APPROPRIATE SHOT PEENING TECHNOLOGY FOR AGRICULTURAL EQUIPMENT

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ABSTRACT

Agricultural equipment are generally failed due to fatigue, wear, impact and corrosion and therefore demand greater attention to the structural design aspects for durability and ensuring adequate fatigue life. Shot peening as a manufacturing tool has been found to be useful for improving surface properties of metal parts and enhancing service life of components. The purpose of this paper is to identify appropriate shot peening technology for agricultural equipment to make it cost-effective and techno-economically acceptable to agricultural equipment manufacturers.

1. INTRODUCTION

Critical components of agricultural equipment are those which come into direct contact with the soil/crop or some vital parts of a mechanism. These components are exposed to fatigue, wear and impact and therefore require certain level of hardness, toughness and fatigue resistance. The consequences of impact, fatigue and wear are serious in terms of both replacement cost (parts, labour and down time) and its effect on timeliness of field operations. Further, cost, higher speed of operation and research for higher reliability demand greater attention to the structural design of implements employing minimum metal or lighter weight and yet ensuring an adequate fatigue life of key components and also durability of wearing parts.

Several investigators have reported that for a given material the amount of wear decreases when its hardness exceeds to that of abrasives. Surveys of failure in agricultural machinery have shown the importance of fatigue of structural members. Failure occurs when the fatigue strength at some point is not adequate to the stress history imposed by the service loading. On the other hand if the strength far exceeds the imposed fatigue loading, as is more often the case, the machine becomes heavy and costly. At one time designers of agricultural machinery could emphasise on the side of safety, since weight was often unimportant or even beneficial. Now that farmers seek better cost effectiveness from machines bought in an increasingly competitive market, with greater recognition of the damage to the soil structure from excessive tractor and implement weight, design by experience and engineering judgement is no
longer adequate. Ideally it is pertinent that agricultural machinery designers should know accurately the service loading and stresses in which their machines will be subjected and the effect of these on fatigue life would therefore be more appropriate.

2. SERVICE LOADING AND FAILURES

In many agricultural machines it is difficult to measure all the loads that occur in service. For example, on the rotavator (Fig. 1) linkage loads are measured using a linkage dynamometer, and pto torque measured using a shaft dynamometer, but it is not practicable to measure loads at each individual blade. Therefore service loads and strains are often recorded in short laboratory tests closely simulating the severe field conditions. However a manufacturer will want assurance that even the most aggressive use will produce only limited failures.

Most companies use field testings to assess the durability of their prototypes and, for a final check, this is essential. In the development phase, however, life assessment by computer prediction or laboratory testing provides more reproducible data more quickly and is independent of weather and season. At the design stage before the machines are available for test, only theoretical methods can be used.
4. APPROPRIATE SHOT PEEING

Syphonic type shot peening machine was found to be useful for low intensity peening (0.25 mm 'A') at which the improvement in surface properties of 0.18% C steel was found to be comparable to that of bulk material property of 0.78% C steel and accordingly the corresponding peening parameters were considered to be of appropriate.

Peening with this syphonic system was also found to be safe when saturation peening time was even increased to three times. The effect of multiple saturation on surface roughness was found to be negligible as shot velocity was moderate (around 15 m/s) and thereby it did not affect the fatigue strength of specimen. The advantage of multiple saturation peening may be due to greater strain hardening effect and lesser stress relaxation at lower stress levels and it may therefore be well suited to the requirements of agricultural tools. Further the cost of peening per h by the use of this machine was found to be around 80% less as compared to commercially available shot peening machine. Therefore the syphonic system was considered to be more cost-effective for improvement of surface properties.

5. CONCLUSIONS

The improvement in surface properties of 0.18% C steel being shot peened after carburising, hardening and tempering has been found to be comparable to that of bulk material properties of 0.78% C steel, giving better cost-effectiveness.
Syphonic type peening machine was considered to be more appropriate for peening agricultural machine parts at lower peening intensities with related peening parameters.

6. REFERENCES


A SURVEY ON MODERN (1995) MASS FLOW EQUIPMENT

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ABSTRACT

A condensed description of commonly known and popular mass flow measuring systems and also flow metering systems involved. It refers to the field of industrial and scientific peening and blasting engineering working with air operated machinery.

KEYWORDS

Flow monitoring, Flow measuring, Flow control.

1. INTRODUCTION

The interest in having peening/blasting machines equipped with precise mass flow equipment has primarily arisen due to the knowledge gained in high-tech shotpeening. In the field of such flow equipment, some literature exists, but normally it is an internal speciality of the peening machine manufacturers.

Information about media flow-rates in peening machinery is required in compliance with various specifications such as in MIL, SAE, GE, BAC, etc. Also for full automated processes, including abrasive blasting, flow measuring can be advisable for quality control reasons or to improve productivity continuation. Also for other specialized peening and blasting, eg. in research work, such processes will always ask for mass flow information, this again connected with appropriate flow metering equipment.

This paper does not enter into more scientific details discussing the importance and finally necessitates accuracy of media flow monitoring. Just to mention this one sample: "it is commonly known that in air operated shot peening processes, the media flow has somehow a self-compensating effect. When the media flow gets increased this results in an air pressure drop at the nozzle, equivalent to a shot speed drop due to higher friction inside the hose and a higher acceleration work in the media inlet area" (and vice versa), but eg. it does not affect the coverage very much. Such effects create a certain complexity in the field of media flow technology. Also the scope of this paper will not include supplementary equipment such as shot velocity measuring devices eg. by Helispire F-Saint-Ismir with TRAVEL.

2. FLOW MEASUREMENT

2.1 History

At least for Europe, it is believed that in 1972 a Swiss company* has first