No 4220 A.D. 1901

Date of Application, 27th Feb., 1901

Complete Specification Left, 27th Nov., 1901—Accepted, 30th Jan., 1902

PROVISIONAL SPECIFICATION.

"Improvements in, and connected with, Internal Combustion Engines."

We ARTHUR VERNET and PIERRE CLERGET both of 4 Rue de Colmar Dijon Department of Cote d'Or, in the Republic of France, Engineers, do hereby declare the nature of this invention to be as follows:—

This invention relates to internal combustion engines in which the motive power is obtained by the expansion due to the ignition of a combustible charge in the cylinder and the said invention provides a new cycle of operations which has for its object to better utilize the force due to the combustion of the charge by modifying the said combustion by the introduction into the cylinder, of an oxidising agent other than air and capable of acting as a substitute for air.

If, in an internal combustion engine, a charge of combustible fluid be introduced at, or towards, the end of the compression of a charge of air in the cylinder, the said charge will be burnt by the oxygen of the air. The temperature and consequently the pressure will decrease rapidly so that, if the charge employed consists of several constituents burning at various temperatures, the most inflammable constituent will unite with the oxygen required for combustion before the other constituents ignite and therefore the latter (which are generally the heavier) become mixed with inert gases and, for the want of oxygen, they are useless.

According to this invention, we introduce into the cylinder at the time the temperature reaches its maximum (at the end of the compression of a charge of air in the cylinder) the combustible fluid and an auxiliary constituent other than air capable of completing the combustion.

The fluid introduced into the cylinder may be both combustible and capable of maintaining combustion, in which case this auxiliary fuel will act conjointly with the main fuel.

For instance, in this second case, the auxiliary fuel may be water which, owing to the high temperature in the cylinder, will dissociate, the oxygen resulting from this decomposition uniting with the carbon of the fuel, leaving the hydrogen, resulting from the dissociation, free, and this hydrogen will, like the hydrogen of the hydrocarbon, burn under the influence of the oxygen of the air of the initial charge.

The following are suitable means for carrying our invention into effect.

A reservoir is provided containing the fluids at a pressure equal to, or greater than, that of the pressure due to combustion. It is divided into as many compartments as there are working fluids. In the present example we will suppose that there are two fluids, say a liquid hydrocarbon and water., the said reservoir then comprising two compartments containing respectively the liquid hydrocarbon and the water. The space above the surface of the liquids is filled with compressed air. Each of these three spaces is connected by pipes to the nozzles of a distributing apparatus. These nozzles open into the combustion chamber of the engine and are closed respectively by plug valves, the movements of which are controlled by a valve gear which may be similar to the gear used in ordinary internal combustion engines, for example, the shaft which actuates the valve gear may carry a stepped cam acting on a bell crank lever pivotally attached to the

engine cylinder and carrying a cross bar in which are provided three depressions engaging with the ends of screws carried in brackets fixed to the stems of the aforesaid plug valves which valves will therefore be raised each time the stepped cam acts on the aforesaid lever. As the position of the screws can be readily adjusted it is possible to cause, if necessary, any one of the plug valves (for instance that admitting the hydrocarbon) to open a little before the others.

The regulation of our internal combustion engine is effected by causing a governor (which may be of the ordinary kind) to shift the aforesaid stepped cam on the valve gear driving shaft.

An air inlet valve is provided and also an exhaust valve controlled by a lever actuated by the aforesaid stepped cam.

The operation is as follows: The valve gear is so set that the cam which governs the opening of the nozzles raises the plug valves at the end of the compression stroke. The hydrocarbon first burns partially, the water being dissociated while the carbon of the hydrocarbon unites with the nascent oxygen resulting from this dissociation to form carbon-monoxide and the hydrogen of the water acts conjointly with that of the hydrocarbon. The mixture of these combustible gases burns at the expense of the oxygen of the air that has not taken part in the first combustion. At the end of the combustion the cylinder contains nitrogen, carbon-dioxide and aqueous vapour.

The fuel is generally a liquid hydrocarbon but the auxiliary fluid, which is to be both combustible and combustion supporting, need not necessarily be water. It may be a more energetic supporter of combustion; we may for instance inject through one of the nozzles an oxidizing body such as chromic acid, a chlorate or the like. It will also be possible to introduce at the same time a body capable only of supporting combustion, such as, for instance, compressed oxygen.

The aforesaid plug valves can be adjusted in such a manner that any one of the nozzles will be opened somewhat before the others and the gear operating the said plug valves may be provided with any cam, or other arrangement permitting of the pre-ignition of the motive fluid being varied.

Dated this 27th day of February 1901.

JOHNSONS & WILLCOX.
47 Lincolns Inn Fields, London W.C. Agents.

COMPLETE SPECIFICATION.

"Improvements in, and connected with, Internal Combustion Engines"

We, ARTHUR VERNET and PIERRE CLERGET, both of 4 Rue de Colmar Dijon Department of Cote d'Or, in the Republic of France, Engineers, 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 relates to internal combustion engines in which the motive power is obtained by the expansion due to the ignition of a combustible charge in the cylinder and the said invention provides a new cycle of operations which has for its object to better utilize the force due to the combustion of the charge by modifying the said combustion by the introduction into the cylinder, of an oxidising agent other than air and capable of acting as a substitute for air. If, in an internal combustion engine, a charge of combustible fluid be introduced at, or towards, the end of the compression of a charge of air in the cylinder, the said charge will be burnt by the oxygen of the air. The temperature and conse-

quently the pressure will decrease rapidly so that if the charge employed consists of several constituents burning at various temperatures, the most inflammable constituent will unite with the oxygen required for combustion before the other constituents ignite and therefore the latter (which are generally the heavier) become mixed with inert gases and, for the want of oxygen, they are useless. According to this invention, we introduce into the cylinder at the time the temperature reaches its maximum, (at the end of the compression) of a charge of air in the cylinder) the combustible fluid and an auxiliary constituent other than air capable of completing the combustion.

The fluid introduced into the cylinder may be both combustible and capable of maintaining combustion, in which case this auxiliary fuel will act conjointly with the main fuel.

For instance, in this second case, the auxiliary fuel may be water which, owing to the high temperature in the cylinder, will dissociate, the oxygen resulting from this decomposition uniting with the carbon of the fuel, leaving the hydrogen, resulting from the dissociation, free and this hydrogen will, like the hydrogen of the hydrocarbon, burn under the influence of the oxygen of the air of the initial charge.

Referring to the accompanying drawings which illustrate means for carrying this invention into effect, Figure 1 is a rear view of an engine shewing the apparatus for the supply of the fluids, namely the usual working medium and the auxiliary combustion supporting medium Figure 2 is a cross section of the part supplying these fluids and Figure 3 shews an example of a motor constructed in accordance with our invention.

A reservoir *a* Figure 1 is provided, containing the fluids at a pressure equal to, or greater than that of the pressure due to combustion. It is divided into as many compartments as there are working fluids. In the present example there are two fluids employed, say a liquid hydrocarbon and water, the said reservoir comprising two compartments *b c* containing respectively the liquid hydro-carbon and the water. The space *d* above the surface of the liquids is filled with compressed air. Each of these three spaces *b c d* is connected by pipes *e f g* to the nozzles *h i j* of a distributing apparatus shewn in Figure 2. These nozzles open into the combustion chamber *k* of the engine (Figure 3) and are provided with plug valves *m n o* normally kept closed by springs and supplying respectively to the combustion chamber water liquid hydrocarbons and compressed air. The movements of which are controlled by a valve gear which may be similar to the gear used in ordinary internal combustion engines, for example in Figure 3 the shaft *p* which actuates the valve gear may carry a stepped cam *q* acting on a bell crank lever *r* pivotally attached at *s* to the engine cylinder and carrying a cross bar *t* in which are provided three depressions *u* (Figures 1 and 3 engaging with the ends of screws *v* carried in brackets fixed to the stems of the aforesaid plug valves *m n o*, which valves will therefore be raised each time the stepped cam acts on the aforesaid lever *r*. As the position of the screws can be readily adjusted it is possible to cause, if necessary, any one of the plug valves (for instance that admitting the hydrocarbon) to open a little before the others.

The regulation of our internal combustion engine is effected by causing a governor *w* (which may be of the ordinary kind) to shift the aforesaid stepped cam *q* on the valve gear driving shaft *p*.

An air inlet valve *x* is provided and also an exhaust valve *y* controlled by a lever *z* actuated by the aforesaid stepped cam *q* as shewn in Figure 1. To maintain the required air pressure in the compartment *d* the latter is connected to an air pump not shewn in the drawing and driven by the engine itself.

The operation is as follows:—The valve gear is so set that the cam which governs the opening of the nozzles *h i j* raises the plug valves *m n o* at the end of the compression stroke. The hydrocarbon first burns partially, the water being dissociated while the carbon of the hydrocarbon unites with the nascent oxygen

resulting from this dissociation to form carbon monoxide and the hydrogen of the water acts conjointly with that of the hydrocarbon. The mixture of these combustible gases burns at the expense of the oxygen of the air that has not taken part in the first combustion. At the end of the combustion the cylinder contains nitrogen, carbon-dioxide and aqueous vapour.

The fuel is generally a liquid hydrocarbon but the auxiliary fluid, need not be both combustible and combustion supporting, as is the case with water. It may be only an energetic supporter of combustion; we may for instance inject through one of the nozzles an oxidizing agent such as a solution of chromic acid or of a chlorate or the like. Compressed oxygen might also be used for the same purpose.

The aforesaid plug valves can be adjusted in such a manner that any one of the nozzles will be opened somewhat before the others and the gear operating the said plug valves may be provided with a cam, or other, arrangement permitting of the pre-ignition of the motive fluid being varied.

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

1. The combination with internal combustion engines of means for introducing at the end of the compression of a charge of air in the cylinder and at the same time as the fuel, a combustion supporting fluid; substantially as hereinbefore explained.

2. The combination with internal combustion engines, of means for introducing at the end of the compression of a charge of air in the cylinder and at the same time as the fuel a fluid the dissociation of which produces simultaneously a fuel and a combustion supporting fluid; substantially as hereinbefore described.

3. In internal combustion engines for the purpose of carrying out the processes according to the preceding claiming clauses, a nozzle fluid-supplying arrangement, the opening of which is controlled by the governor, substantially as hereinbefore described.

Dated this 27th day of November, 1901.

JOHNSONS & WILLCOX.
47 Lincoln's Inn Fields, London, W.C. Agents.

Redhill: Printed for His Majesty's Stationery Office, by Malcomson & Co., Ltd.—1902.

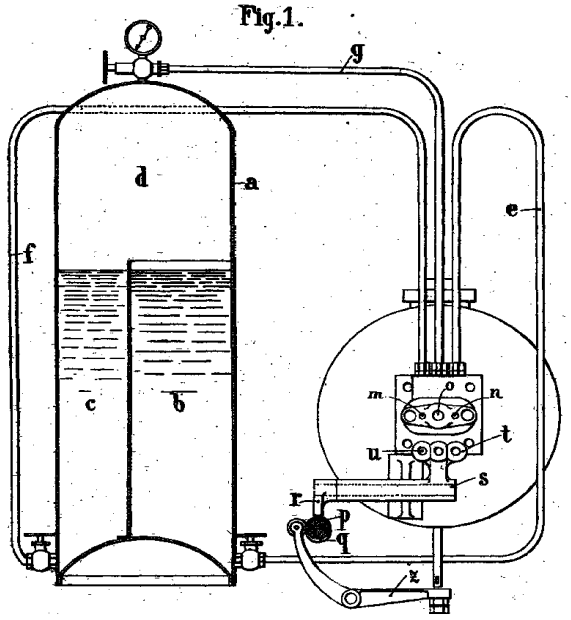
A.D. 1901. Feb. 27. N° 4220.

VERNET & *another's* Complete Specification.

(2 SHEETS)

SHEET 1.

Fig.1.



SHEET 2.

Fig.2.

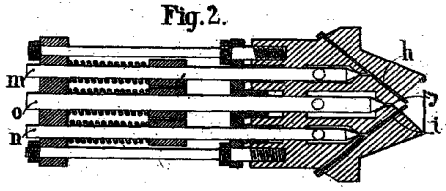
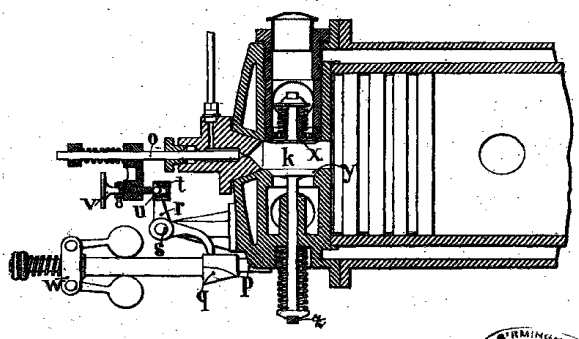


Fig.3.



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

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Fig.1.

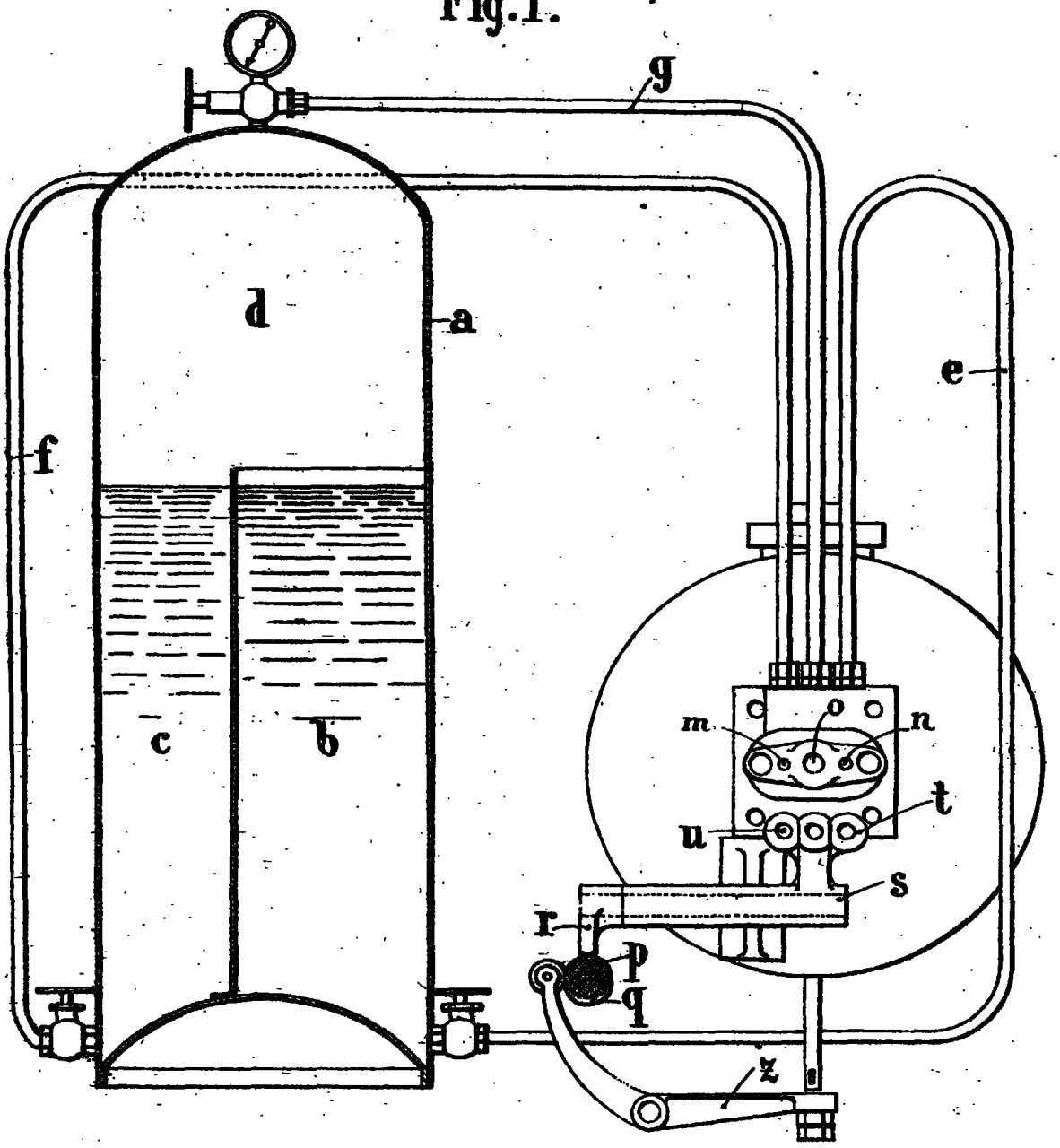


Fig. 2.

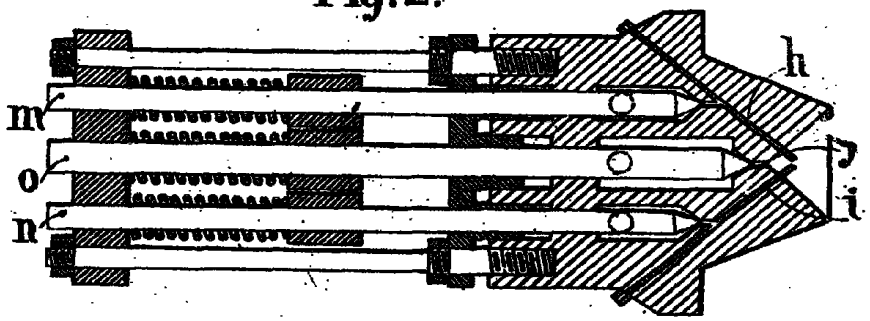
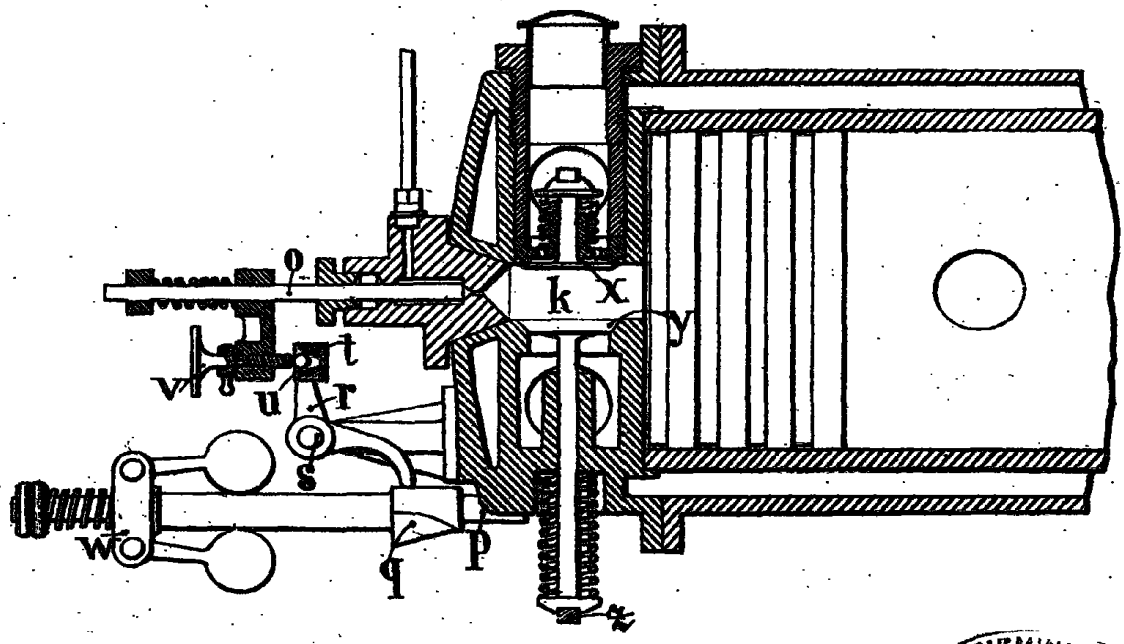


Fig. 3.



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