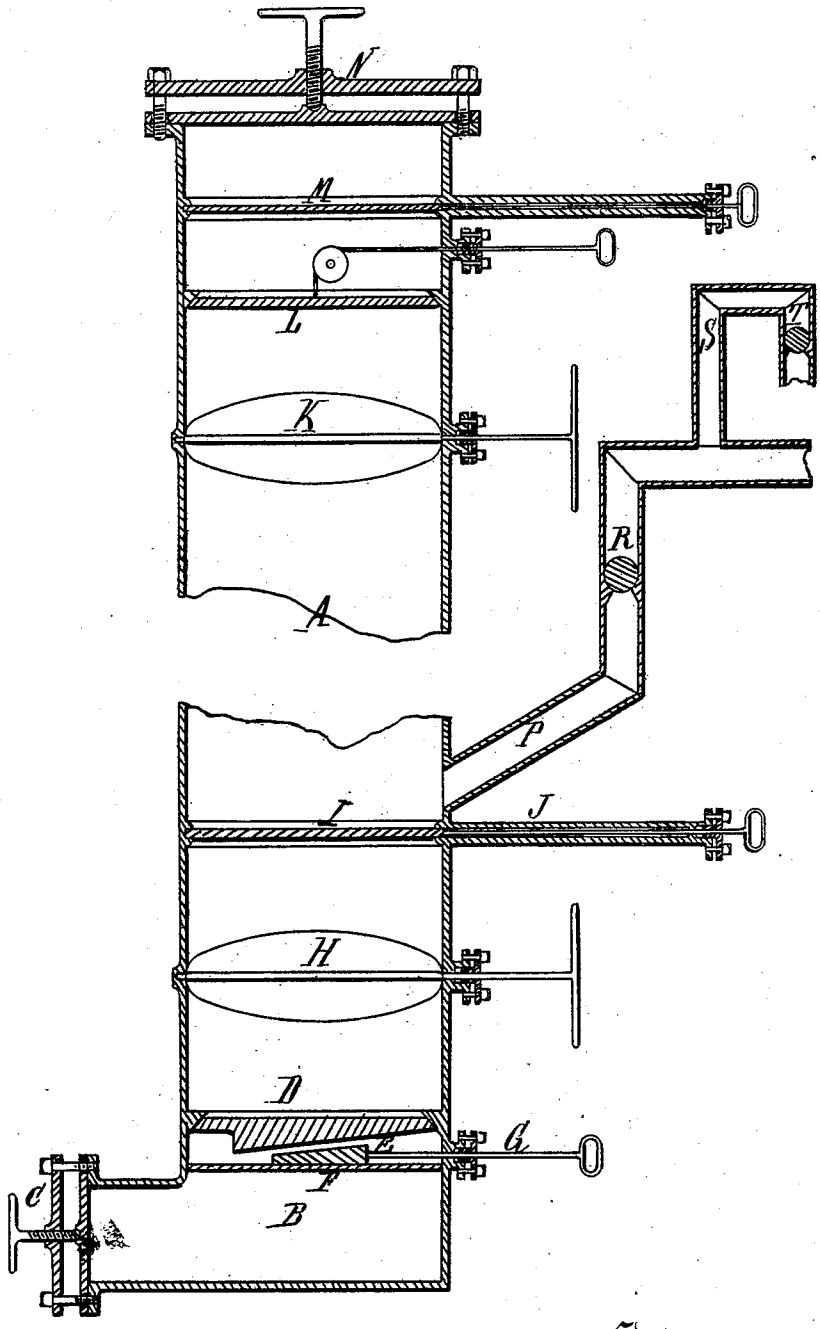
A. G. HUNTER.

RETORTS FOR DISTILLING PHOSPHORUS.

No. 171,813. Patented Jan. 4, 1876.



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ANDREW GEORGE HUNTER, OF DETROIT, MICHIGAN.

IMPROVEMENT IN RETORTS FOR DISTILLING PHOSPHORUS.

Specification forming part of Letters Patent No. **171,813**, dated January 4, 1876; application filed August 28, 1874.

To all whom it may concern:

Be it known that I, ANDREW GEORGE HUNTER, of Detroit, in the county of Wayne and State of Michigan, have invented an Improvement in Retorts for Distilling Phosphorus, of which the following is a specification:

The nature of this invention relates to an improvement in the construction of retorts for the purpose and process of distilling phosphorus from phosphoric acid; and it has for its object, first, to so arrange the retort that the process of distillation may be continuous, if desired, thereby effecting a large saving in fuel and breakage of retorts over the usual intermittent mode; second, that volatilized phosphoric acid shall, previous to being permitted to pass to the condensing apparatus, be brought into such intimate contact with carbon at a temperature sufficiently high as to deoxidize it and reduce it to phosphorus. This latter result may be attained either by a continuous-distillation process or retorts, or, if the distillation is intermittent, by placing in the retorts, when one retort only is used, and the distillation is intended to be completed in one such retort, a quantity of carbon in addition to that mixed with the phosphoric acid, and raising said additional carbon to a white heat before heating that portion of the retort containing the phosphoric-acid mixture, and causing the volatilized products from said acid mixture to traverse intimately through or among the highly-heated carbon before reaching the outlet to the condensing apparatus, or by the employment of two or more retorts, one or more containing carbon maintained at a white heat, and the other or others containing the phosphoric-acid mixture, the products from the said acid being passed by means of suitable connecting-pipes, which may be provided with automatically-acting valves, if desired, through one or more carbon-filled retorts, the carbon therein being maintained at a white heat before passing to the condensers. The retorts may be set horizontally, vertically, or at any angle that may be desired, the proper modifications in construction and operation, as hereinafter described, being adapted to suit each particular variety of retort and mode of setting. For continuous distillation retorts, they may advantageously be set vertically, and be provided with properly-arranged valves, above and below, by means of which they may be charged and emptied while at work, without stoppage or permitting access of air to their interior. By charging such retorts above and withdrawing from below, the charge continuously passes downward and arrives at the bottom in a spent condition. In such continuous-distillation retorts the exit-pipes, or connection leading to the condensers, are most advantageously placed near the bottom of the retort, just above the discharging-valves, thereby forcing all the products of distillation to traverse nearly the entire length of the retorts, through the white-hot carbon, so that phosphoric acid volatilized in the upper portion of the retort shall, in its descent to the exit-pipe, pass through a mass of carbon (being the excess of former charges) maintained at a white heat, thereby becoming deoxidized before passing into the condenser. These connecting-pipes may be provided with self-acting or other valves, if desired, to govern the outflow, and for the admission of air when required. In continuous, as well as in intermittent distillation, one or more retorts may be used, one or more containing the phosphoric-acid mixture, and one or more containing carbon maintained at a white heat, the volatilized products from the former being caused to traverse through the heated carbon in the latter before passing to the condensers; the main feature being to deoxidize the volatilized phosphoric acid before permitting it to pass to the condensers, by forcing or compelling it to pass through, or so intimately in contact with, carbon maintained at a heat sufficiently great to accomplish the purpose, whether one or more retorts are employed and set in any desired position, so that the desired end is attained.

In order to accomplish this end, I show a vertical section in the annexed drawings of a vertically-set retort, designed more especially for continuous distillation.

A represents a vertical retort, provided with pit B, fitted with a cap, C, which should be removed when it is desired to remove the residuum of the distillation. D is a valve made to fit into its seat, as shown; the under face of this valve is an inclined plane. E is a

wedge sliding on the bar F, and is actuated by means of the screw-rod G, from outside the retort, so that by being forced inward it confines the valve to its seat, or, being withdrawn, it allows the valve to fall from its seat, so that the débris accumulated above it may fall into the pit B. H is another valve, which may be of any suitable or desired construction, placed about midway between the valve D and the valve I. In the drawing this latter-named valve is shown as a slide-valve, withdrawing into a recess, J, cast or fitted to the side of the retort. K L M are other valves of any suitable construction, fitted into the upper part of the retort, dividing said upper part into an upper, middle, and lower chamber, as shown, and the upper end of the retort is closed with the cap N, in the usual manner of fitting caps to retorts. Any or all of these valves may be kept cool by passing a current of water through them. The upper and lower parts of the retort may be provided with water-jackets to keep these portions cool. P is a pipe, which may also be provided with a water-jacket, leading from the retort to the condenser. In this pipe is fitted a ball-valve, R, or other valve, so that a pressure from the retort will open the valve, and allow the volatilized and deoxidized vapors from the phosphoric-acid mixture to flow into the condenser. It sometimes happens that the pressure will be from the condenser toward the retort. In this latter case the valve will produce a more beneficial result, if so arranged that it will close by reason of said back pressure. S is an air-inlet pipe leading into the pipe P, and is provided with a ball or other valve, T, that whenever the pressure within the pipe P is less than the atmospheric pressure, the valve will open and close as soon as the pressure is equalized.

To commence the process of distillation, the cap C and the valves D H I are closed. The retort is then filled to about two-thirds of its capacity with carbon, through the cap N and the valves K L M, which have been opened for the purpose. The cap N and valves are then closed, and heat is applied until the carbon is at a white heat. The lower, middle, and upper chamber, as above described, having in the meantime been filled with a mixture of carbon and phosphoric acid, the withdrawal of one or more of the valves K I M precipitates the mixture as much as may be desired into the body of the retort, when the valves and cap should be closed after the chambers have been again filled to be in like manner precipitated, as required.

The heat is kept up, which rapidly volatilizes the vapors of the phosphoric-acid mixture, and they pass down through the carbon in the lower part of the retort, and which is maintained at a white heat. Thus the vapors are deoxidized before they pass through the pipe P to the condenser. When it is desired to precipitate more carbon and acid mixture, the valve I is withdrawn, allowing the whole mass to settle, when more of the mixture may be precipitated and the process continued indefinitely by repeated withdrawals from below of spent materials, and fresh supplies above of phosphoric-acid mixture.

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

1. The vertical retort A, constructed substantially as described, for distilling phosphorus, and provided with pit B and wedge-valve E, and adapted for continuous charging with material and discharging by gravitation, substantially as described and shown.

2. The process, substantially as described, of distilling phosphorus by placing a quantity of carbon in a retort and raising the same to a white heat, and heating phosphoric-acid mixture in another portion of the retort, and causing the volatilized products from the acid mixture to traverse intimately through the heated carbon before reaching the outlet to the condensing apparatus, as described and set forth.

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