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PEENING MACHINE

Charles E. Kamper, R.R. 2, and Richard R. Compton, % Zero Manufacturing Co., 811 Duncan Ave., both of Washington, Mo. 63090

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ABSTRACT OF THE DISCLOSURE

This peening machine includes a storage reservoir coupled to a metering chamber and supplying a discharge gun and the machine is provided with a flow control reclaim unit. The control apparatus includes a by-pass conduit which purges residual blasting material from the metering chamber and the discharge ductwork, and returns it to the reservoir. The purging action is effectuated by suction from a blower located in the reservoir, the suction being applied to the metering chamber via the by-pass conduit when the gun is inoperative. A metering platform below the reservoir orifice collects blasting material and effectively plugs the orifice to preclude escape of the blasting material from the reservoir when the gun is inoperative.

BACKGROUND OF THE INVENTION

This invention relates in general to blasting and peening machines, and more particularly to a flow control apparatus for the reclaimer unit of a peening machine.

Peening machines are used primarily for cleaning and finishing metal and plastic articles, and the peening process consists essentially of blasting a jet of microscopic glass beads into direct contact with the article to be worked on.

For reasons of economy, it is important that the beads be reusable, and to this end, peening machines are invariably provided with a reclaimer unit, usually in conjunction with a filter unit. The blasting material is supplied from a storage reservoir to the discharge gun, and after use, fragmented particles are removed and reusable beads are returned to storage. Typical of such a machine is that described in U.S. Pat. No. 3,199,171.

A vexing problem encountered in machines of this type is that, when the immediate blasting operation is completed, blasting material from the discharge gun and the duct connecting the gun to the reservoir tends to spill out from the gun. The source of the spillage is not only residual blasting material in the ductwork, but also the blasting material drawn from the reservoir itself, because the reservoir communicates with this discharge ductwork at all times unless some form of valve is provided. The blasting material in the reservoir is formed of minute beads, having a diametrical range usually from about 0.005 to 0.05, depending upon the application, and the depth of such beads in the storage reservoir can create a considerable head tending to discharge beads from the reservoir.

Blasting and peening machines are used extensively by industry, and have many applications, both commercial and military. Specifications controlling the use of these machines, and valve controls which involve the participation of an operator are often looked upon with disfavor by many users. Automatic valve operation is preferred to electrical, mechanical and manual devices which require operator actuation.

SUMMARY OF THE INVENTION

This flow control apparatus provides a purging system effectively cleaning out residual blasting material from the ductwork. A by-pass conduit effectively returns the purged material to the storage reservoir automatically when the discharge gun is inoperative. A valve means is provided which prevents reservoir material from escaping into the discharge ductwork when the discharge gun is inoperative. The valve means is automatic and does not require actuation, either electrically, mechanically or manually by an operator. Further, the valve means does not include any moving mechanical parts. The flow control apparatus includes a reservoir supplying a discharge gun. A return conduit communicating with the gun, returns the blasting materials to the reservoir. The reservoir includes an orifice at its lower end which feeds blasting material into a metering chamber communicating with the discharge gun, and a pressure producing-means effectuates the transfer of blasting material from the metering chamber to the discharge gun.

The by-pass conduit communicates between the chamber and the reservoir and a second pressure-producing means applies suction to the chamber to remove residual blast-material from the chamber to the reservoir by way of the by-pass conduit. The valve means controls the flow of blasting material from the orifice to the chamber. The valve means includes metering means in the form of a platform disposed in spaced relation below the orifice to selectively collect blasting material and form a granular plug controlling flow from the orifice means. The reservoir includes a storage hopper and the orifice is located at the lower end of the hopper. The orifice includes a re-entrant pipe mouthpiece which opens directly into the chamber.

The by-pass conduit includes a pipe opening into the storage hopper above the storage level. The second pressure-producing means is disposed above the storage hopper and creates a suction which is applied by way of the pipe opening to the chamber whereby to remove residual blasting material therefrom by suction effect. A deflector is disposed in the reservoir above the by-pass opening and below the second pressure-producing means whereby to deflect said blasting material into the storage hopper.

A controlled air supply, delivered to the discharge gun, provides the first pressure-producing means. The gun includes a venturi communicating with the air supply and creating a suction which is applied to the chamber during the blasting process to draw blasting material into the air supply. Cutting off the air supply reduces pressure in the chamber which permits the build-up of the blasting material on the metering platform to form a granular plug having sufficient stability to remain substantially intact under the action of the suction from the first pressure-producing means,

The chamber is provided by a substantially horizontal pipe fitting and a flexible hose connects the chamber to the discharge gun.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a perspective view of a blasting machine including a reclaimer unit;

FIG. 2 is an enlarged side elevation, partly in cross section, illustrating the reclaimer unit of the blasting machine;

FIG. 3 is an enlarged, fragmentary sectional view, illustrating the manner in which the valve device functions to cut off blasting material supply, and

FIG. 4 is a fragmentary view of the blasting gun, partly in cross section.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now by characters of reference to the drawing and first to FIG. 1, the portable blasting and cleaning

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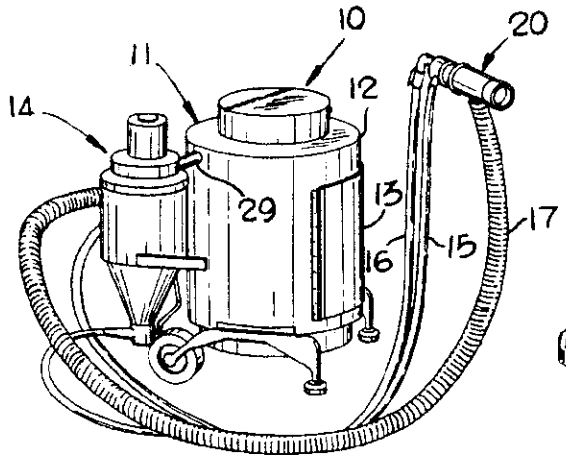

FIG. 1

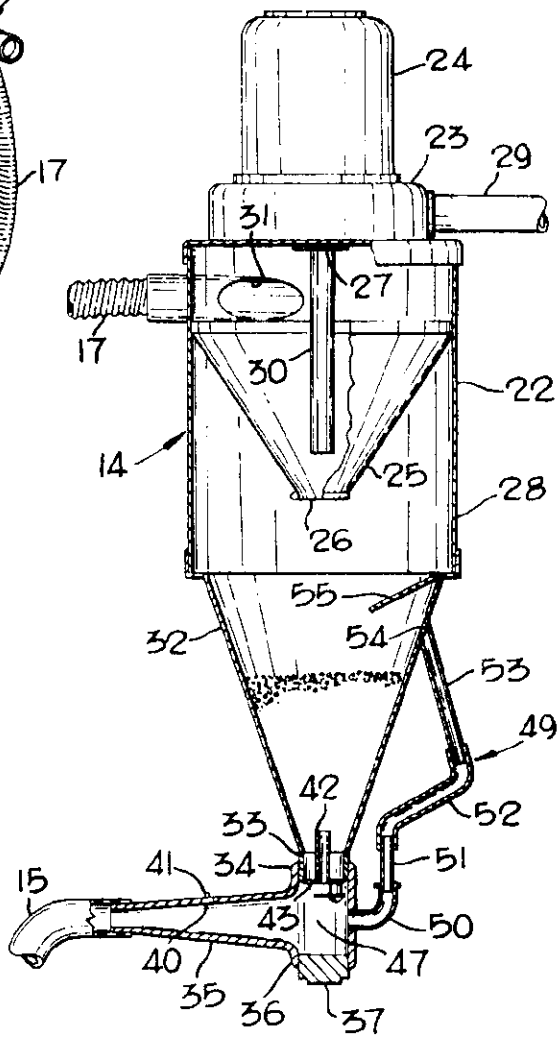

FIG. 2

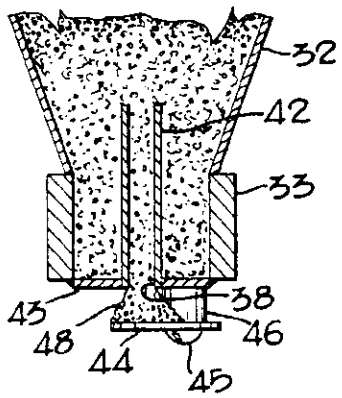

FIG. 3

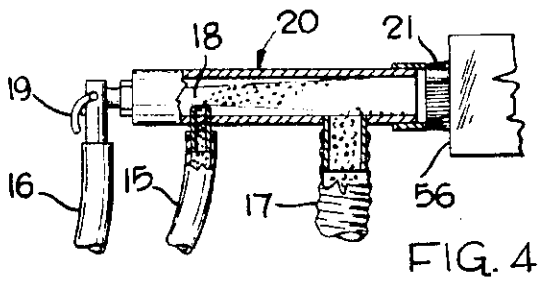

FIG. 4

Inventors
RICHARD R. COMPTON
CHARLES E. KAMPER
By Cohn and Powell
Attorneys

machine is generally indicated by numeral 10. The machine includes a filtering unit 11 having a cylindrical casing 12 with an access door 13. The unit 11 includes filtering means and a container for the residual cleanings. The machine 10 includes a separator and hopper assembly indicated by 14 which provides a reclaim apparatus and supplies blasting material conducted by suction through a hose 15 to a blasting gun 20.

Within the gun 20, the blasting material becomes entrained in a discharging stream of air under pressure supplied to the gun 20 by the air hose 16, and constituting a first pressure-producing means. The nozzle of the gun 20 has a forwardly-projecting, brush-terminating nozzle 21 which provides an air-pervious shroud ring and permits the discharging air to escape into the ambient atmosphere, but traps within its confines, spent blasting material and waste cleanings. The blasting material and cleanings are returned by suction to a hose 17 which leads to the separator 22 of the reclaim assembly 14 to provide continues cyclical action. The reclaim assembly 14 will now be described in greater detail.

As best appears in FIG. 2, the reclaim assembly 14 includes a separator 22 surmounted by a centrifugal blower 23, constituting a second pressure-producing means. The blower 23 includes an impeller wheel (not shown) which is driven by an electric motor 24. Within the cylindrical casing 28 of the separator 22 is a conical or funnel-shaped member or hopper 25 with an opening 26 at its lower end coaxially disposed with respect to the blower 23. Depending from the central intake opening of the blower 23 is a suction pipe 30, the opened lower end of which is spaced a short distance above the plane of the hopper opening 26. The suction hose 17 through which the spent blasting material and cleanings are delivered to the funnel member 25 near its upper end, constitutes a return conduit means and terminates in the wall opening 31, which is arranged so that when the blasting material exits from the hose 17, circumferential motion is induced into the particles.

A conical hopper 32 depends from and is secured to the lower end of the separator casing 28. At its lower end, the hopper 32 terminates in a collar 33 threadedly joined to a short leg 34 of a T-shaped pipe fitting 35. The opposite short leg 36 of this fitting is normally closed by a removable plug 37. The longer leg of the T-fitting 35 has a tapered configuration. The relatively attenuated outer end of the fitting 35 is coupled to hose 15.

A threaded opening 40 in the wall of the T-fitting 35 is normally closed by a plug 41. This plug 41 may be removed to admit air and reduce the degree of vacuum or negative pressure within the fitting 35, whereby to effect a reduction in the flow rate of the blasting material to the discharge gun 20.

As shown in FIG. 3, granular blasting material passes from the lower end of the hopper 32 into the T-fitting 35 through a short tube 42 having a relatively restricted internal diameter, and constituting an orifice mouthpiece. The tube 42 is carried by a disc 43 that closes off the lower end of the hopper 32 except for the passage afforded by the tube 42. An imperforate plate 44, constituting a metering platform, is disposed in spaced relation below the exit aperture 38 of the tube 42 and is supported from the disc 43 by a screw 45. A spacer collar 46 fixes the spaced relation of the plate 44 below the exit aperture 38 opening into the T-fitting 35. The T-fitting 35 provides a metering chamber 47, constituting a chamber means, and the metering plate 44 functions to limit the flow of blasting material from the hopper 32 to the metering chamber 47. Essentially, a granular plug 48 constitute a valve means and acts in the manner of a valve that includes no moving parts.

A by-pass conduit means is provided between the metering chamber 47 and the upper end of the hopper 32, and is formed by composite length of conduit 49 including an elbow tube 50, an S-tube 52, and two straight tubes 51 and 53. The tube 53 terminates upwardly at an opening 54 in the wall of the hopper 32. When the blasting gun 20 is shut off, the residual granules in the chamber 47 and the hose 15 tend to return to the hopper 32 under the action of suction from the blower. A baffle plate 55, constituting a deflector, extends angularly inwardly from the hopper wall above the opening 54, and acts to deflect granules of blasting material emerging from the pipe 53, downwardly and away from the opening 26 of the funnel member 25.

It is thought that the structural features and advantages of this blasting and peening machine have become fully apparent from the foregoing description of parts, but for completeness of disclosure, the operation of the machine will be briefly described.

When the control valve 19 of the blasting gun 20 is opened, a stream of compressed air passes through an aspirator or venturi tube creating a vacuum or negative pressure of substantial magnitude. The resulting suction in the chamber 47 of the T-fitting 35, aided by gravity, draws the dry, granular blasting material from the hopper 32 into the chamber 47 through the hose 15. The blasting material induced into the gun chamber 18 is transported forwardly by the air stream towards the nozzle 21 to impinge against a workpiece face generally indicated by 56.

After losing its energy following impingement on the workpiece 56, the blasting material together with the cleaning waste formed by the impact, is drawn into the hose 17 by suction from the blower 23. The material is returned by the hose 17 through the wall opening 31, and thence into the funnel member 25.

Cessation of the blasting operation by closing the gun control valve 19 which constitutes an air supply actuating means, cuts off the flow of material through hose 15. This cut-off reduces the relatively high suction pressure within the chamber 47 with the result that the chamber experiences only such suction pressure as is induced by the suction created by the blowers 23 by way of the by-pass conduit 49. The elimination of the high suction pressure in the chamber 47 reduces the flow of material through the pipe 42, and by reason of reducing this flow and because of the proximity of the plate 44 to the discharge aperture of the tube 42, the material collects and piles up on the plate 44, as shown in FIG. 3, to form a granular plug 48, cutting off further flow from the hopper 32 to the chamber 47. Residual blasting material in the chamber 47 and the hose 15 tends to return to the hopper 32 by virtue of suction from the blower 23 acting through the return conduit 49, the suction causing a reversal of flow from that caused by the air supply to the gun.

Blower 23 has as its primary function, the creation of a suction flow drawing spent blasting material and cleanings from the gun 20 via the hose 17 back into the reclaim assembly 14 wherein the particles are whirled and separated centrifugally. The relatively lighter waste cleanings enter pipe 30 and are discharged into the filter unit 11 by way of the pipe 29 interconnecting the reclaim assembly 14 to the filter unit 11. The reclaimed blasting material gravitates along the surfaces of the funnel member 25 and drops into the storage hopper 32 for subsequent reuse. The secondary suction pressure caused by the blower is normally considerably less than that created by the venturi action of the blasting gun 20. It is, therefore insufficient to counteract or interfere with the flow of blasting material from the hopper 32 to the chamber 47, and from the chamber 47 through hose 15 to the gun 20, during the blasting operation. However, as noted, when blasting is discontinued, the suction induced by blower 23 and communicated to chamber 47 draws the blasting material remaining in hose 15 and chamber 47 back into the hopper 32 through by-pass conduit 49. Thus, the hose 15 and the chamber 47 are scavenged or purged, and the loss of material due to spillage from the gun 20 is prevented.

The closing off of the passage in the tube 42 by the

granular plug **48** prevents blasting material from continuous circulation from hopper **32** to chamber **47** and back into hopper **32** under the influence of the secondary vacuum pressure induced by the blower **23**.

When the blasting gun **20** is again actuated, the resulting suction in the metering chamber **47** eliminates the granular plug **48** and the blasting operation proceeds in the normal manner.

It has been determined that with the use of blasting material consisting of minute glass beads of the size currently in use, which range from about 0.005 to 0.05 inch in diameter, a tube **42** of some $\frac{3}{16}$ internal diameter and a plate **44** spaced about one-quarter of an inch below the exit aperture **38** of the tube **42** results in the desired valvular effect of closing off the tube as heretofore described when the blasting operation is discontinued.

We claim as our invention:

1. In a flow control apparatus for a peening and blasting machine:

(a) reservoir means containing blasting material and including an orifice means,

(b) discharge means,

(c) chamber means communicating between the orifice means and the discharge means,

(d) a first pressure-producing means transferring blasting material from the reservoir means to the discharge means during blasting,

(e) return conduit means communicating with the discharge means and the reservoir means,

(f) by-pass conduit means communicating with the chamber means and the reservoir means,

(g) valve means including metering means disposed in spaced relation to the orifice means whereby to selectively collect blasting material and form a granular plug controlling and substantially precluding flow from the orifice means following blasting, and

(h) a second pressure-producing means applying pressure to the chamber means to selectively remove blasting material from the chamber means to the reservoir means by way of the by-pass conduit means following blasting.

2. An apparatus as defined in claim **1**, in which:

(i) the by-pass conduit means communicates with the chamber means below the level of the metering means.

3. An apparatus as defined in claim **1**, in which:

(i) the reservoir means includes a storage hopper;

(j) the orifice means is located at the lower end of the storage hopper and includes a re-entrant pipe mouthpiece.

4. An apparatus as defined in claim **1**, in which:

(i) the chamber means includes a metering chamber,

(j) the orifice means includes an aperture opening into the metering chamber, and

(k) the metering means includes a metering platform disposed in spaced relation below the aperture whereby to selectively collect blasting material issuing from the aperture and form the granular plug controlling flow of said blasting material.

5. An apparatus as defined in claim **4**, in which:

(l) the reservoir means includes a storage hopper adapted to store blasting material,

(m) the by-pass conduit means includes a pipe opening into the storage hopper above the storage level and a pipe opening into the metering chamber below the level of the metering platform, and

(n) the second pressure-producing means is disposed above the storage hopper and creates a suction therein, the suction being applied to the metering chamber by way of the pipe openings.

6. An apparatus as defined in claim **5**, in which:

(o) a deflector is disposed in the reservoir above the pipe opening and below the second pressure-producing means whereby to deflect the blasting material into the storage hopper.

7. An apparatus as defined in claim **1**, in which:

(i) actuating means controls the air supply delivered to the discharge means,

(j) the actuating means, upon de-actuation, reducing pressure in the chamber means to permit the build-up of the blasting material on the metering means and form the granular plug yet to permit scavenging of said chamber means by the second pressure-producing means.

8. In a flow control apparatus for a peening and blasting machine:

(a) reservoir means containing blasting material and including an orifice means,

(b) discharge means,

(c) chamber means communicating between the orifice means and the discharge means,

(d) a first pressure-producing means selectively transferring blasting material from the reservoir means to the discharge means,

(e) return conduit means communicating between the discharge means and the reservoir means,

(f) a second pressure-producing means applying sufficient pressure to the chamber means to selectively remove residual blasting material from the chamber means when said first pressure-producing means is less than said second pressure-producing means, and

(g) valve means controlling flow of the blasting material between the reservoir means and the chamber means, the valve means including metering means disposed in spaced relation from the orifice means whereby to collect blasting material and form a granular plug to substantially cut off flow from the orifice means when the first pressure-producing means is less than the second pressure-producing means to substantially preclude continuous cycling of blasting material between the chamber means and the reservoir means.

9. An apparatus as defined in claim **8**, in which:

(h) the orifice means includes an aperture opening into the chamber means, and

(i) the metering means includes a platform disposed below the aperture and collecting blasting material issuing from the aperture to form the granular plug closing the aperture.

10. An apparatus as defined in claim **8**, in which:

(h) the reservoir means includes a storage hopper,

(i) the chamber means includes a metering chamber,

(j) the orifice means is located at the lower end of the storage hopper and includes a pipe mouthpiece providing an aperture into the metering chamber,

(k) the metering means includes a metering platform disposed below the aperture in the metering chamber, and

(l) spacer means holds the metering platform in position.

References Cited

UNITED STATES PATENTS

1,858,475	5/1932	Wolever	51—11 X
2,770,924	11/1956	Mead et al.	51—8
3,075,318	1/1963	Dilliard et al.	51—12 X
3,199,171	8/1965	Hellmann et al.	72—53 UX

LESTER M. SWINGLE, Primary Examiner

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51—12; 72—53