(No Model.)

C. M. HOLLINGSWORTH.

PROCESS OF VAPORIZING LIQUID HYDROCARBONS AND SUPPLYING THE VAPOR TO BURNERS.

No. 420,797. Patented Feb. 4, 1890.

Fig. 1.

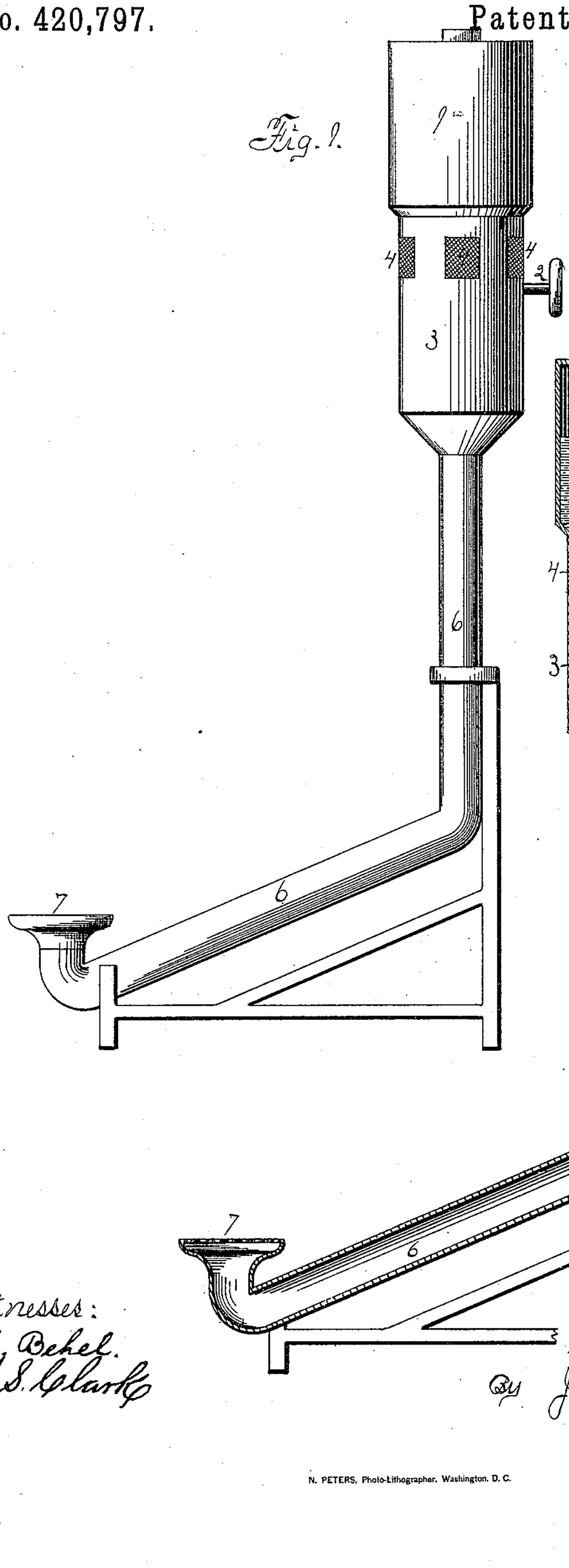
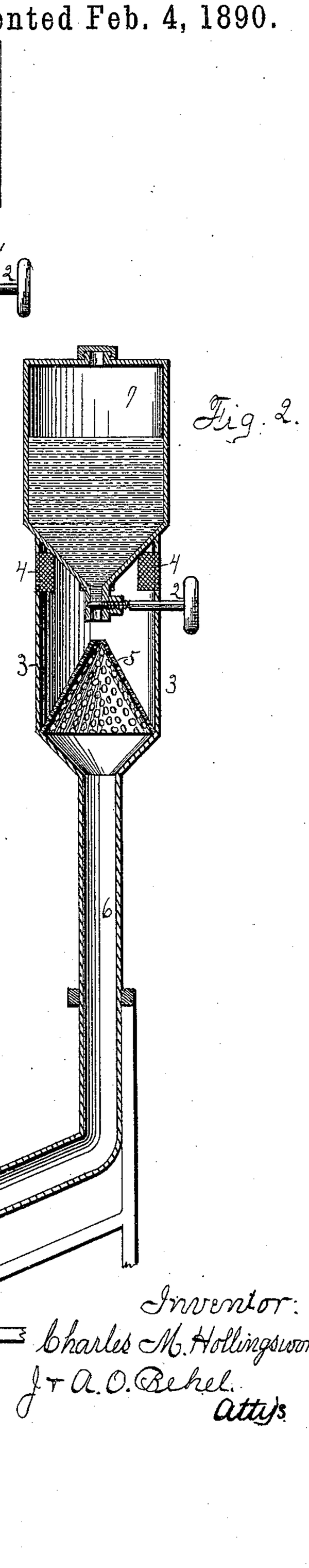


Fig. 2.



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PROCESS OF VAPORIZING LIQUID HYDROCARBONS AND SUPPLYING THE VAPOR TO BURNERS.

SPECIFICATION forming part of Letters Patent No. 420,797, dated February 4, 1890.

Application filed August 8, 1888. Serial No. 282,197. (No model.)

To all whom it may concern:

Be it known that I, CHARLES M. HOLLINGSWORTH, a citizen of the United States, residing at Rockford, in the county of Winnebago and State of Illinois, have invented certain new and useful Improvements in Processes of Vaporizing Liquid Hydrocarbon and Supplying the Vapor to Burners; and I hereby declare that the following is a full, clear, and exact description of the invention.

The object I have in view is to produce a mixture of hydrocarbon vapor and air in a regulated manner and immediately as it is required for use and supply it directly to a burner, and especially so to produce and supply such mixture in the proportion of vapor to air required to give in combustion a blue flame of great heating efficiency. My method of accomplishing these results is to freely expose to the air a suitable regulated feed of liquid hydrocarbon to be vaporized as it is fed and convey the mingled vapor and air automatically to the burner by gravity. I expose the liquid to the air by spreading it in a thin layer or coating over a preferably non-absorbent evaporating-surface within a special vaporizing-chamber, thus vaporizing it without the use of wicking or other absorbent material and without passing the vaporizing air-current through the reservoir or other receptacle which contains the supply of liquid to be vaporized and consumed, and the process is thus intended and suited to serve as a convenient and safe method of vaporizing and consuming gasoline in vapor-stoves suitably constructed for the purpose and in other similar heating apparatus in which this fuel may be employed.

The conditions and manner of carrying out my process may be more clearly explained by reference to the accompanying drawings, representing one form of apparatus that may be used, in which—

Figure 1 is a side elevation of the entire apparatus, and Fig. 2 a vertical central section of the same.

A reservoir 1 for the liquid gasoline is here shown placed immediately over the vaporizing-chamber 3 and supported by the walls of the latter; but the reservoir has no communication with the vaporizing-chamber except through the drip-valve 2, by means of which the liquid is delivered in a regulated feed as required for vaporization. The requisite evaporating-surface is provided, chiefly, by a hollow cone of perforated metal plate 5, suitably placed within the vaporizing-chamber, and having its apex truncated or flattened horizontally to receive the feed of liquid and cause it to spread to all sides of the cone. This flat receiving-cap is preferably made of unperforated material, and it is desirable that the liquid should be delivered from a suitable drip-point centrally upon it.

The inner surface of the wall or bottom of the vaporizing-chamber below the base of the perforated cone and also the inner surface of the conducting-tube 6 may serve as supplementary evaporating-surfaces, over which any residue of liquid not vaporized from the cone may spread.

At the upper part of the chamber 3 are located air-inlets 4—here represented as covered with wire-gauze.

A suitable conducting-tube 6 leads from the vaporizing-chamber downward and laterally to the burner 7.

It will readily be seen that when by means of the valve 2 a suitable feed of the liquid gasoline is delivered on the top of the perforated cone 5 it will immediately spread downward over the surface of the same and be rapidly vaporized and mixed with the air which comes in contact with it, the air being free to pass downward in a renewing-current through the many perforations in the metal plate. Then with the vaporizing-chamber placed above the level of the burner, as shown, and communicating with the burner at its final outlet, the greater specific gravity of the mixture of hydrocarbon vapor and air formed within the vaporizing-chamber, as compared with the specific gravity of external air, or in the continuation of the process, as compared, in part, with the specific gravity of the flame from the burner after ignition, and in part with the specific gravity of that portion of the combustible mixture which has reached the burner, and in passing through it is expanded by heat from it, serves as a moving force to carry the mixture as it is formed to the burner and discharge it therefrom for combustion, at the same time constantly renewing the air in the

vaporizing-chamber, and thereby vaporizing the liquid as fast as it is fed.

It will be understood that the greater specific gravity of the mixture of hydrocarbon vapor and air within the vaporizing-chamber, as compared with the external air, is due in part to the fact that the vapors of those grades of liquid hydrocarbon that are adapted by their volatility for use in this way are heavier than air at the same temperature and pressure, and in part to the fact that in the process of vaporization both the vapor and the air with which it becomes mixed are reduced to a lower temperature than that of the external air, and thereby condensed, heat being taken up or rendered "latent" in the conversion of the hydrocarbon from the liquid to the vaporous state.

Since, in the method I have now described of exposing and vaporizing the liquid gasoline, the vapor is taken up by the air in the course of a direct or nearly direct downward movement of the air through the vaporizing-chamber with very little resistance to such movement, the fullest effect of the gravity action is thus secured, and especially that part of it which depends on the condensation of the air by loss of heat. This I find to be an important condition to the successful application of the process to the particular use for which I have intended it—namely, the production and consumption of a lightly-carbureted mixture of vapor and air that will give in combustion a blue flame having great heating-power, for, owing to the large proportion of air to vapor in this case—about from six to ten times as much air as vapor being required in the mixture—the gravity action which is made available for producing and maintaining the current is small or weak as compared with the quantity of air to be passed through the apparatus by it, and will not suffice to overcome any considerable resistance due to an indirect or much-obstructed passage-way for the air-current, and in view of the comparatively slow movement of the air-current it is necessary to provide a proportionately ample evaporating-surface for exposing the liquid to the current, in order to vaporize at the rate required to supply the burner.

I find that the efficiency of the process does not depend upon any specific form of evaporating-surface or specific character of the material used, as to its being perforated or imperforate, provided that it is so shaped and placed as to facilitate the spreading of the liquid over it and offer but little resistance to the movement of the vaporizing-current, while at the same time freely exposing to the air any liquid spread upon it.

I prefer to employ for an evaporating-surface the surface of a material that is wholly non-absorbent, in which case a small quantity of the liquid will suffice to cover a relatively large area with the following advantages: A sufficient area is quickly covered when the feed is turned on to bring the rate of vaporization up to the point that will afford an effective supply to the burner, and but little delay will be experienced in starting the process and putting the burner to use. The size of the flame may be quickly increased or diminished, as desired, by varying the feed of liquid, and on stopping the feed the evaporating-surface will be quickly dried, and all the vapor that has been formed may be allowed to pass out and be consumed.

By delivering the liquid into the vaporizing-chamber only as it is required for immediate vaporization I attain an important advantage over any method or process in which a considerable body of liquid is exposed for vaporization without constant recruiting of the supply, in that when it is thus delivered the lighter and heavier parts are vaporized together, and the conditions of the process do not in any way vary with variations in the quantity of liquid in the reservoir; but a proper regulation of the feed of liquid to the evaporating-surface gives complete control of the burner.

If, by accident to the burner, fire should be communicated to the inflammable mixture within the conducting-tube, and thereby pass to the vaporizing-chamber, it will there extinguish itself, as the oxygen of the air contained within the chamber will be immediately consumed and an upward movement of the heated contents of the tube and chamber will arrest the inflow of fresh air, while the wire-gauze covering the air-inlets will prevent the flame from reaching the external air; but, as a greater precaution against danger or for any other reason, the reservoir may be placed at any desired distance away from the vaporizing-chamber and the liquid gasoline carried to the latter by means of a small pipe and fed from it as required. Moreover, by means of suitable pipes liquid from the same reservoir may be delivered to any number of separate vaporizing-chambers for the supply of as many different burners.

I am aware that carburetors operated on the gravity principle, but in which the vaporization of the liquid hydrocarbon is effected within a receptacle containing a considerable body of liquid and provided with wicking or other means of exposing it to the admitted air, have been used in the production of heavily-carbureted mixtures of vapor and air suitable for illuminating purposes; but I have found this method objectionable and impracticable in carbureting for heating purposes, owing partly to the unwieldiness of the apparatus required where so large a quantity of air is to be passed through the reservoir, and partly to the more explosive nature of a lightly-carbureted mixture and the danger from having the requisite free communication between a burner and a carbureting-reservoir, from which the burner is supplied with such mixture; but, owing especially to

the difficulty or impossibility of properly regulating or controlling the vaporization under such conditions or getting it to go on with sufficient uniformity, either an over-carbureted mixture being produced after each refilling of the reservoir or the rate of vaporization so diminishing with the exhaustion of the liquid from it as to fail to give a sufficient supply to the burner.

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

The process of vaporizing a liquid hydrocarbon and supplying the vapor mixed with air to a burner, which consists in delivering the liquid hydrocarbon in a drip or stream as it is required for vaporization, and receiving and spreading the fed liquid on an evaporating-surface freely exposed to the air, thereby vaporizing it as it is fed and conducting the resulting mixture of vapor and air as it is formed directly to the burner by gravity.

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