

No. 664,720.

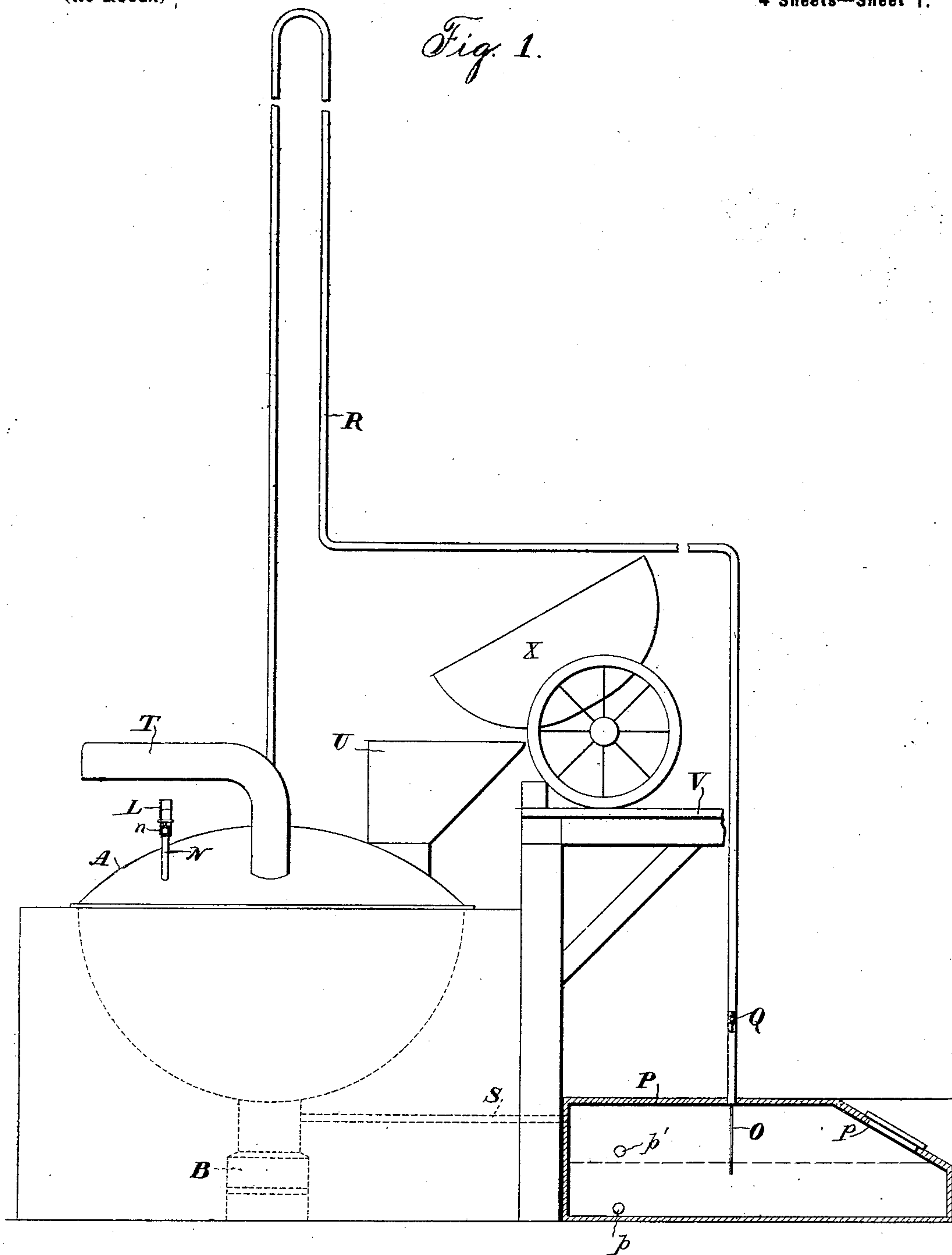
Patented Dec. 25, 1900.

S. H. BROWN.
RENDERING APPARATUS.

(Application filed Mar. 28, 1896.)

(No Model.)

4 Sheets—Sheet 1.



Witnesses
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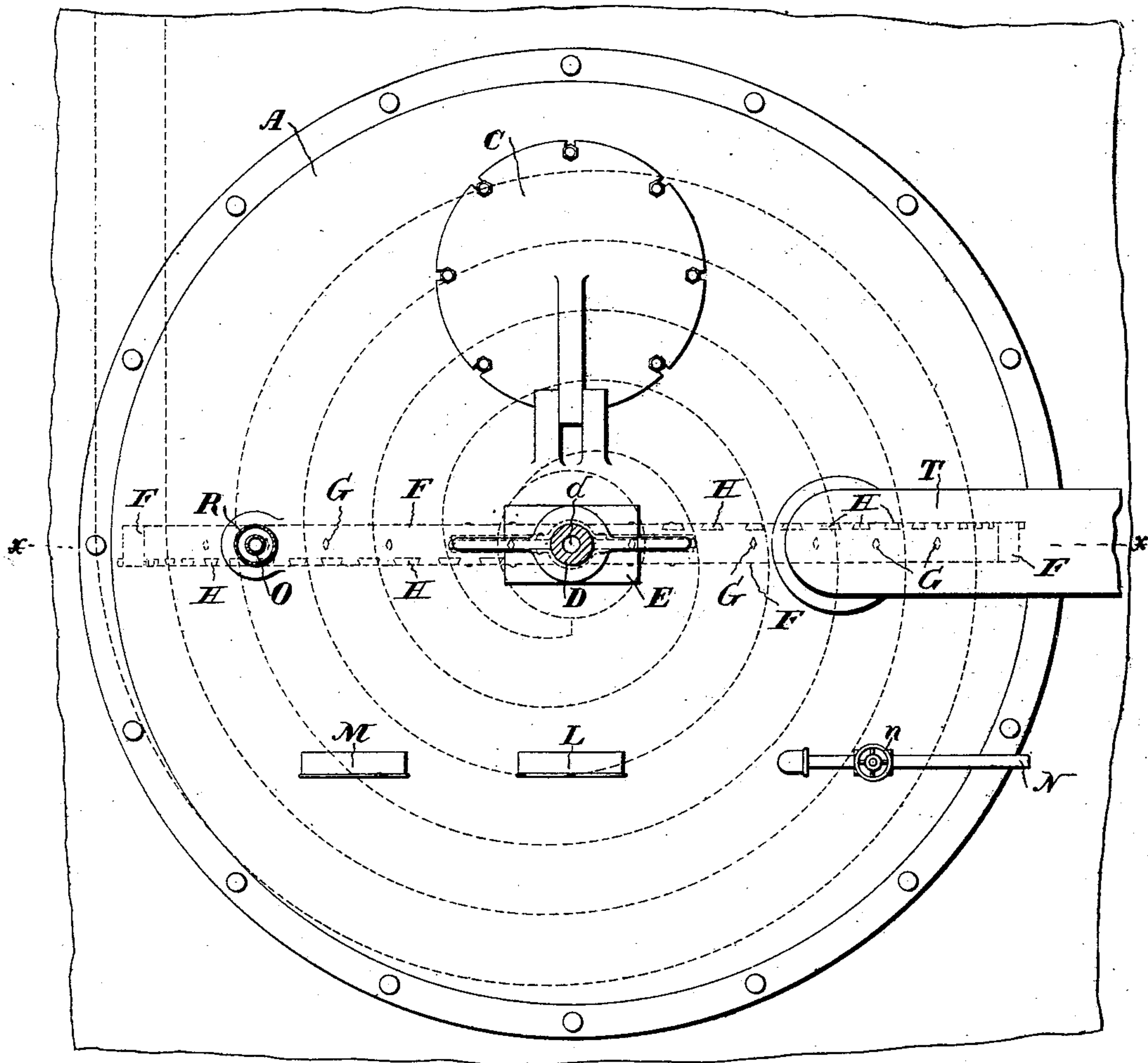
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Fig. 2.



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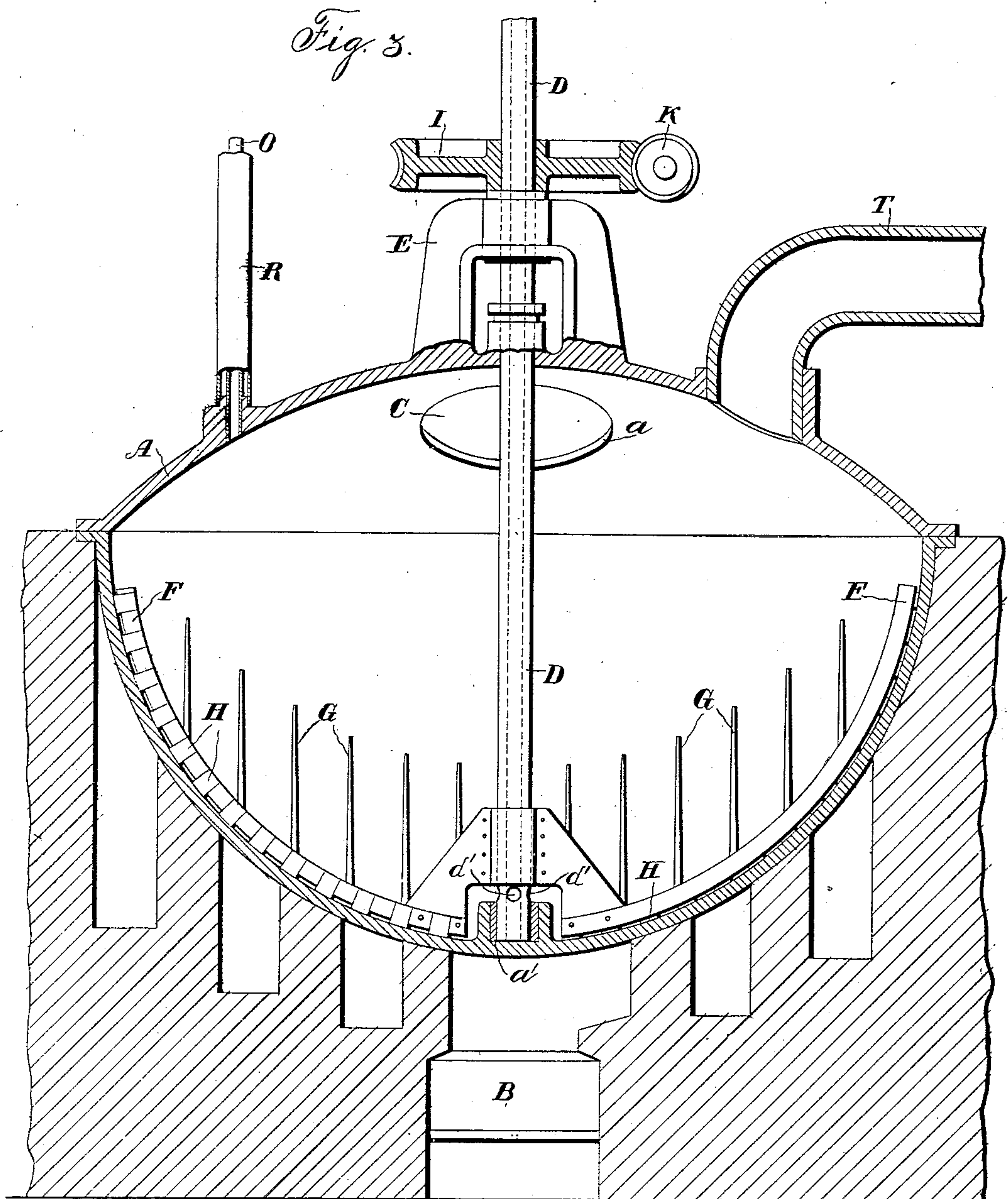
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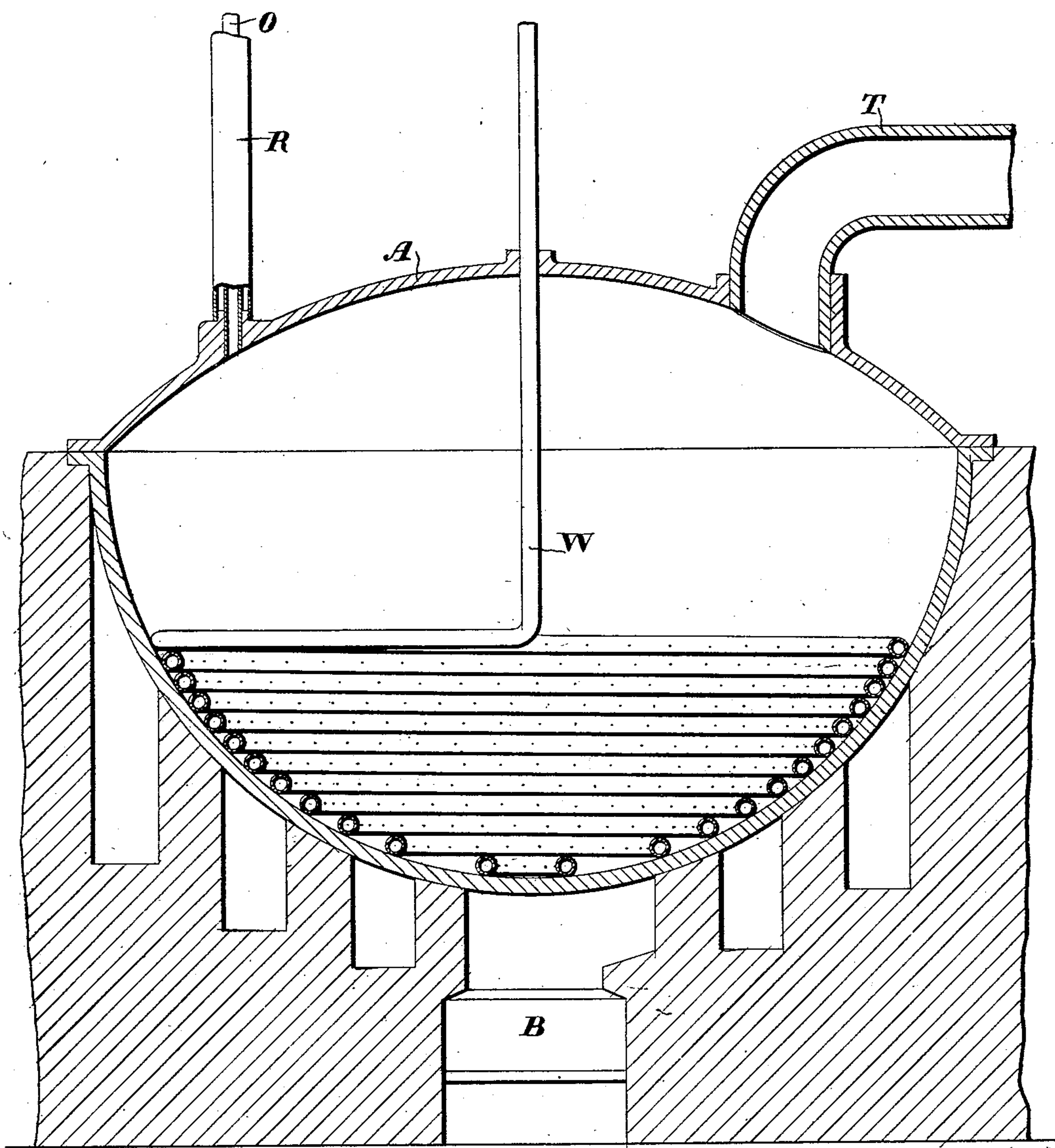
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Fig. 4.



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UNITED STATES PATENT OFFICE.

SAMUEL H. BROWN, OF WASHINGTON, DISTRICT OF COLUMBIA, ASSIGNOR,
BY DIRECT AND MESNE ASSIGNMENTS, TO THE AMERICAN DIGESTER
MANUFACTURING COMPANY, OF NEW JERSEY.

RENDERING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 664,720, dated December 25, 1900.

Application filed March 28, 1898. Serial No. 675,429. (No model.)

To all whom it may concern:

Be it known that I, SAMUEL H. BROWN, of Washington city, in the District of Columbia, have invented certain new and useful improvements in apparatus for the separation and purification and final recovery of oils and fats of animal and vegetable matter, &c.; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, in which—

Figure 1 is a view in elevation of one form of my apparatus with the condensing-receptacle for the oils and fats shown in section; Fig. 2, a top plan view of the digester and the furnace; Fig. 3, a vertical section through the same on the line *xx*, Fig. 2; and Fig. 4 is a like view showing a different form of digester.

Letters of like name and kind refer to like parts in each of the figures.

The object of my invention is to effect the thorough separation of the oils and fats in vegetable and animal waste and other matter in an economical manner, both in respect to the first cost of the apparatus required and the cost of operating the same; and to this end said invention consists in the apparatus employed, substantially as hereinafter specified.

In the making of my invention I have had in view the defects which have characterized and have rendered commercially impracticable the apparatus for and modes of treatment of animal and vegetable waste whose use has heretofore been attempted and have avoided such defects. These have principally been inefficient heating means, so that but a small percentage—less than twenty per cent.—of the energy of the fuel used was availed of and the requirement of extended handling of the products to put the same in a marketable condition. By means of my invention from forty to sixty per cent. of the energy of the fuel is utilized and the separation of the heavy as well as the light oils and the desiccation of the remaining substance without extra handling by the costly methods of squeezing and drying are effected.

In the carrying of my invention into prac-

tice I employ a digester A, preferably of cast-iron and made in two sections united on a horizontal plane, the lower section being hemispherical in form and the upper section a concavo-convex form, but much less than a hemisphere. The two sections have annular flanges at their abutting edges, by which they are bolted together, the joint being packed with asbestos gaskets.

Beneath the digester is a furnace B, the heat of which is applied directly to the under side of the digester and which is preferably of the construction shown, which comprises a central chamber and a flue or passage leading off therefrom in the form of a spiral, this construction being employed because of the thorough utilization of the heat that it affords and the uniform application of heat to the entire digester. Any kind of fuel desired may be used in the furnace; but oil is preferably used.

In the upper section of the digester at one side of the center is a manhole *a*, having a hinged cover C, that is adapted to be securely fastened over the hole. The material to be treated is introduced into the digester through the manhole.

At the center of the digester A is a vertical shaft D, the lower end of which is supported by and journaled in a suitable bearing *a'* on the bottom of the digester and whose upper end passes through an opening in the upper section to a point above the latter. On the top of the upper section is an open frame E, having a bearing for journaling the shaft, and a suitable stuffing-box is provided where the shaft passes through the upper section. Attached to the lower end of the shaft D are two diametrically opposite radial arms F and F, preferably of forged steel, that lie close to but do not touch the inner surface of the lower section, being curved on an arc concentric with such surface. Projecting from the upper side of each of said arms is a series of parallel equidistant knives G and G, that serve when the arms are in motion to macerate or cut up and stir the material within the digester. The knives G and G do not all reach to the same height, but their tops from

the outermost ones inward are in successively lower and lower planes. By this arrangement when after the first stage in the operation the material begins to solidify into a mass and arch in the upper part of the digester only the highest knives have to act on it instead of all of the knives at once, and as such highest knives are the outermost ones the mass cut through and loosened by them falls until it is supported by the more contracted lower portion of the digester-bottom, where another set of knives can act, and so on until the mass has completely descended. The advantages from this action are that less power is required to operate the knives than would be the case did all have to act at once on the hardened mass, the possibility of stoppage or breakage which would exist did all of the knives have to act at once is avoided, and a more beneficial action on the material treated is secured by the gradual precipitation of a less-heated portion thereof to the higher-heated portion at the bottom of the digester, for the latter in the intervals of the dislodgment and descent of small masses has time to be heated to the desired extent, whereas there would be detriment from contact with a large mass of material of lower temperature, and the mingling of the two portions prevents injurious overheating of the portion next to the bottom of the digester. Upon one side of each of said arms F and F' is a series of wide radially-arranged knives or scrapers H and H', that extend to and touch the inner surface of the digester and operate to cut or scrape from such surface any matter tending to adhere thereto. The knives G and G' are secured to the arms by having their lower ends fastened in openings therein, and knives H and H' are secured to the arms by being provided with dovetailed shanks that fit and are secured within dovetailed slots in the sides of the arms, and the arrangement of the knives H and H' in the respective bars is such that the knives of one bar travel over the surface of the digester that lies between the paths of adjoining knives of the other bar, so as to avoid the travel of two knives over the same surface and provide spaces through which the material may pass. The knives G and H are made of Mushet or other steel that will stand a high degree of heat without loss of temper.

As one of various means that may be used to revolve the shaft D to move the knife-carrying arms I show a worm-wheel I upon the upper end of the shaft and a worm K, meshing therewith, which receives power from any suitable source.

To enable the accurate regulation of the temperature in the digester, a pyrometer L is applied thereto, and for showing the pressure within the digester a pressure-gage M is provided, the connections between these and the digester being through the top of the latter. For a purpose to appear hereinafter a pipe N, connected with a source of supply of steam and provided with a pressure-reducing

valve *n*, communicates through the top of the digester with the interior thereof. Passing through an opening in the top of the digester is a pipe O, that extends upward to a point above which atmospheric pressure will not raise water and then is carried downward to a receiving-tank P, located at some convenient point, which is partially filled with water, into which the end of said pipe projects. A circulation of water through the tank is kept up by introducing the water at the bottom of the tank, as by a pipe *p*, and drawing it off at the desired level, as by a pipe *p'*. Through the pipe O the gaseous or volatilized contents of the digester are drawn off and delivered to said tank P. Just above the latter the pipe is provided with a check-valve Q. Surrounding the pipe O is a jacket R of such diameter as to provide an annular space for steam to keep the pipe O at a temperature which will prevent the condensation and solidification within the pipe of grease passing therethrough in a volatilized form. From the space in the tank P above the water therein a pipe S runs to the furnace to convey to the latter such combustible gases as may pass to the tank. A manhole *p* is provided in an inclined top wall of the tank to permit the removal of grease therefrom.

For the removal of the solid matter which may remain in the digester at the close of an operation a pipe T, connected with some air-exhausting device, communicates with the interior of the digester, at the top thereof, and to permit the exhaust of the digester contents provision is made to prevent the formation of a partial vacuum by forming the shaft D with a longitudinal perforation *d* and at its lower end with lateral perforations *d'* and *d''* and supplying steam or air there-through into the digester.

In the working of the invention a gang or series of digesters will be placed side by side and a hopper U, movable from one to another, will be employed to receive the contents from collecting-carts run upon a platform or staging V and deliver such contents into the digesters. A collecting-cart X is shown in Fig. 1.

In operating with the apparatus constructed as thus described I proceed as follows: The manhole of the digester being opened, the matter to be treated is passed there-through into the digester, the shaft D being revolved to cause its arms and the knives carried thereby to level down the matter. The digester having been thus charged, its contents are subjected to a temperature of 600° Fahrenheit, such a temperature being one that will effect the rapid and thorough liberation and volatilization of the heavy as well as the light oils and fats, and of course whatever moisture may be in the material under treatment. The gases and vapors produced will pass from the digester into and through the pipe O and be delivered thereby into the tank P, passing into the body of water there-

in, the vaporized oils being condensed and solidified upon the surface of the water and such gases as are not condensed being passed by the pipe S into the furnace by reason of the pressure produced in the tank. As the water is circulated through the tank a temperature is maintained which insures the condensation desired. If desired, a pressure-valve may be placed in the pipe O to prevent the passage from the digester of the gases and vapors until a predetermined pressure is produced in the digester. To assist the volatilization of the heavy oils, steam under low pressure is passed through the pipe N in the last stages of the treatment. In the final or last stages of treatment—say the last half-hour—the temperature within the digester is raised to 800° Fahrenheit. This is done to effect the partial carburization of the solid matter and the disintegration of such substance as bone, with the result that the matter remaining in the digester is brought to a powdered condition. It is to be understood that during the entire treatment the knife-carrying arms are revolved, causing by the action of the knives G and G the maceration and agitation of the material and by the action of the knives H and H the scraping of matter from the surface of the digester and its agitation, so that it may not adhere and vitrify to such surface. The stirrer-knives G and G facilitate and ease the work of the scraper-knives H and H by dislodging and precipitating the moist masses of material to the lower part of the digester, which by reason of their moistness conduce to the softening or prevent the hardening of the matter next to the digester-surface. It is evident that the scraper-knives can do their work more readily and with greater efficiency by reason of the ready yielding and breaking up of the coating when softened than when it is hard and stiff or unyielding. As the arms F and F, which carry the knives, are close to the bottom of the digester, they become highly heated, as do the stirrer-knives, because of their connection with said arms, and hence the stirrer-knives, projecting, as they do, up into the mass, serve to conduct and apply heat thereto. The extraction of the oils and moisture having been completed, so that nothing but the dried or desiccated powdered solid matter is left, such matter or tankage is drawn by suction through the pipe T and delivered to some suitably-placed receptacle.

Should the check-valve *o* in the pipe O fail to operate, it will be impossible for the contents of the tank P to be drawn back into the digester because of the height to which the pipe O is carried.

The oils and fats removed by my treatment will be found very pure, containing no foul substance, and hence have a superior market value, and the tankage when removed from the digester is in a marketable condition, calling for no further treatment.

For the treatment of large animal-carasses,

such as horses, I use a digester having the construction shown in Fig. 4, in which the shaft and knife-carrying arms are omitted and a coil of pipe W is used, that lies against the bottom of the digester and has numerous small perforations for the discharge of fine jets of steam upon the carcass to aid in its reduction. In other respects there is no change in the apparatus or mode of treatment.

Besides the treatment of garbage and like waste I propose to use my invention in the extraction of oil from cotton-seed.

The construction of my apparatus is such that its first cost will be low and the cost of maintenance will be low, as the digester is built of heavy and substantial material and has the heat applied to it in such a manner that the expansion and contraction of all parts are substantially uniform.

Compared with those modes of treatment which employ steam within the digester as the heating medium the operating expenses with my apparatus are low, as the fuel is more economically used and as the work is more quickly and thoroughly done.

Having thus described my invention, what I claim is—

1. The combination of a digester, and agitators therein whose upper ends are free and are in substantially different horizontal planes, substantially as and for the purpose described.

2. The combination of a digester, having a curved bottom, and agitators therein whose upper ends are free and are in substantially different horizontal planes, substantially as and for the purpose described.

3. The combination of a digester, with a curved bottom, and rotary arms carrying vertical agitators, whose upper ends are free and at points successively farther and farther from the center of motion of the arms are substantially higher and higher, substantially as described.

4. The combination of a digester with a curved bottom, arms carrying vertical knives whose upper ends at points successively farther and farther from the center of motion of the arms are higher and higher, substantially as described.

5. The combination of a digester, scrapers for the inner surface thereof, arms carrying said scrapers, and agitators projecting upward from said arms, said arms being close to the portion of the digester to which heat is applied, substantially as and for the purpose described.

6. The combination of a digester, scrapers for the inner surface thereof, arms carrying said scrapers, and fingers projecting upward from the arms, said arms being close to the portion of the digester to which heat is applied, substantially as and for the purpose described.

7. The combination of a digester, arms close to the portion of the digester to which heat is applied, and agitators carried by and reaching from the arms up into the material within

the digester, substantially as and for the purpose described.

8. The combination of a digester, a central, rotatable shaft therein, arms attached to said shaft, and a series of knives carried by each arm, separated by spaces, the knives of one arm being arranged to agree in position with the spaces between the knives of the other arm, substantially as and for the purpose described.

9. The combination of a digester, a central, rotatable shaft therein, radial arms attached

to said shaft, and a series of knives carried by each arm whose edges extend in the same direction as the arm, the knives of each arm being separated by spaces, substantially as and for the purpose described.

In testimony that I claim the foregoing I have hereunto set my hand this 24th day of March, A. D. 1898.

SAMUEL H. BROWN.

Witnesses:

CHARLES F. ZIEGLER,
JOSEPH F. O'NEILL.