

(No Model.)

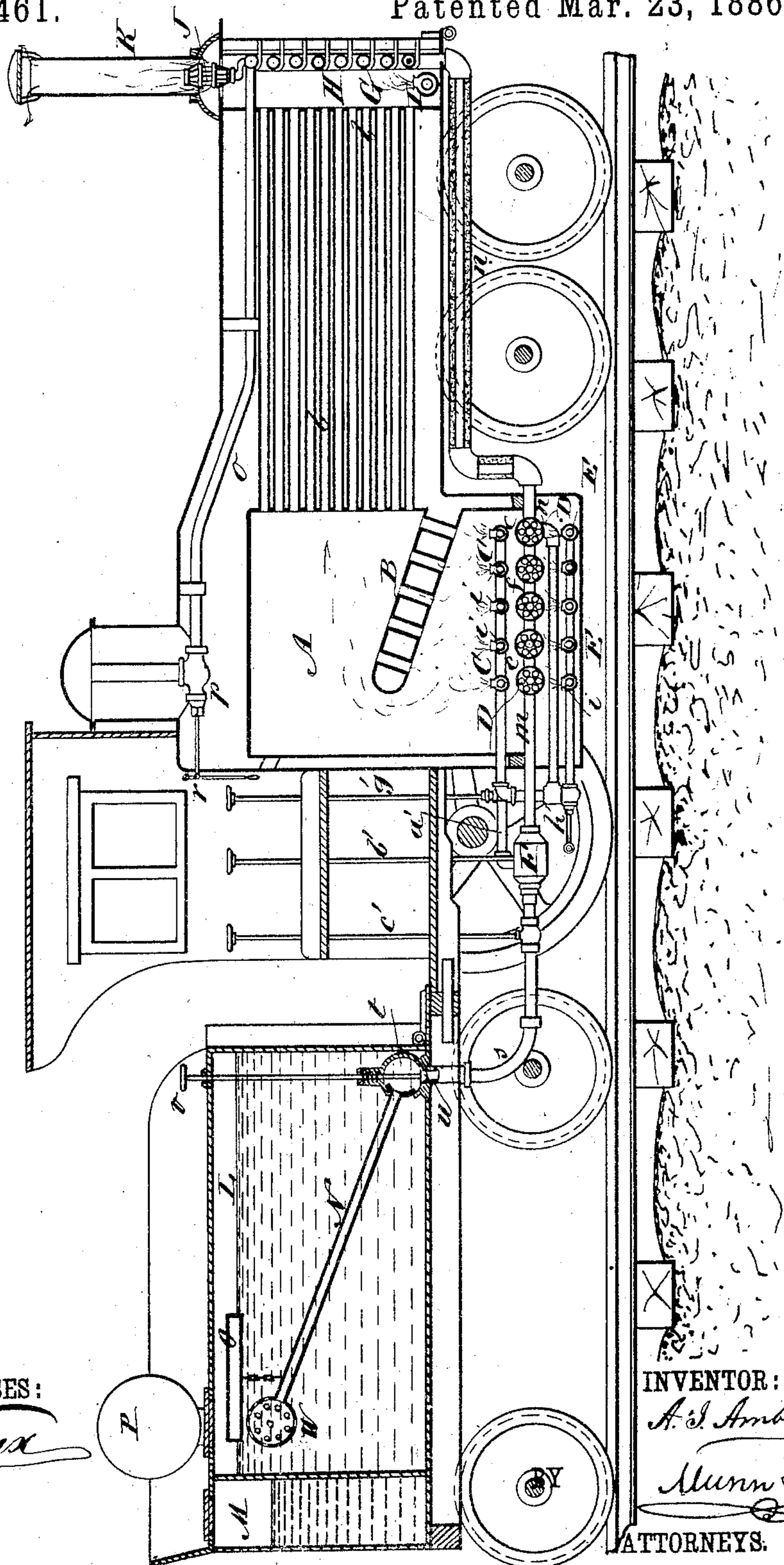
4 Sheets—Sheet 1.

A. I. AMBLER.  
VAPOR FUEL APPARATUS.

No. 338,461.

Patented Mar. 23, 1886.

*Fig. 1*



WITNESSES:

*C. Neveu*

*C. Sedgwick*

INVENTOR:

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(No Model.)

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Fig. 4

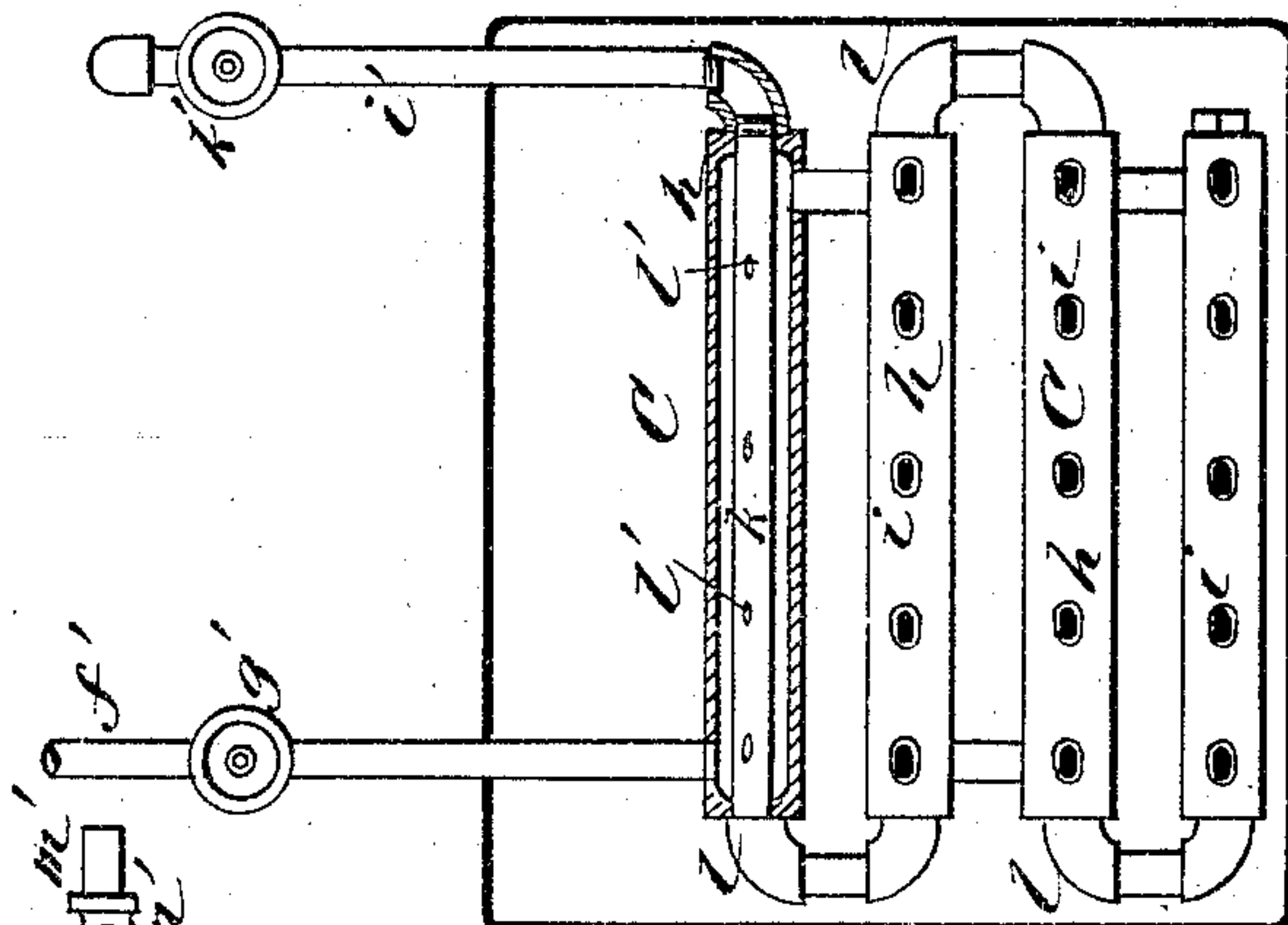


Fig. 5

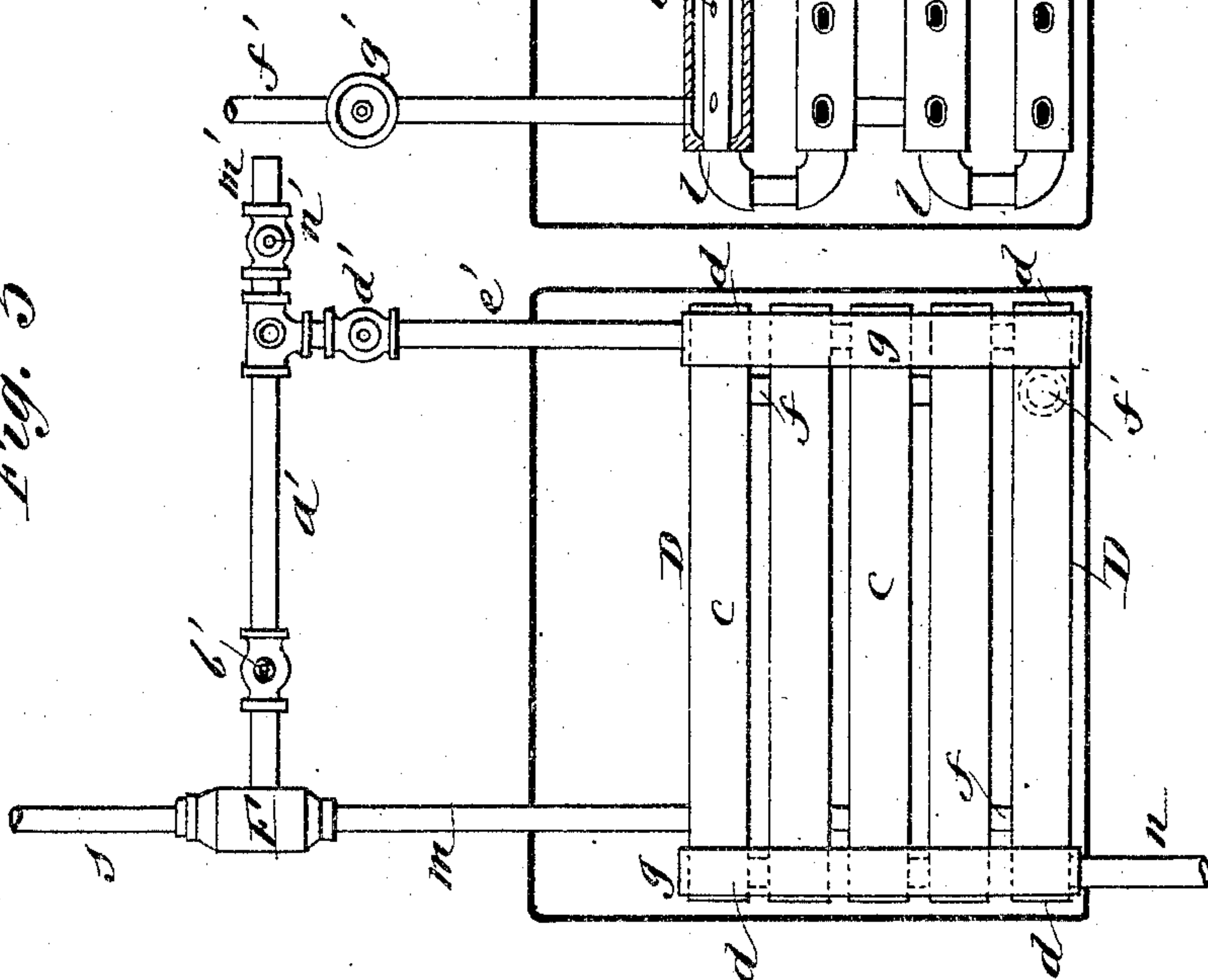
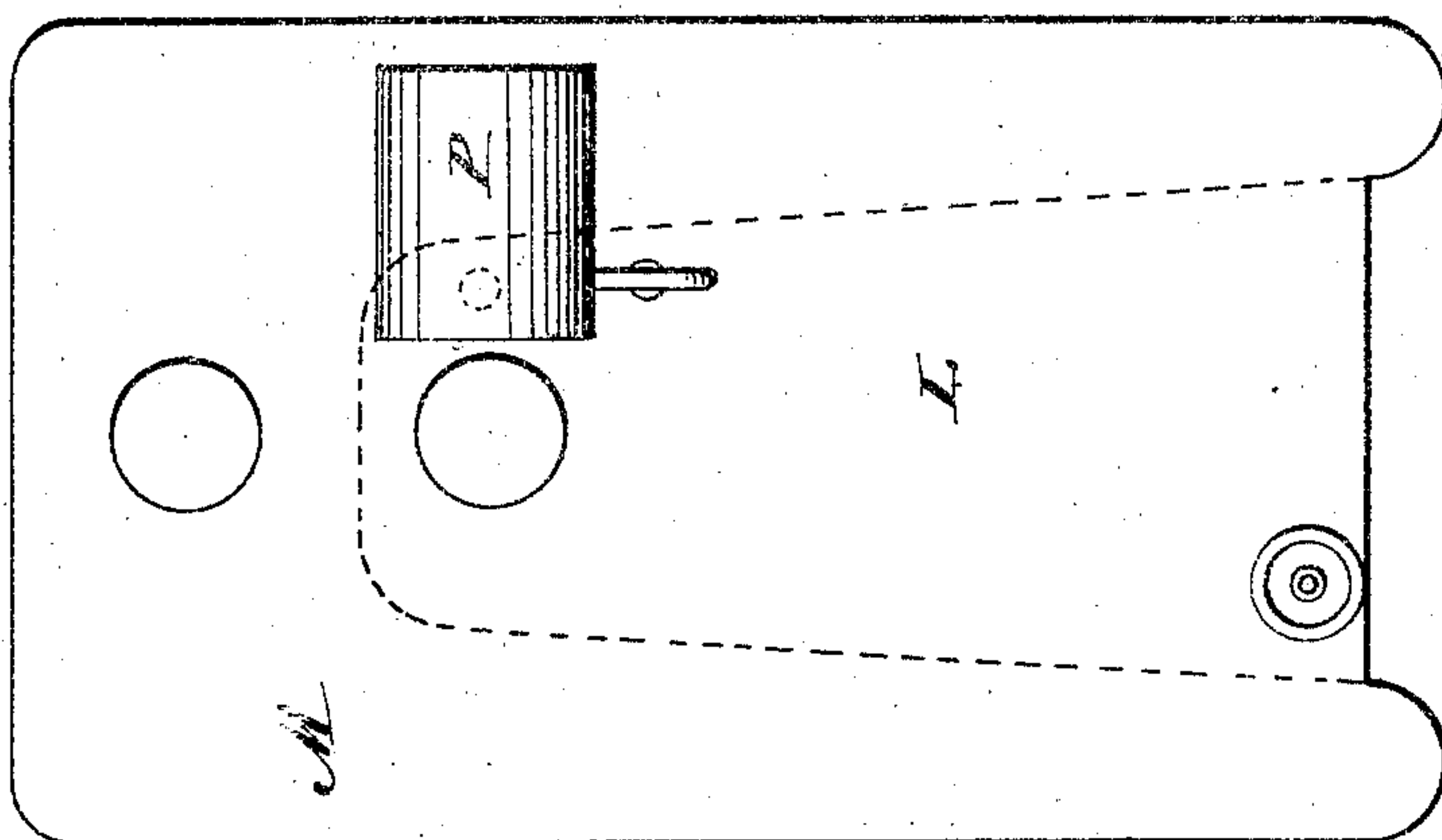


Fig. 2



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(No Model.)

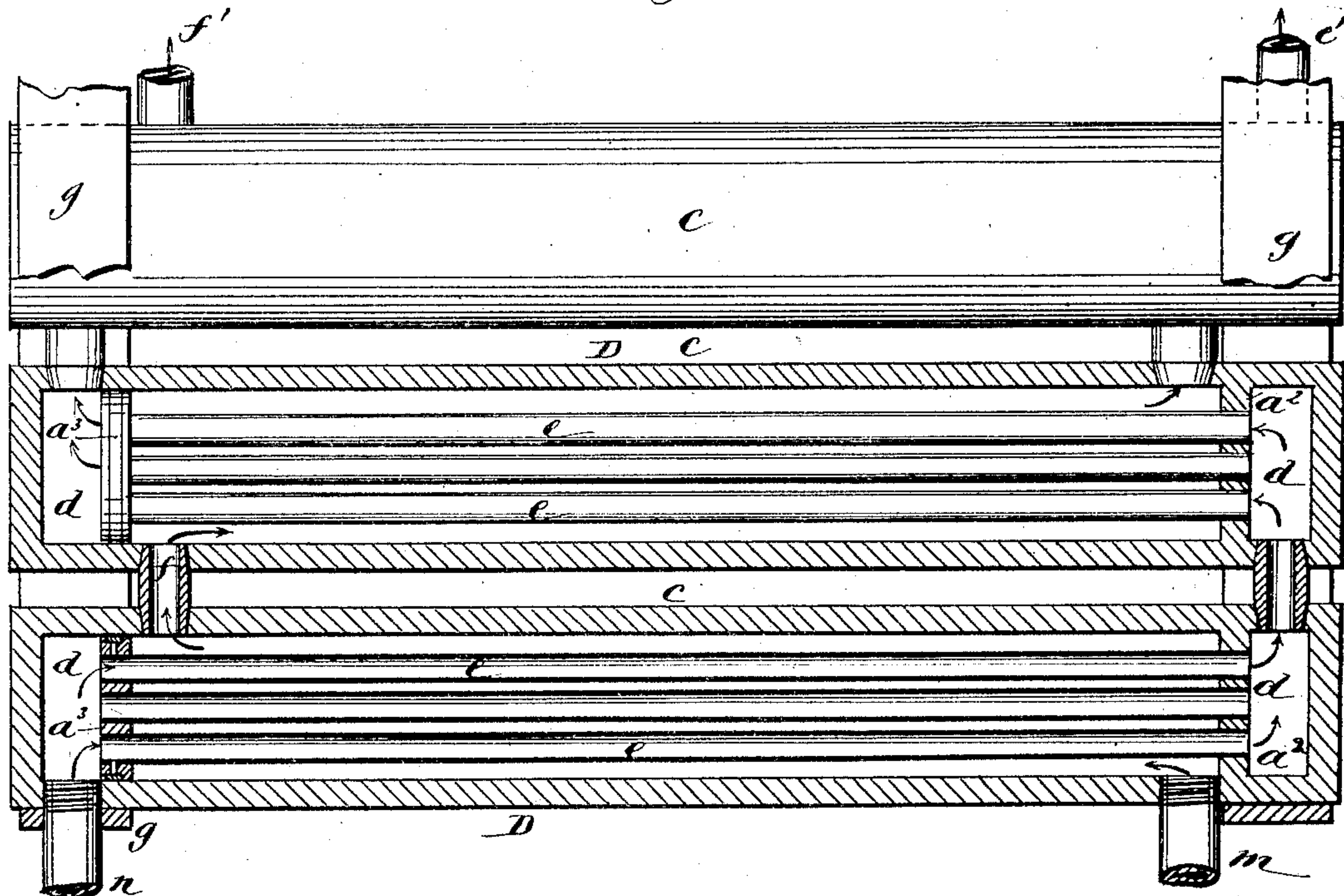
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A. I. AMBLER.  
VAPOR FUEL APPARATUS.

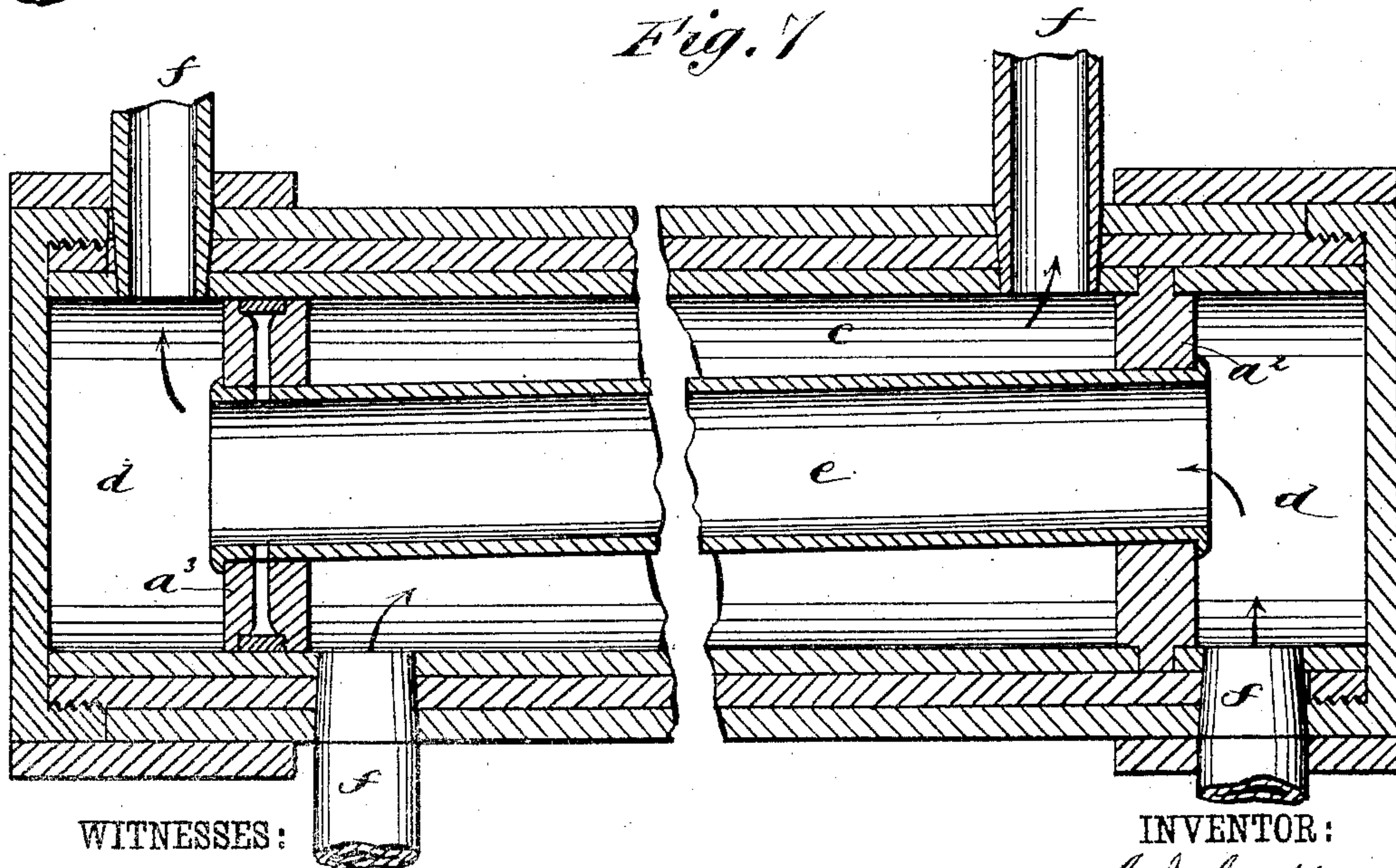
No. 338,461.

Patented Mar. 23, 1886.

*Fig. 5*



*Fig. 7*



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*C. Hodgwick*

INVENTOR:

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(No Model.)

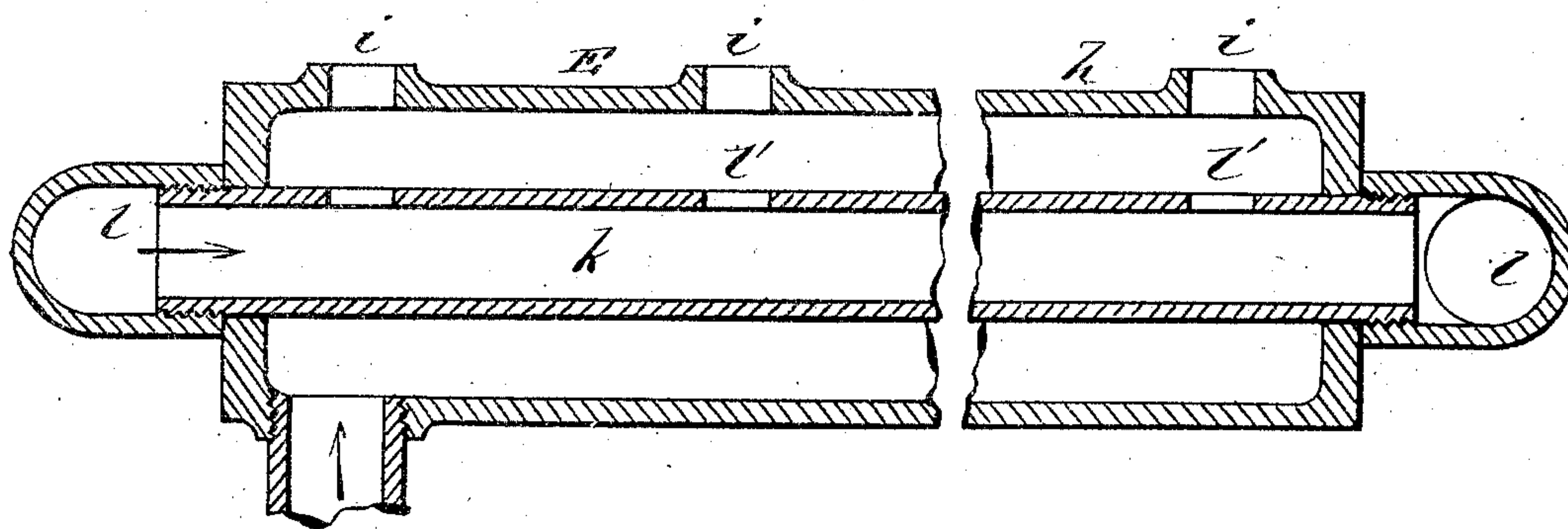
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A. I. AMBLER.  
VAPOR FUEL APPARATUS.

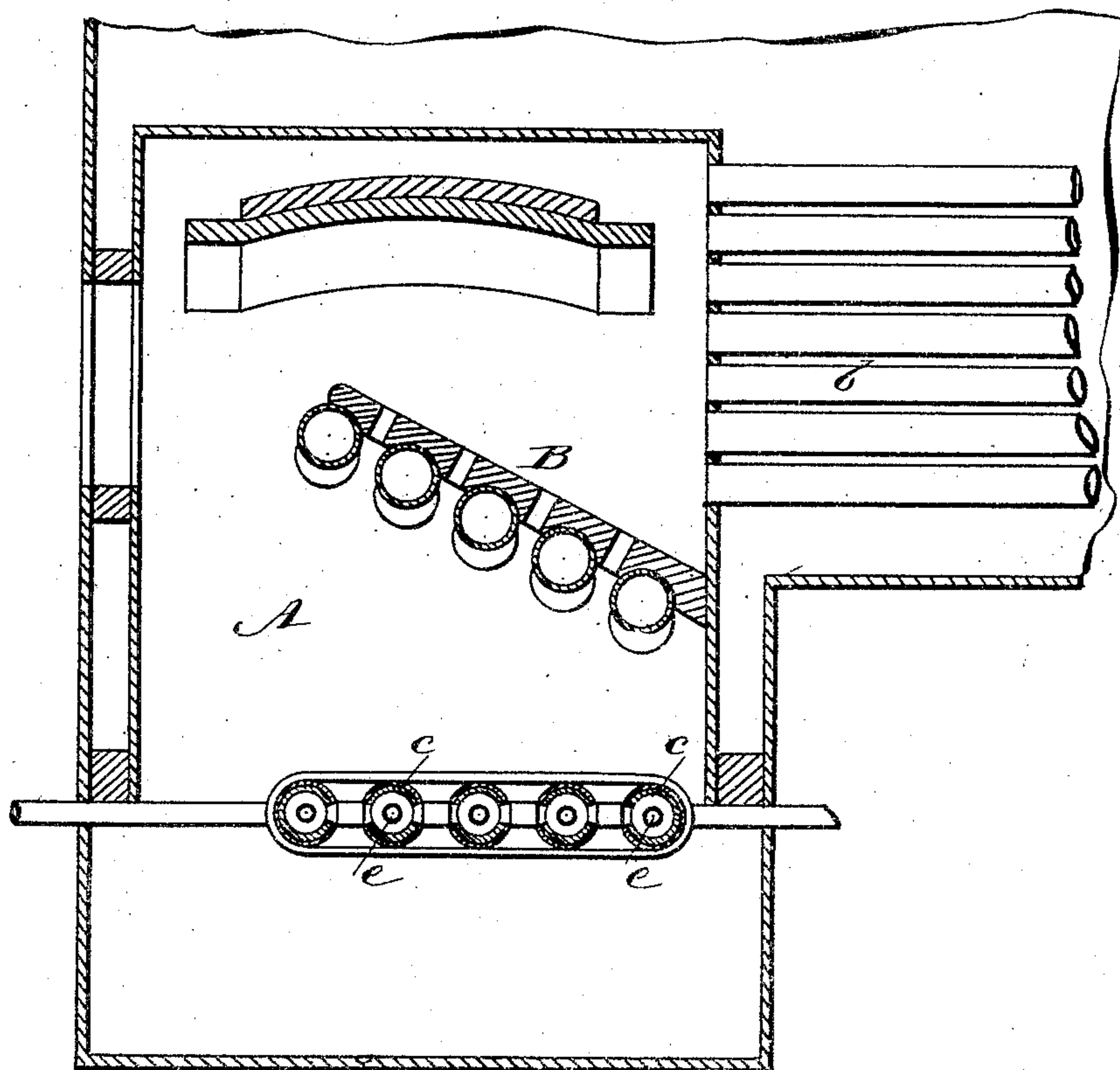
No. 338,461.

Patented Mar. 23, 1886.

*Fig. 6*



*Fig. 8*



WITNESSES:

*C. Neveu*

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# UNITED STATES PATENT OFFICE.

AUGUSTIN IREL AMBLER, OF CHICAGO, ILLINOIS.

## VAPOR-FUEL APPARATUS.

SPECIFICATION forming part of Letters Patent No. 338,461, dated March 23, 1886.

Application filed December 9, 1885. Serial No. 185,137. (No model.)

*To all whom it may concern:*

Be it known that I, AUGUSTIN IREL AMBLER, of Chicago, in the county of Cook and State of Illinois, have invented a new and useful Improvement in Vapor-Fuel Apparatus, of which the following is a full, clear, and exact description.

This invention relates to apparatus for producing and utilizing vapor-fuel by the combined use of petroleum or its products and steam, for generating steam and other purposes, or wherever the production of flame and heat is required, including the supplying of vapor-fuel to burning brick, lime, crockery, and for the reduction of ores in furnaces, &c.

The invention, however, is more particularly designed to be used in connection with locomotive-engine boilers, or other boilers of the locomotive type, and it will be described more especially with reference to such use.

The invention consists in certain novel constructions and combinations of parts, whereby the vaporizing of the petroleum or oil and the mixture of the steam with it or its vapor are very perfectly and economically secured, and other advantages are obtained, substantially as hereinafter described, and pointed out in the claims.

Reference is to be had to the accompanying drawings, forming a part of this specification, in which similar letters of reference indicate corresponding parts in all the figures.

Figure 1 represents a vertical longitudinal section of a locomotive-engine, in part, with tender, having my invention applied. Fig. 2 is a plan view of the tender with certain attachments. Fig. 3 represents a plan view of a series of multiple retorts with connections, applicable to or forming part of the invention; Fig. 4, a partly sectional plan view of the main burner portion of the apparatus. Fig. 5 is a mainly sectional plan view, upon a larger scale, of the multiple retort under one form of its construction; Fig. 6, a longitudinal section, also upon a larger scale, of the burner portion of the apparatus; Fig. 7, a horizontal section of a single-flue retort, which may be used in place of the multiple one; and Fig. 8, a vertical longitudinal section of the fire-box end of the boiler, showing a modified construction of the bridge and a series of single-cylinder retorts.

Referring, in the first instance, or, more particularly, to the first six figures of the drawings, A is the fire-box of the boiler of a locomotive-engine, or it might be any other boiler of locomotive type.

B is a water bridge, compartment, or diaphragm within the fire-box, to deflect and direct the flame against the water-leg of the fire-box, also against the crown-sheet, and, as shown by the arrow in Fig. 1, directly into the tubes or flues of the boiler.

C C are the main burners used to run the locomotive, D D the multiple retorts, and E E the burners below the retorts for heating the latter. These several devices are all located below the water-bridge B in regular order, one above or below the other, the main burners C C being above the retorts and the burners E E below the retorts.

The multiple retorts consist of a series of cylinders or outer boxes, *c*, arranged horizontally side by side, with end compartments, *d*, in them, and numerous interior longitudinal tubes or flues, *e*, connecting said compartments at the opposite ends of the cylinders. The several retorts are connected together by means of right and left hand nipples *f*, arranged to produce a return action through the several retorts in succession, as clearly shown in Fig. 5; or said retorts may be otherwise equivalently connected than by nipples, which latter, when used, may either be reversely tapering and smooth, or have right and left hand threads on their opposite ends, respectively. Bands or straps *g* also serve to bind or hold the several retorts together. The burners C C and E E are also constructed of parallel outer cylinders, *h*, connected, respectively, at their opposite ends, and with burner-orifices *i* in and along them, and having a perforated longitudinal tube or flue, *k*, extending through each of them and connected by end elbow attachments, *l*, the whole being arranged so as to produce a return action through the entire series of inner and outer tubes, or cylinders and tubes, respectively.

F is a pump or mixing-chamber for the steam and oil or vapor, and *m* a pipe connecting the one end of the retorts D with said mixer for supplying vapor to the retorts, and *n* a pipe connecting the retorts with the one end of a superheater or superheating-coil, G, said super-



heater being supplied with steam at its opposite end from the steam dome or chamber of the boiler by a pipe, *o*, subject to control by a cock, *p*, through a handle, *r*, from the outside of the boiler. The superheater *G* is arranged within a suction-chamber, *H*, at the forward end of the boiler.

*I* is a supplementary burner arranged cross-wise within the suction-chamber *H*, to give additional heat to the superheater, or to heat the same at starting the apparatus.

*J* is a perforated nozzle arranged in the upper part of the suction-chamber *H* or within the stack *K*, and through which steam is blown from the pipe *o* to create a constant suction or partial vacuum within the chamber *H* to assist the draft.

The tender of the engine is constructed to form an inner oil-reservoir, *L*, for supplying the retorts *D* through the mixer *F*, and an outer water tank or reservoir, *M*, for supplying the boiler with water to keep up the steam.

Oil is supplied to the mixer *F* from the reservoir *L* by a pipe, *s*. This pipe is connected at its receiving end with a chamber or circular socket, *t*, in the lower part of the oil-reservoir near its one end, and through which the stem of a valve, *u*, passes, to admit oil to or to shut it off from the supply-pipe *s*, the stem of said valve, which may be a screw-threaded one, passing upward and being operated by a wheel or handle, *v*, from above. As it is always desirable to supply the retorts with the oil which is lightest and freest from sediment, it is supplied to the chamber or socket *t* from the upper surface of the oil in the reservoir *L*, regardless of the depth of oil therein, by means of a rising and falling pipe, *N*, provided at its upper end with a screen or rose, *w*, and float *O*, and connected at its opposite or lower end in a free or loose manner—as, for instance, by a partial ball-and socket joint—with the chamber *t*.

*P* is an upper cylinder or chamber on or connected with the oil-reservoir *L*, for the purpose of receiving ascending vapors, produced either mechanically or otherwise, for use in starting when steam cannot be obtained. This may be done by well-known means—as, for instance, by a force-pump and pipe connected with the bottom of the oil-reservoir.

Steam is applied to the mixer *F* by a pipe, *a'*, and *b'* is a valve, with its attached stem and wheel, for controlling the flow of steam there-through.

*c'* indicates the valve to regulate and control the flow and supply of oil by the pipe *s* to the mixer *F*.

*d'*, Fig. 3, is a valve in a branch pipe, *e'*, to regulate and control the flow of steam to the retorts in starting.

*f'* is the pipe to conduct the vapor from the multiple retorts *D*, through branch pipes and valves *g'* *h'*, to the burners *C* and *E* above and below the retorts, the valve *g'* controlling the supply to the burners *C*, and the valve *h'*,

which may be worked by a lever, (not shown here,) controlling the supply to the burners *E*.

*i'* is a pipe having a controlling-valve, *k'*, for conveying steam through perforations *l'* in the pipes *k* to and through the orifices in the burners, to quicken the draft and assist combustion.

All the pipes which are exposed should have an asbestos or other suitable covering, as shown, for the portion of the pipe *n* which passes beneath the boiler.

A pipe, *m'*, provided with a valve, *n'*, may be arranged to connect the apparatus with a donkey-boiler (not shown) for supplying steam at starting, and by which and the connecting-pipes steam may be caused to flow to all parts of the apparatus, and may be so continued by the operation of the proper valves until steam of a suitable pressure is obtained in the main boiler or boiler proper of the apparatus, when connection with the donkey-boiler may be shut off.

The interior construction of the multiple retorts, as hereinbefore described, is more clearly seen in Fig. 5, in which, although the relative arrangements of the vapor-connecting pipes *m'* *f'* and steam-connecting pipes *n'* *e'* are somewhat different to the arrangement shown in Fig. 3, and only three connected retorts are represented, the return action or course of the steam through the tubes or pipes *e*, and vapor through the outside cylinders or pipes, *c*, (shown by arrows,) is the same, the invention not being restricted to any precise arrangement of the connections, nor yet to the number of connected retorts, the whole series of which form, in effect, but a single retort. As shown and described, the retort comprises an outer chamber, or series of outer chambers, in which the combined vapors of steam and oil, as coming from the mixer, are both externally heated by means of the lower burners, *E*, and internally heated by steam circulating through the tubes *e*, which connect at their opposite ends with the steam-chambers *d*. One, *a'*, of the heads *a'* *a'*, in which these tubes *e* within each cylinder *c* fit, is welded or otherwise securely attached to the cylinder in a steam-tight manner. The other head, *a'*, in which the opposite ends of the tubes *e* fit, is of a piston-like construction, with a metallic spring-packing in its periphery to make a close but sliding joint with the interior of the cylinder. This construction compensates for any inequality in the expansion and contraction of the inner and outer tubes, or cylinders and tubes. If desired, steamways may be used in the heads *a'* and end portions of the tubes *e* fitting therein, to admit steam to the backs of the metallic packings, to secure their close and more perfect action, as shown in Fig. 7 of the drawings. This figure represents a modified construction of the retort, in which each cylinder or chamber *c* has but one steam-tube *e* within it. Fig. 8 of the drawings shows such modified construction of the



retort or retorts in place within the fire-box of the boiler, and a modified construction of or substitute for the bridge B, the same being designed to show that the ordinary brick arch  
 5 or cross-tubes, with or without brick, may be employed to deflect the flame instead of the water-bridge shown in Fig. 1.

The operation is as follows: Steam having been made in the boiler, the valve *p* in the  
 10 pipe *o* is opened, which allows of the steam passing to and through the superheater and to and through all parts of the apparatus to which it is required or desirable to admit it—  
 15 as, for instance, to and through the steam-pipes in the retort and in the burners. When the retorts and other parts are thoroughly heated up, the valve admitting steam to the mixer F, also the valve admitting oil to the mixer, are opened, and from thence the com-  
 20 bined oil and steam are passed into the vapor spaces or chambers of the retort, steam being admitted also to all the tubes and steam-chambers of the retort, the steam starting from the dome and entering the retort by the  
 25 pipe *n*, and the oil supplied from the oil-reservoir passing first to the mixer F by the pipes *s*, and afterward, in a broken-up condition and mixed with the steam, by the pipe *m* to the vapor-chambers of the retort, from  
 30 whence the vapor, in a highly-heated condition, by reason of the steam-pipes in the retort and burners E on the outside thereof, passes and keeps up the supply to the burners C and E. When the vapor is thus made  
 35 or becomes sufficiently inflammable to burn freely, which may be tested by opening the valves *g'* and *h'*, that admit the vapor to the burners, and igniting the vapor from time to time as it issues from the burners, the engineer  
 40 or operator may then set his valves to secure a steady flow of vapor, also steam, by the pipes *k* to the burners to produce the necessary degree and quality of flame and heat for doing the work it is required to perform.  
 45 This by experience the operator will soon be familiar with, so as to obtain the best or most desirable results.

It will readily be seen that by a proper manipulation of the valves the operator may  
 50 have the most perfect control over the heat and flame, as well as its quality or character, and that he can turn his flame down to a series of mere jets, or, if necessary, fill the fire-box, boiler-flues, and suction-chamber in  
 55 front of the boiler with flame, and that these or other changes can be made instantaneously. The invention essentially differs from a mere atomizing system of devices, and will be found much more advantageous in the results ob-  
 60 tained, as well as more economical.

Applied to a locomotive, the chamber, which constitutes an exhaust one, and smoke box are converted into a suction and heating chamber, and no sharp exhaust is needed to  
 65 break up a solid bed of coal in the fire-box or to create a draft, but the exhaust-steam from the cylinders of the engine may by

very simple means be condensed and utilized to heat both the water and oil in the tender.

The utility of the invention in its combined use of petroleum or its products and steam is more perfectly attained in boilers of the locomotive type, as described.

If desired, air instead of steam, may be  
 75 ejected through the burners for use in connection with the flame produced from the vapor.

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

1. In apparatus for the production and use as vapor-fuel of petroleum or its products and steam combined, the combination, with a mixer of the oil and steam, of a retort  
 85 or retorts for heating the vapor derived from said mixer, and a series of burners arranged above and below said retorts, and arranged to receive their supply of heated vapor from the retorts, essentially as described.

2. In vapor-fuel apparatus, the combination, with oil and water reservoirs and tanks, of a steam-boiler of locomotive type, having a suction-chamber in its forward end, a superheater for the steam, a steam and oil  
 95 mixer, a retort or retorts arranged within the fire-box of the boiler, burners arranged above and below said retorts and connected with them, and pipes and valves connecting and controlling the supply of oil and steam  
 100 to the mixer and retorts, and vapor from the retorts to the burners, substantially as described.

3. The retort or retorts of the apparatus, consisting of a series of outer return vapor  
 105 tubes or chambers, and inner return steam pipes or tubes secured at their one end to inner fixed heads and at their opposite end to inner sliding or piston like-heads, substantially as shown and described.

4. In an apparatus for the production and use of vapor-fuel, the combination of an oil and steam supply, a mixer and force-pump, retort-cylinders closed at each end, internal  
 115 steam-heating tubes, steam-chambers, a vapor-chamber in each cylinder, and connecting-pipes for the passage of the steam and vapor from one cylinder to the other of the retort, substantially as shown and described.

5. The cylinders forming the outer casings  
 120 of each part of the multiple retort, the headings therein, the internal steam-heating tubes, the steam-chambers, and vapor-chambers, combined with the pipes connecting the steam-chambers and the vapor-chambers of each  
 125 retort, and the pipes and valves connecting the apparatus with the supply of oil and steam and the burners, substantially as described.

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Witnesses:

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