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ANTI-CLOGGING DEVICE FOR DRYWASHER FLOW OPENING

Abstract

A drywasher agitator is configured for use with a hopper and a recovery box. The hopper includes a flow opening formed therein to allow particulate within the hopper to pass through the flow opening and into the recovery box. The recovery box includes a main body and a panel extending from the main body. The agitator includes a wire having a first segment and a second segment. The first segment is connectable to the panel and extends along a first axis and a second segment extends along a second axis angled relative to the first axis. The wire is configured to extend from the panel and into the flow opening during use of the hopper and the recovery box to agitate particulate near the flow opening to mitigate clogging of particulate within the flow opening.

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Background/Summary

CROSS-REFERENCE TO RELATED APPLICATIONS [0001] This patent application claims the benefit of U.S. Provisional Application Ser. No. 63/551,213, filed Feb. 8, 2024, the contents of which are expressly incorporated herein by reference.

STATEMENT RE: FEDERALLY SPONSORED RESEARCH/DEVELOPMENT
[0002] Not Applicable
BACKGROUND
1. Technical Field
[0003] The present disclosure relates generally to a device for use with a drywasher, and more particularly, to an agitator configured to break-up clogged particulate near a flow opening in a drywasher hopper.
2. Description of the Related Art
[0004] The mining of gold, and other precious metals, is a well-known practice. A common piece of equipment used when mining is a drywasher, which may be useful in separating the targeted material from the remaining particulate. A conventional drywasher may utilize forced air to separate heavier materials, like gold, from the lighter materials. A drywasher may include riffles which trap the desired heavier materials, while the lighter materials may be lifted by the forced air, and may flow over the riffles or be blown away.
[0005] The riffles used in a drywasher may be fitted within a recovery box, which may be positioned below a hopper which receives the raw material. A preliminary separation procedure may occur when the raw material is fed into the hopper, which may include a classifying screen. Large particulate may be prevented from passing through the screen, while small particulate passes through the screen and into the hopper. The small particulate travels downwardly through the hopper, and is fed to the recovery box through a flow opening formed in the hopper.
[0006] A significant drawback associated with conventional drywashers is that clogging may occur at, or near, the flow opening. In particular, the small particulate may accumulate and form a blockage to prevent flow through the flow opening. When such blockage occurs, a user may need to suspend operations, and manually clear the blockage. Once clear, the operation of the drywasher may resume. In some instances, blockages may occur every couple of minutes, which may test the patience of the user, as well as act as a severe limitation on the volume of material that may be processed by the drywasher.
[0007] Accordingly, there is a need in the art for a device which mitigates clogging or blockages at, or near, the flow opening on a drywasher. Various aspects of the present disclosure address this particular need, as will be discussed in more detail below.
BRIEF SUMMARY
[0008] In accordance with one embodiment of the present disclosure, there is provided a device specifically designed to reduce clogging in a drywasher. In particular, an anti-clogging device may be attached to a recovery box and may move with the vibrations of the recovery box during operation thereof to agitate particulate near a flow opening formed in a hopper positioned above the recovery box. The agitation provided by the device may mitigate clogging of particulate at the flow opening to allow for more continuous, uninterrupted operation of the drywasher.
[0009] According to one embodiment, there is provided a drywasher comprising a hopper having a base and a sidewall extending from the base. The base and sidewall collectively define a hopper reservoir, with the base having a flow opening formed therein and in communication with the hopper reservoir. The hopper is configured to receive particulate within the hopper reservoir and allow the particular to pass through the opening formed in the base. The drywasher additionally includes a recovery box having a main body and a panel extending from the main body. The

recovery box is positionable in proximity to the hopper to receive at least a portion of the particulate having passed through the flow opening. The recovery box is configured to vibrate to facilitate sorting of the portion of the particulate received at the recovery box. An agitating body is connectable to the panel of the recovery box and is configured to extend from the panel and into the flow opening of the base when the agitating body is connected to the panel and the recovery box is in proximity to the hopper. The agitating body is moveable relative to the hopper to agitate particulate near the flow opening to mitigate clogging of particulate within the flow opening.
[0010] The agitating body may include a wire having a first segment extending along a first axis and a second segment extending along a second axis angled relative to the first axis. The agitating body may further include a threaded body extending around a portion of the wire. The threaded body may be tig welded to the wire. The panel may include an opening formed therein, and the threaded body may be advanceable through the opening in the panel to facilitate connection of the threaded body to the panel.
[0011] The wire of the agitating body may include a proximal end portion coupled to the panel and a distal end portion extending away from the panel, with the distal end portion having an enlarged body. The enlarged body may be of a bulbous configuration.
[0012] According to another embodiment, there is provided an agitator configured for use with a hopper and a recovery box. The hopper includes a flow opening formed therein to allow particulate within the hopper to pass through the flow opening and into the recovery box. The recovery box includes a main body and a panel extending from the main body. The agitator includes a wire having a first segment and a second segment. The first segment is connectable to the panel and extends along a first axis and a second segment extends along a second axis angled relative to the first axis. The wire is configured to extend from the panel and into the flow opening during use of the hopper and the recovery box.
[0013] According to yet another embodiment, there is provided a recovery box assembly configured for use with a hopper having a flow opening formed therein to allow particulate within the hopper to pass through the flow opening. The recovery box assembly includes a recovery box having a main body and a panel extending from the main body. The recovery box is positionable in proximity to the hopper to receive at least a portion of the particulate having passed through the opening. The recovery box is configured to vibrate to facilitate sorting of the portion of the particulate received at the recovery box. An agitating body is connectable to the panel of the recovery box and is configured to extend from the panel and into the flow opening when the agitating body is connected to the panel and the recovery box is in proximity to the hopper. The agitating body is moveable relative to the hopper to agitate particulate near the flow opening to mitigate clogging of particulate within the flow opening.
[0014] The present disclosure will be best understood by reference to the following detailed description when read in conjunction with the accompanying drawings.

Description

BRIEF DESCRIPTION OF THE DRAWINGS
[0015] These and other features and advantages of the various embodiments disclosed herein will be better understood with respect to the following description and drawings, in which:
[0016] FIG. **1** is an upper perspective view of a drywasher having an agitating body coupled to a recovery box and extending into a flow opening of a hopper;
[0017] FIG. **2** is a partial, enlarged, rear, upper perspective view of the drywasher depicted in FIG. **1**, particularly depicting the agitating body extending between the recovery box and the flow opening;
[0018] FIG. **3** is an exploded side view of the agitating body;

[0019] FIG. **4** is a cross sectional view of the agitating body coupled to a panel of the recovery box;
[0020] FIG. **5** is a partial, upper perspective view of the agitating body extending from the recovery box and into the flow opening of the hopper; and
[0021] FIG. **6** is a partial, cross sectional view of the drywasher and hopper, with the agitating body extending from the drywasher into the flow opening of the hopper.
[0022] Common reference numerals are used throughout the drawings and the detailed description to indicate the same elements.

DETAILED DESCRIPTION

[0023] The detailed description set forth below in connection with the appended drawings is intended as a description of certain embodiments of an anti-clogging device for a drywasher and is not intended to represent the only forms that may be developed or utilized. The description sets forth the various structure and/or functions in connection with the illustrated embodiments, but it is to be understood, however, that the same or equivalent structure and/or functions may be accomplished by different embodiments that are also intended to be encompassed within the scope of the present disclosure. It is further understood that the use of relational terms such as first and second, and the like are used solely to distinguish one entity from another without necessarily requiring or implying any actual such relationship or order between such entities.
[0024] Various aspects of the present disclosure relate to a drywasher specifically configured and adapted to allow for substantially continuous flow of particulate from an upper hopper to a lower recovery box by mitigating clogging of particulate flowing from the hopper to the recovery box. The drywasher may include an agitator coupled to the recovery box and configured to extend into a flow opening in the hopper. The agitator may vibrate during operation of the drywasher to move within the flow opening and break up congested particulate in, or near, the flow opening to facilitate particulate flow through the flow opening.
[0025] Referring now to the drawings, wherein the showings are for purposes of illustrating preferred embodiments of the present disclosure, and are not for purposes of limiting the same, there is depicted a drywasher **10** for separating precious metal deposits, such as silver and gold, from other sediment. The combination of precious metal deposits and other sediment that may be placed within the drywasher **10** may be referred to herein as particulate.
[0026] The drywasher **10** generally includes a hopper **12**, a recovery box **14**, and an agitator **16**. FIG. **1** shows the drywasher **10** in a deployed configuration, with the hopper **12** being supported by a support frame **18** and the recovery box **14** being suspended from the hopper **12** by chains **20** at one end portion of the recovery box **14** and chains **22** at another end portion of the recovery box **14**. The support frame **18** may include a first pair of support legs **19** and a second pair of support legs **21** pivotally connected to each other. The bottoms of the pairs of support legs **19**, **21** may be moved relative to each other to stabilize the hopper **12** and the recovery box **14**, while also allowing for adjustment in the angle at which the hopper **12** is oriented. In this regard, the first pair of support legs **19** may be attached to one end portion of the hopper **12**, while the second pair of support legs **21** may be attached to another end portion of the hopper **12**. The length of the support legs **19**, **21** may be telescopically adjustable to selectively lengthen or shorten the support legs **19**, **21**, as may be desired.
[0027] The hopper **12** may include a base **24** and a sidewall **26** extending from the base **24**. A peripheral funneling wall **28** may extend from the sidewall **26** at an angle, with the funneling wall **28** flaring upwardly and outwardly from the sidewall **26**. The funneling wall **28** may be configured to catch particulate that may not fall directly into the footprint defined by the sidewall **26**. It is contemplated that the funneling wall **28** may extend from only a portion of the sidewall **26**. In the exemplary embodiment depicted in FIG. **1**, the funneling wall **28** extends from only three sides of the sidewall **26**, with a lower side of the sidewall **26** having no portion of the funneling wall **28** extending therefrom.
[0028] The base **24** and sidewall **26** may collectively define a hopper reservoir **30**. A screen **32** may

extend over the hopper reservoir **30** and may be configured to separate large particulate from smaller particulate. In particular, the screen **32** may have openings formed therein, such that smaller particulate may pass through the openings in the screen **32**, while larger particulate may be prevented from passing through the openings in the screen **32**. The screen **32** may be connected, or otherwise supported by the sidewall **26** and may be sized to substantially cover the hopper reservoir **30**. In this regard, when the screen **32** is installed, the funneling wall **28** may extend upwardly and outwardly from the screen **32**. It is contemplated that the screen **32** may be removed from the hopper **12** and replaced with a screen **32** having openings that are of different sizes. It is also contemplated that in other embodiments, the screen **32** may be riveted in place relative to the hopper **12**.

[0029] The base **24** extends below the screen **32** and may include a flow opening **34** formed therein. The flow opening **34** may be formed adjacent an end portion of the hopper **12**. As can be seen in FIG. **1**, during use, the hopper **12** may be angled during use, with one end portion of the hopper **12** being raised or elevated above the opposite end portion of the hopper **12**. The flow opening **34** may be formed in, or adjacent, the lower end portion of the hopper **12**, which may also be the end of the hopper **12** formed without a funneling wall **28**. The flow opening **34** is configured to be in communication with the hopper reservoir **30** and configured to allow smaller particulate to pass through the flow opening **34** to flow toward the recovery box **14**. One or more opening adjustment panels **36** may be coupled to the base **24** and moveable relative to the flow opening **34** to selectively adjust the effective size of the flow opening **34**. In particular, the adjustment panels **36** may be moveable (e.g., translatable, rotatable, etc.) relative to the base **24** to vary the degree to which each adjustment panel **36** overlaps with the flow opening **34**. As the degree of overlap between the adjustment panel(s) **36** and the flow opening **34** increases, the effective size of the flow opening **34** decreases. Conversely, as the degree of overlap between the adjustment panel(s) **36** and the flow opening **34** decreases, the effective size of the flow opening **34** increases.

[0030] The recovery box **14** is positionable below the hopper **14** in a position to receive smaller particulate that falls through the flow opening **34**. The recovery box **14** generally includes a main body **38** and a panel **40** extending from the main body **38**. The main body **38** may include a bottom wall **42** and sidewall **44** extending from the bottom wall **42**. The sidewall **44** may extend from a periphery of the bottom wall **42**. In one particular embodiment, the sidewall **44** may extend from three edges of the bottom wall **42**, with one edge (e.g., a lowermost edge) not having the sidewall **44** extending therefrom. The bottom wall **42** and the sidewall **44** may collectively define a recovery box cavity **46**.

[0031] The bottom wall **42** may include an opening formed therein, and a blower may be connected to the recovery box **14** to blow air under pressure into the recovery box cavity **46**. The air blown by the blower may facilitate separation of lighter particulate from heavier particulate, to aid in the particulate separation process. Furthermore, a fan **48** may be configured to create a vibration force, which may be transferred to the recovery box **14**, such that when the fan **48** is operating, the recovery box **14** vibrates. The vibration caused by the fan **48** may be created by an asymmetrical weighting of the fan **48**, i.e., one fan blade may be heavier or lighter than the remaining fan blades, such that when the fan **48** rotates, the fan **48** causes vibration of the recovery box **14**.

[0032] It is contemplated that the fan **48** may be in communication with the blower which forces air under pressure through the fan **48**, thereby causing rotation of the fan **48**. A hose **50** may deliver the pressurized air from the blower to the fan **48**. Alternatively, the fan **48** may be powered by an onboard motor to cause rotation of the fan **48**.

[0033] The recovery box **14** may be fitted with various inserts configured to facilitate separation of the particulate received at the recovery box **14** in response to air being blown into the recovery box **14** and in response to vibration of the recovery box **14**. For instance, a riffle assembly **52** having a plurality of riffle structures **54** may be inserted into the recovery box **14**. A diffuser plate and fibrous mat may be placed under the riffle assembly **52** to aid in distributing the pressurized air, and

also to facilitate in the separation of the particulate. For more information regarding the riffle assembly, please refer to U.S. Pat. No. 9,259,740 entitled EXTENDED RIFFLE STRUCTURE FOR A DRYWASHER, U.S. Pat. No. 9,259,740 entitled EXTENDED RIFFLE STRUCTURE FOR A DRYWASHER, the contents of which are expressly incorporated herein by reference.

[0034] As noted above, the recovery box **14** includes a panel **40** extending at an upward and rearward angle from an elevated end portion of the recovery box **14** during use. The panel **40** may be configured to function as a wind shield by blocking wind blowing across the top of the recovery box **14**.

[0035] The agitator **16** (e.g., agitating body) is connectable to the panel **40** and is configured to extend from the panel **40** and into the flow opening **34** during use of the drywasher **10**. In more detail, the agitating body **16** may include a wire **55** having a first segment **56** extending along a first axis **58** and a second segment **60** extending along a second axis **62** angled relative to the first axis **58** by an angle Θ. The angle Θ between the first axis **58** and the second axis **62** may be between 10°-80°, and in some embodiments, between 35°-60°. The angle Θ between the first segment **56** and the second segment **60** may facilitate deployment of the drywasher **10**, and in particular, positioning of the recovery box **14** relative to the hopper **12**, when setting up the drywasher **10** in a desired location.

[0036] The wire **55** may be formed from high carbon steel (e.g., hardened piano wire), or other similar materials known in the art. The wire **55** may include a proximal end portion coupled to the panel **40** and a distal end portion extending away from the panel **40**. In one embodiment, the distal end portion may include an enlarged body **64**, which may be of a bulbous configuration. The enlarged body **64** may be configured to protect a user from scratching or catching on the user's clothes during set up or tear down of the drywasher **10**, and in particular, when moving the hopper **12** having the agitator **16** connected thereto.

[0037] The agitator **16** may further include a threaded body **66** extending around a portion of the wire **55**. In one embodiment, the threaded body **66** includes a bolt having a hole or aperture formed therein, which accommodates receipt of the wire **55**. The threaded body **66** may be tig welded to the wire **55** or secured to the wire **55** via other means known in the art, such as via press-fitting, the use of adhesives or other mechanical fasteners.

[0038] The agitator **16** may be secured to the panel **40** via an opening **68** formed in the panel **40**. In retrofit implementations, the opening **68** may need to be formed in the panel **40** with a drill. The threaded body **66** may be advanceable through the opening **68** such that a shaft of the threaded body extends through the opening **68** with a distal end portion of the shaft protruding through the opening **68** by an amount which allows for threaded engagement with a nut **70**, or other securing/locking mechanisms known in the art. The threaded body **66** may also include a head **72** fixed to the shaft, with the head and the nut **70** being disposed on opposite sides of the panel **40**, and resting tightly against the panel **40**, i.e., the panel **40** is slightly compressed between head **72** and nut **70**.

[0039] With the basic structure of the drywasher **10** having been described above, the following discussion relates to an exemplary use of the drywasher **10**. With the agitator **16** attached to the panel **40** according to the attachment described above, the drywasher **10** is set up/assembled by setting up support frame **18** and hopper **12**. The hopper **12** may be angled to achieve a downward flow of the particulate toward a desired end of the hopper **12**.

[0040] The recovery box **14** is moved into position below the hopper **12**, with the agitator **16** being coupled to the recovery box **14**. The distal end portion of the agitator **16** is moved into proximity to the flow opening **34** of the hopper **12**. Once the distal end portion of the agitator **16** is aligned with the flow opening **34**, e.g., once the second axis **62** extends through the flow opening **34**, the user moves the recovery box **14** to slightly advance the distal end portion of the agitator **16** into the flow opening **34**. Once the recovery box **14** is so positioned, the recovery box **14** is attached to the hopper **12** via the chains **20**, **22**. The chains **20**, **22** may include hooks that may attached to

corresponding rings formed on one of the recovery box **12** or hopper **12** to facilitate such attachment. The effective length of the chains **20**, **22** may be adjusted to eliminate any slack, or alternatively, create additional length, to allow the recovery box **14** to assume a desired position and angular orientation relative to the hopper **12**. If a blower is used in connection with the recovery box **14**, the blower and/or an associated hose **50** may be connected to the recovery box **14**.
[0041] After the drywasher **10** is set up, the blower may be turned on, which causes pressurized air to move through the hose and induce rotation of the fan **48**. As the fan **48** rotates, the recovery box **14** vibrates, which in turn, causes vibration of the agitator **16** within the flow opening **34**, relative to the hopper **12**.
[0042] The user may load the hopper **12** with particulate, with larger particulate being separated from the smaller particulate via screen **32**. The smaller particulate falls into the hopper reservoir **30**, and moves toward the flow opening **34** due to the angular orientation of the hopper **12**. The smaller particulate passes through the flow opening **34** and into the recovery box **14** for further separation.
[0043] Over time, the smaller particulate within the hopper reservoir **30** may begin to accumulate near the flow opening **34**. The position of the agitator **16** and the movement of the agitator **16**, via the vibration of the recovery box **14**, may break up accumulated particulate, thereby allowing the broken-up particulate to more freely move through the flow opening **34**. The agitator **16** may also move rocks or other larger objects that may obstruct passage through the flow opening **34**. Thus, the incorporation of the agitator **16** may allow for more continuous, uninterrupted flow of particulate through the flow opening **34**. As such, the user may not need to pay close attention to possible buildup of particulate near the flow opening **34**, and may not need to shut down operation to clear any buildup. Thus, the agitator saves time and effort during operation of the drywasher **10**.
[0044] While the foregoing describes the agitator **16** as initially being separate from the recovery box **14**, it is contemplated that in certain embodiments, the agitator **16** may be incorporated into the recovery box **14** during initial assembly thereof, or may be more permanently attached to the recovery box, such as via welding of the agitator **16** to the recovery box **14**.
[0045] The particulars shown herein are by way of example only for purposes of illustrative discussion, and are not presented in the cause of providing what is believed to be most useful and readily understood description of the principles and conceptual aspects of the various embodiments of the present disclosure. In this regard, no attempt is made to show any more detail than is necessary for a fundamental understanding of the different features of the various embodiments, the description taken with the drawings making apparent to those skilled in the art how these may be implemented in practice.

Claims

1. A drywasher comprising: a hopper having a base and a sidewall extending from the base, the base and sidewall collectively defining a hopper reservoir, the base having a flow opening formed therein and in communication with the hopper reservoir, the hopper being configured to receive particulate within the hopper reservoir allow the particulate to pass through the flow opening formed in the base; a recovery box having a main body and a panel extending from the main body, the recovery box being positionable in proximity to the hopper to receive at least a portion of the particulate having passed through the flow opening, the recovery box being configured to vibrate to facilitate sorting of the at least a portion of the particulate received at the recovery box; and an agitating body connectable to the panel of the recovery box and configured to extend from the panel and into the flow opening when the agitating body is connected to the panel and the recovery box is in proximity to the hopper, the agitating body being moveable relative to the hopper to agitate particulate near the flow opening to mitigate clogging of particulate within the flow opening.
2. The drywasher recited in claim 1, wherein the agitating body includes a wire having a first

segment extending along a first axis and a second segment extending along a second axis angled relative to the first axis.

3. The drywasher recited in claim 2, wherein the agitating body further includes a threaded body extending around a portion of the wire.

4. The drywasher recited in claim 3, wherein the threaded body is tig welded to the wire.

5. The drywasher recited in claim 3, wherein the panel includes an opening formed therein, the threaded body being advanceable through the opening in the panel to facilitate connection of the threaded body to the panel.

6. The drywasher recited in claim 1, wherein the agitating body includes a wire having a proximal end portion coupled to the panel and a distal end portion extending away from the panel, the distal end portion having an enlarged body.

7. The drywasher recited in claim 6, wherein the enlarged body of a bulbous configuration.

8. An agitator configured for use with a hopper and a recovery box, the hopper having a flow opening formed therein to allow particulate within the hopper to pass through the flow opening and into the recovery box, the recovery box having a main body and a panel extending from the main body, the agitator comprising: a wire having a first segment and a second segment, the first segment being connectable to the panel and extending along a first axis and a second segment extending along a second axis angled relative to the first axis, the wire being configured to extend from the panel and into the flow opening during use of the hopper and the recovery box.

9. The agitator recited in claim 8, further comprising a threaded body extending around a portion of the wire.

10. The agitator recited in claim 9, wherein the threaded body is tig welded to the wire.

11. The agitator recited in claim 8, wherein the second segment includes an enlarged body.

12. The agitator recited in claim 11, wherein the enlarged body of a bulbous configuration.

13. The agitator recited in claim 8, wherein the wire is formed from high carbon steel.

14. A recovery box assembly configured for use with a hopper having a flow opening formed therein to allow particulate within the hopper to pass through the flow opening, the recovery box assembly comprising: a recovery box having a main body and a panel extending from the main body, the recovery box being positionable in proximity to the hopper to receive at least a portion of the particulate having passed through the flow opening, the recovery box being configured to vibrate to facilitate sorting of the at least a portion of the particulate received at the recovery box; and an agitating body connectable to the panel of the recovery box and configured to extend from the panel and into the flow opening when the agitating body is connected to the panel and the recovery box is in proximity to the hopper, the agitating body being moveable relative to the hopper to agitate particulate near the flow opening to mitigate clogging of particulate within the flow opening.

15. The recovery box assembly recited in claim 14, wherein the agitating body includes a wire having a first segment extending along a first axis and a second segment extending along a second axis angled relative to the first axis.

16. The recovery box assembly recited in claim 15, wherein the agitating body further includes a threaded body extending around a portion of the wire.

17. The recovery box assembly recited in claim 16, wherein the panel includes an opening formed therein, the threaded body being advanceable through the opening in the panel to facilitate connection of the threaded body to the panel.

18. The recovery box assembly recited in claim 16, wherein the threaded body is tig welded to the wire.

19. The recovery box assembly recited in claim 14, wherein the agitating body include a wire having a proximal end portion coupled to the panel and a distal end portion extending away from the panel, the distal end portion having an enlarged body.

20. The recovery box assembly recited in claim 18, wherein the enlarged body of a bulbous configuration.