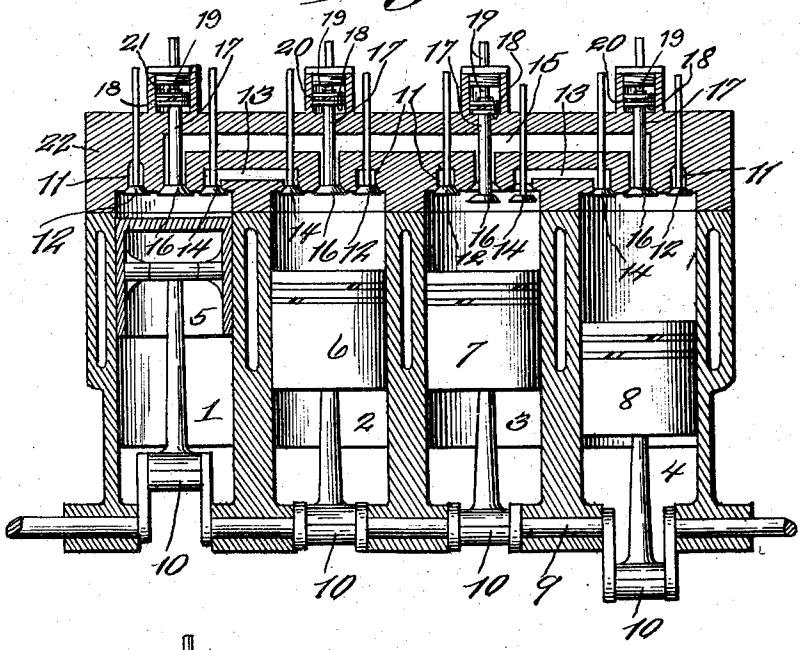
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INTERNAL COMBUSTION ENGINE

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Fig. 1.



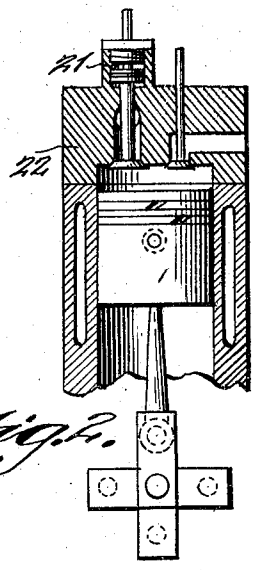


Fig. 2.

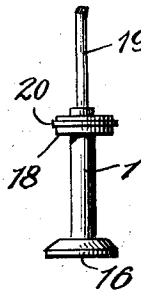


Fig. 3.

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Fig. 3.

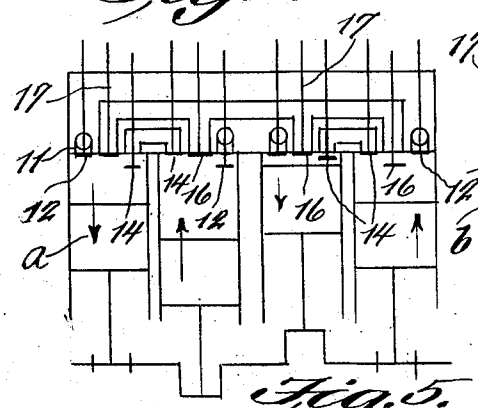


Fig. 4.

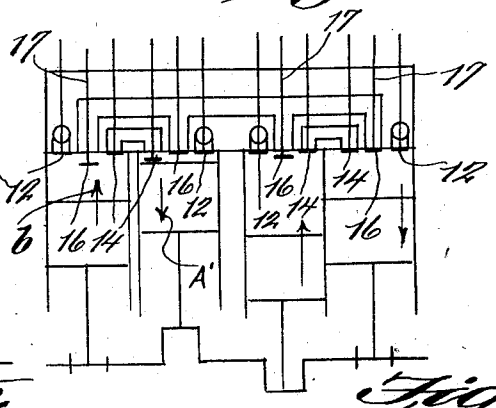


Fig. 5.

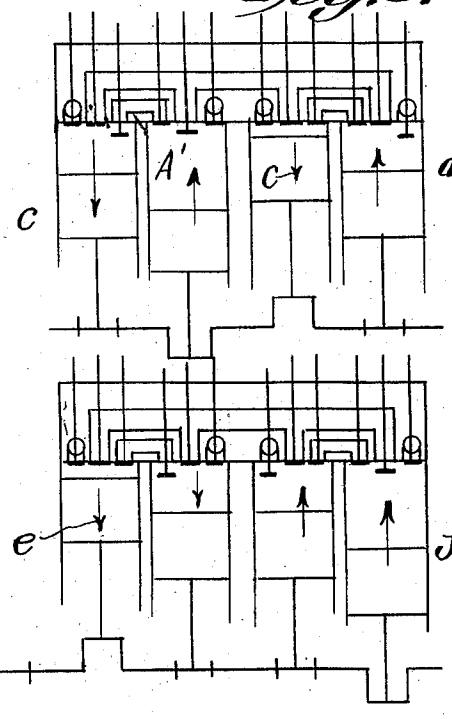


Fig. 6.

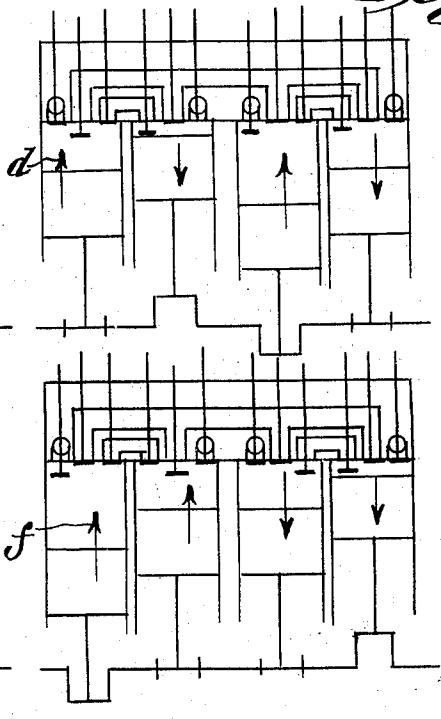


Fig. 7.

Fig. 8.

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Patented July 22, 1930 1,771,335

UNITED STATES PATENT OFFICE

ELLIS B. KARPES, OF PHILADELPHIA, PENNSYLVANIA

INTERNAL-COMBUSTION ENGINE

Application filed September 12, 1927. Serial No. 219,145.

This invention relates to internal combustion engines and an object of the invention is to provide an engine which will develop a high percentage of fuel efficiency, resulting in the development of a maximum amount of power upon the utilizing of a minimum quantity of fuel.

Another object of this invention is to provide a multiple cylinder internal combustion engine in which the cylinders and pistons are used during additional cycles of operation of the engine to compress fuel to a high stage of compression and force the same under such compression into a cylinder next thereto in firing order.

Other objects of the invention will appear in the following detail description, and in the accompanying drawings therein:

Figure 1 is a longitudinal section through the improved internal combustion engine.

Figure 2 is a vertical section through the internal combustion engine.

Figures 3, 4, 5, 6, 7 and 8, are diagrammatic views illustrating the various actions of the fuel during the operation of the motor.

Figure 9 is a detail view of a valve structure used in the motor.

Referring more particularly to the drawings: the improved internal combustion engine comprises a plurality of cylinders 1, 2, 3 and 4. Four cylinders are shown in the present application. However it is to be understood that the invention may be embodied in any multiples of twin cylinders.

The cylinders have pistons 5, 6, 7 and 8, respectively, reciprocably mounted therein which are connected in the usual manner to the crank-shaft 9. The crank portions 10 of the crankshaft are arranged in proper relation one with the other, to provide the efficient and proper operation of the engine, as will be hereinafter more fully described. The various cylinders have independent exhaust outlets 11 which are controlled by any approved type of valves 12 and they also have intake manifolds 13 which are arranged to communicate with each pair of cylinders and are controlled by approved types of valves 14. An auxiliary manifold 15 is provided which extends the full length of the cylinder block and has branch communication with each individual cylinder, as clearly shown in Figure 1 of the drawings. Approved valves 16 are provided for controlling communication between the auxiliary manifold 15 and the respective cylinders. The internal combustion engine is geared to provide a six-stroke cycle internal combustion engine, and the camshaft (not shown) which controls operation of the various valves will travel at one-third of the crankshaft speed.

If it is so desired, a novel form of plunger may be connected to the valve 16, and this plunger is particularly provided to prevent escape of any fuel under compression from the auxiliary manifold 15. The plunger or valve structure includes the valve discs 16 which are mounted upon the lower ends of the relatively large stems 17. Pistons 18 are mounted on the reduced portions 19 of the stems and rest against the shoulder formed at the upper end of the relatively large portions 17 of the stems. A suitable compression ring 20 is carried by the pistons 18 and it fits tightly within the wells or recesses 21 within the cylinder-head 22.

The crankshaft 9 is designed so that the four throws 10 are in two planes at right angles to each other, as is usual in crankshaft construction, and it is to be understood, that the shape and construction of the cams for controlling the respective valves, are to be made, as practical operation, as the engine determines.

In operation, the improved internal combustion engine works as follows:

When the piston 5 is starting down on the first suction stroke of the engine, the intake valve 14 having communication with the cylinder 1 opens and the mixture of fuel and air from the carburetor (not shown) is drawn into the cylinder. When the piston has finished its first suction stroke, it starts on its upward movement or the pump stroke at which time the valve 16 which establishes communication between the cylinder 1 and the chamber 15, opens and the mixture in the combustion chamber within the cylinder 1 is pumped or forced into the auxiliary chamber 15, where it is held under compression.

At the terminal of the pump or upward stroke of the piston 5, the valve 16 is closed, and the piston 5 starts downward on a second suction stroke at which time the intake valve 14 opens and permits the combustion chamber within the cylinder to receive another charge of fuel from the carburetor. During this operation, the intake valve 14 closes on the bottom or at the lower terminal of the movement of the piston, and the valve 16 opens, allowing the mixture under pressure to pass from the chamber 15 into the cylinder. During this forcing of the fuel under pressure from the auxiliary chamber 15 into the cylinder, the piston 5 is moving upwards on its compression stroke and when the piston has completed approximately half of its compression stroke the valve 16 is closed, and the piston continues on its compression stroke with the supplemental charge of fuel within the cylinder. The usual firing stroke and exhaust or scavaging stroke then follow in succession, which completes the six cycles of the unit of the engine and the piston is then ready to move downwardly on its first suction stroke in the subsequent operation of the engine.

Referring to the diagrammatic views, Figures 3 to 8 inclusive, it will be noted in the operation of the engine, the pistons will follow the different strokes illustrated in the views, for instance in Figure 3 piston number "1" is on its first suction stroke as indicated at "*a*", Figure 4 "*b*" shows the same piston on its first compression stroke while "*c*" in Figure 5 shows the same piston on its second suction stroke. In Figure 6 "*d*" illustrates the piston on its second compression stroke. In Figure 7 "*e*" illustrates the same piston starting on its firing stroke while "*f*" in Figure 8 shows the piston in its movement on the exhaust stroke. From this it will be apparent that the second piston illustrated in Figure 3 is at the bottom of its first suction stroke prior to the closing of valve "14", the return of the piston on its compression stroke and prior to the opening of the valve "16" while the same piston indicated A′ being shown in Figure 4 about to descend on its second suction stroke and in Figure 5 the same piston indicated at A′ is about to ascend on its second compression stroke and when this piston is approximately half way up the piston "C" in the same view will be at the lower terminal of its second suction stroke.

It is to be understood that the particulars herein given are in no way limitative, and that while still keeping within the scope of the invention, any desired modification of details and proportions may be made in the construction of the appliance according to circumstances.

The crankshaft 9 is so designed that when one piston is on the lower terminal of the second suction stroke, there is always another piston, approximately half way up on its compression stroke for delivering a charge of compressed fuel into the auxiliary chamber 15 which in turn delivers the mixture to the cylinder in which the piston is at the lower terminal of its second suction stroke.

What I claim is:—

In an internal combustion engine operating on a six stroke cycle, the combination with a plurality of cylinders having a cylinder head therefor, of pistons operable in the cylinder, said cylinder head having a plurality of intake manifold passages, one communicating with each two cylinders, said cylinder head having exhaust manifolds, one for each cylinder, valves controlling communication between the intake and exhaust manifolds and the cylinders, said cylinder head having an auxiliary manifold communicating with all of the cylinders, valves controlling communication between the auxiliary manifold and said cylinders, and operating devices which open each of said valves during the first upstroke of the piston during each cycle in a corresponding cylinder and again during the second downstroke in each cycle whereby the fuel is stored for a time in the auxiliary manifold and receives an initial compression due to the absorption of heat.

ELLIS B. KARPES.