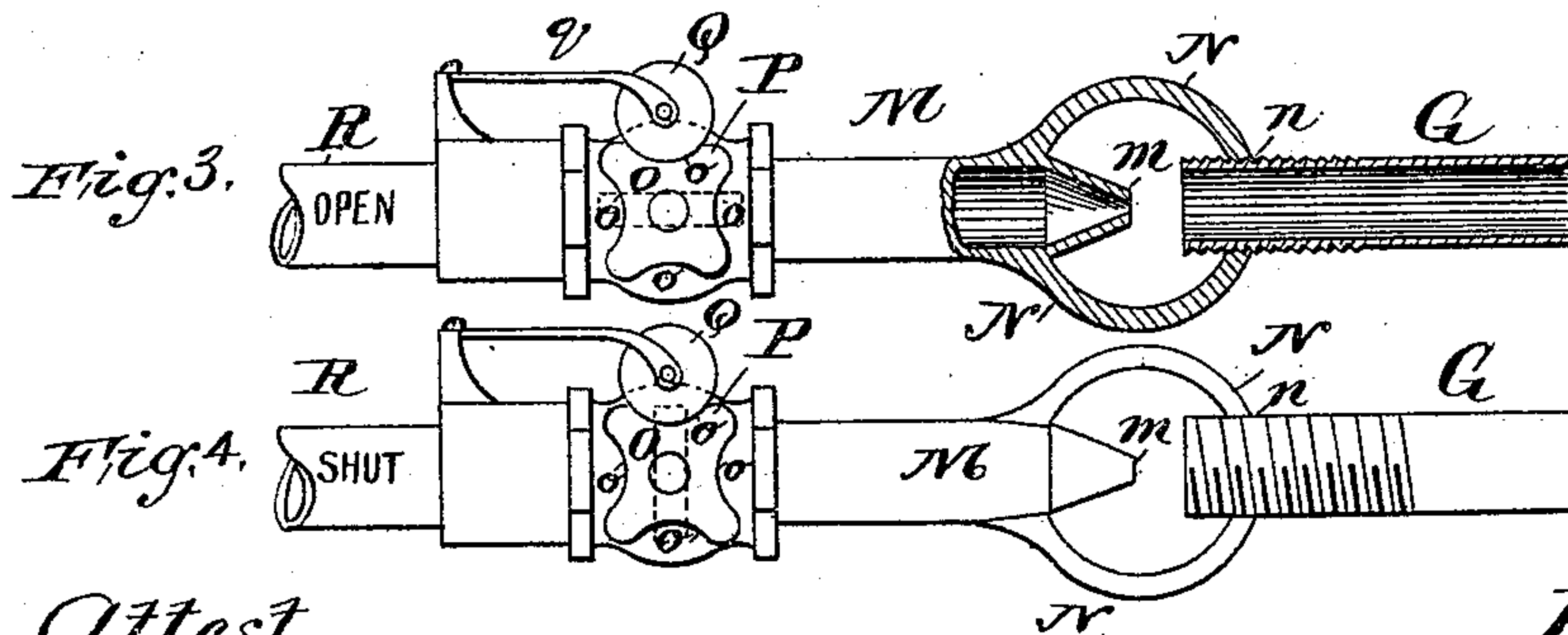
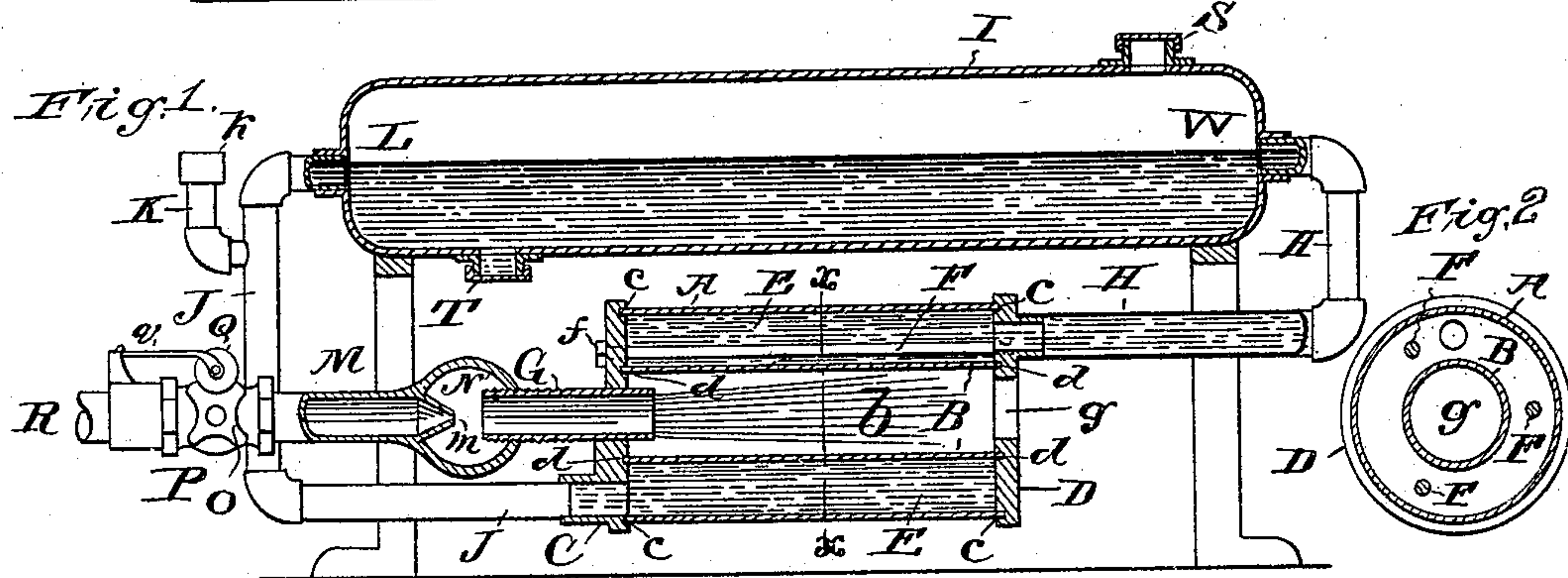
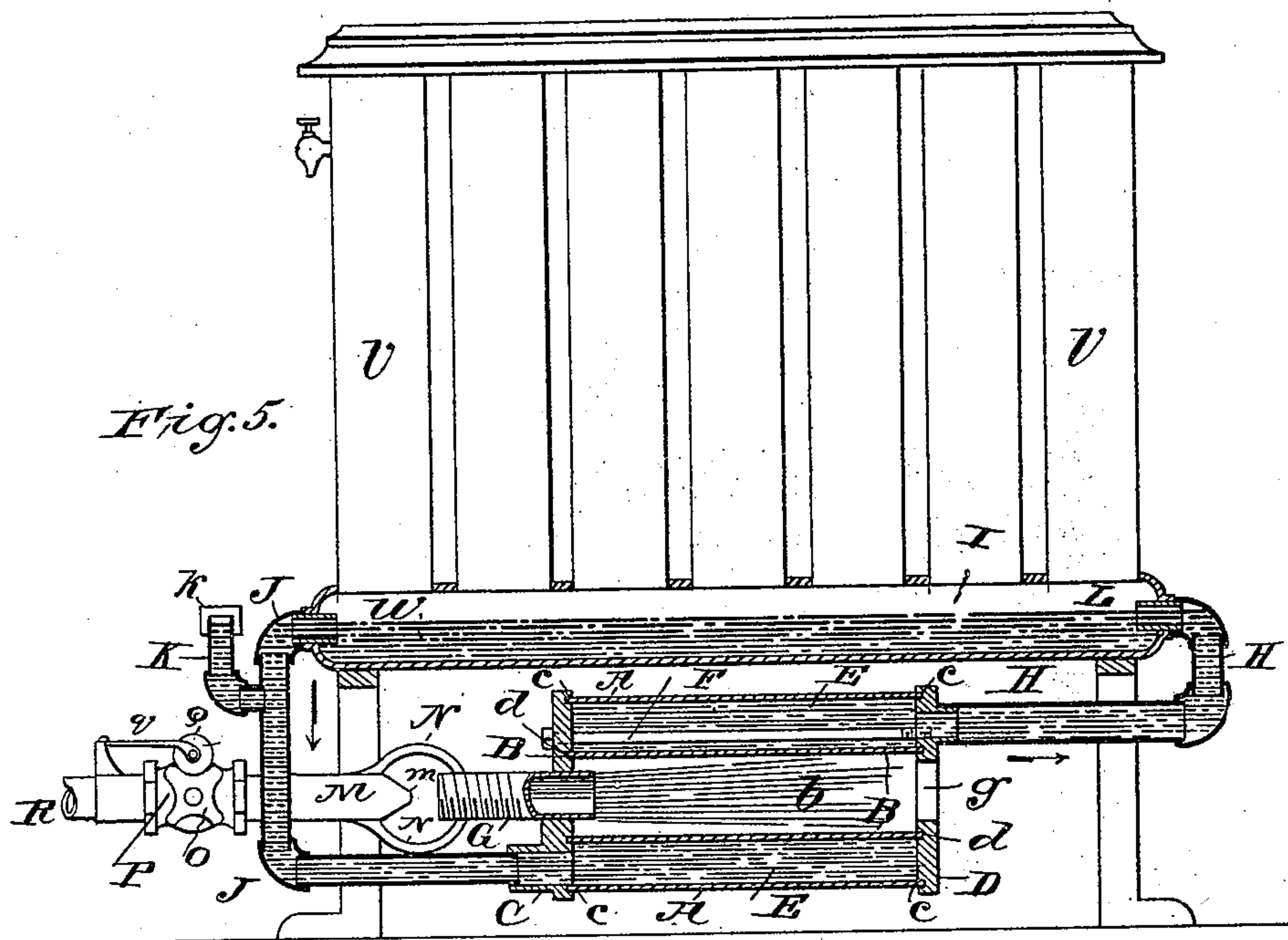


(No Model.)

H. C. EARLE.  
GAS HEATER.

No. 471,211.

Patented Mar. 22, 1892.



Attest,  
L. M. Benjamin.  
Bernard J. Roche

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Henry Clarke Earle.  
by Dr. Walter Brown,  
his Attorney



# UNITED STATES PATENT OFFICE.

HENRY CLARKE EARLE, OF NEW YORK, N. Y., ASSIGNOR, BY DIRECT AND MESNE ASSIGNMENTS, TO THE EARLE PORTABLE STEAM HEATER COMPANY, OF NEW JERSEY.

## GAS-HEATER.

SPECIFICATION forming part of Letters Patent No. 471,211, dated March 22, 1892.

Application filed May 7, 1891. Serial No. 391,961. (No model.)

*To all whom it may concern:*

Be it known that I, HENRY CLARKE EARLE, a citizen of the United States, and a resident of New York, in the county and State of New York, have invented a certain new and useful Improvement in Gas-Heaters, of which the following is a specification.

My invention relates to gas and other hydrocarbon and vapor, water, and steam heaters.

It consists, essentially, in the combination, with the hydrocarbon gas or vapor burner, of a double cylinder so constructed that there is an internal flame and combustion chamber for the combustion of the gases and vapors and a surrounding annular water-chamber. By this arrangement I am able to expose a great amount of surface to the direct action of the flames, and thereby derive a great heating efficiency from a small, compact, and cheap apparatus. To increase the heating effect, the water-chamber is connected with an external water and steam circulation, so that there is a constant circulation of water through the annular water-chamber.

Referring now to the drawings, which accompany the specification to aid the description, Figure 1 is a longitudinal vertical section of my apparatus, showing the burner, water-heater, circulating system, and external water or steam reservoir. Fig. 2 is a cross-section of the double cylinder on the line X X of Fig. 1. Fig. 3 is an enlarged detail of the burner and its attachments, the cock being shown open. Fig. 4 is a view of the same, the cock being shown closed. Fig. 5 is a sectional elevation of a radiator attached directly to the external reservoir.

My heater consists of two concentric cylindrical metal shells A and B and two heads C and D. The said heads C and D each have two concentric circular grooves *c c d d*, which fit over the ends of the cylindrical shells A B, and I very slightly bevel the edges of said shells A and B, so that they may wedge into the grooves *c c d d*. Tie-rods F F, which may be three or more in number, extend lengthwise of the annular space E between the

shells A and B, and at one end said tie-rods F F will be threaded into the head D, while at the other end said tie-rods pass with close fit through the head C and have threads on the ends which project beyond said head C, on which are threaded nuts *f f* with washers in the ordinary manner. Thus by tightening the nuts *f f* the heads C D will be drawn tightly on the shells A B.

The head D will be perforated with a central opening *g* of nearly the same diameter as the inner shell B, and through the head C will project with easy working fit the burner-tube G. Now the inner shell B constitutes the flame or combustion chamber and the annular space E between the shells A and B constitutes the water-chamber, and this said water-chamber E is connected with an external circulating system consisting of the flow-pipe H, which leads out near the top of the annular water-chamber E at one end and into the external water and steam reservoir I, and of the return circulation-pipe J, which returns from the other end of the external reservoir I into the lower part of the annular water-chamber E, and preferably at the end thereof opposite to the end which is connected with the flow-pipe H. The said pipes H and J will be connected with the annular water-chamber E and with the external reservoir I in any manner usual in steam-fitting.

K is a pipe for filling the annular water-chamber E. It will be carried up above the water-line W L of the apparatus and may be closed by an ordinary screw-cap *k*. Now when the apparatus is in use there will be a continual circulation of the hot water up from the annular water-chamber E by pipe H to the external reservoir I, and thence down again by pipe J to the aforesaid annular water-chamber E, and thus the rapid heating of the water and its conversion into steam will be effected.

The drawings show a burner adapted to burning ordinary coal-gas. The said burner consists of the aforesaid tube G, which projects through the inner shell B and of the burner proper M. The drawings show the



left head of the shells A B fitting around the tube of the burner with an easy close fit; but said left head is in fact formed with an opening larger than said burner-tube, so that air  
 5 may be admitted through said opening to support combustion and produce an indraft which will remove the products of combustion from the other end of the inner shell. Formed integral with the said burner M is the open  
 10 ring N N, which is perforated with a female threaded opening *n*, which fits male threads on the tube G. Thus by revolving the tube G it may be approached toward or drawn from the tip of the burner M, and thereby the  
 15 quantity of air admitted to the tube G and combustion-chamber *b* may be regulated to suit any given quality or pressure of gas. The burner M is contracted at the tip in cone shape, so as to form a small needle-opening  
 20 *m* for the passage of the gas.

P is a cock, which regulates the supply of gas to the burner. On the plug-spindle of this cock is fixed the four-pointed star-wheel O, which star-wheel O is so set with reference  
 25 to the passage through the plug of the cock P that when either of two opposite intervals between the points of the star are uppermost the cock P will be open and when either of the intervals between the other two points of  
 30 the star are uppermost the cock will be shut. The relative positions of open and shut may be indicated by proper lettering or by pointers in any usual manner. Now the said intervals between any two points of the star-  
 35 wheel O are concave surfaces *o o*, on which rides a spring-actuated wheel Q. The spring *q*, which tends to press the cam Q upon the concave surfaces *o o*, is fastened at one end into the cam Q and is fixed at the other end  
 40 to a stationary part of the cock P or gas-pipe R. The purpose of the star-wheel O and cam Q is that the cock P shall always be opened (when it is opened) to its full capacity, for the cam Q will always bring some one of the  
 45 concave surfaces *o* exactly uppermost, so that when a person turns on the gas the cock is bound to be turned on full. Therefore the tube G will be set for the proper quantity of air to consume the quantity of gas passing  
 50 through the cock P. Then whenever the said cock P is afterward opened just the same quantity of gas will pass through, and it will not be necessary to readjust the tube G.

The whole operates as follows: The annu-  
 55 lar water-chamber E and the external reservoir I being filled with water up to the water-line W L and gas being turned onto the burner M and ignited, the gas draws the air in through the ring N into the flame and com-  
 60 bustion chamber *b* on the principle of the injector, and the gas being ignited in the said combustion-chamber *b* burns with just the proper quantity of air to consume it. The gas-flame intensely heats the surface of the  
 65 shell B, which shell is entirely surrounded by

the water in the annular water-chamber E, and thus the water is very quickly raised to a high temperature and usually much above the boiling-point. Immediately a rapid cir-  
 70 culation begins up through pipe H, along through reservoir I, and down through pipe J and back into the annular water-chamber *c*. Much heat will be given off from the sur-  
 75 face of reservoir I to heat a room, and this said reservoir I may have flow-pipes leading from it, as at S, and connecting with radiators and returning to the reservoir I at T, and thus radiating-surfaces at a distance from the reservoir I may be heated by steam or hot  
 80 water.

The arrangement shown in Fig. 1 is a steam-heater. The water being, as aforesaid, heated much above the boiling-point, if radiating-  
 85 pipes be connected with the upper part of the reservoir I, as by pipes from the connection S, steam will be given off from the surface of the water in reservoir I and will enter the ra-  
 90 diating-pipes in the same manner as from an ordinary steam-boiler. The radiator-pipes may also be connected directly with the res-  
 95 ervoir I by threading them into said reservoir I, as into a radiator-base. This arrangement is shown in Fig. 5, where V V are the radiator-pipes.

When the apparatus is thus used as a steam-  
 95 heater, it is not necessary that the apparatus be filled with water up to the level W L in the reservoir I. It will be sufficient if the annular water-chamber E be filled above the  
 100 inner shell B, leaving steam-space above the water in the annular space E. In that case the reservoir I will be a steam-dome. Steam will rise into it through pipe H, and when the  
 105 condensation has filled reservoir I up to the pipe J the condensed water will return to the annular water-chamber through pipe J.

Having now described my apparatus, I claim as my invention—

1. In a hydrocarbon heating apparatus, the combination of an injector gas-flame burner,  
 110 a flame-chamber arranged axially with respect to the said burner and adapted to encompass the gas-flame and in immediate proximity thereto, an annular water-chamber surround-  
 115 ing the flame-chamber, a steam-chamber above the water-chamber, and an external primary circulation connecting the said steam-chamber with said water-chamber, the flow-pipe of  
 120 said circulation communicating with the upper part of the said water-chamber and the return-pipe of the same communicating with the lower part of said water-chamber, as de-  
 125 scribed.

2. In a hydrocarbon heating apparatus, the combination of an ejector gas-flame burner,  
 125 a flame-chamber arranged axially with reference to said burner and adapted to encompass the gas-flame in immediate proximity thereto, an annular water-chamber surround-  
 130 ing the said flame-chamber, and a steam-cham-



ber above said water-chamber and connected  
therewith at one end by a flow-pipe which  
rises from the upper part of the said water-  
chamber and at the other end by a return-  
5 pipe which descends to the lower part of said  
water-chamber, as described.

In testimony that I claim the foregoing as

my invention I have signed my name, in pres-  
ence of two witnesses, this 17th day of April,  
1891.

HENRY CLARKE EARLE.

Witnesses:

ALBERT TURNER,  
JOSEPH P. TIBBS.