Nov. 11, 1924. 1,515,103

C. H. GAGE

DIGESTER

Filed Jan. 26, 1922 4 Sheets-Sheet 1

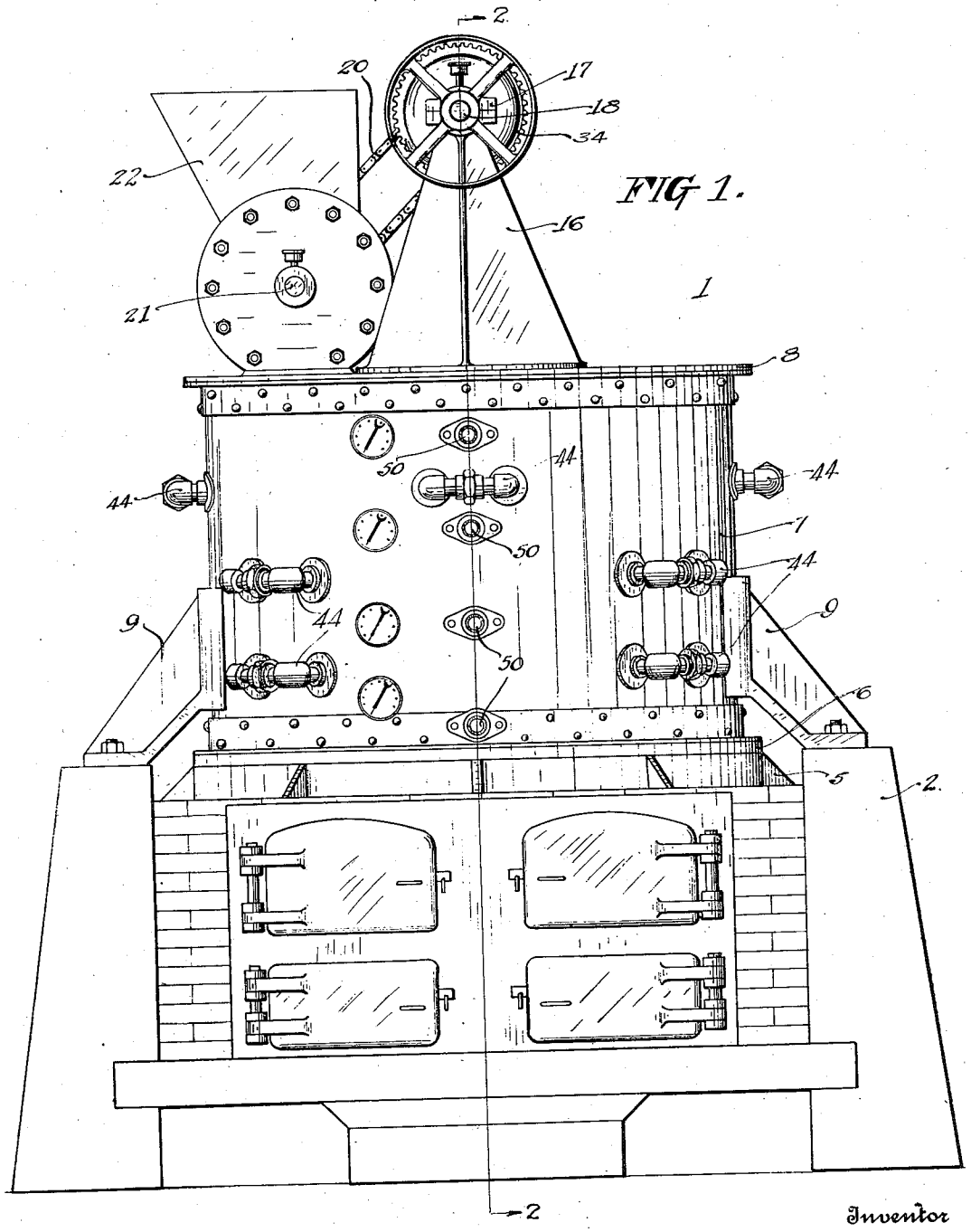


FIG 1.

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Nov. 11, 1924.

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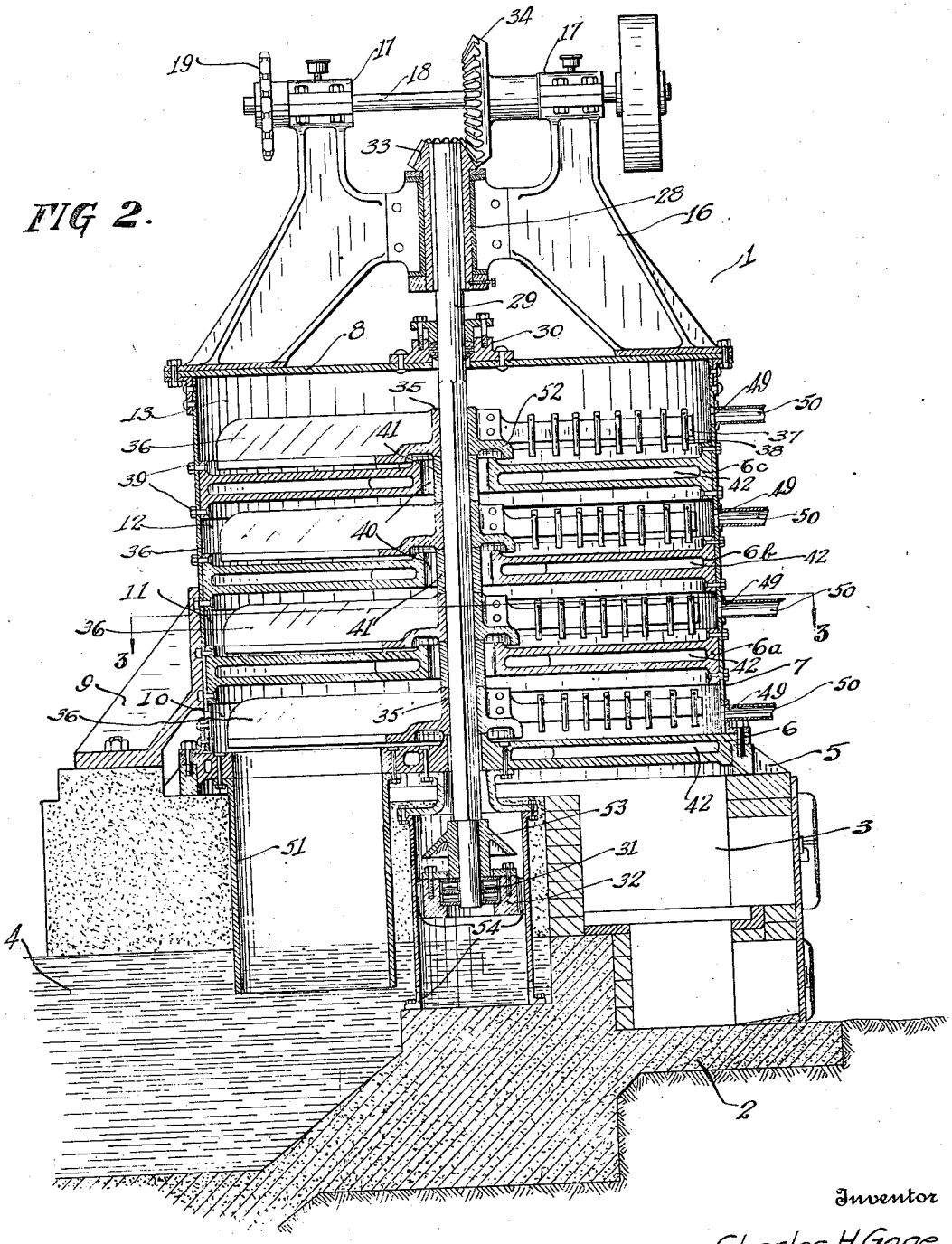
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FIG 2.



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FIG 3

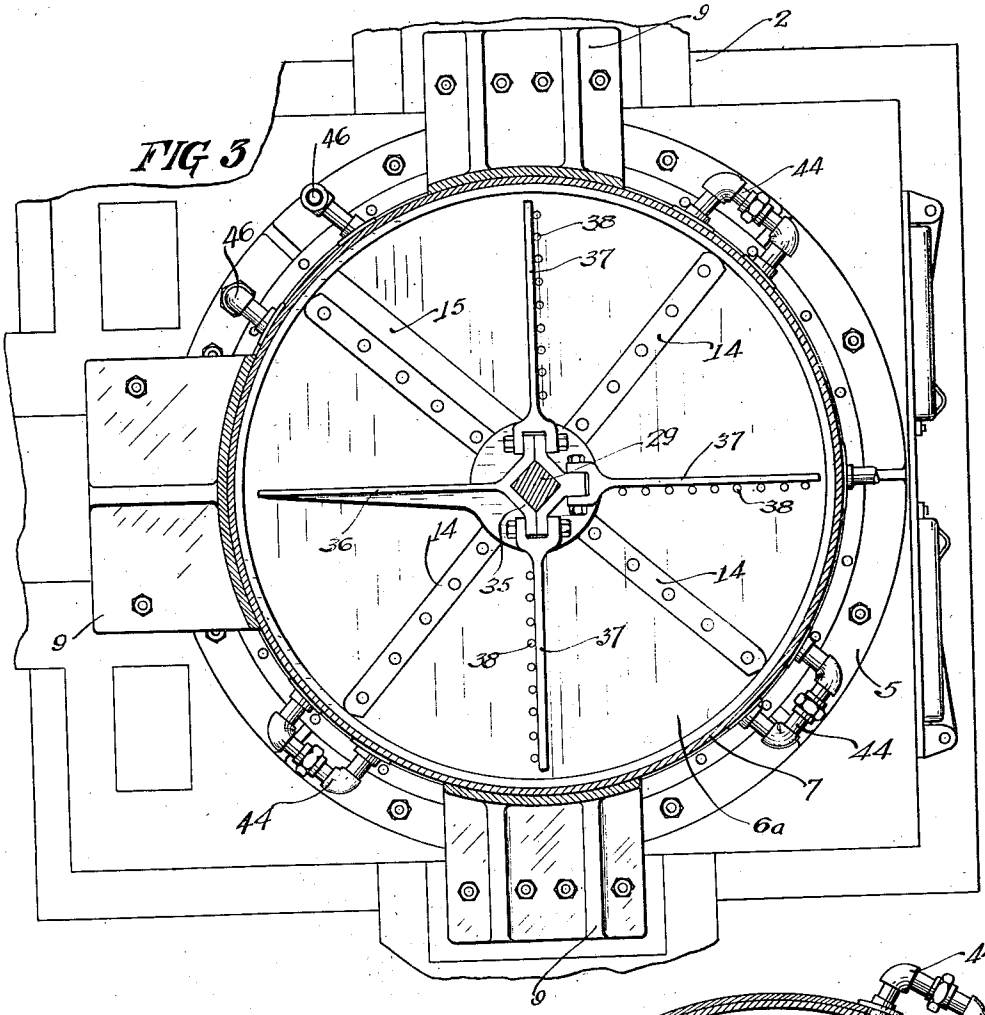


FIG 5

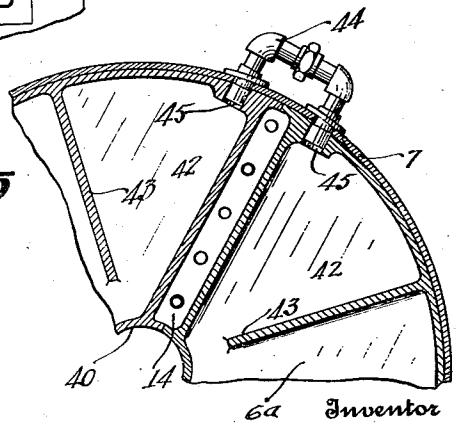
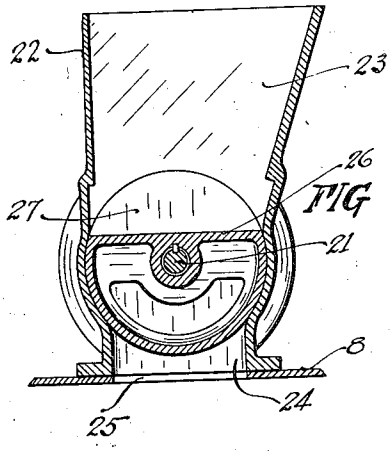


FIG 4



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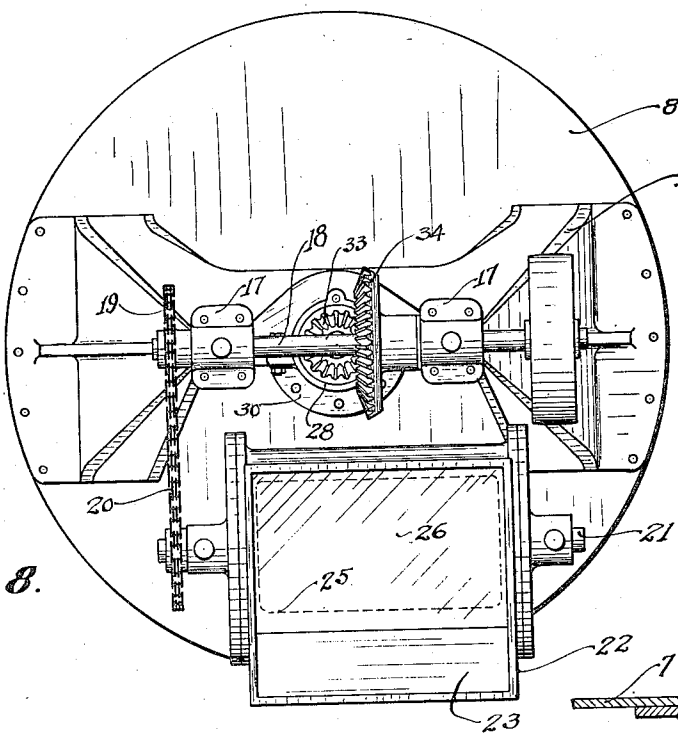


FIG. 8.

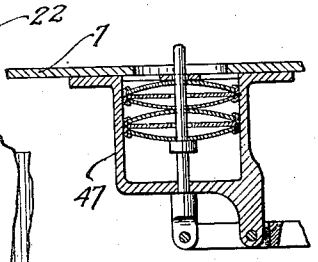


FIG. 7.

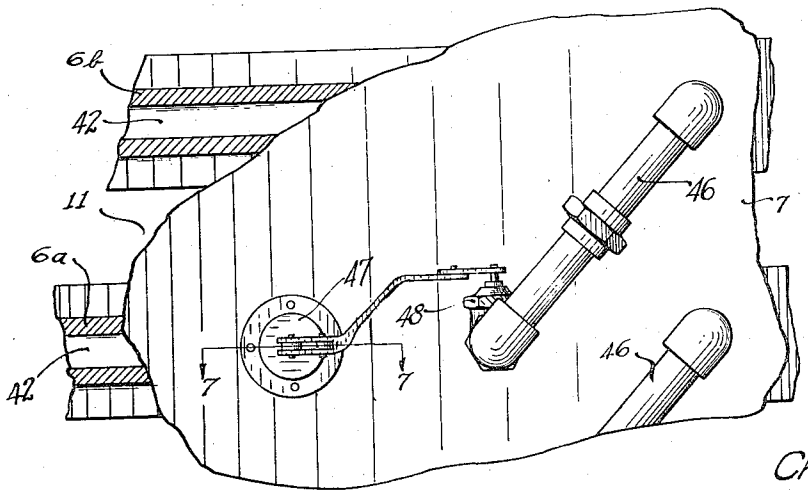


FIG. 6.

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Patented Nov. 11, 1924. 1,515,103

UNITED STATES PATENT OFFICE.

CHARLES H. GAGE, OF COLUMBUS, OHIO.

DIGESTER.

Application filed January 26, 1922. Serial No. 532,005.

To all whom it may concern:

Be it known that CHARLES H. GAGE, a citizen of the United States, residing at Columbus, in the county of Franklin and State of Ohio, has invented certain new and useful Improvements in Digesters, of which the following is a specification.

This invention relates to an improved digester or a low carbonization still by means of which essential oils or gums can be extracted from organic matter in an economical, efficient and practicable manner without resort to high pressure or destructive distillation.

Another object of the invention resides in the provision of apparatus of the character specified which includes a casing divided into a plurality of superposed compartments by means of apertured steam heated and jacketed plates having openings formed therein admitting of the passage of material under treatment to be successively dropped from an upper compartment to the next adjacent lower compartment, the said compartments possessing different temperatures, subjecting the materials to gradually increasing temperatures as the same pass from one compartment of the apparatus to the next compartments, whereby the condensable gases in said materials will be effectively liberated and transferred to cooperative apparatus for condensing and separating purposes.

A further object of the invention rests in providing the apparatus with a timed and automatic feeding mechanism by means of which material to be treated, will be intermittently deposited into the uppermost compartment of the apparatus in such quantities as the capacity of the apparatus will admit of successful handling.

A still further object resides in providing each compartment with a rotatable means for properly distributing the materials over the full area of the steam heated plates in thin, layer formation, in order that said material will be uniformly subjected to the heat of the still; in providing rotatable means cooperative with said first named means, for scraping the material off of said plates and discharging the same from an upper to a lower compartment after the material has been subjected to the heat of a certain compartment for a predetermined period, in means including a water sealed compartment permitting of the discharge of the spent or vitiated material from the apparatus without lowering the internal temperature of the latter, and in other specific improvements hereinafter more fully described.

In the accompanying drawings, forming a part of this specification, and in which similar characters of reference denote like and corresponding parts throughout the several views thereof:

Figure 1 is a front elevation of the improved digester or still comprising the present invention,

Figure 2 is a vertical sectional view taken through the apparatus on the line 2—2 of Figure 1,

Figure 3 is a horizontal sectional view on the line 3—3 of Figure 2,

Figure 4 is a vertical sectional view taken through the magazine structure,

Figure 5 is a horizontal sectional view taken through one of the steam heated plates,

Figure 6 is a detail view of a modified form of the invention in which a thermostatic control is disclosed for controlling steam flow from one of the plates of the apparatus to the others,

Figure 7 is a horizontal sectional view taken on line 7—7 through the thermostat, and

Figure 8 is a top plan view of the operating mechanism.

Referring more particularly to the structural details of the form of the invention illustrated in the accompanying drawings, the numeral 1 designates my improved digester in its entirety. This digester may be successfully used for extracting hydrocarbon oils from shale, suitably ground, or cannel coal or various other materials. The digester includes preferably a concrete foundation 2, formed to include a fire box 3 in the front thereof, and a liquid containing discharge chamber 4 in the rear thereof into which the spent material discharged from the digester is deposited and carried away.

Arranged upon the upper surface of the foundation 2 is a base plate 5 upon which is mounted and rigidly secured the bottom plate 6 of the digester. Arising from the plate 6 is a metallic casing 7, in this instance of drum shaped formation, suitably braced and reinforced to be of substantial construction and having its upper end closed by means of a top plate 8. An arcuate

casting 9 is mounted upon the foundation 2 and is suitably secured to the outer side of the casing 7 to strengthen and brace the casing and rigidly maintain the same on the foundation.

The bottom plate 6 constitutes the lowermost of a series of horizontally arranged, vertically spaced, superposed heating plates 6, 6^a, 6^b, and 6^c, which define therebetween communicating compartments 10, 11, 12 and 13. The plates 6 to 6^c inclusive are of similar formation and for convenience in manufacture each consist of a plurality of segmental metallic sections, shown more particularly in Figure 3, which have their radial adjoining edges securely folded, riveted or otherwise fastened together as indicated at 14 in such manner that each plate will present a smooth unobstructed upper surface, constituting a table upon which the materials handled by the apparatus are adapted to be deposited and subjected to the action of heat. It will be observed, by reference to Figure 3, that each plate includes a substantially radially extending slot 15, disposed in offset relationship with respect to the similar slots provided in the remaining plates. By means of the slots 15 provision is made whereby communication between said compartments is effected in order that the material under treatment will be successively passed from one compartment to another during the passage of the material through the apparatus.

Mounted upon the top plate 8 is a bearing casting 16, including horizontally arranged and aligned bearings 17, in which a power shaft 18 is rotatably positioned and adapted to be suitably driven. In this instance the shaft 18 carries a sprocket 19, having an endless chain 20 passed thereover, which is also trained over a similar sprocket provided upon the shaft 21 of an automatically operating hopper or magazine 22. This magazine includes a hopper 23 having a material passageway 24 provided vertically therethrough, the said hopper being positioned immediately over an entrance opening 25 provided in the top plate 8. Located in the passageway 24 of the hopper is a shaft 21, which carries a valve 26, having an arcuate slot 27 formed therein. It will be manifest, by reference to Figure 4, that the rotation of the valve 26 will result at predetermined intervals in aligning the slot 27 with the passageway 24, permitting of direct passage of the material to be treated into the top compartment 13 of the digester. The introduction of this material may, of course, be regulated by controlling the speed of rotation of the shaft 18.

The bearing casting 16 is also provided with an elongated vertical bearing 28, which receives the upper end of a shaft 29 extending vertically and diametrically through the casing 7, the said shaft being extended through a packing gland 30 formed in connection with the top plate 8. The lower end of the shaft 29 rests upon an anti-friction bearing 31 located in a bearing housing 32 situated below the bottom plate 6 and mounted upon the foundation 2 in communication with the discharge chamber 4. The upper end of the shaft 29 carries a pinion 33, which meshes with an enlarged gear 34 fixed upon the shaft 18 and by means of which rotary motion is imparted to the shaft 29. For the greater part of its length the shaft 29 is of square cross-sectional formation, and receives the split hubs 35 of scraping blades 36, one of which being provided in each of the compartments 10 to 13, and so disposed as to extend radially of such compartments and operate over the table surfaces thereof for the purpose of scraping such material from said table surfaces and discharge the same through the slots 15. Also carried by the hubs 35 and located within each compartment is a plurality of radially extending spaced arms 37 carrying teeth 38 constituting rakes. These teeth are so disposed as to first engage with the material after the latter has been deposited upon the upper surface of each table, and by the rotation of the shaft 29, the said teeth will serve to evenly distribute the material over the full area of said tables in thin layer formation, in order that the materials will be subjected uniformly to the heat radiated from each of said tables and also to the temperature of each of the compartments. Following the action of the raking arms 37, the material is engaged by the scraping blades 36 and forced into registration with the discharge slots 15, causing the material to be discharged successively from an upper to the next adjoining lower compartment.

The outer peripheral edges of the plates or tables 6 to 6^c are suitably flanged and bolted or riveted as at 39 to the inside walls of the casing 7, the said sections being axially terminated to provide in each table a diametrically located opening 40, in each of which is positioned a spacing sleeve 41, surrounding the shaft 29 and serving to maintain in spaced relationship the hubs 35 of the blades 36 and the arms 37. As shown in Figure 5, each of the segments of the tables 6 to 6^c is jacketed as at 42 to admit of the circulation of a heating medium through the tables, preferably steam, and each of these jackets includes a radial web 43, by means of which steam circulation through the jackets will be rendered circuitous. Steam flow between the segments of each table is effected by the provision of piping 44 situated exteriorly of the casing 7 and communicating with inlet and outlet ports 45 for the jackets 42 provided in the

walls of the table segments and the casing 7. Other pipes 46 are utilized to admit of the passage of the stream from a lower table to an upper table, while the piping 44 is utilized to merely control the passage of steam between the segments of each table. The steam supply may be obtained from any suitable source and lead to the apparatus, the fire box 3 in this instance being employed simply as an ancillary aid to the steam in the heating of the apparatus.

As shown in Figure 6, the pipes 46 may be provided with thermostats 47, controlling the operation of regulating valves 48 provided in the pipes 46 and governing the passage of steam therethrough. These thermostats may be set so that the same will respond to predetermined temperatures to open or close the valves 48 governed thereby, thus regulating the inflow of steam into each of the tables and enabling various temperatures to be maintained in each of the compartments. Ordinarily, this thermostatic control is not absolutely necessary in carrying out the ends of the invention.

In operation, ground shale, cannel coal or other materials, after being suitably ground, are introduced into the top of the digester by way of the magazine construction 22 in regulated and predetermined quantities. This ground material is first discharged into the upper compartment 13 at a position upon the upper surface of the table 6^c made in registration with the entrance opening 25 formed in the top 8. This material is then subjected initially to the action of the raking arms 37 which are of such form that the teeth thereof will engage with said material and uniformly distribute the same over the upper surface of the table 6^c. The material is then subjected to the action of the heat of said table effected by the circulation of steam, or any other suitable heating medium therethrough. When thus initially subjected to the heat of the apparatus the lighter or more volatile oils of the material will be released and will pass off in the form of a condensable gas through discharge openings 49 and conduits 50 provided in connection with the casing 7. Following this action the material is subjected to the action of the blades 36 which scrape the material from the upper surface of the table 6^c and discharge the same through the slot 15 formed therein, in order that said material will be deposited into the next underlying compartment 6^b. The material is then subjected to the increased temperatures prevailing in the compartment 12 so as to further effect the liberation of vapors or gases therefrom which are of a heavier character than those liberated in the compartment 13. By these successive stages the material passes through the compartments 13, 12, 11 and 10, and is gradually subjected in each of said compartments, in the order named to increasing temperatures for the purpose of positively and effectively liberating to a maximum extent the gaseous or vaporous content thereof, which latter will be in the form of a condensable gas, with the possible exception of certain materials yielding fixed helium gas, and discharged by way of the conduits 50 to condensing apparatus, not shown, by means of which the gases or vapors are condensed and separated into their respective classes, for example, gasoline, benzine, lubricating oils, or other essential oils or gums, obtained from the distillation of cannel and bituminous coal, cannel shale, turpentine wood, balsam, sassafras, camphor or any other organic matter containing essential oils or gums. The bottom plate or table 6 is provided with a discharge spout 51, which has its lower end terminated in the discharge chamber 4, at a position materially beneath the water level in the latter. By the provision of the spout 51, the spent or vitiated material is discharged into water so that an effective liquid seal is provided to prevent undue escape of the heat within the casing 7. It will be observed that the hubs 35 include skirt flanges 52, which overlie the axial openings formed in the tables 6 to 6^c. The arrangement being such that the ground, crushed or pulverized material handled by the machine will be prevented by this construction from entering the bearings for the shaft 29. It will also be observed that the extreme lower end of the shaft 29 is provided, above the roller bearing 31 with a flanged sleeve 53, which protects the said bearing 31 from foreign matter, and enables such material to be discharged into the liquid contained in the discharge chamber 4, said liquid being permitted to enter the housing 32 by way of openings 54 formed in the bottom thereof.

In view of the foregoing description, taken in conjunction with the accompanying drawings it will be seen that the present invention provides a simple, practical and efficient apparatus for carrying out refining processes in which oils or gums are extracted from natural organic matter. The operation of the apparatus is substantially automatic and requires but a minimum of manual attention or supervision. It will of course be understood that the invention is not limited to the specific disclosure above set forth, but that such changes may be made therein as may be said to fairly fall within the scope of the following claims.

What is claimed is:

1. In a digester, a casing, a horizontally disposed table structure disposed within said casing, said structure consisting of a plurality of segmental interfitting sections, jackets formed in each of said sections admitting of the circulation of a heating me-

dium therethrough, means establishing communication between said jackets admitting of a circuitous passage of steam through said jackets and means for distributing the material to be treated over the upper surface of said table structure.

2. In a digester, a casing, a steam heated table structure, means for depositing material to be heated upon said table structure, said table structure including a discharge opening and central opening, a shaft journaled for rotation within the central opening of the table structure, a hub mounted upon said shaft and having skirted flanges for overlying the central opening, revoluble rack arms carried by said hub and serving to distribute said material over said table, and a scraper blade movable in unison with said hub and operated to discharge material from said table through said discharge opening.

In testimony whereof I affix my signature.

CHARLES H. GAGE.