

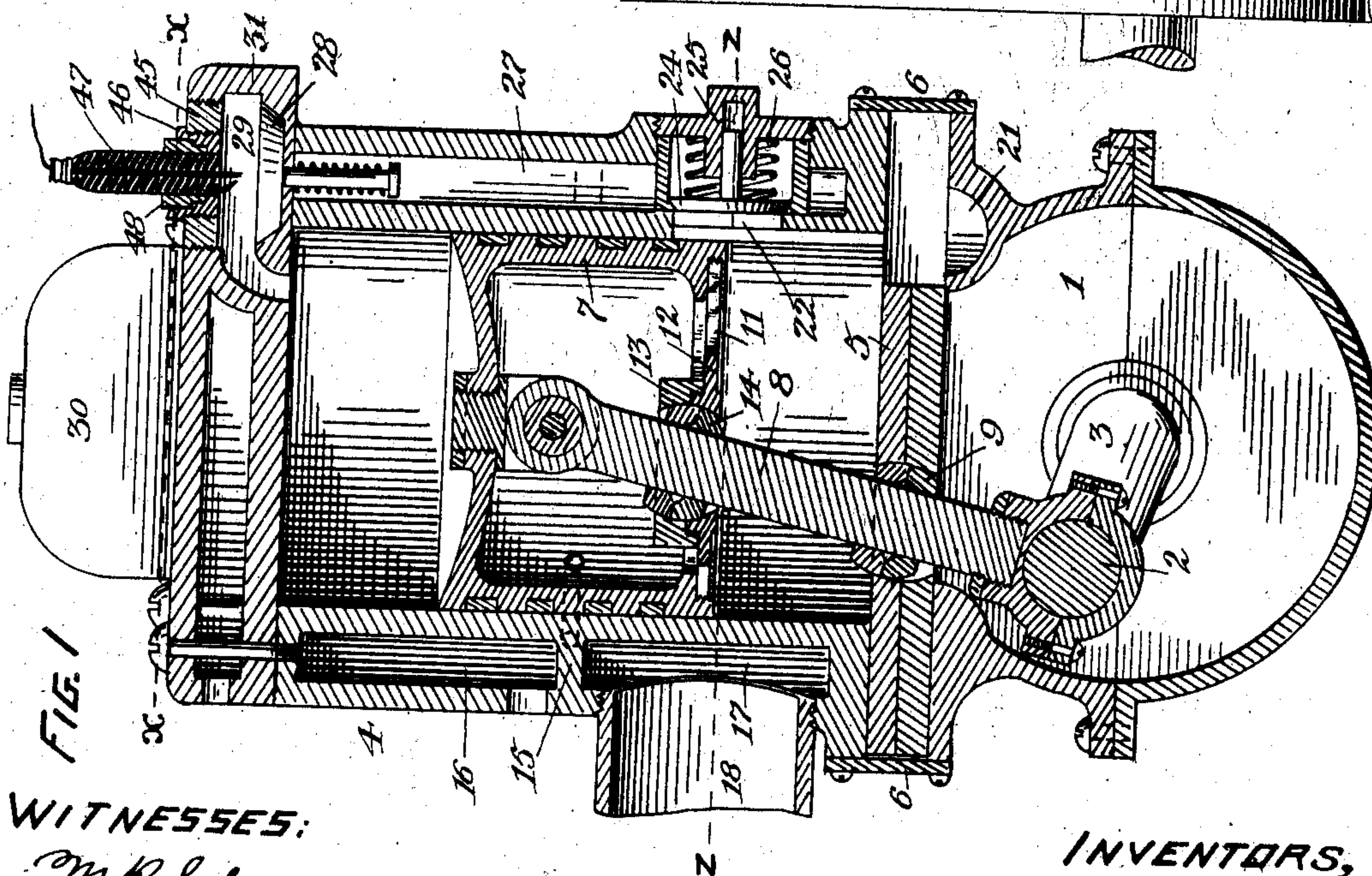
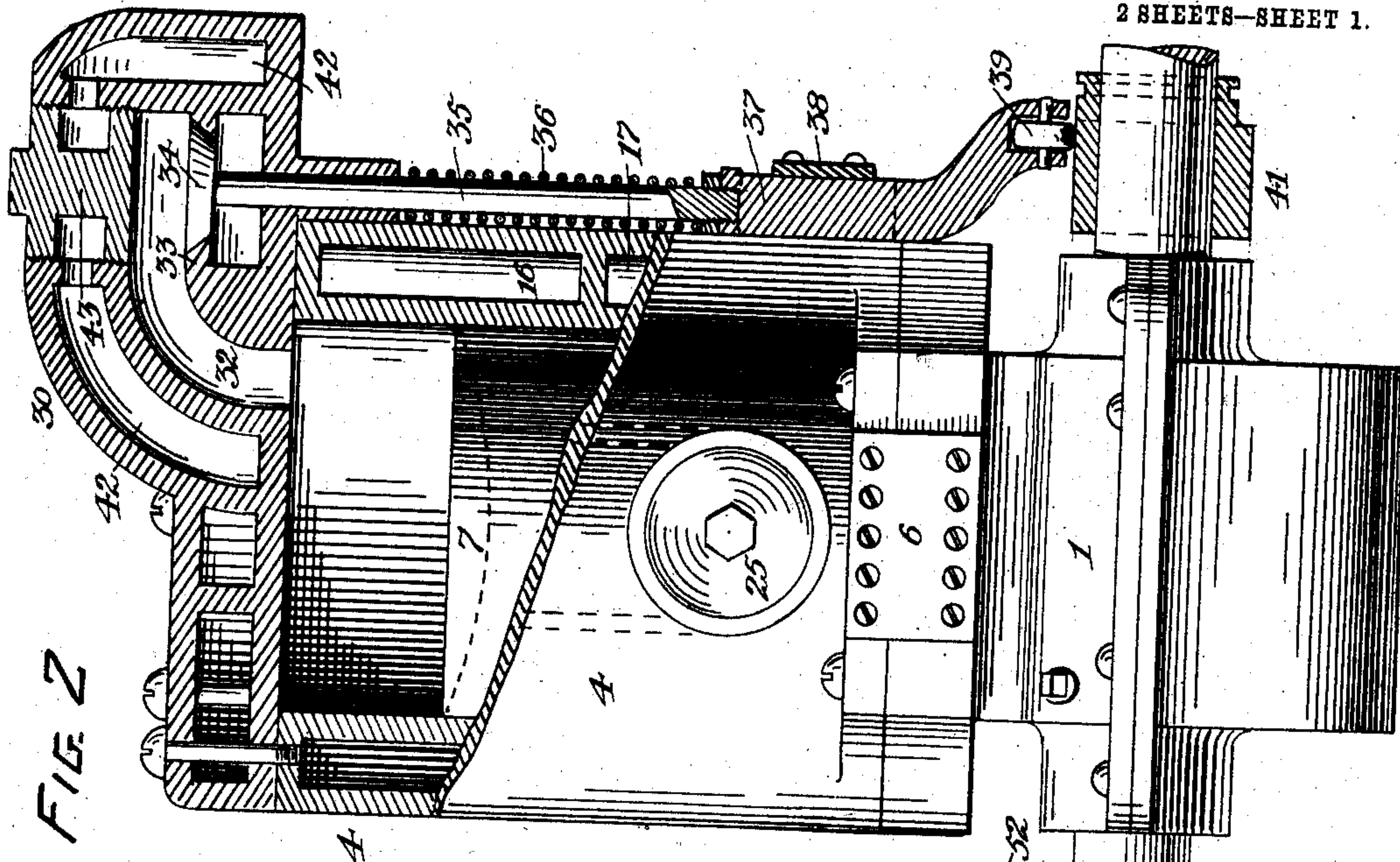
No. 854,092.

PATENTED MAY 21, 1907.

W. H. HOOPER & F. S. HUTCHINS.
GAS ENGINE.

APPLICATION FILED APR. 28, 1906.

2 SHEETS—SHEET 1.



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2 SHEETS—SHEET 2.

FIG. 3

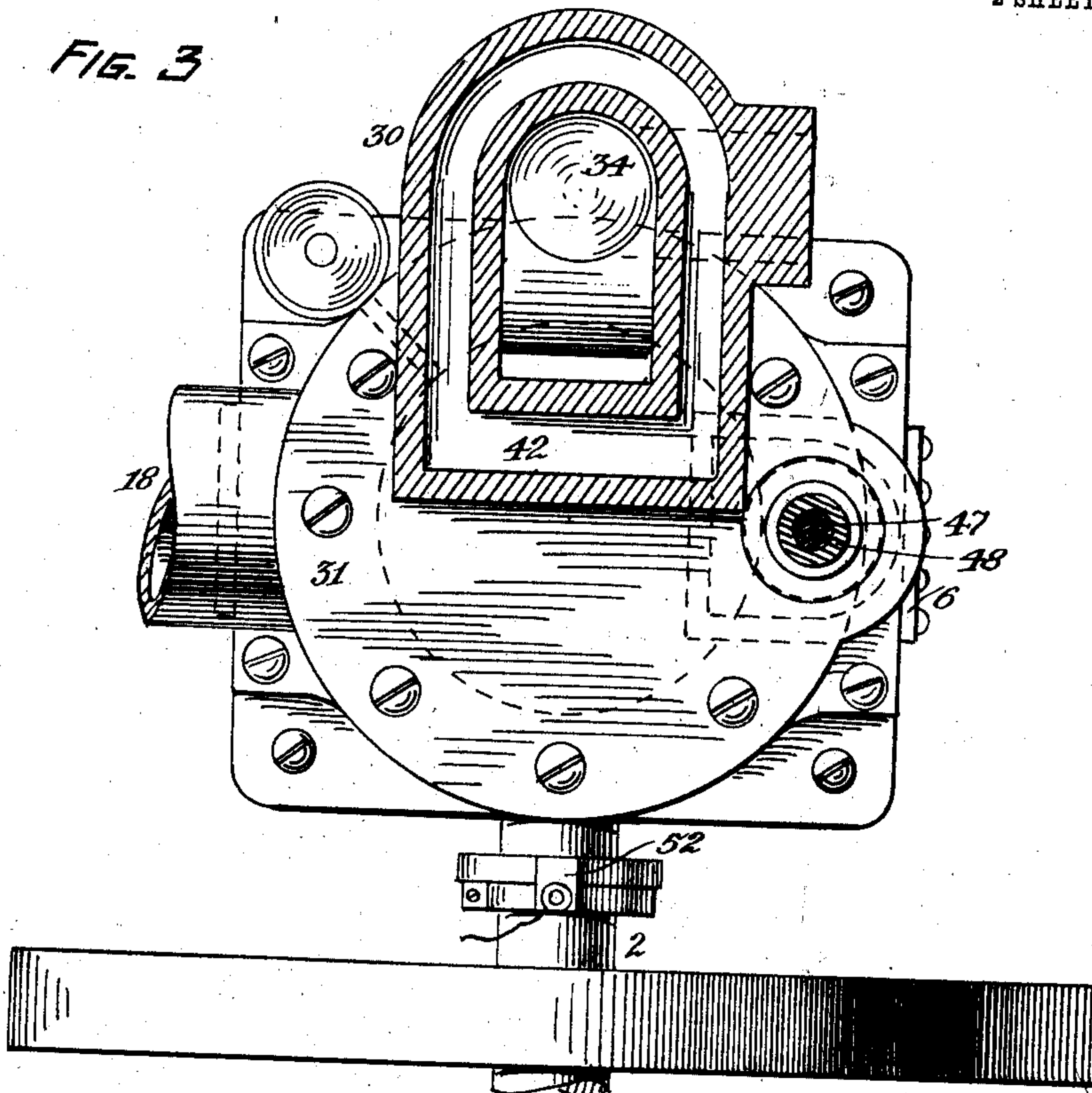
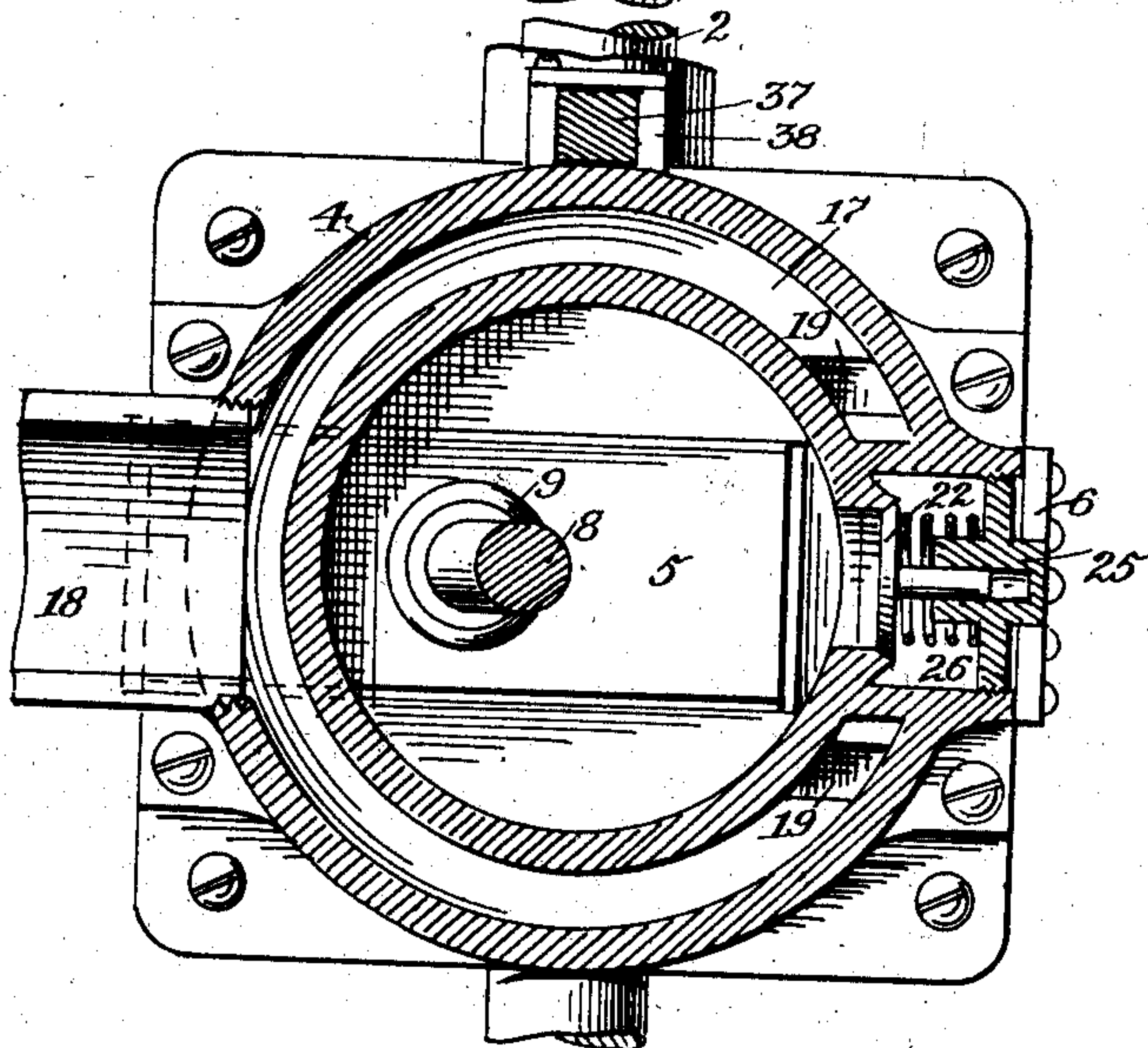


FIG. 4



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UNITED STATES PATENT OFFICE.

WILLIAM H. HOOPER AND FREDERICK S. HUTCHINS, OF SAN FRANCISCO,
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GAS-ENGINE.

No. 854,092.

Specification of Letters Patent.

Patented May 21, 1907.

Application filed April 28, 1905. Serial No. 257,888.

To all whom it may concern:

Be it known that we, WILLIAM H. HOOPER and FREDERICK S. HUTCHINS, citizens of the United States, residing at San Francisco, in the county of San Francisco and State of California, have invented certain new and useful Improvements in Gas - Engines, of which the following is a specification.

Our invention relates to gas engines of the two-cycle-type in which by a very cheap, light and simple construction we are able to develop proportionately greater power than engines of this type heretofore used.

It is our object to provide a two-cycle engine which shall possess all the advantages of the type, and which shall obviate some of the disadvantages heretofore attaching to it. We have found in practice that our improved construction has all the advantages of the four cycle type as to the complete and perfect utilization of the whole of the explosive charge, as well as to the perfect clearance of the cylinder from the explosive charge.

Various features of invention and improvement are hereinafter described and a practical embodiment as shown in the drawings:—

In these drawings:—Figure 1 is a vertical section of the engine: Fig. 2 is an elevation at right angles to Fig. 1, showing the upper part of the engine in section: Fig. 3 is a horizontal section looking downward at the line $x-x$ in Fig. 1: Fig. 4 is a similar section looking downward at the line $z-z$ in Fig. 1.

The engine is supported upon a base or bed of any suitable character which is not shown in the drawings.

Through the crank case 1, passes the engine shaft 2 formed with or secured to the crank 3. The case is closed and is adapted to contain oil which is splashed freely upon the shaft and crank bearings. The engine cylinder 4 is secured rigidly to the crank case, and a diametrical guide way is formed in their meeting places to receive and guide the reciprocating slide valve 5. This guide way is closed at each end by an external plate 6.

A hollow piston 7 reciprocates in the cylinder and the connecting rod 8 is jointed to the piston and also to the crank as shown. The connecting rod passes through the slide valve 5, a special opening being formed in said valve in which is universally seated, a ball 9 through which the rod moves freely.

The slide valve is thus operated by the oscillation of the connecting rod. The lower end of the hollow piston is closed by a slotted plate or partition 11, having guides for a slide 12, in which, and in an associated cap or plate 13 is a spherical seat for a ball 14 surrounding the connecting rod which plays freely through said ball. The lower end of the piston is always closed, the slot, guide, sliding plate and ball being employed to permit the free oscillation of the connecting rod. By this construction the space into which the gas is drawn, and which in engines of this type usually includes the whole interior of the piston, is much reduced permitting the whole charge to be utilized.

The cylinder has a space formed in its wall, which is divided about midway by a partition 15 which separates said space into two, the upper 16 being an ordinary water jacket, while the lower 17 is a gas space and a passage. The gas inlet is shown at 18 entering the space 17. The bottom of this space 17 is provided with openings 19 as shown in Fig. 4, and the crank case has a channel 21 which affords a communication into the cylinder below the piston. This communication is opened and closed at proper intervals by the slide valve 5, Fig. 1 showing it as open. In the wall of the cylinder is an opening 22 adjacent to which is a valve seat for the gas outlet valve 24, whose stem is guided in a base 25, and which is seated by a spring 26. The gas which passes this valve is forced up through a passage 27 at the upper end of which is a spring-seated lift valve 28. The cylinder has an ignition space 29 above this valve, which communicates with the interior of the cylinder above the piston.

The cylinder head is provided with an extension 30 in which is formed the exhaust passage 32, and a seat 33 for the exhaust valve 34. The valve is a simple lift valve, whose stem 35, suitably guided, is encircled by a pressure spring 36. The lower end of the valve stem is connected to an arm 37 working in a guide 38 and carrying a roller 39.

On the engine shaft is an adjustable eccentric 44 with whose face the roller 39 is in contact. This cam can be adjusted by turning it upon the shaft so as to vary the exhaust and provide for high or low compression as may be desired. For instance, when the full

compression is not desired the exhaust is so arranged that a portion of the fresh charge is permitted to escape with the exploded charge of the previous compression.

5 The extension 30 of the cylinder head is water jacketed as shown at 42, and such extension is provided with an opening to permit the exhaust valve to be set in position. Such opening is closed in any suitable way, 10 as by the screw plug 43 which is formed so as to permit the water to pass around it.

The sparking device comprises a jump sparker in the ignition space, controlled by 15 contacts opened and closed by the engine shaft. In the cylinder head is threaded a plate 45, in which is screwed the support 46 for the sparking plug 47, the latter passing through a gland 48. One igniting terminal extends through this plug, and the other, in 20 close proximity is connected to the engine. In the electrical circuit are also the contacts 49, 51, of which one is carried by a stationary bracket 52 suitably supported in proximity to the engine shaft, while the other, 51, is 25 carried by a disk 53 which revolves with said shaft and causes the points 49 and 51 to make and break a contact at each revolution.

In describing the operation we shall commence by assuming that the piston is at the 30 lower end of the cylinder, the crank at its lowest position, and the connecting rod vertical. The communication between the gas inlet and the lower part of the cylinder is closed because the slide valve 5 is covering 35 the channel 21. As the piston rises as shown in Fig. 1 the slide valve opens this communication and gas is drawn into the space 17 and thence into the cylinder beneath the closed lower end of the rising piston. 40 On the return stroke the slide valve closes the gas inlet to the cylinder and the descending piston forces the explosive charge out of the cylinder through the valve 24 and the passage 27 into the ignition space, whence 45 it extends into the upper part of the cylinder above the piston where it is exploded. The force of the explosion and the spring on the stem of the valve 28 holds the valve upon its seat until substantially the entire charge has 50 escaped when the fresh charge forces open the valve and enters the explosion chamber ready to be compressed and exploded on the return upstroke of the piston. In this manner a fresh charge is drawn in and compressed 55 at every stroke of the engine instead of every other stroke, as with the ordinary four cycle engines. The closing of the end of the piston reduces the compression space, which in engines of this type, generally includes the

whole interior of the hollow piston; and we 60 have found in practice that with such a closed piston the clearing of the compression space is complete at all speeds, which it is well known is not the case when the interior 65 of the piston forms a part of such space. By using the universally jointed arrangement for the connecting rod, we not only provide an exceedingly simple and effective means for operating the slide valve 5, but also enable 70 the said rod to be connected in the proper relation to a piston having both ends closed.

While we have shown and described an engine of the vertical type, it must be understood that our improvements can be applied 75 to horizontal engines as well.

We do not limit ourselves to the particular constructions and arrangements herein described and shown in the accompanying 80 drawings, as we desire to avail ourselves of such modifications and equivalents as fall properly within the spirit of our invention.

Having thus fully described our invention, what we claim as new and desire to secure by Letters Patent is:—

1. In a gas engine the combination with 85 the cylinder and with a piston closed at both ends, of the engine shaft and crank and a connecting rod passing through one end of said piston and jointed to the other end.

2. In a gas engine, a cylinder, a hollow piston 90 closed at both ends, a slot in the closure at one end, a slide for closing said slot and a connecting rod passing through said slide and hinged directly to the piston.

3. In a gas engine, a cylinder, a piston 95 closed at both ends, a slot in the closure for one end, a slide covering said slot, a ball seated in said slide and a connecting rod passing through said ball and hinged to said piston.

4. In a gas engine a cylinder, having a hollow 100 forming a gas space or passage provided with a gas inlet; a crank case secured with the cylinder, a guide way between the cylinder and crank case; a slide valve in said guide way; a channel in the crank case communicating with said gas passage and with said 105 guide way and means for operating the slide valve; whereby gas is drawn into the cylinder through said gas inlet, gas passage, channel and guide way when said valve is open. 110

In testimony whereof we have affixed our signature, in presence of two witnesses, this 15th day of April 1905.

WILLIAM H. HOOPER.
FRED. S. HUTCHINS.

Witnesses:
L. W. SEELY,
CELESTE ANSELL.