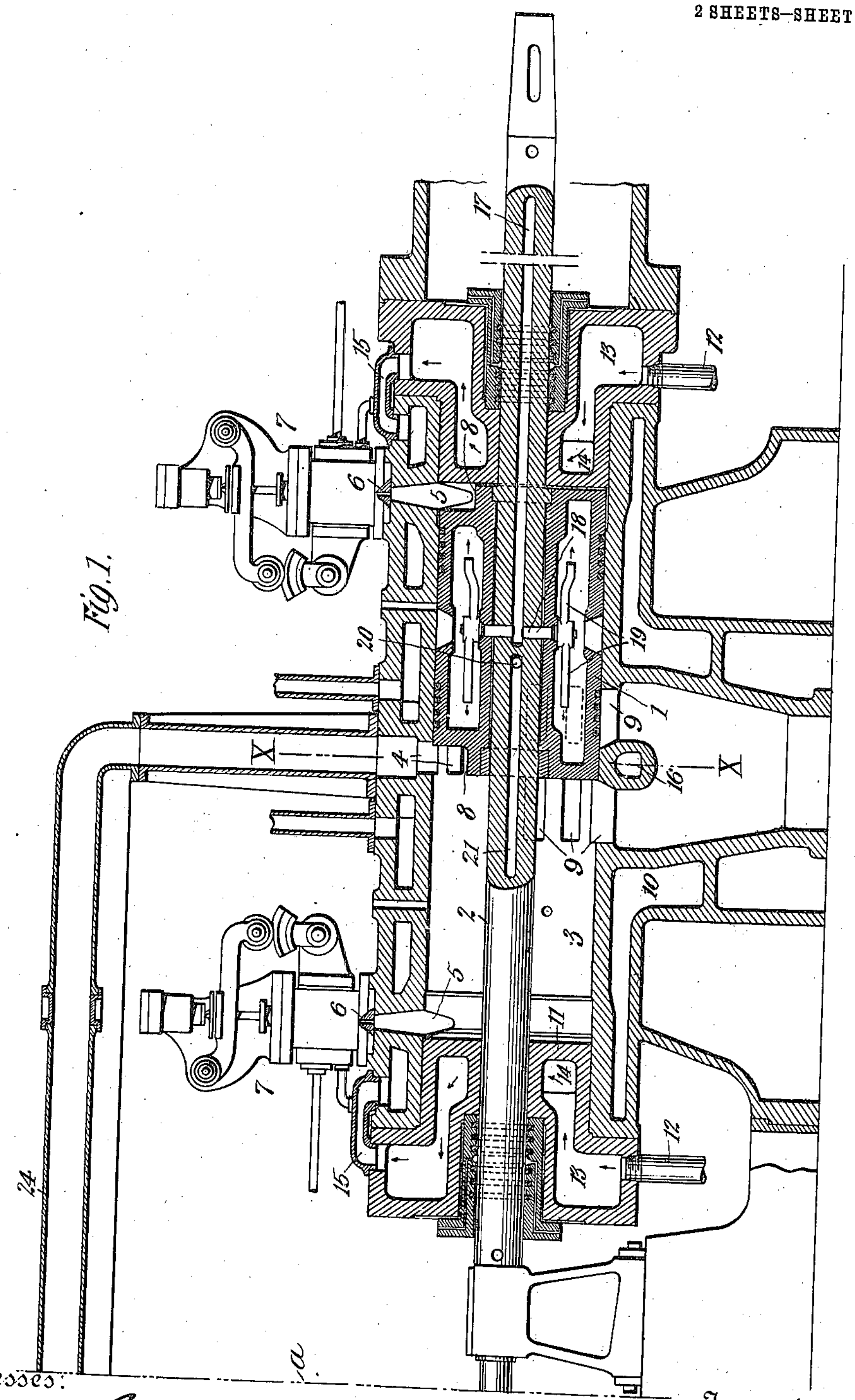
G. F. MURPHY.
GAS ENGINE.
APPLICATION FILED MAY 5, 1910.

1,013,888.

Patented Jan. 9, 1912.
2 SHEETS—SHEET 1.



Witnesses:
Francis Ober
Waldo M. Chapin

Inventor
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By his Attorneys
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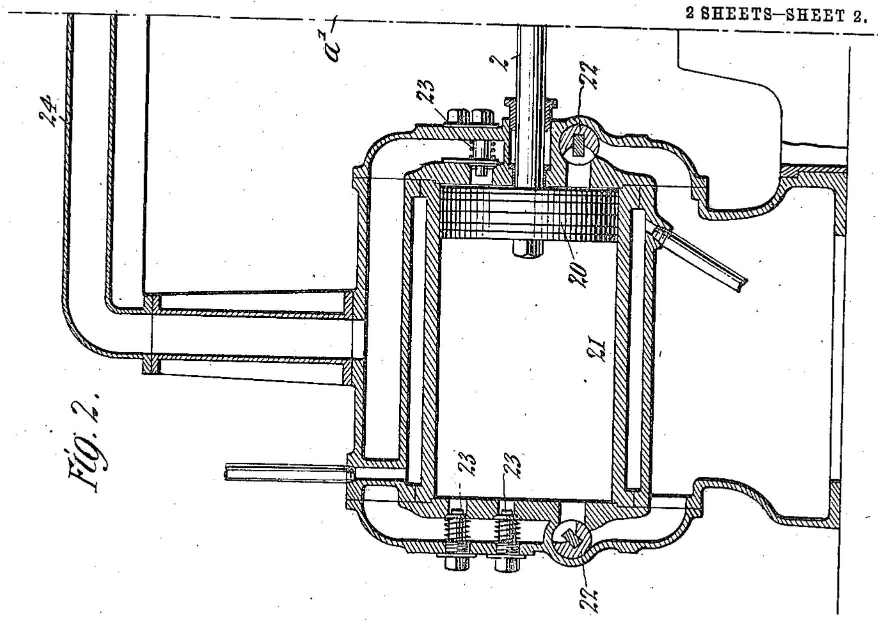

Fig. 2.

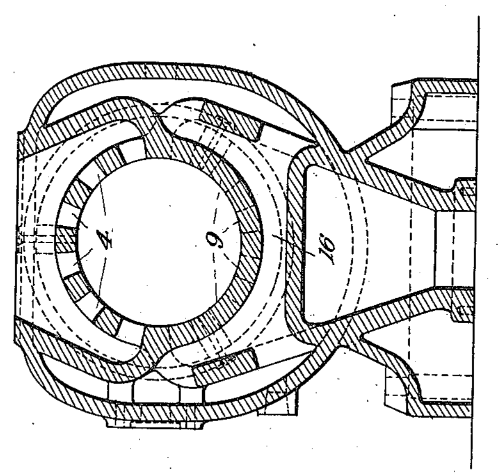

Fig. 3.

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UNITED STATES PATENT OFFICE.

GEORGE F. MURPHY, OF PROVIDENCE, RHODE ISLAND, ASSIGNOR TO FUEL OIL ENGINE COMPANY, A CORPORATION OF RHODE ISLAND.

GAS-ENGINE.

1,013,888. Specification of Letters Patent. Patented Jan. 9, 1912.

Application filed May 5, 1910. Serial No. 559,497.

To all whom it may concern:

Be it known that I, George F. Murphy, a citizen of the United States, residing at Providence, in the county of Providence and State of Rhode Island, have invented certain new and useful Improvements in Gas-Engines, of which the following is a full, clear, and exact description.

This invention relates to internal combustion engines, and has special reference to the two-cycle type of engine in which the explosive mixture is ignited by the heat developed in compression.

The object of the invention is to provide an engine of this character adapted either as a single or double acting engine which shall be efficient and economical in operation and afford the greatest output in power under given conditions.

To this end, the invention consists in certain details of construction which will be fully hereinafter described and pointed out in the claim.

Referring to the drawings: Figure 1 is a longitudinal section through a gas engine constructed in accordance with my invention. Fig. 2 is a similar section of an air pump used in connection with the engine; and Fig. 3 is a section on line X—X of Fig. 1. Figs. 1 and 2 should be read together as if the apparatus of Fig. 2 were joined to the left side of Fig. 1, so that the two dotted lines *a—a'* will coincide.

My invention is illustrated in connection with a double acting engine, the piston 1 of which is attached to a piston rod 2 which extends through both heads of the cylinder 3 and connects on the right hand end with a fly-wheel, not shown, and at the left hand end with the piston of an air pump hereinafter particularly referred to. The cylinder 3 is in length twice that of the piston plus the width of inlet ports 4 at the middle line of the cylinder, so that at each stroke of the piston it barely avoids touching the cylinder heads, leaving only sufficient clearance to avoid knocking, as indicated at the right hand end of the piston in Fig. 1. At each end of the cylinder is formed in the wall thereof a conical cavity 5 having an axis transverse to that of the cylinder. In this cavity is an inlet 6 for fuel which is injected at the proper point in the cycle of the engine by means of the apparatus 7 which forms no part of my invention. Each end of the piston is cut-away at its edge to form a cavity 8 having one wall substantially parallel to the axis of the cylinder and another perpendicular thereto and so located that when the piston is at the forward end of its stroke this cavity will stand opposite the cavity 5 in the cylinder and together therewith will form a single closed chamber which I shall designate as the compression chamber. At the same time this cavity in the end of the piston is also arranged to be opposite the inlet ports 4 of the cylinder when the piston is at the extremity of its rearward or working stroke, and when in this position the cavity 8 serves as a deflector to direct the material flowing through the ports 4 into the cylinder, toward the head thereof. The cylinder is provided with independent exhaust ports 8 for each end which are of such shape and location as to be uncovered by the piston shortly before the inlet ports 4 are uncovered. The cylinder is surrounded as usual by a water jacket 10 and the heads of the cylinder are cored out in such a manner that the cool water is caused to circulate directly against the inner wall 11 of the head where the greatest heat is developed. The water leads from the inlet pipe 12 through a passage 13 into an annular passage 14 around which it circulates to the opposite side of the head whence the water joins that in the main jacket through the passage 15. Around the lower middle zone of the cylinder is a water arch 16 intended to cool the walls through which the exhaust ports 9 lead and thus lower the pressure and noise of the exhaust. Circulation for a cooling medium within the piston is also provided. Water enters the hollow piston through a passage 17 in the rod, a cross passage 18 connecting therewith and pipes 19 leading toward the opposite heads of the piston, whereby the cool water is directed at once against the heads where the greatest heat is developed. From the piston chamber the water leads out through a lateral passage 20 and a longitudinal passage 21 in the rod. The arrangement of the pipes within the piston for directing the water against the heads thereof is believed to be an improvement over prior cooling arrangements for the piston.

The air pump piston to which the piston rod 2 connects is indicated by 20, and it works in a cylinder 21 of slightly larger diameter, but of about the same stroke as the cylinder 3. This cylinder is provided with inlet valves 22 and outlet check valves 23; it is double acting the same as the engine. The air from this pump is delivered into a receiver 24 in the form of a pipe, so proportioned that each stroke of the pump will raise the pressure a definite amount above atmospheric. The connection between the pump and the engine through the receiver is direct, the pressure in the receiver being held only by the wall of the piston 1 of the engine until the ports 4 are uncovered, when it is released into the cylinder 3.

The operation of the engine is as follows: Assuming the air in cylinder 3 to be at atmospheric pressure, a movement of the piston to the left compresses the air in the cylinder until at the end of the stroke, it is all confined in the small compression chamber formed jointly by the cavities 5 and 8. At about the time the piston finishes its stroke crude oil or other suitable fuel is injected into the cavity 5, which upon mixing with the air becomes an explosive mixture which is at once ignited by the heat developed in the compression of the air. The explosion which follows drives the piston to the opposite end of the cylinder. During this explosion stroke the pump piston has raised the pressure of air in the receiver 24 to a predetermined degree. As soon as the piston 3 uncovers the exhaust ports 9 the burned gases commence to escape and upon the final movement of the piston the air ports 4 are opened and the air is directed by the deflecting walls of cavity 8 toward the front end and along one side of the cylinder whence it is returned to the rear and along the opposite side and drives out all of the products of combustion, the pressure in the cylinder and in the receiver 24 being thereby again reduced to atmospheric before the piston starts on its next cycle. Of course at the opposite end of the cylinder the same operations take place except that the compression stroke occurs during the power stroke of the other side.

By dropping the air in the receiver to atmospheric pressure at each stroke, two advantages are gained. One is, that there will be no reëxpansion of air in the clearance space of the pump at the beginning of the next stroke, and the other is that the initial air pressure in the engine cylinder at the beginning of each compression stroke is always the same, to wit, atmospheric.

So far as known to me gas engines heretofore devised that work on the principle of this one, have taken the air from a source under a constant pressure greater than the atmosphere, so that controlling devices such as reducing valves and cut-offs, all of which are more or less unreliable, were necessary, but with my engine all such devices are dispensed with and the pressure is an absolutely known quantity at all points of the cycle.

Having described my invention, what I claim, is:

In combination, an internal combustion engine comprising a double acting cylinder having an air inlet at the middle thereof, an exhaust port, an offset cavity in each end of said cylinder and a fuel inlet in each of said cavities, a piston having a cavity on each face both of which are adapted to coöperate with said air inlet to deflect the air entering from the same and each of which is adapted to co-act with the corresponding offset cavity in the cylinder to form therewith a compression chamber, a double acting air pump having a cylinder capacity per stroke greater than that of the engine cylinder, said pump being directly connected to said engine piston, the pump and engine piston being reciprocable in unison, and air conduits between the respective sides of said pump and the air inlet of said engine cylinder.

In witness whereof, I subscribe my signature, in the presence of two witnesses.

GEORGE F. MURPHY.

Witnesses:
JAMES A. ROGERS,
RUFUS S. ADAMS.