Jan. 30, 1945. F. B. ALLEN 2,368,395

DUST VALVE MECHANISM

Filed Nov. 6, 1942 5 Sheets-Sheet 1

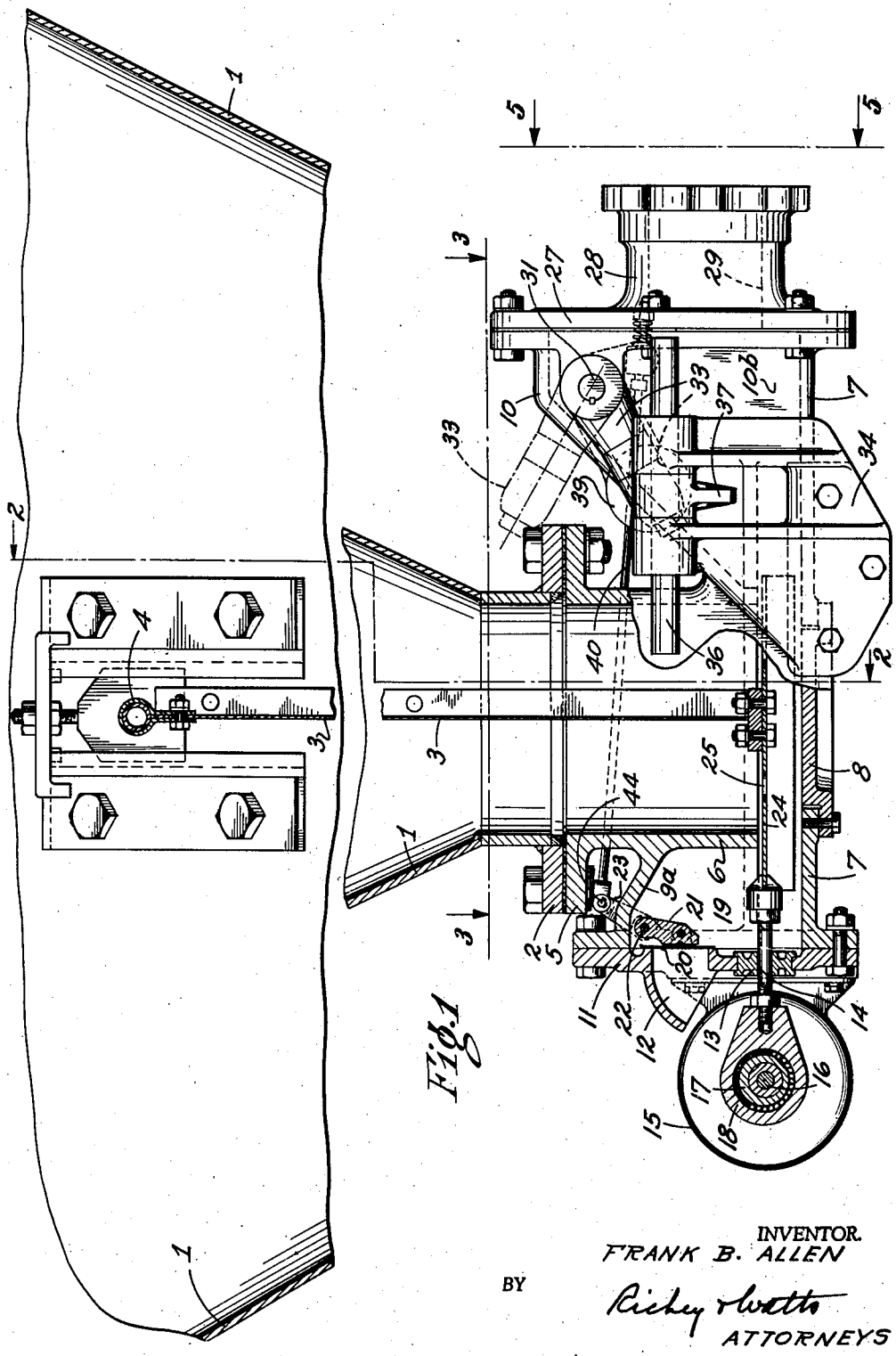


Fig. 1

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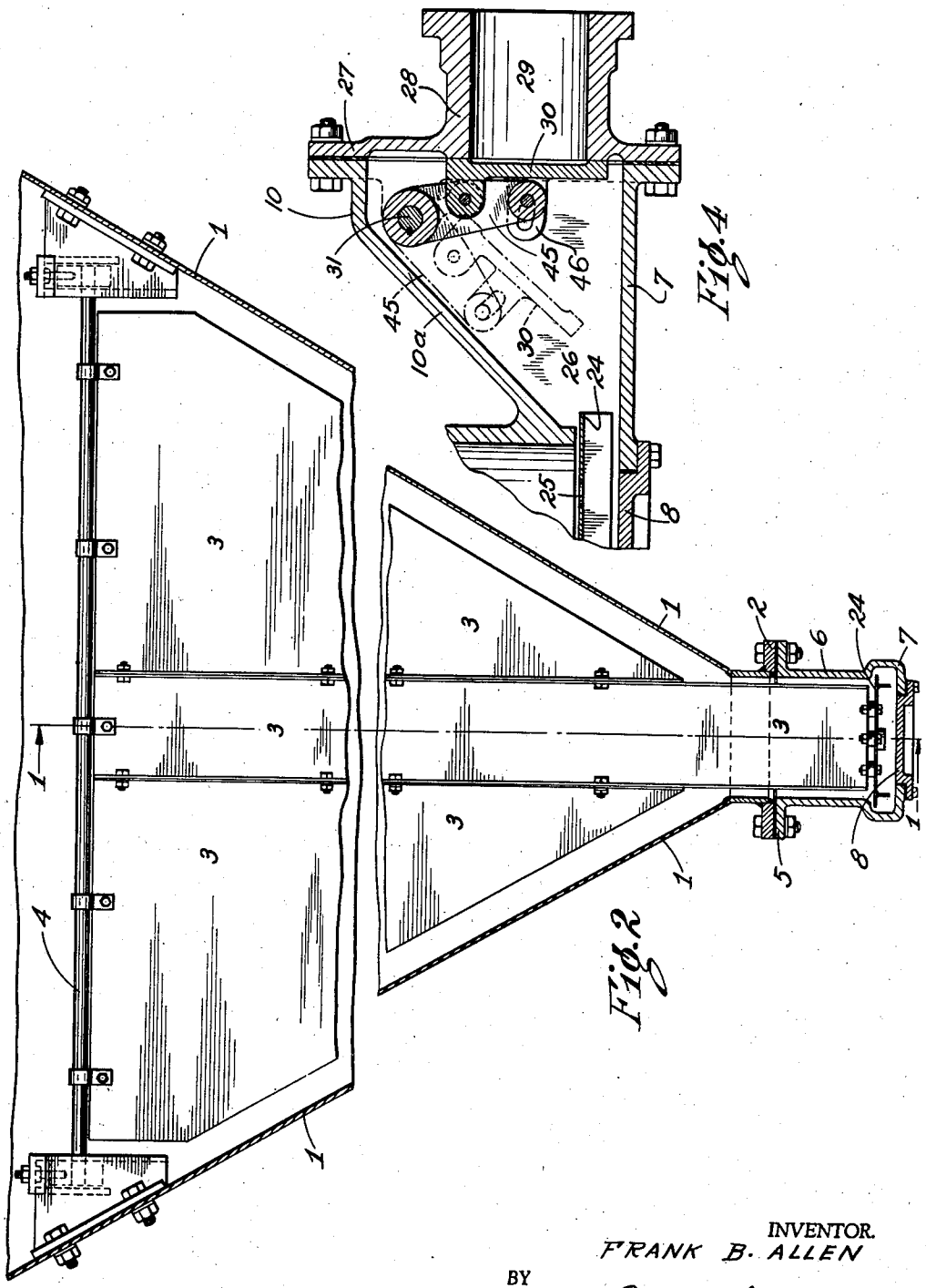


Fig. 4

Fig. 2

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DUST VALVE MECHANISM

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Fig. 3

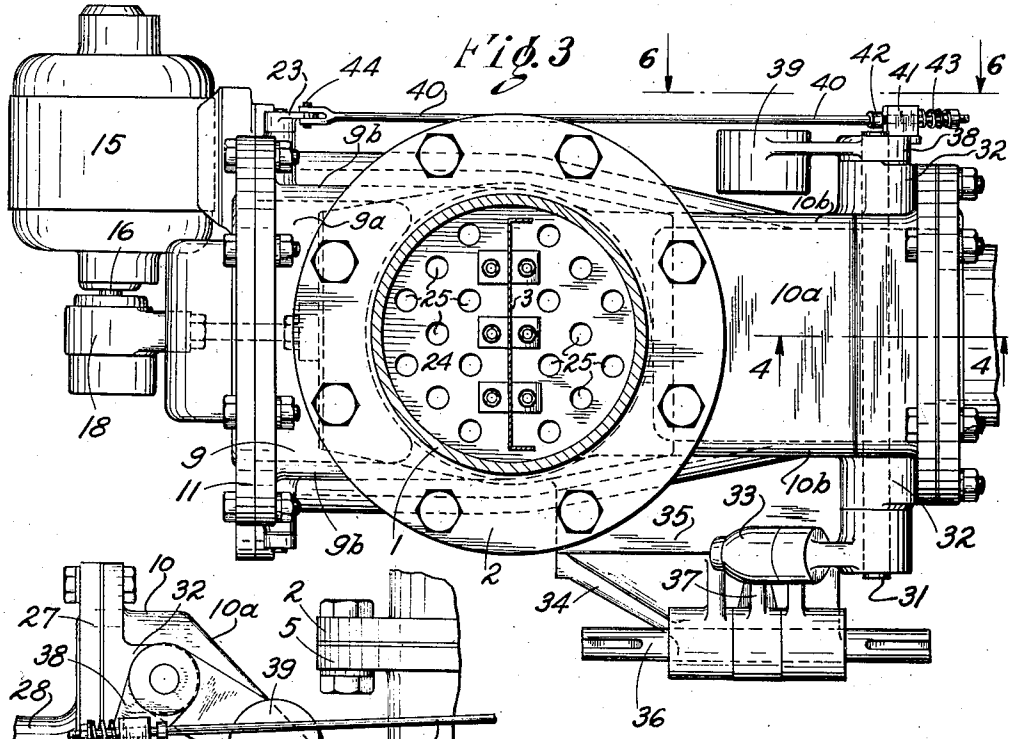


Fig. 6

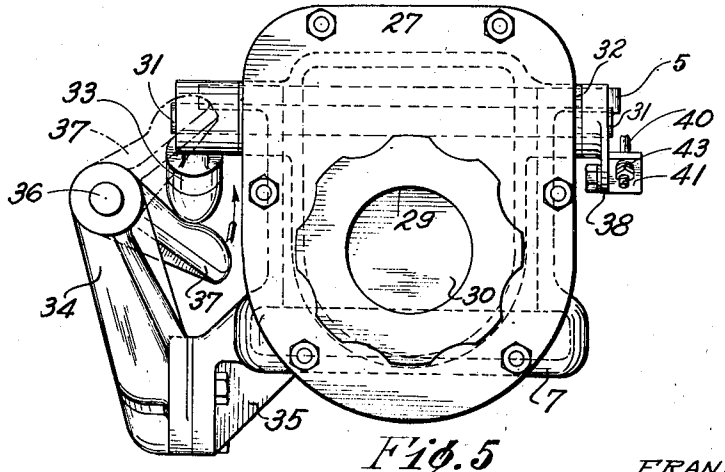


Fig. 5

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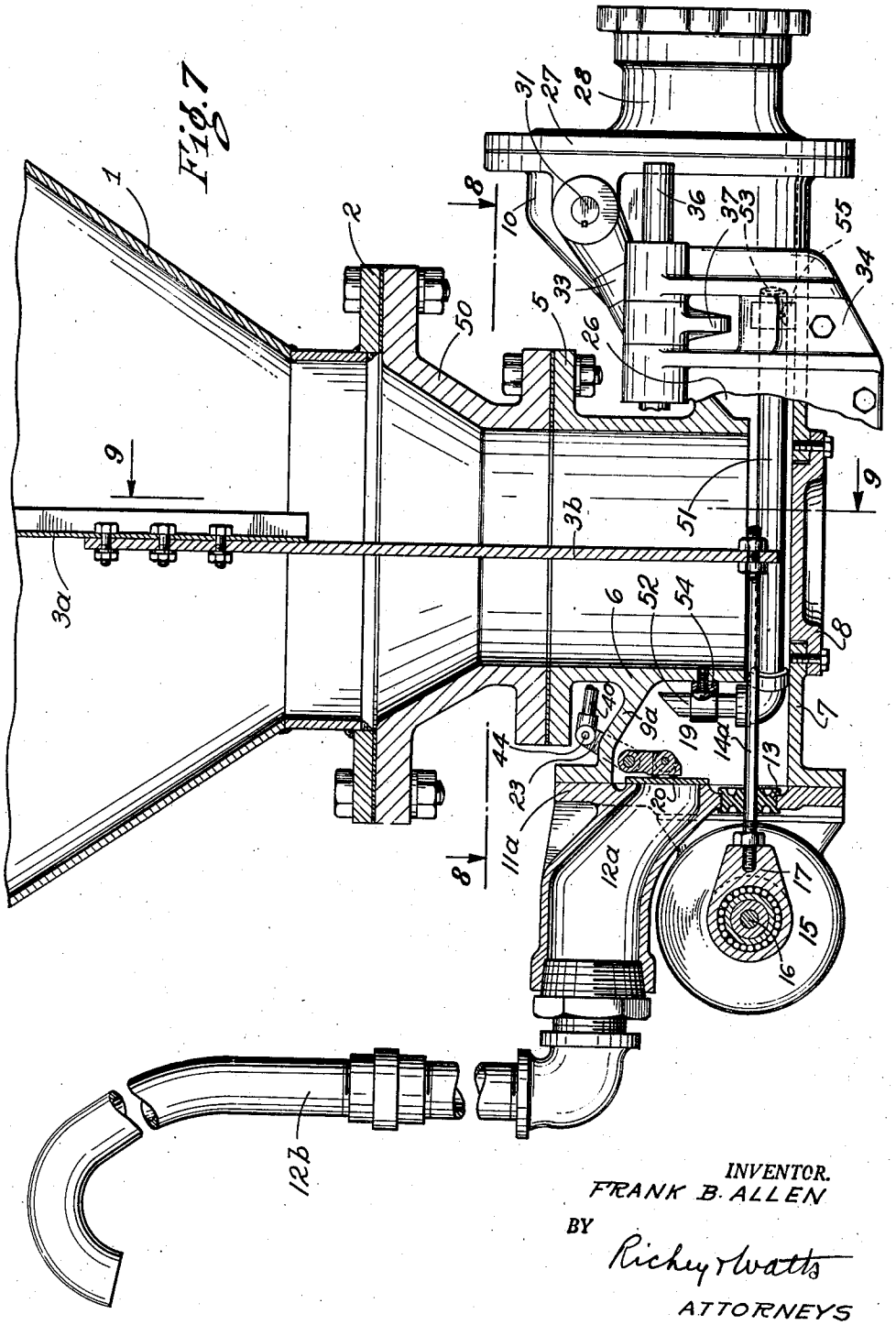
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Fig. 7



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DUST VALVE MECHANISM

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Fig. 8

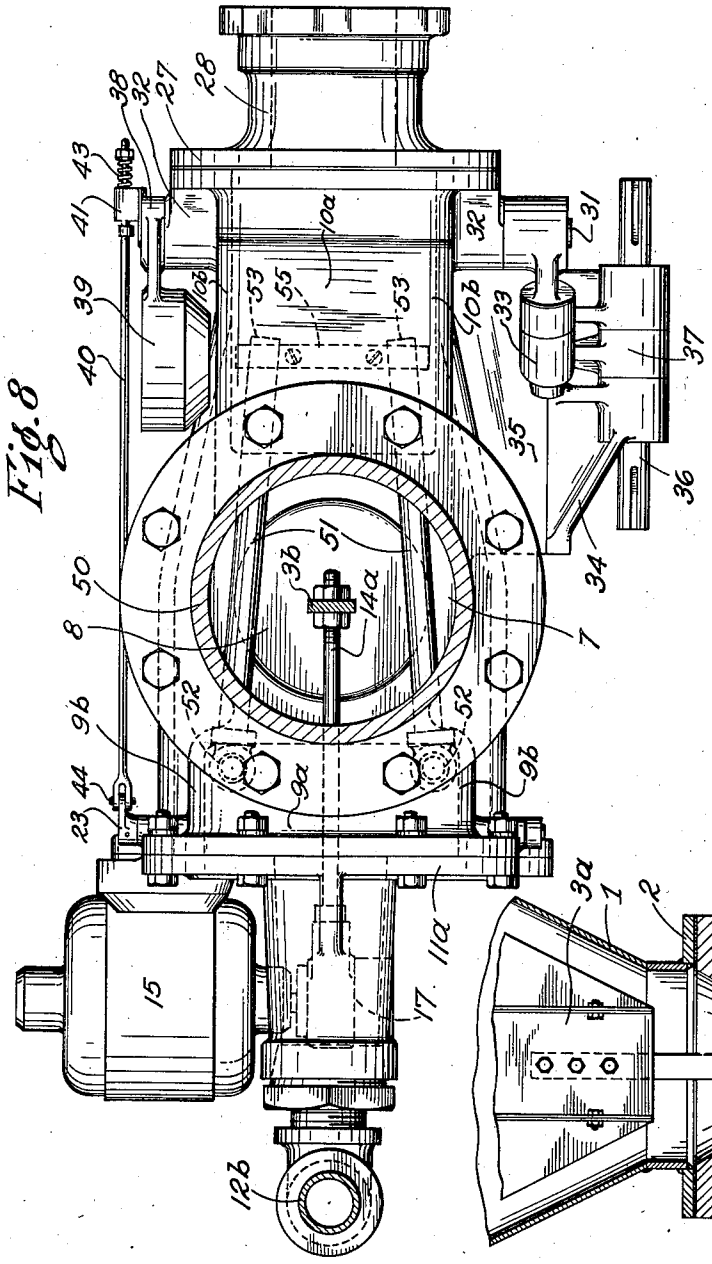
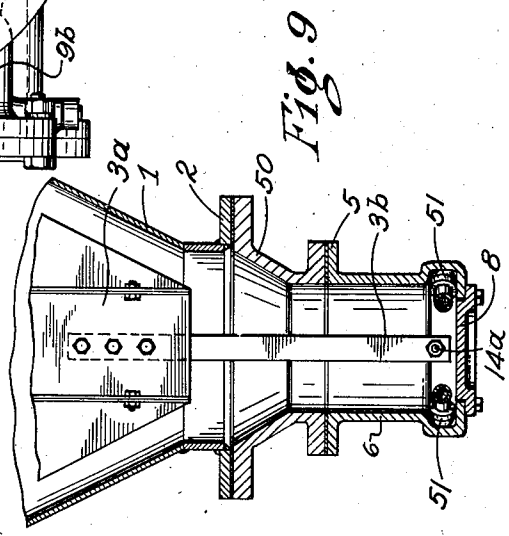


Fig. 9



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Patented Jan. 30, 1945 2,368,395

UNITED STATES PATENT OFFICE

2,368,395

DUST VALVE MECHANISM

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Application November 6, 1942, Serial No. 464,720

3 Claims. (Cl. 302—56)

This invention relates generally to the art of handling finely divided solids, such as dust in power plants, and relates particularly to new and improved apparatus for removing finely divided solids from a collecting hopper for transfer to a place of disposal.

The apparatus embodying the present invention is highly efficient as compared with prior apparatus in that the maximum solid-material-carrying capacity of the swiftly moving air is utilized thruout substantially the entire time of operation. These results are attained by forming in a restricted passage below a hopper a plurality of small piles of solids, passing a stream of air thru the passage and about the piles and feeding solids from the hopper in a plurality of streams into the passage and air stream as the solids in the piles are removed until the hopper is emptied of solids. By suitably proportioning the number and size of the streams of solids and the volume and velocity of air flow thru the passage, each unit volume of air will pick up and carry away a quantity of solids equivalent substantially to its full carrying capacity.

The present invention will be better understood by reference to the drawings which accompany and form a part of this specification and in which

Figure 1 is a side elevational view, partly in section, of one form of apparatus embodying the present invention;

Figure 2 is a transverse sectional view, partly in elevation taken on lines 2—2 of the apparatus shown in Fig. 1;

Figure 3 is a plan view, partly in section taken on line 3—3 of Fig. 1;

Figure 4 is an enlarged detail sectional view taken on line 4—4 of Fig. 3;

Figure 5 is a fragmentary and elevational view taken on line 5—5 of Fig. 1;

Figure 6 is an enlarged, fragmentary view taken on line 6—6 of Fig. 3;

Figure 7 is a view similar to Fig. 1 but showing a modified form of apparatus embodying the present invention;

Figure 8 is a partly sectional plan view taken on line 8—8 of Fig. 7; and

Figure 9 is a cross-sectional view taken on line 9—9 of Fig. 7.

In Figs. 1 to 6 of the drawings, the downwardly converging hopper walls 1 are provided with bottom ring 2 from which depends a valve apparatus, presently to be described. Within the hopper a thin metal wall 3, preferably composed of sheets secured together, is pivotally suspended on a rod 4 at its upper end and extends down into the valve apparatus.

The valve apparatus includes a ring 5, a cylindrical wall 6, a bottom wall 7 provided with a removable plate 8, projecting end walls, and end plates. These parts may be considered as constituting a housing defining and enclosing a hopper discharge opening. End plate 11 is detachably secured to end walls 9a and 9b and is provided with an air inlet passage 12 and a bearing thru which a rod 14 may reciprocate. The end plate 11 also carries a motor 15 which has an extended rotor shaft 16 on the end of which is positioned an eccentric ring 17 surrounded by an eccentric strap 18 which is attached to the adjacent end of the shaft 14.

The end walls 9a and 9b, together with bottom wall 7, define an enlarged inlet chamber 19. A closure 20 serves to open and close inlet opening 12. This closure is carried by an arm 21 keyed to shaft 22 which extends thru walls 9b and carries an arm 23 keyed thereto outside of one wall 9b.

A plate 24 having a plurality of small holes 25 is attached to the lower end of wall 3 and is attached at one end to shaft 14. Plate 24 is thereby disposed adjacent to the bottom end of wall 6 and serves to retain dust in the hopper except when the shaft 14 reciprocates the plate.

End walls 10a and 10 extend outwardly on one side of wall 6 and with bottom plate 7 define an enlarged outlet chamber 26. End plate 27 has a cylindrical boss 28 for attachment to a conduit and a central opening 29. This opening may be opened or closed by a closure 30 in chamber 26.

A shaft 31 is mounted in bosses 32 of the side walls 10b and extends across chamber 26. On one end of this shaft 31 is keyed an arm 33. A bracket 34 mounted on an extension 35 of side wall 10b carries a shaft 36 which has keyed to it a cam 37 engageable with arm 33.

The opposite end of shaft 31 has keyed thereto a combined lever arm 38 and counterweight 39. A rod 40 is slidably mounted in block 41 carried by lever arm 38 and is provided with a fixed shoulder 42 on one side of the block, and a nut-adjusted spring 43 on the other side of said block. The rod 40 is pivotally connected by pin 44 to lever arm 23 which is keyed to shaft 22, as previously described. A lever arm 45 is keyed to shaft 31 within the chamber 26 and is pivotally connected to closure 30 for the outlet passage from that chamber. The lever arm 45 has a lost motion connection with a slotted lug 46 integral with closure 30.

The operation of the above described apparatus is substantially as follows: When finely divided solids have been collected in the hopper and are to be removed therefrom, shaft 36 is rotated in the direction indicated by the arrow on Fig. 5 sufficiently to lift arm 33 to the dot and dash line position shown in Figs. 1 and 5 thereby rotating shaft 31 and simultaneously moving closure 30 to open position and moving rod 40 endwise, thereby rotating shaft 23 and moving closure 20 to open position. A source of suction is applied to the conduit attached to boss 28. Then power is applied to motor 15 with the result that rod 14 and plate 24 are reciprocated. The reciprocation of plate 24 feeds finely divided solids out of the hopper thru holes 25, and at the same time moves wall 3 about its support 4, thereby agitating and loosening the solids in the hopper and preventing "arching" of those solids and assuring constant and substantially uniform downward feeding of the solids onto and thru plate 24.

It will be understood that while solids are collecting in the hopper a small pile of solids will form in the chamber beneath each hole 25 and will fill the holes. When closures 20 and 30 are opened and the suction or vacuum is applied to the interior of valve apparatus, air will enter thru inlet passage 12 and will flow at high velocity beneath plate 24 and thence thru chamber 26 in contact with the small piles of solids and out thru outlet passage 29. The air will pick up solids from the piles and carry it into the connected conduit and to a place of disposal. As solids are taken from the piles more solids can pass thru holes 25 and onto the piles or into the air stream. In this manner the air has full opportunity to pick up all the solids it can carry away and to do so as long as any solids remain in the hopper. By properly correlating the suction or vacuum applied to the conduit, the amount of air admitted thru inlet passage 12, and the size and number of holes 25 in plate 24, a ratio of air to solids which is best suited to carrying the maximum amount of solids may be established and maintained, and the maximum amount of solids can be removed from the hopper and transported to a place of disposal without any substantial separation of the solids from the air.

For the sake of brevity I have chosen to use the term "dust" in the accompanying claims but intend that this term should include all manner of finely divided solids.

The modified apparatus shown in Figs. 7 to 9 is generally similar to the apparatus shown in Figs. 1 to 6 inclusive and described hereinabove. Accordingly, only the differences in construction will be described.

The hopper 1 has pivoted therein a thin metal wall 3a which corresponds generally in shape to wall 3 of Fig. 1 and which is similarly pivotally suspended in the hopper. Between the ring 2 of hopper 1 and the housing composed of cylindrical wall 6, bottom wall 7 and end plates, is disposed a ring 50. A bar 3b secured at its upper end to wall 3a extends centrally down thru ring 50 and cylinder 6 with its lower end terminating just below the lower end of the latter. This bar 3b constitutes an extension of the wall 3a corresponding generally to the vertical-sided lower portion of wall 3 of Fig. 2 which projects into cylinder 6. The rod 14a extends from eccentric ring 17 of motor 15 to and is secured to the lower end of bar 3b.

The plate 11a corresponds to plate 11 of Fig. 1 but is provided with a passage 12a which communicates with an upwardly extending intake pipe 12b which has a downwardly bent upper end.

Within the space in the housing are disposed two pipes 51 as shown in Figs. 7 to 9. The intake ends 52 of these pipes are disposed above the lower end of cylinder 6 in space 19 and preferably on the opposite sides of and on about the same horizontal elevation as the outlet end of passage 12. As is better shown in Fig. 8, these pipes 51 extend convergingly across the discharge end of cylinder 6 and terminate in open ends 53 within the enlarged chamber 26. The pipes 51 may be secured in place in the housing in any convenient manner but, as shown, they rest on the bottom wall 7 of the housing, are clamped against cushion blocks 54 on the outer side of cylinder 6, and their opposite ends are secured in place by a cross bar 55 which is connected to wall 7 of the housing.

From the foregoing description it will be understood that the perforated plate 24 of the modification shown in Figs. 1 to 6 has been omitted, rod 14 has been replaced by rod 14a connected to an extension of wall 3a and pipes 51 have been included. Also pipe 12b has been added.

The operation of the apparatus of Figs. 7 to 9 is quite similar to the above described operation of apparatus of Figs. 1 to 6. When finely divided solids are to be removed from hopper 1 and the housing therebelow, the inlet and outlet closures 20 and 30 are moved to open position and the shaft 14a is reciprocated by actuation of motor 15 with resultant pivotal movement of wall 3a about its pivot support. The application of a source of suction to the outlet opening of the housing induces a flow of air thru pipe 12b and passage 12a into chamber 19 and thence into chamber 26. Some of this air passes around cylinder 6, some passes directly beneath the discharge end of cylinder 6, and some of it passes thru pipes 51. Reciprocation of wall 3a agitates finely divided solids in the hopper and expedites flow of such material into the space below cylinder 6, where it is entrained in the air and is thereby carried away thru the discharge outlet from the housing.

This application is a continuation-in-part of my copending application Ser. No. 429,269, filed February 2, 1942.

Having thus described my invention so that others skilled in the art may be able to understand and practice the same, I state that what I desire to secure by Letters Patent is defined in what is claimed.

What is claimed is:

1. Ash handling apparatus including an ash hopper having a discharge opening in its lower portion, a housing below said hopper, said housing comprising an annular wall defining a passage communicating at its upper end with said hopper discharge opening, a bottom wall spaced a short vertical distance below the lower end of said annular wall, end walls spaced from opposite sides of said annular wall and defining therewith air inlet and outlet chambers, and vertically short, outwardly and downwardly extending opposed side walls between said end walls and connecting said annular wall with said bottom wall, said side and bottom walls defining a short vertical space below the lower end of said annular wall and slightly wider than said passage, a wall pivotally supported in said hopper, an extension from said pivoted wall small in cross section as

compared with the cross sectional area of said passage and extending lengthwise of said passage and into said short vertical space, and means connected to said extension in said short vertical space and extending through the inlet chamber and the adjacent end wall for reciprocating said pivoted wall about its support, and vacuum creating means connected with said outlet chamber for creating a flow of air through said vertical space from the inlet chamber to the outlet chamber while ash agitated by said reciprocating wall is flowing from said passage into said short vertical space.

2. Ash handling apparatus including an ash hopper having a discharge opening in its lower portion, a housing below said hopper, said housing comprising an annular wall defining a passage communicating at its upper end with said hopper discharge opening, a bottom wall spaced a short vertical distance below the lower end of said annular wall, end walls spaced from opposite sides of said annular wall and defining therewith air inlet and outlet chambers, vertically short, outwardly and downwardly extending opposed side walls between said end walls and connecting said annular wall with said bottom wall, a pipe in said short vertical space and extending from an open end in the inlet chamber to an open end in the outlet chamber, said side and bottom walls defining a short vertical space below the lower end of said annular wall and slightly wider than said passage, a wall pivotally supported in said hopper, an extension from said pivoted wall small in cross section as compared with the cross sectional area of said passage and extending lengthwise of said passage and into said short vertical space, and means connected to said extension in said short vertical space and extending through the inlet chamber and the adjacent end wall for reciprocating said pivoted wall about its support, and a vacuum creating means connected with said outlet chamber for creating a flow of air through said short vertical space through the inlet chamber to the outlet chamber while ash agitated by said reciprocating wall is flowing from said passage into said short vertical space.

3. Ash handling apparatus including an ash hopper having a discharge opening in its lower portion, a housing below said hopper, said housing comprising an annular wall defining a passage communicating at its upper end with said hopper discharge opening, a bottom wall spaced a short vertical distance below the lower end of said annular wall, end walls spaced from opposite sides of said annular wall and defining therewith air inlet and outlet chambers, and vertically short outwardly and downwardly extending opposed side walls between said end walls and connecting said annular wall with said bottom wall, said side and bottom walls defining a short vertical space below the lower end of said annular wall and slightly wider than said passage, a wall pivotally supported in said hopper, an extension from said pivoted wall small in cross section as compared with the cross sectional area of said passage and extending lengthwise of said passage and into said short vertical space, a perforated plate extending horizontally in said short vertical space below said passage and connected to the lower end of said extension, and means extending from said plate through the adjacent end wall of the housing for the reciprocating said perforated plate, and a vacuum creating means connected with said outlet chamber for creating a flow of air through said vertical space through the inlet chamber to the outlet chamber while ash agitated by said reciprocating wall is flowing from said passage into said short vertical space.

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