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SUPPLY APPARATUS FOR PEENING COMPONENTS

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ABSTRACT OF THE DISCLOSURE

This invention is directed to a supply system for supplying peening material, such as a slurry, to peening jets. The invention comprises essentially the use of a distribution tank from which slurry under pressure is supplied to a plurality of outlets feeding the peening jets. The supply outlets are all arranged so that each jet is supplied with the slurry at substantially like pressure.

This invention relates to components for use with peening apparatus. It is particularly directed to the distribution system for peening supplies to be fed to peening nozzles for application to work under treatment.

Normally, in peening apparatus, work to be treated is either subjected to the action of dry peening components, such as hardened steel, cobalt or other similar metal balls forced against the work through a nozzle under the influence of some type of fluid pressure system, such as an air jet. In other forms of peening apparatus, it has been found that preferred results are achieved where the work to be treated is subjected to the action of a slurry formed of a liquid and a pre-established concentration of some type of peening component. In most instances, the peening component that is included in the liquid slurry and which is sufficient to make the slurry of the selected concentration is a glass bead or ball of extremely small size.

For many types of work, the glass bead or ball is to be preferred because it is both hard and yet resilient and can be formed in extremely small size with great uniformity. Glass balls used for such types of peening apparatus may be made which vary only within extremely minor limitations from a size as small as 0.001 inch in diameter up to, say 0.004 inch in diameter. These glass balls are often fed along with water as the sustaining liquid to be directed outwardly from a peening jet under the influence of some suitable type of fluid, such as air, forced into the nozzle area at relatively high pressure.

The peening solution or slurry is also supplied at some selected pressure above atmospheric through a distributor element, then to be fed into the nozzles into which the high pressure air is also directed. This serves to both draw the slurry from the distribution tank by suction and also to force the slurry at high pressure against the work to be treated.

In many instances in the past it has been customary to provide the slurry and to feed it into a manifold from which different outlets were progressively provided to direct the material to the different succession of nozzles. In the average form of manifold, the first outlet usually was so located that substantially the pressure of the slurry feeding pump is maintained. The slurry then feeds along with the injected air or other fluid through the nozzle against the work. As a slurry from the source of supply is forced through the distributor and manifold, an inherent drop in pressure occurs because of the distance from the source and then also at each outlet in the sequence from the distribution point down to that outlet in the manifold which is most remote from that end at which the slurry enters. The result has been generally that the slurry at the distant outlets is released under less pressure than at the head end, due primarily to the greater distance of flow from the distribution point of the manifold, and consequently the slurry from the last outlet will not be as dense as at that outlet nearest the source of distribution and the slurry concentration is reduced.

Remote nozzles then actually receive less solids in the slurry than do others and consequently a lack of uniform peening of the work toward which the nozzles are directed frequently occurs. This is particularly of substantial significance where the work is held stationary for a limited period of time and is then stepped along to bring a complete new section into the outlet region of the different nozzles.

Where the work is moving continously with respect to a whole series of nozzles, this is generally not quite as significant as for intermittent motion but, nonetheless, if the nozzles are so arranged as to be transverse to the work some portions of the work within the region of the nozzle outlets tend to be peened to a greater extent than some other sections of the work. As a result of this, the hardness of the work acted upon may differ to some extent. If this occurs, the efficiency of operation of the system as a whole decreases rapidly.

In the instance of turbine blades, where some nozzles direct their output closer to the root of the blade and others direct their output nearer to the edge of the blade, a marked difference in the blade treatment can occur because of such difference in the slurry concentration.

This invention has as its aims and objects those of providing for the obtainment of substantially uniform concentration of the impacting slurry at all regions so that the slurry fed into any nozzle is of approximately the same concentration. Then, when the nozzles direct the output of the slurry along with the feeding air supply, the treatment which each section of the work within the range of the supply nozzles receives is approximately the same.

This objective is achieved according to the present invention by providing a tank or distribution element into which the slurry input is fed from a suitable pump at a suitable pressure and from which tank the output of the slurry is taken at points where the slurry concentration and pressure is substantially equal. Usually the distribution tank is formed more or less as a cup-shaped element with the inlet from the supply pump feeding in at the bottom. Numerous outlet connections from substantially along a circumferential path are arranged about the distribution tank and are generally equally angularly spaced. The connections of the peening nozzles to the distribution tank are then provided by short length conduits, usually flexible in nature, leading to one entrance port of a projecting nozzle. The input slurry normally feeds into the nozzle chamber. All slurry feeding into the nozzle chamber is then ejected under the force of some form of fluid, such as air, which is fed into the same nozzle chamber and is of sufficient force to draw the slurry along with it as it is forced toward the nozzle outlet.

In a refined form of the invention, the distribution tank is so provided that as the input slurry from the source feeds into the tank, sufficient pressure is created internally of the tank to close an air valve so that all slurry within the tank is fed out at each of the exit ports in substantially equal volume. The air closure element is so arranged that it is adapted to open as soon as the pressure within the slurry feeding passage from its pump is reduced below an optimum pressure value at which the slurry is most easily fed into the various outlet connections and at which pressure the air valve closes. The opening of the air valve is sufficient to break any vacuum condition which might exist in the distribution tank and thus promptly permit any slurry contained within the distribution tank as well as the slurry line promptly to drain back through the pump and into a suitable source of supply.

Various modifications of the arrangement may be provided as desired but the invention in one of its preferred forms has been illustrated by the accompanying drawings wherein

FIG. 1 illustrates in diagrammatic form the general plan of operation of the assembly showing the pump, the distribution tank and the slurry nozzles directed toward the work;

FIG. 2 shows in vertical section the upper part of the slurry distribution tank taken along the line 2—2 of FIG. 1 and

FIG. 3 shows a top view of the distribution tank as the slurry is fed from it.

If reference is now made to the drawings, the slurry distribution tank 11 is provided with an inlet passage 12 at its lower end from which, by way of a suitable connection 13, slurry of any desired concentration may be fed from the pump, schematically shown at 14. The connection points are shown at 15 from which the slurry can be released to the nozzle elements.

The nozzle elements 20 and 21, of which there may be any desired number, are shown as directing their output (shown in dotted outline) toward an assumed work-piece which can be regarded for illustrative purposes as the edge of a turbine blade. In the form in which the distribution tank is shown, there is a series of outlet connections 25, 26, 27 and 28 which lead outwardly from the distribution tank 11 to flexible connecting members, such as those diagrammed at 30 and 31, which connect into the nozzle chambers illustrated schematically at 32 and 33. Fluid under pressure (such as air) is also supplied into the nozzle chambers. The fluid is derived in most instances from some separate source (not shown), such as a tank, and is fed in by way of the inlet ports 35 and 36 so that any slurry fed into the nozzle chambers 32, 33 will be forced outwardly toward the work element.

With the slurry feeding into the distribution tank 11 by way of the connecting tube 13 from the pump 14, it is apparent that in the plane of the outlet connections 25 through 28 the pressure will be approximately the same. Therefore, the pressure at which the slurry is feeding through the tubes illustrated at 30 and 31, for instance, into the chambers of the ejecting jets 21 and 20, respectively, will be approximately the same (assuming the same size and length feed tube). The slurry, in feeding into the distribution chamber 11, is fed in at sufficient pressure to close the check valve 40 and make the edges 41 of the check valve seat tightly against the inner upper portion 42 of the distribution tank and thereby close the tank off against the inlet of air through the opening 43 formed adjacent to the bracket 44 which suspends the edges of the check valve internally of the distribution tank.

Under these circumstances whenever the slurry is being fed through the tube 13 to the distribution tank 11, the check valve closes and the pressure build up within the tank 11 forces the slurry outwardly through the connections 25 through 28. However, at times when the pump

14 ceases to force slurry through the tube 13 to the tank 11, the weight of the check valve 40 is sufficient to permit it to drop down and to permit the rectangular support element 44 to rest against the top surface 45 of the distribution tank 11. This permits motion of the check valve 40 up and down as indicated by the arrows adjacent to it and immediately lets air into the tank 11 to break any vacuum which might be created.

Oftentimes, it has been found that the slurry may tend to cling to the surface of the check valve and particularly to the protruding edges 40 thereof. Consequently, to avoid this possibility, it is occasionally desirable to be able manually to turn the check valve to a limited extent and to move it up and down manually at times when the pump 14 is cut off. This is done by the pin element 46 which extends outwardly from the bolt 47 which threads through the rectangular support element 44 thereby to hold the entire assembly in place. The bolt may be knurled at its outer end to make turning the same by hand relatively easy.

Various other modifications may, of course, be made in the structure described without departing in any respect from the essence of the invention or the features of novelty hereinabove described.

Having now described the invention, what is claimed is:

1. A distribution system for feeding slurry to peening nozzles comprising:
   - a substantially circular cross-section slurry distribution tank,
   - means to supply the tank with slurry adapted to be directed thereto from a pressure source to build up within the tank pressure approximating that of the source,
   - a plurality of generally uniformly spaced outlet taps from the tank at spaced regions whereat each outlet pressure is substantially initially equal,
   - an air vent check valve in the upper section of the tank in a region above that of any of the outlet taps, said air inlet being adapted to be closed when the pressure of the supplied slurry exceeds a selected optimum value, and
   - means to cause the air vent to open at time periods when the supply pressure drops below the selected optimum.

2. A distribution system as in claim 1 comprising, in addition, means to raise and lower the check valve manually thereby to release to the tank any slurry which might collect at times of supply cut-off.

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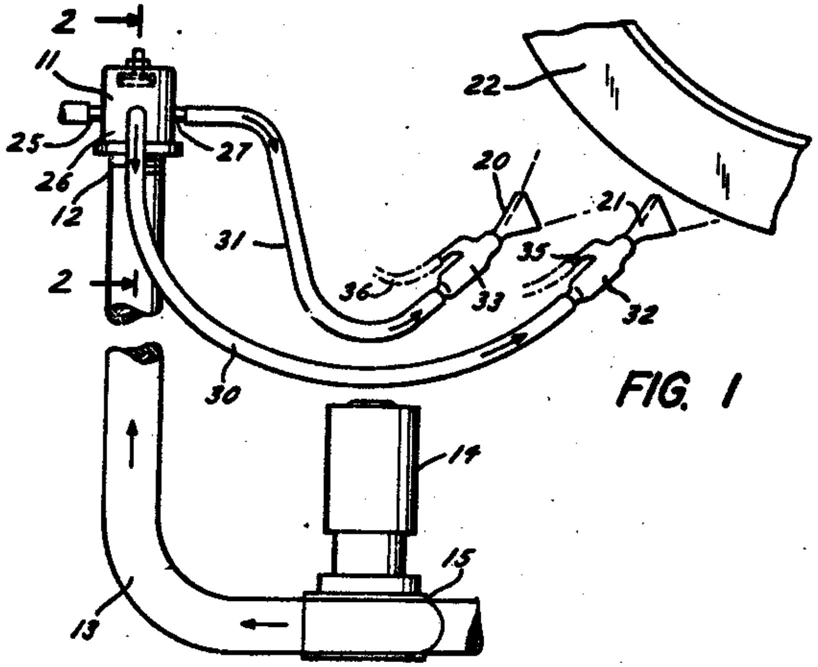
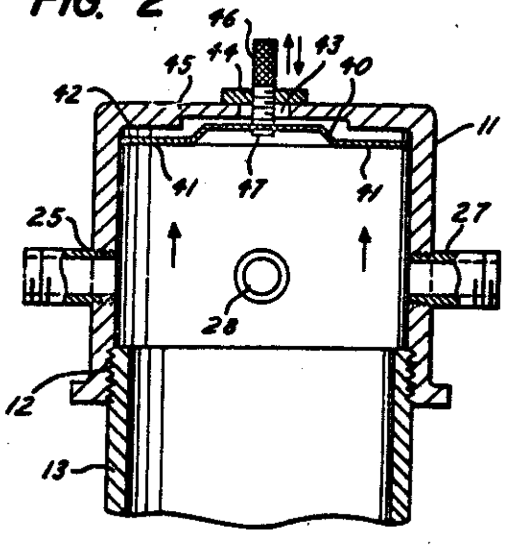


FIG. 1

FIG. 2



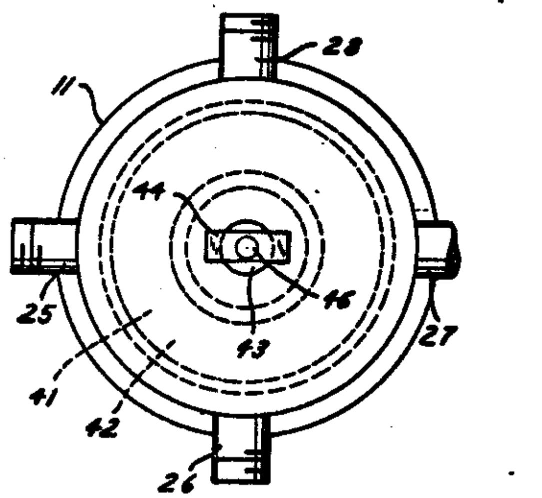


FIG. 3

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