No. 882,325. PATENTED MAR. 17, 1908.

L. L. LEWIS.

FIRING DEVICE FOR GAS ENGINES.

APPLICATION FILED NOV. 24, 1906.

Fig. 2.

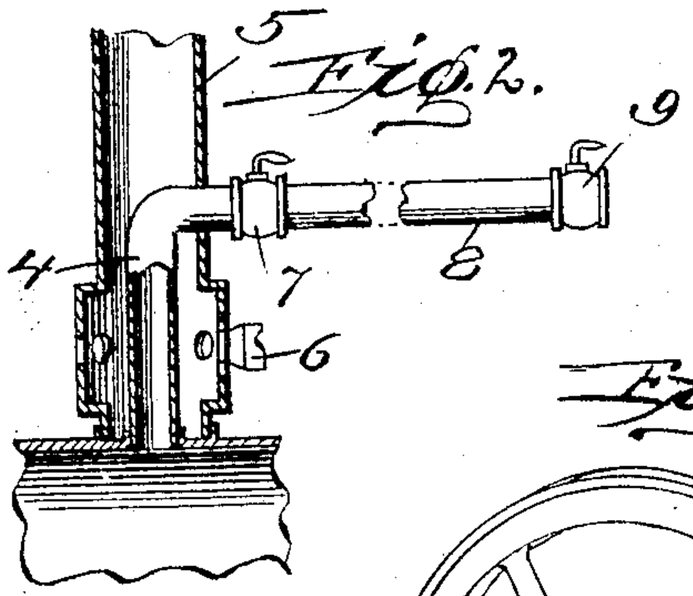


Fig. 1.

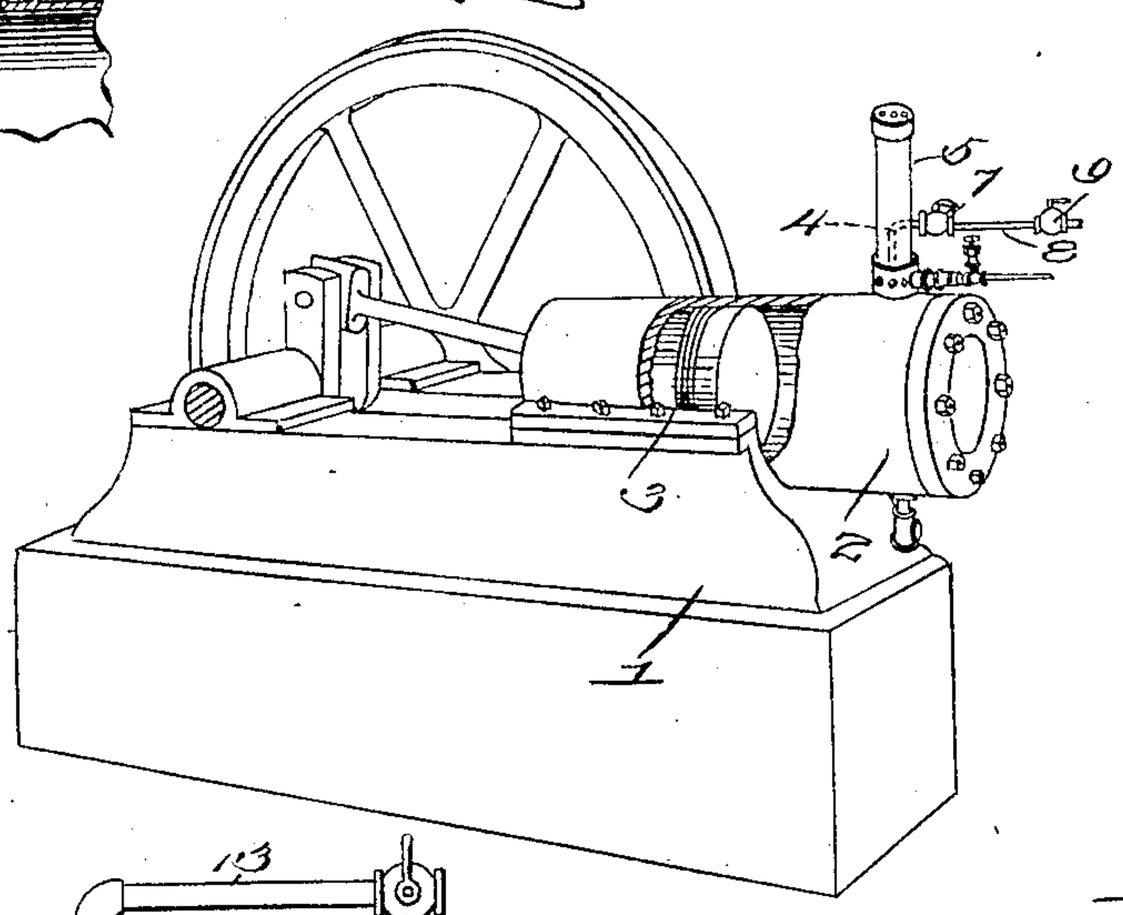


Fig. 4.

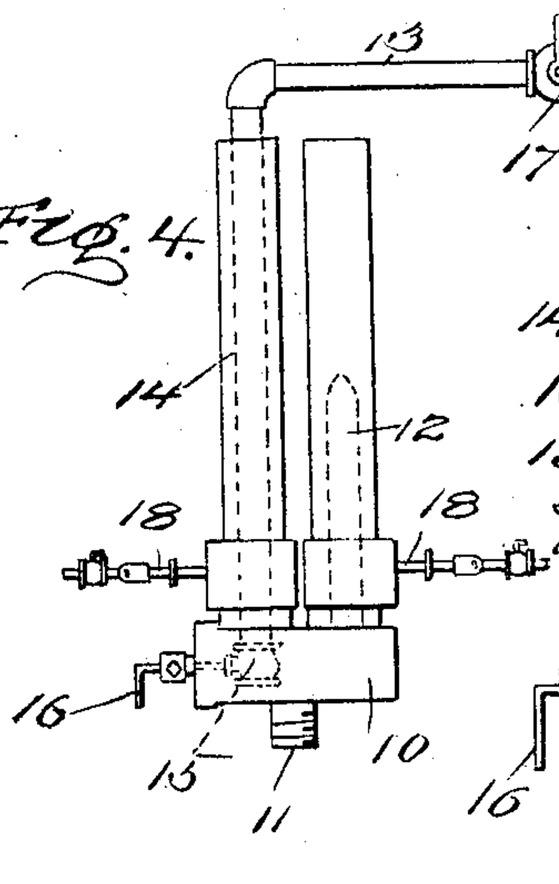


Fig. 5.

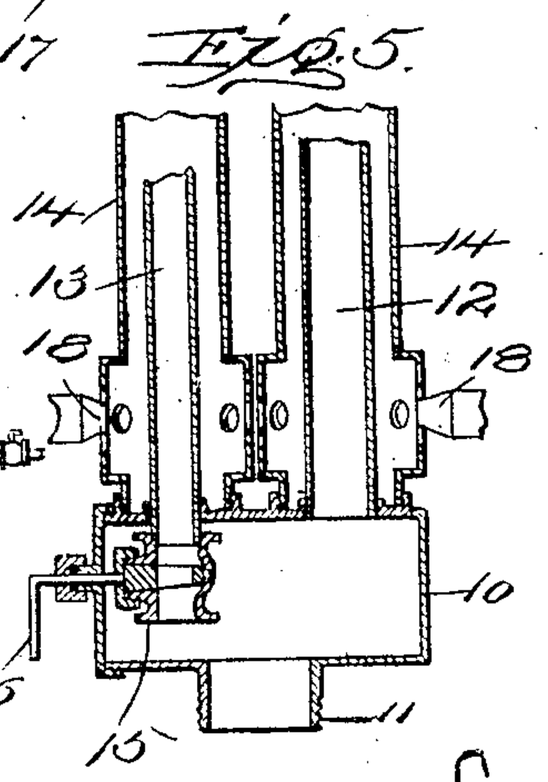
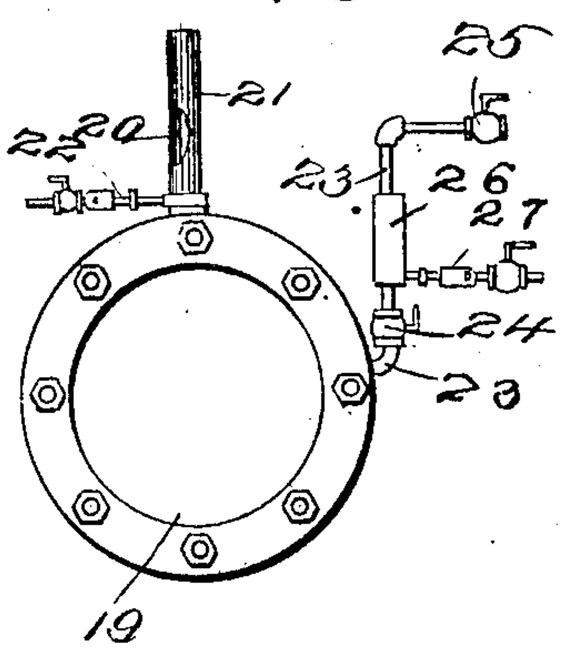


Fig. 3.



Inventor

Lester L. Lewis

By Mason, Fenwick & Lawrence

his Attorneys

Witnesses

J. M. Fowler Jr

Edgar M Ritchin

UNITED STATES PATENT OFFICE.

LESTER L. LEWIS, OF OIL CITY, PENNSYLVANIA, ASSIGNOR TO E. J. CURRAN, OF OIL CITY, PENNSYLVANIA.

FIRING DEVICE FOR GAS-ENGINES.

No. 882,325. Specification of Letters Patent. Patented March 17, 1908.

Application filed November 24, 1906. Serial No. 344,966.

To all whom it may concern:

Be it known that I, LESTER L. LEWIS, a citizen of the United States, residing at Oil City, in the county of Venango and State of Pennsylvania, have invented certain new and useful Improvements in Firing Devices for Gas-Engines; and I do hereby declare the following to be a full, clear, and exact description of the invention such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to improvements in firing devices for gas engines, and more particularly to means for firing the initial charge regardless of the degree of compression thereof.

The object of the invention is the firing of a charge of gaseous mixture regardless of the degree of compression thereof for imparting the initial stroke to the piston of the engine and thus starting the same.

The invention comprises certain novel constructions, combinations and arrangement of parts as will be hereinafter fully described and claimed.

In the accompanying drawing,—Figure 1 is a perspective view of a portion of a gas engine having an embodiment of the present invention applied thereon. Fig. 2 is an enlarged detail section through the firing device, some of the parts being shown in elevation. Fig. 3 is a view in end elevation of the cylinder of a gas engine to which is applied another embodiment of the present invention. Fig. 4 is a detail view of a slightly modified embodiment of the present improved firing device detached. Fig. 5 is a longitudinal, vertical, central section taken through the parts seen in Fig. 4.

In the gas engine art much difficulty has been experienced in imparting to the piston of a gas engine its initial stroke with sufficient velocity for compressing a charge of gas in the engine cylinder sufficiently for firing the same. This is true, of course, principally with reference to engines fired by a hot tube, the class of engines fired by an electric spark not being considered for the reason that a sparker is not considered reliable wherever the use of a hot tube is practicable.

It is well known to those skilled in the art that a hot tube used for firing an engine is simply a tube closed at its outer end and in communication with that end of the cylinder of the engine at which the explosion occurs.

In practice it is found that the hot tube must be relatively small and short in order to successfully fire the charges of air and gas under high compression. The larger and longer the hot tube the lower the compression required for firing. This is due to the fact that each time the explosion occurs, a certain amount of gases remain in the hot tube and are not discharged when the burned gases escape from the cylinder, so that when another charge is introduced into the cylinder, the gases in the hot tube act as a cushion and must be compressed sufficiently for permitting a part of the newly admitted charge to enter the hot tube for a sufficient distance for contacting with the heated portion of the hot tube. After the engine has stopped operation and cooled down, a certain amount of air and gas still remains in the hot tube and produces a cushion, so that in starting the engine the first charge of air and gas must be compressed substantially to the same degree as the later charges in order to force a portion of the first charge up into the hot tube.

To obviate the difficulty of compressing the initial charge, it has been proposed to lengthen the hot tube so as to decrease the resistance of the gas cushion within the tube, but when the size of the hot tube was increased, either as to diameter or length, it was found that all of the charges would explode under low compression and the firing would occur too rapidly for a high pressure engine. It was then proposed to obviate this difficulty by cutting off the communication between the cylinder of the engine and the enlarged firing tube at all times except when it was desired to have the charge fired. It was proposed to accomplish this result by the interposition of a valve in the length of the hot tube and the provision of mechanism actuated by the crank shaft of the engine for actuating said valve in timed relation to the operation of the piston, so that the valve would be opened just as soon as the piston had compressed the charge to the required degree. This structure, it was found, would operate successfully temporarily, but the valve mechanism was necessarily intricate and easy to get out of order, and the valve

itself, being in a position where it was necessarily constantly heated, would wear and the parts against which the valve contacted would also wear so as to require constant renewing.

By the present invention it is proposed to obviate the difficulties found in the use of such a valve and at the same time obviate the difficulty of the too rapid firing of the engine or the undesirable firing at a low pressure, the invention involving means for attaining these desirable results, and also permitting firing at low pressure when desired, without including features of construction which are intricate or expensive or liable to rapid wearing.

Referring to the accompanying drawing by numerals in which are illustrated a few of the preferred embodiments of the present invention, 1 indicates a suitable base on which rests a gas engine whose cylinder 2 is provided with the usual piston 3 and may be provided with any of the ordinary forms of gas supplying devices preferred. Projecting from the cylinder and communicating therewith is a comparatively short relatively small hot tube 4 surrounded by a heating chamber 5, provided with the usual gas blast pipe 6. The heating device 5 may, of course, assume any form whatever, as it is entirely immaterial, as far as the present invention is concerned, what means are employed for heating the hot tube. The hot tube 2 is preferably bent at its upper end and extends outside the heating chamber 5, and has its outer end provided with a valve 7 of any preferred type. The length of the pipe 4 from the cylinder of the engine to the valve 7 is preferably no greater than the ordinary hot tube for any given high pressure gas engine.

Beyond the valve 7 the pipe 4 is provided with the extension 8 which is provided at its outer end with a valve 9. The extension pipe 8 may be of any length desired, it being found that the greater the length the more nearly perfect is the vacuum produced when exhausting the cylinder, and therefore the more easy the firing of the charge. In other words, when a comparatively long section of pipe 8 is employed, the new charge will fire at a very low pressure, and when a shorter section is employed a slightly higher degree of pressure is required. It is possible to make the section 8 a sufficient length for causing the vacuum produced by the exhausting of the pipe 4 to be so nearly perfect that a new charge will be fired on the intake stroke of the piston before any compression whatever takes place.

In operation, when it is desired to start the engine, the valves 7 and 9 are opened and the fly wheel of the engine revolved sufficiently for causing the gases within the cylinder to be discharged out of the tube 4. The gas blast from pipe 6, of course, is lighted and left burning a sufficient time for raising the temperature of that part of the tube 4 within the heating chamber 5 to a degree sufficient for igniting a gaseous charge. This heating of the tube causes all of the air and gases to be exhausted out of the tube, and valve 9 is then closed leaving the tube 4 containing highly attenuated air and other gases, the exhausting of the air and gas from the tube being such as to produce a partial vacuum. Thus it is to be noted that instead of a cushion being present, which must be overcome before the new charge can enter the tube 4, a vacuum exists which tends to draw a new charge into the tube 4. Hence, when the new charge has been drawn in by the revolution of the fly wheel and the receding of the piston, it is only necessary to turn the fly wheel a sufficient distance for causing the piston to slightly compress the charge in the cylinder, whereupon a portion of such charge is driven up into the tube 4 and the entire charge is thus ignited. This ignition will occur at low pressure and will throw the piston with sufficient velocity for revolving the fly wheel for causing the second stroke of the piston to produce a high compression of the second charge, the valve 7 being closed immediately upon the firing of the initial charge so as to leave pipe 4 in condition for taking care of regular high compression charges.

It is to be noted that the second charge will not fire at low compression for the reason that the firing of the first charge leaves a gaseous cushion in tube 4 which must be overcome by each subsequent charge before ignition occurs, the valve 7 being left closed during the regular operation of the engine.

It should be obvious from the foregoing that an engine may be started easily and readily without the use of an expensive starter and without requiring a great deal of labor, it being unnecessary to compress the new charge to any material degree, and it is of course obvious that the labor heretofore required for starting a gas engine has been largely due to the necessity for compressing the new charge to as great an extent as is required during the continuous operation of the engine. Thus it will be seen that I have produced a structure capable of facilitating the starting of an engine at low pressure and being immediately transformed into a device requiring a high compression of subsequent charges, and therefore the present invention is applicable to all high compression engines.

As will be readily obvious to any one skilled in the art, the present invention is by no means limited to the particular embodiment above described, but may assume many varied forms, all incorporating the broad conception of the invention including the provision of a hot tube in an exhausted condition for producing the first explosion, and

having a gaseous cushion after the first explosion. As illustrative of further embodiments of the present invention, reference may be had to Figs. 4 and 5 in which I have shown a box 10 of any desired shape and form, but preferably comparatively small, having a threaded tube 11 adapted to be threaded into place in the engine cylinder in place of the usual hot tube, the usual hot tube and heating chamber therefor being removed. Extending from the box or casing 10 is a main hot tube 12 and an auxiliary hot tube 13, each of which is surrounded by a heating chamber 14 of any ordinary type. The end of the auxiliary hot tube 13 is preferably provided with any suitable valve 15 having its stem extending beyond the box or casing 10, and provided with an operating handle 16. The pipe 13 is the same in structure and function as the pipe 8, and may be formed of any length desired and is provided at its outer end with a valve 17 for the same purpose as the valve 9, the valve 15 serving the same function as valve 7. The tube 12 is of the size of the ordinary hot tube always used in conjunction with the particular engine to which the invention is to be applied, it being of course intended that the box 10 shall be of so small dimensions as not to make any material difference in the operation of the tube 12, or if any difference should be made, then the tube 12 must, of course, be reduced in size sufficiently for causing the said tube to act exactly the same as the ordinary hot tube. In this connection it is of course obvious that the tube 4, as seen in Figs. 1 and 2, acts as an auxiliary hot tube for the first firing and as a main hot tube afterwards, or, when the exhaust pipe 8 is employed, the said pipe 8 acts as the auxiliary hot tube.

In operation, the structures seen in Figs. 4 and 5 produce the same results as are accomplished by the structures seen in Figs. 1 and 2. The heating chambers 14 are of course provided with gas or other suitable blast pipes 18, and said blast pipes are placed in operation prior to attempting to start the engine. After the tubes 12 and 13 have been heated to the required degree, the valves 16 and 17 being open, the fly wheel is revolved for causing the piston to force out all the gases in the cylinder. The valve 17 is then closed, a partial vacuum within the pipe 13 being produced by the heated condition thereof. After the fresh charge of gaseous mixture has been drawn in, the fly wheel is further revolved for slightly compressing the same, whereupon part of the fresh charge enters the casing 10 and the tube 13, the gaseous cushion existing within the tube 12 preventing the admission of any part of the charge into contact with the heated portion of the tube owing to the low compression. The charge is however fired by the tube 13, and, as soon as the explosion occurs, the valve 16 is turned off, and the blast 18 for the tube 13 may also be turned off. This leaves the hot tube 12 in operative condition, and the second charge which is drawn in will be sufficiently compressed for having a portion thereof driven up into contact with the heated portion of the tube 12. The engine continues to operate under high compression, the explosions being produced by the tube 12, and the valve 16 being maintained closed, so that the operation is the same as if the tube 13 did not exist.

In Fig. 3, I have illustrated a further embodiment of the invention, in which 19 indicates a cylinder of a gas engine provided with the ordinary form of hot tube 20 surrounded by the usual heating chamber 21, and provided with a gas blast pipe 22. This hot tube and its heating means is just as it is found on any ordinary engine, and in this connection it is to be observed that the present invention may be easily and readily applied to any engine already in use, regardless of whether the invention assumes the form of either of the two embodiments above described, or takes the form seen in Fig. 3. When it is desired not to disturb the hot tube already in use, the structure seen in Fig. 3 is employed, which consists of a pipe 23 connected with the explosion end of the cylinder and extending preferably upwardly therefrom for any suitable distance. As near the cylinder as is practicable, a valve 24 is interposed in the length of the pipe 23, and the said pipe 23 is also provided with a valve 25 at its outer end. The pipe 23 is surrounded at a suitable point by the usual heating chamber 26, provided with any ordinary form of gas blast pipe 27.

In operation the hot tube 20 acts the same as if the present improvement had not been applied, and, when it is desired to start an engine, the valves 24 and 25 are opened and the piston is caused to travel throughout the length of the cylinder for discharging the gases out of the same. The blast 27 is started and its operation continued until the pipe 23 is heated sufficiently for producing an explosion when the charge of air and gas contacts therewith. This heated condition of the pipe of course produces a partial vacuum therein, and then the valve 25 is closed. The piston is caused to recede for drawing in a charge of air and gas, and then again moved toward the explosion end of the cylinder, whereupon, after the fresh charge has been slightly compressed, a portion of the charge will enter the auxiliary hot tube 23 and explode the charge. As soon as this explosion occurs, the valve 24 is closed and the blast 27 may be turned off. This first explosion of course is sufficient for revolving the fly wheel and causing the second charge to be compressed to the degree required for

overcoming the gaseous cushion in the tube 20, and producing the desired explosion. The engine then continues to operate under high compression, the same as if the auxiliary hot tube 23 was not employed, the valve 24 being maintained closed.

It will be observed that the tubes 13 and 23 are shown bent intermediate their length, but it is of course obvious that this is simply a matter of choice, and each of said tubes may be constructed of any shape or form most desirable for any particular engine.

What I claim is,—

1. The combination with a gas engine, of a relatively long hot tube in communication therewith, and valves in the length of said hot tube for enabling and controlling the intake and exhaust to and from said tube.

2. The combination with a gas engine, of a relatively long hot tube in communication therewith, a valve at the inner end thereof, and a valve at the outer end of the tube.

3. The combination with a gas engine, of hot tubes communicating with the cylinder thereof, one of the same being relatively small and being closed at its outer end, and the other being relatively large and valved at each end, and means for heating said tubes.

4. The combination with a gas engine having a hot tube for regularly firing the same, of a tube valved at each end and communicating with said engine, and means for heating said last mentioned tube.

5. As an article of manufacture, a hot tube adapted to be applied to a gas engine cylinder independently of the regular firing device thereof and without interfering with the communication of such firing device with the cylinder, and valves in the length of said hot tube for enabling and controlling the intake and exhaust to and from said hot tube.

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

LESTER L. LEWIS.

Witnesses:
SAML. W. COCKRELL,
EDGAR W. KITCHIN.