

Sept. 22, 1925.

1,554,587

F. LAMPLOUGH
DISTILLATION APPARATUS

Filed Nov. 22, 1923

3 Sheets-Sheet 1

Fig. 1.

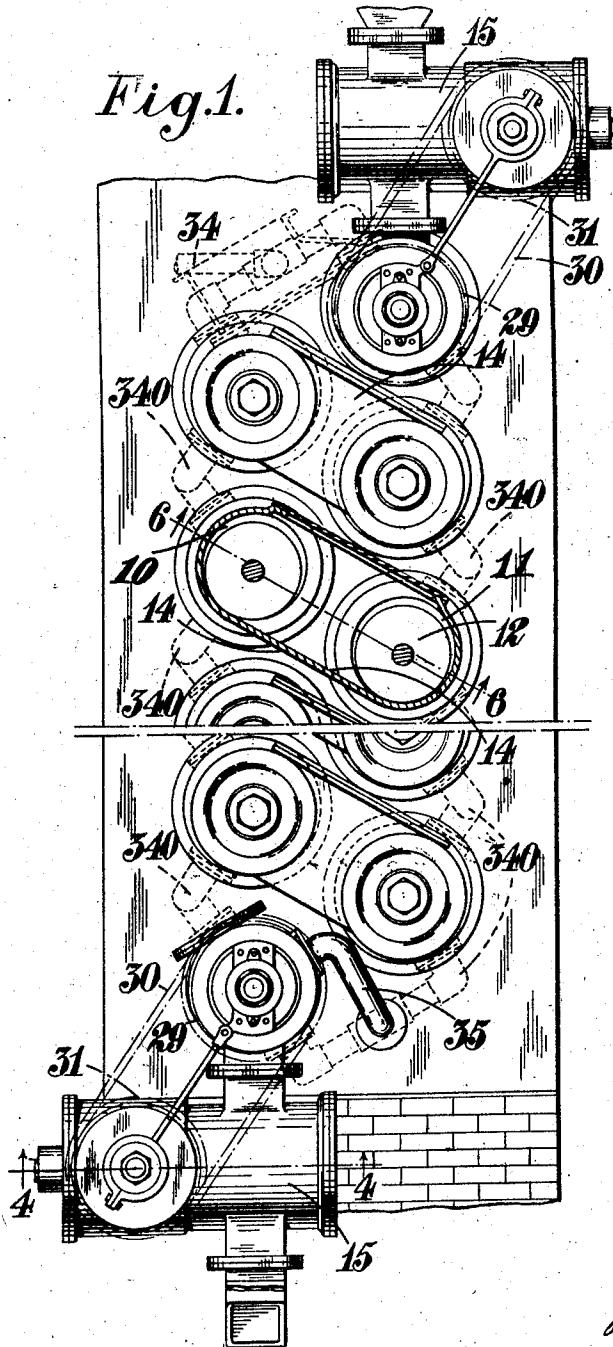
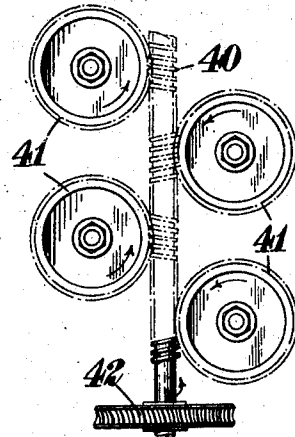


Fig. 3.



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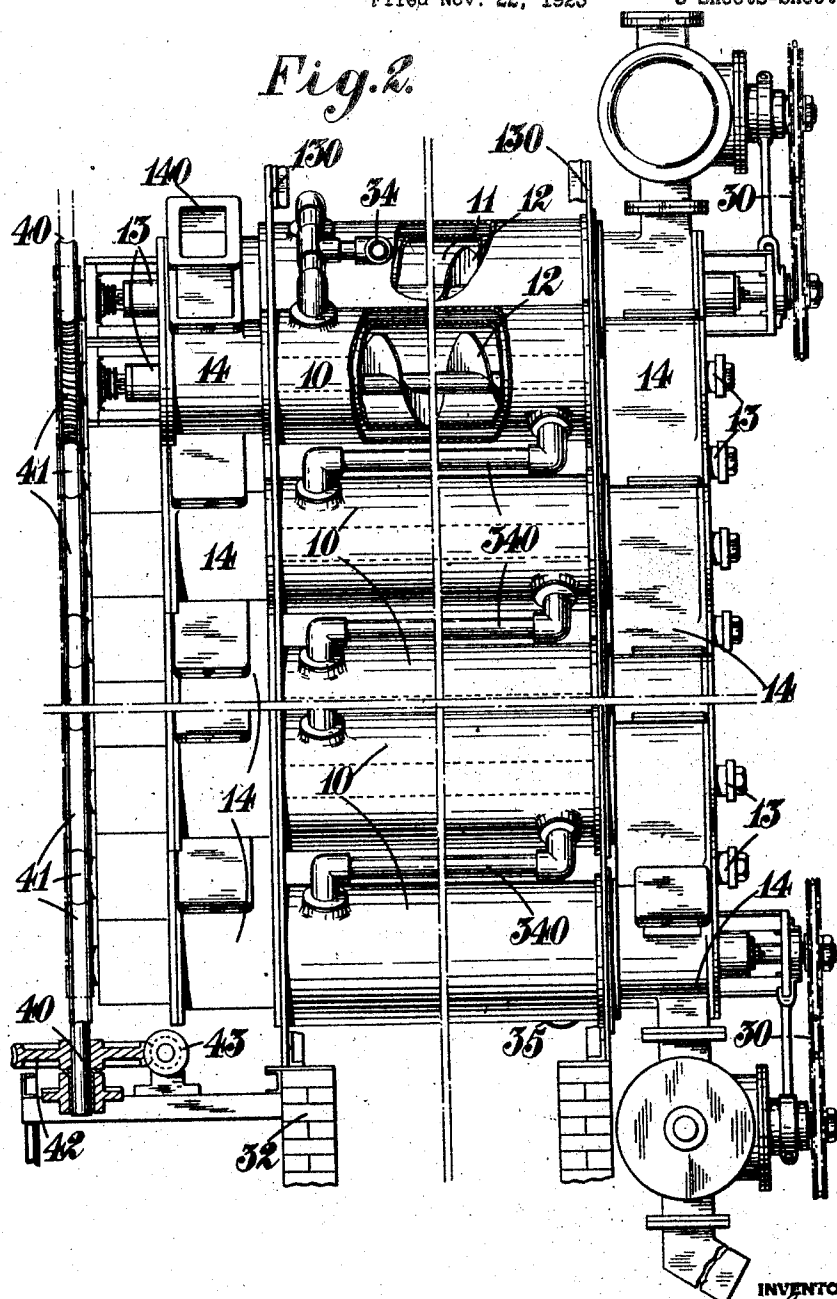
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3 Sheets-Sheet 2

Fig. 2.



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3 Sheets-Sheet 3

Fig. 6.

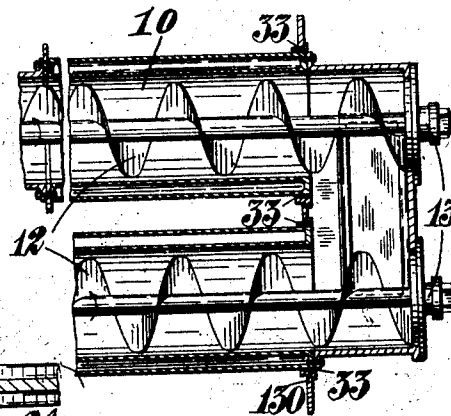


Fig. 4

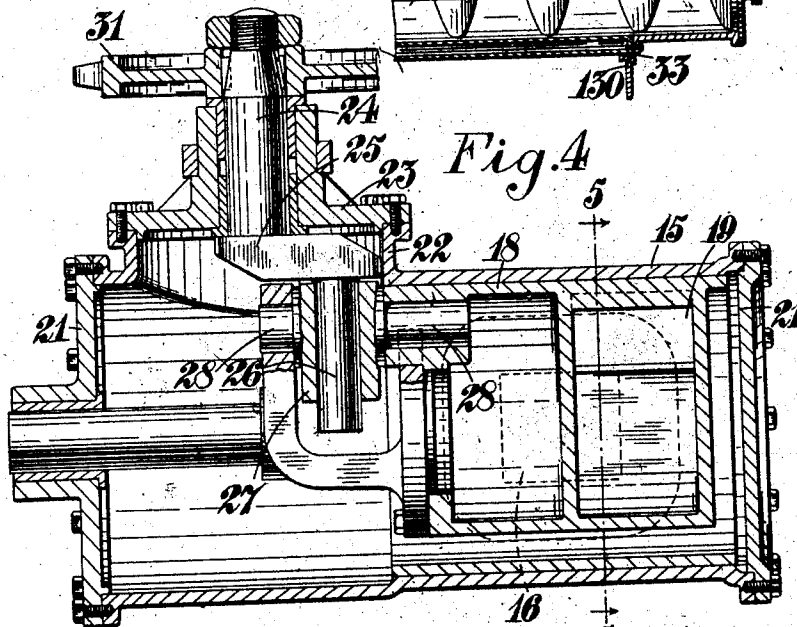
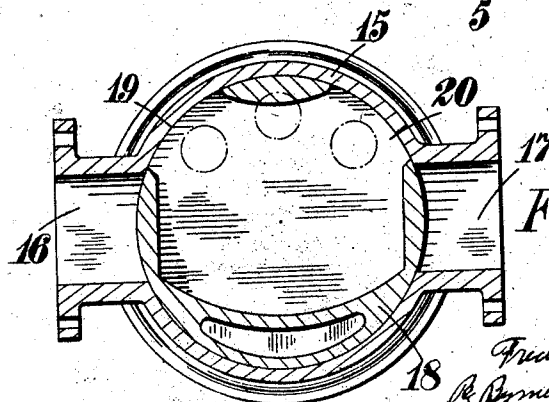


Fig. 5.



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UNITED STATES PATENT OFFICE.

FREDERICK LAMPLOUGH, OF HIGHFIELD, FELTHAM, ENGLAND, ASSIGNOR TO F. LAMPLOUGH & COMPANY, LIMITED, OF LONDON, ENGLAND, A BRITISH COMPANY.

DISTILLATION APPARATUS.

Application filed November 22, 1923. Serial No. 676,270.

To all whom it may concern:

Be it known that I, FREDERICK LAMPLOUGH, a subject of the King of England, residing in Highfield, Feltham, Middlesex, England, have invented certain new and useful Improvements in Distillation Apparatus, of which the following is a specification.

This invention consists in improvements in or relating to distillation apparatus, which is particularly suitable for the distillation of shale and solid carbonaceous fuels, and refers to that type of apparatus in which there is employed a plurality of tubular retorts each arranged in a horizontal or substantially horizontal position.

Fuel-distillation apparatus according to the present invention comprises in combination a plurality of tubular retorts with their axes extending substantially horizontally, said retorts being arranged in vertical rows with the retorts in one row staggered in a vertical direction in relation to those in the next row, fuel-transfer means operative between opposite ends of each retort and the corresponding ends of the retorts next above and below it in an adjacent row, and means to propel the fuel along each retort from that end which communicates with a retort at a higher level to that end which communicates with a retort at a lower level.

The invention also includes the combination of apparatus as above described, with means to lead steam into the steam-jacket of an upper retort and to pass it in succession through jackets of the retorts below, and means to pass steam from the jacket of a lower retort through the interior of that retort and then in succession through the interiors of the retorts above it.

The foregoing and other features of the invention will be more clearly understood from the following description of one preferred embodiment of the invention now described by way of example only, with the aid of the accompanying drawings, in which—

Figure 1 is an end elevation of a distillation apparatus, parts being removed for clearness;

Figure 2 is a view of the apparatus shown in Figure 1 and viewed from the left thereof, the outer wall of the enclosing furnace being omitted to show the retorts;

Figure 3 is a detail of part of the drive mechanism for the retort-conveyors;

Figure 4 is a section on the line 4—4 of Figure 1;

Figure 5 is a section on the line 5—5 of Figure 4; and

Figure 6 is a section on the line 6—6 of Figure 1.

Like reference numerals indicate like parts in the several figures of the drawings.

Two rows of jacketed retorts 10—10 and 11—11 arranged in staggered relationship as described above are employed (Figures 1 and 2), and in each of these is a conveyor-screw 12 for transporting the material to be distilled from one end of the retort to the other. At the upper end of Figure 2, parts are shown broken away in two retorts to illustrate the jacketing.

The ends of the conveyors are provided with bearings 13 arranged in end covers or boxes 14 at the ends of the retorts, and conduits are provided by means of these boxes interconnecting the ends of a retort in one row and a retort next below it in the other row. These connections are made alternately from opposite ends of the retorts so that fuel which passes through a retort under the action of its conveyor-screw 12 is discharged from one end of it through the diagonally arranged box or conduit into the adjacent end of the retort next below it in the other row, thence through the latter retort by means of its conveyor-screw and from the opposite end of it to the adjacent end of the retort next below it in the first-mentioned row; and so on successively throughout the entire number of retorts.

The boxes thus afford inclined shoots or passages down which the material passes from one retort to the next smoothly and without such violence as would attain were it to drop vertically from one retort to the other.

The screw-conveyors, as shown in the drawings (see Figure 3) may be alternately right- and left-handed and the shafts of all the conveyors are driven by means of outside gearing all in the same direction. Such gearing comprises, for example, a worm 40 meshing with worm-wheels 41 arranged alternately on opposite sides of the worm-axis and secured respectively to the conveyor-screws of the several retorts. The worm-

spindle will be formed with a plurality of worms alternately right- and left-handed so that all the worm-wheels are driven in the same direction. This serves to balance, to a large extent, end-thrust on the worm-spindle which would otherwise occur if the worm-wheels on opposite sides were all driven from a single worm. The screw-conveyors for one row of retorts will be opposite-handed with respect to those of the other row and the worm 40 can be driven by a main worm-drive 42, from any convenient source of power 43.

Material to be distilled is fed into the top retort and discharged from the bottom retort by similar devices each of which comprises an outer tubular casing 15 having inlet and outlet apertures 16 and 17 respectively spaced from one another round the periphery of the casing. Within the casing is a tubular drum 18 having in its periphery two apertures 19 and 20 of such size and so disposed that they will both be covered by a part of the wall of the outer casing which is situated between proximate edges of the inlet and outlet apertures therein as shown in Figures 4 and 5.

The ends of the casing 15 are closed by plates 21 bolted to flanges on the casing and a tubular boss 22 extending from the side wall of the casing is furnished with a cover 23 affording a bearing for a spindle 24. The spindle is formed with a crank 25 and crank-pin 26 which latter slidingly engages within a sleeve 27 mounted on pivots 28 in an extended portion of the skirt of the member 18. Thus, as the spindle 24 is rotated the member 18 will be given a combined motion of reciprocation and oscillation so that first its port 19 will be brought into alignment with the port 16 and the member 18 will receive a charge. Thereafter further rotation of the spindle 24 serves to move the port 19 until it is closed by the wall of the casing 15 and then to open the port 20 to the port 17 whereupon the contents of the member 18 will be discharged.

It will be appreciated that one device such as has just been described serves at the upper end of the apparatus to feed successive measured charges to the uppermost retort, and a similar device at the bottom serves to discharge the residue from the lowermost retort-chamber. The feeding device is driven by a chain and sprocket connection 29, 30, 31 from the conveyor-screw spindle of the uppermost retort and the discharge device is driven by a similar connection from the conveyor-screw spindle of the lowermost retort.

Each tubular retort is preferably supported at its opposite ends in two opposed walls 130 of an enclosing chamber such as a furnace-chamber having a brick fire-box or hearth-chamber 32. One end of each re-

tort is rigidly secured to the adjacent wall 130, as shown in detail in Figure 6, while the opposite end of each retort is supported in sliding relation, by means of a packed gland or similar joint 33, with the opposite wall 130 of the chamber aforesaid. Thus, expansion of the retort-chambers is accommodated without imposing undue stresses on the walls of the enclosing chamber.

In addition to the gearing for driving the conveyor-screws there is provided an elevating mechanism, not shown, for carrying the charge to the top of the retort in such a manner as to enable the speed of charging to be synchronized with the speed of the conveyors, thereby avoiding any overcharging and consequent blocking of the retorts.

Conveniently the retorts are bricked in and fired from below with an ordinary furnace or by producer gas.

In operation superheated steam or steam at ordinary temperature is admitted through an inlet-pipe 34 to the jacket-space of the top retort in each row and, as hereinbefore described, is passed in succession through the jackets of the retorts below by means of pipes 340. By the time the steam has passed through the bottom jackets it has attained a considerable temperature of superheat, for example 300°-400° C. At this temperature the steam is led by a pipe 35 into the interior of the bottom retort via its end box 14 and successively in an upward direction through the interiors of the retorts above. In so doing it carries with it vapours given off by the material under treatment, the steam and oil vapours making their exit from the top retort and being transferred therefrom to a condensing plant through a conduit branching at 140 from the box 14.

One advantage of using the steam-jacketed tubes in the manner above described is that the furnace-heat is directed on to the walls of the jackets and the walls of the retort-chambers are insulated from direct firing. Hence the material in the retorts is not subjected to a direct fierce heat, which often results in excessive local heating and brings about certain objectionable reactions. The heat is evenly distributed and as the steam first passes through the jackets in a counterflow relation to the ascending furnace gases and then through the interior of the retorts in a counterflow direction to the descending material undergoing distillation, economy in fuel consumption is obtained.

Obviously the retorts may be jacketed in pairs or in any desired number instead of being individually jacketed as above described.

The invention also includes a method which consists in passing steam successively through jacket-spaces surrounding the several retorts in a direction downwardly towards the furnace-grate and thereafter

passing the steam in the reverse direction through the interior of the retorts commencing at the bottom.

Obviously modifications may be made in many details of construction, for example in the form of charging and discharging devices, the drives for the various parts, the design and construction of the jacketed retorts and in the method by which the retorts and the jacket-spaces are interconnected, without departing from the spirit of the invention.

I claim:

1. Apparatus for the distillation of solid carbonaceous fuels and shale comprising in combination a plurality of steam-jacketed tubular retorts with their axes extending substantially horizontally, said retorts being arranged in vertical rows with the retorts in one row staggered in a vertical direction in relation to those in the next row, fuel-transfer means operative between opposite ends of each retort and the corresponding ends of the retorts next above and below it in an adjacent row, means to propel the fuel along each retort from that end which communicates with a retort at a higher level to that end which communicates with a retort at a lower level, means to pass steam in succession through the retort steam jackets in a direction from the upper to the lower retorts, and means to pass steam from the steam jacket of a lower retort through the interior of that retort and then in succession through the interior of the retorts above it.

2. Apparatus for the distillation of solid carbonaceous fuels and shale comprising in combination a plurality of externally-fired tubular retorts with their axes extending substantially horizontally, said retorts being arranged in vertical rows with the retorts in one row staggered in a vertical direction in relation to those in the next row, a chamber enclosing the retorts aforesaid and having two opposed walls engaging and supporting opposite ends respectively of the re-

torts, the engagement at one end being rigid and that at the other being arranged to permit sliding movement of the retort-ends relatively to the supporting wall, fuel-transfer means operative between opposite ends of each retort and the corresponding ends of the retorts next above and below it in an adjacent row, and means to propel the fuel along each retort from that end which communicates with a retort at a higher level to that end which communicates with a retort at a lower level.

3. Apparatus for the distillation of solid carbonaceous fuels and shale comprising in combination a plurality of tubular retorts with their axes extending substantially horizontally, said retorts being arranged in vertical rows with the retorts in one row staggered in a vertical direction in relation to those in the next row, fuel transfer means operative between opposite ends of each retort and the corresponding ends of the retorts next above and below it in an adjacent row, means to propel the fuel along each retort from that end which communicates with a retort at a higher level to that end which communicates with a retort at a lower level and fuel feeding and extracting devices each consisting of a tubular casing having in its peripheral wall an inlet and an outlet spaced apart in a circumferential direction, a tubular drum engaging in a sliding fit within the casing aforesaid and having two apertures in its peripheral wall spaced apart in a circumferential direction but located completely within the limits of an arcuate section of the same dimensions as that enclosed between the proximate edges of the inlet and outlet apertures in the casing, and means to oscillate the drum between a position in which one of the drum apertures is in register with the inlet aperture in the casing and a position in which the other drum aperture is in register with the outlet aperture in the casing.

In testimony whereof I affix my signature.

FREDERICK LAMPLUGH.