B. M. ASLAKSON.

INTERNAL COMBUSTION ENGINE.

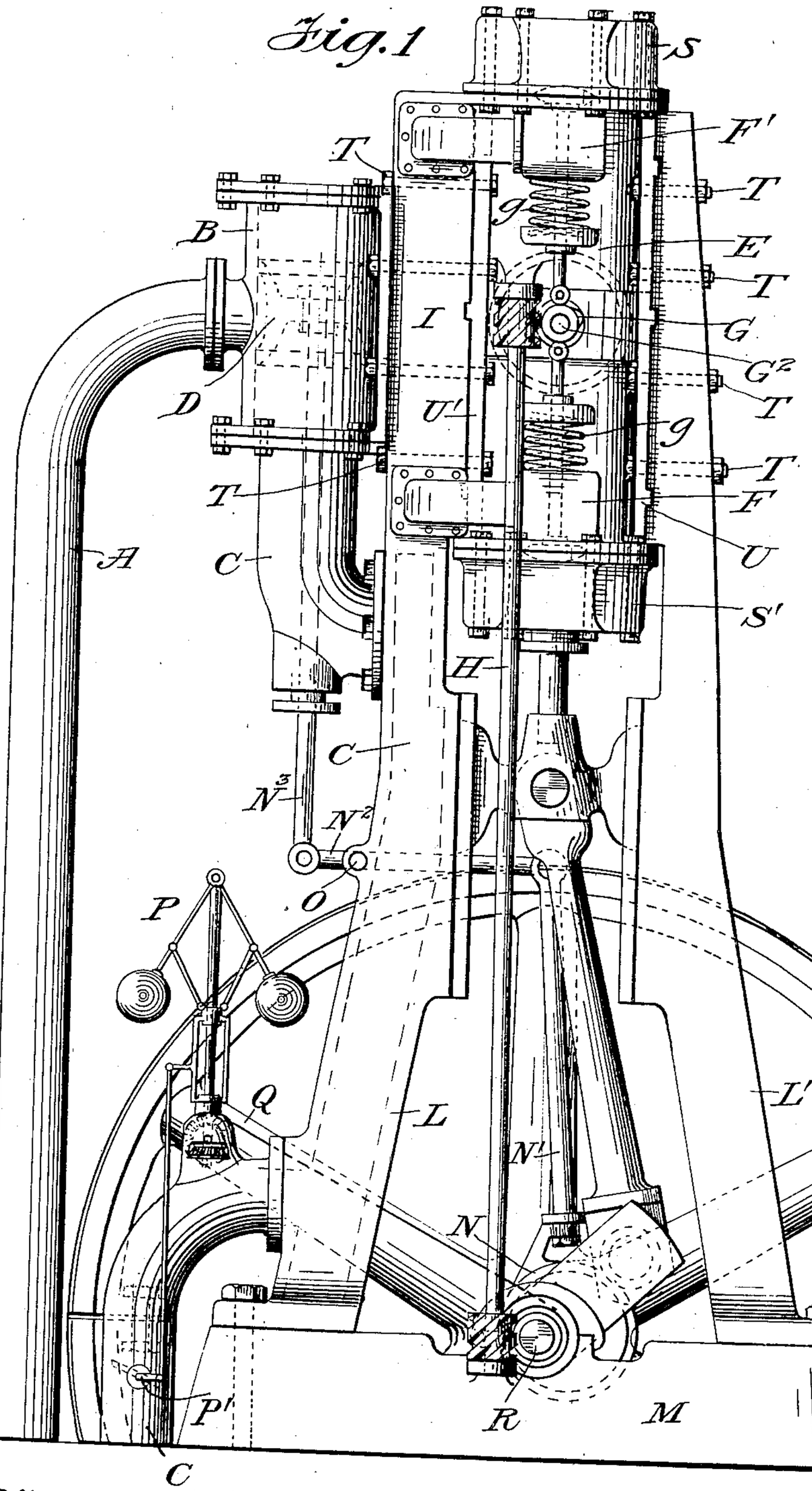
APPLICATION FILED MAR. 2, 1905.

921,657.

Patented May 18, 1909.

5 SHEETS—SHEET 1.

Fig. 1



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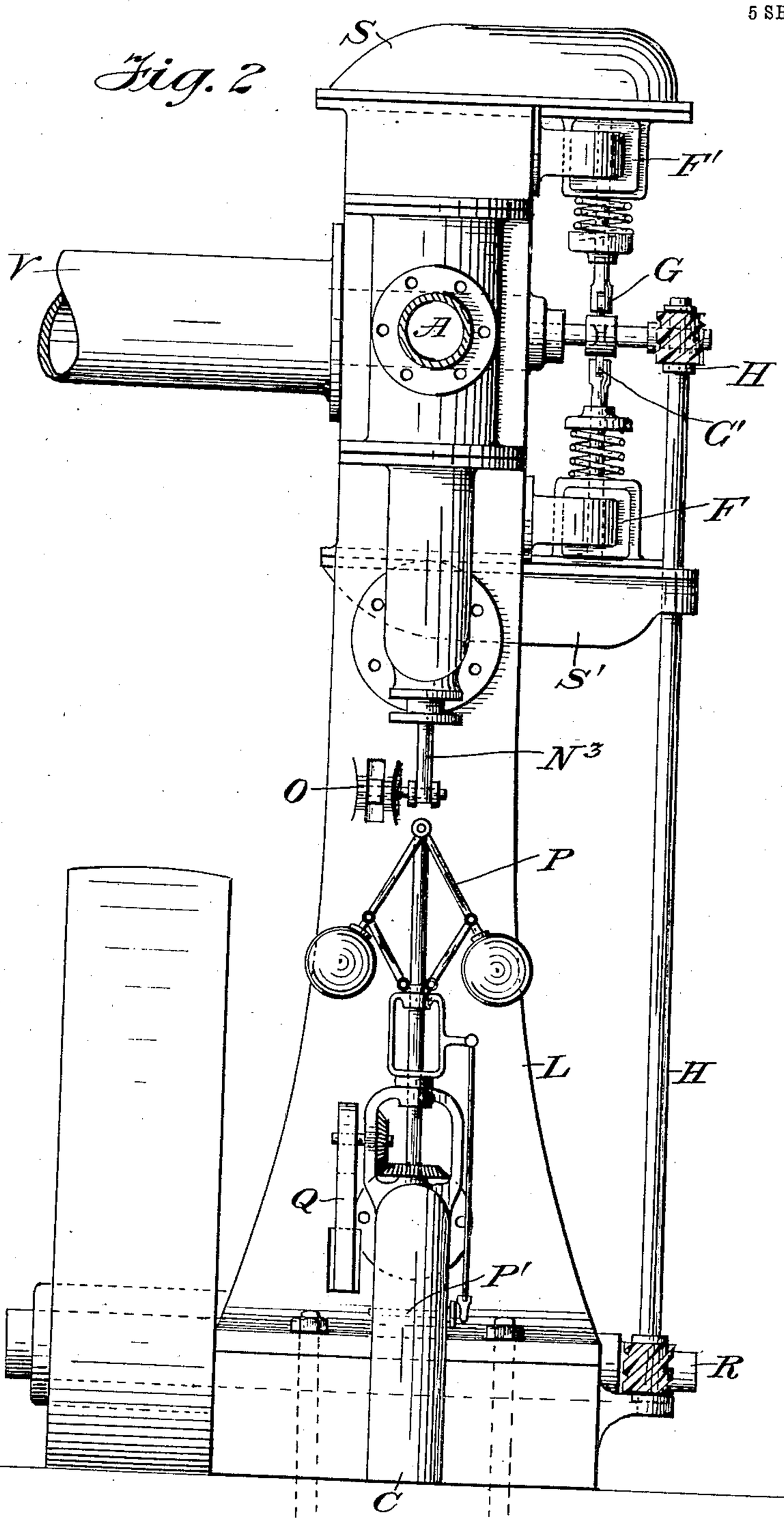
5 SHEETS—SHEET 2.

Fig. 2



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5 SHEETS—SHEET 3.

Fig. 3

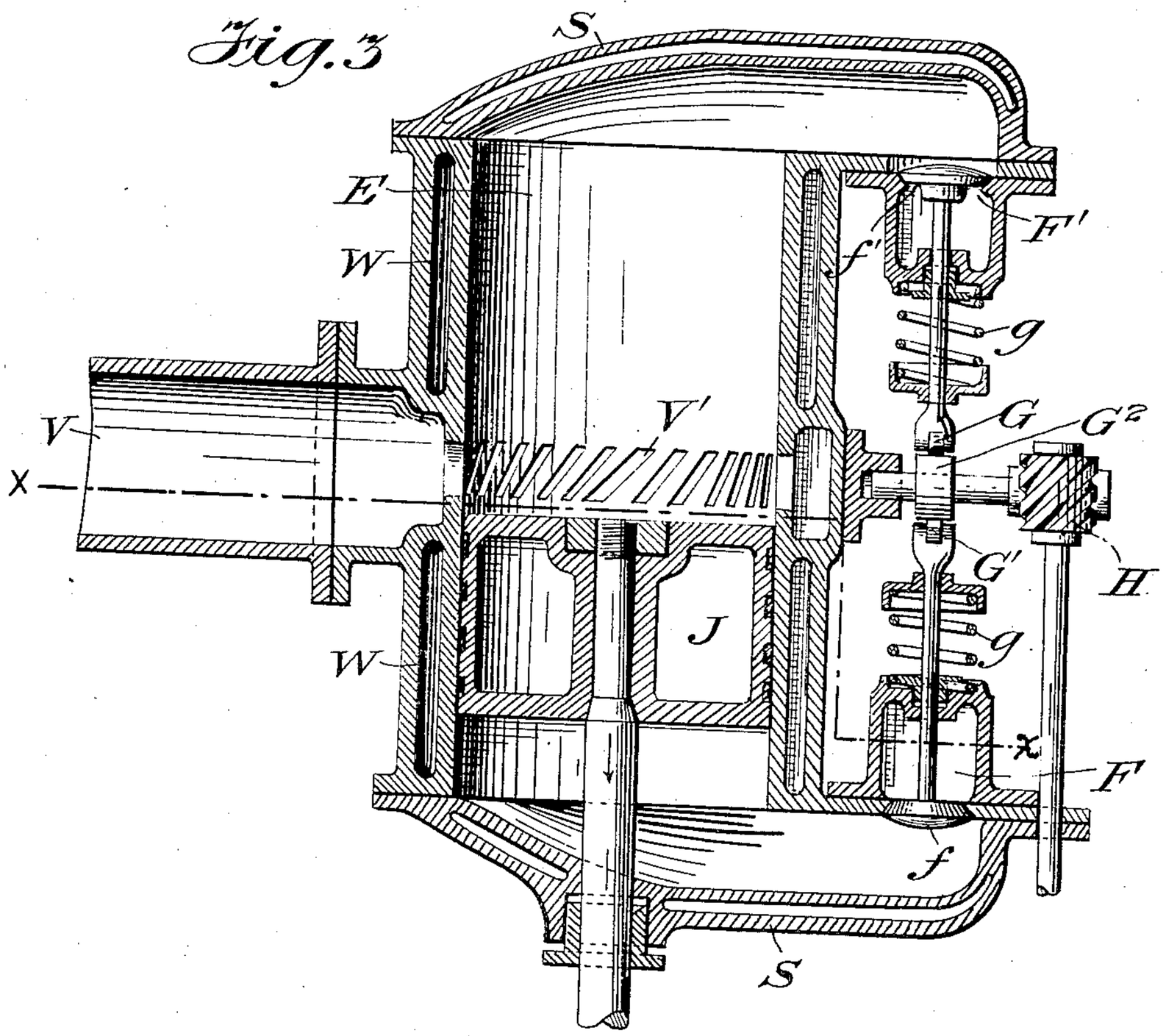
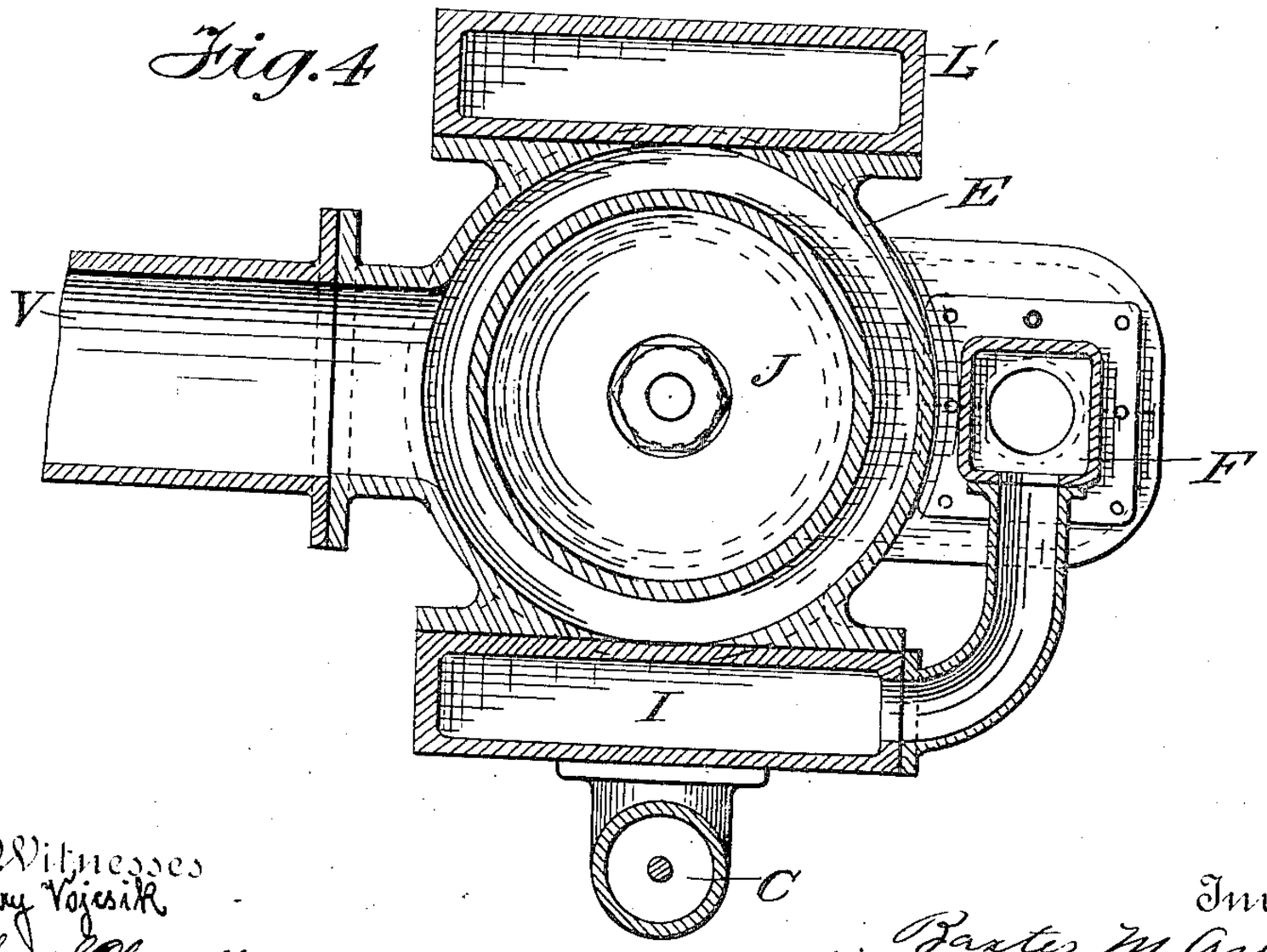


Fig. 4



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5 SHEETS—SHEET 4.

Fig. 5

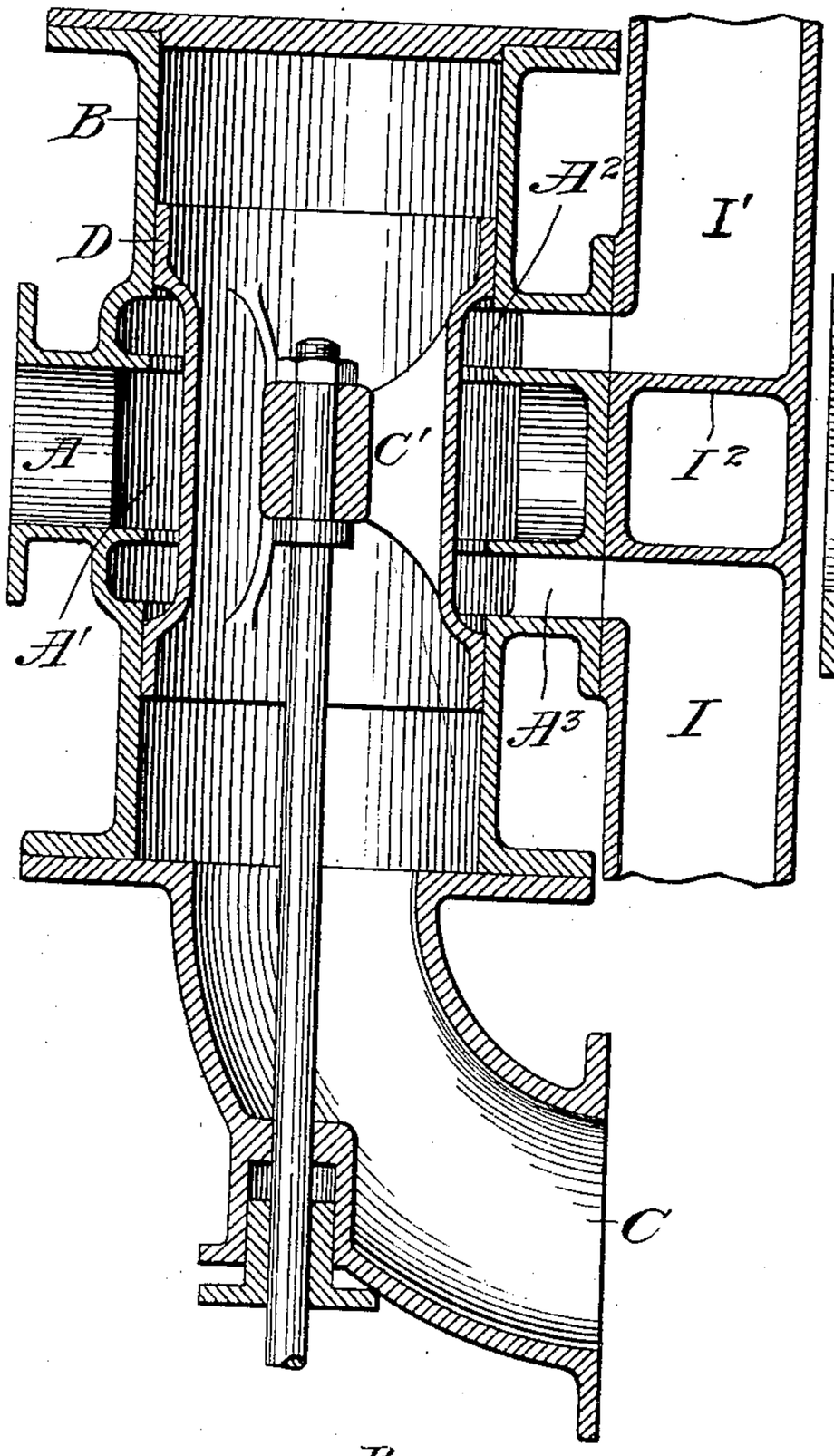
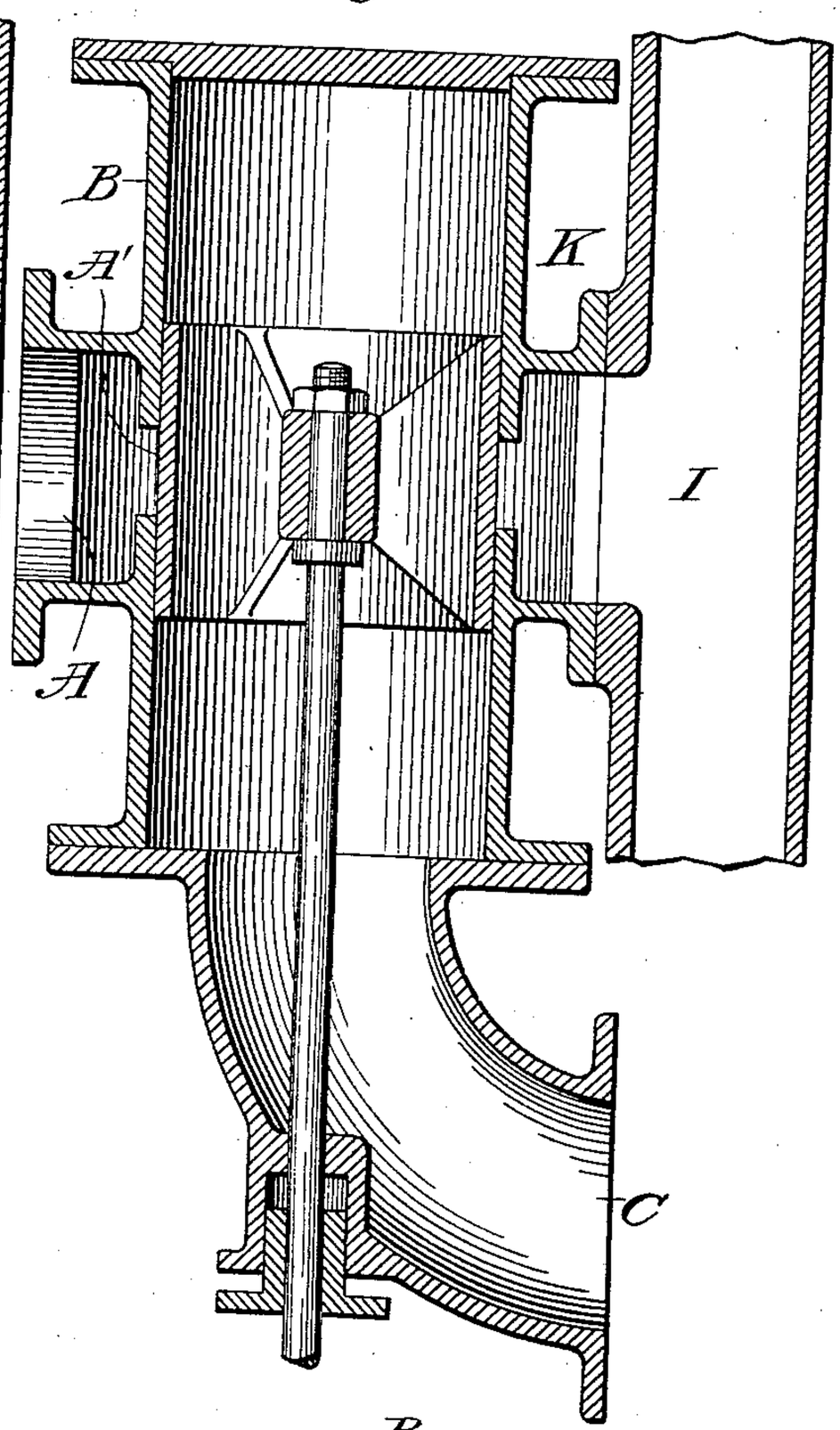


Fig. 7



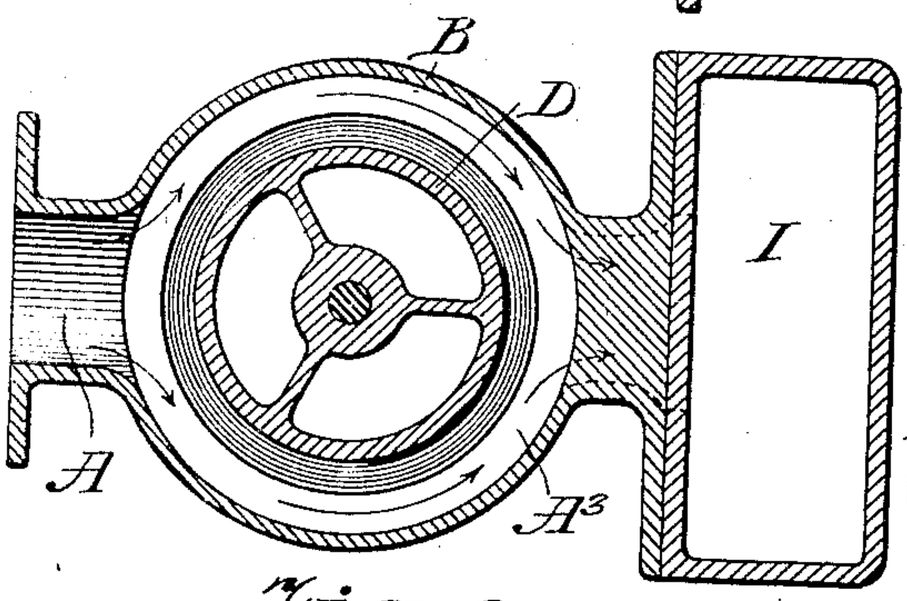


Fig. 6

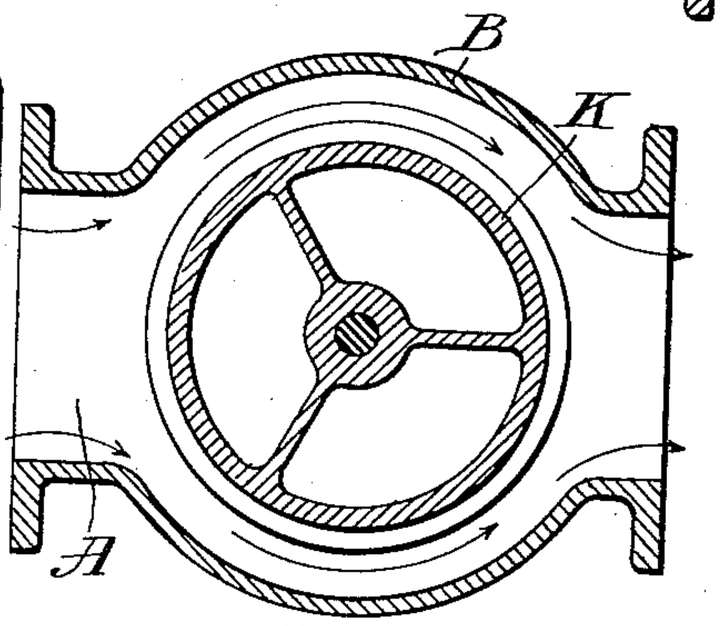


Fig. 8

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5 SHEETS—SHEET 5.

Fig. 9

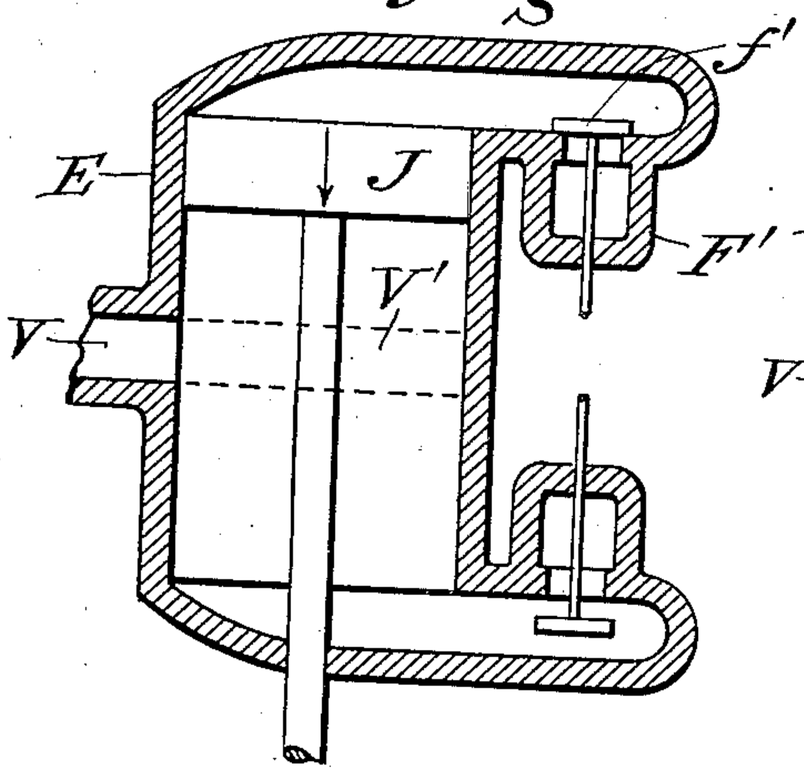


Fig. 10

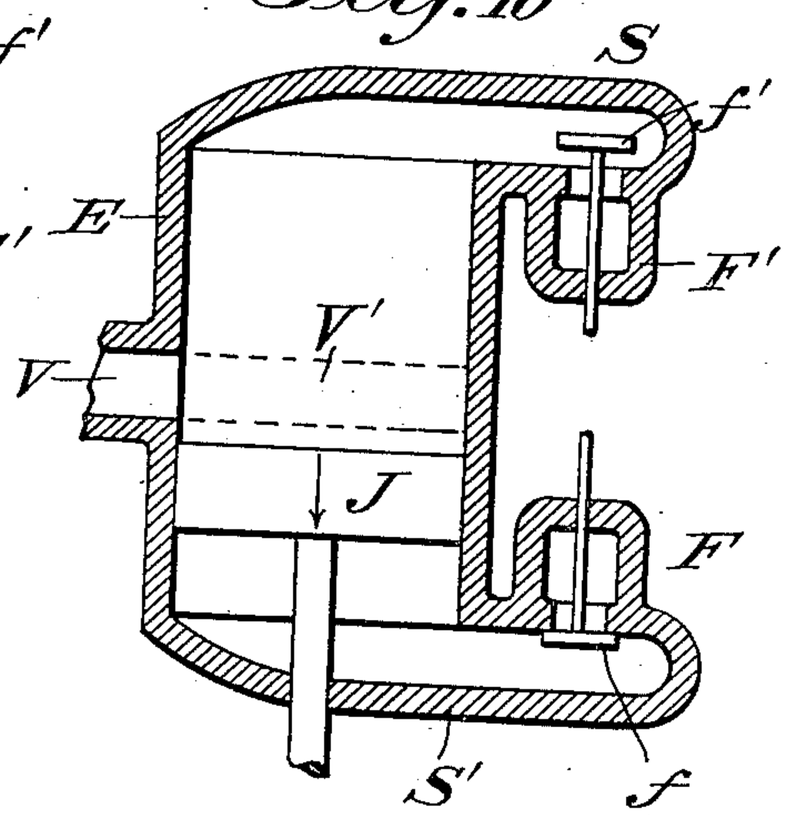


Fig. 11

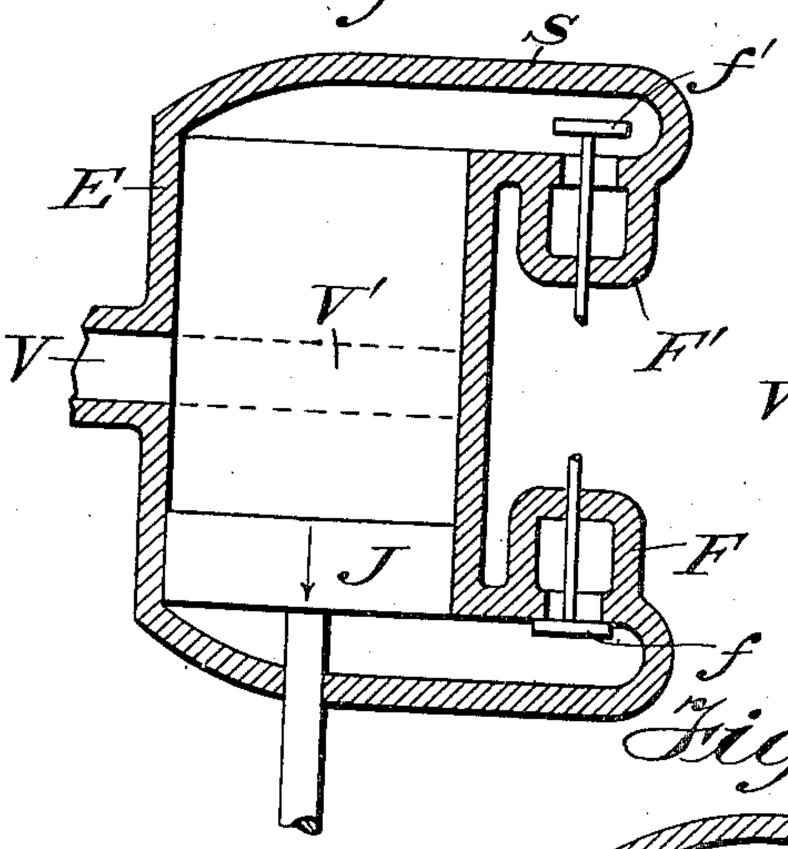


Fig. 12

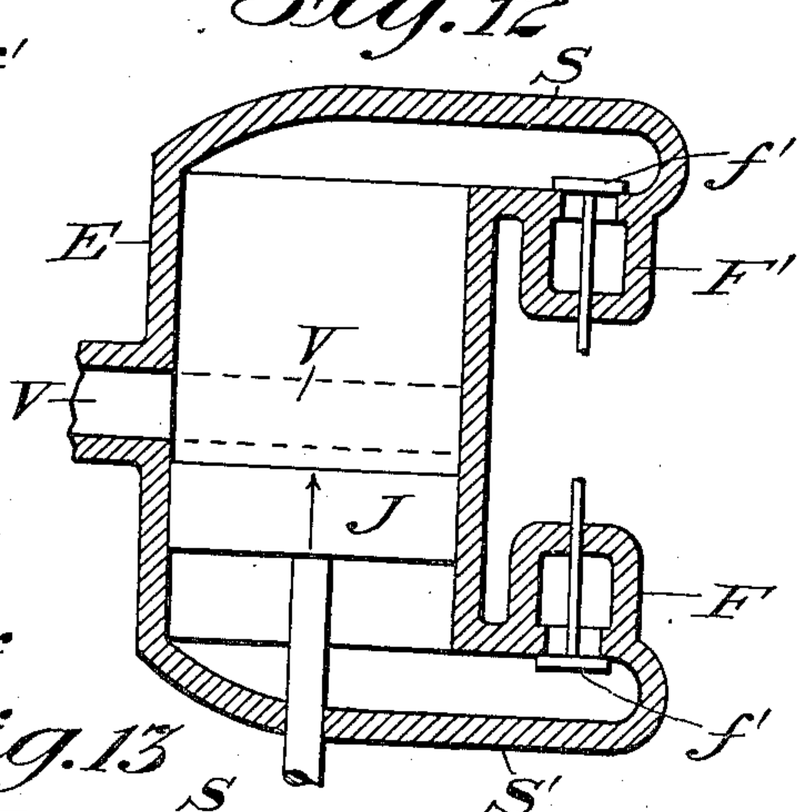
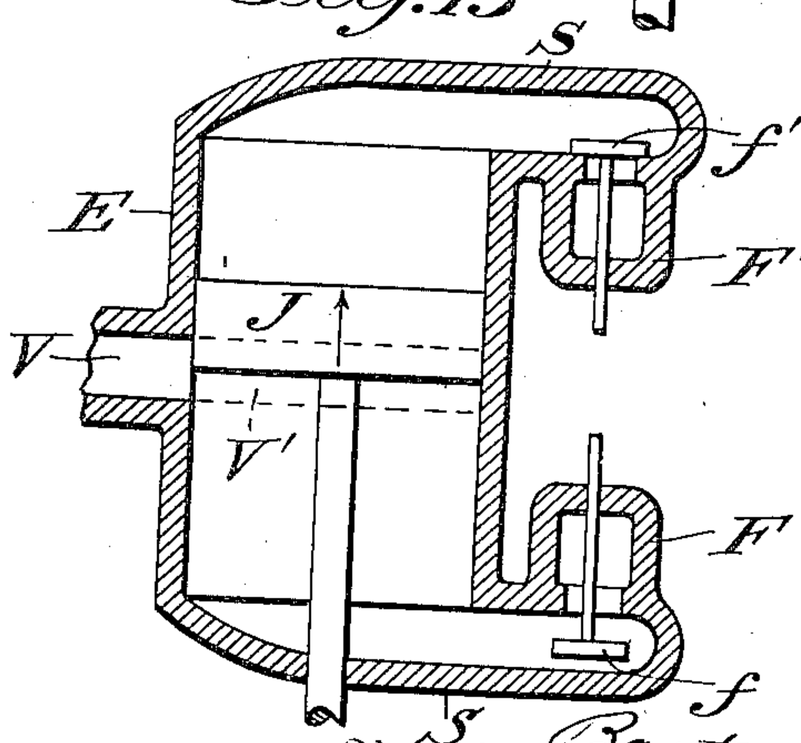


Fig. 13



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UNITED STATES PATENT OFFICE.

BAXTER M. ASLAKSON, OF SALEM, OHIO.

INTERNAL-COMBUSTION ENGINE.

No. 921,657. Specification of Letters Patent. Patented May 18, 1909.

Application filed March 2, 1905. Serial No. 248,187.

To all whom it may concern:

Be it known that I, BAXTER M. ASLAKSON, a citizen of the United States, residing at Salem, Ohio, have invented certain new and useful Improvements in Internal-Combustion Engines, of which the following is a specification.

This invention relates to that class of internal combustion engines in which the fuel is supplied to the engine cylinder under pressure, created by means separate from the engine proper.

The object of the invention is to create an engine in which every stroke of the piston will be a power stroke and to control the fuel supply thereto and in which the fuel used will be proportional to the power developed.

A further object is to attain a high economy in fuel consumption and to attain a construction that will be simple, durable, reliable and compact.

The type of engine is what is commonly known as the two cycle engine.

In the present case I introduce the fuel into the cylinders on both sides of the piston, whereby I am enabled to secure an impulse at each stroke of the same. I use air under pressure to force out the products of combustion and then admit air and gas to form a proper fuel mixture, thereby preventing the loss of any of the fresh charge of gas, which might otherwise escape through the exhaust ports with the burned gases.

The accompanying drawings which form part of this specification, illustrate my invention, and similar letters of reference indicate corresponding parts.

Figure 1, is a side elevational view of my engine showing the valve gear, governor and fuel conduits. Fig. 2, is a rear elevaton of the same. Fig. 3, is a central vertical section of the cylinder showing the valves, exhaust ports, and piston in section. Fig. 4, is a cross section of the cylinder and one of the valve housings on the line X—X of Fig. 3. Fig. 5, is a central vertical section of the control valve casing, valve and fuel conduits. Fig. 6, is a cross section of the same. Fig. 7, is a central vertical section of another form of construction of a control valve that may be employed. Fig. 8, is a cross section of the valve shown in Fig. 8, showing the air passages therethrough. Figs. 9, 10, 11, 12 and 13, are diagram central vertical sectional views showing different positions of the piston in the cylinder and the corresponding position of the inlet valves.

Referring to the drawings, in Fig. 1, A, indicates the air conduit, through which the air is delivered under pressure to the valve casing B. C, indicates the gas conduit through which the gas is conducted to the casing B, where it is controlled by the control valve D, located in casing B. E, indicates the cylinder of the engine. F, and F′, indicate the fuel valve housings in which the valves *f*, and *f′*, Fig. 3, are located and said valves are operated by the cam interposed between the rollers G, and G′ carried by the valve stems, and the valve transmission gear H. I, indicates the fuel chest, through which the gases pass to the housings F, and F′, and thence through the valves *f*, and *f′*, to the cylinder E.

J, in Figs. 3 and 4, and 9 to 13, inclusive, indicates the piston of the engine.

K, Figs. 7 and 8, indicates another form of control valve in which the air is free to pass at all times directly into the fuel chest I, whereas in the valve shown in Figs. 5 and 6, the air can be shut off from the fuel chest I, as will be hereafter explained. L, and L′, indicate the supporting columns or frame work which are cast hollow so as to make a light but rigid frame. M, indicates the base plate in which are mounted the main shaft bearings, and to which the frame work is secured. N, indicates the eccentric which is secured on the main shaft and through which the control valve D, is operated through the connecting rods N′, N², and N³, having one member fulcrumed at O, whereby reciprocating motion may be transmitted to control valve D. P, indicates the gas governor which controls a valve P′, located in the conduit C, by means of the connecting mechanism as shown, and well known in the art. This governor is driven by a belt Q, which is in turn connected in driving relation to the main shaft R, which is driven in the usual manner by the crank, connecting rod, piston rod, etc., by power exerted on piston J. S, and S′, indicate the cylinder heads of the engine which are so formed as to act as a conduit through which the fuel is admitted to the cylinder E. The frame work L, and L′, is secured to the cylinder by bolts T, T, etc., through flanges U and U′, thus keeping the parts as light as possible, so they may be handled without much trouble. V, indicates

the exhaust pipe. W, indicates the water jacket for the cooling of the cylinder.

I will now describe the operation of the engine. It will be remembered that the air and gas is being supplied to the engine through the conduits A, and C, under pressure from an outside source. I prefer to have the air under a pressure of from 5 to 10 lbs. per square inch and the gas under a pressure a few pounds greater than the air pressure. By referring to Fig. 5, wherein the control valve is shown in section, the air supply enters the valve through the conduit A, and passes around the annular groove A′, and thence to the charge chest I. It will be noted in this figure, that the charge chest I is separated by a partition I², which allows the control valve D, during a period of its travel to close the air supply to the said charge chest I, the said air being cut off from the upper portion of the chest, when the control valve is in its lowest position and from the upper portion thereof, when the said valve is in its highest position. In the position as shown, the air is passing through conduit A, and the annular conduit or groove A′, and into the charge chest I, at both sides of the partition I² and by referring to Fig. 4, it will be seen that the lower portion of the chest I leads direct to the valve housing F, in which is located the fuel control valve *f*, which controls the admission of the fuel to the cylinder of the engine as shown in Fig. 3, and a similar valve *f′*, at the opposite end of the cylinder performs a like function. It will thus be seen that the air supply is now under pressure in the valve housings F, and F′, and if we refer to Fig. 3, it will be noticed that both the valves *f*, and *f′* are closed and that the piston J, has just passed in its downward movement the exhaust ports V′, thus allowing the products of combustion to leave the cylinder through the exhaust pipe V; the cam between the rollers G and G′, is now in position to open the valve *f′* and allow the air under pressure to act as a scavenger and force the products of combustion through the exhaust ports V′, and thence to the atmosphere through exhaust pipe V, and continue so to flow until the piston J, has completed its downward stroke. In the meantime however, the control valve D, Fig. 5, will have been traveling in a downward direction and have cut off the air through the passage A′, to the upper portion of the charge chest I, and the air will, during a small portion of the stroke of the piston be flowing through the cylinder E, of the engine under a force due to its pressure which is gradually decreasing due to the escape of the same through the exhaust ports V′. The top of the control valve D, which is still continuing in its downward direction passes below the annular opening A², which allows the gas which has entered by way of the conduit C, and has passed through the passage ways C′, in the valve D, to flow through the annular opening A², through the upper portion of the charge chest I, to the admission valve *f′*, Fig. 3, into the engine cylinder E. During this period of admission of the gas, the piston J, has reversed its movement and is now traveling toward the top of the cylinder. Immediately after a sufficient amount of gas has been admitted through the control valve D, to the upper portion of the charge chest I, the control valve reverses its direction and cuts off the gas supply to this part of the chest, and again admits air thereto through the conduit A′, which air carries before it the charge of gas and forces the whole of the same into the cylinder E, when the valve *f′*, is again closed which closure is effected at the time the piston J, has just covered the exhaust port V′, in its upward movement. When compression takes place and when the piston has reached the highest point of its travel, the charge is ignited and the piston is driven in its downward stroke past the exhaust ports V′, and the products of combustion are exhausted into the atmosphere through said ports, and exhaust pipe V.

As both ends of the cylinder are duplicates, so far as the engine is concerned, in the burning of the gases it will be obvious that what has just been explained is equally true of the operation in the opposite end of the cylinder the only difference being that the lower end of the control valve D, is controlling the opening A³, which conducts the gases through the lower portion of the charge chest I, and thence to the lower end of the cylinder E.

It will be observed that in the control valve illustrated in Fig. 5, means are provided whereby the air may be shut off from the charge chest I and I′. In Fig. 7, I show another form of control valve in which the air is at no time shut off from the charge chest I, and in this event I do not require the use of any partition such as is shown at I², in Fig. 5. In Fig. 7, the air flows through the annular passage A′, into the charge chest I, and passes thence to the cylinder E, of the engine. The control valve K, in Fig. 7, is operated in the same manner as the control valve D, in Fig. 5, that is, its upper and lower edges alternately overlap in the annular passage A′, and thus allow the gas in the conduit C, to pass into the charge chest I, at the required time in order to properly supply the cylinder of the engine with fuel but in both of these valves, the air is first admitted to the cylinder of the engine, the fuel charge or gas alone, as the case may be second, and another air admission third, before the valve *f*, and *f′*, is closed, whereby the said fuel charge may be trapped in the cylinder of the engine and no gas left in the charge chest I or chests I and I′.

It will thus be seen that no explosive mixture is left in either form of the charge chest I, except for a very brief period when both valves *f*, and *f'*, are closed and that at all other times when the fuel charge of air and gas is passing through the fuel chest I, either the valve *f*, or *f'*, is open and therefore the exhaust ports V' are also opened, so that should a fuel charge of air and gas become ignited by reason of back-firing, the exhaust port would be open and the charge would therefore cause no damage as it would be free to exhaust through the exhaust ports V', to the atmosphere.

By referring to Figs. 9 to 13, inclusive, the valves will be seen in their relative positions according to the position of the piston within the cylinder E. In Fig. 9, we will assume that complete compression has just taken place in the top of the cylinder E, above the piston J, and valve *f'*. The gases are now ignited and the piston travels downward as shown in Fig. 10, when the gases will have exhausted through the port V', and exhaust pipe V, and the valve *f'*, will have opened and the charge of air under pressure will be forcing the products of combustion from the cylinder. In Fig. 11, the piston J, has reached its lowest position and the valve *f'*, is still open and remains open until after the piston has reached the position on its return stroke as shown in Fig. 12, or approximately in this position, by which time the charge of fuel will have been admitted to the cylinder E, and the valve *f'* will have closed and compression will begin immediately after the exhaust port V', has been closed by the upward movement of the piston J, as illustrated in Fig. 13, when the fuel charge will again be compressed and fired as shown in Fig. 9. This cycle is repeated in the same manner in the lower end of the cylinder and the figures illustrate the position of the valves *f*, relative to the position of the piston J, to accomplish this cycle.

The cam operating between the rollers G, and G', Fig. 3, is so formed that it will open the valves at the proper time and hold the same in their open position until the revolution of the shaft G^2, allows each valve to go to its seat under the influence of the pressure of its spring *g*, and this shaft in turn is caused to perform its function by the transmitting mechanism H, as shown which is driven by worm gearing from the main engine shaft K. The speed of the engine is governed by the centrifugal action of the ball governor P, which in turn controls the valve P', located in the conduit C. It will be remembered that this gas is under pressure and it will thus be seen that if this valve is closed there is still a supply of gas under pressure in the conduit C, above the valve P'; therefore, if the valve P', be closed entirely, due to the engine exceeding the normal speed there is still a supply of gas to be drawn from to supply the engine with fuel but as this gas will immediately fall in pressure after the control valve opens, a corresponding diminution of the volume of gas will be drawn into the cylinder of the engine in the succeeding charges until the engine will slow down due to a diminution in the fuel supply; this action permits of the governor P, being located at a greater distance from the control valve D, than would otherwise be permissible, but I do not confine myself to the position in the conduit at which the valve P', shall be located as it is evident that I may place it in any part of the conduit C, where it will best perform the services required.

In building very large engines say of 1,000 horsepower and upward, the amount of space required for a given power is of considerable importance and one of the objects pointed out in my specification is to attain the greatest amount of compactness for a given power. The use of the gas in both ends of the cylinder allow me to generate a given amount of power in a much smaller space and with less weight of metal than would be the case were I obliged to generate the same amount of power with a single acting two cycle engine; the means used to secure the cylinder to the frame columns L and L', I believe to be novel and, permits of the engine being built in sections, whereby the time required to build the engine may be reduced as the maximum of workmen may be employed on each section without their work interfering and also permits of easy and quick repairs in case of a defective part or of a broken part resulting from accident.

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

1. In a double acting internal combustion engine, the combination of a cylinder having an exhaust port located at or near the point of the end of the power stroke of the piston through which the gases burned in said cylinder are exhausted, a charge chest communicating with each end of said cylinder, a valve controlling the admission of air and gas to said charge chest, a valve located at each end of said cylinder through which the gas and air must pass to enter said cylinder, means for controlling said valves whereby first a charge of air, then a charge of gas and finally a further charge of air may be admitted to the cylinder for the purpose set forth, and means for compressing and igniting said gases.

2. In a double acting gas engine of the character described, an air passage and a gas passage, a valve controlling said air and gas passages, a charge chest into which gases may flow from said passages after passing

said valve, and mechanically operated valves controlling the ingress of gases from said charge chest to the cylinder of the engine.

3. In a double acting gas engine of the character described, an air passage and a gas passage, a valve controlling said air and gas passages, a charge chest into which gases may flow from said passages after passing said valve, separate independent valves which admit the ingress of gases alternately to the upper and lower ends of the engine cylinder, and means for operating said valves.

4. In an internal combustion engine, the combination of an air supply, a gas supply, means for regulating the pressure of the gas according to the speed of the engine, a valve controlling the air and gas supplies, and a charge chest to which the air and gas is alternately admitted by said controlling valve and in which the air and gas is mixed.

5. In an internal combustion engine to which the fuel is supplied under pressure, a cylinder, a charge chest, a slide valve which is adapted to control the admission of both air and gas to said charge chest, means for controlling the degree of pressure of the gas flowing to said slide valve, means for controlling said slide valve whereby first air, then air and gas combined and finally air alone may be admitted to said cylinder, and means for compressing and igniting said gases in the cylinder.

6. In an internal combustion engine to which the fuel is supplied under pressure, a cylinder, a charge chest, a slide valve having a constant stroke which is adapted to control the admission of both the air and gas to said chest, means for automatically controlling the degree of pressure and consequent volume of gas delivered to said charge chest, and means whereby the air may be introduced first into said cylinder and thereafter a mixed charge of air and gas combined, and means for compressing and igniting said gases.

7. In a double acting two cycle internal combustion engine in which the air and gas is supplied to the cylinder under pressure, a cylinder having an exhaust port located at or near the point at the end of the power stroke of the piston, a charge chest, a control valve which controls both the air and gas on their way to the said charge chest, and is adapted to admit first air and then gas thereto, means for introducing the said gases to the engine cylinder at the proper moment, means for exhausting the burned gases from the cylinder and immediately thereafter admitting a further charge of air to the cylinder and exhausting a portion thereof through the exhaust port of the engine.

8. In a double acting two cycle internal combustion engine in which the air and gas is supplied to the cylinder under pressure, a cylinder having an exhaust port located at or near the point at the end of the power stroke of the piston, a charge chest, a control valve which controls both the air and gas on their way to said charge chest, means for introducing first air to the engine cylinder for the purpose set forth, then gas to said cylinder and then a further charge of air whereby the charge chest will be entirely cleared from an explosive mixture by reason of the air charge sweeping therethrough, the said proportions of air and gas remaining in said cylinder being such as to form an explosive mixture, and means for automatically controlling the amount of gas admitted to said charge chest.

9. In a gas engine of the character described, a frame comprising two castings provided with flanges adapted to support the engine cylinder between them, an engine cylinder provided with a charge chest extending to each end thereof, a conduit located in one of the frame elements and communicating with a source of gas supply at one end and with the charge chest at its opposite end.

10. In a gas engine of the character described, a vertical frame comprising two castings provided with flanges located on their sides adapted to support the engine cylinder between them, an engine cylinder provided with a charge chest, a conduit located in one of the frame elements and communicating with a source of gas supply at one end and with the charge chest at its opposite end, and a governor valve located in the gas conduit and adapted to control the pressure of gas at the valve outlet.

11. In an internal combustion engine, a frame, a cylinder supported in an upright position at the top of the frame, a charge chest formed within said frame, means providing communication between the charge chest and cylinder including removable housings at the opposite ends of the cylinder, arranged in substantial vertical alinement, mechanically operated valves for controlling said communication, a casing communicating with said charge chest, air and fuel supplies connecting with the casing at different points, and a unitary valve controlling said supplies.

12. In a double acting two cycle gas engine of the character described, a charge chest, a slide valve which operates in unison with the revolutions of the engine and is adapted to control the admission of air and gas to said charge chest, and a valve located at each end of the cylinder of the engine and means for operating said valves.

13. In an internal combustion engine, the combination of a casing, a charge chest in communication therewith, air and gas supplies connecting with the casing at different points, a valve operable in the casing to alternately admit the air and gas to the charge

chest, and an independently actuated valve controlling ingress to the cylinder of the engine.

14. In an internal combustion engine to which the fuel is supplied under pressure, a combustion cylinder, a charge chest, a single valve which is designed and adapted to control the admission of both air and gas to said chest as follows; first air, then air and gas combined and then air again, means for admitting the gases in the order stated into the combustion cylinder, and means for compressing and igniting said mixture.

15. In a double acting gas engine, a cylinder, a charge chest a slide valve adapted to admit air, then air and gas, and then air again into said chest, a valve controlling the admission of said gases into said cylinder at one end thereof, the said cycle as above set forth being repeated to admit the gases alternately at each end of said cylinder as described.

16. In a gas engine of the character described, a frame comprising two castings provided with flanges adapted to support the engine cylinder between them, an engine cylinder provided with a charge chest extending to each end thereof, a conduit located in one of the frame elements and communicating with a source of gas supply at one end and with the charge chest at its opposite end, a valve adapted to control the gas flowing to said charge chest, an air passage leading to said charge chest and also controlled by said valve, means for operating said valve so that air, then air and gas and then air again will be passed to said charge chest, and means for controlling the admission of said gases to the engine cylinder.

17. In an engine of the character described, a cylinder, a valve chamber, communication between said cylinder and said valve chamber comprising conduits leading to each end of said cylinder, a hollow cylindrical balanced slide valve adapted to be reciprocated in said valve chamber, a gas conduit and an air conduit leading to said valve chamber, means for operating said valve whereby first air then air and gas and then air again will be admitted to said first named conduits, and means for admitting said gases in the order named to each end of the cylinder alternately, substantially as and for the purpose set forth.

18. In an engine of the character described, a cylinder, a valve chamber, communication between said cylinder and said valve chamber comprising conduits leading to each end of said cylinder, a hollow cylindrical balanced slide valve adapted to be reciprocated in said valve chamber, a gas conduit and an air conduit leading to said valve chamber, means for operating said valve whereby first air then air and gas and then air again will be admitted to said first named conduits, a valve located in a removable housing at each end of said cylinder and in alinement with each other, means located between said valves such as a cam and adapted to operate them alternately to admit the gases from the first named conduits alternately to each end of said cylinder.

19. In an engine of the character described, a cylinder, an exhaust port located at the center thereof and controlled by the engine piston, inlet valves connected to said cylinder and located in removable housings, means for operating said valves alternately, a charge chest extending to each end of said cylinder, a hollow cylindrical balanced slide valve controlling the admission of gases to said charge chest, means for operating said valve to admit first air to said charge chest, then air and gas combined and then air again, and in unison with the inlet valves whereby the gases will flow into the cylinder in the order stated and alternately to its ends for the purpose set forth.

20. In an engine of the character described, a slide valve comprising a hollow shell adapted to be reciprocated in a valve chamber, a gas conduit communicating with the interior of said valve, an air conduit leading to the exterior thereof, means for reciprocating said valve and thereby controlling the air and gas, first to pass air, then air and gas together and then air alone, a conduit leading from the said valve to the engine cylinder, and an inlet valve adapted to control the period of admission of the gases to the said cylinder.

21. In an internal combustion engine, the combination of a cylinder, a valve casing communicating therewith, a slide valve in the casing in communication with both ends thereof and a fuel supply and an air supply, one of which passes into the casing through said valve and the other passing into said casing around said valve.

22. In an internal combustion engine, the combination of a cylinder, a valve casing communicating therewith, a slide valve in the casing open throughout its length, a fuel supply passing into the casing and valve, and an air supply passing into the casing around said valve.

23. In an internal combustion engine, the combination of a cylinder, a charge chest communicating therewith, mechanically operated valves for controlling said communication, a casing communicating with said charge chest, air and fuel supplies leading to the casing and a unitary valve controlling said supplies.

24. In an internal combustion engine, the combination of a cylinder, a charge chest communicating therewith, mechanically operated valves for controlling said communication, a casing communicating with said

charge chest, air and fuel supplies leading to the casing and a slide valve in the casing operating to alternately admit air and fuel to said chest.

25. In an internal combustion engine, the combination of a cylinder, a casing communicating therewith, an upright hollow frame supporting both the cylinder and the casing, an air supply leading to the casing, a fuel supply passing through said frame to the casing and a valve operating in the casing for controlling said supplies.

26. In an internal combustion engine, the combination of a cylinder, valve housings communicating with the opposite ends of the cylinder and controlled by oppositely disposed valves, means for alternately supplying each housing under its respective valve with air and then fuel, mechanical means for controlling said valve, and means for exhausting the cylinder at a point intermediate its length.

27. In an internal combustion engine, the combination of a cylinder, a casing communicating with the cylinder, a gas supply leading to the casing, a valve operating within the casing for controlling said gas, an air supply passing through the casing around said valve, means for automatically regulating the pressure of said gas supply preparatory to the passage of gas to the casing, and means for actuating said valve to admit first air and then gas to said cylinder.

28. In an internal combustion engine, the combination of a cylinder having an exhaust intermediate its length, valve-housings carried at each end of the cylinder, oppositely disposed valves for controlling the communication between said housings and the cylinder, means for successively supplying each housing under its respective valve with air and then fuel and means operating between said valves to open them in sequential order.

29. In an internal combustion engine, the combination of a cylinder, a charge chest communicating with the opposite ends of the cylinder, mechanically operated valves controlling the communication between the charge chest and cylinder, a casing communicating with the charge chest, a hollow slide valve operating within the casing, air and gas supplies leading into the casing one of which passes into the slide valve and the other passing thereabout.

30. In an internal combustion engine, the combination of a cylinder, valve housings communicating with the opposite ends thereof, oppositely disposed valves for controlling the communication between the housings and cylinder, a casing communicating with each housing, air and gas supplies leading into the casing and means within the casing operating to alternately feed said supplies to each housing.

31. In a gas engine, a working cylinder, a valve controlling ingress thereto, means for introducing into said cylinder through said valve, first a charge of air, then a charge of fuel alone, and then a further charge of air, and means for compressing and igniting said mixture.

32. In a gas engine, a working cylinder, a valve controlling ingress thereto, a conduit leading from said valve to a source of air supply and gas supply, means for admitting to said cylinder by way of said conduit and valve, first a charge of air, then a charge of fuel while the air remains cut off, and then a further charge of air, said last named charge of air serving to force all of said gas out of said conduit into said cylinder, and means for compressing and igniting said gases for the purpose set forth.

33. In an internal combustion engine, a cylinder having a piston, means for introducing into the cylinder at each working stroke of the piston first, a charge of air, then a charge of fuel alone, and finally, a second charge of air.

34. In a gas engine, a cylinder having an inlet passage, a valve controlling said passage, a second valve operated independently of said first named valve, an air conduit leading to the second valve and a fuel conduit leading to the second valve, and means for operating said second valve to admit first air, then fuel and then air again by said valve to said cylinder.

In testimony whereof, I, BAXTER M. ASLAKSON have signed my name to this specification in the presence of two subscribing witnesses, this twenty third day of February 1905.

BAXTER M. ASLAKSON.

Witnesses:
GEO. S. COOPER,
L. P. ST. CYR.