J. J. KULAGE.

INTERNAL COMBUSTION ENGINE.

APPLICATION FILED JAN. 30, 1908.

929,769.

Patented Aug. 3, 1909.

2 SHEETS—SHEET 1.

Fig.1.

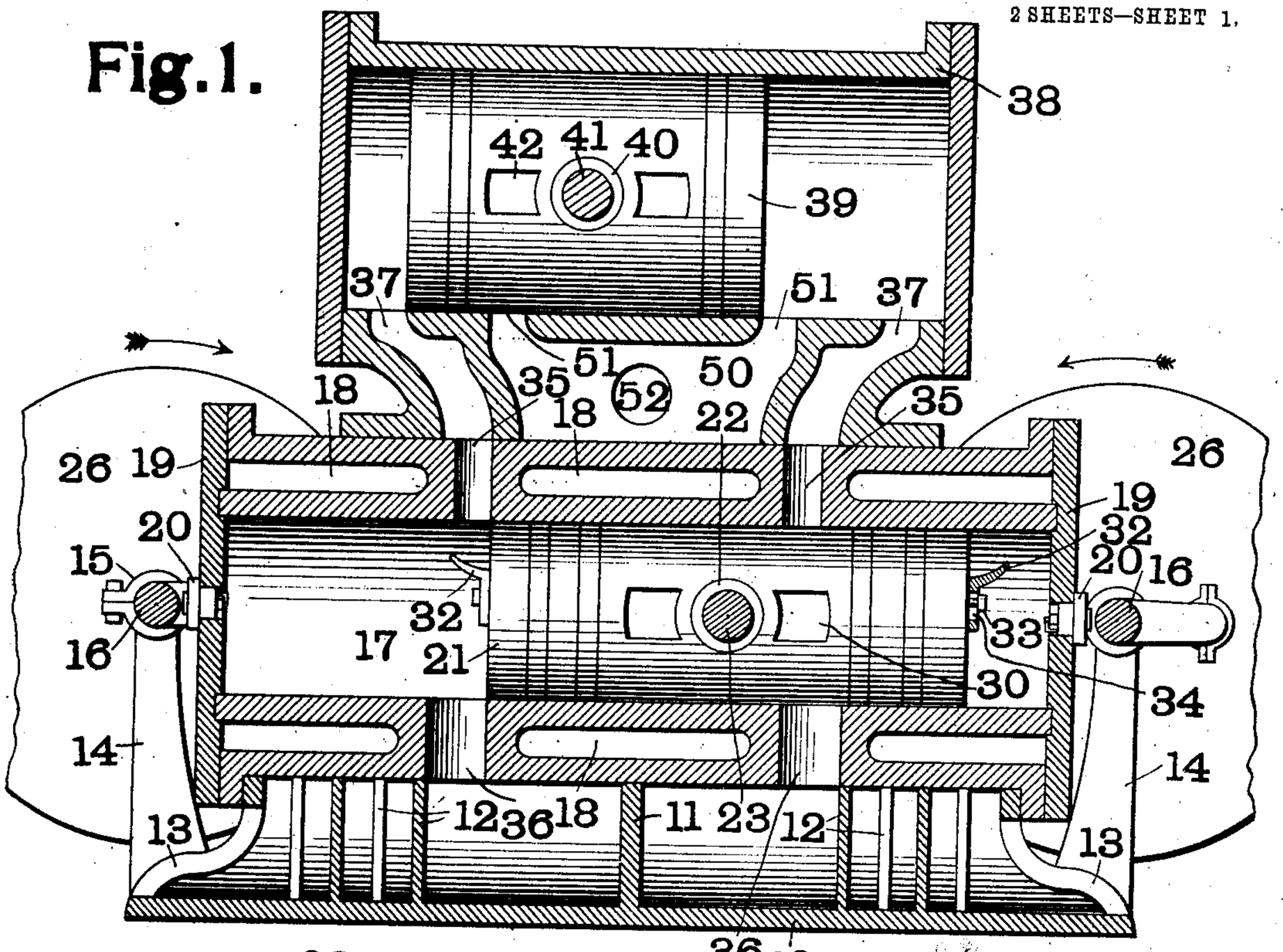
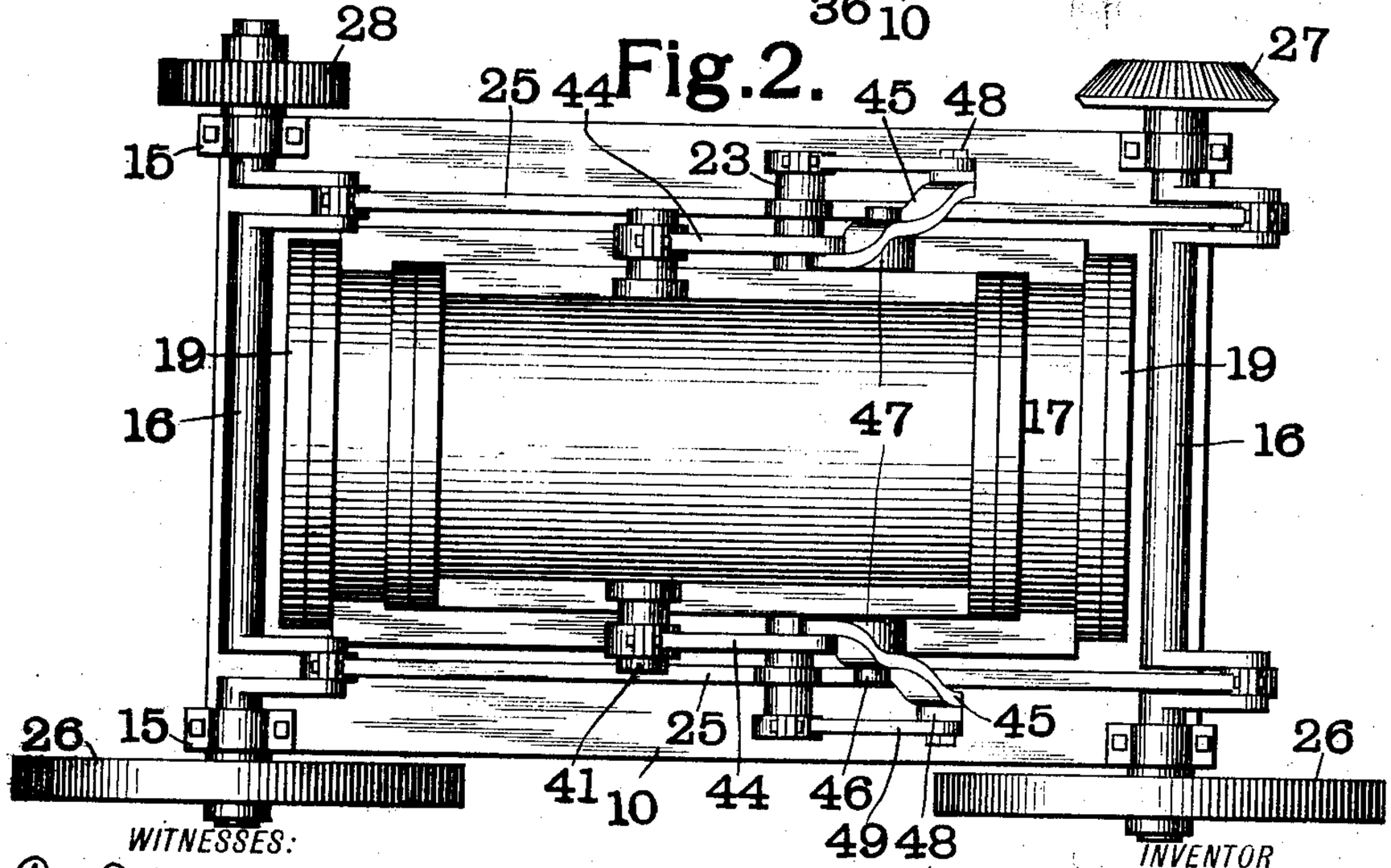


Fig.2.



WITNESSES:

L. L. Mead

W. A. Alexander.

INVENTOR

J. J. Kulage

BY

Fowler & Bryson

ATTORNEYS

J. J. KULAGE.

INTERNAL COMBUSTION ENGINE.

APPLICATION FILED JAN. 30, 1908.

929,769.

Patented Aug. 3, 1909.

2 SHEETS—SHEET 2.

Fig. 3.

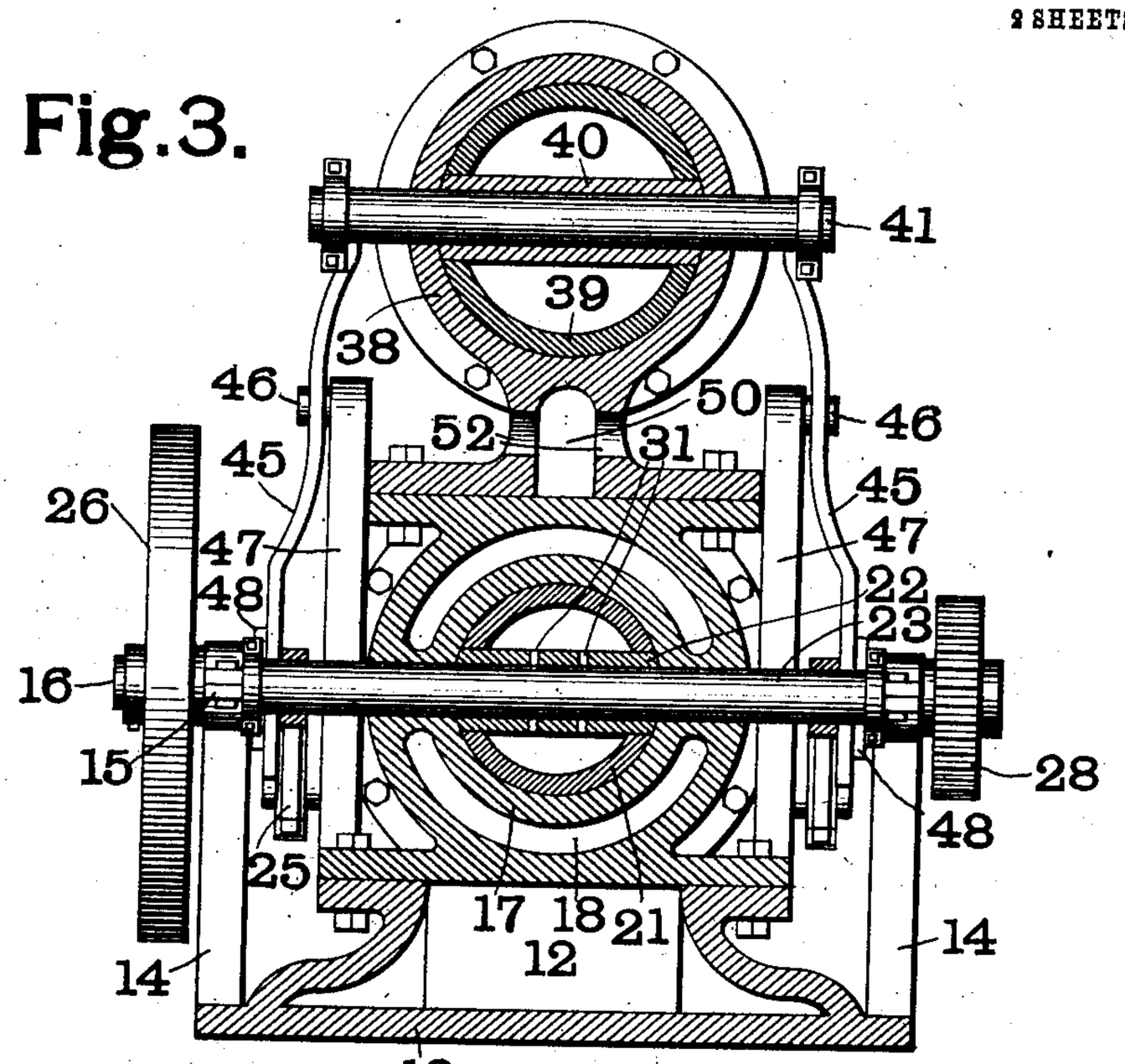
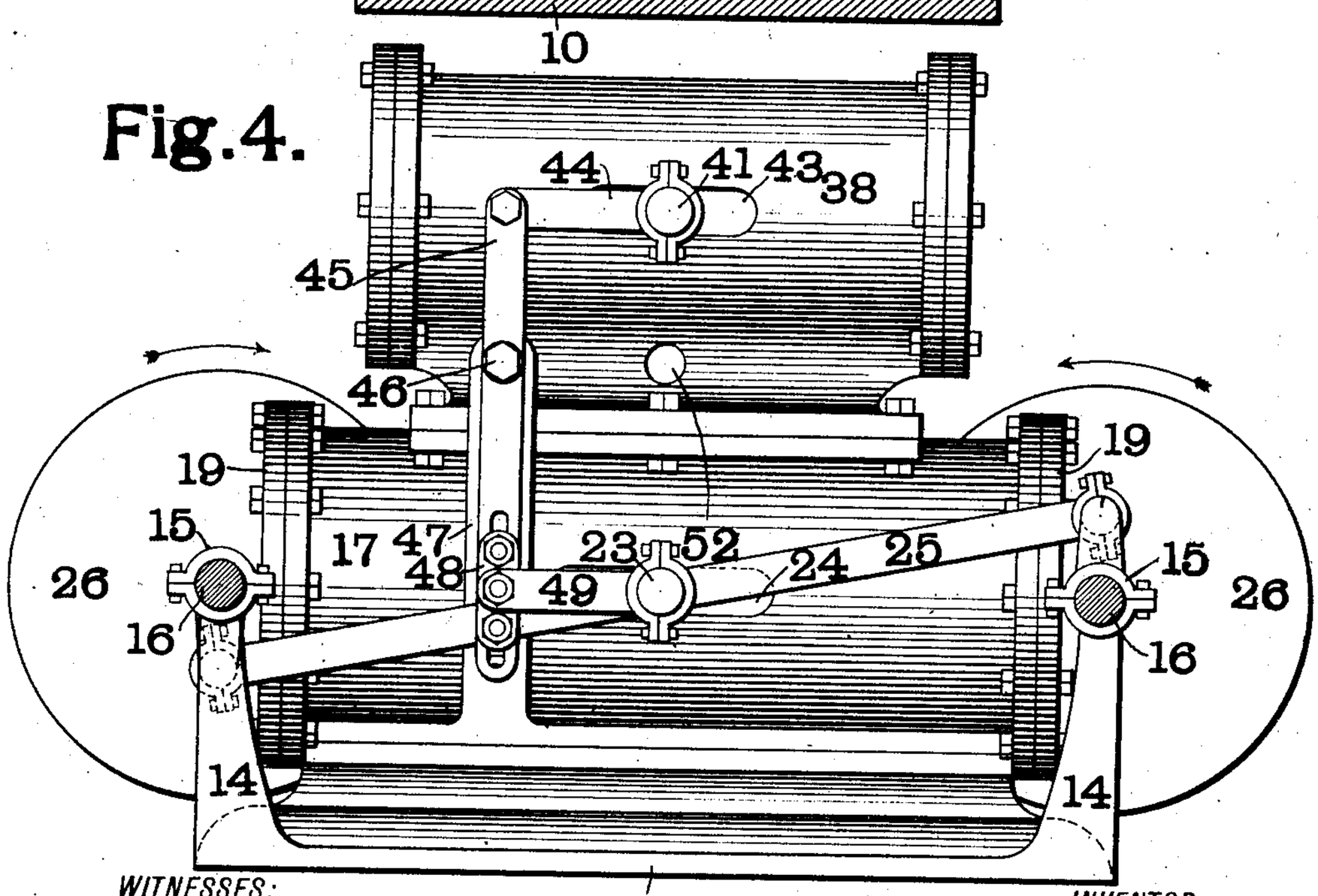


Fig. 4.



WITNESSES:

L. L. Mead.

W. A. Alexander.

INVENTOR

J. J. Kulage

BY

Fowler & Bryson.

ATTORNEYS

UNITED STATES PATENT OFFICE.

JOSEPH J. KULAGE, OF ST. LOUIS, MISSOURI.

INTERNAL-COMBUSTION ENGINE.

No. 929,769. Specification of Letters Patent. Patented Aug. 3, 1909.

Application filed January 30, 1908. Serial No. 413,388.

To all whom it may concern:

Be it known that I, JOSEPH J. KULAGE, a citizen of the United States, residing at St. Louis, in the State of Missouri, have invented a certain new and useful Internal-Combustion Engine, of which the following is such a full, clear, and exact description as will enable any one skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, forming part of this specification.

My invention relates to internal combustion engines, more particularly to that class of internal combustion engines in which the explosive charge is supplied to both ends of the piston, and in which the charge at each end of the piston is exploded at each stroke of the piston.

One object of my invention is to provide an engine of the class above described with a separate compression cylinder, in which the stroke of the piston may be varied relatively to the stroke of the piston in the main or explosion cylinder.

Another object of my invention is to so construct the engine as to dispense with piston rods and stuffing boxes in both the main and the compression cylinders.

Still another object of my invention is to obviate the use of valves in both of the cylinders, causing the pistons themselves to open and close the various ports.

Still another object of my invention is to provide the improved form of connecting rod.

Still another object of my invention is to provide a cylinder, the interior of which will be open to permit inspection and also to give access to the air for cooling, and which will also serve as a receptacle for lubricating material.

Still another object of my invention is to improve the general details of construction of the engine.

In the accompanying drawings which illustrate one form of engine made in accordance with my invention, Figure 1 is a vertical, longitudinal section. Fig. 2 is a top plan view. Fig. 3 is a vertical cross-section, and Fig. 4 is a side elevation.

Like marks of reference refer to similar parts in the several views of the drawings.

10 represents the base plate of the engine. This base plate 10 is hollow and is provided with a central partition 11 and with baffle plates 12, forming a muffler.

13 are the outlets of the muffler, formed at the ends of the base 10.

The base 10 is provided at each end with a pair of uprights 14 on the upper ends of which are bearings 15 for the crank shaft 16. Carried on the base 10 is the main or combustion cylinder 17. This cylinder 17 is surrounded by annular spaces 18, forming a water jacket. The heads 19 of the cylinder 17 are provided with sparking plugs 20 of any suitable construction.

Situated within the cylinder 17 is the main piston 21. This piston 21 is hollow and closed at both ends. Passing through the piston 21 is a sleeve 22 in which is journaled a pivot pin 23. This pivot pin 23 also extends through openings 24 in the sides of the cylinder 17. Rigidly secured to the pivot pin 23 at each side of the cylinder is a single pitman rod 25 which connects said pivot pin with both of the crank shafts 16 hereinbefore referred to. The movement of the piston 21 thus imparts to the crank shafts 16 simultaneous rotation in opposite directions as indicated by the arrows in Figs. 1 and 4. Secured to one end of each of the crank shafts 16 is a disk 26, which acts as a fly-wheel, and to the opposite ends are secured a bevel wheel 27 and a spur-wheel 28, respectively. The piston 21 is also provided at each side with a pair of openings 30 adapted to be alternately brought into register with the slots 24 in the sides of the cylinder 17, thus giving access of air to the interior of the piston for cooling the same and also providing means whereby oil may be introduced into the interior of the piston for cooling and oiling the cylinder and piston and also oiling the pivot pin 23, the sleeve 22 being provided with oil openings 31 for this purpose. The openings in the piston and cylinder also provide means for permitting the inspection of the interior of the piston at all times. To each end of the piston 21 is secured a deflector 32 for a purpose hereinafter more fully to be described. These deflectors 32 are secured in position by means of bolts 33, passing through slots 34 so that the deflectors may be adjusted in a direction across the face of the piston.

The cylinder 17 is provided with a pair of inlet ports 35 and a pair of outlet ports 36,

both of which are adapted to be opened and closed by the movement of the main piston 21. The ports 36 communicate with the muffler formed in the base 10 of the engine and the ports 35 communicate with ports 37 formed in the compression cylinder 38. Situated within the compression cylinder 38 is the compression piston 39. This piston 39 is similar to the piston 21 but is preferably larger in diameter, and has a somewhat shorter stroke. It is provided with a sleeve 40, pivot pin 41 and side openings 42. These side openings 42 are adapted to be brought alternately into alinement with slots 43 in the sides of the cylinder 38. These openings provide means for cooling the interior of the piston and also permit inspection of the interior of the piston at all times. The pin 41 is connected by means of links 44, with a pair of levers 45, pivoted at 46 to uprights 47, carried by the main cylinder 17. The lower ends of these levers 45 are secured by means of adjustable connections 48 to links 49, secured to the pivot pin 23 of the main cylinder. By means of the adjustable connection 48, the stroke of the compression piston 39 may be varied so as to regulate the charge delivered to the main or combustion cylinder. Formed in the lower part of the compression cylinder 38 is a mixing chamber 50, provided with ports 51 opening into the said compression cylinder and with supply ports 52, connected with any suitable fuel supply.

The operation of my engine is as follows: Supposing the parts to be in the position shown in Fig. 1 of the drawings, the right hand end of the main cylinder 17 will contain fuel under compression and ready for ignition, while the left hand end of said cylinder will contain a charge of fuel under atmospheric pressure. When the charge is ignited in the right hand end of the cylinder, the piston will be driven toward the left, thus closing the left hand ports 35 and 36 and compressing the charge for ignition at the next half of the revolution. At the same time the compression piston 39 will be moved toward the right by the connections 44, 45 and 49. This movement of the compression piston toward the right will close the port 51 and compress the charge in the right hand end of the cylinder 38. At the same time a partial vacuum will be formed in the left hand end of the cylinder 38 so that when the left hand port 51 is uncovered fuel will be drawn up through such port from the mixing chamber 50. Slightly before the piston 21 reaches its extreme left hand position, the right hand port 35 will be uncovered, allowing the compressed charge of fuel from the right hand end of the cylinder 38 to enter. The deflecting plate 32 prevents the charge from passing directly through the cylinder, and out at the exhaust 36. In place of this the charge is deflected toward the end of the cylinder, driving out the old charge. The plate 32 is so arranged that it may be adjusted across the face of the piston so as to secure the best results. As has been above described, the amount of movement of the piston 39 may be varied, so as to secure the proper charge.

It will be seen that while my engine is of the simplest possible construction, being provided with neither valves nor stuffing boxes, it secures the maximum amount of efficiency as the piston is double-acting and the charge is ignited at each end of the piston at each stroke. At the same time the connection with the rotating parts of the engine is such as to secure the simultaneous rotation of the two crank shafts in opposite directions, thus preventing vibration and jar of the engine.

Various changes in the form and arrangement of the parts of my engine may be made without departing from the spirit of my invention, and I therefore do not desire to limit myself to the exact construction shown and described except where specifically stated in the claims.

Having fully described my invention, what I claim as new and desire to secure by Letters Patent of the United States is:

1. In an internal combustion engine, the combination with a combustion cylinder, of a piston therein having a lateral projection extending through an opening in the side of said cylinder, a compression cylinder connected with said combustion cylinder by an unobstructed port, a piston in said compression cylinder, and adapted to be operated by the piston in said combustion cylinder, said port being controlled by said first named piston, and means for varying the stroke of said compression piston relatively to the stroke of the piston in said combustion chamber.

2. In an internal combustion engine the combination with a combustion cylinder of a piston therein, a compression cylinder connected with said combustion cylinder by a port, a piston in said compression cylinder, and adjustable connections between said first and second named pistons on each side of said cylinders for imparting a variable movement to the latter relatively to the former.

3. In an internal combustion engine, the combination of a combustion cylinder with lateral openings, with a piston therein, a pivot pin extending through the openings in said cylinder, a compression cylinder connected with said combustion cylinder by ports, a piston in said compression cylinder, lever connections between said pistons on each side of the cylinder, and means for adjusting said connections to vary the stroke of the piston in the said compression cylinder relative to the stroke of the piston in the said combustion cylinder.

4. In an internal combustion engine the combination with a combustion cylinder provided with inlet and outlet ports of a piston in said cylinder adapted to control said ports and a gas deflector, carried by the end of said piston, said deflector being adjustable transversely to the axis of said piston.

In testimony whereof I have hereunto set my hand and affixed my seal in the presence of the two subscribing witnesses.

JOSEPH J. KULAGE. [L. S.]

Witnesses:

W. A. ALEXANDER,

EDITH MAGINN.