March 26, 1929. L. J. ROBB 1,706,708

DRIER

Filed July 3, 1926 4 Sheets-Sheet 1

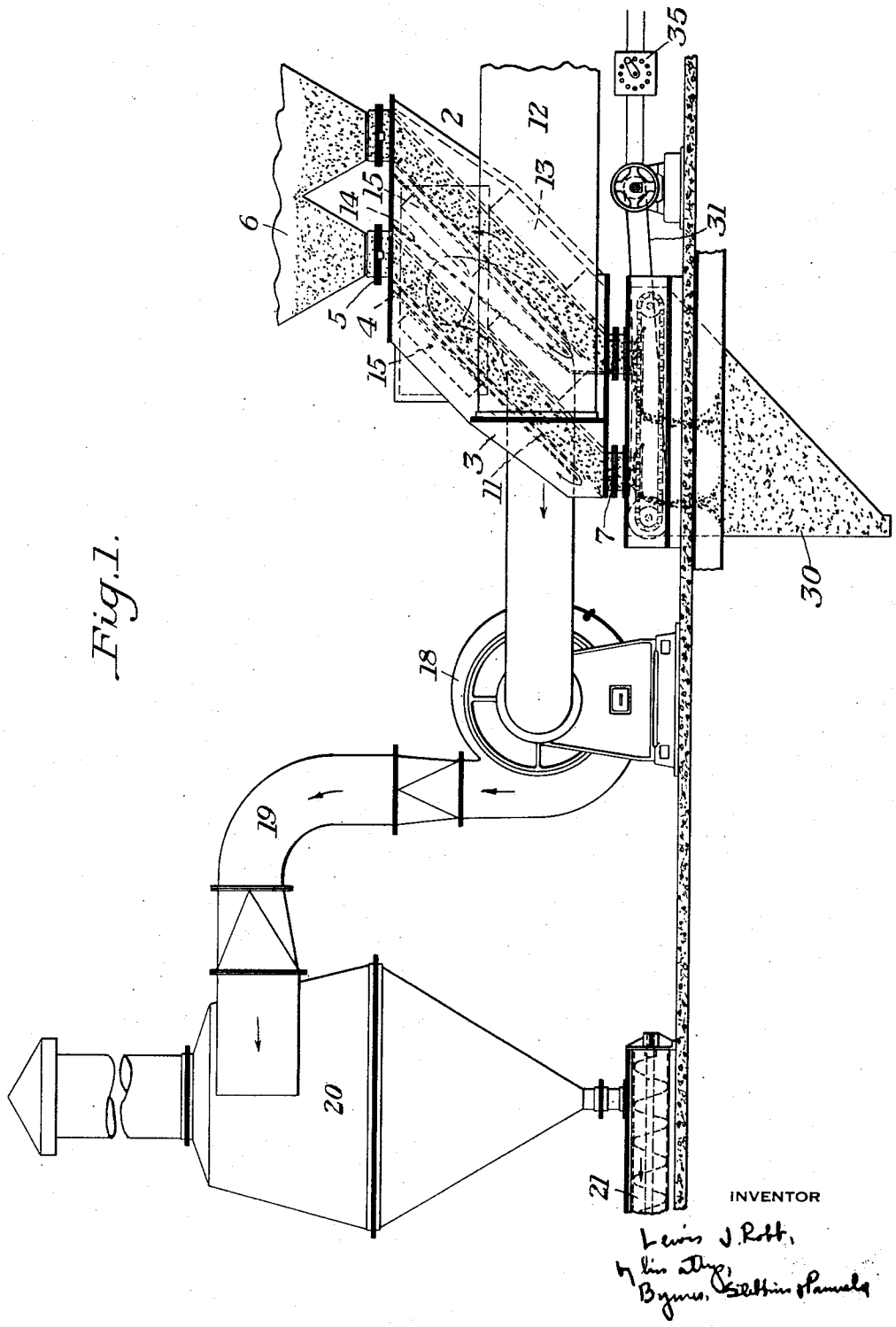


Fig. 1.

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Byrnes, Gilbert & Pamela

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DRIER

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Fig. 2.

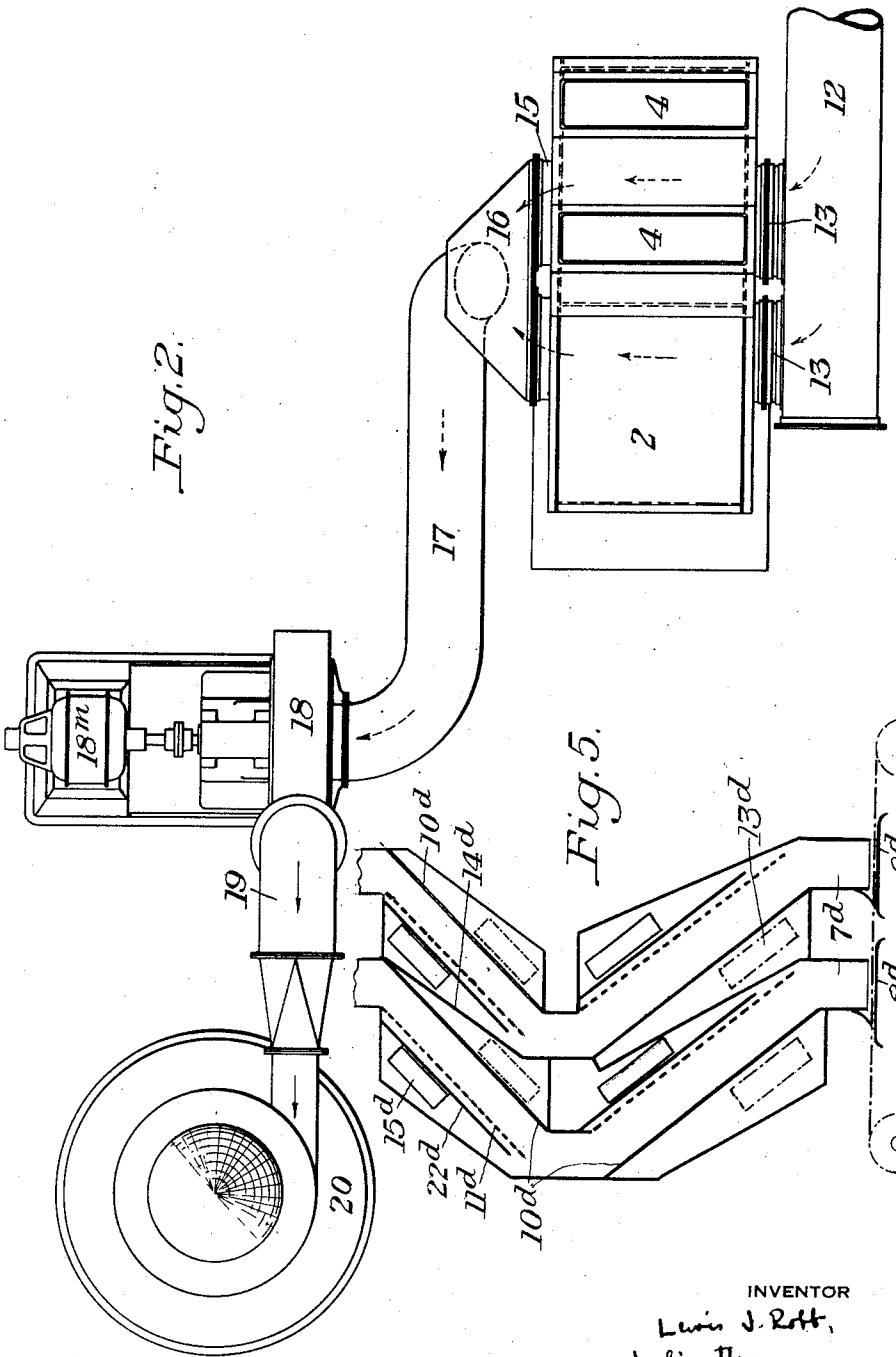


Fig. 5.

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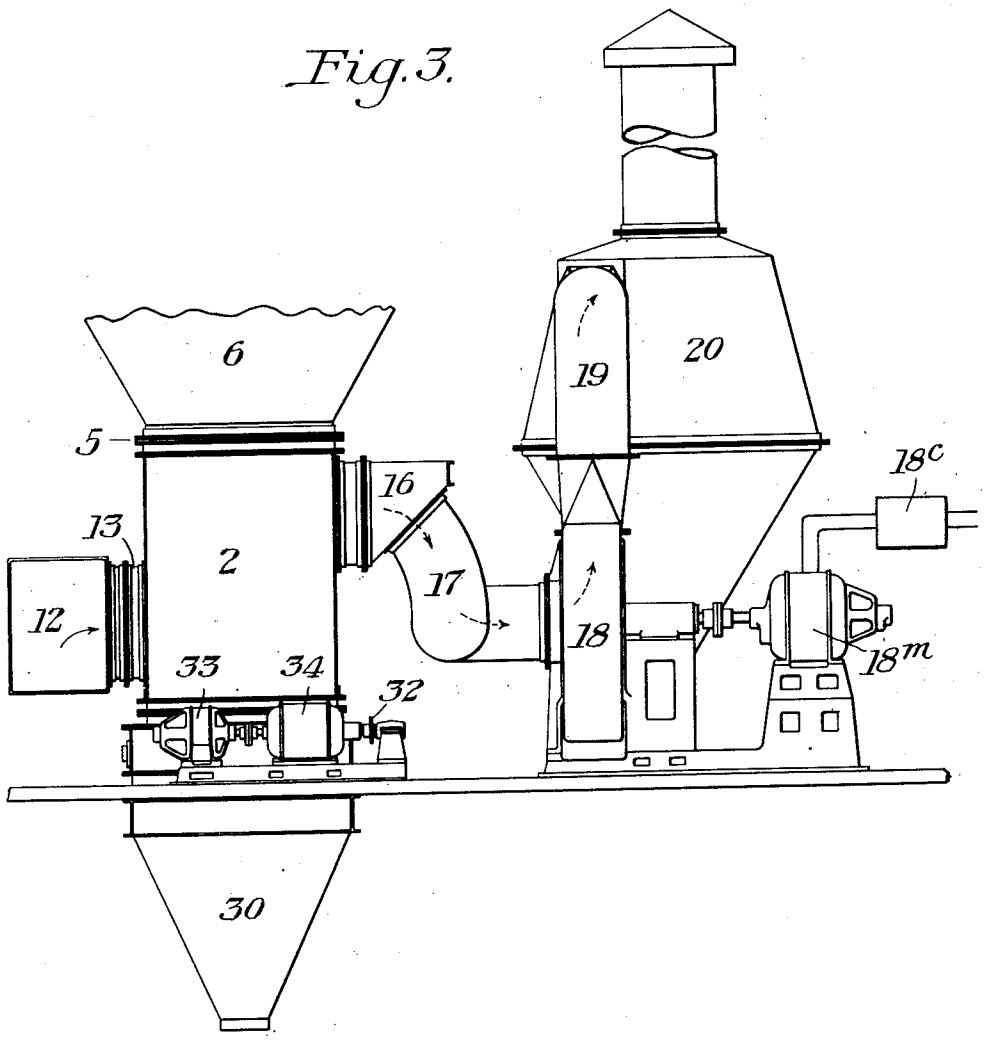
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Fig. 3.



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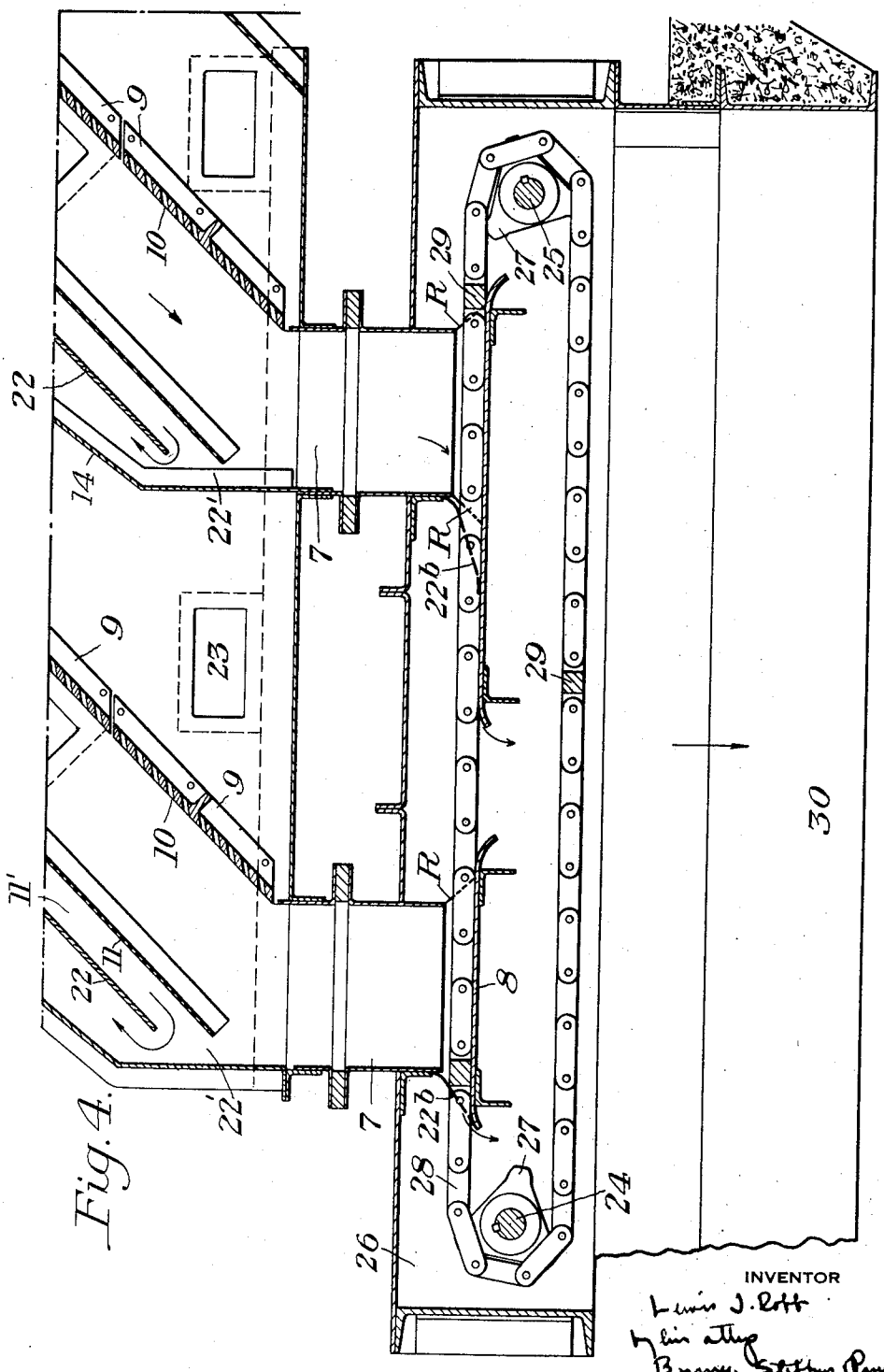


Fig. 4.

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Patented Mar. 26, 1929. 1,706,708

UNITED STATES PATENT OFFICE.

LEWIS J. ROBB, OF PITTSBURGH, PENNSYLVANIA, ASSIGNOR TO HEYL & PATTERSON, INC., OF PITTSBURGH, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA.

DRIER.

Application filed July 3, 1926. Serial No. 120,300.

In the preparation of coal for pulverizing it is important that the coal be dried evenly before it is supplied to the pulverizer. Various schemes have been tried for this purpose, some of them utilizing the gaseous products of combustion as a heating medium, but these attempts have not been wholly successful. It is found in many cases that the material to be dried ignites in certain parts of the drier while in other parts the moisture content is actually increased instead of being diminished. Even where ignition does not take place the material discharged from these driers is likely to be variable as to dryness and may be said to be "streaked" with moisture, and this of course gives rise to serious difficulties in the pulverizing operation.

It has been proposed to use driers in which the coal is moved in a vertical column between grids which act as guides for the column of coal. In the use of these devices it is found that the velocity of the drying gases has a tendency to hold the coal against the sides of the vertical grids and thus give rise to non-uniform operation. Also it has frequently been found that the transfer of heat from the gases causes the coal to heat rapidly on the incoming side and carry the moisture to the outgoing side, the result being an unequal drying of the coal and on occasion combustion thereof on the incoming side.

I provide a drier comprising an inclined chute with take off means at the bottom of the chute for regulating the flow of material with means for passing a drying fluid through the material in the chute. Preferably there is provided a chamber through which the chute extends. This chute is provided with a grid on the under side through which the drying medium may pass and is provided with a screen on the upper side for defining the thickness of the column of coal to be dried. Preferably the chute is supplied from a source of material adapted to maintain the chute substantially full at all times as this results in uniform drying. This supply means may constitute a bin with a regulating gate.

In order to secure regulation of the quantity of material being dried I preferably employ a control for the take off means at the bottom of the chute. In order to secure the desired capacity for the apparatus I preferably employ a plurality of chutes and use a single take off means therefor. With this arrangement the rate of flow of material through the entire apparatus may be regulated by a single adjustment. The drying medium is preferably taken off from the drier proper and passed to a separator where any entrained material is taken therefrom.

In the accompanying drawings which illustrate the present preferred embodiment of my invention:

Figure 1 is a side elevation showing a drier with the separator for spent drying fluid;

Figure 2 is a top plan view of the apparatus shown in Figure 1 but with the supply bin removed;

Figure 3 is an end elevation of the apparatus shown in Figure 1;

Figure 4 is a vertical longitudinal section to enlarged scale of a portion of the drier, and

Figure 5 is a vertical section through a modified form of drier.

In the illustrated embodiment of the invention there is shown a drier indicated generally by the reference character 2 comprising an outer shell 3 having a plurality of inclined chutes 4 extending therethrough. At the top of each chute 4 is a regulating gate 5 and a discharge leg of a supply bin 6. The coal or other material flows from the bin 6 through the gate 5 into the chute 4. At the bottom of each chute there is provided a short vertically extending portion 7 whose bottom terminates above but is spaced away from a plate 8. (See Figure 4.) The downflowing material tends to pile up on the plate 8, the material assuming its natural angle of repose, until such flow is checked by the bottom edge of the vertically extending chute portion 7. I have indicated by the letter R on Figure 4 the angle of repose for the material being handled and I make the plates 8 of such length that they extend beyond a line determined by the intersection of the line R with the plane of the plates.

Since the flow of the material from each chute is checked by the plate 8 the material piles up in the chute until it is substantially filled as shown in Figure 1.

The chutes 4 are preferably rectangular in cross section as best shown in Figure 2 and each of them comprises a bottom plate made up of grids 9 having slots 10 extending therethrough. These slots are preferably horizontal or near horizontal as this prevents leakage of small particles of coal or other material through the same while it permits of free flow of drying fluid to the column of coal and also delivers the drying fluid to the material in the chute in such manner that binding of the material is eliminated.

The top of each chute comprises a screen 11 which is effective for defining the thickness of the column of material being dried.

The drying fluid, which may be waste gaseous products of combustion, is supplied to the apparatus through a conduit 12 having outlets 13 leading to the drier 2. One of these outlets is provided for each chute in the drier 2 and a division plate 14 is provided within the drier for completely isolating one chute and its gas supply system from the other.

The hot gases pass from the space within the drier below the bottom plate 9 through the slots 10. The gases pass through the column of coal, drying the same, and then pass off through the screen 11 to the space 11′ in the drier above such screen. Outlets 15 are provided on the side of the drier remote from the inlets 13 and these communicate through a manifold 16 with a conduit 17 leading to an exhauster 18. The exhauster discharges into a conduit 19 leading to a cyclone collector 20. This collector is effective for separating entrained particles of dried material from the exhaust gases. The collected material is discharged into a screw conveyor 21 by which it may be taken to the pulverizer or any other desired place.

Referring now in more detail to the drier 2, the chutes 4, as already pointed out, are inclined. These chutes may be made at any angle from 35° to 50° from the horizontal but it is found that the nearer the angle approaches 45° the more easily and uniformly will the coal flow through the apparatus.

The screens 11, while effective for defining the thickness of the column of coal flowing through the apparatus, must of course be open enough to permit of free discharge of the drying gases and due to this fact and also due to the tendency of the drying gases to entrain small particles of solid material, a certain amount of material may get into the space above the screens 11 but still not be carried through the outlets 15 to the conduit 17. I therefore provide a baffle plate 22 which makes it necessary for the gases to move downwardly and then upwardly, as indicated by arrows in Figure 4, in order to get out of the drier. The solid particles tend to separate at the bottom of the plate 22 and are discharged through an opening 22′.

By reason of the increasing area of the space above the plate 22, the gaseous stream slows down after it starts upwardly, and this causes further separation. The baffle also prevents clogging of the opening 22′. A tendency to such clogging was observed in a drier not provided with such baffle. This tendency seems due, at least in part, to the fact that atmospheric gases are drawn upwardly through the coal lying in the discharge legs 7. To offset this tendency, I prefer to employ one or more flexible baffles 22^b secured to the legs 7 as shown. These baffles, while they permit free action of the discharge mechanism, increase the resistance to the upward flow of atmospheric gases. They will have this effect even though they are held clear of the plate 8 by dried coal, as in this case they increase the length of the gas path by substantially their own length.

When dealing with material of this character it is of course possible for such material to percolate into all parts of the apparatus. The tendency of the material to sift through the grids 9 is minimized by the provision of the horizontal slots 10, but hand holes 23 having suitable cover plates are provided for cleaning out the wind boxes below the chutes.

With the apparatus so far described there is no tendency for the columns of coal to move through the apparatus because of the fact that the coal itself chokes off the flow. The means for controlling the flow of solid material through the apparatus will now be described.

A pair of shafts 24 and 25 is provided at each end of the discharge chamber 26 in which the plates 8 are located and sprockets 27 are placed on each shaft. A pair of sprocket chains 28 extends around the sprockets 27, passing over the plates 8 near each side thereof. The sprocket chains 28 are connected at intervals by cross bars 29 which pass between the plates 8 and the bottom of the chute portions 7 as shown in Figure 4. These bars act as scrapers or sweeps and are effective for sliding the dried material over the plate 8 from which it falls into a bin 30. When the material is swept out from under the chute the material in the chute moves downwardly until its flow is again checked as above described.

The speed of the discharge mechanism and therefore the rate at which material is dried in the apparatus is controlled entirely by the speed of the shaft 24. This shaft is connected through a sprocket chain 31 to a drive sprocket 32. The drive sprocket 32 is connected to a driving motor 33 through a speed reducer 34 and a speed controller 35 is

provided for the motor 33. By suitably regulating the speed controller 35 the flow of material through the apparatus may be regulated as desired. The flow of heating gases through the drier may be regulated by a controller 18^c connected to the motor 18^m which drives the exhauster 18.

In Figure 5 I have shown a modified form of apparatus wherein each of the inclined coal chutes is formed from a plurality of staggered portions. This arrangement may be used to secure greater drying capacity. In this form of the invention parts corresponding to similar parts in the first described embodiment have been given the same reference character with a letter *d* suffixed. It will be noted that each section of the chute has its own fluid supply means, and these are preferably independently regulable. It will also be noted that in the lower section the gases travel through the coal from left to right, while in the section thereabove they travel through the coal from right to left.

I have illustrated and described a preferred embodiment of my invention as particularly applied to the drying of coal. It will be understood, however, that the invention is not limited to the form shown as it may be otherwise embodied within the scope of the following claims.

I claim:

1. A drier, comprising a chamber having an inclined chute therein, means for supplying drying gases to the chamber below the chute, the chute having a perforate bottom plate to permit passage of the drying gases therethrough, and a perforate top plate for the chute, the chamber being provided with a discharge outlet for material above the top plate.

2. A drier, comprising a chamber having an inclined supporting surface therein for material to be dried, means spaced from the supporting surface for determining the thickness of material thereon, means for passing a drying fluid through the material, and a discharge outlet for the material collecting above the means which determines the thickness of the material.

3. A drier, comprising an inclined chute, take off means at the bottom of the chute, means for passing a gaseous drying fluid from side to side through the material in the chute, and a baffle for atmospheric gases at one end of the chute.

4. A drier, comprising an inclined chute, take off means at the bottom of the chute, means for passing a gaseous drying fluid from side to side through the material in the chute, a plate spaced from the bottom of the chute, a sweep adapted for movement between the plate and the bottom of the chute, and a yieldable baffle in the path of the sweep.

5. A drier, comprising a chamber having an inclined perforated supporting surface therein for material to be dried, perforated means spaced from the supporting surface for determining the thickness of material thereon, means for passing drying fluid through the material, supporting surface and spaced means, and means for causing the drying fluid, after passing through the spaced means, to move along the upper surface thereof for removing particles of material deposited thereon.

6. A drier, comprising a chamber having an inclined perforated supporting surface therein for material to be dried, perforated means spaced from the supporting surface for determining the thickness of material thereon, means for passing drying fluid through the material, supporting surface and spaced means, means for causing the drying fluid after passing through the spaced means, to move along the upper surface thereof for removing particles of material deposited thereon and a discharge outlet for the material collected above the spaced means.

7. A drier, comprising a chamber having an inclined perforated supporting surface therein for material to be dried, perforated means spaced from the supporting surface for determining the thickness of material thereon, means for passing drying fluid through the material, supporting surface and spaced means, means for causing the drying fluid, after passing through the spaced means, to move along the upper surface thereof for removing particles of material deposited thereon and a discharge outlet for returning the material collected above the spaced means to the main body of the material.

8. A drier, comprising a chamber having an inclined perforated supporting surface therein for material to be dried, perforated means spaced from the supporting surface for determining the thickness of material thereon, means for passing drying fluid through the material, supporting surface and spaced means, means for causing the drying fluid, after passing through the spaced means, to move along the upper surface thereof for removing particles of material deposited thereon and a discharge outlet for returning the material collected above the spaced means to the main body of the material below the supporting surface.

9. In a drier, a chamber, a perforated chute disposed within the chamber, means for passing drying fluid through the chamber and material therein, and a baffle for directing the drying fluid along the lee side of the chute for removing particles of material adhering thereto.

10. In a drier, a chamber, a perforated chute disposed within the chamber, means

for passing drying fluid through the chamber and material therein, and a baffle for directing the drying fluid along the lee side of the chute for removing particles of material adhering thereto and for imparting a sudden change in the movement of the fluid for discharging the particles of material.

11. In a drier, a chamber, a perforated chute disposed within the chamber, means for passing drying fluid through the chamber and material therein, a baffle for directing the drying fluid along the lee side of the chute for removing particles of material adhering thereto and for imparting a sudden change in the movement of the fluid for discharging the particles of material, and a discharge outlet for returning the particles of matter to the material after its discharge from the chute.

In testimony whereof I have hereunto set my hand.

LEWIS J. ROBB.

CERTIFICATE OF CORRECTION.

Patent No. 1,706,708. **Granted March 26, 1929, to**

LEWIS J. ROBB.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 1, at the beginning of the specification, insert as the first paragraph "This invention relates to driers and is particularly useful for the drying of coal or other material in granular form."; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 23rd day of April, A. D. 1929.

M. J. Moore,
Acting Commissioner of Patents.

(Seal)

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