

No. 875,899.

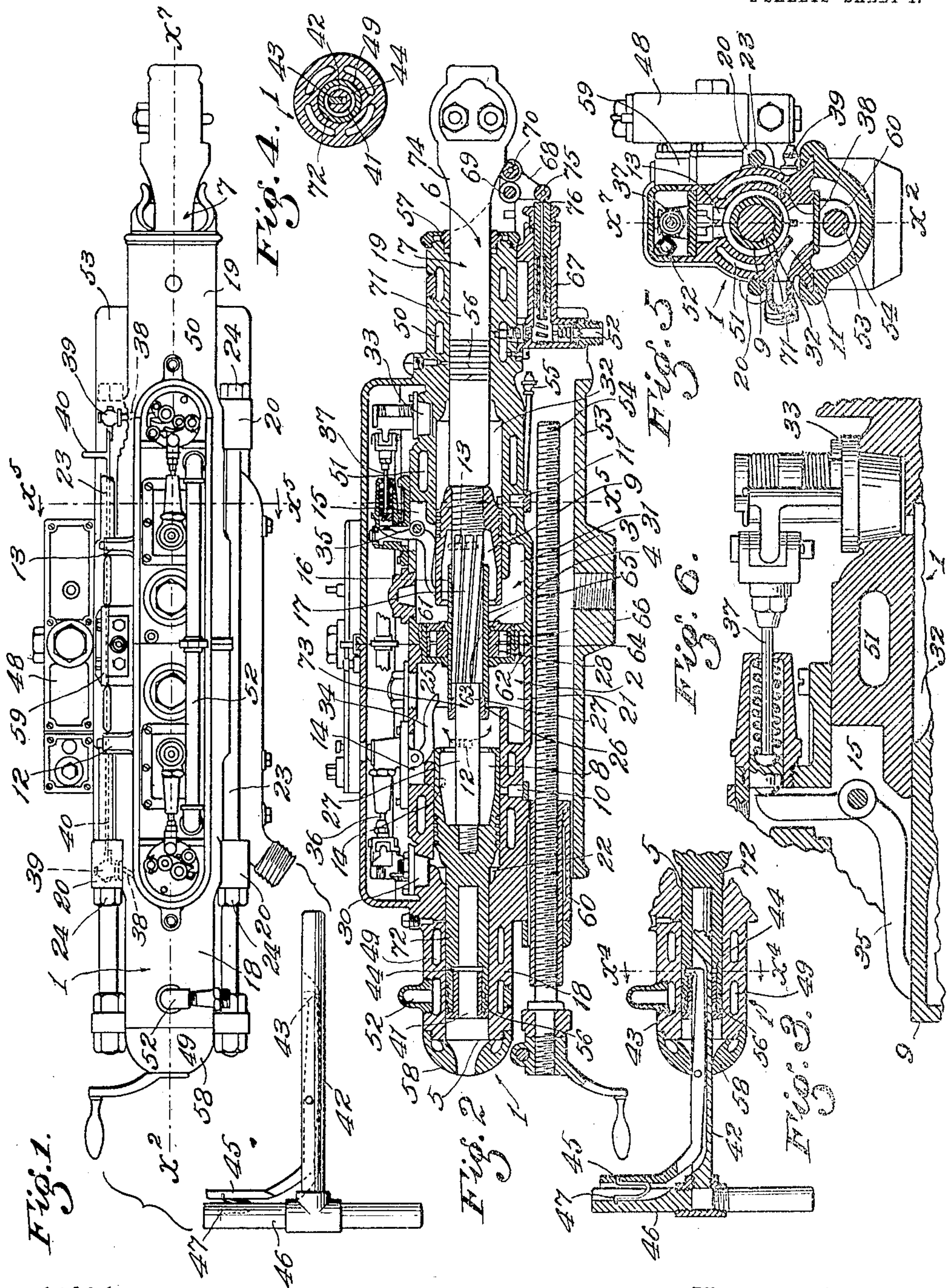
PATENTED JAN. 7, 1908.

O. C. DURYEA.

DOUBLE ACTING GAS OR VAPOR ENGINE.

APPLICATION FILED FEB. 15, 1907.

2 SHEETS—SHEET 1.



Witnesses
C. C. Holly.
J. Townsend.

Inventor
Otho C. Duryea.
James R. Townsend
his Atty

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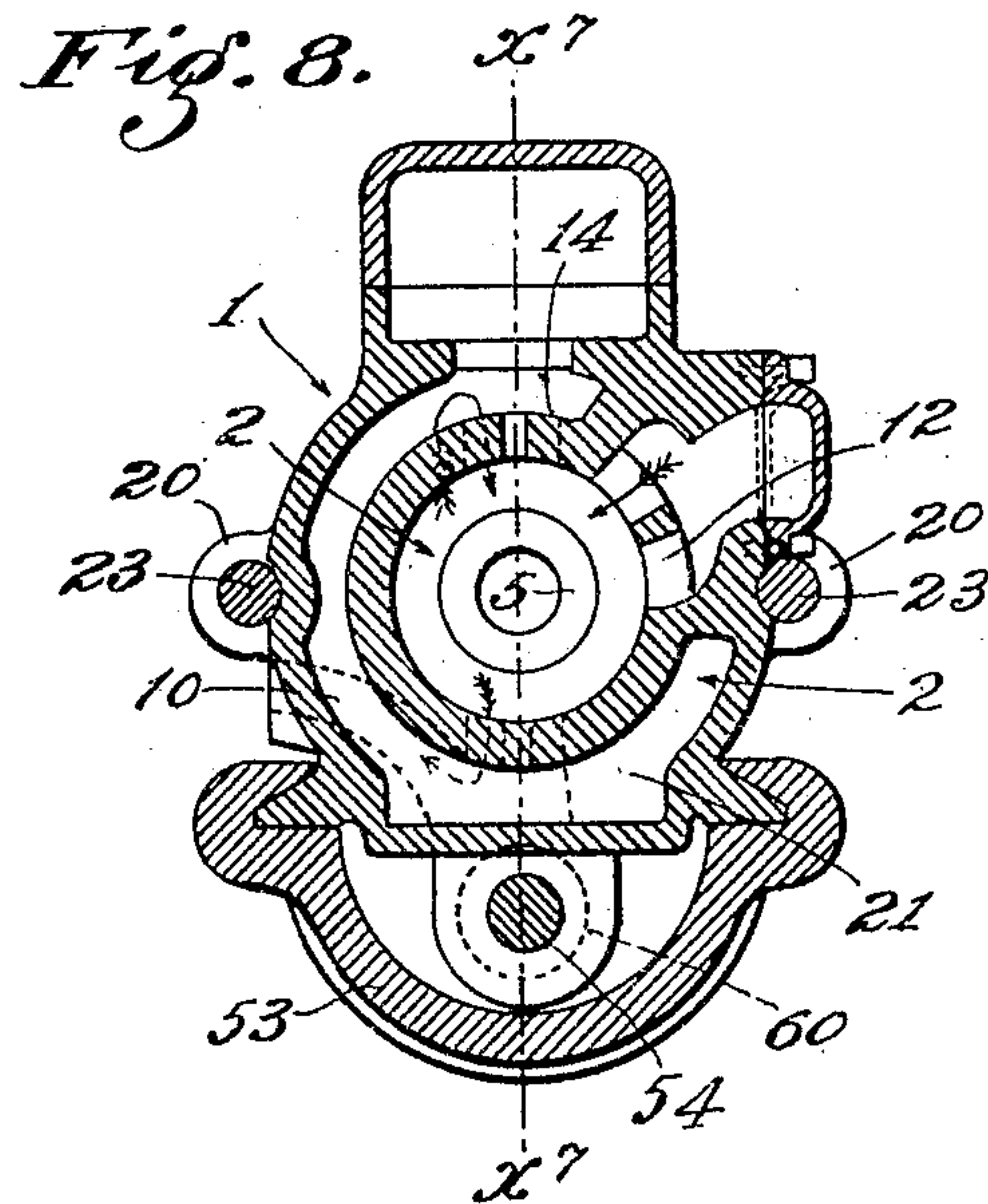
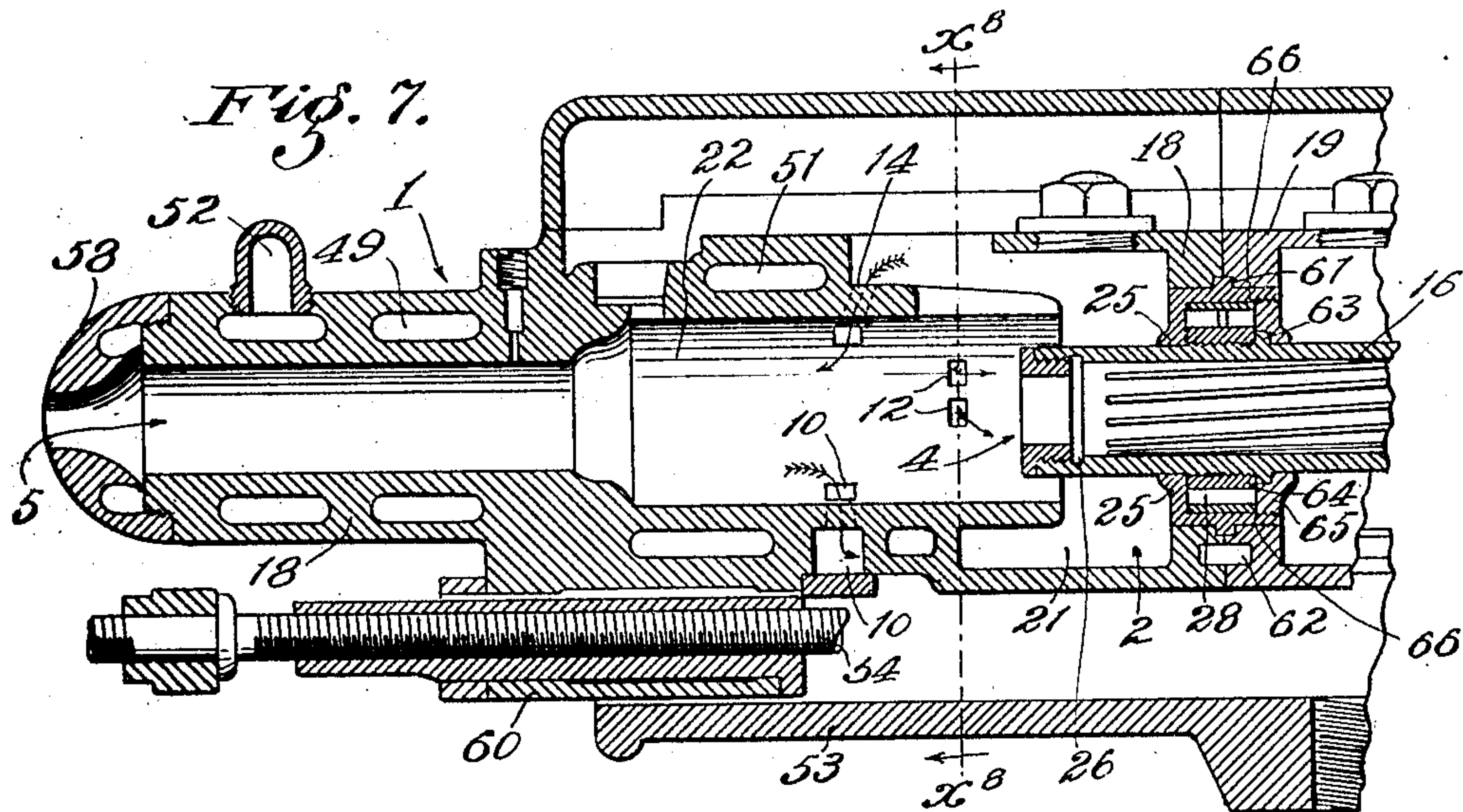
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UNITED STATES PATENT OFFICE.

OTHO CROMWELL DURYEA, OF LOS ANGELES, CALIFORNIA.

DOUBLE-ACTING GAS OR VAPOR ENGINE.

No. 875,899.

Specification of Letters Patent.

Patented Jan. 7, 1908.

Application filed February 15, 1907. Serial No. 357,586.

To all whom it may concern:

Be it known that I, OTHO CROMWELL DURYEA, a citizen of the United States, residing at Los Angeles, in the county of Los Angeles and State of California, have invented new and useful Improvements in Double-Acting Gas or Vapor Engines, of which the following is a specification.

This invention is applicable in various forms of engines among which may be mentioned free-piston engines, rock-drills, power hammers and the like.

An object of this invention is to improve engines of this class with respect to convenience, cheapness and completeness of construction at the same time preserving the effectiveness and smoothness of operation.

An object of this invention is to devise a double acting rear compression engine which can be made to advantage in large quantities with a minimum number of special tools and jigs.

This invention relates more especially to direct double acting free piston engines in which the working connection with the piston head is made through one end of one of the explosion chambers. In engines of this kind a serious difficulty to overcome is the liability of unequal action of the explosive charges in the opposite explosion chambers. In a form of this kind of engine which I have built I found this difficulty almost insurmountable and successful operation of the engine very difficult without the use of a fly wheel.

An object of this invention is to entirely obviate all difficulty of this nature in engines of the kind last referred to. All such difficulty is completely overcome in this invention in which the body of the engine has reversely arranged cavities for reversely arranged duplicate explosion chambers, and also has ways opening from the explosion ends of such cavities, respectively, piston heads connected together and moving in said cavities respectively, a piston rod connected with one of said heads and having a portion extending therefrom and fitting in and running through one of said ways, and a counterpart of said rod-portion connected with the other piston head and extending therefrom and fitting and running in the other way.

Another object is to construct an engine of this class which can be most readily started and which will be devoid of any external

moving parts liable to strike, catch or harm the attendants. This is accomplished by making the engine body open at the rear end and providing a detachable handle by which the piston rod of the construction above referred to can be reciprocated from the rear for priming and for initial explosion.

Another object is to provide a double acting rear compression engine having improved means for positive operation of any igniter or other device for causing the explosions to occur appropriately.

A further improvement pertains to equalizing the compression chambers by a new arrangement of the rifle sleeve relative to such chambers whereby the compression of the charges for each explosion chamber will be practically the same as that for the other, and ample room for the rifle bar is provided.

A further object is to provide a better construction and arrangement for the rifle sleeve. Also to provide for keeping the same and the pistons cool in the best and most economical way.

Another object is to equalize the cooling of the parts pertaining to both explosion chambers. This is accomplished by providing, at the ends of the explosion chambers, cooling devices in which those portions of the piston rod which are subject to the fire of the explosion chambers may be cooled after each explosion. Also by providing a pumping attachment free from but actuated by a sloping portion of the piston.

The accompanying drawings illustrate the invention:—

Figure 1 is a plan of a gas-actuated rock drill embodying the invention; the starting handle being shown withdrawn. A portion of the drill body is broken to show a pet cock. Fig. 2 is an axial section on line X²—X⁷, Figs. 1 and 5, the feed screw handle being turned to a position different from that in Fig. 1. Fig. 3 is a fragmental, sectional view showing the starting handle in place ready for starting the drill into operation. Fig. 4 is a section on line X⁴—X⁴, Fig. 3. Fig. 5 is a section on line X⁵—X⁵, Figs. 1 and 2. Fig. 6 is a fragmental detail illustrating the mechanism for operating the make and break sparkers for igniting the charges. Fig. 7 is an enlarged fragmental section on line X²—X⁷ Figs. 1 and 5 and on line X⁷—X⁷ Fig. 8, and is a view of the rear end of the engine body, omitting the piston to clearly

show the ports. The electric igniter and the cover for passage 14 are also omitted. Fig. 8 is a section on line X⁸; Fig. 7.

1 is the engine body having cavities 2, 3, a way 4 between the cavities and ways, 5, 6 at the opposite ends of the cavities, respectively. 7 designates generally a rod moving in and closing said ways. 8 is a piston head on the rod dividing one of said cavities into a compression chamber 21 and an explosion chamber 22. 9 is a piston head on the rod dividing the other of said cavities into a compression chamber 31 and an explosion chamber 32. 10 and 11 are exhaust ports.

12 and 13 are inlets opening into the compression chambers, 21 and 31 respectively.

14 is a passage in the body leading from one compression chamber 21 to its companion explosion chamber 22 and 15 is a like passage in the body leading from the other compression chamber to the other explosion chamber.

The piston rod 7 is composed of a power applying portion 71, a counterpart portion 72 and an intermediate portion 73. The portion 71 fits in and runs through the front end way 6, the portion 72 fits the rear end way 5, and the portion 73 fits and runs through the intermediate way 4 which is formed by a rifle sleeve in which a rifle section 17 of the intermediate portion of the rod fits and moves.

The body 1 of the engine is formed of two complementary shells 18, 19 socketed together and having lugs 20 and held together by bolts 23 passed through said lugs and secured by nuts 24, and has an intermediate wall or partition 25 at the middle where the two shells abut together, and in which the rifle sleeve 16 is mounted to form the intermediate way for the piston rod. The sleeve 16 is practically balanced being mounted at its middle, and projects equally into the compression chambers 21 and 31 to thereby be chambered in the engine body free from action of explosive charges and at the same time establishing a conformity between the two compression chambers 21, 31, and allowing a rifle bar of ample length and size to be chambered in the engine body to advantage, being cooled by the inflowing gases and protected from dirt. The piston heads are cup shaped and at their compression strokes partially chamber their respective ends of the rifle sleeve. Said sleeve is desirably provided with a stuffing box 26 at one end through which a smooth cylindrical portion 27 of the piston rod moves.

The rifle sleeve 16 is fixed against endwise movement and is mounted to rotate in the partition 25. An annular clutch 28 in said partition is arranged to allow rotation of the sleeve in one direction only, for rotating the drill in the usual manner.

The passages 14, 15 open into the explo-

sion chambers respectively in the form of oblique supply ports that are directed toward the portions 71 72 of the rod and toward the explosion ends of said chambers respectively, which chamber ends are practically conformed to the outer ends of the piston-heads to allow said heads, with a short stroke, to produce a high compression of the charges of explosive gas or vapor and to cushion thereon. The explosive charges issuing from the supply ports at 14 and 15 are thereby directed along the portions 71 and 72 of the piston rods which form deflectors extending from the piston heads to the explosion ends of the chambers, and therefore, in each explosion chamber, portions of each explosive charge are conducted to the explosion end of the chamber while the burned gases escape through the exhaust port 10 or 11 as the case may be; said ports being on the side of the deflector opposite the supply ports at 14 and 15, respectively, and each opening somewhat nearer the explosion end of its chamber than the supply inlet so that the emission of burned gas shall begin before the explosive charge is admitted. The sparkers 30 and 33 are located in the same side of the chambers as the supply ports so that each explosive charge is directed to drive out all burned gas from around the sparker.

The outer ends of the pistons are tapered in ogee form around the portions 71 and 72 so that when either piston passes its supply port to open it, the explosive charge thus admitted is at once given the desired direction. The piston-heads are spaced apart and between them, in the compression chambers 2 and 3 are devices 34 and 35 which the piston heads actuate to alternately operate the make and break sparkers 30, 33 by means of push rods 36 and 37. Ducts 38 are provided opening from the explosion ends of the explosion chambers respectively. 39 designates relief cocks for said ducts, and 40 is a handle connected with both said cocks for their simultaneous operation.

41 is a socket in the rear end of the piston rod to receive the stock 42 of a detachable starting handle having a spring released catch 43 to engage a catch formed by an annular gain 44 in the wall of the socket 41. The catch 43 is bent to form a finger piece or handle 45 extending along one arm of a cross head 46 of the starting handle. The releasing spring 47 of the catch normally retracts the catch into the stock 42 and thus leaves said stock normally free from the piston rod and ready to be inserted or withdrawn at pleasure.

The rear counterpart portion or extension 72 of the piston rod is of a length practically corresponding to that of the rear way 5 so that it does not protrude from the engine body at any portion of its stroke.

48 is a gasoline receptacle and vaporizer

for supplying explosive charges to the front and rear compression chambers through pipes forming extensions of inlets 12 and 13.

49 is an extended waterjacket nose around the rear end way 5, and 50 is a like nose around the front end way 6. The same form the cooling devices for cooling portions of the piston rod, including those that are subjected to the fire of the explosion chambers. A considerable amount of the unconverted heat of the explosions may thus be removed from the piston rod and pistons. Other portions of such heat are removed by the usual water jackets 51 around the explosion chambers. 52 designates the water pipes communicating with and between such jackets.

53 is the bed and 54 the screw for moving the body 1 thereon in the usual way for drilling.

It is to be understood that this invention may be embodied in various forms and I do not propose to limit the construction to the particular form shown but may vary the same without departing from this invention.

55 designates drain cocks connected with the rear compression chambers, for draining oil therefrom.

56 designates packing rings on the rod to prevent leakage and 57 is a stuffing box screwed on one end of the body 1 to wipe the piston rod and exclude dirt from the front way 6. 58 is a finishing tip screwed in like manner on the rear end of the body.

59 designates brackets to support the vaporizer 48.

The main body of the partition 25 is a hollow annular member having an intermediate flange 61 to fit a gain in the abutting end of one shell. The shells are turned to fit together and are held against relative rotation by a dowel pin 62.

The rifle sleeve 16 has a hub formed of a flange 63 against which is screwed a collar 64. The hub rotates in the clutch and partition, being chambered in and abutting against the partition member 25. A plate 65 is screwed into said member 25 against a shoulder 66 therein and holds the sleeve 16 and the members of the clutch in place.

The two shells 18 and 19 are practically duplicates of each other and may be cast from the same patterns by appropriately changing the cores and prints from the inlet and exhaust ports and the vaporizer bracket from their positions appropriate for casting one shell, to complementary positions for casting the other shell. Also in the construction for the drill a print and core for the feed screw lug 60 will be applied in the pattern for casting the rear shell. Both shells may be finished by the same jig and tools.

In practice the starting handle is normally detached from the engine, and when the attendant desires to start the engine into operation he may open relief cock 39, grasp the

cross head of the starting handle with both hands and insert the stock through the rear way 5 into the socket 41, then by gripping the finger piece or catch handle 45 against the cross head he will throw the catch into the gain 44 and by means of the starting handle he will give a few reciprocations to the piston rod and its heads to draw in explosive charges and at the same time actuate the sparkers. As soon as the explosion chambers are charged explosions will occur, blowing out through the relief cocks, whereupon the operator will close the same by means of the cock handle 40 and then by a further movement of the piston rod will again cause one of the sparkers to act to ignite an explosive charge thus starting the engine into operation. At the same instant he will release his grip on the finger piece 45, and thereupon the spring 47 will retract the catch and at once release the starting handle from the piston rod thus allowing the piston to run free and the operator to withdraw the starting handle.

The cylindrical form of the stock 42 and the seat therefor formed of the socket 41 and annular gain 44 allows the piston rod to rotate without turning the detachable starting handle in the hands of the attendant, and whenever the finger piece 45 is released, the starting handle is instantly detached from the piston rod.

Each piston head is so arranged with relation to the inlet, exhaust and supply ports for its compression and explosion chambers and the device for operating the igniter in its explosion chamber, that at the close of its compressing stroke, after having closed the inlet to its compression chamber, it will actuate the device for operating the igniter of its explosion chamber.

The further operation of the engine will be understood from the foregoing description, reference being had to the drawings. The relief cock ducts 38 are small so as not to destroy the practical conformity of the pistons to the explosion chambers and each is desirably located at the extension of the cylindrical portion of its explosion chambers; thus allowing a full reciprocation of the pistons for priming. When the relief cocks are closed and the engine is in operation the explosive charges in the explosion chambers cushion the pistons so that the engine, its piston rod with its pistons is self-balanced, and high compression of the explosive charges may be effected in the explosion chambers.

67 designates a pump connected with the passage of the water jackets 49, 50 and 51. 68 is a bell crank pivoted at 69 to the body of the engine. 70 is a roller engaging a sloping portion 74 of the piston rod and 75 is a roller for actuating the spring returned piston 76 of the pump 67. By this means water

may be pumped through the pipe 52 and circulated through the water jacket. The rollers and bell crank are free from the piston rod, and the pump piston operates responsively to both the long and short strokes of the piston rod which may occur during the operation of the engine.

What I claim is:—

1. In a double acting gas or vapor engine, complementary shells socketed together, piston heads and a rifled piston rod in said shells, a clutch fastened to one of said shells and a rifle sleeve for the piston rod rotatably mounted in the clutch and projecting into the cavities of both shells.

2. A double acting rear compression gas or vapor engine having a rifle bar and sleeve located between and extending into its rear compression chambers.

3. In a double acting rear compression gas or vapor engine the combination with the engine body of an annular clutch in the partition between the rear compression chambers, a rifle sleeve having a hub rotating in said partition and clutch, a stuffing box on one end of the sleeve, and a piston rod connected with the pistons of the engine and having a rifled portion working in the rifled sleeve and a smooth cylindrical portion working in the stuffing box.

In testimony whereof, I have hereunto set my hand at Chico, Calif., this 4th day of February, 1907.

OTHO CROMWELL DURYEA.

In the presence of—

H. L. WEED,

INGLES M. UPPERS.