(No Model.) 6 Sheets—Sheet 1.

H. FOURNESS.

WATER-OIL GAS APPARATUS.

No. 526,364. Patented Sept. 18, 1894.

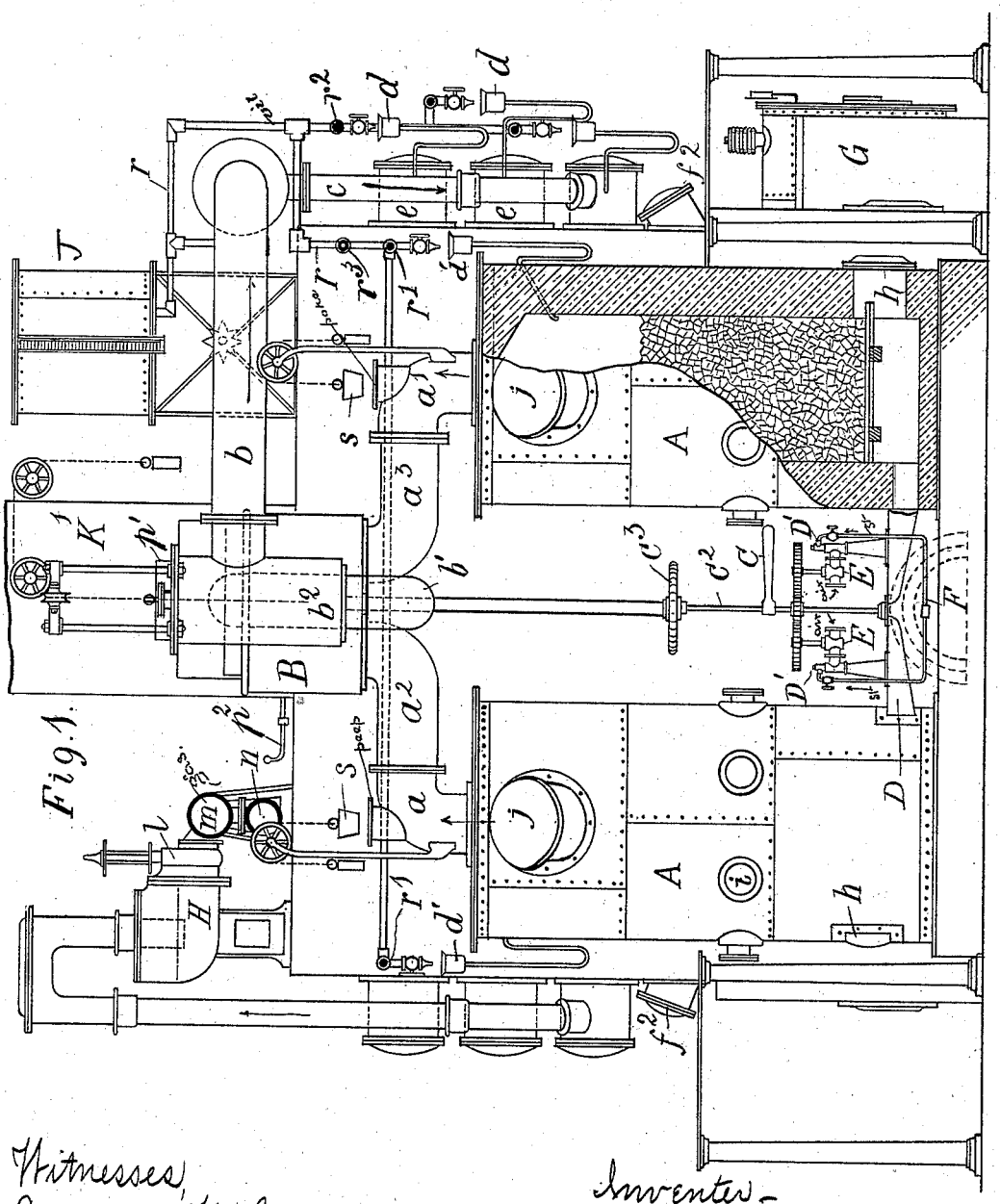

Fig. 1.

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(No Model.) 6 Sheets—Sheet 2.

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WATER-OIL GAS APPARATUS.

No. 526,364. Patented Sept. 18, 1894.

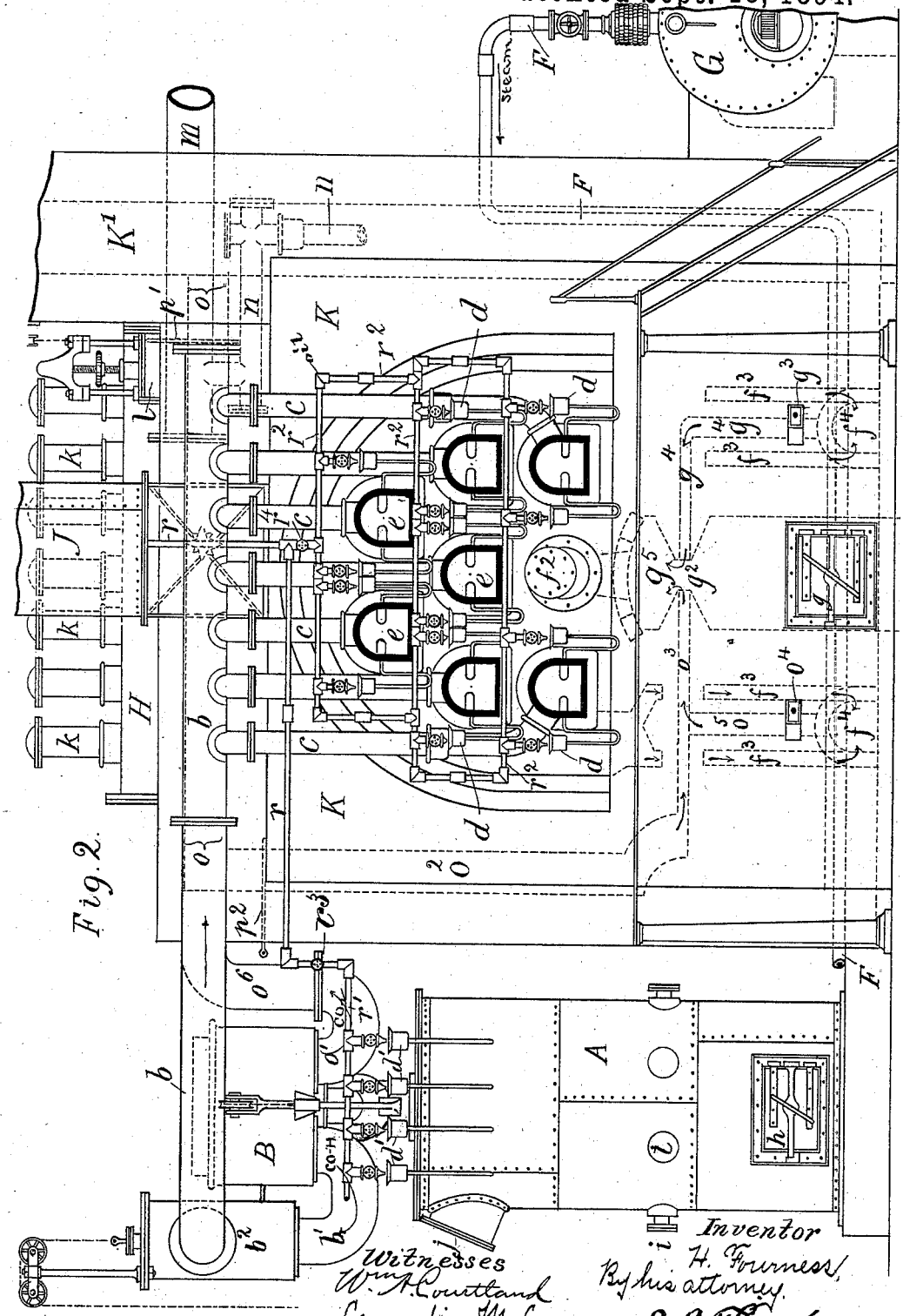

Fig. 2.

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H. FOURNESS.

WATER-OIL GAS APPARATUS.

No. 526,364. Patented Sept. 18, 1894.

Fig. 3.

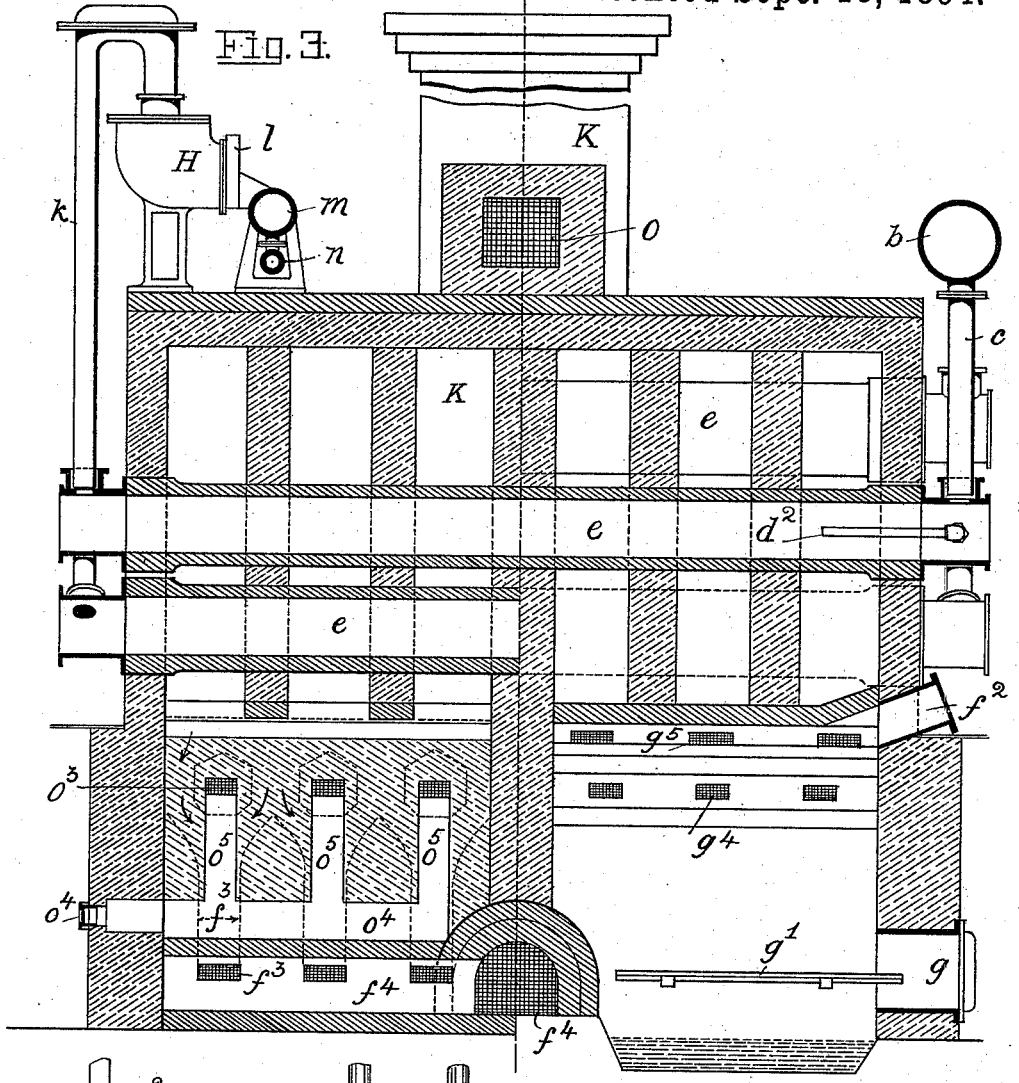
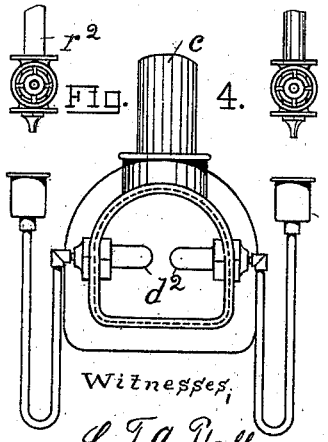


Fig. 4.



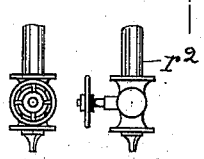
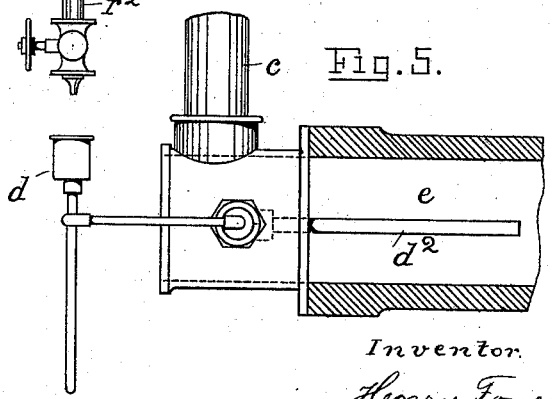


Fig. 5.



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(No Model.) 6 Sheets—Sheet 4.

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WATER-OIL GAS APPARATUS.

No. 526,364. Patented Sept. 18, 1894.

Fig. 6.

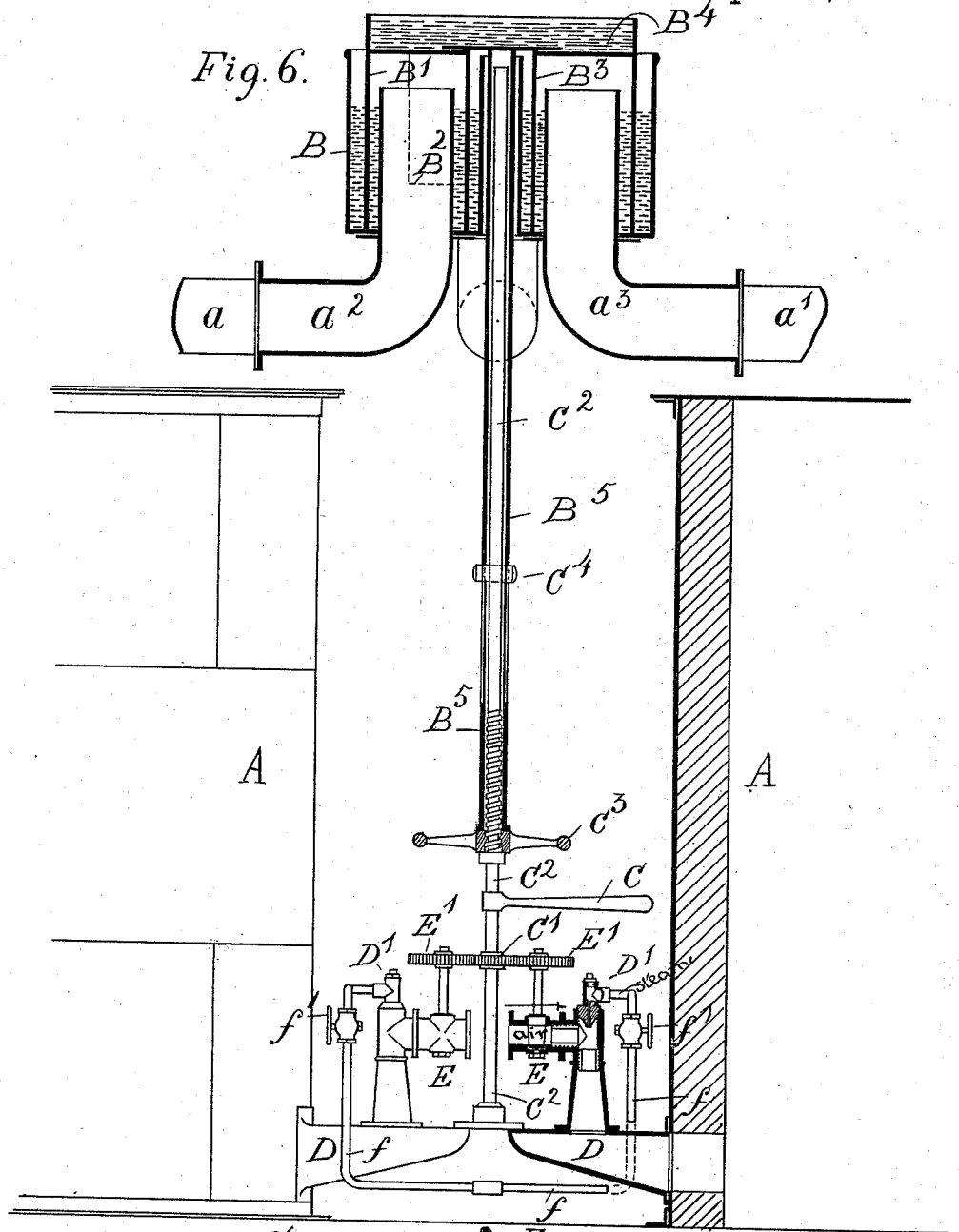

Fig. 7.

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(No Model.) 6 Sheets—Sheet 5.

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WATER-OIL GAS APPARATUS.

No. 526,364. Patented Sept. 18, 1894.

Fig. 8.

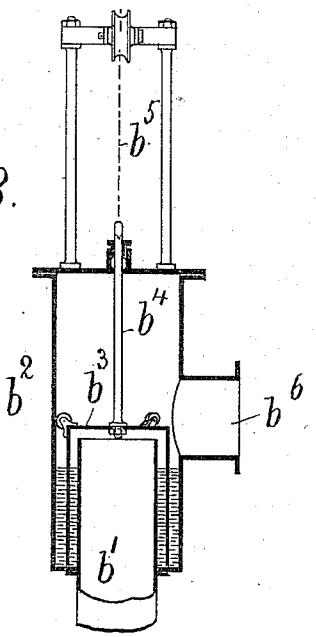
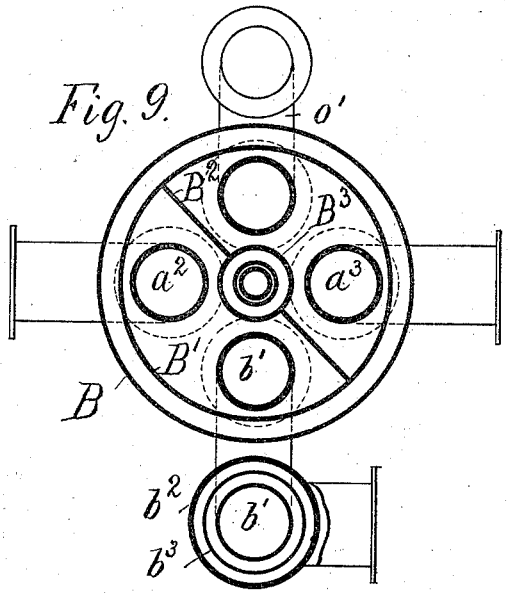


Fig. 9.



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(No Model.)

6 Sheets—Sheet 6.

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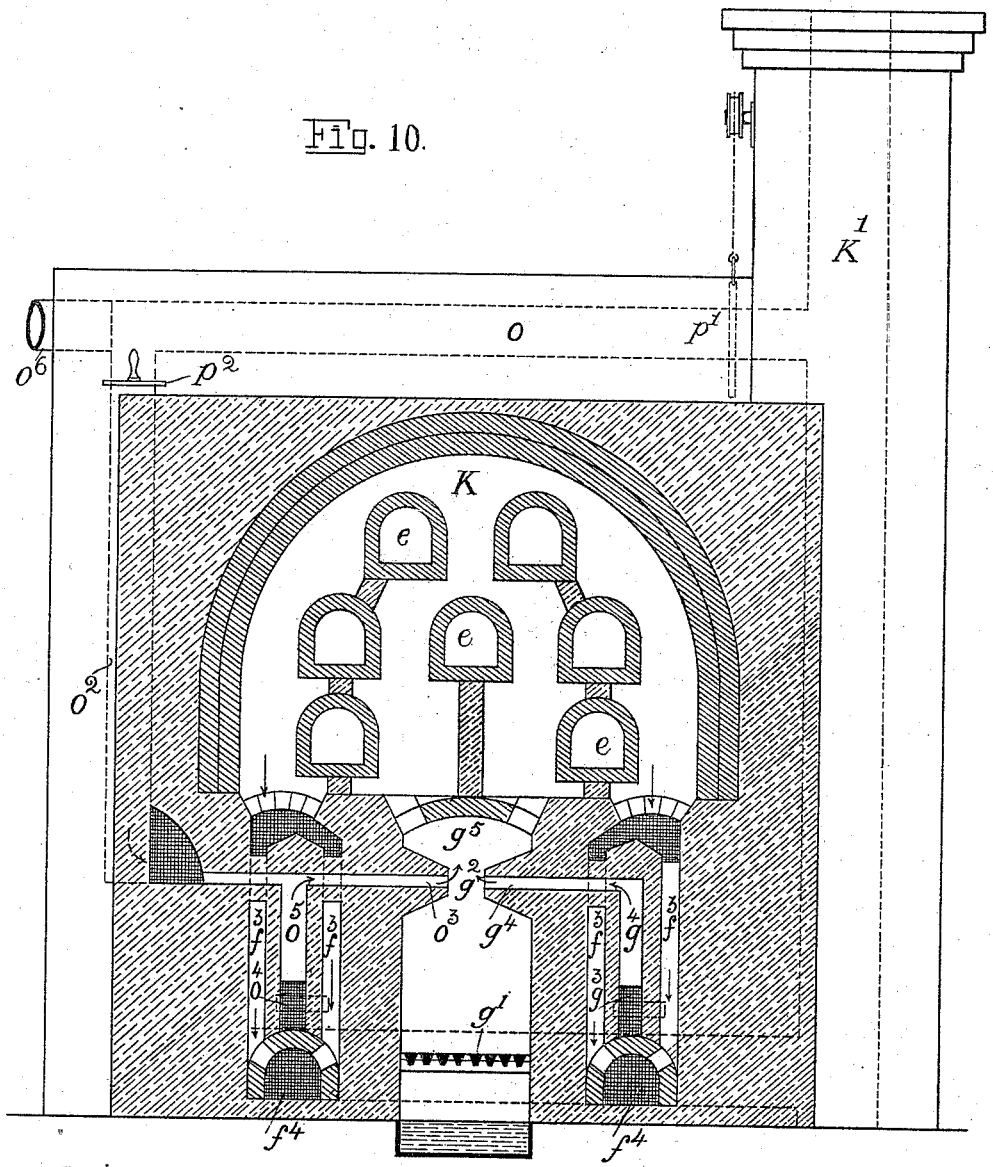
WATER-OIL GAS APPARATUS.

No. 526,364. Patented Sept. 18, 1894.

Fig. 10.



Witnesses;
A. T. A. Pfaff.
Beatrice Williams.

Inventor;
Henry Fourness.
by his Attorney;
Edward P. Thompson

UNITED STATES PATENT OFFICE.

HENRY FOURNESS, OF MANCHESTER, ENGLAND.

WATER-OIL-GAS APPARATUS.

SPECIFICATION forming part of Letters Patent No. 526,364, dated September 18, 1894.

Application filed December 21, 1892. Serial No. 455,875. (No model.) Patented in England September 12, 1891, No. 15,469.

To all whom it may concern:

Be it known that I, HENRY FOURNESS, a subject of the Queen of Great Britain, residing at Manchester, in the county of Lancaster and Kingdom of England, have invented certain new and useful Improvements in Water-Oil-Gas Plants or Apparatus, (patented in Great Britain, No. 15,469, dated September 12, 1891,) of which the following is a specification.

The subject of my invention is a continuously acting plant for manufacturing lighting and heating gas composed of an admixture of water and oil gas, which plant is characterized by the particular arrangement of the flues and construction of the combustion chamber for utilizing the gas produced during the blowing-up of the coke in the generators for the purpose of heating the fixing retorts and the arrangement of the valves for controlling the continuous operation of the plant.

On the sheets of drawings appended hereto, Figure 1, shows a front view and Fig. 2, a side view of the plant; Fig. 3, a section through the fixing retort and combustion chamber; Figs. 4 and 5, front and side views of the retort mouths; Fig. 6, the arrangement of valve controlling apparatus in elevation partly sectioned; Fig. 7, a plan of the blower valves; Fig. 8, a sectional elevation of gas check valve, and Fig. 9 a sectional plan of gas distributing valve. Fig. 10 is a vertical cross section of the furnace.

The plant consists of two alternately working generators A, the retort chamber K with chimney, the steam boiler G, and oil cistern J and the necessary pipes and valves.

The generators A consist each as usual of a shell lined with firebrick and fitted with grate and ashpit closed by doors *h*, poke and peep-holes *i*, charging hole and cover *j*, and covers at the top on which the gas conveying elbow pipes *a*, *a'* are mounted. These are formed with a vertical branch plugged by a counter-weighted plug *s* and serve as peep and poke holes for the purpose of pushing a bar through the coke when the latter becomes clogged at the same time acting as safety valve in case an explosion should occur in the generator. At the lower end each generator is fitted with two tuyeres D (Figs. 6 and 7) each of which carries a steam jet blower D' with an air inlet cock E. The pipe F leading from the boiler G, to the steam blowers, passes through the chimney and the flues leading to the same as shown on Fig. 2, and the steam is superheated thereby. The pipe F is connected to the branch pipes *f f*, leading to the steam jets D', each fitted with a stop valve *f'* which however is kept open while the plant is in operation; the steam jet being kept on continuously while the plant is working, the air inlet being alternately opened for blowing the coke into incandescence and closed for the production of gas.

In order to assure the alternate working of the generators A, the four air cocks E are connected by wheel gearing, the wheels E' on the cock spindles gearing with a wheel C' on a vertical shaft C^2 operated by a handle C. The diameters of the wheels E' and C' are equal so that a quarter turn of the handle C turns the cocks a quarter turn and shuts or opens them.

The oil for gasification flows from the cistern J, through the pipe *r* to a pipe *r'*, arranged over each generator, whence it drops through adjustable drip cocks into the oil cups *d'*, fixed upon the top of siphon pipes making a hydrostatic seal, from which it enters the generators near to their top ends as usual and falling upon the coke is gasified, the oil gas mixing with the water gas produced by blowing steam through the coke. When the heat of the coke has been reduced near to the lowest temperature required for the decomposition of the steam, the oil supply is stopped and the steam blast continued to clear the coke and generator of all residue of oil and oil gas before the air blast for reheating the coke is turned on, whereby explosions in the generator are prevented. The gas produced is conducted through the elbow pipes *a*, *a'* into the four way hydraulic valve box B. The latter is arranged similarly to hydraulic valves for controlling purifiers, and consists of a circular water tank B, Figs. 6 and 9, to which four elbow pipes, a^2, a^3, and *o'* and *b'* are fixed, extending upward into the tank B as shown. The pipes a^2, a^3, are connected to the pipes *a*, *a'* on the generators respectively, pipe *o'* to the pipe o^6, leading through a flue to the chimney, and the pipe

b' to the check valve b^2, leading to the range of pipes b b (Figs. 1 and 2), extending over the fronts of the retorts e, and connected to them by the down pipes c.

The generator in which the coke is blown up by the air blast is placed in connection with the pipe o^6, while the other generator, in which water gas is produced, is in connection with the pipes b. This connection is effected and reversed by means of the bell valve B′ formed with a diametrical partition B^2, between the central tube B^3, and the outside wall of bell B′. This partition does not extend to the bottom edge of the bell but stops short a certain distance therefrom so that when the bell B′ is lifted up till the bottom edge of the partition is above the top of the pipes a^2, a^3, o', b', the edge of the bell B′ and tube B^3 are still immersed in the water in the tank B. The bell can then be turned by a quarter turn and lowered again whereby the communication of the generator with the pipes o' and b' is reversed. In the position of the bell B′, shown on the drawings, the water-oil gas from the left generator passes through pipes a^2, b', to the pipes b and retorts, the air cocks E′ of the blowers for this generator being closed, and the combustion gas from the right generator, the air cocks E′ of which are open, passes through pipes a^3, o' to pipe o^6 or chimney. For reversing the communications, the bell B′ is first lifted by means of the hand wheel C^3, the boss of which is tapped with a screw thread and threaded upon the screwed part of the spindle C^2. To the top plate B^4 of the bell B′ a long tube B^5 is fixed, which rests upon the boss of the hand wheel C^3, so that when the latter is turned and screwed upward on the spindle C^2, the bell B′ is lifted. The tube B^5 is slotted in one part on both sides and a cotter C^4 passing through the slots is fixed in the spindle C^2. By giving the latter a quarter turn by means of the handle C, the bell is turned to the same extent and after being lowered by the screwing back of the hand wheel, the communications are reversed, the pipe a^2 now communicating with pipe o', and pipe a^3 with pipe b'. The quarter turn of the handle C simultaneously reverses the cocks E′, those on the left hand side being opened for admitting air to the left generator for blowing up the coke, and those on the right being closed for production of water gas in the right hand generator. By these means the inadvertent mixing of the water oil gas from one generator with the combustion gas of the other, which would produce explosions, is prevented. As the lifting of the bell might draw water oil gas from the retorts through pipes b b', which mixing with the combustion gas might also cause explosions, the check valve b^2 is interposed. This consists of a casing into the lower end of which the pipe b' extends upward. The space between the casing and pipe contains water, in which the bottom edge of the bell b^3 is immersed, the bell being attached to a rod b^4 passing through a stuffing box at the top and attached to the chain b^5 passing over guide pulleys. While the generators are working the bell is raised and the gas passes through the lateral branch b^6 of the casing to the pipes b and retorts. Previous to reversal of valve B′ the bell b^3 is lowered and the return flow of gas from the retorts stopped, till the reversal has been effected, when the bell b^3 is raised again. The top of the bell B′ is covered with water as shown, to cool the same.

The water oil gas passing into the retorts e is fixed therein as usual, and in order to enrich it and permit the continuation of the steam blast for clearing the generator from oil and oil gas as before described, during which a poor gas consisting mainly of water gas is produced, a second supply of oil is introduced into the retorts in a similar manner to that described in my British patent, No. 15,469, of 1891. From the pipes r descending from the oil cistern J another range of pipes r^2 is branched off as shown on Fig. 2, leading to adjustable drip cocks over the oil cups d. Two of such oil cups are arranged at the side of each retort mouth, as shown in detail by Figs. 4 and 5, on the top of siphon pipes for making a hydraulic seal, the oil pipes being connected to gas elbow pipes d^2 inside the retorts. The oil introduced by these becomes gasified in the retorts and mixes with the gas produced in the generator, and a sufficiently powerful illuminating gas is thus produced while the supply of oil to the generators is shut off, for mixing with the gas previously produced without materially affecting its quality, and the use of heavy oils low in price is thereby rendered possible. Obviously the oil supply to the retorts may be stopped while that to the generator continues, if preferred, each supply being controlled by a single valve r^3 and r^4. From the retorts the gas is led by rising pipes k at the back end to the hydraulic main H, and through valves l to the gas main m leading to the gas holder, the pipes n serving to draw off the tar, of which only a small quantity is however produced.

A further special feature of the plant is the arrangements for utilizing the combustion products, produced during the blowing up of the coke in the generators, for the purpose of assisting in heating the retorts and consuming the smoke from the retort fires. These combustion gases are as before described, conducted from the generators through the valve chest B to the pipe o' which leads to a flue o (Figs. 2 and 3) above the retorts, through which they can pass directly to the chimney K when the damper p' at the chimney end is opened and the damper p^2 closed. When the former is closed and the latter opened, they pass down a flue o^2, at the side of the retort chamber into a series of horizontal flues o^3 where they become mixed with fresh air drawn through the inlets o^4 into ascending flues o^5 communicating with flues o^3 and issue from them into a narrow

passage g^2, formed in the roof of the fire box of the retort fires. The latter consist as usual of two grates g' g' with stoke doors g and charging doors f^2. The flame and smoke evolved from the fires ascend to the passage g^2 where they meet the current of smoke gases from the generator issuing from flues o^3 and another current of fresh air admitted through the inlets g^3 into the flues g^4 which also issue in the passage g^2. The intermingled smoke and air thence passes into the combustion chamber g^5 where they are completely burned and thence through openings into roof of the chamber g^5 into the retort chamber, whence after circulating round the retorts they are conducted through the down flues f^3 into the flue f^4 leading to the chimney. The flues f^3 are arranged on each side of the air flues o^4 and g^4 so that the air in these becomes heated before it reaches the combustion chamber and the fuel and heat are utilized in the best manner.

I claim—

1. In an apparatus for manufacturing gas, the combination with a fixing retort and two generators of a valve casing pipe connecting the interior of said casing with the inlet of the fixing retort and also with the gas outlet of said generators, a partitioned bell-valve arranged in said casing over the mouths of the pipes therein, said valve having an annular wall about its upper face whereby a water chamber is formed and means for turning said valve substantially as set forth.

2. In an apparatus for manufacturing gas, the combination with two generators, each provided with tuyeres and having gas outlets of steam blowers connected to the tuyeres, air-cocks mounted on said blowers and constructed to admit air thereto, gear wheels on the spindles of said cocks a four way valve in communication with the gas outlet of said generators and adapted to control the flow of gas therefrom, said valve having a projecting stem and a gear wheel on said stem meshing with the gear wheels on the respective air-cocks, substantially as set forth.

3. In an apparatus for manufacturing gas the combiuation with a retort furnace having a fixing retort and a flue communicating with the chimney of said furnace of a generator having gas outlet pipe constructed for communication with the flue of the furnace and also with the inlet of the fixing retort therein, a valve controlling the outlet from the generator to either said flue of the furnace or the inlet of the fixing retort therein, means comprising a steam blower and an air cock for blowing up said generator and gear wheels mounted on the spindles of the air-cocks and gas outlet valve, said gear wheels being in mesh substantially as set forth.

4. In an apparatus for manufacturing gas, the combination with two generators each having a gas outlet pipe and a four way valve controlling the outlets of both generators, means comprising a steam blower and an air-cock for blowing up said generator and gear wheels mounted on the spindles of the air-cocks and gas outlet valve, said gear wheels being in mesh substantially as set forth.

5. In an apparatus for manufacturing gas, the combination with two generators each having a gas outlet pipe and a four way valve controlling the outlets of both generators, means comprising a steam blower and an air-cock for blowing up each of said generators gear wheels on the spindles of each of said air-cocks, and a gear wheel on the spindle of the four-way valve, the gear wheels on the air cocks being in mesh with that on the gas valve spindle.

6. In an apparatus for manufacturing gas, the combination with a furnace having a flue communicating with chimney and a fixing retort arranged in said furnace of two generators having gas outlet pipes which communicate with both the flue of the furnace and the inlet of the retort therein and a four-way valve controlling the passage through said gas outlet pipes to the flue and retort inlet.

7. In an apparatus for manufacturing gas, the combination with a furnace having a flue and a fixing retort arranged in said furnace of two generators having gas outlet pipes which communicate with both the flue of the furnace and the inlet of the retort therein a four-way valve controlling the passage through said gas outlet pipes to the flue and retort inlet, means comprising a steam blower and an air cock for blowing up each of said generators and means for operating said air cocks simultaneously with the operation of the four-way valve.

8. In an apparatus for manufacturing gas, the combination with a furnace having a flue communicating with the chimney, and a fixing retort arranged in said furnace of two generators having gas outlet pipes which communicate with both the furnace flue and the retort inlet, a four-way valve controlling the passage through said gas outlet pipes to the flue and retort inlet, a gear wheel secured to the spindle of said valve means comprising a steam blower and an air cock for blowing up each of said generators and gear wheels secured to the spindles of said air cocks, and meshing with the gear on the spindle of the four-way valve.

9. In an apparatus for manufacturing gas, the combination with a fixing retort and two generators of an annular valve casing, pipes connecting the interior of valve casing with the retort inlet and the gas outlet of each of the said generators, a partitioned bell valve arranged in said valve casing over the mouths of the pipes therein, said valve having a screw threaded stem which projects through the central opening of the valve casing and engages a correspondingly screw threaded portion of the apparatus.

10. In an apparatus for manufacturing gas, the combination with a fixing retort and two generators of an annular valve casing, pipes connecting the interior of said valve casing

with the retort inlet and also with the gas outlet of each of said generators, a partitioned bell valve arranged in said valve casing over the mouths of the pipes therein said valve having a hollow stem which projects down through the central opening of the valve casing, a screw threaded shaft arranged in the hollow of said stem, a hand wheel having a central screw threaded collar engaging with the screw threaded shaft below said hollow valve stem, and means for rotating said valve stem.

11. In an apparatus for manufacturing gas, the combination with a fixing retort and two generators of an annular valve casing, pipes connecting the interior of the valve casing with the retort inlet and with the gas outlet of each of said generators, a partitioned bell valve arranged in said valve casing over the mouths of the pipes therein said valve having a hollow stem which projects down through the central opening of the valve casing, a screw threaded shaft arranged in the hollow of said stem a hand wheel having a screw threaded collar, engaging the screw threaded shaft below said hollow valve stem, a collar fixed to said shaft and engaging vertical guideway in the tubular valve stem and a handle secured to said shaft below the screw threaded portion thereof.

12. In an apparatus for manufacturing gas, the combination with a fixing retort and two generators of means comprising a steam blower and an air cock for blowing up each of said generators, an annular valve casing, pipes connecting the interior of the valve casing with the retort inlet and also with the gas outlet and also with gas outlet of each of said generators, a partitioned bell valve arranged in said valve casing over the mouths of the pipes therein, said valve having a hollow stem projecting down through the central opening of the valve casing a screw threaded shaft arranged in the hollow of said stem, a hand wheel having a central screw threaded collar engaging the screw threaded shaft below said hollow valve stem, a cotter fixed to said shaft and engaging vertical guide ways in the hollow valve stem, a gear wheel on said shaft below said valve stem, gear wheels on the spindles of the air-cocks of the respective generators, said gear wheels on the air cock spindles engaging with the gear on said screw threaded shaft and a handle on said screw threaded shaft substantially as set forth.

13. In an apparatus for manufacturing water oil gas, the combination with a furnace containing fixing retorts and a flue adjacent to said retorts and communicating with the chimney of a generator having a gas outlet pipe constructed for communication with both the flue and the inlet of the retorts and a two way valve controlling the outlet from the generator to either said flue or inlet of the fixing retorts siphon tubes attached to said generator, the short arms of which project through its walls and the outer longer arms of which are provided with cups drip cocks fixed above said cups, an oil cistern having an oil supply pipe connecting to said drip cocks, siphon tubes provided with cups and attached to the covers of said retorts, drip cocks fixed above said cups and an oil supply pipe leading from said oil cistern to said cocks, substantially as set forth.

14. In an apparatus for manufacturing water oil gas the combination with a furnace containing fixing retorts, and a flue adjacent to said retorts and communicating with the chimney, of a generator having a gas outlet pipe constructed for communication with both the flue and the inlets of the retorts, and a two way valve controlling the outlet from the generator to either said flue or inlets of the fixing retorts, and an oil cistern constructed for supplying both the generator and the retorts with oil substantially as set forth.

15. In an apparatus for manufacturing gas, the combination with a furnace having a flue constructed to communicate with the chimney and a fixing retort arranged in said furnace of two generators having gas outlet pipes which communicate with both the flue of the furnace, and the inlet of the retort therein, a four-way valve controlling the passage through said gas outlet pipe to the flue and retort inlet, siphon tubes attached to said generator and a cover of the fixing retorts said siphon tubes being provided with cups, drip cocks fixed above said cups, and an oil cistern having oil supply pipes connected to said drip cocks substantially as set forth.

16. In an apparatus for manufacturing gas the combination with a furnace having a flue and a fixing retort arranged in said furnace, of two generators having gas outlet pipes which communicate with both the flue of the furnace and the inlet of the retort therein, a four-way valve controlling the passage through said gas outlet pipes to the flue and retort inlet, means comprising a steam blower and an air cock for blowing up each of said generators, and means for operating said air cocks simultaneously with the operation of the four way valve, siphon tubes attached to said generators and the cover of the fixing retorts, said siphon tubes being provided with cups, drip cocks fixed above said cups and an oil cistern having oil supply pipes connected to said drip cocks, substantially as set forth.

17. In an apparatus for manufacturing gas, the combination with a fixing retort and two generators, of means comprising a steam blower and an air cock for blowing up each of said generators, an annular valve casing, pipes connecting the interior of the valve casing over the mouths of the pipes therein, said valve having a hollow stem projecting through the central opening of the valve casing, a screw threaded shaft below said hollow valve stem, a cotter fixed to said shaft, and engaging vertically guide ways in the hollow-valve-stem, a gear wheel on said shaft below said valve stem, gear-wheels on the spindles

of the air-cocks of the respective generators said gear wheels on the air cock spindles engaging with the gear on said screw threaded shaft, siphon tubes attached to said generators and the cover of the fixing retort, said siphon tubes being provided with cups, drip-cocks fixed above said cups, and an oil cistern having oil supply pipes connected to said drip cocks substantially as set forth.

18. In an apparatus for manufacturing water-oil gas the combination with a furnace containing a fixing retort and a flue leading to the chimney, of a generator having a gas outlet constructed for communication with both the flue and the inlet of the retort, and a valve controlling the outlet from the generator to either said flue or inlet of the fixing retort, a damper for closing said flue to the chimney, a flue leading from said flue to a slit in the roof of the firegrate of said furnace, a damper for closing or opening this flue, air flues constructed to admit air to the flue, air flues constructed to admit air to said slit, a combustion chamber above the roof of the fire grate and communicating therewith through said slit and having openings communicating with the retort chamber, down flues from said chamber placed at the side of said air flues constructed for heating said air flues, substantially as set forth.

19. In an apparatus for manufacturing water oil gas, the combination with a furnace having a flue constructed for communication with the chimney and a fixing retort arranged in said furnace two generators having gas outlet pipes which communicate with both the flue of the furnace and the inlet of the retort therein, a four way valve controlling the passage through said gas outlet pipes to the flues and retort inlet, a damper for closing said flue to the chimney, a flue leading from said flue to a slit in the roof of the fire grate of said furnace, a damper for closing or opening this flue, air-flues constructed to admit air to said slit, a combustion chamber above the roof of the fire grate, and communicating therewith through said slit and having openings communicating with the retort chamber, down flues from said chamber placed at the side of said air flues constructed for heating said air flues, substantially as set forth.

20. In an apparatus for manufacturing gas, the combination with a furnace having a flue constructed for communication with the chimney, and a fixing retort arranged in said furnace, of two generators having gas outlet pipes which communicate with both the furnace flue and the retort inlet, a four way valve controlling the passage through said gas outlet pipes to the flues, and retort inlet, means comprising a steam blower and an air cock for blowing up each of said generators and means for operating said air cock simultaneously with the operation of the four way valve, a damper for closing said flue to the chimney, a flue leading from said flue to a slit in the roof of the firegrate of said furnace, a damper for closing or opening this flue, air flues constructed to admit air to the flue, air flues constructed to admit air to said slit, a combustion chamber above the roof of the firegrate and communicating therewith through said slit and having openings communicating with the retort chambers, down flues from said chambers placed at the side of said air flues constructed for heating said air flues, substantially as set forth.

21. In an apparatus for manufacturing gas, the combination with a furnace containing a fixing retort, and a flue leading to the chimney, of two generators, means comprising a steam blower and an aircock for blowing up each of said generators an annular valve casing with the retort inlet and said flue and also with the gas outlet of each generator, a partitioned bell valve arranged in said valve casing over the mouth of the pipes therein, said valve having a hollow stem which projects down through the central opening of the valve casing a screw threaded shaft arranged in the hollow of said stem, a hand-wheel having a central screw threaded bush engaging with the screw threaded shaft below said tubular valve stem, a cotter fixed to said shaft and engaging vertical guide ways in the hollow-valve-stem, a gear wheel on said shaft below said valve stem, gear wheels on the spindles of the air cocks of the respective generators, said gear wheels on the air cock spindles engaging with the gear on said screw threaded shaft a handle on the same, a damper for closing said flue to the chimney, a flue leading from said flue to a slit in the roof of the firegrate of said furnace, damper for closing or opening this flue, air flues constructed to admit air to the flue, air-flues constructed to admit air to the slit, a combustion chamber above the roof of the fire grate and communicating therewith through said slit and having openings communicating with the retort chamber, down flues from said chamber placed at the side of said air flues constructed for heating said air flues substantially as set forth.

22. In an apparatus for manufacturing water oil gas the combination with a furnace containing a fixing retort and a flue leading to the chimney, of a generator having gas outlet constructed for communication with both the flue and with the inlet of the retort and a valve controlling the outlet from the generator to either said flue or inlet of the fixing retort, a damper for closing said flue to the chimney, a flue leading from said flue to a slit in the roof of the firegrate of said furnace, a damper for closing or opening this flue air flues constructed to admit air to the flue, air flues constructed to admit air to said slit, a combustion chamber above the roof of the fire grate and communicating therewith through said slit and having openings communicating with the retort chamber, down flues from said chamber placed at the side of said air flues, constructed for heating said air

flues, siphon tubes attached to said generator and the cover of the fixing retort, said siphon-tubes being provided on their outer ends with cups, dripcocks fixed above said cups, and an oil cistern having oil supply pipes connected to said drip cocks substantially as set forth.

23. In an apparatus for manufacturing water oil gas, the combination with a furnace having a flue constructed for communication with the chimney and a fixing retort arranged in said furnace of two generators having gas outlet pipes which communicate with both the flue of the furnace and the inlet of the retort therein, a fourway valve controlling the passage through said gas outlet pipes to the flue and retort inlet, a damper for closing said flue to the chimney, a flue leading from said flue to a slit in the roof of the firegrate of said furnace, a damper for closing or opening this flue, air flues constructed to admit air to the flues, airflues constructed to admit air to said slit, a combustion chamber above the roof of the firegrate and communicating therewith through said slit and having openings communicating with the retort chamber, down flues from said chamber placed at the side of said air flues constructed for heating said air flues, siphon tubes attached to said generators, and the cover of the fixing retort, said siphon tubes being provided on their outer ends with cups, drip cocks fixed above said cups and an oil cistern having oil supply pipes connected to said drip cocks substantially as set forth.

24. In an apparatus for manufacturing gas, the combination with a furnace having a flue constructed for communication with the chimney, and a fixing retort arranged in said furnace, of two generators having gas outlet pipes which communicate with both the furnace flue and the retort inlet, a four way valve controlling the passage through said gas outlet pipes to the flue and retort inlet, means comprising a steam blower and an aircock for blowing up each of said generators and means for operating said aircocks simultaneously with the operation of the two way valve, a damper for closing said flue to the chimney, a flue leading from said flue to a slit in the roof of the firegrate of said furnace a damper for closing or opening this flue, airflues constructed to admit air to the flue, air flues constructed to admit air to said slit, a combustion chamber above the roof of the firegrate and communicating therewith through said slit and having openings communicating with the retort chamber, down flues from said chamber placed at the side of said air flues constructed for heating said air flues, siphon tubes attached to said generators and the covers of the fixing retort, said siphon tubes being provided on their outer ends with cups, drip cocks fixed above said cups and an oil cistern having oil supply pipes connected to said drip cocks substantially as set forth.

25. In anapparatus for manufacturing gas, the combination with a furnace containing a fixing retort and a flue leading to the chimney of two generators, means comprising a steam blower, and an air cock for blowing up each of said generators an annular valve casing, pipes connecting the interior of the valve casing with the retort inlet and said flue, and also with the gas outlet of each generator, a partitioned bell valve arranged in said valve casing over the mouths of the pipes therein, said valve having a hollow stem which projects down through the central opening of the valve casing, a screw threaded shaft arranged in the hollow of said stem a hand-wheel having a central screw threaded bush engaging with the screw threaded shaft below said tubular valve stem a cotter fixed to said shaft and engaging vertical guide ways in the hollow valve stem, a gear wheel on said shaft below said valve stem, gear wheels on the spindles of the air cocks of the respective generators, said gear wheels on the air cocks spindles engaging with the gear on said screw threaded shaft, a handle on the same, a damper for closing said flue to the chimney a flue leading from said flue to a slit in the roof of the firegrate of said furnace, a damper for closing or opening this flue, air flues constructed to admit air to the flue, air flues constructed to admit air to the slit, a combustion chamber above the roof of the firegrate and communicating therewith through said slit and having openings communicating with the retort chamber, down flues from said chamber placed at the side of said air flues constructed for heating said air flues, siphon tubes attached to said generators and the cover of the fixing retort, said siphon tubes being provided on their outer ends with cups, dripcocks fixed above said cups and an oil cistern having oil supply pipes connected to said dripcocks substantially as set forth.

26. In a water-oil gas plant the combination with two generators A of tuyere D fitted with steam blowers D′, and air cocks E, steam pipes *f*, connected to steam blower, and to steam pipe F, from boiler G, wheels E′ C′ connecting air cocks to spindle C^2, a handle C fixed on spindle a handwheel C^3 forming a nut on screw part of spindle C^2 a four way valve consisting of tank B with pipes a^2, a^3, b', o', and bell B′, with partition B^2 a tubular sleeve B^5, attached to bell B′, and resting on hand wheel C^3, and connected to the spindle C^2 by a cotter C^4; pipes *a* and *a′*, connecting the generator to the fourway valve, check valve B^2, connecting bell B′, with range of pipes *b*, pipes *c* connecting them to the retorts *e*, pipes e^6, connecting pipe *c′*, to flue *o* leading to chimney, and oil cistern J, with pipes *r r′*, fitted with drip cocks supplying oil to the generators and pipes *r* r^2 fitted with drip cocks supplying oil to the retorts *e* substantially as and for the purposes set forth.

27. In a water oil gas plant the combination with two generators A of tuyeres D, fitted with steam blowers D′, and air cock E steam pipes F, from boiler G, wheels E′, C′, con-

necting air cocks to spindle C^2, a handle C, fixed thereon a handwheel C^3, forming a nut on a screwed part of spindle C^2, a hydraulic four way valve B, with bell B′, and sleeve B^5, attached to said bell and resting on handwheel C^3, and connected by a cotter to spindle C^2, pipes connecting the generators to the four-way valve check valves b^2, connecting pipe b', with pipes b, pipes C, connecting these with retorts e, a retort chamber containing flue o connected to the fourway valve, dampers p', p^2, smoke flues o^2, o^3, air flues o^5, with inlets o^4, air flues g^4, with inlet g^3, smoke flues f^3 and f^4, retort furnaces with grates g, and roof containing slit g^2, and combustion chamber g^5, an oil cistern J, with pipes supplying the generators as well as the retorts through drip cocks, substantially as and for the purposes set forth.

28. In an apparatus for manufacturing water oil gas the combination with a furnace containing fixing retorts, and a flue adjacent to said retorts and communicating with the chimney, of a generator having a gas outlet pipe constructed for communication with both the flue and the inlets of the retorts, and a two way valve controlling the outlet from the generator to either said flue or inlets of the fixing retorts, and means for supplying both the generator and the retorts with oil substantially as set forth.

29. In an apparatus for manufacturing gas, the combination with a furnace having a flue constructed to communicate with the chimney and a fixing retort arranged in said furnace of two generators having gas outlet pipes which communicate with both the flue of the furnace and the inlet of the retort therein, a four way valve controlling the passage through said gas outlet pipe to the flue and retort inlet, siphon tubes attached to said generators and a cover of the fixing retorts said siphon tubes being provided with cups, drip cocks fixed above said cups, and an oil cistern having oil supply pipes connected to said drip cocks, fixed above said cups and supplied with oil substantially as set forth.

In testimony whereof I have hereto set my hand in presence of two witnesses.

HENRY FOURNESS.

Witnesses:
C. BOLLÉ,
W. A. FOURNESS.