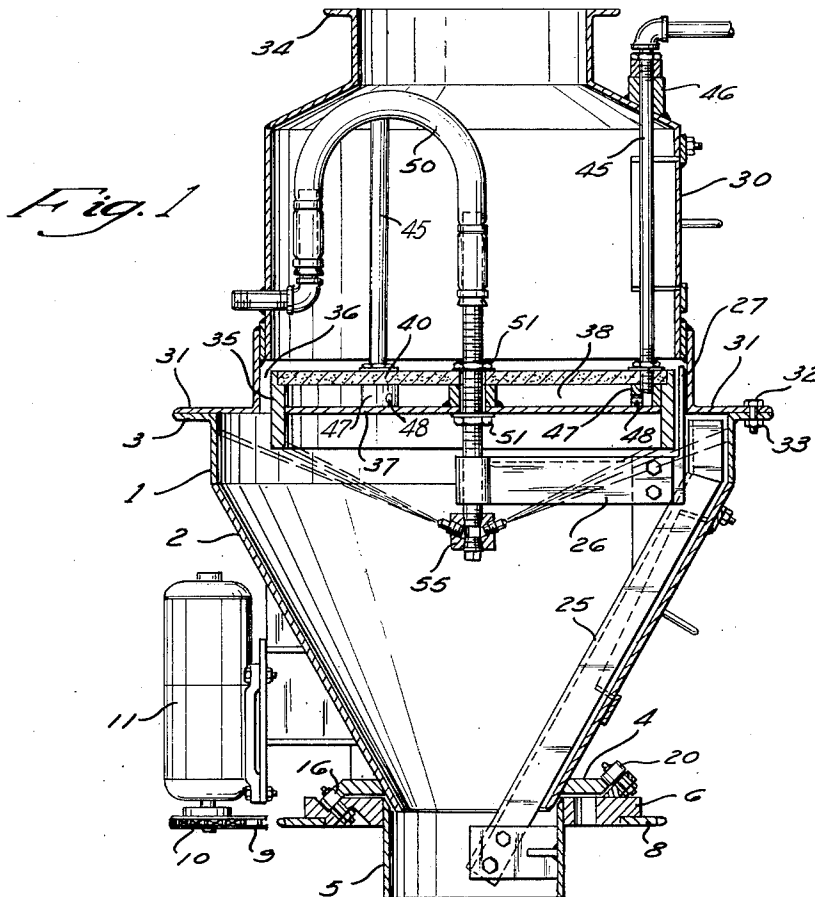
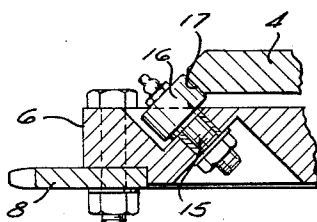
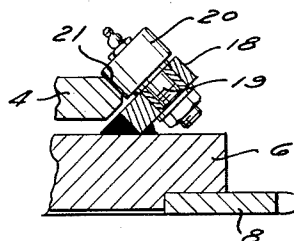


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L. E. MYLTING ET AL
DUST HANDLING APPARATUS

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3,038,482

DUST HANDLING APPARATUS

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This invention relates to the art of handling fine solids and is particularly concerned with new apparatus for handling dust and fitting it for ease in handling.

In certain industries very finely divided solids, frequently referred to as dust, are produced in quantity and are quite difficult to dispose of in the dry condition or to wet to the extent necessary for easy handling. One illustration of such dust and dust handling problem is found in the fine ash produced in the generation of power in powdered fuel burning furnaces. The gases flowing from such a furnace to the stack contain finely divided solids, for example, particles less than 200 mesh in size, and these solids are separated from the gases and are collected in cyclone hoppers whence they must be periodically removed for disposal. Since they are separated from the gases while dry they are in dry condition in the hopper. Various proposals have been made over a span of many years as to how such dust could be handled from the collecting hopper to a place of disposal but, so far as we know, none of these proposals has been entirely satisfactory.

The present invention aims to provide a simple and yet highly effective and efficient device for putting the dry dust into a condition such that it can be readily handled between the collecting hopper and a place of disposal, for example, in an open top truck.

The present invention will be better understood by those skilled in the art from the following description taken in connection with the drawing which accompanies and forms a part of this specification and in which:

FIGURE 1 is a central vertical sectional view of a preferred form of apparatus embodying the present invention; and

FIGURES 2 and 3 are fragmentary, sectional views of parts of the apparatus of FIGURE 1.

In the drawings, the hopper 1 is open at the top and bottom and is provided with a frusto-conical side wall 2 having outwardly extending flanges 3 and 4 at its upper and lower ends. A nozzle 5 open at both ends is positioned closely adjacent to the bottom end of the hopper 1 and is provided with an outwardly extending flange 6 carrying on its lower side a sprocket 8. A chain 9 engages this sprocket and a sprocket 10 maintained on the rotor shaft of a motor 11 which is attached by bracket 12 to the side of hopper 1.

The flange 6 is provided with oppositely positioned shafts 15 inclined upwardly and outwardly at an acute angle, for example, about 30° to the horizontal. Each shaft 15 is provided with a roller 16 which is positioned to bear against a correspondingly inclined annular surface 17 of flange 4. A plurality of brackets 18, circumferentially spaced from shafts 15, are attached to and extend upwardly and outwardly from flange 6 at an acute angle, for example, about 30° to the horizontal. Shafts 19 secured in brackets 18 carry rollers 20 which run on downwardly inclined annular surface 21 on flange 4. Rollers 20 support nozzle 5 for rotation and rollers 16 prevent the tilting of nozzle 5.

A blade 25 is attached to the inner side of nozzle 5 and extends up along and closely adjacent to the inner

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surface of the frusto-conical wall 2 of hopper 1. This blade terminates preferably close to the upper end of hopper 1 and is stayed by arm 26 which extends to and loosely surrounds pipe 50, presently to be described. Arm 26 has an upwardly projecting finger 27 which extends up through annular space 36, about to be described to prevent accumulation of dust therein.

A dust aerating shell 30 is disposed above hopper 1 and is provided with an outwardly extending flange 31 which rests on, and may be attached to, flange 3 of hopper 1 by any suitable means, for example, by bolts 32 and nuts 33. At its upper end shell 30 is provided with means, for example, the outwardly extending flange 34 by which it may be attached to the lower discharge opening of a cyclone dust collecting hopper (not shown).

Within shell 30 and adjacent to its lower end is disposed a ring 35 which defines with the inner opposed surface of the shell a narrow annular space 36. A disc 37 is secured within, and closes the opening through, ring 35. A porous disc 40 rests on ring 35 and, together with disc 37 defines a vertically shallow chamber 38. A plurality of circumferentially spaced pipes 45 extend through bosses 46 in the upper part of the side walls of shell 30. At their lower ends, pipes 45 have screw threaded engagement with bosses 47 carried by ring 35 and communicate through passages 48 with chamber 38. Pipes 45 support ring 35 and discs 37 and 40. Air under pressure may flow through pipe 45 and passages 48 into chamber 38 whence the air may escape into the porous disc 40 and enter the disc on the top surface thereof with resultant aeration and fluidization of the dust. The aerated dust will flow down through the annular space 36 and into hopper 1.

Means are provided for wetting the dust as it flows through annular space 36. This means, as illustrated, includes a pipe line 50 which extends through a side wall of shell 30 and down through the porous wall 40 and the disc 37, preferably on the axis of the hopper. This pipe 50 may be threaded for nuts 51 which may serve to hold the discs 37 and 40 in assembled position. At its lower end pipe 50 is provided with a nozzle 55 having a plurality of circumferentially spaced apertures through which streams of water, with or without a suitable dust wetting agent, may be discharged. A sufficient number of these apertures is provided so that the liquid sprayed from nozzle 55 will form a substantially continuous circumferential sheet of liquid spray which is directed across the path of the solids flowing down through annular space 36 and into the upper portion of the hopper. Dust wetted by this liquid will collect on the downwardly inclined inner surface of hopper 1 and much of it will be washed down through nozzle 5. Any dust tending to stick to the sloping wall may be removed by the blade 25 as it is moved in close proximity along this surface of the hopper wall by rotation of nozzle 5.

In the illustrated apparatus the radial length of the annular space 36 between ring 35 and the inner surface of the side wall of shell 30 is approximately 3/4 inch, when the ring diameter was 20 inches. These dimensions have been found to be satisfactory.

The effective size of the annular space 36 may be varied by raising or lowering the ring 35, as may be done by correspondingly shifting the pipes 45 since the wall of shell 30 projects inwardly and vertically over the upper edge of ring 35. The range of adjustment of the vertical dimension of this space in the illustrated apparatus is from 0 to about 3/4 inch.

This adjustment can also be made by automatic means either maintaining a constant level above the aerating disc or from any other desired variable. This adjustment can

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also be made to tie into the liquids supply maintaining constant liquid to dust ratio.

The mode of operation and results of the above described embodiment of the present invention are believed to be readily understandable from the foregoing description. However, they may be described briefly as follows. A charge of finely divided solids is placed in shell 30, air under pressure is discharged through pipes 45 into chamber 38 with resultant fluidization of the solids and flow of the fluidized solids down through annular space 36. Liquid under pressure, for example water with or without a wetting agent, is discharged through pipe 50 and nozzles 55 against the fluidized solids flowing through annular space 36 and motor 11 is energized to rotate nozzle 5, blade 25 and finger 27. The blade and finger prevent accumulation of solids on the walls 2, hopper 1 and in annular space 36. The solids and liquid pass out through the nozzle 5.

Having thus described this invention in such full, clear, concise and exact terms as to enable any person skilled in the art to which it pertains to make and use the same, and having set forth the best mode contemplated of carrying out this invention, we state that the subject matter which we have described as being our invention is particularly pointed out and distinctly claimed in what is claimed, it being understood that equivalents or modifications of, or substitutions for, parts of the above specifically described embodiments of the invention may be made without departing from the scope of the invention as set forth in what is claimed.

What is claimed is:

1. A dust conditioner comprising a hopper having an outwardly extending flange near its lower open end, an open end nozzle rotatably supported by said flange and having a scraper extending upwardly along and closely adjacent to the inner surface of said hopper, a shell mounted on the upper end of the hopper and partly defining a dust aerating chamber, means defining with the lower part of said shell a narrow, annular space connecting the interiors of said hopper and shell, means for aerating dust in said shell including a porous wall pervious to air under pressure and disposed in the lower part of the shell, and means for spraying liquid outwardly against aerated dust flowing from said annular space and into said hopper.

2. A dust conditioner comprising a hopper having an outwardly extending flange near its lower open end, an open end nozzle rotatably supported by said flange and having a scraper extending upwardly along and closely adjacent to the inner surface of said hopper, means carried by said hopper for rotating said nozzle, a shell mounted on the upper end of the hopper and partly defining a dust aerating chamber, means defining with the lower part of said shell a narrow, annular space connecting the interiors of said hopper and shell, means for aerating dust in said shell including a porous wall pervious to air under pressure and disposed in the lower part of the shell, and means for spraying liquid outwardly against aerated dust flowing from said annular space and into said hopper.

3. A dust conditioner comprising a hopper having an outwardly extending flange near its lower open end, an open end nozzle rotatably supported by said flange and having a scraper extending upwardly along and closely adjacent to the inner surface of said hopper, a shell mounted on the upper end of the hopper and partly defining a dust aerating chamber, means adjustably positioned in the lower part of said shell and defining a variable annular space connecting the interiors of said hopper and shell, means for aerating dust in said shell including a porous wall pervious to air under pressure and disposed in the lower part of the shell, and means for spraying liquid outwardly against aerated dust flowing from said annular space into said hopper.

4. A dust conditioner comprising a hopper having an outwardly extending flange near its lower open end, an

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open end nozzle rotatably supported by said flange and having a scraper extending upwardly along and closely adjacent to the inner surface of said hopper, a shell mounted on the upper end of the hopper and partly defining a dust aerating chamber, means defining with the lower part of said shell a narrow, annular space connecting the interiors of said hopper and shell, means for aerating dust in said shell including a porous wall pervious to air under pressure and disposed in the lower part of the shell, and means for spraying a substantially continuous circumferential sheet of liquid outwardly toward the upper portion of the hopper and into contact with dust passing from said annular space into said hopper.

5. A dust conditioner comprising a hopper having an outwardly extending flange near its lower open end, an open end nozzle rotatably supported by said flange and having a scraper extending upwardly along and closely adjacent to the inner surface of said hopper, a shell mounted on the upper end of the hopper and partly defining a dust aerating chamber, means defining with the lower part of said shell a narrow, annular space connecting the interiors of said hopper and shell, means for aerating dust in said shell including a vertically shallow chamber partly defined by a porous wall pervious to air under pressure and disposed in the lower part of the shell and an impervious wall spaced below said porous wall, and means for spraying liquid outwardly against aerated dust flowing from said annular space and into said hopper.

6. A dust conditioner comprising a hopper having an outwardly extending flange near its lower open end, an open end nozzle rotatably supported by said flange and having a scraper extending upwardly along and closely adjacent to the inner surface of said hopper, a shell mounted on the upper end of the hopper and partly defining a dust aerating chamber, means defining with the lower part of said shell a narrow, annular space with the interiors of said hoppers and shell, means for aerating dust in said shell including a porous wall pervious to air under pressure and disposed in the lower part of the shell, and a substantially continuous circumferential sheet of liquid spray outwardly toward the upper portion of the hopper and into contact with aerated dust flowing from said annular space and into said hopper.

7. A dust conditioner comprising a hopper having an outwardly extending flange near its lower open end, an open end nozzle rotatably supported by said flange and having a scraper extending upwardly along and closely adjacent to the inner surface of said hopper, a shell mounted on the upper end of the hopper and partly defining a dust aerating chamber, means in the lower part of said shell partly defining a narrow, annular space with the inner surface of the shell and a vertically shallow chamber having a porous top wall pervious to air under pressure, air inlet pipes having outlets at their lower ends into said chamber, and means for spraying a sheet of liquid outwardly toward the upper portion of the hopper and into contact with aerated dust passing from said annular space into the hopper.

8. A dust conditioner comprising a hopper having an outwardly extending annular flange near its lower open end, an open end nozzle rotatably supported by said flange and having a scraper extending upwardly along and closely adjacent to the inner surface of said hopper, a shell mounted on the upper end of the hopper and partly defining a dust aerating chamber, means in the lower part of said shell partly defining a narrow, annular space with the inner surface of the shell and a vertically shallow chamber having a porous top wall pervious to air under pressure, and an impervious bottom wall, air inlet pipes suspending said means in the shell and having outlets at their lower ends into said shallow chamber, and means for spraying a sheet of liquid outwardly toward the upper portion of the hopper and into contact with

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aerated dust passing from said annular space into said hopper.

9. A dust conditioner comprising a hopper having an outwardly extending flange near its lower open end, an open end nozzle rotatably supported by said flange and having a scraper extending upwardly along and closely adjacent to the inner surface of said hopper, a shell mounted on the upper end of the hopper and partly defining a dust aerating chamber, means in the lower part of said shell partly defining a narrow, annular space with the inner surface of the shell, a vertically shallow chamber defined partly by a porous top wall, and an impervious bottom wall, air inlet pipes having outlets at their lower ends into said shallow chamber, and means for spraying liquid into contact with aerated dust flowing through said annular space, said means including a pipe positioned axially in the hopper and a nozzle on the pipe having openings to direct a substantially continuous circumferential sheet of liquid spray outwardly toward the upper portion of the hopper and into contact with dust passing from said annular space into the hopper.

10. A dust conditioner comprising a hopper having downwardly converging walls and an outwardly extending annular flange near its lower open end, an open end nozzle rotatably supported by said flange and having a scraper extending upwardly and outwardly to lie along and closely adjacent to the inner converging surface of said hopper, a shell mounted on the upper end of the

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hopper, and partly defining a dust aerating chamber, means in the lower part of said shell partly defining a narrow, annular space with the inner surface of the shell and a vertically shallow chamber having a porous top wall pervious to air under pressure, air inlet pipes suspending said means in the shell and having outlets at their lower ends into said shallow chamber, and means for spraying liquid into contact with aerated dust flowing down through said annular space, said means including a pipe positioned axially in the hopper and a nozzle on the pipe having openings to direct a substantially continuous circumferential sheet of liquid spray outwardly toward the upper portion of the hopper and into contact with dust passing from said annular space into said hopper.

11. The combination of elements set forth in claim 1 in which a finger is attached to the scraper and extends upwardly in, and substantially to the top of, said annular space and is disposed out of contact with the means defining said space.

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**UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION**

Patent No. 3,038,482

June 12, 1962

Lauritz E. Mylting et al.

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

In the grant, line 4, and in the heading to the printed specification, lines 5 and 6, for "a corporation of California", each occurrence, read -- a corporation of Pennsylvania --; column 4, line 38, for "hoppers" read -- hopper --.

Signed and sealed this 9th day of October 1962.

(SEAL)

Attest:

ERNEST W. SWIDER

Attesting Officer

DAVID L. LADD

Commissioner of Patents