P. D. JOHNSTON.

MIXING VALVE FOR HYDROCARBON ENGINES.

APPLICATION FILED JULY 7, 1906.

982,825.

Patented Jan. 31, 1911.

4 SHEETS—SHEET 1.

Fig. 2

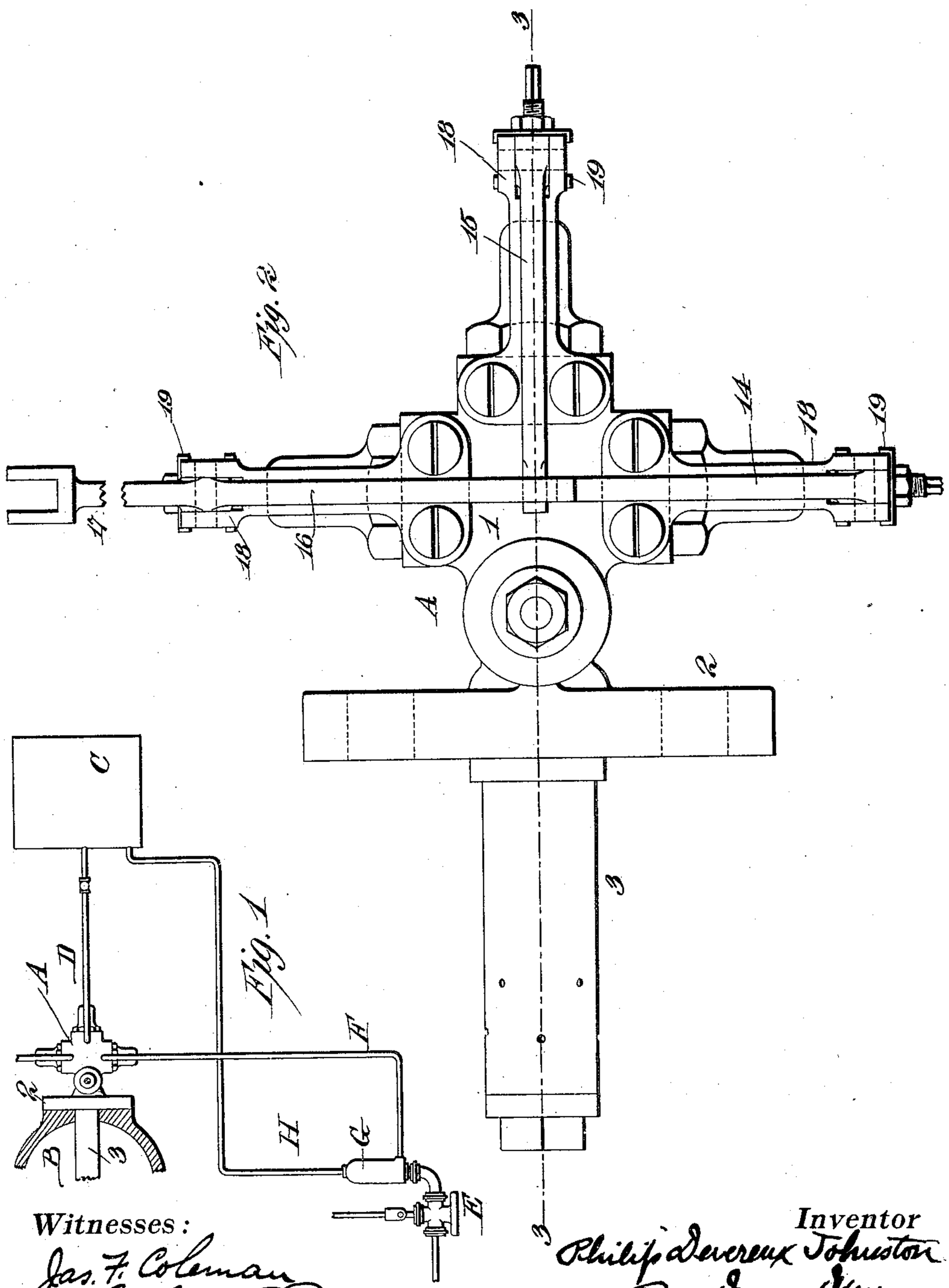

Fig. 1

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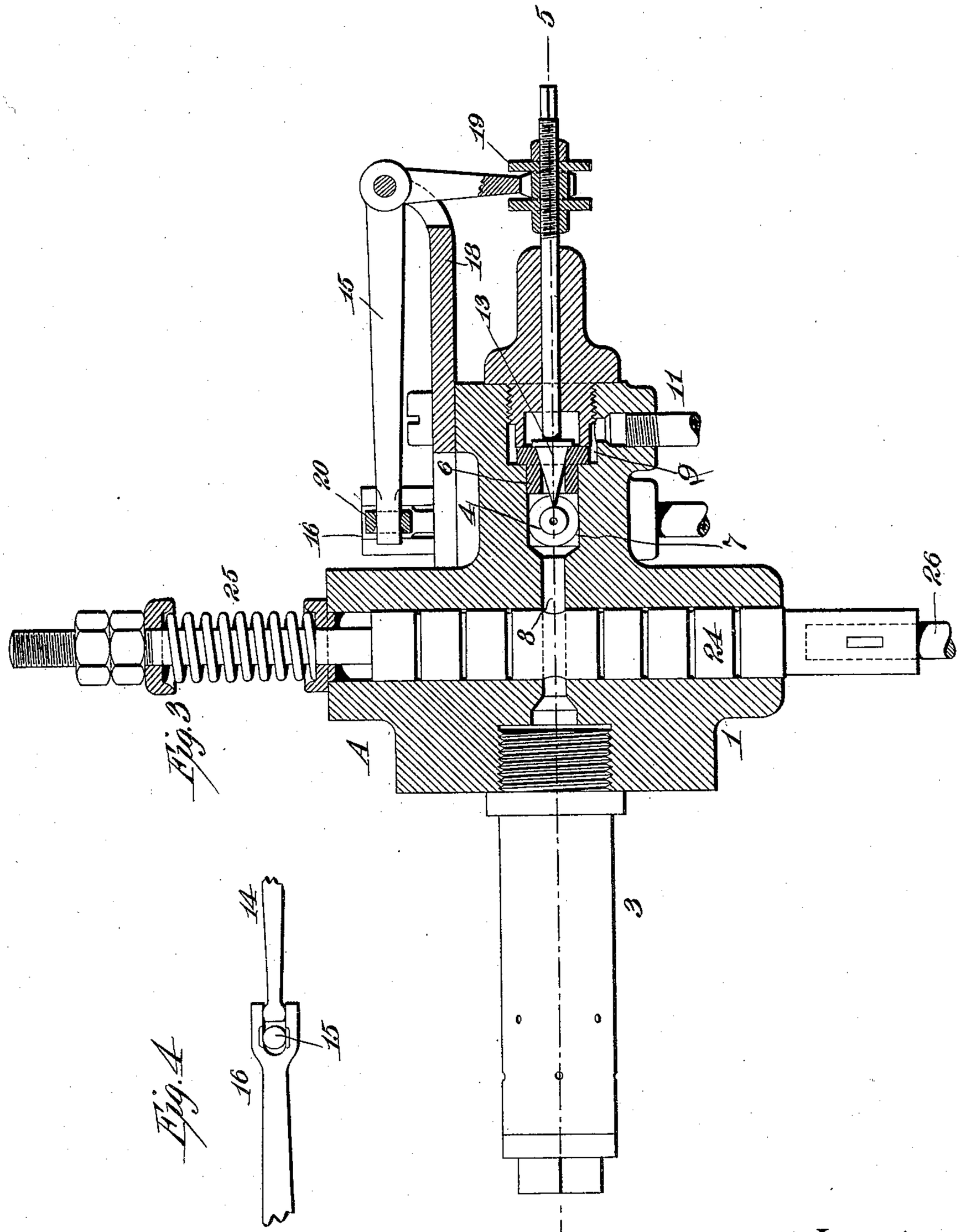

Fig. 3.

Fig. 4.

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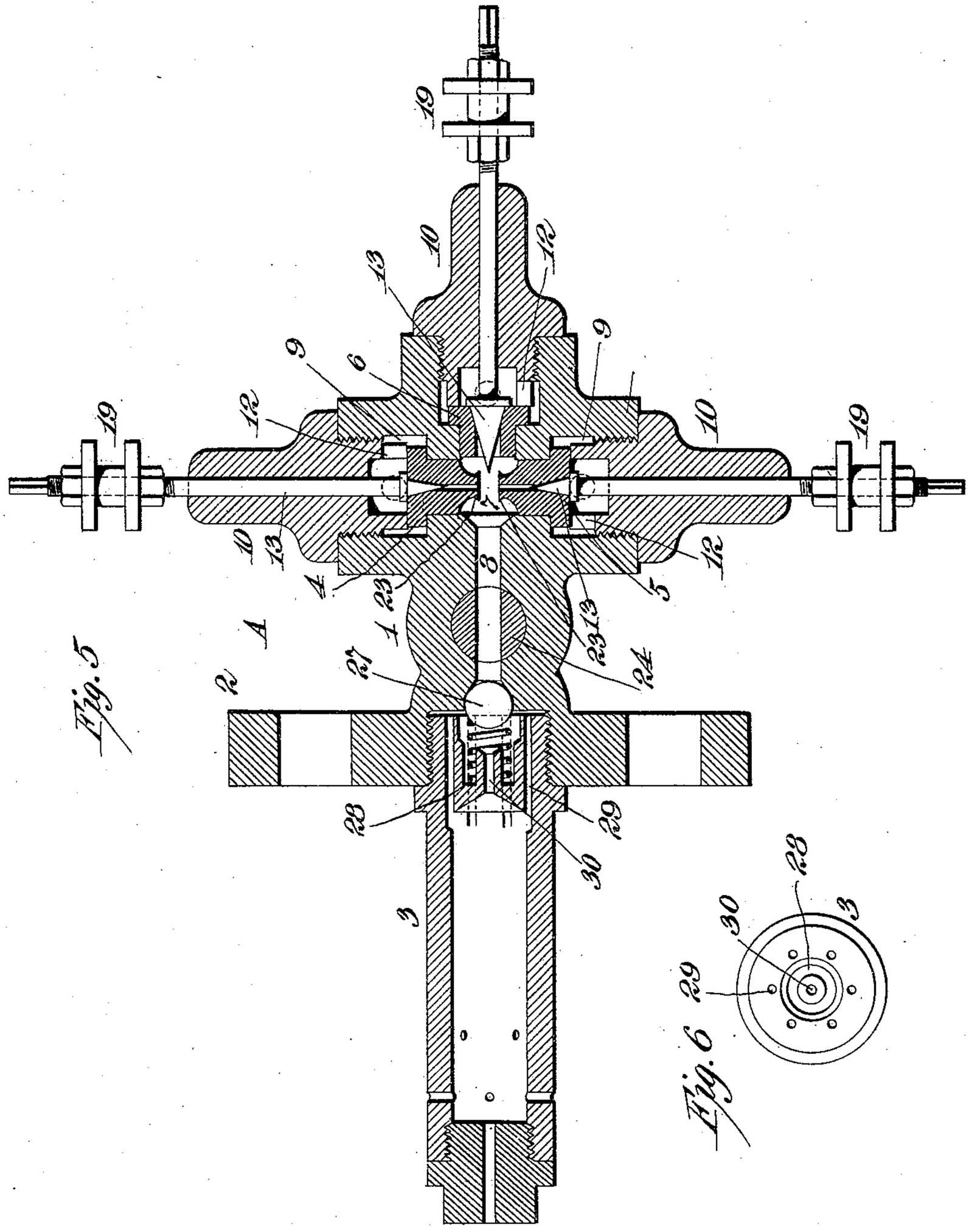

Fig. 5

Fig. 6

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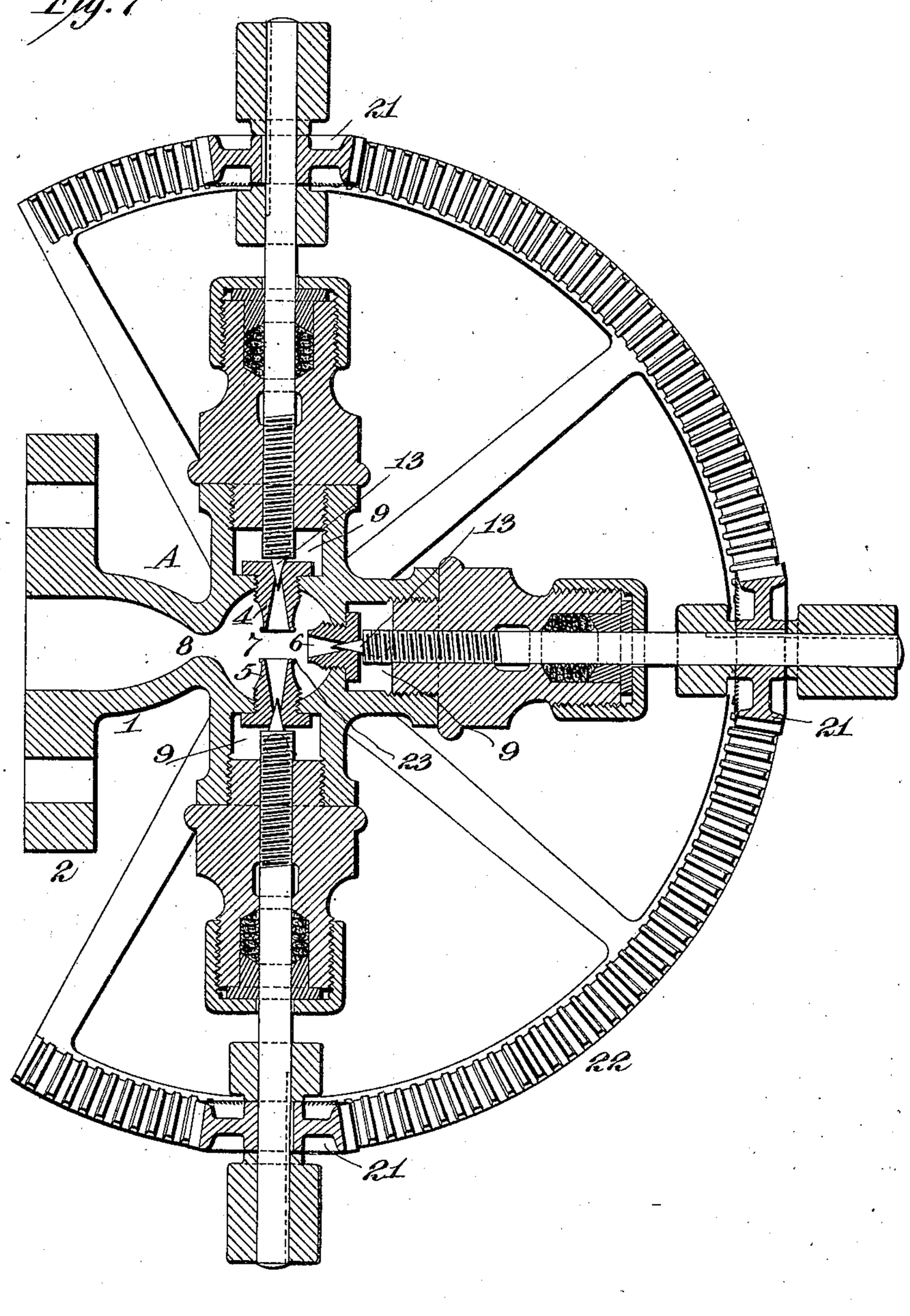
4 SHEETS—SHEET 4.

Fig. 7



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UNITED STATES PATENT OFFICE.

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MIXING-VALVE FOR HYDROCARBON-ENGINES.

982,825. Specification of Letters Patent. Patented Jan. 31, 1911.

Application filed July 7, 1906. Serial No. 325,111.

To all whom it may concern:

Be it known that I, PHILIP DEVEREUX JOHNSTON, a citizen of the United States, residing in the village of Cold Spring, county of Putnam, and State of New York, have invented a certain new and useful Improvement in Mixing-Valves for Hydrocarbon-Engines, of which the following is a specification.

The objects I have in view are the production of a device for minutely dividing and intimately mixing oil, air and water, in connection with hydro-carbon engines of the internal combustion type.

The invention has a further object in permitting the complete vaporization or atomization of heavy oils for internal combustion engines.

Other objects of the invention will appear more fully from the following specification.

I attain the objects of my invention by the mechanism illustrated in the accompanying drawings, in which—

Figure 1 is a diagrammatical view of the mixing valve and its connections as applied to the cylinder and combustion chamber of an internal combustion engine. Fig. 2 is a plan view of a device embodying my invention; Fig. 3 is a longitudinal section taken on the line 3—3 of Fig. 2; Fig. 4 is a detail of the controlling levers; Fig. 5 is a horizontal section on the line 5—5 of Fig. 3; Fig. 6 is an end view of the retort, and Fig. 7 is a horizontal sectional view of a modification.

In all of the several views like parts are designated by the same reference characters.

In carrying out the invention I provide a mixing valve A which has a body 1, having a flange 2 which may be bolted or screwed against the side of the combustion chamber B of the engine so that the retort 3 will extend into the combustion chamber, and the valve body remain on the outside. Within the valve body is a plurality of fuel admitting means, those shown comprising an oil nozzle 4, a water nozzle 5 and an air nozzle 6. These nozzles rest within openings formed within the valve body, and extend into a central mixing chamber 7. As shown in Fig. 5, the orifices of the oil nozzle and water nozzle are opposed one to another and the air nozzle is arranged to discharge at right angles to the discharge of the other two nozzles. The chamber 7 communicates by means of a passage 8 to the retort 3. The chamber 7 forms a mixing chamber, in which the oil, water and air are vaporized and intermingled, and are caused to pass into the retort 3 through the passage 8 by means of air forced through the air nozzle 6, and the suction of the descending piston of the engine.

The oil and water nozzles 4 and 5 are preferably each alike, and each is formed of a plug having a flange, which rests against the outside of the base of an opening 9 formed within the valve body. A bonnet 10 is screwed into the opening 9, and abuts against the nozzle plug, holding the flange of the latter securely against the base of the opening 9.

The air nozzle 6 is quite similar to the other nozzles, except that it is larger, and the central bore is of sufficient size to permit the requisite amount of air to flow through it. The inlets to the oil, air and water pipes, connect with the valve body similarly, the air inlet pipe being shown in Fig. 3 at 11. It connects with the opening 9, a notch 12 being formed on the inner end of the bonnet 10 to permit free circulation of the liquid or fluid from the entrance pipe into the center bore of the nozzle.

The discharge from the three nozzles is controlled by needle valves 13, which are carried upon stems which pass through the bonnets, a recess being formed in the inner end of each bonnet to permit the valve to be slid back sufficiently far to open the central passage of the nozzle the necessary extent. These valves are actuated in any manner, but preferably automatically by means of the governor. The preferred means of actuating them are shown in Figs. 2 to 6 inclusive. Each valve is slid in and out by means of a bell crank lever, there being one lever for each valve. In Fig. 2, 14 is the oil valve controlling lever, 15, the air valve controlling lever, and 16 the oil valve controlling lever, the latter having an extension 17, with a bifurcated extremity, which may be connected in any way to the governor. These levers are each pivoted to a support 18, secured by screws to the valve body. The depending portion of each lever is forked so as to straddle the valve stem and engages with a spool 19 thereon having flanges between which the forked ends of the lever work. Each spool is secured to the valve stem by screw-threads so that its position may be adjusted and a lock nut holds it definitely in position. The

inner ends of the three levers are connected together in such a manner that movement of the lever 16 contributes movement simultaneously to the other two levers. The inner end of the lever 16 is forked as shown in Fig. 4 and engages with the inner end of the lever 14, which is enlarged to form a ball which snugly engages with the inner walls of the fork of the lever 16, so that movements up and down of the lever 16, will be accurately transmitted to the lever 14. The lever 15, is made cylindrical at its outer end, which cylindrical portion passes through the fork of the lever 16 at right angles to the lever 14. That portion of the fork of the lever 16 with which the cylindrical portion of the lever 15 engages is rounded at 20, as shown in Fig. 3, so that the cylindrical portion of the lever 15 snugly engages this rounded portion of the fork 16 which insures that movements of the latter lever will be accurately transmitted to the lever 15. By the construction described any movement of the extension 17 by means of the governor will simultaneously move the three levers 14, 15 and 16 to an equal extent. By varying the position of the spools 19 upon the various valve stems the relative positions of the valves can be varied. For instance, should it be desired to have the air valve particularly unaffected by movements of the governor, such valve can be moved away from its seat to a sufficient extent, by shifting the position of the spool 19, so that movements of its controlling lever 15 will in no way affect the extent of opening of the valve.

The simultaneous actuation of the three valves may be attained by means other than those described. One modification is shown in Fig. 7, in which the three valves are slid, by being screwed in and out. In order to secure simultaneous rotation each is provided with a small pinion 21 which engages with a rack 22, which in turn is actuated by the governor. The pinions 21 are secured to the valve spindles in such a manner that the spindles may be rotated by the pinions and caused to be moved inward and outward by the engagement of their screw-threads with the supporting nut, but at the same time the pinions will not be longitudinally moved. This end may be secured by making the connection between the valve spindle and the pinion in the form of a feather.

It is important to prevent the formation of drops of oil or water upon the ends of the oil and water nozzles within the mixing chamber. A device for accomplishing this purpose is shown in Fig. 5. The ends of the nozzles extending into the chamber 7 are provided with a bead or raised edge 23. By this means when influx of oil or water ceases during that portion of the cycle, where the supply of mixture is stopped, the liquid will collect upon this bead, and be ultimately vaporized. There will be no opportunity for the liquid to run down the sides of the end of the nozzle, as would be the case were these beads not provided. All of the liquid introduced into the chamber will be vaporized at the time it is introduced without danger of liquid accumulating within the chamber.

For the purpose of closing the passage 8 during that portion of the operating cycle of the engine during which the charge is not being drawn in, I provide a valve 24, which slides within a passage formed in the valve body 1. This valve is shown as having a cylindrical body, with a central opening which may be brought into coincidence with the passage 8, by sliding the valve. The valve is slid in one direction by means of a spring 25, and in the other by a rod 26 which connects with a cam or eccentric on the engine, to move the valve at the proper time during the operating cycle, when the charge is no longer being drawn into the cylinder. This valve is shown as provided with a number of baffling grooves on each side of the central opening, these baffling grooves effectively preventing leakage from the central passage 8 outward. The baffling grooves are not only to prevent the escape of gas, but serve the purpose of collecting grit and dust which may pass into the valve, thus preventing cutting and abrasion of the valve and valve passage.

An additional means may be provided for closing entrance to the passage 8, such means consisting of a ball valve 27, which is forced against a seat within an extension of the passage 8 by means of a spring as shown, such spring resting within a seat 28, formed on the inner end of the retort 3. If desired, the slide valve may be used without the ball valve or the ball valve without the slide valve, as well as the two together. The ball will be drawn away from its seat when the back pressure within the combustion chamber is sufficiently slight, to permit the pressure of fluid within the nozzle to overcome the resistance of the spring, which seats the ball 27.

The retort 3 consists of a length of tubing, the inner end being closed by a plug having a central opening therethrough. Additional openings are shown as formed in the walls of the tube near this plug. The inner end of the tube is solid, and is provided with an annular row of holes 29. A central hole 30 communicates with the interior of the retort through the valve seat 28. This central opening aids in seating the ball by back pressure, and at the same time it will be closed by the ball during the influx of the mixture into the retort, so that the mixture will enter the retort through the annular row of holes and will be directed against the hot walls of the retort, and will thereby be more effectively vaporized.

The mixing valve is applied to an engine of the internal combustion type, the flange 2 being bolted or otherwise secured to the side of the combustion chamber, and the retort 3 extending therein. The oil and water nozzles are connected with a source of supply so arranged that a certain definite quantity of liquid will be injected into the mixing chamber during a certain portion of the cycle of the operation of the engine, such portion being preferably the whole of the intake stroke, and a portion of the compression stroke. The air nozzle is connected with a source of air under pressure, the cut-off valve being useful for cutting off the inlet of the air during any portion of the cycle.

The connections between the oil and air sources of supply are shown in Fig. 1, the water connections being similar to the oil. A tank C contains air under pressure. Air is admitted to this tank in any way, for instance, by means of a pump worked off the engine. A pipe D communicates with the air nozzle of the mixing valve. A pump E connects with a source of oil supply, and injects into the oil nozzle through a pipe F. An equilibrium tank G is inserted in the oil passage between the pump and pipe F. This equilibrium tank communicates with the air tank C by means of the pipe H, so that the pressure in the tanks G and C will be the same. The mixing chamber communicates with the tank C by means of a pipe, and consequently the pressure in both tanks and mixing chamber will be accurately balanced.

In operation, the oil and water will be driven in simultaneously through their respective nozzles, and the two streams meeting within the chamber 7 will thoroughly vaporize or atomize and mix the two streams of oil and water. These two intermingling streams will be engaged at right angles by a stream of air from the air nozzle, and the entire mixture will be partly forced and partly drawn through the passage 8 into the retort 3 which extending into the combustion chamber will be kept sufficiently hot to convert the mixture of oil, air and water into gas, which will be consumed within the cylinder, in the presence of an additional supply of air, and an additional supply of water if necessary. The governing of the engine will be attained by the movement of the valves, so as to vary the amount of the mixture. If desired, one of the valves, for instance the air valve, may be disconnected, so that the richness as well as the amount of the mixture will be varied. When the cut-off valve 24 is closed or the back pressure in the combustion chamber is such as to equal or exceed that in the tank C, no more oil or water will be driven into the mixing chamber, but on the contrary, the liquid which is handled by the particular pump, will be forced into the equilibrium tank G, and none will be forced into the mixing chamber. When the cut-off valve is open and the back pressure is small enough to permit flow of air into the mixing chamber, oil and water will also enter the chamber through their respective nozzles. By means of the structure described, the oil and water will not enter the mixing chamber, except when the air is also entering. The same effect can be secured by omitting the equilibrium chamber, and timing the stroke of the liquid pump for the proper instant. Such a modification is not so desirable as that illustrated.

Having now described my invention, what I claim as new and desire to secure by Letters Patent, is:

1. A mixing valve for hydrocarbon internal combustion engines, having an oil and a water nozzle, opposed to each other within a chamber and an air nozzle at right angles to the oil and water nozzles.

2. In a mixing valve for hydrocarbon internal combustion engines, the combination of a mixing chamber, and an oil nozzle, a water nozzle and an air nozzle, three valves, for controlling the nozzles, each having a stem, a lever for each valve stem, the three levers engaging together and means for moving one of the levers to simultaneously move the other two.

3. In a mixing valve for hydrocarbon internal combustion engines, the combination of an oil nozzle, a water nozzle and an air nozzle, a valve for each nozzle, the three valves each having a stem, and three levers for moving the valve stems, one of said levers having a bifurcated extremity into which the other two levers engage.

4. In a mixing valve for hydrocarbon internal combustion engines, the combination of an oil nozzle, a water nozzle, and an air nozzle, a valve for each nozzle, the three valves each having a stem and a lever for moving each stem, one of said levers having a forked extremity, another lever having a cylindrical extremity and another lever having a ball extremity, the extremities of these two levers engaging with the forked extremity of the first lever.

5. In combination with a combustion chamber, a mixing valve for hydrocarbon combustion engines, having a body, a mixing chamber therein, and a valve closing communication between the mixing chamber and the combustion chamber, the said valve being a slide valve, and having baffling grooves thereon.

This specification signed and witnessed this 3rd day of July, 1906.

PHILIP DEVEREUX JOHNSTON.

Witnesses:
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