April 11, 1961 H. SHOENMAKERS 2,978,847

ABRASIVE CUTTING WHEEL

Filed April 25, 1958

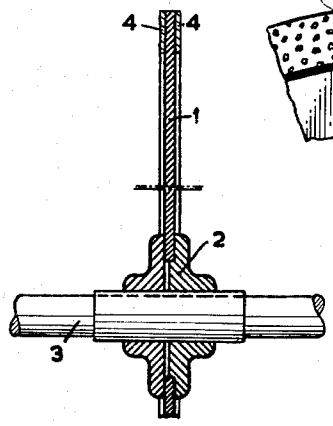

FIG.1

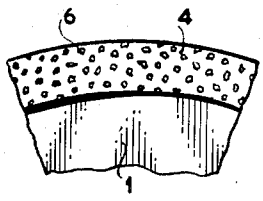

FIG.2

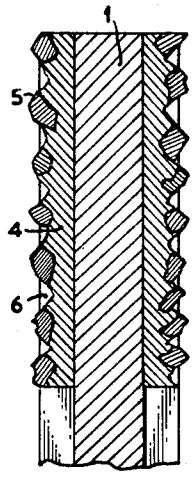

FIG.3

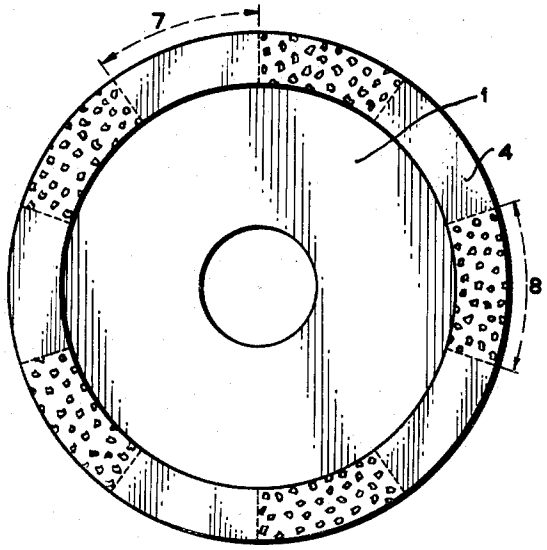

FIG.4

INVENTOR
HENDRIKUS SCHOENMAKERS

BY Frank R. Trifari
AGENT

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ABRASIVE CUTTING WHEEL

Hendrikus Schoenmakers, Eindhoven, Netherlands, assignor to North American Philips Company, Inc., New York, N.Y., a corporation of Delaware

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2 Claims. (Cl. 51—206)

This invention relates to an abrasive cutting wheel, the sides of which are provided through a certain area with bonded diamond grains and which is used for sawing into lengths hard materials, more particularly glass tubes and rods. Such abrasive cutting wheels are expensive tools capable of cutting rapidly and accurately, however, they have a limitation in that they glaze comparatively rapidly under certain conditions. One can continue cutting with such a glazed wheel, however, wear of the wheel will be great and there will be a high reject percentage of the product, since the wheel wobbles slightly; the sizes of the severed lengths are no longer the same and the end faces are chipped and no longer at right angles to the longitudinal axes. It was surprising to find that a much higher output with a smaller reject percentage can be obtained with such a cutting wheel, if in accordance with the invention the wheel is designed so that the cutting surfaces are provided not only with the inherent recesses, but also with a number of further small recesses which preferably are distributed irregularly.

In one embodiment of the invention the recesses made deliberately are shaped conically with an apical angle of preferably 60°.

The efficiency and the life of the cutting wheel are found to be particularly increased if, in another embodiment of the invention, at the most about 15 recesses are provided per cm.^{2} of the cutting surface.

It is not necessary for the entire cutting surface on both sides of the wheel to be provided with recesses. Satisfactory results are obtained also if according to a further embodiment of the invention the cutting surface on one side is divided in an even number of imaginary equal sectors every other one of which is provided with recesses, while the cutting surface on the other side is divided in an equal number of similarly arranged imaginary sectors, the recesses on this side being provided in sectors staggered with respect to the other side. This embodiment of the invention is particularly advantageous, if the recesses have to be provided in a finished wheel, since with this arrangement the wheel is less likely to warp due to the provision of the recesses.

In a cutting wheel in accordance with the invention, which is made of metal, has a maximum thickness along the cutting surfaces of 1 mm. and a maximum diameter of 200 mms., the irregularly arranged recesses deliberately provided in the cutting surfaces according to a further embodiment of the invention have a depth of about 0.2 mm.

In order that the invention may readily be carried out, one embodiment thereof will now be described more fully with reference to the accompanying drawing, in which:

Fig. 1 is a sectional view taken along the centre line of a cutting wheel provided at the sides with bonded diamond grains,

Fig. 2 shows on a greatly enlarged scale an elevation of part of a side of Fig. 1,

Fig. 3 shows likewise on a greatly enlarged scale part of the sectional view according to Fig. 1, and

Fig. 4 is a side view of a cutting wheel of the kind shown in Fig. 1.

In the figures, reference numeral 1 designates a metal wheel which is secured to a shaft 3 in known manner by two clamping means 2. At its circumference the wheel is provided on either side with a cutting surface 4 comprising bonded diamond grains. As is shown more clearly in Figs. 2 and 3, recesses 6 are provided between diamond grains 5. In a wheel having a diameter of at the most 200 mms. and a thickness along the cutting surfaces of at the most 1 mm., these recesses have a depth of about 0.2 mm., provision being made of at the most about 15 recesses per cm.^{2} of the cutting surface. In practice it is found that such a wheel provides a much higher output than a non-recessed wheel. As an example a wheel having a diameter of 150 mms. and a thickness along the cutting surfaces of 0.8 mm. may be used. The width of the cutting surfaces was 10 mms. Prior to the provision of the recesses there could be cut from glass tubing having an outer diameter of 4.5 mms. and a wall thickness of from 0.7 to 0.9 mm. 8000 lengths per hour for 40 hours. The reject percentage was about 10 percent owing to oblique end faces and chipping. At the end of 40 hours the cutting surfaces were worn off entirely. Every hour of cutting required an hour of sorting. The high reject percentage and the wear of the wheel were due to the fact that the cutting surfaces became glazed so that the cutting effect was reduced and furthermore the wheel tended to wobble in operation. Due to the reduction in the cutting action a higher amount of energy was required which again increased the wear. In operation a water jet was continuously directed onto the product and the wheel. After the provision of the recesses a similar disc could cut slightly more than 12,000 lengths per hour from tubing of glass of the same kind and having the same dimensions for 60 hours under the same operating conditions; the reject percentage was negligible and certainly less than 1 percent. Sorting, which under the previously mentioned conditions would have taken 3 hours for 12,000 lengths, could be omitted. Presumably the grindings mainly find their way into the recesses from which they are washed by the water jet, so that the cutting surfaces do not become glazed.

Fig. 4 is a side view of a cutting wheel in which the cutting surfaces 4 are divided in ten imaginary sectors. In five sectors 8 recesses are provided, the remaining sectors 7 not being recessed. The cutting surface on the other side of the wheel is divided in the same number of sectors; here, however, the recesses are provided in the sectors registering with the sectors 7 while the sectors registering with the sectors 8 are not recessed. This arrangement is of advantage when a normal commercially available disc is provided with recesses since the disc is less liable to warp due to the recessing.

The invention is not only highly advantageous in cutting glass tubes and glass rods but abrasive cutting wheels deliberately provided with recesses in accordand with the invention can also be used to advantage in cutting ceramic tubes and rods and in general in cutting all hard materials for which diamond bonded cutting wheels are used.

What is claimed is:

1. A grinding wheel having cutting surfaces provided with a multiplicity of abrasive grains bonded to said wheel for cutting relatively hard materials into predetermined lengths, the cutting surfaces of said grinding wheel being provided with a relatively large number of small, irregularly distributed recesses in addition to the inherent recesses of the grinding wheel, said recesses being conical in shape with an apical angle of approximately

60°, the cutting surface on one side of said grinding wheel having said recesses in spaced sections therein, while the cutting surface on the opposite side of said grinding wheel has said recesses in spaced sections located in a staggered relation with respect to the spaced sections on said one side of the grinding wheel.

2. A grinding wheel as claimed in claim 1 wherein said grinding wheel is constituted of metal, has a maximum thickness along the cutting surfaces of 1 mm. and a maximum diameter of 200 mms., the irregularly distributed recesses being provided in the cutting surfaces with a depth of approximately 0.2 mm.

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