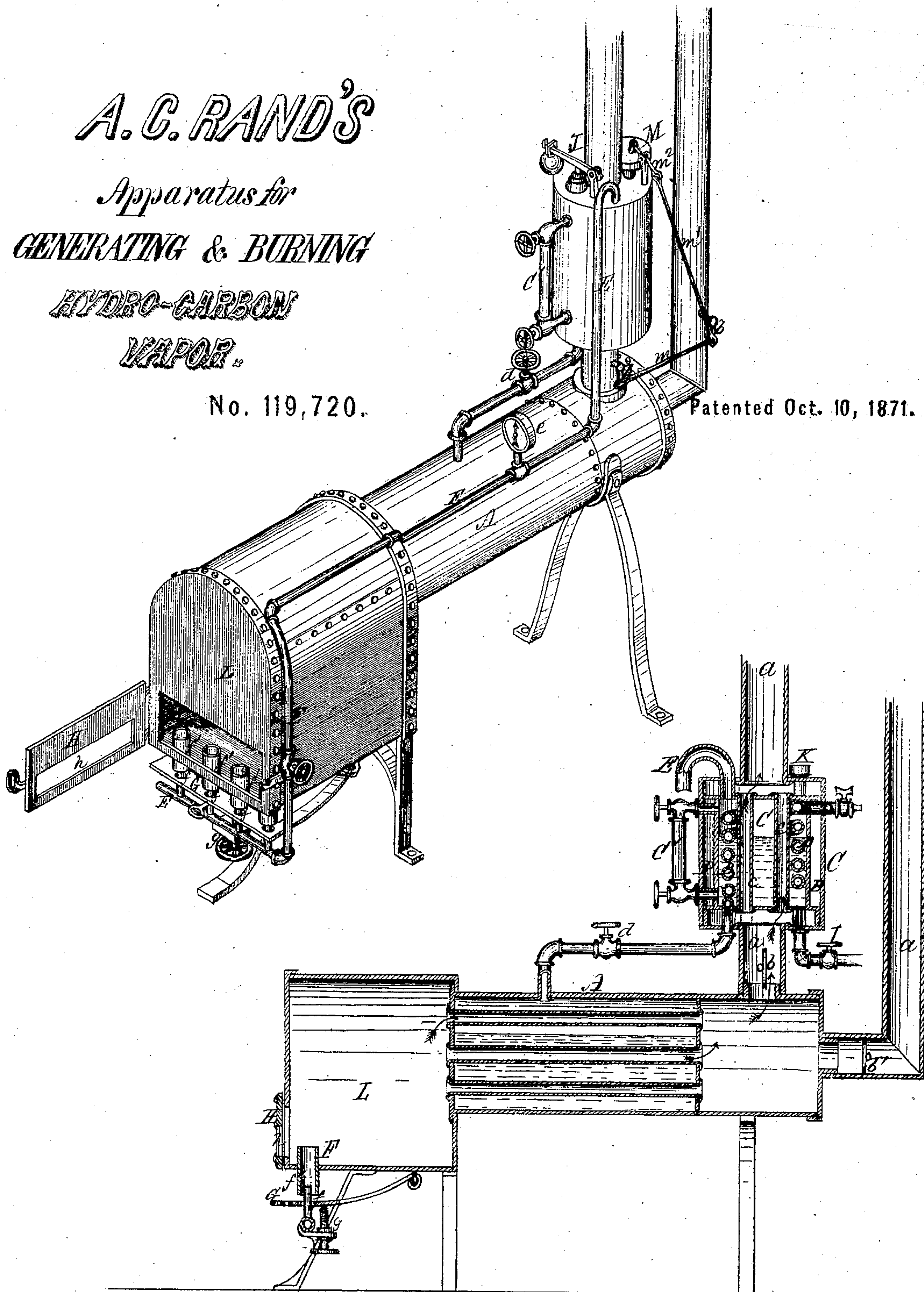


A. C. RAND'S

Apparatus for
GENERATING & BURNING
HYDRO-CARBON
VAPOR.

No. 119,720.

Patented Oct. 10, 1871.



Witnesses.

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UNITED STATES PATENT OFFICE.

ALONZO C. RAND, OF CHICAGO, ILLINOIS.

IMPROVEMENT IN BURNING HYDROCARBONS ON LOCOMOTIVES.

Specification forming part of Letters Patent No. 119,720, dated October 10, 1871.

To all whom it may concern:

Be it known that I, ALONZO C. RAND, of the city of Chicago, in the county of Cook and State of Illinois, have invented certain Improvements in Liquid-Fuel Apparatus, of which the following is a specification:

My invention consists in utilizing the waste heat which ordinarily passes out of the smoke-stack of a steam-engine and is lost by employing it to evaporate crude petroleum or its products after distillation, and then burning the vapor thus given off to increase the product of steam in the boiler.

In the drawing, Figure I is a perspective view of a steam-boiler with my apparatus for vaporizing and burning hydrocarbon liquids applied thereto; Fig. II, a longitudinal section of the same, showing the arrangement of the smoke-flues in the reservoir, and also the outer jacket, and the coil of pipe in the inner jacket.

A is a plain form of boiler provided with two smoke-pipes, *a a'*, each of which latter has a damper, *b b'*. To the pipe *a* is attached a reservoir, C, through which the gaseous products of combustion are conducted by the pipes or flues *c c*. The reservoir C has a coil of pipe, D, connected with the boiler A, and admitting steam from the boiler at the stop-cock *d*. E is a pipe for conducting vapor from the reservoir C to the burners F. Attached to this pipe is a gauge, *e*, to indicate the pressure of vapor in the reservoir or generator C, and a level-gauge, C', of ordinary construction, is also connected with the reservoir to show at any time the amount of liquid contained in said reservoir. The burners F consist of a nipple, *f*, and a larger tube, *f'*, surrounding the nipple. There is also a draught-plate, G, controlled in its action by the screw *g*. A safety-valve is shown on the reservoir at J, a draw-off cock at I, and filling tube with screw cap at K. The door H of the fire-box or furnace L is provided with a mica window, *h*, for the purpose of observing the character of the flame passing from the tube *f'*. The dampers *b b'* in the smoke-pipes *a a'* are designed to be automatic in their action by connecting the two lever-arms which control them by a rod, *m*, which rod is controlled in turn by another rod, *m¹*, which latter is attached to a centrally-pivoted lever, *m²*, which transmits the motion of the diaphragm M. An exterior jacket, P, to prevent radiation of heat, is shown on the reservoir C.

The action of the apparatus is as follows: The exit of the heated gases, formed by combustion in the fire-box, through the pipe *a*, being stopped by closing the damper *b'*, all the waste heat from the boiler-flues is conducted by the pipe *a* through the flues *c c* in the reservoir C. The waste heat in its passage through the reservoir serves to vaporize the petroleum or other hydrocarbon liquid contained in C, and the vapor thus evolved passes by the pipe E to the burners F. The force of the vapor as it issues under pressure from the nipple *f* draws in with it into the tube *f'* a large amount of atmospheric air, so that when ignited at the top of the said tube the large amount of oxygen derived from the air which has mingled with the vapor causes it to burn with a blue flame and very intense heat. The character of the heat may at all times be known by examining the color of the blaze through the mica window *h* in the door H. If the flame is not sufficiently blue more air may be admitted by lowering the draught-plate G by the screw *g*, and if on the other hand the flame is too thin and light the opening for the admission of air at the base of the tubes *f'* may be closed to the required degree by screwing up the draught-plate. If no diaphragm or mercury float is employed to regulate the dampers *b b'*, by noticing the indicator *e* the proper pressure of vapor in the reservoir may always be maintained through regulation by hand of the said dampers, so as to direct more or less of the escaping heat through the reservoir C, according as more or less pressure of vapor is required. If, by carelessness or accident, the pressure of vapor in the generator C should become too great, its harmless escape is provided for in the safety-valve indicated at N in Fig. I. When for any cause an extra amount of heat is required in the reservoir C it is readily obtained by admitting steam through the stop-cock *d* to the coil D. When the circumstances of the case are such that the vapor-supply pipe E cannot be well protected on the outside of the boiler it may be preferably conducted to the burners through one of the boiler-flues.

The advantages claimed for my device are important. By employing a large percentage of the heat which is usually lost through the smoke-stack to evaporate petroleum and its products, and then burning the vapor thus generated in combination with a large amount of oxygen, a blow-pipe heat is produced which multiplies many

times the original heat which went to vaporize the hydrocarbon. Where water is heated for the boiler in a somewhat similar manner only that amount of caloric is saved which passes from the escaping heat into the water. In the case of this invention the same amount of heat contained in a gaseous form is many times increased by igniting the gas in the presence of a large percentage of oxygen. The cost of material to make the vapor is alone to be recorded against the economy of the heat to be produced, and the latter is so intense, being almost equal to the oxy-hydrogen blow-pipe, that the percentage of gain by using this invention will far overbalance the additional cost of material.

The special advantage of this arrangement for carrying the above principles into effect lies, first, in its simplicity and, therefore, small cost; second, in the ease with which it may be applied to ordinary boilers; and third, in the readiness with which its action may be gauged and controlled.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. The hydrocarbon-reservoir or generator C, having one or more flues or smoke-passages *c c*, arranged and operating for the purpose set forth.

2. The smoke-pipes *a a'*, dampers *b b'*, in com-

bination with the reservoir C, arranged and operating as set forth.

3. The burners F F, consisting of the nipples *f f*, and chimney-tube *f' f'*, in combination with the vapor-pipe E and reservoir C, arranged for operation as set forth.

4. The draught-plate G, in combination with the burners F F, for the purpose of regulating the amount of air admitted to the tubes *f' f'*.

5. The jacket P, in combination with the reservoir C, for the purpose described.

6. The coil of pipe D, with its stop-cock *d*, in combination with the reservoir C, for the purpose specified.

7. The liquid-fuel apparatus and arrangement as a whole, consisting of the reservoir C, the smoke-pipes *a a'*, with their dampers *b b'*, the vapor-supply pipe E, the burners F F, and the draught-plate G, all arranged substantially as described for the purposes set forth.

In witness whereof I have hereunto signed my name in the presence of two subscribing witnesses.

A. C. RAND,

Witnesses:

J. B. GREIFENHAGEN,
GEO. W. MIATT.