Jan. 7, 1947. C. M. GOSSARD 2,414,038

ABRASIVE SUPPLY SYSTEM

Filed April 27, 1942

Fig. 1

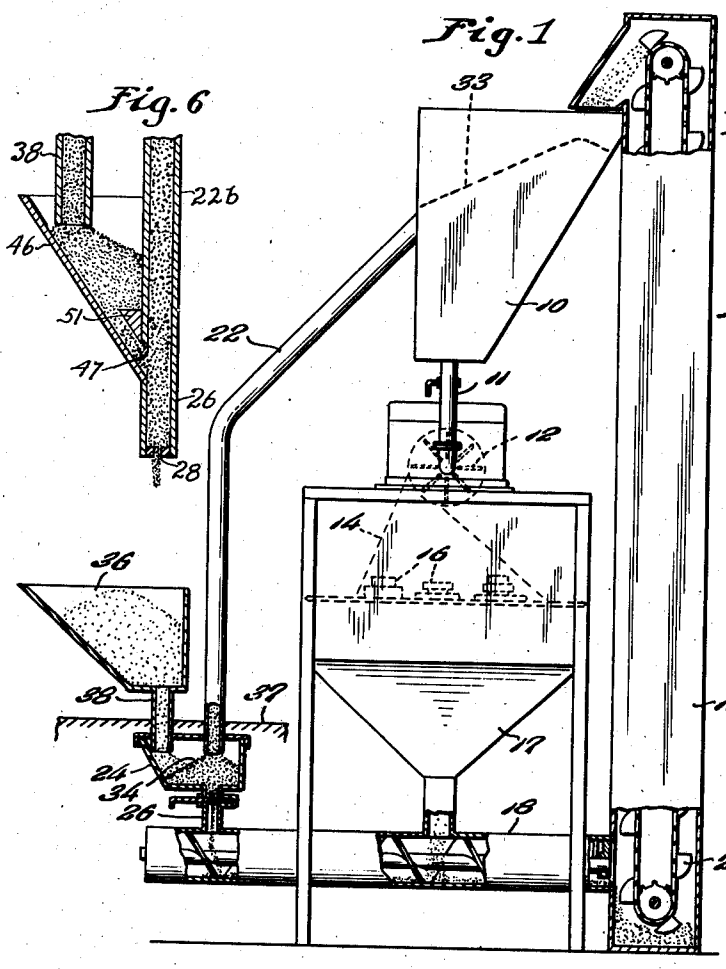


Fig. 6

Fig. 7

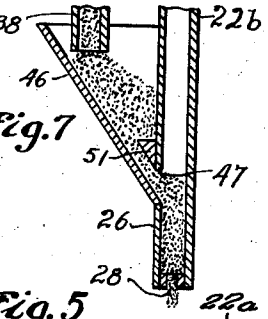


Fig. 5

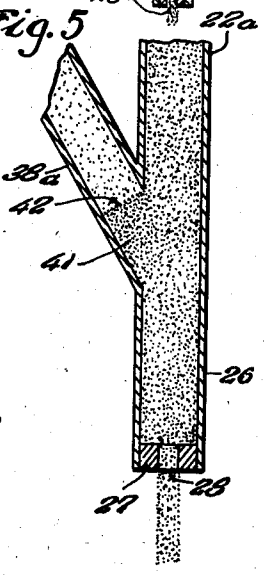


Fig. 8.

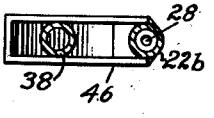


Fig. 2.

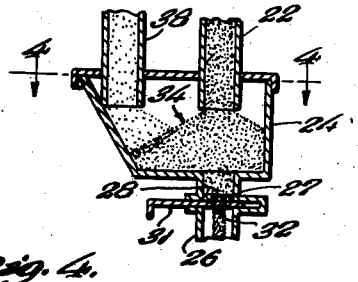


Fig. 3.

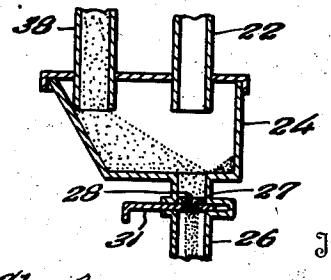
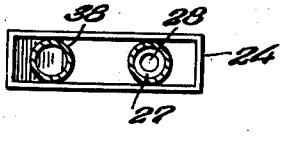


Fig. 4.



Inventor

Charles M. Gossard

By Spear, Donaldson & Hall

Attorneys

Patented Jan. 7, 1947

2,414,038

UNITED STATES PATENT OFFICE

2,414,038

ABRASIVE SUPPLY SYSTEM

Charles M. Gossard, Hagerstown, Md., assignor to Pangborn Corporation, Hagerstown, Md., a corporation of Maryland

Application April 27, 1942, Serial No. 440,689

11 Claims. (Cl. 51—263)

1

The present invention relates to apparatus for replenishing the abrasive particles supplied to devices or machines for projecting such particles at abrading or blasting velocities and more particularly pertains to means for automatically controlling the addition of new or fresh particles to the abrasive in a system circulating abrasive particles through abrasive projecting apparatus.

A conventional system for supplying abrasive to apparatus for projecting the particles usually includes a bin in which a main supply of abrasive is stored. The machine or device for projecting the abrasive particles at an abrading or blasting velocity is usually mounted below the main bin so that the particles may flow downwardly therefrom into a position for being acted on by the propelling apparatus. The prior arrangements often include means for recovering the spent particles projected by the machine or blast nozzles and means for returning the collected particles to the main bin or hopper for recirculation through the abrading or blasting apparatus.

An object of the invention pertains to the provision of a replenishing bin for receiving an auxiliary supply of abrasive including conduit means extending downwardly therefrom for guiding or feeding abrasive from the replenishing bin into the main supply circuit only when the abrasive stored in the main bin is below a predetermined quantity.

Another object of the invention pertains to the provision of means for controlling the flow of granular material from at least two sources including means for guiding the granular material from one source in a substantially vertically downward moving stream and means for guiding granular particles from the other source to a position adjacent the downward moving stream so that the moving granular material flows more readily and blocks the movement of granular particles into the substantially vertical moving stream.

A further and more specific object of the invention pertains to the provision of an auxiliary shunt or bypass circuit through which a small overflow of abrasive from the main bin is guided downwardly into the main abrasive circuit and a replenishing bin in open communication with the auxiliary circuit for supplying abrasive to the main circuit when the supply of abrasive in the main bin is depleted to such a point that the overflow ceases.

Other objects and features of the invention will be more apparent to those skilled in the art upon a consideration of the accompanying drawing and the following detailed description wherein several exemplary embodiments of the invention are disclosed.

2

In the drawing:

Fig. 1 is a substantially diagrammatic elevational view partly in section of apparatus embodying the invention and showing the general organization of the abrasive circuits.

Fig. 2 is an enlarged sectional view of a container or valve box for receiving abrasive from the main bin and the replenishing bin and illustrating the manner in which the auxiliary supply is blocked.

Fig. 3 is a similar sectional view of the valve box illustrating the movement of granular material from the auxiliary supply therethrough.

Fig. 4 is a top plan view of the valve box taken on the line 4—4 of Fig. 2 with the cover thereof removed.

Fig. 5 is an enlarged sectional view of another form of conduit means for controlling the movement of granular material illustrating the overflow from the main bin blocking the particles from the auxiliary supply.

Fig. 6 is a sectional view of a modified arrangement for guiding and controlling the flow of granular material wherein the downwardly moving stream from the main bin prevents movement of particles from the auxiliary supply.

Fig. 7 is a similar view illustrating the unblocked condition of the conduit means shown in Fig. 6 so that particles may flow from the auxiliary supply.

Fig. 8 is a plan view of the arrangement shown in Fig. 6.

Referring to the drawing and particularly to Fig. 1, there is shown at 10 a main bin for receiving and storing a supply of particles suitable for an abrading or blasting operation. The abrasive stored in the bin 10 may be of any type such as metal particles, steel shot, sand or other suitable granular material. The apparatus includes means for guiding the abrasive from the main bin 10 downwardly into apparatus for projecting the abrasive particles. Such guide means may take the form of a feed spout or conduit 11 for directing or guiding the abrasive into an operative position in relation to the projecting apparatus shown generally at 12. Any type of machine or device may be employed for projecting the abrasive particles, and for the purposes of illustration only a rotor or wheel is shown in Fig. 1 for accelerating the abrasive and projecting the abrasive particles on to articles to be

cleaned or abraded. The abrasive projecting apparatus may include a rotor as disclosed in the patent to Keefer, No. 2,108,005, having a series of blades for projecting the abrasive particles in any direction and in one example the abrasive stream is directed downwardly as indicated by the dotted lines 14 blasting articles such as a plurality of castings 16.

The projected abrasive particles are collected and returned to the main bin 10 by any suitable means which may include a housing 17 having sloping side walls, worm conveyor means shown at 18 and an elevator type conveyor means indicated generally at 19. The worm conveyor 18 may be mounted in any conventional manner so as to move the spent abrasive particles into the casing of the elevator 19. The elevator may also be of a conventional type including, for example, an endless chain carrying cups or buckets 21 whereby the used particles are returned to the main bin 10 for recirculation through the abrading or blasting apparatus 12. The worm conveyor 18 and the elevator 19 may be driven by any suitable source of power not shown. Appropriate means not shown may also be provided for driving the abrasive projecting apparatus 12. A main abrasive supply circuit is thus provided for guiding the abrasive particles from the main bin 10 to the abrasive projecting apparatus 12 and collecting and returning the projected particles to the main bin by the conveyor means 18 and 19.

The impingement of the abrasive particles on the articles 16 will cause some of the particles to be broken and further recirculation of the broken abrasive particles will result in further breaking of such partly broken particles so that eventually some of the abrasive will be lost from the system in the form of dust. In addition to the disintegration of the abrasive other particles will escape from the system so that the supply will be steadily depleted.

The invention includes means for automatically adding abrasive particles to the main supply circuit when the particles stored in the main bin or hopper 10 are depleted below a predetermined quantity or below a predetermined level whereby the abrasive in the main bin is replenished before the bin 10 is completely exhausted. An embodiment of such means may include a pipe 22 extending downwardly from the main bin 10 from a position above the bottom thereof into open communication with the worm conveyor 18 through a box 24. The pipe 22 terminates in the valve box 24 so that a small overflow of abrasive may flow from the main bin 10 into the box 24. The valve box 24 is provided with a discharge outlet or conduit 26 extending downwardly into open communication with the conveyor 18. The discharge outlet for the box 24 is preferably positioned in substantial vertical alignment with the pipe 22 and the purpose thereof will be more apparent as the present description proceeds. A small apertured diaphragm 27 or any suitable means may be associated with the discharge outlet of the valve box so as to restrict the flow of abrasive material therefrom. Thus, the diaphragm 27 may be provided with a relatively small orifice 28 having a smaller cross sectional area than the internal area of the pipe 22. The area of the opening or orifice 28 may be adjusted by suitable means such as a plate 31 having an opening 32 therein which is mounted for movement transversely of the conduit 26.

The normal or desired level of abrasive in the main bin 10 is indicated by the dotted line 33, and as long as the abrasive stored in the main bin 10 is above the level 33 a small overflow will move downwardly in the pipe 22 into the container or valve box 24. This granular material cannot escape from the valve box 24 at the same rate that the abrasive enters the pipe 22 since the orifice 28 restricts the flow of abrasive into the conveyor 18. A quantity of abrasive is thus stored in the box 24 and assumes an angle of repose therein as indicated at 34. The area of opening 28 may be adjusted by movement of the plate 31 but this orifice should be at all times large enough to permit a downward moving stream of abrasive in the conduit 26 at a rate which is greater than the loss of abrasive from the main abrasive circuit.

An auxiliary supply of new or unbroken abrasive particles may be stored in a replenishing bin 36 which is preferably mounted near a floor level diagrammatically represented at 37 so that the new abrasive may be dumped thereinto and for the further purpose of permitting the contents of the replenishing bin to be observed by an attendant. The abrasive from the replenishing bin 36 is guided downwardly into the container or valve box 24 by means of a tube 38 or an equivalent feed spout. The abrasive from the replenishing bin 36, however, cannot move into the conduit 26 as long as the pipe 22 is supplied with abrasive from the main bin 10. In other words, the surplus abrasive in the box 24 will assume an angle of repose as approximately indicated at 34 and this surplus blocks the flow of abrasive from the replenishing bin 36. In this connection it is to be noted that the outlet orifice 28 is positioned substantially vertically below the pipe 22 so that the abrasive leaving the container 24 is supplied by the pipe 22 and the flow from the replenishing bin is blocked as long as the abrasive in the main bin 10 is above a predetermined quantity or above the level of the upper end of the pipe 22.

After the supply in the main bin 10 falls below the level of the upper end of the pipe 22 the supply of abrasive to the pipe 22 ceases and eventually all of the abrasive in the pipe 22 and all of the abrasive in the container 24 directly under the pipe 22 will flow through the orifice 28 into the conveyor 18. When the pipe 22 is empty the arrangement will assume an operating condition as illustrated in Fig. 3 from which it will be noted that there is no surplus abrasive present in the container 24 for blocking the flow of abrasive from the tube 38 and abrasive from the replenishing bin may then flow through the orifice 28. The discharge outlet for the box 24 must therefor be so positioned as to be overlapped by the abrasive assuming an unobstructed angle of repose as it issues from the tube 38. Thus, fresh abrasive particles may flow from the replenishing bin 36 into the conveyor 18 from which they are elevated into the main bin 10. The fresh abrasive particles are therefor added to the main abrasive circuit whenever the abrasive stored in the main bin 10 is below a predetermined quantity. The new abrasive entering the system is mixed with the used abrasive passing into the conveyor 18 from the housing 17 so that the unbroken abrasive particles are thus dispersed throughout the abrasive to provide uniform abrading or blasting.

An auxiliary shunt circuit is thus provided for guiding abrasive from the main bin 10 downwardly into the main abrasive circuit. The auxiliary circuit includes the pipe 22, a portion of

the box 24 and the conduit 26. In view of the fact that the abrasive flowing through the auxiliary circuit into the conveyor 18 bypasses the abrasive projecting apparatus 12 no abrading is accomplished with the abrasive overflowing from the main bin. Thus, it is preferable that the flow of abrasive from the main bin through the auxiliary circuit be as small as possible to reduce the power necessary to return the overflow to main bin. The orifice 28 is therefore small in cross-sectional area but large enough to permit abrasive to enter the main circuit from the replenishing bin at a rate which is greater than the loss of abrasive from the main circuit when the conditions as shown in Fig. 3 are established. The opening in the main bin 10 admitting abrasive into the pipe 22 must be larger than the orifice 28 so that the pipe 22 may be filled and a surplus stored in the box 24 at 34. The capacity of the pipe 22 should however be small since its total contents must be emptied through the orifice 28 after the flow from main bin 10 ceases before particles from the replenishing bin may pass into the conveyor 18.

The auxiliary circuit or the pipe 22 and a portion of the box 24 and the conduit 26 including the tube 38 provide conduit means operable to admit abrasive to the main circuit when the quantity of abrasive in the main supply circuit is partially depleted. In other words, when there is enough abrasive present in the pipe 22 to provide more particles in the box 24 than necessary to maintain a discharge through the orifice 28 the movement of particles from the tube 38 towards the orifice 28 is blocked. This phenomena does not appear to follow hydraulic principles but seems to function by reason of the orifice 28 being substantially vertically under the discharge from the pipe 22. In other words, less frictional resistance appears to be encountered by the abrasive vertical of the orifice 28 in moving therethrough than the friction of the abrasive laterally of the orifice 28 in attempting to drain therethrough. Whatever may be the principle or theory involved, the control means has been found to operate in a valve-like manner to control the flow of granular material from at least two sources. After the pipe 22 is emptied of granular material the new abrasive from the auxiliary supply or replenishing bin 36 may flow from the tube 38 and assume an unobstructed angle of repose as shown in Fig. 3 which overlaps the orifice 28 and drains therethrough so that abrasive is then added to the main supply circuit. It is thus apparent that the orifice 28 must be large enough to admit the new or unbroken particles at a rate greater than the loss of abrasive from the main supply system. When the abrasive added to the main circuit replenishes the supply sufficiently, the abrasive in the main bin 10 will then be above the level of the upper end of the pipe 22. The overflow is thus reestablished to supply abrasive into the box 24 from the main bin. This small overflow will immediately pass through the orifice 28 crowding out particles from the replenishing bin 36 since the particles from the pipe 22 are more directly over the orifice 28. For a short period the overflow from the main bin 10 through the pipe 22 may be insufficient to completely block the flow from the replenishing bin and there may be a small trickle from both sources through the orifice 28. When the new abrasive raises the level of the particles in the main bin the overflow will be sufficient to fill the pipe 22 to a point above the box 24 so that the angle of repose as indicated at 34 will be reestablished to completely block the flow of abrasive from the replenishing bin 36 and establish the conditions shown in Fig. 2.

A modified form of means for controlling the admission of abrasive particles to the main supply circuit is illustrated in Fig. 5 wherein a pipe 22a extends downwardly from the main bin and is adapted to supply the overflowing abrasive into the conveyor 18 through a conduit portion 26 having a diaphragm 27 therein provided with an orifice 28. A tube 38a extends from the replenishing bin in this arrangement and is directly connected to the pipe 22a and preferably at an acute angle as shown in Fig. 5. This arrangement has been found to operate efficiently when the angle between the pipe 22a and the tube 38a is approximately thirty degrees. The abrasive flowing through the orifice 28 is drawn from the pipe 22a and since the rate of abrasive flowing through the orifice 28 is less than the rate at which the abrasive is supplied to the pipe 22a, a surplus of abrasive is stored in the vertical part of the pipe 22a so as to block admission of the particles from the replenishing bin through the tube 38a. The surplus abrasive is indicated generally at 41 and assumes an angle of repose approximately as indicated at 42 which serves to block the tube 38a.

After the supply of abrasive within the main bin falls below a predetermined level, the pipe 22a will no longer be supplied with abrasive and this pipe will eventually be emptied to a point below the confluence of the pipe 22a and the tube 38a, whereby the abrasive block indicated at 41 will be removed and abrasive may flow into the conduit portion 26 from the replenishing bin. When the new or unbroken abrasive supplied to the main abrasive supply circuit is sufficient to fill the main bin 10 above the level of the upper end of the pipe 22a this pipe will be again filled to provide the block of abrasive at 41. Thus the pipe 22a and the tube 38a and the conduit portion 26 provide conduit means for controlling admission of abrasive to the main abrasive circuit.

The modification shown in Figs. 6, 7 and 8 embodies a similar principle wherein the pipe 22b is supplied with abrasive from the main bin 10. This arrangement includes a triangular shaped container or box 46 attached to the pipe 22b for receiving abrasive from the replenishing bin through the tube 38. The abrasive received in the container 46 is blocked from entrance into the pipe 22b through an opening 47 as long as the pipe 22b is filled with abrasive above the opening 47. In other words it appears that the frictional resistance of the granular material flowing through the orifice 28 is considerably less in the vertical pipe 22b than the frictional resistance of the abrasive in the container 46 in endeavoring to move through the opening 47 so that entrance of the abrasive from the container 46 into the pipe 22b is prevented as long as the abrasive is above the opening 47 in the pipe 22b. After the pipe 22b is no longer supplied with abrasive from the main bin 10 the flow of the abrasive assumes the conditions shown in Fig. 7 wherein the abrasive block at the opening 47 is removed and abrasive may flow from the container 46 into the pipe 22b. When sufficient new abrasive is supplied into the conveyor 18 and moved into the main bin 10, an overflow will again move downwardly in the pipe 22b. Since the abrasive drains more readily through the orifice 28 from the pipe 22b the opening 47 will again be blocked

as indicated in Fig. 6. The pipe 22b having the opening 47 therein and the container 46 therefore provide conduit means operable to admit abrasive to the main circuit only when abrasive stored in the main bin 10 is below a predetermined level.

In some instances a small triangular shaped member 51 may be arranged in the container 46 adjacent the pipe 22b so as to prevent downward trickling movement of the abrasive in the container 46 along the outer surface of the pipe 22b. The member 51 will thus direct all of the abrasive in the container 46 at an acute angle with respect to the downward moving stream in the pipe 22b to thereby increase the frictional resistance of the particles in the container in endeavoring to enter the pipe 22b.

While the invention has been described with reference to specific structural details such as the pipes and conduits, it will be appreciated that changes may be made therein by those skilled in the art. Such modifications and alterations may be made without departing from the spirit and scope of the invention as set forth in the appended claims.

I claim:

1. In abrasive blasting apparatus, abrasive projecting apparatus, a main bin for storing a quantity of abrasive particles, means providing a main circuit for guiding abrasive particles from said main bin to said abrasive projecting apparatus and returning the projecting particles to said main bin, means providing an auxiliary circuit operable to guide abrasive particles from the main bin into said main circuit as long as the abrasive particles in the main bin are above a predetermined point, a replenishing bin in open communication with said auxiliary circuit for supplying abrasive particles to the main circuit when abrasive particles cease flowing in the auxiliary circuit from the main bin.

2. In abrasive blasting apparatus, a main bin for storing abrasive, abrasive projecting apparatus receiving abrasive from the main bin, conveyor means for moving the projected abrasive into the main bin for recirculation through said abrasive projecting apparatus, a pipe extending downwardly from the main bin from a point above the bottom thereof into communication with said conveyor means, a replenishing bin for receiving abrasive, conduit means extending downwardly from the replenishing bin and in open communication with said pipe whereby abrasive from the replenishing bin may enter said conveyor means through said conduit means and a portion of said pipe until the abrasive stored in said main bin is sufficient to fill said pipe to a point above said conduit means.

3. In abrasive blasting apparatus, a main bin for storing abrasive, abrasive projecting apparatus receiving abrasive from the main bin, conveyor means for moving the projected abrasive into the main bin for recirculation through said abrasive projecting apparatus, a pipe extending downwardly from the main bin from a point above the bottom thereof into communication with said conveyor means, a replenishing bin for receiving abrasive, a tube extending downwardly from the replenishing bin and in open communication with said pipe at an angle of approximately 30 degrees between the pipe and the tube whereby abrasive from the replenishing bin may flow through said tube and a portion of said pipe into said conveyor means until the abrasive stored in the main bin is sufficient to fill said pipe to a point above the confluence of the pipe and the tube.

4. In abrasive blasting apparatus, a bin for storing abrasive particles, abrasive projecting apparatus, means providing a circuit guiding particles from the bin to said abrading apparatus and returning the projected particles into said bin, a pipe extending downwardly from a point above the bottom of said bin, a container receiving abrasive particles from said bin through said pipe, said container having a discharge orifice substantially under said pipe and of a smaller area than the internal cross sectional area of said pipe for admitting abrasive particles into said circuit, an auxiliary supply of abrasive particles in said container laterally of said pipe capable of flowing through said orifice, whereby abrasive particles entering the container from said pipe in excess of the particles passing through said orifice prevent said auxiliary particles from moving towards the orifice.

5. In abrasive blasting apparatus, a main bin for storing abrasive particles, abrasive projecting apparatus, means providing a circuit for guiding abrasive particles from said bin to the abrasive projecting apparatus and returning the projected particles into said bin, a box having an outlet to admit abrasive particles to said circuit at a rate greater than the loss of abrasive particles from said circuit, a pipe extending downwardly from a point above the bottom of the main bin and terminating in said box above the bottom thereof for depositing abrasive from the main bin into the box substantially vertically of said outlet whereby abrasive particles may flow in a substantially vertical downward steam from the main bin through said pipe and said outlet into said circuit, a replenishing bin, a tube extending downwardly from the replenishing bin terminating in said box laterally of said pipe so that a normal angle of repose of the abrasive particles deposited in the box from the replenishing bin overlaps said outlet, and said pipe being of greater internal diameter than the diameter of said outlet whereby abrasive deposited in said box from said pipe prevents abrasive supplied by said tube from moving towards said outlet.

6. In abrasive blasting apparatus, a bin for storing abrasive particles, abrasive projecting apparatus, means providing a circuit for guiding abrasive particles from said bin to said abrasive projecting apparatus and returning the projected particles into said bin, a pipe extending downwardly from a point above the bottom of said bin for guiding abrasive from the bin into said circuit, said pipe having a lateral opening therein, means supplying abrasive adjacent the outside of said pipe and adjacent said opening from a point above the opening, and means below said opening restricting the flow of abrasive in said pipe to a rate greater than the loss of abrasive from said circuit.

7. Apparatus for controlling the flow of granular particles comprising, means guiding granular material substantially vertically downward from one source and having a discharge orifice substantially vertically thereunder, means guiding granular particles downwardly from another source to a position laterally adjacent the first guide means above said discharge orifice and to a position for flowing through said discharge orifice whereby the granular material in the first guide means moves downwardly through the discharge orifice more readily than the granular particles in endeavoring to move towards the discharge orifice.

8. Apparatus for controlling the flow of gran-

ular particles comprising, means guiding granular material substantially vertically downward, means providing a discharge orifice of smaller cross sectional area than the internal cross sectional area of said guide means and aligned substantially vertically with the axis of the guide means, means in open communication with said discharge orifice supporting a supply of granular particles above said discharge orifice laterally of the guide means and capable of flowing at an unobstructed angle of repose through said discharge orifice whereby granular material vertically of the discharge orifice falls therethrough before the granular particles may move through the discharge orifice.

9. Apparatus for blocking the flow of granular particles from one source while granular material flows from another source comprising, a container having a discharge orifice in a lower portion thereof, means guiding granular material from one source into said container to a position substantially vertically above said discharge orifice for downward movement therethrough, means guiding granular particles from another source into said container to a position laterally of the axis of said discharge orifice and sufficiently adjacent said axis that the granular particles issuing from the second guide means at an unobstructed angle of repose overlie said discharge orifice, whereby the granular material deposited in said container from said first guide means and arranged substantially vertically above the discharge orifice drains therethrough before the granular particles may assume an unobstructed angle of repose to overlie the discharge orifice and drain therethrough.

10. Apparatus for blocking the flow of granular particles while granular material flows from another source comprising, a container having a discarge orifice in a lower portion thereof, means guiding granular material into said container to a position substantially vertically above said discharge orifice for downward movement therethrough, said means guiding granular particles into said container to a position laterally of the axis of said discharge orifice and sufficiently adjacent said axis that the granular particles issuing from the second guide means at an unobstructed angle of repose overlie said discharge orifice whereby the granular material deposited in said container from said first guide means and arranged substantially vertically above the discharge orifice drains therethrough before the granular particles may assume an unobstructed angle of repose to overlie the discharge orifice and drain therethrough, and means for adjusting the area of said discharge orifice.

11. In abrasive projecting apparatus, a bin for storing abrasive, an abrasive projecting device receiving abrasive from the bin, means for returning the spent abrasive projected by said device to the bin for recirculation through said abrasive projecting device, container means receiving abrasive from said bin, said container means having a discharge orifice substantially vertically under the point where the abrasive is supplied to said container means whereby abrasive may escape through the said orifice for movement into the bin, an auxiliary supply of abrasive in said container means laterally of and above said orifice so as to flow through the discharge orifice when the angle of repose of the auxiliary supply of abrasive is unobstructed by the other abrasive in said container means.

CHARLES M. GOSSARD.