

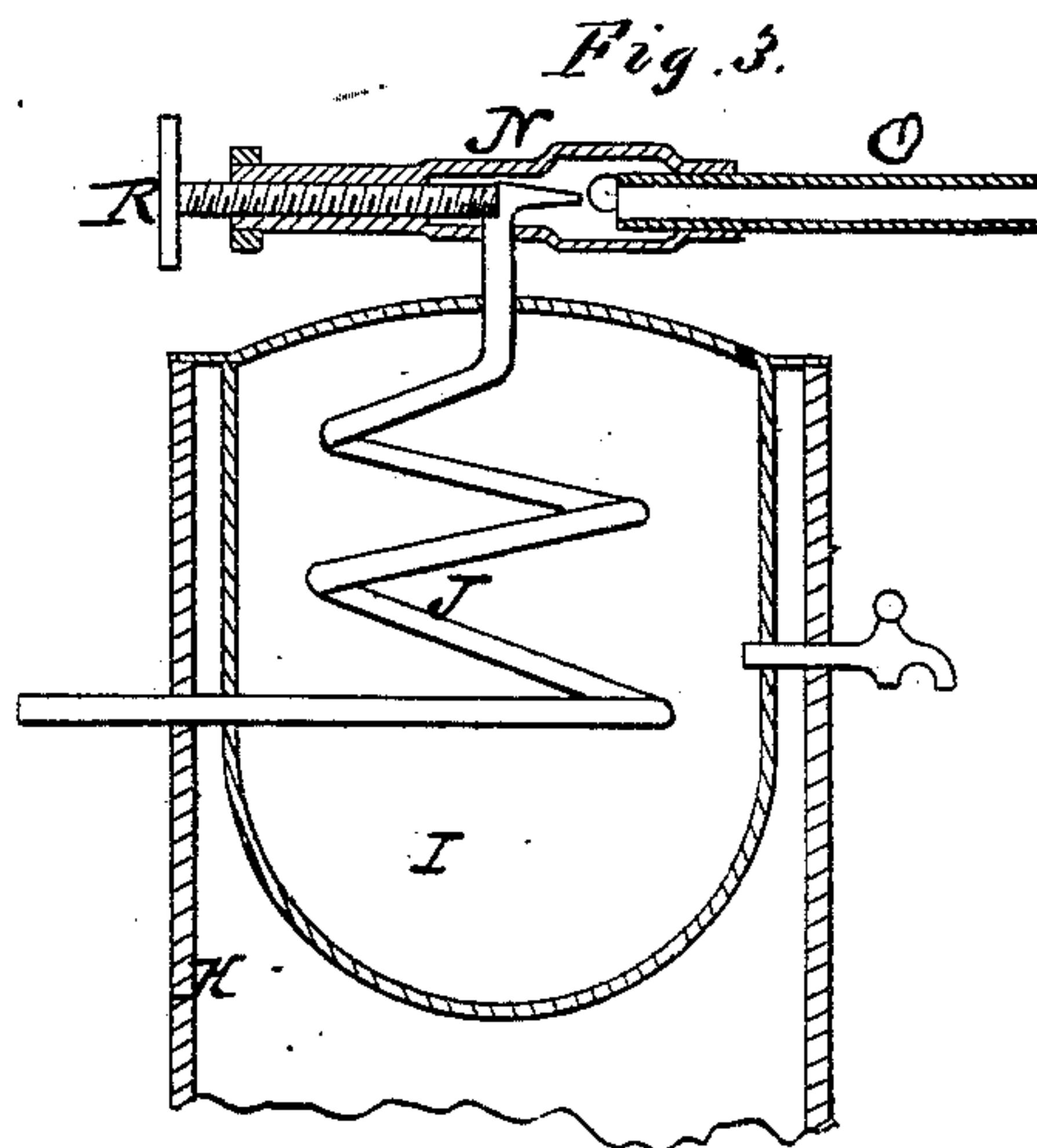
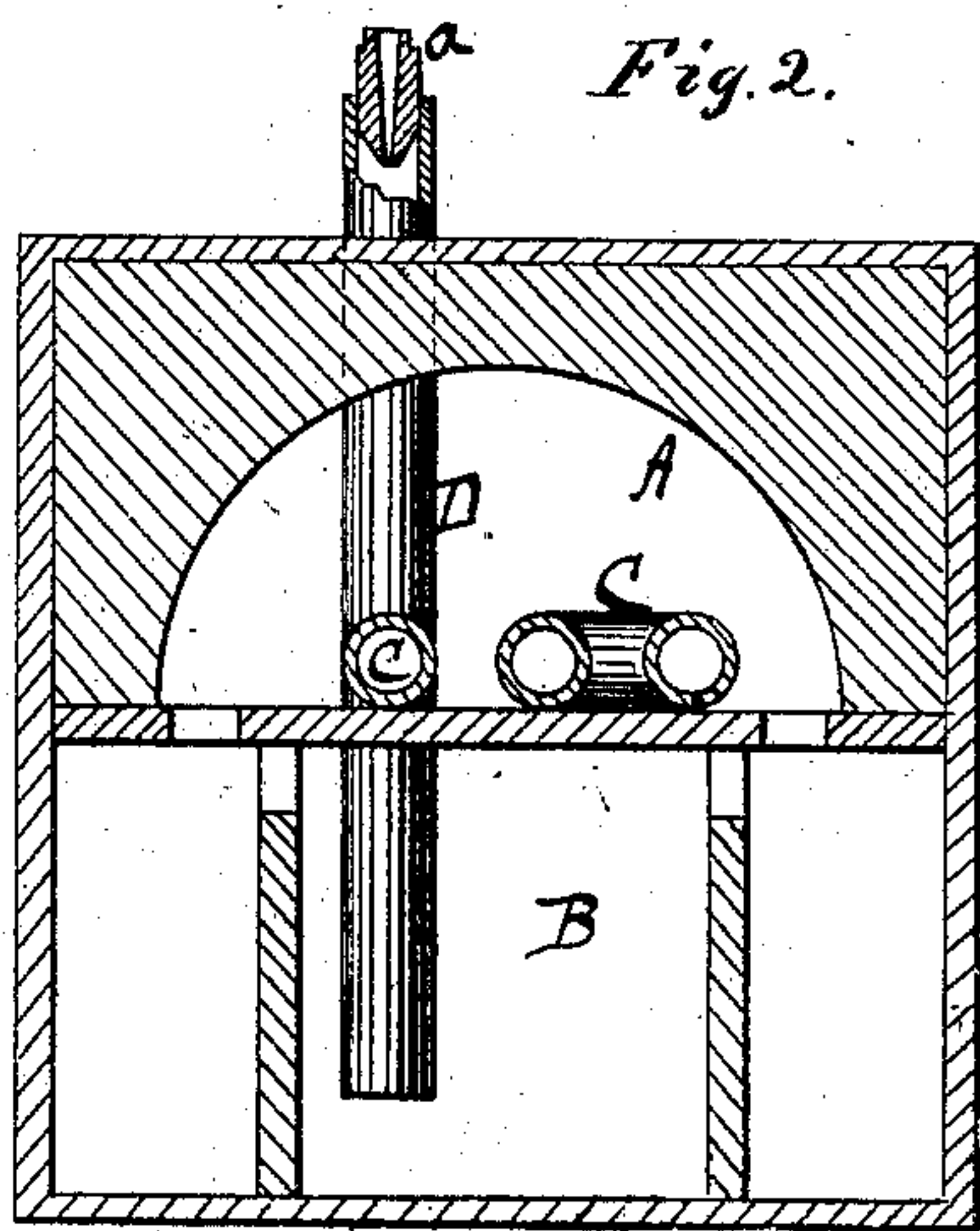
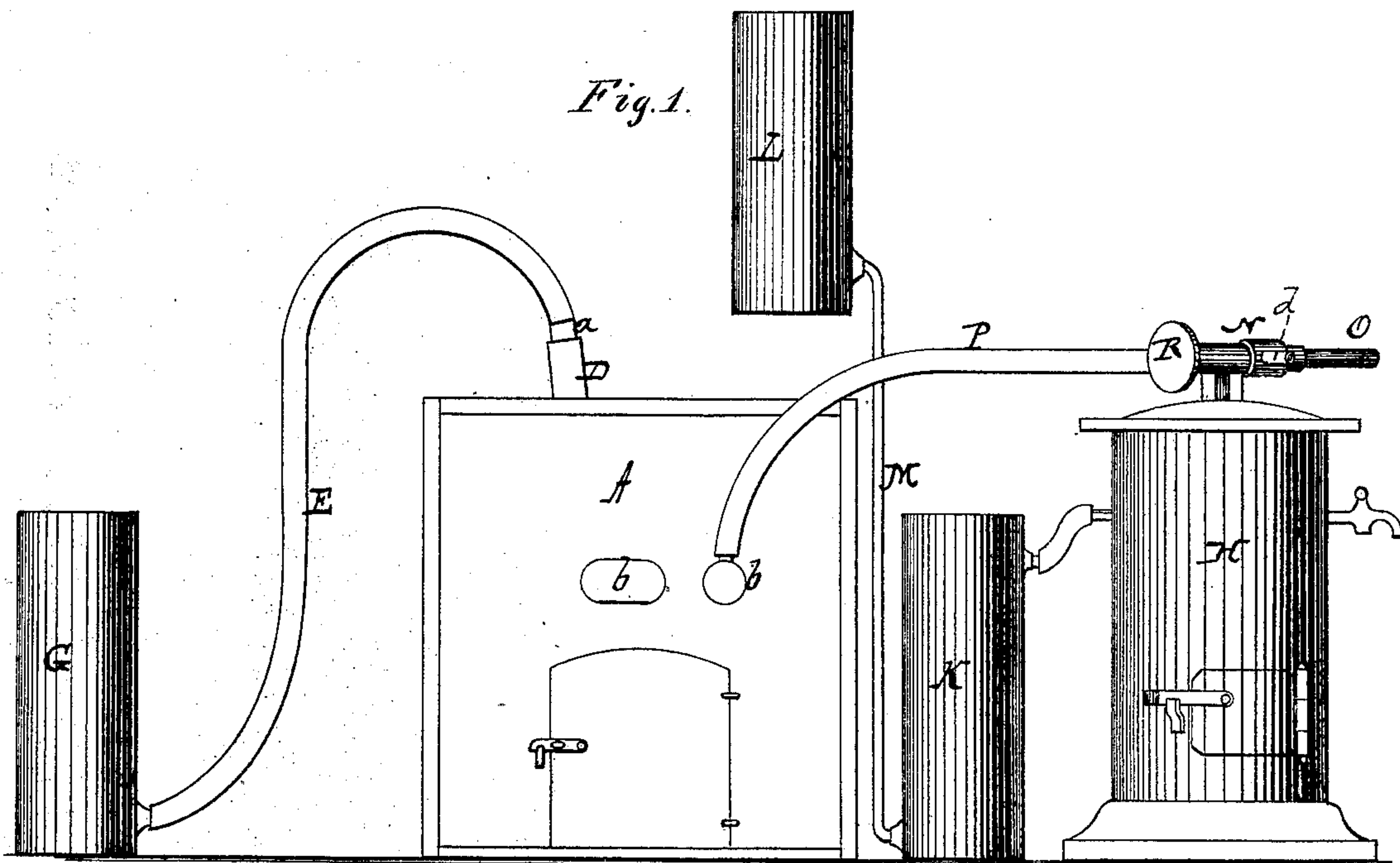
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THEODORE G. SPRINGER.

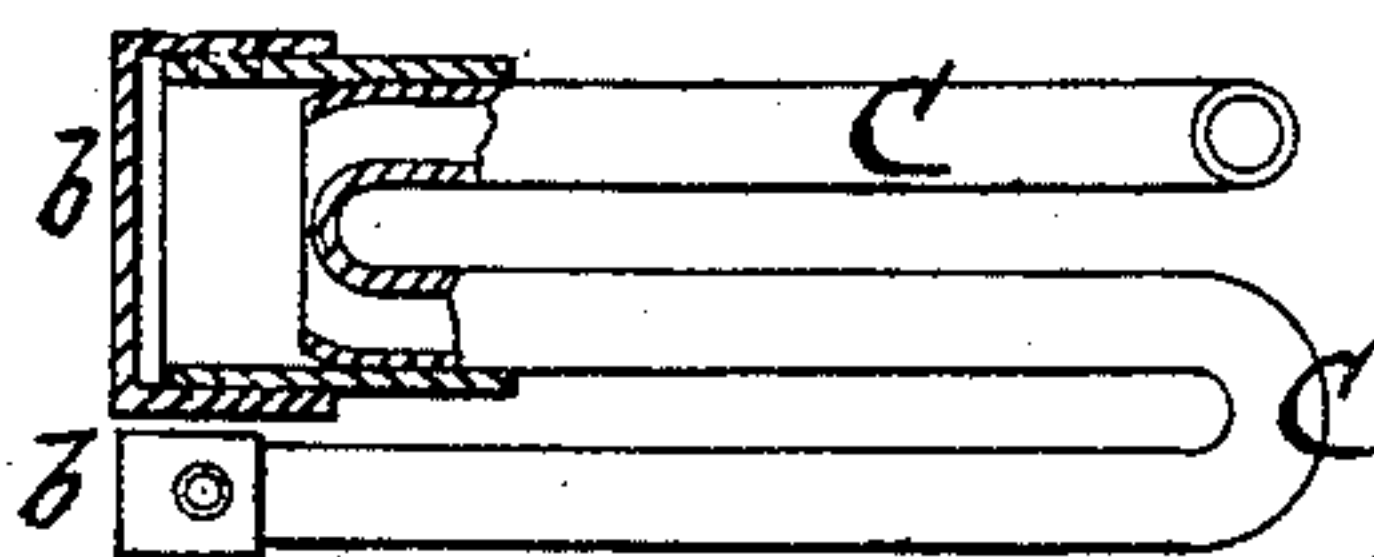
Improvement in the Manufacture of Illuminating Gas.

No. 121,679.

Patented Dec. 5, 1871.



*Fig. 4.*



Witnesses:

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# UNITED STATES PATENT OFFICE.

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## IMPROVEMENT IN THE MANUFACTURE OF ILLUMINATING-GAS.

Specification forming part of Letters Patent No. 121,679, dated December 5, 1871.

*To all whom it may concern:*

Be it known that I, THEODORE G. SPRINGER, of Fayette City, in the county of Fayette and in the State of Pennsylvania, have invented certain new and useful Improvements in Illuminating-Gas; and do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawing and to the letters of reference marked thereon making a part of this specification.

My invention relates to that class of processes and apparatus for the manufacture of illuminating-gas where hydrocarbon liquids are used as the material from which the gas is principally formed; and the nature of my invention consists in an illuminating-gas formed by the automatic admixture or combination of a fixed gas or carbureted hydrogen and a vapor gas or carbureted air. It also consists in the process for forming the fixed gas from hydrocarbon liquids and the process for automatically mixing or combining the same with vapor-gas; and my invention, lastly, consists in the construction of the apparatus or means whereby my process is carried into operation, all of which will be hereinafter more fully set forth.

In order to enable others skilled in the art to which my invention appertains to make and use the same, I will now proceed to describe the construction and operation of my apparatus and the manner in which my process is or may be carried into effect, referring to the annexed drawing, in which—

Figure 1 is a front elevation of my entire apparatus. Fig. 2 is a vertical section of the furnace in which the fixed gas is made. Fig. 3 is an enlarged vertical section of the furnace and retort in which the vapor-gas is formed, with a longitudinal vertical section of the apparatus for mixing the fixed and vapor gases; and Fig. 4 is a plan view, part in section, of the retort in which the fixed gas is completed before mixing with the vapor-gas.

A represents a furnace constructed in substantially the same manner as is usually done for the manufacture of coal-gas, with a fire-box, B, underneath, the flames and heat from the fire-box passing up the sides of the arch of the furnace through the vents or openings, as shown in Fig. 2. In the furnace A is located a retort or tortuous tube, C, one end of which communicates

with a vertical pipe, D, said pipe passing through the furnace and as far down in the fire-box as may be desired, the lower end of the pipe being closed. In the upper end of the pipe D is inserted a nozzle, *a*, having a very small orifice, through which the hydrocarbon liquid is fed into the pipe D. The hydrocarbon liquid is contained in the tank G, which is connected with the nozzle *a* by a flexible or other tube, E. The liquid may be forced, by pressure or otherwise, from the tank G through the tube and nozzle into the vertical pipe D. It comes out through the orifice in the nozzle in drops, and each drop as it falls from the nozzle goes down in the center of the pipe D without touching the sides of this pipe. The pipe D forming a part of the retort being heated to the required degree, the drop of hydrocarbon liquid is, during its passage down said pipe, expanded and transformed into gas before it reaches the bottom of the pipe. The gas thus formed is drawn by suction through the remaining part of the retort C, and during its passage through said retort any particles of the hydrocarbon liquid which while in the pipe D may not have been completely transformed into fixed gas are thus transformed. The suction necessary to draw the gas (carbureted hydrogen) through the retort C is created by means that will be hereinafter described. The outer end of the retort C, as well as the curves of the same at the front side of the furnace, are provided with caps *b* projecting through the front side of the furnace for the purpose of cleaning out the retort when necessary. H represents another furnace, in which is an ordinary retort, I, to be filled or partially filled with water. Through this retort passes a coil pipe, J, one end of which passes up through the top of the retort and the other end through the side of the retort and furnace, and this end of the coil is, by a flexible or other pipe, connected with a tank, K, at or near its upper end. This tank contains hydrocarbon liquid, which is fed up through the coil J by hydraulic pressure, a water-tank, L, being elevated to any suitable height above the other tank and furnace and connected by a pipe, M, with the hydrocarbon-tank K, said pipe M entering both of said tanks at or near their lower ends, as shown in Fig. 1. The liquid may be fed by other means, if so desired. By this means the hydrocarbon-liquid is fed at equal pressure through the coil J in the retort I, where it is con-



verted into vapor, and this vapor passes through a very small orifice in the upper end of the coil into the mixing-tube N. Directly opposite this orifice in the end of the coil, and inserted in the mixing-tube, is a pipe, O, the inner diameter of which should be about thirty-six times larger than that of said orifice. The vapor passing through this orifice and into the pipe O creates a suction to draw in the atmospheric air through a tube or opening, *d*, which enters the mixing-tube N between the end of the coil and the end of the pipe O, thus mixing the hydrocarbon vapor with the atmospheric air, forming vapor-gas or carbureted air. But at the same time as the suction is formed to draw in atmospheric air suction is also by the same means formed to draw the fixed gas—carbureted hydrogen—formed in the pipe D and retort C through a tube, P, into the mixing-tube, said tube P entering the mixing-tube directly opposite the tube-opening *d* through which the atmospheric air is drawn, thus mixing the carbureted hydrogen with the carbureted air, producing a superior illuminating-gas, which is conducted through the pipe O to the gas-holder. In the mixing-tube N is a screw, R, by which to regulate the flow of vapor through the coil J.

My process for making this illuminating-gas thus consists of three separate operations: First, the making of a fixed gas—carbureted hydrogen; second, the making of a vapor-gas—carbureted air; and third, the mixing or combining the two gases into one. The fixed gas is made by feeding the hydrocarbon liquid directly into a red-hot retort, or a retort heated to the necessary degree. Hitherto it has been considered that by feeding the hydrocarbon liquid directly into the retort destructive distillation would ensue; and so it does, if no means were provided for the removal of the gas as rapidly as it is formed. Hence it has been the custom to convert the hydrocarbon liquid into vapor first and then feeding the vapor to the retort or surface. But by the suction from the mixing-tube a vacuum or partial vacuum is formed in the retort, so that the gas is withdrawn from the same almost as fast as it is created, thereby preventing destructive distillation, and thus enabling me to feed the liquid direct into the retort without first converting it into vapor. By mixing the fixed gas or carbureted hydrogen with the vapor-gas or carbureted air an illuminating-gas is formed which

I have found by practical experiments to be far superior to those heretofore used.

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

1. Feeding hydrocarbon liquids into a vacuum or partial vacuum formed in a retort heated to a sufficient degree to decompose the liquid and form a fixed gas, substantially for the purposes herein set forth.
2. Feeding hydrocarbon liquids directly into a vacuum or partial vacuum formed in a retort heated to a sufficient degree to decompose the liquid and form a fixed gas, and withdrawing said fixed gas from the retort in the same ratio as the liquid is fed in, by means of a vacuum or partial vacuum created and maintained in the retort by continual suction, substantially as herein set forth.
3. In a decomposing-chamber or retort heated sufficiently hot to convert hydrocarbon liquids into a fixed gas, producing a vacuum or partial vacuum, and continuing the same while the liquids are being introduced, by creating a constant suction on said chamber or retort, substantially for the purposes herein set forth.
4. Feeding hydrocarbon liquid to a gas-retort by hydraulic pressure, substantially as herein set forth.
5. The combination of the furnace A, retort C with caps *b b* and nozzle *a*, all constructed and arranged substantially as and for the purposes herein set forth.
6. The mixing-tube N with end of coil J, air-inlet *d*, outlet O, and tube P connecting with the retort C, all constructed and arranged as described, to create and maintain a vacuum in the retort and mix the fixed gas with the vapor-gas, substantially as herein set forth.
7. The combination of the furnaces A H, retorts C I, tanks G K L, coil J, mixing-tube N, and connecting-tubes E M P, all constructed and arranged substantially as and for the purposes herein set forth.

In testimony that I claim the foregoing I have hereunto set my hand this 11th day of November, 1871.

THEODORE G. SPRINGER.

Witnesses:

C. L. EVERT,  
EDM. F. BROWN.

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