No. 725,191. PATENTED APR. 14, 1903.

R. O. ALLSOP.

PETROLEUM ENGINE.

APPLICATION FILED DEC. 2, 1901.

NO MODEL. 6 SHEETS—SHEET 1.

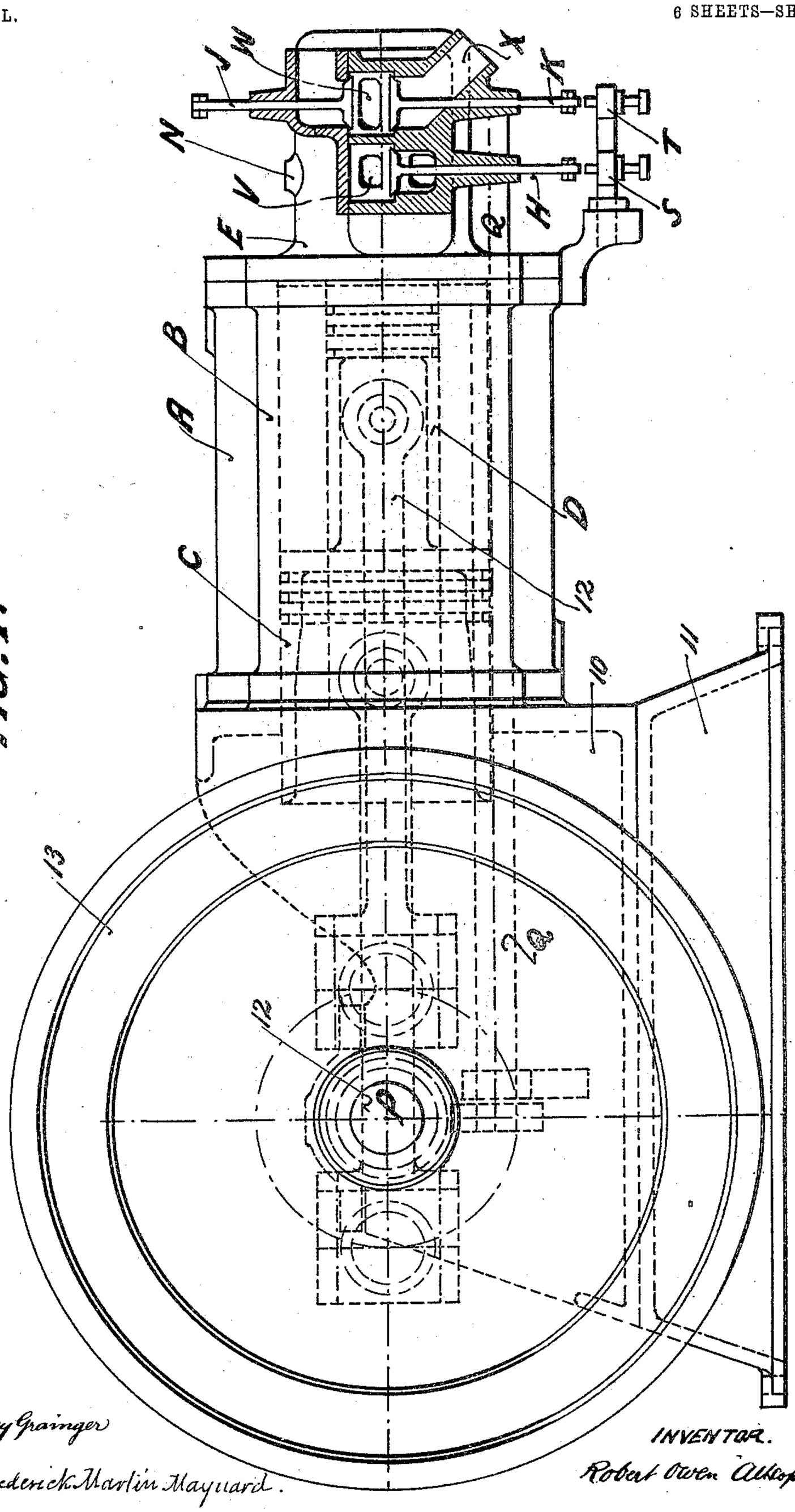

FIG. 1.

WITNESSES:

Harry Sydney Grainger

Hayden Frederick Martin Maynard.

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NO MODEL. 6 SHEETS—SHEET 2.

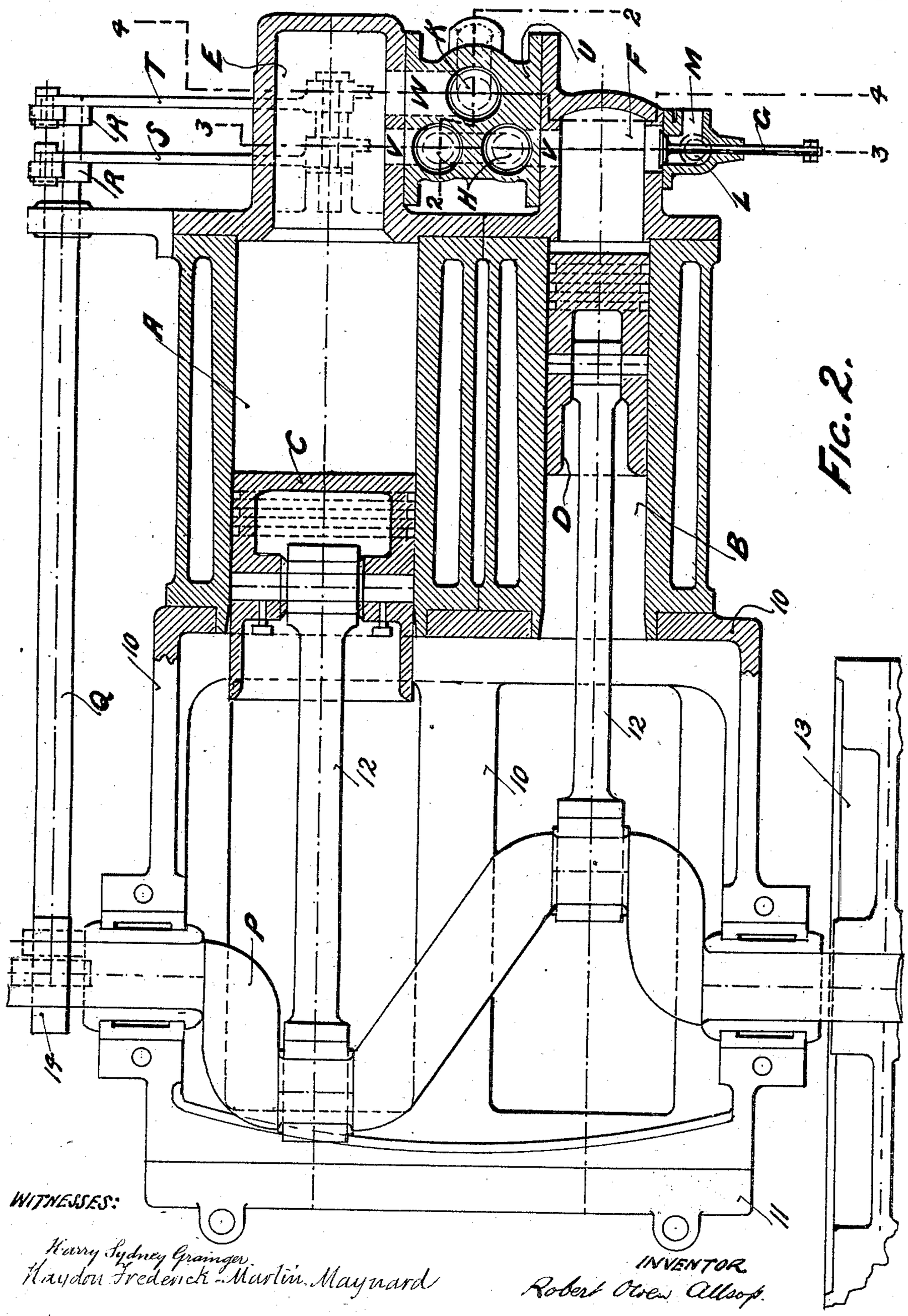

FIG. 2.

WITNESSES:

Harry Sydney Grainger
Haydon Frederick Marlin Maynard

INVENTOR
Robert Owen Allsop

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NO MODEL. 6 SHEETS—SHEET 3.

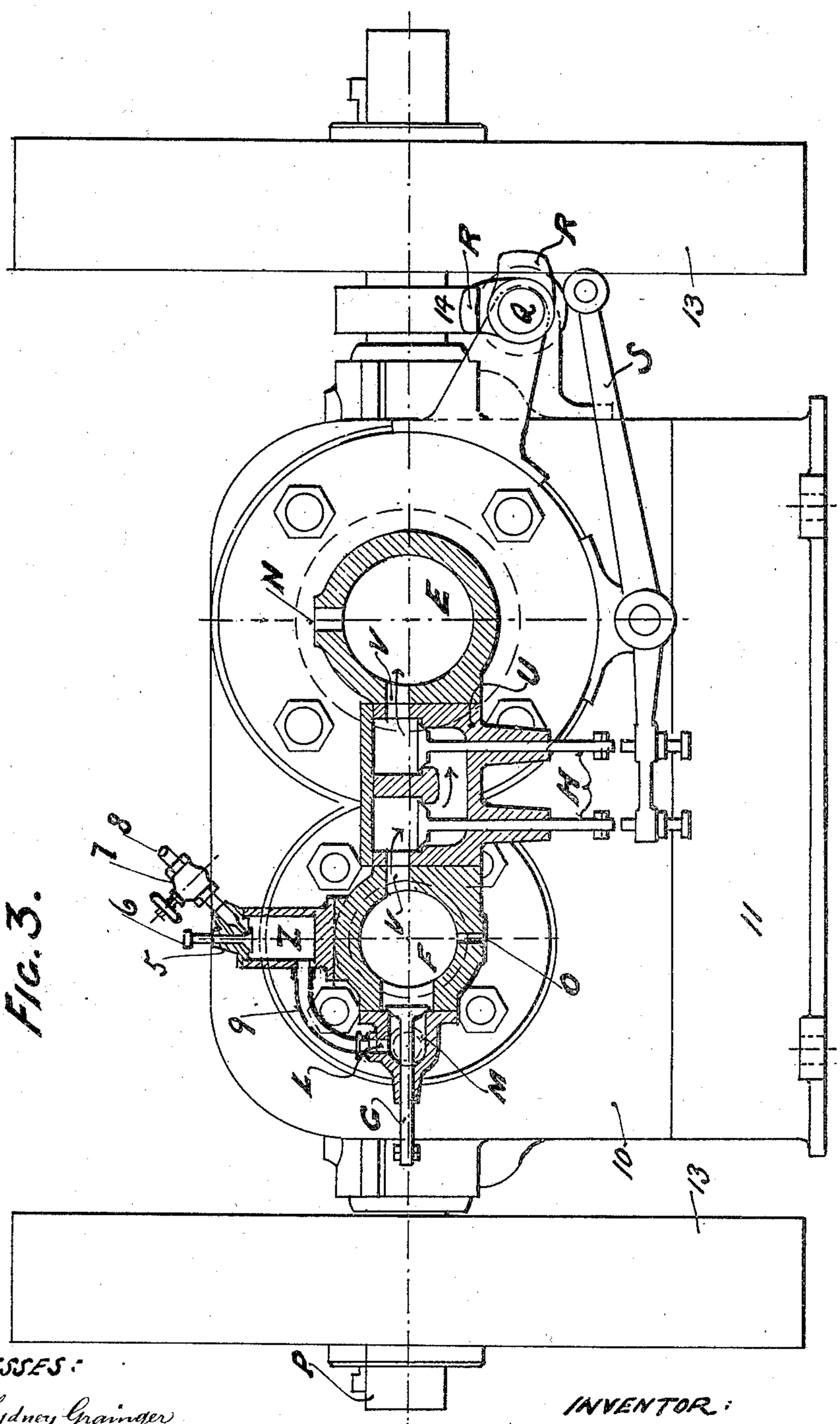

FIG. 3.

WITNESSES:

Harry Sydney Grainger

Haydon Frederick Marlin Maynard

INVENTOR:

Robert Owen Allsop.

No. 725,191. PATENTED APR. 14, 1903.

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PETROLEUM ENGINE.

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NO MODEL. 6 SHEETS—SHEET 4.

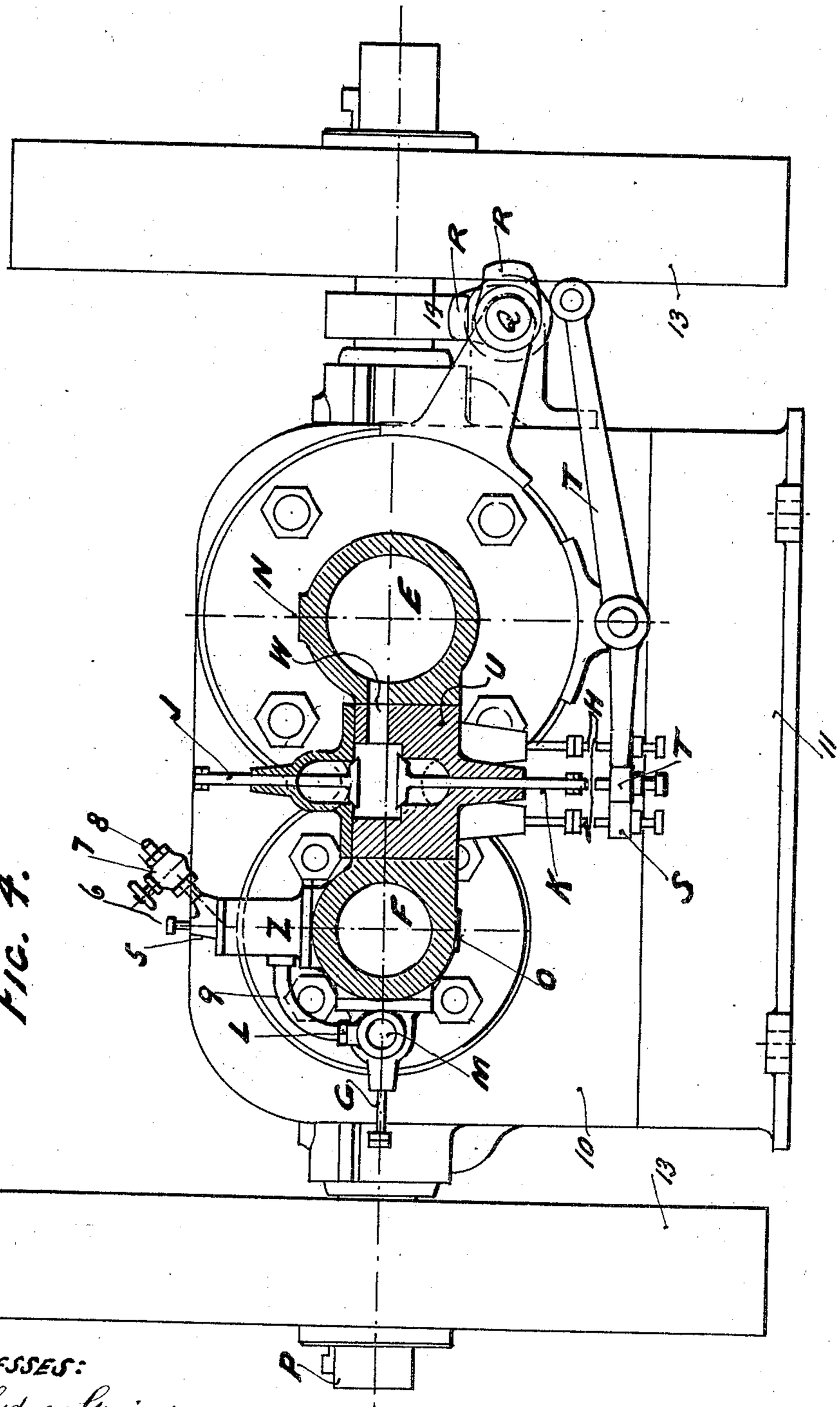

FIG. 4.

WITNESSES:

Harry Sydney Grainger

Haydon Frederick Marlin Maynard.

INVENTOR:

Robert Owen Allsop

No. 725,191. PATENTED APR. 14, 1903.

R. O. ALLSOP.

PETROLEUM ENGINE.

APPLICATION FILED DEC. 2, 1901.

NO MODEL. 6 SHEETS—SHEET 5.

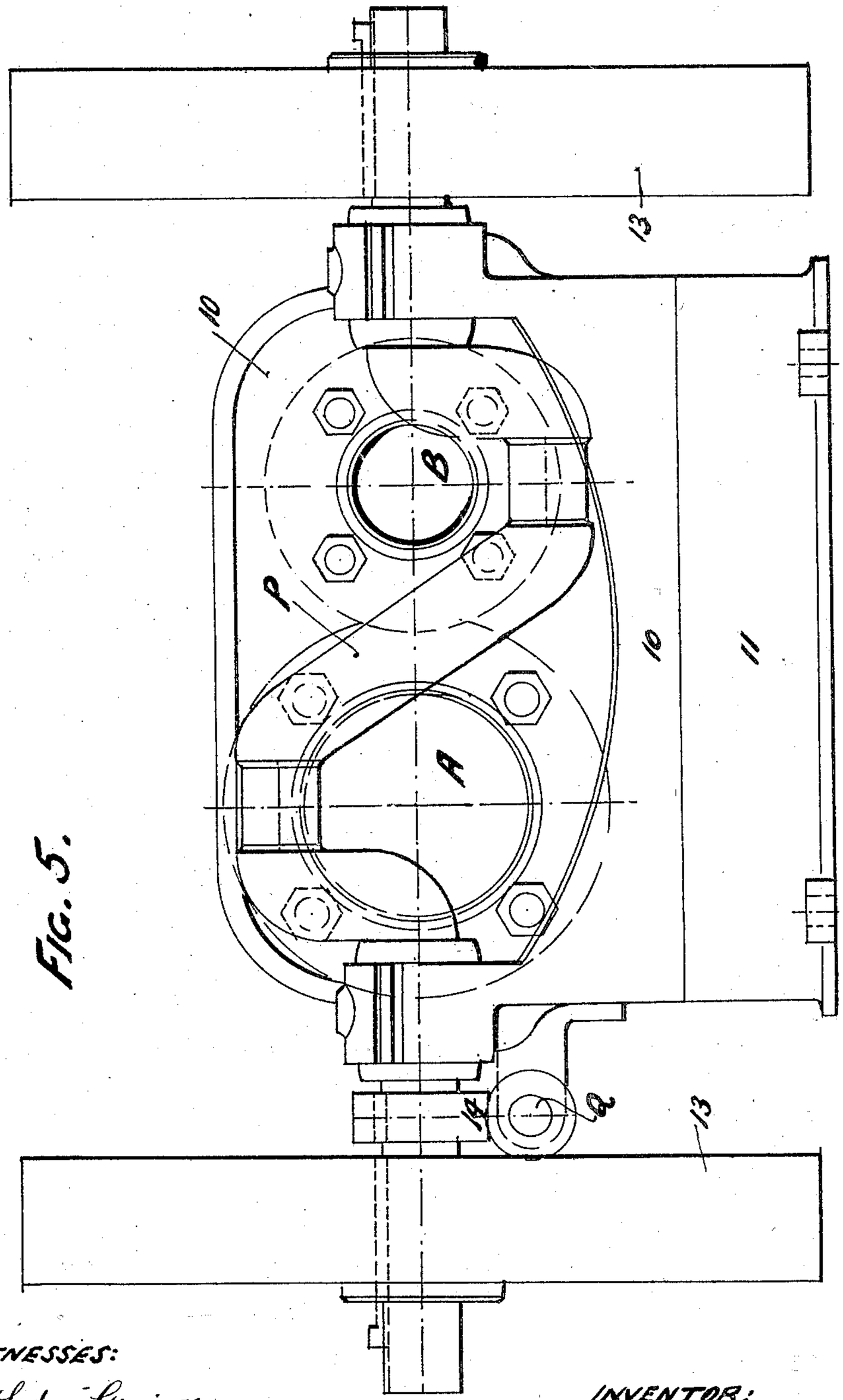

FIG. 5.

WITNESSES:

Harry Sydney Grainger.

Haydon Frederick Marlin Maynard.

INVENTOR:

Robert Owen Allsop.

No. 725,191. PATENTED APR. 14, 1903.

R. O. ALLSOP.

PETROLEUM ENGINE.

APPLICATION FILED DEC. 2, 1901.

NO MODEL. 6 SHEETS—SHEET 6.

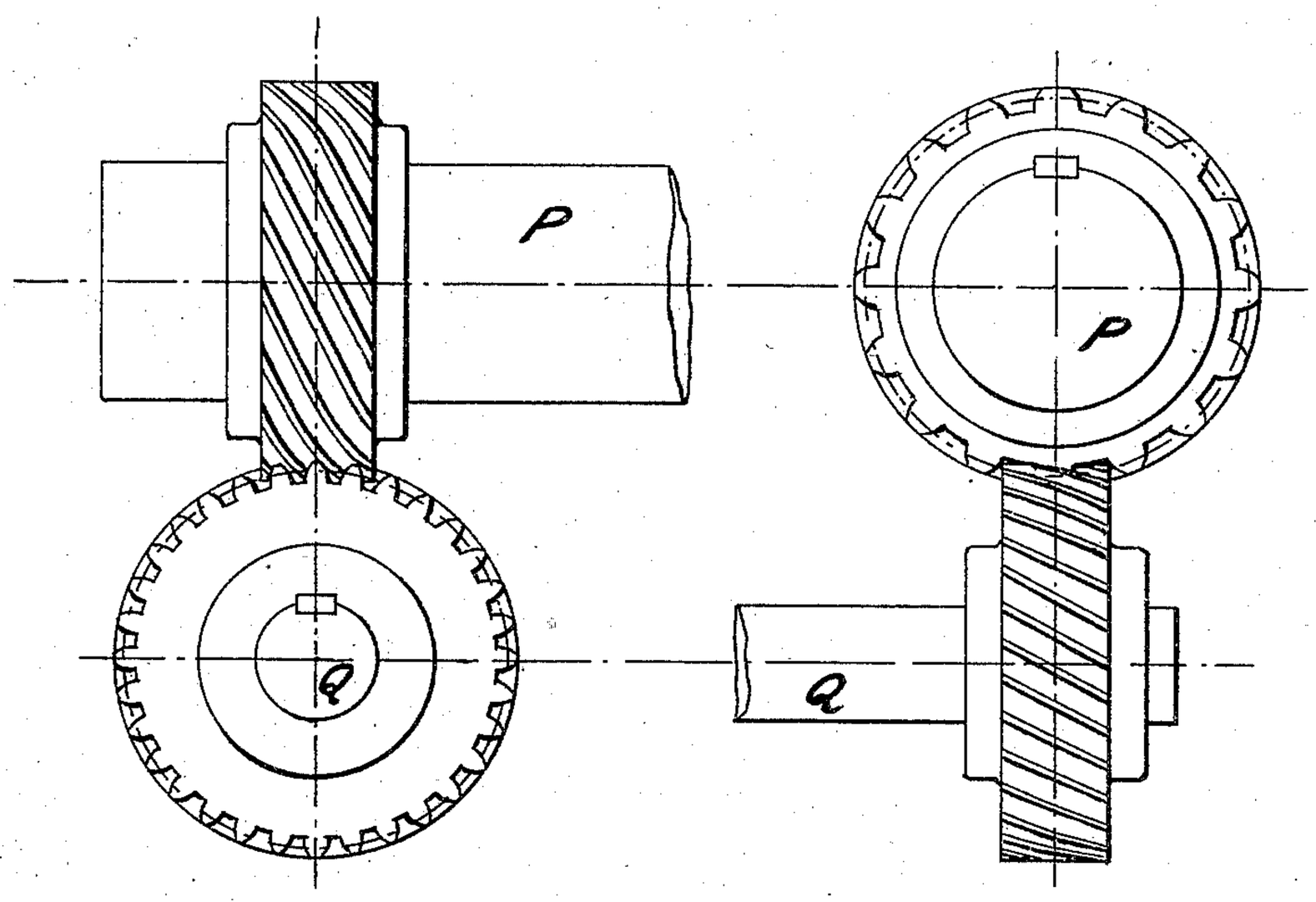

FIG. 6.

FIG. 7.

WITNESSES:

Haydon. Frederick Martin
Maynard

Harry Sydney Grainger

INVENTOR:

Robert Owen Allsop.

UNITED STATES PATENT OFFICE.

ROBERT OWEN ALLSOP, OF ORPINGTON, ENGLAND.

PETROLEUM-ENGINE.

SPECIFICATION forming part of Letters Patent No. 725,191, dated April 14, 1903.

Application filed December 2, 1901. Serial No. 84,466. (No model.)

To all whom it may concern:

Be it known that I, ROBERT OWEN ALLSOP, a subject of the King of Great Britain and Ireland, residing at Orpington, in the county of Kent, England, have invented a new and useful Petroleum-Engine, of which the following is a specification.

This invention relates to internal-combustion engines using petroleum as their source of power.

The object of this invention is, first, the more perfect combustion of the hydrocarbon, and especially of heavy hydrocarbons, such as kerosene or paraffin, in order that such hydrocarbon-engines may not cause a nuisance by casting out of the exhaust noxious smoke and fumes, and, secondly, the production of a petroleum-engine that may be started with ease and certainty and that shall work well under varying loads, and, thirdly, the economical consumption of the hydrocarbon.

In carrying out this invention I employ a suitable motor or power cylinder together with and suitably connected to a smaller pump-cylinder. In the motor-cylinder is performed an ordinary "Otto" or "Beau de Rochas" four-cycle, and I also employ a similar four-cycle in the pump-cylinder; but I do not ignite the contents of the pump-cylinder. In the said pump-cylinder by the heat of the adiabatic compression-stroke of the cycle aided by the heat stored in and acquired by the engine in working I thoroughly vaporize, decompose, or gasify the hydrocarbon in the presence of a suitable amount of air, such air being, preferably, insufficient for combustion, and this vaporized, gasified, or decomposed hydrocarbon and the said air I pass through suitable non-return valve or valves into the motor-cylinder.

An essential point in this invention is the compression of the hydrocarbon in the presence of air, but without ignition in the small pump-cylinder, in combination with the motor-cylinder wherein is performed an Otto four-cycle.

In carrying out this invention I make the pump-cylinder and motor-cylinder of suitable relative sizes, preferably with a motor-cylinder twice the bore of the pump-cylinder and preferably with equal lengths of stroke. I connect the said cylinders or their respective combustion or compression chambers with a suitable non-return valve or valves suitably operated. I set the two cranks at one hundred and eighty degrees, and with an outstroke of the pump-piston I draw into the pump-cylinder suitably sprayed or vaporized hydrocarbon and air. On the return instroke of the piston this hydrocarbon and air are suitably compressed, with the result that the compression-chamber is filled with a smoky vapor or gas by virtue of the adiabatic compression plus the heat stored in the engine. On the following outstroke of pump-piston the said vapor or gas is expanded, so that on the succeeding instroke it is discharged evenly and regularly through a suitable non-return valve or valves into the motor-cylinder. The cranks of the engine being set at one hundred and eighty degrees it follows that as the small piston is making the last said instroke with the said non-return valve open the large piston of the motor-cylinder is making an outstroke, and as the cubic contents of the large cylinder is greater than that of the small cylinder the large piston tends to create a vacuum, and thus draws in through a suitable valve additional air for combustion. The large or motor cylinder, therefore, becomes charged with a mixture composed of the contents of the small cylinder, together with the air that has entered through the above-said air-valve. The large piston then completes an ordinary Otto four-cycle—that is to say, the last-said mixture is compressed, ignited, and expanded, and the products of combustion are discharged through a suitable exhaust-valve. The result of this cycle of events is that using ordinary lamp-oil, such as kerosene or paraffin, an engine constructed in accordance with this invention perfectly consumes the hydrocarbon, so that the exhaust may be made absolutely invisible and practically inodorous. The cause of this perfect combustion of heavy oils and the inoffensive exhaust products is, I assume, the gasifying or decomposing of the hydrocarbon by compression and heat before such hydrocarbon is delivered into the motor-cylinder, and, further, that practically no condensation of petroleum takes place on the walls of the motor-cylinder. There being no condensation there are no coarse particles of petroleum

in the motor-cylinder to be cast out with the exhaust partially consumed. The exhaust in engines constructed in accordance with this invention will remain invisible as long as the engine is running with air and petroleum supply suitably adjusted. Even with greatly-altered loads and varied speeds the exhaust of the engine will remain invisible, and the engine may be slowed down to any speed short of that which will actually stop it, and when the load is taken off it will regain its normal speed without alteration of the air-valves. The reason that the engine is not sensitive to varying loads and speed is that there being a separate pump-cylinder the air-inlet of which is greatly throttled there is at all times a vigorous suction through the vaporizer or other suitable inlet for the petroleum. A further advantage in the construction of engines in accordance with this invention is that the main air-supply for combustion being situated on the motor-cylinder this air-supply need not be throttled in the manner frequently necessary on a common construction of heavy-oil engines of the present day, the object of such throttling being to cause a vigorous suction through the vaporizer. As a consequence of the non-necessity for throttling the main air-supply in engines constructed in accordance with this invention, such engines will develop great power for their size, as there is a full charge and a full compression of such charge.

In an engine constructed in accordance with this invention after such engine has become suitably heated with working if there is no water-jacket to the combustion-chamber and sufficiently high compression, such engine needs no device for firing, but will fire itself with perfect regularity and absence of misfires by the heat of the combustion-chamber walls. I, however, preferably use on small engines for self-propelled vehicles electric ignition, and for large power-engines incandescent-tube ignition, using the automatic ignition in special cases. When the engine has become suitably heated in working, there is no necessity for any highly-heated vaporizer, as the vigorous suction of air through the inlet for hydrocarbon and air to the pump-cylinder sufficiently sprays the petroleum and vaporization takes place during the compression-stroke in the pump-cylinder. On first starting the engine, however, I preferably heat the vaporizer or chamber through which the petroleum is drawn, and I heat by a petroleum blow-lamp or other suitable means the compression-chamber of the small cylinder, so as to avoid initial condensation of the oil at starting, and I preferably keep hot by the heat of the engine the said chamber or vaporizer.

It is desirable that the engine be so constructed that the small pump-cylinder is kept at a temperature sufficiently high to prevent a condensation of petroleum during the suction and expanding stroke of the pump-piston—that is to say, that the engine be so constructed that the superfluous heat generated may be conducted through suitable parts to the pump-cylinder walls.

I place the pump and motor cylinders in any suitable position, preferably in one plane parallel with each other.

I operate the pump and motor pistons with any suitable connecting rods, cranks, or crank-pins, and the pump-piston on suitable occasions by an eccentric.

I construct engines in accordance with this invention either horizontally, vertically, or suitably inclined, and with suitable bed-plates, cranes, and fly-wheels, and I complete the design and construction of the engines in any suitable manner.

Referring to the drawings, Figure 1 is a sectional elevation and section on line 2 2. (See plan.) Fig. 2 is a sectional plan; Fig. 3, a section on line 3 3; Fig. 4, a section on line 4 4; Fig. 5, a crank end elevation. Figs. 6 and 7 show to an enlarged scale the gear-wheels operating the side shaft.

The drawings clearly show bed-plate 10 and base-plate 11, crank-shaft with crank set at one hundred and eighty degrees, connecting-rods 12, and fly-wheels 13, with side shaft operated at half-speed of crank-shaft by worm-wheels 14 and operating by cams the valve-levers. The motor-cylinder is water-jacketed. The pump-cylinder may have an air-jacket, as shown, which can be connected to a pipe leading to inlet-valve on the pump-cylinder, so that the warm air may assist to spray the petroleum. The combustion-chamber E is shown without water-jacket; but for high compression this should be water-jacketed.

In the drawings, A is the motor-cylinder; B, the pump-cylinder; C, the motor-piston; D, the pump-piston. E is the combustion-chamber of motor-cylinder; F, the compression-chamber of pump-cylinder.

At G is the inlet-valve to pump-cylinder.

At H are a pair of valves forming a non-return couple.

J is the air-valve to the motor-cylinder.

K is the exhaust-valve.

The levers opening the non-return and exhaust valves by means of suitable cams on the side shaft are clearly shown in the drawings, though for the sake of clearness in the drawings the levers are shown broken off on the plan Fig. 2 and cams and parts of levers omitted in Fig. 1. It should be noted that one lever opens the two valves forming the non-return couple. The inlet-valve to the pump-cylinder and the air-valve to the motor-cylinder are automatic, being actuated by the suction of the pistons. All valves are closed by suitable springs, which in the non-return valves and exhaust-valve should be sufficiently strong to resist the suction of pistons.

At L, being a drilled boss on the inlet-valve,

I connect the engine with any suitable vaporizer, preferably one that sprays the petroleum.

At M, I place a throttle-valve to regulate the supply of air, or said air may be drawn through the vaporizer with suitable throttle.

At N is a boss or combustion-chamber for an electric ignition-plug or for an incandescent ignition-tube.

O is a boss for a small tap for clearing out any condensed petroleum.

The drawings show clearly the ports of communication between the compression and combustion chambers controlled by the non-return valve. The arrows shown in Fig. 3 indicate the course of the mixture supplied to the motor-cylinder. The arrangement of valves H allows compression in both cylinders. The port of communication between the air and exhaust valves in the motor-cylinder is also clearly shown. The valve-box containing non-return valves and exhaust-valves is a separate casting, and in the cover of said valve-box is placed the air-valve. The said valve-box is suitably bolted to and connects the combustion and compression chambers. The box of inlet-valve G is bolted to the compression-chamber.

The drawings are further lettered as follows: P, the crank-shaft; Q, side shaft; R R, cams; S, lever operating non-return valves; T, lever operating exhaust-valve; U, valve-box; V, ports connecting compression and combustion chambers; W, port for air and exhaust valves of motor-cylinder; X, exhaust-outlet.

At Z is shown a suitable vaporizer, being a casting secured to the compression-chamber with a cover 5, in which is a valve 6. A small hole in seating of this valve admits petroleum from pipe 8, which is connected with a suitable reservoir for petroleum. The petroleum-supply may be either by gravity or under pressure and is regulated by the valve 7. The air-inlet M being greatly throttled, the suction of pump-piston reduces pressure in vaporizer and opens valve 6. A small amount of air entering past the spindle of the valve serves to spray the hydrocarbon. The use of the valve 6 is not absolutely necessary, but it assists in controlling the supply of petroleum. In place of the arrangement shown the throttled air-inlet instead of being placed at M can be placed on the vaporizer—as, for example, in the position of valve 6. For heavier hydrocarbons the vaporizer Z may be placed on the cover of valve-box U, which becoming quickly hot in the working of the engine would heat vaporizer sooner and serve more readily to assist vaporization or spraying. The sprayed or vaporized hydrocarbon passes from vaporizer to inlet-valve G by way of pipe 9, which pipe should be preferably covered with a non-conducting composition to retain heat.

I start the engine in any suitable manner, preferably as follows: I first heat the vaporizer or spraying-chamber and I heat the compression-chamber F by a blow-lamp or other suitable means. In cold weather I also preferably heat the pump-cylinder by blowing on the walls through a suitable opening in the jacket. The object of the said heating is to prevent condensation of petroleum at starting, and the more thoroughly this preliminary heating is carried out the more easily the engine can be started. The said heating having been accomplished I start the engine by suitably turning the fly-wheels. The operation of the engine is then as follows: An outstroke of the pump-piston D draws in a mixture of hydrocarbon spray or vapor and a small amount of air. On the return instroke of the pump-piston the said mixture is compressed, and by the heat of adiabatic compression plus the heat of the engine this mixture is more or less gasified. The following outstroke expands the mixture, so that on the next succeeding instroke, the valves H being suitably opened by the cam, as described, the mixture is evenly and regularly discharged into the motor-cylinder. During this discharging stroke of the pump-piston the motor-piston is making a charging stroke, and, as hereinbefore explained, draws in additional fresh air through valve J. The following instroke of the motor-piston compresses the complete mixture and at the in dead-center the mixture is fired with expansion and exhaust, as usual. It therefore follows that there is in operation in the engine illustrated and described an Otto four-cycle without ignition in the pump-cylinder, and in the motor-cylinder an Otto four-cycle with the usual ignition and combustion of the charge.

I govern the engine in any suitable manner, preferably by providing centrifugal action, whereby suitable levers cut off communication between the two cylinders by causing the cam-operating non-return valve to slide on the side shafts, said cam missing lever and the non-return valve remaining closed. The hydrocarbon-supply is thus cut off and the motor-piston draws in air only through valve J.

When the engine has become well heated through working, it may remain stopped some time and be readily started again with very great ease and certainty, requiring no blow-lamp operation, as above described.

I am aware that an internal-combustion engine composed of a pump-cylinder and a motor-cylinder is an old idea; but so far as I have been able to ascertain the use of such pump for compression of hydrocarbon and air without ignition previous to and in addition to the compression of the Otto working cycle for the purpose of gasifying or decomposing the hydrocarbon in the manner hereinbefore set forth is novel. It should be observed, further, that I interpose between the first and second compressions a charge-expanding stroke. It should also be noticed

that I do not compress the mixture into any intermediate reservoir or receiver with the intention of storing the mixture under pressure. The preliminary compression of the hydrocarbon and air with an interposed charging stroke, as said, and the drawing in of the main charge of air for combustion through a separate valve on the motor-cylinder carried out in the practical manner hereinbefore detailed are essential points in this invention. The objects of the invention, as above stated, have been to perfect the combustion in heavy petroleum-engines, to produce an engine that will work well under varying loads, and the economical combustion of the hydrocarbons. At the present date I find that the majority, if not the whole, of the existing style of petroleum-engines cause a greater or less nuisance from smoke and smell of the exhaust, and that they are further extremely sensitive and liable to be thrown out of order, both as regards development of power and the combustion of fuel, by variations in the load and speed. It is by reason of these drawbacks and difficulties that the majority of internal-combustion engines on automobiles or self-propelled vehicles are compelled to use as fuel a petroleum-spirit. My invention enables such engines of automobiles to use as fuel a safe petroleum of high flashing-point.

Inasmuch as I am aware, as hereinabove stated, that the combination of a pump-cylinder and a motor-cylinder in internal-combustion engines is not new, I do not claim such combination broadly.

What I do claim as my invention, and desire to secure by Letters Patent, is—

1. In internal-combustion hydrocarbon-engines the combination with an engine working on the four-stroke cycle, of a fuel-vapor pump connected therewith to make the same number of strokes as the engine and arranged to deliver the vapor to the engine only on every fourth stroke of the pump, substantially as described.

2. In internal-combustion hydrocarbon-engines the combination with a four-stroke cycle-engine of a fuel-vapor pump connected therewith making the same number of strokes as the engine and delivering, to the engine, only on every fourth stroke of the pump, vapor that has undergone compression and expansion, in the manner and by the means hereinbefore described and specified, for the purposes and with the objects set forth, substantially as described.

3. In internal-combustion hydrocarbon-engines, the combination of a four-stroke cycle-engine, a fuel-vapor pump to make the same number of strokes as the engine, and arranged to deliver the vapor to the engine only on every fourth stroke of the pump, and a non-return valve allowing compression to be effected independently in both the cylinder of the four-stroke cycle-engine and in the pump-cylinder, in the manner hereinbefore specified, substantially as described.

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

ROBERT OWEN ALLSOP.

Witnesses:

HARRY SYDNEY GRAINGER,

HAYDON FREDERICK MARTIN MAYNARD.