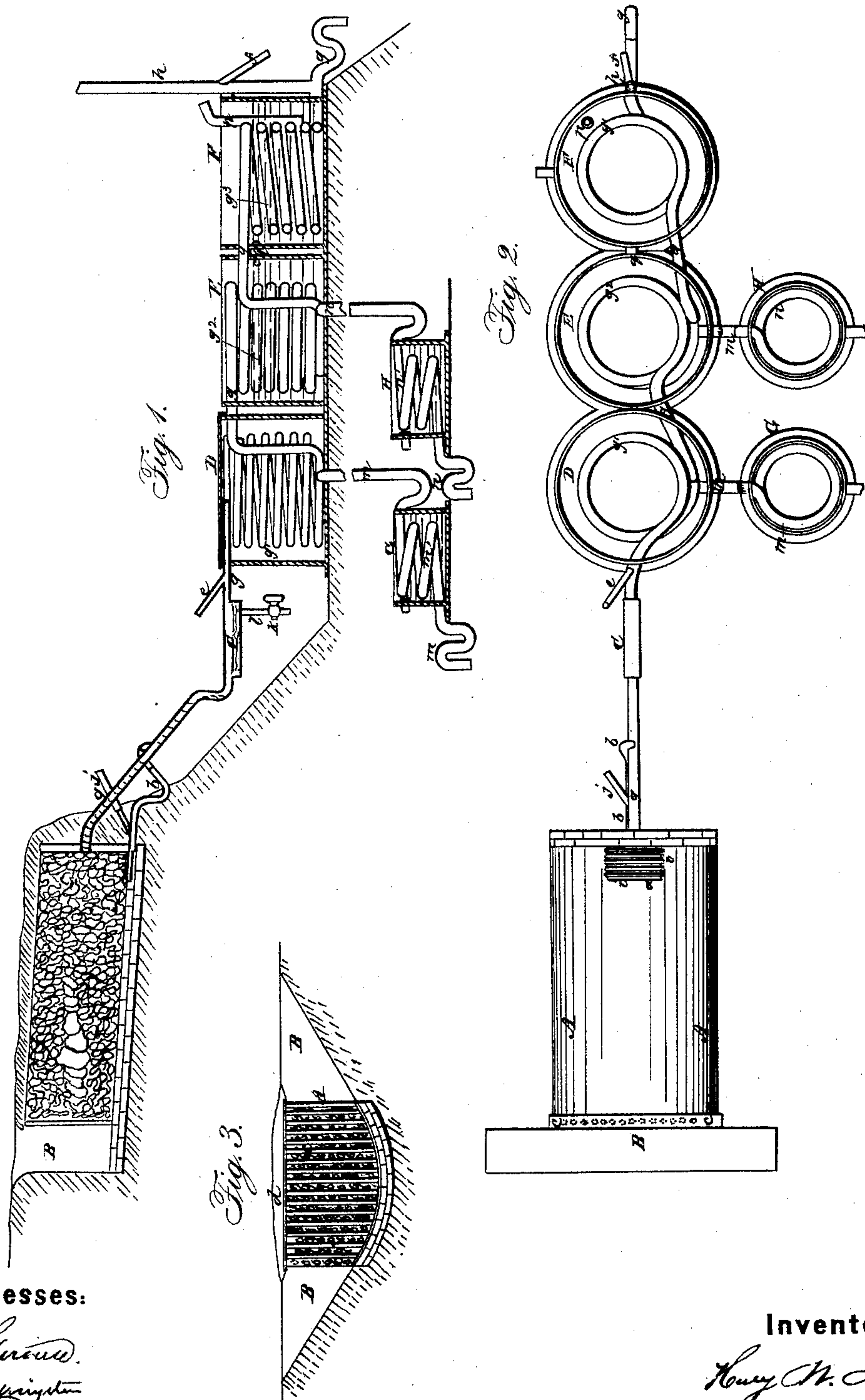


H. W. ADAMS.

Oil Still.

No. 28,446.

Patented May 29, 1860.



Witnesses:

B. J. Adams
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UNITED STATES PATENT OFFICE.

HENRY W. ADAMS, OF BROOKLYN, NEW YORK.

IMPROVEMENT IN APPARATUS FOR DISTILLING COAL-OILS.

Specification forming part of Letters Patent No. 28,446, dated May 29, 1860.

To all whom it may concern:

Be it known that I, HENRY W. ADAMS, of Brooklyn, in the county of Kings and State of New York, have invented certain new and useful improvements in apparatus for obtaining oil or other liquid products from coal or other substances by distillation; and I do hereby declare that the following is a full, clear, and exact description of the same, reference being had to the accompanying drawings, forming part of this specification, in which—

Figure 1 is a vertical section of a distilling apparatus constructed according to my invention. Fig. 2 is a plan of the same. Fig. 3 is a transverse section of the entrance to the retort.

Similar letters of reference indicate corresponding parts in the several figures.

My invention consists in a certain construction of a retort and certain improvements in the apparatus for collecting the products of distillation, whereby I am enabled to effect the distillation of oil or other liquid products from coal, shale, or other analogous substances on a very large scale in a more convenient and economical manner than has heretofore been practiced.

To enable others skilled in the art to make and use my invention, I will proceed to describe its construction and operation.

A is the retort, represented as a pit dug in the earth, preferably in the side of a hill, so that the condensing and collecting apparatus may be arranged below it, said pit being of an oblong quadrangular form in its horizontal section, its sides upright, and its bottom having a regular inclination in the direction of its greatest length sufficient for any condensed liquid products to flow down in it, and a concave form in its transverse section. The inclined concave bottom is constructed of or lined with brick, stone, or iron or other suitable material impervious, or nearly so, to oil or water, to prevent the absorption into the earth of such of the heavier oils or other liquid products of distillation as may be condensed in their passage through the charge, and to conduct such liquid products to the lower end of the said bottom, where there is provided a small pit, *a*, for the collection of such liquid products, that they may escape by a descending pipe, *b*, leading from the bottom of said

pit to the condensing apparatus. At about the middle of the lower or rear end of the retort is a suction-pipe, *g*, for the escape of the vapors and for giving draft to the fire. Across the higher end of the retort there is made a narrow transverse pit, B, having its sides so inclined as to afford convenience for charging the retort and for taking away the residuary coke in wheelbarrows or by other convenient means, said pit B being only separated from the retort by an upright grating, *c c*, the bars of which should be movable. The pit A thus constructed may be charged by throwing in the coal at the top or from the transverse pit B, or by both of these means, and the charge should reach to within a short distance—say about one foot—of the surface of the ground. When the pit is charged to this depth, it is covered with earth or ashes, as shown at *d d* in Fig. 1, to such a depth as to fill the pit, and on this earth being packed tightly the retort is completed and sealed at all points, except at its outlet-pipes and the upper end next the pit B. This pit is left open, the coal being prevented from falling into it from the retort by the upright grating *c c*, which separates it from the retort. The coal is ignited by fire applied to the grating, and the charge burns away slowly from the upper or front toward the lower or rear end, the heat from the burning portion of the charge serving to effect the distillation of the liquid products from the portion of the charge in rear of it, which is not yet ignited, the draft being kept up by jets of steam introduced by pipes *e f*, applied to the suction or main discharge pipe *g* and to the escape-pipe *h*, which will be presently explained. As the charge burns away the coke and ashes and other residuum are withdrawn from the retort through the pit B, that they may not prevent the ingress of air to the charge, the bars of the grating *c c* being removed for this purpose at an early stage of the working of a charge. The charge being worked off in this way and the residuum removed as fast as it accumulates not only prevents the residuum obstructing the process, but leaves the retort free to be recharged at once as soon as one charge is worked off, while in most other retorts, after a charge is worked off, the residuum is required to cool to a certain extent before it can be taken out. The

small pit *a* may be covered with a grating, *i*, for the purpose of preventing the coal or other solid matter from entering the pipe *b*, which, to distinguish it from the main discharge-pipe *g*, I will term the "eduction-pipe." This grating may, however, be dispensed with by placing some loose pieces of brick or other material in the pit. Close to the junction of the eduction-pipe with the retort there is connected with the said pipe a steam-pipe, *j*, for the admission of steam to the pit *a* and the rear part of the retort, which is farthest from the fire, for the purpose of warming the rear portion of the charge and of keeping the condensed oil melted in and about the pit *a*, where it would otherwise become so chilled as to flow freely to and through the eduction-pipe *b*. This pipe *j* may enter the retort instead of being connected directly with the eduction-pipe, as represented. The eduction-pipe *b* connects with the suction or main discharge pipe *g* not far from the retort, so that all the products of distillation are collected in the latter pipe, and in order to prevent the steam admitted to the eduction-pipe *b* and retort by the pipe *j* from interfering with the draft in the main discharge-pipe *g* a trap is formed in the pipe *b* by a downward bend, as shown in Fig. 1, for the collection of a sufficient quantity of oil to form a seal.

At some distance behind the connection of the eduction-pipe and main discharge-pipe *b* and *g*, I provide in or below the main discharge-pipe *g* a reservoir, *C*, such reservoir being formed by constructing a dam across the lower part of the said pipe, or consisting of a shallow pit sunk a little below the said pipe, as represented. From the bottom of this reservoir there descends a pipe, *l*, furnished with a cock, *k*. The object of this reservoir and cock is to provide for the separation from the oil of the water which always comes over from the retort in greater or less quantity. This separation is usually effected by a subsequent distillation of the crude oil, and every one who has had practical experience must be fully aware that this first distillation of the oil is very troublesome and dangerous, inasmuch as the still is liable to foam and the whole body of the charge to run out at the worm by the conversion into steam of the large quantity of adhering water which is always contained in isolated particles in all heavy and thick crude oil.

Experience teaches that the best method of separating the water from the oil is to allow it to remain in a state of repose at a high temperature, not below 212°, in which condition the water slowly subsides.

The reservoir *C* constitutes a means of employing this method for separating the water from the heavier portions of the oil, from which, owing to less difference of their specific gravity, the separation is more difficult. The distance at which the said reservoir is placed from the retort should be such—say about twenty feet—that much of the heavier

vapor will be condensed before reaching it, and it will collect these condensed products, as well as the liquid products which leave the retort, by the eduction-pipe *b*, all of which are at a high temperature, and so keep them for some time in a state of repose. The water subsiding in the said reservoir *C* falls into the pipe *l*, which constitutes a well, from which it may be drawn off from time to time by opening the cock *k*, or be allowed to run away continuously by opening the cock to a properly limited extent, and the oil as it accumulates in the said reservoir overflows gradually toward the outlet of the discharge-pipe *g*. The discharge-pipe *g* is formed beyond the reservoir *C* into three separate and successive coils, *g'*, *g''*, and *g'''*, the front one being inclosed in a box, *D*, to prevent its cooling, the second being arranged in a water-tank, *E*, and the third in a water-tank, *F*, the entrance to the said coils being in all cases at the top. A constant circulation of water through the tanks *E* and *F* is kept up by pumping cold water into the last tank, *F*, which is next the escape-pipe *h*, through a pipe, *p*, and letting it overflow by a pipe, *q*, from *F* to *E*, so that the water in *E* will be much warmer than that in *F*. I prefer the water in *E* to be kept at or near the boiling temperature.

From the bottom of the coil *g'* there branches off a pipe, *m*, which takes the form of a coil, *m'*, within a cooler, *G*, which is kept supplied with cold water, and from the bottom of the coil *g''* there branches off another pipe, *n*, which takes the form of a coil, *n'*, within a cooler, *H*, which is kept constantly supplied with cold water. The steam-pipe *e* enters the pipe *g* between the reservoir *C* and the first coil, *g'*, and close to the entrance of said coil. The pressure of the jet of steam thus admitted to the pipe *g* should be from eighty-five to one hundred and fifty pounds per square inch on its issue from the pipe *e*, to which pressure will be due a temperature of about from 315° to 350° Fahrenheit. This steam-jet is intended to convert into vapor all the particles of condensed water that passes or overflows the dam or reservoir *C*, if any do so pass or overflow, and also all the light and most valuable burning-oils, such as toluene, which boils at 237° Fahrenheit, and cumene, which boils at 314° Fahrenheit. These lighter oil-vapors are transported through the first or distilling worm, *g'*, by means of the steam, and pass on to the second worm, *g''*, while the main portion of the creosote, boiling at 400° Fahrenheit, the naphthaline, boiling at 428° Fahrenheit, and the paraffine, boiling at 700° Fahrenheit, and the heavy and impure bodies, all free from water, are condensed in the said worm *g*, and flow therefrom in a liquid state through the pipe *m* and cooling-worm *m'* to a suitable receptacle. The latter grade of oil, freed of water and separated from the greatest part of the burning-oil, is now in a condition to be treated for the purification and separation of the various bodies which it contains.

I have before stated that the worm g' is inclosed to prevent it cooling. My object is to keep the said worm as hot as the steam inside will make it, and in order that the steam may be brought into the most intimate contact with the oil flowing through the said coil, and that the perfect evaporation of all the contained water may be effected, I propose to flatten the pipe of said coil to cause the oil to spread and flow over a very extensive surface.

In the second worm, which I have described as being kept surrounded by water at or near the boiling-point, the light burning-oils which I have above enumerated are condensed, and these flow off from the bottom of the said worm in a liquid state through the pipe n and cooling-worm n' to a suitable receptacle. The uncondensed vapors of the lightest oils only and the steam, if there be any, pass on into the third worm, g'' , where complete condensation takes place, and from whence they flow off to a suitable receptacle under the extremity of the discharge-pipe g , and the incondensable gases escape by the pipe h to the atmosphere. The small amount of water which is condensed in the second and third worms, g'' and g''' , will at once separate from the said oils and fall to the bottoms of the receivers in which the said oils are collected by reason of its much greater specific gravity. These two grades of light oil, when decanted, may be mixed together unless the benzole and naphtha condensed in the third worm are desired for separate use, and are ready to be refined for burning.

I have described the retort as being a pit dug in the ground. In this construction of the retort there is evidently great economy; but a similar retort may be built of masonry or of iron. I have described the bottom of the

retort as having a downward inclination toward the discharge and eduction pipes g h ; but this, though preferable, is not absolutely necessary, though care must be taken not to let it have an inclination in the opposite direction.

Having thus described my invention, I will proceed to state what I claim as my invention and desire to secure by Letters Patent:

1. The employment, in the distillation of coal, shale, and other analogous substances to obtain the oil and other liquid products therefrom, of a retort consisting of a pit dug or otherwise made in the earth, substantially as herein described.

2. The construction of a retort for distilling oil and other liquid products from coal, shale, or other analogous substances in a horizontal or slightly-inclined form, with a draft through it in a horizontal direction or parallel with the floor, and without a separate furnace, so that the charge may burn away gradually toward the outlet, substantially as herein described.

3. Though I do not claim the use of a separate pipe or conductor to carry off the liquid products condensed in the retort, or the introduction of steam into the retort, I claim the steam-pipe j , in combination with the eduction-pipe b , substantially as and for the purpose herein specified.

4. Connecting the eduction-pipe by which the condensed liquid products leave the retort with the main discharge-pipe by which the vapors leave the retort, substantially as herein described.

HENRY W. ADAMS.

Witnesses:

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B. GIROUX.