U. S. TRAUB.

INTERNAL COMBUSTION ENGINE.

APPLICATION FILED MAR. 2, 1910.

990,082.

Patented Apr. 18, 1911.

3 SHEETS—SHEET 1.

Fig. 1

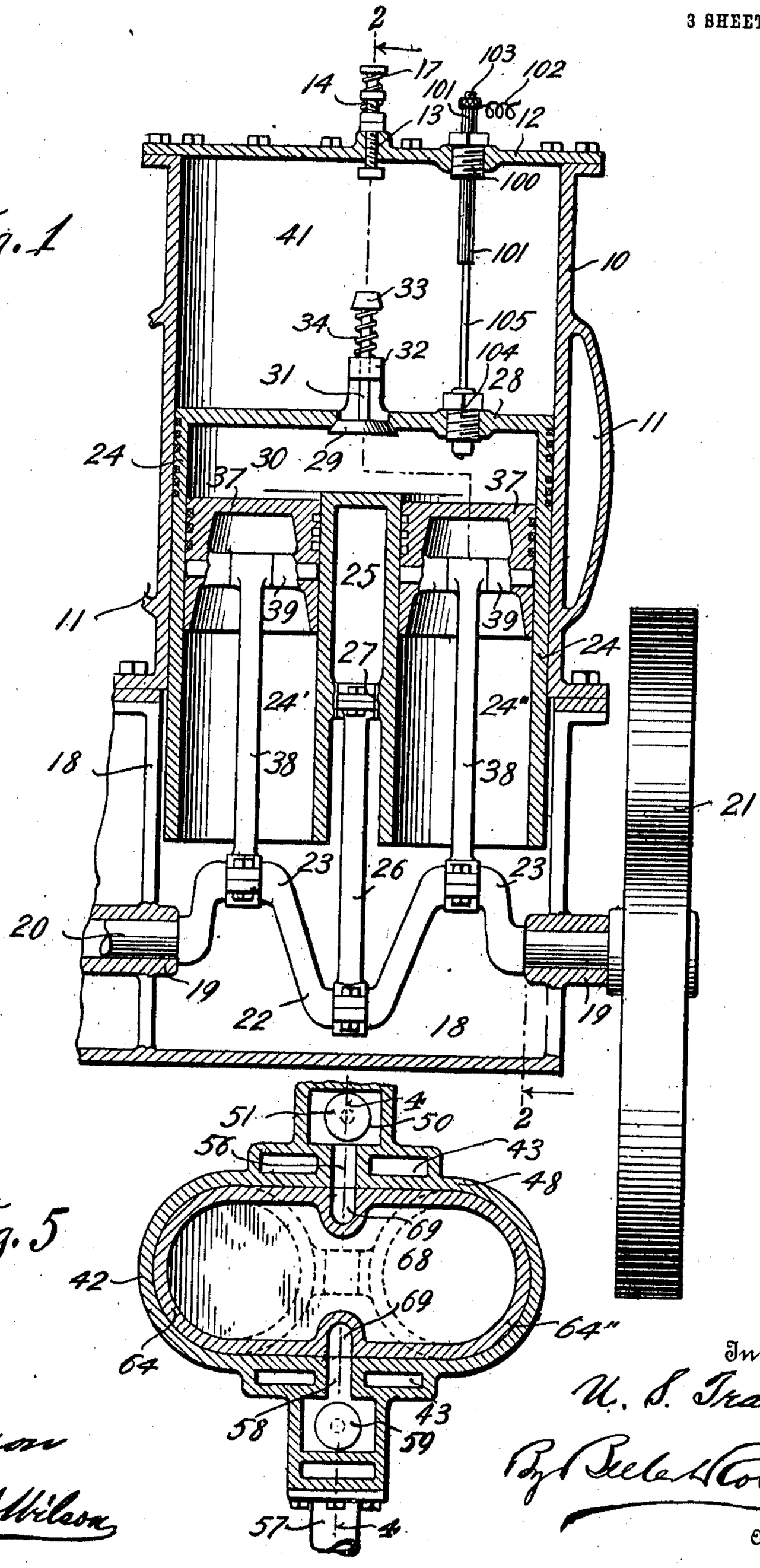

Fig. 5

Witnesses

E. Larson

Charles S. Wilson

Inventor

U. S. Traub,

By Peele & Cobb

Attorneys

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3 SHEETS—SHEET 2.

Fig. 2

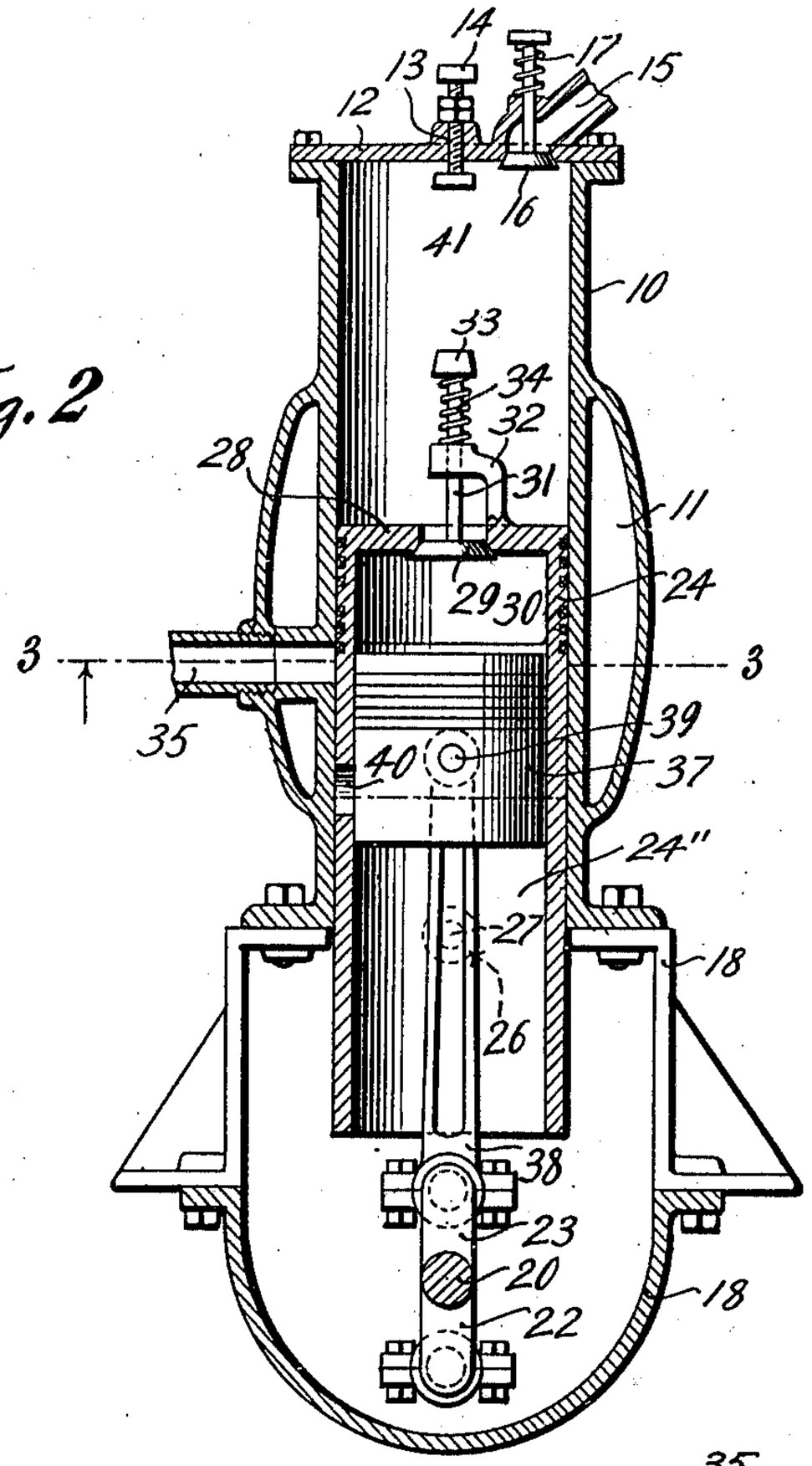
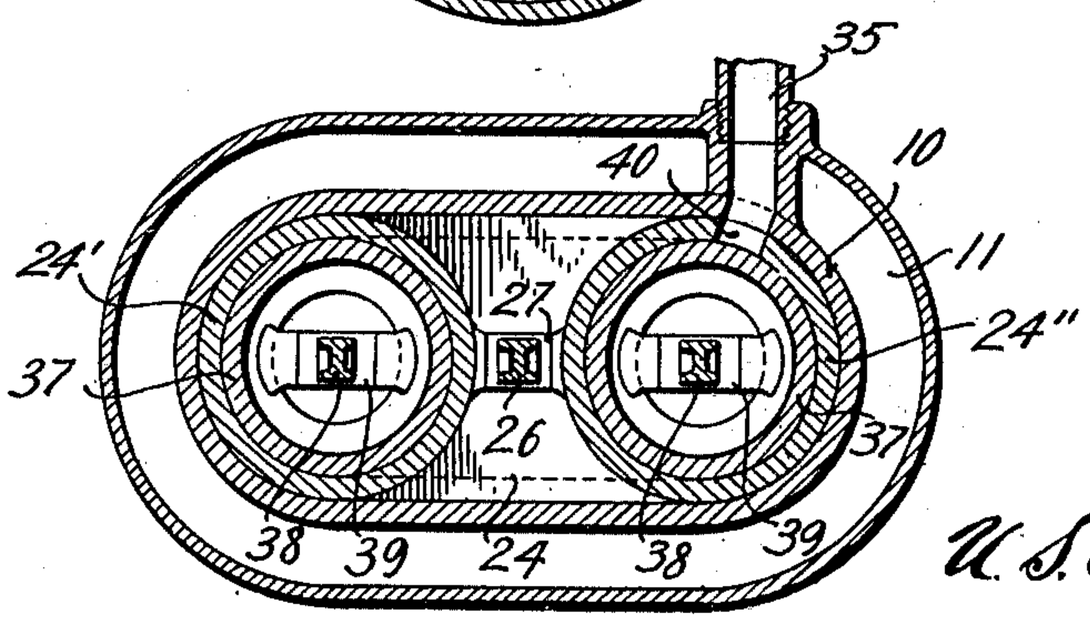


Fig. 3



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E. Larson

Charles S. Wilson

Inventor

U. S. Traub,

By Beeler & Cobb

Attorneys

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3 SHEETS—SHEET 3.

Fig. 4

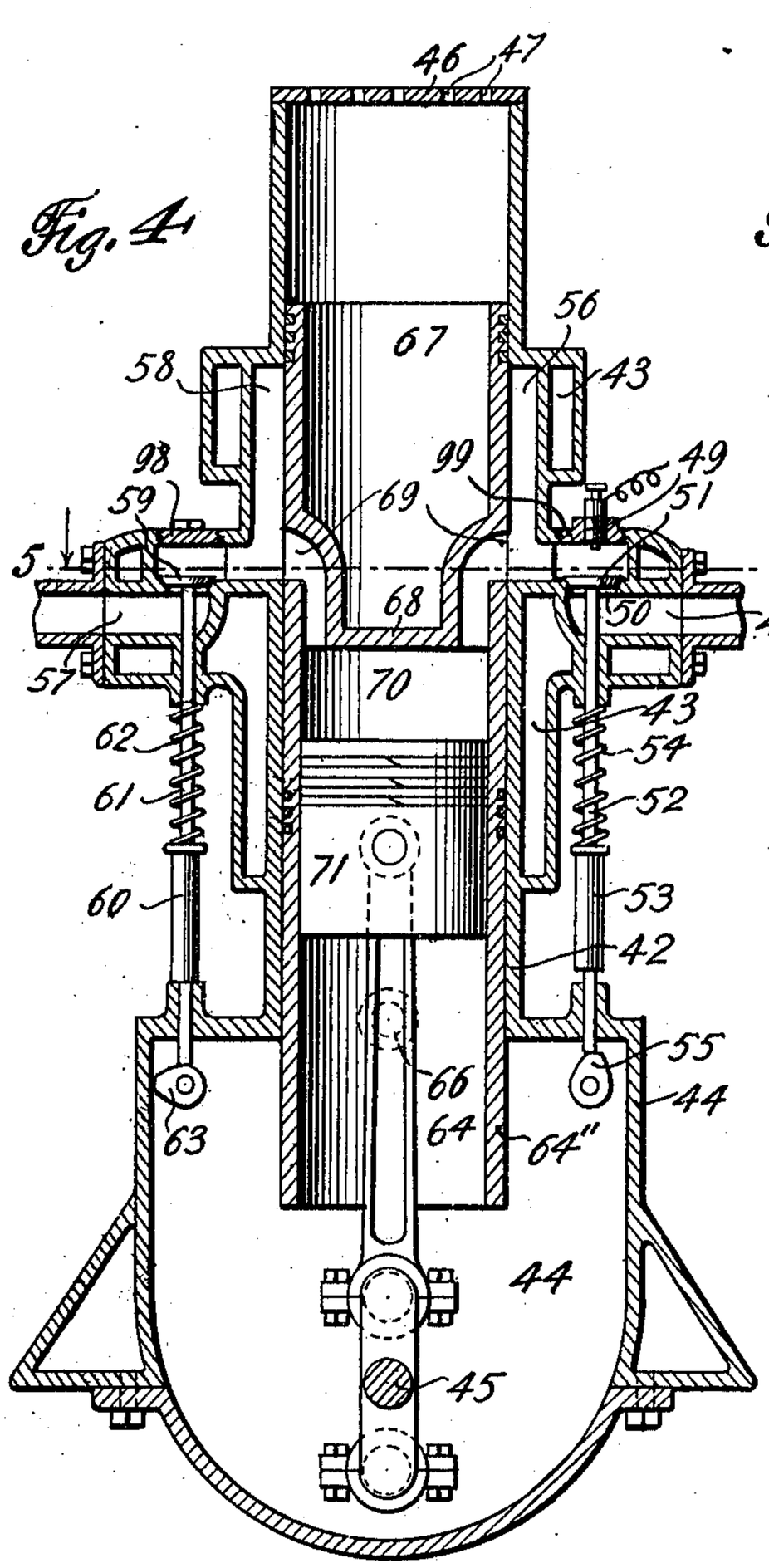


Fig. 7

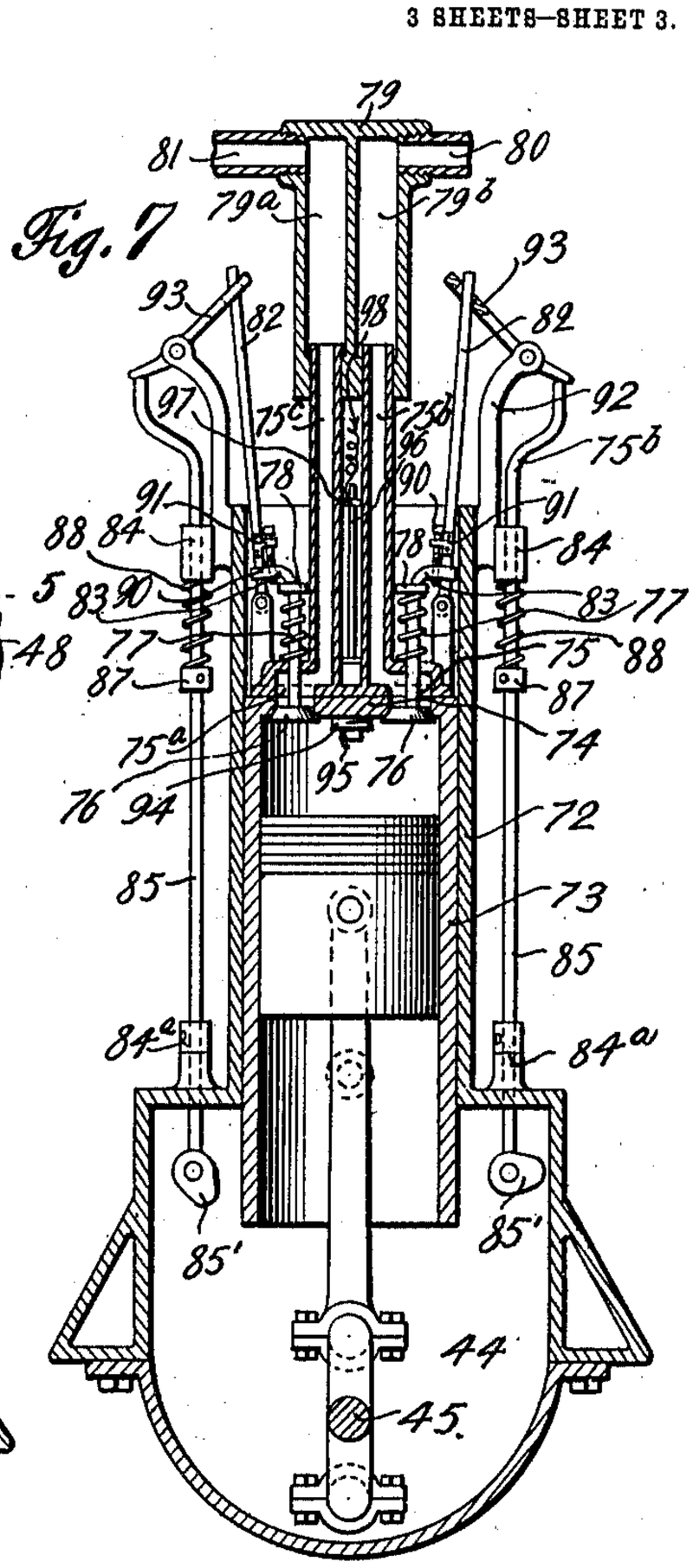
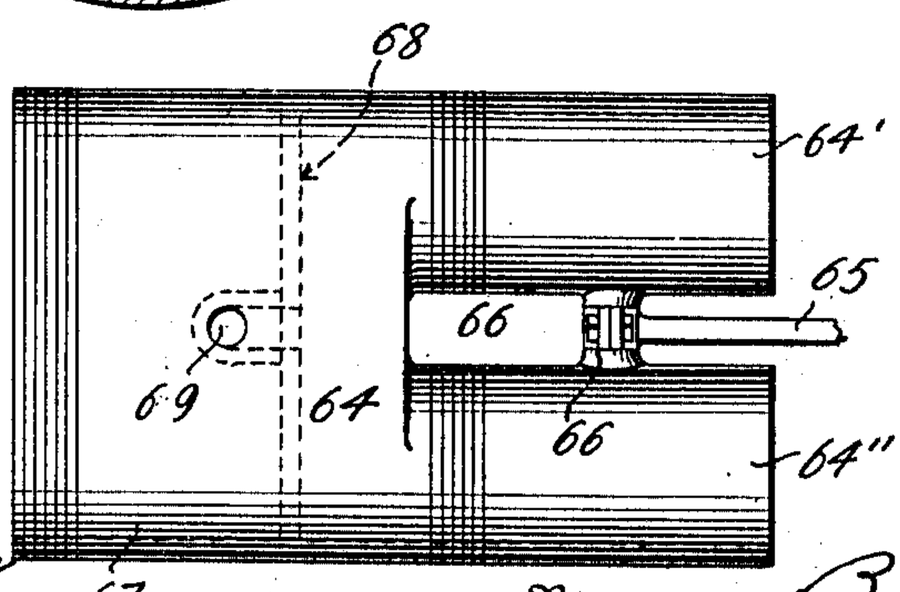


Fig. 6



Witnesses

E. Larson

Charles S. Wilson

Inventor

U. S. Traub,

By Beebe & Cobb

Attorneys

UNITED STATES PATENT OFFICE.

URAL STILWELL TRAUB, OF YONKERS, NEW YORK.

INTERNAL-COMBUSTION ENGINE.

990,082. Specification of Letters Patent. Patented Apr. 18, 1911.

Application filed March 2, 1910. Serial No. 546,938.

To all whom it may concern:

Be it known that I, URAL STILWELL TRAUB, a citizen of the United States, residing at Yonkers, in the county of Westchester and State of New York, have invented certain new and useful Improvements in Internal-Combustion Engines, of which the following is a specification.

This invention relates to internal combustion engines and is designed to construct an engine of this type that will be provided with three pistons, two of which are contained in the third, said pistons operating in opposite directions exerting an equal force in each direction on the crank shaft. The present invention also contemplates an engine of this type and character that will be adaptable to two and four cycle engines, providing a compression chamber for said two cycle type.

With the above and other objects in view, this invention consists of the construction, combination and arrangement of parts all as hereinafter more fully described, claimed and illustrated in the accompanying drawings, wherein:

Figure 1 is a central vertical section of a two cycle engine constructed in accordance with the present invention; Fig. 2 is a section taken along broken line 2—2 of Fig. 1; Fig. 3 is a transverse section taken along line 3—3 of Fig. 2; Fig. 4 is a central vertical section of a four cycle engine constructed in accordance with the present invention illustrating one of the inner pistons; Fig. 5 is a transverse section taken along line 5—5 of Fig. 4; Fig. 6 is an elevation of the outer piston; Fig. 7 is a central vertical section of a four cycle engine taken similar to Fig. 4 illustrating a modification of the exhaust and inlet openings.

Reference being had to the drawings and particularly to Figs. 1, 2, and 3, 10 indicates a cylinder of elliptical or oval construction provided with the water jacket 11 about the portion thereof in which the explosion occurs. The head 12 of the cylinder is secured thereto in the usual manner and is provided with a centrally disposed threaded opening 13. A vertically adjustable set screw 14 operates in the opening 13 and provides a means whereby the opening of the inlet valve may be governed. Adjacent the set screw 14 is the supply pipe and opening 15 which connects the engine to the carbureter. The opening into the cylinder is provided with a valve 16 held in a closed position by the tension coil 17, said coil being of sufficient strength to retain the valve closed against all ordinary pressure. The cylinder 10 is also provided on one side thereof with an exhaust port 35 extending through the water jacket 11. At the lower extremity of the cylinder is attached the crank shaft casing 18, said casing being of any desired construction and provided with suitable bearings 19 for the crank shaft 20. A fly-wheel 21 is carried in the ordinary manner at one extremity of the crank shaft. The crank shaft 20 is provided with the centrally disposed crank 22 which is flanked by the cranks 23, said cranks being oppositely disposed to the crank 22 and adapted to operate in the opposite direction thereto. An outer piston 24 reciprocates in the cylinder 10 and is so constructed that the same forms approximately two cylinders connected at the base thereof. The outer piston 24 conforms with the contour of the cylinder and has the space 25 formed between the cylinders 24′ and 24″, said cylinders acting as a single cylinder. The piston 24 is connected to the central crank 22 by the piston rod 26 secured to said piston by the wrist pin 27 located transversely in the space 25 between the cylinders 24′ and 24″. Located in the piston head 28 is the inlet valve 29 of the explosion chamber 30. This valve is operated by the valve rod 31 operating in the bracket 32, said valve rod being provided with the head 33 against which operates the spring 34 bearing between said head and bracket 32, normally retaining the valve closed. The head 33 of the valve rod 31 is adapted to cooperate with the base portion of the set screw 13 and be opened at predetermined intervals thereby, permitting the gas to be admitted into the explosion chamber 30. A pair of pistons 37 operate in the cylinders 24′ and 24″ of the piston 24 and form in combination with the head 28 of said piston, the explosion chamber 30. These pistons are connected by the piston rods 38 to the extreme cranks 23 of the crank shaft, said piston rods 38 being connected to the pistons by the wrist pins 39. From this construction it will be seen that upon exploding gases within the chamber 30, the pistons 37 will be forced downwardly while the piston 24 operates upwardly in an opposite direction to

that of the pistons 37, consequently exerting a pull on the crank shaft while the inner pistons 37 exert a push.

In operation the pistons are located as set forth in Figs. 1 and 2 immediately before the explosion occurs in the chamber 30. When said explosion takes place, the outer piston will be forced upwardly and the inner pistons downwardly as heretofore described, the burning gases being exhausted when the exhaust opening 40 in the side of the piston 24 registers with the exhaust port 35. After the exhaust is completed the piston continues upwardly until the head 33 of the valve rod comes in contact with the screw 13 which causes the valve 29 to be opened, and the gases partially compressed in the chamber 41 between the heads 28 and 12 of the piston and cylinder respectively to be admitted to the explosion chamber 30 where they are compressed upon the return stroke of the piston. This leaves the chamber 41 a partial vacuum, and consequently exerts a suction on the valve 16, which opens said valve and fills the chamber 41, that is, until the pressure of the gases in the chamber 41 balances the force exerted by the incoming gases and permits the spring 17 to close the valve 16. On the next explosion occurring in the chamber 30, the operation is repeated, thus making the chamber 41 a partial compression chamber.

Referring now to the four cycle engine set forth in Fig. 4, 42 indicates a cylinder constructed similarly to the cylinder 10 of the two cycle engine, being provided with a central water jacket 43 and a casing 44 at the base thereof in which operates the crank shaft 45, said crank shaft being exactly similar to that used in the two cycle engine. The cylinder head comprises a plate 46 provided with apertures 47. Located to one side of the cylinder 42 is the inlet port 48, said inlet port extending angularly through the water jacket 43. In the upper side of the inlet port adjacent the cylinder is the spark plug 49, said spark plug being of any suitable construction and design and mounted in a removable plate 99. Located directly below the spark plug and in a bend in the port is an opening 50 through which all gases must pass in order to enter the cylinder. This opening 50 is provided with a valve 51 operating on the valve rod 52, said valve rod having rigidly secured thereon the collar 53. Access is had to this valve through the instrumentality of the removable plate 99 carrying the spark plug 49. A spring 54 exerts a pressure between the sides of the inlet port 48 and the collar 53 in such a manner that the valve 51 is normally retained closed. The lower extremity of the valve rod 52 extends through the casing 44 and is located adjacent a cam 55 which is rotated by any desirable means, raising the valve rod at predetermined intervals against the pressure of the spring 54. The side of the cylinder, adjacent the inlet port 48, is provided with an elongated upwardly extending outward depression 56, said opening adapted to coöperate with the inlet port of the piston. Oppositely disposed to the inlet port 48 is the exhaust port 57 constructed exactly similar to the inlet port 48, and is provided with an elongated upwardly extending outward depression 58 which corresponds with a similar depression adjacent the inlet port. A valve 59 operates in the exhaust port 57 and is provided with the collar 60 on the valve rod 61 thereof against which operates the spring 62. The lower extremity of the valve rod 61 operates adjacent the cam 63, which is so located on the shaft thereof that the valve rod is raised opening the valve 59 at predetermined intervals with respect to the opening of the inlet valve 51, that is, the exhaust valve remains closed during the entire time the inlet valve remains open, while the inlet valve is open during the portion of the period said exhaust valve is closed, both valves being closed during a portion of the operation. The outer piston 64 is constructed somewhat similar to the outer piston of the two cycle engine with the exception of the upper extremity thereof, the connecting rod 65 being pivoted by the wrist pins 66 between the cylinders 64′ and 64″ of the piston 64. The upper extremity of the piston comprises approximately the hollow guide 67 taking no part in the operation of the engine, no compression being exerted above the piston head 68 located substantially mid-way of the entire length of the piston. The cylinders of the piston 64 are provided with the oppositely disposed ports 69, one of said ports being adapted to coöperate with the inlet port while the other coöperates with the exhaust port. These ports are adjacent the elongated openings or depressions 56 and 58, consequently said depressions supply sufficient time for the cylinders to exhaust or take in a fresh supply of gas, during the reciprocation of the piston. The pistons are located as set forth in Fig. 4 immediately previous to the explosion in the chamber 70 located between the head 68 of the outer piston and the heads of the inner pistons 71. When the explosion occurs, the outer piston is forced upwardly and the lower pistons 71 downwardly, after which the exhaust opens and allows the burning gases to pass out through the port 57. The next stroke of the piston causes the inlet port to open admitting gases to the chamber 70. The pistons then come together compressing the gases in the chamber previous to the explosion, after which the operation is repeated as heretofore described.

The modification set forth in Fig. 7 is

constructed similarly to the hereinbefore described types. The cylinder 72 is open at the top and has the outer piston 73 operating within the cylinder as heretofore described. The piston head 74 is provided with the adjacent openings 75 and 75[a], said openings having the supply and exhaust pipes 75[b] and 75[c] respectively. The openings 75 and 75[a] are provided with the valves 76 which are retained in a closed position by the springs 77, the valve rods being provided at their upper extremities with the heads 78. The supply and exhaust pipes 75[b] and 75[c] reciprocate at their free extremities in the casing 79, said casing having the independent compartments 79[a] and 79[b] formed therein, each compartment being adapted to receive one of said pipes 75[b] and 75[c]. The compartment 79[b] is connected to the supply pipe 80 from the carbureter, while the compartment 79[a] is similarly connected to the exhaust pipe 81. From the foregoing it will be seen that the supply and exhaust pipes are in constant connection with the cylinder and operate therewith, said pipes being securely packed in the casing 79 in such a manner that leakage is eliminated. In order to supply a means whereby the valves may move at regular predetermined intervals, a rod 82 is pivotally carried by the piston head adjacent each of the valve heads 78, said rod being provided with the arm 83 which is adjustable vertically thereon through the provision of the screw 90 operating in the bracket 91, the arm bearing normally against the head 78 of the valve. A bracket 92 is mounted on the cylinder adjacent the sleeve 84 in which operates the rocker 93, said rocker being provided with an enlarged opening in which the free terminal of the rod 82 is received. Operating in the base of the cylinder and reciprocating in the mountings 84[a] is the vertical rod 85 on each side of the cylinder adapted to bear at its lower extremity against the cam 85′ and at its upper extremity against the free end of the rocker 93. A collar 87 is secured to the head 85 and forms a bearing for the spring 88 which normally retains the head against said cam. Each of the valves 76 is provided with such a mechanism, the cams 85′ thereof being so timed that the rods 85 are raised at different intervals. This engine is of a four cycle type and operates as follows: After the explosion occurs, the pistons operate in a manner heretofore described, the outer piston rising and the inner pistons going down. When the pistons are nearly to the extreme movement of their stroke the cam 85′ operating the exhaust raises the rod 85 causing the same to operate the rocker 93 and swing the rod 82 inwardly, as a result forcing the arm 83 against the valve head and opening the exhaust valve 76. While the engine is exhausting the cam 85′ operating the supply valve is so located that the same remains closed, but after the exhaust has been completed the supply valve is opened in a manner exactly similar to the exhaust valve.

The gas in an engine of the aforesaid type is exploded by a sparking apparatus known as the jump spark plug and comprises a removable cap 94 threaded in the head of the piston 73 between the tubes forming the inlet and outlet. This cap is provided with an ordinary jump spark plug provided with the rod 96 which reciprocates in and is constantly in engagement with the bracket 97 to which is attached the wire 98, thus conducting current to the plug. In this manner the lower terminal of the rod 96 constantly forms the remaining contact point of the spark creating mechanism.

In the two cycle type of engine illustrated in Fig. 1 the sparking apparatus comprises an insulated plug 100 set in the head of the cylinder through which passes the tube 101, said tube extending partially into the primary compression chamber. The upper terminal of the tube has the line wire 102 secured thereto through the instrumentality of the binding post 103. The device indicated in general as 104 carried in the head of the outer piston 24 is exactly similar to the device used in the head of the piston of the tube set forth in Fig. 7, being provided with a rod 105 which coöperates with the tube and obtains its current therefrom.

Having thus described my invention, what is claimed as new is:

1. In an internal combustion engine, the combination with a cylinder, of an outer hollow piston reciprocating in said cylinder, a plurality of inner pistons reciprocating in said outer piston and a crank shaft driven by said outer and inner pistons independently.

2. In an internal combustion engine, the combination with a cylinder, of an outer hollow piston adapted to reciprocate therein, said outer piston being formed to provide a plurality of cylinders, and a plurality of inner pistons operating in the cylinders of said outer piston.

3. In an internal combustion engine, the combination with a cylinder, of an outer hollow piston adapted to reciprocate therein, a plurality of inner pistons operating in said outer piston, a crank shaft disposed below said pistons and adapted to be operated upon by said inner pistons and outer piston independently, and means whereby the explosion may occur between the heads of said inner pistons and the head of said outer piston.

4. In an internal combustion engine, the combination with a cylinder, of an outer piston adapted to reciprocate therein, said outer piston having a plurality of cylinders

formed therein, a plurality of inner pistons adapted to reciprocate in the cylinders of said outer piston and in an opposite direction thereto, means whereby the gas may be injected between the heads of said pistons, means whereby said gas may be exploded, and means whereby the exploded gases may be exhausted.

5. In an internal combustion engine, the combination with a cylinder, of an outer piston adapted to reciprocate in said cylinder, having a plurality of cylinders formed therein, a plurality of inner pistons adapted to reciprocate in the cylinders of said outer piston, a crank shaft disposed below said cylinder and adapted to be operated on by said inner pistons and the outer piston independently, means whereby gas may be injected between the heads of said pistons, means whereby said gases may be exploded, forcing the inner and outer pistons in opposite directions, and means whereby the gases may be exhausted.

6. In an internal combustion engine, the combination with a cylinder, of an outer piston adapted to reciprocate in said cylinder, the head of said outer piston forming in combination with the head of the cylinder a primary compression chamber, a plurality of inner pistons adapted to reciprocate in said outer piston, forming in combination with the head of the outer piston, an explosion chamber, means whereby gases may be admitted to the compression chamber, and means whereby said gases may be admitted from said compression chamber to said explosion chamber at the extreme outward movement of the stroke of the pistons.

7. In an internal combustion engine, the combination with a cylinder, of an outer piston adapted to reciprocate in said cylinder, the head of said outer piston forming in combination with the head of the cylinder a primary compression chamber, a plurality of inner pistons adapted to reciprocate in said outer piston forming in combination with the head of the outer piston, an explosion chamber, means whereby gases may be admitted to the compression chamber, means whereby said gases may be admitted from said compression chamber to said explosion chamber at the extreme outward movement of the stroke of the pistons, and a sparking plug carried by the head of the outer piston adapted to retain its coöperative relation with the ignition system irrespective of the movement of the piston.

8. In an internal combustion engine, the combination with a cylinder, of an outer piston adapted to reciprocate therein forming in combination with said cylinder a compression chamber, means for conducting gases to said compression chamber, a plurality of cylinders formed in said outer piston, a plurality of pistons adapted to reciprocate in the cylinders of said outer piston and operate in an opposite direction to said piston, a valve carried by the head of the outer piston whereby gases may be conducted from said compression chamber to an explosion chamber formed between the heads of the inner pistons and the head of the outer piston, and adjustable means carried by the cylinder for operating said valve whereby the admission of gases to the explosion chamber may be regulated.

9. In an internal combustion engine, the combination with a cylinder, of an outer piston adapted to reciprocate therein forming in combination with said cylinder, a compression chamber, means for conducting gases to said compression chamber, a plurality of cylinders formed in said outer piston, a plurality of pistons adapted to reciprocate in the cylinders of said outer piston and operate in an opposite direction to said piston, means whereby the admission of gases from said compression chamber to an explosion chamber formed between the heads of the inner pistons and the head of the outer piston may be regulated, and a spark plug carried by the head of the outer piston adapted to retain its coöperative relation to the ignition system irrespective of the movement of the piston.

10. In an internal combustion engine, the combination with a cylinder, of an outer piston adapted to reciprocate therein forming in combination with said cylinder a compression chamber, means for conducting gases to said compression chamber, a plurality of cylinders formed in said outer piston, a plurality of pistons adapted to reciprocate in the cylinders of said outer piston and operate in an opposite direction to said piston, means whereby gases may be admitted to an explosion chamber formed between the heads of the inner pistons and the head of the outer piston, means carried by the cylinder whereby the gases to said chamber may be regulated, and means whereby the products of the explosion located between the inner pistons and outer piston may be exhausted previous to the admission of new gases.

11. In an internal combustion engine, the combination with a cylinder having an exhaust port on one side thereof, of an outer piston adapted to reciprocate therein, said piston forming a plurality of cylinders and having an exhaust port therein which at predetermined intervals registers with the exhaust port of the cylinder to permit the products of the explosion in said outer piston to escape, and a plurality of inner pistons adapted to reciprocate in the cylinders of said outer piston.

12. In an internal combustion engine, the combination with a cylinder having an exhaust port on one side thereof, of an outer

piston adapted to reciprocate therein, said piston forming a plurality of cylinders and having an exhaust port therein which at predetermined intervals registers with the exhaust port of the cylinder to permit the products of the explosion in said outer piston to escape, a plurality of inner pistons adapted to reciprocate in the cylinders of said outer piston, and means carried by the head of the outer piston adapted to admit gases to the interior of said piston.

13. In an internal combustion engine, the combination with a cylinder having an exhaust port on one side thereof, of an outer piston adapted to reciprocate therein, said piston forming a plurality of cylinders and having an exhaust port therein which at predetermined intervals registers with the exhaust port of the cylinder to permit the products of the explosion in said outer piston to escape, a plurality of inner pistons adapted to reciprocate in the cylinders of said outer piston, a valve carried by the head of the outer piston adapted to admit gases to the interior of said piston, and adjustable means carried by the head of the cylinder whereby said last named means may be automatically operated at predetermined intervals.

In testimony whereof I affix my signature in presence of two witnesses.

URAL STILWELL TRAUB.

Witnesses:
JOSEPH SCHALL,
JOHN M. HOBE.