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PROVISIONAL SPECIFICATION.

Improvements in High Pressure Gas Engines.

I, WILHELM VON OECHELHAEUSER, of 30 Kavalierstrasse, Dessau, in the Empire of Germany, Engineer, do hereby declare the nature of this invention to be as follows:—

This invention has for its object improvements in high pressure gas engines
5 having two pistons moving in opposite directions in the same working chamber, which pistons in their outermost end position uncover the openings arranged at the opposite ends of the working chamber for the admission of compressed air, and the escape of the products of combustion.

If such a gas engine be operated by very poor gas, such, for instance, as blast
10 furnace top gas, which has only about a fifth of the heating power of ordinary lighting gas, five times as large a quantity of gas as in the case of working with lighting gas must, during the period of compression, be forced from the gas pump into the combustion chamber between
15 the two working pistons where the high pressure pump hitherto employed is used for compressing the gas. The loss of power would thereby be considerably increased, firstly through friction in the high pressure gas pump which latter has to be increased five-fold in volume, and thus at each moment must produce a somewhat higher pressure than actually exists in the working chamber; secondly, by the excess pressure of the gas.

20 In order to avoid these drawbacks, which where poor combustible gas is used, considerably diminish several advantages of high pressure gas engines as regards consumption of gas, space occupied, weight and cost of erection, a new form of construction of the machine must be invented.

The present invention avoids not only the disadvantages hereinbefore mentioned
25 but provides at the same time a considerable simplification of the gas engines hitherto known on this system.

According to the present invention the gas pump when necessary is coupled or
connected tandem fashion to the rear piston, which, in working with blast furnace
30 top gas, has to draw in the gas but only to a pressure of about 3 to 6 atmospheres instead of, as in the arrangement for lighting gas, to 10 to 12 atmospheres whilst the necessary air for expelling the products of combustion is obtained in this case from an existing air pipe, (in other cases from a central compressed-air pipe or the like). When the poor gas in question is already at disposal at a sufficient pressure, the pump is dispensed with. In some cases it may be retained as an air pump if
35 an air pipe with sufficient pressure does not exist, or is not always at disposal.

The admission of gas to the working chamber takes place only at a low pressure of, for instance, 1/3 of an atmosphere, and the high compression of the gas and also of the air, necessary for a high pressure gas engine (for instance 10 atmospheres) only takes place in the working chamber between the approaching pistons.
40 An expulsion as complete as possible of all the gases of combustion, and a separation at certain periods and places of the expelling air current from the gas

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charge is, according to the different kinds of gas supply, effected by the other piston, which regulates the induction by uncovering at the end of its outward stroke two rows of openings arranged immediately behind one another in the wall of the cylinder, of which rows the first is connected with the pipe supplying the expelling air, and the second with the gas pipe which is separate from said air pipe. Therefore at the conclusion of the expansion period, after the rear piston has uncovered the discharge openings at the rear end of the cylinder, the row of openings for the inlet of air will first be uncovered by the other piston, and then the row of openings for the inlet of gas. On the return of the pistons the openings will be again covered and closed in the reverse order. If it be desired to avoid the double row of openings, and to work with a single row, the induction of gas may be effected from a pipe in close proximity to the working chamber leading into an air chest or supply chamber fed from an air pipe, the gas induction being controlled by a valve whereby the gas actually enters the working chamber through the same openings as the air but at a somewhat later period of time. A valve or closing device may however be provided for the gas pipe and the latter be entirely separate from the air pipe, so that the gas enters directly into the working cylinder through the gas opening as soon as the piston has closed the air opening. The gas opening may here be arranged in any suitable position relative to the air opening.

In order to equally quickly, certainly and evenly consume poor combustible gas which ignites with greater difficulty than lighting gas, such gas may already, before its entrance into the working chamber be mixed (for instance in the low pressure gas pump) with air for combustion.

The considerable simplification hereinbefore described of high pressure gas engines having two pistons moving in the same working chamber in opposite directions, is the more important the greater in size the gas engines are made.

Dated this 6th day of November 1896.

WM. P. THOMPSON & Co.,
Of 6 Lord Street, Liverpool, Agents for the Applicant.

COMPLETE SPECIFICATION.

Improvements in High Pressure Gas Engines.

I, WILHELM VON OECHELHAEUSER of 30 Kavalierstrasse, Dessau, in the Empire of Germany, Engineer, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention has for its object improvements in high pressure gas engines having two pistons moving in opposite directions in the same working chamber, which pistons in their outermost end position uncover the openings arranged at the opposite ends of the working chamber for the admission of compressed air, and the escape of the products of combustion.

If such a gas engine as for instance that described in Patent No. 14317⁹² be operated by a very poor gas, such, for instance, as blast furnace top gas, which has only about a fifth of the heating power of ordinary lighting gas, it would be necessary to force from the gas pump five times as large a quantity of gas as, in the case of working with lighting gas, must, during the period of compression, be forced from the gas pump into the combustion chamber between the two working pistons if the high pressure pump hitherto employed were used for highly compressing the gas. The loss of power would thereby be considerably increased, firstly through friction in the high pressure gas pump, which latter has to be

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increased five-fold in volume, and thus at each moment must produce a somewhat higher pressure than actually exists in the working chamber; secondly, by the excess pressure of the gas.

In order to avoid these drawbacks which, where poor combustible gas is used, considerably diminish several advantages of high pressure gas engines as regards consumption of gas, space occupied, weight and cost of erection, a new form of construction of the machine must be invented and this is shown in the accompanying drawings, in which

Figure 1 is a horizontal section of the machine whilst
 10 Figures 2, 3 and 4 are detail views.

The present invention avoids not only the disadvantages hereinbefore mentioned but provides at the same time a considerable simplification of the gas engines hitherto known on this system.

According to the present invention the gas pump P when necessary is coupled
 15 or connected tandem fashion to the rear piston, which in working with blast furnace top gas, has to draw in the gas but only compresses it to a pressure of about 3 to 6 atmospheres instead of, as in the known arrangement for lighting gas, to 10 to 12 atmospheres, whilst the necessary air for expelling the products
 20 of combustion is obtained in this case from an existing air pipe, (in other cases from a central compressed-air pipe or the like). When the poor gas in question is already at disposal at a sufficient pressure, the pump P is dispensed with. In some cases it may be retained as an air pump if an air pipe with sufficient pressure does not exist, or is not always at disposal.

The admission of gas to the working chamber takes place only at a low pressure of,
 25 for instance, 1/3 of an atmosphere, and the high compression of the gas and also of the air, necessary for a high pressure gas engine (for instance 10 atmospheres) only takes place in the working chamber between the approaching pistons. An expulsion as complete as possible of all the gases of combustion, and a separation at certain periods and places of the expelling air current from the gas charge is,
 30 according to the different kinds of gas supply, effected by the other piston B, which regulates the induction by uncovering at the end of its outward stroke two rows of openings arranged immediately behind one another in the wall of the cylinder, of which rows the first 1 is connected with the pipe supplying the expelling air, and the second 1^a with the gas pipe which is separate from said air
 35 pipe. Therefore at the conclusion of the expansion period, after the rear piston C has uncovered the discharge openings 2 at the rear end of the cylinder, the row of openings 1 for the inlet of air will first be uncovered by the other piston B, and then the row of openings 1^a for the inlet of gas. On the return of the pistons, the openings will be again covered and closed in the reverse order. If it be desired
 40 to avoid the double row of openings 1 and 1^a and to work with a single row, the induction of gas may be effected from a pipe G, Figures 2 and 3 in close proximity to the working chamber leading into an air chest or supply chamber K fed from an air pipe L, the gas induction being controlled by a valve *v* whereby the gas actually enters the working chamber through the same openings 1 as the air but at a some-
 45 what later period of time. A valve or closing device V may however be provided for the gas pipe G and the latter be entirely separate from the air pipe, L, Figure 4, so that the gas enters directly into the working cylinder through the gas opening 1^a as soon as the piston has closed the air opening 1. The gas openings 1^a may here be arranged in any suitable position relative to the air opening 1.

50 In order to equally quickly, certainly and evenly consume poor combustible gas which ignites with greater difficulty than lighting gas, such gas may already before its entrance into the working chamber be mixed (for instance in the low pressure gas pump) with air for combustion.

The considerable simplification hereinbefore described of high pressure gas
 55 engines having two pistons moving in the same working chamber in opposite directions, is the more important the greater in size the gas engines are made.

Oechelhaeuser's Improvements in High Pressure Gas Engines.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:—

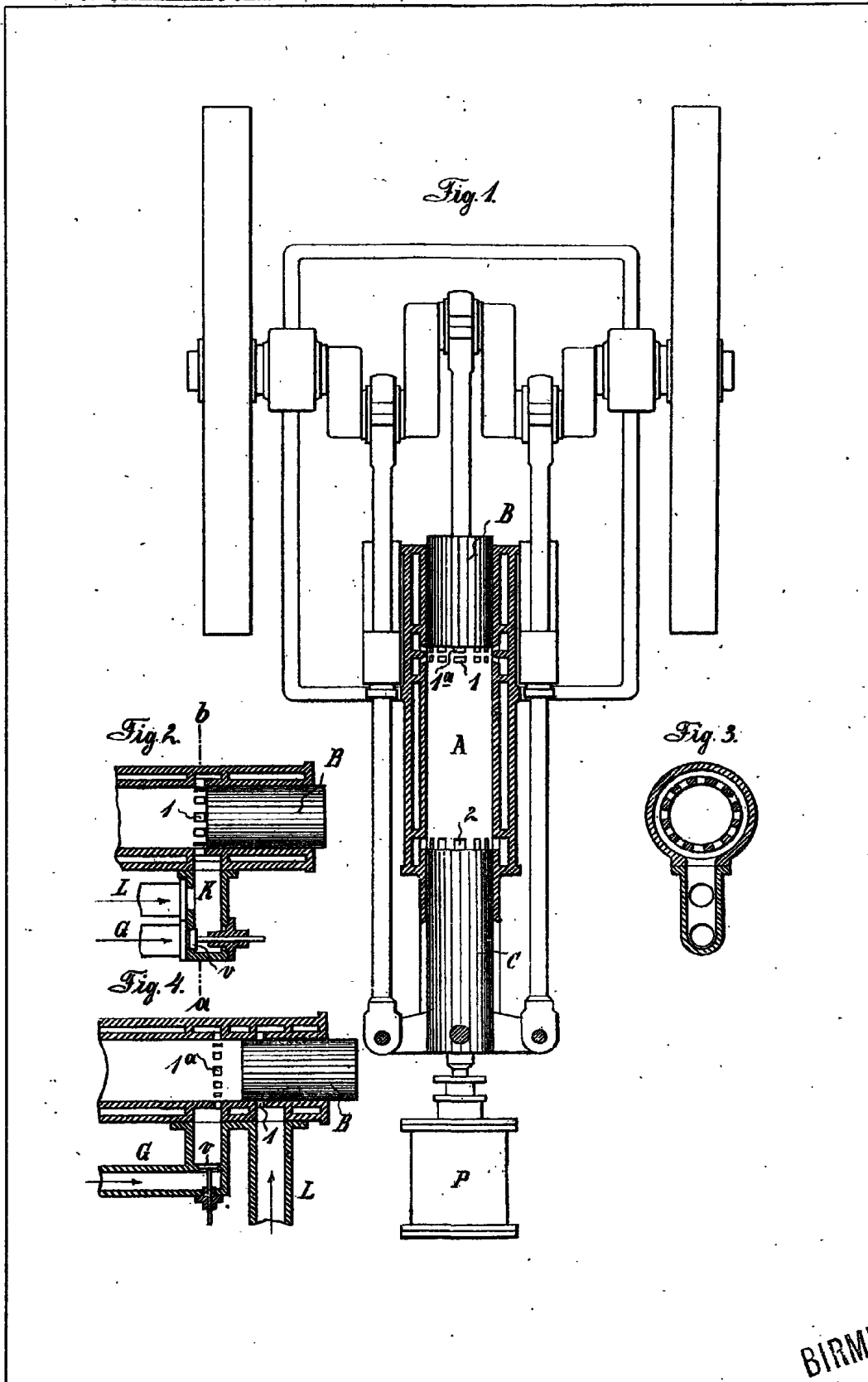
1. A high pressure gas engine in which, after the combustion and expansion is completed in the working chamber, and after said chamber has received through 5 openings (1) fresh compressed air for passing through it from end to end, there is introduced, compressed gas or a compressed mixture of gas and air on the further separation of the pistons and immediately before the outer dead point, by means of a second series of openings (1^a), after which by the approach of the pistons the mixture of air and gas enclosed by them undergoes a sufficiently high compression 10 and is ignited at the inner dead point, substantially as hereinbefore described.

2. A high pressure gas engine in which, after the combustion and expansion is completed in the working chamber and fresh compressed air has been admitted through openings (1) to pass through it from end to end, there is introduced gas or a mixture of gas and air by means of a suitable valve through the same or 15 separate openings, whereupon, by the approach of the pistons, the mixture of gas and air enclosed between them undergoes a suitably high compression and is ignited at the inner dead point, substantially as hereinbefore described.

Dated this 19th day of July 1897.

W. P. THOMPSON & Co.,
Of 6 Lord Street, Liverpool, Agents for the Applicant.

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[This Drawing is a reproduction of the Original on a reduced scale.]

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