GRAVITY FLOW WETTING AND MIXING DEVICE AND MIXING EXTENSION THEREFOR

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ABSTRACT

A gravity flow wetting and mixing device consisting of an elongated generally vertically oriented hollow container having an input opening at the upper end of one side wall with adjustable flow control baffle means mounted within the upper end of the container and in the trajectory of the input material and a plurality of sets of vertically stacked material mixing, wetting and turning members between the input opening and a bottom output opening. The opposed side walls of the device may be tapered inwardly and adjacent the outlet adjustable baffles may be mounted so that the through-path of the material is at a maximum at the input end and at a minimum at the output opening. The assembly may also include a further mixing box having a plurality of staggered, vertically stacked material mixing and turning members.

5 Claims, 11 Drawing Figures
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GRAVITY FLOW WETTING AND MIXING DEVICE
AND MIXING EXTENSION THEREFOR

BACKGROUND OF THE INVENTION

When handling of gravel aggregate and other free
flowing particulate materials, it is often necessary or
desirable to uniformly wet and mix the particles or ag-
gregate without undue loss or over-use of the wetting
liquid or liquids and thereby reduce handling costs to
a minimum.

OBJECTS OF THE PRESENT INVENTION

It is a primary object of the present invention to pro-
vide an improved wetting and mixing device or box
wherein particulate material is uniformly wetted in a
device having no moving active parts and wherein the
flow of wetting liquid is readily adjustable for optimum
efficiency.

Another object of the present invention is to provide
such a wetting and mixing box wherein the material to
be wetted free falls through the box and the particles
are rotated and mixed at a plurality of transverse,
spaced, vertically stacked mixing and wetting zones.

A further object of the present invention is to provide
such a device wherein the conduits, for directing the
wetting liquid to the particles to be wetted, are pro-
tected by the particle direction changing baffles.

Another object is to provide such a device wherein
the flow path of the material entering the mixing box
may be varied over a substantial range to optimize the
operation of the wetting box at various flow rates and
for various sizes of particulate material to be wetted.

Another object is to provide such a device which in-
cludes a mixing box extension wherein wetted and
mixed materials are subjected to further mixing.

These and other objects and advantages are provided by
a gravity flow wetting and mixing device comprising
an elongated generally vertically oriented hollow con-
tainer; an input opening at the upper end of one side
wall of said hollow container; and adjustable flow con-
trol baffle means mounted within the upper end of the
container in the trajectory of the material entering the
box at the input opening; a plurality of sets of staggered
vertically stacked material wetting, mixing, and turning
members between the input opening and the lower end
of the hollow container; a bottom outlet opening for
said container and means for directing a wetting liquid
to each of the sets of staggered vertically stacked wet-
ting, mixing and turning members.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be more particularly described in
reference to the accompanying drawings wherein:

FIG. 1 is a perspective view of a wetting and mixing
device incorporating the features of the present inven-
tion;

FIG. 2 is a section substantially on line 2—2 of FIG.
1;

FIG. 3 is a section on line 3—3 of FIG. 2;

FIG. 4 is a section on line 4—4 of FIG. 3;

FIG. 5 is an enlarged fragmentary partially sectional
view of the means for varying the position of the flow
control baffle;

FIG. 6 is a section on line 6—6 of FIG. 3;

FIG. 7 is a diagrammatic view of a typical liquid spray
pattern in a zone of opposed spray heads;

FIG. 8 is a fragmentary perspective view of a portion
of the wetting and mixing box and the mixing extension
therefor;

FIG. 9 is a section substantially on line 9—9 of FIG.
8;

FIG. 10 is a section substantially on line 10—10 of
FIG. 8; and

FIG. 11 is a top plan view of the mixing extension.

DETAILED DESCRIPTION OF AN EMBODIMENT
OF THE INVENTION

Referring to the drawing, 10 generally designates the
improved wetting and mixing device or box. The box
comprises top wall 12, front wall 14, back wall 16, and
side walls 18 and 20. The bottom of the box is open at
24 for discharge of the material passing through the
mixer, which material is illustrated as gravel G.

The front wall 14 is provided with an opening 22,
which opening, as more clearly shown in FIG. 3, ex-
tends substantially across the container 10 and close to
the top 12. Further, as more clearly illustrated in FIGS.
2 and 3, the bottom opening 24 has a minimum trans-
verse area formed by sloping or tapering the front and
rear walls 14 and 16 generally inwardly and by a pair
of sloping baffle members 26 and 28 adjacent the bot-
tom outlet 24, as more clearly shown in FIG. 3. The
baffles 26 and 28 are adjustably mounted and each is
provided with a control member 29 having a plurality
of teeth 31 thereon which selectively engage an edge of
the supporting side wall 18 or 20.

Adjacent the input or inlet opening 22 at the upper
end of front wall 14 is means for rotatably mounting a
pulley or roller 30, which pulley or roller is about 20
inches in diameter and has trained thereabout a con-
ventional conveyor belt 32. The mounting means for
the pulley or roller 30 may comprise brackets 34 bored
to receive pulley shaft 36 on suitable bearings not
shown. The mounting of the pulley 30 and its diameter
are so selected that a portion of the traveling conveyor
belt 32 projects into the opening 22 whereby gravel or
the like G being conveyed thereon is directed into the
container 10, as shown by directional arrow A, FIG. 2
of the drawing.

Mounted for adjustable movement in the upper end
of the mixing box or container 10 is a strike plate or
baffle generally designated 36. The baffle 36 is
mounted adjacent its upper end on a transverse shaft
38 having its ends journaled in bores in the upper end
of side walls 18 and 20. The pivotally mounted baffle
plate 36 is mounted for controlled adjustment through
plate adjusting means generally designated 40, as more
clearly shown in FIGS. 2, 3 and 5. Referring to these
drawings, the adjusting means comprises a threaded
shaft 42 which is in threaded engagement with a ball
nut 44 mounted in a curved housing 46 formed by a
pair of plates 48, which are mounted in a bore in back
wall 16 of the mixing box. The radius of curvature of
the ball nut 44 and the radius of curvature of the plates
48 are such that the ball nut has substantially universal
pivotal movement in the wall 16.

The ball nut is provided with a hand engaging inte-
grally formed turning handle 50, whereby upon rota-
tion of the handle 50 the threaded shaft 42 moves in-
w ardly and outwardly in respect to the back wall 16.
The lower end of threaded shaft 42 is flattened and
bored as at 52 and pivotally mounted between a pair of
ears 54 which are secured to the lower end of the baffle
plate 36, as more clearly shown in FIG. 5. A pin 56 connects the pair of ears 54 and the extended flattened end of shaft 42. It will thus be seen that upon rotation of the handle 50, the lower end of the baffle plate 36 is urged forward and away from the pulley 30 to thereby vary the path of the gravel G as it enters the mixing box.

Below the input opening 22 in the mixing box are mounted a pair of liquid distributors or pipes 64 and 66. Each of the pipes 64 and 66 is provided with a plurality of outlet nozzles 68, details of which will be more fully described and shown in reference to FIG. 6.

The outlet nozzles 68 are positioned such that the stream of wetting liquid follows a generally transverse path toward the center of the housing as shown by directional arrows B and thereby the wetting liquid strikes each of the discrete particles G falling therebetween. Where the distance between the pair of side plates or conduits approximately 2 inches in diameter and provided with seven or eight outlet nozzles has been found to be very adequate. As more clearly shown in FIG. 1, liquid distribution conduits 64 and 66 form the legs of a U-shaped conduit 60 center connected to a main distribution header 70. The U-shaped conduit 60 is provided with a pair of flow control valves 72" for leg 64 and 74" for leg 66.

Below the conduits 64 and 66 is mounted a first set of transverse mixing, wetting and turning members generally designated 70. The unit or set 70 comprises a pair of sloping baffles 72 and 74 mounted along side walls 18 and 20 respectively. Further, the wetting and mixing unit 70 comprises three generally V-shaped baffle members 76, 78 and 80 mounted intermediate the baffles 72 and 74 and generally in the same transverse plane.

Beneath each of the baffles 71, 76, 74, 78 and 80 is mounted a fluid distribution conduit 82, 84, 86, 88 and 90, respectively, which conduits 82 and 84 having a plurality of outlet nozzles 68' facing toward the center of the wetting box while conduits 86, 88 and 90 are fitted with pluralities of outlet nozzles 68" arranged in two rows with the two rows facing in opposite directions to provide concentrated spray zones in the spaces between the various pairs of baffles. It will also be particularly noted that baffles 72, 74, 76, 78 and 80 cause the falling particles to split into four paths and particles G striking one of the baffles will be caused to rotate or spin so that surfaces other than those wetted in the uppermost spray zone will not necessarily be rewetted.

Wetting liquid is provided for the conduits 82, 84, 86, 88 and 90 by a generally U-shaped header generally designated 92 having flow control valves 94 and 96 on opposite sides of the primary distribution header 70' previously described. By cutting off flow through valve 96 only valve 94 provides liquid for the headers thus a substantial control of the fluid passing to the conduits 82 through 90 is obtainable by the system of the present invention.

Below the particle wetting, mixing, and turning unit or set 70 is a further wetting, mixing and turning set generally designated 71. The unit 71 consists of a centrally mounted liquid distribution pipe 73 provided with a plurality of oppositely directed outlet nozzles 68". Above the pipe 73 is mounted a single V-shaped baffle member 75. It will be noted that baffle 75 runs 90° to baffles 72, 74, 76, 78 and 80. Pipe 73 is connected to the main header 70' via a manual control valve 77.

Below the particle wetting and mixing set 71 is a further wetting, mixing and turning set generally designated 100. The set 100 comprises a pair of edge baffles 102 and 104 positioned about 6 inches below baffle 75. As in the previous form of the invention, the baffles 102 and 104 lie in the same transverse plane and are 90° displaced in respect to the baffles in the wetting and mixing section 70. As in the previous wetting, mixing and turning sections each of the baffles 102 and 104 is provided with a fluid distribution conduit mounted thereunder which conduits are designated 108 and 110 for baffles 102 and 104, respectively, with each of the conduits being provided with a plurality of outlet nozzles 68" which direct wetting liquid in a generally transverse plane and into the space formed between the baffle sets.

With a washer having a height of about 6 feet from the top 12 to the discharge opening 24 very satisfactory results are obtained when the lowermost turning and mixing section 70 is about 1 foot above the discharge opening; the next higher wetting and turning device or section 71 is 6 inches thereabout and section 70 is about 2 feet above the discharge opening 24 and the first in the series of the wetting sections is about 3 feet above the discharge opening. With the header 70' connected to a 4 inch feeder line generally designated 120, a typical spray section is illustrated in FIG. 7 for one of the passages in the wetting and mixing section 70 position between spray pipes or conduits 88 and 90.

With the outlet 24 having a dimension of about 16 inches between the front wall 14 and the rear wall 16 and a cross dimension of about 4 feet, the wetting and mixing box has a maximum capacity of up to about 2,000 tons of gravel per hour and the system will properly function at a gravel flow rate as low as 500 tons per hour. Functioning with normal water pressure and a 4 inch feeder pipe 120 and with all of the valves 72", 74", 77, 94, 96, 116 and 118 fully opened approximately 800 gallons of water will flow through the plural outlet nozzles per minute which is ample for normal wetting of about 2,000 tons of gravel per hour.

As hereinafter set forth the improved wetting and mixing box may include a mixing extension whereby after the particulate material has been wetted and mixed further mixing without additional wetting may be carried out.

Referring to FIGS. 8, 9, 10 and 11, 200 generally designates an auxiliary mixing box composed of front wall 202, rear wall 204 and end walls 206 and 208. The walls 202, 204, 206 and 208 are assembled to form an elongated vertically directed trough having an upper flared end generally designated 210. The cross dimensions of the lower portion 212 of the auxiliary mixing box is about 2 feet by, for example, about 16 inches whereas the upper part 210 has dimensions of about 4 feet by 16 inches so that discharge from the wetting and mixing device 10 will feed directly into the upper end of the auxiliary mixing box.

Within the confines of the mixing box are a plurality of vertically stacked, oppositely oriented, transverse rows of V-shaped baffles 214. The baffles 214 are similar to those employed in the wetting and mixing box and may be suitably constructed of angle iron 3/16 by 2 by 2 inches with the transverse rows being vertically spaced about 5 inches and with the baffle elements.
being spaced one from the other about for example 8 inches on center in the lower section and from about 4 to 8 inches on center in the upper section 210. While the exact spacing of the plural transverse rows of mixing baffles is not critical and may be varied depending upon the particular materials to be mixed the above dimensions have proved to be very satisfactory. Further it will be appreciated that the length of the auxiliary mixing extension for the wetting and mixing box may be varied substantially and it will be appreciated that the lowermost baffles should be of the type which direct the material being mixed toward the center of the box and away from the side walls as shown by the directional arrows C.

From the foregoing detailed description of a preferred embodiment of my invention, it will be seen by those skilled in the art that the aims and objects hereinbefore set forth and others are fully accomplished.

I claim:

1. A gravity flow wetting and mixing device comprising sidewalls defining an elongated generally vertically oriented hollow container, an input opening at the upper end of one sidewall of said container through which particulate material is forcibly introduced substantially transversely into the container, said container having an open bottom end defining an outlet opening of smaller cross section than said input opening for wetted particulate material and a pair of the sidewalls converging from the input opening to the bottom outlet opening, an adjustable flow control striker means pivotally mounted within the upper end of the container in spaced confronting relation to the input opening and in the flow path of particulate material entering the input opening and against which the material impinges to bounce off thereof and be deflected downwardly towards the bottom outlet opening in a dispersed and separated manner, a plurality of sets of vertically stacked material mixing wetting and turning members between the input opening and said bottom output opening, means for supplying a wetting liquid to each of said material mixing, wetting and turning members, each of said sets of vertically stacked material mixing, wetting and turning members comprising a plurality of material deflecting baffle plates and a liquid conduit co-extensive with each of said baffle plates, a plurality of horizontally directed outlet nozzles from each of said liquid conduits, each of the baffle plates of each of said sets of vertically stacked members being oriented 90° with respect to its vertically opposed baffle plate, and said adjustable striker means comprising an elongated plate, means pivotally mounting said plate along the top wall thereof for arcuate movement towards and away from the input opening and hand-adjusting means for urging said plate in an arcuate path about its pivotal mounting.

2. The invention defined in claim 1 wherein the uppermost set of mixing, turning and wetting members is preceded by wetting conduits.

3. The invention defined in claim 1 including a mixing and turning box attachable to the outlet end of the mixing and wetting device.

4. The invention defined in claim 1 wherein there are three of said superposed vertically stacked material mixing, wetting and turning members.

5. The invention defined in claim 1 wherein the front and back walls taper inwardly from the first in a series of vertically stacked material mixing, wetting and turning members to the bottom output opening, and the sidewalls are provided with adjustable baffle plates at their lower ends. * * * * *