All Angel Abrasive Cutting Machine

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Abstract: *A high speed abrasive cutting machine was designed and developed. The abrasive wheel of 4mm thickness was used and the speed was 2500 rpm. It is driven by an electric motor having a power of about 3.67 kW. Tests results on the machine showed that it can cut 25mm and 60mmmild steel rods in 7.5s and 21.3s respectively; 25mm and 60mm stainless steel rods in 15.3s and136.7s respectively. It was discovered from the tests that depending on the length of cut and material being cut, the high speed abrasive cutting machine was more efficient, in terms of cutting time, than the power hacksaw. The grinding/wear ratio was also dependent on the material being cut and the length of cut.*

Keywords: Abrasive Wheel, Discontinuous Chip Cutting, Development, Machine, High Speed.

I. Introduction

Saws are amongst the most common of machine tools and they are used in contouring and cutting off. There are three basic types of saws: hacksaw, circular and band saw. Circular saws are made of three types: metal saws, steel friction disks and abrasive disks. Circular saw blades are economical methods used for cut-off operations that require dimensional accuracy and a good surface finish (Sarwar et al, 1996; Zohdi et al., 2006). Oberg and Jones (1996) classified the cut-off machines into types which include simple machines which are used to cut one piece at a time, production machines used for many purposes such as making angle-cuts and plate cut-offs, and those used to cut large and tough materials. Sarwar et al, (1996) showed that the machinability of nickel based alloys are variable and relatively poor and also noted that high speed saw blades were not suitable for machining certain types of nickel based alloys due to high localized temperatures generated which cause plastic deformation of tool and rapid rates of wear.

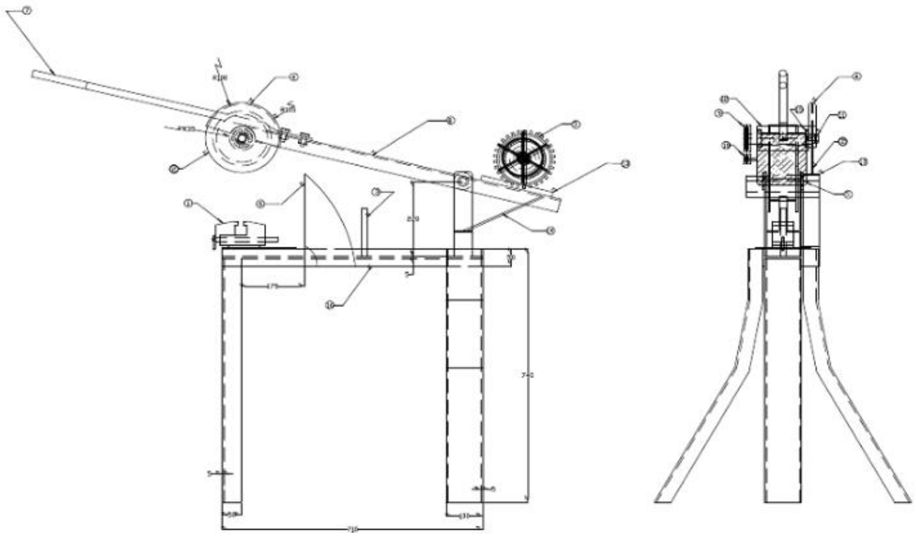
Abrasive cutting was initially regarded as a tool room method only but it has now grown to be a high-speed production operation, often preferable to steel saws, shears and flame cutting from the point of view of economy. Closer tolerances are achieved, eliminating subsequent finishing operation (Sahu and Sagar, 2006). Abrasive disks are mainly aluminium oxide grains or silicon carbide grains bonded together. They are used to cut ferrous and nonferrous metal (Zohdi et al, 2006). With abrasive parting-off there is no danger of work hardening of the work prior to the cutting action as is the case with other forms of cutting methods.

Jain (2008) described the abrasive cut-off sawing machine using abrasive cutter as a special grinding machine. Radford and Richardson (2007) suggested, however, that the abrasive wheel can be regarded and modelled

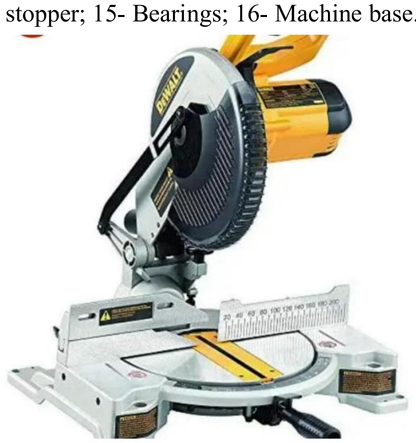
II. Operation of the High Speed Abrasive Cutting Machine

The high speed abrasive cutting machine, shown in Figure 1 and Plate 1, operates on a similar principle as other machine tools, particularly the grinding and the milling machine. It has a rotating tool (the abrasive cutting wheel) which is carried on one end of a lever, and operated by a pulley which receives transmission from an electric motor. A small vertical feed force at the end of a lever carrying the cutting tool to lower the cutting tool to, and through, the workpiece.

The workpiece is held firmly in a vice provided on the upper platform and the Feed Speed (fV) Nagpal (2005) and Jain (2008) noted that a typical value of feed ranges between 0.2 to 0.6 m/s. A feed speed of 0.6 m/s, which corresponds to 100 mm/min, is chosen Speed of Abrasive wheel (N) Jain (2008) stated that the rubber bonded abrasive wheel of up to 0.1 mm thickness can be operated at speeds ranging from 3000 to 5000 m/min. Expressed in revolutions per minute, using, Nπ60 Where, U = linear velocity at the circumference of the wheel,



1-Machine vice; 2- Abrasive cutting disk; 3- Stopper; 4- Cutting disk guide; 5- Electric motor; 6- Grit collector; 7- Handle; 8- Lever arm; 9- Driven pulley; 10- Electric motor pulley; 11- Disk holder and bolt; 12- Spindle shaft housing; 13- Electric motor base; 14- Lever end stopper; 15- Bearings; 16- Machine base.



III. Results And Discussions

The results of the test obtained from cutting mild steel rod samples of 25mm diameter with the high speed abrasive cutter are presented in table 1. While table 2 presents the results of the test obtained from cutting mild steel rod samples of 60mm diameter using the high speed abrasive cutter. Tables 3 and 4 present results for test carried out when the high speed abrasive cutter is used to cut stainless steel rod samples of 25mm diameter and 60mm diameter respectively. Table 5 compares the average time taken when the high speed abrasive cutter was used with the time taken when the power.

IV. Acknowledgment

I would like to express my special thanks of gratitude to my guide Prof. Y. R. Kodhilkar. Then to my HOD Prof. B. S. Deshmukh as well as our principal Dr. D. B. Uphade who gave me the golden opportunity to do this wonderful project on the topic all angel abrasive cutting machine review. It also helped me in doing a lot of Research and I came to know about so many new things I am really thankful to them

V. Conclusion

The high speed abrasive cutter designed has a better efficiency than the conventional cut- off operations involving the use of power hacksaws. The rate of wear of the abrasive wheel depends on the hardness of the material being cut which depends on its composition. The high speed abrasive cutting machine can be used as a cut-off machine in workshops and can be fabricated in a machine shop which is

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