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COOLING FLUID OF ANTILEAK AND NONFOAMING CHARACTER

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The invention relates to cooling fluids of non-foaming and anti-leak characteristics, and is particularly concerned with anti-freeze cooling liquids incorporating additive materials adapted to retard or prevent fluid loss in circulatory cooling systems through either foaming or leakage.

The occurrence of leaks in the cooling system of automobile engines is not at all uncommon, and the operating conditions of such a system are conducive to the formation of foam in cooling fluids containing an alcohol type freezing point depressant. Leakage may occur through small orifices such as solder pores, through minute crevices resulting from imperfect union of the metal parts, or through other small openings which may develop in the seams or soldered joints by road shock and vibration, corrosion, or freezing of the cooling fluid. Foaming in a cooling liquid is invariably promoted by unavoidable aeration accompanied with a rapid circulation and agitation at high temperatures, causing air bubbles to become entrained in the fluid; and the presence of corrosion inhibitors or other additive agents, now commonly used in anti-freeze liquids, may also increase the foaming tendency. Serious liquid loss and other difficulties may result from either leakage or foaming, and both are obviously undesirable.

It is an object of this invention to provide improved cooling fluids inhibited against leakage and foaming under all normal conditions of use in a circulatory cooling system. A further object is to provide an inhibitor mixture having both a leakage and foam preventive function, and in certain instances a corrosion inhibiting action, which mixture is particularly adaptable to incorporation with cooling fluids containing a freezing point depressant composed of a monohydric or polyhydric alcohol.

I have found that alginate compounds, or salts of alginic acid, have characteristics excellently adapting them as leakage preventatives in cooling fluids. Available materials, in particular the commercial alkali metal and ammonium salts, have a certain fibrous nature sufficient to clog or stop both small crevice leaks and those of a pinhole type, and through what appears to be an oxidation or thermal setting, they have a sealing action as well, and fix the fibers in the leakage orifices in a substantially permanent manner. Sodium alginate, a preferred compound for the purpose of the invention, is in pure form a colorless, odorless, and tasteless colloid, neutral in reaction, and soluble in hot or cold water. The alginates swell in water, and in small concentrations will form very viscous solutions, but the compounds are uniformly dispersible in cooling fluids entirely of water, or in those containing freezing point depressants such as alcohols, glycols or glycerine. Various alginate products are available commercially in dry powdered form or as pastes, and tests on many of these have indicated a universal effectiveness in their leak stoppage action. A product particularly satisfactory is a finely milled sodium alginate which has not been entirely purified, and may contain up to 25% of insoluble fibrous material. The insoluble component is, however, unessential to the leak sealing action of the product, and the more highly purified alginate compounds are likewise effective for the purpose of the invention. The amount of alginate necessary in the cooling fluid to impart satisfactory anti-leak properties will vary with the particular conditions under which it is used, but for all normal purposes only very small amounts are required, preferably within the range of 0.0001% to 0.10% by weight of the cooling solution.

As an anti-foam agent, in accordance with the invention, I propose to add along with the alginate compound a soluble alkaline earth metal salt, in small proportions but sufficient to create in the cooling fluid a definite ion content of the metal. Calcium, barium, and strontium salts, as well as salts of magnesium—the latter metal being included herein within the group indicated and defined as alkaline earth metals—are especially effective in amounts which will produce in a concentrated anti-freeze solution a metal ion content preferably exceeding about 0.05%, the total amount of salt addition depending to a certain extent upon the quantity of the alginate component present. These salts function to prevent the normal foaming tendency of an alcohol freezing point depressant, and they counteract any additional foaming influence which may be created by the alginate compound. The associated action of the components of this proposed mixture is, furthermore, quite unexpected in view of the known properties of the two materials. Alginates of the alkaline earth metals are quite insoluble and might normally be expected to form by reaction in the solution with the added alkaline earth metal salts. This would cause a precipitation of the insoluble alginate and a depletion of the inhibitor agent present in the smaller equivalent proportion, with a consequent loss in effect of either the anti-foam or anti-leak action. These results do not, however, occur, and the anti-leak function of the

alginate is not substantially affected, even though the preferred amounts of the added metal ion is well in excess of that which would normally precipitate the alginate quantitatively.

Within the range of suitable proportions of the alginate anti-leak as above expressed, specifically 0.0001% to 0.10% by weight of the cooling solution, the amount of soluble alkaline earth metal salt may be varied from about 0.10% to 1.0%. To insure further compatibility of the two components of this mixture, as well as to improve the dispersion of the alginate member, a preferred procedure of incorporating the compounds in a concentrated alcohol solution consists in first mixing a small portion of the required calcium or other salt component in aqueous solution with the alginate, to form a thin coating on the alginate particles, and then adding the additional required amount of salt along with a pretreated alginate compound. A number of specific salts will serve the purpose here intended, but an additional important advantage can be attained with this invention by employing as the anti-foam agent a salt containing a nitrite or nitrate ion, both of which ions in solution are known to be excellent corrosion inhibitor agents. Thus calcium, barium, strontium, or magnesium nitrites or nitrates, individually or in mixture, are the preferred anti-foam salt components, which in further mixture with sodium alginate will provide a complete inhibitor composition of a corrosion preventive function, as well as of anti-leak and non-foaming properties. Characteristic formulae which have proven especially effective with alcohols, including ethylene glycol or other glycol anti-freeze solutions, contain about 0.01% to 0.10% by weight of the alcohol of sodium alginate, and about 0.3% to 1.0% on a similar weight basis of calcium nitrite. Calcium nitrate may be substituted, in whole or in part, for the calcium nitrite of such formula, as can also similar barium, strontium, and magnesium salts. A typical mixture for an ethylene glycol anti-freeze, containing both a nitrate and nitrite salt, consists, in percentage by weight of the glycol, of about 0.55% calcium nitrite, about 0.07% calcium nitrate, and about 0.035% sodium alginate. Other inhibitor materials can be added to this formula if desired.

The invention contemplates the use of the inhibitor mixture specified with many different coolants, particularly those containing monohydric or polyhydric alcohols as freezing point depressants, and further specific corrosion inhibitors, or other additive agents, may be used in conjunction with the essential anti-leak and anti-foam composition disclosed. Obviously many different anti-freeze cooling fluid formulae are possible within the broader scope of the invention, which should not be limited other than as defined by the appended claims.

This application is a continuation-in-part of my copending application Serial No. 294,630, filed September 13, 1939.

I claim:

1. A cooling fluid containing an alcohol as a freezing point depressant, and a leakage and foam preventive composition comprising a mixture essentially composed of a compound of the group consisting of alkali metal and ammonium salts of alginic acid, and a member of the group consisting of soluble salts of calcium, barium, strontium and magnesium, the respective amounts of said components being about 0.0001% to 0.10% by weight of the cooling fluid of the alginic acid salt, and about 0.10% to about 1.0% by weight of the soluble metal salt.

2. A cooling fluid containing an alcohol as a freezing point depressant, and a leakage, foam, and corrosion preventive composition comprising a mixture essentially composed of sodium alginate, and a member of the group consisting of nitrites and nitrates of calcium, barium, strontium and magnesium, the respective amounts of said components being about 0.01% to 0.10% by weight of the alcohol of the alginate, and about 0.30% to 1.0% by weight of the metal salt.

3. A cooling fluid containing ethylene glycol as a freezing point depressant, and a leakage, foam, and corrosion preventive composition comprising a mixture essentially composed of sodium alginate and a member of the group consisting of calcium nitrite and calcium nitrate, the respective amounts of said components being about 0.01% to 0.10% by weight of the glycol of the alginate, and about 0.30% to 1.0% by weight of the calcium salt.

4. A cooling fluid containing ethylene glycol as a freezing point depressant, and a leakage, foam, and corrosion preventive composition comprising a mixture essentially composed of about 0.035% by weight of the glycol of sodium alginate, about 0.55% by weight of calcium nitrite, and about 0.07% by weight of calcium nitrate.

5. Method of preventing leakage and foaming of cooling fluid in a circulatory cooling system, which comprises circulating said cooling fluid with an admixture thereto of an anti-leak and anti-foam composition essentially comprising a mixture of a compound of the group consisting of alkali metal and ammonium salts of alginic acid, and a soluble alkaline earth metal salt, said components being present in an amount of about 0.0001% to 0.10% by weight of the cooling fluid of the alginic acid salt, and about 0.10% to 1.0% by weight of the alkaline earth metal salt.

6. Method of preventing leakage, foaming and corrosion of an alcohol-containing cooling fluid in a circulatory cooling system, which comprises circulating said cooling fluid with an admixture thereto of a composition essentially comprising a mixture of sodium alginate and a member of the group consisting of nitrites and nitrates of calcium, barium, strontium and magnesium, said components being present in an amount of about 0.01% to 0.10% by weight of the alcohol of the alginate, and about 0.30% to 1.0% by weight of the alkaline earth metal salt.

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