

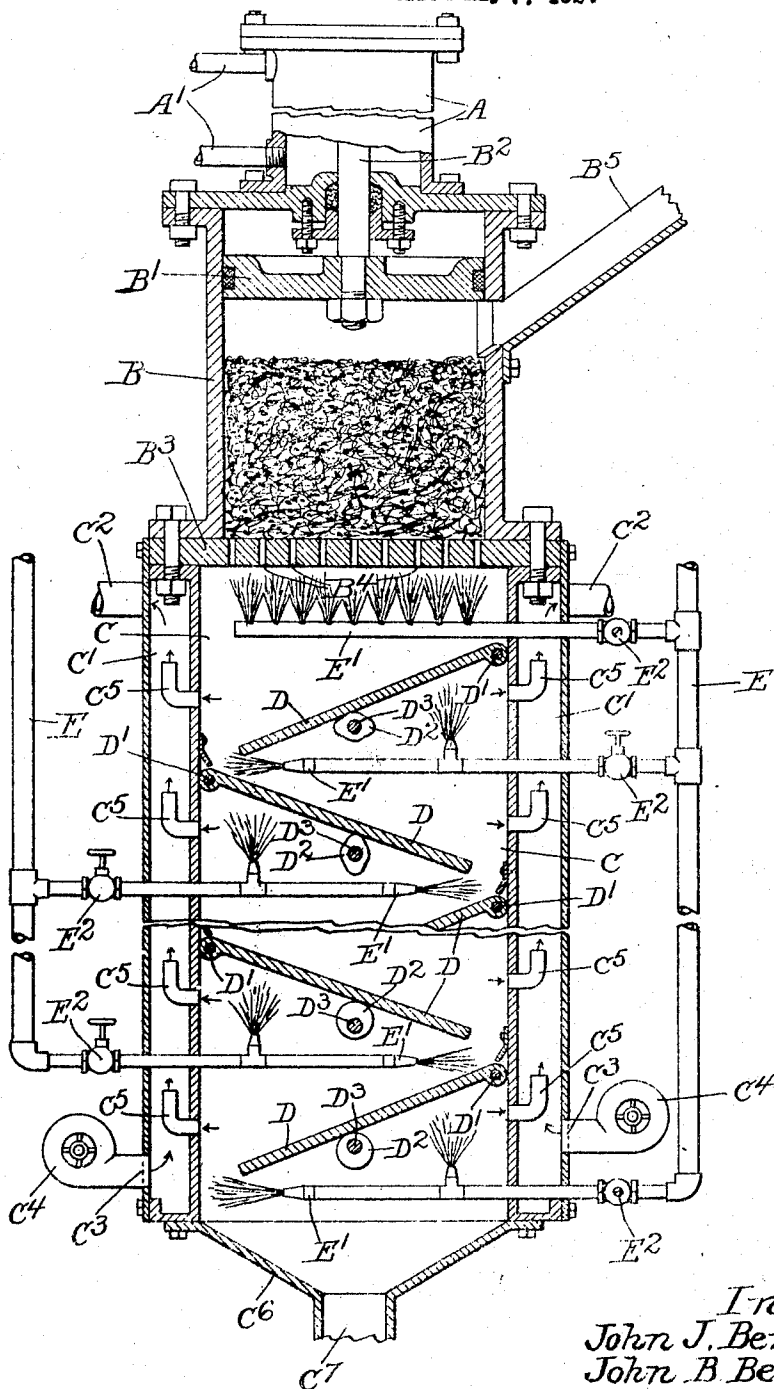
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DRIER AND PROCESS OF DRYING

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UNITED STATES PATENT OFFICE.

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DRIER AND PROCESS OF DRYING.

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To all whom it may concern:

Be it known that JOHN J. BERRIGAN and JOHN B. BERRIGAN, citizens of the United States, residing at Chicago, county of Cook, and State of Illinois, have invented a certain new and useful Improvement in Driers and Processes of Drying, of which the following is a specification.

This invention relates to a drier and particularly to a drier adapted to dry solid material removed from sewage, such for example as "activated sludge," although it may be applied to dry other material. Driers adapted to operate on this class of material have heretofore been large and cumbersome and have been on the order of ovens in which a sufficiently high degree of heat for drying required many hours of heating before drying could be commenced. It is, therefore, one object of our invention to provide a drier which can be put into operation practically instantaneously without the necessity of any preheating period before drying commences. Another object of our invention is to provide a drier by means of which material to be dried will be finely reduced so as to avoid the necessity of crushing or otherwise breaking up the dried particles. Another object of our invention is to provide a drier in which the material may be dried complete by passing once through the drier. A further object of our invention is to provide means for finely dividing the material and then drying it in this finely divided condition. Other objects will appear from time to time throughout the specification and claims.

Our invention is illustrated more or less diagrammatically in the accompanying drawing, wherein:

Figure 1 is a vertical cross section of one form of our drier.

Like parts are designated by like characters throughout.

A is a hydraulic cylinder of any suitable form. Its details are not here illustrated as they form no part of the present invention. A¹ A¹ are intake and exit pipes leading to the interior of the cylinder and by means of which fluid or pressure may be introduced and withdrawn.

B is a receiving compartment into which material to be dried is introduced. B¹ is a piston located within the cylinder B and carried on a shaft B² which extends through

into the hydraulic cylinder A. As pressure is applied to the cylinder, the shaft B² is forced down, the piston B¹ moves with it, and the material within the cylinder B is forced down and out through the perforated plate B³ which forms the bottom of the cylinder. This plate is provided with a large number of small perforations B⁴ which are preferably of very small size. For some purposes it is desirable to have them no larger than one-sixteenth of an inch in diameter, although this size may vary considerably with different classes of material to be acted upon. B⁵ is a chute by means of which material to be dried is introduced into the cylinder B.

C is a drying chamber provided preferably throughout all or a part of its exterior with passages C¹ C¹. These passages are provided at the top with the discharge connections C² C² and at the bottom with the intake connections C³ C³ through which a current of air may be forced by blowers C⁴. Leading into the passages C¹ from the interior of the drying chamber are escape passages C⁵ preferably formed as upturned pipes. As the material is dried within the drier a certain amount of steam and other vapor is forced off and this passes out through the discharge connections C². The drying chamber C terminates preferably in a funnel-shaped bottom C⁶ in which the dry material is collected and passes out through a discharge opening C⁷ to any suitable receiving means, such for example as a conveyor.

Within the drying chamber are mounted a plurality of movable inclined baffle plates D. These plates are pivotally mounted at D¹ on the inner wall of the drying chamber, and beneath each of them is mounted one or more cams D². These cams as here shown are mounted on shafts D³ which may extend through the drier and are mounted for rotation. As the shafts are rotated, the cams act upon the baffle plates to move them up and down and the shape of the cam may be such to make this movement more or less violent.

E, E are supply pipes for connection with the fuel burners E¹ E¹. E² are valves for controlling the burners. One of such burners is located immediately below the perforated plate and is of such size and arrangement that as material falls through the perforated plate it passes through a zone of flame and substan-

tially all of the material comes in direct contact with the flame and is immediately dried on its exterior. The other burners are arranged so that each of them heats generally one of the baffle plates. They may or may not play directly upon it. Preferably the jets from each of such burners extend beyond the lower end of the plate immediately above it as shown. Thus the material as it falls from plate to plate preferably passes again through a zone of flame. While we prefer to have the material pass thus repeatedly through zones of flames, it is of course not an essential feature, and a sufficiently high degree of heat may be obtained in the drier so that the operation will be satisfactory even through the material does not pass through the zone of flame, but we have found that it is generally more satisfactory to have it pass through such zones.

Although we have shown an operative device, still it will be obvious that many changes might be made in size, shape and arrangement of parts without departing materially from the spirit of our invention, and we wish, therefore, that our showing be taken as in a sense diagrammatic.

Particular changes which might be made in the mechanism shown without departing from the spirit of our invention include the following: After material has first been pressed through the perforated plate and allowed to pass through the first zone of flame so as to give it its preliminary drying its subsequent drying may be carried out in any suitable manner. It might be run through any sort of drier, for example, a rotary type of drier now in common use. If the material is used in a drier such as the one shown, the number and inclination of the baffle plates might be varied, the amount of movement given the baffle plates might be varied, the distance from plate to plate, that is to say, the size of the intervening flame swept zone might also be varied.

The use and operation of our invention are as follows:

The material is introduced into the pressure cylinder and as so introduced is, in the case of "activated sludge", a thick moist gluey mass which readily adheres to any surface with which it comes in contact, even if a hot surface and it is extremely difficult to handle in this condition. When the pressure is applied, the material is forced in fine string-like streams through the perforated plate in the bottom of the cylinder and as it emerges from this plate it is swept by the flames and is practically instantaneously dried on its outside. Thus when it comes in contact with the first of the baffle plates it does not adhere to the surface but moves down along its surface being further and more thoroughly dried as it moves. It passes

off the upper plate and is reversed in its movement and may preferably pass through a zone of flames, and moves down a second heated plate. This process is repeated until the material has passed to the bottom of the drier, and by that time it is comparatively dried through and has been broken up into very small particles.

We prefer to use perforations about one-sixteenth inch in diameter and the particles when passed through such a plate and through the drier will be a little more than one-sixteenth inch in diameter and will vary in length usually from about one-quarter inch to something less than one inch.

We have described the operation of our device in connection with its use on "activated sludge", but is is not at all limited to such use, and it clearly may be applied to any use where wet material is to be dried and any such use is within the contemplation of our invention.

We claim:

1. The process of drying material which includes causing it to fall freely through a highly heated zone, and subsequently causing it to move less rapidly across a heated surface of lower temperature.

2. The process of drying material which consists in causing it to fall freely through a highly heated zone and subsequently causing it to move less rapidly across a plurality of heated surfaces of lower temperature one below the other with an intervening heated zone separating each of said surfaces.

3. The process of drying material which includes causing it to fall freely through a flame swept zone and subsequently moving it across a plurality of heated surfaces with intervening flame swept zones separating each of said surfaces.

4. The process of drying material which consists in forming it into a stream of comparatively small cross section, causing it to fall freely through a heated zone and subsequently moving it less rapidly over a heated surface.

5. The process of drying plastic, not easily inflammable material which includes forming it into a stream of comparatively small cross section and causing said stream to fall freely through a flame swept zone.

6. The process of drying material which consists in forming it into a stream of comparatively small cross section, causing said stream to fall freely through a flame swept zone and subsequently causing the material to move over a heated surface.

7. The process of drying material which includes forming it into a plurality of streams of comparatively small cross section, discharging said streams into a flame swept zone.

8. The process of drying viscous material which consists in forming it into a plurality

of streams of comparatively small cross section, causing said streams to fall freely through a flame swept zone, and subsequently causing them to move less rapidly across a heated surface.

9. The process of drying material which consists in forming it into a plurality of streams of comparatively small cross sectional area, causing said streams to fall freely through a fire swept zone thereby effecting a surface drying of the material, and causing the material subsequently to move across a plurality of heated surfaces, and alternately through a plurality of fire swept zones.

10. In combination with a drier, means for introducing material to be dried to said drier, means for causing said material to fall freely through the drier, means for heating the material as it falls, a baffle plate within the drier adapted to receive the material after its first heating and to discharge the material from it, said baffle plate being heated.

11. In combination with a drier, means for introducing material to be dried to said drier, means for causing said material to fall freely through the drier, means for heating the material as it falls, a succession of baffle plates adapted successively to receive the material after its first heating and to discharge the material from them, said plates being heated.

12. In combination with a drier, means for introducing material to be dried to said drier, means for causing said material to fall freely through the drier, means for heating the material as it falls, a succession of baffle plates adapted successively to receive the material after its first heating and to discharge the material from them, said plates being heated, and means for moving said plates to assist movement of the material across them.

13. In combination with a drier, means for introducing material to be dried to said drier, means for causing said material to fall freely through the drier, means for heating the material as it falls, a succession of baffle plates adapted successively to receive the material after its first heating and to discharge the material from them, said plates being heated, and a plurality of fire swept zones between said baffle plates through which the material is caused to fall.

14. In combination with a drier, means for introducing material to be dried to said drier, means for causing said material to fall freely through the drier, means for heating the material as it falls, a succession of baffle plates adapted successively to receive the material after its first heating and to discharge the material from them, said plates being heated, and means for moving said plates to assist movement of

the material across them, and a plurality of fire swept zones between said baffle plates through which the material is caused to fall.

15. In combination with a drier, means for forming a plastic mass of material to be dried into particles of small cross section, means for causing said particles to fall freely through the drier, heating means active upon them as they fall.

16. In combination with a drier, means for forming a plastic mass of material to be dried into particles of small cross section, means for causing said particles to fall freely through the drier, heating means active upon them as they fall, a baffle plate adapted to intercept said material, said plate being heated.

17. In combination with a drier, means for forming a plastic mass of material to be dried into particles of small cross section, means for causing said particles to fall freely through the drier, heating means active upon them as they fall, and a succession of baffle plates adapted to intercept said material, said baffle plates being heated.

18. In combination with a drier, means for forming a plastic mass of material to be dried into particles of small cross section, means for causing said particles to fall freely through the drier, heating means active upon them as they fall, and a succession of baffle plates adapted to intercept said material, said baffle plates being heated and separated each from the other by a flame swept zone through which the material passes.

19. In combination in a drier means for reducing the material to be dried to particles of small size, means for drying the exterior of said particles with great rapidity, and means for subsequently less rapidly completing the drying operation.

20. In combination in a drier a pressing chamber having a perforated bottom, means for forcing material from the chamber through said bottom, means for heating the outside of the particles emerging from said bottom, and means for subsequently further heating and drying said particles, said means including burners adapted to project flames upon said material and shaking inclined baffle plates across which said material moves.

21. The process of drying material which consists in causing it to fall freely through a flame swept zone to effect surface drying and subsequently subjecting it to the influence of a plurality of heated zones separated by alternate additional flame swept zones.

22. The process of drying material which consists in forcing it through a perforated plate, thereafter causing it to fall freely through a flame swept zone.

23. The process of drying material which consists in forcing it through a perforated

plate, thereafter immediately passing it through flames.

24. The process of drying a mass of plastic, not easily inflammable sticky material which consists in first reducing the material to particles of comparatively small size, subjecting these particles to an intense heat to effect surface drying to destroy the stickiness of the material, and subsequently further drying the material.

25. The process of drying a mass of plastic, not easily inflammable sticky material which consists in first reducing the material to particles of comparatively small size,

passing the particles through flames to effect surface drying to destroy the stickiness of the material, and subsequently further drying the material.

26. The process of drying plastic, not easily inflammable material which includes forming it into a stream of comparatively small cross section and causing said stream to fall freely through a highly heated zone.

Signed at Chicago, county of Cook, State of Illinois, this 5th day of May, 1924.

JOHN J. BERRIGAN.
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