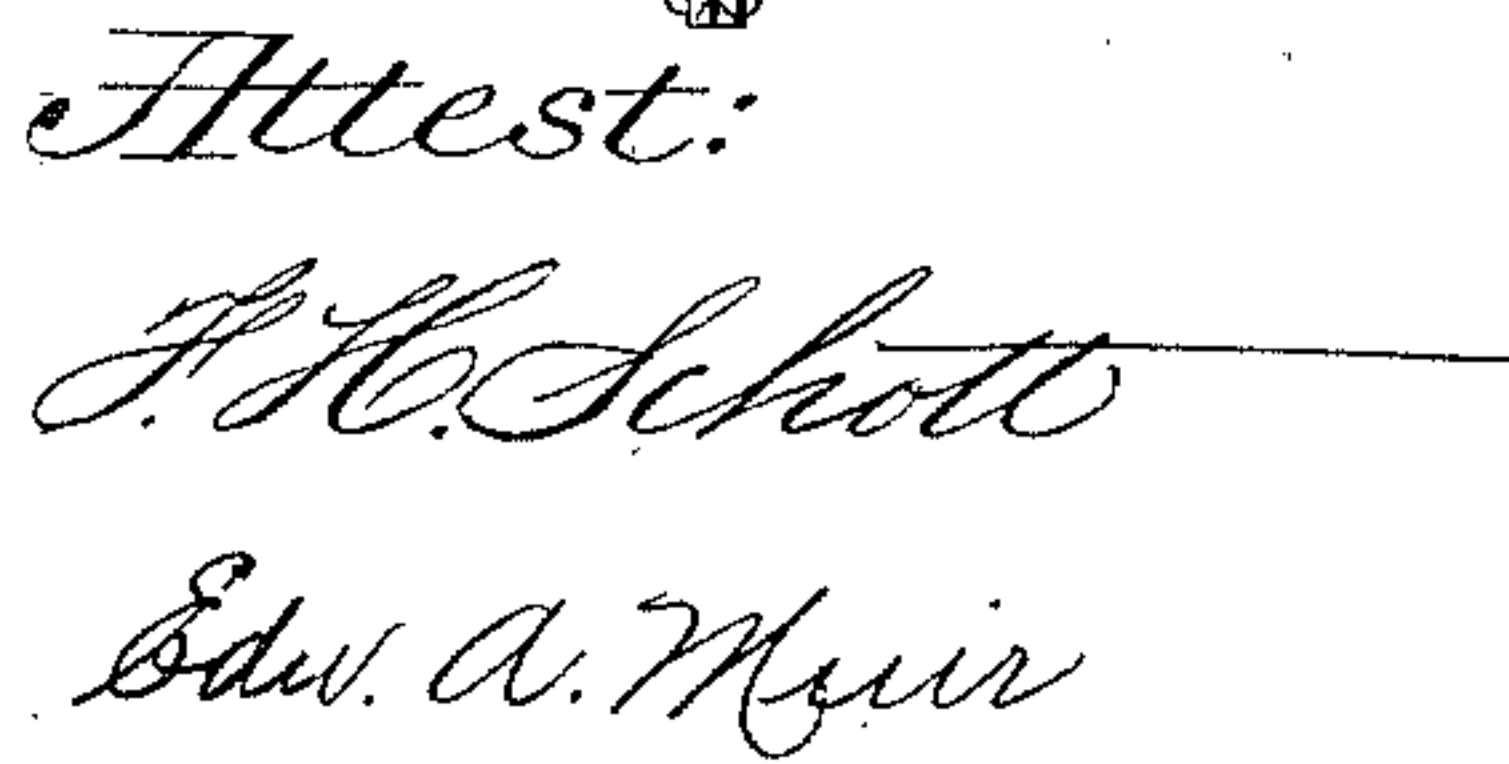


A. KITSON.  
GAS GENERATOR.

Patented Nov. 3, 1891.



Arthur Kitson

By - E. H. Clark atty.



# UNITED STATES PATENT OFFICE.

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## GAS-GENERATOR.

SPECIFICATION forming part of Letters Patent No. 462,561, dated November 3, 1891.

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*To all whom it may concern:*

Be it known that I, ARTHUR KITSON, a subject of the Queen of Great Britain, residing at Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented certain new and useful Improvements in Gas-Generators; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to an improved gas-generating furnace adapted more particularly for generating fuel-gas for domestic heating and cooking and for manufacturing purposes.

The object of the invention is to provide for more certainly passing steam and air down through the body of heated fuel and conducting the resulting gases away centrally through the movable grate or hearth.

Another object of the invention is to simplify the construction and arrangement of the mechanism for imparting to the grate or hearth which supports the coal a rotary or spiral and a vertical up-and-down motion for removing ash and cinder at the peripheral opening and for causing the coal to properly feed downwardly and preventing it from caking in case bituminous or soft coal is used.

Another object is to provide a simpler and more effective arrangement of air-heating flues in the wall of the generator and connecting injectors for forcing hot air either up or down and into the top or bottom of the generator.

The matter constituting my invention will be defined in the claims.

In order that my invention may be fully understood, I will now particularly describe it by reference to the accompanying drawings, in which—

Figure 1 represents a vertical section of the generator. Fig. 2 represents a vertical section taken at right angles to the view shown in Fig. 1.

The walls of the furnace F are constructed of fire-brick and inclosed in an iron jacket in the usual manner.

The fuel-chamber is provided at the bottom with an annular iron plate P, which is supported upon the iron columns Y'. The iron

ash-chamber A is also bolted to the annular plate P and suspended therefrom. The ash-chamber is provided at the bottom with a downwardly-extending passage or opening *a'*, provided with a valve *a*, having a handle for removal of ashes. It is also provided with a door or lid *a''* for giving access to the interior for cleaning or inspecting the gearing and other mechanism connected with the grate or hearth.

The large fire-box heretofore proposed is very much simplified in construction and is practically done away with, and I substitute therefor a grate or hearth provided with means for giving it both a rotary and vertical up-and-down motion. I also provide a central passage-way through the hearth connected by pipes passing through the ash-pit with the gas-escape pipe and with a supply-pipe for air and steam. I also provide an opening between the periphery of the hearth and wall of the furnace for the removal of ash and cinder, thus permitting them to be shaken out while gas is being passed off through the central opening and the pipe leading therefrom through the ash-pit.

The hearth B is preferably made of iron having a turned-up circumferential flange and filled in or covered over with fire-brick, as shown. It is provided centrally with an opening *b'''*, and above such opening with a central cap *b'*, supported on blocks a short distance above the grate, so as to form ports *b''*. The grate or hearth is connected to and supported centrally by the short hollow screw-shaft E, having a central opening *e*, which is mounted in the collar or hub H, which is internally screw-threaded and supported by the legs *h*. The screw-threads upon shaft E are made large and strong, so as to withstand the pressure of the body of coal resting upon the hearth B.

To the under side of the hearth B there is riveted or bolted the large annular hub *b*, carrying at its lower end the large toothed gear-wheel B', arranged to mesh with the long pinion T, mounted on shaft *t*, by means of which the hearth is rotated and raised or lowered. The shaft *t* is journaled at top and bottom and has secured to it the beveled gear-wheel *z'*, meshing with the beveled gear *z*, secured



to the inner end of horizontal shaft Z, which is provided at its outer end with handle Y. By means of this mechanism the hearth is readily rotated and raised or lowered according to the direction in which the handle is turned. The object of these two motions is to shake up the fuel more thoroughly and to provide for more effectively using bituminous or soft coal in the generator. It will be understood that as the hearth B and toothed wheel B' are turned in one direction the screw-shaft E will be traversed upward through the hub H, and if turned in the other direction will be traversed downward through such hub, so as to raise and lower the hearth.

The hollow screw-shaft E, fitting in the hub, is simple in construction and positive in action, so that the hearth cannot stick when it is desired to move it either up or down.

The large hollow hub *b* serves as a hood to protect the screw-shaft and its hub from ash and cinder. A short vertical pipe N, having two elbows at its lower end, projects up into the passage *e* of the screw-shaft E, fitting loosely therein, so that the shaft may be readily turned around it. This pipe N connects by one elbow with the gas-take-off pipe X', leading outward and connecting with the main gas-take-off pipe X. Pipe N also connects by the other elbow with the inlet-pipe D for air and steam.

By mounting the movable solid hearth upon a central support, as above described, I provide an annular opening *g* between its periphery and the wall of the furnace for the removal of ash and cinder.

The steam-coils Q are preferably arranged in a channel formed in the brick lining at or near the base of the fuel-chamber F, and they are inclosed in such channel by removable tile *f*. A steam or water supply pipe J, provided with a drip-valve *v'*, connects with the inlet end of the coil Q. In case water is admitted into the coil, the supply-pipe J is preferably supplied with a small jet-nozzle *j*, so that water may be forced under pressure and in the form of spray into the coil-pipe Q for rapidly generating steam when it is desired to generate the steam within the furnace.

The outlet end of coil Q is connected by pipe Q' and a branch pipe *q* with the upper injector R, and by a branch pipe *q'* with the lower injector R'. The air-supply box K, provided with a removable or adjustable lid or slide *k*, connects with the upper injector R and also with a hot-air flue C at the top of the furnace. The lower injector R' connects with an air-supply box L, having a removable lid or slide *l*, and connecting with the lower end of the hot-air flue C. The lower injector R', having a valve *r'*, opens into the supply-pipe D, connecting with the interior of the fuel-chamber through the central opening in the hearth B. The hot-air flue C is formed spirally or in other equivalent manner in the brick lining of the furnace, and may be lined with metal or formed of metal-

lic tubing, if desired. The upper injector R, having a valve *r*, connects with the top of the furnace by inlet-passage V.

When the furnace is in operation and steam is supplied to the injectors under suitable pressure, valve *r* may be closed, while valve *r'* is opened, and the lid *k* of air-box K may be removed, thus admitting air into the top of flue C, in which case the air will flow downward and be heated in its passage through the flue, and will then flow through box L to injector R' for supplying air to the base of the fuel-chamber. In case it is desired to supply air to the top of the furnace, the injector R is put in operation, the valve *r'* being closed and the valve *r* opened, and the lid *l* of box L is removed, thus admitting air into the lower end of the flue C, so that it is heated by passage up through such flue, and finally escapes through box K, injector R, and supply-passage V into the top of the furnace. The gas-take-off pipe W leads from the top of the furnace to the chimney W', and a pipe X'', provided with a valve 10, leads from pipe W to the holder or to a place where the gas is burned. Pipe X connects the lower pipe X' with the upper pipe X'', and is provided with a valve 11, so that gas may be passed off from either the top or bottom of the furnace and thence to the holder.

The fuel-supply opening G is provided at the top of the furnace, and in practice may have connected with it a suitable charging-hopper with valves for admitting measured quantities of fuel, as required. The bottom of the fuel-chamber is made of greater diameter than its upper portion, so that when the hearth B is lowered the entire weight of the fuel exerts its full pressure downward, unchecked by friction against the side walls of the furnace. This provides for cleaning the fire, and in case bituminous coal is used any bridge or arch formed in the upper portion of the fuel is readily broken. After the hearth has been lowered it is then raised to its normal position, thereby compacting the fuel into a body of uniform density, thus preventing the formation of blow-holes or cavities and securing more uniform action of the air and steam on the fuel, resulting in a better production of gas. In order to better mix a fresh charge of coal with the body of incandescent fuel in the furnace, the hearth B may be lowered by turning the toothed wheel B' in the right direction (after first having introduced a fresh charge of coal) and then again rapidly turning and raising such hearth. The fresh fuel thus becomes mixed with the incandescent coal and forms a compact body.

The furnace may be operated for the production of gas as follows: The chimney-valve (not here shown) is opened, valves 10 and 11 are closed, and the ash-pit door or valve is opened. A fire is then kindled upon the hearth, being allowed to burn by natural draft, and is gradually supplied with fuel till a brisk fire is started and steam is generated



in the coils Q. So soon as a sufficient pressure of steam is produced for operating the injectors the ash-pit door and valve are closed, the chimney-valve is also closed, valve 10 is opened, and air and steam are injected through pipe D, passage e, and ports b'' into the bottom of the fuel-chamber. In this manner the fire is blasted and the fuel soon heated to incandescence, at the same time generating producer-gas. Fresh fuel is supplied at suitable intervals until a deep body of it is formed, in an incandescent condition. After a deep body of incandescent fuel has been formed the air-supply may be very much reduced or entirely shut off for a time, so as to generate almost pure water-gas by continuing the admission of steam, and the steam may be passed either up or down through the body of fuel and the gas passed off either at top or bottom of the furnace. Whenever found desirable during the operation of the furnace, the lower injector R' may be closed and the upper injector R started, in which case the lid l of air-box L will be opened, permitting air to pass through box L and up through the flue C, and thence through box K into injector R. In this case valve 10 of the take-off pipe is closed and valve 11 opened, permitting gas to be passed off from the bottom of the fuel-chamber through ports b'', passage e, pipes N and X'.

My generator may be operated intermittently, so as to generate pure water-gas at one period and at the next period generate producer-gas, and the two kinds of gas may be stored or used separately. If it is desired to generate rich gas, hydrocarbon oil may be admitted into the fuel-chamber at the top of the furnace through pipe O, having valve o, and the resulting carbureted hydrogen passed off, either alone or with the water-gas.

By forming an opening centrally in the hearth and connecting directly therewith the gas-take-off pipe, the air and steam admitted to the top of the furnace will naturally pass down through the body of fuel and away from the lining or wall of the chamber, and the resulting gases are also drawn to the central part of the chamber and away from the side walls in order to pass out at the central opening. Better gasification of the fuel and decomposition of the steam and air are thereby effected, resulting in the production of a better quality of gas.

The gas-take-off pipe X, connecting with the central opening in a solid hearth and passing out through the ash-pit, is an important feature of my invention, for by means of such construction I am enabled to rotate and raise and lower the grate while the furnace is in operation for the removal of ash and cinder and deposit them in the ash-pit without filling the outgoing gas with such ash and cinder. A cleaner purer gas is thus delivered from the generator, while at the same time the generator may be operated continuously, avoiding the long stops in the generation of gas

usually required in order to properly clean the fire. Under certain conditions it is quite important to operate the generator continuously in order to maintain the required volume of gas, and by my improved construction I attain this advantageous result.

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

1. A gas-generating furnace having a steam and air injector at the top, in combination with a movable solid hearth having a central opening, the wall of the furnace and said hearth having an opening between them, an ash-pit below the hearth, a pipe leading from the central opening of the hearth through the ash-pit to the gas-take-off pipe, and suitable gearing for giving said hearth both a rotary and an up-and-down motion, whereby the fuel at suitable intervals may be stirred and mixed and caking prevented, the ash removed, and the generator operated continuously for manufacturing gas.

2. The fuel-chamber of the furnace and the solid hearth provided with an annular opening between them, and said hearth having a central opening, in combination with an ash-pit below the hearth, a gas-take-off pipe leading from said central opening through the ash-pit, and a steam and air injector connecting with the top of the generator, substantially as described.

3. In combination with the fuel-chamber and solid hearth constructed with a peripheral opening between them, and said hearth having a central opening, a cap above such opening having circumferential ports, an ash-pit below the hearth, a gas-take-off pipe leading from the base of the generator, a pipe passing through the ash-pit connecting such pipe with the central opening in the hearth, and a steam and air injector connecting with the top of the generator, substantially as described.

4. In combination with the fuel-chamber and solid movable hearth constructed with a peripheral opening between them, and said hearth having a central opening, an ash-pit below the hearth, a hollow screw-shaft connecting with the hearth at the central opening, a screw-threaded hub with which said shaft engages, means for rotating the hearth, and the gas-take-off pipe passing through the ash-pit and connecting with said hollow screw-shaft, substantially as described.

5. In combination with the fuel-chamber and the solid hearth having a central opening, a hollow screw-shaft connecting with the hearth at such opening, a screw-threaded hub supporting said shaft, a pipe connecting with said hollow shaft, an injector connecting with the fuel-chamber, a large gear-wheel connecting with the hearth, and connecting gearing for giving the hearth both a rotary and an up-and-down motion, substantially as described.

6. In combination with the fuel-chamber



and hearth, the screw-shaft, a screw-threaded hub supporting said shaft, a hollow hub *b*, projecting down from the hearth around said screw-shaft and hub for protecting them  
5 from ash and cinder, a large gear-wheel connecting with said hub *b*, and operating-gearing connecting with such gear-wheel, substantially as described.

7. The fuel-chamber having an air-heating  
10 flue in its walls extending from the top to near the bottom thereof, in combination with injectors and air-boxes having ports and removable covers connecting with the upper and lower ends of the air-flue for drawing air  
15 in either direction through the flue, pipes connecting the injector with the top and bottom of the generator, and a gas-take-off pipe, substantially as described.

8. In combination with the fuel-chamber  
20 having an air-flue in its wall provided with an inlet-port and a connecting injector, the movable solid hearth having a central open-

ing, said fuel-chamber and hearth having a peripheral opening between them, an ash-pit below the hearth, a pipe connecting the injector with the central opening of the hearth, a gas-take-off pipe connecting with the fuel-chamber, and mechanism for giving the hearth both a rotary and an up-and-down motion, substantially as described.

9. In combination with the hearth having a central opening, an elbow-pipe *N* in the ash-pit connecting with such opening, an injector, and steam and air supply pipe, and a gas-take off pipe, both connecting with pipe  
35 *N*, said pipe passing through the ash-pit, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

ARTHUR KITSON.

Witnesses:

EVAN J. LESTER,  
E. CLINTON RHOADS.