No. 868,017. PATENTED OCT. 15, 1907.

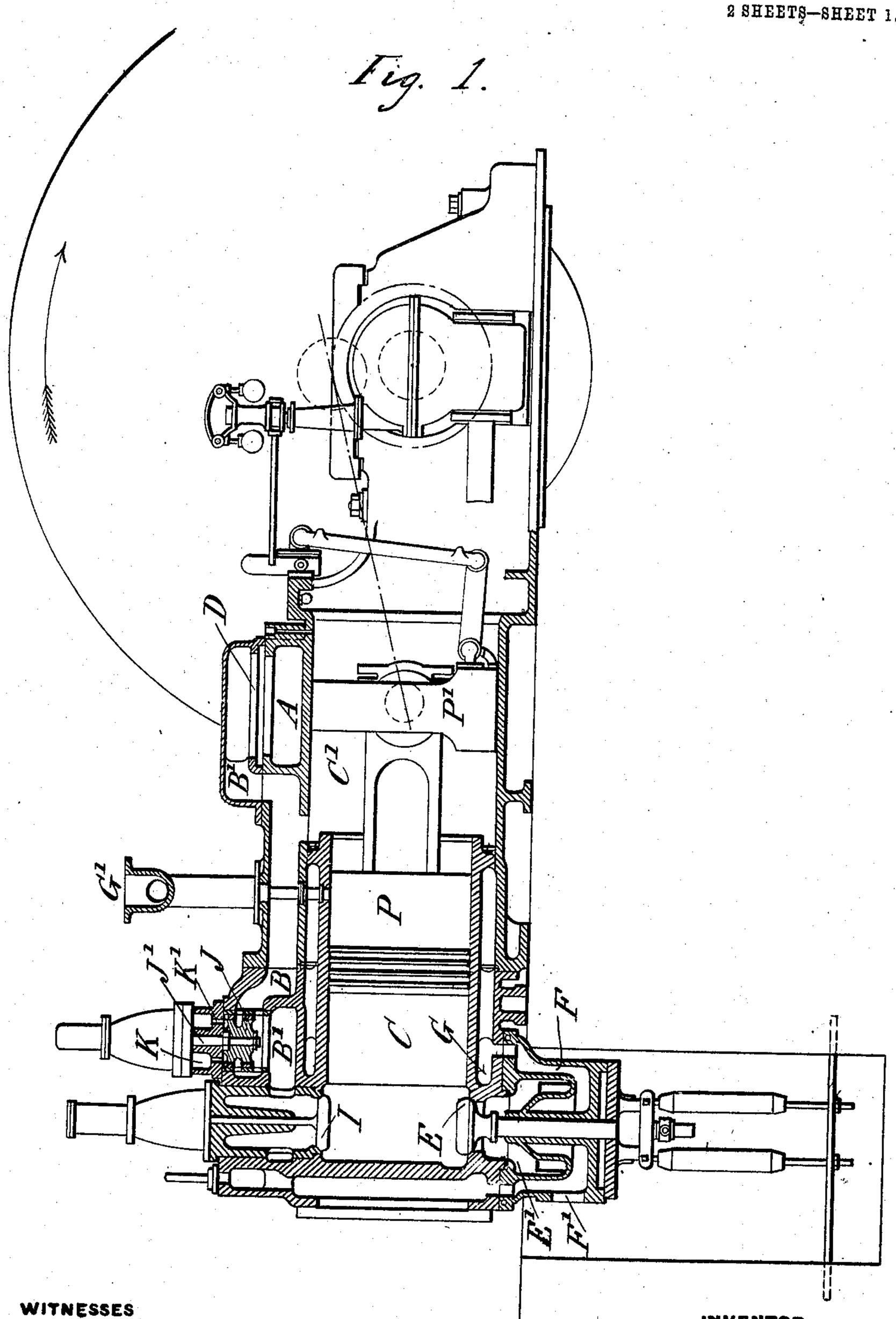
A. ROLLASON.

INTERNAL COMBUSTION ENGINE.

APPLICATION FILED AUG. 28, 1906.

2 SHEETS—SHEET 1.

Fig. 1.



WITNESSES

G. B. Blaming

John Miller

INVENTOR

Arthur Rollason,

by Bakewell & Byrnes,

his Attys

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2 SHEETS—SHEET 2.

Fig. 2.

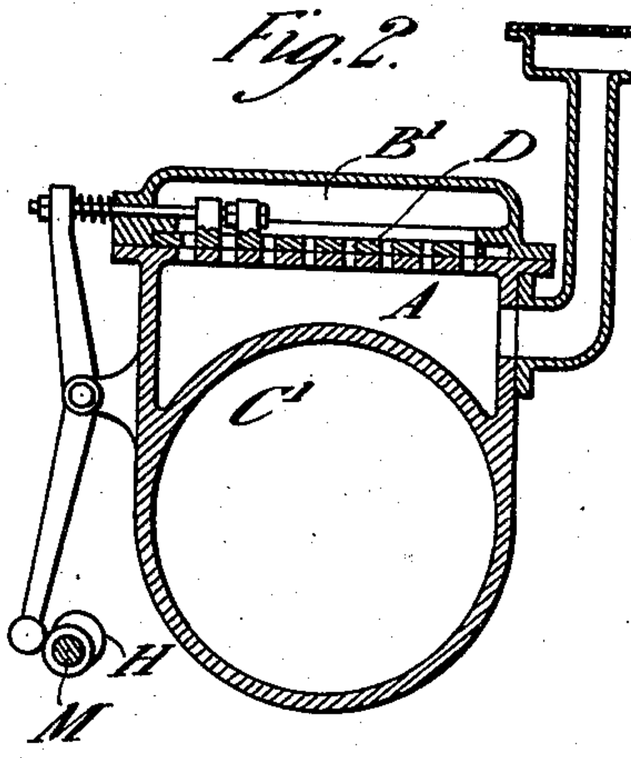


Fig. 3.

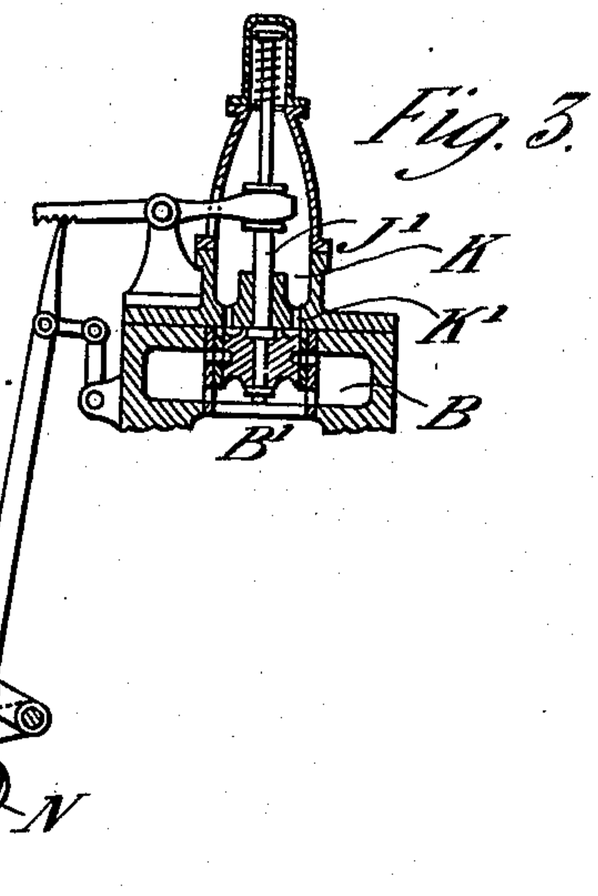
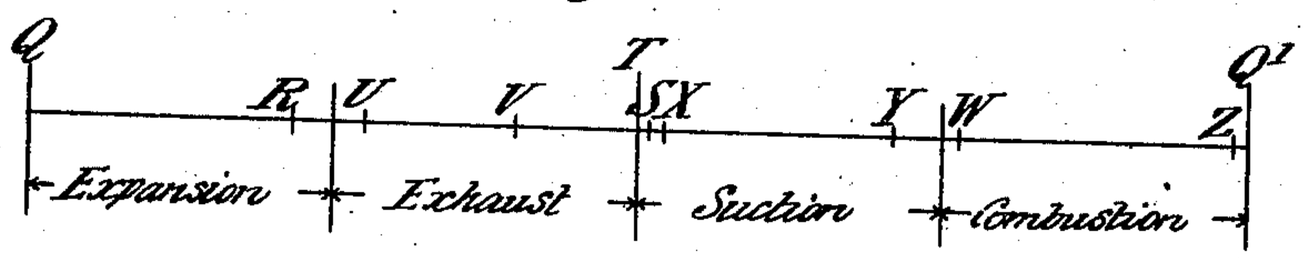


Fig. 4.



WITNESSES

W. W. Swartz

R. A. Baldeson

INVENTOR

Arthur Rollason,

by Bakewell & Byrnes,

his Attys.

UNITED STATES PATENT OFFICE.

ARTHER ROLLASON, OF LONG EATON, ENGLAND, ASSIGNOR TO ROBERT MOND, OF LONDON, ENGLAND.

INTERNAL-COMBUSTION ENGINE.

No. 868,017. Specification of Letters Patent. Patented Oct. 15, 1907.

Application filed August 28, 1906. Serial No. 332,313.

To all whom it may concern:

Be it known that I, ARTHUR ROLLASON, a subject of the King of Great Britain and Ireland, residing at Long Eaton, in the county of Derby, England, engineer, have invented certain new and useful Improvements in Internal-Combustion Engines, of which the following is a specification.

This invention relates to single cylinder internal combustion engines working on the four-stroke cycle, and has for its object to increase the economy and efficiency of such engines and to prevent or reduce shock and avoid strains which arise in operating.

With this object in view a double or differential piston is employed one part constituting the working piston and the other a pump piston reciprocating synchronously with the working piston in an extension of the working cylinder, and the admission valve, the gas and mixing valve, and the air valve are made separate and are mechanically operated in such a manner that during the suction stroke a stratified charge is taken into the cylinder, first air, then gas, and finally air, as described in a prior application filed by the present applicant on 26th September 1905, the Serial No. of which is 280115.

In the present invention the air and admission valves remain open until the piston begins to return on the compression stroke, the velocity of the air through the valves being utilized to increase the mass of the charge taken into the cylinder and raise the pressure thereof as much as possible before direct compression commences.

These and other features constituting the present invention will be more specifically described with reference to the accompanying drawings in which

Figure 1 shows a longitudinal section of the improved engine. Fig. 2 is a section through the air inlet valve, Fig. 3 is a section through the mixing valve, Fig. 4 is a diagram showing the relative periods at which the various valves open and close during one complete cycle.

Referring to the drawing, C is the working cylinder and P the working piston, C′ the pump cylinder and P′ the pump piston.

A is a port communicating with the atmosphere and controlled by a slide valve D which is operated by a cam H on a longitudinal lay shaft M and is held open for fully three strokes of the engine cycle to allow the air to be freely drawn and expelled by the pump piston.

Communication between the working cylinder and the atmosphere is established through the inlet valve I, ports in the valve J, passage B, slide valve D and port A. The valve J controls the admission of the air and gas into the cylinder on the suction stroke and forms a mixing or diffusing valve when opened, and when closed and in the normal position shown in the drawing allows free access of air for scavenging.

E is the exhaust valve admitting to an exhaust chamber E′ the walls of which are exposed to the cooling water which enters at F′ traverses the exhaust jacket F and passes thence around the water jacket G of the working cylinder to the discharge outlet G′.

When the suction stroke begins, the clearance space in rear of the piston P is filled with air and as both the inlet and exhaust valves I, E, are at the moment open, the air is at atmospheric pressure. The gas valve spindle J′ is now depressed by the action of a second cam N on the lay shaft, taking with it the valve J which cuts off the entrance of air through the valve ports, the gas ports K′ which communicate with the space K being at the same time uncovered, thus admitting gas only to the cylinder. When near the end of the suction stroke according to the quality of the gas the valve J is raised and air only is taken into the cylinder, being drawn through the slide valve D, which is now open, passage B and ports in valve J and inlet valve I. The valves I, J and D remain open until the piston begins to return on the compression stroke, by which time, since the flow of the entering gases has been at a high velocity, the air taken in last will by reason of its inertia have crowded into the cylinder so as to raise the pressure thereof practically to that of the atmosphere. The inlet valve I is now closed and during the next two strokes compression, ignition and expansion of the charge occurs. The exhaust valve E is opened at the end of the expansion stroke and at the beginning of the exhaust stroke the slide valve D is clos and the air now filling the closed space in rear of the piston P′ is compressed into the passages B, B′, while the combustion products are being expelled from the working cylinder of the piston P. Just before the end of the exhaust stroke that is to say when about 6/10ths of the stroke has been completed the valve I is opened and the air stored under pressure in the passages B, B′ sweeps out the remaining products of combustion and leaves cool air in the clearance behind the piston P, as stated to be the condition at the beginning of the cycle.

Fig. 4 shows diagrammatically the periods at which the opening and closing of the various valves, as alluded to above, occur, and the relative setting of the cams on the lay shaft can easily be deduced therefrom. The expansion stroke, or the commencement of the cycle, is represented as beginning at Q and the end of the compression stroke, or the end of the cycle, occurs at Q′. The exhaust valve E opens at R and closes at S; the air slide valve D opens at T and remaining open during the suction, compression, and expansion strokes, closes

at V during the exhaust stroke; the admission valve I opens at V and closes at W; the gas ports open at X and close at Y; and ignition of the charge occurs at Z.

Having thus described the nature of my said invention and the best means I know of carrying the same into practical effect, I claim:—

A single cylinder four stroke cycle internal combustion engine having a scavenging piston reciprocated by the piston rod of the engine, an air valve controlling the admission of air to the rear of the scavenging piston, said valve being held open during fully three strokes of the engine cycle and closed to cut off communication with the atmosphere only during the exhaust stroke, a combined gas and air control valve, said air control valve being interposed between the air admission valve and the cylinder inlet valve and being open during the entire cycle except for a portion of the suction stroke, during which the gas valve is open, substantially as described.

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

ARTHUR ROLLASON

Witnesses:

EDWARD GARDNER.

I. J. [illegible]