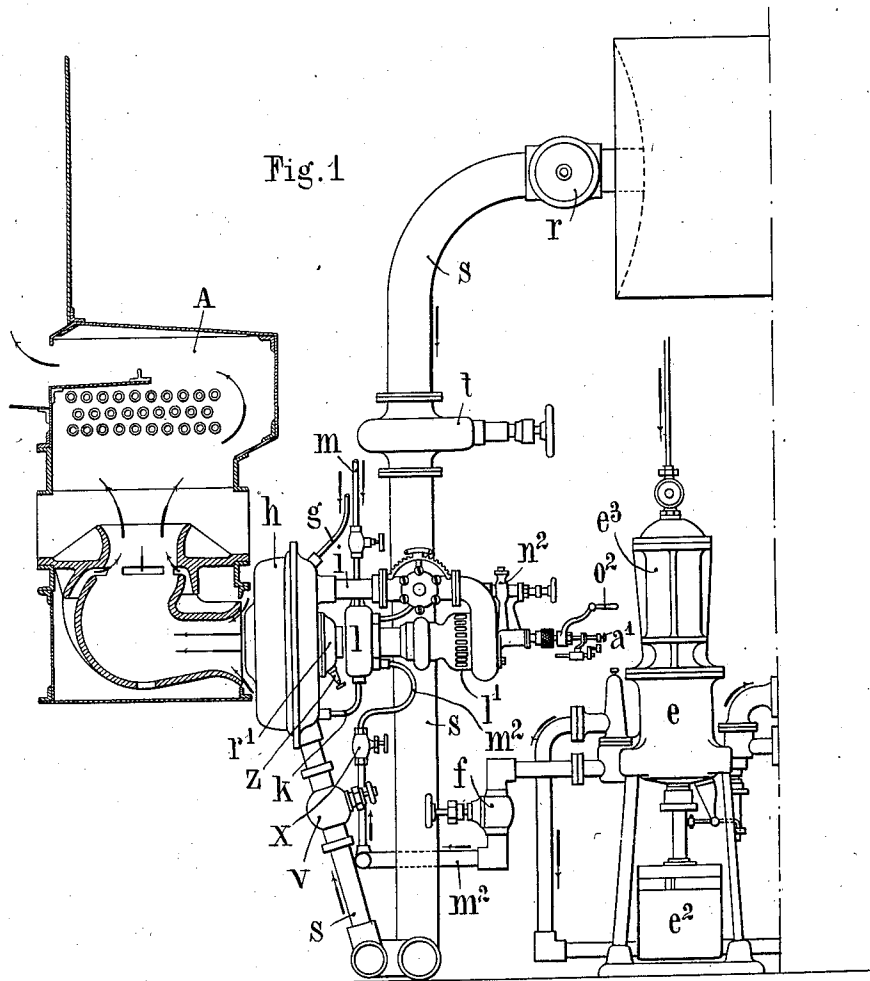


R. L. D'ESPUJOLS.
HYDROCARBON BURNER.
APPLICATION FILED MAY 5, 1909.

1,023,422.

Patented Apr. 16, 1912.

3 SHEETS—SHEET 1.



Witnesses
M. H. Darg.
L. A. Price.

Inventor:
Robert L. d'Espujols,
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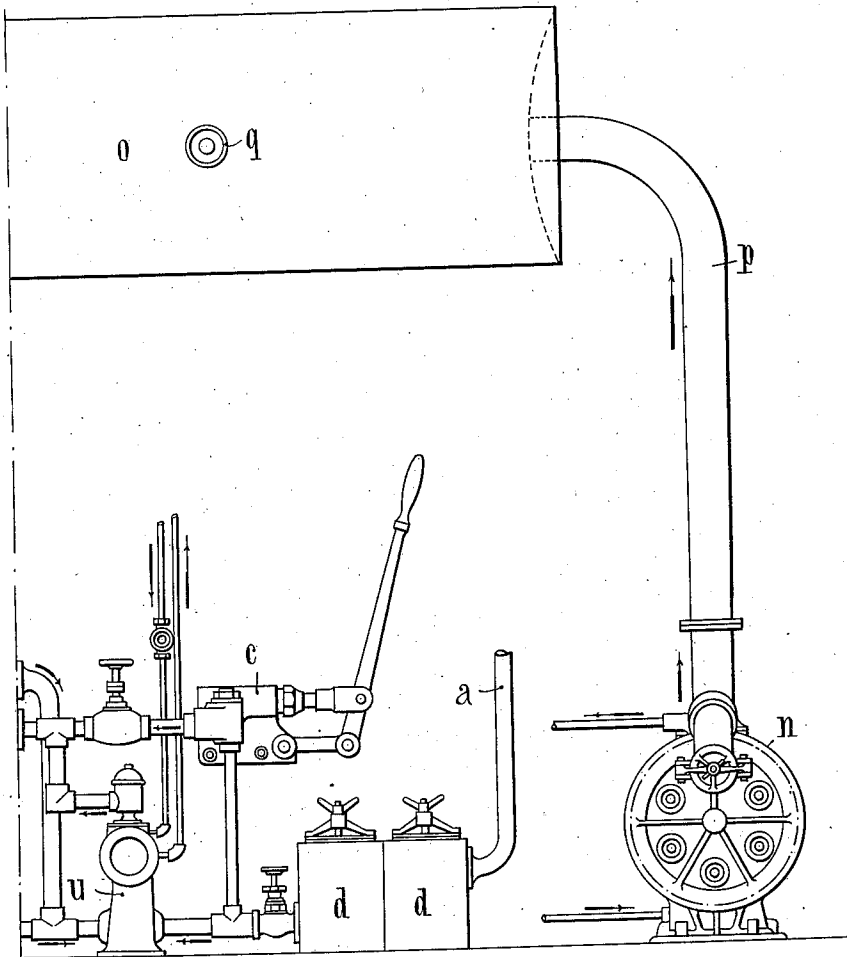
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Fig. 1^a



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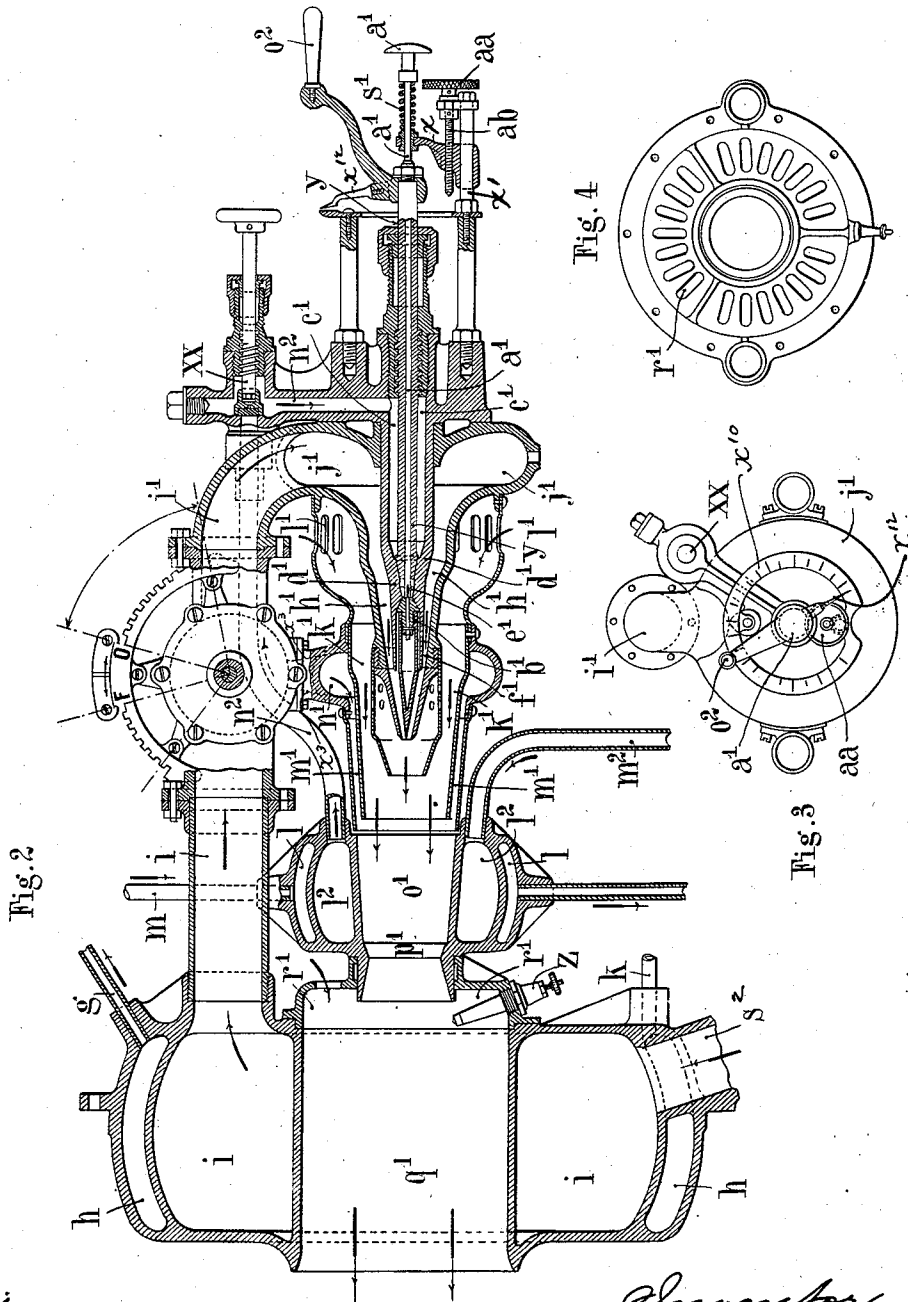
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UNITED STATES PATENT OFFICE.

ROBERT LUCIEN D'ESPUJOLS, OF ALFORT, FRANCE.

HYDROCARBON-BURNER.

1,023,422.

Specification of Letters Patent.

Patented Apr. 16, 1912.

Application filed May 5, 1909. Serial No. 494,153.

To all whom it may concern:

Be it known that I, ROBERT LUCIEN D'ESPUJOLS, a citizen of the Republic of France, and resident of 5 Rue Boulay, Alfort, Seine, France, have invented Improvements in Hydrocarbon-Burners, of which the following is a specification.

My invention relates to hydro-carbon burners and it has for its object to provide an apparatus adapted for the combustion of hydro-carbons in general, oils, residues derived from the distillation of coal, coal-tar, and petroleum and its residues.

The invention consists in the novel construction, arrangement and combination of parts as hereinafter fully described, illustrated in the drawings and pointed out in the appended claims.

In the drawings, Figures 1 and 1^a show an elevation, partly in section, of an apparatus embodying my invention, Fig. 1 showing the left-hand portion of the apparatus, and Fig. 1^a the right-hand portion. Fig. 2 is a vertical sectional view of a horizontal burner for marine furnaces or the like. Fig. 3 is an end view of the air-regulating device. Fig. 4 is a front view of a portion of the burner.

My invention comprises two essential parts, coöperating together, *i. e.* the burner, and the devices for feeding said burner.

My invention relates particularly to apparatus of the type in which liquid fuel, compressed air, atmospheric air and additional compressed air, are supplied through four concentric passages to the combustion chamber, and it is so constructed and arranged as to cause the liquid fuel, the atmospheric air, and the primary and secondary supplies of compressed air to be heated during their passage to the combustion chamber, and thus effect the complete gasification of the liquid fuel inside the burner.

The actions to which the liquid fuel is subjected, the transformations that they produce, and the manner in which they are realized, are explained below in detail and in order.

First. The fuel is rendered fluid in order that it may circulate freely in the apparatus. With this object it is heated but not excessively which presents the further advantage, while raising its temperature progressively, of bringing it closer to its point of vaporization. This fluidity is obtained in

two ways. (1) On starting by a supply of steam through the pipe *m* to the heater *l* through which steam circulates and which heater communicates the appropriate temperature to the fuel contained in the chamber *z*. (2) The apparatus being operative and the admission of steam being interrupted the heating takes place automatically by the conductivity of the parts which transmit and preserve in the heater the initial temperature. In order to do this the dimensions and the position of the heater relatively to the other parts are absolutely fixed.

Secondly. The liquid fuel is conveyed, that is to say conducted, to the discharge orifices, this result being attained by supplying it under an appropriate pressure. The fuel coming from the filter tank *d* (Fig. 1^a) in communication with suitable reservoirs or magazines (not shown) by means of a pipe *a* is sucked by the pump *u* which forces it into an apparatus *e* termed the automatic feed compressor. This compressor serves, whatever the running of the pump *u* may be, to regulate the predetermined pressure uniform upon any point of the conduit *m*². From this compressor the fuel is sent to the burner through the conduit *m*² passing through the stop valves *f* and *x* and distributed through the conduit *n*² to the flow orifices *c' c'* (Fig. 2) through which it reaches the part *b'* termed the diffusion cone the form of which is such that it tends to divide the liquid into molecules. The valve *y* serves to regulate the annular flow orifice in proximity to the diffuser *b'*.

Thirdly. The fuel is converted into a fine spray by admitting at the same time a current of compressed air which becomes heated in chamber *i*, before entering the blast pipe *h'* which surrounds the inlet for the liquid. This heated air mixes with the liquid which leaves the outlet opening with a whirling motion and in the form of a fine spray. The compressed air is obtained by the employment of a compressor, pump or blowing engine *n* (Fig. 1^a) which delivers through a pipe *p* into a reservoir *o* thence distributes it through a valve *r* to a gas pipe *S* to which a pressure regulator *t* is fitted. The air reaches the burner through port *S*² in the chamber *i* (Fig. 2) likewise provided with a steam heating chamber *h* with conduits *k g* for admitting the steam, where it

is heated by the steam (or by any other source of heat) on starting and then automatically by the heat radiated from the flame issuing at q' . Thus heated, the air coming from chamber i , passes through a regulating register provided exteriorly with the letters O and F. The letter O indicates if the register is open, while the letter F indicates if it is closed. On leaving the register through a passage x^3 which communicates with the chamber n' a portion of the air enters said chamber n' while a portion of the air passing through the register passes into chamber j' . From the chamber j' the air passes to the nozzle h' and during its path encounters the extremity f' of the part d' ; this extremity, forming the body of the diffuser, is constructed in such a manner that the air carries along by suction the molecules of fuel already obtained by the diffusion cone b' with which molecules it becomes progressively saturated. The air being hot the fine spray with which it is thus saturated assumes its temperature and begins to vaporize.

Fourthly. The fine spray is vaporized. In order to do this a fresh current of air under pressure and heated to a temperature approximating that of the vaporizing point of mazout is caused to reach the fuel thus divided mechanically. The air just mentioned is heated by its passage through chamber i , which latter is heated by steam passing through jacket h , and the heated air after reaching the chamber n' passes thence into chamber m' , which communicates, as seen in Fig. 2, with chamber n' . The conducting of heated air to the fuel is necessary because the first current of hot air having served to transform the fuel into spray and to begin its vaporization has become expanded and consequently lost all its *vis viva*. Accordingly it could not alone complete the physical transformation. From the chamber n' the hot air under pressure passing through m' surrounds the nozzles h' and h'' , through which the fine spray referred to above is projected, and in flowing off carries this spray along, completing the vaporization all along its path as far as o' where this vaporization finishes under the influence of the temperature which is increasingly high in proportion as the chamber q' is approached. At the same time the reduction of pressure, resulting from the two concentric drafts, produced by the currents of hot air from j' and n' , carries along in the mixture a volume of atmospheric air admitted through the orifices l' . At this moment the mixture has become completely vaporous and begins to become combustible.

Fifthly. These vapors are then gasified that is to say their temperature is increased much beyond the point of vaporization in order to obtain a mixture upon which the

effects of the condensation can no longer be produced. The second current of hot compressed air, from n' , which while affecting these mixtures and these transformations has preserved its *vis viva* (because it has not been subjected to any expansion) continues to project the mixture and carries it into the chamber q' . Upon its path and by reason particularly of the conductivity of the metal, which in proportion as it advances imparts to it a temperature nearer and nearer to the combustion temperature, the mixture becomes superheated until complete gasification takes place. Independently of the conductivity of the parts the direct radiation of the flame is felt to a decreasing extent to the rear of the burner. Consequently in the chamber o' the mixture then attains a high temperature approximating that which it will attain when it has passed through the port p' and reached the combustion chamber q' .

Sixthly. The mixture thus gasified is rendered more highly inflammable this result being attained by supplying to it progressively fresh atmospheric air drawn along by the partial vacuum which is proportionate to the delivery.

At r' a vent hole is arranged which supplies to the gasified mixture the volume of fresh air which renders it inflammable and definitely insures the combustion.

At z there is an electric ignition plug for starting, but any other ignition device may be employed, the gas at this point lighting as readily as illuminating gas.

I will now explain the automatic and uniform operation of the parts of the burner and of its auxiliary appliances which insure stable equilibrium between the proportions of fuel, artificial air and fresh ambient air. This result is obtained principally by a regulator which comprises a rod a' held in the body of the regulating valve y and formed with claws c' . The diffuser b' is fixed to one end of a rod a' and may be cone-shaped.

S' is a spring adjustable in a very sensitive manner by means of the micrometric screw $a b$, terminating in a head a , a , and engaging a threaded aperture in a block x sliding on the rods a' and x' and bearing against the spring S' .

In operation, the liquid fuel coming under pressure through conduit m^2 heats up in chamber l^2 , whence it leaves through pipe n^2 in order to pass into chamber c' . From this chamber the liquid finds a passage between the conical end of the valve y , and the bearing d' of chamber c' . Through the grooves provided on the rod a' this fuel passes out and strikes the periphery of the diffusing cone b' , which, by the aid of the diffuser body f' helps to effect a molecular division of the jet of liquid fuel, or in other words, to produce a fine spray. This spray sub-

jected to the action of hot air which, it meets in the blast pipe h' (the hot air coming from i) is very finely subdivided and becomes a vaporous mixture which combined with the fresh air coming through the channel k' from openings l' and besides with the additional air current coming through channel m' from chamber n' , forms in chamber o' a combustible mixture which the contracted portion p' renders still more intimate. By contact with the igniter z , this mixture ignites in the combustion chamber q' which is fed with fresh air through vent r' . In the same way the current of compressed air coming from chamber j' exercises an energetic influence on the diffuser and in the same direction that the liquid passes in under pressure. The combustion of the liquid exercises a reaction on the diffuser but in a direction opposed to the inflow produced by the air current coming from j' , that is it tends to return the diffuser to its seat. This counter pressure is proportionate to the intensity of the combustion.

The function of the spring s' is to produce an equilibrium between the diverse reactions produced upon the diffusing cone b' , *i. e.* the reaction of the opening produced by the arrival of the liquid fuel under pressure as well as by the arrival of the air in chamber h , and the closing reaction produced by the combustion of the mixture. This equilibrium is unstable for it changes very quickly by reason of the more or less voluminous quantity of fuel and, consequently, the intensity of combustion; for this reason the sensibility of spring s' must be very great and the regulation must be made with a micrometric screw.

When during the operation the supply of fuel diminishes (or if while it remains the same the liquid supplied varies in density) the intensity of the combustion immediately feels the effect and becomes less. Its reaction upon the diffuser b' becomes weaker and the latter under the double influence of the pressure of the fuel and of the artificial air suction separates farther from its seat permitting of the passage of a larger quantity of fuel which increases the combustion. When the combustion increases in intensity the inverse takes place, the diffuser approaches its seat and less fuel passes in such a manner that the diffuser is constantly movably axially and acts as an extremely sensitive regulator no matter for what supply the valve y has been regulated.

If a foreign body should enter the discharge orifice partial or total obstruction might result therefrom. In this case it is only necessary to press the knob of a' several times; the foreign body seized by the claws e' with which the rod a' is provided is carried from the seat of the diffuser and expelled outside the apparatus by the pres-

sure of the fuel and the artificial air suction.

In the case of blockage resulting from the accumulation of particles of sand, gravel or other body the intensity of the combustion diminishes and the diffuser separates from its seat and the foreign bodies are expelled as before.

In order to be able to effect the starting the diffuser b' is provided on the part which constitutes its seat with a certain number of fine grooves, the depth of which is such that they permit the passage of just the amount of liquid necessary for the starting. In these conditions in order to form the by-pass it is only necessary for the operator to pull toward him by hand the knob of the rod a' .

After starting, the normal operation is attained by opening the diffuser b' by pressing inwardly the rod a' by hand.

Instantaneous interrupter.—In accordance with the structure of the diffusing cone b' , by pulling the knob a'' the apparatus is extinguished while running fully.

In the auxiliary appliances the running is rendered automatic, continuous and uniform by means comprising an air compressor n , fuel supply pump u , constant feed compressor e , and these operate continuously. The air compressor n forces the air through the conduit p into the reservoir o provided with a safety-valve q and with a stop cock r opening into a conduit S which proceeds to the burners and has a pressure regulator t , the object of which is to render the pressure of the air invariable at all the points where it is utilized whatever the number of burners may be. The feed pump u forces the liquid fuel coming from the filters d d into the fuel compressor e .

The compressor of the feeding device e , receives the liquid fuel under a piston, the rod of which is extended above and below the body of the cylinder e ; below, the rod supports a heavy mass e^2 formed of counterweights, the force of the inertia of which exercises upon the liquid introduced under the piston of this compressor an invariable pressure whatever the output of the pump is or the consumption of the burners might be; above, the piston rod is connected with another movable piston in a steam cylinder e^3 fed by a pipe branched off from the single conduit and subject to the influence of a stop in common with the pump u and compressor n . This steam exercises upon the piston of cylinder e^3 and consequently upon the piston of compressor e , a pressure which is added to that of the counterweights.

o^2 is the operating lever for rod y and carries a pointer x^{12} playing over a scale x^{10} to indicate the degree of adjustment of the valve y .

X X is a valve controlling the admission of fuel into the conduit n^2 .

V is an air pipe branched from pipe S and communicating with the passage S² leading to the burner.

A indicates the device to be heated, in this instance a steam generator.

What I claim is:—

1. In an apparatus of the character described, a burner comprising a combustion chamber, a plurality of concentrically arranged conduits for conducting fuel, compressed air and free atmospheric air to the combustion chamber, means for heating the fuel and compressed air during their passage to the combustion chamber, and a controlling device for varying the proportions of fuel and air comprising a diffuser arranged to divide the fuel before reaching the combustion chamber, a rod carried by the diffuser, a spring acting upon said rod, and means for varying the stress of the spring.

2. In an apparatus of the character described, a burner comprising a combustion chamber, a plurality of concentrically ar-

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ranged conduits for conducting fuel, compressed air and free atmospheric air to the combustion chamber, means for heating the fuel and compressed air during their passage to the combustion chamber, a controlling device for varying the proportions of fuel and air comprising a diffuser arranged to divide the fuel before reaching the combustion chamber, a rod carried by the diffuser, a spring acting upon said rod, and means for varying the stress of the spring comprising a block slidably mounted on the said rod and against which block one end of the spring bears, a second rod on which said block is also slidably mounted, and a micro-metric screw engaging a threaded aperture in the said block. 30 35 40

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

ROBERT LUCIEN D'ESPUJOLS.

Witnesses:

DEAN B. MASON,
HECTOR MATRAN.