

Patented Jun. 27. 1846

N^o 4,604.



UNITED STATES PATENT OFFICE.

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APPARATUS FOR GENERATING GAS.

Specification of Letters Patent No. 4,604, dated June 27, 1846; Antedated December 27, 1845.

To all whom it may concern:

Be it known that I, AMARIA PIERCE, of the city and county of Philadelphia and State of Pennsylvania, have invented a new and Improved Mode of Generating Gas from Poison and other oily substances by the assistance of red-hot iron balls, connected with other new and useful combinations and arrangements; and I do hereby declare that the following is a full, clear, and exact description of the construction and operation of the apparatus, reference being had to the annexed drawings, making a part of this specification, in which—

Figure 1. Representing in perspective a view of the gas-generating apparatus.

The same letters are used through all the figures as the same parts of the apparatus.

(A) the foundation, or floor, (B, B,) the roofing of the furnaces, (C, C,) the chimney, (D, D,) the body's of the furnaces, (E) the platform, before the fire place, (F, F,) the kettles for melting rosin, etc., (G, G,) the heater, (H, H,) the pipe and stopcock, to conduct the melted rosin into the trap (I), (K, K,) the outside cup, (L, L,) the cover, of the pipe for distributing the melted rosin, (M, M,) the first gas condenser, (N, N,) connecting gas pipe of the first condenser and tar chest, (O) the tar chest (P) the worm-shaped gas-cooler or condenser, (Q) the last gas controlling pipe, leading the gas from the apparatus to the gasometer (not shown in the drawings). (R) reservoir for water, (S) a pump to raise the water from the reservoir, to the supply barrel (U), (T) the top cover and opening at the reservoir, (U) the supply barrel, (V) the top cover and opening of the supply barrel (W) pillar or post to support the supply barrel (U) at the proper height, (H) the supply pipe and stop cock (a), to conduct cold water from the supply barrel (U) into the worm cooler (P), (Y) the warm water return pipe from the worm cooler (P) to the first cooler (Z) through the pipe (b, b,) (d, d, d, d,) the last return pipe, through which the hot water from the first cooler (Z) is discharged, and returned for cooling and the next operation to the reservoir (R).

Fig. 2. Representing the end view of a furnace entire, (B) the arched roof, (C) the chimney and (D) the body of the furnace: (e) the door of the ashpit, (f) the door of the fire place, (g) the rim of the large retort, (h) the rim of the inside heating retort,

(i, i,) handles and straps of iron to fasten the heating retort to the rim of the large retort (g) (k) the cover of the heating retort.

Fig. 3. The same end view, but the inside shown in a section, (B) the arched roof of iron (C) the chimney and (D) the body of the furnace, (l, l, l, l,) the inside wall, of five bricks, (m, m,) the ashpit, (n, n,) the grates of the fire place (o) (p, p, p,) the armature or jackets, to place the large retort in it, to prevent its burning by the immediate contact with the fire from the furnace, (g, g, g, &c.) the large retort, (r, r,) the return heating space above the large retort (g, g), (s, s,) the inside heating retort, (t) the leg, or support of the heating retort near its extreme, (u) the red hot iron balls within the heating retort (s), (v) the end of the rosin distributing pipe, within the large retort (g, g,) the dotted line (w, w,) showing the connection with the trap and cup (x), (y y) the iron balls—heating or to make them hot into the furnace (o).

Fig. 4. Showing the shape and mode of fastening the armature or jacket to, and under the large retort (q, q). (q, q,) The large retort, and (r r, r r,) ribs, cast to the large retort in one piece, to receive the armature (1). The groove (2) to be fitted, and slipped over the rib (r r, r r) at the extreme, or near the neck (3) of the large retort (q q). In view to give vent to the fire, from the fire place to the upper part of the large retort and to the chimney (C). (p, p, p,) another kind of armature or jacket resting with their flanges (p, p) upon the fire bricks, of the side walls (l, l,) and cutting off the communication of the fire from the under to the upper part of the large retort (q, q).

Fig. 5. Showing the place where the said ribs (r r, r r,) to be, (q,) the big retort, (M) the first condenser, and (3) the neck or communication between the inside of the large retort and the first condenser (M), (Z) the cooler, (b) the warm water pipe, and (d) the hot water discharge pipe, (N) connecting gas pipe, (r r, r r,) the said rib cast together with the large retort (q) as before mentioned.

Fig. 6. Representing a horizontal section of the furnace and retort, (q) the large retort, (M) the first gas condenser, (Z) the first cooler (3) the neck, (4) the space between the large and the inside heating retorts (5), (u u u) the red hot iron balls, (k) the cover of the heating retort, (p, p,) the

flanges of the armature without groove, resting on the surrounding brick wall (*l, l*), (1, 1,) the grooved armature or jacket, slipped on the ribs (*r r, r r*) as before described, (4, 4) openings for the fire to turn from the fire place (*o*) to the upper part of the large retort (*q*), and the chimney (C).

Fig. 7. Explaining the communication between the first condenser, the tar chest, the worm cooler, and the pipe leading to the gasometer. (M, M) the first gas condenser, (Z Z) the first cooler, (N, N,) the connecting gas pipe of the first gas condenser and tar chest (O), the pipe (N) being fixed to the cover of the tar chest by the flanges and screws (5, 5). In the inside of the tar chest at the end of said pipe (N) is the tar trap (6) fixed, to prevent the gas returning from said chest into the retort, at times when the retorts should be opened. (7, 7, 7, 7, &c.) holes in the cover of the chest. These are better illustrated at (Fig. 8), where the cover (O) is represented reversed; (7, 7, 7, 7, &c.) the holes and (6, 6) the tar traps. (P, P,) the gas or worm cooler, (8) the worm-shaped tubes, are each of them connected at their lower end with one of the holes (7,) above the chest, but the tubs (8) are also fastened each in a separate hole (9) at the lower end of the closed pipe (Q), which pipe projects through the upper cover of the worm cooler (P, P); the pipe (Q) is continued and connected with the gasometer, (not shown in the drawings).

Fig. 9. Representing the trap (I), the outside cap (K), the cover (L) of the distributing pipe case (20), the screws (10), the rosin supply pipe (11), and the distributing pipe (12) (13) are the small holes in the said pipe (12) through which the fluid rosin or other oily substances, has to pass on the surface of the heating retort (*s, s*). The trap (I) is composed of two vessels, or three parts, a shallow rim (14) to receive the fluid rosin, a small tube (17) open at both ends, fixed in the center of the bottom of the shallow rim (14), and a wide cap (15) is fastened to the said tube (17) by two pins or screws (16) under the shallow rim (14), so that a small space is left between the upper rim of said cap, and the shallow rim bottom, of (14), and also a small space is left between the lower part of the open tube (17) and the inside bottom of the cap (15), this arrangement forming the said trap; this trap (I) is inserted and united with the outside cap (K), as shown by the dotted lines (18). A trap of this described construction, will give free access and passage for the rosin to enter the outside cap (K), the feeding or supply pipe (11), and the distributing pipe (12), and at the same time preventing the escape of the gas from the large retort through the same passage which is cut off by the said

trap. The hot fluid rosin, entering the distributing pipe (12) will run out through the numerous small holes (13, 13, &c.) in small streams, all along and over the surface of the heating retort (*s, s*), and be decomposed. The narrow and long opening or case which admits the distributing pipe (12,) into the large retort, is closely fastened by the cover (L) and air tight, screwed by (10, 10, 10, &c.), the said cover being cast in one piece with the outside cap (K) and pipes (11 and 12).

Fig. 10. Showing a longitudinal section of the apparatus (19, 19, 19, &c.) the iron arched roofing and covering of the whole furnace and retort, &c.: (B, B,) The upper part or roofing (D) The body of the furnace: (*m*) The ashpit. (*n*) The fire grate. (*l, l, l*.) The inside walling of fire bricks. (*p, p, p, &c.*) The armature or jackets of the large retort (*q*) resting with their flanges on the side walls: (*r, r, r, r*.) The grooved jacket on the ribs of the large retort being by this arrangement, an open space (4, 4,) between the flanges of the grooved jacket (*r, r, r*.) and the wall, large enough for the fire to pass from the lower part of the retort to the upper and the chimney as shown in the drawings by the painted flame, and the direction of the arrows: (C) The chimney (G) The heater, and on top the rosin kettle (F) (I) The traps and caps, (11) the supply pipe and (12) the distributing pipe (*s', s'*.) The upper part of the inside heater, in which the red hot iron balls are contained; (*t*) The support of said retort (*s*) and (*q*) the upper part of the great retort, (L') The air tight covering of the narrow space or case (20) which is cast with the large retort, in one piece. (*y, y, y*.) The iron balls to be heated within the furnace—(3) The communication from the large retort to the first condenser (M)—(Z) the first cooler—(N) connecting gas pipe,—(6) The tar trap,—(O) The tar chest,—(7) The holes in the cover of the tar chest—(P P) The worm cooler. (8) The worm shaped tubes,—(Q) The gas pipe leading to the gasometer. (21,) a pipe provided with a short knee bent downward in the inside and near to the bottom of the tar chest (O)—this pipe has at the outside of said chest a stop cock, 22 an upright pipe (23) is also connected with said horizontal pipe, between the stop cock and chest. This pipe (23) is open and terminating in a funnel shape, the rim of said funnel to be several inches below the line of the cover of tar chest. The knee at the pipe (21) before mentioned is for the purpose to prevent the gas to escape through the said pipe, when the chest is to be emptied of tar, and the upright pipe and funnel (23) to insure that the tar within the chest may not enter the worm cooling apparatus, and

by said open tube the depth of the tar in the chest may at all times be known.

(R) The reservoir,—(S') The pump to lift the water from the said reservoir into the supply barrel (U),—(X') The supply pipe, to conduct the water within the worm cooler (P, P.),—(Y) and (b, b,) discharge pipes—and (d, d,) The hot water return pipes.

10 Fig. 11. A wire grate for the purpose to withdraw the iron balls from the inside of the heating retort (s', s') when necessary. (a, a,) two parallel iron strong wires connected together at intervals by cross pieces,—
15 at the farthest extreme are two hooks (b b,) bent upward,—as the forepart, the wires are united and bent upward also, forming a loop or handle—the grate and balls are introduced together, by and by, within the
20 heating retort,—and when desired to remove the said balls from the inside retort, the wire grate is pulled at the said handle (c' c') and the balls will be drawn out all together.

25 Fig. 12, representing the narrow case (20) at the large retort,—through which the distributing pipe (12) is to be inserted. (q q,) The large retorts—(K) the traps,—and (L) the airtight cover over said opening
30 of the case (20)—marked by dotted lines,—at (a a a) the same cover (L) and traps (K) is shown separately.

Fig. 13. The said case (20) and large retort is shown from a side view (q, q,) The large retort, (b x) The case of the distributing tube (12) cast in one piece with the large retort,—the cover, trap, supply and distributing pipes are shown by the dotted lines (o o, o o).

40 The following is the explanation of the operation of said gas generating apparatus. At first, rosin is put into the kettle (F) (Fig. 1, and Fig. 10). The stopcock (a) of the pipe, from the supply barrel (U) is opened.
45 (The supply barrel being higher situated than the worm cooler (P) and the first cooler (Z) in the first condenser (M),) will soon fill (P) and (Z Z) with cold water, and when through the pipe (d, d,) the water
50 begins to run into the reserve barrel (R) the stopcock a is to be shut. The iron balls (y, y) are placed into the furnace (O) covered with coal, and ignited, &c., the flame striking in the furnace the armature or
55 jackets (p p) of the large retort (q, q,) following the draft, and passing through the opening (4 4) to the upper part of the large retort, and in passing toward the chimney (C) heat and melt the rosin in the kettle (F.) The iron balls are removed as soon as
60 they become red hot, from the furnace and introduced into the heating retort (s', s') in the manner as before described, the heating retort closed with the cover (k) and the
65 stopcock (f f) from the rosin kettle opened,

only so much is to be drawn as to get the desired quantity of melted rosin for operation; the rosin running into the trap (f) filling the cap (19') and through the pipe descending into the distributing pipe (12) 70 where the rosin in small streams is dispersed through the holes (13, 13, 13,) over the hot surface of the heating retort, (s', s') and is decomposed, and hydrogen gas and tar is the result—the evolved gas and the 75 tar passing; after being doubly heated, from the outside by the large retort (q, q) and the inside by the heating retort (s, s) and red hot balls (u u),—through the communication neck (3) into the first gas con- 80 denser (M), to be condensed by the first cooler (Z) in circulating round the same and descending through the connecting gas pipe (N) (Fig. 10), and through the tar trap (6, 6,) into the tar chest (O) (Fig. 7,) and 85 from the tar chest (O) through the holes in the cover (7, 7, 7, 7,) (as shown in Fig. 8) will enter the worm shaped tubes (8)—these tubes (8) being confined in the worm cooler (T) and surrounded by cold water— 90 the upper extreme of said tubs entering each in a hole of a reviving tube as (g, g, g, g), connected as before described, by this arrangement, the tar is separated by the perfect cooling, from the gas—the tar 95 descending through the worm tube into the tar chest (O) and the gas, pure and cold ascending through the pipe (Q) and passing off, toward the gasometer, (not shown in the drawings.) As soon as the fluid 100 rosin is conducted into the trap (I) and gas disengaged,—the stopcock (a) from the cold water supply barrel (U) is again opened and a constant circulating stream of cold water kept up (and the quantity regu- 105 lated by said stop cock (a).

At the lower part of the worm cooler (P, P,) the water from the supply barrel (U) is conducted in and round the worm tubes (8)—as the upper part of said worm 110 cooler, is another pipe (y) to carry off the warm water, and circulate by the pipes (b, b,) through the first cooler (Z) entering the same at the lower part and passing off as hot water through the pipes (d, d,) into 115 the reservoir (R) where the water is left to cool, and then raised by the pump (S') again into the supply barrel (U) when the same operation may be repeated. The supply barrel (U) being higher stationed than 120 (P, and Z,) and (R) still lower than any of the former—it is evident that by such an arrangement a stream of water may be circulated and kept up, for any length of time. 125

It may be here repeated, that at the tar chest (O) the tar trap will prevent, the gas from returning to the first condenser, so will the trap of the fluid rosin make it perfect and safe in said joint,—the discharge pipe 130

to empty the tar chest, is also by the application of the bent knee of said pipe, so arranged as to prevent the escape of gas when the tar is drawn from the chest (O), and the pipe (23) prevents the tar from accumulating too much in the tar chest, so, that the operation can be carried on, with the greater ease and safety.

The large retort (*q, q*) the first condenser (M) the neck (3) the rib (*r r, r r*) (Fig. 5) the narrow case to be (20) (Fig. 13) (to receive the distributing pipe (11 and 12)) the flanges (*g, g*) and (*s, s*) are all cast in one piece, including the proper openings at both ends of said large retort, to receive as the one, the heating retort (*s, s*) and at the other the first cooler (Z) they are to be fastened by screws to the flanges of the big retort (*q, q*).

The heating retort (*s, s*) has at its extreme end toward the neck (3), of the large retort a proper support (*t*) (Fig. 3 and Fig. 10) cast to the body of the heating retort to give the said retort a solid stand in its position.

The armature or jacket of the large retort Fig. 4 are also cast iron, made to fit exactly to the body of said retort (*q, q*) to prevent the injurious effect of heat upon the body of the retort the flanges (1, 1,) resting on the surrounding firebrick wall, to support the said retort between the grooved jacket on the ribs (*r r, r r*) and the brick wall, is an opening (4, 4,) left in the manner as shown at (Fig. 4) by (1, 1, 1,) and (*r r, r r*) the fire passing in and through said opening (4, 4,) (Fig. 6) to the upper part of the large retort as represented in (Fig. 6) and (Fig. 10.)

Fig. 10 representing a longitudinal section of the fire place or furnace, the drafts, through all windings; and the parts which are heated by the same flame or heat, from the fire grates (*n*) to the chimney (C) illustrated by the colored flame and arrows in the drawings.

Fig. 14, showing a plan for large apparatus to heat the retort (*s s*) without the use of red-hot iron balls by simply introducing the fuel in the inside of the retort (*s s*) and conducting the fire through the same in full length of the retort,— the smoke is

further carried through a short tube or pipe (*p p*) which connects the inside of the retort (*s s*) with the smoke, arch of the furnace from the large retort (*q q*) uniting at (*r r*) and escaping in common through the chimney (C).

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

1. The combination, use, and arrangement of two retorts one in the inside of the other, fastened and secured as above described, for the purpose to generate gas from rosin or any other oily substance, as set forth,— which rosin, or oily substance is introduced in the space between the heated (large) retort (*q*), and the inside heating retort (*s' s'*), as described in the specification and represented in the drawings (No. 1, Fig. 14 at *x' x', x' x'*) and (No. 11, Fig. 10 at 12 and 13.)

2. I claim the use and combined arrangement, to keep up a constant and uninterrupted current of water through the condensers (P and *z z*) for the purpose of cooling and condensing the gas, (which is arranged in the following manner: The supply barrel (U) is supplied by the pump (S') from the reservoir (R), the current of water passes through the supply barrel (U) into the wormshaped gas cooler (P) through the supply pipe (*x*), and then through the warm water pipe (*Y b b*) into the first coolers (*z, z*) and lastly, returning the heated water by the return pipes (*d d*) again into the reservoir (R) to renew the circulation, as described in the specification.)

3. I claim the combining the armature or jacket with the retort in the manner described (see) No. 1, (1 and *p*, Fig. 4) for the purpose to inclose and secure the lower parts of the large retort (*q*) from the destructive action of the fire.

4. I claim the arrangement of the tar-trap (*b*) being in the inside of the tar-chest (O) (Fig. 7) attached to the lower extremity of the conducting gass pipe (N) for the use and purpose as described above.

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Witnesses:

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