Oct. 5, 1971 H. E. McKINNEY 3,609,920

SONIC POLISHING APPARATUS

Filed March 6, 1968

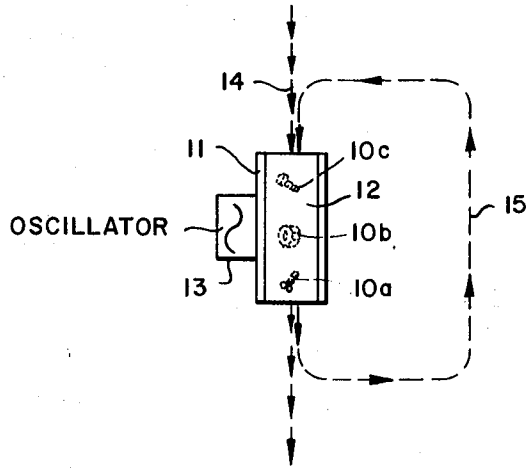

FIG. 1

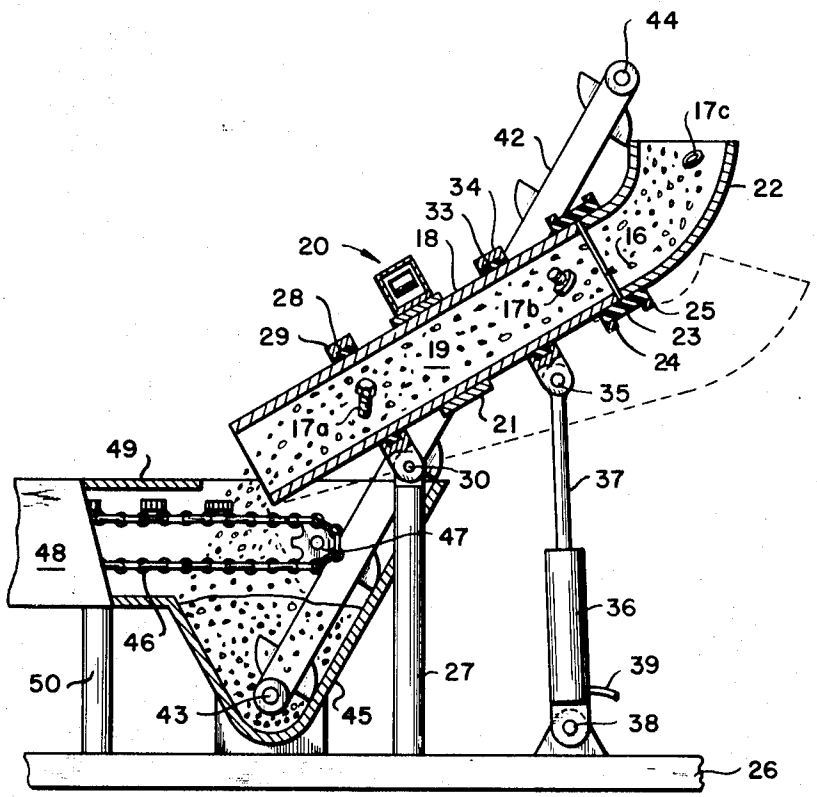

FIG. 2

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United States Patent Office 3,609,920 Patented Oct. 5, 1971

3,609,920

SONIC POLISHING APPARATUS

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Filed Mar. 6, 1968, Ser. No. 710,993
Int. Cl. B24b 31/00
U.S. Cl. 51—163 1 Claim

ABSTRACT OF THE DISCLOSURE

Industrial metal parts are finished by passing them in a continuous flow process through a sonically activated chamber containing suitable grit medium.

BACKGROUND OF THE INVENTION

The present invention relates to the art of sonic finishing of industrial parts and pertains more particularly to a continuous flow process of sonic finishing of industrial parts.

Industrial parts are fabricated by any number of means or methods including casting, forging and machining. Parts emerging from any of these fabrication steps normally are rough, contain burrs and sharp edges and in the case of castings contain molding sand imbedded in the surface thereof. These parts normally need finishing such as cleaning, deburring, edges rounded and polishing prior to further machining or assembly into machines. Many techniques have been used for cleaning and polishing or finishing of these parts including hand scrubbing and grinding. Other methods of cleaning and finishing of these parts include tumbling and shaking of the parts in a grit medium. The tumbling type finishing operation is carried out by loading the parts in a barrel or bin type container which is partially filled with a grit medium and then tumbling the parts in the grit medium by rotating the container about a horizontal axis. The shaking type finishing apparatus bodily shake or generally employs eccentric mass type shakers or vibrators to vibrate a container containing suitable finishing medium and parts. This type of vibration requires massive shakers or vibrators to develop the necessary forces involved in large batch type containers. The above-described methods of cleaning and finishing are time consuming and cannot keep up with modern techniques for the production of industrial parts.

The present invention employs the principle of a resonantly vibrating sonic system for the introduction of high levels of sonic energy rapidly and efficiently into a cleaning or finishing medium. The elastic resonant sonic vibration system of the present invention permits the use of a steady flow process of parts finishing wherein the parts go through the finishing chamber at such a rate as to obtain the desired finishing in a short period of time.

The energy transmitting system of the present invention employs a resonantly vibrating system which may be referred to as an acoustic circuit. For a better understanding of such systems, a close analogy may be drawn between the acoustic circuit and an electrical circuit as pointed out, for example, in chapter 2 of Sonics by Heuter and Bolt, published in 1955 by John Wiley and Sons.

The present invention overcomes the foregoing problems in the prior art devices and methods by providing a method and apparatus for a continuous flow process for sonic cleaning of industrial parts. The present system comprises a resonantly vibrating polishing chamber through which the parts pass in intimate contact with the polishing or finishing medium.

BRIEF DESCRIPTION OF THE DRAWINGS

Many additional objects and advantages of the present invention will be evident to those skilled in the art from the following detailed description and drawings wherein:

FIG. 1 is a schematic illustration of a suitable layout for a system in accordance with the present invention;

FIG. 2 is a side elevation partially in section of a preferred embodiment of apparatus for carrying out the present invention.

Description of the preferred embodiments

With particular reference to FIG. 1 there is illustrated a schematic layout of a suitable system for carrying out the present invention. As shown in FIG. 1 there is illustrated a conduit member **11** which is preferably constructed of a suitable elastic material, and forms a polishing chamber **12** through which articles to be polished are passed in the cleaning process. The conduit member may be of any suitable cross-section and may even be an open channel or trough. A sonic oscillator **13** is operatively coupled to the conduit member **11** to transmit elastic vibrations into a polishing medium contained in its chamber **12**. The oscillator **13** and elastic conduit member **11** form an elastic sonic energy transmission system which when operated at or near its resonance frequency provides for the rapid and efficient delivery of energy to the polishing medium in the chamber. Parts **10***a*, **10***b* and **10***c* to be polished pass, such as along a path **14**, into chamber **12** wherein the polishing medium under the influence of sonic energy impacts against and along the surfaces of the parts providing effective cleaning and polishing thereof. The polishing medium, which may be any suitable type of abrasive particles such as an aluminum oxide, may be retained in a chamber **12** as the articles are passed therethrough or in the alternative may be arranged so as to flow therethrough substantially along with the articles. Moreover, provisions may be made for the recycling of the abrasive or polishing medium such as along the path such as **15**. The polishing media may be of any suitable type or composition to obtain the desired results. For example, the medium may comprise dry granules or may be slightly moistened as desired. Also, the medium may be a slurry comprising abrasive particles suspended in a suitable liquid. The level of polishing medium in chamber **12** and the rate of flow therethrough of the medium as well as the articles to be polished is preferably adjustable all independently in order to obtain the proper degree of finishing.

In FIG. 2 is illustrated a suitable arrangement of apparatus of carrying out the present invention. As shown in FIG. 2 an elastic conduit member **18** forms a polishing chamber **19** and serves to transmit energy from a sonic vibration generator **20** into the polishing medium **16**. The oscillator **20** is coupled such as by means of a band or clamp **21** to the conduit member **18**. The vibration generator **20** is preferably though not limited to the oribiting mass type oscillator, such as disclosed in U.S. Pat. No. 2,960,-314, issued to A. G. Bodine on Nov. 15, 1960. The oscillator may be of the single roller type or twin roller type. With a single roller type with its rotative axis parallel to axis of the elastic member **18** will undergo a gyrating elastic standing wave motion characteristic of an elastic standing wave pattern with the ends and center of the tube undergoing a gyratory motion. A lateral standing mode of vibration may be obtained by the use of dual roller oscillator having counter-rotating rollers or by the use of a single roller oscillator having its rotative axis perpendicular to the conduit member **18**. Suitable means such as a hopper or chute **22** is utilized for feeding or conveying the polishing medium **16** and parts **17***a*, **17***b* and **17***c* to the polishing chamber **19**. The hopper **22** is preferably vibrationally isolated from conduit member **18** such as by means of a resilient or elastomeric ring **23** held in place such as by expandable metal bands **24** and **25**.

At least some portion of the flow path of the present invention is preferably tilted to provide a continuous

gravity feed of the materials through the polishing chamber. Of course, other methods of inducing flow, such as pumping may be utilized to maintain a suitable rate of flow through the polishing chamber. The apparatus illustrated in FIG. 2 is supported from suitable support means such as the base member **26** from which extends a vertical strut member **27**. The elastic conduit member **18** is preferably supported at nodal points by suitable vibration-isolating means such as an elastomeric band **28** surrounded by band member **29** which is in turn pivotly supported by pin **30** to strut **27**. A second elastomeric band **33** and metal band **34** encircle the elastic conduit **18** in the vicinity of the upper nodal point and is in turn pivotally connected by pivot pin **35** to an extendible support member such as fluid transducer **36** which is in turn pivotally supported by pivot pin **38** to base member **26**. A conduit **39** extends to a suitable source (not shown) of hydraulic fluid for operating the fluid motor **36**. The above-described support structure permits the adjustment of the tilt of the conduit **18** and consequently the rate of flow as well as the volume of material in a chamber **19** at a given moment. The rate of flow will determine the residence time or length of time spent in the chamber by the part. A high degree of filling of the polishing chamber **19** with polishing medium provides a better sonic coupling of the energy from the conduit **18** into the polishing medium in chamber **19** and consequently an increased rate of finishing and polishing of the parts fed therethrough. A suitable bin **45** is located at the discharge end of conduit **18** to catch the polishing medium upon its discharge from the polishing chamber. The parts may be permitted to fall in a heap with the polishing medium from which it is there retrieved or they may be preferably caught by means of a conveyor belt or chain **46** which permits an unrestricted flow of the polishing medium therethrough into the bin **45**. The conveyor **46** is supported such as by means of roller **47** and driven by suitable means not shown. Suitable guide panels **48** and **49**

supported by means of a strut **50** extend along the sides of the conveyor belt or chain **46**.

While the invention has been described in detail with respect to specific embodiments, it will be apparent to those skilled in the art that various changes and modifications may be made without departing from the spirit and scope of the invention as defined by the appended claim.

I claim:

1. An apparatus for finishing parts in an abrasive finishing medium, said apparatus comprising:

a tubular elastic finishing chamber located in a conduit and adapted for receiving a continuous flow of said parts and said finishing medium;

an orbiting mass sonic oscillator directly operatively coupled to said finishing chamber without intervening resonating members in a manner so as to resonantly vibrate said chamber in a gyratory standing wave motion;

the chamber being acoustically isolated from the remainder of the conduit by elastomeric material connecting the chamber to the conduit; and

feeding means for continuously feeding said parts through said chamber, the chamber being tiltable to adjust the rate of flow of parts and medium therethrough.

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