

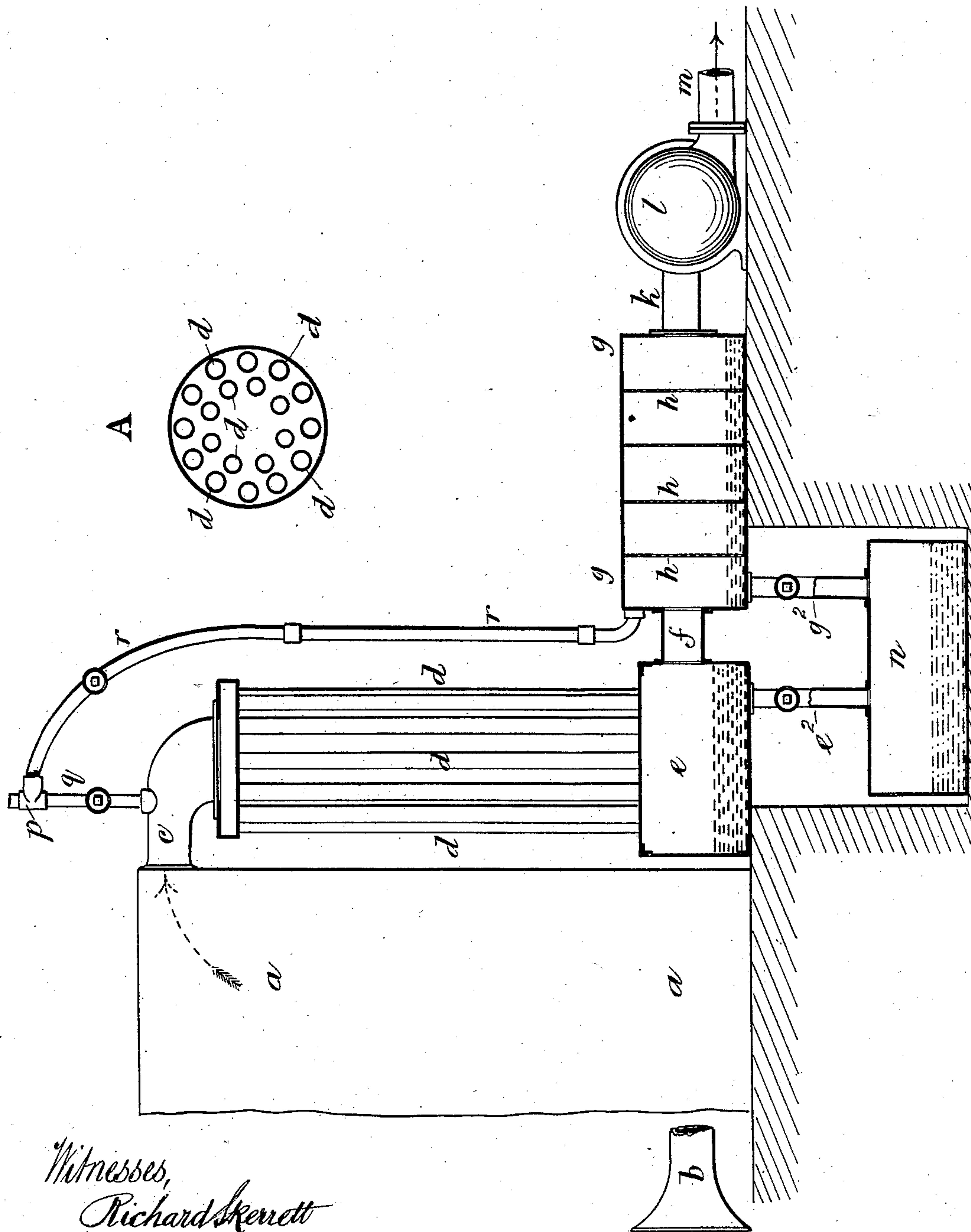
(No Model.)

S. LLOYD.

APPARATUS FOR GENERATING AND PURIFYING GASEOUS FUEL.

No. 294,646.

Patented Mar. 4, 1884.



Witnesses,
Richard Kerrett
Arthur J. Powell.

Inventor
Samuel Lloyd.

UNITED STATES PATENT OFFICE.

SAMUEL LLOYD, OF BIRMINGHAM, COUNTY OF WARWICK, ENGLAND.

APPARATUS FOR GENERATING AND PURIFYING GASEOUS FUEL.

SPECIFICATION forming part of Letters Patent No. 294,646, dated March 4, 1884.

Application filed November 4, 1881. (No model.) Patented in England June 25, 1881, No. 2,797.

To all whom it may concern:

Be it known that I, SAMUEL LLOYD, a subject of the Queen of Great Britain, residing at Birmingham, in the county of Warwick, England, iron-master, have invented certain new and useful Improvements in Apparatus for Generating and Purifying Gaseous Fuel and Preventing the Formation of Smoke in the Burning of Gaseous Fuel, (for which I have received Letters Patent in England, No. 2,797, dated June 25, 1881;) and I do hereby declare that the following is a full, clear, and exact description of the invention, which will enable others skilled in the art to which it appertains to make and use the same.

The object of my invention is to economize the production of gaseous fuel and to prevent or diminish smoke in the burning of gaseous fuel, to condense and precipitate volatile and suspended matter contained in gaseous fuel, to effect the burning of the said fuel economically, and to obtain valuable products from the condensed and precipitated matter.

My invention is especially applicable to the furnaces of boilers of locomotive steam-engines and the furnaces of the boilers of marine steam-engines, but is also applicable to the furnaces of steam-boilers for stationary steam-engines, as well as to furnaces generally in which gaseous fuel is employed.

In generating the gaseous fuel I employ generators of the ordinary kind, excepting that in the generators employed on locomotive-engines and on board steam-vessels for marine-engine boilers I avail myself of the rapid motion of the generator through the air to secure a strong draft through the generator, so as to produce the gaseous fuel rapidly, and thereby permit of the use of a smaller generator than is practicable where no such draft is available.

In order to produce a draft in the generator by the motion of the locomotive or steam-vessel in addition to the draft produced by the combustion in the generator, I fix one or more tubes in the line of the locomotive or steam-vessel's motion, the open ends of the tubes being turned in the direction of the said motion. The said open ends of the tubes are expanded or trumpet-shaped. The other ends of these

tubes terminate in tuyeres at or near the bottom of the generator. That portion of each tube between its trumpet-mouth and tuyere is coiled around the hottest part of the generator. The air entering the tubes is thereby heated on its way to the generator, and by its high temperature promotes combustion in the said generator. In order to regulate the supply of air passing through these tubes into the generator, I fix in each of them a valve or tap, by means of which the passage of air may be partially or wholly stopped, as desired, and I also fix in each air-tube a steam jet or injector, so as to propel air through it into the generator when the locomotive or steam-vessel is not in motion, or is not moving at sufficient speed through the air to give the requisite draft. I also provide a steam-pipe communicating from the boiler to the generator, the said pipe having a tap, so that should there be too much fire in the generator the same may be reduced in extent, or entirely put out should occasion require, and thus be under perfect control. Where, as in locomotives, the generator is in the open air, I sometimes obtain increased draft by means of a deflector consisting of a metallic plate fixed a short distance below the bottom or fire bars of the generator. This deflector is carried by a horizontal axis situated at the middle of the plate, so that whichever way the generator is traveling the said deflector can be so inclined as to direct a current of air through the bottom of the generator, the said current of air being heated by contact with the deflector. When convenient, I make the fire-bars of the generator hollow, and cause the current of air entering the generator to be further heated by passing through the fire-bars. Before effecting the combustion of the gaseous fuel passing from the generator, I pass it, immediately upon its leaving the generator, through a pipe having the shape of an inverted siphon, with a tank below it. The siphon collects anything that may be deposited, and then conveys the gas through pipes, tubes, or passages into a condensing-chamber, where the volatile matter is more completely condensed, the suspended matter precipitated, and the gaseous fuel cooled.

Where, in stationary generators and fur-

naces, the draft of the generator, combined with that of the furnace in which the gaseous fuel is burned, is not sufficient to determine the passage of the gaseous fuel from the generator to the furnace with the rapidity necessary, I assist the natural draft by means either of a rotary fan or blower or a steam-exhausting jet such as are commonly used for like purposes. A rotary fan may also be used with locomotives, and driven by vanes fixed on an axis, and made to rotate by being carried rapidly through the air by the traveling of the locomotive; but in the case of locomotives the exhaust-steam will in general produce sufficient draft.

The condenser into which the gaseous fuel from the generator is passed in order to cool it and condense and precipitate the volatile and suspended matter is constructed as follows: In a hollow cylinder or casing I fix a series of tubes open at each end. The gas from the generator is conveyed into the said cylinder or casing, and is cooled by contact with the tubes, which are kept cool by the passage of water or air through them; or the gas may pass through the tubes, which in this case are cooled by water or air in contact with their exterior. In order still more effectually to purify the gas from suspended matter, I cause it to pass through a series of perforated plates or shelves fixed at one end of the casing of the condenser or fixed in a separate casing. Where the gas requires to be urged forward by means of a rotary fan between the condenser and furnace, I inclose the rotary fan in a perforated casing, the latter being inclosed in an outer casing. The gas is admitted at the center of the fan, and by its passage through the perforated casing suspended matter is precipitated and falls into a receptacle below the fan.

In applying my invention to steam-vessels I prefer to place the condenser horizontally below the level of the water, and in such a position within the interior of the vessel that the tubes described, through which the water passes, are in a line or nearly in a line with the vessel's motion. The position of the condenser may, however, be varied according to requirements; but if placed above the water-level a centrifugal or other pump should be used to cause sufficient water to pass through the condenser to produce the cooling effect required.

In applying my invention to locomotive-engines I prefer to place the condenser in such a position that the tubes through which the air passes are in a line or nearly in a line with the locomotive's motion; and to facilitate the passage of water or air through the condenser, I prefer to make the ends of the tubes at which the water or air enters of a trumpet shape.

When gaseous fuel, before being burned, is passed through a condensing apparatus according to my invention, the tar and other suspended matter is precipitated and the ammonia and other condensable matters condensed, and the gaseous fuel thus purified, when burned

with a proper supply of air, burns with a flame quite smokeless, and locomotives and steam-vessels to which my invention is applied travel without producing the nuisance of smoke, so objectionable in ordinary locomotives and steam-vessels.

In order to burn the gaseous fuel in the most efficient manner, I pass both it and the air through passages or pipes round or along the heated sides of the furnace, so that one or both may be in a highly-heated state prior to combustion. By this means the heating effect, when combustion takes place, is very greatly increased.

The condensed and precipitated matter arrested by the condenser and pipes leading to and from it and from the receptacle below the fan or blower may be treated for the production therefrom of tar or tar products and ammonia compounds.

The pipes, tubes, or passages leading to and from the condenser, as well as those in the interior of the condenser, require cleaning from time to time, in order to remove the deposit of carbonaceous matter that is formed in them. I effect this cleansing by passing a current of steam or a current of hot water through them. The heat and solvent power of the steam or water loosens and detaches the deposited matter.

The accompanying drawing represents in elevation and part in plan an apparatus constructed according to my invention for generating and purifying gaseous fuel and preventing the formation of smoke in the burning of gaseous fuel.

a is the generator, of the ordinary construction, excepting that when my invention is employed on a locomotive or steam-vessel I employ one or more trumpet-mouthed tubes, *b*, to produce a draft in the generator. The tubes *b* may have valves or stop-cocks to regulate the amount of air entering the generator.

Instead of or in addition to the trumpet-mouthed tubes *b*, one or more steam-jets for injecting air into the generator may be employed. The gaseous fuel passing out of the generator at *c* descends the tubes *d d*, constituting a condenser passing into the vessel *e*, where the greater part of the tar and ammoniacal liquor produced in the generator is deposited by the cooling of the gas as it passes through the said tubes *d d*. When water is employed to cool the tubes *d d*, they are surrounded by a water-tight casing, through which water is made to circulate by being introduced at the bottom and passing off at the top. From the chamber *e* the gas passes by the pipe *f* into the chamber *g*, which contains a series of plates, *h h*, made of perforated sheet metal or wire-gauze. Any uncondensed tar or suspended particles of tar is condensed or arrested by the said plates *h h* and collects in the bottom of the chamber *g*. From the chamber *g* the purified gas passes by the pipe *k* to the blower or fan *l*, by which it is forced, under pressure, along the pipe *m* to the place where it is to be burned. Where there is sufficient

draft without the blower or fan *l*, it may be dispensed with.

The contents of the chambers *e* and *g* may from time to time be drawn off through the pipes *e*² *g*², provided with stop-cocks, into the receptacle *n*.

p is a branched steam-pipe, one branch, *q*, of which, provided with a stop-cock, opens into the top of the condenser *d*. The branch *r* of the said pipe *p*, also provided with a stop-cock, opens into the chamber *g* in the manner represented in the drawing.

The tubes *d* of the condenser and the plates *h* of the chamber *g* are liable to get clogged with tar and other matters, and in order to clean them steam is introduced through the pipes *q* *r*, the tarry matter is thereby liquefied, and by the rush of the steam the pipes *d* and plates *h* are cleared, the tar falling into the chambers *e* and *g*, and from thence passing to the reservoir *n*, from which it is removed from time to time in order to separate it into its constituents and utilize those of them which are of value.

The figure at A shows the pipes *d* of the condenser in plan.

My improvements are applicable both to gaseous fuel obtained by slow or imperfect combustion carried on for the purpose of producing the said gaseous fuel, and to gaseous fuel obtained as a residual or waste product—as, for example, the gaseous fuel evolved from blast-furnaces in the smelting of iron. Mixtures of these kinds of fuel may also be treated according to my invention.

Having now described the nature of my invention and the manner in which the same is

to be performed, I wish it to be understood that I claim as my invention—

1. The combination, with a gaseous-fuel generator comprising a stack and air-inlets, of a tubular surface condenser, a dry friction-scrubber, and steam-pipes for admitting steam into the condenser and scrubber for cleaning the same, substantially as described.

2. The combination of the gaseous-fuel generator provided with air-inlets, the condenser comprising the series of tubes, the scrubber comprising perforated plates inclosed in a casing, and the branched steam-pipe having a branch opening into the condenser, and a second branch opening into the scrubber, substantially as described.

3. In a steam-propelled vehicle—such as a steamboat, locomotive, or the like—the combination, with the boiler-furnace, of a gaseous-fuel generator comprising a stack and air-inlets, and purifying apparatus for condensing and separating the smoke-producing elements, interposed between the generator and boiler-furnace, substantially as described.

4. In a vehicle—such as a steamboat, locomotive, and the like—the combination, with a gaseous-fuel generator carried by said vehicle, of a condenser for purifying the gaseous fuel, and means for cooling the condenser by a current or circulation of the fluid, air, or water through which the vehicle moves, substantially as described.

SAMUEL LLOYD. [L. S.]

Witnesses:

GEORGE SHAW,

RICHARD SKERRETT,

Both of No. 37 Temple Street, Birmingham.