder, a tubular piston-head closed at one end and extending within the cylinder into the piston and concentric with both, there being an annular space between said head and the cylinder, the piston adapted to travel within said annular space, a gas inlet and a gas outlet opening through the said head directly into the explosion chamber of the piston, and a valve for each said passage, the cylinder head being bodily removable from the cylinder substantially as set forth for the purposes described.

3. In a gas explosion engine, a cylinder adapted to be air cooled, a water jacket surrounding the same at one end, a tubular cylinder-head closed at one end and extending within that end of the cylinder having said water jacket, there being an annular space between said tubular head and the cylinder, a tubular piston having a cavity constituting the ignition, compression and explosion chamber, its open end adapted to enter and travel within the said annular space, and in the region surrounded by the water jacket, the said piston adapted for sliding contact with both the cylinder and the cylinder-head, a packing ring between the said piston and the said cylinder-head, there being a gas inlet and a gas outlet passage opening through the cylinder-head into the explosion chamber, and a valve for controlling each said passage substantially as set forth.

4. In a gas explosion engine, a cylinder adapted to be air cooled, a water jacket surrounding the same at one end, a tubular cylinder-head closed at one end and extending within that end of the cylinder having said water jacket, there being an annular space between said tubular head and the cylinder, a tubular piston having a cavity constituting the ignition, compression and explosion chamber, its open end adapted to enter and travel within the said annular space, and in the region surrounded by the water jacket, the said piston adapted for sliding contact with both the cylinder and the cylinder-head, a packing ring between said piston and the said cylinder-head, a packing ring between the piston and cylinder, there being a gas inlet and a gas outlet passage opening through the cylinder-head into the explosion chamber, and a valve for controlling each said passage substantially as set forth.

5. In a gas explosion engine, a cylinder adapted to be air cooled for the greater portion of its length and having a water jacket at one end surrounding the same, a tubular cylinder-head removably attached to the cylinder and closed at one end said

closed end extending within that end of the cylinder having said water jacket, there being an annular space between said tubular head and the cylinder, a tubular piston open at one end and closed near its other end, its open end adapted to enter and travel within the said annular space, there being a cavity within the piston for, together with the cylinder-head, constituting the explosion chamber, the said piston providing for a sliding contact throughout its length with the cylinder for the purposes set forth, a packing ring between said piston and cylinder, a packing ring between the piston and cylinder-head, there being a gas inlet and a gas outlet passage opening through the cylinder-head directly to and from the explosion chamber, and a valve in each said passage substantially as set forth.

6. In a gas explosion engine, a cylinder, an annular inclosed space at the outer end of the cylinder for containing water and constituting a water jacket for cooling purposes at that end, the opposite end of the cylinder adapted to be air cooled, a tubular piston closed at its inner end and open at its outer end within the cylinder and constituting an explosion chamber, the air cooled portion of the cylinder being substantially equal in length to the length of the piston and having a straight bore of a diameter equal to that of the piston, and with which the entire surface of the piston contacts, a tubular cylinder head extending within the cylinder and closed at its inner end and open at its outer end into the air for the introduction of outer air proximate to the explosion chamber, said head being concentric with the cylinder there being an annular space between the cylinder and said head for receiving the piston during its reciprocations, there being relief openings from said recess for the purposes described, there also being a gas inlet and a gas outlet passage communicating with the interior of the piston through the cylinder-head, a valve for controlling each and means for operating and timing the valves.

In testimony whereof I affix my signature, in presence of two witnesses.

WILLIAM S. KELLOGG, JR.

Witnesses:
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