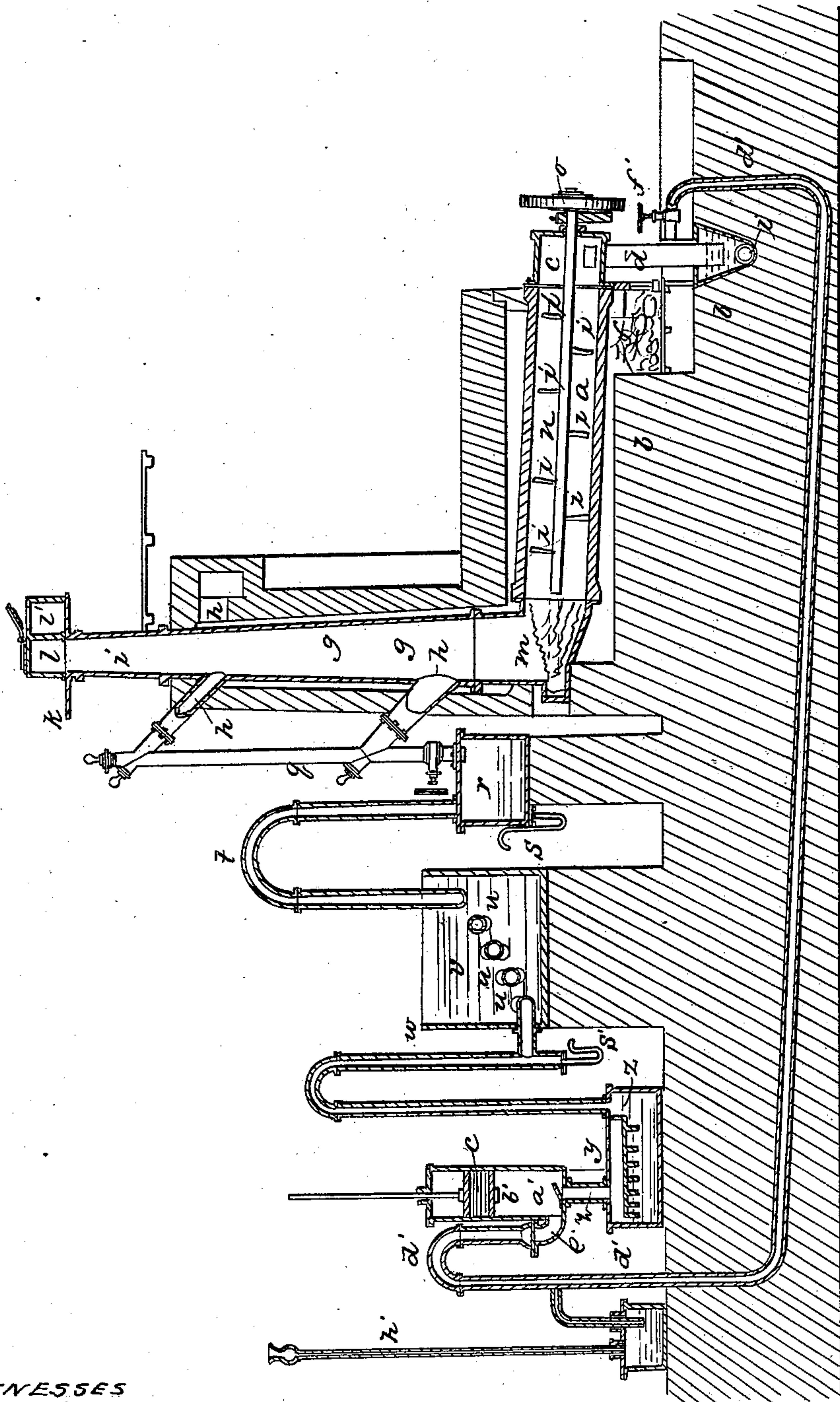


H. P. GENGEMBRE.

Oil Still.

No. 24,454.

Patented June 21, 1859.



WITNESSES
J. Moslin Cooper
Martin G. Lusk

INVENTOR
Henry P. Gengembre

UNITED STATES PATENT OFFICE.

HENRY P. GENGEMBRE, OF ALLEGHENY CITY, PENNSYLVANIA.

IMPROVEMENT IN RETORTS FOR DISTILLING COAL-OIL.

Specification forming part of Letters Patent No. 24,454, dated June 21, 1859.

To all whom it may concern:

Be it known that I, HENRY P. GENGEMBRE, of Allegheny City, in the county of Allegheny and State of Pennsylvania, have invented a new and useful improvement in apparatus for the destructive distillation of oleiferous minerals—such as shale, bituminous plates, and cannel-coal—for the purpose of extracting therefrom oils and tars; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the annexed drawing, forming part of this specification, which is a sectional elevation of my improved apparatus.

My invention consists in the combination and arrangement of the various parts of my apparatus, as hereinafter described, for the purpose of excluding the coal or other substance under treatment, as well as the product of distillation, from all contact with atmospheric air until it is fully cooled, and of creating and keeping up a strong and uninterrupted circulation of permanent gas through the retort or generator and condensing-worm in a direction opposite to the course of the coal or other subject of distillation, thereby facilitating the generation of oleaginous vapor and increasing the yield of oil and diminishing the relative quantity of permanent gas; also, in the use of an L-shaped retort furnished with charging-boxes so arranged and constructed as to prevent the access of any atmospheric air to the interior of the retort, and the combination therewith of a coal-crusher at that point of the retort where its contents are exposed to a slight degree of heat sufficient to volatilize the lighter oils.

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

In the drawing, *a* is a cylindrical retort, made of fire-clay, iron, brick, or other suitable material, though I prefer the use of a clay retort, as being more susceptible of a uniformly-low degree of heat, such as is necessary for the generation of oleaginous vapor, as distinguished from permanent gas. This retort *a* is set in a suitable furnace, *b*, in a slightly inclined or nearly horizontal position, the front or fire end of the retort being lower than the rear end, which is farthest from the fire. This retort projects at its front end beyond the wall of the furnace, and this projecting end or

mouth-piece *c* of the retort may be made of iron and fastened to the body of the retort.

A perpendicular spout, *d*, connects with the mouth-piece *c* and opens into the retort. The lower end of the spout *d*, being open, is immersed in a trough, *e*, of water, so as to form a water-joint, allowing the discharge into the trough *e* of the coke, or residuum of the substance under treatment, and yet excluding the air from passing up it into the retort.

Immediately back of the mouth-piece *c*, and at the front end of the body of the retort *a*, is the fire-chamber *f* of the furnace, which is so arranged that the heat and flame pass back and all around the body of the retort.

At the rear end of the retort *a*, and connected with it, is an upright conical tower, *g*, constructed of iron, which is set in an upright continuation of the furnace in such a manner that the heat and flame of the furnace pass around it, the smoke passing out near the top into the chimney at *h*. This tower *g* rises above the top of the upright part of the furnace, as seen at *i*, and terminates at its upper end in a horizontal table, *k*, on which is the charging-box *l l'*, which slides back and forward on the table *k* over the orifice of the tower *g*. The charging-box has two separate compartments, each furnished with a tightly-fitting lid. When the compartment *l* is over the orifice of the tower *g* its lid is kept closed, which shuts up the orifice and prevents the admission of any atmospheric air; but the other compartment, *l'*, not being in communication with the orifice of the tower, may be filled with coal or other substance to be distilled, ready to charge the tower, which is effected by shifting the box over to the other side of the horizontal table *k*, when its contents are discharged into the tower *g* of the retort, and the compartment *l* is in its turn ready to receive a charge, to be fed into the tower when necessary.

At the bottom of the tower *g*, which is the rear end of the horizontal retort *a*, is placed a revolving crusher, *m*, rigidly attached to and revolving with the shaft *n*, which passes through the center of the cylindrical horizontal retort *a*. This shaft *n* passes through the front end or mouth-piece, *c*, of the retort, and is caused to revolve by power applied to the cog-wheel or drum *o*. The shaft *n* is furnished with vanes *i i*, &c., which project at right angles from the shaft at intervals throughout

its length. These vanes *i* are set so that the flat surface of each is in a plane not at right angles to the axis of the retort, but slightly inclined, so as not only to stir the contents of the retort, but also to move them gradually forward toward the front end of the retort, where the charge, as it is exhausted, is continually discharged through the perpendicular spout *d*. The teeth of the crusher *m* are two inches in length, varying in shape and number according to the nature of the coal to be treated, and set at an angle with the axle of the shaft, so as not only to break up the charge, but to cause it to pass into the horizontal retort *a*.

The tower-retort *g* has two or more exits, *p p*, at different points to equalize the discharge of the volatile products and allow them to pass off without remaining longer than necessary exposed to the heat of the retort, which would tend more or less to convert them into permanent gas. These exits *p p* open into a perpendicular pipe, *q*, which terminates below in the tank or main *r*, in which the less volatile products of distillation and any tar which may be formed are collected.

The goose-neck *s* serves to discharge the contents of the tank as they accumulate without allowing the entrance of any air.

The pipe *t* carries off the oleaginous vapor which does not immediately condense in the tank *r*, and connects with the worm *u u* in the refrigerating-cistern *v*, where the condensable vapor is separated from the permanent gas, which latter rises through the upright pipe *w*, while the oil and other fluid products of distillation condensed in the refrigerating-worm *u* pass off through the goose-neck *s'* into any receptacle placed to receive them, while the entrance of the atmospheric air at this point also is by the goose-neck effectually prevented.

The permanent gas passing through the pipe *w* enters the washing-vessel *x*, which is kept nearly full of water. The diaphragm *y*, immersed in the water, being made with transverse ribs, causes the gas to pass up and down through the water before it reaches its exit at the pipe *z*. The pipe *z* is closed at top by a valve, *a'*, which opens upward into the cylinder of an exhaust and force pump, *b'*, with a solid piston, *c'*, by which the permanent gas is drawn off from the retorts through the series of pipes, worm, and washing-vessel on each upstroke of the piston and forced through the pipe *d'* on each downstroke. The pipe *d'* connects the escape-pipe *e'* of the force-pump *b'* with the upright spout *d* at the front end of the horizontal retort *a*, so that the permanent gas, after leaving the condensing apparatus, is returned into the retorts in a continuous stream.

The throttle-valve *f'* in the pipe *d'*, near the spout *d*, serves to regulate the flow of gas into the retorts, and a safety-valve, *h'*, regulates the pressure of the gas in the retorts and allows it to escape when it accumulates in too great quantity in the apparatus.

In the trough of water *e*, just below the end

of the spout *d*, is an endless screw, *i'*, which carries off the coke or other residuum of distillation as it is discharged from the retorts through the spout *d*.

Any convenient number of L-shaped retorts constructed as before described may be placed side by side, each having its pipe *q* terminating in the main or tank *r*, which is made long enough to answer that purpose. The rest of the apparatus for condensing the oleaginous vapors and separating the permanent gas, if made correspondingly large, will treat the products of a series of such retorts.

Having thus described my improved apparatus for the extraction of the fluid products of coal and other oleiferous minerals or substances by destructive distillation, I will briefly explain its operation.

The coal or other substance to be treated, being broken up into pieces, is placed alternately in one or other of the compartments *l* or *l'* of the feeding-box, and is fed into the top of the tower-retort by pushing the filled compartment over the mouth of the retort *g*. The tower-retort is kept filled up to the top of the brick-work of the furnace, not far from the top of the tower-retort. The coal gradually sinks in the tower as it is fed into the horizontal retort *a* by the crusher *m*. The heat is of course greatest immediately over the fire, which is at the front end of the horizontal retort *a*, and gradually diminishes toward the rear end of the retort at the foot of the tower-retort *g*, and grows still less toward the top of the tower-retort. Thus the coal at the top of the tower-retort is exposed to but slight heat, and as it sinks in the retort it is gradually subjected to an increased degree of heat, which at the bottom of the tower-retort, where the crusher is situated, is sufficient for the volatilization of the lighter oils. The coal in the tower-retort is thus gradually heated, and some of the oleaginous vapor is driven off and escapes through the exits *p p* before the coal leaves the tower. This heating of the coal has the effect of rendering it very easy to break up, so that the crusher readily divides it into small pieces before it enters the horizontal retort *a*. The coal thus descends through the tower-retort, passes into the horizontal retort, and when exhausted of all its volatile particles the coke or other residuum is discharged through the spout *d* into the trough of water *e* and is carried off by a screw or conveyor, *i'*.

During the whole time that this process of distillation is being carried on, and which may be continued with intermission, there is a stream of permanent gas which is forced by the air-pump or exhauster *b'* through the pipe *d'* in the direction of the arrow, and which enters the spout *d* just below the mouth-piece *c* of the retort *a*, the quantity of gas introduced being regulated by the throttle-valve *f'*. This stream of permanent gas thus forms a strong and continuous current, passing through the retort and entering the hottest part of the re-

tort, and passing through the hot coke or residuum, it becomes itself heated, and greatly facilitates the generation and liberation of the oleaginous vapors from the coal. This current of heated gas is forced through the coal in the retorts in a direction opposite to that in which the coal is traveling, and passing upward and through the exits *p p* carries with it the oleaginous vapors, which thence pass down the pipe *q* into the tank *r*. Here the heavy oil, which is condensed by passing through the pipe *q*, is deposited, with any tar and other heavy products of distillation, which are drawn off through the goose-neck *s*. The vapors thence pass through the worm *u* in the refrigerating-cistern *v*, and all the condensable products are deposited in the bottom of the pipe *w*, and pass off through the goose-neck *s'*. The permanent gas thence passes through the water-vessel, where it is well washed by passing around the ribs of the diaphragm *y*, and thence into the exhaustor *b'*. The pump or exhaustor *b'*, by drawing the gas from one end of the apparatus and forcing it in at the other, causes the current of gas to flow rapidly through the apparatus, and thus carries off from the retorts the vapors as soon as generated, thus removing them as speedily as possible from the heat of the retorts, and preventing their being converted into permanent gas, which is very apt to occur if they are long exposed to heat.

I have described the exhaustor used by me as a force-pump; but any other well-known device may be employed to produce a similar result.

Having thus described my improved apparatus for the dry distillation of coal and other oleiferous substances, I do not claim therein as new the use of cylindrical retorts, nor the use of horizontal shafts with contrivances thereon for agitating or moving forward the contents of the retorts; neither do I claim originality in the use of the mouth-piece *c* of the retort and spout *d*, nor in the crusher itself considered or otherwise than in the position and combination hereinbefore described, nor in the pump for exhausting the apparatus and forcing the gas; but

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

1. The use of an L-shaped retort combined with charging-boxes, crusher, and discharging-tube, as described, capable of being subjected to a degree of temperature at the end of the horizontal part, at which the residuum of the substance under treatment is discharged, higher than at the upright part, at which the coal is charged, the whole so arranged as to avoid the admission of atmospheric air.

2. The combination, with my retort, constructed substantially as hereinbefore described, of a crusher suited to the material to be distilled, placed within the retort at a point intermediate between the points where the heat is highest and lowest, for the purpose of breaking up the coal or other substance before the process of distillation is complete.

H. P. GENGEMBRE. [L. S.]

Witnesses:

I. MASLIN COOPER,
MARTIN G. CUSHING.