(No Model.)

3 Sheets—Sheet 1.

J. FRASER.

GAS PRODUCER.

No. 603,328. Patented May 3, 1898.

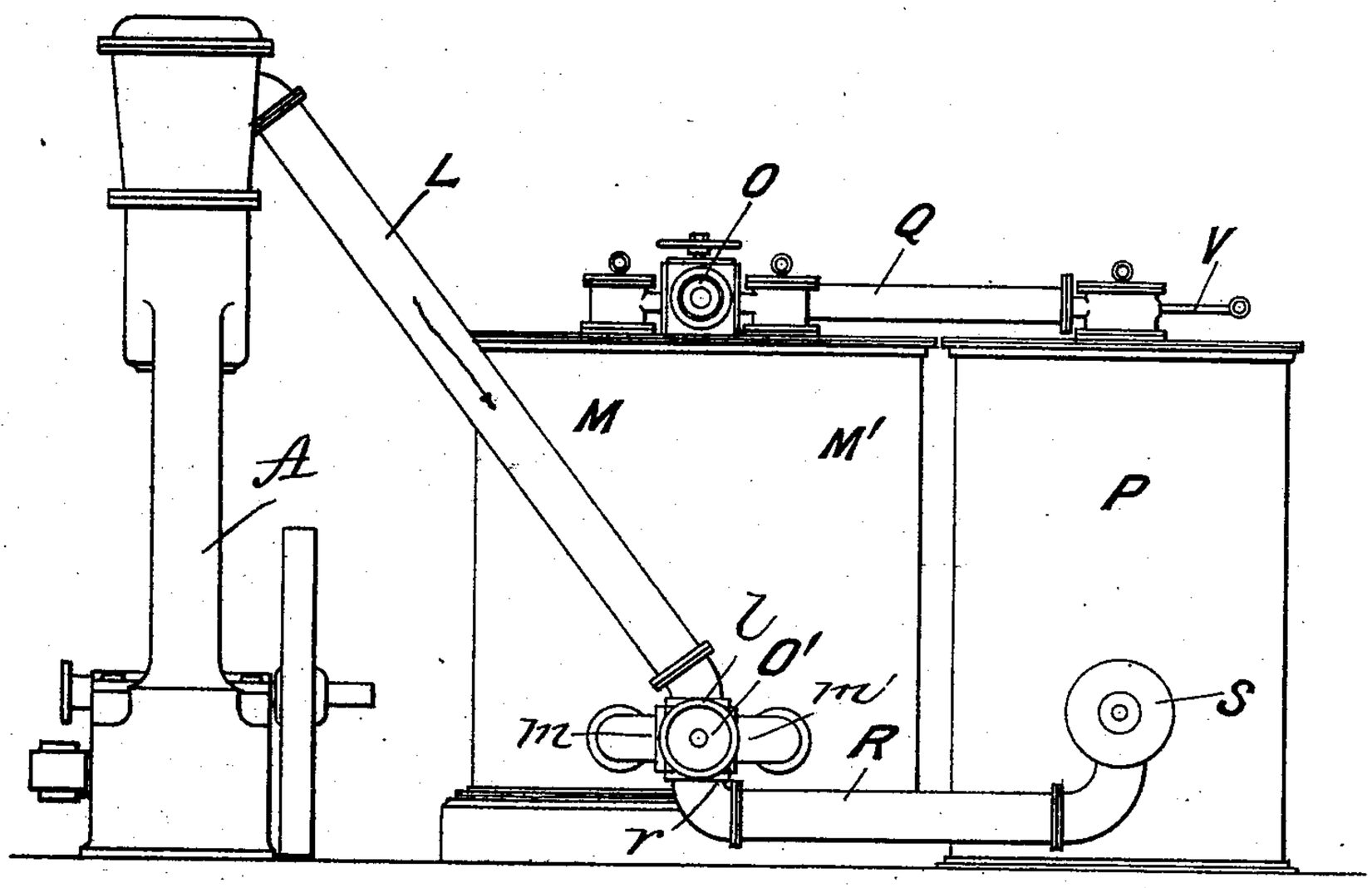

FIG. 1

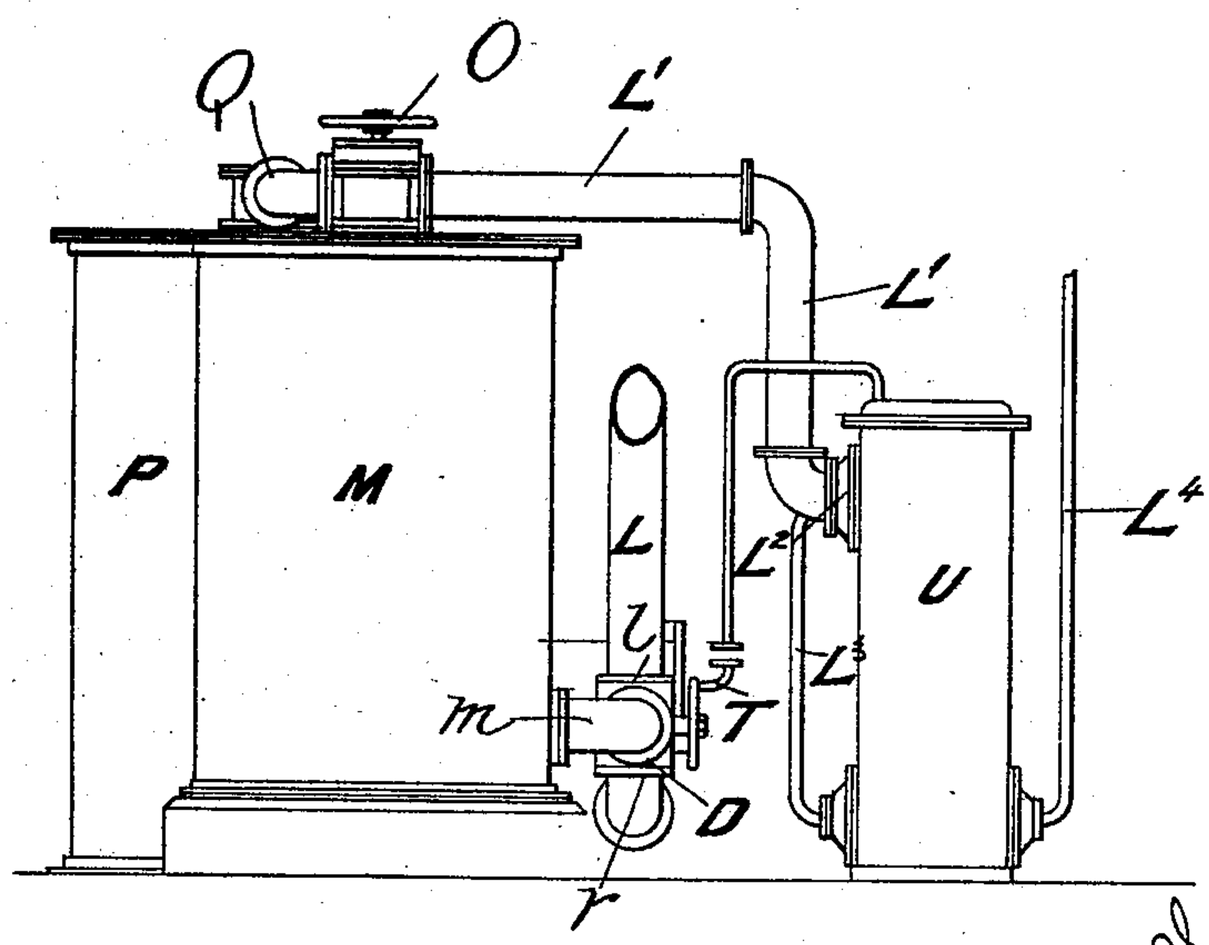

FIG. 2

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(No Model.)

3 Sheets—Sheet 2.

J. FRASER.

GAS PRODUCER.

No. 603,328. Patented May 3, 1898.

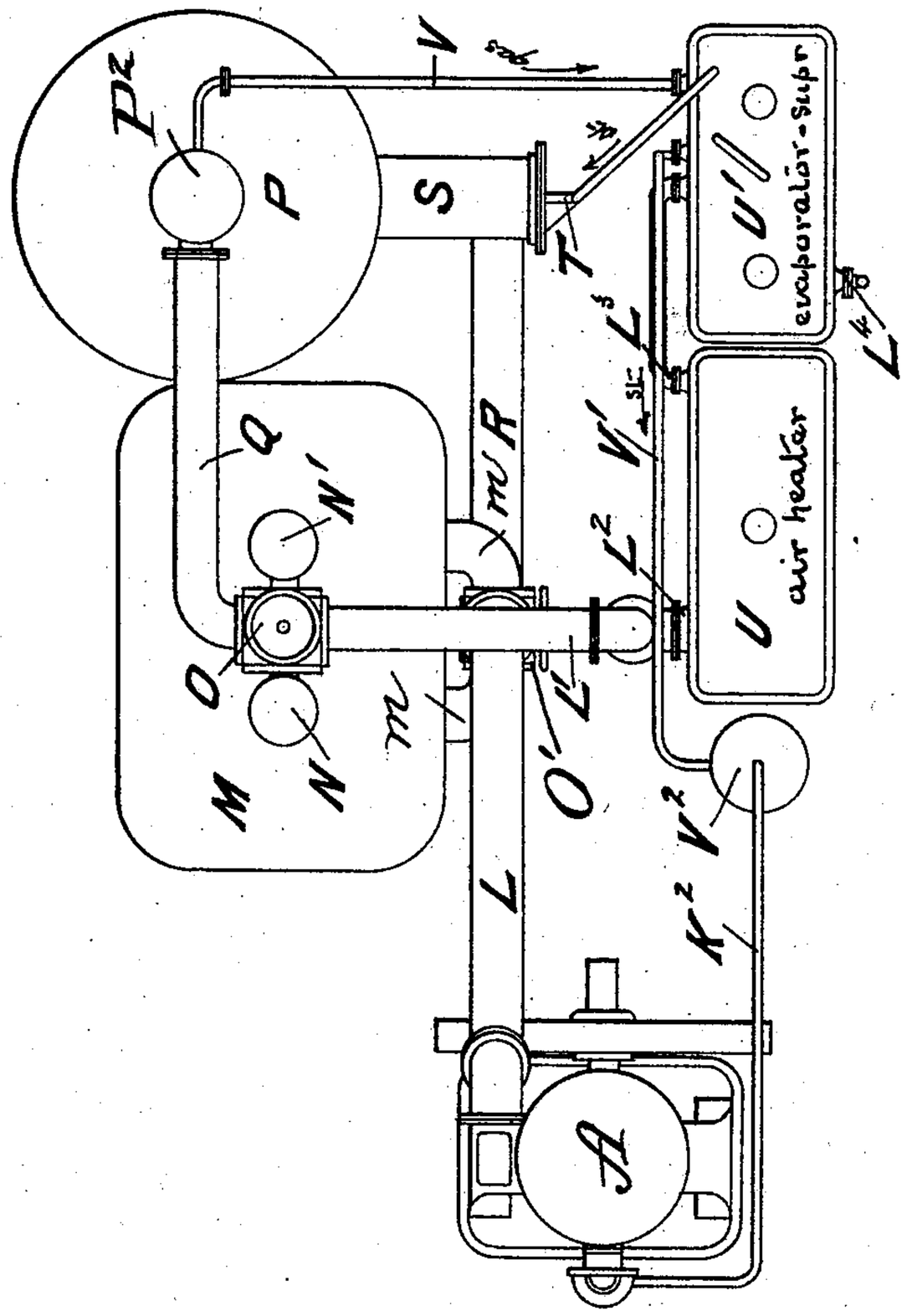

FIG. 3

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(No Model.) 3 Sheets—Sheet 3.

J. FRASER.

GAS PRODUCER.

No. 603,328. Patented May 3, 1898.

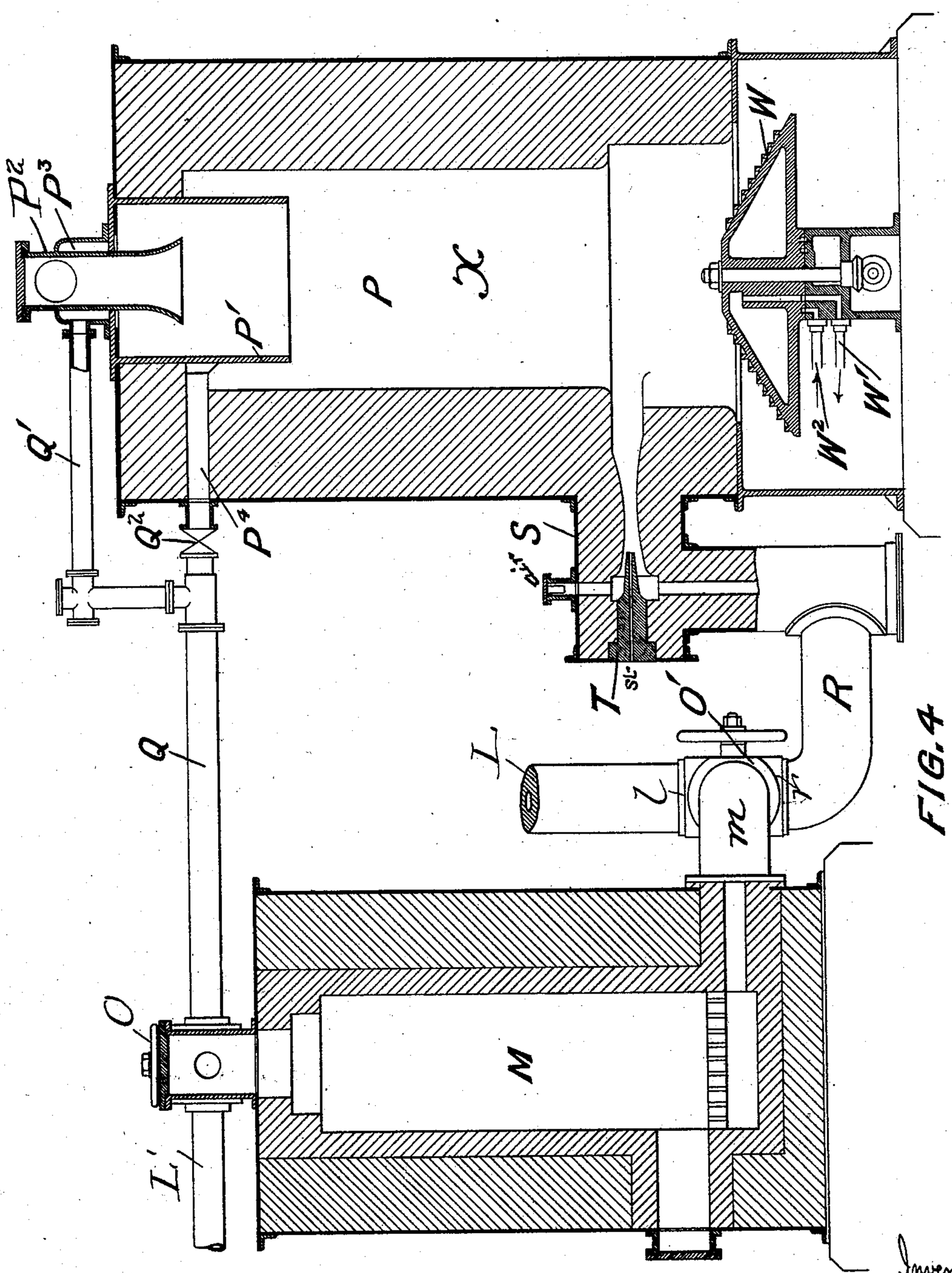

FIG. 4

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UNITED STATES PATENT OFFICE.

JAMES FRASER, OF LONDON, ENGLAND.

GAS-PRODUCER.

SPECIFICATION forming part of Letters Patent No. 603,328, dated May 3, 1898.

Application filed June 15, 1896. Serial No. 595,629. (No model.)

To all whom it may concern:

Be it known that I, JAMES FRASER, engineer, a citizen of Great Britain, residing at 9 Malvern Terrace, Barnsbury, London, N., England, have invented certain new and useful Improvements in Gas-Producers for Gas-Engines, of which the following is a specification.

My invention relates to gas-producers for gas-engines and includes utilizing the heat of the exhaust-gases from a gas-engine by passing the said exhaust-gases through a regenerator or regenerators to absorb the heat and using the heat so absorbed to supply heat to a gas-producer in order to maintain the contents of the producer at a sufficient temperature to cause the carbon to continuously decompose a supply of superheated steam of high temperature and produce an inflammable gas free from or nearly free from nitrogen.

A great advantage of the use of my invention is to greatly diminish the amount of air required to be injected with the steam into the incandescent fuel of a gas-producer.

Referring to the accompanying sheet of drawings, which illustrate an application of my invention to an engine and gas-producer, Figure 1 is a general elevation of a gas producer and engine as arranged in combination. Fig. 2 is an end elevation, and Fig. 3 is a corresponding plan. Fig. 4 is a vertical longitudinal section through the gas-producer and one of the regenerators shown in the preceding figures, with the relative position of the regenerators and producer slightly altered, so that a section may be shown through both, and also the pipe arrangement slightly altered.

The gas-producer, connected up to the engine, together with the air-heater and the water evaporator and superheater, is shown in general elevation at Figs. 1, 2, and 3, while the producer and regenerators in detail and on a larger scale, partly in section, are illustrated at Fig. 4.

The gas-producer consists of a producer proper, P, connected suitably to regenerating-chambers M M′. These regenerating-chambers are heated alternately by the exhaust-gases from the engine A in order to make the waste heat of the engine available for the purpose of producing pure inflammable gas without appreciable dilution of nitrogen. The exhaust-gases leave the engine by the pipe L, which pipe is lined with fire-brick or other non-conducting material in order to retain the heat. The gases enter the regenerator or gas-heater by way of a valve O′, and I so arrange the valve-box with four ways *m m′ l r*, controlled by a centrally-hung butterfly or flap valve of the type common in producers, that in one position of the valve the gas-exhaust pipe L and the regenerator M are in communication at the same time as the producer-pipe R and regenerator M′, while upon the rotation of the valve the exhaust-pipe L and the regenerator M′ come into communication simultaneously with the producer-pipe R and the regenerator M. As is usual with furnace-regenerators, the heating-gases are passed through one regenerator to heat up the material within it while the other regenerator is being used for the purpose of giving out heat to the gas which is to be heated.

At the top of the regenerators a valve O similar in construction to O′ is placed, and by its means communication from the producer to either of the regenerators M M′ is secured when required, the valve O at the same time putting the regenerator shut off from the producer in communication with the air-heater U, while the valve O′ is operated simultaneously in the manner hereinbefore described in conjunction with O to insure proper distribution of the exhaust and producer gases. The exhaust-gases thus pass through one regenerator—say M—heating up the fire-brick contained in it, then through the valve O to the pipe L′, by which time the gases have been considerably reduced in temperature. From L′ the gases, still hot, enter the air-heater U, which does not require to be described in detail, give up a further quantity of heat to compressed air, and then pass by way of the pipe L^3 into the water evaporater and superheater U′, whence the exhaust is discharged into the atmosphere by the pipe L^4, having lost nearly all its heat.

The producer is started in the manner usual with ordinary gas-producers, and as the fuel is ignited and the steam-jet T and air-cock *n* turned on the jet acting as an air-injector, while the gas first produced is used to heat up the regenerators and also to super-

heat the steam for the jet. When the necessary temperature of the steam producer and regenerators has been reached, the gas-engine is started, the valve *n* shut off, and the valves *o* and *o'* adjusted. The generation of water-gas then takes place, operating as follows: While the exhaust-gases are heating M, the regenerator-surfaces within M' are giving up the heat to the producer-gases. To effect this, the gaseous contents of the producer are continuously circulated, passing away at the top through the pipe Q, then down through the fire-brick surfaces in the regenerator M', and out by way of the pipe R to enter the producer again at the bottom by the pipe S. To cause the circulation, the steam-injector T is used, which is more clearly seen at Fig. 4. This injector is supplied with steam under pressure partly heated from the water evaporator and superheater and finally superheated to the required temperature by a supply of gas from the producer. The gas which may be used in heating the superheater may be supplied through any ordinary pipe connection from the annulus P^3 to a ring, or a suitable flame-burner fixed in the superheater may be employed. The gases are thus caused to flow continuously through the producer P, entering the bottom and leaving at the top. In the section, Fig. 4, the gases are shown as leaving by the passage P^1 at the top end of the interior X of the producer through the regulating-valve Q^2 into the pipe Q, and also up into the annulus P^3 in the producer-cover down the pipe Q' into Q, both streams of gas meeting there and passing into the regenerator, to be returned again at the bottom by the valve O' and the pipes R and S.

The circulation of the gases may be effected by other means—by a fan or blower, for instance.

By the hereinbefore-described arrangements the gases of the producer P are heated up to a considerable extent by the exhaust-gases from the engine, and so the heat which would otherwise be wasted in the exhaust-gases is restored to the system to be partly utilized to aid chemical action for the following reasons: In decomposing steam in the presence of incandescent carbon it is not necessary that air or oxygen should be admitted to maintain continuous generation of gas, provided that the steam is admitted at a temperature above that at which decomposition begins, and as the carbon or coke could not be sensibly reduced in temperature below that of the gas impinging against it (usually about 1,000° centigrade) the coke in immediate contact would be raised to a state of incandescence and the steam therefore be decomposed. Again, the amount of carbonic acid remaining unreduced in passing up the producer would make the gas very low in heating power if the circulating devices described were not employed. These devices employ a large quantity of the gas itself as a carrier of heat from generator to producer, and as the temperature of the generators from the gas-engine exhaust would be about 1,000° centigrade the extra heat for the reduction of the carbonic acid in the upper zone of the producer would be supplied.

The gas to be used in the engine is taken from the producer by a pipe, such as V. (See Figs. 1 and 3.) It passes through the water evaporator and superheater to give up its heat, then along the pipe V to a cooler V^2, whence it passes by the pipe K^2 to the engine gas-pump. The producer, shown in vertical section and part plan section at Fig. 4, is fed with fuel through the pipes P^2 down the pipe P' into the body of the producer X. The passage P^4 is placed considerably above the lower lip of the pipe P'. The coal, which may be of any ordinary kind, heats up within the body of the producer X, and is also heated up by some of the circulating gas being forced through it, the relative or required amount being regulated by the valve Q^2, the remainder of the gas being taken off for consumption in the engine and, if necessary, the superheater U'. The coal becomes coked, giving off volatile hydrocarbon, and the gases pass up into the annulus P^3, which is open around its bottom edge and leads into the pipe P', and the amount in excess of that required for consumption in the engine, &c., passes into the pipe Q through the pipe Q'. The remaining portion of the other gases arising from the incandescent fuel in the producer below the lip of P' pass away from the producer by the passage P^4 and enter the pipe Q to proceed to either of the regenerators M M'.

The producer P is provided with a circular conical bottom W, having a spiral groove on its surface and kept cool by water circulation within it, entering by the pipe W^2 and passing out by the pipe W'. This conical bottom is rotated continuously by suitable gearing in such direction as to screw the contents of the producer—that is, ash and slag at the bottom of the producer—out the ash-pit. The air heated in the heater U is utilized in the gas-engine, which is of special construction.

In constructing these producers I regulate their dimensions, so that the amount of gas they could produce would be only slightly in excess of the amount required for a consumption, and I also automatically regulate the production to the required amount by regulating the quantity of steam sent in at the injector either by a throttle-valve controlled from the engine-governor or a pressure device controlled from the producer-top, there being a number of easily-applied devices known to engineers for this purpose.

Although I have described one form of producer, yet the construction may be modified without departing from its main features.

It is to be distinctly understood that my invention, so far as relates to gas production, may be carried into effect in combination with any known gas-engine.

It is also to be understood that although I

have described part of the heat of the exhaust as being utilized to heat compressed air, yet I do not claim that as part of my invention.

Having now described my invention, what I claim as new, and desire to secure by Letters Patent, is—

In combination in a gas-producing apparatus, the producer P, an air and steam supply leading thereto, a pair of regenerators, a connection between the same and the producer P, the gas-engine, a connection between the same and the regenerators and a reversing-valve for controlling the connections between the regenerators and the gas-producer and between the gas-engine and the regenerators so that the exhaust-gases from the engine are sent alternately through the regenerators to heat them for the passage of the partially-formed producer-gas, said valve also sending the producer-gas alternately through the regenerators, the said gas-engine being of sufficient size to use all or nearly all the gas produced at full load.

In witness whereof I have hereunto set my hand in presence of two witnesses.

JAMES FRASER.

Witnesses:
FRANK WESLEY DICK,
ALFRED SOPWITH.