R. F. HERPOLSHEIMER.

INTERNAL COMBUSTION ENGINE.

APPLICATION FILED FEB. 7, 1910.

989,972. Patented Apr. 18, 1911.

3 SHEETS—SHEET 1.

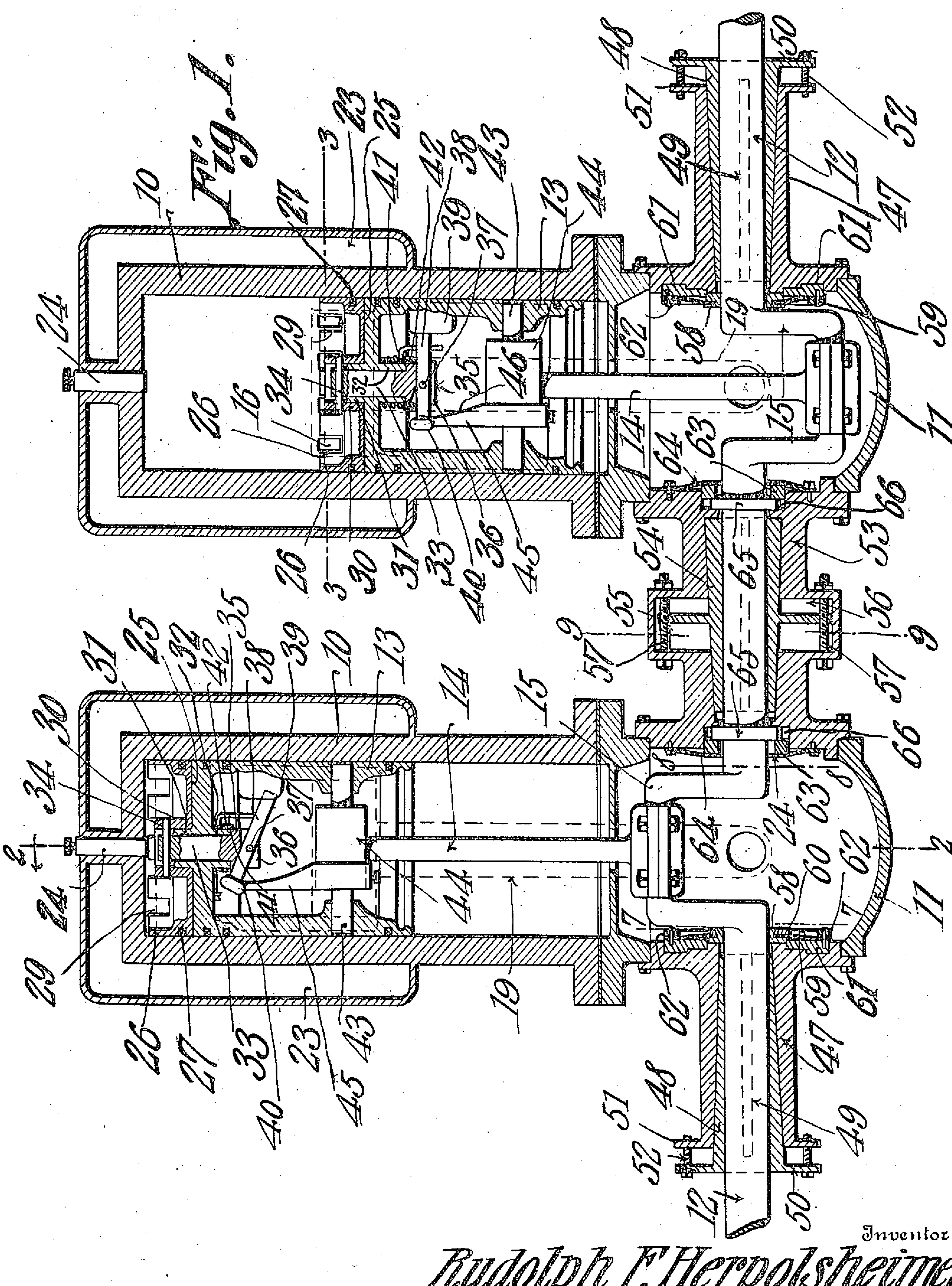

Fig. 1.

Inventor

Rudolph F. Herpolsheimer.

Witnesses

C. A. Stewart

M. A. Schmidt

By C. A. Snow & Co.

Attorneys

989,972.

R. F. HERPOLSHEIMER.

INTERNAL COMBUSTION ENGINE.

APPLICATION FILED FEB. 7, 1910.

Patented Apr. 18, 1911.

3 SHEETS—SHEET 2.

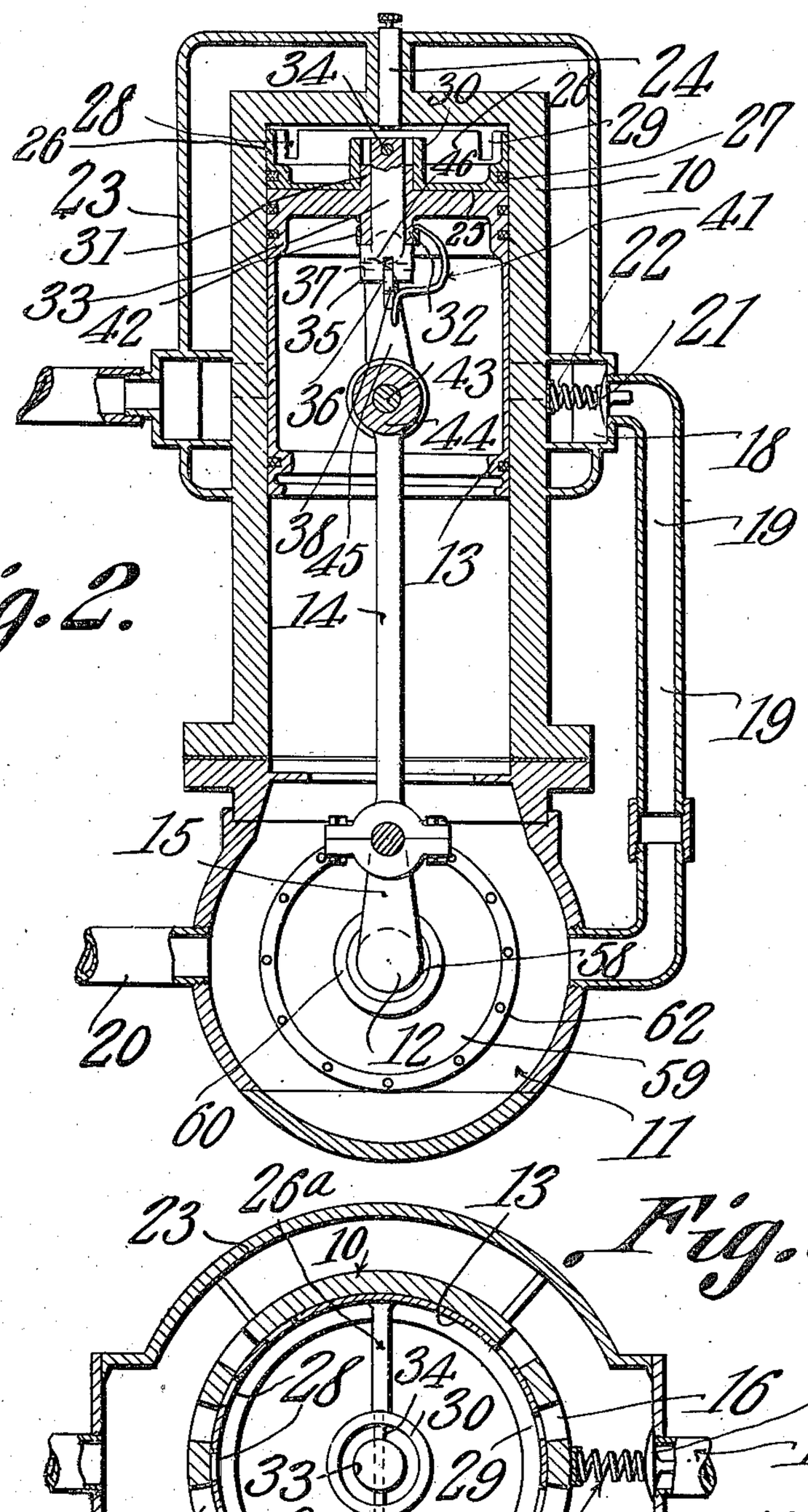

Fig. 2.

Fig. 3.

Witnesses

E. G. Siggert

M. A. Schmieder

Inventor

Rudolph F. Herpolsheimer.

By Church & Co.

Attorneys

989,972.

R. F. HERPOLSHEIMER.

INTERNAL COMBUSTION ENGINE.

APPLICATION FILED FEB. 7, 1910.

Patented Apr. 18, 1911

3 SHEETS—SHEET 3.

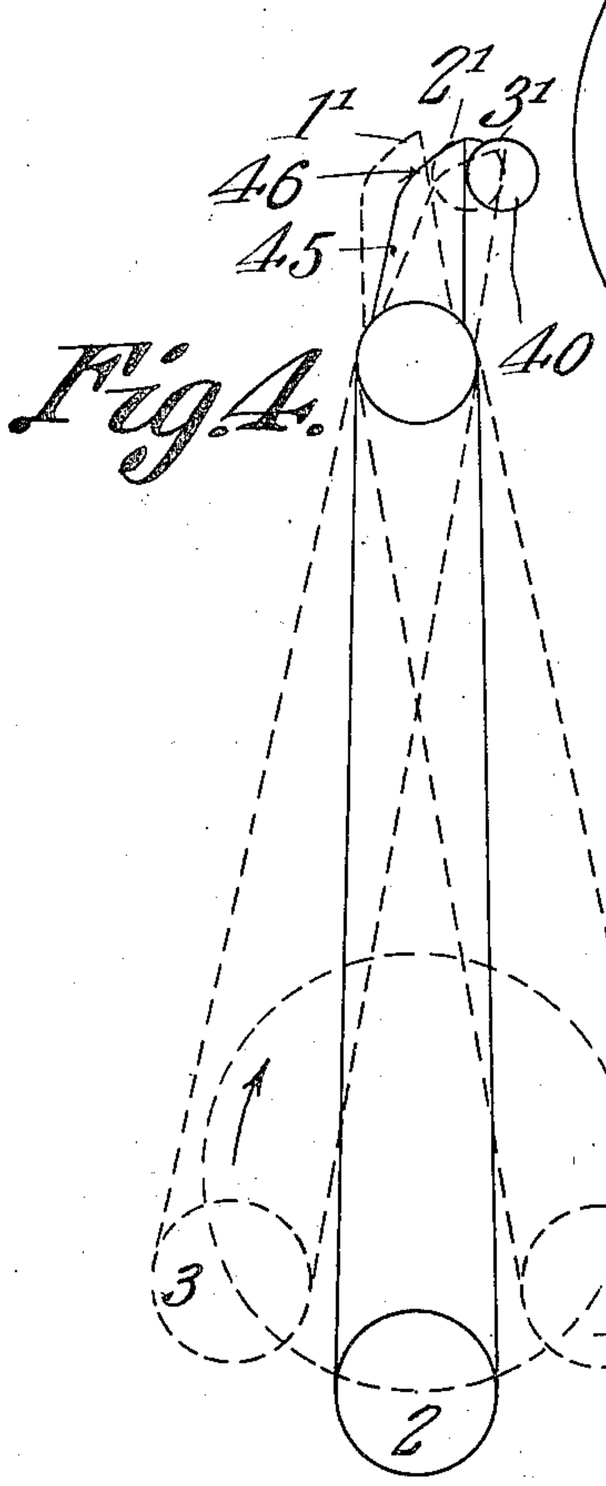

Fig. 4.

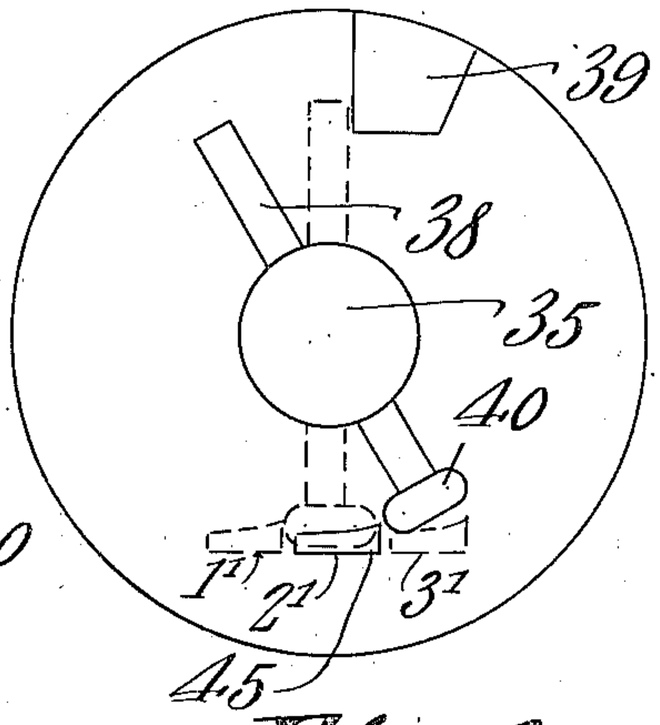

Fig. 6.

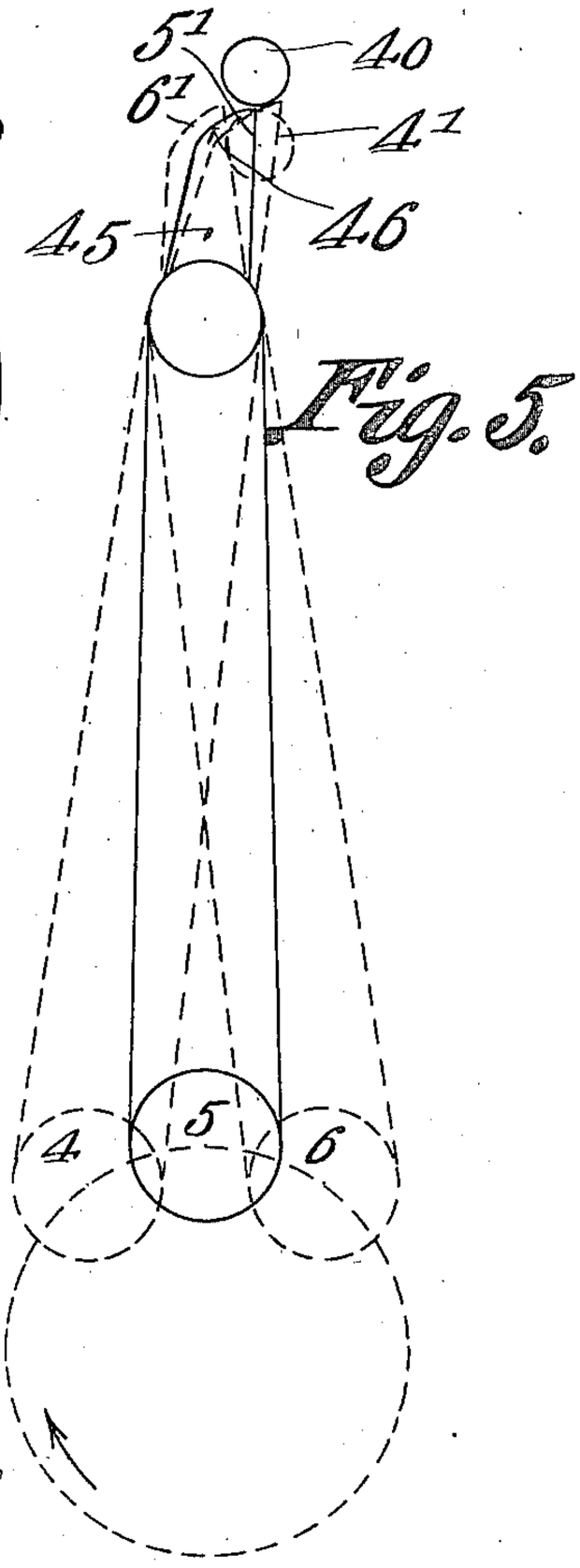

Fig. 5.

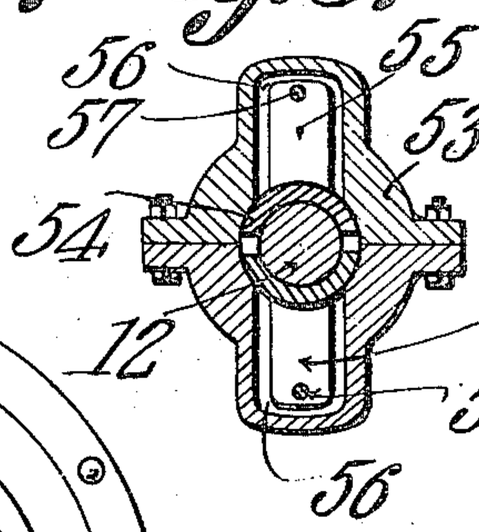

Fig. 9.

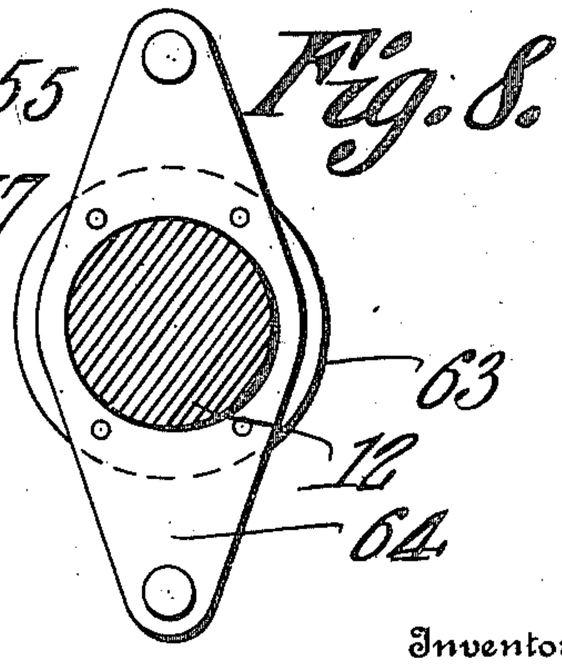

Fig. 8.

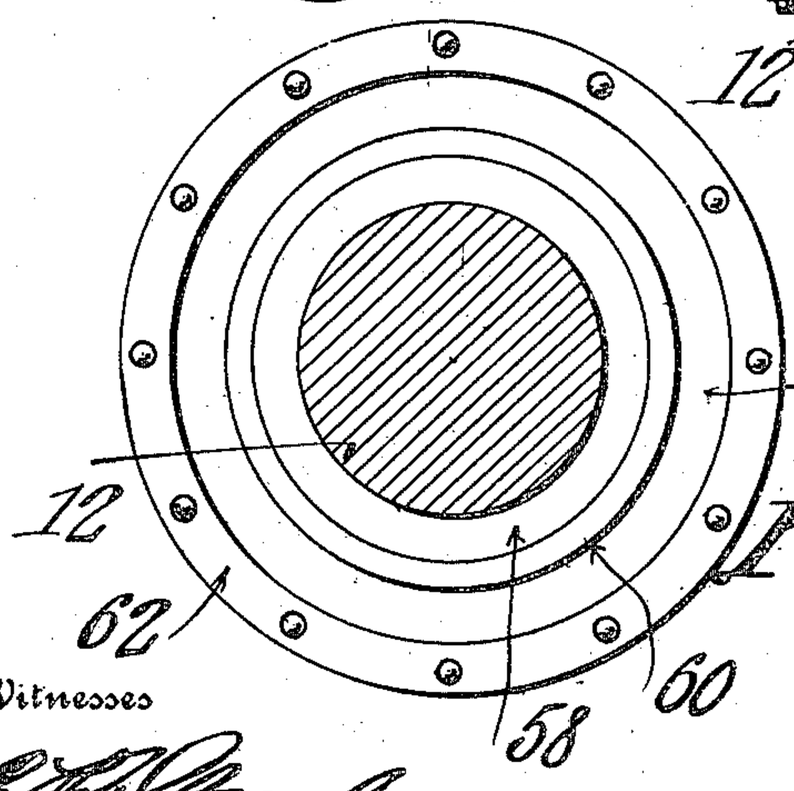

Fig. 7.

Witnesses

E. F. Ellis

M. A. Schorcht

Inventor

Rudolph F. Herpolsheimer.

By Church & Co.

Attorneys

UNITED STATES PATENT OFFICE.

RUDOLPH F. HERPOLSHEIMER, OF LINCOLN, NEBRASKA.

INTERNAL-COMBUSTION ENGINE.

989,972. Specification of Letters Patent. Patented Apr. 18, 1911.

Application filed February 7, 1910. Serial No. 542,560.

To all whom it may concern:

Be it known that I, RUDOLPH F. HERPOLSHEIMER, a citizen of the United States, residing at Lincoln, in the county of Lancaster and State of Nebraska, have invented a new and useful Internal-Combustion Engine, of which the following is a specification.

This invention relates to two-cycle internal combustion engines of the crank case compression type, and it has for its object to provide in an engine of this kind a novel and improved valve mechanism for controlling the intake and the exhaust, a valve mechanism being provided which is so constructed and arranged that the intake is held closed until the end of the exhaust, thereby preventing any portion of the new charge from being swept out by the exhaust, and thus wasted.

With this object in view, the invention consists in a novel construction and arrangement of parts to be hereinafter described and claimed, and in order that the invention may be better understood, reference is had to the accompanying drawings, in which—

Figure 1 is a longitudinal section of the engine. Fig. 2 is a cross section on the line 2—2 of Fig. 1. Fig. 3 is a horizontal section on the line 3—3 of Fig. 1. Figs. 4 to 6 are diagrams illustrating the operation of the valve mechanism. Figs. 7, 8 and 9 are sections on the lines 7—7, 8—8 and 9—9 respectively of Fig. 1, drawn to an enlarged scale.

The drawings disclose a two cylinder engine, the cylinders of which are each denoted by the reference numeral 10. Each cylinder opens into a crank case 11 provided with bearings for supporting the crank shaft 12. The crank cases are separate, leakage from one into the other being prevented by a packing to be presently described.

In each cylinder 10 works a trunk piston 13 connected by a rod 14 to a crank 15 on the shaft 12. Each piston acts as a working piston, as well as a pump piston for supplying a fresh charge to the working end of the cylinder. In ordinary two-cycle engines of the crank case compression type, the inlet and exhaust ports are formed in the cylinder walls, and are controlled by the piston as it reciprocates, the piston covering the ports, and thus closing the same, and uncovering the same to permit the spent charge to exhaust, and the new charge to enter the cylinder at the proper time. This construction is followed in the engine which is the subject of the present invention, and in addition thereto, a novel valve mechanism, to be presently described, is provided.

The intake ports are indicated at 16, and the exhaust ports at 17. The intake ports open into the cylinder, and into a chamber 18 formed in the cylinder wall, and connected by a pipe 19 to the crank case. Each crank case is connected to a suitable charge forming device by a pipe 20 or other means. On that end of the pipe 19 which opens into the chamber 18 is seated a valve 21, which is held to its seat by a spring 22. This valve opens to let the charge into the chamber, and closes to prevent return of the charge into the pipe 19.

Each cylinder 10 is provided with a water jacket 23 as usual, and a suitable device 24 for igniting the charge is also provided.

On the head of each piston 13 is mounted for rotary movement a valve comprising a disk 25 fitting the back of the piston head, and having at its edge an upstanding annular flange 26, dimensioned to fit snugly within the bore of the cylinder, the outer surface of the flange being provided with a packing ring 27. In the edge of the flange are two sets of recesses or ports, indicated at 28 and 29 respectively, located at diametrically opposite points on the flange, the ports 28 being located so as to coöperate with the exhaust ports 17, and the ports 29 with the intake ports 16. At the center of the disk is an opening which is surrounded by an annular flange 30 rising a suitable distance from the disk. Into this opening extends a stud 31 rising from the piston head, at the center thereof, said stud serving as a pivotal axis for the disk. In the stud is an opening which is also continued through the piston head, the inner side of the latter being also formed with a stud 32 in alinement with the stud 31, and the opening also being continued through said stud 32. In this

opening is mounted for rotary movement the stem 33 of the valve disk 25. The stem rises a short distance from the stud 31, and carries above the latter a cross pin 34 passing through the flange 30 whereby the valve disk is connected to the stem so as to rotate therewith.

Within the space inclosed by the flange 26, is a deflector 26ª on one side of which are located the ports 16, and on the other side the ports 17. This deflector is formed by diametrically opposite upstanding flanges extending between the flanges 26 and 30.

Below the stud 32, the valve stem 33 is formed with a head or enlargement 35 having a slot 36 in which is mounted on a transverse pin 37 a lever 38, one end of said lever extending into the plane of a stop projection 39 in the bore of the piston, and the other end of the lever carrying a roller 40. The valve stem 33 is mounted in the center of the piston head, and rotates on an axis coinciding with the piston axis, and the lever 38 swings on a pivot extending transversely to this axis. The depth of the slot 36 is increased at one end, so that the end of the lever which carries the roller may tilt upwardly as shown in Fig. 1.

Around the stud 32 is coiled a spring 41, one end of which is made fast to the piston head, and its other end presses against that end of the lever 38 which is in the plane of the stop 39, for a purpose to be presently described, the spring being a torsion as well as a compression spring.

The outer surface of the head 35 extends flush with the outer surface of the stud 32, and on said parts, between the lever 38 and the spring 41, is slidably mounted a sleeve 42. This sleeve is pushed upwardly and compresses the spring when the lever 38 tilts upwardly as shown in Fig. 1, and when the device which moves the lever to this position clears the same, the spring expands, and through the sleeve swings the lever back to its normal position.

The piston 13 is an ordinary trunk piston, the rod 14 being pivoted thereto by a cross pin 43. On the wrist 44 of the rod is made fast by a set screw, or any other suitable means, a finger 45 extending in the direction of the roller 40 so as to strike the same. The tip of the finger is beveled off on one side as indicated at 46, which is for a purpose to be presently described. When the piston is reciprocating, the wrist 44 has a slight oscillatory movement about the pin 43, which, through the finger 45, and the parts associated therewith, operates to rotate the valve disk 25.

The function of the valve mechanism herein described is to open the exhaust just before the end of the working stroke of the piston, and to close the exhaust at the end of said stroke, and to simultaneously open the intake.

The operation of the mechanism is shown diagrammatically in Figs. 4 to 6. Referring to these figures it will be seen that the tip of the finger 45 swings in an arc having for its center the axis of the pin 43. Assuming the crank shaft to be rotating in the direction of the arrow, the tip of the finger swings toward the right, and describes an arc during the movement of the crank between the last half of the working stroke, and the first half of the return stroke. During the last half of the return stroke, and the first half of the next working stroke, the tip of the finger swings to the left in the same path just taken. The lever 38 is so positioned with respect to the finger that the valve movement takes place during the latter portion of the working stroke, and the first part of the return stroke, as shown in Fig. 4. The ports 28 are normally in the same vertical plane as the exhaust ports 17, so that when the piston on its working stroke brings said ports into registering position, which is near the end of the working stroke, the exhaust takes place. At the same time the finger comes into position behind the roller 40, and during the remainder of the working stroke, when the crank is traveling from the points 1 to 2, the finger swings from 1′ to 2′, and pushes the lever to one side. This rotates the valve stem 33 and the valve disk 25 as the latter is made fast to the valve stem. The width of the ports is such that when the crank arrives at the position 2, and the lever has been swung to the position 2′, the exhaust ports are closed, and the inlet ports are open. The crank now moves to the position 3 and the finger to 3′, whereupon the latter clears the roller 40, as shown in Fig. 6, and the spring 41 swings the lever back against the stop 39, and restores the disk 25 to its normal position with the ports 28 in the same vertical plane as the ports 17. In order to facilitate the release of the finger from the roller, the former is beveled on its side which faces the end of the roller as shown in Fig. 6. At the latter portion of the return stroke, and the first portion of the next working stroke, when the crank is moving from 4 to 6, (Fig. 5) the finger swings in the arc 4′, 5′, 6′, but in a direction opposite the one taken in describing the arc 1′, 2′, 3′. The swing of the finger is therefore in a direction to present its beveled portion to the roller, whereby the lever 38 is tilted as shown in Fig. 1 (left hand cylinder) and in Fig. 5, and the finger thus clears the roller, in order that it may assume the position 1′ at the latter portion of the working stroke, whereupon the cycle of operation is repeated.

It will be evident from the foregoing that

no valve movement takes place except when the crank is moving between the points 1 and 3, and the operation of the valve is therefore properly timed.

The outer ends of the crank cases 11 are formed with hubs 47 for supporting the shaft 12. In each hub is mounted a boxing 48 which is machined so as to nicely fit the shaft, and said boxing is also machined on the outside to a taper, the bore of the hub being tapered accordingly. The boxing is formed with a slot 49 extending throughout a greater portion of its length, and the widest portion of the boxing projects a short distance from the hub 47, and is then formed with an outstanding flange 50 located opposite an outstanding flange 51 formed on the outer end of the hub. Cap screws 52 are threaded through these flanges, and upon tightening up said screws, the bushing is adjusted to take up wear, its tapered shape causing it to tightly embrace the shaft as it is pushed farther into the bore of the hub.

Between the two crank cases 11 is a center bearing 53 for supporting that portion of the shaft which extends between the crank cases. This bearing is made in two parts so that it may be positioned on the shaft, and the ends of the bearing are shaped to form the inner end walls of the crank cases. The bore of the bearing contains a bushing 54 which is tapered, and is formed in two parts so that it may be slipped over the shaft. The bushing is formed with an outstanding flange 55 intermediate its ends, which flange extends into a recess 56 made in the bearing. In the walls of this recess are mounted non-traveling screws 57 which are threaded through the flange 55, these screws being provided for adjusting the boxing on the shaft to take up wear.

In order to prevent leakage of the charge from the crank cases 11, the following packing is provided: 58 denotes a ring which is driven on the shaft 12 so as to rotate therewith. A portion of this ring is machined out on one side so as to leave a shoulder, the ring being machined out deeper in the center than at the outer edge. To this ring is fastened a disk 59 of thin spring metal, said disk being slightly dished. The disk is placed on the ring against the shoulder, and then a ring 60 is heated and shrunk on the ring 58 in the machined out portion thereof, so that the disk 59 will be securely held between the ring 60 and the shoulder of the ring 58. A ring 61 is machined so that it will fit over the ring 58, and a ring 62 is machined so that its outside diameter will be the same as the ring 61. The ring 61 is then placed on one side of the disk 59, and the ring 62 on the other side, and the two rings are then drawn together by rivets or screws, whereby the ring 61 is securely fastened to the disk 59. The ring 61 is machined to fit the inner surface of the end wall of the crank case, said wall having an annular groove into which the ring extends at a snug fit, and in which it is held by the resiliency of the disk 59. This packing makes a fluid tight joint, and thus prevents the escape of the charge from the crank case. The center bearing is also provided with a packing in order to prevent the escape of the charge from one crank case into the other. This packing comprises a ring 63, and a spring 64 for pressing the ring against a collar 65 formed on the shaft 12. The inner diameter of the ring is such that it can be slipped over the bends of the crank shaft. The collar 65 is engaged on one side by the ring 63, and this side, and the contiguous side of the ring, are machined so that a tight fit is had.

The spring 64 is a thin strip of spring metal having an opening through which the shaft passes, and made fast at its ends to the end wall of the crank case. The said wall is also formed with a recess 66 which is entered by the collar 65, and the ring 63 also fits snugly in this recess. By this packing the charge is most effectually prevented from escaping though the center bearing from one crank case into the other.

What is claimed is:

1. In an internal combustion engine, a cylinder having intake and exhaust ports in its side, a piston working in the cylinder, a crank shaft, a rod connecting the piston to the crank shaft, said rod being pivotally connected to the piston, a rotary valve carried by the piston, said valve rotating on an axis parallel to the piston axis, and controlling the intake and exhaust ports, a rocking member carried by the piston rod, and means connected to the valve, and engageable by the rocking member for operating the valve.

2. In an internal combustion engine, a cylinder having intake and exhaust ports in its side, a piston working in the cylinder, a crank shaft, a rod connecting the piston to the crank shaft, said rod being pivotally connected to the piston, a rotary valve carried by the piston, said valve rotating on an axis parallel to the piston axis, and controlling the intake and exhaust ports, and means on the piston rod for operating the valve.

3. In an internal combustion engine, a cylinder having intake and exhaust ports in its side, a piston working in the cylinder, a crank shaft, a rod connecting the piston to the crank shaft, said rod being pivotally connected to the piston, a rotary valve mounted on the piston, and controlling the intake and exhaust ports, a stem connected to the valve, a lever carried by the stem, and a finger connected to the piston rod, and

engageable with the lever for rotating the valve stem to actuate the valve.

4. In an internal combustion engine, a cylinder having intake and exhaust ports in its side, a piston working in the cylinder, a crank shaft, a rod connecting the piston to the crank shaft, said rod being pivotally connected to the piston, a stem connected to the valve, and mounted for rotary movement on the piston, the axis of the stem coinciding with the axis of the piston, a lever carried by the stem, and extending transversely of the piston axis, and a finger connected to the piston rod, and engageable with the lever for rotating the valve stem to actuate the valve.

5. In an internal combustion engine, a cylinder having intake and exhaust ports in its side, a piston working in the cylinder, a rotary valve mounted on the piston, and controlling the intake and exhaust ports, a stem connected to the valve, a lever carried by the stem, and a rocking member carried by the piston, and engageable with the lever for rotating the stem to actuate the valve.

6. In an internal combustion engine, a cylinder having intake and exhaust ports in its side, a piston working in the cylinder, a rotary valve mounted on the piston, and controlling the intake and exhaust ports, a stem connected to the valve, a lever carried by the stem, a stop on the piston engageable by the lever for limiting the rotary movement of the valve stem in one direction, yielding means for holding the lever against the stop, and a rocking member carried by the piston for swinging the lever away from the stop to rotate the stem and actuate the valve.

7. In an internal combustion engine, a cylinder having intake and exhaust ports in its side, a piston working in the cylinder, a rotary valve mounted on the piston, and controlling the intake and exhaust ports, a stem connected to the valve, a lever pivoted on the stem, and a rocking member carried by the piston, and engageable with the lever for rotating the stem to actuate the valve, said rocking member being shaped to swing the lever on its pivot and clear the same when rocking in one direction.

8. In an internal combustion engine, a cylinder having intake and exhaust ports in its side, a piston working in the cylinder, a rotary valve mounted on the piston and controlling the intake and exhaust ports, a stem connected to the valve, a lever pivoted on the stem, and extending transversely thereof, and a rocking member carried by the piston and engageable with the lever for rotating the stem to actuate the valve, said rocking member being shaped to swing the lever on its pivot and clear the same when rocking in one direction.

9. In an internal combustion engine, a cylinder having intake and exhaust ports in its side, a piston working in the cylinder, a rotary valve mounted on the piston, and controlling the intake and exhaust ports, a stem connected to the valve, a lever pivoted on the stem, and extending transversely thereof, and a rocking finger carried by the piston, and engageable with the lever for rotating the stem to actuate the valve, one side of the finger being beveled, to swing the lever on its pivot upon engaging the same.

10. In an internal combustion engine, a cylinder having intake and exhaust ports in its side, a piston working in the cylinder, studs on opposite sides of the piston head, said studs and piston head having an opening, a valve carried by the piston, and rotatably mounted on one of the studs, a stem connected to the valve, and mounted in the opening, said stem projecting from the other stud, a lever pivoted to the projecting end of the stem, and extending transversely thereof, and a rocking member carried by the piston, and engageable with the lever for rotating the stem to actuate the valve.

11. In an internal combustion engine, a cylinder having intake and exhaust ports in its side, a piston working in the cylinder, studs on opposite sides of the piston head, said piston head and studs having an opening, a valve carried by the piston, and rotatable on one of the studs, a stem connected to the valve, and mounted in the opening, said stem projecting from the other stud, a lever pivoted on the projecting end of the stem, and extending transversely thereof, a sleeve slidably mounted on the last-mentioned stud, and engageable with the lever, a spring coiled around the stud between the sleeve and the piston head, and a rocking member carried by the piston and engageable with the lever for rotating the stem to actuate the valve, said rocking member being shaped to swing the lever on its pivot and clear the same when rocking in one direction.

12. In an internal combustion engine, a cylinder having intake and exhaust ports in its side, a piston working in the cylinder, a rotary valve mounted on the piston, and controlling the intake and exhaust ports, studs on opposite sides of the piston head, said piston head and studs having an opening, and the valve being mounted on one of the studs, a stem connected to the valve, and mounted in the opening, said stem projecting from the other stud, a lever carried by the projecting end of the stem, and extending transversely thereof, a stop on the piston engageable by the lever for limiting the rotary movement of the valve stem in one direction, a sleeve slidably mounted on the last-mentioned stud, and engageable with the lever, a spring coiled around the said

stud between the sleeve and the piston head, and connected to one end of the lever for swinging the same in the direction of the stop, and a rocking member carried by the piston, and engageable with the lever for rotating the stem to actuate the valve.

In testimony that I claim the foregoing as my own, I have hereto affixed my signature in the presence of two witnesses.

RUDOLPH F. HERPOLSHEIMER.

Witnesses:
HENRY F. PETERS,
G. T. KINNE.