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METHOD OF LUBRICATION AS APPLIED TO THE PROCESSING OF ALUMINUM AND ALUMINUM ALLOYS

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This invention relates to a lubricating composition adapted for use in the processing of aluminum and aluminum alloys, and particularly to a non-staining aluminum roll oil.

In the processing or rolling of aluminum and aluminum alloys into sheets and strips it is the usual practice to spray the rolls and working metal with a light mineral oil to lubricate the rolls and prevent sticking of the working metal surface. After the final pass through the rolls, prior to annealing, this oil must be thoroughly removed from the metal surface. This step is of particular importance in the production of planished sheets and strips, due to the fact that any oil remaining on the metal will result in a brown or black discoloration or stain on subsequent annealing. In general, annealing is carried out at temperatures ranging from 600 to 900° F. for two to five hours, depending upon the characteristics desired. Under these conditions, any residual oil remaining on the metal surface is burned into the metal, leaving brown or black stains which are not removable.

It is the purpose of the invention to provide a lubricating composition which effectively lubricates the metal surfaces of the sheets and strips during the rolling operations and which, without being removed therefrom, may pass through the annealing ovens without leaving an undesirable stain on the metal surface.

It has been found that a low viscosity mineral oil compounded with small amounts of the combination of an oxidation product obtained by partial oxidation of high molecular weight petroleum hydrocarbons and an oxidation-inhibitor falling within the class of N-substituted aromatic amines, provides a lubricating oil especially adapted to the lubrication of aluminum and aluminum alloy metals during the processing or rolling thereof, and which, upon subsequent annealing of the metals, without undergoing an oil removal operation, will leave no oil stains on the surfaces of the working metal. In addition to the exceptional nonstaining characteristics, the compounded oil possesses improved wetting and spreading properties which minimize scratching of the metal surfaces during the rolling operation, protects against water-staining, and prevents metal pick-up on the rolls.

In accordance with the present invention a

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nonstaining aluminum roll oil may be prepared by incorporating in a mineral oil, within the viscosity range of 35–100 Saybolt Universal seconds at 100° F., the combination of 0.01–1.0% by weight of an oxidation product obtained by partial oxidation of high molecular weight petroleum hydrocarbons, such as lubricating oils, petrolatum or wax, which are oxidized to a neutralization number not greater than 70 and 0.01–1.5% by weight of an N-substituted aromatic amine, such as a phenyl naphthylamine, diaryl amine, diamino diaryl alkane, etc., which possesses oxidation inhibiting properties.

The preferred lubricating composition of the invention is composed of a mineral lubricating oil within the viscosity range of 40–60 Saybolt Universal seconds at 100° F., which is compounded with 0.01–0.10% by weight of an oxidation product obtained by catalytic partial oxidation of petroleum wax to a neutralization number within the range of 20–50 and 0.05–0.5% by weight of a diamino diaryl alkane possessing oxidation inhibiting properties.

In order to further disclose the invention, the following example is given, it being understood that the example is merely for purposes of illustration and the invention is not restricted thereto.

1400 gallons of 300 oil, which is an acid-treated, doctor-sweetened burning oil distillate, were blended in a kettle equipped with a steam jacket and air-blowing facilities with 1475 gallons of car oil stock "T," which is a caustic-washed distillate blending stock. The tests on these oils are as follows:

	300 oil	Car oil stock "T"
Gravity, ° API	37.9	28.2
Flash, C-Cleve., ° F.	275	310
Fire, Cleve., ° F.	300	350
Visc. Saybolt Univ. secs. at 100° F. (conv. from Kin.)	41.1	56.7
Carbon residue, percent		0.02

The resulting blend had a viscosity of approximately 46 Saybolt Universal seconds at 100° F. The blend was then heated by steam until the temperature reached 140° F. Thereafter, the steam was cut off and the oil vigorously agitated by air-blowing. 20.6 pounds of tetramethyl

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diamino diphenyl methane were then slowly added to the oil, followed by the addition of 10.3 pounds of oxidized wax. The contents of the kettle were then air-blown for 20 to 30 minutes and the compounded oil then slowly cooled by circulating water through the jacket. The resulting product, containing 0.10% tetramethyl diamino diphenyl methane and 0.05% oxidized wax, possessed the following tests:

Gravity, °API	32.6
Flash, C-Cleve., °F	285
Fire, Cleve., °F	315
Visc. Saybolt Univ. secs. at 100° F	46.1
Carbon residue, percent	0.01

The oxidized wax component of the foregoing product was prepared by oxidizing a petrolatum stock from a solvent-dewaxed filtered wax distillate at 238-250° F., using 3 cu. ft. of air per hour per pound with 1% manganese naphthenate as a catalyst until the oxidized wax had a neutralization number of 28.8 and a saponification number of 73. The catalyst was removed by acid treatment, using 10% by volume of 40% sulfuric acid, followed by washing with hot water in which no inorganic acidity was present as indicated by methyl-orange. The catalyst-free oxidized wax was then steam-stripped under 0.6 inches absolute mercury pressure and a maximum oil pressure of 300° F. The oxidized wax so prepared analyzed as follows:

Neutralization No.	26
Saponification No.	64
Percent unsaponifiable	72
Ash, percent	Trace

To determine the effectiveness of the various oil compositions compounded in accordance with the present invention, the oils were tested in accordance with an empirical test which was designed to correlate with the staining characteristics of the oil in actual rolling mill operation. In this test, an aluminum test plate, 5" x 5" x 1/8", which was polished to a mirror finish, was used. 0.8 ccs. of the test oil was spread evenly over the upper surface of the test plate with a rubber replacement. The coated test plate was then placed in an oven for a half hour at 340° C. (644° F.). At the end of this period, the plate was then removed and examined for stains. It was found that the oils of the invention all satisfactorily passed this so-called "stain test" with results ranging from a very slight stain to no stain at all.

Obviously many modifications and variations of the invention, as hereinbefore set forth, may be made without departing from the spirit and scope thereof, and therefore only such limitations

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should be imposed as are indicated in the appended claims.

I claim:

1. A method of lubrication as applied to the processing of aluminum and aluminum alloys in which the metal is subjected to a rolling operation, followed by annealing, which comprises supplying to the rolls and metal surfaces a hydrocarbon lubricating oil within the viscosity range of 35-100 Saybolt Universal seconds at 100° F., having incorporated therein a combination of 0.01-1.0% by weight of an oxidation product obtained by the partial oxidation of high molecular weight petroleum hydrocarbons, and 0.1-1.5% by weight of an N-substituted aromatic amine of the class consisting of phenyl naphthylamines, diaryl amines, and diamino diaryl alkanes possessing oxidation inhibiting properties.

2. A method of lubrication as applied to the processing of aluminum and aluminum alloys in which the metal is subjected to a rolling operation, followed by annealing, which comprises supplying to the rolls and metal surfaces a hydrocarbon lubricating oil within the viscosity range of 35-100 Saybolt Universal seconds at 100° F., having incorporated therein a combination of 0.01-1.0% by weight of an oxidation product obtained by the partial oxidation of high molecular weight petroleum hydrocarbons which are oxidized to a neutralization number not greater than 70, and 0.1-1.5% by weight of an N-substituted aromatic amine of the class consisting of phenyl naphthylamines, diaryl amines, and diamino diaryl alkanes possessing oxidation inhibiting properties.

3. A method of lubrication as applied to the processing of aluminum and aluminum alloys in which the metal is subjected to a rolling operation, followed by annealing, which comprises supplying to the rolls and metal surfaces a hydrocarbon lubricating oil within the viscosity range of 35-100 Saybolt Universal seconds at 100° F., having incorporated therein a combination of 0.01-1.0% by weight of an oxidation product obtained by the partial oxidation of high molecular weight petroleum hydrocarbons, and 0.1-1.5% by weight of a diamino diaryl alkane possessing oxidation inhibiting properties.

4. A method of lubrication as applied to the processing of aluminum and aluminum alloys in which the metal is subjected to a rolling operation, followed by annealing, which comprises supplying to the rolls and metal surfaces a hydrocarbon lubricating oil within the viscosity range of 35-100 Saybolt Universal seconds at 100° F., having incorporated therein a combination of 0.01-1.0% by weight of an oxidized petroleum wax, and 0.1-1.5% by weight of tetramethyl diamino diphenyl methane.

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