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LUBRICANT

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3 Claims. (Cl. 252—59)

This invention relates to a lubricant which must remain in place under varying conditions, such as when exposed to elevated temperatures, and particularly to a lubricant to be used on bullets and similar articles. The use thereof will be described specifically relative to bullet lubrication, but it is to be understood that it is suitable for general purposes.

The present application is a division of a prior co-pending application, Serial Number 319,106, filed February 15, 1940, and issued October 13, 1942, as Patent No. 2,298,844.

A bullet lubricant is necessary when lead or a plating over the lead is used, as the bullet is cut by the rifling, and the lead will be deposited in the barrel and rifling. The contact of the lead against the barrel also results in sufficient friction between the barrel and the bullet so as to seriously affect the accuracy of the bullet. It is evident that the greater the friction, the slower will be the egress of the bullet from the barrel with a resultant deterrent effect upon the accuracy and final velocity of the bullet as it hits the target. Lubricants hitherto used have consisted chiefly of various mixtures of waxes and greases, so selected as to withstand the conditions of ammunition storage in various places. However, at elevated temperatures and high relative humidity, as found in such places as the tropics or in uncontrolled ammunition storage places, there has been considerable difficulty resulting from the apparent running of the lubricant, which tends to mix with the propellant charge used to propel the bullet from the barrel. The running of the bullet lubricant also tends to reduce the efficiency thereof and thereby defeats its purpose as a lubricant. Lubricants are also used for other purposes wherein it is desired that the lubricant be of the dry type which will not run and will stay in place under conditions of high temperatures, such as, for example, is reached in the tropics and in the summer.

Constituents of a bullet lubricant should be easily obtainable and cheap in cost. Some of the previous lubricants such as Japan wax are costly and difficult to prepare for use. The present invention comprises the discovery of the use of a micro-crystalline petrolatum wax in conjunction with bullet lubricants, which serves to reduce the running of the lubricant or portions thereof under elevated temperature conditions, and, at the same time, not to decrease the efficiency of the lubricant. The lubricant must not be so brittle as to chip off easily. It should also not change form or characteristics over a period of time, as otherwise the accuracy of the bullet might be affected after being in storage.

In the fractional distillation of petroleum, various waxes are obtained. Paraffin wax is the crystalline wax recovered from the light lubricating oil fraction, and may be obtained in different manners. One method of recovering the paraffin wax is by chilling the light lubricating oil fraction and separating the wax therefrom by means of a filter in accordance with well-known principles. The wax so filtered is commonly known as "slack wax." Slack wax contains a considerable amount of oil within its crystalline structure, which is removed generally by what is known as "sweating." In sweating, the material is subjected to a temperature below the melting point of the wax, which allows the entrained oil to drain away. It is theorized that upon chilling, the higher melting point paraffins form a mass of needlelike interlacing crystals entraining some oil, and when the wax is heated by the sweating process, some of the wax melts, freeing the sealed-up oil and thereby permitting the oil to flow out and drain off. The resultant wax is known generally as "crude scale wax," and usually has a plate-like crystalline structure. The wax may be further refined, if desired, by remelting and purifying, so as to produce the white crystalline paraffin wax of commerce. The removal of the oil by the sweating process generally increases the melting point of the wax so that the paraffin waxes produced by this method have a higher melting point as the refining is carried to a higher degree. The particular manner of producing the crystalline petroleum wax may be carried out in many ways and is not limited to that described.

The heavy oil lubricating fraction that lies above the paraffin wax fraction, or light lubricating oil distillate, contains wax of a different characteristic than the wax of the paraffin fraction, the structure of this latter wax being amorphous or micro-crystalline. The wax in the higher viscosity or heavy lubricating fraction is sometimes referred to as "slop wax," and is not recoverable by the pressing and filtering method which may be applied to paraffin wax. Various methods have been used for the recovery of this wax which are well-known in the art, such as the "cold settling" method, or the use of a solvent such as naphtha followed by centrifuging or by some other method of separation. The petroleum resi-

due left in the still after the higher viscosity distillates have been driven off may also have the wax therein recovered by a similar method such as by the use of naphtha followed by a centrifuging or separation process. There are many other methods and solvents used for the purpose of recovering the amorphous or micro-crystalline waxes, solvents such as methyl ethyl ketone or various combinations of solvents being used, all of these being familiar to those skilled in the art. The micro-crystalline waxes apparently come from the residue after the paraffin wax fraction has been removed.

The term "petrolatum" may be used to mean the mixture of the amorphous wax and oil. Petrolatum is a soft plastic mass of varying color, depending upon the degree of refinement, and is composed of a sufficient variety of petroleum products to give an indistinct melting point. Petrolatum wax, when used in this specification, means a wax other than the paraffin waxes, which is derived from the heavier distillates and residues. Petrolatum wax has a higher melting point than the paraffin waxes, being as high as 180° F., and is a tough rubbery substance varying in color in dependence upon the amount of refining to which it has been subjected. Petrolatum wax is to be understood not to mean petroleum jelly.

As a specific example of the treatment to produce a petrolatum wax, the petrolatum may be mixed with naphtha, which will change the petrolatum from a plastic to a fluid. This can then be chilled by refrigeration and the heavy portion allowed to settle, following which the lighter portion can be pumped off. Instead of allowing the settling, the amorphous wax may also be separated by means of a centrifuge. Another example would be that wherein the higher viscosity cut from the still is mixed with a solvent such as methyl ethyl ketone, or any of the numerous solvents such as propane, benzol-acetone, a mixture of cresol and propane, and many others too numerous to mention. There is a possibility that the presence of other substances in the wax prevents the formation of the crystals so that a microcrystalline wax is formed. It is evident that the presence of high boiling impurities in the stock would tend to prevent the growth of large crystals. In order to obtain certain desirable characteristics of the petrolatum wax, the wax may contain varying percentages of one or more fats, fatty acids, or other organic compounds.

The exact structure of the resultant wax is not precisely known, nor is the exact action thereof in the invention described herein. As an example, one microcrystalline petrolatum wax that has been found to be satisfactory has the following characteristics:

Flash point	Fire point	Saybolt viscosity @ 210° F.	Melting point
495° F.	550° F.	65-72	147°-155° F.

It is to be understood, however, that this is merely given as an example and that petrolatum waxes having melting points as low as 120° F. would be satisfactory and that petrolatum waxes having melting points as high as 180° F. have been prepared.

The previously used bullet lubricants, when placed upon the bullet have a damaging effect upon the propellant powder if the lubricant or any of the constituents thereof run into and mix with the propellant powder. This results in decreased pressures, velocities, and even misfires of the cartridges. It is quite common for the cartridge in storage in tropical countries, for example, or in ammunition sheds to reach a temperature of 120° at a high relative humidity, which causes the running of the lubricant.

By the mixing of a petrolatum wax with various bullet lubricants, the running of the lubricant or a constituent thereof into the powder charge is prevented. The bullet lubricant also remains in place on the bullet and performs properly its function of lubricating the bullets in their passage through the barrel. The exact reason for this phenomenon is not known. An ordinary crude scale wax, for example, when used as a bullet lubricant, will not perform satisfactorily in that it will have undesirable running. It is to be noted that a crude scale wax or a refined wax are also not completely satisfactory lubricants by themselves because some kinds are apt to become brittle and scale off, and may not possess the proper lubricating properties to give the necessary accuracy. The oil contained in the various ingredients helps improve the lubrication qualities. The waxes also by themselves are liable to cake in the working parts of a gun and prevent proper functioning thereof. However, by the addition of a petrolatum wax, the lubricant is held in place and does not run or affect the propellant charge, and the correct lubricating properties of the mixture are maintained. It can be theorized that there might be some action of the microcrystalline wax upon the crude scale wax or other ingredient that tends to hold the entrained oil or the lower melting waxes in the mixture in place, although, as has been stated, the exact reason is not known. The amount of petrolatum wax that is necessary to be added to the crude scale wax or other lubricants varies and will depend upon the result desired, although in general it has been found that it is necessary to add at least 5% thereof, although it is possible that smaller quantities will satisfactorily operate. It is to be understood that the amount necessary also depends upon the specified lubricants with which it is combined. The petrolatum wax is usually more expensive than the crude scale wax and similar waxes, and, in the interest of economy, it is generally desirable that as little of the petrolatum wax be used as is necessary. The anti-running properties are not produced by the mixing of a high melting point paraffin wax with a low melting point paraffin wax, as in such a mixture the lower melting waxes will melt and run at their individual melting points. The addition of the petrolatum wax prevents this running. Other bullet lubricants and lubricants containing substances such as high melting point petrolatum having a melting point, for example, in the vicinity of 130° F. or over, a low melting point amber petrolatum having a lower melting point, ozokerite, oleostearine and/or a mixture of solid fatty alcohols containing principally alconols having 16 and 18 carbon atoms, will give the anti-running properties desired. The crude scale and the paraffin waxes may have melting points as low as 120° F. and as high as 135° F., the latter being limited only by that which can be produced. It is evident that 120° F. is as low a melting point as will be practicable because the lubricant must remain in place at this temperature.

The following are given as specific examples

of lubricant compositions that have been found to be satisfactory:

	Per cent
1. Petrolatum wax	35
Crude scale wax	65
2. Petrolatum wax	20
High melting point petrolatum	20
Paraffin wax	60
3. Petrolatum wax	23½
High melting point petrolatum	23½
Ozokerite	28
Oleostearine	25
4. Petrolatum wax	25
Fatty alcohol mixture (C16 and C18)	75
5. Petrolatum wax	5
High melting point petrolatum	20
Ozokerite	30
Low melting point amber petrolatum	45

It is to be understood, however, that these are merely examples and that the petrolatum wax may be added to various compositions to produce the desired effect.

The measurement of the running of a lubricant and the relation of the experimental data obtained to actual results is difficult. Applicants have devised a test for the running of the lubricant wherein a cylindrical sample of 1.45 cm. diameter of the lubricant composition is placed upon a piece of filter paper of 9 cm. diameter. This is put into a humidifier, and held at 120° F. 90% relative humidity for two hours or any other desirable period. At the end of the period in the humidifier, the longest diameter and the one at right angles thereto showing the spread of the lubricant are measured, the area not being defined usually by a true circle. An area of the test piece is included in this area, of course, and the product of the two diameters in cm. is taken as the running number. The test of a crude scale wax of approximately 126° F. melting point showed a running number of over 81. With an addition of 10% microcrystalline petrolatum wax, the running number was reduced to 53.3. An addition of 20% petrolatum wax reduced the number to 31.9, and the addition of 35% petrolatum wax so that the composition was 35% petrolatum wax and 65% crude scale wax gave a running number of 18.3. From this it can clearly be seen that the addition of the petrolatum wax to the crude scale wax materially reduced the running number.

As another example, a paraffin wax having a melting point of 135° F. gave a running number of 7.0, and stearic acid gave a running number of 2.1, which, as has been stated, is the original area of the test piece. However, with a composition of 99½% of the same paraffin and ½% stearic acid, the running number became 76.5. Similarly, an 85% paraffin wax and 15% stearic acid covered the entire filter paper so that the running number was over 81. With a 90% paraffin wax and 10% stearic acid, the entire filter paper was also covered, giving a running number greater than 81. However, by adding 5% petrolatum wax to 85% paraffin and 10% stearic acid, the running number was reduced to 12.2. The above composition is not necessarily a good bullet lubricant, but it does give an indication of the effectiveness of petrolatum wax in substantially reducing the running of a paraffin and stearic acid composition.

As has been previously stated, paraffin by itself is not a completely satisfactory lubricant, so it is necessary to add other ingredients thereto to give the desired lubricating properties, and, as has just been seen, the addition of a small quantity of another substance may very materially increase the running. It is also of interest, to note that a composition containing 40% crude scale wax, and 10% S. A. E. #10 lubricating oil and 50% petrolatum wax has a running number of only 2.6, showing that even with the addition of a very light lubricating oil the petrolatum wax is effective in the prevention of the running of the oil.

In the application of a bullet lubricant in production methods, the molten bath of lubricant at the necessary comparatively high temperature results in the partial decomposition of some of the higher melting point waxes. The addition of the petrolatum wax apparently inhibits this decomposition or materially reduces the same, and the anti-running properties of a lubricant containing petrolatum wax is maintained even when it is kept in a molten bath for a considerable period for application purposes.

The lubricant takes the form of a substantially solid coating on the bullet or other part at ordinary temperatures. The term "substantially solid" is meant to include petrolatum or the petroleum jellies in contrast to an oil which is mobile.

It is seen therefore from the foregoing description that the discovery of the use of microcrystalline petrolatum wax in a lubricant has produced a new process and lubricant that does not have the objectionable running properties of previous lubricants, and which is particularly adapted to the lubrication of bullets.

Many modifications may be made, and the specific compositions are merely by way of example, so that the scope of the invention is not intended to be limited except as defined by the appended claims.

What is claimed is:

1. A substantially solid lubricant comprising predominately petrolatum and ozokerite; and not less than about 5% of a microcrystalline petrolatum wax to inhibit running of said lubricant.

2. A substantially solid lubricant comprising predominately petrolatum and ozokerite; and not less than about 5% of a microcrystalline petrolatum wax having a melting point of between about 120° and 175° F. to inhibit running of said lubricant.

3. A substantially solid lubricant comprising substantially 5% microcrystalline petrolatum wax having a melting point of between about 120° and 175° F., substantially 30% ozokerite, and substantially 65% of a mixture of petrolatums.

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