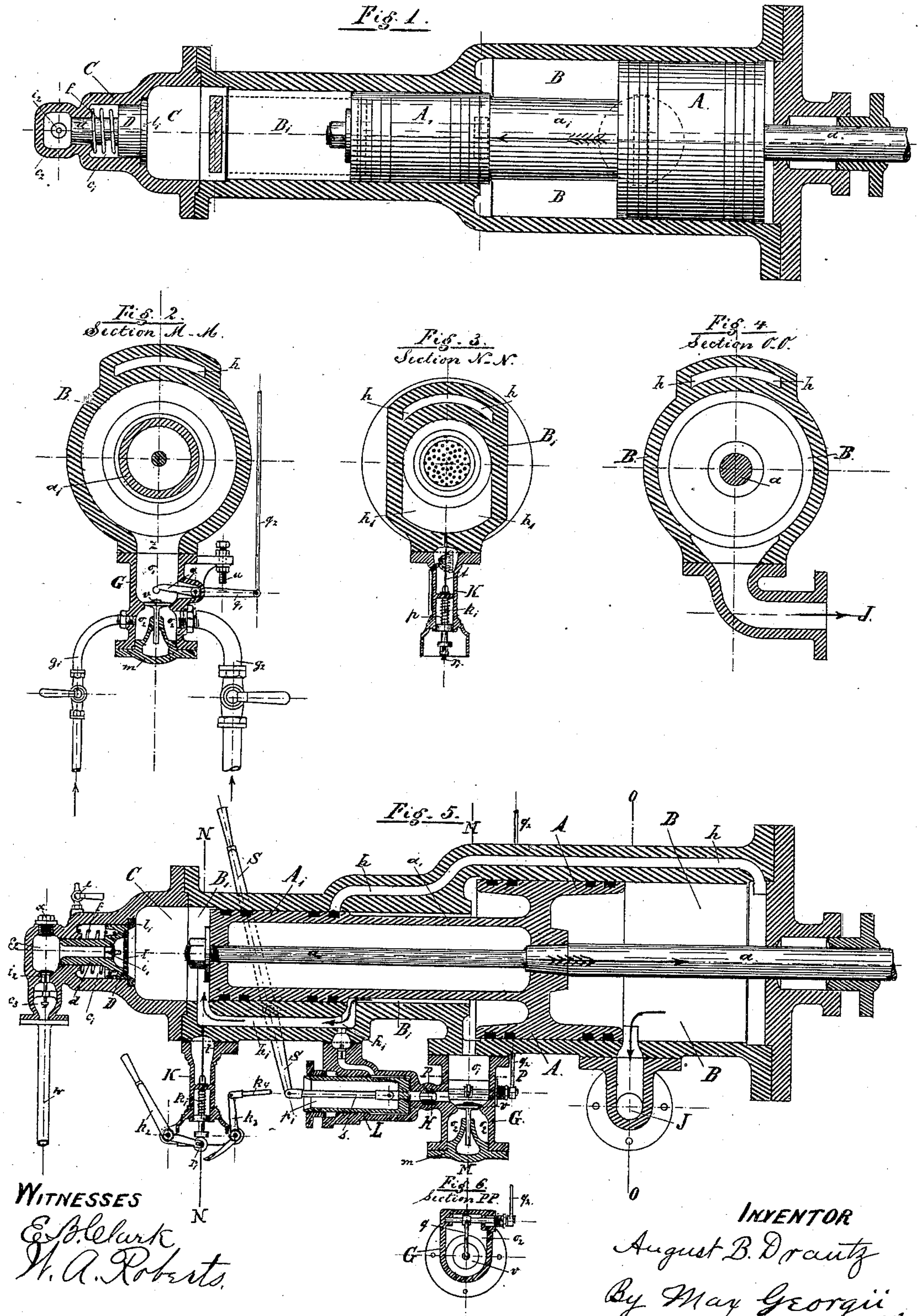
(No Model.)

A. B. DRAUTZ.

COMPOUND GAS OR STEAM ENGINE.

No. 423,224. Patented Mar. 11, 1890.



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UNITED STATES PATENT OFFICE.

AUGUST B. DRAUTZ, OF STUTTGART, WÜRTEMBERG, GERMANY.

COMPOUND GAS AND STEAM ENGINE.

SPECIFICATION forming part of Letters Patent No. 423,224, dated March 11, 1890.

Application filed July 29, 1889. Serial No. 319,087. (No model.)

To all whom it may concern:

Be it known that I, AUGUST B. DRAUTZ, a subject of the King of Würtemberg and Emperor of Germany, residing at Stuttgart, Kingdom of Würtemberg, Empire of Germany, have invented a new and useful Improvement in Compound Gas and Steam Engines, of which the following is a specification, reference being had therein to the accompanying drawings.

This invention is directed to a compound gas and steam engine having two pistons of different sizes working in corresponding cylinders connected by two distributing-channels, the cylindrical spaces located between the two pistons and the smaller channel serving for the suction, compression, and ignition of the explosive mixture, while the cylindrical space lying in advance of the smaller piston, as well as the co-ordinate cover, serves as an explosion-chamber. This chamber is then cooled off by means of an adjacent automatic water-injector, and subsequently serves for the production of steam of high tension. The steam so generated and the exploded mixture is conducted to the opposite half of the larger cylinder at the end of the forward stroke of the piston through the larger distributing-channel, expanding there (in said cylinder) during the opposite stroke of the piston, and escapes toward the end of the stroke either into the air or to a condenser for further utilization.

In the drawings, Figure 1 represents a horizontal longitudinal section of a device embodying my invention; Fig. 5, a vertical longitudinal central section of the same; and Figs. 2, 3, and 4, transverse sections on lines M M, N N, and O O, respectively, of Fig. 5. Fig. 6 is a detail view.

Assuming the parts to be in the position indicated by Fig. 5, and the pistons A and A′ connected by the thinner part a' advancing in the direction of the arrows in that figure, the port at the right of channel h' will be first closed by the piston and the explosive mixture between the cover C and the piston ignited by the pin t, heated by a gas-flame. The igniting-pin t is attached to a small rod k', having at its bottom a small anti-friction roller r'. The rod k' slides in the ignition-cylinder K, and is urged downward by a spring p bearing against a shoulder at the bottom of said rod k'. This rod is advanced into the channel h' by means of a bell-crank lever k^3 bearing against the roller r' and actuated by the rod k^4, deriving its motion from a suitable cam. In conjunction with this machine-operated lever k^3 there is provided a hand-lever k^2, which is operated by the attendant when the engine is to be started or if for any cause the lever k^2 will not operate. The advantage of this additional lever will be readily understood when the difficulty of moving the various parts of an engine when at rest are considered.

The high tension of the gases generated by the explosion throws the yielding piston D, which I term the "differential" piston, back, thereby forcing the water in chamber c^2 into the explosion-chamber past the valve i'. The sprayer l serves to introduce the water in the form of spray. The hot gases effect the immediate vaporization of the water and a rapid cooling off of the products of combustion and render an external cooling device unnecessary. The mixture of gases and steam forces the pistons forward in the direction of the arrows in Fig. 5 until the left port of channel h is freed and the gases enter into the cylinder B and the pressure on the two pistons A and A′ is equalized. In view of the difference of area between the two pistons A and A′, the same are now pushed in the opposite direction (that indicated by the arrows in Fig. 1) and the mixture of gases and steam on the right-hand side expands until the outlet-channel J is exposed and the mixture flows into the air or into a condenser, while on the left side of the piston A pressure is exerted to introduce a fresh charge of gas.

It will be seen that while the working gases operate on the outside of both pistons the right port of the channel h' is first closed during the motion from left to right, and in the further motion from left to right a vacuum is produced. The valve v, closing the suction-chamber o' of the duct G, is opened, and air and gas arriving through the pipes g' and g^2 introduced therethrough. During the reverse movement of the pistons the valve v is closed, the mixture of gas and air compressed, and finally forced into the combustion-chamber B′, and there ignited at the change of the piston-stroke and the closing of the mouth at the right of channel h', the cam having again forced the igniting-pin t into said channel h'. The valve v itself serves to regulate the motor in this way. When a surplus of power exists, this valve is kept wholly or partially closed by a lever q, (see Figs. 2 and 6,) connected with the governor by a rod q^2, whereby the introduction of explosive mixture is prevented or reduced, and no explosion, or a slight explosion, is accordingly produced.

The introduction of the water into the explosion-chamber is effected and regulated as follows: In order to effect the introduction of the water only at each explosion, a yielding and hollow piston D d, which I term the "differential piston," is fitted into cover C of cylinder B′, and held yieldingly in the position indicated in Figs. 1 and 5 by a spiral spring f. A pressure-valve i' is arranged in the said piston D d, a suction-valve i^2 in a plug forming part of cover C and connected with the suction-tube w. The air-cock e, by controlling the air-exit opening, serves to regulate the movement of the differential piston D d, and thereby the quantity of the water injected into the explosion-chamber; for it is apparent that the said piston on being thrown back must overcome the resistance of the spring f and the air contained in the space between the cover C and the said piston. This compression may be regulated by means of the said air-cock e.

l represents a sprayer attached to the forward end of piston D, and serving for finely dividing the water injected into the explosion-chamber, and l' an annular ledge attached to the cover C and limiting the forward motion of the piston D. On the backward motion of the piston D d water is forced into the explosion-chamber through valve i', and on its return movement, due to spring f, water is sucked into the chamber c^2 from the suction-chamber c^3.

In order to start the engine the following mechanism is provided: The space o^2, communicating through the valve v with the supply of explosive mixture, is connected with the channel h' by a hand-pump L, which may be shut off by means of a cock H. The piston p' of this pump is operated by lever S through the pitman s. The engine is so arranged that when ceasing to run the parts will be so located that the smaller piston A′ has closed the right-hand opening of channel h'. Upon working the hand-pump L with this relative position of the parts, it will be seen that the explosive gases are forced into the explosion-chamber. The cock H is then shut off, and the ignition-pin t is forced upward by a supplemental hand-lever k^2. The explosion then takes place and the parts begin to operate as above described.

The most apparent advantages arising from my construction are the following:

First. The saving of the cooling-water, the volume of water used being much less than a fortieth of that formerly necessary.

Second. The omission of a double-walled cylinder, formerly necessary for the circulation of the cooling-liquid around the combustion-chamber.

Third. A greater reduction of the final temperature of the products of combustion. While formerly the temperature was reduced to from 600° to 700° centigrade, under my construction a reduction to from 40° to 110° centigrade is effected.

Fourth. The water, being thrown into the explosion-chamber in a finely-comminuted state, is immediately converted into steam of high pressure, which performs an essential part of the work, while formerly a vast percentage of the caloric was carried off by the cooling-liquid. While formerly about thirteen to fourteen per cent. of the heat was utilized, by my construction I am enabled to utilize twenty per cent. or more thereof.

Fifth. The solid residuum of the combustion, which formerly necessitated a frequent cleaning of the valves and cylinders, is in my construction dissolved by the steam and carried off with the exhaust-steam.

Sixth. A simpler and cheaper construction, arising from the omission of all slide-valves, and enabling most of the parts to be turned on the lathe.

Seventh. I produce a one-stroke engine, while all former engines of this kind were two or four stroke engines.

I claim—

1. In combination with the combustion-chamber of a gas-engine having a port, a needle adapted to be heated by a flame and to enter said port, a lever operated by said engine for forcing the needle into the port, and a spring for retracting the needle, substantially as described.

2. In combination with the combustion-chamber of a gas-engine, a spring-held needle adapted to be heated by a flame and to enter a port in said chamber, mechanism operate by the engine for forcing said needle into said port against the action of said spring, and a hand-lever for operating the needle independently of the engine mechanism, substantially as described.

3. In a compound gas and steam engine, the combination, with the explosion-chamber, of the differential piston yieldingly held forward against said explosion-chamber, and provided with a valve-closed opening for the injection of the water, substantially as described.

4. In a compound gas and steam engine, the combination, with the explosion-chamber, of a cover carrying a hollow piston held against the chamber by a spring and carrying a pressure and a suction valve, the latter being connected with the water-supply, substantially as described.

5. In a compound gas and steam engine, the combination, with the explosion-chamber,

of a cover carrying a differential hollow and yielding piston, the head of said piston being foraminated to form a sprayer, substantially as described.

6. In a compound gas and steam engine, the means for regulating the supply of explosive mixture, consisting of the duct G, provided with valve v, in combination with the pivoted levers q q', controlled from the governor, substantially as described.

7. In a compound gas and steam engine, the combination, substantially as described, of the following parts: the cylinders B and B′, of different diameters, the channels h and h', connecting the cylinders B and B′, the pistons A and A′, fitting into the cylinders B and B′ and controlling said channels, respectively, the duct G, and the exhaust-duct J, the channel h' being so arranged that the suction and compression of the explosive gases take place between the two pistons, and the channel h being so arranged that at the same time the explosion takes place outside the smaller piston and the further expansion outside the larger piston.

8. In a compound gas and steam engine, the starting mechanism consisting of the hand-pump L, combined with and connecting the duct G and the channel h', and means for cutting off the connection between the pump and the duct G, substantially as described.

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

AUGUST B. DRAUTZ.

Witnesses:
GUSTAV GROSS,
THEODORE ABENHEIM.