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DISTRIBUTOR FOR DENSE PARTICULATE MATERIAL

Filed Aug. 28, 1964

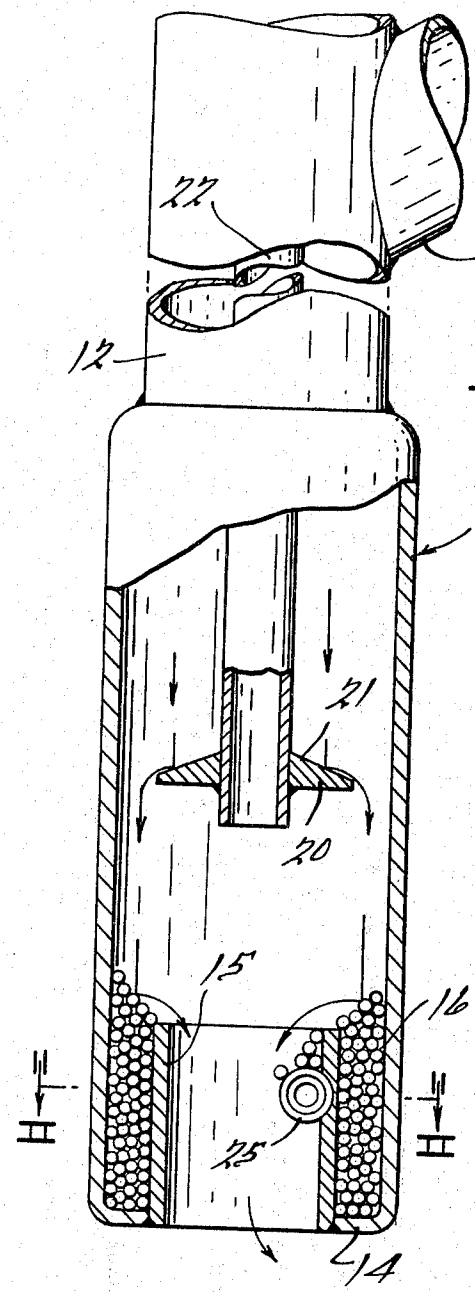

FIG. 1.

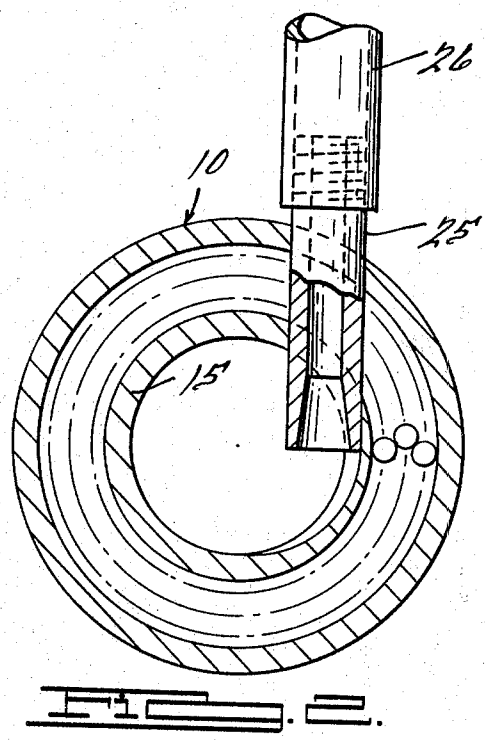

FIG. 2.

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DISTRIBUTOR FOR DENSE PARTICULATE MATERIAL

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9 Claims. (Cl. 51—11)

The present invention relates to devices for distributing hard objects or particles such as steel shot, and particularly to improved means for achieving a relatively uniform and widely distributed spread of such particles where a reliable uniformity of scattering is desired, as for example in the cleaning of tubular boilers and other heat exchanging apparatus. It has become common to employ spherical shot of approximately ¼-inch diameter, which is permitted to cascade downwardly under the influence of gravity over and among the tubes of superheaters, economizers, preheaters and other surfaces of heat exchanging apparatus to dislodge fouling materials. An important object of the invention is to provide a distributing device of the indicated character which, while achieving a high degree of uniformity of distribution of the shot or other material, is so designed as to reduce to a minimum the tendency of the shot to cause undue wear of the distributing mechanism itself.

Other objects and advantages will become apparent upon consideration of the present disclosure in its entirety.

In the drawing:

FIGURE 1 is a view principally in diametric longitudinal section but partly in side elevation of my preferred distributing mechanism, and

FIGURE 2 is a cross sectional view thereof taken substantially on the line II—II of FIGURE 1 and looking in the direction of the arrows.

Referring now to the drawing, reference character **10** designates generally the cylindrical casing of my improved distributor. In a successful embodiment of the invention the casing **10** is formed of 4 inch standard pipe. In use it is supported on a vertical axis in a suitable position above the surface areas over which the shot is to be distributed. The inlet pipe **12** through which the shot is delivered to the casing **10** may serve to support the latter.

The inlet pipe may be conventional 3 inch pipe, welded to the upper end of the casing **10**, the latter being necked inwardly to join the inlet. At its lower extremity the casing is also swaged or otherwise flanged inwardly, as indicated at **14**, such in-flanged portion being sized to accept a re-entrantly projecting cylindrical member **15** which in the preferred embodiment referred to is formed of 2½-inch standard pipe welded at its lower end to flange **14**. The wall defined by pipe section **15** forms the outlet orifice and also cooperates with the casing wall to define an upwardly opening annular retarder pocket **16** within the casing and in which shot accumulates.

A shot inlet feed pipe **18** opens laterally into the vertical supporting inlet pipe **12** to permit the introduction of shot, which may be delivered to the pipe **18** through the agency of suitable transporting means such as a continuous hoist or lift (not shown).

Supported within the casing **10** in a position concentric with the axis is a deflector disc **20** which is somewhat smaller than the internal diameter of the casing but preferably larger than the internal diameter of the outlet orifice member **15**. Disc **20** is provided with a top surface portion **21** which slopes angularly outwardly and downwardly in all directions at an acute angle to the horizontal and is supported in axial position in the casing by an axially extending rod or pipe, shown as a depending supporting pipe **22**. It will be appreciated that the supporting pipe portions **12** and **22** may be carried from their tops (not shown) by suitable flanges and/or weldments or other appropriate conventional mechanical attachment to the supporting structure of the boiler setting or other heat exchanger structure.

A tubular nozzle member **25** extends through the side walls of casing **10**, outlet member **15**, the outlet end of nozzle member **25** discharging within outlet member **15** in a position relatively close to and substantially tangential with respect to the inner wall of member **15**. Nozzle **25** is supplied with a suitable fluid such as air through a pipe **26**. Nozzle member **25** is spaced below the top of outlet member **15**. Although the nozzle member is shown with its axis horizontal and has been successfully operated in such position under conditions which will be referred to hereinafter, the nozzle may be sloped upwardly or downwardly to increase or decrease the downward component of gravity on the shot, as the design considerations of the particular installation may make preferable.

Although the first shot entering through the pipe **18** falls freely within the casing **10** until it either strikes the deflector surface **21** or, if it misses the deflector plate, strikes the shot which is normally present in the retarder box defined by the annular space **16**, the shot which first strikes the deflector disc **20** is retarded and bounces upwardly and radially. Under normal conditions a sufficient quantity of shot is constantly striking and bouncing upwardly from the deflector disc so that the great majority of the shot is arrested by other shot before it could strike the disc **20**. The shot, so arrested, then flows downwardly around the disc **20** and onto the accumulated shot in the retarder box section **16**, and then overflows inwardly and downwardly into the open upper end of outlet member **15**. The shot thus enters member **15** substantially free from gravitational acceleration yet without having severely impacted any portions of the distributor structure.

The nozzle **25** imparts an angular orbital velocity to the shot, which is whirled by the air blast in the lower portion of member **15**, and due to its angular velocity the whirled shot is projected outwardly by centrifugal force as it leaves the lower end of outlet **15**. It will be noted, however, that some of the shot which enters the upper end of outlet member **15** is required to pass over the top of air nozzle **25**, which thereby positively assists in directing some of the shot inwardly toward the center. Due to such deflecting tendency of the nozzle **25**, and the relatively large volume of shot, some of the shot which falls downwardly near the axis of member **15** receives little or no angular acceleration from the air blast and thus falls more nearly straight, to cover the more central areas of the pattern of distribution.

With a distributor of the construction disclosed having the outlet 36 inches above a surface area to be covered, very uniform distribution over an area of 144 square feet is obtained with an airflow of 106 c.f.m. and a shot delivery rate of approximately 87.7 lbs. per minute.

With the distributor somewhat higher above the area to be covered, a substantial reduction in the air requirement is obtainable, although the area covered is also somewhat reduced. Effective coverage of an area of approximately 100 square feet has been obtained with an airflow of only 73 c.f.m. when the distributor outlet height is raised to 42 inches, with a short delivery rate of 78.7 lbs. per minute.

While it will be apparent that the preferred embodiment of the invention disclosed is well calculated to fullfill the objects above stated, it will be appreciated that the invention is susceptible to modification, variation and change

without departing from the proper scope or fair meaning of the subjoined claims.

What is claimed is:

1. In a construction for distributing a plurality of solid objects over a desired area, in combination with an upright hollow casing having an upper inlet portion for objects to be distributed and having means defining a bottom outlet bounded by a wall of circular cross section, a deflector element within the casing between the inlet portion and said outlet and at least partially obstructing the flow of objects through said casing to the outlet, and means for delivering a flow of fluid through said wall and into the outlet in a generally tangential direction to impart orbital rotation to objects in said outlet, whereby centrifugal force causes lateral dispersion of objects escaping from the outlet.

2. A construction as defined in claim 1 wherein said wall is of lesser diameter than and projects upwardly into the interior of the casing from the bottom and coacts with the casing to define a pocket-like receptacle surrounding the wall and open at its top within the casing at a position below the deflector element.

3. A construction as defined in claim 1 wherein said wall projects upwardly into the interior of the casing from the bottom and coacts with the casing to define a pocket-like receptacle surrounding the wall and open at its top within the casing, the deflector element being positioned to deflect objects away from the outlet and into the receptacle.

4. A construction as defined in claim 3 wherein the casing is of tubular form and the deflector and the outlet wall are concentric with the axis of the casing and are lesser diameter than the interior of the casing.

5. A construction as defined in claim 1 wherein the deflector has a downwardly and outwardly sloping top surface.

6. A construction as defined in claim 1 wherein the deflector has a downwardly and outwardly sloping top surface lying at an acute angle to the horizontal whereby objects falling thereupon tend to bounce upwardly and outwardly toward the wall of the casing and thereby obstruct the free fall of other objects through the casing.

7. A construction as defined in claim 4 wherein the deflector has a downwardly and outwardly sloping top surface lying at an acute angle to the horizontal whereby objects falling thereupon tend to bounce upwardly and outwardly toward the wall of the casing and thereby obstruct the free fall of other objects through the casing.

8. A construction as defined in claim 3 wherein the means for delivering fluid comprises a nozzle member partially obstructing the outlet whereby a certain number of objects overflowing from the receptacle are required to pass over the nozzle member toward the center of the outlet.

9. A construction as defined in claim 3 wherein the means for delivering fluid includes a conduit element extending through the casing and opening through said wall at a position below the top of the receptacle, whereby objects accumulating in the receptacle cover said conduit element.

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