C. GROW.

INTERNAL COMBUSTION ENGINE.

APPLICATION FILED JULY 24, 1917.

1,253,171.

Patented Jan. 8, 1918.

2 SHEETS—SHEET 1.

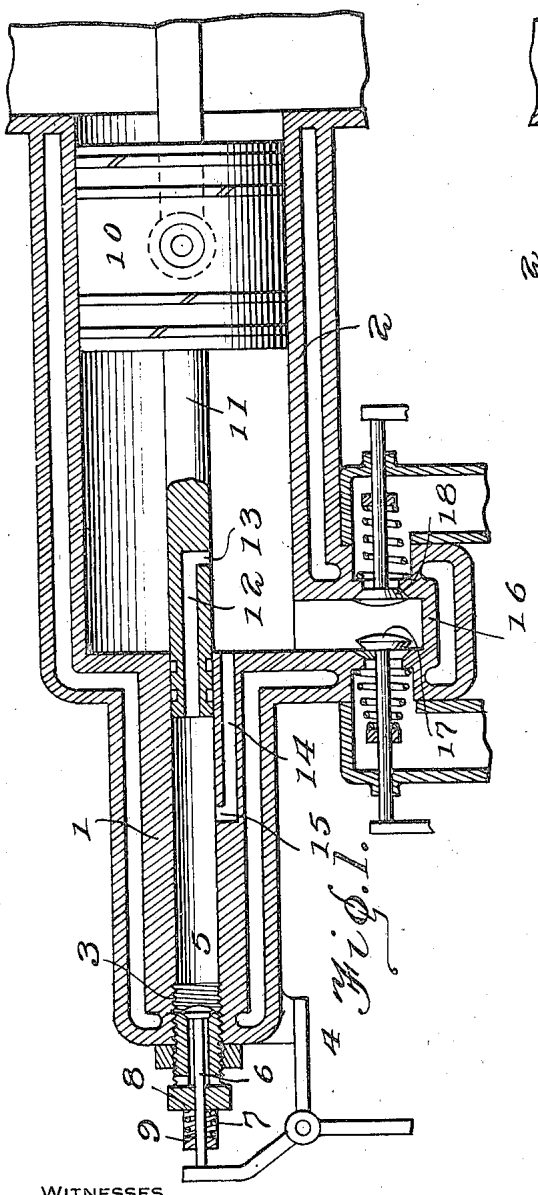

Fig. 1.

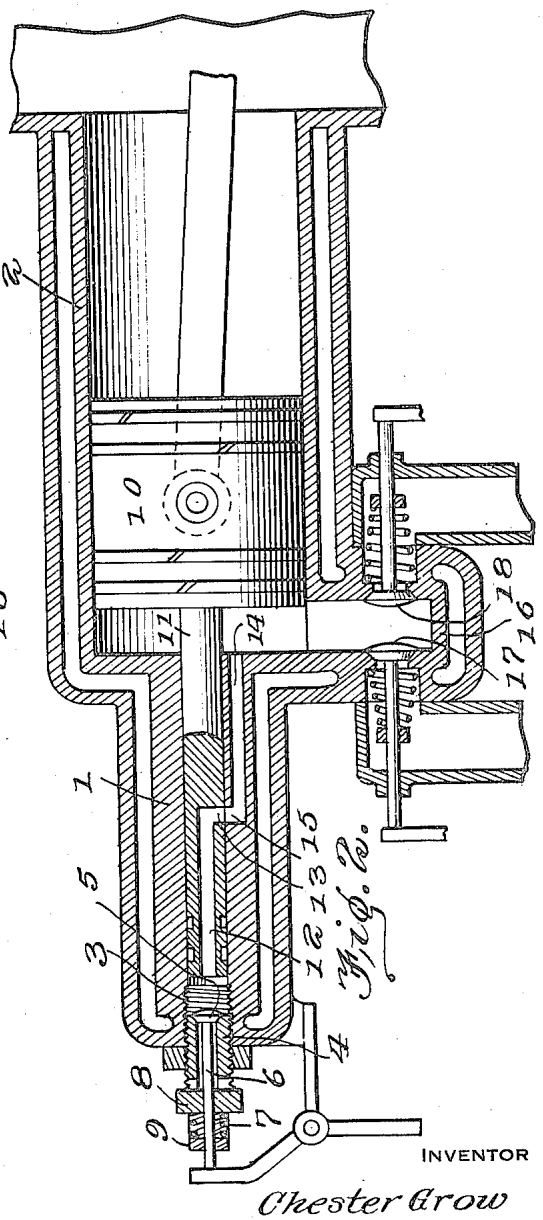

Fig. 2.

WITNESSES

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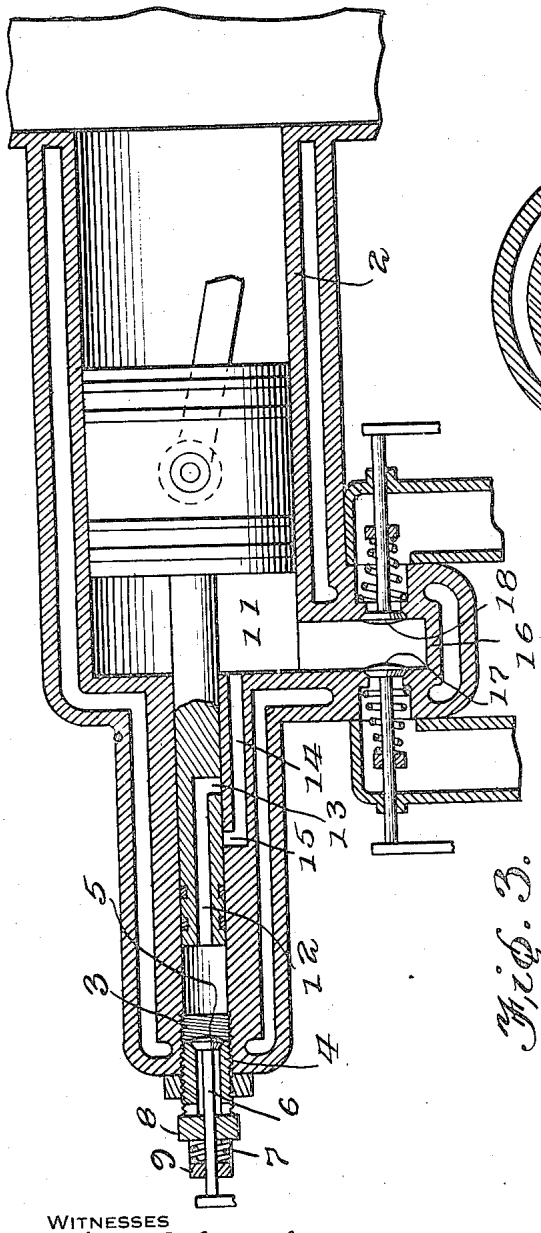

Fig. 3.

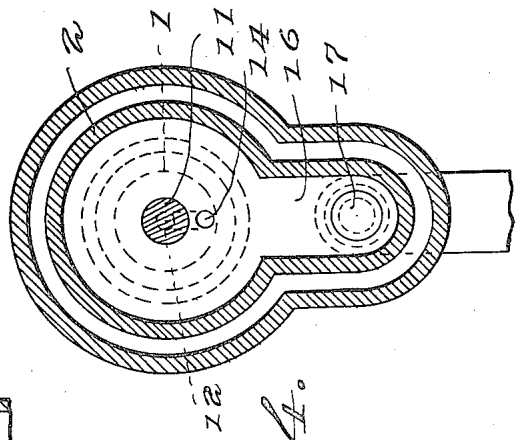

Fig. 4.

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UNITED STATES PATENT OFFICE.

CHESTER GROW, OF LA HARPE, KANSAS.

INTERNAL-COMBUSTION ENGINE.

1,253,171. Specification of Letters Patent. Patented Jan. 8, 1918.

Application filed July 24, 1917. Serial No. 182,466.

To all whom it may concern:

Be it known that I, CHESTER GROW, a citizen of the United States, residing at La Harpe, in the county of Allen and State of Kansas, have invented new and useful Improvements in Internal-Combustion Engines, of which the following is a specification.

This invention relates to internal combustion engines in which a high pressure combustion chamber and a low pressure combustion chamber are employed, the object in view being to provide in connection with an engine of the type referred to, simple and effective means for igniting a charge in the high pressure combustion chamber and transmitting a portion of the ignited mixture to the low pressure chamber at the time of ignition of the charge in the high pressure chamber.

A further object of the invention is to provide means for adjusting or varying the degree of compression in the high compression cylinder in order to insure the ignition of the charges therein.

With the above and other objects in view, the invention consists in the novel construction, combination and arrangement of parts, herein fully described, illustrated and claimed.

In the accompanying drawings:—

Figure 1 is a sectional view taken centrally of the high and low pressure cylinders, showing the pistons at the beginning of their compression strokes.

Fig. 2 is a similar view showing the pistons at the beginning of their firing or working strokes.

Fig. 3 is a similar view showing the position of the parts when the high and low pressure cylinders are thrown out of communication with each other.

Fig. 4 is a cross sectional view taken adjacent to the inner head of the low pressure cylinder.

Referring to the drawings 1 designates the high pressure cylinder and 2 the low pressure cylinder, the same being preferably formed integrally with each other as shown although it will be obvious that they may be formed separately and fastened together if found desirable. The high pressure cylinder is located at one end of and forms a longitudinal extension of the high pressure cylinder 2. The outer end of the high pressure cylinder 1 is internally threaded as shown at 3 to receive the externally threaded casing 4 of a valve 5 which has several functions. The valve 5 serves to relieve vacuum in the high compression cylinder, also to relieve compression and prevent the formation of a cushion in said high pressure chamber, and said valve also acts as a compression head, against which the charges are compressed by the action of the high pressure piston working in said cylinder. The valve 5 has an outwardly extending stem 6 and is surrounded by a compression spring 7 which is arranged between a collar 9 on the stem 6 and a head 8 on the guide 4 through which the valve stem 6 is slidable.

The low pressure piston is indicated at 10 and has extending therefrom into the high pressure cylinder 1 a high pressure piston 11. Both pistons are equipped with the usual packing rings and the high pressure piston 11 is formed with a firing port or passage 12 extending longitudinally through a part of the high pressure piston and having a laterally opening port 13. The cylinder 1 is provided with a firing port or passage 14 corresponding substantially in shape and capacity with the firing port 12 in the high pressure piston 11. The port 14 is however disposed reversely to the port 12 and has a lateral port or opening 15 through the inside wall of the cylinder 1.

The low pressure cylinder is shown as provided with a laterally offset valve chamber 16 at one side of which is arranged a spring seated intake valve 17 while at the opposite side of said chamber is the exhaust valve 18. Any suitable operating means, may be used in conjunction with the valves 5 and 18 for operating the same at the proper intervals, such operating connections being ordinarily actuated by the crank shaft of the engine. Starting with the parts in the position illustrated in Fig. 1 at the initial end of the compression strokes of the high and low pressure pistons, the piston 11 moves along its compression stroke until the port 13 is covered by the high pressure cylinder. Prior to that time part of the mixture in the low compression chamber has been forced through the passage 14 into the high com-

pression cylinder. Just as the port 13 is covered by the high compression cylinder, the port 15 is also closed and now as the pistons continue to move in the same direction, the charge in the low pressure cylinder is compressed by the piston 10 and the relatively small charge in the high pressure cylinder is compressed by the piston 11. Just as the extremity of the high pressure piston reaches the limit of its movement and compresses the charge in the high pressure cylinder to the ignition point, the ports 13 and 15 register and a portion of the ignited charge in the cylinder 1 rushes through the port 15 and passage 14 and ignites the relatively large charge in the low compression cylinder 2. The ports 13 and 15 are then covered during the remainder of the firing or working stroke. In the exhaust strokes, the valves 5 and 18 are unseated by the operating connections referred to thus allowing for the free exhaust of the burned gases from both the high compression and low compression cylinders. In the full suction stroke, the valve 17 opens automatically to let in a fresh charge of mixture while the valve 5 opens to relieve the vacuum which would otherwise be created in the high pressure cylinder 1. Thus the valve 17 opens once only in each complete cycle of the engine while the valve 5 opens twice during such complete cycle of the engine. The valve 5 of course remains closed during the firing stroke and at such time forms the head of the high pressure cylinder against which the charge contained therein is compressed to a high degree by the piston 11.

It will be observed that the engine does away with the present unreliable system of ignition and also embodies an extremely simple construction, the engine being thus particularly adapted for use in connection with aeroplanes, dirigibles and other aircraft.

I claim:—

1. In an internal combustion engine, a low pressure cylinder, a high pressure cylinder extending from one end of the low pressure cylinder, said high and low pressure cylinders having their longitudinal axes coincident, a low pressure piston operating in the low pressure cylinder, a high pressure piston having a fixed relation to and projecting from the low pressure piston, and a vacuum and compression relief valve in the head of the high compression cylinder, the high compression cylinder and the high compression piston being formed with firing passages which are brought into communication when the high pressure piston reaches the point of highest compression in the high pressure cylinder, whereby a portion of the mixture ignited at such point is transmitted to the low pressure cylinder to ignite the charge therein.

2. In an internal combustion engine, a low pressure cylinder, a high pressure cylinder extending from one end of the low pressure cylinder, said high and low pressure cylinders having their longitudinal axes coincident, a low pressure piston operating in the low pressure cylinder, a high pressure piston having a fixed relation to and projecting from the low pressure piston, and a vacuum and compression relief valve in the head of the high compression cylinder, the high compression cylinder and the high compression piston being formed with firing passages which are brought into communication when the high pressure piston reaches the point of highest compression in the high pressure cylinder, whereby a portion of the mixture ignited at such point is transmitted to the low pressure cylinder to ignite the charge therein, the low pressure cylinder being controlled by an intake valve and an exhaust valve adjacent to the head thereof.

3. In an internal combustion engine, a low pressure cylinder, a high pressure cylinder extending from one end of the low pressure cylinder, said high and low pressure cylinders having their longitudinal axes coincident, a low pressure piston operating in the low pressure cylinder, a high pressure piston having a fixed relation to and projecting from the low pressure piston, and a vacuum and compression relief valve in the head of the high compression cylinder, the high compression cylinder and the high compression piston being formed with firing passages which are brought into communication when the high pressure piston reaches the point of highest compression in the high pressure cylinder, whereby a portion of the mixture ignited at such point is transmitted to the low pressure cylinder to ignite the charge therein, each of said firing passages embodying a portion extending longitudinally of the respective part in which it is formed and also embodying a laterally opening port intersecting said longitudinal portion of the passage, one of said lateral ports opening into the high compression cylinder and the other of said ports opening into the low compression cylinder.

4. In an internal combustion engine, a low pressure cylinder, a high pressure cylinder extending from one end of the low pressure cylinder, said high and low pressure cylinders having their longitudinal axes coincident, a low pressure piston operating in the low pressure cylinder, a high pressure piston having a fixed relation to and projecting from the low pressure piston, and a vacuum and compression relief valve in the head of the high compression cylinder, the high compression cylinder and the high compression piston being formed with firing passages which are brought into communication when the high pressure piston

reaches the point of highest compression in the high pressure cylinder, whereby a portion of the mixture ignited at such point is transmitted to the low pressure cylinder to ignite the charge therein, said vacuum and compression relief valve being adjustable for the purpose of increasing or diminishing the distance between said valve and the adjacent head of the high pressure piston when the latter is at the limit of its compressing movement.

In testimony whereof I affix my signature.

CHESTER GROW.