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Wheelpeening Equipment in Nozzle-Like Configuration

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Problem

Shot peening commonly will be performed either with air powered or wheel powered technique. The systems are entirely different and in many applications a peening job could be done in both ways whereas particular jobs require the only applicable method. From the technical point of view, wheel equipment works e.g. at a 300 kg/min shot rate with a velocity of 60 m/s thus requiring 20 HP. Air propelled shot at a rate of 5 kg/min, even at a lower projectile speed, will require a 30 HP motor to drive the compressor. Even this figures are very approximate, the difference of energetic efficiency in practical work is at least a factor of over 100. Also an unpleasant effect is the expanded air inside a process cabin or such an necessary enclosure. So the ventilation system with filter and blower will be considerably bigger for air operated machine.

Solution

The idea is, to gain somehow the advantages of this two different pieces of equipment. That means to desist from air power machinery, but to have a nozzle like shot stream arrangement. A nozzle at the end of a hose is a very handy item to be attached to a manipulator working in one or more axis directions. Also such a nozzle can be directed exactly as needed, depending on the peening job to be performed. As small type wheel equipment is not uncommon, the step was not big to make use of this existing technique and to add an outlet duct to such a blaster, finally to get nozzle like stream characteristics. Fig.1 shows the principle with the impeller casing (1), the focus duct (2), the nozzle outlet (3) and the shot pattern (4) induced. To have a fully equipped system, additionally fixtures, shot feed line, protection, powers supply had to be designed and the principle applications had to be worked out.

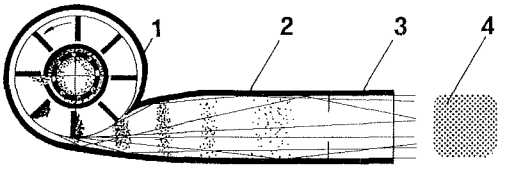

Figure 1. Principal Arrangement

Aim of present development

A system will be optimized to have a similar characteristic as standard 8 to 15 mm dia. nozzles equivalent from 2 bars to somewhat over pneumatically max. velocity which is said to be around 50 m/s. Accordingly the shot flow shall be between 3 to 20 kg/s. Such a unit gives at least the performance of three pieces simultaneously operating 12 mm dia. nozzles. Shot size S70 to S550 or even ceramic if of interest.

The unit shall be attachable e.g. to a common 6-axis robot with not more than 15 kg capacity necessary.

Technical details of accelerator

The most important equipment is the accelerator device (Fig. 2 and 6/Fig. 3). The way of focusing the shot after leaving the impeller (1/Fig 2) is most important, any hard rebouncing from the lining must be avoided. All shot exposed parts of the actual accelerator device must be of very hard steel, so it has been proved that a split aluminum casing lined with steel plates is most economical (2). The speed controlled DC-motor (3) is directly coupled to the impeller with an additional bearing in between. Exterior parts are specially protected (4) against the hazardous conditions within a peening cabin.

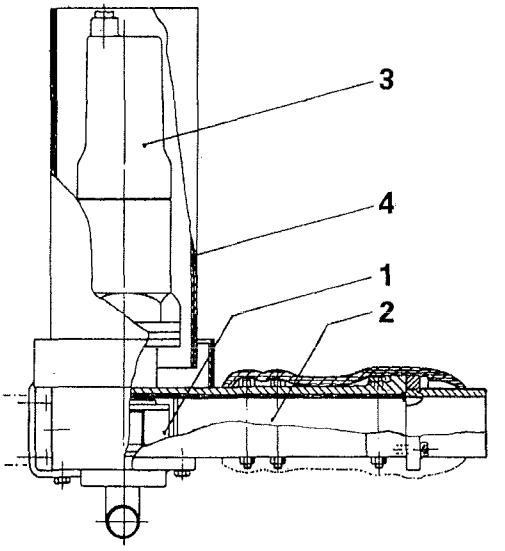

Figure 2. Accelerator Device

Installation

A flexible feed line (2/Fig.3) for the shot is suspended from the ceiling of the cabin (1) and fixed by the elbow (7) in axial direction opposite the impeller input shaft of the accelerator device. As there is gravity feed, a hose is not practical. A system of flexible joints with a telescopic tube allows a free movement as performed by the robot head (3). The shot must be stored over the installation and as it had become common practice, the material is fed by a metering device (4) ev. with flow meter (5). All other peripherals are of standard shot peening design. As mentioned, the ventilation necessary is little, say an air renewal rate of 1/minute can be sufficient.

Special features

Different to air driven equipment, the here presented device operates to specifications within a few seconds after switching on. In addition, the shot velocity as a parameter of the peening intensity can be adjusted at highest accuracy

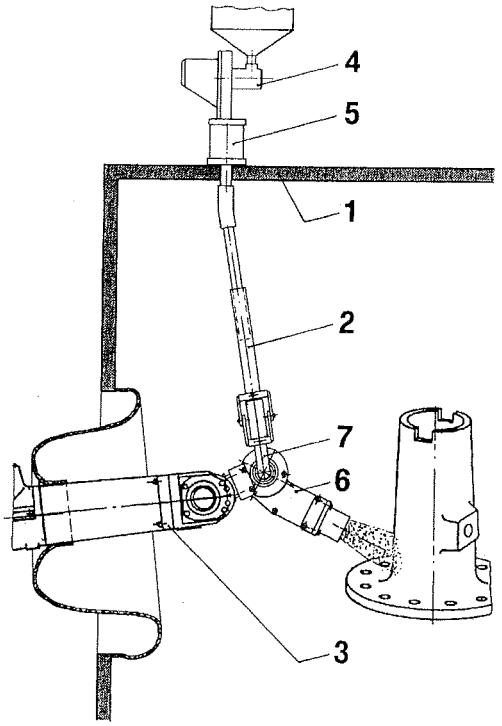

Figure 3. Complete Installation

provided by the electrical control. Same applies to the metering and flow control unit. In case for applications where very short shot cycles are required, a small device can be integrated. In practice, the elbow (7/Fig.3) that guides the shot into the center of the impeller, has to be replaced by a shot flow suitable 3-way controlled valve. In such an operation mode, the impeller can speed up, or run, whilst the shot flow is bypassing the accelerator device. To activate or deactivate peening, only the 3-way valve has to be switched. Peening cycles within second intervals are visible even there may be no technical need for normal industrial application.

Compared to air propelled peening, here the active peening spot is bigger. In many cases this can be an advantage, easily a pair of even more nozzles can be replaced by a single accelerator doing the same work.

Outlook

The newly proposed peening system is about to prove its principle practicability. It will not replace existing conventional systems, but for many applications it could well be a way to process parts more economical. Patents are pending. Hence it will still be quite a way to create standards, getting the theoretical and practical figures and be able to present a range of models with all the corresponding peripherals. O