F. O. KILGORE.

GAS ENGINE.

APPLICATION FILED APR. 7, 1906.

962,437.

Patented June 28, 1910.

3 SHEETS—SHEET 1.

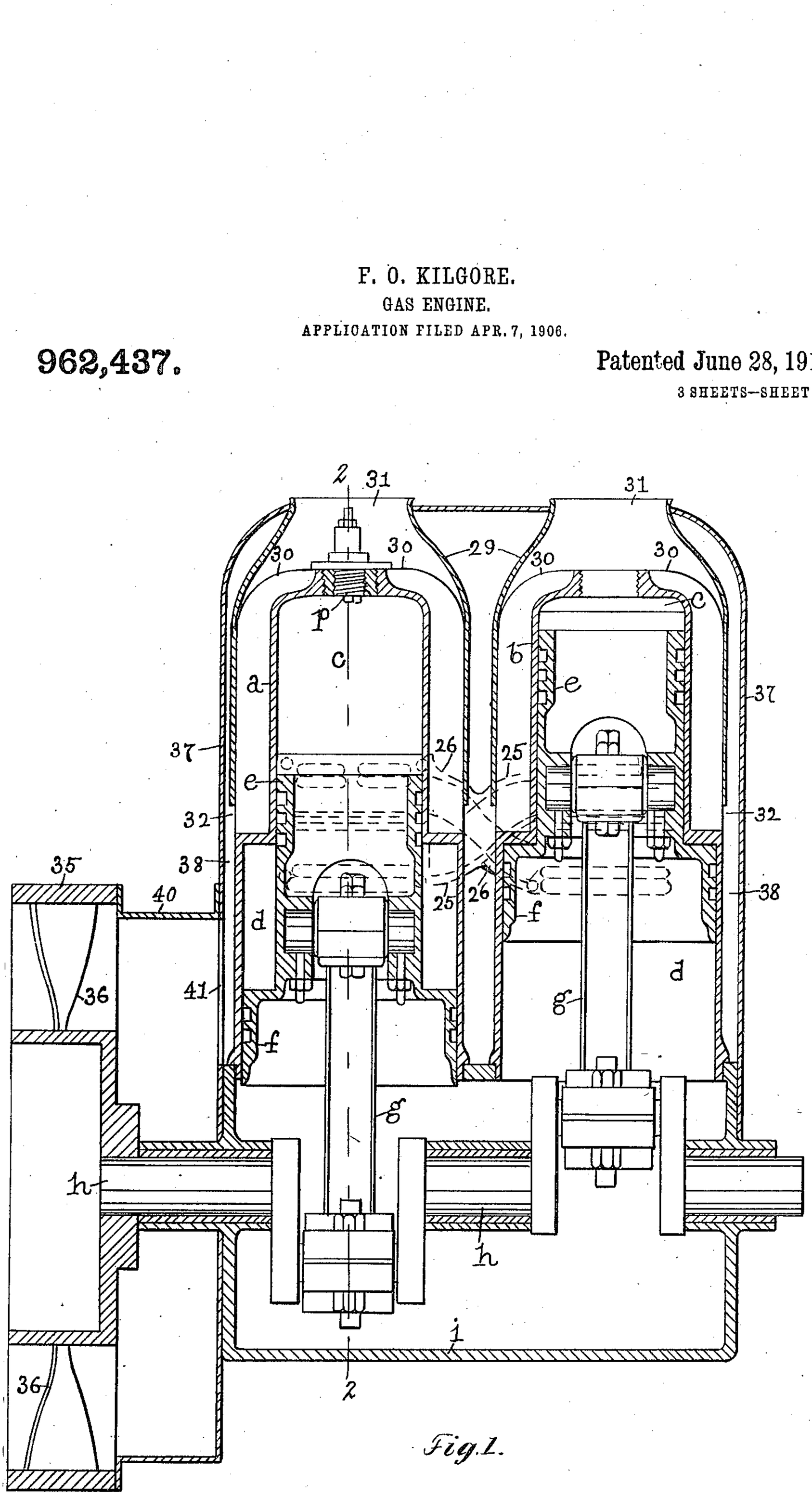

Fig. 1.

Witnesses.
C. H. Garnett
J. Murphy

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Frederick O. Kilgore
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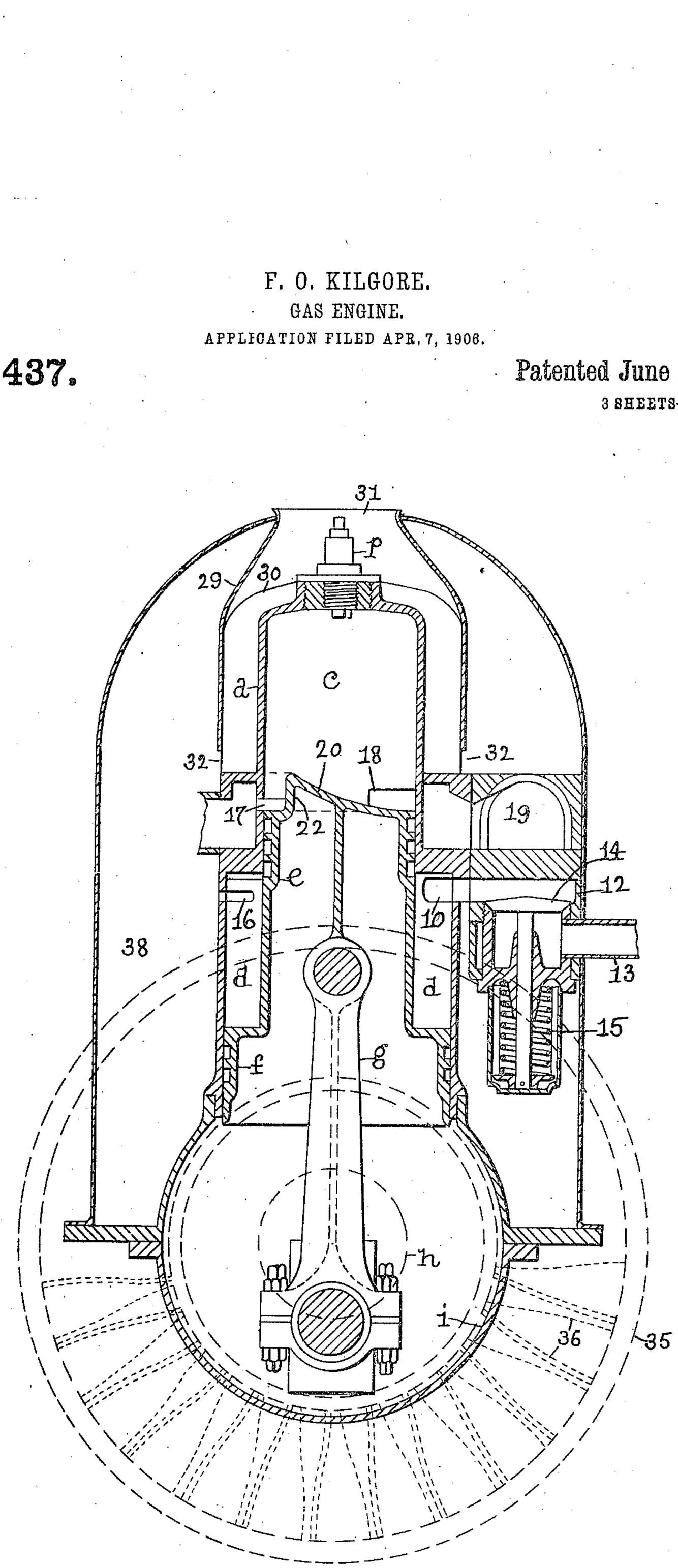

Fig. 2.

Witnesses.
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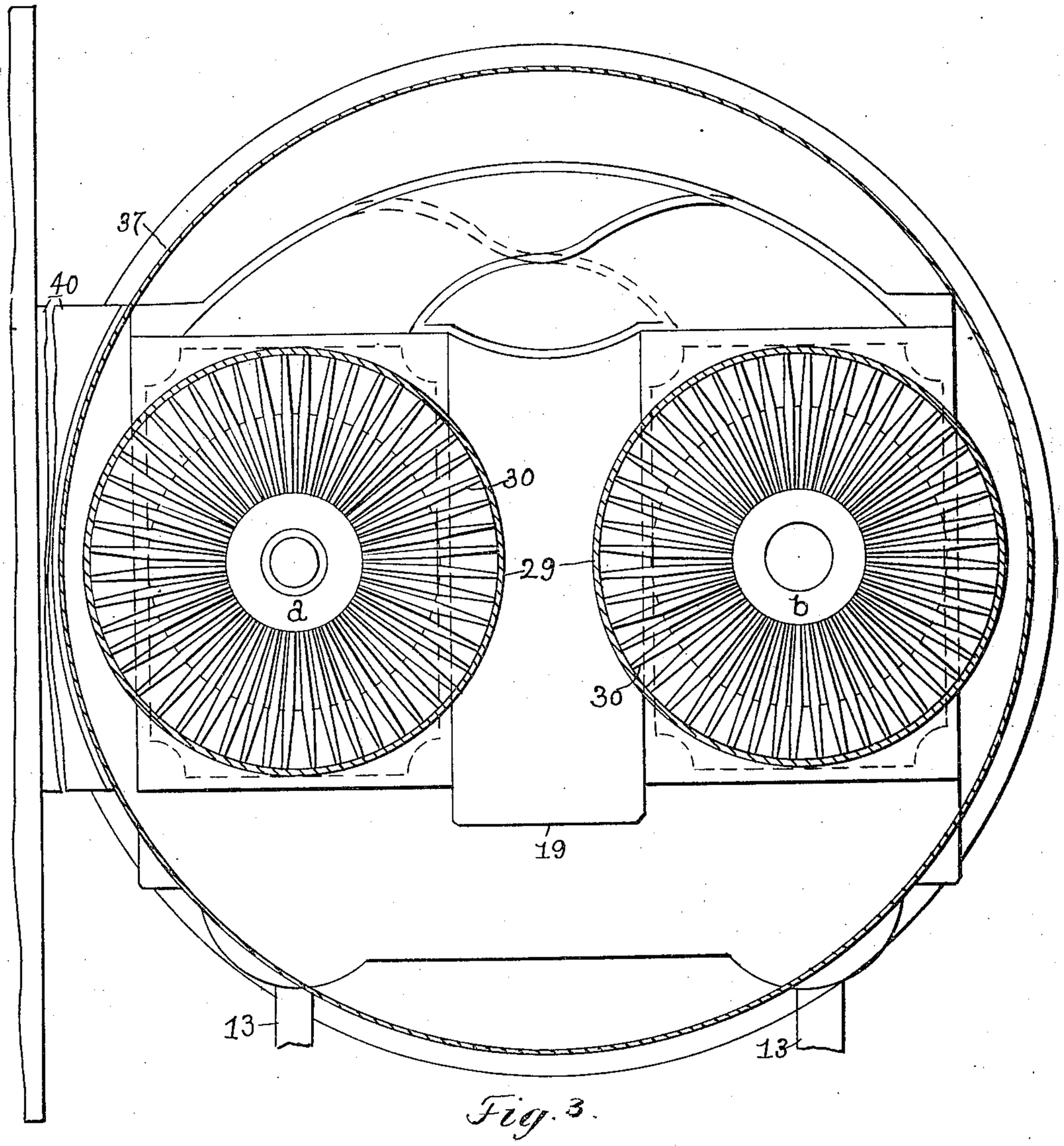

Fig. 3.

Witnesses.
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UNITED STATES PATENT OFFICE.

FREDERICK O. KILGORE, OF MINNEAPOLIS, MINNESOTA.

GAS-ENGINE.

962,437. Specification of Letters Patent. Patented June 28, 1910.

Application filed April 7, 1906. Serial No. 310,437.

To all whom it may concern:

Be it known that I, FREDERICK O. KILGORE, a citizen of the United States, residing in Minneapolis, in the county of Hennepin, in the State of Minnesota, have invented an Improvement in Gas-Engines, of which the following description, in connection with the accompanying drawings, is a specification, like characters on the drawings representing like parts.

This invention relates to gas-engines and is herein shown as embodied in an engine of the class commonly known as two-cycle internal combustion engines.

The particular features of this invention will be pointed out in the claims at the end of this specification.

Figure 1 is a vertical section of a two-cycle engine embodying this invention. Fig. 2, a vertical section on the line 2—2, Fig. 1, and Fig. 3, a detail in plan on an enlarged scale to be referred to.

In the present instance the invention is shown as embodied in an upright engine provided with a plurality of cylinders arranged side by side and herein shown as two in number and marked *a*, *b*, but it will be understood that any desired number or pairs of cylinders may be used.

Each of the cylinders *a*, *b* is made of unequal diameters to form chambers *c*, *d*, which may be designated the explosion and compression chambers respectively.

The chambers *c*, *d*, contain within them pistons *e*, *f*, preferably made hollow and in one piece, the piston *e* being closed at its upper end and reciprocating in the chamber *c*, and the piston *f* being open at its lower end and reciprocating in the chamber *d*. The pistons *e*, *f*, are joined by their common piston rod *g* to a crank-shaft *h* supported in suitable bearings in a crank-case *i*, upon which the cylinders *a*, *b* are supported and secured thereto in any suitable manner.

The compression chamber *d* of each cylinder is provided at its upper end with a port 10 connected with a valve casing 12, provided with an inlet port or passage 13 which is connected to the usual carbureter or other source of explosive mixture or gas and not herein shown.

The valve casing 12 is provided with a valve 14, normally held closed by a spring 15 and adapted to be opened by the suction produced in the compression chamber, when the piston *f* therein is moved downward. The compression chamber is also provided at its upper end with an outlet port 16, and both of the ports 10, 16 are designed to be closed on the upstroke of the piston *f*.

The chamber *c* of each cylinder at or near its lower end is provided with two ports 17, 18, the port 17 constituting a gas inlet port, and the port 18 a gas exhaust port, which latter communicates with an enlarged exhaust chamber 19, which leads to the atmosphere. The piston *e* is preferably provided with a curved or inclined head 20 (see Fig. 2), which extends upward from the exhaust side of the chamber toward the inlet side thereof, and which at its high part is reduced in diameter and is connected with the cylindrical portion of the piston by a substantially straight wall 22 located substantially opposite the gas inlet port 17, and forming a deflector for the incoming unexploded gases. The curved or inclined head 20 enables the exhaust port 18 to be made materially larger than the inlet port and facilitates the discharge of the exhaust gases from the explosion chamber. The cylinders *a*, *b* are arranged in pairs with their pistons connected to the crank-shaft at substantially diametrically opposite points so as to be opposed to each other, and the gas outlet port for the compression chamber *d* of one cylinder as *a* is connected by the pipe or passage 25 with the gas inlet port 17 of the explosion chamber *c* of the other cylinder *b* (see Fig. 1), and the outlet port 16 of the compression chamber *d* of cylinder *b* is connected by the pipe or passage 26 with the inlet port 17 of the explosion chamber of the other cylinder *a*. It will be understood that the cylinder *b* is provided with a valve 14 controlling the admission of gas and air or other explosive medium into its compression chamber. The operation of the engine as thus far described, may be readily understood by inspection of Figs. 1 and 2.

Referring to Figs. 1 and 2, the piston *f* in the cylinder *a* on its down stroke, creates a suction in the compression chamber *d* of said cylinder and in the valve casing 12 above the valve 14, thereby opening the said valve and drawing the explosive mixture into the compression chamber *d* of cylinder *a*. On the up-stroke of the piston *f* of cylinder *a*, the explosive mixture is compressed in the chamber *d* and in the pipe or passage 25 leading to the inlet port 17 of the explosion chamber *c* of the cylinder *b*, which

inlet port at such time is closed by the piston *e* in the cylinder *b*. The gaseous mixture thus compressed by the piston *f* in cylinder *a*, rushes into the explosion chamber of cylinder *b* when the port 17 of said cylinder is uncovered on the downward movement of the piston *e* in cylinder *b*. The exhaust port 18 of cylinder *b* is uncovered preferably before the inlet port 17, and the fresh gas admitted into chamber *c* of cylinder *b* strikes the deflector 22 and is directed toward the end of the cylinder and thence back toward the exhaust port 18 and against the curved or inclined head 20 of the piston *e*, which facilitates the discharge of the exhaust gases. In this manner the fresh gas pushes the dead or exhaust gases out of the explosion chamber, so that when the piston *e* of the cylinder *b* makes its upstroke, it compresses the fresh gases into condition to be ignited and exploded in the usual manner. On the downstroke of the piston *f* in the compression chamber *d* of cylinder *b*, fresh gas is drawn into said chamber and on the up-stroke of said piston is compressed in said chamber and the pipe or passage 26 leading to the inlet port 17 of the explosion chamber *c* of cylinder *a*, into which chamber the compressed gases rush, when the port 17 is uncovered on the downward stroke of the piston *e* in the cylinder *a*, the in-rushing gases being directed by the deflector 22 to the end of the chamber *c* and then back to the exhaust port 18 of the cylinder *a*, thus driving the dead gases out through the exhaust port of said cylinder as described with relation to cylinder *b*. The piston *f* on its up-stroke closes the gas outlet port 16 for the compression chamber and also preferably passes a little beyond the said outlet port, so as to maintain said port closed until the piston in the explosion chamber of the coöperating cylinder has opened and again closed the inlet 17 for said companion cylinder, thereby avoiding danger of back fire and diminution of pressure of the compressed gases. The gases may be ignited in any suitable or usual manner as by the igniter *p*.

The cylinders *a*, *b*, may be provided with heat-radiating ribs or vanes 30 on their outer surface, which are arranged longitudinally of said cylinders and extend from the top of the cylinders down to and beyond the compression chambers thereof, and are preferably made of a width so as to be substantially flush with the outer surface of said compression chambers.

The present invention consists in providing means for increasing the efficiency of the heat radiating surface of the cylinders, and for this purpose, each cylinder of the engine is provided with a jacket 29 of larger diameter than the cylinder and coöperating therewith to form an air chamber which surrounds the cylinder for a portion of its length, and is provided with inlet and outlet openings 31, 32.

In the present instance, the jacket 29 is fitted somewhat snugly upon the radiating ribs or wings 30 (see Fig. 3), and extends down to near the compression chamber of the engine cylinder, but stops short thereof as clearly represented in Figs. 1 and 2 so as to leave the air outlets 32 at the bottom of the jacket.

Provision is made for drawing air down through the jackets, and for this purpose I prefer to employ the fly wheel 35 of the engine, which wheel is fast on the crank shaft *h* and is provided with spokes 36 which are so shaped as to form the blades of a fan. In order to obtain the desired suction, the fly-wheel fan coöperates with the outlet mouth of a casing 37, which incloses the engine substantially air-tight, and is provided at its upper end with openings into or through which the upper ends of the jackets 29 extend as clearly shown in Fig. 1. The inclosing casing 37 may be made in two parts, one of which is fitted onto the crank case of the engine so as to leave a space 38 about the enlarged portion of the cylinders, with which communicates the air outlet 32 of the jacket, and the other part of which casing is made as a cylinder 40, which surrounds the crank shaft between the fly wheel 35 and the crank case, which cylinder communicates with the space 38 through a port or opening 41 in the casing 37.

By reference to Fig. 1, it will be seen that as the fly wheel is revolved, a current of air is created, and cool air is drawn into the jacket 29 surrounding each cylinder and passes down around the hottest part of the same, namely, the explosion chamber, in contact not only with the outer surface of the explosion chamber but also with the heat radiating ribs thereof, and the air thus heated is drawn out of the lower end of the jackets of each cylinder into the space 38 about the compression chamber of the engine cylinder, from which space it is drawn through the port 41 into the cylinder 40 and through the fan or fly wheel 35.

It will be observed that each cylinder is provided with a jacket surrounding its explosion chamber and that these jackets discharge into a common chamber formed by the casing 37 from which the heated air is exhausted by the fan or fly wheel.

By providing each cylinder with its own jacket, cool air is brought into contact with the explosion chamber of each cylinder, thereby effectively cooling the latter.

I may prefer to employ the jacket 29 in connection with cylinders provided with heat radiating ribs, as by so doing a maximum cooling effect is obtained, but I do not desire to limit my invention in this respect, as the jackets may be employed to advantage

with an engine whose explosion cylinders are not provided with heat radiating ribs. I may prefer to make the spokes of the fly wheel in the form of fan blades, as by so doing, I avoid the use of a separate fan, but it is not desired to limit the invention in this respect, as a fan of ordinary construction may be used instead of the fly wheel fan, in which case a separate fly wheel of ordinary construction may be used.

I have herein shown the engine as provided with two cylinders, but it is not desired to limit the invention to the particular number of cylinders shown.

By locating the port 16 intermediate the ends of the stroke of the piston *f*, the compression chamber *d* of one cylinder is cut off from the explosion chamber *c* of the companion cylinder while the port 17 of said companion cylinder is opened for the admission of the compressed gases and again closed. By this means, the piston *f* is prevented from drawing back into its chamber, compressed gases in the pipe connecting said chamber with the explosion chamber of the companion cylinder, thereby avoiding decreasing the gaseous charge admitted into the explosion chamber of one cylinder from the compression chamber of the other or companion cylinder.

By compressing the gases into the passage connecting the compression chamber of one cylinder with the explosion chamber of the other cylinder, a maximum quantity of fresh gas under sufficient pressure to insure filling the explosion chamber, is obtained, even when the engine is running at a high speed.

Claims.

1. In an apparatus of the class described, in combination, an internal combustion engine having a plurality of cylinders, a casing inclosing said cylinders, and provided with a plurality of openings substantially in line with said cylinders, an air jacket for each of said cylinders and communicating with the atmosphere through the opening in the casing in line with the cylinder with which said air jacket coöperates, said air jacket communicating with said casing, and a fan to draw air from the casing and cause cool air to be simultaneously drawn through the air jackets to first make contact with the hottest part of the cylinder, substantially as described.

2. In an apparatus of the class described, in combination, an internal combustion engine having a plurality of cylinders, a crank shaft to which the pistons of said cylinders are connected, a fly wheel fan attached to the crank shaft, air jackets surrounding said cylinders, a casing inclosing all the cylinders, a casing surrounding the crank shaft between the fly wheel and the casing inclosing the cylinders and communicating with the latter, and air jackets for said cylinders surrounding the same and extended through openings in the inclosing casing substantially in line with the cylinders and communicating at their lower ends with the inclosing casing, substantially as described.

3. In an apparatus of the class described, in combination, an internal combustion engine having a plurality of cylinders, a casing common to all of said cylinders, an air jacket for each cylinder communicating with the atmosphere through said casing to supply cool air to the hottest part of the cylinders, and communicating with the casing to discharge therein the air heated by said cylinders, and means for drawing heated air from said casing, substantially as described.

In testimony whereof, I have signed my name to this specification in the presence of two subscribing witnesses.

FREDERICK O. KILGORE.

Witnesses:
JAS. H. CHURCHILL,
J. MURPHY.