W. S. KELLOGG, Jr.

GAS ENGINE.

APPLICATION FILED FEB. 17, 1908.

950,395. Patented Feb. 22, 1910.

2 SHEETS—SHEET 1

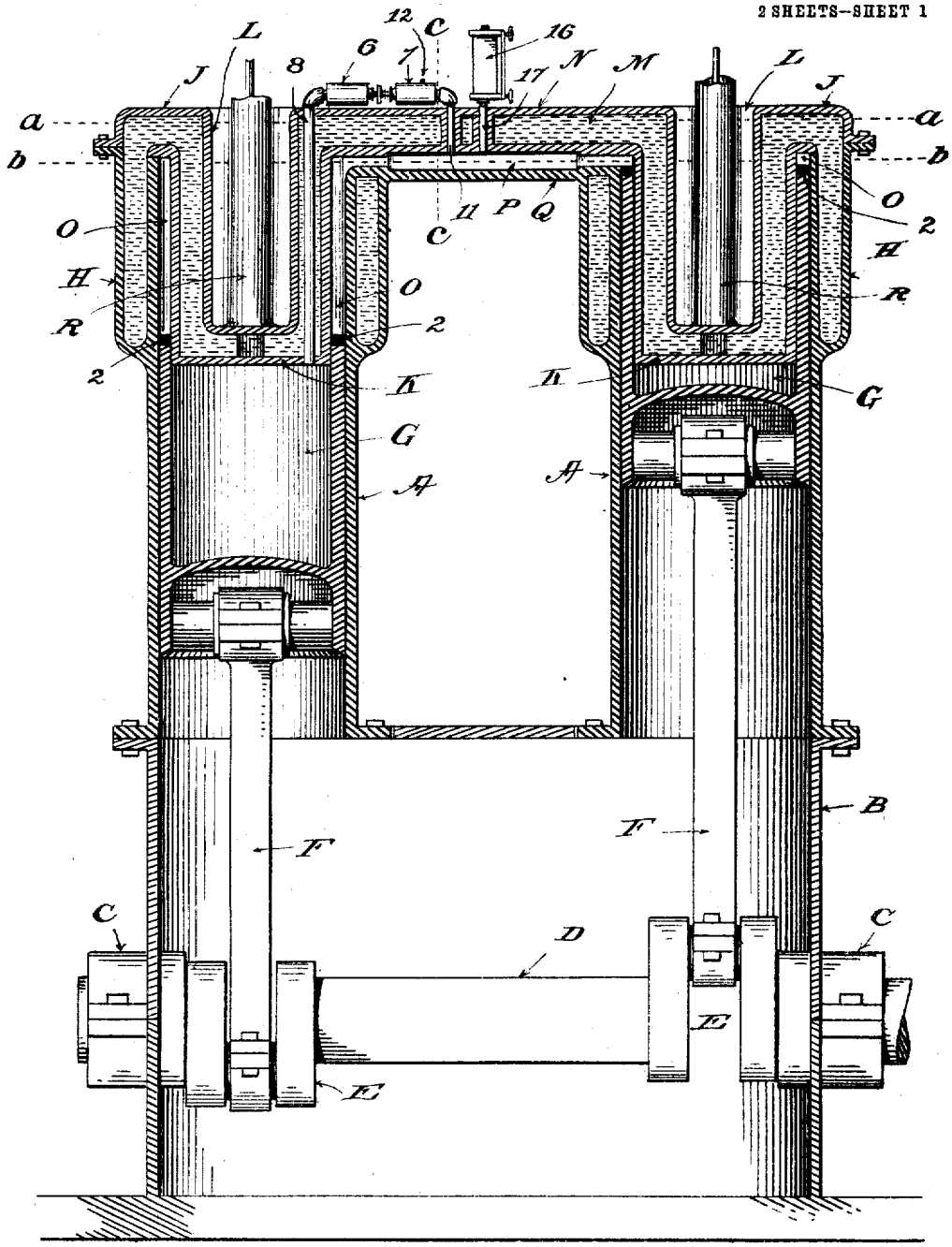

FIG. 1.

Witnesses:
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2 SHEETS—SHEET 2.

FIG. 2.

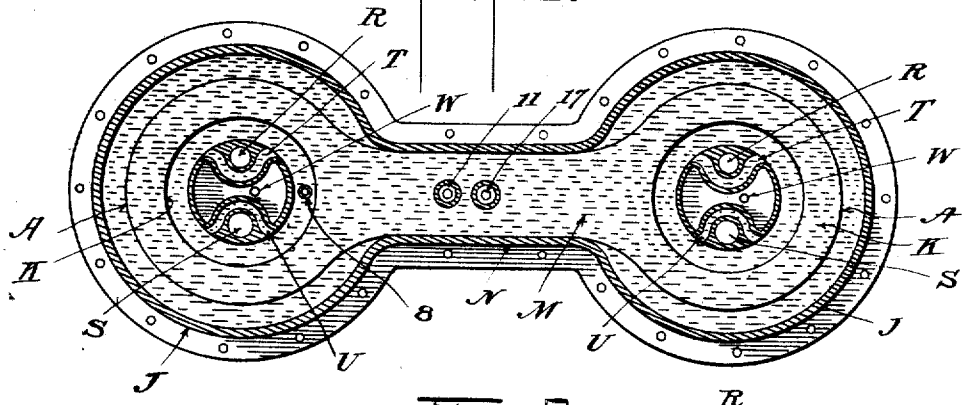
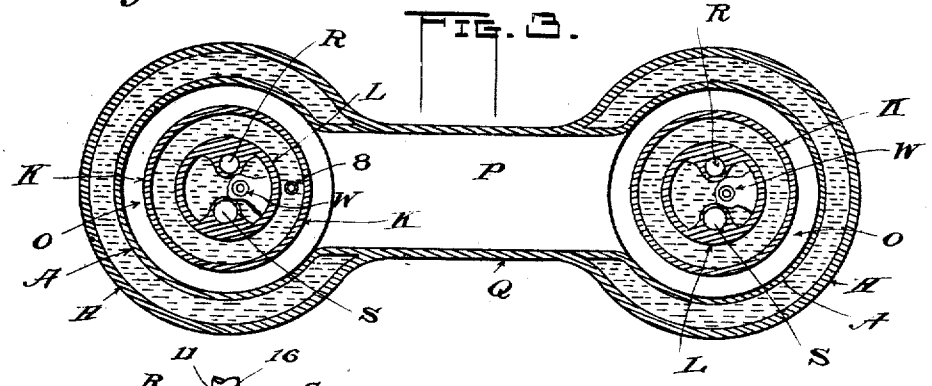


FIG. 3.



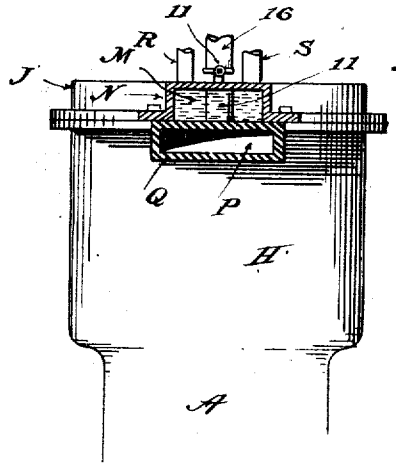
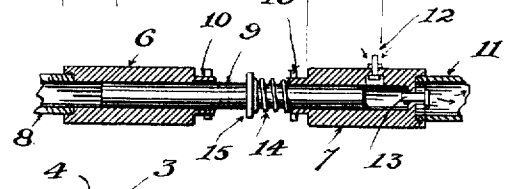


FIG. 4.

FIG. 5.



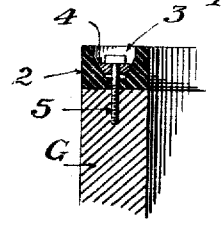


FIG. 6.

Witnesses:
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UNITED STATES PATENT OFFICE.

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

GAS-ENGINE.

950,395. Specification of Letters Patent. Patented Feb. 22, 1910.

Application filed February 17, 1908. Serial No. 416,392.

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-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, relating more particularly, however, to a new form of piston packing.

An object of the invention is to improve upon the engine described in my former application, filed June 22, 1907, numbered 353,418, in which the limb of a hollow inverted piston reciprocates within an annular recess created between the engine cylinder and the cylinder head which depends within the latter; there being a packing ring in the piston and one in the cylinder head to prevent the gases which are ignited in said piston from reaching the contacting surfaces of the said cylinder and piston.

The present invention provides a new form of piston-packing for said piston, and means and a certain method by which it can be spread into contact with and perfectly fit the contacting or wearing surfaces for preventing the products of combustion reaching said wearing surfaces.

A further object is to employ a packing ring upon the end of the limb of a piston such as is used in gas engines of the particular form described in my application above referred to.

A further object in connection with the packing is to provide a peculiarly arranged mechanical means for spreading such packing and if desired provide for automatically keeping air pressure thereon in addition to the mechanical means to aid in spreading and holding said packing tight, using, however, either or both methods.

Other objects will appear in the following specification.

In the appended drawings, Figure 1 is a vertical sectional elevation of my engine. Fig. 2 is a horizontal section on line *a a*, Fig. 1. Fig. 3 is a horizontal section, line *b b* Fig. 1. Fig. 4 is a vertical elevation of part of the engine showing parts thereof in transverse section on line *c c*, Fig. 1. Fig. 5 is a longitudinal section of a pump. Fig. 6 is a vertical section of a portion of the piston and a packing showing means for spreading the latter.

In said drawings I have preferably shown an engine of a two-cylinder form though my peculiar form of packing is applicable to any piston whether one or more cylinders be used.

The cylinders of the drawing are represented by the letter A being suitably mounted upon a standard or bed B the latter having boxings C for the usual crank shaft D, the cranks E thereof having the pitmen F, connected with the closed end of hollow or recessed pistons G, similar to those of my former application.

Surrounding the upper end of each cylinder is a water jacket H which may be cast with or attached to the cylinders, there being a space constituted between the cylinder and said jacket which is open at its top but covered by a capping J with which is cast a member K cylindrical in form and having a closed lower end and which lies within the cavity of the cylinder A as shown and constituting what I term the cylinder-head. Cast also with the capping is a similar member L of smaller diameter substantially concentric with the said member K, closed at its lower end and which depends within said member K. These two members constitute a water shell within and outside the cylinder A, the water circulating over or above the walls of said cylinder as may be understood by a study of Fig. 1. Both of the shells formed by the members K L communicate with one another through a passage M created in a limb N connecting the caps J of the two engines. The member K of each engine is somewhat smaller in diameter than the internal diameter of the cylinder A and is centrally positioned within the latter so as to leave an annular piston cavity O as shown in Fig. 3 and the cavities of the cylinders are connected with one another through a passage P formed in a connecting member Q between the engine cylinders, Figs. 1 and 4. The limbs of the pistons G are adapted to enter the said annular cavities O as clearly shown in Fig. 1 and remain and travel therein.

The gas intake and the exhaust pipes or conduits are indicated at R and S, in Figs. 2 and 4. The conduit R being also shown in Fig. 1 where it extends through the water space in the bottom of the member K both

said pipes or conduits extending through said water space, and it will be observed in Fig. 2 that there are water passages T and U for said pipes R and S respectively, by which water can circulate around them for cooling purposes. At any desired point, for instance, as at W may be placed the usual spark plug by which the charges of gas may be ignited. I have shown no operating means nor valves for the conduits R and S mentioned, since they are well known in all types of engines and do not form any part of my invention. But it is sufficient to state here that the charge of gas is entered first to one cylinder and then the other, the exhaust of one alternating with the charge introduced into the other.

The main object of my invention will now be described.

I have stated that the pistons travel within the cavities O and this is done in order that the gases which are ignited within the piston cavities cannot pass to the wearing surfaces between the piston and cylinder A, for it is seen that as constructed the gases cannot get into the cavities and in order to make a tight packing I have provided a packing in the form of a ring or annulus mounted upon the annular limb of the piston as indicated at 2, the form of this being shown clearly in Fig. 6, and may be of asbestos or other suitable and approved form of flexible packing not affected by heat, in which is preferably a V-shaped channel as indicated at 3, in which is placed a metal ring 4 of corresponding form, the ring and packing being held in place upon the piston by means of suitable bolts at intervals, one of which is indicated at 5. By adjusting the bolts or any other means employed for the purpose the packing can be compressed and spread by means of the said ring 4 causing the packing to snugly contact with the surfaces of the cylinder A and the cylinder-head K. The snugly fitting packing positively holds the lubricant in the cavity O so that it cannot lead below the lowest point of travel of the piston thus insuring a thorough lubrication where needed. It will be seen that this tightly fitting packing would compress the air in the cavities if no relief were provided for it. A means of communication is provided, however, from one cylinder cavity to the other through a passage P, Figs. 1 and 3, so that as the pistons travel in opposite directions the air will pass alternately from one cavity to the other through said passage P and would not be under appreciable compression, but in addition to the means already described for spreading the packing 2, I provide a pressure of air sufficient to spread the upwardly extending sides of said packing. Suitably mounted upon the top of the engine is a pump comprising two cylinders 6 and 7, the former having connection through a pipe 8 with one of the piston cavities so as to receive a portion of the pressure from the exploding gas. This pipe extends vertically through the water space in the cylinder-head K so as to keep it cool, the pressure carried therethrough acting upon a piston 9 in said cylinders 6 and 7, Fig. 5, there being suitable packing means at 10 on both said cylinders to prevent leakage of air to be pumped. The said piston 9 in its simplest form consists of a straight rod, one end receiving the pressure from the engine through the pipe 8, its other end forcing air from the piston 7 into a pipe 11 extending from said cylinder and terminating in the air passage P, there being a check valve 12 for entrance of air to the cylinder 7 and a similar valve 13 through which air pressure is forced into said pipe 11. A spring 14 is interposed between a fixed collar 15 on the piston and the end of the cylinder 7 so that when the pressure is relieved through the pipe 8 when the pressure from the engine is relieved, the piston 9 will return to a normal or starting position.

In operation air is drawn in through the check valve 12 and expelled through valve 13 continuously. By each explosion a charge of air is automatically entered to the passage P which, by having connection with the cavities O, will spread the sides of the packing rings 2 by a pressure sufficient to offset that of the pressure from the piston cavity that tend to pass by said packing into the cavities O. In thus providing a packing on the end of the piston and maintaining a counter pressure thereon the products of combustion cannot reach the wearing surfaces.

Preferably at 16 I employ an automatic oiler connected by a pipe 17 into the air passage P whereby a continuous feed of oil can be had which will pass to the pistons G and keep them thoroughly lubricated.

As with the engine in my former application, it is also my intention herein to provide an air cooled or a combination air and water cooled engine in which the piston has direct contact with the cylinder A which is exposed to the air by which the said piston is cooled through the thin wall of said cylinder. By arranging a water jacket as shown herein, the heated piston can contact with water cooled metals at both sides so that though at the very highest heat the metal will readily be kept cool. Also by having the water directly applied to the cylinder head K greater heat of the explosions is absorbed without affecting the proper operation of the engine which always works best at a fair heat as is well known.

The operation of the pump is automatic in that when the pressure of air upon the packing of the piston equalizes that of the

force of the pressure through the pipe 8 due to the exploding gases it will stop until by any reason the air pressure falls, at which time the action will be renewed and the pressure raised.

In my engine the forces are all downward upon the piston, *i. e.* the force of the explosion is necessarily a downward one upon the piston, while in the upward movement of said piston the pressure thereon due to the air in the cavities O will furnish a resistance to the too easy upward movement of the piston in a more or less firm manner, and because of this the pitmen F are constantly held upon the crank pins during their entire revolution and by this means there are never any loose or hammering bearing points.

Having thus described my invention, I claim:

1. The combination of a cylinder, a piston having an annular wall and a cavity, an annulus secured upon the end face of said wall and adapted to yield beyond said wall against the cylinder wall, and means to spread said annulus.

2. In a gas explosion engine the combination of a piston having an annular wall and a cavity the latter constituting the ignition and explosion chamber, a cylinder, a cylinder-head extending into the cylinder there being an annular space between the cylinder and its head to receive the wall of the piston, an annulus mounted on the end of the piston-wall and means to secure the same thereto.

3. In a gas explosion engine the combination of a piston having an annular wall and a cavity the latter constituting the ignition and explosion chamber, a cylinder, a cylinder-head extending into the cylinder there being an annular space between the cylinder and its head to receive the wall of the piston, an annulus mounted on the end of the piston and means to secure the same thereto, said means also adapted to spread the annulus.

4. In a gas explosion engine, a cylinder, a piston therein of tubular form, a cylinder head extending into the said cylinder concentric therewith, there being an annular space between said cylinder-head and said cylinder to receive the open end of the piston, and an annulus secured upon the end of the piston within the said annular space for contacting with the surface of both the cylinder and the cylinder-head.

5. In a gas explosion engine, a cylinder, a piston having a cavity and an open end, a cylinder-head extending into the cylinder concentric therewith, there being an annular space between the said cylinder and the cylinder-head, the latter having a diameter substantially equal to the diameter of the cavity of the piston and likewise extending into the piston-cavity, and an annulus mounted upon the end of the piston within the annular space and constituting a packing ring to contact with the surfaces of the cylinder and cylinder-head.

6. In a gas explosion engine, a cylinder, a tubular piston, a cylinder-head extending into the cylinder and into the piston and adapted to snugly fit the latter, a packing-ring secured on the end of the piston and occupying a position between the cylinder and cylinder-head and contacting with both, and means for maintaining pressure upon said packing.

7. In a gas explosion engine, a cylinder, a tubular piston, a cylinder head extending within the cylinder and snugly fitting the cavity of the said tubular piston, a packing secured to the end of the piston and adapted to contact with the cylinder and cylinder-head, and means for maintaining air pressure upon said packing.

8. In a gas explosion engine, a cylinder, a tubular piston therein having a closed end and an open end, a cylinder-head extending within the cylinder and within the open end of the piston, there being a cavity between the wall of the cylinder and the cylinder-head within which the piston is adapted to reciprocate, and a packing-ring mounted on the extremity of the open end of the piston within said cavity.

9. In a gas explosion engine, a cylinder, a tubular piston therein having a closed end and an open end, a cylinder head extending into the cylinder and into the tubular piston, there being a cavity in the cylinder surrounding the cylinder-head and within which the piston is adapted to reciprocate, a packing on the extremity of the end of the piston within said cavity, and means for adjusting the packing to hold it in contact with the surfaces of the cylinder and cylinder head.

10. In a gas explosion engine the combination of a pair of cylinders, a piston for each of the latter having an annular wall and a cavity the latter constituting the ignition and explosion chamber, a cylinder-head extending into each cylinder there being an annular space between said head and the cylinder and a packing carried on the ends of the annular walls of the pistons there being a passage connecting the annular spaces of the cylinder.

11. A gas explosion engine comprising two cylinders, a piston for each, a packing for each piston, said packing being mounted on the end surface of the piston lying perpendicular to the direction of travel thereof, and a passage opening into and connecting the two cylinders.

12. A gas explosion engine comprising a plurality of cylinders, a tubular piston for each, a cylinder-head extending into the cylinder and into the piston, there being an an-

nular cavity between the cylinder and the cylinder-head within which the piston is adapted to travel, a packing upon the end of the piston within said cavity to contact with both the cylinder and cylinder-head, there being a free passage connected from one to the other of said annular cavities.

13. A gas explosion engine comprising a plurality of cylinders, a tubular piston for each, a cylinder-head extending into the cylinder and into the piston, there being an annular cavity within the cylinder and between it and the cylinder head within which the piston is adapted to reciprocate, a packing upon the extreme end of each piston within its respective cylinder-cavity, there being an air passage connecting the cavities, and means for introducing air pressure to the passage and said cavities.

14. A gas explosion engine comprising a plurality of cylinders, a tubular piston for each, a cylinder-head extending into the cylinder, and into the piston, there being an annular cavity within the cylinder between it and the cylinder-head within which the piston is adapted to reciprocate, a packing upon the end of each piston within its respective cylinder-cavity, there being an air passage connecting the annular cavities, means for introducing pressure of air to the passage and cavities, and means for conducting a portion of the pressure of gas explosions of the engine thereinto for operating it for the purposes set forth.

15. A gas explosion engine comprising a plurality of cylinders, a tubular piston for each, a cylinder-head extending into the cylinder and into the piston, there being an annular cavity within the cylinder between it and the cylinder-head within which the piston is adapted to reciprocate, a packing upon the end of each piston within its respective cylinder-cavity, there being an air passage connecting the annular cavities, and means to automatically introduce air under pressure to the passages and cavities by the force of the explosion in the engine for the purposes set forth.

16. In a gas explosion engine the combination of a piston having an annular wall and a cavity as the explosion chamber, a cylinder to receive the piston and having a portion to extend into said cavity, said cylinder itself having a cavity to receive the annular wall of the piston, a packing ring secured upon the end of the said annular wall and adapted to spread into contact with both of the adjacent surfaces of the cylinder, pressure means having communication with the cylinder cavity and having separate communication also with the piston cavity and adapted for the introduction of air pressure into the said cylinder cavity by impulses imparted to it by the explosions in the piston cavity.

17. In a gas engine, a pair of cylinders, a tubular piston for each and each having a closed end, and constituting an explosion chamber, a tubular cupped cylinder-head extending into each cylinder and into the open end of its tubular piston, there being an annular cavity between each cylinder and its cylinder-head for travel of the piston, a packing-ring on the extremity of the open end of the piston, a passage connecting the cavities, an air pump connected at one end into the passage, and a pipe connecting the opposite end of the pump with the explosion chamber for automatically maintaining pressure of air upon the packing for the purposes set forth.

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

WILLIAM S. KELLOGG, Jr.

Witnesses:
E. J. Abersol,
L. M. Thurlow.