

Patented Mar. 16, 1937

2,074,224

UNITED STATES PATENT OFFICE

2,074,224

DRAWING WIRE

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No Drawing. Application May 13, 1935, Serial No. 21,295

28 Claims. (Cl. 205—21)

My invention relates to the drawing of wire, and more particularly to an improvement in the coating of steel rods which are to be drawn into wire through dies.

5 The metal rod which is to be drawn into wire has generally been previously subjected to a pickling treatment in hot sulphuric acid to remove scale, rust and dirt. This metal rod is then coated to protect the surface of the rod from the air and to facilitate drawing. The present invention relates to a coating material for this purpose.

Although some material such as soap is used in the dies, this alone is insufficient as a lubricant and therefore it is desirable to utilize a coating material which has lubricating properties.

15 In the past, lime has been the most generally used material for this purpose inasmuch as it is cheap and has the ability of neutralizing any traces of acid.

20 This lime is either applied in a single light coating where a bright surface is desired or on top of a dull coat consisting of a layer of rust or oxide on the surface of the wire, and produced by spraying with water, where a dull coat is desirable.

25 In the use of a lime coating, one of the principal disadvantages is that it is often difficult to remove the lime at the end of the process. When the lime is drawn through a die in which soap is used as the die lubricant, an insoluble lime soap is formed on the wire. This insoluble soap is hard to remove, and is likely to prevent satisfactory use of the wire where a coating is to be applied thereto, as by galvanizing or electroplating, or where the wire is to be welded, as for instance in manufacturing tire chains, wire shelves and the like. During welding, the lime soap coating carbonizes and prevents the formation of perfect welds. Also, wire to be used in the manufacture of welding rods must be free from lime soap, and wire produced by drawing with lime is therefore unsatisfactory.

30 In addition, the use of a lime coating causes pollution of the soap in the die box, and this soap must be thrown away periodically.

35 The object of the present invention is to provide a process for coating metal to be drawn into wire, and a composition for such coating, which avoids the many disadvantages of lime coatings. The primary object is to provide a material which does not leave streaks on the wire, and

which can easily be removed completely from the wire by washing, after the drawing operation.

40 A second object of the invention is to provide a coating material which will protect the wire to be drawn so as to produce a minimum of scratches or imperfections and minimum of wear or injury to the die, such as are frequently caused by the use of lime. Of course, imperfections in the rods from which the wire is made will not be eliminated by the use of the new coating agents.

45 My invention also has numerous other advantages. In the first place, the lubricant or coating is more effective than lime, so that less power is required for drawing wire. The consumption of material is less, being about $\frac{1}{3}$ that of the lime. The soap in the die box is used up only half as rapidly as where lime is employed, and is not contaminated, so that a considerable saving is effected. The material does not shell off of the rod as lime does, and therefore the operation is cleaner. The coating according to my invention can be used either with or without a dull coat, and wire of any desired finish and size may be produced. In addition, no baking is required, and the time and expense of this step are eliminated.

50 Finally, the coated coils are easier to handle because they dry immediately after they are removed from the coating bath.

55 According to the invention, the coating composition consists essentially of a water-soluble alkaline material such as an alkali or alkaline salt, and of a material which is insoluble in water and which is inert with respect to the alkali or alkaline salts. The composition may further contain soap, and if this is used the insoluble material must be also inert with respect to the soap.

60 As the alkali or alkaline salt, I may use sodium hydroxide, sodium carbonate (soda ash), sodium bicarbonate, trisodium phosphate, sodium orthosilicate, sodium metasilicate, or less alkaline silicates, commonly known as waterglass, sodium metaborate, sodium tetraborate, or any of the corresponding potassium compounds. I may also use a mixture of two or more of these compounds.

65 As the inert material, I prefer to use bentonite. However, other materials of a similar nature can be used, such as talc, soapstone, steatite, kaolinite, china clay, kaolin, fuller's earth, and the like. Preferably the material is one which consists principally of hydrated silicates of aluminum

or magnesium. Mixtures of these ingredients may also be used.

The soap may be of the stearic, palmitic or oleic acid types, or of the resin type. These soaps may either be added as such to the composition or may be formed when the composition is added to water by the inclusion of suitable oils, fats or fatty acids which will react with a portion of the alkali to form the soap.

According to the invention, each of these ingredients may have more than one function in the final composition and process. First, the alkali serves, in the same manner as has the lime in the prior art, to neutralize the acid remaining on the rod after the pickling operation.

As my preferred insoluble material, I use a colloidal clay, and particularly bentonite. It is very difficult to form a suspension of this material in water, since it tends to gelatinize with water. Even where the bentonite is finely powdered, when it is added to water it sticks together forming lumps. Shaking with water will form a jelly which is unsuitable. However, I have discovered that if a water soluble alkali or alkaline salt is added in approximately the ratio of two parts to one part of clay, before the clay is added to the water, a uniform suspension can be prepared in any amount of water. Furthermore, such proportions give the proper quantities of neutralizing agent and coating agent for use in many types of wire drawing. Apparently, the alkali is a water soluble material which separates the particles of bentonite and thereby prevents them from sticking together and forming a jelly.

Furthermore, the proportion of alkali to be used must be sufficient to prevent the bentonite from swelling in the water. A very small amount of alkali apparently increases the swelling property of the bentonite, but a larger amount will prevent such swelling. The alkali will produce a suspension of the bentonite which, while not permanent, will remain as a suspension during operation merely because of the agitation caused by the heating of the solution and by the movement in the solution of the parts to be coated. This suspension will settle out if allowed to stand quiet, but during operation the clay will remain suspended.

In other words, the alkaline material acts as a dispersing and deflocculating agent, by separating the particles of bentonite and by preventing their swelling.

Where kaolin is used as the insoluble material, the alkali has somewhat the same effects. Kaolin tends to agglomerate or lump together when added to water, and the alkali will prevent such lumping and make the production of a suspension in water much easier. However, less alkali is required than in the case of bentonite. In the other materials, such as talc, the alkali does not act as a deflocculating agent since these materials do not tend to swell or gelatinize when mixed with water. However, such materials settle out of solution rapidly, and I prefer to include in the coating agent at least a portion of a material which gelatinizes with water in order to obtain a suspension which will remain as such without any other agitation than that which is naturally incident to the operation of the process.

The bentonite or other insoluble material acts as the principal coating agent, and the combination of alkali and bentonite gives a material which has the necessary neutralizing and coating prop-

erties. In the case of materials which do not gelatinize, the proportion of alkali to inert material is not so important, as long as there is a sufficient quantity of each to accomplish the necessary function. Furthermore, in addition to a gelatinizing material and a sufficient quantity of alkali to prevent flocculation or gelatinization thereof, I may also add a considerable quantity of non-gelatinizing materials.

The bentonite or other material should be in finely powdered form so as to give a good suspension.

I may also add to the coating material a soap, although this is not a necessary part of the composition. Good results can be obtained with alkali and bentonite alone. However, soap aids in lubrication and further promotes adhesion of the coating. Furthermore, by the selection of some particular soap and regulation of the temperature, I may control the viscosity of the bath and thereby control the thickness of the coating. The soap will also act with the alkali to produce an increase in viscosity.

A bath suitable for coating may be produced by adding a mixture of alkaline material and an inert material, with or without soap, to water, and agitating so as to produce a suspension. The bath may be cold or may be heated to various temperatures, but I prefer to heat the bath to the boiling point. At this temperature, any hydrogen which has been absorbed by the rods during the pickling will in most cases be expelled upon treatment for from 10 to 15 minutes in the bath. If the rods are removed from the bath and allowed to dry, the coating will remain in place thereon without any baking and the rods may be immediately drawn.

Under some circumstances, however, some baking may be desirable. In the use of high carbon stock, baking may be required in order to remove all of the hydrogen. Furthermore, if a cold bath is used then the coating must be baked in the same manner as at present. In other words, the coating is of general application regardless of the specific manner in which it may be applied.

In the die box through which the rods coated with this material are drawn, a number of different materials which are at present well known may be used. For example, grease, powdered soap or a mixture of soap and lime may be employed. Where the rods are coated with bentonite the use of lime with soap in the die box raises no difficulties because the amount of lime added can be so regulated as to give the desired proportion of lime and soap. This is not true in the case of lime coated wire, however, inasmuch as the lime of such wire will be forced off the rod and will accumulate in the soap. This will dilute the soap in the die box so that more soap must be added to obtain proper lubrication. According to the present invention such dilution is practically avoided, and considerable savings in the quantity of soap required, as high as 50% may be obtained.

A preferred composition for use according to my invention may be as follows:

	Parts
Bentonite	30
Soda ash	63
Soap	7

This composition is used in the concentration of from 8 to 24 ounces per gallon of water. Such a bath is very satisfactory for the coating of wire.

The quantity of alkali in proportion to the

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bentonite must be at least great enough to prevent flocculation of the bentonite (regardless of the presence or absence of other inert materials), and I prefer to use bentonite in the proportion of 5 from 45% to 65% of the alkali. Where kaolin or other materials are substituted for the bentonite, however, only enough alkali need be used to neutralize the acid on the metal rod and to prevent agglomeration in the case of kaolin. In 10 addition to the bentonite or gelatinizing material, however, I may also add considerable quantities of non-gelatinizing material. For instance, I may use a composition of the following ingredients:

	Parts
Bentonite -----	30
Talc -----	40
Soda ash -----	63
Soap -----	7

20 The adhesion of the coating can be greatly improved by incorporating a certain amount of sodium silicate, possibly in the form of sodium metasilicate, but preferably in the form of the less alkaline silicates commonly known as water- 25 glass. I prefer the less alkaline silicates such as a 40° Bé. or 60° Bé. waterglass. The following formula containing both kaolin and waterglass in addition to the other ingredients produces a satisfactory suspension when mixed with water.

	Parts
Bentonite -----	20
Kaolin -----	25
Soda ash -----	30
Soap -----	5
Waterglass 40° Bé. -----	20

The waterglass in this formula, of course, is one of the alkaline materials which will have acid neutralizing properties, but it is of very low alkalinity and its chief purpose is as an adhesion 40 promoting agent rather than as a neutralizing agent.

The quantity of soap may vary considerably and may range up to 20% or higher of the total 45 composition. However, I prefer to use from 5 to 15%, the proportion depending considerably on the type of drawing operation and on the type of soap being used.

The term "alkaline salt" is used in the specification and claims to indicate any salt which gives an alkaline reaction in an aqueous solution, and refers particularly to the salts obtained when the alkali metals, sodium and potassium, are combined with weak inorganic acids such as carbonic acid, phosphoric acid, silicic acid and boric acid to form the corresponding carbonates, phosphates, silicates and borates. The term "alkali" 50 is used to indicate the hydroxides of sodium and potassium.

While I have described herein some embodiments of my invention, I wish it to be understood that I do not intend to limit myself thereby except within the scope of the appended claims.

I claim:

65 1. A composition for coating metal which is to be submitted to a drawing operation in the manufacture of wire, comprising an alkaline compound of an alkali metal, and water-insoluble material and which consists principally of a hydrated silicate of at least one substance selected from the group consisting of magnesium and aluminum.

75 2. A composition for coating metal which is to be submitted to a drawing operation in the

manufacture of wire, comprising an alkaline compound of an alkali metal, and water-insoluble material which is inert to the alkaline compound and which agglomerates with water.

3. A composition for coating metal which is 5 to be submitted to a drawing operation in the manufacture of wire, comprising an alkaline compound of an alkali metal, and water-insoluble material which is inert to the alkaline compound, which consists principally of a hydrated silicate 10 of at least one substance selected from the group consisting of magnesium and aluminum and which gelatinizes with water.

4. A composition for coating metal which is 15 to be submitted to a drawing operation in the manufacture of wire, comprising an alkaline compound of an alkali metal, and water-insoluble material which is inert to the alkaline compound and which agglomerates with water, the proportion of alkaline compound being sufficient to prevent 20 agglomeration of the insoluble material when the composition is added to water.

5. A composition for coating metal which is 25 to be submitted to a drawing operation in the manufacture of wire, comprising an alkaline compound of an alkali metal, a soap and water-insoluble material which is inert to the alkaline compound.

6. A composition for coating metal which is 30 to be submitted to a drawing operation in the manufacture of wire, comprising an alkaline compound of an alkali metal, a soap and water-insoluble material which is inert to the alkaline compound and which gelatinizes with water.

7. A composition for coating metal which is 35 to be submitted to a drawing operation in the manufacture of wire, comprising an alkaline substance selected from the group consisting of alkalies and alkaline salts of alkali metal, and a material which is inert to the alkaline substances, which consists principally of a hydrated silicate of at least one substance selected from the group consisting of magnesium and aluminum and which gelatinizes with water, the proportion of alkaline substance being sufficient to prevent 40 gelatinization of the insoluble material when the composition is added to water.

8. A composition for coating metal which is 50 to be submitted to a drawing operation in the manufacture of wire, comprising an alkaline substance selected from the group consisting of alkalies and alkaline salts of alkali metal, a soap and a material which is inert to the alkaline substance, which consists principally of a hydrated silicate of at least one substance selected from the group consisting of magnesium and aluminum and which gelatinizes with water, the proportion of alkaline substance being sufficient to prevent gelatinization of the insoluble material when the composition is added to water.

9. A composition for coating metal which is 65 to be submitted to a drawing operation in the manufacture of wire, comprising an alkaline substance selected from the group consisting of alkalies and alkaline salts of alkali metal, and a colloidal clay.

10. A composition for coating metal which is 70 to be submitted to a drawing operation in the manufacture of wire, comprising an alkaline salt of an alkali metal and bentonite.

11. A composition for coating metal which is 75 to be submitted to a drawing operation in the manufacture of wire, comprising an alkaline substance selected from the group consisting of

alkalies and alkaline salts, and a colloidal clay, the colloidal clay being present in the proportion of from 45% to 65% of the alkaline substance.

12. A composition for coating metal which is to be submitted to a drawing operation in the manufacture of wire, comprising 30 parts of bentonite and 63 parts of sodium carbonate.

13. A composition for coating metal which is to be submitted to a drawing operation in the manufacture of wire, comprising 30 parts of bentonite, 7 parts of soap and 63 parts of sodium carbonate.

14. A composition for coating metal which is to be submitted to a drawing operation in the manufacture of wire, comprising 30 parts of bentonite, 7 parts of soap, 40 parts of talc and 63 parts of sodium carbonate.

15. A composition for coating metal which is to be submitted to a drawing operation in the manufacture of wire, comprising 20 parts of bentonite, 25 parts of kaolin, 5 parts of soap, 30 parts of sodium carbonate and 20 parts of waterglass.

16. A composition for coating metal which is to be submitted to a drawing operation in the manufacture of wire, comprising an alkaline compound of an alkali metal, a water-insoluble material which is inert to the alkaline compound and which gelatinizes in water, the proportion of alkaline compound being sufficient to prevent gelatinization of the inert material where the composition is added to water, and a second inert coating material which does not gelatinize in water.

17. A bath for coating metal which is to be submitted to a drawing operation in the manufacture of wire, comprising a suspension in a water solution of an alkaline compound of an alkali metal of a water-insoluble material which is inert to the alkaline compound and which gelatinizes with water, the proportion of alkaline compound being sufficient to prevent gelatinization of the insoluble material.

18. A bath for coating metal which is to be submitted to a drawing operation in the manufacture of wire, comprising a suspension, in a water solution of a soap and an alkaline compound of an alkali metal, of a water-insoluble material which is inert to the alkaline compound and which gelatinizes with water, the proportion of alkaline compound being sufficient to prevent gelatinization of the insoluble material.

19. A bath for coating metal which is to be submitted to a drawing operation in the manufacture of wire, comprising a suspension, in a water solution of an alkaline salt of an alkali metal, of a colloidal clay.

20. A bath for coating metal which is to be submitted to a drawing operation in the manufacture of wire, comprising a suspension, in a water solution of an alkaline salt, of bentonite, the proportion of alkaline salt being sufficient to prevent gelatinization of the bentonite.

21. A bath for coating metal which is to be submitted to a drawing operation in the manufacture of wire, comprising a suspension, in a water solution of an alkaline salt, of bentonite, the proportion of bentonite being from 45% to

65% of the alkaline salt, said mixture being present in the amount of from 8 to 24 ounces to each gallon of water.

22. The method of coating metal which is to be submitted to a drawing operation in the manufacture of wire, which consists in applying thereto a suspension, in a water solution of an alkaline compound of an alkali metal, of a water-insoluble material which is inert to the alkaline compound and which gelatinizes with water, the proportion of alkaline compound being sufficient to prevent gelatinization of the insoluble material.

23. The method of coating metal which is to be submitted to a drawing operation in the manufacture of wire, which consists in dipping the rod into a bath comprising a suspension, in a water solution of an alkaline compound of an alkali metal, of a water-insoluble material which is inert to the alkaline compound and which gelatinizes with water, the proportion of alkaline compound being sufficient to prevent gelatinization of the insoluble material, and drying the suspension on the wire to form a coating.

24. The method of coating metal which is to be submitted to a drawing operation in the manufacture of wire, which consists in dipping the rod into a bath comprising a suspension, in a water solution of an alkaline compound of an alkali metal, of a water-insoluble material which is inert to the alkaline compound and which gelatinizes with water, the proportion of alkaline compound being sufficient to prevent gelatinization of the insoluble material, the temperature of said bath being close to the boiling point thereof, removing the rod from the bath, and permitting the suspension to dry on the rod.

25. The method of drawing metal to form wire which consists in applying to the metal a neutralizing, lubricating and protecting coating comprising an alkaline compound of an alkali metal, and water-insoluble material which is inert to the alkaline compound and is composed principally of a hydrated silicate of at least one substance selected from the group consisting of magnesium and alumina, and drawing the coated metal through a die.

26. The method of drawing metal to form wire which consists in applying to the metal a neutralizing, lubricating and protecting casing comprising an alkaline salt of an alkali metal and a colloidal clay, and drawing the coated metal through a die.

27. Metal to be drawn into wire, having thereon a dry neutralizing, lubricating and protecting coating comprising an alkaline compound of an alkali metal, and water-insoluble material which is inert to the alkaline compound and is composed principally of a hydrated silicate of at least one substance selected from the group consisting of magnesium and alumina.

28. Metal to be drawn into wire, having thereon a dry neutralizing, lubricating and protecting coating comprising an alkaline salt and bentonite, and a second water-insoluble material which is inert to the alkaline salt.

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