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3,269,948

AMINE SALTS OF PERHALOGENATED MONOBASIC CARBOXYLIC ACIDS

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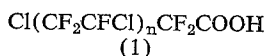
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This application is a continuation-in-part of application Serial No. 853,471, filed November 17, 1959, and abandoned subsequent to the filing of the present application.

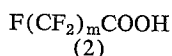
This invention relates to salts of aliphatic amines and monobasic halogen-containing carboxylic acids and to liquid lubricating oil and fuel compositions containing said salts as a wear reducing additive. More particularly, the invention relates to amine salts formed by reacting primary, secondary, or tertiary C₃ to C₃₀ aliphatic amines with monobasic, halogen-containing, C₂ to C₁₂ carboxylic acids and to the use of these salts in lubricating oil and fuel compositions to reduce wear (particularly scuffing) during normal use of the lubricant or fuel.

It is well known in the prior art that halogen-containing organic compounds may be used as additives in mineral lubricating oils to improve such properties as load carrying ability. However, many of such halogenated compounds have been found to be corrosive toward metals. It has now been found that by reacting halogen-containing monobasic carboxylic acids with aliphatic amines, compounds are formed which are not only non-corrosive but which have particular utility as additives for lubricants and fuels in that they reduce wear and metal-to-metal contact.

The halogen-containing monobasic carboxylic acids useful in this invention are the perhalogenated acids containing from 2 to 12 carbon atoms per molecule and wherein the number of halogen atoms exceeds the number of carbon atoms. Of particular utility are the perhalogenated monobasic carboxylic acids having the following general formulae:



(1)



(2)

when $n=1$ to 4 and $m=3$ to 10. The hexanoic ($n=2$) and octanoic ($n=3$) acids of Formula 1 are available from the Minnesota Mining and Manufacturing Company as Kel-F Acids 683 and 8114, respectively. The decapentylfluoro octanoic ($m=7$) acid of Formula 2 is also available from the Minnesota Mining and Manufacturing Company. Pentanoic ($m=4$) and nonanoic ($m=8$) fluoroacids of Formula 2 are available from E. I. duPont de Nemours and Company. Amine salts prepared from the perhalogenated acids of the above formulae are particularly useful in lubricating oil compositions containing conventional detergents. The less complex monobasic halogen-containing carboxylic acids such as trichloroacetic and trifluoroacetic acids may also be used in forming the amine salts of this invention. However, the amine salts formed with the more complex acids are more desirable when used as additives in lubricants containing detergent inhibitors.

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The amines useful in forming the salts of this invention may be primary, second or tertiary C₃ to C₃₀ aliphatic and cycloaliphatic amines. Of particular utility are the unsubstituted aliphatic amines of the foregoing description. Specific examples of amines which may be used are the Primenes (C₁₈ to C₂₄) made by Rohm and Haas, the Armeens made by Armour (e.g., technical dodecylamine and technical octadecylamine), propylamine, amylamine, diamylamine, triamylamine, hexylamine, octylamine, oleylamine, linoleylamine and cyclohexylamine. The higher molecular weight amines in the range of C₁₂ to C₂₄ are particularly useful since their salts are more oil-soluble than those of the lower molecular weight aliphatic amines. The tertiary alkyl amines are also preferred because the higher degree of branching within the aliphatic chain imparts greater solubility to the salts formed therefrom.

The liquid compositions useful in this invention are mineral lubricating oils, synthetic lubricating oils and distillate fuels boiling in the range from about 50° F. to 750° F. The lubricating oil may be a mineral lubricating oil, a synthetic hydrocarbon oil or other synthetic lubricating oils such as diethylhexyl sebacate, carbonate esters, glycol esters such as C₁₃ oxo acid diesters of tetraethylene glycol, other diesters, silicone polymers, complex esters as for example the complex ester formed by the reaction of 1 mole of sebacic acid with 2 moles of tetraethylene glycol and 2 moles of 2-ethyl hexanoic acid, etc. The lubricating oil will have a viscosity at 210° F. in the range of 30 to 200 SSU, preferably 35 to 100 SSU at 210° F., and a viscosity index in the range of 0 to 150.

The distillate fuels employed in the instant invention include aviation turbo-jet fuels, rocket fuel (MIL-R-25576B), gasolines, kerosenes, diesel fuels and heating oils. Aviation turbo-jet fuels in which the amine salts of the present invention may be used normally boil between about 50° F. and about 550° F. and are used in both military and civilian aircraft. Such fuels are more fully defined by U.S. Military Specifications MIL-F-5624F, MIL-F-25656A, MIL-F-25554A, MIL-F-25558B, and amendments thereto, and in ASTM D-1655-62T. Kerosenes and heating oils will normally have boiling ranges between about 300° and about 750° F. and are more fully described in ASTM Specification D-396-48T and supplements thereto, where they are referred to as No. 1 and No. 2 fuel oils. Diesel fuels in which the amine salts may be employed are described in detail in ASTM Specification D-975-35T and later versions of the same specification. Gasolines which may be benefited include both motor gasolines and aviation gasolines such as those defined by ASTM Specifications D-910-56 and D-439-56T.

The liquid lubricating oil compositions of this invention will comprise a major proportion of the lubricating oil and 0.01 to 5 weight percent, more usually 0.1 to 3 weight percent, based upon the total weight of the composition, of the amine salts of the halogen-containing acids. The liquid fuel compositions of this invention will likewise comprise a major proportion of the liquid fuel and about 0.01 to 5 weight percent, based on the total weight of the composition, of the amine salts of the

halogen-containing acids, and more usually 0.01 to 0.20 weight percent.

Other additives which may be used in the liquid compositions of this invention include viscosity index improvers, pour point depressants, corrosion inhibitors, thickeners, sludge dispersants, rust inhibitors, anti-emulsifying agents, anti-oxidants, dyes, dye stabilizers and the like.

The amine salts of this invention are prepared by simple addition of the halogen-containing monobasic carboxylic acid to about an equal molar proportion of the C₃ to C₃₀ aliphatic amine. The reaction is exothermic and will normally proceed at temperatures between 70° and 200° F. Care should be taken to prevent the temperature from exceeding 200° F. since water may be driven off and an insoluble amide might be formed in place of the amine salt reaction product of this invention.

The following examples are submitted as illustrating the practice of this invention. The invention, however, is in no way limited by these examples.

EXAMPLE 1

One gram mole (114 grams) of trifluoroacetic acid was dissolved in ether to give a total volume of 500 ml. This solution was added to a beaker containing one gram mole (315 grams) of a mixture of t-C₁₈H₃₇NH₂ to t-C₂₄H₄₉NH₂ (sold commercially as Primene JM-T by the Rohm and Haas Company). The mixture was immersed in a beaker in ice and water to keep the temperature low, since the acid is volatile. During the addition, which took 20 minutes, the temperature rose from 54° F. to 68° F. and the color of the liquid changed from a light yellow to a dark orange. The ether was then evaporated on a steam bath to leave a clear dark amber liquid product. The above procedure was repeated using one gram mole (163.4 grams) of trichloroacetic acid.

The above salts were then added in amounts ranging from 0.8 to 2.0 wt. percent to a mineral lubricating oil of Mid-Continent origin having a viscosity at 210° F. of 40.8 SSU. The test compositions and the base oil were compared in the Four-Ball Extreme Pressure Machine. For purposes of brevity, the above test will hereafter be referred to as the 4-Ball EP test. In this apparatus, three lower balls are fixed in a pot which also holds the test lubricant. The fourth ball, held in a chuck, is pressed against the three lower balls with a known force and is rotated at a selected speed. The machine is usually operated with the lubricant at ambient temperature, with the upper ball rotating at 1800 r.p.m. A series of short duration tests are run at gradually increasing load increments until initial seizure occurs. Table I illustrates the maximum load which could be carried in the 4-Ball EP test for one minute without film failure or scuffing.

Table I

EFFECT OF AMINE SALTS OF CCl₃COOH AND CF₃COOH ON EP PROPERTIES OF OIL

Wt. percent additive in mineral oil 40.8 SSU viscosity @ 210° F.:	Maximum load carried in 4-ball E.P. test ¹ in kg. ²
None	45
0.08% Primene JM-T salt of CCl ₃ COOH	75
0.80% Primene JM-T salt of CCl ₃ COOH	60
0.20% Primene JM-T salt of CF ₃ COOH	70
2.0% Primene JM-T salt of CF ₃ COOH	80

¹ Maximum load that can be carried for 1 minute without film failure or scuffing.

² Steel-on-steel at 1800 r.p.m.

As shown by Table I, the amine salts of both the trichloroacetic acid and trifluoroacetic acid improve the load-carrying properties of the mineral oil as measured in the 4-Ball EP test. All of the blends submitted to the 4-Ball EP test were clear at room temperature with the exception of the last one (2% concentration) which was slightly hazy.

To determine the effect of these two halogen-containing amine salts on valve train wear (a problem of increasing importance in automotive lubrication), tests were carried out in a laboratory Cadillac engine equipped with radioactive steel valve lifters. These tests were run for three hours at 1000 r.p.m., no load, with normal valve spring tension, and the jacket outlet temperature controlled to 180° F. The valve lifter wear is calculated from the total amount of radioactive wear debris contained in the oil recovered from the three-hour test. The engine is flushed with fresh oil before and after each test run. Under these conditions, the radioactive wear test gives good correlation with field tests using the same oils, engines, and valve train metallurgy. This test is more fully described in the July, 1958, issue of "Lubrication Engineering," a journal of the American Society of Lubrication Engineers, pages 302 to 309.

As seen by the valve train wear data summarized in Table II, the addition of 0.28% of the CCl₃COOH salt and of 0.28% of the CF₃COOH salt to mineral oil of 40.8 SSU viscosity at 210° F. reduced wear by 68% and 76% respectively. At 0.08 wt. percent, the CCl₃COOH salt had only a slight effect, whereas at 0.2% concentration the CF₃COOH salt reduced wear by 57%. That these effects are not due to the Primene JM-T is shown in Table II where it is seen that Primene JM-T alone increases wear.

Table II

EFFECT OF PRIMENE SALTS OF CCl₃COOH AND CF₃COOH ON VALVE TRAIN WEAR

Wt. percent additive in mineral oil, 40.8 SSU @ 210° F.	Relative valve lifter wear
None	100
0.08% Primene JM-T salt of CCl ₃ COOH	96
0.28% Primene JM-T salt of CCl ₃ COOH	32
0.20% Primene JM-T salt of CF ₃ COOH	43
0.28% Primene JM-T salt of CF ₃ COOH	24
0.08% Primene JM-T salt of CCl ₃ COOH + 0.20% Primene JM-T salt of CF ₃ COOH	23
0.40% Primene JM-T	149

EXAMPLE 2

To further illustrate the preparation of the amine salts of this invention and their use in lubricating oil compositions, an amine salt of Cl(CF₂CFCl)₃CF₂COOH (Kel-F acid 8114) was prepared by adding one mole (480 grams) of the acid to one mole of Primene JM-T (315 grams based on neutralization equivalent) at room temperature with constant stirring. The reaction occurred immediately and the temperature rapidly climbed to 100° F. The product when cooled to room temperature was a clear amber viscous fluid. The percent chlorine in this product was 17.2% which compares well with the theoretical value of 17.8%. This salt was then added to a mineral lubricating oil of Mid-Continent origin having a viscosity at 210° F. of 40.8 SSU. The resultant lubricating oil composition was then tested for valve train wear by the procedure described in Example 1 (Laboratory Cadillac Engine Test). The results are shown in Table

Table III

INFLUENCE OF PRIMENE JM-T SALT OF $\text{Cl}(\text{CF}_2\text{CFCl})_3\text{CF}_2\text{COOH}$ ON VALVE
TRAIN WEAR

Lubricant Base.....	Relative Valve Lifter Wear		
	Mineral Oil 40.8 SSU Visc. at 210° F.	10W-30 Base ¹ Containing—	
		Detergent 5 vol. percent ²	Inhibitors 4 vol. percent ³
Additive, wt. percent, Primene JM-T/ $\text{Cl}(\text{CF}_2\text{CFCl})_3\text{CF}_2\text{COOH}$:			
None.....	100	126	105
0.01.....	66		
0.1.....	16		
1.0.....	10	28	22

¹ 10W-30 SAE Mineral lubricating oil base.² Mixture of 37.5% calcium sulfonate and 62.5% P_2S_5 treated barium iso-nonyl phenol sulfide. (Additive concentrate containing approximately 58 wt. percent mineral oil).³ Mixture of barium iso-nonyl phenol sulfide, P_2S_5 treated polyisobutylene of 1100 molecular weight and a barium alkyl benzene sulfonate. Contains 1.28 wt. percent phosphorus, 8.59 wt. percent barium and 4.18 wt. percent sulfur. (Additive concentrate containing approximately 50 wt. percent mineral oil).

The above salt was tested in the SOD Bearing Corrosion test at 340° F. This is a test for oxidation stability and corrosion resistance and involves determination of bearing weight loss and oil viscosity increase when a copper-lead bearing is immersed in the test oil at 340° F. for 20 and 24 hours. Results are shown in Table IV.

Table IV

EFFECT OF PRIMENE JM-T SALT OF $\text{Cl}(\text{CF}_2\text{CFCl})_3\text{CF}_2\text{COOH}$
ON SOD BEARING CORROSION AT 340° F.

Wt. Percent Primene JM-T/ $\text{Cl}(\text{CF}_2\text{CFCl})_3\text{CF}_2\text{COOH}$ Salt in Mineral Oil, 80 SSU vis. at 210° F	0	0.1	1.0
Viscosity Increase (SUS at 100° F.):			
20 hours.....	1,095	761	820
24 hours.....	1,506	1,090	1,144
Bearing Weight Loss (mg.).....	455	261	314

Tables III and IV illustrate the fact that salts of this invention serve as wear reducing additives without adversely affecting corrosion when used in internal combustion engines. Table III also shows that the salts of this invention are extremely effective in reducing valve train wear when used in mineral oils containing conventional detergent inhibitors.

The extreme pressure properties of the Primene salt in mineral lubricating oils were tested by means of the standard 4-Ball EP test used in Table I. The results are set forth in Table V.

Table V

EFFECT OF PRIMENE JM-T SALT OF
 $\text{Cl}(\text{CF}_2\text{CFCl})_3\text{CF}_2\text{COOH}$
ON EXTREME PRESSURE PROPERTIES OF OIL

Wt. percent additive in mineral oil 40.8 SSU viscosity @ 210° F.:	Maximum load carried in 4-ball E.P. test ¹ in kg. ²
None.....	45
0.1%.....	60
1.0%.....	70

¹ Maximum load that can be carried for 1 minute without film failure or scuffing.² Steel-on-steel at 1800 r.p.m.

EXAMPLE 3

This example illustrates the reduction in valve train wear obtained in a Volkswagen engine where small quantities of the amine salts of this invention are added to the lubricating oil. Test results appear in Table VI.

Volkswagen test procedure

The Volkswagen cyclic test is a valve train wear and intake valve deposit test. It is designed to evaluate the protection against valve train wear in the Volkswagen engine which an oil affords and to evaluate the tendency of an oil to give deposits on the undersides of intake valves.

Test operating conditions

Cycle:

5 min. @ 600 ± 25 r.p.m. No load
10 min. @ 1200 ± 25 r.p.m. No load
1 min. @ shutdown

⁵⁵ Test duration as reported in Table VI.

Table VI

VOLKSWAGEN VALVE TRAIN WEAR

Additive, wt. percent in base oil ¹	Time (hrs.)	Wear in 0.0001 in.						Tappet failures (> 0.001" wear)	Intake valve deposit wts. in gms. (average)
		Tappet		Cam		Total			
		Average	Range	Average	Range	Average	Range		
None.....	24	20.5	(4-48)						
Do.....	41	33.5	(7-67)						
Do.....	100	50.1	(17-108)	48	(40-54)	98	(68-160)	8	0.93
1.0 wt. percent Primene JM-T Salt of Cl(CF ₂ CFCl) ₃ CF ₂ COOH.....	24	0.5	(0.1)						
Do.....	41	1.1	(0.3)						
Do.....	² 79	1.4	(1.3)	1.5	(0-4)	3	(1-5)	0	0.41
Do.....	³ 100	1.8							

¹ 10W-30 SAE mineral oil (commercial lubricant) containing 4 vol. percent of the detergent-inhibitor of footnote 3 of Table III.² Test stopped at 79 hrs. due to electronic control difficulties.³ Extrapolated.

EXAMPLE 4

In order to demonstrate further the scope of the present invention, amine salts of $\text{Cl}(\text{CF}_2\text{CFCl})_3\text{CF}_2\text{COOH}$ (Kel-F 8114) were prepared by adding 1 gram mole (480 grams) of the acid to 1 gram mole of each of the following amines: Primene JM-T, propylamine, amylamine, diamylamine, triamylamine and octylamine. The resulting salts were added to separate portions of a mineral lubricating oil of Mid-Continent origin having a viscosity at 210° F. of 40.8 SSU.

The respective oil compositions were tested for wear and scuffing in a rotating cylinder apparatus designed to measure metallic contact and friction between sliding, lubricated surfaces. The test is more fully described in the paper, "Metallic Contact and Friction Between Sliding Surfaces," by M. J. Furey, ASLE Transactions, volume 4, pages 1-11, 1961. The paper is by reference herewith incorporated in its entirety in this application. The apparatus consists basically of a fixed metal ball loaded against a rotating steel cylinder. The extent of metallic contact is determined by measuring both the instantaneous and average electrical resistance between the two surfaces. It is expressed as the percent of the time that metallic contact occurs in a given period of time. Friction between the ball and cylinder is recorded simultaneously with contact. This is noted as coefficient of friction, which is the ratio of friction force to the load. It has been found that there is, in general, a good correlation between metallic contact measured in this manner and the amount of surface damage which occurs.

The evaluations of the compositions were obtained under the following conditions:

System ----- AISI 52100 steel $\frac{1}{2}$ " diam. ball
on $\frac{1}{4}$ " diam. cylinder.
Speed (r.p.m.) ----- 240.
Running Time (min.) --- 32.
Oil Temperature ----- 77° F.
Load (grams) ----- 240, 1000, 4000.
Calculated mean Hertz
pressure (p.s.i.) ----- 34,400; 88,000; 141,000.

The results of the tests are summarized in Table VII and show that the addition of only 0.1% by weight of the Kel-F acid salts of various amines markedly reduces metallic contact.

Table VII

METALLIC CONTACT TESTS

Additive in Base Mineral Oil (Wt. Percent)	Percent Metallic Contact at—		
	240 g.	1,000 g.	4,000 g.
None	92.0	97.9	98.2
0.1% Primene/Kel-F Acid Salt	42.8	80.6	94.3
0.1% Propylamine/Kel-F Acid Salt	0.3	0.7	99.1
0.1% Amylamine/Kel-F Acid Salt	1.1	2.0	2.3
0.1% Diamylamine/Kel-F Acid Salt	11.3	24.8	86.7
0.1% Triamylamine/Kel-F Acid Salt	10.2	12.4	62.6
0.1% Octylamine/Kel-F Acid Salt	59.5	77.9	80.6

EXAMPLE 5

It has further been found that amine salts of perfluoro acids having the general formula $\text{F}(\text{CF}_2)_m\text{COOH}$, where m may range from 3 to 10, are extremely effective in reducing wear and metallic contact. In order to demonstrate this, a Primene JM-T salt of decapentylfluoro octanoic acid was prepared in the following manner and then subjected to a series of tests.

Separate solutions were made of 0.1 mole (30.3 g.) of Primene JM-T in 100 g. of tetrahydrofuran and 0.1 mole (41.4 g.) of decapentylfluoro octanoic acid ($\text{C}_7\text{F}_{15}\text{COOH}$) in 200 g. of tetrahydrofuran. The acid solution was slowly added at room temperature to the amine solution with stirring. The temperature rose from 25° C. to

35° C. The tetrahydrofuran was then evaporated by passing nitrogen over the solution overnight followed by heating to 75° C. for 5 minutes. The yield was 72.2 grams, indicating that only 0.5 gram of tetrahydrofuran remained. The final product was an amber, viscous fluid soluble in hydrocarbons. Thereafter, 0.1% by weight of the above amine salt was dissolved in a straight mineral oil, namely a solvent-extracted distillate having a viscosity of 35 cps. at 77° F. and a V.I. of 110, and the resulting test sample subjected to the Ball-on-Cylinder test of Example 4. The results of that test appear in Table VIII.

Table VIII

EFFECT OF PRIMENE/ $\text{C}_7\text{F}_{15}\text{COOH}$ SALT ON METALLIC CONTACT IN BALL-ON-CYLINDER TESTS

Load (g.)	Mean Hertz Pressure (p.s.i.)	Percent Metallic Contact	
		Base Oil	Base Plus 0.1% Amine Salt
240	54,700	92	1
1,000	88,000	98	6
4,000	141,000	98	0

As shown by Table VIII, the Primene- $\text{C}_7\text{F}_{15}\text{COOH}$ salt is extremely effective in reducing metallic contact over a wide range of loads.

Further evidence of the effect of the above amine salt on wear was obtained in the Four-Ball Wear Test. The test was conducted as follows: Test solutions were placed in the cup of the machine and heated to 100° C. The test cup contained 3 steel balls which were fixed in position by a screw cap. A fourth steel ball, held in a chuck, was pressed against the 3 lower balls with a force of 40 kilograms and rotated at 1200 r.p.m. for a period of 1 hour. At the end of the test, the amount of wear was determined by measuring the diameter of the wear scar on each of the balls and averaging the results. As can be seen from the data in Table IX, the addition of 0.1% by weight of the Primene- $\text{C}_7\text{F}_{15}\text{COOH}$ salt to the base oil reduced wear by over 60%.

Table IX

EFFECT OF PRIMENE/ $\text{C}_7\text{F}_{15}\text{COOH}$ SALT ON WEAR IN THE 4-BALL WEAR TEST¹

Additive in mineral lubricating oil:	Avg. scar diam. in 4-Ball test (mm.)
None	1.69
0.1% Primene/ $\text{C}_7\text{F}_{15}\text{COOH}$ Salt	0.59

¹ Steel-on-steel, 40 kg. load, 1 hr., 100° C., 1200 r.p.m.

EXAMPLE 6

The utility of the amine salts of the present invention was further evaluated by adding Primene salts of decapentylfluoro octanoic acid and Kel-F 8114 acid to various liquid compositions. The resulting test compositions were tested in Ryder Gear Apparatus (Ryder, E. A., ASTM Bulletin 184, 41 (1951)). The results of those tests appear in Table X.

Table X

EFFECT ON LOAD-CARRYING CAPACITY
IN THE RYDER GEAR TEST

Test Composition:	Ryder rating (lbs./inch)
Synthetic lubricant A ¹	1650
A+0.2% Primene-C ₇ F ₁₅ COOH salt	2250
Synthetic lubricant B ²	2500
B+0.2% Primene-C ₇ F ₁₅ COOH salt	2760
B+0.25% Primene-Kel-F (8114) acid salt ..	3010
Jet Fuel ³	400
Jet Fuel+0.01% Primene-Kel-F (8114) acid salt	980
Jet fuel+0.1% Primene-Kel-F (8114) acid salt	2290

¹ A blend of 69% of di-2-ethyl hexyl sebacate with 17.3% C₈ azelate and 13.7% C₁₀ adipate. The oil also contained triresyl phosphate for load-carrying capacity.

² A blend of 55% trimethylol-propane triester of pelargonic acid and 45% complex ester of neopentyl glycol, trimethyl pentanol and sebacic acid.

³ A highly isoparaffinic fuel of 375-500° F. boiling range, high thermal stability, low freezing point and low sulfur content.

The above data further demonstrate the effectiveness of the amine salts of the present invention in improving the anti-wear and anti-scuffing properties of hydrocarbon liquids.

What is claimed is:

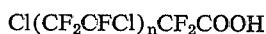
1. A liquid composition comprising a major proportion of a liquid selected from the group consisting of mineral lubricating oils, synthetic lubricating oils and distillate fuels boiling in the range from about 50° F. to 750° F., and about 0.01 to 5 wt. percent, based on the total weight of the composition, of an amine salt of an unsubstituted aliphatic mono amine containing in the range of 3 to 30 carbon atoms per molecule and a halogen-containing C₂ to C₁₂ monobasic carboxylic acid wherein the number of halogen atoms exceeds the number of carbon atoms and the halogen is selected from the group consisting of chlorine and fluorine.

2. A lubricating composition comprising a major proportion of lubricating oil and about 0.01 to 5 wt. percent based on the total weight of the composition, of an amine salt of an unsubstituted aliphatic mono amine containing in the range of 3 to 30 carbon atoms per molecule and a halogen-containing C₂ to C₁₂ monobasic carboxylic acid, wherein the number of halogen atoms exceeds the number of carbon atoms and the halogen is selected from the group consisting of chlorine and fluorine.

3. A lubricating oil composition according to claim 2 wherein said acid is trifluoroacetic acid.

4. A lubricating oil composition according to claim 2 wherein said acid is trichloroacetic acid.

5. A lubricating composition comprising a major proportion of lubricating oil and about 0.01 to 5 wt. percent, based on the total weight of the composition, of an amine salt of a halogen-containing monobasic carboxylic acid having the following general formula:

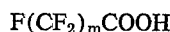


where n is an integer from 1 to 4, and an unsubstituted aliphatic mono amine containing about 3 to 30 carbon atoms per molecule.

6. A lubricating composition according to claim 5 wherein said lubricating oil is a mineral lubricating oil having a viscosity at 210° F. in the range of 35 to 100 SSU.

7. A lubricating composition according to claim 5 wherein n is equal to 3.

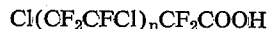
8. A lubricating composition comprising a major proportion of lubricating oil and about 0.01 to 5 wt. percent, based on the total weight of the composition, of an amine salt of a halogen-containing monobasic carboxylic acid having the following general formula:



where m is an integer from 3 to 9, and an unsubstituted aliphatic amine containing about 3 to 30 carbon atoms per molecule.

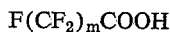
9. A lubricating composition according to claim 8 wherein m is equal to 7.

10. A lubricating oil composition comprising a major proportion of mineral lubricating oil and about 0.1 to 3.0 wt. percent, based on the weight of the total composition, of an amine salt of a mixture of tertiary C₁₈ to C₂₄ unsubstituted aliphatic mono amines and an acid of the formula:



wherein n is a number of from 1 to 4.

11. A lubricating oil composition comprising a major proportion of mineral lubricating oil and about 0.1 to 3.0 wt. percent, based on the weight of the total composition, of an amine salt of a mixture of tertiary C₁₈ to C₂₄ unsubstituted aliphatic mono amines and an acid of the formula:

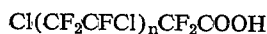


wherein m is a number of from 3 to 9.

12. A lubricating oil composition comprising a major proportion of mineral lubricating oil and about 0.1 to 3 weight percent of the amine salt of trichloroacetic acid and a mixture of tertiary C₁₈ to C₂₄ unsubstituted aliphatic mono amines.

13. A lubricating oil composition comprising a major proportion of mineral lubricating oil and about 0.1 to 3 wt. percent of the amine salt of trifluoroacetic acid and a mixture of tertiary C₁₈ to C₂₄ unsubstituted aliphatic mono amines.

14. A jet fuel composition comprising a major proportion of jet fuel and about 0.01 to 0.20 wt. percent, based on the total weight of the composition, of an amine salt of a halogen-containing monobasic carboxylic acid having the following general formula:



wherein n is an integer from 1 to 4, and an unsubstituted aliphatic mono amine containing about 3 to 30 carbon atoms per molecule.

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