No. 898,124. PATENTED SEPT. 8, 1908.

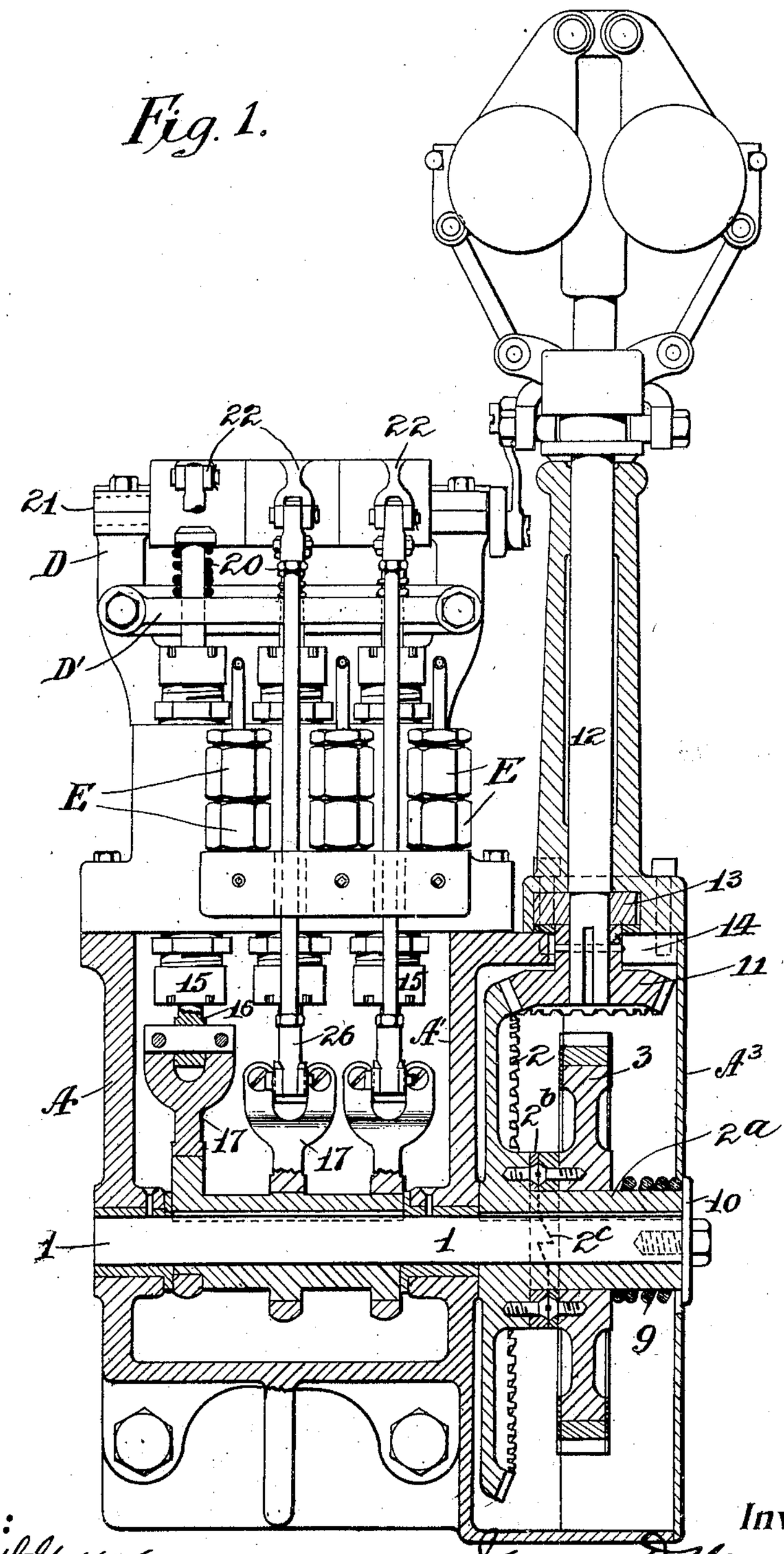
J. D. MACPHERSON.

FUEL PUMP FOR INTERNAL COMBUSTION ENGINES.

APPLICATION FILED AUG. 25, 1906.

3 SHEETS—SHEET 1.

Fig. 1.



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3 SHEETS—SHEET 2.

Fig. 3.

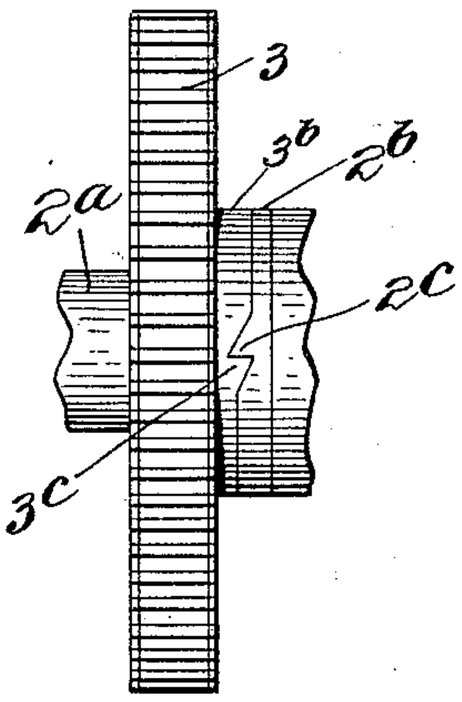
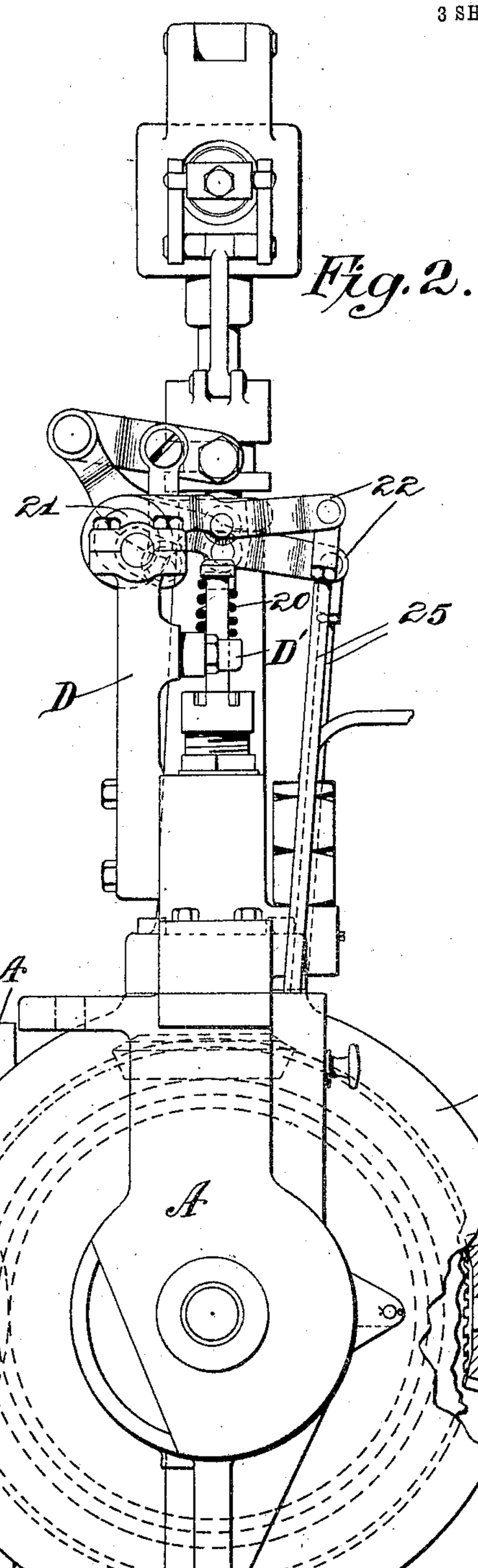


Fig. 2.



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3 SHEETS—SHEET 3.

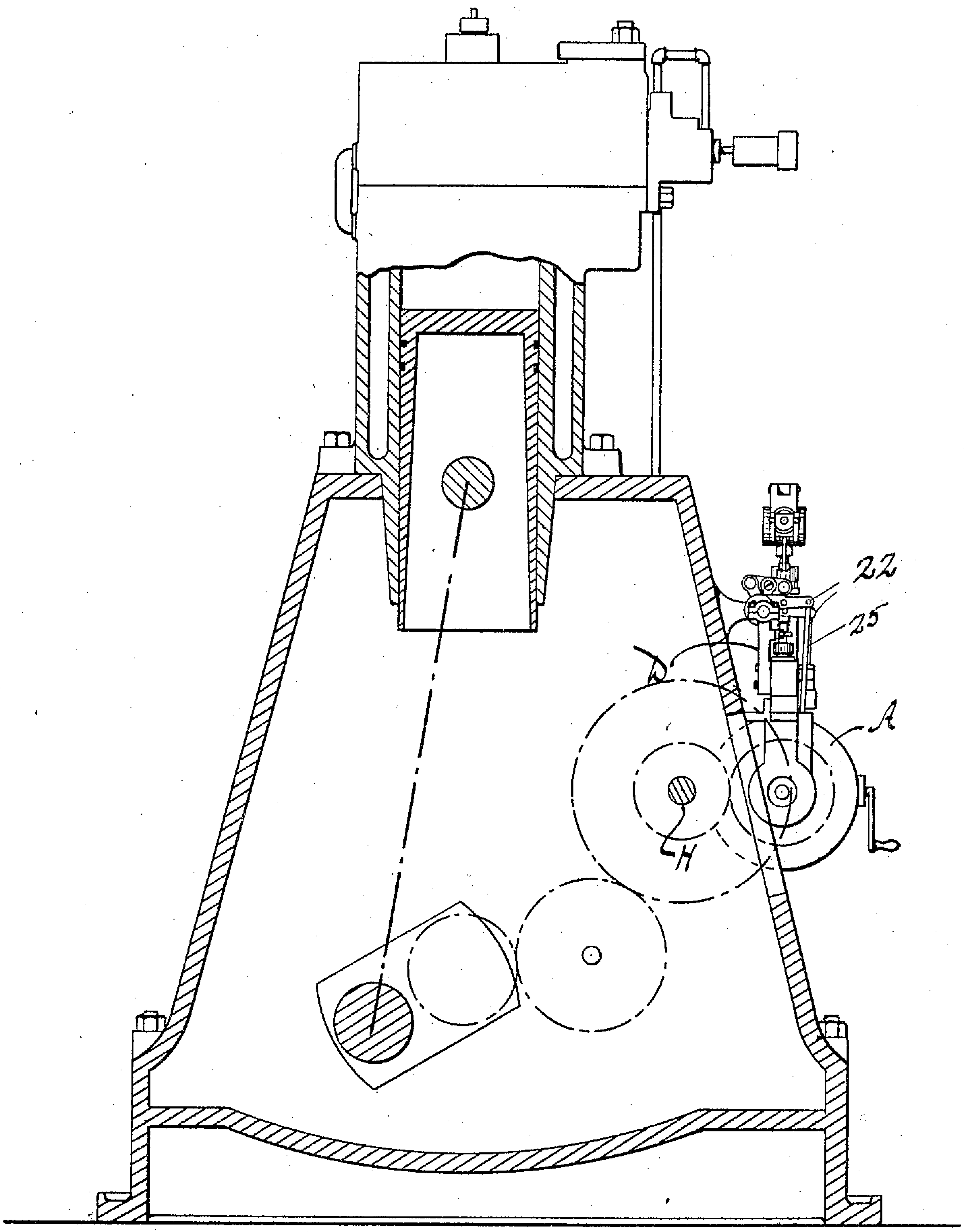

Fig. 4.

Attest:

Edgeworth Greene

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James D. Macpherson

Inventor:

by [signature]

Att'ys.

UNITED STATES PATENT OFFICE.

JAMES D. MACPHERSON, OF NEW YORK, N. Y., ASSIGNOR TO AMERICAN DIESEL ENGINE COMPANY, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

FUEL-PUMP FOR INTERNAL-COMBUSTION ENGINES.

No. 898,124. Specification of Letters Patent. Patented Sept. 8, 1908.

Original application filed April 7, 1905, Serial No. 254,267. Divided and this application filed August 25, 1906. Serial No. 331,970.

To all whom it may concern:

Be it known that I, JAMES D. MACPHERSON, a citizen of the United States, residing in the city, county, and State of New York, have invented certain new and useful Improvements in Fuel-Pumps for Internal-Combustion Engines, of which the following is a full, clear, and concise specification.

My invention relates to fuel pumps for internal combustion engines of the kind described in a previous application filed by me April 7th, 1905, Serial Number 254,267, the present application being a division of said prior application.

More particularly the invention herein disclosed relates to the means whereby the pump of my earlier application can be operated by hand, in order to produce a preliminary compression of the fuel in starting the engine, and the invention consists of the formation and relative arrangement of the several parts of the pump-driving mechanism and its allied parts, whereby certain advantages, hereinafter made manifest, may be secured.

Referring to the accompanying drawings, forming a part hereof, and in which like reference characters refer to like parts throughout, Figure 1 is a front elevation, with parts broken away and partly in vertical central section, of a fuel pump of three cylinders such as disclosed in the prior application, adapted for use with a three cylinder internal combustion engine, not shown; Fig. 2 is a side elevation of Fig. 1, with starting pinion and adjacent casing in section; Fig. 3 is a detail in elevation of the clutching means. Fig. 4 is a general view indicating the relation of the fuel pump to the engine.

Referring to Fig. 1, the reference character A represents a frame or casing provided with suitable flanges for attachment to the main standard or casing of the engine and affording journal seats for the main pump shaft 1. The casing is divided by a partition A′ into two compartments, one for the driving gearing of the governor and the other for the cranks or eccentric mechanism for driving the pump plungers. Within the first mentioned compartment the pump shaft 1 carries a bevel gear 2 for driving the governor shaft 12, and a spur gear 3 which is adapted to mesh with a gear G carried and driven by the ordinary countershaft H of the engine and contained within the attached casing A^3 (Fig. 2). The end of the compartment is closed by a removable cover plate A^3. The gear 3 is the driving gear of the pump and imparts its motion thereto through the instrumentality of a one-way clutching apparatus, presently described, and the pump shaft 1, while adapted to be driven by said gear, is capable of forward rotation independently thereof so that when the gear is motionless, as when the engine is idle, the pumping apparatus may nevertheless be operated by another or manual means to compress the fuel for the initial compression in the engine cylinder or cylinders.

The clutching apparatus is constructed as follows. The bevel or governor gear 2, which is keyed to the pump shaft, is formed with a long hub or boss 2^a, and with a clutch member 2^b which is conveniently formed as an annulus and secured by the screws shown, to a faced shoulder on the hub proper of said bevel gear. The clutch member comprises a single ratchet tooth or projection indicated by 2^c. The driving gear 3 is loosely mounted on the boss 2^a and carries a corresponding clutch member 3^b with a single tooth 3^c, which is intended to encounter the clutch tooth 2^c, which as stated is fast on the shaft 1 (see Fig. 3). The clutch members are held up to each other by the pressure of the helical spring 9 and the latter is held in place, surrounding the end of the pump shaft, by a cap plate 10 and a suitable bolt screwed therein. As shown herein the gear 3 and its clutch member are movable as a unit along the shaft but only clutch with the shaft 1 or gear 2 when they are driven in a forward direction. When the shaft 1 is rotated independently, the clutch teeth 2^c and 3^c, by reason of their inclined backs, snap past each other in obvious manner.

It is important in internal combustion engines such as the Diesel type, that the fuel compression and feed take place for each cylinder at a certain predetermined or controlled point in the cycle and therefore that the pump shaft 1 shall rotate in phase with the engine crank-shaft or with the countershaft H. By the employment of a clutching means between these two parts which will always seize or lock in the same relative angular positions, such as the single tooth clutch members just described, this unison of action is brought about, for it is obvious that, irrespective of the relative positions of

the gear 3 with respect to the shaft 1, when the engine is idle, the gear will take up the difference when the engine is started, and the parts will then rotate properly together as soon as the clutch teeth come into driving engagement.

The means for operating the pump apparatus independently of the gear 3, comprise a bevel pinion 4 which is journaled in the front of the casing, and provided with a hand crank 5 on the outer end of the short shaft upon which it is mounted. The shaft, which is shown as provided with a bushing 4^a, is adapted to slide back and forth in its journal seat, the pinion 4 being in mesh with the bevel gear 2 in the innermost position and out of mesh therewith in the outermost position. Two annular grooves formed in the bushing coöperate with the spring-pressed detent bolt 6 to hold the pinion in each position.

In operation the pinion may be pushed into mesh with the gear by lifting the lock pin and pushing the hub of the crank inwardly, and after the engine has been started and the gear 2 becomes driven by the gear 3, the end-thrust on the pinion will force it back again, the detent bolt being lifted. The governor-shaft 12 is geared to wheel 2 by means of a pinion 11 in constant mesh therewith, and the said governor shaft and pinion are carried by an upright column B bolted to the top of the casing A so as to be parallel with and in the same plane as the pump cylinder, the said shaft being shouldered and provided with a coller 13 housed within the column to take the weight of the shaft as well as the thrust of the pinion 11. The casing A is slotted, as shown at 14, to permit the ready removal of pinion 11 when the bolts of the column are released. At its upper end the governor shaft drives the usual centrifugal governor, which has connections with the actuating means of the induction valves of the pump for automatically regulating the adjustment thereof, as will be presently described, it being observed that the disposition of the said shaft is close to the end cylinder of the group and that it is of such length as to bring the governor in close proximity to the induction valve extensions.

The pump herein shown is a multi-cylinder apparatus, and the several cylinders thereof are formed in a single forging C which is bolted to the top of the casing A directly over the shaft 1 so that the said cylinders are in line with the said shaft and parallel with the governor shaft above mentioned. The stuffing boxes 15 are located within the casing A and the plungers 16 are connected for operation by the pump shaft by means of the eccentrics 17, the latter being angularly spaced in proper relative phase thereon. The induction valves are located in the top of the cylinder forging C, being of the puppet type, and with extensions or extended valve-stems, projected to the exterior of the cylinder forging. The several extensions are guided in an apertured cross-bar D′ of a bracket D, the latter being mounted at the rear of the cylinder casting or preferably bolted directly to it, and helical springs 20 are interposed between the headed ends of the extensions and the said bar D′ for holding the valves 19 closed against their seats when not actuated by their valve levers. The bracket D also carries a rock shaft 21, which is disposed thereon at the rear side of the valve extensions, and with respect to said extensions serves the purpose of providing a common adjustable fulcrum for their several actuating levers 22. The valve levers 22 are adapted to operate the valve extensions by means of the connecting rods 25, which are joined at their bottom ends to projecting studs 26 on the cranks 17. The eduction valves are shown at E, being located on the front of the part C. The engine governor, of ordinary construction and driven by shaft 12, controls the adjustment of the shifting fulcrum of the valve-operating levers 22 by rocking the shaft 21 through the connecting crank 28 thereon and link 29 in the manner which is fully described in my pending application above referred to, the purpose of the valve controlling arrangements being to regulate the supply of fuel automatically in accordance with the load on the engine.

Having described my invention, what I claim and desire to secure by United States Letters Patent, is:

1. In apparatus for injecting fuel for internal combustion engines, the combination with a part driven by the engine and a pump shaft, of clutching means between said parts comprising clutch members adapted to interlock or seize only in a definite angular relation which relation is predetermined with reference to the cycle of the engine, and independent means for forwardly rotating said shaft with respect to said engine-driven part.

2. In a fuel pump for internal combustion engines, a pump shaft, an engine-driven driving gear idly mounted thereon, a single tooth ratchet clutch mechanism between said parts and means for forwardly rotating said shaft with respect to said driving gear.

3. In a fuel pump for internal combustion engines, an engine governor, a pump shaft driving said governor and having a gear fast thereon and a driving gear loosely mounted thereon, in combination with clutch-members carried by said gears arranged to permit the forward rotation of the shaft with respect to said driving gear and independent means for rotating said shaft.

4. In a fuel pump for internal combustion engines, a casing having a partition dividing the same into compartments and a pump

shaft common to said compartments, pump operating means on said shaft within one compartment and a driving gear loosely mounted on said shaft in the other compartment, in combination with clutching mechanism between said gear and shaft adapted to permit forward rotation of the latter with respect to said driving gear, means for independently driving said shaft, and an engine governor supported on the casing of the latter compartment.

5. In a fuel pump for internal combustion engines, a pump shaft, a driving gear for said shaft loosely mounted thereon, a second gear fast on said shaft and adapted to be automatically clutched to said driving gear under forward rotation of the latter, in combination with a governor shaft and a pinion thereon in mesh with the aforesaid second gear.

6. In a fuel pump for internal combustion engines, a pump shaft, a driving gear therefor, a second gear fast on said shaft and provided with a hub upon which said driving gear is mounted, ratchet teeth on the proximate faces of said gears spring pressed into engagement, and means for independently operating said second gear, in combination with a governor shaft actuated by the aforesaid second gear.

7. In a fuel pump for internal combustion engines, a pump shaft, a gear fast thereon and a governor shaft driven by said gear, a driving gear for said pump shaft having ratchet clutch engagement with said first mentioned gear, in combination with an independent driving pinion movable into and out of engagement with said first mentioned gear and adapted to drive the same and said governor shaft independently of the main driving gear.

8. In a fuel pump for internal combustion engines, a pump shaft and a governor shaft, gearing connecting said shafts whereby they revolve in unison, a driving gear for one of said shafts adapted to drive the same in a forward direction, combined with means for driving said shafts independently of the main driving gear.

9. In a fuel pump for internal combustion engines, a main pump shaft and a bevel gear fast thereon, a governor driven by said bevel gear, a driving gear for said shaft, and a ratchet clutch interposed between the same and said shaft, adapted to permit the independent forward rotation of the latter, in combination with means adapted for engagement with said bevel gear for driving it independently of said driving gear.

10. In a fuel pump for internal combustion engines, a main pump shaft, a bevel gear fast thereon, a driving gear for said shaft and a clutching mechanism interposed between the same and said shaft and adapted to permit the independent forward rotation of the latter, in combination with a bevel pinion mounted to slide into and out of engagement with said bevel gear and means for rotating said pinion.

11. In a fuel pump for internal combustion engines, a pump shaft, a bevel gear fast thereon and a governor shaft driven by said bevel gear, and a main driving gear on the pump shaft adapted to drive the same in a forward direction only, in combination with a bevel pinion slidingly mounted to move into and out of engagement with said bevel gear for driving the same forwardly independently of the main driving gear, and means for maintaining said pinion in either position.

In testimony whereof, I have signed my name to the specification in the presence of two subscribing witnesses.

JAMES D. MACPHERSON.

Witnesses:

THEODORE LUCAS,

HUGO FRIEDRICHS.