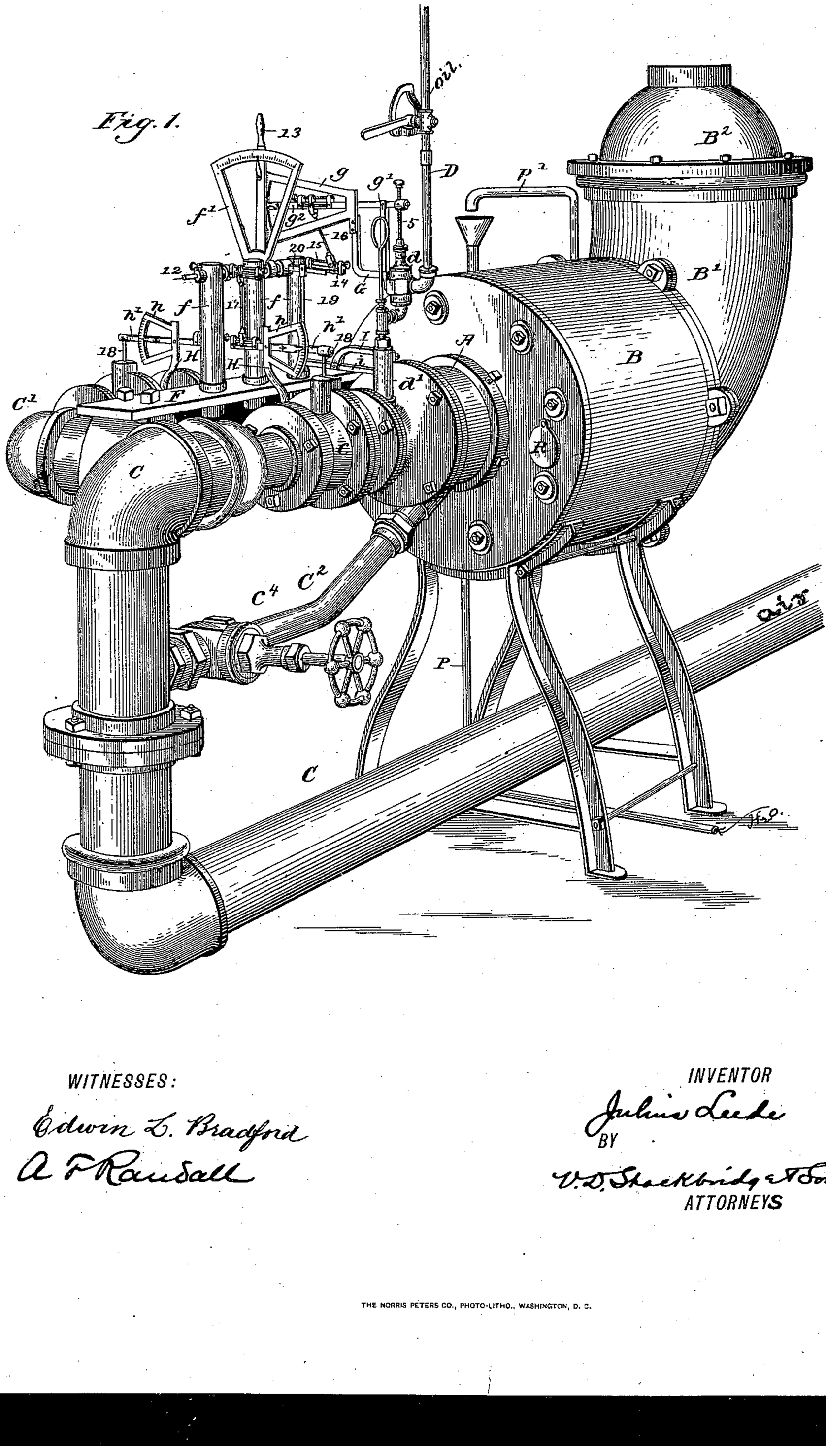
(No Model.) 3 Sheets—Sheet 1.

J. LEEDE.

PROCESS OF AND APPARATUS FOR MAKING GAS.

No. 471,671. Patented Mar. 29, 1892.

Fig. 1.



WITNESSES:

Edwin L. Bradford

A. F. Randall

INVENTOR

Julius Leede

BY

V. D. Shackbridge & Son.

ATTORNEYS

(No Model.) 3 Sheets—Sheet 2.

J. LEEDE.

PROCESS OF AND APPARATUS FOR MAKING GAS.

No. 471,671. Patented Mar. 29, 1892.

Fig. 2.

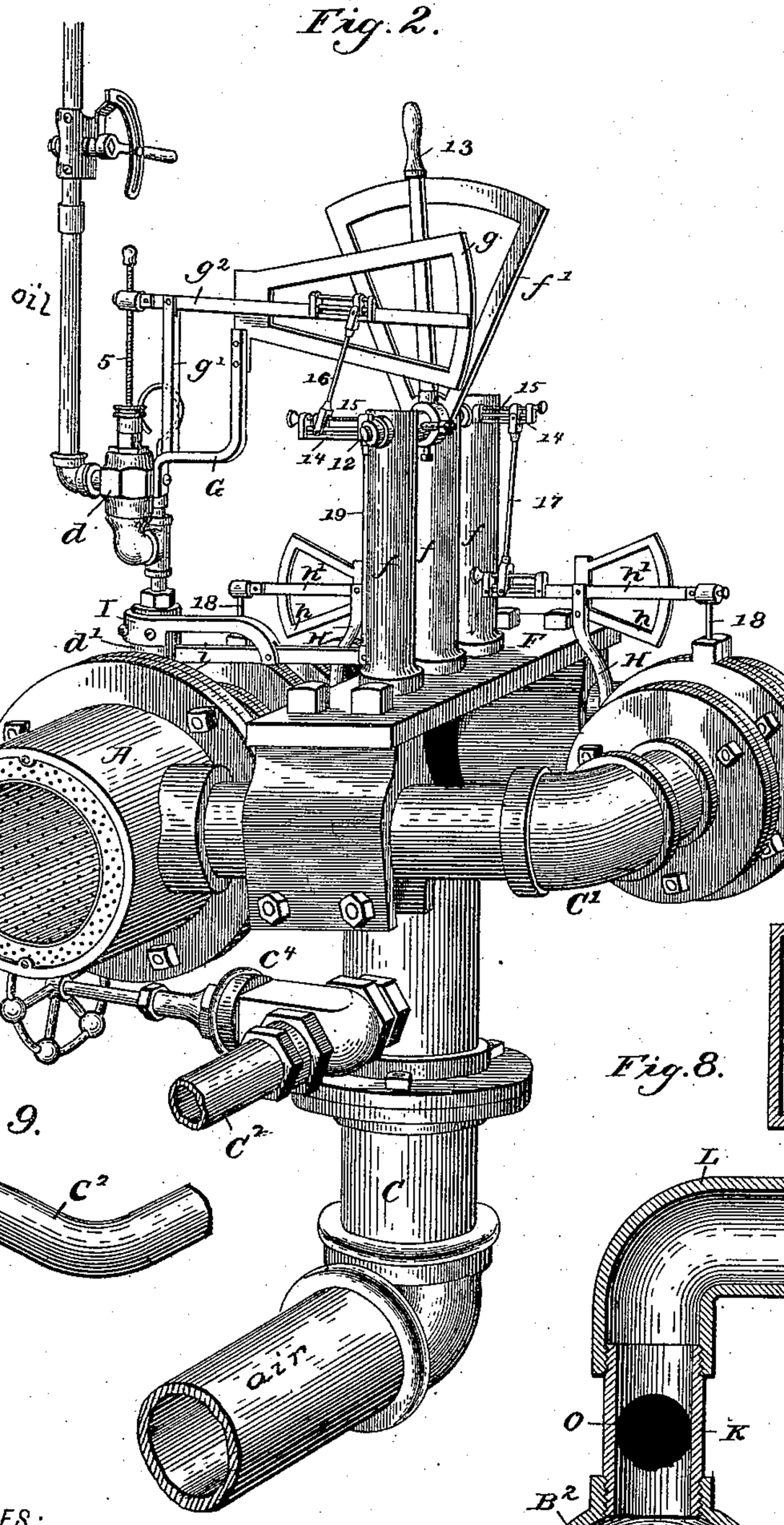
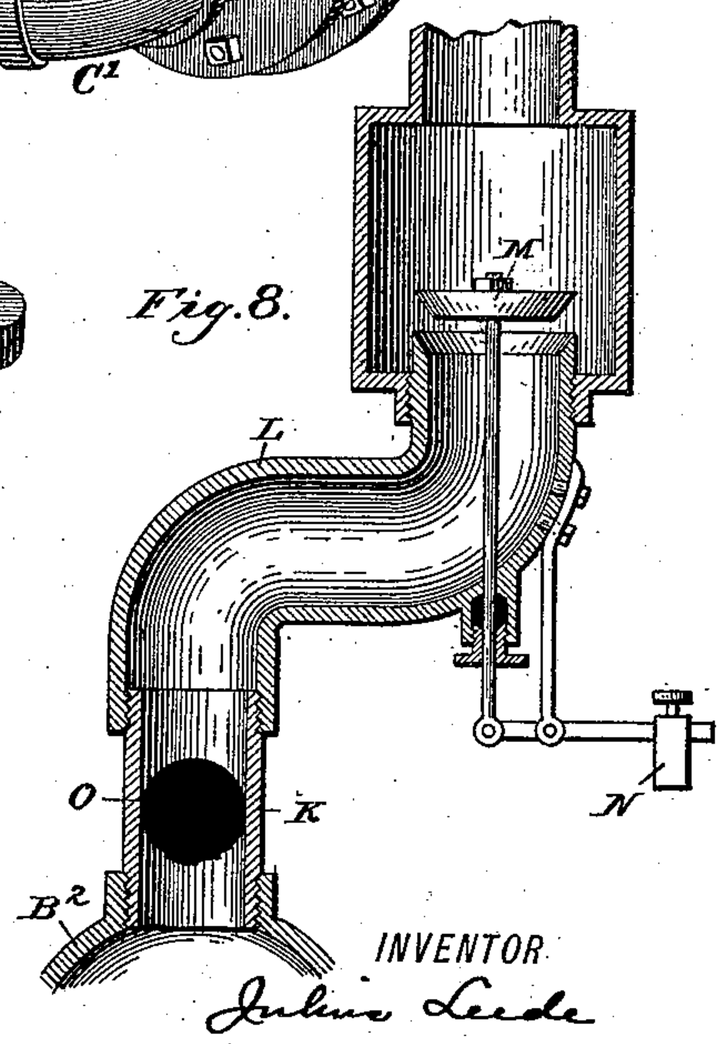


Fig. 9.

Fig. 8.



WITNESSES:

Edwin L. Bradford

A F Randall

INVENTOR

Julius Leede

BY

V. D. Shackbridge & Son.

ATTORNEYS

(No Model.) 3 Sheets—Sheet 3.

J. LEEDE.

PROCESS OF AND APPARATUS FOR MAKING GAS.

No. 471,671. Patented Mar. 29, 1892.

Fig. 3.

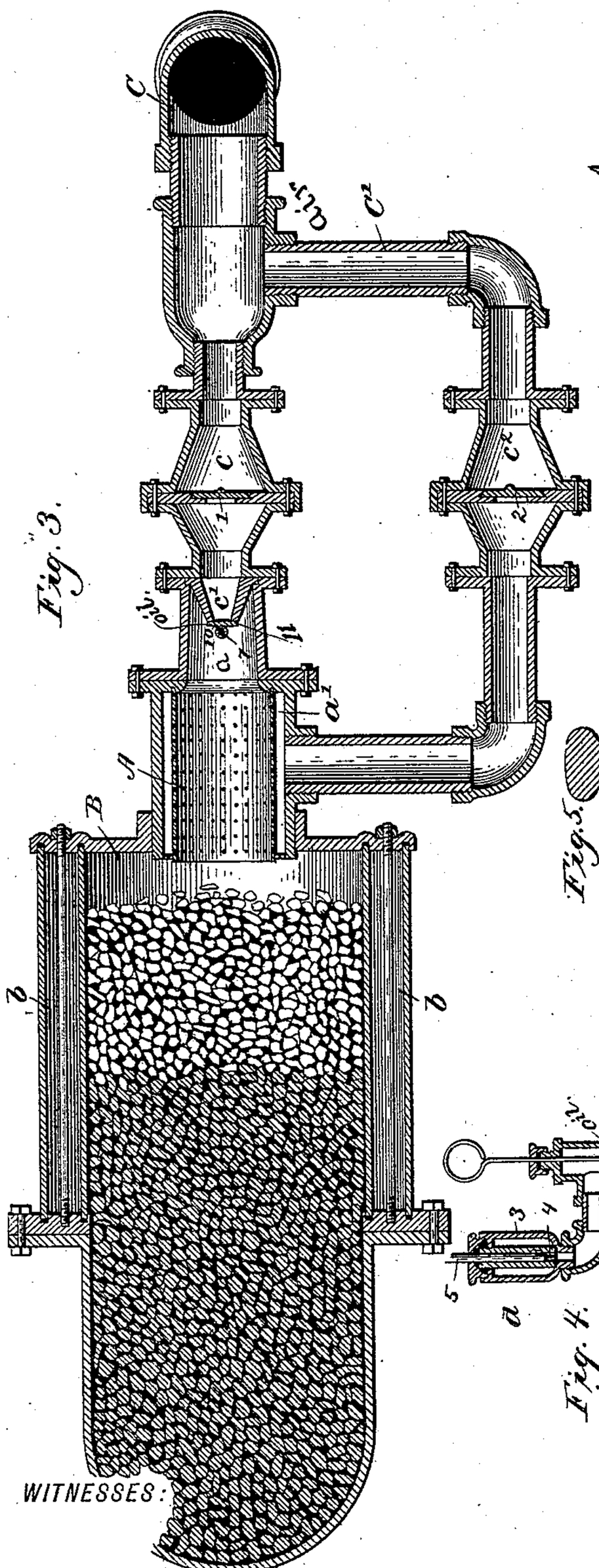


Fig. 5.

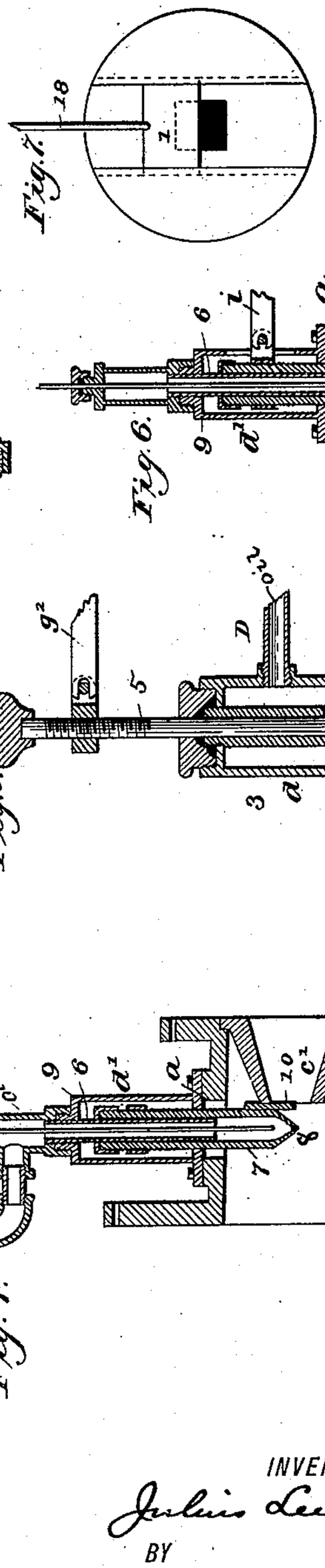
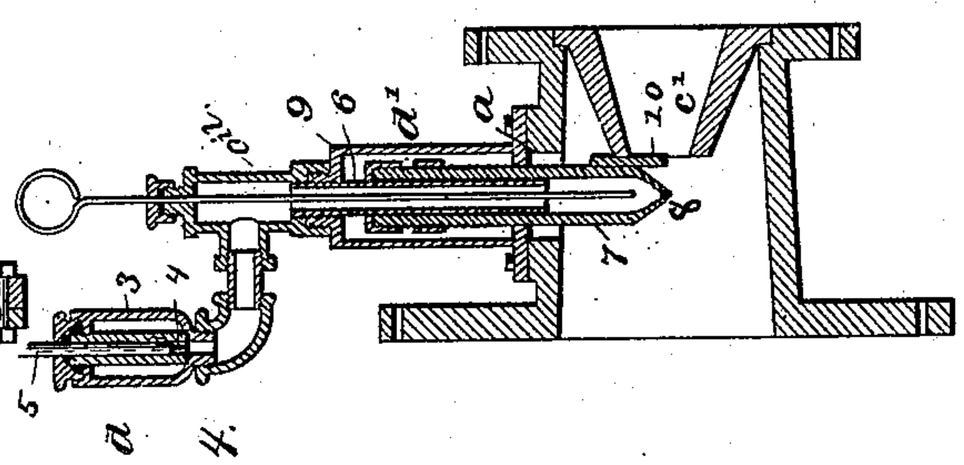


Fig. 6.

Fig. 4.



WITNESSES:

Edwin L. Bradford

A. F. Randall

INVENTOR

Julius Leede

BY

V. S. Stackbridge & Son.

ATTORNEYS

UNITED STATES PATENT OFFICE.

JULIUS LEEDE, OF MINNEAPOLIS, MINNESOTA.

PROCESS OF AND APPARATUS FOR MAKING GAS.

SPECIFICATION forming part of Letters Patent No. 471,671, dated March 29, 1892.

Application filed December 20, 1890. Serial No. 375,370. (No model.)

To all whom it may concern:

Be it known that I, JULIUS LEEDE, a citizen of the United States, residing in the city of Minneapolis, Hennepin county, Minnesota, have invented certain new and useful Improvements in Processes of and Apparatus for Making Gas; and I do declare that the following is a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to a new and useful improvement in the processes and apparatus for making combustible gas.

The primary object of my invention is to produce fuel and other gas in relatively small quantities continuously, conveniently, and economically. In the effort to attain this end I have discovered that by injecting the flame of burning fuel surcharged with carbon against a mass of incandescent refractory material and passing the resultant products thereof through or over said mass there is produced a combustible gas which may be conducted away to holder or to service. Under this process there can be obtained "producer gas," or a more highly carbureted product suitable for illuminating purposes merely by regulating the volume of fuel with relation to the air supplied to support combustion.

In the drawings I have shown a preferred form of apparatus for carrying out my new process, and which involves certain points of novelty hereinafter fully described and claimed.

Figure 1 is a perspective of the apparatus. Fig. 2 is also a perspective looking in the direction opposite that in Fig. 1, a part being removed to show the front of the primary combustion-chamber. Fig. 3 is a central horizontal section through the apparatus. Fig. 4 is a section through the oil-valve, oil-nozzle, and blast-nozzle. Fig. 5 is an enlarged section through the oil-valve. Fig. 6 is an enlarged section of the oil-nozzle on a line at right angles to the section in Fig. 4. Fig. 7 is an elevation of one of the valve-plates in the air-ducts. Fig. 8 is a section of a chimney-flue valve and take-off, and Fig. 9 is a perspective showing nozzle of pipe C^2.

A is a primary combustion-chamber; B a, supplemental combustion and heating chamber; C, an air duct or pipe; C′ and C^2, branches thereof, and D is an oil-supply pipe.

The first combustion-chamber A is by preference made cylindrical and arranged horizontally. The inside wall and an annulus at the front is perforated, as shown in Figs. 2 and 3, and around this inner wall is a casing arranged to leave an annular chamber a' between the inner and outer walls.

The supplemental combustion and heating chamber B is connected with the front end of the primary chamber, and by preference is of a diameter about three times as great as that of chamber A, and in length is equal to about one and one-half diameter. This chamber is provided with or has surrounding it a water-jacket b, as shown, and to its front there is secured an elbow or uptake B′, of about the same diameter as the chamber. A reducer B^2 is connected to the uptake, through which and a connected pipe the gases generated within the apparatus are conducted to holder or service in the usual way. Obviously the products may be passed through washer and purifier before storage or consumption without departing from my invention.

The chamber B is partially filled with broken fire-brick or other refractory material beginning in a relatively thin layer next the chamber A and increasing so as to fill the outer end at its junction with the uptake B′, the latter being also partially or wholly filled with this material.

The air-duct C leads from a blower or other source of air-supply under pressure through valve-chamber c to blast-nozzle c', where it is discharged through the mouth a to primary combustion-chamber A. The branch C′ leads from the main pipe behind the valve-chamber c, through valve-chamber c^2, to the annular chamber a', around the combustion-chamber A. Branch C^2 leads from the main pipe into the rear end of chamber B at a point below and next to the outer wall of chamber A, the nozzle or discharge-orifice c^3 being crescent-shaped, as shown in Fig. 9. A cock or valve c^4 is adjusted in this branch for regulating the blast therethrough.

The oil-supply pipe D leads from suitable reservoir or source of supply, through oil-valve

d and oil-nozzle d' to a position in front of the blast-nozzle c' in the mouth a of combustion-chamber A.

The blast through pipe C and its branches and the oil through pipe D, valve d, and nozzle d' being started and the oil ignited, the operation will be as follows: The oil will first be sprayed by the blast from the nozzle c', combustion will begin, the air through branch C′ will pass into the annular chamber a', and thence inwardly through the perforations and thereby tend to check the forward impulse due to the blast through nozzle c' and hold or retard the movement of the vapors and products of combustion in chamber A, and will furnish oxygen to support further combustion, the air through branch C^2 will impinge against the volume of gases and vapors issuing from chamber A and spray whatever of liquid may be mixed with the volume and furnish oxygen for still further combustion. This operation being continued the refractory material in chamber B and uptake B′ will soon become incandescent. While the refractory material is being heated the flow of oil is regulated to the blast or the blast to the oil, so as to secure substantially complete combustion, and the products of such combustion are conducted away through a chimney-flue, as E, Fig. 8. When the refractory material has become heated to incandescence—say in about fifteen minutes—the relation between the supply of oil and the blast is changed to augment the relative proportion of oil, so that complete or perfect combustion of all the carbon of the fuel will not take place in the chambers A and B. The products of this incomplete oxidation or combustion, as carbonic-acid gas, carbon and other vapors are forced over and through the incandescent refractory material the carbonic acid is reduced to carbonic oxide and the entire product is taken off in any of the usual ways to holder or service. This operation may be continued indefinitely simply by keeping up the supply of fuel and the blast, the heat from combustion in the chambers A and B being sufficient to maintain incandescence in the refractory material. It is also possible to so far enrich this product by the introduction of a relatively greater amount of oil as to produce an illuminating-gas.

In carrying out my process practically I have found that it is very desirable to be able to nicely adjust every movable part of the apparatus with relation to the stationary parts and with relation to each other, and also to so regulate and operate them as to move some of the parts a greater relative distance than the others.

In the valve-chambers c and c^2 I arrange valve or cut-offs 1 and 2, respectively. These valves or cut-offs reciprocate in dovetail grooves (shown in Fig. 3) to enlarge and contract ports in the diaphragms of the valve-chambers, one of which is shown in elevation, Fig. 7. The oil is admitted through a regulating-valve d and nozzle d'. (Shown in Figs. 4, 5, and 6.) The oil-valve consists of a gland 3, to which the feed-pipe D leads, a tubular part provided with a slit or elongated narrow port 4 within said gland, and a central stem or plunger 5. The joints between gland and tube and between tube and plunger are stuffed in any suitable way. The valve is connected with the nozzle by an elbow or angle-coupling, as shown in Fig. 4. The nozzle consists of a central tube 6 and a movable tube 7, the latter having a narrow slit or port 8 at its lower end. The movable tube is supported and slides up and down on the central tube 6, which is supported in a riser 9, bolted to the mouth a above the blast-nozzle. Attached to the rear side of the movable part of the nozzle is a plate or cut-off 10. The bottom of this plate and the mouth of the oil-nozzle are coincident, and they are arranged in front of and opposite the blast-nozzle c'. The adjustment of the oil-nozzle involves the adjustment of the plate and insures that the blast will directly impinge the thin sheet of oil as it issues from its nozzle. Within the central tube I arrange a stem having a thin plate 11 at its lower end which serves as a clearer to keep the oil-nozzle free from deposits of any kind.

Upon and over the pipe C and its branches is mounted a table or platform F, and upon this platform are mounted risers or standards $f\,f\,f$, one of which carries a scale f', and all of which carry a rock-shaft 12, operated by lever 13. The rock-shaft carries laterally-extending arms 14 14, each of which has mounted on it a movable block adjustable to a greater or less distance from the axis of the rock-shaft by means of screw 15. A bracket G, mounted on valve d or other support, carries a scale g and a vertical branch g', which supports a lever g^2, one end of which is attached to the valve-piston 5 and the other operatively coupled with one of the arms 14 by a link-rod 16. The lever g^2 also carries an adjustable block similar to those on arms 14. Other brackets H H support scales $h\,h$ and vibrating levers $h'\,h'$. These levers are coupled through links 17 17 with arms 14 on the rock-shaft, and through rods 18 18 with valves 1 and 2 in the valve-chambers c and c^2, respectively. Another bracket I, attached to the support of the oil-nozzle d' or other point carries a lever i, one end of which connects with the movable tube 7 of the oil-nozzle and the other end with the rock-shaft through link 19 and lateral arm 20.

K is a T-coupling connected with reducer B^2; L, an elbow, M a valve mounted in the elbow, and N a weight to balance the valve, when desired.

When heating up the apparatus at the beginning, the weight N is adjusted, as shown, to permit the escape of the products of combustion through the chimney-flue. When combustible gas is being generated, the weight is moved inward, when the valve closes by

gravity and the products are conducted away through passage O. The water-jacket is supplied through pipe P at the bottom and released through pipe P′ at the top. The pipe P′ discharges into funnel or receptacle from whence the heated water is conducted as feed-water to a boiler or to other use, as may be desired. The movable adjustable blocks on the arms 14 14, projecting from the rock-shaft and on the levers g^2 and h' h', afford convenient means for adjusting the relative movement of the oil-valve and the air-valves 1 and 2 in valve-chambers C and C^2. All these parts and the oil-nozzle, with attached valve-plate 10, are connected with the rock-shaft through links and arms, described, so as to be simultaneously operated. By changing the position of the movable blocks on the arms 14 14 or levers g^2 and h' h' the movement of each can be regulated to the exact range required to give the results desired. With oils having different constituents I have found that different proportions of air are required, and it is frequently desirable to change the relative amount of air admitted through the several branches of the air-duct. The volume of air for vaporization through valve 1 and air-nozzle c' and that through valve 2 and annular chamber a' may be regulated to a given volume of oil by hand; but the increase or decrease in the amount of oil used requires a differential movement of the air-valves 1 and 2, and this difference varies somewhat with the character of oil used. Hence the importance of the delicate means of adjustment of these devices. The piston 5 of the oil-valve is separately adjustable within the central tube through its screw-spindle.

R is a valve or door at the rear end of supplemental combustion and heating chamber, through which a torch may be introduced for igniting the vapors or gases when starting the apparatus.

Having now described my invention, what I claim is—

1. The process herein described of producing combustible gas, which consists in raising a mass of refractory material to incandescence by passing through said mass the products of approximately complete combustion of fuel and then changing the relative volumes of carbon and air to produce imperfect combustion and passing said products through said incandescent mass, substantially as described.

2. The combination of a primary combustion-chamber having air-inlet ports around its sides and separate port in one end, means, as an oil-pipe, for supplying oil to said chamber, an enlarged supplemental combustion and heating chamber partially filled with refractory material, and means, as pipes and air under pressure, for forcing air into the primary chamber through its passages and to said enlarged chamber, substantially as described.

3. The combination of a primary combustion-chamber having side air-inlet passages and separate end inlet, an oil-supply pipe, a supplemental combustion and heating chamber, means for forcing air into the primary chamber and into said supplemental chamber adjacent to the primary chamber, an uptake filled with refractory material, and a discharge-pipe for conducting the product from the apparatus, substantially as described.

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

JULIUS LEEDE.

Witnesses:
A. F. RANDALL,
V. D. STOCKBRIDGE.