Oct. 16, 1945. G. T. PEARCE ET AL 2,386,975

APPARATUS FOR RECOVERING WASTE MATERIALS

Filed June 27, 1941 2 Sheets-Sheet 1

Fig. 1.

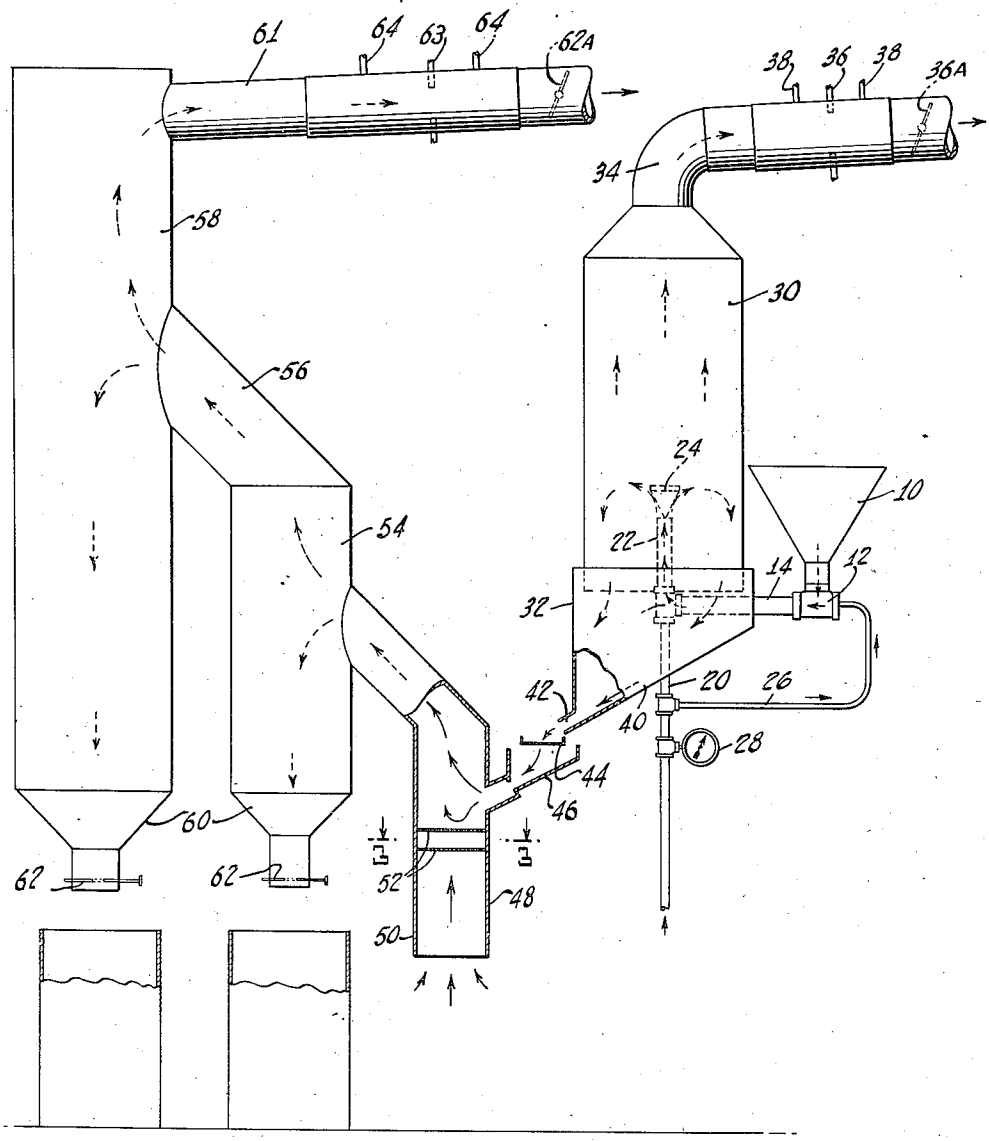

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Fig. 2.

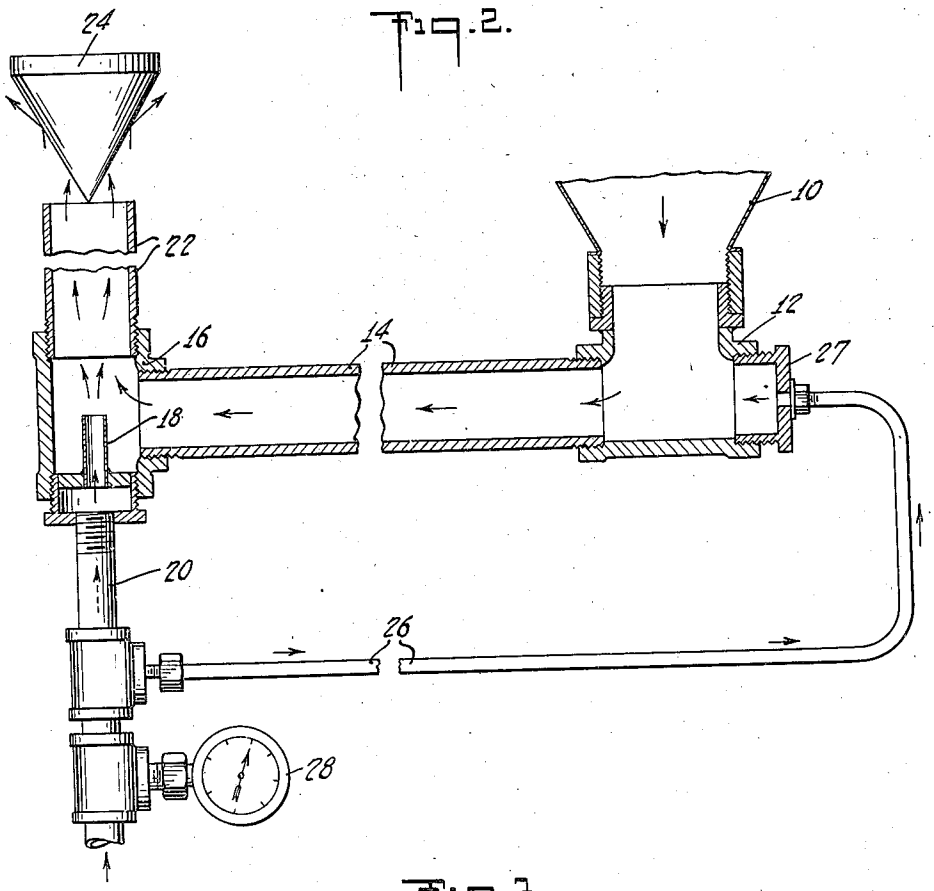
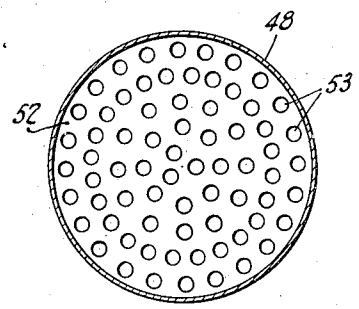


Fig. 3.



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APPARATUS FOR RECOVERING WASTE MATERIALS

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Application June 27, 1941, Serial No. 400,126

6 Claims. (Cl. 241—40)

The instant invention relates to the recovery of waste materials for use in the manufacture of commercial products, and, in a more specific phase, to the recovery of fibre-free mineral wool granules or particles, normally termed "shot," from the masses of shot and fibre collected in the shot traps of a mineral wool forming apparatus.

In the conventional manufacture of mineral wool, a stream of molten raw material is subjected to a steam blast, or the like, and thereby converted into a major proportion of fibres and a minor proportion of substantially spherical unfiberized particles or shot, partially formed fibres, coarse fibres, fibre bundles, and the like, which are deleterious to mineral wool products and, hence, are separated from the fibres as much as possible by the use of shot traps and the like. The shot, coarse fibres, and fibre bundles form a mass in the traps. The shot, which is of substantially uniform specific gravity but varies in size, includes substantial fractions which have been determined to be of real utility in substitution for sand and other granules as employed, for example, in the manufacture of roofings and sidings. However, for this and other commercial purposes, the shot must be substantially completely free of fibre or partially formed fibre, a requirement which has heretofore prevented any substantial commercial use of the shot.

The principal object of the instant invention is the provision of a method and apparatus for recovering waste material of the type referred to for commercial use.

Another object of the invention is the provision of a method and apparatus for separating mineral wool shot from fibres and the like with which it is intermixed.

Another object of the invention is the provision of a method and apparatus for separating mineral wool shot from a fibrous intermixture and for classifying the recovered particles as to size in a continuous operation.

A further object of the invention is the provision of a method and apparatus of the type referred to, adapted for high capacity and low cost commercial operation.

Briefly stated, our invention resides in the provision of a method and means whereby a mixture of shot and fibre, as it comes from the shot traps and the like, is impelled by a fluid jet against a baffle which separates the shot from the fibre. The shot rebounds from the baffle and falls by gravity to a hopper device, from which it is delivered directly to an air classifier for separation into fractions of different sizes. The fibre is carried by an air stream to any suitable place of deposit.

Our invention will be more fully understood and further objects and advantages thereof will become apparent when reference is made to the more detailed description thereof which is to follow and to the accompanying drawings, in which:

Fig. 1 is an elevational view, partially diagrammatic, of an apparatus in accordance with the instant invention and for use in carrying out the method thereof;

Fig. 2 is a view, partially in elevation and partially in section and on an enlarged scale, of a portion of the apparatus of Fig. 1; and

Fig. 3 is a sectional view, on an enlarged scale, taken on the line 3—3 of Fig. 1.

Referring now particularly to Figs. 1 and 2, the apparatus comprises a hopper 10, adapted to receive a supply of the particle and fibre mixture from which the particles are to be recovered. Although not illustrated, it will be understood that the hopper may be fed by any suitable type of conveyor, or the like, or by manual operation. Hopper 10 is secured in a suitable manner, as by the T connection 12 illustrated, to a feed duct 14 terminating at and in communication with a jet housing 16.

Housing 16 encloses jet nozzle 18, connected to a suitable source of fluid under pressure by pipe 20. Housing 16 includes an extension 22, which may be formed either separately or integrally therewith. Supported above extension 22, by any suitable means (not shown), is a particle separating baffle 24, preferably conical in form and with its apex substantially on the center line of housing 16. In lieu of the conical shape shown, the baffle may take other forms. For example, a pyramidal baffle may be employed. The major diameter of baffle 24 is at least equal to the diameter of extension 22 and is preferably somewhat larger, as illustrated.

Connected into pipe 20 is tube 26, extending to and connected in a plug, or the like, 27, forming a closure for feed duct 14 at the end thereof adjacent the discharge zone of hopper 10. Also connected in pipe 20 is a suitable pressure gauge, as indicated at 28.

Referring now particularly to Fig. 1, housing 16 and baffle 24, as well as a portion of feed duct 14 and fluid supply pipe 20, are enclosed in a suitable housing comprising hood 30 and hopper 32. Hood 30 is connected to exhaust line 34,

leading to any suitable type of collector for the fibrous content of the fibre-shot mixture. If desired, an exhausting device may be connected in line 34, or the fluid blast issuing from nozzle 18 (Fig. 2) may be alone utilized for carrying the fibres through hood 30 and duct 34 to the collecting device. Duct 34 may include a damper illustrated diagrammatically at 36A, for controlling the movement of fluid therethrough, and also is preferably provided with an orifice at 36 and flow meter (not shown) connected as by leads 38.

Hopper 32 includes slanting bottom 40, whereby material in the hopper is discharged by gravity through a port 42 onto a shaker screen 44 of a mesh size such that the recovered granules will pass therethrough. Screen 44 is preferably given a reciprocating motion by a mechanism of any suitable or conventional type (not shown).

A hopper 46 is located below shaker screen 44 and port 42 and includes a slanting bottom discharging materials deposited thereon into duct 48. Duct 48 includes an end 50 suitably opening into the room, and is provided with baffles 52 (see particularly Fig. 3) comprising circular plates having relatively closely spaced perforations. Duct 48 communicates with classifying chamber 54 of larger cross sectional area than the duct, and chamber 54 is in communication at its upper end by means of a duct 56 with a second classifying chamber 58 of greater cross sectional area than chamber 54. As will be understood, any number of classifying chambers may be employed, depending upon the degree to which the particles are to be separated into fractions of different size. Chambers 54 and 58 include hopper bottoms 60 and gates 62, whereby materials gathered therein may be discharged into suitable containers or onto conveyor belts, or the like. The upper end of chamber 58 is in communication with a duct 61, which, in turn, is in communication with the exhaust side of a suitable fan or other exhausting means. Duct 61 includes damper 62A for controlling the passage of air therethrough and is preferably provided with an orifice 63 and flow meter (not shown) connected in the duct as by leads 64.

In the operation of the apparatus above described and in the carrying out of the method of the instant invention, a mixture of mineral wool shot, coarse fibres, partially formed fibres, fibre bundles, and the like, as it is obtained from a mineral wool forming apparatus, is discharged manually or by a suitable conveyor system into hopper 10. Fluid under pressure, preferably compressed air, is supplied through pipe 20 and discharged through nozzle 18 to form a high velocity jet impinging on conical baffle 24. For purposes of example only and without limitation, it may be stated that in commercial operation it has been found that satisfactory results are obtained through the use of air at a pressure of, say, 60 lbs. per square inch, a nozzle with a discharge orifice measuring $^{15}/_{64}$" in diameter, and a housing 1" in diameter.

The fluid under pressure, preferably compressed air, conveyed by pipe 20, is partially diverted through tube 26 to form a pusher jet issuing from the end of the tube in plug 27, the pusher jet, together with the inspirational effect of the jet issuing from nozzle 18, providing a constant movement of the material from hopper 10 to the main jet. The material is impelled or blasted by the jet issuing from nozzle 18 against baffle 24 with rebounding of the particles between the surface of the baffle and the surrounding walls of hood 30. During this action the fibres and particles are separated, the fibres moving upwardly with the air supplied by the blast and passing through duct 34 under the impelling force of such supplied air or by the exhausting action of a suitable fan, or the like, if desired.

The separated particles, which are of too great a mass to be carried by the air stream, drop by gravity into hopper 32 and pass therefrom through port 42 onto shaker screen 44. The shaker screen, as previously advised, is provided with mesh of a sufficient size to permit the particles to pass readily therethrough, but to retain the minor proportion of fibres which have agglomerated into bundles of sufficient mass to fall into the hopper rather than be carried by the air stream. The particles pass through shaker screen 44 into hopper 46, and from thence into duct 48 through which a stream of air is moving at high velocity due to the air exhaustion means, such as a fan, connected into duct 60. The velocity of the air movement in duct 48 is such as to reverse the downward gravitational movements of the particles and carry them upwardly in the duct to chamber 54. To enhance the lifting effect of the air stream in duct 48 and to eliminate the necessity of a substantially elongated duct which might otherwise be necessary to effect the reversing movement, baffles 52 are provided, which, as previously pointed out, include a plurality of closely spaced apertures 53 which divide the column of air into a plurality of high velocity jets operating to break up the mass of particles and initiate their upward movement.

The diameter of chamber 54 is suitably proportioned, depending upon the size of particles to be segregated, to lower the velocity of air movement therethrough sufficiently that the desired sizes of particles drop to the bottom of the chamber into hopper 60. The diameter of chamber 58 is similarly suitably proportioned so that the velocity of air movement therein is lowered to such an extent that a finer fraction of the particles will no longer be carried by the air stream but drop to the bottom of the chamber into its hopper 60. Still finer fractions, dust, and the like, will be carried by the air stream through duct 60 to a suitable disposal point. As will be readily understood, further classifying chambers may be employed if a greater degree of subdivision of the particles into fractions of different size is desired.

As will be understood from the above description of the apparatus and method, the instant invention provides for the rapid, continuous recovery of particles, particularly mineral wool shot, from a mass of fibres and shot, and their separation into fractions of desired size. The recovered shot, free of any appreciable fibre, is employed in direct substitution for sand, slate, and the like, particularly that used for a first surfacing on asphalt shingles of the overlay type in which a second coating is applied to a gritted surface of a first coating layer. The recovered shot may also be employed for other purposes.

Having thus described our invention in rather full detail, it will be understood that these details need not be strictly adhered to, but that various changes and modifications will suggest themselves to one skilled in the art, all falling within the scope of the invention as defined by the subjoined claims.

What we claim is:

1. An apparatus for separating discrete particles from a mixture of fibre and particles, comprising a nozzle for a fluid jet, a conical baffle in-

cluding an apex spaced from and in line with said nozzle, a housing surrounding said nozzle and leading to a point adjacent said baffle, said baffle overlying the adjacent end of said housing, means for supplying a fluid medium under pressure to said nozzle, and fluid pressure means supplied from said first-mentioned means for conveying a mixture of particles and fibres into position to be impelled against said baffle by the jet issuing from said nozzle.

2. An apparatus for separating discrete particles from a mixture of particles and fibre, comprising a nozzle for a fluid jet, means for supplying fluid under pressure to said jet, a conical baffle, a housing to surround said jet and leading to said baffle, a feed line for the passage of a mixture of particles and fibres to said jet, a hood surrounding said baffle and housing and terminating in a hopper below said baffle, said hood having an outlet for said fluid and fibers located above said hopper, a classifier, and means for conducting particles continuously from said hopper to said classifier.

3. An apparatus for separating discrete particles from a mixture of particles and fibre, comprising a nozzle for a fluid jet, a conical baffle, a housing to surround said jet and leading to said baffle, a feed line for the passage of a mixture of particles and fibres to said jet, means for applying fluid pressure to move said mixture along said feed line to said jet, means for supplying fluid under pressure to said nozzle and said first-mentioned means, a hood surrounding said baffle and housing and terminating in a hopper below said baffle and including an opening above said baffle for escape of said fluid and fibres carried thereby, a classifier, and means for conducting particles continuously from said hopper to said classifier.

4. An apparatus for separating discrete particles from a mixture of particles and fibre, comprising a nozzle for a fluid jet, a conical baffle, a housing to surround said jet and leading to said baffle, a feed line for the passage of a mixture of particles and fibres to said jet, a hood surrounding said baffle and housing and terminating in a hopper below said baffle, a classifier, and means for conducting particles from said hopper to said classifier, said means including a shaker screen for separating foreign materials contained with particles in said hopper.

5. An apparatus for recovering mineral wool shot from a mixture of fibre and shot, comprising a fluid jet defining nozzle, means for supplying fluid under pressure to said nozzle, a conical baffle including an apex spaced from and in line with said jet, a housing surrounding said jet and terminating adjacent said baffle, a feed line for the passage of a mixture of shot and fibres to said jet, a supply hopper in communication with said feed line, and means for applying fluid pressure to move said mixture along said feed line to said jet.

6. An apparatus for recovering mineral wool shot from a mixture of fibre and shot, comprising a substantially vertically directed fluid jet defining nozzle, means for supplying fluid under pressure to said nozzle, a conical baffle including an apex spaced from and in line with said jet, a housing surrounding said jet and terminating adjacent said baffle, a substantially horizontal feed line for the passage of a mixture of particles and fibres to said jet, a supply hopper in communication with said feed line, means for applying fluid pressure to move said mixture along said feed line to said jet, a hood surrounding said baffle and terminating in a hopper, and an exhaust duct connected in said hood for removing fluid and fibres therefrom.

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