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H. B. NICODEMUS.

GAS ENGINE ATTACHMENT FOR STEAM ENGINES.

APPLICATION FILED FEB. 27, 1902.

NO MODEL.

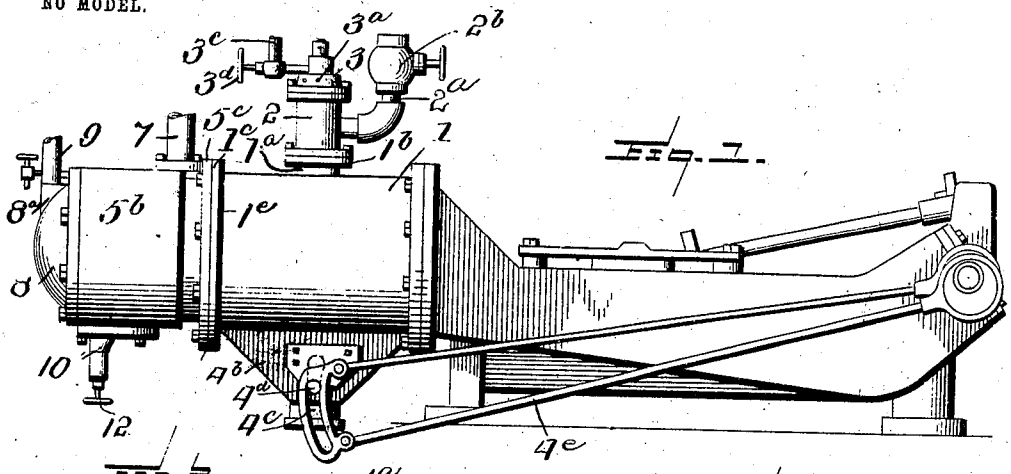


Fig. 1.

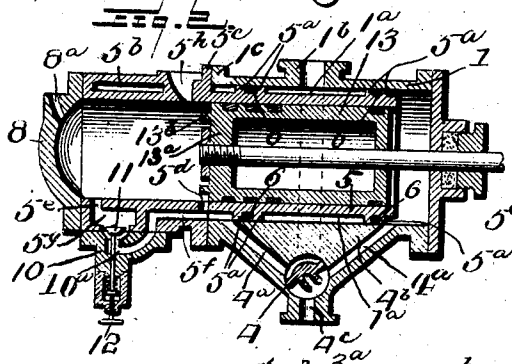


Fig. 2.

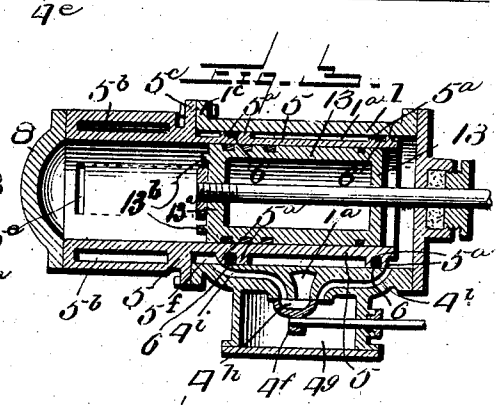


Fig. 3.

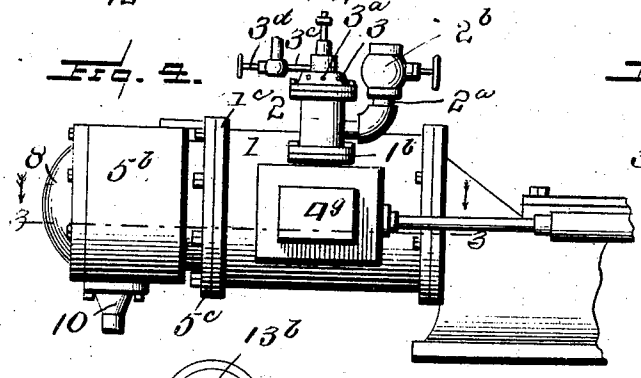


Fig. 4.

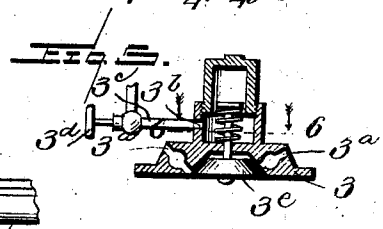


Fig. 5.

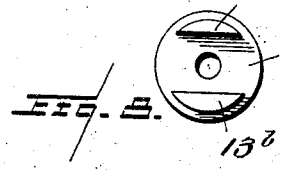


Fig. 8.

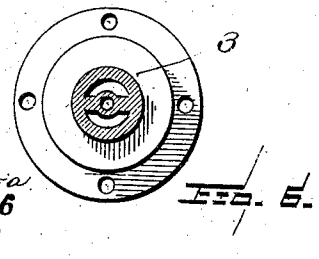


Fig. 6.

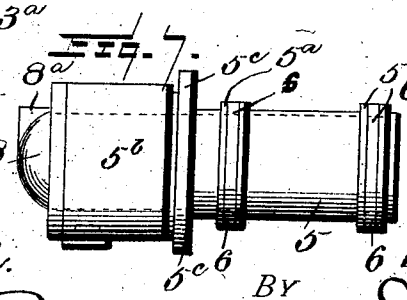


Fig. 7.

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No. 754,385. Patented March 8, 1904.

UNITED STATES PATENT OFFICE.

HENRY B. NICODEMUS, OF ALLEGHENY, PENNSYLVANIA, ASSIGNOR TO GEORGE K. BENNER, OF ALLEGHENY, PENNSYLVANIA.

GAS-ENGINE ATTACHMENT FOR STEAM-ENGINES.

SPECIFICATION forming part of Letters Patent No. 754,385, dated March 8, 1904.

Application filed February 27, 1902. Serial No. 95,897. (No model.)

To all whom it may concern:

Be it known that I, HENRY B. NICODEMUS, a citizen of the United States of America, residing at Allegheny, in the county of Allegheny and State of Pennsylvania, have invented certain new and useful Improvements in Air and Gas Attachments for Steam-Engines, of which the following is a specification, reference being had therein to the accompanying drawings.

My invention is an improvement in gas-engine attachments for steam-engines, whereby a steam-engine can be readily converted into a gas-engine when the steam is shut off and commingled air and gas admitted or used as a steam-engine when the commingled air and gas is shut off and steam is admitted.

One object of my invention is to provide means which will enable the piston to be operated either by steam or by the explosion of comminged air and gas, the piston-cylinder providing either a steam-chamber or an explosion-chamber.

Referring to the drawings, Figure 1 is a side elevation of a steam-engine having my improved gas-engine attachment applied to the cylinder thereof, the cylinder having an ordinary rotary valve and link motion. Fig. 2 is a vertical longitudinal section of the cylinder end of the engine. Fig. 3 is a horizontal section of the cylinder end of an engine, taken on the line 3 3 of Fig. 4 looking in the direction of the arrows, the cylinder having a chest and slide-valve. Fig. 4 is a side elevation of the same. Fig. 5 is a detail vertical section of the air and gas valve. Fig. 6 is a horizontal section of the same, taken on the line 6 6 of Fig. 5 looking in the direction of the arrows. Fig. 7 is a side elevation of the piston-cylinder. Fig. 8 is a view of the outer end of the piston, showing the deflector-plates.

In the drawings I have shown an engine which is adapted to be driven either by steam or by commingled air and gas as an explosive compound.

1 is a main cylinder constructed with a feed pipe or passage 1^a, having a flanged inlet 1^b, on which is secured a feed-chamber 2, with which is connected a steam-pipe 2^a, having a controlling-valve 2^b. Surmounting this feed-chamber 2 and secured thereto is a valve-casing 3, formed in its lower part with air-inlets 3^a and at its upper part with an opening 3^b, with which is connected a gas-pipe 3^c, having a controlling-valve 3^d. Within this valve-casing 3 is located an outwardly-seating spring-supported check-valve 3^e for admitting combined air and gas to the feed-chamber 2, which acts as a commingling or mixing chamber for the combined air and gas flowing thereinto. The main cylinder is also provided with a rotary valve 4, located at the outlet of the feed pipe or passage 1^a, as shown in Figs. 1 and 2, for directing the feed to either the front or the rear branch passages 4^a of the chest 4^b, having an exhaust 4^c, the rotary valve 4 having a crank-arm 4^d, which is operated by the usual link mechanism 4^e. Instead of the rotary valve 4 I may employ a slide-valve 4^f, having a chamber 4^h directing the feed into either the front or rear branch passages 4^i.

5 is a piston-cylinder located partly within the main cylinder 1. This piston-cylinder 5 is constructed at its inner part within the main cylinder 1 with pairs of flanges 5^a and a packing-ring 6 between the flanges 5^a of each pair, so as to make the passage 1^a between the inner flanges of each pair of flanges tight at the sides. The outer part of the piston-cylinder 5 is constructed with a water-jacket 5^b, a flange 5^c, whereby the piston-cylinder 5 is bolted to the outer flange 1^c of the main cylinder 1, an inner port 5^d, an outer port 5^e, an inner passage 5^f, with which the outer branch passage 4^a and inner port 5^d communicate, an outer passage or antechamber 5^g, and an exhaust-port 5^h, receiving a check-valve casing 7. (See Fig. ..)

8 is the flanged head of the piston-cylinder 5, which is formed with an opening 8^a for the insertion of any form of igniter 9. (See Fig. 1.)

10 is a valve-casing having a passage 10^a, providing communication between the inner passage 5^f and the outer passage or antechamber 5^g of the piston-cylinder 5.

11 is an outwardly-seating spring-check valve within the valve-casing 10 for closing the passage 10^a within the valve-casing 10 and which may be held open by a screw-rod 12.

13 is the piston operating within the piston-cylinder 5 and having its outer head 13^a provided with deflecting-plates 13^b, whereby the explosive mixture is directed toward the outer end of the chamber of the piston-cylinder. The space within the piston-cylinder 5 between the head 8 of the piston-cylinder 5 and the outer head 13^a of the piston 13 provides an explosive-chamber.

In order to start the engine by commingled air and gas, it is necessary that the steam-valve 2^b be closed tight. If the engine has a rotary valve 4, it is necessary for the link mechanism 4^e to be disconnected from the crank-arm 4^d and the rotary valve 4 reversed, so that the branch passages 4^a will be opened through the valve-chamber from end to end, thereby permitting the explosive mixture to pass from the inner end of the piston 13 to the outer end of the chamber of the piston-cylinder 5. The exhaust of the main cylinder 1 is closed by the reversal of the rotary valve 4, and the air and gas having been previously thoroughly mixed in the feed-chamber 2 is permitted to enter the outer end of the chamber of the piston-cylinder 5, at which time the fly-wheel (not shown) of the engine is moved to such a position that the piston 13 is moved to the rearward direction, the piston 13 thereby creating a partial vacuum, which will cause the explosive mixture to enter into the chest 4^b through the branch passages 4^a to the end of the piston-cylinder, at which time the piston 13 is moved forward, causing the explosive mixture to move back through the branch passages 4^a in the steam-chest 4^b and in the passages 5^f 5^g in the piston-cylinder to the check-valve 11 and from thence into the piston-cylinder. The piston 13 is now moved back again and compresses the explosive mixture. The igniter now acts, and the explosion occurring at this time will start the engine. Attention is called to the fact that while the engine is in motion the explosive mixture does not go through the check-valve 11 until the engine exhausts.

In order to use steam as a means of propulsion within the piston-cylinder, the screw-rod 12 of the check-valve 11 is raised sufficiently to cause the check-valve 11 to be unseated, thereby lifting the valve 11, so the steam will freely pass the steam-valve 4, the latter being rearranged to regulate the steam. When the steam is turned on, the pressure thereof will keep the air and gas check valve 2^b closed, so that the steam will not interfere with the air and gas check valve 2^b.

If the engine has a slide-valve 4^f, the valve-rod must be disconnected and the valve moved, so that the branch passage 4^i may be open from end to end of the piston-cylinder.

It will therefore be apparent that by simply arranging certain valves the engine can be driven by either steam or an explosive mixture.

To start the engine by gas in a rotary-valve engine, the rotary valve is turned upside down to open the ports in the main cylinder and at the same time close the exhaust of the main cylinder. The crank at the forward end of the engine is set in position, and in turn the piston will be set in position, so that when the gas is turned on and the fly-wheel (not shown) turned back the piston will draw in a charge of commingled air and gas into the front end of the cylinder. Then the fly-wheel is turned ahead to press the commingled air and gas into the exploding end of the piston-cylinder. Then if the fly-wheel is turned back the air and gas will be compressed and make the explosion. At the same time there will be another charge in the front end of the cylinder ready to be received in the exploding end when engine exhausts the old charge.

To start the engine by gas on a slide-valve engine, the valve-slide is disconnected from the cam-rod and the slide-valve moved, so that the ports will be wide open and to let the commingled air and gas travel free from the front end of the cylinder through the steam-chest to the exploding end of the piston-cylinder.

When it is desired to run the engine by steam, the steam-exhaust is opened, the exhaust closed on piston-cylinder, and the valves properly arranged to let steam pass through free, and then turn on the steam.

Having thus described my invention, the following is what I claim as new therein and desire to secure by Letters Patent:

1. The combination with a main cylinder; of a piston-cylinder having its inner part located within the main cylinder and providing either a steam-chamber or explosion-chamber, passages for feeding either steam or an explosive mixture into the piston-cylinder, valves for controlling the flow through the passages, and an igniter for the explosive mixture.

2. The combination with a main cylinder, of a feed pipe or channel, a valve-casing communicating with the feed-chamber having air-inlets, a gas-pipe connected with the valve-casing, a check-valve within the valve-casing, a piston-cylinder having its inner part located within the main cylinder and providing either a steam-chamber or explosion-chamber, feed-passages providing communication between the opposite ends of the piston-cylinder, a valve-casing having a check-valve whereby communication with the outer part of the chamber of the piston-cylinder is controlled, and an igniter for the explosive mixture connected with the outer part of the piston-cylinder.

3. The combination with the main cylinder, of a piston-cylinder secured to one end of the

main cylinder having a part thereof located within the main cylinder and the remainder thereof extending beyond the main cylinder, the said piston-cylinder providing either an explosion or steam chamber, means for controlling the admission of an explosive mixture to the chamber of the piston-cylinder, a piston located within the piston-cylinder, and means for controlling the admission and exhaust of steam to the piston-cylinder.

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

HENRY B. NICODEMUS.

Witnesses:
JOHN NOLAND,
E. E. POTTER.