Jan. 4, 1966 C. H. BRADLEY 3,227,327

SELF-CLEANING METERING DEVICE

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Fig. 1.

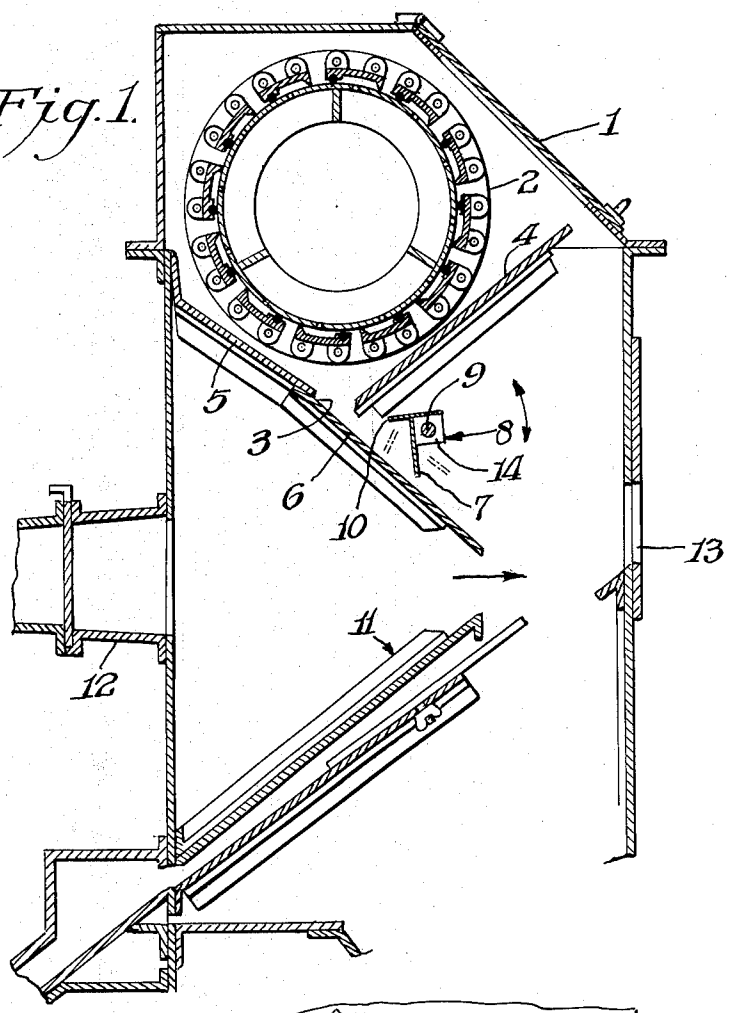
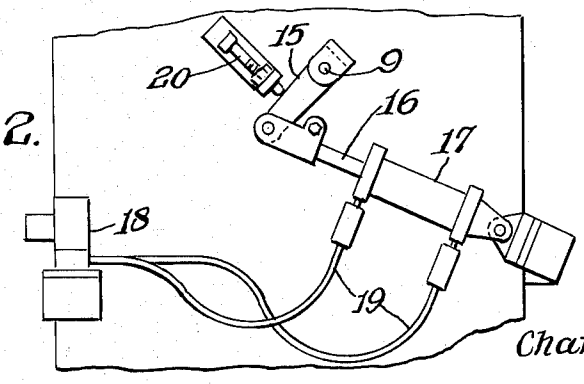


Fig. 2.



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Fig. 3.

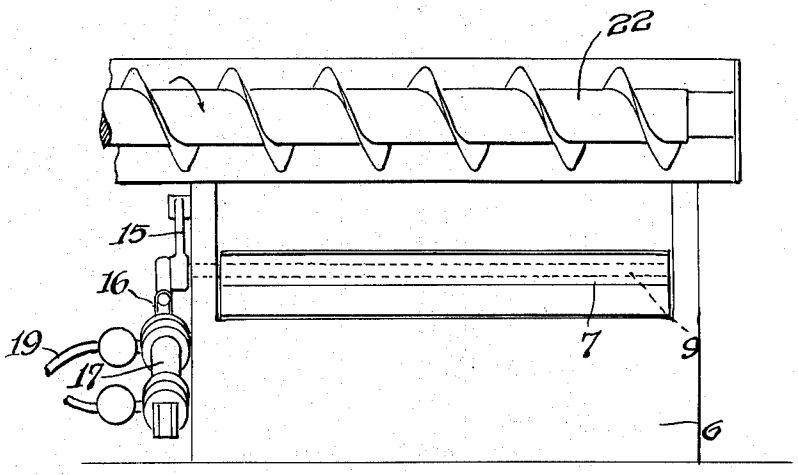


Fig. 4.

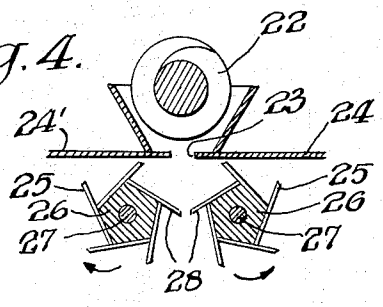


Fig. 5.

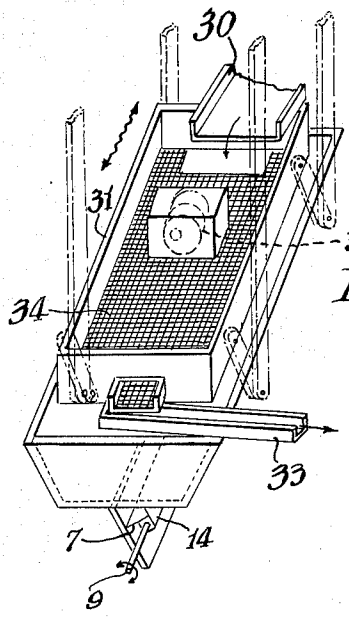


Fig. 6.

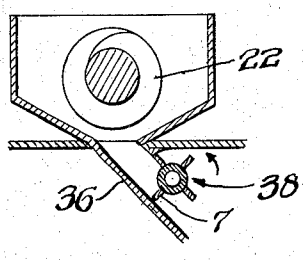
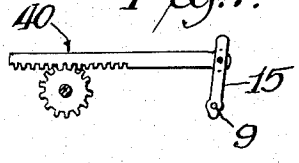


Fig. 7.



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SELF-CLEANING METERING DEVICE

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Filed Aug. 2, 1962, Ser. No. 214,271
1 Claim. (Cl. 222—334)

The invention relates to a metering gate arrangement for controlling the feed of particular matter. More particularly, the present invention is directed to a device which controls a continuous movement of a stream of particles through a narrow opening or port and removes any jam or obstructions therefrom.

The invention is particularly concerned with the handling and sorting of abrasive particles such as are employed in blasting equipment for cleaning, peening, abrading metal pieces.

When using such blasting apparatus, it is most desirous that the blastant particles be collected and recycled through the apparatus. It frequently happens, however, that foreign bodies, fines and conglomerates removed from the metal or other pieces being cleaned tend to accumulate and interfere with their reuse. This foreign matter must first be removed before it can be recycled through the apparatus. One very useful technique for effecting such removal passes a jetstream of air through a thin, evenly-distributed curtain of the contaminated particles as they are being recycled. Although the technique is found useful and generally achieves the objectives intended, it is difficult to consistently obtain an even flow and distribution of particles in view of jams and blockages which tend to form in the contaminated particles. This is particularly the case when narrow passages are used to control particle flow. When a blockage occurs in such a device, it is essential that the condition be corrected as soon as possible. This usually requires machine shut down in order to remove the blockage or the control port must be temporarily enlarged to allow free passage of the block. The resulting variations in flow are undesirable and generally result in inefficient operation.

It is therefore an object of the present invention to provide a suitable gate and metering device for clearing obstructions without the necessity of machine shut down, or interruption, or variation in the flow of particulate matter.

It is a further object of the present invention to provide a suitable device for preventing blockage of narrow particle or abrasive feed ports by the periodic automatic clearing of small obstructions at a predetermined frequency.

Other objects and a fuller understanding of the invention may be obtained by referring to the following description and claims taken in conjunction with the accompanying drawings wherein:

FIGURE 1 is a longitudinal section view, partly broken away, of a particle sorting, cleaning and feeding device of the present invention;

FIGURE 2 is a detail showing one embodiment for operating the metering gate;

FIGURE 3 is a side view partly broken away of a worm feeding arrangement for feeding the contaminated particles or abrasive to the metering slot;

FIGURE 4 is a detail partially in section showing a double gate arrangement for the metering slot;

FIGURE 5 is a further detail showing another embodiment for feeding the contaminated abrasive to the metering gate.

FIGURE 6 is a detail partially in section showing a further embodiment of a metering gate, and

FIGURE 7 is a detail showing another modification for operating the metering gate.

In accordance with the present invention, an obstruction may be cleared from a port or narrow discharge opening without requiring complete shutdown or loss of control of particle flow by employing a particular type of metering gate. Such a device preferably contains at least one rotatably mounted central element to which are secured a plurality of spaced vanes or blades. The vanes are in intersecting planar relationship such as a radial arrangement or intersecting abutting relationship at an angle not substantially greater than about 120°. By utilizing a vane as one side of a discharge port, it is possible to conveniently enlarge the port at will by rotation or oscillation of the central element while, at the same time, maintaining flow control by means of an additional vane or vanes which rotate into the position formerly occupied by the rotated vane which served as the side of the discharge port.

For the purpose of the present invention, each vane can be in the form of an elongated rectangular plate secured at the end or along the side to the face of a central element. Such central element can be cylindrically shaped with slots for mounting the vanes, or a polysided element having a triangular, square, pentagonal, or a hexagonal cross section. The central element can, if desired, also be keyed directly to a rotatably mounted shaft of convenient length.

The shaft, in turn, is conveniently oscillated or rotated by means of an arm keyed to one end of the shaft and movably pivoted at the end remote from said shaft to a member adapted for linear reciprocal movement. The movement may also be obtained by a belting or gearing arrangement, or similar device employed to obtain rotational movement.

For the purpose of the present invention, a single shaft of from about 3 to 10 feet in length having keyed thereto at least two cube-shaped central elements is deemed sufficient. The vanes are secured to the central element and project outwardly or overhang by at least one-half the distance of an edge, such an arrangement can be employed together with a permanent wall or chute with one of the vanes lying in the particle discharge path of the chute. It is also possible, however, to employ a duplicate metering arrangement whereby both units may be rotated simultaneously or individually as required to remove and replace the vanes in the path of the particles being discharged.

For the purpose of the present invention, a number of devices may be employed to supply the particulate matter to be metered. A screw conveyor, a movable chute, an open vibratory screen arrangement or even a rotational screened scalping drum have been found suitable.

In FIGURE 1, there is shown one suitable form of the cleaning and metering device of the invention. As seen therein, a housing **1** includes a rotatable scalping drum **2** for introducing and recycling the abrasive contaminated with fines and other foreign matter. The specific construction and operation of the scalping drum **2** is disclosed in U.S. Patent No. 2,771,189. From the drum **2**, the contaminated particles or abrasive passes through a central opening or port **3** formed by permanent plates **4** and **5**. Actually, the plates **4** and **5** serve to collect a supply of particles before passing through port **3**. From this port the abrasive passes downwardly on to a fixed slide **6**. The particles then slide through the opening formed by vane **7** of the gate assembly **8** and the fixed conveying slide **6**. This opening or metering slot provides a slot of about ¼ to ⅜ of an inch through which the particles are metered.

It is necessary to relieve or fully open this formed

metering slot periodically; otherwise, it will become clogged or jammed. To accomplish this periodic opening or relieving of the formed metering slot, the gate assembly **8** is rotated by its mounting shaft **9** whereby vane **7** is moved to the adjacent dotted line position shown in FIGURE 1 while vane **10** is rotated to its adjacent dotted line position. By this action, the clogging or jamming of the abrasive is completely removed and a new metering slot is formed as vane **10** moves into its dotted line position. After approximately 10 seconds, the rotation of the gate is reversed and vanes **7** and **10** return to their full line position.

The gate assembly may be rotated approximately every 10 minutes as explained above to relieve or prevent clogging or jamming. The time period involved can vary according to conditions encountered in the operation.

The abrasive particles having passed through the metering slot formed by vane **7** and slide **6** then drop off the end of slide **6** into free fall drop to be picked up by a chute generally indentified as **11** by which it is passed to a suitable supply hopper (not shown) for the blasting wheel operation.

During the free fall, a suction is created in the direction of the arrow shown in the free fall area by introducing air into the housing **1** through inlet **12** and withdrawing outlet **13** in the opposite side of the housing **1**. The air suction flow removes the fines from the heavier blastant particles, thus providing clean abrasive of suitable size for the blasting operation.

FIGURE 2 shows one device for operating the gate assembly **8** of FIGURE 1. As seen there, a shaft **9** supporting the cube-shaped vane support **14** (FIGURE 1) and the vanes **7** and **10** are connected with a rocking arm **15** which in turn is connected to the shaft **16** of an air operated cylinder **17**. The cylinder **17** is actuated to move the shaft **16** back and forth as explained above with respect to FIGURE 1 by a solenoid valve **18** through suitable connections **19**. Adjusting screw **20** is used to limit or adjust the range of movement of rocking arm **15**.

FIGURE 3 shows another embodiment for feeding the abrasive to the fixed slide **6** and the metering slot formed by the slide **6** and vanes **7** and **10**. As shown therein, a screw conveyor **22** is provided for receiving and advancing the abrasive to the metering slot.

FIGURE 4 illustrates the double wheel metering gate assembly for accomplishing the objects and purposes of the invention. Here, the conveyor screw **22** feed the contaminated abrasive through port **23** formed by plates **24, 24'**. The vanes **25** are supported here on polysided supports **26** mounted on rotatable shafts **27**. In this case, the vanes **28** (which are driven by any conventional means or by the various means described, in this application) cooperate with one another as shown in the figure to form a narrow metering slot through which the abrasive passes from opening **23**. As the vanes are rotated periodically, the subsequent adjacent vanes move around to assume the position of the withdrawn vanes.

FIGURE 5 shows another modification for feeding the abrasive to the metering slot. The abrasive is introduced through feeding slide **30** into a vibratory screen device **31** which is vibrated by eccentric weight-shaft mechanism **32**. The larger undesirable abrasive cannot pass through smaller screen openings and is discharged from the opposite end of the screen box **31** on to trough **33**. The suitable size abrasive passes through screen **34** to the metering slot formed by vane **7**.

FIGURE 6 shows a further modification of the assembly wherein the abrasive fed by screw conveyor **22** drops through chute **36** and through a metering slot formed by vane **7**. A following vane shown in FIGURE 6 forms an extension of one wall of the chute **36** in the sense that this vane which is parallel to chute **36** acts as a top for chute. As the gate **38** is rotated periodically, the following vanes **7** move into the positions occupied by withdrawn vanes **7**.

FIGURE 7 shows another modification for operating the gate assembly **8** wherein ratchet wheel assembly **40** operates the rocker arm **15** to rotate the shaft **9** for the gate assembly **8**.

Obviously many modifications and variations of the present invention are possible in the light of the above teaching. It is, therefore, to be understood that within the scope of the appended claim the invention may be practiced otherwise than as specifically described.

What is claimed is:

A particulate metering device comprising, in combination, particle collecting means, a discharge port in said particle collecting means, conveying means positioned to receive the particles discharged from said collecting means, said conveying means comprising an inclined chute in line with said discharge port, a gate and metering device, said gate and metering device having a central element, drive means for rotating said central element, said drive means including oscillating means for rotating said central element in two directions, said oscillating means comprising an arm keyed to said central element, a linkage pivoted to the end of said arm remote from said central element whereby a linear reciprocal movement is transmitted to said central element as oscillating rotational movement, said linear reciprocal movement being obtained by a fluid-actuated cylinder and piston assembly pivoted at one end to said arm, adjustable stop means limiting the movement of said arm, a pair of relatively elongated vanes on said central element, one of said vanes being disposed toward said chute to form a metering slot with respect to said chute, and the other of said vanes being disposed above said chute to act as a top for said chute whereby said oscillating means may intermittently alternate the relative disposition of said vanes with respect to said chute to prevent clogging of the metering slot and to maintain the area of the metering slot substantially constant after either of said vanes is rotated toward said chute.

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