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GRINDING OIL COMPOSITION

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2 Claims. (Cl. 51—281)

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This invention relates to grinding oils, more particularly to a method of grinding with an improved grinding oil composition which greatly increases the efficiency of grinding operations.

Grinding oils are used when grinding tempered steel with an abrasive grinding wheel. If the steel gets too hot during such a grinding operation with a worn wheel, the steel becomes discolored. The color may or may not indicate a deterioration in the quality of the steel, but it is undesirable commercially. After the wheel has been used to an extent where the so-called temper color shows in the steel, it is necessary to redress the grinding wheel, i. e., to resurface it by running a diamond point over the wheel surface to even out rough and worn spots.

The prior art commercial grinding oils do not allow the use of a grinding wheel to an extent where the surface of the wheel is so rough that it is no longer useful for precision grinding. Long before this point is reached, the wheel will have caused the steel to become discolored. In order to maintain the appearance of the finished piece the wheel must be resurfaced long before its otherwise useful life is expended. It is customary, therefore, to appraise grinding oil in terms of the amount of grinding that can be done with a wheel before it must be redressed.

It has been found, in accordance with the invention, that the efficiency of grinding operations may be considerably increased by the use of a new grinding oil composition, so that considerably more grinding can be done before redressing the grinding tool. The oil of this invention, moreover, delays the temper color formation sufficiently to allow grinding to proceed to a point where the wheel approaches more nearly its limit of usefulness as far as its surface is concerned. This oil, therefore, allows grinding to a point of greater deterioration of the wheel, because it helps prolong the use of the wheel before formation of temper color and need for redressing.

Grinding oils are to be distinguished from cutting oils. Some oils which are good for cutting purposes are not good for grinding and vice versa. A cutting oil is generally used in cutting steel or other metal with a cutting tool, such as in a lathe, whereas a grinding oil is used in grinding tempered steel with an abrasive. The grindability of tool steel is extremely sensitive to the type of grinding oil used, particularly under severe condtions of operation.

The objects achieved by the invention include a method of grinding with a grinding oil composition by the use of which a great increase in grinding efficiency is obtained; and other objects which will become apparent as the invention is described hereinafter.

It has been found, unexpectedly, that a composition comprising a mixture of two oils of widely

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divergent viscosities, gives much superior results when used as a grinding oil. One of the oils has a relatively low viscosity in the range of 50 to 100 SUS at 100° F. and may be, for example, a straw oil. The other oil has a very high viscosity in the range of 2000 to 6000 SUS at 100° F. This heavier oil may be, for example, a so-called "bright stock" and the following are given as examples with the viscosities (SUS) at 100° F. and 210° F. Generally the viscosity is measured at 210° F. and that at 100° F. calculated in a manner well known in the art:

SUS at 210° F. --	165	185	113	160	156
SUS at 100° F. --	3740	4300	2100	3500	2218

These heavy viscosity oils are also characterized by their high boiling points.

The oil mixture should comprise from about 53 to 78 weight percent of the low viscosity oil and from about 47 to 22 weight percent of the high viscosity oil. These proportions are subject to the further qualification that they be selected within the above ranges so that the mixture of oil should have a viscosity in the range of 150 to 300 SUS at 100° F., in order that the oil may flow properly as it is fed to the wheel during grinding.

In order to evaluate the efficiency of a grinding oil, a test was developed in which a commercial shop grinder was mounted with a dynamometer so as to measure the horizontal component of the grinding force as the steel is moved in contact with the grinding wheel. The grinding wheel speed, the speed of table traverse of the steel against the wheel, and the rate of oil application are constant. The horizontal component of force measured in this test is an indication of the grinding efficiency, which is in turn related to the practical operating considerations such as wheel life, number of cuts made before wheel dressing, amount of heat generated during operation, permissible cutting speeds, etc.

In grinding tests on "Momax" steel grinding out a section 10" in length and 0.040" deep, the following results were obtained with different oils:

Weight Per Cent of Light Oil 75 SUS at 100° F.	Weight Per Cent of Heavy Oil 4300 SUS at 100° F.	Weight Per Cent of Medium Oil 200 SUS at 100° F.	Viscosity of Mixture SUS at 100° F.	Force, grams
100	None	None	75	4,300
65	35	None	210	3,380
None	100	None	4,300	(1)
None	None	100	200	3,720

[1] Oil too viscous to be used as grinding oil.

The mixture of light and heavy oils shows a lower force component than any of the others, and may be viewed merely as illustrative of one of the preferred embodiments of the invention.

Other tests indicate the range of proportions and viscosities suitable as described heretofore as comprising the generic scope of the invention.

In the above tests the numerical difference in the force may not appear large and the grinding efficiency is not directly proportional to the difference in force. The oils were checked in practical grinding tests by industrial companies using grinding oils and it was found that even an apparently small difference in the force measured in our test is indicative of marked superiority in practical grinding operations.

The marked efficiency of the new grinding oil composition as compared with two of the best commercial grinding oils available on the open market, is illustrated by the following tests. These tests were made by grinding twist drills of the same size with automatic machines under identical conditions. A grinding oil composition was made up in accordance with the invention and consisted of 65 weight percent of straw paraffin oil having a viscosity of 75 SUS at 100° F. and 35 weight percent of bright stock having a viscosity of 4300 SUS at 100° F.; the viscosity of the grinding oil composition was 210 SUS at 100° F. The following results are typical.

Oil	Viscosity SUS at 100° F.	No. of Drills/Dressing of the Grinding Wheel
Oil of Invention: 75 SUS at 100° F. 65% 4300 SUS at 100° F. 35%	210	300-330
Commercial Grinding Oil No. 1	250	60-70
Commercial Grinding Oil No. 2	90	40-50

The above oil mixture should comprise at least 90% of the grinding oil composition, since the presence of about 10% of other oils or oil-like components do not interfere with the beneficial results from a composition, the major portion of which is made in accordance with the invention. Other ingredients may be present, such as detergents, alkali neutralized sulfonate hydrocarbons, such as the residue obtained from acid treated lubricating oil fractions, other lubricants such as fatty oils, lecithin, etc.

Although the invention is not limited to any particular theory, it is thought that the following comments may be of aid in understanding the operation of the oil.

Oils having ordinary viscosities in the range of 175–275 SUS at 100° F., which might be compared with the mixture of oils made in accordance with the invention, have a limited effectiveness because they are too light in body to lubricate effectively under the intense conditions encountered in grinding.

The heavy oil in our composition is believed to be the active lubricant which lubricates the abrasive and steel surfaces because a major or substantial portion has a boiling point higher than that of the grinding temperature, and it is not

volatilized by the intense heat developed during the grinding. The heavy oil itself, however, is too viscous to flow into the very fine space between the abrasive and the metal. Therefore, if a heavy oil alone were used, there will be a failure of lubrication at the points where it is needed most.

The light oil alone would not be a very efficient lubricant, and furthermore, it is sufficiently volatile so that it flashes off to a certain extent at the very point where the abrasive touches the metal, due to the heat generated in the grinding operation. However, the light oil is light enough to flow into the fine space between the two surfaces.

In the mixture the light oil carries the heavy lubricating oil into the space to perform its lubricating function. The vaporization of the light oil is not sufficient to cause any appreciable thickening of the grinding oil. The oil is recycled in the grinding operation, losses being replenished by the addition of new oil.

The grinding wheel hereinbefore referred to is illustrative of a bonded abrasive.

In view of the foregoing disclosure, variations and modifications of the invention will be apparent to one skilled in the art. The invention contemplates all such variations and modifications as come within the scope of the appended claims.

We claim:

1. A method of grinding which comprises grinding steel with a bonded abrasive in the presence of an oil at least 90 weight per cent of which is composed of a mixture of an amount of a mineral oil of 50 to 100 SUS at 100° F. within the range of 53 to 78 weight per cent and an amount of a mineral oil of 2000 to 6000 SUS at 100° F. within the range of 47 to 22 weight per cent to provide a mixture having a viscosity in the range of 150 to 300 SUS at 100° F.

2. A method of grinding which comprises grinding steel with a bonded abrasive in the presence of an oil at least 90 weight per cent of which is composed of a mixture of about 65 weight per cent of a mineral oil of viscosity of about 75 SUS at 100° F. and about 35 weight per cent of a mineral oil of viscosity of about 4300 SUS at 100° F., which mixture has a viscosity of about 210 SUS at 100° F.

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REFERENCES CITED

The following references are of record in the file of this patent:

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1,473,947	Bailey	Nov. 13, 1923
2,384,225	Wilson	Sept. 4, 1945

Certificate of Correction

Patent No. 2,453,709. November 16, 1948.

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It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows:

Column 4, following line 62, list of references cited, add the following:

2,183,783	Bray	Dec. 19, 1939
2,360,446	Reid	Oct. 17, 1944

and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 31st day of May, A. D. 1949.

[SEAL]

THOMAS F. MURPHY,
Assistant Commissioner of Patents.