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LUBRICATING SURFACES

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ABSTRACT OF THE DISCLOSURE

Friction between a surface and clayey earth or materials of construction is reduced by the application to the surface of an aqueous solution of a high molecular weight, essentially linear acrylic amide polymer.

The present invention concerns lubricating surfaces to diminish friction. More particularly, the invention concerns a lubricant for clayey earth contacting surfaces and penetrating fasteners for materials of construction.

It is a notorious fact that earth contacting surfaces, including earth working tools as well as vehicle wheels and treads, tend to accumulate substantial deposits of earth which interfere with their operation. For an illustration, one need only consider the problems encountered in the use of a hand shovel when digging wet soil that contains some wet clay. The earth sticks tenaciously to the surface and the shovel load cannot be readily shaken off. The shovel does not scour in such soil and it is not long before the shovel surface must be scraped.

Another illustration of the problem can be seen in tractor tires and caterpillar treads which have been working over clayey soils. Often, when the moisture conditions are right, the treads of the tractors and caterpillars accumulate considerable mud which impairs their efficiency. Also mud accumulations on shoes and boots is often a problem of sonsiderable consequence.

Another area of practical, though seemingly mundane application of friction reducing agents, is with the use of metal fasteners, such as screws and nails. Although such fasteners utilize friction to achieve their intended function, decreasing the friction between the fastener and substrate material of construction during its installation manifestly increases the ease of installation. When as in the present invention the friction reducing agent dissipates after use, the useful friction is fully restored.

It would be desirable, and is an object of the present invention to provide an aqueous lubricant for surfaces subject to frictional contact with clayey earth or materials of construction. Particular objects are to minimize clayey earth accumulations on metal tools for earth working, rubber treads, and foot wear. Additional specific objects are to provide an aqueous lubricant for friction dependent fasteners. The above objects, and other benefits as will become apparent hereinafter, are accomplished in the present invention.

In accordance with the invention, the friction surfaces of earth working tools and vehicle wheels and treads are rendered less susceptible to the accumulation of moist calyey earth and metal or friction fastening devices are installed in construction materials more easily by coating the friction surface, prior to its use, with an aqueous solution of a high molecular weight, essentially linear, acrylic amide polymer. The amount of polymer dissolved in the solution can be from as little as about 0.05 percent up to as much as about 4 percent, by weight of the solution. The actual amount dissolved will depend somewhat on the molecular weight of the polymer and a convenient applicating solution viscosity.

The acrylic amide polymers useful herein include the homopolymers of acrylamide and methacrylamide and

water soluble copolymers of the foregoing with other suitable monoethylenically unsaturated monomers copolymerizable therewith. In general, the acrylic amide polymers used are water soluble, vinyl type polymers characterized by substantial linearity, i.e., having little or no cross-linking between polymer chains. The benefits of the invention are most pronounced with polymers having a high molecular weight. By this is meant polymers having a molecular weight of at least about 100,000 and up to 10 million or more. It is preferred to use polymers with a molecular weight over one million. In other terms, the polymers useful herein have a molecular weight such that they are characterized by a solution viscosity of at least about 4 centipoises as a 0.5 percent by weight solution in distilled water adjusted to a pH of 3 at a temperature of 21.5° C. The viscosity is determined with an Ostwald viscosimeter. Specific examples of acrylic amide polymers in addition to the forementioned homopolymers, are copolymers of acrylamide or methylacrylamide with comonomers containing water solubilizing groups as for example acrylic acid, methacrylic acid, maleic acid, alkali metal salts of the foregoing acidic monomers, other monomers are vinylbenzyl compounds (such as trimethylvinylbenzylammonium chloride), vinylbenzenesulfonic acid, 2-sulfoethyl acrylate, 2-aminoethyl acrylate, N-vinyl-2-oxazolidone, N-vinylpyrrolidone, N-vinylmorpholinone and the like. In such copolymers, the comonomer often may constitute as much as 50 mole percent of the finished copolymer. Comonomers that are water insoluble may also be copolymerized with the amide monomers, but in such instances the amount should not exceed more than about 25 mole percent of the finished copolymer in order to maintain its water solubility. Examples of such comonomers include methylvinyl ether, vinylacetate, styrene, methylacrylate, ethylacrylate, propylene, vinyl chloride, vinylidene chloride and the like.

In a specific embodiment of the invention, a shovel was coated with a sufficient amount of a solution containing 2 percent by weight of a high molecular weight polyacrylamide to wet the surface of the shovel. The molecular weight was above 2 million. After being used to dig 8 scoops of a very sticky, wet gumbo soil, the shovel remained substantially free of clayey earth accumulation. By comparison, a shovel, the surface of which was simply wetted by water prior to use, was covered with mud and had to be scraped clean after being used to dig about 8 scoops of the same soil.

In another application, the auger of a 12" diameter post hole digger was coated with sufficient acrylic amide polymer solution, containing 1 percent by weight polymer solute, to wet the surface of the auger. After boring a hole about 4 feet deep in a clayey soil, the auger was retrieved with little or no earth accumulation. Several more holes were dug with the same result.

The auger was then washed to remove all traces of the polymer and several more holes were dug. The surface was covered with a mud layer that stuck to the metal surface so tenaciously that it could not be readily scraped off. The surface was scrubbed clean with a wire brush and recoated with the polymer solution. More holes were dug. Again the tool stayed clean and shiny.

Some digging had to be done in a muddy soil. The gumbo mud stuck tightly to the boots of the workers. They soon had as much as 1" of mud stuck to them and the efficiency and safety of the workers was impaired. The area was dusted with a dry polyacrylamide powder. The mud no longer accumulated on the boots and it was much easier to walk around.

In a third embodiment of the invention a ¼" x 1½" lag screw was turned into a 5/16" diameter hole in a piece of Douglas Fir with a torque wrench. When the screw

was embedded 1.1 inches into the wood, it required 40 inch-pounds of torque to screw it in. When the screw was wetted with water, it required 29 inch-pounds of torque at the same depth in other hole. When dipped into a 2 percent by weight aqueous solution of a high molecular weight polyacrylamide, the torque requirement dropped to 24.5 inch-pounds under comparable test conditions.

What is claimed is:

1. A method for decreasing friction between a friction surface in contact with clayey earth or materials of construction, which comprises coating the surface with an aqueous solution of a high molecular weight, essentially linear acrylic amide polymer characterized by a molecular weight of at least 100,000.

2. A method for decreasing the friction between a surface of metal tool and clayey earth which comprises coating the surface of the metal tool with an aqueous solution of a high molecular weight, essentially linear, acrylic amide polymer characterized by a molecular weight of at least 100,000.

3. A method for decreasing the friction encountered when a metal fastener for materials of construction is installed which comprises coating the fastener with an aqueous solution of a high molecular weight, essentially linear, acrylic amide polymer characterized by a molecular weight of at least 100,000.

4. A method as in claim 1 wherein the surface is a vehicle wheel or tread and the frictional contact is relative to clayey earth.

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