C. E. SARGENT.

INTERNAL COMBUSTION ENGINE.

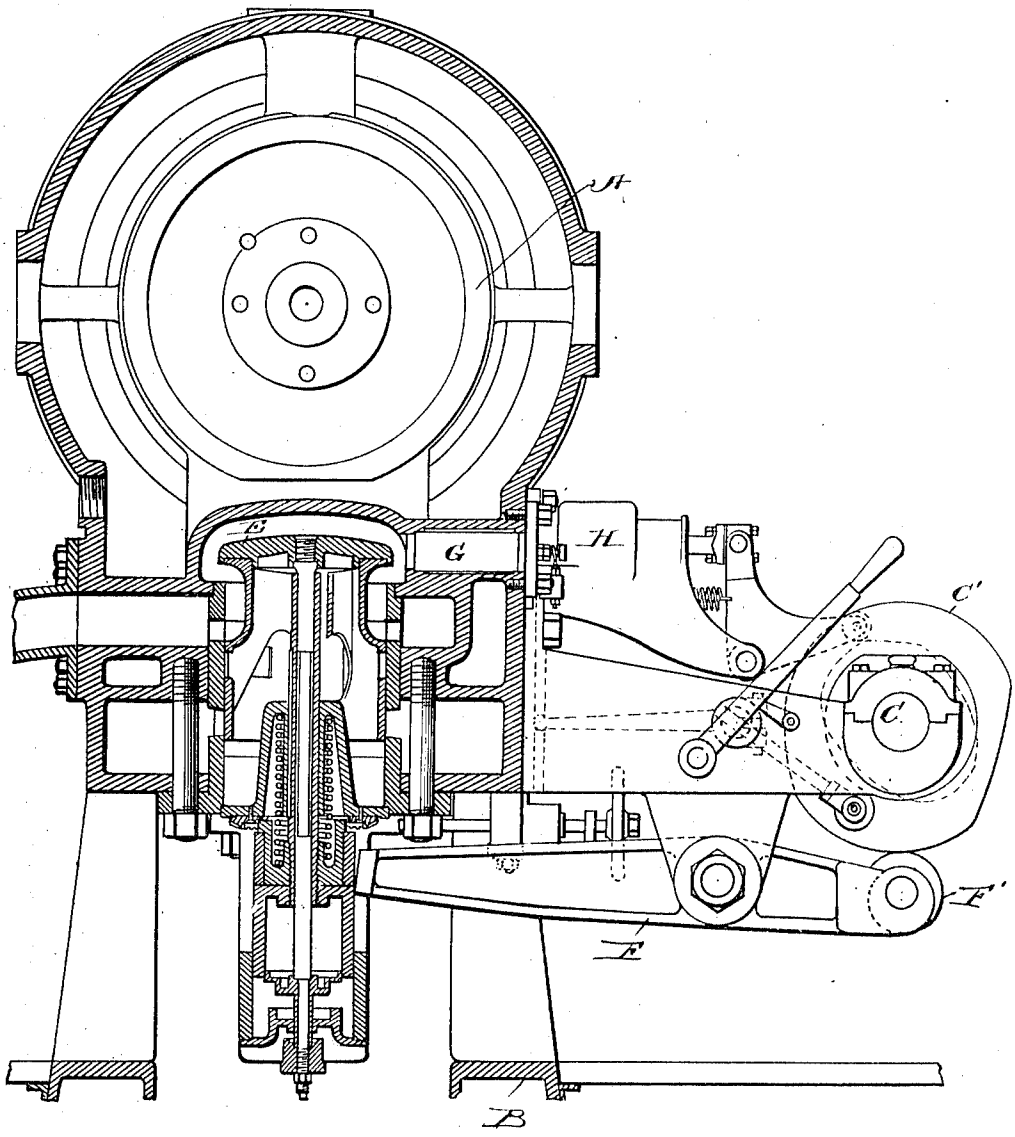
APPLICATION FILED OCT. 7, 1905.

1,061,249.

Patented May 6, 1913.

2 SHEETS—SHEET 1.

Fig. 1.



Witnesses

J. M. Fowler Jr.

Jesse C. Miller.

Inventor

Charles E. Sargent

By

Wallace Barnes,

Attorney

C. E. SARGENT.

INTERNAL COMBUSTION ENGINE.

APPLICATION FILED OCT. 7, 1905.

1,061,249.

Patented May 6, 1913.

2 SHEETS—SHEET 2.

Fig. 2.

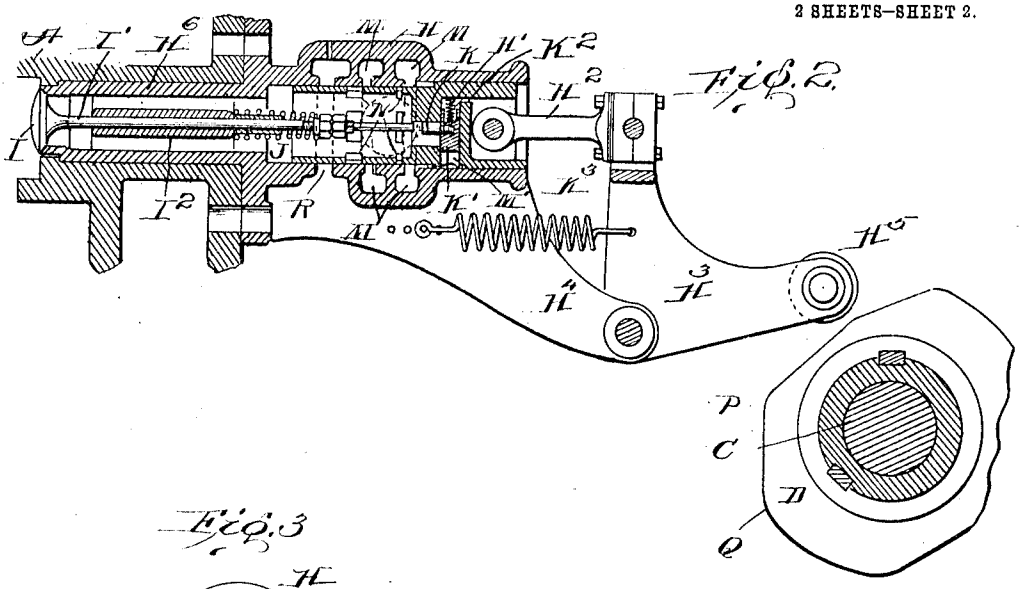


Fig. 3.

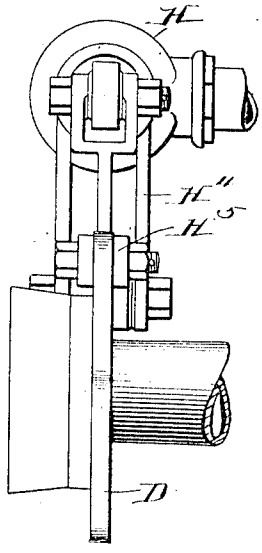
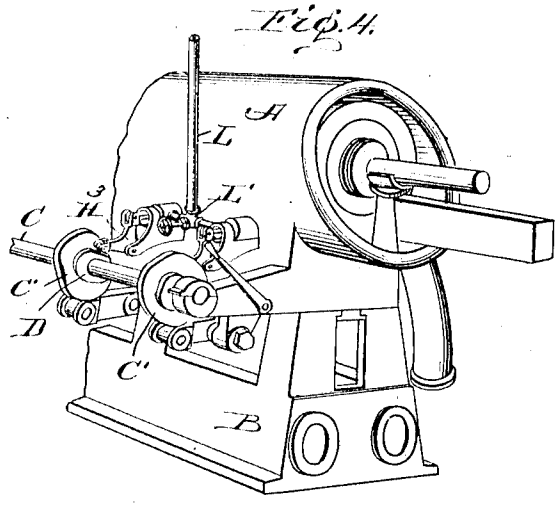


Fig. 4.



Witnesses

J. M. Fowler Jr.

Jesse C. Miller.

Inventor

Charles E. Sargent.

By Wallace Brune,

Attorney

UNITED STATES PATENT OFFICE.

CHARLES E. SARGENT, OF CHICAGO, ILLINOIS, ASSIGNOR TO SARGENT ENGINEERING COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF NEW YORK.

INTERNAL-COMBUSTION ENGINE.

1,061,249. Specification of Letters Patent. Patented May 6, 1913.

Application filed October 7, 1905. Serial No. 281,756.

To all whom it may concern:

Be it known that I, CHARLES E. SARGENT, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented new and useful Improvements in Internal-Combustion Engines, of which the following is a specification.

The difficulty in starting very large internal combustion engines is well known and it is now common to employ compressed air, through the agency of somewhat inconvenient apparatus, to put such engines in motion.

The general object of this invention is to provide means whereby the largest engine of this kind may be started as readily and certainly as a steam engine, by merely opening and closing a small valve. With this end in view, the engine provided with admission and exhaust devices without novelty is also provided with independent devices for admitting compressed air, said devices being normally out of action but brought into action by the pressure of the compressed air itself when the latter is allowed to pass a certain valve, and the arrangement is such that when air is thus admitted, the admission of gas or the usual explosive mixture, is automatically prevented as the result of well known physical principles until the air is again cut off. The engine being thus put in motion by the air, cutting off the air supply causes the immediate admission of explosive mixture, and thereafter the engine runs as an internal combustion engine until it is again shut down. In other words, if we have an engine of for example one thousand horse power, the opening of a small air valve puts the engine into action as a compressed air engine, and when the desired speed is reached, shutting off the air automatically causes the engine to change from air to gas as an operating agent.

For the purpose of illustrating my invention, I have chosen a double acting tandem engine having in itself no novelty herein claimed. To this has been added air admitting mechanism involving an admission valve through which air passes directly into the cylinder and an outer valve opened and closed by hand for admitting compressed air to the admission valve and at will cutting it off. The admission valve, which serves also as an exhaust valve, is actuated at proper times by a cam on the usual side shaft, but it remains closed and is in no way affected by this cam except when compressed air is allowed to pass the outer valve; and while air is thus allowed to enter, no explosive mixture enters through the ordinary admission valve, the engine running by compressed air only.

In the accompanying drawings, Figure 1 is a cross section through an engine cylinder, showing an admission and exhaust valve of well known construction actuated by devices without novelty. Fig. 2 is a vertical axial section through certain compressed air mechanism seen also in Fig. 1. Fig. 3 is a view looking from the right in Fig. 2. Fig. 4 is a perspective view of one end of the engine shown in the other figures, the view showing one only of the cylinders of a tandem engine.

In these figures, A represents an engine cylinder supported upon a suitable base B and having the usual side shaft C carrying cams C^1, D, for operating gas and air controlling devices, respectively. As these devices are similar for the two ends of each cylinder, the description of one set only is necessary.

Fig. 1 shows an admission and exhaust valve E, operated by a cam C^1 upon the shaft C, acting through a roller F^1 and pivoted lever F, the entire combination being well known and devoid of novelty, admission being by suction and exhaust by the action of the cam upon the valve operating elements.

For starting the engine, compressed air is admitted to the engine cylinder by independent devices, air entering at G into the space above the valve E temporarily holding the valve closed. In line with the opening G, a casing H is secured, and in this moves a horizontal differential piston valve H^1, connected by a pitman H^2 to a bell-crank lever H^3 pivoted to a bracket H^4 and carrying at its lower end a roller H^5 to rest against the periphery of the corresponding cam D upon the side shaft C. This casing extends inward in the cavity G as a sleeve H^6 and terminates in a seat for a puppet valve I whose stem I^1, sliding in a bearing I^2, projects into the hollow piston valve H^1. A spring J normally holds this valve closed, but it is opened at intervals by two distinct

means, as will be seen. A push pin, K, carried by a small piston K^1 moving transversely in a way in the differential valve, normally lies out of alinement with the valve stem I^1 and is held out of alinement by a spring K^2. Normally also, a spring K^3 holds the bell-crank lever lifted so that its roller is out of the path of the cam. As seen in Fig. 4, a valved pipe L between the air mechanism for the two ends of the same cylinder, admits compressed air to both when the valve is opened. The air enters communicating chambers M which receive air through a large inlet shown in dotted lines in Fig. 2, and pushes the piston valve outward, overcoming the force of the spring K^3 and causing the roller H^5 to ride on the cam D, and at the same time enters the space below the piston K^1, lifting the latter and bringing the push pin into alinement with the valve stem I^1. This outward movement of the piston valve brings its unequal ports N into registry with the chambers M, allowing the compressed air to enter the valve and the chamber in which it moves, where it overcomes the force of the spring J and opening the valve I passes into the engine cylinder. The timing of the cam D is such that the air is thus admitted just when the engine piston is ready for its stroke, and the cam is so formed that when a predetermined point of the stroke is reached the cam further lifts the roller, sliding the piston valve inward and cutting off the air. The expansion of the air in the cylinder carries the piston onward to the end of its stroke, and at this point the cam still further raises the roller, so that the push pin K strikes the end of the stem of the valve I, which had closed after the air was cut off, again opening it while the larger of the ports N is in registry with exhaust ports R. This cycle of movements is repeated so long as air is admitted to the chambers M, the admission and exhaust being governed by the cam D and the engine working with perfect regularity as an air engine. During this working as an air engine no gas is admitted for although it would normally be admitted during the first part of alternate strokes, at such times the compressed air is entering the cylinder and no suction is possible. The cam C^1 being all the time in action opens the regular main exhaust at every other stroke, but this opening occurs at the same time as the exhausting through the ports R and consequently the only effect is to in part relieve those ports of their duty at alternate strokes. When it is desired to change from air to gas as an operating agent, or usually as soon as the engine has reached proper speed, it is only necessary to close the air valve L, when the admission valve I closes, the push pin falls out of alinement, and the roller H^5 rises from the cam, the whole mechanism thus passing out of commission. At the same time the momentum of the moving parts, such as pertain to all engines of this class, draws in and compresses a combustible charge, and this being exploded the engine is then and thereafter acting as an internal combustion engine, until it is again shut down.

Obviously the invention is not restricted to use in or with the kind of engine illustrated; and compressed air here represents any fluid under pressure.

What I claim is:

1. The combination with an internal combustion engine and valve mechanism for operating it in the usual manner, of a normally closed valve for admitting air to the engine cylinder, engine-actuated devices normally disconnected during the operation of the engine as an internal combustion engine for opening said valve at intervals, an outer hand valve for admitting compressed air to the valve first mentioned, and intermediate mechanism operated by air from the hand valve to throw said devices into operative connection.

2. The combination with an internal combustion engine, of a valve for admitting compressed air to the space upon the inner side of the gas valve, means for at will admitting compressed air to said air admitting valve and cutting it off therefrom, normally disconnected engine actuated devices for opening the air admission valve at intervals, and means whereby air pressure may connect the disconnected devices.

3. In an engine of the class described having valve apparatus for operating the engine as an explosion engine, the combination with a normally closed valve for admitting compressed air to the engine cylinder, of an engine operated valve-actuating mechanism normally unconnected with said valve, an air operated device, normally out of operative position, for connecting said mechanism and valve, and means for at will throwing said device into operative position.

4. In an engine of the class described having valve apparatus for operating the engine as an explosion engine, the combination with a valve for admitting compressed air to the engine cylinder, a spring normally holding said valve closed during such operation, engine operated mechanism for opening said valve at intervals but normally unconnected therewith during the operation of the engine as an explosion engine, manually controlled means for admitting compressed air to said valve, and means whereby the admitted air connects said mechanism and valve.

5. In an engine of the class described having valve apparatus for operating the engine as an explosion engine, the combina-

tion with the engine cylinder and a compressed air chamber alongside the same, of a valve controlling communication between said chamber and cylinder, manually operated means for controlling the admission of compressed air to said chamber, devices adapted to control periodic admission of air to and exhaust from said chamber, engine operated mechanism for actuating said valve, and devices, and automatic means for disconnecting said mechanism when air pressure in said chamber ceases.

6. In an engine of the class described having valve apparatus for operating the engine as an explosion engine, the combination with the engine cylinder of a compressed air chamber, alongside the same, provided with inlet and exhaust ports, a reciprocating valve controlling communication between said cylinder and chamber, an engine operated member reciprocating in the line of the valve stem but at some distance therefrom and provided with devices controlling said inlet and exhaust ports, an air actuated device for filling the gap between the valve stem and said chamber, a spring urging said device out of operative position, and manually operated means for controlling access of compressed air to said inlet ports.

In testimony whereof I affix my signature, in presence of two subscribing witnesses.

CHARLES E. SARGENT.

Witnesses:
HARRIETT TAYLOR,
W. T. ANGELL.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents. Washington, D. C."