

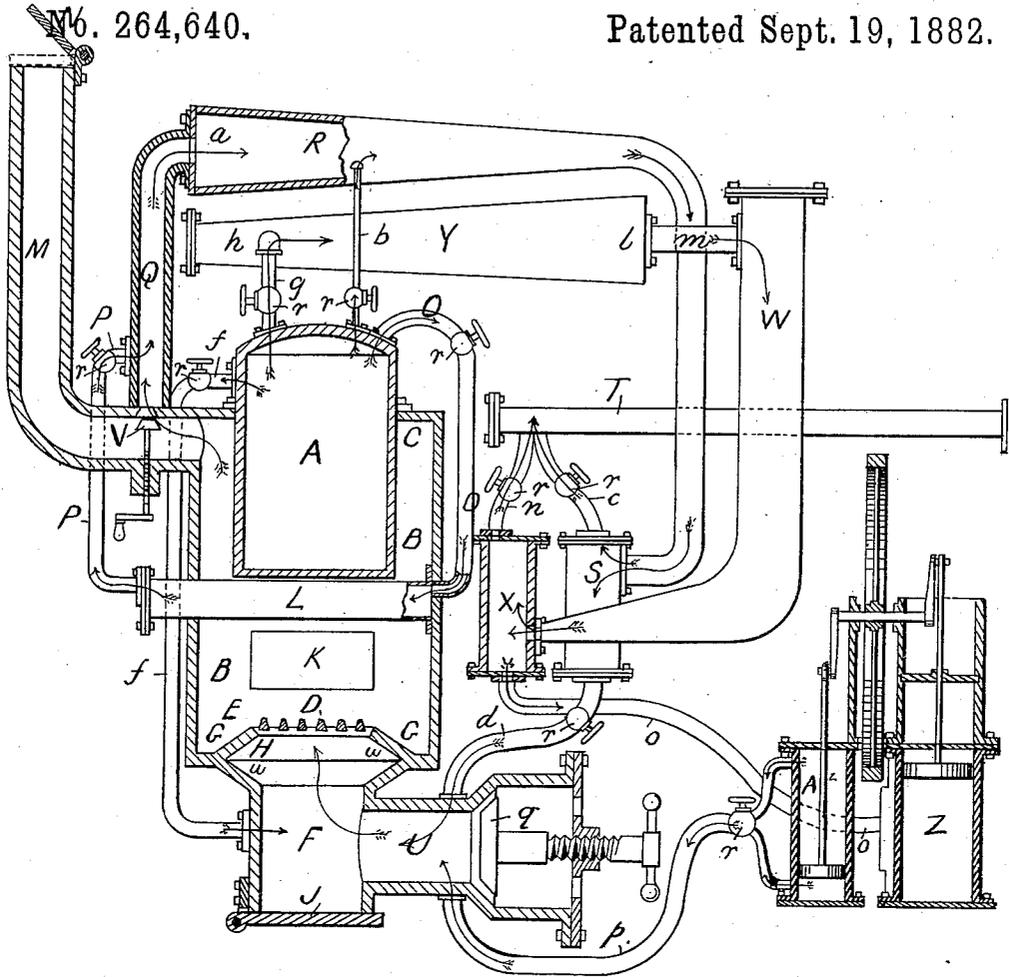
(No Model.)

B. W. DUNKLEE.

GAS REFINING AND STEAM POWER APPARATUS.

No. 264,640.

Patented Sept. 19, 1882.



WITNESSES.

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BENJAMIN W. DUNKLEE, OF BOSTON, MASSACHUSETTS.

GAS-REFINING AND STEAM-POWER APPARATUS.

SPECIFICATION forming part of Letters Patent No. 264,640, dated September 19, 1882.

Application filed April 26, 1882. (No model.)

To all whom it may concern:

Be it known that I, BENJAMIN WELLS DUNKLEE, of Boston, in the county of Suffolk and State of Massachusetts, have invented certain new and useful Improvements in Gas-Refining and Steam-Power Apparatus, of which the following is a full, clear, and exact description.

This invention, in substance, consists in the arrangement and construction of an apparatus combined with a steam-boiler, all substantially as hereinafter described, for the admixture of air under pressure, gaseous products from combustion of coal, and superheated steam, in a manner to refine said gaseous products and remove the moisture of the steam, and for conveying such composite of vapors through one passage into a chamber to which low or wet steam is also conveyed through another and separate passage, all in a manner to produce within said chamber an effect resembling that of a cyclone, and thereby securing great power, to be used as may be desired.

The apparatus of this invention is shown in the accompanying plate of drawings by a view in some parts in vertical section and in others a side elevation.

In the drawings, A is a steam-boiler of cylindrical shape, placed upright within and surrounded by a combustion or gas-generating chamber, B. The boiler projects above and outside of the upper end, C, of said chamber B.

D is the fire-grate, located and suitably supported upon the bottom E of the chamber B and above the ash-pit F. The bottom E of the gas-generating chamber B is depressed about and around the grate D, and thus makes an annular chamber or recess, G, to receive and hold coal below the level of the grate to eliminate the gases therefrom, as will hereinafter appear. The ash-pit F is enlarged into a chamber, H, just below the grate, which chamber is of a double wedge or angular shape in vertical section, as shown at *u*, and its lower end is closed by a hinged cover or lid, J.

K is a door-opening through which to feed the combustion or gas-generating chamber B with fuel, bituminous or other soft coal being preferable.

L is an inclosed chamber for superheating steam. This steam-superheating chamber is

within the combustion or gas-generating chamber B, below and between the steam-boiler A and the fire-grate D, and it is made of a shape and size for the products of combustion to pass about and around it to and about the steam-boiler in the upper portion of the combustion or gas-generating chamber, and thence into an escape pipe or flue, M, which is adapted to be opened and closed by a hinged lid or cover, N.

O is a steam-pipe which enters the top of steam-boiler, and from thence passes downward and enters one end of the superheater L, and P is a pipe which also enters the superheater on the opposite side to the entrance of steam-pipe O, and from thence it passes upward and enters into a vertical pipe, Q. This pipe Q, at its lower end, enters the flue M, and at its upper end it enters the larger end *a* of a horizontal tapering chamber, R, which at its smaller end is continued in a downward direction and entered into the side near the upper part of a vertical drum or hollow cylinder, S. The chamber R, between its two ends, has direct communication with the steam-boiler through a vertical pipe, *b*. The drum S, at its upper end, through a pipe, *c*, has communication with a horizontal cylindrical chamber, T, to be hereinafter called the "power-chamber," and at its lower end it communicates, through a pipe, *d*, with a horizontal air-passage, U, leading into one side of the ash-pit F.

f is a steam-pipe leading from the side of the upper portion of steam-boiler downward and thence into the ash-pit F.

g is a steam-pipe which leads from upper end of boiler into the smaller end *h* of a horizontal tapering pipe or chamber, Y, that at its larger end *l* is connected by a pipe, *m*, of reduced diameter, with the upper portion of a vertical pipe, W, of an enlarged diameter. The lower portion of the vertical pipe W tapers and enters the side near the lower end of an upright drum or hollow cylinder, X, that at its upper end, through a vertical pipe, *n*, is in communication with the power-chamber T, and at its lower end, through a pipe, *o*, connects with the steam-piston cylinder Z of a steam-engine of any suitable arrangement and construction.

The steam-engine is for working an air-pump, (shown at A².) This air-pump A² is connected by a pipe, P, with the air-passage

U, leading into one side of the ash-pit F, and this air-passage U is opened and closed to the entrance of air from the outside into the ash-pit by a valve, *g*, suitably arranged therefor, and as shown.

The several steam-pipes, *f*, *g*, *b*, and O, leading from the steam-boiler, and also the other pipes, *p*, *n*, *c*, and *d*, herein described, are each provided with a valve, *r*, for opening and closing communication through them, or between them and the pipes or chambers which they connect, as has been explained.

With an arrangement of pipes or passages and chambers such as have been described it is plain, first, that steam from the steam-boiler A, that superheated steam from the superheater L, that gases from the combustion or gas-generating chamber B, and that compressed air from the air-pump A² can, either one or more or all, be made to pass into the ash-pit, and from thence through the coal of the combustion or gas-generating chamber B to and into said chamber, to there mingle and combine with the gases generated or eliminated from the coal; and, second, that then this combination or composite of gaseous elements, to again mingle together with steam from the steam-boiler A, superheated steam from the superheater, compressed air from the air-pump A², and air at the ash-pit passage U, or either one or more or all of the same, can be made to pass into the ash-pit, and from thence through the coal of the combustion or gas-generating chamber to and into said chamber, to there mingle again with the gases resulting from the combustion and elimination of the gases of the coal, and so on, the whole producing a most thorough union, distillation, and refining of all of said several elements, as well as reducing the steam to a perfectly dry condition preparatory to their ultimate admission to the power-chamber T, to there meet and come in instant contact with low or moist steam made to pass directly from the boiler to said power-chamber. By this meeting within a common chamber of elements of opposite conditions—to wit, one dry and the other moist, and both obviously under pressure and each conducted through separate passages thereto—an effect resembling that of a cyclone is produced in said chamber, and thus a power developed capable of use as may be desired.

To work the apparatus which has been herein described for the results above stated for bringing the coal upon the fire-grate to a sufficient state of ignition and the steam raised to the desired pressure, open the cover N to the flue M and the valve *g* to air-passage leading to grate and close all other valves and passages. After this is accomplished close the cover N to flue M, also the valve *g* in ash-pit air-passage U, and open the valve V in the vertical pipe Q, which is in communication with the steam-pipe P from the superheater, as also all the other and various pipes and chambers, except the valves in pipes *c* *n*, leading from cylinders S and X, thus securing the passage

of live steam from the steam-boiler and superheated steam from the superheater, and gases from the combustion or gas-generating chamber B, and compressed air from the air-pump A² to and through the ash-pit, and thence through the combustion or gas-generating chamber and so on, all under balancing pressure. Thus the steam and the superheated steam direct from the boiler A, together with the compressed air from the air-pump A², and the gaseous vapors generated in the combustion or gas-generating chamber, are thoroughly combined, refined, and mixed, and the steam and superheated steam is brought to a dry condition and made ready for admission to the power-chamber T, which is secured by opening the valve *r* in passage *c* leading from cylinder S, while at the same time low or moist steam is admitted to the same chamber through another and separate passage, *n*, leading from a cylinder, X, having previously opened the valve in said passage *n*. In this manner the operation of the apparatus continues of course from time to time renewing the coal and otherwise regulating the action by the various valves, as may be found necessary. The coal which is within the depressed chamber G, surrounding the fire-grate, becomes heated from the burning of the coal upon the grate, and thus its gases are eliminated without burning the coal, which in substance is reduced to coke.

The enlargement H of the ash-pit at the fire-grate acts to increase the draft of the gaseous elements entering the ash-pit through the fire-grate. The tapering passage R, through which superheated steam and gases from the combustion or gas-generating chamber, together with the live steam direct from the boiler, pass on their way to the power-chamber T, acts, as the superheated steam, gases, and live steam admitted to it pass into it at its end of larger diameter and out of it at its end of smaller diameter, to retard the travel thereof between such two ends of different diameter, and thereby to bring the steam, both superheated and live, to a more refined and concentrated condition. The tapering passage Y, through which live steam from the steam-boiler passes on its way to the power-chamber, allows the steam which enters it at its smaller end to expand as it passes through it and before it escapes at its larger end, and thus secures its partial condensation, which is again secured in its passage through the enlarged pipe W, the whole bringing the steam to a condition of great moisture, reducing its pressure, the better to act within the power-chamber when it there meets with the combination of elements hereinbefore described, which are made to enter said power-chamber through another and separate passage, *c*, leading from the cylinder S.

The superheater L can be arranged in the gas-generating chamber otherwise than as shown and described.

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

1. The depression or chamber G, about and below the fire-grate, having its walls solid, in combination with the enlargement or chamber H of the ash-pit F, at and below the fire-grate, having its walls of angular shape, substantially as and for the purpose specified.
2. The enlargement or chamber H of the ash-pit F, at and below the fire-grate, having its walls outside of and beyond the fire-grate solid and of angular shape, substantially as and for the purpose specified.
3. A steam-boiler, A, a gas-generating chamber, B, a superheater, L, and a power-chamber, T, in combination with a passage, Q, communicating with the superheater, and tapering pipe R, in communication with the power-chamber T, substantially as described, for the purpose specified.
4. A steam-boiler, A, and a power-chamber, T, in combination with a tapering passage, Y, and cylinder X, in communication with the boiler A and power-chamber, substantially as described, for the purpose specified.
5. A steam-boiler, A, and a power-chamber, T, in combination with a tapering passage, Y, cylinder X, and enlarged passage *l*, connected by a passage, *m*, of reduced diameter, and all making a communication between the boiler and power-chamber, substantially as described, for the purpose specified.
6. A steam-boiler, A, a combustion or gas-generating chamber, B, a superheater, L, and a cylinder, S, in combination with a passage leading from the boiler, the superheater, and gas-generating chamber to the cylinder S, and to the gas-generating chamber through the ash-pit, substantially as and for the purpose specified.
7. A steam-boiler, A, and cylinder X, in combination with a passage leading direct from the boiler to the cylinder X, and a passage from cylinder X to the steam-engine Z, arranged to operate an air-pump, A², substantially as and for the purpose specified.
8. A steam-boiler, A, a combustion or gas-generating chamber, B, a superheater, L, cylinders S and X, and a power-chamber, T, in combination with passages leading, the one direct from the boiler and the other from the superheater and gas-generating chamber, to the power-chamber, all substantially as and for the purpose described.
9. A steam-boiler, A, a combustion or gas-generating chamber, B, a superheater, L, and a power-chamber, T, in combination with passages leading, the one direct from the boiler and the other from the superheater and gas-generating chamber, to the power-chamber, and both to the gas-generating chamber through the ash-pit, all substantially as described, for the purpose specified.
10. A steam-boiler, A, a combustion or gas-generating chamber, B, a superheater, L, a power-chamber, T, and an air-pump, A², in combination with passages leading one direct from the superheater and gas-generating chamber to the power-chamber, and both to the gas-generating chamber through the ash-pit, and with a passage, P, leading from the air-pump to the gas-generating chamber through the ash-pit, all substantially as described, for the purpose specified.
11. The ash-pit F, having passages *f*, *d*, and *p* entering the same, and making communication between it and a steam-boiler, A, chamber S, and air-pump A², all substantially as described, for the purpose specified.
12. The superheater L, arranged to communicate by a pipe, P, with a pipe, Q, extending from the gas-generating chamber, substantially as and for the purpose specified.
13. The combination, with the power-chamber T, of cylinders X and S, arranged to have connection therewith, and the one, X, with a steam-boiler, A, and the other, S, with a steam-boiler, A, a superheater, L, and gas-generating chamber B, through the ash-pit, with said cylinder S, said cylinder X connecting with a steam-engine, Z, and air-pump A², substantially as and for the purpose specified.
- In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

BENJAMIN WELLS DUNKLEE.

Witnesses:

EDWIN W. BROWN,
WM. L. BELLOWS.