

(Model.)

V. D. ANDERSON.

2 Sheets—Sheet 1.

DRYING APPARATUS.

No. 348,541.

Patented Sept. 7, 1886.

Fig. 1.

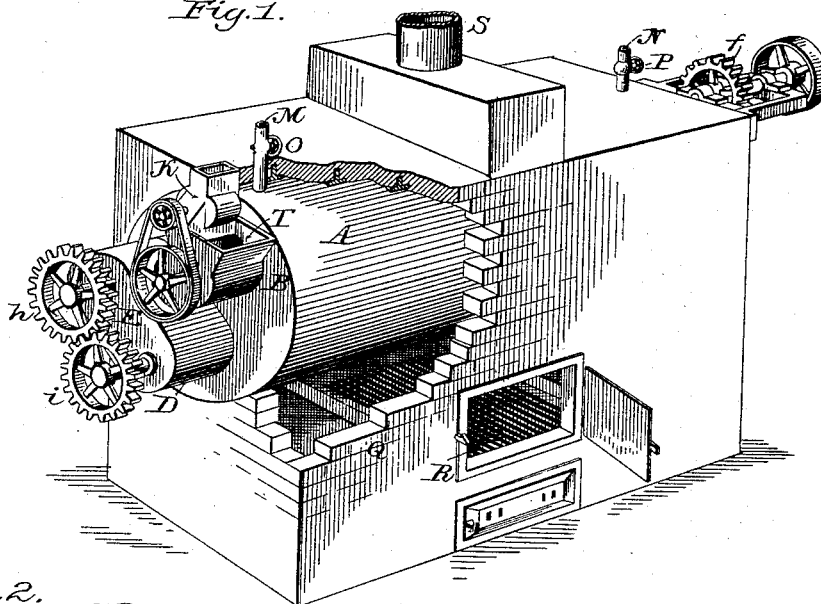


Fig. 2.

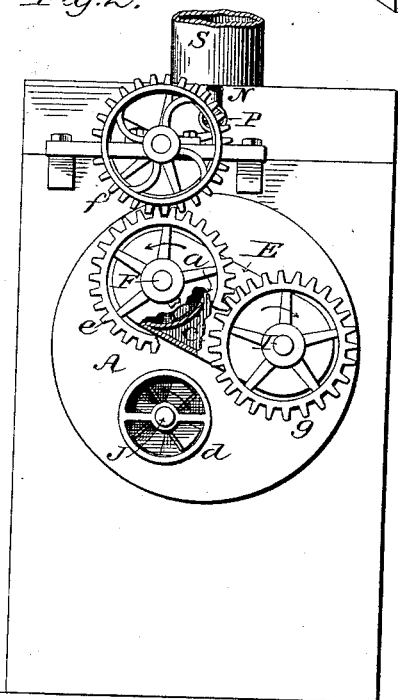
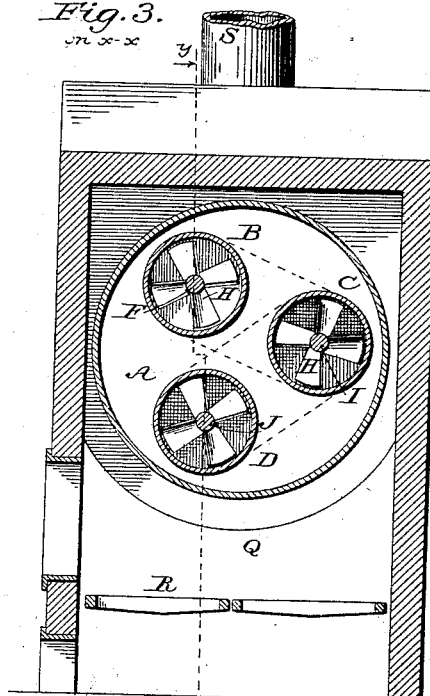


Fig. 3.



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Inventor:

Valerius D. Anderson,  
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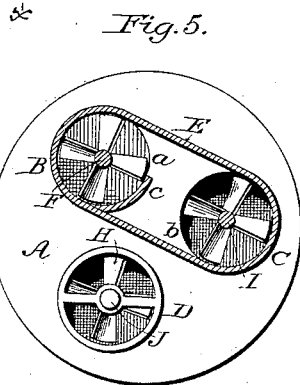
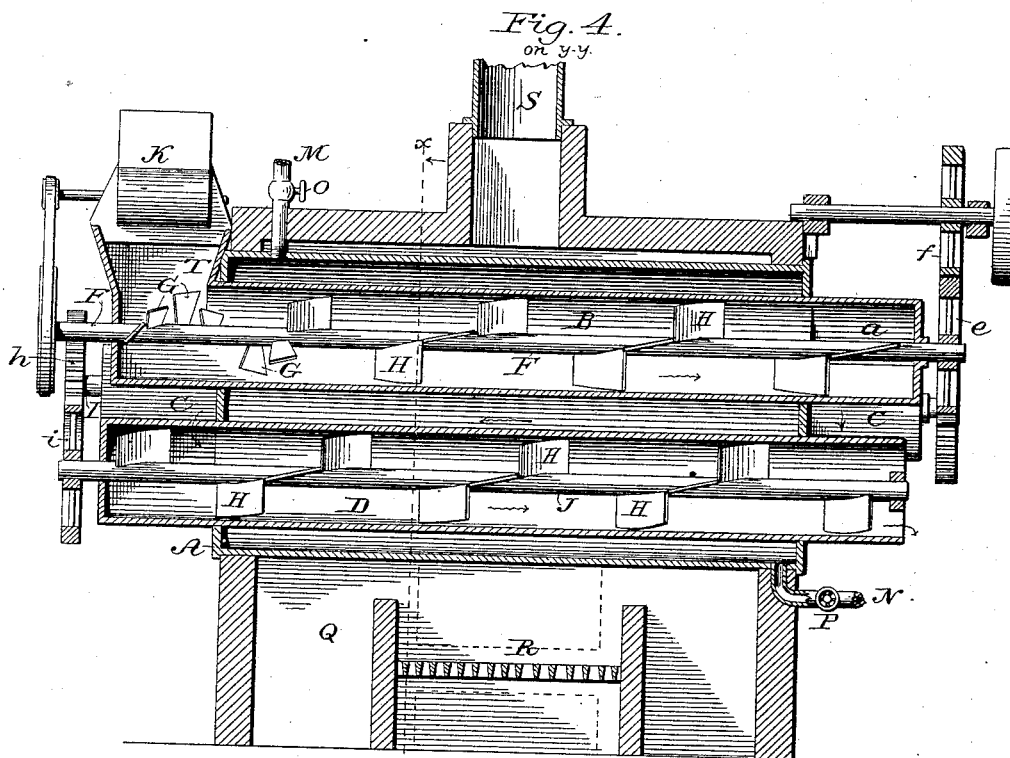
(Model.)

V. D. ANDERSON.  
DRYING APPARATUS.

2 Sheets—Sheet 2.

No. 348,541.

Patented Sept. 7, 1886.



Witnesses:

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# UNITED STATES PATENT OFFICE.

VALERIUS D. ANDERSON, OF CLEVELAND, OHIO.

## DRYING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 348,541, dated September 7, 1886.

Application filed April 21, 1885. Serial No. 162,944. (Model.)

*To all whom it may concern:*

Be it known that I, VALERIUS D. ANDERSON, of Cleveland, in the county of Cuyahoga and State of Ohio, have invented certain new and useful Improvements in Drying Apparatus, of which the following is a specification.

This invention relates to apparatus for drying offal and refuse, particularly such as comes from rendering-tanks in which the offal from slaughter-houses is cooked.

The apparatus consists of a series of connected pipes of large diameter passing through a steam boiler or drum and forming a continuous passage for the travel of the material, shafts extending axially through the pipes and provided with inclined blades to advance and stir the material, and a fan or equivalent device for producing a current of air through the pipes in a direction opposite to the travel of the material.

In the annexed drawings, Figure 1 is a perspective view of the improved drier with the casing partly broken away; Fig. 2, a rear end view, partially broken away; Fig. 3, a vertical transverse section on line *x x*, Fig. 4; Fig. 4, a longitudinal section on the line *y y*, Fig. 3; Fig. 5, a detail view.

The purpose of this invention is to produce a drying apparatus in which material of the character mentioned may be rapidly dried and pulverized in large quantities with steam-heat instead of the direct heat of a fire.

It has been determined by experience that the direct heat of fire and even of superheated steam is unsuitable for drying material of the character mentioned, and greatly impairs the value of the finished product as a fertilizer, for which purpose it is extensively used. To overcome this difficulty it has been proposed to use steam as a heating agent in such machinery; but to do this requires a much longer travel of the material than where the direct heat of a fire is used, and so long a travel that it is impracticable to make the cylinder or passage in one straight and continuous body and to extend and drive the shafting through the same from end to end. To avoid the necessity of so doing I employ the series of pipes arranged parallel and connected with each other at opposite ends, alternately, so that the same effect is secured as would be

done by the continuous straight cylinder; and in order to get the requisite fall of the material without undue height of apparatus the pipes are set alternately to one and the other side of a given vertical plane. In some driers of which I am aware such pipes have been connected end to end, but placed directly above another in a chamber requiring expensive stay-bolting, and thus the cost of manufacture has been unduly great. By passing the pipes through a cylindrical steam-boiler I avoid the necessity of such stay-bolting, secure the necessary space for proper and convenient location of the pipes with reference to the delivery of material from one to another, and produce a machine the steam drum or body of which can be procured ready for use as a regular article of trade, thus greatly facilitating the manufacture and placing of the apparatus upon the market. With all prior apparatus of this class known to me there has been a considerable amount of dust discharged into the atmosphere, causing much inconvenience and annoyance. By the use of a fan at the receiving end of the apparatus, and producing a current of air through the machine from the discharge to the receiving end, I carry the fine dust back into the upper tubes or chambers, where it encounters the moisture of the undried material and is deposited in the mass, so that little or none of the dust passes to the fan. Another and far more important result of using the fan at this point is that the steam and moisture are carried off by the air-current, and the drying is greatly facilitated, the deposit or collection of the dust in the manner described permitting the use of a strong air-current and the consequent rapid withdrawal of steam and vapors, which would otherwise be impracticable.

Referring now to the drawings, A indicates the shell of a cylindrical steam-boiler, riveted together as usual; and B C D indicate three large pipes passing longitudinally through said shell at different levels and projecting beyond the ends thereof, as shown in Fig. 4, though such projection is not essential. The pipe B is provided at its front end with a supply hopper or inlet, T, to receive the material to be treated, and is placed at a higher level than pipes C and D.

At the rear end of the apparatus the pipe

B is cut away on one side, to permit the escape of material therefrom to pipe C, which is placed below pipe B and to one side, as shown in Figs. 1, 2, and 3. From the opening *a* thus formed the material passes to a similar opening, *b*, in the side of pipe C at its rear end, the material being conducted from one opening to the other by a head or cap, E, connecting the two pipes and tightly closed to prevent escape of steam, vapors, or liquid.

In order to get pipes of adequate size within the boiler without making the latter unduly large or wasting space, the difference in elevation or level is necessarily made comparatively slight and does not give the heads or caps E sufficient inclination to cause the descent of the material if delivered thereon; hence in forming the outlet *a*, I cut away the pipe only from the top to a point above the bottom at the discharge side, leaving a raised edge, *c*, over which the material is raised and from which it falls freely to the opening *b* of the pipe below. The material as it is raised up over the edge *c* falls upon the inclined bottom of the cap E in a thin even stream and breaks up any lumps or masses that may be formed, thus facilitating the drying by exposing all the particles to the heat. The same arrangement of outlet *a*, inlet *b*, edge *c*, and head or cap E is used at the front end of the machine to connect the pipes C D, and the rear end of pipe D is formed with an outlet or discharge opening, *d*, as shown in Fig. 2.

Within the pipe B, and concentric therewith, is a shaft, F, provided at its forward end beneath the supply-hopper or inlet, and for a short distance beyond, with a series of radial blades, G, arranged in a spiral row about the shaft, and set with their edges at or nearly at right angles to the axis of the shaft for the purpose of dividing up the pulpy mass of material delivered into the machine. Beyond the blades G, and to the rear end of the pipe or cylinder, to which point the shaft F extends, the shaft is provided with radial arms carrying broader blades or paddles H, set at an inclination to the axis of the shaft to feed the material along while stirring, turning, and mixing it, the arms being arranged in a spiral line about the shaft, so that the blades produce jointly a spiral conveyer. In like manner a shaft, I, passes longitudinally and centrally through the pipe or cylinder C and a shaft, J, passes through the pipe or cylinder D, each provided with blades or paddles H. Shaft F is provided with a gear-wheel, *e*, at its rear end, which receives motion through a pinion, *f*, from any convenient source, and gives motion to a gear-wheel, *g*, on the rear end of shaft I. Shaft I is furnished at its front end with a gear-wheel, *h*, which meshes with a gear-wheel, *i*, on the front end of shaft J. In this way all three shafts are caused to rotate, the first in one direction, the second in the reverse direction, and the third in the same direction as the

first—an arrangement which is advantageous in that it causes the material to be turned first in one direction and then in another. It also avoids the presence of any gearing at the discharge end of pipe D.

K indicates a fan located at one side of the feed-hopper or inlet T, which hopper being kept filled with material permits little or no air to enter through it. This fan is arranged to draw air from the interior of pipe B, and as said pipe is connected with pipes C and D, and has no other inlet, air will be drawn in at the discharge-outlet *d* and pass through pipe D, thence through pipe C, and finally through pipe B, leaving all dusty matters behind and emerging from the fan-case laden with moisture and vapors.

The boiler A is adapted to contain water for the generation of steam, and is also furnished with inlet and outlet pipes M and N, provided with suitable valves, O and P, to regulate the inlet and outlet of steam in case it be desired to produce the steam in a separate generator and to introduce it into the boiler or shell A in that form.

In order to adapt the apparatus for use in either way at will, I set the boiler A in a suitable chamber, Q, containing a fire-pot, ash-pit, a grate, R, and a chimney or smoke-stack, S, as for an ordinary steam-boiler. If used in this way the usual pressure-gage, water-gage, gage-cocks, safety-valve, and other appliances will of course be provided, and in fact they will ordinarily be supplied in every case to permit the apparatus to be used in either way at will.

The pipes B C D and the boiler A being all cylindrical require no stay-bolts, and are cheap in construction, durable, and easily kept tight, whereas any structure for this purpose requiring stay-bolts will soon leak around such bolts, permitting steam to enter the space containing the material under treatment and to prevent the proper drying thereof, such leakage also causing waste of steam and escape of vapors and odors into the atmosphere. The pipes must of course be smooth or without projections on the inside.

I am aware that it has been proposed to construct a drier with a series of troughs communicating with a feed and discharge opening, each trough being in open communication with the interior of the cylinder and provided with a spiral conveyer, and this I do not claim, as my plan differs from this in that the pipes or troughs project beyond both ends of the boiler and are closed. By extending the pipes out beyond the boiler at each end I am enabled to place the gearing where it is easy of access and where it may be oiled and repaired as occasion requires.

Having thus described my invention, what I claim is—

1. In combination with cylindrical shell A, pipes B C D, connected at their ends by caps E, the pipes B and C, being severally provided

with opening *a* and raised edge *c* at the lower side of the opening, substantially as and for the purpose explained.

2. In combination with boiler or shell A, 5 having steam inlet and outlet openings M N, pipes B C D, heads E, and conveyer-shafts F I J, chamber Q, containing fire-grate R and provided with stack or chimney S, whereby

the apparatus is adapted to be operated with steam from an outside source, or to generate its own steam, substantially as set forth.

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Witnesses:

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