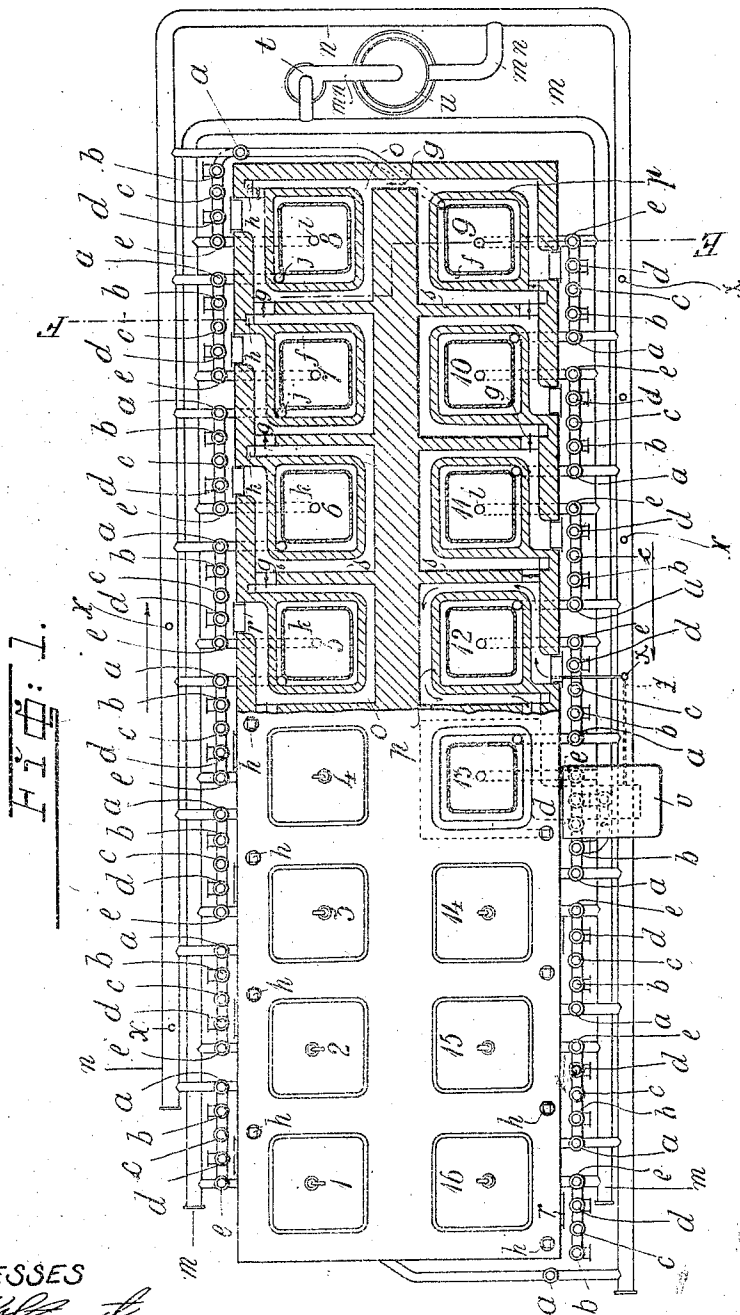


No. 389,150

PATENTED MAY 26, 1908.

T. M. U. VON POST.
DISTILLING APPARATUS.
APPLICATION FILED MAR. 8, 1906.

5 SHEETS—SHEET 1.



WITNESSES

E. H. Stuart
J. M. Carter

Thom. Melcher Uryern von Post
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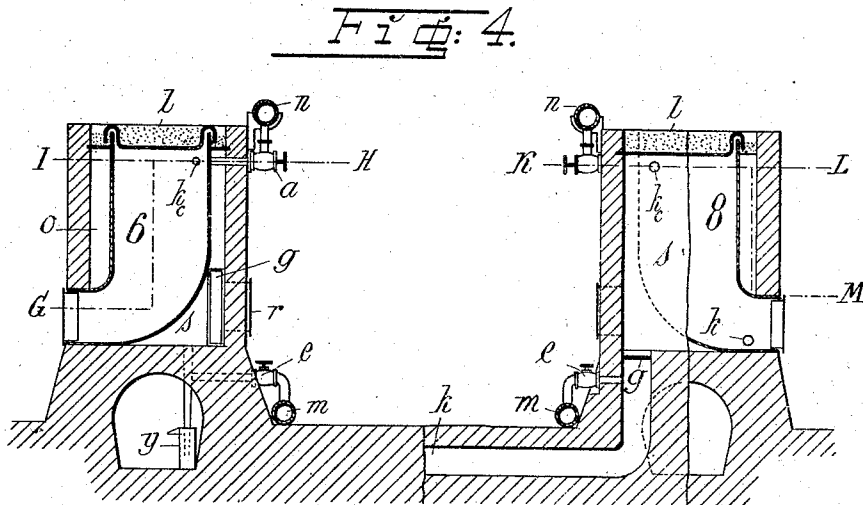
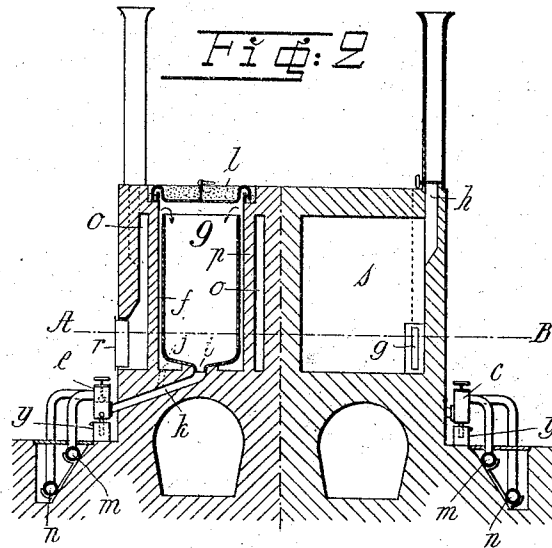
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No. 889,150.

PATENTED MAY 26, 1908.

T. M. U. VON POST.
DISTILLING APPARATUS.
APPLICATION FILED MAR. 8, 1906.

6 SHEETS—SHEET 2.



WITNESSES

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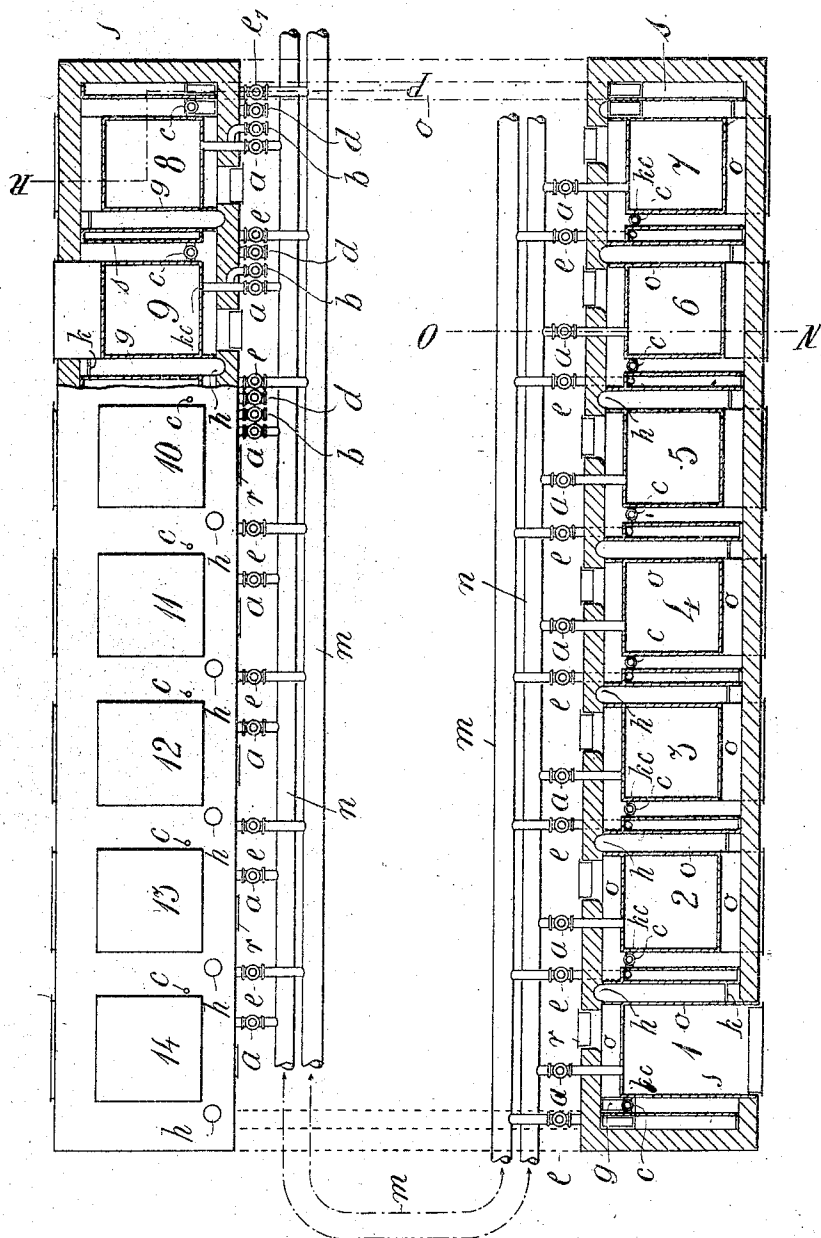
No. 889,150.

PATENTED MAY 26, 1908.

T. M. U. VON POST.
DISTILLING APPARATUS.
APPLICATION FILED MAR. 8, 1906.

6 SHEETS—SHEET 3.

Fig. 3.



WITNESSES

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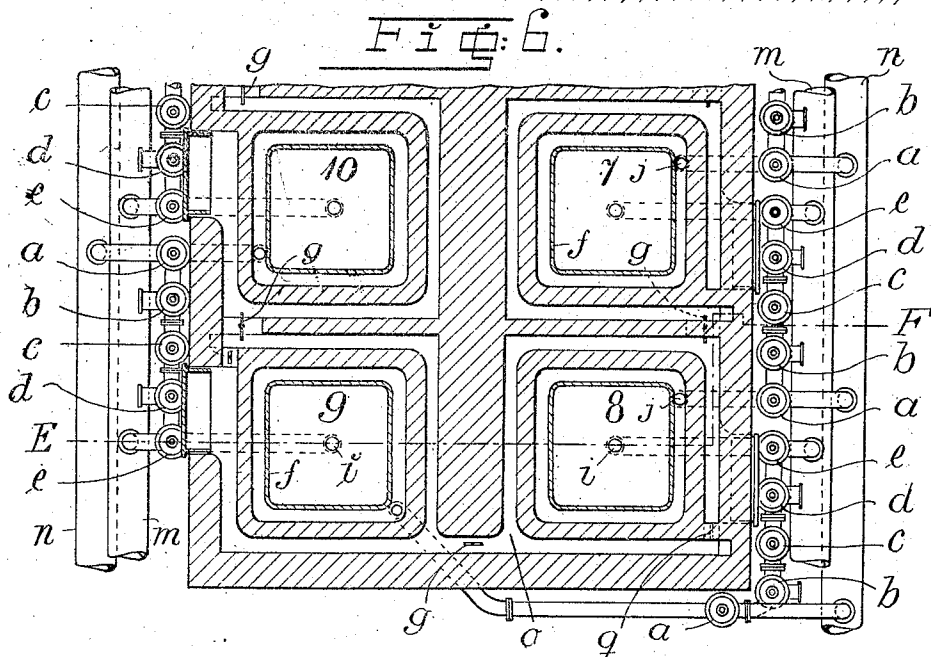
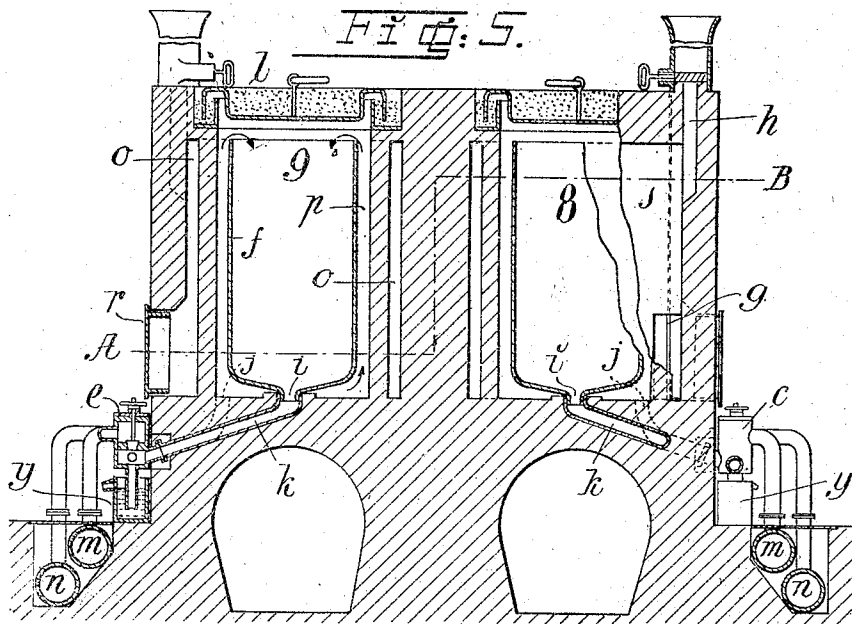
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No. 889,150.

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T. M. U. VON POST.
DISTILLING APPARATUS.
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6 SHEETS—SHEET 4.



WITNESSES:

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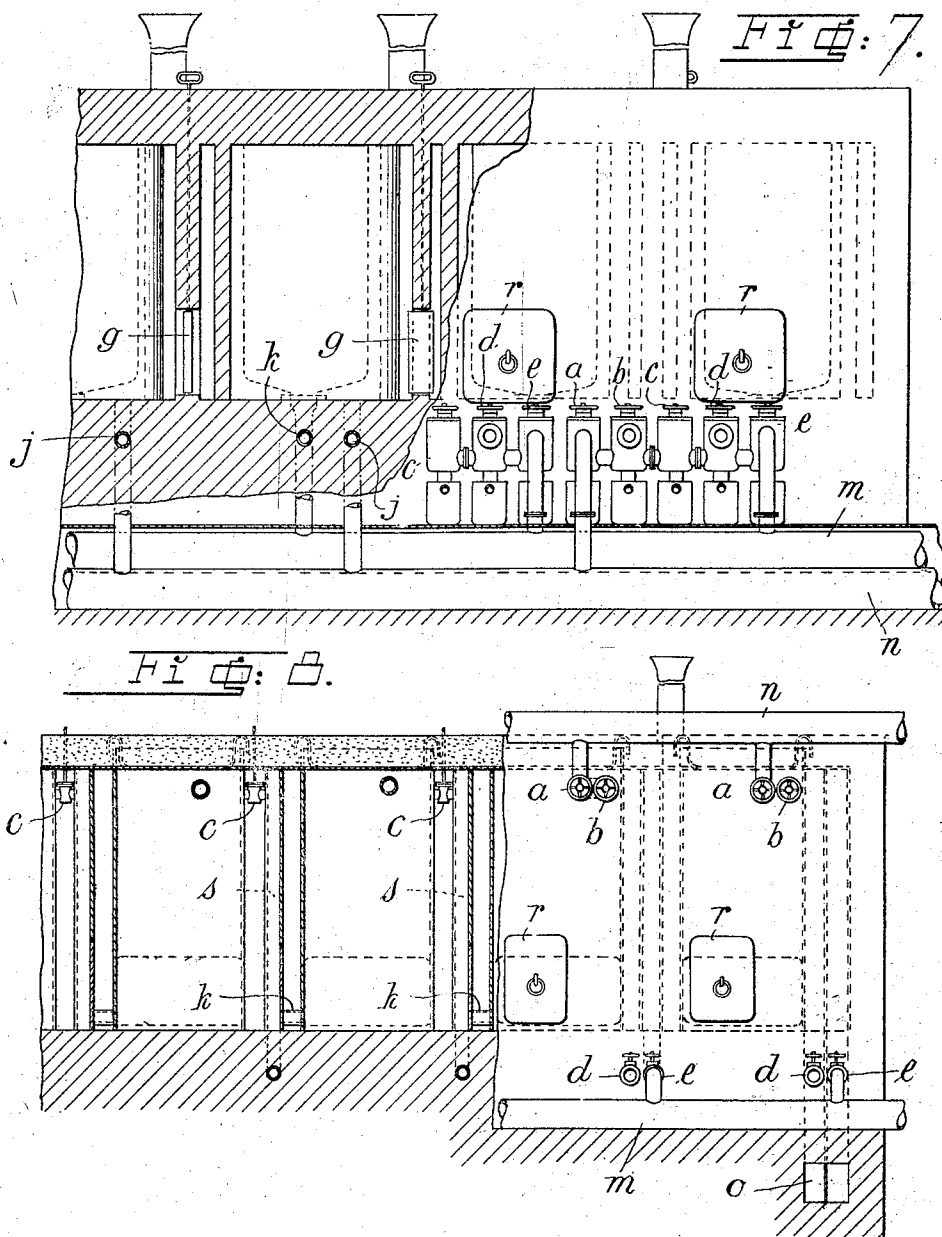
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APPLICATION FILED MAR. 8, 1906.

6 SHEETS—SHEET 5.



WITNESSES

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UNITED STATES PATENT OFFICE.

THOM MELCHER. UNGERN VON POST, OF STOCKHOLM, SWEDEN.

DISTILLING APPARATUS.

No. 889,150.

Specification of Letters Patent.

Patented May 26, 1908.

Original application filed June 29, 1905, Serial No. 267,658. Divided and this application filed March 8, 1906.

Serial No. 304,945.

To all whom it may concern:

Be it known that I, THOM MELCHER UNGERN VON POST, a subject of the King of Sweden, residing at Västmannagatan 47, Stockholm, Sweden, have invented a new and useful Distilling Apparatus, of which the following is a specification.

This invention has reference to improvements in apparatus for the distillation of organic matters, such, for instance, as wood, peat, coal, and the like, and is designed to produce a means whereby the process of distillation may be carried out progressively through an endless series of connected retorts, so that when a retort becomes exhausted it may be removed from the series and recharged or replaced by a freshly charged retort, without interrupting the continuity of the process.

The present application is limited to the apparatus, while the method or process of distillation which is carried out by the apparatus forming the subject-matter of this application is set forth in my application No. 267,658, filed June 29, 1905, of which the present application is a division.

The present invention comprises a suitable number of retorts, each surrounded by a chamber connected with the next preceding retort of the series, which chamber discharges into the retort at the top of the latter so that the products of distillation coming from the preceding retort are first caused to circulate around the retort under consideration and then to pass through the same from above downward, heating the contents of the said retort and then passing from the bottom thereof to the chamber surrounding the next succeeding retort, to again pass through the last-named retort and proceed in like order from retort to retort in progressive succession.

Surrounding the chambers in which are located the retorts are flues or conduits for the products of combustion coming from a suitable furnace, but these flues have no communication with the chambers except that the walls of the flues may be made sufficiently thin so that the heat of the product of combustion will be conducted through such walls and serve to heat the products of distillation circulating in the chambers surrounding the retorts.

The several chambers and retorts are connected by conduits in such manner that the

products of distillation may be caused to flow from chamber to retort in succession throughout the whole series, and certain retorts and chambers may be cut out of the series without interrupting the flow through the others, while the products of combustion from the furnace may be caused to flow around a certain number of the chambers inclosing the retorts in series and be then diverted from the remainder.

By making the furnace movable, so that it may be brought into operative relation to any one of the flues surrounding any particular retort and its chamber, the direct action of the hot gases of combustion may be utilized for that particular retort, thereby heating it to a high degree and causing the distillation of its volatile products. The hot gases of combustion are carried by the second, third, and succeeding retorts in order, getting progressively cooler until they finally become too cool for further action upon the contents of the retorts, when they may be discharged into the open air. During the heating of the first retort there is a distillation of its volatile contents which, in the form of hot gases, are carried through the second retort, first receiving heat from the surrounding smoke flue, and on passing through the second retort the most easily condensed products of distillation are deposited in said second retort, while the contents of this second retort are raised to a high degree of heat, sufficient to cause the distillation of a certain amount of the volatile products of the contents of said second retort. Now, in passing to the third retort the gases of distillation are still further cooled, but are still hot enough to volatilize some of the contents of the third retort, but also deposit some more of the products of distillation in this third retort, and then pass on to the fourth retort and to the succeeding retorts of the series. This fractional distillation progresses until finally the gases are too cool to further heat the contents of the retorts, and may then be carried to a suitable condenser for the extraction of all condensable matters. In order that the gases may flow readily through the several retorts, it is advantageous to use a blower for causing the circulation of these gases and to carry them through the condenser, after which the lean gases may be utilized for supplying the

furnace with combustible material, and, as is usually the case, the surplus gases may be stored for future use.

During the process described, after the circulation is once established, the contents of the first retort considered become thoroughly coked and the furnace may then be moved to the next retort, while the first retort may be cut out of the series and allowed to cool; then the second retort is cut out and allowed to cool, and so on. Ultimately the first retort considered is cooled sufficiently to permit it to be removed from the chamber containing it, or, where the retort is made as a permanent fixture, its contents may be removed and the retort be recharged. Now the lean gases coming from the condenser are led through the several retorts that are cooling after being coked and before the coked material is removed therefrom, and thus absorb heat from these retorts and thereby cool the latter. These gases now continue onward through the closed circuit as before described.

From the foregoing it will be seen that I have provided a means whereby the distilling of the volatile contents of organic matter may be carried on continuously and progressively through a closed series of retorts, that is, without interrupting the continuity of the process. The means which I have devised for this purpose are illustrated in the accompanying drawings, in which,—

Figure 1 is a plan view, partly in section on the line A—B of Fig. 2; of a series of kilns or retorts constructed and arranged in accordance with the present invention; Fig. 2 is a vertical section on the line E—F of Fig. 1; Fig. 3 is a plan view, partly in section, on the lines I—H, G—H, K—L, and K—M of Fig. 4, showing a slightly modified construction; Fig. 4 is a vertical section on the lines N—O and P—R of Fig. 3; Fig. 5 is a view similar to Fig. 2, except that the section is taken on a different line than that of Fig. 2, i. e., on the line E'—F' of Fig. 6; Fig. 6 is a section on an enlarged scale of a portion of the structure generally shown in Fig. 1, but taken on the line A'—B' of Fig. 5; Fig. 7 is a front elevation, with parts in longitudinal section, of a number of retorts on a larger scale than shown in Fig. 1; and Fig. 8 is a similar view of the structure shown in Fig. 3.

Referring to the drawings, there is shown in Fig. 1 a system of sixteen retorts, which are numbered 1 to 16 consecutively, while in Fig. 3 but fourteen such retorts are shown, but, of course, the number of retorts may vary considerably. These retorts are placed vertically, and are each open at the top and closed at the bottom in the structure shown in Figs. 1, 2, 5, 6 and 7 except for a central passage *i* at the bottom, or these retorts may be shaped as best shown in Fig. 4, to which reference will hereinafter be made. Each

retort is surrounded by a chamber *f* formed between the retort and encircling walls *p*, which latter are divided by a surrounding passage *o* from the main walls of the structure inclosing the entire series. The passage *o* around one encircling wall *p* is separated from the passage *o* of the next encircling wall *p* by a division wall *s*, and in this last-named wall is a valve *g* arranged to open or close a passage therethrough. Each passage *o* communicates with the exterior of the inclosing wall of the entire structure through a door *r* opposite which may be brought a portable furnace *v* for a purpose which will presently appear.

The top of each retort does not reach quite to the upper end of the chamber *f*, and this upper end is closed by a cover *l* on which may be placed a layer of sand for heat-insulating purposes, the said cover being removable for the removal or insertion of the retort.

Each passage *o* may communicate through a conduit *h* with a suitable outlet or flue communicating with the external air, and this flue may be provided with a damper, as shown.

The passage *i* at the bottom of each retort is in communication by a pipe *k* with another pipe in which are arranged a series of valves *a*, *b*, *c*, *d* and *e*, the valve *e* serving to close communication between the pipe *k* and a pipe *m* common to all the retorts. Alongside the pipe *m* is another common pipe *n*, which, however, is in communication with the chamber *f* of each retort through a pipe *j* in which is included the valve *a*. Leading from the pipe *k* is an extension thereof emptying into a receptacle *y* which, as will hereinafter appear, is designed to receive the products of distillation which have become condensed within the retort. The pipe *m* is in communication with a suitable blower *t* and with a condenser *u* through a branch pipe *mn*, and this condenser is in communication through a continuation of the pipe *mn* with the pipe *n*.

Now, let it be assumed that there are sixteen retorts in the series and that all these retorts are charged ready for the distilling of their contents, and let it be assumed further that the fire chamber *v* is placed opposite one of the retorts, say, the retort 11. Under these conditions all the dampers *g* through the passages *o* surrounding the retorts 12, 13, 14, 15, 16, 1, 2, 3, 4 and 5, and the damper in the passage *h* corresponding to the retort 5, are opened, while the other dampers *h* corresponding to the same series of retorts are kept closed. Likewise, all the valves *a*, *b*, *c*, and *d* are closed, while the valves *e* are opened. The fan or blower *t* is put into operation and a valve *x* in the pipe *n* is opened, this valve being arranged for communication with the external air. The hot products of combustion flow through the several

passages *o* and finally escape through the passage *h* which is open to the external air adjacent to the retort 5. The contents of the retort 11 begin to give off gaseous products which expel the air from the retort. In order to expel the air from the chamber *f* surrounding this retort, the corresponding valve *e* is closed, while the valve *b* is opened. When the air has been expelled from the retort 11 and the corresponding chamber *f*, the valve *c* is opened and the valve *b* is closed, whereupon the volatile products of distillation enter the chamber *f* surrounding the retort 12 and pass from the bottom of said chamber upward into the top of the retort 12, as indicated by the arrows in Fig. 2.

Passing downward through the retort the gases flow outward through the pipe or passage *k*, driving the air before them and carrying with them the volatile products generated in the retort 12. When the air has been expelled from the retort 12 the valve *b* is closed and the valve *c* is opened, whereupon the gases of distillation enter the chamber *f* surrounding the retort 13 and then pass into said retort 13. In this manner the process continues throughout the whole system of kilns or retorts until the whole circuit of sixteen retorts, with the chambers *f*, the pipes *k*, and the passages or pipes *m* and *n*, together with the fan or blower *t* and the condenser *u*, is full of gases generated by the distillation, the circuit being maintained by the said blower or fan.

The gases of distillation upon passing through the several chambers *f* surrounding the retorts 11, 12, and so on, absorb heat from the hot products of combustion traveling through the passages *o*, and these gases give off the heat so absorbed to the contents of the retorts. This causes the temperature of the gases to decrease from retort to retort. The consequence of this is that those products of distillation which have been given off at the highest temperature are the first to condense in a succeeding retort, and do, in fact, condense in the next retort to the one in which they were generated. These condensed products pass into the receptacle *y* through the continuations of the pipes *k*.

By the time the continuity of the process has been established throughout the whole series of retorts the contents of the retort 11 have become practically coked and all that remains to be accomplished in this retort is to expel the least volatile substances. In the retort 12 the distillation has progressed but not to such an extent as it has in the retort 11. In the retort 13 the distillation is at a still earlier stage, and so on until the temperature has dropped to such a degree that no real distillation has yet begun in some of the retorts, say in the retorts 2 to 5. That portion of the system embraced between the retorts 12 to 16 and 1 to 5 constitutes what

may be termed the distillation or heating zone. Now, by moving the furnace opposite the retort 12 and allowing it to communicate through an opening closed by the door *r* with the smoke passage or flue *o* surrounding said retort, the heating zone has been advanced one retort, while the exit flue *h* corresponding to the retort 6 may now be opened, and so from time to time the furnace may be advanced from retort to retort in serial order in the manner indicated. Of course, the process may be hastened by using several furnaces and by increasing the speed of the gases flowing through the system, and, in addition, the length of the heating zone may be increased. But these are all obvious adaptations of the apparatus and need no special description.

Now, let it be assumed that the process has been in operation and that the contents of the retorts 10, 9, 8 and 7 have been all coked. The retort 10 is, of course, still hot, while the retorts 9, 8 and 7 are progressively cooler. These retorts constitute what may be termed the cooling zone. The gases generated in the distillation or heating zone and flowing through the same and thereby collecting and depositing the products of distillation at retort after retort, in order, are led out from the system through the valve *e* corresponding to the retort 5, and are carried through the pipe *m* and condenser *u* for the purpose of separating such condensable products as may be present and still uncondensed. These gases are then led through the pipe *n* and again enter the system through the valve *a* corresponding to retort 7, and they flow through the chambers *f* and retorts in order, thus absorbing heat from the retorts 7, 8, 9 and 10 and at the same time cooling these retorts. These gases thus reach the distilling zone in a heated condition, and then continue onward through the closed circuit as before described.

Under the conditions thus far assumed the retort 6 is supposed to have been cooled sufficiently and to have been cut off from the system and from the circuit of the gases. This is done by closing the corresponding damper *g* and the valves *c* corresponding to the retorts 5 and 6 and also the valves *a* and *e* corresponding to the retort 6. The retort 6 (and also the retort 7 if cool enough) is now ready to be discharged or emptied. For this purpose the cover *l* is removed and the retort is lifted out of the chamber *f* and may then be removed to a point of deposit for the coked material, and, after its contents have been discharged, the retort may be refilled and replaced in the system, or freshly charged retorts may be provided which can be placed in the system as soon as a retort is removed therefrom, thus saving time. By having freshly charged retorts ready for insertion the capacity of production of the kiln

system may be thus increased, since the retorts may be taken out while still quite hot. But in order to prevent their contents from taking fire spontaneously it is necessary that
 5 a suitable cover be provided to be placed on the retort as soon as the cover *l* is removed.

As soon as the freshly charged retort is placed in the system it is coupled up into the heating zone and begins to be heated by the
 10 gases of combustion and also the gases of distillation and in the progress of the operation the freshly charged retort is subjected to greater and greater heat and is ultimately reached by the furnace and its contents be-
 15 come coked and it is again removed from the system as before described.

Each time a retort is placed in the system the furnace may be advanced one retort further in the series, thus advancing the
 20 heating zone, there being enough retorts in the heating zone to permit of this operation. In this manner the process is carried from one retort to another in succession, so that at each step the distillation is carried one step
 25 farther and an additional part of the products of distillation are condensed and led away to the corresponding receptacle *y*.

For heating the furnace either solid, liquid or gaseous fuel may be used, and a part or
 30 even the whole of the air necessary for combustion may be obtained already heated by introducing the same through the fire opening *r* corresponding to the coolest of the series of retorts then constituting the cooling zone.

During the process of distillation greater quantities of gas are usually generated than are needed for the closed circuit, and for this reason there may be a suitable gas receptacle inserted in the circuit for the accumulation
 40 of the lean gases until there is use for the same. Since these gases are combustible, they may be used for feeding the fire in the firing zone. For this purpose cold gas may be taken directly from the tube *n* through
 45 one of the valves by means of a movable pipe or tube section *z*, which latter may be led to the furnace *ϕ* or to an adjacent flue *o* surrounding the retort to be treated by the fire, the said pipe being introduced through the cor-
 50 responding opening *r*. If heated gas is to be used then one of the valves *b* or *d* is connected by a suitable hose or tube with the fireplace. In certain cases it may be advan-
 55 tageous to concentrate a greater heat in one place, or around a certain retort in the system, than at other places. For this purpose the fireplace *v* may be provided with a number of tubes around which the fire sweeps, and these tubes may be connected with the
 60 valves *b* and *d*, in which case the intervening valve *c* is closed. By this means the circulating gases of distillation are led out from the circuit of kilns into the fireplace, whence they are heated to a high temperature and
 65 are again led into the circuit of kilns.

The arrangement shown in Figs. 3 and 4 differs from that described in that the retorts are stationary and are provided with discharge openings for the coked material. Besides this, the chambers *f* are omitted and the
 70 walls *s* are made hollow and extend across the flues *o*. These hollow walls communicate by means of passages *k* and *kc* with the retorts in the same manner as do the passages *k* and chambers *f* of Figs. 1 and 2. The pipe
 75 *n* is carried along above the retorts and the pipe *m* below the same, while the several valves *a* to *e* inclusive are disposed accordingly. There is no difference in the operation of the structure shown in Fig. 3 from
 80 that already described with reference to Fig. 1, the differences being in details of the parts and not in the functions thereof. In Fig. 4 it will be seen that the cover *l* is applied directly to the top of the retort instead of to
 85 the top of the chamber *f*, as in Fig. 2.

In order to obtain a flow of the products of combustion through the system natural draft may, of course, be used. But in such instance the gases must be exhausted at a
 90 temperature which would be too high to secure economy of heat. In such cases the products of combustion will leave the chimney or escape flue at a temperature of from
 95 250 to 300 degrees centigrade, while distillation begins to take place at a temperature considerably below this and is often finished at a temperature of from 350 to 400 degrees centigrade. It is found therefore more ad-
 100 vantageous to use forced draft applied in any manner best suited to the conditions present. By conducting heat to the material to be coked or distilled by the current of hot gases as described, the temperature may be readily
 105 controlled and the heat may be uniformly distributed within each separate retort, and, owing to the speed with which the gases of distillation and the products of combustion circulate, the process may be accomplished in
 110 a much shorter time than usual, and the kiln system will, therefore, have a much greater capacity than would be the case if the gases of distillation were simply allowed to flow away by the pressure due to their generation.

It will be understood, of course, that where-
 115 ever the conduits for the hot gases are subject to losses by radiation, suitable coverings for preventing such heat radiation may be applied.

I claim:—

1. In an apparatus of the class described, an endless series of retorts, means for applying heat to a predetermined successive number of said retorts, means for cooling another predetermined successive number of said retorts already subjected to heat, and means
 125 for cutting out another predetermined number of said retorts from the circuit for removing their contents and recharging them.

2. In an apparatus of the class described, 130

an endless series of retorts, means for cutting in or out of the circuit any one or a number of said retorts without impairing the continuity of the circuit through the retorts not cut out, and means for applying heat at any point in the circuit and conducting the same in succession around a predetermined number of successive retorts.

3. In an apparatus of the class described, a number of retorts, means for connecting the same in endless series, means for cutting out any of the retorts without breaking the continuity of the circuit, means for applying heat at any point in the circuit, and means for conducting the heat around a predetermined successive number of the retorts.

4. In an apparatus of the class described, a series of retorts comprising a predetermined number of the retorts arranged to form a distilling zone, another predetermined number of the retorts arranged to form a charging zone, and still another predetermined number of the retorts arranged to form a cooling zone, and means for shifting said zones throughout the entire series of retorts to include all the retorts successively.

5. In an apparatus of the class described, a series of retorts, chambers surrounding said retorts and communicating with the upper ends of said retorts, and means for connecting the discharge end of each retort with the chamber surrounding the next successive retort.

6. In an apparatus of the class described, a series of retorts, and means for conducting the products of distillation from one retort around the exterior of and then into the next succeeding retort.

7. In an apparatus of the class described, a series of retorts, means for conducting the products of distillation from one retort around the exterior of and then into the next succeeding retort, and means in each retort for withdrawing therefrom the condensed portions of the products of distillation received from the next preceding retort.

8. In an apparatus of the class described, a series of retorts, means for conducting the products of distillation from one retort around the exterior of and then into the next succeeding retort, and means for applying heat to one of the retorts and for conveying the products of combustion generated by the heating means around a predetermined number of the retorts in succession.

9. In an apparatus of the class described, a series of retorts, means for conducting the products of distillation from one retort around the exterior of and then into the next succeeding retort, means exterior to the retorts and the conduits for the products of distillation for heating the retorts and the products of distillation.

10. In an apparatus of the class described, a series of retorts, means for conducting the

products of distillation from one retort around the exterior of and then into the next succeeding retort, means exterior to the retorts and the conduits for the products of distillation for heating the retorts and the products of distillation, and means in each retort for withdrawing therefrom the condensed portion of the products of distillation received from the next preceding retort.

11. In an apparatus of the class described, a series of retorts, chambers receiving the same and with which the retorts are in communication at their upper ends, means for drawing off condensed products of distillation from the lower ends of the retorts, means for coupling each retort to the chamber surrounding the next succeeding retort, and means surrounding the chamber inclosing each retort for conveying heat to the said chambers and through them to the retorts in succession.

12. In an apparatus of the class described, a series of retorts, means for conveying the products of combustion, from a source of heat, around the retorts in succession, and means for conveying the products of distillation successively through the retorts in the order of recession from the source of heat.

13. In an apparatus of the class described, a series of retorts, means for applying heat at one end of the series, means for conveying the products of combustion by the several retorts in the order of recession from the source of heat, and means for conveying the products of distillation through the retorts in the same order as the products of combustion are conveyed past the retorts.

14. In an apparatus of the class described, a continuous series of retorts, means for heating a predetermined number of the retorts to produce distillation of the volatile portion of their contents, means for directing the products of distillation in succession through said retorts, a condenser, means for directing the products of distillation through the condenser, and means for returning the lean gases into the system through retorts in which the distillation has been completed, for cooling the said retorts.

15. In an apparatus of the class described, a continuous series of connected retorts, a movable burner or combustion chamber adapted to be brought into operative relation to any one of the retorts, and means for connecting a successive number of the retorts to the retort connected to the source of heat.

In testimony that I claim the foregoing as my own, I have hereto affixed my signature in the presence of two witnesses.

THOM MELCHER UNGERN VON POST.

Witnesses:

AUG. HAGELIN,
ALMA PETTERSSON.