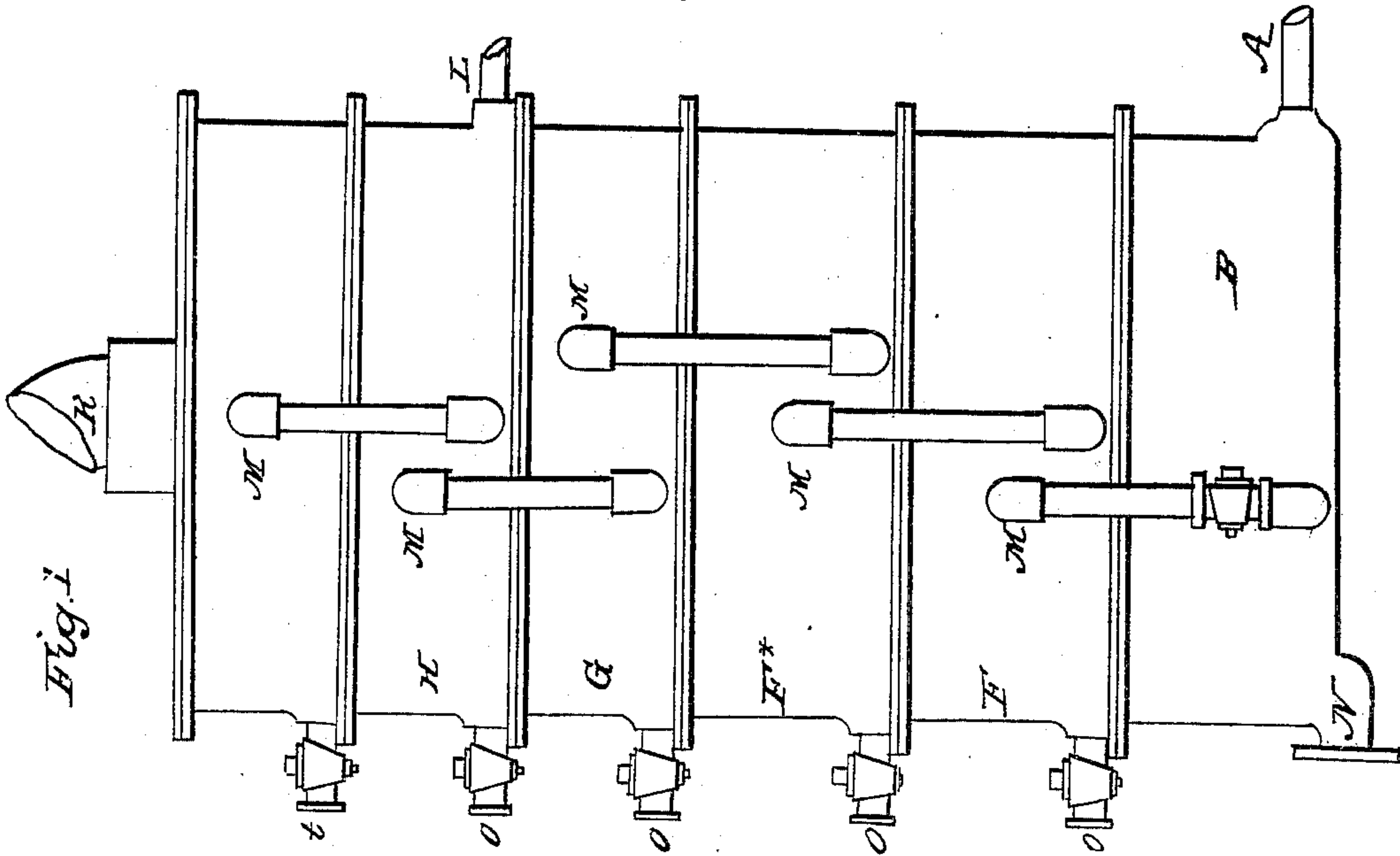
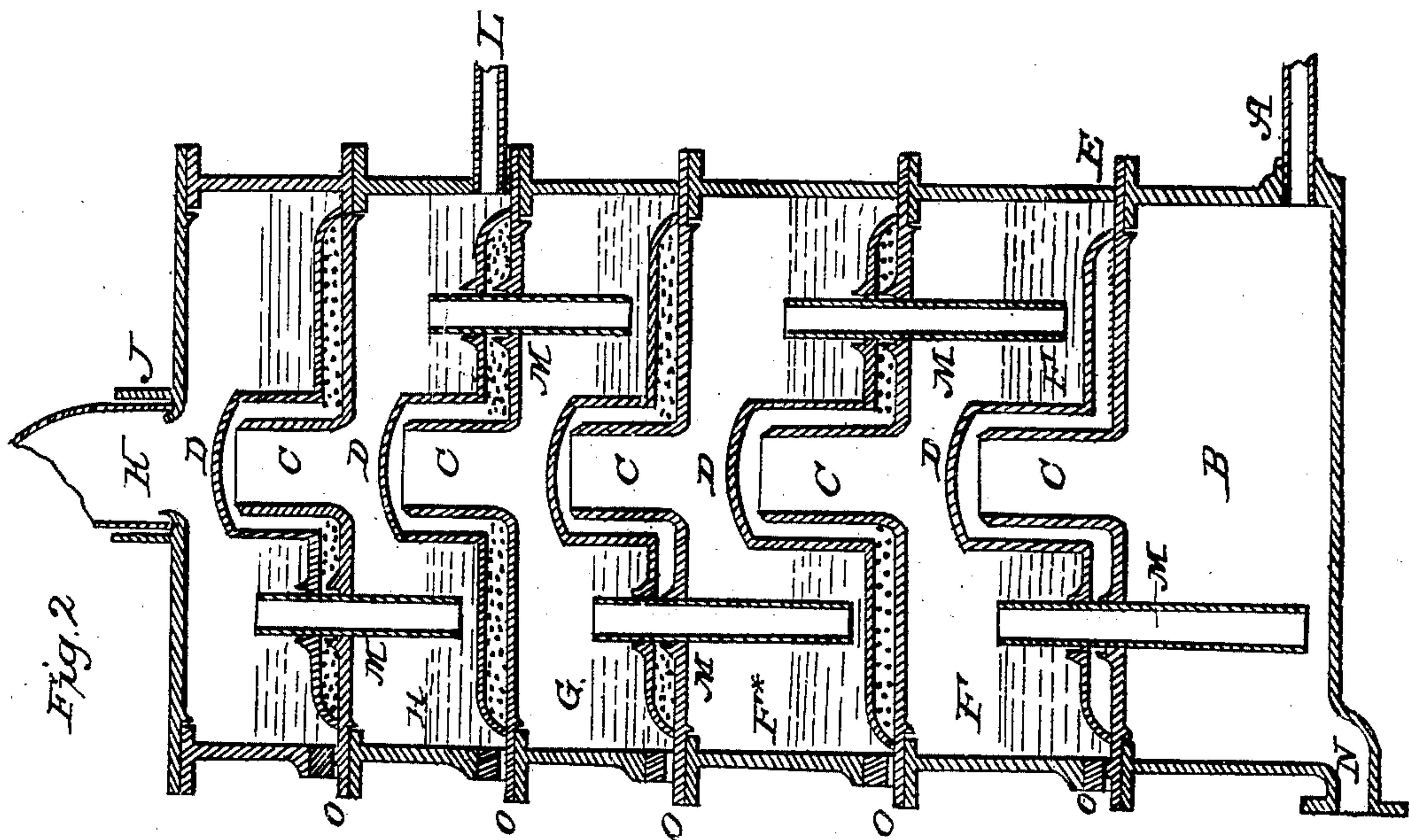


J. I. VAUGHAN.

Apparatus for the Continuous Distillation of Petroleum.

No. 49,689.

Patented Aug. 29, 1865.



Witnesses  
John A. ...  
A. E. ...

Inventor.  
John Ives Vaughan



# UNITED STATES PATENT OFFICE.

JOHN IVES VAUGHAN, OF LONDON, ENGLAND.

IMPROVED APPARATUS FOR THE CONTINUOUS DISTILLATION OF PETROLEUM, &c.

Specification forming part of Letters Patent No. 49,689, dated August 29, 1865.

*To all whom it may concern:*

Be it known that I, JOHN IVES VAUGHAN, of No. 4 Brabant Court, Philpot Lane, in the city of London, England, have invented certain Improvements in the Manufacture of Rosin and Resinous Substances, and in the Apparatus Employed therein, parts of such improvements being applicable to the refining of coal, petroleum, animal and vegetable oils and fats, paraffine and analogous acids and hydrocarbons; and I do hereby declare that the following is a full and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon.

The first part of my invention relates to an improvement in the manufacture of or mode of obtaining products from resinous substances, and consists in carrying on continuously the process of separating the spirits from the heavier substances contained in the crude turpentine or similar balsams, and refining the residual resin by distillation without cooling or packing in the interval between the operations.

The mode of effecting the separation of the turpentine or spirituous oils from the crude substance is not material in this part of my invention, but may be accomplished either by the use of fire, steam, or superheated steam, or by boiling in a still containing water, in accordance with the method hitherto adopted for the drawing or distilling turpentine. The residuum or resin from the material under treatment, after the spirit and light oils have been extracted, is to be run into other apparatus for the purpose of refining the same by distillation.

The form of apparatus or mode of refining the residual resin in the first part of my said invention is not of moment or importance, the improvement consisting in the economy of heat and labor by using the material already in a heated state, and also in the opportunity afforded thereby to prevent the access of air to the material under treatment, the quality of the articles being rapidly deteriorated when in a heated state by the action of oxygen.

The second part of my invention consists in the arrangement or construction and mode of working of apparatus for the purpose of distillation, affording thereby a means of supplying

the crude substance in a continuous stream and obtaining therefrom a continuous flow of the volatilized or distilled product and residuum, which may be intermittent at the will of the operator and in accordance with the requirements of the article under treatment. The apparatus also economizes in a very high degree those distilling or subliming agents—such as steam or gases of various temperatures—which have hitherto been employed to distill, sublime, or volatilize resinous, fatty, or mineral acids or hydrocarbons.

In order that the nature of my invention may be more fully understood, I will describe the apparatus by which the distillation is conducted.

In the drawings hereunto annexed is shown a still or distilling head or column, Figure 1 being an elevation, and Fig. 2 a section, of the same.

A is an inlet-pipe for the admission of steam or gases of the required temperature, to be governed in the usual manner by a stop-cock or suitable valve.

B is the first chamber into which the steam, gas, or vapor enters, which chamber may also serve as a receiver for the residual products during the distillation, which may be thence continuously or occasionally run off as required.

C is a pipe or way to the chamber above, through which the steam passes, and thence under D, the deflecting hood or bonnet E, the lower flange of which may be pierced with holes or serrated, as shown in the first or lower hood, for the purpose of dividing the vapors into small streams or jets, so as to be more effective in action in rising through the substance or substances under treatment; or upon or in place of the deflecting-hood a series of perforated plates or sieves may be placed under the fluid, so that both the steam or vapor may be minutely divided, and also that an electrical action may be thereby set up, which I believe materially assists the distillation. This is repeated in every superposed vessel or chamber F F' G H I.

J is a lute-box to form a joint with the issue-pipe K, which leads the vapors to the condenser. Any other usual form of joint may be substituted for this arrangement.



L is the inlet-pipe for the supply of the material to be distilled.

M is the dropping-pipe, fitted internally, for the purpose of conveying the superfluous contents of the superposed vessel (when they exceed the height of the stand-pipe) to the next beneath.

Over the top of the dropping-pipe M, and leaving a space between the two, it may be necessary to place a cap of considerably larger internal diameter than the diameter of the pipe M, having a small hole in the top to prevent any siphoning action when the steam may be shut off. This cap should reach nearly to the top of the flange of the bonnet, so that the material shall run from below the surface into the vessel below, as the higher vessels contain the lighter substances, and which might rise to the surface of the material in the lower vessels, into which it flows, notwithstanding the ebullition caused by the ascending steam.

M, Fig. 1, is another form of dropping-pipe, fitted externally, which may be used in the same manner as the last mentioned. These pipes must be fitted so that the charge shall not be carried upward by the bubbling of the steam near its base. On this plan a stop-cock may be inserted in the dropping-pipe, that the contents of any lower vessel may be run off while working. In M, Fig. 1, this arrangement may be modified by constructing a bend dipping below the surface of the fluid, having also a small hole in its apex.

N is a pipe by which the residual products may be drawn off continuously and automatically without the escape of steam or vapor.

O are holes tapped for the insertion of pipes or stop-cocks, to draw off the whole of the charge when necessary, or for occasionally observing the condition of the contents of the vessels.

Having thus described the apparatus employed in the second part of my invention, I proceed to relate the mode of working the same.

The crude material is supplied in a liquid state, or heated to a proper degree and freed from extraneous matter, or otherwise suitably prepared for distillation in the usual manner, to one of the chambers—by preference one of the upper vessels—by a pipe, L, filling the compartments attached thereto to the level of the top of the dropping-pipe M. The excess of the measurement which may be admitted falls through the dropping-pipe M into the vessel immediately beneath, filling that vessel also, and so on. The steam or other distilling agent is then admitted by the pipe A, which pipe may be fitted to any convenient part of the lower chamber, preferably the lowest, and thence passing upward and under the deflecting-bonnet D or by other means under the material, volatilizes a certain portion of the contents of that chamber, the vapor from which is carried with the steam again upward and under the deflecting-bonnet D of the next cham-

ber, and passing through the fluid there contained, is partially deposited and a fresh portion again taken and carried forward in like manner, until, having passed through all the vessels, it reaches the issue-pipe H in a more highly-purified state. It is then ready for condensation and removal in any convenient manner, and in the case of refined is cooled rapidly by exposure in thin layers, to prevent crystallization and to allow any surplus or uncombined aqueous vapor to escape. When the working is in full train the attendant will be enabled, by observing the amount distilled and the condition of the residuum running from the pipe N to supply, with ordinary judgment, the exact amount required to keep the work regular and efficient in all points.

The apparatus may be attached to an ordinary still, which may be heated by fire-heat, in which case the still will constitute and take the part of the lower vessel of the series in the foregoing arrangement, the steam or other power being likewise admitted either above or beneath the material in the still or lower vessel.

When it is desirable to retain the constitution of the material as nearly as possible in its normal state, with but little decomposition or atomic change, the use of steam in considerable amount is necessary and advisable, the change of substance to a secondary compound of a less specific gravity being the general effect produced when the matter has been acted upon by dry external heat.

In the distillation of substances which are not only required to be separated, but the composition of which is desired to be much changed, the same arrangement of apparatus may be attached to the still and the still heated by fire or dry heat only, the vapor of the material under treatment passed through the column or upper vessel in like manner.

When it is found advisable to distill the material to dryness, as in the case of candle tar or pitch, petroleums, oil, oil-pots, and other greases, it may be advisable to connect more than one primary vessel, still, or retort to the column, that the connection between a retort and column may be shut while the coke or hard pitch is removed from one retort, while another such retort is at work to supply the column with vapor.

It may in some cases also be advisable to admit superheated steam direct to one or more of the upper vessels in case the temperature be too rapidly lowered by volatilization or the admission of the fresh material insufficiently heated. This plan can be adopted for the continuous fractional distillation of other analogous substances, where a greater number than two products are obtained, by the employment of one set of chambers or column for each product. Each column, being supplied by its own particular heat, is calculated to produce the substance distillable at that temperature in a uniform manner.

The apparatus in the foregoing arrangement



may be superposed or conjoined in any convenient manner, and when it may appear advisable to assist the action by fire-heat it may be conducted round the vessels by flues arranged in the brick-work; but I prefer to inclose the vessels as far as possible in a non-conducting material, and to depend solely upon the heat directly applied internally by the means previously described.

It will be perceived that by the foregoing process, as the material in the vessels is gradually exhausted of its finer volatile constituents and becomes more foul and dense by the removal of the lighter portion, the remainder will require more heat to distill it. This is provided by the exhausted charges gradually falling toward the greatest heat supplied to and contained in the lower vessel. At the same time the heavy and foul contents of the lower vessels yield but an inferior distillate; hence in passing upward the distillate is purified, deposited, repurified, and passed on. The level in each vessel being at all times uniform, with ordinary vigilance on the part of the attendant who manages the supply of the crude material and heating-power, it follows that the distillation will be continuous and the product uniform in color, quantity, and quality—a result which has not, I believe, been hitherto obtained in the distillation of hydrocarbons or fatty vegetable or mineral acids. In order to obtain a constant and regular working, I insert thermometers or pyrometers in convenient parts of the apparatus, to indicate to the attendant the exact temperature employed.

A considerable saving is effected by this mode of treating the before-mentioned substances, both in labor and material, by reason of the immediate and consecutive distillation, without loss of heat or exposure to atmospheric influence, thereby securing the most highly-purified product as a result with a minimum of residuum; and also when operating on paraffine or animal or vegetable fats I obtain a maximum of solid product having a comparatively-high melting-point.

I may observe that for the successful performance of the foregoing operations it is absolutely necessary that the superheating apparatus be of sufficient power and of good construction, as I am aware that most of the su-

perheaters employed in this country for the purposes of distillation are comparatively far too small and inefficient for the amount of work assigned to them, and hence the general necessity for the use of additional heat applied to the still externally.

Having thus fully declared and ascertained the nature of my said invention, and also the manner in which it is to be performed, I wish it to be distinctly understood that I do not claim the use of any part thereof for the purpose of the distillation of ethylic alcohol or analogous substances similarly soluble in water; nor do I claim the use of superheated steam for the distillation of resin and resinous substances or fatty animal or vegetable matters and hydrocarbons, for all which purposes it has been long since employed; neither do I, in regard to the second part of my said invention, claim the exact form or size of the apparatus before described, as the same must necessarily be in some degree varied with the nature of the substances to be operated upon; but

What I consider novel and original, and therefore claim as constituting my said invention, is—

1. The treatment of resins and resinous substances by continued or connected operations, whereby the spirit is distilled from the crude substances and the residual resin volatilized or distilled into a product which becomes solid at the ordinary temperature of the atmosphere without packing or cooling the resins between the operations, as hereinbefore substantially set forth and described, or any mere modifications thereof.

2. The construction, combination, arrangement, and method of working of the apparatus for the continuous distillation of resin and resinous substances, coal, petroleum, bone, oil, paraffine, and other analogous acids and hydrocarbons, as hereinbefore substantially set forth and described, or any mere modification thereof.

In witness whereof I, the said JOHN IVES VAUGHAN, have hereunto set my hand and seal this 3d day of May, in the year of our Lord one thousand eight hundred and sixty-five.

JOHN IVES VAUGHAN. [L.S.]

Witnesses:

JOSHUA NUNN,  
A. C. ROWLAND.