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HONING AND PEENING ARRANGEMENT

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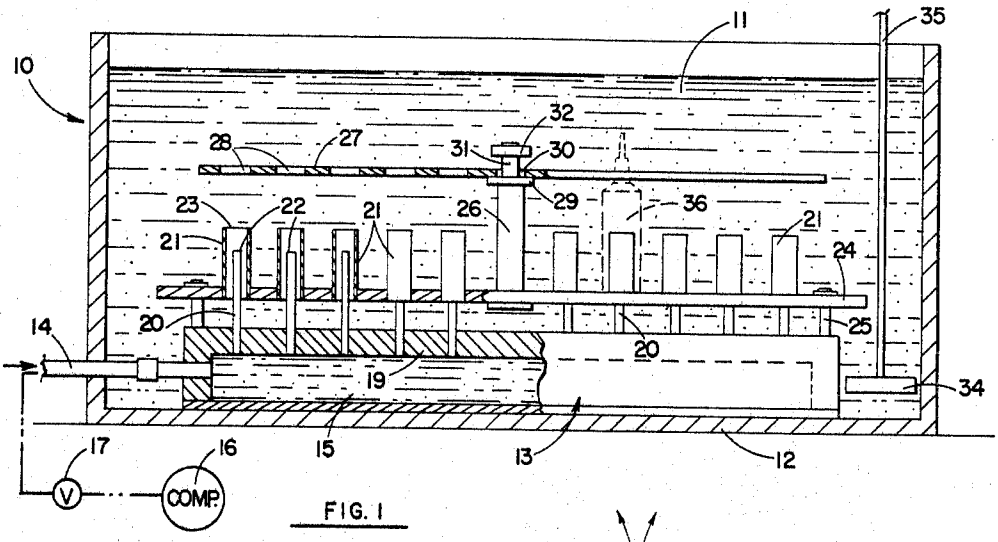


FIG. 1

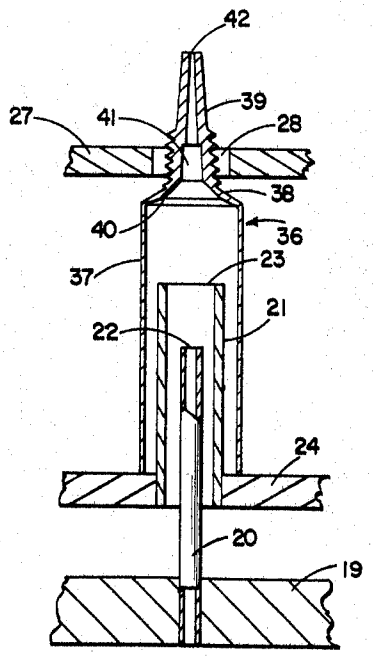


FIG. 2

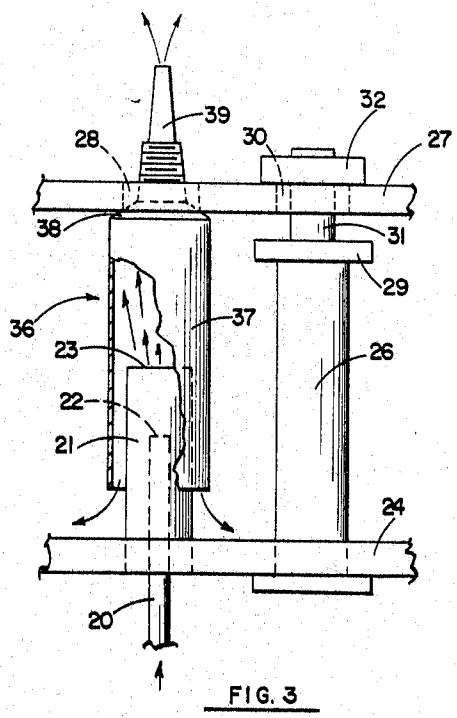


FIG. 3

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HONING AND PEENING ARRANGEMENT

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ABSTRACT OF THE DISCLOSURE

An arrangement for cleaning hollow objects in which the objects to be cleaned are placed around tubes in a vessel containing a particulate material soluble in a known liquid together with a saturated solution of said material in said liquid. A gas nozzle is located inside the tubular member for inducing a flow of said solution and particulate material to impinge upon the interior of the hollow object and clean or peen by mechanical action. After this, the hollow object is placed in a similar vessel and rinsed with the liquid for dissolving any residual quantity of the particulate material.

This invention pertains to an improved arrangement for honing or peening by impinging particulate materials against a part. Residual particles subsequently are removed by dissolving them.

In the cleaning of parts, vapor blasting is a commonly used technique. A stream of particulate material is directed against the part, to hone it by mechanical action as the particles cut away surface irregularities. A problem has arisen from the adhesion of the particles in openings or crevices in the workpiece against which they are blasted. Also, the nozzles through which the particles are discharged may become clogged with the particles. It is a difficult and slow operation to remove the particles once they have adhered in that manner. Often, the particles cannot be dislodged from the workpiece without destroying it so that the part becomes a total loss. Consequently, it has been impossible to assure satisfactory vapor blasting of certain types of parts.

The present invention overcomes these difficulties through the use of a soluble material for honing or peening. The soluble particles simply are dissolved to remove them to assure that there will be no residual particles remaining in the workpiece. This also assures that the blasting nozzles can be kept clean. In order to make certain of the right concentration of particulate material, with uniform blasting and the absence of clogging of the nozzles, it is preferred to use an excess of the soluble particulate in a saturated solution of that material. Particularly suitable is sodium chloride in a saturated sodium chloride solution. The blasting may take place through air injection accomplished by providing an air nozzle within an open-ended tube adjacent which the part is positioned. The entire assembly is submerged in the solution within a tank. When the air is blasted through the nozzle, it induces a flow of the particulate material against the workpiece to accomplish the honing or peening action. After this, the parts are blown dry and then the operation is repeated in a second container of clear water. All residual particles are dissolved and removed, and the part is effectively honed and not contaminated by particles adhering to it.

An object of this invention is to provide an improved honing or peening arrangement.

Another object of this invention is to provide for honing or peening with the ability to remove residual particles from the workpiece.

A further object of this invention is to accomplish honing or peening rapidly and economically.

An additional object of this invention is to provide a honing or peening arrangement adapted for volume production.

These and other objects will become apparent from the following detailed description taken in connection with the accompanying drawing in which:

FIGURE 1 is a sectional view, partially in elevation, illustrating a honing device constructed in accordance with this invention;

FIGURE 2 is an enlarged fragmentary sectional view illustrating the individual honing unit prior to blasting the material against the part; and

FIGURE 3 is a view similar to FIGURE 2, illustrating the action as the honing takes place.

In the embodiment shown, the invention is adapted for cleaning the interiors of conventional metal foil tubes. Even after the most careful manufacture, metal foil tubes retain burrs which subsequently can become dislodged and contaminate the contents of the tubes. This situation is intolerable for many uses, such as where the tube is to retain a medical preparation. Another area where clean foil tubes is essential is in the storage of high-performance adhesives which are catalyzed and kept in a frozen condition to arrest the reaction so that they will not set up until after thawed and ready for use. Such adhesives must be completely pure and free of foreign substances.

As shown in FIGURE 1, there is provided a container **10** that is adapted to be substantially filled with a material **11** that includes the particulate matter used in the honing operation. Within the vessel **10** at its bottom wall **12** is a manifold **13** to which is connected an air line **14**. The manifold **13** is a block of metal, such as aluminum, the interior of which defines a cavity **15**. The air to enter the cavity **15** from the line **14** is supplied by a compressor **16** that is controlled by a valve **17**.

Openings are provided in the top wall **19** of the manifold **13**, and into these are pressed small tubes **20**. The latter elements serve as the air nozzles in the use of the device of this invention. The nozzles **20** are positioned in a parallel relationship and equally spaced apart.

Each nozzle **20** extends into an open-ended larger sleeve **21**, typically of around ¼ inch outside diameter and 5/16 inch inside diameter. The upper end **22** of each nozzle **20** terminates below the upper end **23** of the sleeve **21** that receives it. The inside diameter of the sleeve **21** is greater than the outside diameter of the nozzle **20** so that there is a space between the circumferential wall of the nozzle **20** and that of the interior of the sleeve **21**.

The sleeves **21** are carried by a plate **24** that is supported by studs **25** above and in a parallel relationship to the upper wall **19** of the manifold **13**. The sleeves **21** may be pressed into openings in the plate **24** so that they are projecting above the plate **24** and held in a parallel relationship.

A post **26** extends upwardly from the center of the plate **24** and provides support for a perforated stop plate **27**. Circular openings **28**, which are aligned with the nozzle and sleeve assemblies, provide the perforations in the plate **27**. The post **26** includes a shoulder **29** upon which the plate **27** rests, while the opening **30** through the plate **27** is slightly larger in diameter than the section **31** of the post that extends through it. A nut **32** is received on the upper end of the post **26**, but is slightly above the upper surface of the plate **27**. Consequently, a clearance is provided at the mounting of the plate **27** so that limited floating movement of the plate **27** is possible.

The material **11** in the vessel **10** comprises a saturated solution of a particulate material, together with an excess of the particulate. Especially suitable is table salt, be-

cause it is very carefully graded as to size and is available in substantial quantities at low prices. Thus, the material **11** in the vessel **10** typically is a saturated sodium chloride solution with an excess of sodium chloride added to it. This means that the material **11** is not merely a liquid, but includes also sodium chloride crystals of substantially uniform size. In order to maintain the salt particles dispersed throughout the liquid in the vessel **10**, a paddle **34** is provided, driven by a shaft **35**. This keeps the material in the tank stirred up so that the salt crystals are evenly distributed.

In use of the device of this invention, the perforated plate **27** is removed from the post **26** and the metal foil tubes **36** to be cleaned are fitted over the sleeves **21**, with their unfolded open ends resting on the support plate **24**. Several tubes **36** may be introduced at once for a cleaning operation. It is conventional to package tubes upon manufacture in boxes containing one gross each, so that it is convenient to provide one hundred forty-four sleeve and nozzle assemblies to enable a gross of tubes to be cleaned at one time.

The parts of the tube-cleaning device are proportioned relative to the tubes to be cleaned such that the circumferential wall **37** of the tube **36** is spaced outwardly from the circumference of the sleeve **21**. Also, the upper end **23** of the sleeve is adjacent but spaced from the convergent section **38** of the tube **36** that leads to the externally threaded tapering tip **39**.

With the perforated plate **27** replaced after the tubes **36** have been fitted over the sleeves **21**, the tips **39** extend through the openings **28**. The tips **39** are smaller in diameter than the openings **28** so that a clearance is provided around the tips. Also, the shoulder provided by the inwardly tapering section **38** of the tube is slightly beneath the undersurface of the plate **27**, spaced from it approximately ¼ inch.

Prior to the honing operation, the tube **36** inevitably will have a burr **40** midway along the sloping surface of the section **38** that connects the wall **37** to the tip **39**. This burr arises from a mold parting line that is included in the manufacture of the tubes **36** to permit them to be ejected from the die. In addition, in the entrance portion **41** of the tip **39**, burrs will occur from chuck marks where the tube is gripped during its manufacture. Occasionally, an additional burr is found at the exit opening **42** of the tip **39**. All these burrs will be removed by the honing arrangement of this invention.

In operation of the device, the valve **17** is opened to admit air from the inlet line **14** into the cavity **15** of the manifold **13**. This air, which is typically shop air at 100 p.s.i., then discharges through the small nozzles **20**. Higher pressure air can be used with even greater effectiveness. The air leaving the ends **22** of the nozzles **20** acts as an ejector, inducing a flow of the material **11** through the sleeve **21**. Thus, the material **11** circulates through the bottom end of the sleeve **21**, discharging from the top end **23**. Consequently, a flow takes place of air, saturated salt solution and salt crystals. This stream of material against the interior of the tube **36** causes the tube **36** to rise upwardly until the portion **38** bears against the undersurface of the plate **27** adjacent the opening **28**. The stream of material impinges upon the section **38** of the tube, but does not strike the thinner side wall **37**. The material flows into the entrance **41** of the tip **39**, but, because of the narrow opening through the tip **39**, most of the material then reverses its direction to exit through the open bottom end of the tube **36**, which now is spaced above the plate **24** due to the upward movement of the tube. A small portion of the stream of material flows through the tip **39** and discharges through the exit opening **42**. As the salt crystals are driven across the surfaces of the tube in this manner, all burrs effectively are removed by mechanical action. The salt thoroughly cuts off the burr at the ridge **40** along the surface **38**, the chuck marks at the entrance **41**, as well as the burr that may occur at the tip **42**.

Because of the clearance at the connection between the plate **27** and the post **26**, the plate moves a certain amount as the blasting operation takes place. This is oscillatory and vibratory movement, which causes the tubes **36** to move slightly relative to the stream that is being impinged upon them. This assures that the blasting does not take place on a localized area within the tubes **36**, but that it is distributed throughout the critical portion of the tubes to assure that the burrs are removed in their entirety. The tubes also are free to turn and shift position at the stop plate **27** where there is no rigid connection to the plate, which also helps distribute the cutting action. Moreover, to increase this floating effect, the air blast may be applied intermittently rather than continuously. Typically, in operating the device, the air blast will remain on for a total of 30 seconds, applied in five-second increments.

After the burrs have been cleaned from the tubes **36** in this manner, the tubes are removed from the tank **10**, then dried at least partially by a blast of air. Then they are placed in a second vessel identical to the tank **10**, again being fitted over sleeves that surround air nozzles. The second vessel, however, contains clear water rather than salt and a saturated salt solution. In the second container, the air nozzles are operated as before, causing a flow of water to occur along the interior of the tubes **36** being cleaned. This water blast effectively dissolved any remaining salt particles on the tubes. Then, when the tubes **36** are removed from the water, they not only will not have burrs, but they will be entirely free from any residual particles of the blasting medium. There is no danger of contamination of the tubes because the particles used in the honing operation all will be dissolved and removed. Moreover, the blasting nozzles do not become clogged and are easily kept free by the air ejectors. At the same time, the salt crystals that are used in the honing operation are of the proper size to accomplish the cutting operation needed, are uniform to assure the absence of clogging, yet are not overly abrasive and will not damage the tubes. Ordinary table salt is suitable.

The tank **10** containing clear water without the particulate material can be used for washing the tubes in the first instance rather than blasting the tubes with the salt crystals. This is not as effective because the burrs will not be removed in the absence of the cutting action by the particulate. However, the liquid alone will wash loose material from the tubes satisfactorily, and is quicker and more economical by not requiring a two-step operation.

The exact amount of excess salt added to the salt solution is not critical, but the amount for optimum performance easily is established empirically. Enough crystalline salt should be present to cut the imperfections from the part in a reasonable time without being so concentrated as to tend to clog or fail to flow smoothly.

While described as a honing operation, the principles of the invention operate equally well for a peening procedure, in which event the particulate material is selected as one having a round exterior rather than a sharp-edged irregular form as for salt crystals. The smooth particles will produce a peening effect rather than a cutting action. Again, however, the particulate will be of a soluble nature so that it may be removed from the parts after the peening.

Additionally, the soluble particles may be directed against the workpiece in a dry form, rather than being included in the liquid carrier. However, the liquid offers advantages in assuring a uniform stream of particles that does not vary in concentration. Moreover, clogging is more likely to occur when dry particles are used than when they are contained in a liquid. While salt in a salt-water solution is an effective way of cleaning metal foil tubes, it is possible to employ other soluble particulates, and to use liquids other than water. In any event, how-

ever, the residual particles will be removed by the dissolving action after the honing or peening has been completed. Additionally, the invention is not limited to the cleaning of metal foil tubes, but may be used for other kinds of parts as well.

The foregoing detailed description is to be clearly understood as given by way of illustration and example only, the spirit and scope of this invention being limited solely by the appended claims.

I claim:

1. The method of providing honed and peened workpieces comprising the steps of

causing to impinge upon the surface of a workpiece a stream of particles soluble in a known fluid,

and then treating said workpiece with said fluid to dissolve desidual particles adhering thereto.

2. The method of providing honed and peened workpieces comprising the steps of

causing to impinge upon the surface of a workpiece a stream of particles soluble in a known liquid together with a saturated solution of said particles in said liquid,

and then washing said workpiece with said liquid for dissolving residual particles adhering thereto.

3. The method of honing a workpiece comprising the steps of

causing to impinge upon the surface of a workpiece a stream of salt crystals of substantially uniform size together with a saturated solution of said salt crystals,

and then washing said workpiece with water for dissolving residual salt crystals adhereing thereto.

4. The method of providing a honed workpiece comprising the steps of

providing a saturated aqueous salt solution, providing a quantity of salt crystals in said solution,

then immersing a workpiece in said solution, then discharging a gas in said solution so as to induce a flow of said crystals and solution that impinges on said workpiece,

and then washing said workpiece in water to remove residual salt crystals therefrom.

5. The method as recited in claim 4 including in addition the step of agitating said solution while discharging said gas therein for dispersing said salt crystals in said solution.

6. The method as recited in claim 4 in which said salt is sodium chloride.

7. A device for providing honed and peened workpieces comprising

a quantity of particles soluble in a known liquid,

a saturated solution of such particles in said liquid,

said quantity of particles being received in said solution,

means for directing a stream of said particles and said solution against a workpiece,

and means for washing said workpiece in said liquid after so directing said stream thereagainst for thereby dissolving residual particles adhering to said workpiece.

8. A device as recited in claim 7 in which said particles are sodium chloride crystals, and in which said known liquid is water.

9. An arrangement for providing a honed and peened workpiece comprising

a vessel,

a quantity of particles in said vessel,

said particles being soluble in a known liquid,

a saturated solution of such particles in said liquid in said vessel,

an open-ended sleeve in said vessel,

and a fluid nozzle in said sleeve in a spaced relationship with the wall thereof,

whereby upon ejection of fluid from said fluid nozzle a flow of said particles and said saturated solution is induced through said sleeve for application to a workpiece received in said vessel.

10. A device for cleaning metal foil tubes comprising

a vessel,

a quantity of substantially uniform sharp-edged particles in said vessel,

said particles being soluble in a known liquid,

a saturated solution of said particles in said liquid in said vessel,

said particles being received in said solution,

a sleeve adapted to be received inside a metal foil tube to be cleaned,

an air nozzle extending into said sleeve in a spaced relationship with the wall thereof,

said sleeve having open ends,

whereby discharge of air from said nozzle induces a flow of said particles and said solution through said sleeve,

a support around said sleeve adapted to receive the end of a metal foil tube to be cleaned,

and a stop spaced outwardly from said sleeve for limiting the movement of a metal foil tube during said flow of said particles and solution through said sleeve into such a metal foil tube extending around said sleeve.

11. A device as recited in claim 10 in which said stop includes a member having an opening adapted to receive the tip portion of said metal foil tube, said member outwardly of said opening being engageable with larger portions of said tube adjacent said tip.

12. A device as recited in claim 10 in which said stop is movable a limited amount for permitting limited floating movement of said tube during said flow of said particles and said solution.

13. A device as recited in claim 10 including in addition

a second vessel, second sleeve and second air nozzle similar to said first-mentioned vessel, sleeve and air nozzle,

and a quantity of said known liquid in said second vessel for thereby cleaning said workpiece of residual particles following the application of said particles and solution to said workpiece in said first-mentioned vessel.

14. A device for cleaning a hollow object having an opening comprising

a vessel,

a liquid in said vessel,

a sleeve in said vessel in said liquid,

said sleeve having openings for permitting the passage of liquid therethrough,

said sleeve being adapted to have the open end of a hollow object extended around said sleeve,

a nozzle means in said sleeve,

means connected to said nozzle for providing compressed fluid to be discharge by said nozzle means for causing said liquid to be pumped through said sleeve and impinge upon said hollow object,

and stop means spaced from said sleeve for engagement by said hollow object when said liquid is so pumped through said sleeve for retaining said hollow object on said sleeve,

said stop means being movable a limited amount for permitting limited floating movement of said hollow object when said hollow object is in engagement with said stop means.

15. A device for cleaning a metal foil tube having a tip portion at one end, a projecting shoulder inwardly of said tip portion and an open opposite end, comprising

a vessel,

a liquid in said vessel,

a sleeve in said vessel and in said liquid,

said sleeve being adapted to be received inside the open end of a metal foil tube,

a fluid nozzle extending into said sleeve in a spaced relationship with the wall thereof,

said fluid nozzle having an exit opening spaced inwardly from one end of said sleeve,

said sleeve having open ends whereby discharge of fluid from said fluid nozzle induces a flow of said liquid through said sleeve for impingement upon the interior surface of said metal foil tube,

and means for positioning said metal foil tube around said sleeve for impingement thereon of said liquid flowing through said sleeve as induced by said discharge of fluid,

said means for positioning said tube including a stop spaced outwardly from one end of said sleeve for precluding movement of said tube therebeyond during said flow of liquid through said sleeve into said tube,

said stop including a member having an opening for receiving the tip portion of said metal foil tube,

said member having a surface around said opening engageable with the shoulder of said tube inwardly of said tip portion upon said flow of liquid through said sleeve into said tube.

16. A device as recited in claim **15** in which said stop is movable a limited amount for permitting limited floating movement of said tube during said flow of said liquid.

17. A device as recited in claim **15** in which said means for positioning said tube includes a support element adapted to have the end of said tube resting thereon, said element being spaced from said member such that said opening is adapted to receive said tip portion with said surface around said opening spaced from said shoulder, whereby upon said flow of liquid said tube is movable thereby to bring said shoulder into engagement with said surface around said opening.

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