No. 690,486. Patented Jan. 7, 1902.

T. TOMLINSON.

APPARATUS FOR THE VAPORIZATION, COMBUSTION, AND UTILIZATION OF HYDROCARBON OILS.

(Application filed Jan. 16, 1899.)

(No Model.) 3 Sheets—Sheet 1.

Fig: 1.

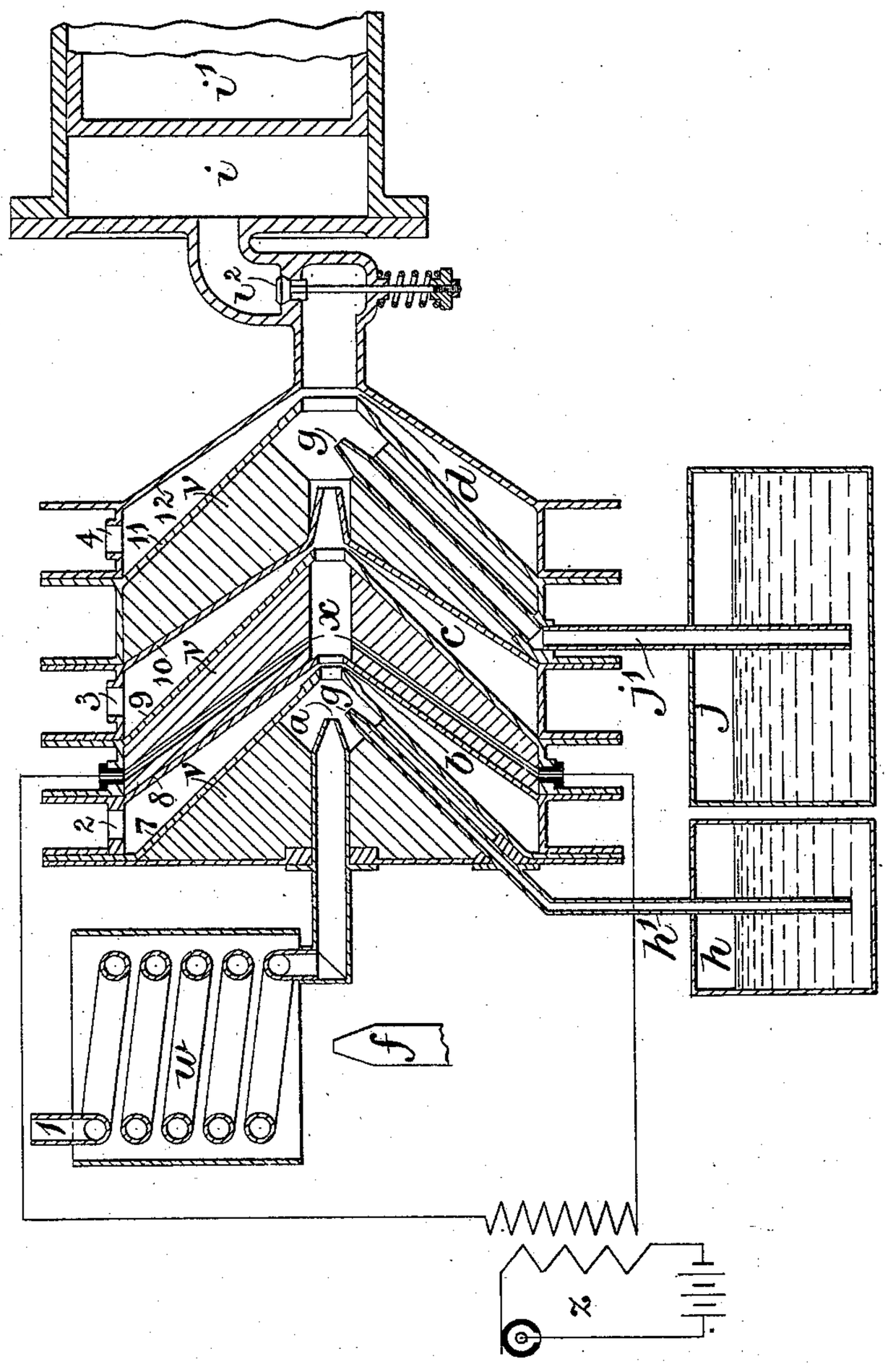

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Fig: 2

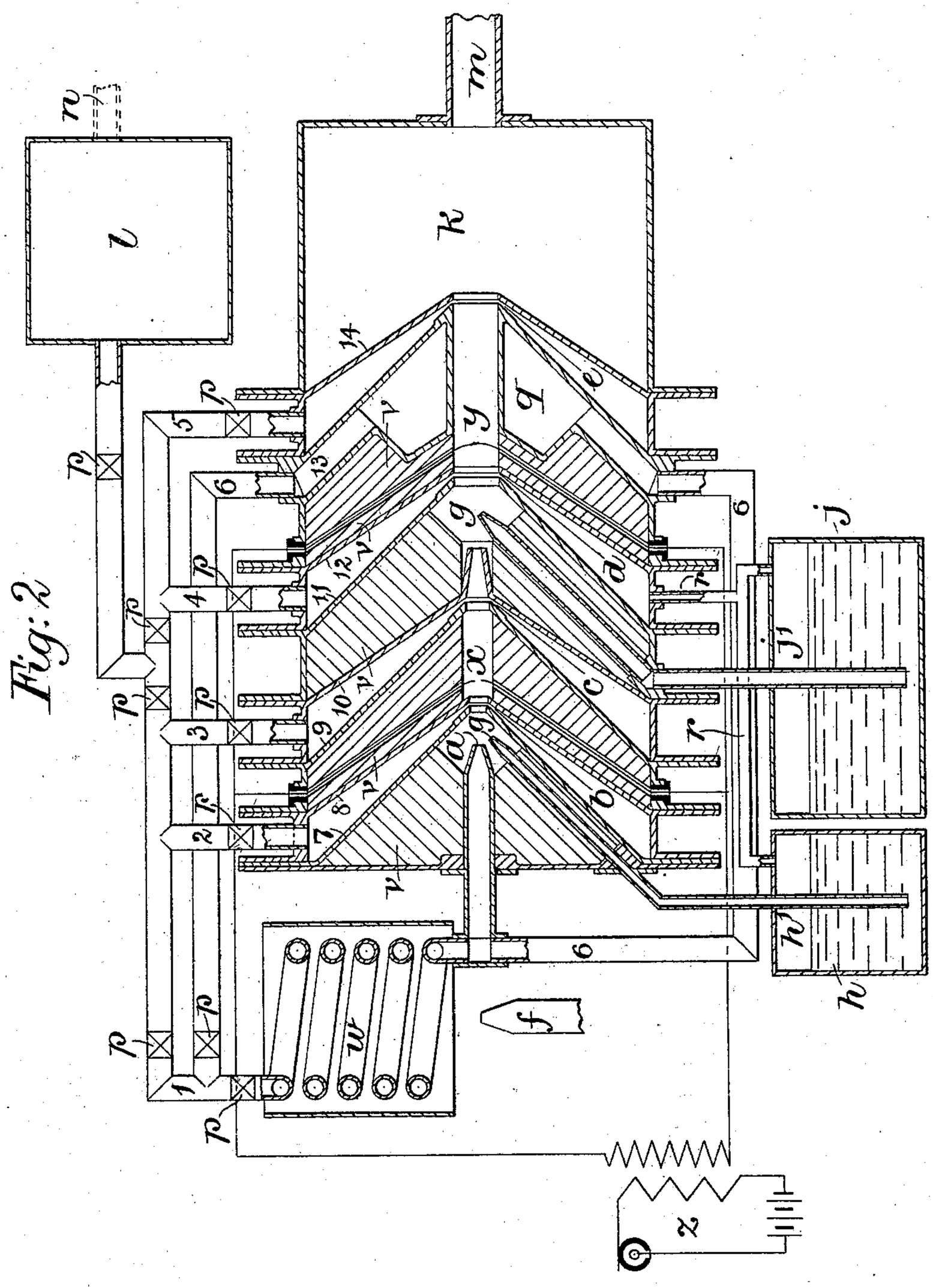

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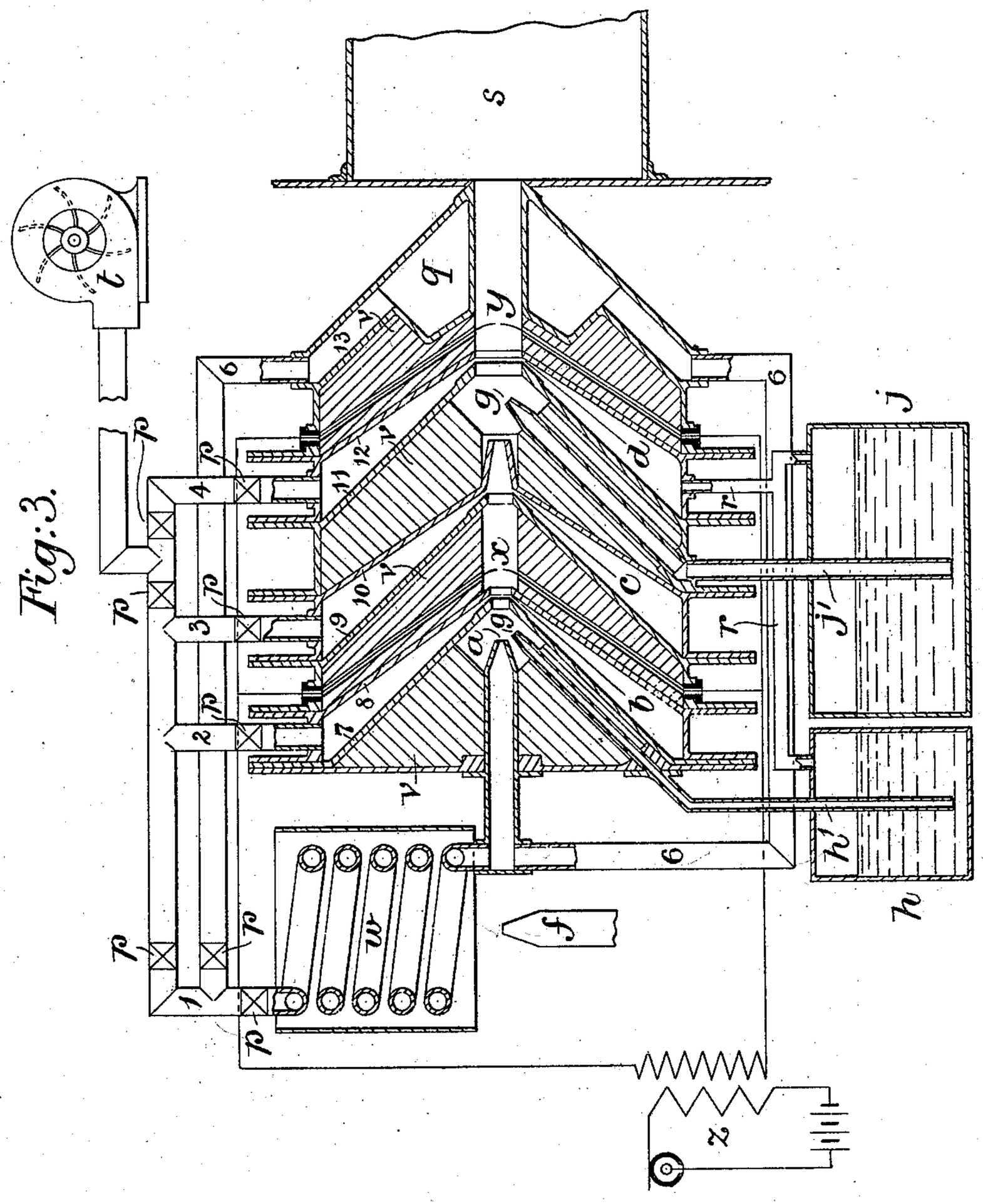
Fig. 3.



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UNITED STATES PATENT OFFICE.

THOMAS TOMLINSON, OF BRAY, IRELAND.

APPARATUS FOR THE VAPORIZATION, COMBUSTION, AND UTILIZATION OF HYDROCARBON OILS.

SPECIFICATION forming part of Letters Patent No. 690,486, dated January 7, 1902.

Application filed January 16, 1899. Serial No. 702,293. (No model.)

To all whom it may concern:

Be it known that I, THOMAS TOMLINSON, a subject of the Queen of Great Britain, residing at Bray, in the county of Wicklow, Ireland, have invented certain new and useful Improvements in Apparatus for the Vaporization, Combustion, and Utilization of Hydrocarbon Oils, of which the following is a specification.

My invention has for its object to effect the vaporization of heavy hydrocarbon oils in a more efficient way than has been hitherto practicable. This I accomplish by the adoption of apparatus for carrying on what I denominate "stage vaporization." I may employ my apparatus for the production of power in an internal-combustion engine or in a compressed-air engine (the combustion in the latter case taking place in a closed chamber external to the engine) or for heating or other useful purposes.

In any attempt to utilize the energy of combustion of hydrocarbon oils with air (or with pure oxygen, if intense heat be desired) the problem is to add to a definite quantity of air a definite quantity of oil in a state of vapor. Generally the vaporizing of the oil is effected by taking a relatively small proportion of the total air, heating such air to a high temperature by passing it through a coil surrounding a flame and passing the air so heated over the measured quantity of oil, also preferably heated, which is carried off as vapor to mix with the remainder of the air. According to my invention I usually retain the same main division of air into vaporizing-air and main-air supplies; but in order to obtain a greater efficiency of vaporization I treat the vaporizing-air differently. Instead of heating the whole vaporizing-air by external means and passing the air so heated over the measured-oil supply for the purpose of vaporizing it I divide the vaporizing portion of the air-supply into a number of suitably-proportioned divisions, (of which one only—the first—is externally heated,) and I similarly divide the measured-oil supply into a number of suitably-proportioned divisions. I effect the combination of the total vaporizing-air and the total supply of oil as vapor in the following manner: I take the small quantity of externally-heated air and by its means vaporize the first portion of the oil. Next I utilize the heat of combustion of the oil so vaporized (ignited after combination with second portion of the vaporizing-air) to heat the third portion of the vaporizing-air to such a temperature as shall vaporize the second oil-supply, and so on until the main air-supply is added and the final ignition and utilization takes place. By this means I obtain a very efficient vaporization without the necessity of providing a large external flame, and so am able to utilize the denser and cheaper hydrocarbon oils (possibly even oil refuse) where the lighter and dearer oils are now used.

The annexed drawings are diagrams illustrative of my invention, Figure 1 showing the application of the vaporizer to an engine using the "Otto" cycle; Fig. 2, its application to cases where it is desired to use an ordinary compressed-air engine without explosion and in which the high temperature permissible in a water-jacketed cylinder is not practicable, and Fig. 3 its application to the production of heat in a furnace or other chamber.

The drawings being diagrammatic, it has been assumed for the sake of simplicity that the oil is drawn up by the heated air in proper quantity as an induced stream by properly-placed nozzles upon the well-known "scent-spray" method; but it is to be understood that any method by which the oil is delivered in proper quantity proportional to the air-supply at the points where it is vaporized is available. It has also been assumed that oils of different qualities are used at the first and second points of delivery. This is to cover the case where on account of using after the first ignition an oil (or refuse) which is vaporizable with difficulty it may be necessary to use (at least at starting) a more easily vaporized oil at the first point. It has also been assumed that electric ignition is used; but any form of ignition is available, and in particular where the action of the apparatus is continuous ignition by heated surfaces will be available after the inner surfaces or parts of them specially prepared have reached the requisite temperature.

In the diagrams the reservoirs from which the oils are drawn are shown at *h* and *j*. Tubes

h' and j' serve for conveying the oils from the reservoirs to the orifices at the nozzles g g. The ignition-points are shown at x and y, and the electric circuit is indicated by z. The admission-orifices b, c, and d are illustrated as being formed by the superposed conical parts or castings 7, 8, 9, 10, 11, and 12, the interstices being filled with refractory material v.

By way of illustration I will first explain the action of my vaporizer as applied to an ordinary explosive-oil engine, Fig. 1. Upon the outstroke of the piston i' (supposed to be the first stroke of the Otto cycle) air is drawn through the admission-valve i^2 into the cylinder i through the pipes or openings 1 2 3 4, the orifices a, b, c, and d being of such dimensions that suitable quantities of the air-supply flow through the pipes or openings 1 2 3 4. That portion of the air which flows through the pipe 1 is heated by passing it through the coil w, surrounding the flame of the lamp f, and in its passage over the nozzle g it draws up, sprays, and vaporizes a suitable portion of oil from the reservoir h. Passing on toward the cylinder i, this mixture of heated air and vapor of oil meets the portion of the vaporizing-air which flows through the pipe or opening 2 and issues from the annular opening b. This is sufficient to supply the extra air necessary for the combustion of the oil-vapor present. The resulting mixture of vaporized oil and the air necessary for its combustion is ignited by the spark x. It is of course arranged that this spark shall be in action only upon the admission stroke of the Otto cycle of the engine. The products of combustion caused by the ignition at an extremely high temperature, passing onward toward the cylinder, meet the third portion of the vaporizing-air, which flows through the pipe 3 and issues from the annular opening c. This is sufficient in quantity and will be heated to a sufficiently high temperature when mixed with and heated by the products of combustion to efficiently vaporize the principal oil-supply (which it draws from the reservoir j) without the formation of deleterious products. The mixture of products of combustion, air, and vaporized oil still flowing onward meets the main-air supply which flows through the pipe 4 and issues from the annular orifice d and which is sufficient to supply the extra oxygen required for the combustion of the oil-supply taken up by the vaporizing-air. This cycle may be repeated as many times as requisite, each time a larger quantity of oil being vaporized, a larger quantity of air added, and the whole ignited, and so on, with the object of producing a large amount of heat (whether in the form of flame or heated vapors) by vaporization and combustion in successive stages. When applied to an oil-engine, the heated vapors will eventually be drawn through the lift-valve i^2 into the cylinder i, where it is subjected to compression, ignition, expansion, and expulsion, according to the Otto cycle. If instead of being drawn in by inspiration air is forced through the apparatus by the action of a pump-cylinder separate from the engine-cylinder, it is evident that the vaporizer becomes applicable to the ordinary impulse-every-revolution oil-engine.

It will be understood that in the instance given in Fig. 1 the final ingnition will take place in the engine-cylinder; but when vaporization is being produced for such purposes as the production of a flame or for a heat-engine another pipe or opening 5, leading to the annular orifice e, Figs. 2 and 3, is added and ignition takes place at y—that is to say, the mixed products of combustion, air, and vaporized oil are ignited at the point y and burned in presence of some excess of air, added through the pipe 5 and annular orifice e, as shall keep the temperature from rising above the point at which it can be economically stored or conveyed to a distance to be there utilized. In Fig. 1 it will be seen that the necessary quantity of air is sucked through the vaporizer. When the air is forced through it, some alterations must be made. In the arrangement illustrated in Fig, 2 a suitable pump (driven either off the engine-shaft or by a separate engine drawing its supply from the same reservoir k as that which supplies the main engine through the pipe m) compresses air into the reservoir or drum l through the pipe n.

It is obvious that in lieu of the drum or reservoir l I may employ a series of pipes containing air compressed to and stored at a very high pressure admitted to the engine through a reducing-valve. In this case it is clear that my apparatus placed upon the pipe leading from the storage-reservoir to the motor will be the means of substantially increasing the work done by the compressed air. If the motor be such that it can use without damage vapors at the temperature of combustion at the point y, then the admission of cooling-air at e may of course be dispensed with.

In Fig. 3, which is otherwise similar in construction to Fig. 2, it will be seen that the means for the admission of final cooling-air is dispensed with and the heated products of combustion pass direct into the furnace-chamber, (indicated at s.) The compressed air is shown in this case as being supplied by a rotary blower t. Alternately an induced draft may obviously be employed.

p p in Figs. 2 and 3 represent a possible arrangement of valves for the purpose of modifying the air-flow through the system. The pipe 6, leading to the chamber q, surrounding the flame ignited at y, forms a by-pass line of supply for the purpose of heating the air flowing through the orifice a without the aid of an external lamp, as f, after starting, and when and so long as the apparatus remains in action. Of course the pipe leading from the chamber q to the orifice a must be efficiently covered to prevent loss of heat by radiation. The line of pipes r in Figs. 2 and

3 is for the purpose of placing the oil-reservoirs under the general air-pressure of the system.

Instead of initially dividing the whole air-supply into vaporizing-air and main-air portions (of which latter portion the cooling-air forms part in Fig. 2) I may initially divide the whole air-supply so that the cooling-air alone forms one division and the vaporizing-air and the air for final combustion together form the other division, this latter part being again subdivided, as illustrated in Fig. 1.

I claim as my invention—

1. The combination of means for mixing oil with air, means for igniting this mixture, means for causing the products of combustion thereof to mix with a further supply of air, means for causing this last-mentioned mixture to vaporize a further supply of oil, and means for combining a further supply of air therewith.

2. In a vaporizer, the combination, with an initial or one vaporization, of means serving respectively (*a*) to ignite the initial or one mixture, (*b*) to admit thereto a portion of the vaporizing-air for the purpose of vaporizing a second or following part of the oil-supply, and (*c*) to admit the main-air supply which final mixture is ignited, substantially as set forth.

3. The combination of a series of nozzles, means for supplying a relatively small quantity of oil to one of the nozzles, means for supplying air thereto, igniting devices for exploding this mixture, means for supplying air to the apex of the next nozzle in the series and causing it to mix with the products of combustion resulting from the air and oil supply to the first nozzle, and means for supplying oil and air to the apex of the next nozzle in the series.

4. The combination of a conical nozzle, means for supplying air to a chamber in the apex thereof, means for supplying oil to this chamber, a second conical nozzle adjacent to the first-mentioned nozzle and having a central chamber, igniting devices in this chamber for exploding the oil and air passing into it from the chamber in the first nozzle, means for supplying air at the apex of the second nozzle, a third nozzle, and means for supplying oil and air thereto near its apex.

In testimony whereof I have hereunto subscribed my name.

THOMAS TOMLINSON.

Witnesses:
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J. SUTTON.