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MANUFACTURE OF PIPE THREAD
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ration of PennsylvaniaNo Drawing. Application January 22, 1936,
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This invention relates to the manufacture of pipe thread lubricants; and it comprises a composition of matter useful for application to pipe threads and the like to prevent seizing, galling and stripping, the said composition comprising a suitable lubricating base, such as petroleum or a metal soap grease, a lubricating metallic powder, such as powdered zinc, and a sulfurized sperm oil or like sulfurized fatty acid ester capable of imparting extreme pressure characteristics to said lubricant; and it further comprises improved methods of making such pipe thread lubricants wherein the said components are mixed and blended together and wherein the said sulfurized oils or esters are produced by controlled sulfurization to obtain substantially neutral organic sulfur compounds or derivatives; all as more fully hereinafter set forth and as claimed.

In the construction of pipe lines, in the oil and natural gas industries for example, a large number of relatively difficult problems have been encountered. One such problem which has caused considerable difficulty is encountered especially in the uncoupling of large sized threaded pipe joints. Such joints, after having been united for a short time, tend to "freeze" or grip tightly, the threads seize and stripping usually results. It has been recognized for some time that a special type of lubricant is required for such threaded joints and a considerable number have been proposed in the art.

Most of the pipe thread lubricants heretofore proposed have included one or more powdered solids dispersed in various types of lubricating bases. These prior lubricants have not, however, solved the difficulties involved. Pipe joints made up with these lubricants after a time have a distinct tendency to freeze. They usually have to be hammered prior to uncoupling; at times stripping is caused. Upon examination of the threads after separation of the joint, it is seen that there is an accumulation of the powdered solid at the base of the threads. The surfaces of the threads have a bright metallic appearance showing that these portions have not been satisfactorily lubricated and that there has been a gripping action between the two metal surfaces.

I have discovered that the freezing of pipe thread joints can be substantially completely avoided by introducing into the ordinary or a suitable pipe thread lubricant containing a grease or petrolatum base and a lubricating metal powder, a component capable of imparting extreme pressure lubricating characteristics or high load carrying properties. In my copending applica-

tion Serial No. 715,551, I have described and claimed the improved pipe thread lubricants so obtained. As there disclosed, suitable components capable of imparting extreme pressure characteristics to these lubricants are chlorinated hydrocarbons or constituents containing sulfur, such as sulfur itself or a sulfurized oil.

The present application is in part a division and in part a continuation of my application Serial No. 715,551 and is directed to the manufacture of pipe thread lubricants containing sulfurized sperm oil or other sulfurized fatty esters, as the component imparting extreme pressure characteristics thereto.

As stated in my said prior application when an ingredient imparting extreme pressure characteristics is added to a lubricant containing a lubricating metallic powder and a grease or petrolatum base, in accordance with my invention, there appears to be a distinct cooperation between the various constituents. Threaded joints made up with such a compound lubricant show almost no tendency to freeze. There is but small tendency for the lubricant to squeeze out under pressure. The joints separate with a smooth and even tightness. Upon examination of a separated joint it is found that the lubricant is spread evenly, without appreciable accumulation at the base of the threads. Moreover, the surfaces of the threads present a dull appearance indicating that these surfaces have been covered with lubricant and have not been in metallic contact with the adjoining surfaces of the threads of the other fitting. A microscopic examination of these surfaces shows that all constituents of the lubricant are present to some extent in a film coating which covers the surfaces of the threads. There is apparently no appreciable segregation of the constituents of my lubricant in this film.

I have tested a large number of materials possessing extreme pressure characteristics and have found that all the materials mentioned in my said prior application are advantageous constituents of pipe thread lubricants. These materials include sulfur, the halogenated, sulfur-oxygen and sulfur-chlorine compounds, sulfurized oils, such as sulfurized sperm oil, various halogenated hydrocarbons such as chlorinated oils and waxes, hexachlorethane, chlorinated naphthalene, lard oil treated with sulfur chloride, etc. All chlorinated hydrocarbons characterized by low volatility appear to be useful in my invention. Finely ground sulfur is one of the best materials which I have tested.

However, I have now found that if the sulfur is combined with a fatty acid ester, in the form of substantially neutral sulfur compounds, and these neutral sulfur compounds, such as sulfurized sperm oil, are introduced into the lubricating base, additional improvements and advantages are obtained. The pipe thread lubricants containing such sulfurized esters are somewhat more stable, more efficient and less corrosive. Thus by the present invention, I obtain superior pipe thread lubricants by blending sulfurized sperm oil and the like, with the lubricating bases, according to the general procedures set forth in my prior application.

The improved pipe thread lubricants of the present invention, therefore, comprise a major portion of lubricating base and minor amounts of a solid lubricant including a lubricating metal powder, and of a sulfurized oil. As a lubricating base, I frequently use lubricating greases comprising a major amount of lubricating oil and minor amounts of a soap and of an aqueous liquid.

I have found that the compounded lubricants comprising a uniform blend of the said components and having the following properties are advantageous for lubricating pipe threads.

Melting point: ° F.
(Hawxhurst) 170 to 230
Penetration, A. S. T. M.
(Mm./10, 77° F., 150 G., 5 sec.)
(unworked) 275 to 375

Compounded lubricants having the above properties are readily obtained with compositions formulated as follows:

		Parts by weight
Lubricating base	Lubricating oil (pale paraffin oil)	55 to 70
	Metal soap (calcium soap)	10 to 14
	Aqueous liquid (water or aqueous glycerine)	1.6 to 2.5
	Metal powder (zinc powder)	10 to 50
Solid lubricant	Graphite	0 to 25
E. P. component	Sulfurized oil or ester (sperm oil, etc.)	4 to 20

The said components may be prepared and blended by various methods. Likewise, the particular components and the ratios thereof may be varied according to the particular consistency and other properties desired in the pipe thread lubricant.

In the present invention any suitable lubricating base may be used. In lieu of the lubricating greases mentioned ante, I may use petrolatum or other lubricating material having a suitable melting point and consistency (viscosity). The lubricating base being the major portion of the composition, should have, in and of itself, good lubricating properties.

Generally, I employ the ordinary lubricating greases, such as are used in cup greases and the like, as the lubricating base. These are the so-called metal soap greases which comprise a blended mixture of a metal soap and lubricating oil. They are well known in the art and can be prepared by any of the usual methods. I find that the alkaline earth soap greases are advantageous in the present invention. However, I may em-

ploy greases containing other metal soaps such as the soaps of aluminum, etc.

Thus in practicing the present invention, I may use suitable lubricating greases of various types; their suitability generally being predicated upon their stability, melting point and penetration. I have found that lubricating greases having the following properties are advantageous lubricating bases for making my improved pipe thread lubricants.

Melting point: ° F.
(Hawxhurst) 170 to 230
Penetration, A. S. T. M.
(Mm./10, 77° F., 150 G., 5 sec.) 275 to 375

However, I have found that the alkaline earth soap greases obtained from pale paraffin oil (150 viscosity at 100° F.), tallow oil and lime, by the so-called pressure saponification methods yield superior results in the present invention. By using tallow oil in making the soap, glycerine is liberated and some of it remains in the lubricating grease. Its presence in the final pipe thread lubricant is advantageous; the glycerine being hygroscopic, it prevents drying and caking of these compositions. Generally, in making my pipe thread lubricants it is sometimes advantageous to add a hygroscopic agent, such as glycerine or glycol in order to prevent caking or drying.

In practicing the present invention, various methods may be used in compounding and blending the lubricating base or grease with the other specified ingredients. Likewise, the viscosity or consistency of the final pipe thread lubricant may be adjusted by varying the ratios of the particular components or by adding a viscosity reducing oil at the desired stage of processing. When it is desired to adjust the viscosity by means of such a reducing oil, I usually employ a light paraffin oil for this purpose; it being sometimes added to effect said adjustment after other ingredients have been incorporated and satisfactorily blended.

As the solid lubricant, I use a lubricating metal powder, either with or without another solid lubricant. In some compositions it is advantageous to use small amounts of graphite in conjunction with the lubricating metal powder. For the present purposes, zinc and aluminum powders appear to be the best, and by employing zinc dust I obtain particularly good pipe thread lubricants. Of course, other suitable metal powders or solid lubricants may be used in making particular compositions for special purposes. The metal powder used should be in rather finely divided form. I find that powders passing a 200 mesh screen are advantageous. By the term "lubricating metal powder", I mean a metallic powder which functions as a lubricant when used as herein described.

While sulfurized fatty oils generally impart extreme pressure characteristics to my pipe thread lubricants, I have found that certain sulfurized fatty esters, particularly those prepared by controlled methods of sulfurization, are advantageous. The sulfurized sperm oil prepared by the methods disclosed in my application Serial No. 60,355 is especially satisfactory as ingredient in the present compositions. As pointed out in the said application, sperm oil is different from ordinary fatty oils, in that it is composed principally of the fatty esters of monohydric alcohols. When such esters are sulfurized by gradually adding from 5 to 20 per cent of finely

divided sulfur to the ester preheated to between 300-385° F., and continuing the heating until the sulfur is combined, substantially neutral sulfur compounds are obtained and these, when compounded with the other ingredients according to the present invention, produce high grade pipe thread lubricants. Likewise, I have found that by a similar controlled sulfurization of fatty glycerides of the olein type, such as lard oil, etc., sulfurized products are obtained which are also useful in the present composition. However, they do not possess all the advantageous characteristics of sulfurized sperm oil, and I ordinarily employ sulfurized sperm oil in making the present pipe thread lubricants.

I have found that the sulfurized fatty esters having the following properties are particularly advantageous in making the pipe thread lubricants of the present invention:

Gravity ° A. P. I.-----	13.6-14.6
Viscosity, S. U. V. 210° F.-----	200-300 sec.
Pour: ° F. (not greater than)-----	+45° F.
Sulfur: %-----	8-14%
Neutralization No.-----	1-1.5

Sulfurized fatty esters having the above properties are readily obtained by the controlled sulfurization mentioned ante.

In the general practice of this invention, the lubricating base or grease is brought to a suitable mobile (workable consistency) and then the lubricating metal powder and the sulfurized fatty oil are added and the mixture warmed and agitated until a uniform composition is obtained. In these operations, heated mixers of the ordinary commercial types may be used. If any adjustment in the consistency of the pipe thread lubricant is necessary this can be done at this stage by adding sufficient lubricating oil as required; added and blended after the other ingredients have been mixed. For this purpose, pale paraffin oil having a viscosity of 150 to 100° F. is advantageous, when it is necessary to dilute or thin the pipe thread lubricant.

In the present pipe thread lubricants a considerable variation in the proportions of the respective ingredients employed is permissible. To obtain commercial pipe thread lubricants fully satisfactory for normal uses, the compound lubricant should contain from 10 to 50 per cent by weight of the metal powder; about 20 per cent being used in most compositions. The grease base should have such a consistency as will hold the metallic powder in uniform dispersion. The amount of lubricating oil and metal soap present in the grease and in the final lubricant varies with the consistency desired in a particular product and with the viscosity of the lubricating oil employed either in making the grease or in adjusting the final consistency. Ordinarily, between 2 to 20 per cent of sulfurized sperm oil, etc., will impart the required extreme pressure characteristics to these compounded lubricants.

In the specific practice of my invention, I prepare a tallow oil soap by saponifying tallow oil with the required amount of milk of lime. This saponification is conducted under steam pressure and in the presence of a small proportion of pale paraffin oil. After the saponification is completed the steam pressure is released and an additional quantity of the paraffin oil is worked into the grease to give a base composition having a suitable consistency. The example given post is an illustrative embodiment of this procedure.

I prepare the sulfurized fatty ester in a sepa-

rate operation. In doing so, the sperm oil is heated to between 325 and 340° and then 5-20 per cent by weight of finely divided sulfur is gradually sifted into the preheated oil, at such a rate that the reaction temperature increases to between 350 and 360° F. After all the sulfur is added, the reaction mixture is maintained at a slightly lower temperature of from 325 to 345 until the sulfur has combined and substantially neutral sulfur compounds are obtained. From 16 to 20 hours of such further heating is ordinarily required. In lieu of sperm oil, other fatty oils such as lard oil or esters of acids of the oleic series may be employed. The sulfurized oil is withdrawn from storage as required in making the compounded lubricant.

The zinc dust or other metal powder employed is of good commercial grade and should have a fineness of at least 200 mesh.

In making the compounded lubricant, the compounding or blending may be effected in the same vessel in which the lubricating grease, mentioned ante, is prepared. Or, again, the lubricating grease while still hot and fluid may be drawn off from the grease kettle, screened if necessary, and then the mixing and blending with other ingredients effected in suitable mixers equipped with blades or other agitating means. In either event, the lubricating grease is usually brought to a workable consistency by warming and then the powdered metal or solid lubricant added and admixed. Then the sulfurized oil is added and blended and finally the consistency is adjusted by adding a further amount of paraffin oil, if such adjustment is necessary. Sometimes, I produce a pipe thread lubricant of a "standard stock" consistency and use this as a master batch in producing pipe thread lubricants of various consistencies. In doing so, the master batch is subsequently admixed and blended with the required amount of paraffin oil to produce a final product of a given consistency as required for particular uses. In any of these operations, the final step is to draw off the grease while still hot and mobile and introduce it into suitable containers or packages.

The pipe thread lubricant so made, in addition to the specified ingredients, also contains small amounts of glycerine as well as a trace of water, which are incident to the manufacture of the alkaline earth soap from tallow oil. Some of the glycerine and most of the water are evaporated during the manufacture of the lubricating grease. However, as is usual in the manufacture of lubricating greases, the moisture content is adjusted, sometimes by the addition of water, to produce greases having the desired consistency. As mentioned ante, aqueous glycerine, etc. may likewise be used in making such adjustment.

In the following examples are given illustrative embodiments of the preparation of typical pipe thread lubricants by the present invention, individual examples being given of the respective steps in their cooperative correlated relation to each other.

Example 1

This example illustrates the manufacture of the lubricating grease by the so-called pressure saponification method.

To form the alkali metal soap, tallow oil is saponified with the required amount of milk of lime in the presence of a small proportion of the lubricating oil by heating a mixture of those materials under pressure. In doing so, there is

charged, into a steam jacketed pressure cooker 73.7 pounds (10 gallons) of pale paraffin oil having a viscosity of 150 at 100° F. Next, 137.3 pounds (17.4 gallons) of commercial tallow oil are added. Finally, a mixture of 147.4 pounds (20 gallons) of the same paraffin oil and milk of lime containing 17.9 pounds of powdered hydrated lime in sufficient water to effect saponification, say 36 gallons of water, is added. The pressure cooker is then closed and made gas-tight and heated to between 240 to 275° F.; the charged mixture being agitated during this operation. About 120 minutes is required to effect saponification and formation of the soap. During this operation, the pressure developed in the pressure cooker is approximately 25 pounds per square inch.

Upon completion of the saponification, the wet mixture of soap and oil is discharged from the pressure cooker, under its own pressure, into a suitable mixer. During this operation the usual precautions are taken to prevent the mixture from becoming unduly chilled and to prevent clogging of the discharge lines. By discharging a hot mixture while under pressure, the release of the pressure causes evaporation of most of the excess water. The soap mixture thus obtained is blended with more lubricating oil to form the lubricating grease having the desired consistency.

In doing so, ordinarily the saponification mixture from the pressure cooker is discharged into an open mixer containing sufficient preheated lubricating oil. By so blending the saponified mixture with 617.2 pounds (83.8 gallons) of the said paraffin oil preheated to approximately 175° F. a lubricating grease having satisfactory consistency and other properties for the present purposes is obtained. The heating and agitation of the mixture in the open mixer is continued until a uniform grease is obtained.

The lubricating grease so obtained has the following properties:—

Penetration, A. S. T. M. (Mm./10. 77° F., 150 G., 5 sec.) (unworked)----- 290
Melting point: °F. (Hawxhurst)----- 185

Its composition is approximately as follows:

Ingredient	Parts by weight
Pale paraffin oil (150 vis. at 100° F.)-----	83.8
Calcium-tallow oil soap-----	14.0
Glycerine-----	1.4
Water-----	0.8
Total-----	100.0

Lubricating grease having the above properties and composition are advantageous lubricating bases for preparing the present pipe thread lubricants. However, as stated ante, lubricating greases of varying composition and properties are also useful in making certain special lubricants.

Example 2

This example illustrates the manufacture of the pipe thread lubricant from the lubricating grease. In compounding the pipe thread lubricant, 76 pounds of the lubricating grease obtained in Example 1 is introduced into a heated open mixer and the other ingredients in suitable proportions are then added. Ordinarily, 20 pounds of zinc dust having a fineness to pass 200 mesh are added and dispersed in the grease. Then 4 pounds (0.5 gallon) of sulfurized sperm oil are next added

and blended. Then, finally, small amounts of a paraffin oil are added and mixed to adjust the consistency, viscosity, etc. of the pipe thread lubricant, if such adjustment is necessary. The above mixing and blending may be effected at approximately 250° F. to quickly obtain a homogeneous stable lubricant. The pipe thread lubricant while still warm and flowable is drawn off into suitable containers or packaged and cooled to room temperature.

By the above procedure, there is obtained a pipe thread lubricant having the following properties:

Penetration, A. S. T. M. Mm./10 77° F., 150 G., 5 sec. (unworked)----- 285
Melting point: °F. (Hawxhurst)----- 180

The percents by weight of the components in this pipe thread lubricant are as follows:

Ingredients	Per cent by weight
Pale paraffin oil (150 vis. at 100° F.)-----	63.7
Calcium-tallow soap-----	10.7
Glycerine-----	1.0
Water-----	0.6
Zinc dust-----	20.0
Sulfurized sperm oil-----	4.0
Total-----	100.0

That is, by adding 20 parts of zinc dust and 4 parts of sulfurized sperm oil to 76 parts of the lubricating grease, I obtain the above advantageous pipe thread lubricant. With it, tight pipe joints are easily obtained, without stripping, seizing or galling of the threads. The joint does not freeze and can be easily uncoupled, even after a long time, without damage to the pipe and the threads thereon.

In lieu of the zinc dust and sulfurized sperm oil employed in the above example, other lubricating metallic powders and other sulfurized oil or esters may be used. Sometimes the lubricating grease may be prepared with a heavier mineral oil and the composition subsequently diluted with the 150 viscosity paraffin oil to the desired final consistency.

In the above example larger amounts of solid lubricants may be used, for instance as much as 50 per cent zinc dust. However, in such cases, part of the zinc dust may be replaced with amorphous graphite. If desired, for instance, I sometimes prepare compositions containing as much as 25 parts of amorphous graphite, adjusting the amount of zinc dust accordingly.

By mixing procedure of Example 2, various pipe-thread lubricants may be obtained. By using a lubricating grease of the same type but having slightly different amounts of oil and calcium soap I obtain another pipe-thread lubricant which is advantageous. For instance, I may employ a lubricating grease in which the ratio of the ingredients by weight is as follows:

Ingredients	Parts by weight
Pale paraffin oil (150 vis. at 100° F.)-----	80.0
Calcium-tallow oil soap-----	17.3
Glycerin-----	1.6
Water-----	1.1
Total-----	100.0

By blending 75 pounds of this grease with 20 pounds of zinc dust and 5 pounds of sulfurized sperm oil, in the manner stated in Example 2, I

obtain a pipe-thread lubricant having the following compositions:

Ingredients	Per cent by weight
5 Pale paraffin oil (150 vis. at 100° F.)	60.0
Calcium-tallow oil soap	13.0
Glycerin	1.2
Water	0.8
Zinc dust	20.0
10 Sulfurized sperm oil	5.0

This pipe-thread lubricant has the following properties:

Penetration A. S. T. M. Mm./10, 77° F. 150 G.	
5 sec. (unworked)	290
15 Melting point: ° F. (Hawxhurst)	178

To the pipe-thread lubricants there may be added suitable scenting agents, for instance 0.002 per cent of oil of cassia.

20 The sulfurized sperm oil used in Example 2 may be prepared as follows:

Example 3

A sperm oil having the following properties:

25 Gravity: ° A. P. I.	29.0
Specific gravity: 60°/60° F.	0.8816
Viscosity S. U. V. -70° F.	171
Viscosity S. U. V. -100° F.	100
30 Viscosity S. U. V. -130° F.	71
Viscosity S. U. V. -210° F.	43.3
Flash, O. C.: ° F.	505
Pour: ° F.	+35
Color, Saybolt	-5
35 Neutralization No.	0.14
Saponification No.	130.9
Iodine No.	87

is sulfurized under controlled conditions, using approximately 12 per cent sulfur by weight on the oil.

40 Into a direct-fired, 20-barrel, open-top grease kettle there is charged 8057 lbs. of said sperm oil (1097 gals.) and the oil is gradually heated to 320° F. in about 4 hours, while being stirred. 45 While continuing the stirring, 1098 lbs. of sulfur flour (approximately 1 lb. of sulfur per gallon of oil) is gradually added by sifting it into the hot oil over a period of two hours; it being added at such a rate as to maintain a steady increase in temperature to 360° F. Then the temperature was gradually lowered to 340° F. and the reaction mixture maintained at that temperature and stirred for 16 hours; the heating being hereafter stopped and the sulfurized oil cooled to normal temperature. The total time from the first addition of sulfur to the completion of the reaction was about 20 hours.

The sulfurized sperm oil so obtained is of high quality and has the following properties:

60 Gravity: ° A. P. I.	14.1
Specific gravity: 60°/60° F.	0.9718
Pounds per gallon	8.093
Viscosity, S. U. V. -210° F.	243
65 Pour: ° F.	+45
Sulfur (B): %	11.10
Neutralization No.	0.63
Color, N. P. A.	dark

70 It is readily soluble or dispersible in mineral oil of various grades. When diluted with 9 parts of mineral oil, the diluted oil gave only a slight tarnish by the copper strip test.

75 In the above example, commercial lard oil may be used in lieu of sperm oil to obtain a sulfurized oil used in the present invention. In sulfurizing

lard oil, about 12 per cent of sulfur by weight on the oil should be used.

The sulfurized lard oil so obtained has the following properties:

Gravity: ° A. P. I.	10.1	5
Specific gravity: 60°/60° F.	0.9993	
Pounds per gallon	8.322	
Viscosity, S. U. V. -210° F.	428	
Pour: ° F.	+65	10
Sulfur (B): %	10.0	
Neutralization No.	21.1	
Color, N. P. A.	dark	

15 It is readily soluble or dispersible in mineral oil of various grades. When diluted with 9 parts of mineral oil, the diluted oil gave only a slight tarnish by the copper strip test.

Example 4

20 This example illustrates the manufacture of the pipe thread lubricant from petrolatum as the lubricating base. Into a heated mixer there are introduced 75 lbs. of a commercial petrolatum having the following properties:

25 Gravity: ° A. P. I.	28.2
Specific gravity: 60°/60° F.	0.8860
Melting Point: ° F. A. S. T. M., Petro-	
latum	120.4
30 Penetration, A. S. T. M., 77° F. 150 G.,	
5 sec. (unworked)	180

Next, 20 lbs. of zinc dust and 5 lbs. of sulfurized sperm oil are added and the mixture is agitated at between 250 and 275° F. until a uniform composition is obtained. About 75 minutes are ordinarily required. The warm fluid composition is then drawn off into suitable containers and cooled.

The pipe thread lubricant so obtained has the following properties:

Penetration, A. S. T. N.: Mm./10, 77° F.,	
150 G., 5 sec. (unworked)	285
Melting Point: ° F. (Hawxhurst)	170

45 I usually prefer to make up my pipe-thread lubricants in paste form to about the consistency of a lubricating grease of medium or soft type. It is possible, of course, to dissolve my composition in a volatile solvent or to melt the same for convenience in application. When applied 50 in this form the composition should be well stirred to keep the solid materials in suspension.

In the present invention, in lieu of sulfurized sperm oil, other sulfurized esters of fatty acids may be employed as stated. For instance the various sulfurized fatty acid esters of monohydric aliphatic alcohols such as disclosed in my application Serial No. 60,357, may be employed. As stated in that application, such sulfurized mono esters are advantageous additions to lubricants 60 containing mineral oils.

What I claim is:

1. As an improved lubricant, suitable for lubricating threaded pipe joints and the like and for making tight, non-freezing joints, a compounded 65 uniform pipe thread lubricant comprising a major amount of a petroleum lubricating base, a minor amount of solid lubricant including a lubricating metallic powder and a minor amount of a sulfurized fatty esters, said sulfurized fatty ester 70 being substantially neutral.

2. The lubricant of claim 1 wherein the said sulfurized fatty ester is sulfurized sperm oil.

3. The lubricant of claim 1 wherein the said sulfurized fatty ester is sulfurized lard oil. 75

4. The lubricant of claim 1 wherein the said lubricating metallic powder is zinc dust.

5. The lubricant of claim 1 wherein the said lubricating base is petrolatum.

5 6. The lubricant of claim 1 wherein the said lubricating base is a grease comprising a major amount of lubricating mineral oil and a minor amount of an alkaline earth metal soap, said grease containing a few per cent of aqueous poly-
10 hydric alcohol.

7. A pipe thread lubricant, having the following properties,

Melting point, Hawxhurst----- 170 to 230° F.
Penetration, A. S. T. M.----- 275 to 375

and comprising 50 to 86.5 parts of a lubricating grease, 10 to 50 parts of a lubricating metallic powder and 4 to 20 parts of sulfurized sperm oil.

8. As an improved pipe thread lubricant, the composition comprising 63.7 parts of lubricating mineral oil, 10.7 parts of calcium-tallow soap, 1.0 part of glycerine, 0.6 part of water, 20.0 parts of zinc dust and 4.0 parts of sulfurized sperm oil. 5

9. An improved pipe thread lubricant comprising a pale paraffin oil of 150 viscosity at 100° F., a calcium-tallow oil soap, amorphous graphite, zinc dust, and a sulfurized sperm oil. 10

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