

June 9, 1936.

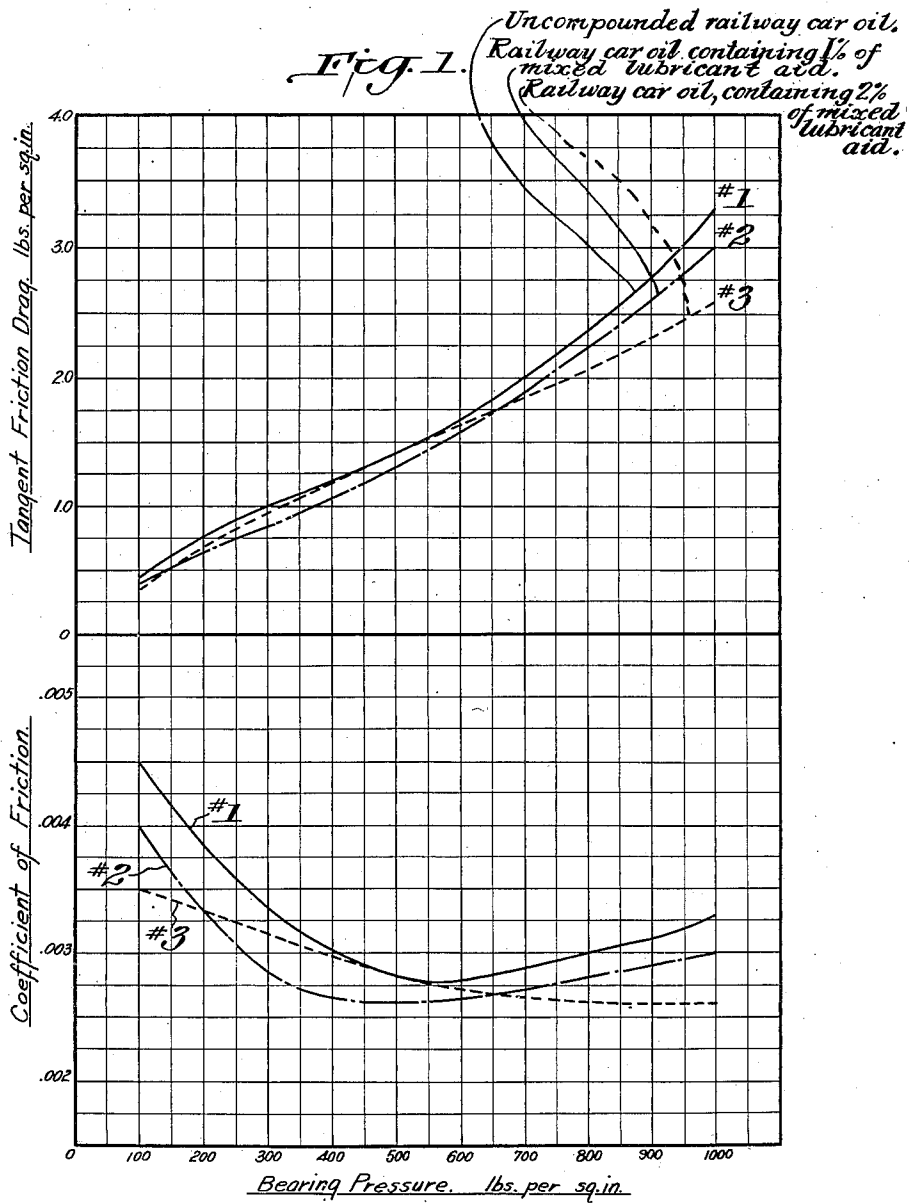
A. W. BURWELL

2,043,923

LUBRICANT COMPOSITION

Filed Jan. 15, 1934

3 Sheets-Sheet 1



Inventor:

Arthur W. Burwell,

By *Potter, Pierce & Scheffler*
his Attorneys.

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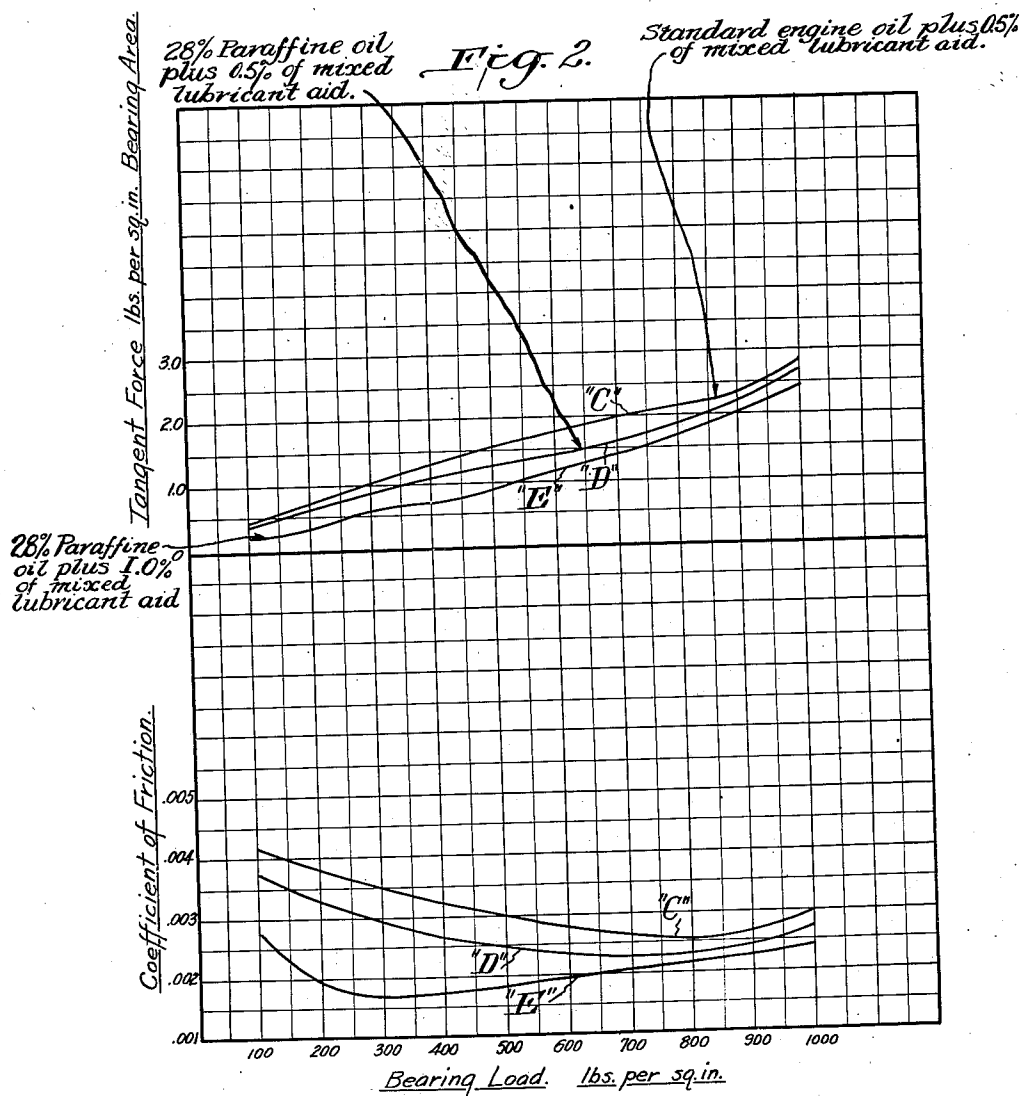
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LUBRICANT COMPOSITION

Filed Jan. 15, 1934

3 Sheets-Sheet 2



Inventor:

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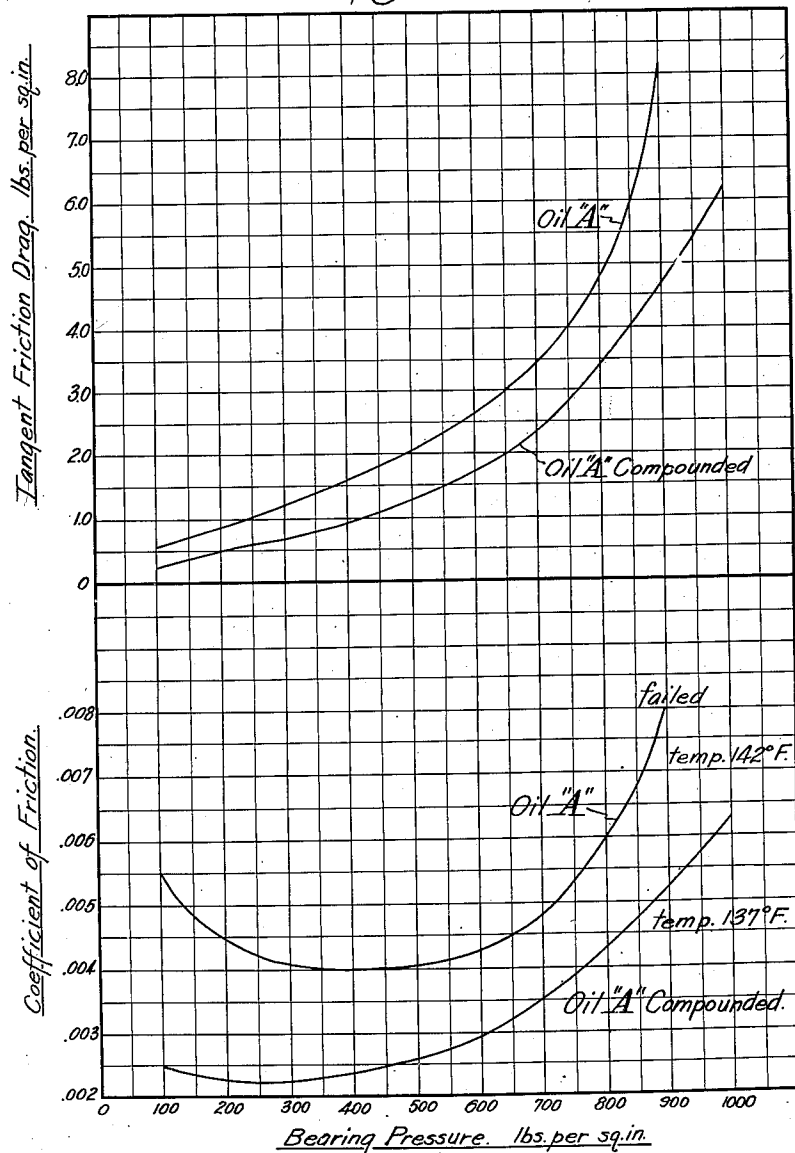
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LUBRICANT COMPOSITION

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3 Sheets-Sheet 3

Fig. 3.



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UNITED STATES PATENT OFFICE

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LUBRICANT COMPOSITION

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ration of New York

Application January 15, 1934, Serial No. 706,740

2 Claims. (Cl. 87-9)

The present invention relates to the produc-
tion of improved lubricant compositions com-
prising lubricating oils of mineral origin as their
bases, and is concerned more particularly with
a composition produced by admixing with a
lubricating oil a plurality of different substances
each having the function of enhancing the
lubricity of the oil.

In U. S. Patent No. 1,863,004 to Arthur W.
Burwell it was disclosed that the lubricity of a
lubricating oil of mineral origin may be improved
by the addition thereto of a relatively very small
but effective amount of an oil soluble addition
material of mineral origin, which material was
substantially free of hydrocarbons and consisted
essentially of high-molecular-weight aliphatic
oxygen-containing compounds including a sub-
stantial proportion of free saturated aliphatic
carboxylic acids. It was there disclosed that
such addition material is obtainable by the con-
trolled, liquid-phase oxidation of scale wax,
"Sharples" wax (i. e., the sticky, amorphous,
translucent, solid obtained by diluting crude
petroleum with light petroleum distillate, chill-
ing the mixture to about minus 17° F., and cen-
trifugally separating precipitated solids from the
chilled mixture), a petroleum distillate, or the
like, at a temperature of from about 100° to
about 150° C. and at a superatmospheric pres-
sure not greater than about 320 pounds per
square inch, in the presence of an exciter of oxida-
tion, until the point of incipient formation of
compounds which are insoluble in petroleum and
in the reaction mixture, such mixture compris-
ing saponifiable and unsaponifiable components,
separating the saponifiable components from at
least the major portion of the unsaponifiable
components, removing the more readily volatile
ingredients of the separated "saponifiables" por-
tion and drying the resulting residue. Likewise,
in application Serial No. 700,018, filed November
27, 1933, in the names of Arthur W. Burwell and
Adolf Kempe, it has been disclosed that wholly
neutral mixtures of such oxygen compounds of
relatively high-molecular-weight hydrocarbons
of mineral origin—specifically, neutral esters
prepared from the acids disclosed in said Bur-
well Patent No. 1,863,004—have the property of
enhancing the lubricity of a lubricating oil of
mineral origin. Whether in the esterized form
or in the free form, these originally acidic mix-
tures of oxidized hydrocarbons are lubricant aids
or lubricity-enhancing materials, and are so de-
nominated herein.

It has now been found that mixtures of such
lubricant aids prepared from a plurality of differ-
ent starting materials have materially greater
effect in lubricant compositions comprising lubri-
cating oil than have the lubricant aids prepared

from a single starting material, and it is the es-
sence of the present invention to provide im-
proved lubricant aids by combining or blending
lubricant aids derived from at least two dissim-
ilar (or at least different) starting materials of
hydrocarbonaceous character and of mineral ori-
gin. For the phenomenon which is the basis of
the present invention no satisfactory explana-
tion can be advanced here; it is very surprising
that a combination of aids from two or more
different sources lends an improvement which is
materially different from the mean of the im-
provements lent by those aids when used sep-
arately.

Illustrating the invention, it may be noted
that the addition to a given lubricating oil of a
relatively small amount, say, 0.3%, of acidic
lubricant aid derived from crude scale wax pro-
duces a lubricant which has a materially lower
internal resistance and is capable of withstand-
ing materially higher pressures than is the case
with the oil per se; that the substitution of a
like amount of a similarly prepared lubricant aid
derived from amorphous, or "Sharples", wax for
the lubricant aid derived from scale wax in the
above lubricant composition shows very nearly
equivalent improvements in the aforesaid prop-
erties; while the substitution of a like amount
of a mixture of similarly prepared lubricant aids
derived from crude scale wax and from amor-
phous wax produces a composition having a ma-
terially reduced internal friction as compared
either with the scale wax aid composition or with
the amorphous wax aid composition alone, which
composition far exceeds the pressure-sustaining
properties of the other two compositions. Typi-
cal of the data supporting the above statements
are the following data collected relative to (a)
the internal friction and (b) pressure-resisting
properties of a motor lubricating oil and of com-
positions prepared from that oil, it being noted
that these tests were made using a "Lubarometer"
testing machine of 1000 pounds per square inch
pressure capacity:

	Oil alone	Oil + 0.3% acids from scale wax	Oil + 0.3% acids from Sharples wax	Oil + 0.15% scale wax acids + 0.15% Sharples wax acids
Internal fric- tion.	Unity.	Reduced by 20-25%.	Reduced by 25-15%.	Reduced by 60-45%.
Pressure at first sign of film rupture.	500#...	600 lbs.	500-700 lbs...	No sign of rupture at 1,000 lbs.
Pressure at film rupture.	600#...	800-900 lbs...	800-900 lbs...	No sign of rupture at 1,000 lbs.

It has been found that the aforesaid phenom-
enon obtains whether the said lubricant aids so
used are, or consist mainly of: (1) the aforesaid

free acids; (2) those acids in completely neutral esterized form; (3) unsaponifiable oxidation products such (as was mentioned hereinbefore) as the naturally completely neutral and unsaponifiable mixtures of alcohols, alcohol-ketones and ketones derived by removing all saponifiable material from an oxidation reaction mixture; or (4) mixtures of the above agents.

The following specific examples, taken in connection with the accompanying drawings, in which Figs. 1, 2 and 3 are graphs showing relationships between bearing pressures and (a) tangent friction drags and (b) coefficients of friction of the lubricant compositions described in the correspondingly numbered examples, will serve to illustrate and further describe the invention:

Example 1

The oil used as the basis of test in this example was a railway car oil having of itself a very high resistance to shock and to film rupture. It had been prepared from a 0-20° F. cold-test pressed oil (from wax distillate) which had been reduced, for flash and fire test, in a still using much bottom steam to prevent cracking of the oil hydrocarbons, and thereafter had been subjected to vigorous aeration in the presence of free steam, at atmospheric pressure, for from 1 to 2 or more hours. This oil was quite black, and had a "fatty" odor (as opposed to the characteristic petroleum odor of the oil prior to treatment).

A mixed lubricant aid, for blending with the aforesaid railway car oil, was prepared by mixing equal parts of unsaponifiable oxidation products (denominated "ketones" herein) from (a) crystalline paraffin wax, (b) "Sharples" wax, and (c) 36-40° distillate (i. e., fuel oil or light ends of pressed oil taken off upon second distillation). These three so-called "ketonic" lubricant aids in each case consisted essentially of acid-free unsaponifiable and completely neutral oxidation products of the hydrocarbons of the named starting material.

The oil was tested alone; thereafter to another portion of the same oil 1% by weight of the above mixture was added and the resulting composition was similarly tested; and finally a composition consisting of 98% by weight of the oil and 2% of the above mixture was tested in the same manner. In this test the bearing metals lubricated were steel and bronze; the bearing speed was 500 feet per minute; the bearing temperature was maintained constant at 140° C.; and the increase in tangent friction drag with increasing bearing pressure was measured in pounds per square inch.

The influences of the mixed lubricant oil in lowering the tangent friction drag, and the coefficient of friction, respectively, of the railway car oil, when added thereto in relatively very small amounts, are shown in Fig. 1, in which the solid lines marked "#1" represent the uncompounded oil, the dot-and-dash lines marked "#2" represent the oil composition containing but 1% of the aforesaid mixed lubricant aid, and the broken lines marked "#3" represent the oil composition containing 2% of the said mixed lubricant aid. Relative to the coefficient of friction curves, it will be noted: that the 1% composition (line #2), within the range of from 200 to 650 pounds per square inch, exhibited a lower (i. e., better) value than did either the uncompounded oil or the composition containing 2% of the mixed lubricant aids; but that at pressures from 650 to 1000 lbs. per square inch curves #1 and #2 showed the imminence of film rupture while curve #3 evi-

denced no suggestion of imminent film rupture on the part of the 2% composition even at the maximum capacity of the testing machine used.

Example 2

In this case the following compositions were compared:

Composition "C"—99.5% of a standard engine oil known as "Renown Engine", into which there was blended 0.5% of a mixed lubricant oil produced by mixing equal parts by weight of the lubricant aids produced, in accordance with the process described and claimed in Burwell Patent No. 1,863,004, from (1) paraffine wax and (2) amorphous or "Sharples" wax.

Composition "D"—99.5% of 28° paraffine oil, having a viscosity of 100 Saybolt at 100° F., and 0.5% of the mixture of lubricant aids referred to under "C" above.

Composition "E"—99.0% of the 28° paraffine oil 20 of composition "D" above, plus 1.0% of the mixture of lubricant aids referred to under "C" above.

These three compositions were tested for coefficient of friction and tangent friction drag, using a bronze bearing and a steel shaft with peripheral speed maintained at 500 feet per minute.

Fig. 2 shows the plotted results of the test, in which the bearing loads were progressively increased, by 100 pound increments, from 100 pounds to 1,000 pounds.

The following data is supplementary to that shown in Fig. 2:

Oil temperature—"C"—132° F.; "D"—130° F.; "E"—126° F. Each composition was tested for 30 minutes at the maximum load of 1,000 pounds, and showed less than 5° increase in temperature above the average of the tests.

All three compositions showed very similar characteristics: they had very low values of friction coefficient and of drag, and at maximum pressure capacity of the testing machine gave no indication of approaching film rupture.

Composition "E" showed properties in all respects as good as those of castor oil, with a considerably lower coefficient of friction (at all points) than that of castor oil.

Example 3

Illustrating the effect of a mixed lubricant aid when blended in very small amount with a lubricating oil of Coastal type, 0.3% by weight of the mixed lubricant aid referred to in "C" of Example 2 above was admixed with 99.7% of "200 Pale Coastal Oil", and this composition, denominated "Oil 'A' compounded", was compared as to tangent friction drag and to coefficient of friction with said oil unblended, denominated "Oil 'A'". The data of this comparative test are shown in Fig. 3.

It is to be noted that the uncompounded oil showed a markedly higher coefficient of friction, at all points, than did the composition, and that the uncompounded oil failed at 900 pounds pressure while the composition still was capable of sustaining further increments of pressure without film rupture. Maximum bearing temperature rose to 142° F. in the case of "Oil 'A'", whereas maximum bearing temperature in the case of "Oil 'A' compounded" was 137° F.

Mixed lubricant aids other than those specifically illustrated above may be employed. Thus, for instance, there may be used mixtures of deacidified oxidized products from a plurality of different sources, such as may be produced by removing free acids from the oxidation reaction

mixtures from two or more different sources, by neutralization and extraction thereof with an alkali, e. g., sodium carbonate, whereby there remain only the self-formed esters, lactones, ketones, alcohols and keto-alcohols of such oxidation reactions. Even mixtures (derived from a plurality of different starting materials) of the so-called ketones have been found to have the heretofore-described property of conferring enhanced "olliness" to lubricating oils of mineral origin. Also, it should be stated that separate oxidation, separation and treatment of each of a plurality of different starting materials is not necessary for the provision of the mixed lubricant aids of the present invention, since the latter may be prepared from oxidation reaction mixtures derived from a mixture of two or more different starting materials. For example, "Sharples" wax may be mixed with a normally

liquid fraction of petroleum and the resulting mixture oxidized and subsequently processed in the manner hereinbefore described with respect to single starting materials.

I claim:

1. A lubricating oil composition comprising a major proportion of a lubricating oil and a minor proportion of a lubricity-increasing agent soluble in said oil, said agent consisting of a mixture of lubricity-increasing oxidation products derived from at least two different petroleum hydrocarbon materials of the group consisting of scale wax, amorphous wax and normally liquid petroleum hydrocarbons.

2. The lubricating oil composition defined in claim 1, characterized in that the said oxidation products are neutral.

ARTHUR W. BURWELL.