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MINERAL OIL

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It is already known to impart to mineral oils employed as lubricants and cooling media in the machining of metals or as gearing oil or as bearing oil, a better adhesiveness, wetting power and active behaviour in regard to the metal surface and so forth by adding to them sulphur, metallic soaps or other chemicals. The use of sulphur is the most advantageous and in order to obviate the disadvantages of the use of warm or hot dissolved sulphur, it is also known to add the sulphur cold in a fine state of division. In the known method, the finely divided sulphur, the particles of which have a size below 50μ and as far as possible between 5 and 20μ has been made into a paste with an oily, fatty or aqueous vehicle, and this paste has then been added to the mineral oil to be improved in quantities such that the amount of added sulphur was about 0.5–1% of the oil. This process of improving mineral oil has not proved completely satisfactory because the pulverizing of the sulphur was not carried far enough. It has been found that sulphur particles of a size above 5μ cannot penetrate sufficiently into the capillary fissures of the metals treated therewith, but on the contrary are retained or squeezed away at the working places at which high pressures usually act. Then, when the oil becomes stationary, they are deposited and even carry the finer particles with them to the bottom and can no longer be mixed with the oil in a sufficient degree.

The present invention obviates these disadvantages by the fact that the grinding of the sulphur is carried so far that after grinding, the particles have a size of less than 5μ and preferably lie in the order of magnitude of 1 to 2μ. With such fine grinding, the ratio of particle surface to particle weight is more satisfactory and a reversible colloid is produced, that is to say, even though slight sediments occur after long standing, they are able to mix with the oil immediately the oil circulates again. In addition, due to the very fine grinding, the active or effective surface of the same amount by weight of sulphur is greater, since it increases in increasing proportion with the fineness.

According to the invention, the sulphur powder is ground into a viscous paste with from the half to its own quantity by weight of mineral oil, preferably in a ball drum mill. Treatment is continued until the largest particles do not exceed 5μ, while the majority of the particles are considerably smaller, having a size of about 1 to 2μ. The treatment lasts for about 200 hours. Of this paste, about 1 to 2% are added to the working oil which is to be refined, and are energetically agitated in a powerful high-speed mixer, this treatment preferably lasting about 15 minutes.

It has been found that the majority of mineral oils dissolve the sulphur. Sulphur dissolved in oil, however, has not the same activity as the fine, undissolved colloidal particles of sulphur, so the dissolving of the sulphur particles reduces the efficiency of the improving process.

In order to prevent such dissolving of the finely divided, relatively expensive sulphur, it is possible to mix with the oil, before adding the paste, first of all another paste consisting of a cheaper, not so finely ground sulphur powder mixed with some mineral oil. For this purpose, it is possible to use either precipitated or chemically prepared colloidal sulphur or sifted flowers of sulphur or dry, finely-ground flowers of sulphur, such as is procurable on the market. The oil then dissolves this cheaper sulphur powder and becomes saturated therewith, so that upon the final addition of the paste according to the invention, no further dissolving of sulphur takes place. Preferably, about 0.5 to 1.5% of the cheaper paste is added to the oil. Mixing is preferably effected between 40 and 70° C.

Especially for difficult work, as for instance, the cutting of threads and the like, more sulphur should be added than that dissolved in the oil at a temperature of 200 to 250° C. This is accomplished by raising the temperature of the oil above the range mentioned and is limited only by the boiling point of the oil itself. At these high temperatures the sulphur and the oil acquire a dark brown color and the lubricating qualities of the oil are thereby changed. This oil is then mixed with the working oil proper in the proportion of approximately 1 to 10 to 1 to 3. Preferably the dissolving oil used is one that boils at a high temperature and that this boiling point be known so that the amount of sulphur to be added may be determined.

Instead of using this second paste, it is also possible to employ for the manufacture of the principal paste a sulphur which is produced in a special manner and which has been found not to possess any solubility in ordinary mineral oil. The manufacture of this sulphur is carried out by pouring in a fine jet into cold water ordinary sulphur between the temperature at which it is brown and viscous, that is to say, about 160° C., and a temperature which is still sufficiently below the boiling point situated at 440° C., that is to say at the most 400° C. The sulphur thus ob-

tained is plastic but after about from 10 to 20 hours becomes hard and brittle and consists of a mixture of ordinary sulphur and a special greyish yellow sulphur. Whereas ordinary sulphur is soluble in oil of any kind, and particularly in carbon disulphide, the greyish yellow sulphur is perfectly insoluble in these liquids. It is harder, more brittle, heavier and chemically much more active than ordinary sulphur. It is more difficult to grind, that is to say, it requires heavier grinding balls, but it is very brittle and during grinding breaks down into very fine particles of the size of about 1μ and less. When mixed with the oil, it then forms a true colloid, and therefore remains permanently in suspension. Apparently, this form of sulphur is a polymerized sulphur which contains more atoms in the molecule than ordinary sulphur.

According to whether the sulphur was heated more or less strongly before being poured into cold water, it contains a larger or smaller proportion of this insoluble greyish-yellow sulphur. At a relatively high temperature, the proportion of greyish-yellow sulphur increases. A pouring temperature of about 300° C. is found to be the best. If, however, it is desired to prevent the spontaneous combustion of the sulphur, which as is well known occurs at 260° C., it is possible to remain below this temperature and to pour the sulphur at about 240° C. In this case, however, it must then be mixed particularly intensively with the cold water and preferably it is sprayed or atomised in a strong jet in the water. In fact, when the sulphur is poured at a lower temperature, it is more viscous and consequently greater attention must be paid to its thorough distribution and dispersion in the water.

The quenched sulphur is crushed and can then be brought into a suitable solvent, for example carbon disulphide, when the soluble yellow sulphur is dissolved by the carbon disulphide. The insoluble residue is then finely ground for making the paste and is treated further in the manner set forth above. The ordinary yellow sulphur dissolved in the carbon disulphide may be recovered in known manner.

If a paste made from such a special sulphur is now used, no sulphur from such a paste will be dissolved in the oil, because as already stated, this sulphur is insoluble in oil. It has been found, however, that it is advisable in some cases to make the paste to be added to the oil not merely of such greyish-yellow insoluble sulphur, but when manufacturing the paste, to mix this sulphur with ordinary sulphur in a certain proportion, namely in a proportion of from about 1:2 to about 1:10 according to the intended purpose. It is preferable to add the ordinary sulphur to the greyish-yellow sulphur before grinding because then the ordinary sulphur is finely ground in a shorter time than when it is ground alone. If the proportion of insoluble and soluble sulphur in the mixture obtained by quenching is known and is kept constant by observing the same working conditions, then instead of subsequently adding soluble sulphur to the pure insoluble sulphur, it is possible to grind the mixture directly, that is to say, without previously dissolving out the soluble component.

Even when such a paste is used, the working oil may in addition be previously saturated by dissolving ordinary sulphur therein.

In general, as stated above, it is sufficient if about 1 to 2% of the paste is added to the working oil. If for special purposes, it is desired to increase the addition of paste, it is preferable to add to the oil special thickening or supporting substances in order to prevent settling of the paste. Metallic soaps, extremely finely ground alkalies, oxides of light metals, carbonates of light metals, kaolin, prepared chalk, whiting, graphite, wool charcoal, liver of sulphur (Hepar sulphuris) and the like substances may be employed as such thickening or supporting substances. Chemically precipitated colloidal sulphur may also be used. In this case, a part of the chemicals required for the production of the colloidal sulphur is added to the paste and the other part to the working oil, so that the chemical colloidal sulphur is only formed upon the paste being mixed in the working oil. For example, sodium thiosulphate or metallic polysulphides may be added to the paste and calcined acids, for example tartaric acid, tannic acid and the like may be added to the working oil, or it is also possible to employ gaseous acids, such as hydrogen chloride or sulphurous acids, which are then injected into the oil.

I claim:

1. A mineral oil for use as a lubricant and cutting oil which is characterised by having admixed therewith a colloidal suspension of sulphur that is insoluble in carbon disulphide and oil and has been so finely ground that the largest particles have a size of 5μ while the majority of the particles have a size of 1 to 2μ.

2. A mineral oil for use as a lubricant and cutting oil, which is characterised by having admixed therewith about 0.5% to 1% of a colloidal suspension of sulphur that is insoluble in carbon disulphide and oil and has been so finely ground that the largest particles have a size of 5μ while the majority of the particles have a size of 1 to 2μ.

3. A mineral oil for use as a lubricant and cutting oil, characterised by having dissolved therein ordinary sulphur and admixed therewith colloidal sulphur which is insoluble in oil and carbon disulphide and has been so finely ground that the largest particles have a size of 5μ while the majority of the particles have a size of 1 to 2μ

4. A mineral oil for use as a lubricant and a cutting oil which is characterised by having admixed therewith a colloidal suspension of finely ground sulphur, the largest particle of which has a size not greater than 5μ, while the majority of the particles have a size of 1 to 2μ and is not soluble in oil or carbon disulphide, and also contains ordinary sulphur which is soluble in oil and carbon disulphide.

5. A mineral oil used as a lubricant and cutting oil, which is characterized by having admixed therewith about 0.5% to 1% of a colloidal suspension of sulphur that is insoluble in carbon disulphide and oil and has been so finely ground that the largest particles have a size of 5μ while the majority of the particles have a size of 1 to 2μ and has a thickening substance added.

6. A mineral oil for use as a lubricant and cutting oil is characterised by having admixed therewith colloidal sulphur that is insoluble in carbon disulphide and oil and has been so finely ground that the largest particle has a size not greater than 5μ and has a thickening substance added which consists of a chemically precipitated colloidal sulphur.

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