United States Patent [19]

Kennel et al.

[11] **3,767,460**

[45] **Oct. 23, 1973**

[54] **METHOD OF DECREASING THE WEAR OF FLEXIBLE BODIES RUBBING ON A RIGID SURFACE**

[75] Inventors: **Michael Kennel; Yves Drapeau,** both of Le Havre, France

[73] Assignee: **Compagnie Francaise De Raffinage,** Paris, France

[22] Filed: **July 26, 1972**

[21] Appl. No.: **275,359**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 62,169, Aug. 7, 1970, abandoned.

[30] **Foreign Application Priority Data**

Aug. 8, 1969	France	692055945
July 8, 1970	Belgium	70753146
July 15, 1970	Italy	70900585
July 23, 1970	Netherlands	707010910

[52] **U.S. Cl.** .... **117/123 E,** 117/652, 117/168, 252/59, 117/123 D, 260/28.5 AV

[51] **Int. Cl.** **C04b 41/00**

[58] **Field of Search** .... 106/270, 273, 285; 117/123 D, 123 E, 132 C, 135, 148, 149, 117/168, 65.2; 260/28.5 AS, 28.5 AV, 28.5 B; 252/12, 56 S, 59

[56] **References Cited**

UNITED STATES PATENTS

2,397,805	4/1946	Ott	106/230
2,499,723	3/1950	Coffman et al.	252/56
3,025,560	3/1962	Lindner	252/12 X
3,175,972	3/1965	Mitacek et al.	252/59 X
3,258,319	6/1966	Cox	252/59 X
3,438,896	4/1969	Council et al.	252/12 X
3,462,249	8/1969	Tunkel	252/59 X
3,607,746	9/1971	Caruso	252/12
3,647,693	3/1972	Crookshank	252/59 X

Primary Examiner—William D. Martin
Assistant Examiner—M. R. Lusignan
Attorney—A. Thomas S. Safford et al.

[57] **ABSTRACT**

A method of decreasing wear on flexible bodies caused by rubbing on rigid surfaces is shown. The rigid surface is coated with a paraffin composition, preferably paraffin or petroleum wax. Improved stability of the composition, with time, is obtained by incorporating, in the composition, an additive such as polyethylene. The compositions are applied to rigid surfaces such as concrete by spraying or by roller application. In the former case the compressed air for the spray gun and the surface to be coated are heated. The coatings may be advantageously applied to concrete tracks upon which air cushion (hover) vehicles are guided.

2 Claims, 6 Drawing Figures

United States Patent [19]
Kennel et al.

[11] **3,767,460**
[45] **Oct. 23, 1973**

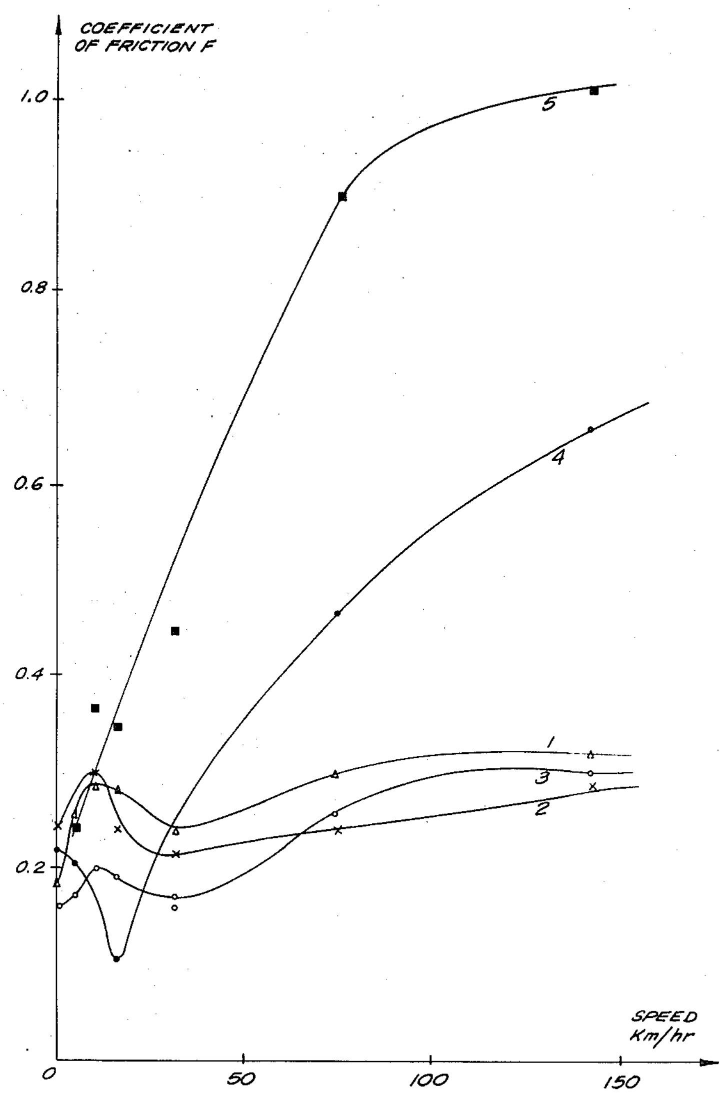


FIG. 1

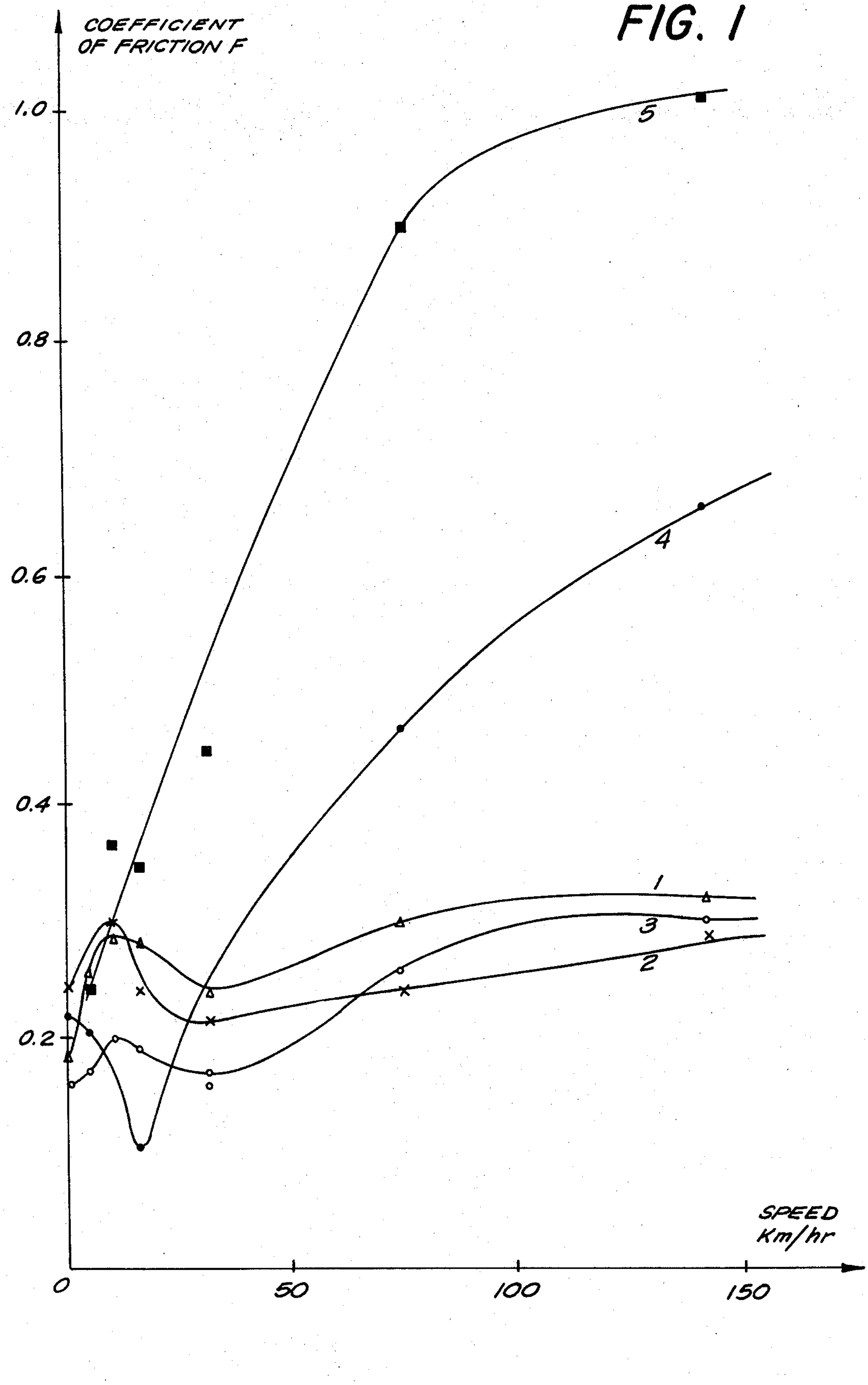

COEFFICIENT
OF FRICTION F
1.0
0.8
0.6
0.4
0.2
5
4
1
3
2
SPEED
Km/hr
0
50
100
150

FIG. 2

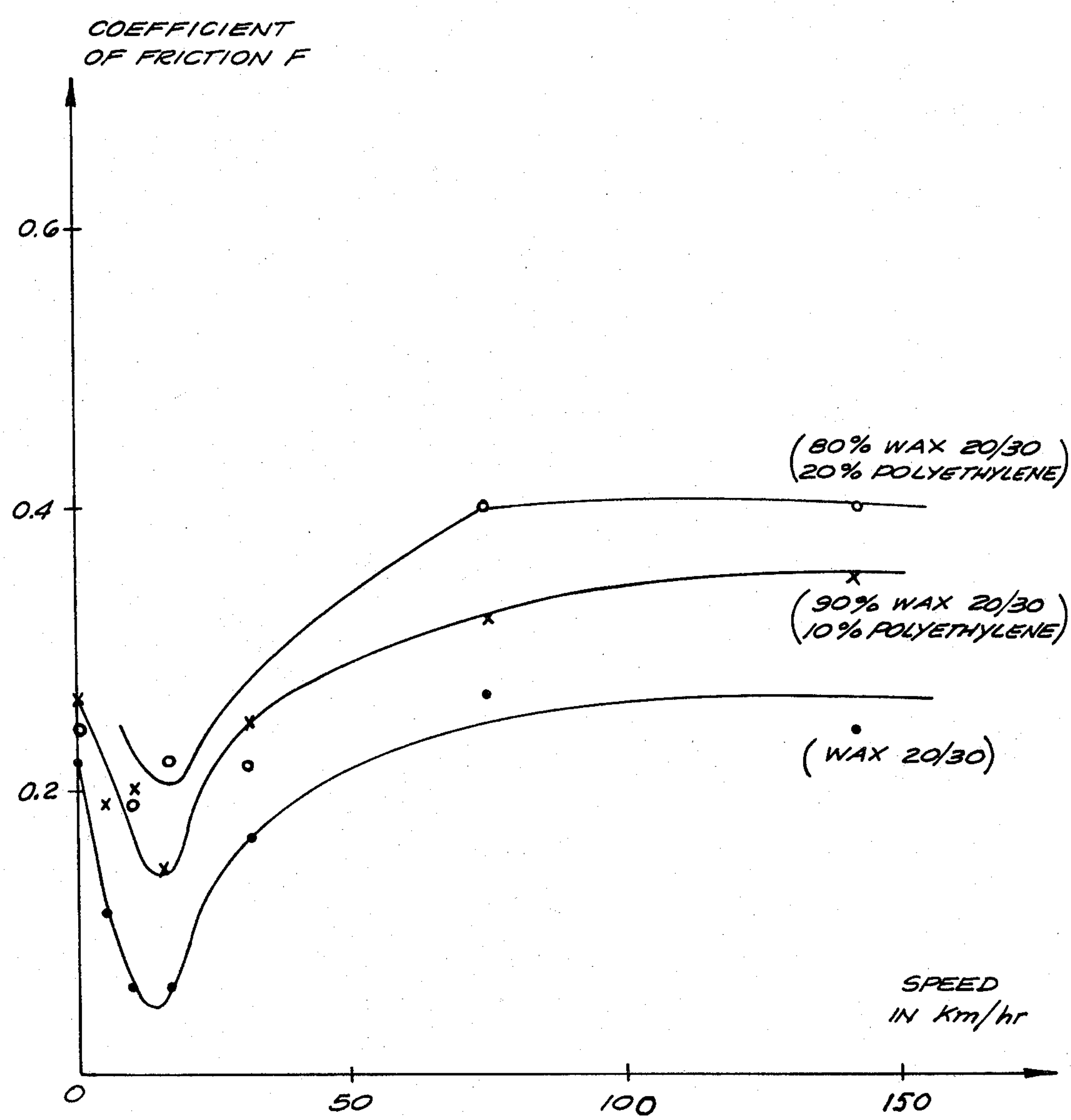

COEFFICIENT
OF FRICTION F
0.6
0.4
0.2
(80% WAX 20/30
20% POLYETHYLENE)
(90% WAX 20/30
10% POLYETHYLENE)
(WAX 20/30)
SPEED
IN Km/hr
0
50
100
150

FIG. 3

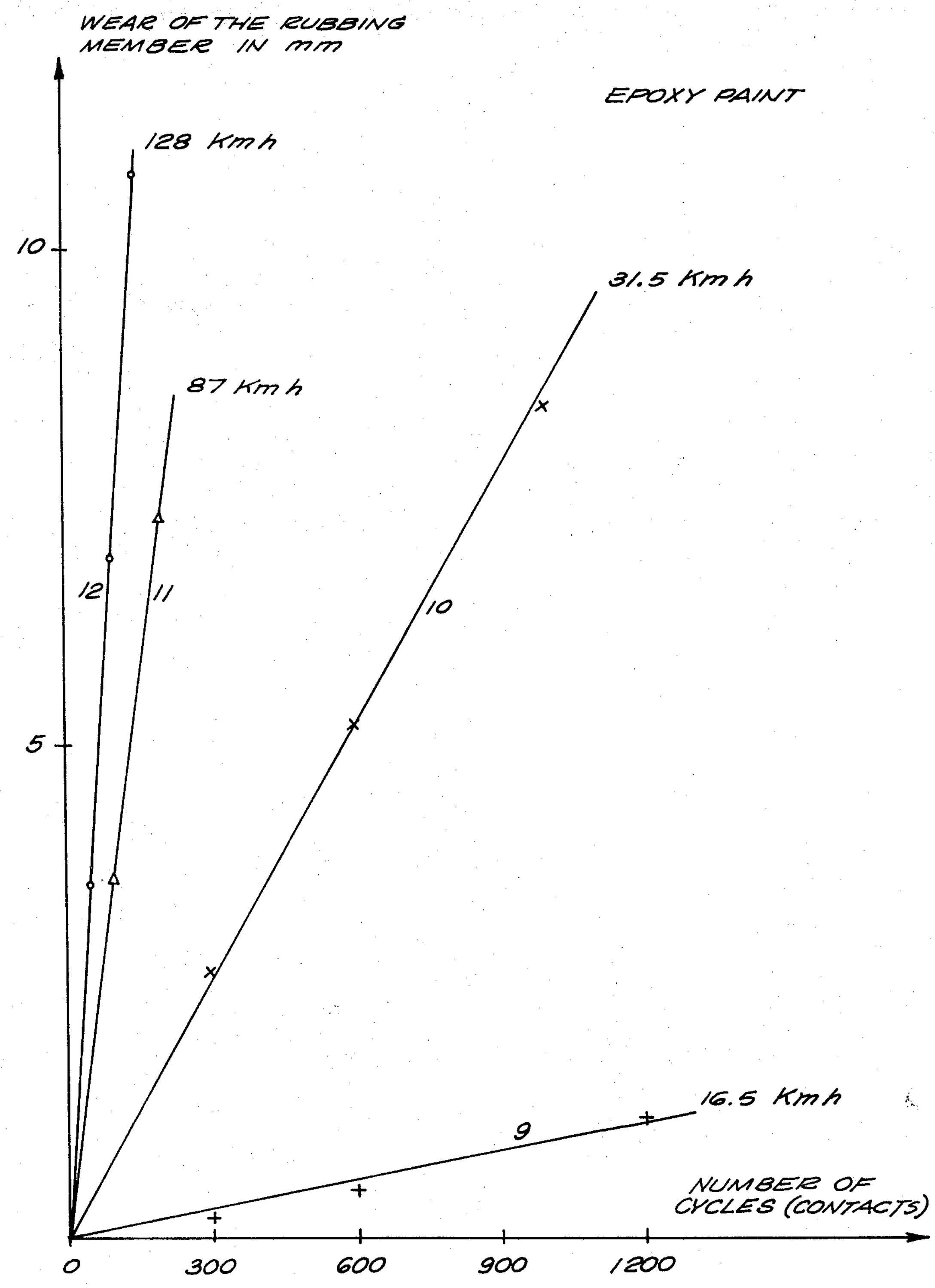

WEAR OF THE RUBBING MEMBER IN mm
EPOXY PAINT
128 Kmh
10
31.5 Kmh
87 Kmh
12
11
10
5
16.5 Kmh
9
NUMBER OF CYCLES (CONTACTS)
0
300
600
900
1200

FIG. 4

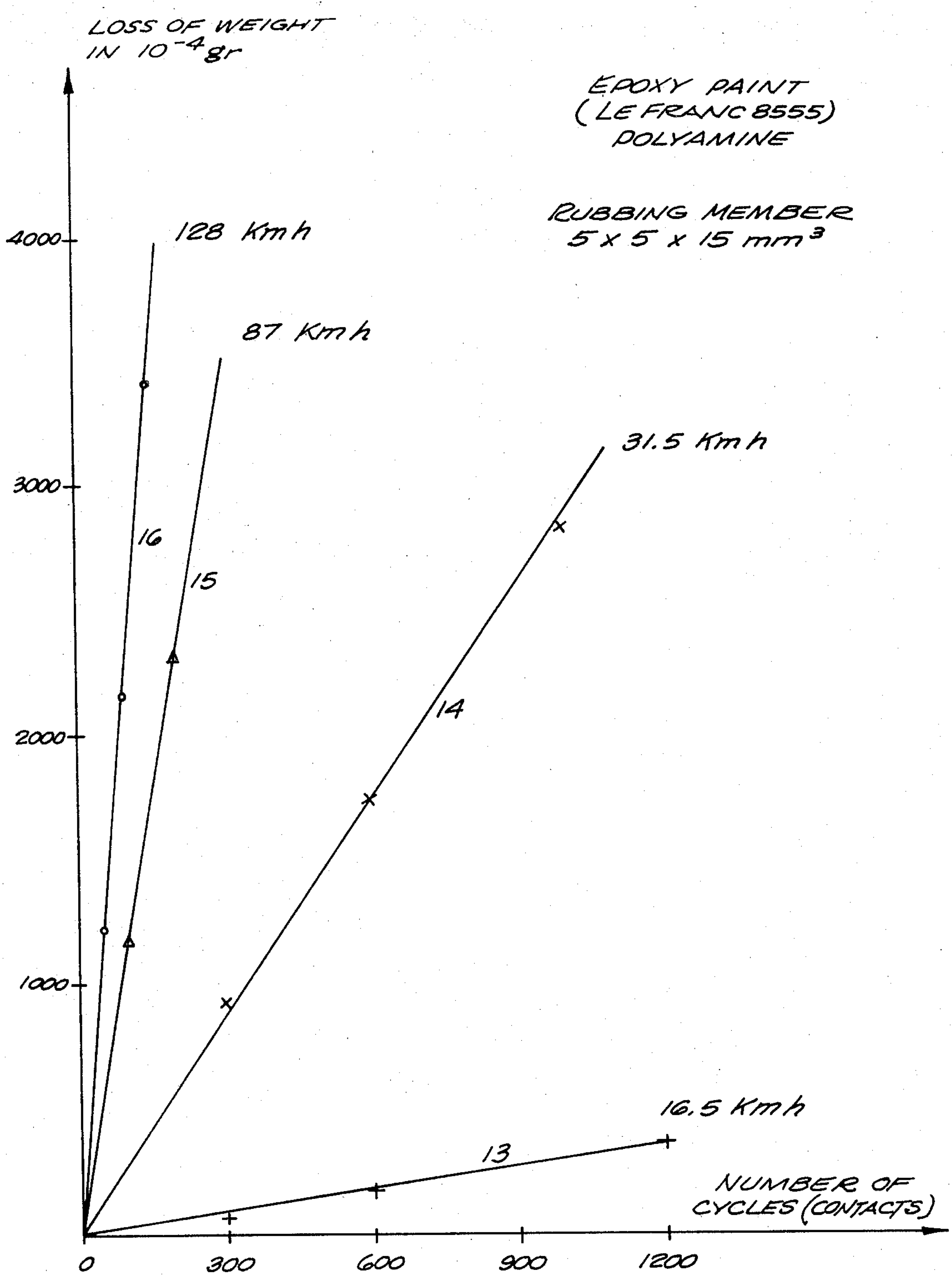
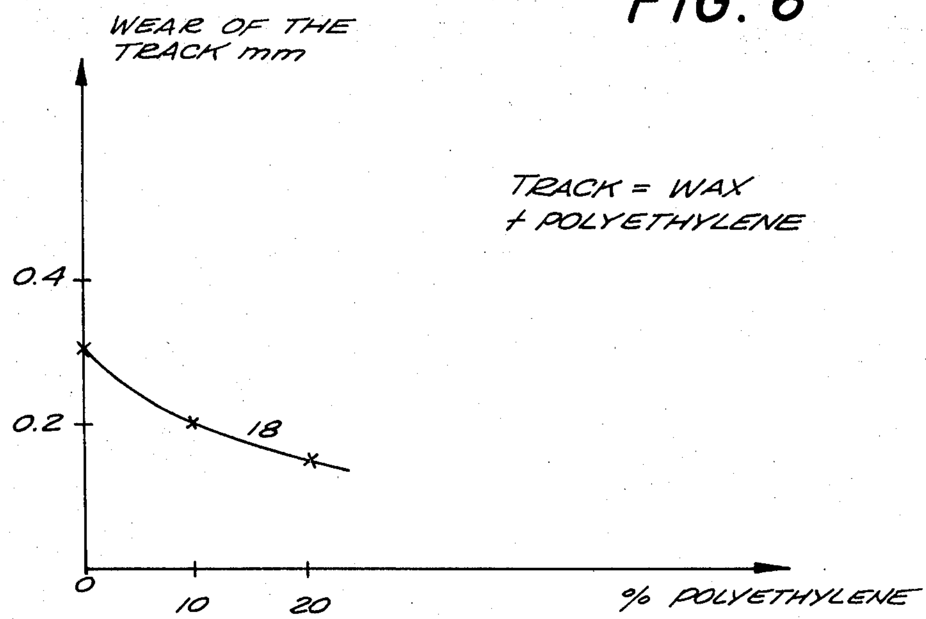

LOSS OF WEIGHT IN 10^{-4} gr
EPOXY PAINT (LE FRANC 8555) POLYAMINE
RUBBING MEMBER 5 x 5 x 15 mm³
128 Kmh
87 Kmh
31.5 Kmh
16.5 Kmh
16
15
14
13
4000
3000
2000
1000
0
300
600
900
1200
NUMBER OF CYCLES (CONTACTS)

FIG. 6


WEAR OF THE TRACK mm
TRACK = WAX + POLYETHYLENE
0.4
0.2
18
0
10
20
% POLYETHYLENE

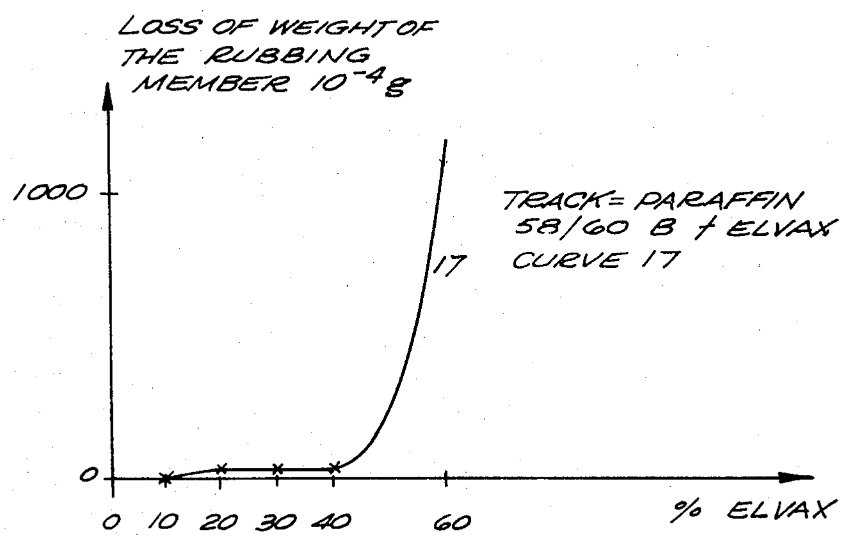

LOSS OF WEIGHT OF THE RUBBING MEMBER 10^{-4}g
1000
TRACK = PARAFFIN 58/60 B + ELVAX CURVE 17
17
0
0 10 20 30 40 60
% ELVAX

FIG. 5

METHOD OF DECREASING THE WEAR OF FLEXIBLE BODIES RUBBING ON A RIGID SURFACE

This application is a continuation-in-part of copending U.S. Pat. application Ser. No. 62,169, filed Aug. 7, 1970 and now abandoned.

This invention relates to a coating for protection against wear. More specifically, it relates to a composition which is applied to rigid bodies in order to avoid the wear of flexible bodies which rub, at high speed, on those rigid bodies. Even more specifically, it relates to rigid bodies covered with a wear reducing composition.

It is known that flexible bodies such as natural and synthetic rubber, plastics, leather and synthetic compounds capable of replacing leather, can become worn very rapidly by rubbing against a rigid material, particularly when the speed of rubbing is high. This is particularly true where the flexible body rubs on bare concrete or even on concrete which has been covered with some protective coatings.

By high speed is meant speeds higher than those encountered in movements lubricated by mixtures containing paraffins and greases, such as, for example, the launching of ships which takes place at very low speeds of the order of 10 to 15 km/hr at the most. More specifically, high speed means speeds at which the lubrication of the movement of a soft body rubbing against a rigid surface can no longer be effected by prior art compositions. This term refers then to speeds of 50 km/hr or more and includes the speed of vehicles supported on air cushions, i.e., speeds of 100 km/hr to 300 km/hr.

To prevent wear of flexible bodies rubbing at high speed on a rigid surface a number of lubricants can be used. Lubricants are known for low speed operations, such as greases, or oils, but the physical phenomena involved in low speed operations, in particular the relatively small amounts of heat which are liberated, are very different from the physical phenomena which occur at high speed where a very substantial amount of heat is liberated by friction. Accordingly, due to the melting of a solid lubricant or to the viscosity reduction of a liquid lubricant, the lubricating qualities required are very substantially different in high speed processes as compared with low speed processes.

One can choose, a priori from among all available lubricants, which are grouped, for discussion, into two classes: liquids and solids. Among liquid lubricants, are heavy viscous oils. It is known that rubbing generates considerable amounts of heat which results in the reduction of the viscosity of the lubricant. Whether due to heat produced by rubbing or due to ambient heat, liquid lubricants will run. After relatively short service the lubricating film may become very irregular, especially when the surfaces to be lubricated are vertical. In addition to running, there is the phenomenon of the lubricant flowing along the lubricated surface.

Although various types of solid coatings have been tested for preventing wear of flexible bodies such as rubber, most have proven unsatisfactory. For discussion, solid lubricants can be subdivided into two subgroups. Lubricants in the first of said subgroups reduce the wear of flexible bodies to a very slight degree, but on the other hand have a long life, the lubricating coating itself not being changed by the rubbing. This is the case, for example, with epoxy resins, polyester, and

Formica, a plastic based on melamine and phenol. Lubricants in the second of the said subgroups completely eliminate the wear of the flexible body. But, on the other hand, they wear down too fast to be used industrially. This is the case, for example, with grafted polyethylene, deasphalting pitch, and of soft tars in general.

The primary object of the present invention is therefore to provide a method of avoiding the wear of flexible bodies rubbing at high speed on rigid bodies.

Another object of this invention is to provide a coating for rigid bodies whereby it is possible to avoid the wear of flexible bodies which rub at their place of contact.

Still another object of this invention is to provide an anti-wear coating which is stable with time and under the atmospheric and other conditions acting on it.

It has been found, that paraffin compositions, whether or nor they contain additives, are excellent antiwear coatings and provide very satisfactory results both with respect to wear of flexible bodies and with respect to the resistance of the composition itself. The paraffin composition of this invention can be applied to the surface of any rigid material, for example, concrete, bituminous aggregate, metal, wood etc.

The rigid material must have certain qualities to ensure satisfactory adhesion of the lubricating coating when the coating and the rigid material have no particular affinity or marked adhesive properties for one another. Concrete, for example, is porous and has a rough surface and the compositions of the invention will fill the surface pores making a smooth surface. The same considerations apply to rough, cast metallic surfaces which, however, are not porous. Neither porosity nor roughness are essential, however, where the rigid material or the lubricating coating have adhesive attraction for one another.

The paraffin compositions of this invention are paraffins and waxes which are normally produced from petroleum. Paraffins from the dewaxing of petroleum distillates, especially those intended for the production of lubricating oils, as well as waxes of higher molecular weight, can be used. Waxes produced, for instance, from de-asphalted vacuum-distillation residues are satisfactory.

Although the paraffins and the waxes by themselves are excellent coatings for rigid surfaces, other properties are required of these coatings, in order to prevent deterioration with time. It has been found that certain additives are capable of imparting to the initial paraffin wax, properties of adherence and of resistance to thermal shock, thus guaranteeing long life of the coating. Such additives may be polyolefins, for instance polyethylenes, polypropylenes, polybutenes or polyisobutenes. Among the olefin polymers which are used are polystyrene, copolymers of ethylene and vinyl cyclohexane, copolymers comprising two or more of the above-mentioned monoolefins and butyl rubber, which is a copolymer of isobutene and isoprene containing a small amount (less than 5 percent) of isoprene. Among the polyolefins are those on which another monomer such as acrylic acid has been grafted in order to impart properties of adhesiveness.

Other additives which are used to dope the paraffins are copolymers of ethylene and a vinyl ester, such as vinyl acetate, ethyl acrylate and isobutyl acrylate. These copolymers, when incorporated into the paraffin provide products having excellent properties of adherence and resistance to thermal shock. Bitumens, which because of their black color and aromatic structure, impart resistance to ultraviolet radiation and light, may also be used to dope the paraffins.

These different additives can be incorporated in the paraffin either alone or in combination so as to impart to the coating of the rigid bodies an optimum antiwear effect with respect to flexible bodies and maximum resistance with respect to mechanical and climatic stresses. The quantities of additives which can be added to the paraffin vary greatly and are not of a critical nature. It is however essential that the paraffin itself represents a substantial part of the coating composition. For example, from 1 to 20 percent of a polymer or copolymer of monoolefin, butyl rubber or grafted polyolefin, from 1 to 20 percent bitumen or from 1 to 60 percent of a copolymer of ethylene and vinyl acetate, may be added. In the latter case, the copolymer of ethylene and vinyl acetate has an ethylene/vinyl acetate molar ratio which may vary within wide limits, for example, between 4 and 16.

The paraffin composition in accordance with this invention may also contain products known as coefficient-of-friction depressors. These are, for example, graphite, molybdenum disulfide and certain phosphates.

It has been found that even a very slight thickness of paraffin composition retains its anti-wear properties. The quantity of paraffin composition which is used to cover a unit of surface depends on the roughness and the porosity of the surface to be coated. Below about 0.5 kg/m^2 on concrete, for example, the coating becomes insufficient and wear will take place. The amount of paraffin composition should, therefore, be at least 0.5 kg/m^2.

The application of the composition to the rigid surface can be effected by means known from paraffin application technology. Two techniques are best suited:

1. application by roller; and
2. spraying.

The spray method is best carried out by preheating the compressed air which feeds the spray gun and also preheating the surface of the concrete. In this way, excessively rapid solidification of the paraffin is avoided and the latter penetrates into the pores of the concrete. Good mechanical adherence is assured and a perfectly smooth protective film is obtained. The heating of the surface of the concrete can be effected by means of a flame or air torch or by radiation heating.

One particularly interesting application of this invention is in the field of vehicles which travel on air cushions, in particular air cushion (hover) vehicles guided by one or more rails. The aprons, which confine the air cushion which supports and guides the vehicle, are subjected to rapid wear due to accidental and more or less haphazard contact with the rail. The rail is generally made of concrete. Much wear on the rail occurs at the time of braking the vehicle. The compositions of this invention make it possible to substantially reduce the

wear of the rubber aprons used on air cushion (hover) vehicles.

The invention is further illustrated by the following drawings and examples.

In the drawings:

FIG. **1** shows the variation of the coefficient of friction of various lubricating mixtures consisting of paraffin 58/60 and a copolymer of ethylene and vinyl acetate;

FIG. **2** sows the variation of the coefficient of friction of mixtures based on wax 20/30 and polyethylene;

FIGS. **3** and **4** show the wear of a rubbing member in millimeters and grams, respectively, as a function of the number of its contacts with and its speed with respect to a tract coated with epoxy-polyamine resin;

FIG. **5** shows the wear of a rubbing member comprised of VOLKOLLAN, expressed in grams, after 6,000 contacts at 145 km/hr with a track coated with mixtures containing paraffin 58/60 and a copolymer of ethylene and vinyl acetate, as a function of the percentage of copolymer in the lubricating mixture; and

FIG. **6** shows the wear of a lubricating coating based on wax 20/30 and polyethylene, after 6,000 contacts at 145 km/hr as a function of the percentage of polyethylene in the lubricating mixture.

The curves in the drawings graphically present the overall results obtained in the following Examples, which illustrate the invention.

EXAMPLE I

The purpose of this example is to demonstrate the physical properties of the compositions of the invention. Several mixtures were prepared based on paraffin wax, with the addition of variable amounts of copolymer of ethylene and vinyl acetate or of polyethylene.

The coefficient of friction was measured for various mixtures as a function of rubbing speed. Curves **1, 2, 3, 4,** and **5** in FIG. **1** and curves **6, 7,** and **8** in FIG. **2** show these coefficients. The various compositions used in these tests are set forth in Table **1.**

In Table **2** are given the mixture conditions and the principal characteristics of the products obtained, namely, penetration at 25° C, "ball-ring" (ASTM) temperature and dropping point.

TABLE 1

% wt Paraffin 58/60	% wt Elvax*	% wt wax 20/30	% wt Polyethylene	Fig.	Curve
100	0	—	—	1	1
90	10	—	—	1	2
80	20	—	—	1	3
60	40	—	—	1	4
40	60	—	—	1	5
—	—	100	0	2	6
—	—	90	10	2	7
—	—	80	20	2	8

*Copolymer of ethylene and vinyl acetate.

TABLE 2

Mixture conditions			Characteristics		
Product	Mixture time	Temperatures	Penetration at 25°C	Ball and ring	Dropping point
Paraffin			15/10	58–60	
Paraffin + 10 percent Elvax*	1 Hr.	120°C.	12/10	66	
Paraffin + 20 percent Elvax	2½ Hrs.	120°C.	9/10	67	
Paraffin + 40 percent Elvax	18 Hrs.	120°C.	7/10	68.8	
Paraffin + 60 percent Elvax	14 Hrs.	First 120°C then 150°C for 5 to 6 hrs.	3/10	73.3	
Wax 10/30			27		75
Wax + 10 percent P.E.	4 Hrs.	120°C.	17/10		91.6
Wax + 20 percent P.E.	6 Hrs.	120°C.	14/10		94.4
Wax + 40 percent P.E.	6 Hrs.	120°C.	8/10		99.4

All these mixtures were made under nitrogen blanket.
*Elvax is a copolymer of ethylene and vinyl acetate.

EXAMPLE II

In order to test the coatings of this invention, a machine is formed comprising a rubbing body of flexible rubber material and a track formed of ordinary cement of 0/3 sand, poured into a circular aluminum mold. After the setting of the concrete, the entire unit is sanded, balanced and coated with the coating and then mounted on the mandrel of the machine. A kinematic chain provides a linear rubbing speed of about 100 km/hr. The rubber is mounted on a movable arm held by an electromagnet. This electromagnet releases the movable arm, which results in periodic rubbing of the rubber on the track, for a short time. The wear of the rubber and the hollowing of the coating are measured as a function of the number of cycles, i.e., the number of rubbing contacts.

In all the following tests the rubbing body consists of VULKOLLAN rubber, a product of the FARBENFABRIKEN BAYER AG comprising polyurethane. The dimensions of the rubber for these tests are 10 mm × 5 mm × 5 mm. The rubbing body rubs on the track along its smallest cross-section and the presence of the rubbing member on the track is about 2 kg/cm^2. Each of the coatings is applied by a spray gun and the thickness of the layer is such that the average application of coating is 0.5 kg/m^2.

The concrete coated with each of the coatings is then placed on the mandrel of the machine described above and the latter is placed in operation. After a number of cycles, depending on the apparatus wear, measurements are made as described above. The results obtained with different coatings are set forth in Table 3 below. In Table 4 the results obtained with paraffin wax and petroleum wax compositions are set forth for comparison. The polyethylene which dopes the paraffin wax is polyethylene of a molecular weight of about 20,000.

TABLE 3.—COMPARISON OF LUBRICATING PRODUCTS (SOLID LUBRICANTS)
(Tested at about 100 kilometers/hour)

Lubricating product	Time of contact between rubbing member and track	Wear of the track	Wear of the rubbing	Conclusion of the test
Polyester	¼ second every 10 seconds	No wear—deposit of the material of the rubbing member.	Extremely severe wear after 1000 cycles.	Abrasion and fusion of the rubbing member.
Grafted Polyethylene	5 seconds per 60 seconds	Cement bared in ½ hour	0.3 mm in 5 sec. contact	Premature wear of the coating.
Grafted Polyethylene—78%/ Grafite—20%/Cabot Monarch Black—74.2%.	5 seconds per 60 seconds	Slight wear	0.2 mm in 5 sec. contact	This is the best result obtained with a coating containing a major portion of grafted polyethylene without paraffin wax product.
Epoxy resin	5 seconds per 60 seconds	No wear—deposit of material of the rubbing member.	2 mm in 5 sec. contact	Track too abrasive. Heat development too excessive.
Formica (Melamine and phenolic plastics).	1/10 second per 1 second	No wear—deposit of material of the rubbing member.	2.3 mm in 10 sec. contact	Track too abrasive. Heat development too excessive.
Industrial bitumen (Type "90–40").	1/10 second per 1 second	Good appearance of the track	1.0 mm in 1,000 cycles	Result good but the rubbing member still wears out slightly too much.

TABLE 4.—BEHAVIOR OF THE PARAFFIN WAX COMPOSITIONS UNDER REPEATED STRESSES
(Tested at about 100 kilometers/hour)

Lubricating Product	Time of contact between rubbing member and track	Number of contacts	Wear of the track	Wear of the rubbing member	Conclusion of the test
Pure paraffin wax (Type 58/60B)	¼ second every 10 seconds	5,000	Good appearance of the track.	Less than 0.1 mm.	Excellent result.
Pure paraffin wax 58/60 doped with 2.5% wt polyethylene	do	5,000	do	No apparent wear.	Do.
Pure paraffin wax 58/60 doped with 10% wt polyethylene	do	5,000	do	do	Do.
Pure paraffin wax 58/60 doped with 15% wt polyethylene	do	5,000	do	do	Do.
Pure paraffin wax 58/60 doped with 20% wt polyethylene	do	5,000	do	do	Do.
10% wt pure paraffin wax 58/60B 30% wt Elvax*	1/10 second every 6 seconds	5,000	Less than 0.1 mm	Much less than 0.1 mm.	Do.
80% wt pure paraffin wax 58/60B 15% wt Elvax* 5% wt butyl rubber.	¼ second every 10 seconds	10,000	Good appearance of the track.	Negligible wear of the rubbing member.	Do.
65% wt pure paraffin wax 58/60B 30% wt Elvax* 5% wt butyl rubber.	do	10,000	do	do	Do.
90% wax 20/30 refined 10% polyethylene	1/10 second every 6 seconds	4,000	Slight rutting of the track.	About 0.1 mm.	Good result.

*Elvax is a copolymer of ethylene and vinyl acetate.

The foregoing data prove that the best results are obtained with paraffin wax and petroleum wax compositions.

EXAMPLE III

The tests of this Example were conducted in the same manner as Example II. However, before putting the machine in motion the lubricating coating is subjected:

a. to thermal shocks of −15° C to +30° C, the temperature being maintained for 15 minutes at −15° C and +30° C; or

b. to ultra violet rays (600 lux).

These tests demonstrate the stability, with time, of the anti-wear properties of the lubricating coatings. The results are summarized in Table 5. The Example shows that the life a pure paraffin lubricating coating is shortened when subjected to the influences described. The inclusion of an additive such as polyethylene or a copolymer greatly reduces the deleterious effect of such influences.

TABLE 5

Lubricating product	Pre-treatment	Contact time—rubber member track	Track wear	Rubbing member wear	Conclusion
Pure paraffin wax 58/60B	30 thermal shocks	1/10 second every 6 seconds or 1/4 second every 10 seconds.	Cracks—discontinuities		Coating not stable with time.
Pure paraffin wax 58/60B + 2.5% polyethylene.	do	do	Same as above to a lesser extent.		Good result but decrease of the life of the track.
Pure paraffin wax 58/60B 10% polyethylene.	do	1/4 second every 10 seconds	Good appearance		
Do	do	1/10 second every 6 seconds	Good appearance after 10,000 contacts.	0.1 mm	Excellent result.
Paraffin wax 58/60B 10% polyethylene.	72 hours under 600 Lux U.V.	1/10 second every 6 seconds	Good appearance of track, no apparent wear.	0.2 mm after 5,000 contacts.	Good result.

EXAMPLE IV

This Example demonstrates the use of one of the claimed paraffin compositions for the lubrication of a flexible body rubbing at different speeds on a rigid surface. The rubbing speed varies from about 10 kilometers per hour to about 300 km/hr. The contact pressure of the rubbing member on the track is 2 kg/cm². In all the tests the rubbing body consists of VULKOLLAN rubber, a product of the FARBENFABRIKEN BAYER AG comprising polyurethane. The dimensions of the rubber are 10 mm × 5 mm × 5 mm and it rubs on the track along its smallest cross-section. The time of contact between the rubbing member and the track is a quarter of a second every ten seconds. For these tests the track is successively coated with three lubricants:

a. with an epoxy-polyamine resin, well known for its adherence to concrete, its water resistance and its long life as a coating;

b. with a Bitumen 90/40 which has many economic advantages; and

c. with a paraffin wax and polyethylene composition typical of the invention.

After the test two measurements were made:

1. wear of the rubbing member which corresponds to the wear of any flexible body rubbing on the coated track; and
2. wear of the coating on the track, or its appearance after a certain number of contacts.

As can be seen in the following results, the two wear measurements depend on the materials, the speed and the number of contacts. The other parameters are not changed, i.e., the pressure of the rubbing member on the track and the ambient temperature of the test. The results therefore can be compared.

Where the Bitumen 90/40 coating is used, there is significant wear of either the track or of the rubbing member, depending on the speed. At low speeds, under about 50 km/hr, the track is bared after 1,000 contacts. At higher speeds, there is a significant deposit of VULKOLLAN rubber on the track, so that after some contacts the rubbing member rubs on VULKOLLAN rubber and wears very quickly. For example, at a speed of about 150 km/hr and after 300 contacts, the rubbing member has lost nearly one half of its weight.

Where the epoxy-polyamine resin coating is used, several tests at different speeds were carried out. At low speeds, from 20 to 30 km/hr the track is slightly hollowed after 1,000 contacts, and the rubbing member is worn very slightly. At higher speeds, the rubbing member is worn very quickly and its loss of weight increased with increasing speed or number of contacts. For example, at a speed of about 130 km/hr and after only 150 contacts, the weight loss is about 60 percent. Moreover, if the experiment is then continued, this loss of weight increases very quickly with the number of contacts. Thus, although the weight loss of the rubbing member at high speeds is rather small, this coating is not satisfactory because wear increases too quickly with rubbing speed and with the number of contacts.

For comparison, a third coating typical of the invention is tested. The composition consists of:

Paraffin wax 58/60	75% wgt
Elvax 260	17% wgt
Escorez	6% wgt
Alcatene	2% wgt

(Elvax 260 is a polyethylene-vinyl acetate copolymer, about 28 percent wgt vinyl acetate; Alcatene is a commercial polyethylene; and Escorez is a petroleum wax.) In this test, the rubbing member does not wear at speeds varying from about 10 km/hr to about 250 km/hr. The hollowing of the track is always slight. At low speeds there is abrasive wear due to the contact with the rubbing member. The coating composition is slightly stripped off. But at all speeds between 10 km/hr and 250 km/hr the depth of the rut is always under 0.2 mm after 6,000 contacts. The number of contacts is much greater than the number of contacts in the other tests.

These tests show that a coating composition according to the invention is superior to other coatings for decreasing the wear of flexible bodies rubbing at high speeds on rigid surfaces, because there is no wear of the rubbing member at different speeds where the track is coated with these compositions.

EXAMPLE V (Comparative Example)

Tests are conducted as in Example IV with a lubricating coating of epoxy polyamine resin, and the wear of the rubbing member and of the track are measured as a function of the number of contacts and of the relative speed of the rubbing member with respect to the track. In FIG. **3** is shown the wear of the flexible rubbing member, the dimensions of which are here 75×5×5 m.m. at different speeds (curves **9, 10, 11** and **12**), in millimeters, and in FIG. **4** the same wear, measured in loss of weight of the flexible rubbing member (curves **13, 14, 15** and **16**).

It can be seen that with a very small number of contacts (less than 300), the rubbing member is almost completely worn if the speed exceeds 150 km/hr. The wear of the rubbing member increases very rapidly with speed. It is not possible therefore to use such a coating to lubricate movement at high speed. The wear of the rubbing member is, however, acceptable for low speeds (at 16.5 km/hr, for example).

EXAMPLE VI

In this Example, it is desired to test various mixtures according to the invention at a speed of about 145 km/hr. Six thousand contacts are made between a flexible rubbing member of VULKOLLAN and a track coated

1. with mixtures based on wax, to which are added various percentages of polyethylene; and
2. with mixtures based on paraffin, to which are added various percentages of Elvax. In both cases, the wear of the rubbing member was measured. For mixtures consisting of 100 percent wax 20/30, 90 percent wax 20/30 and 10 percent polyethylene, 80 percent was 20/30 and 20 percent polyethylene, there is almost no wear in the rubbing member. With six mixtures consisting of paraffin 58/60 and Elvax, the measurements resulted in the data presented in curve **17** of FIG. **5.** It can be seen, that beyond a substantial amount of Elvax (50 to 60 percent), the wear of the rubbing member increases very rapidly. The wear of the track coated with mixtures of wax and polyethylene is also plotted (curve **18,** FIG. **6**).

This Example proves that at high speed and for repeated contacts (6,000 contacts), mixutes according to the invention are very good lubricants for reducing the wear of a flexible body rubbing on a rigid surface.

What is claimed is:

1. A process for reducing the wear caused by friction of a flexible rubber body rubbing at high speed on a rigid surface of concrete, the said process comprising coating the rigid surface with at least 0.5 kg/m^2 of rigid surface of a composition consisting essentially of 80 to 99 percent of a paraffin wax in a pure state and 20 percent to 1 percent of polyethylene.

2. A process as recited in claim **1** wherein the rigid surface is the guide and support rail of a vehicle which is supported on an air cushion.

* * * * *