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## METHOD OF DRAWING

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This invention relates in general to the drawing of wire, and more particularly to an improvement in the coating of metal rods which are to be dry-drawn into wire through conventional dies.

Coils of steel rod for drawing into wire suitable for wire products such as welding wire, zinc electroplated wire, galvanized wire, enameled wire, nail wire, heat treated wire such as rope wire and spring wire, and the like are usually cleaned of scale and dirt in a bath of hot dilute sulfuric acid, rinsed, then placed on a rack and kept moist with fine sprays of water until a thin coat of brownish rust, or sull, appears. The coils of sulled rod are thereupon dipped into tanks containing a suspension of slaked lime in water, or milk of lime, which adheres to the surface, completely covering the rod with a thin coat of whitewash. The rods are then baked at a temperature of 250° to 650° F. to dry the lime coating.

The chief function of the dry lime coating is to serve as an absorbent and carrier of the wire drawing lubricant, which may be pulverized soap or grease or any of the specially prepared drawing compounds, usually placed in the die box so that the rod or wire will have to pass through it before entering the die hole. Other functions of the lime are to neutralize any acidity left on the rods after the pickling and rinsing, and to hinder rusting.

While the use of lime as a base for the drawing lubricant is thus standard practice in the wire industry, it has a number of practical defects.

The commercial grades of lime contain appreciable amounts of abrasive impurities such as silica and alumina, which increase the rate of wear of the dies.

Since the lime does not dissolve in the water in the lime tank but is merely suspended in it, the lime tends to settle to the bottom of the tank as a thick sediment. Means are used to agitate the suspension so as to distribute the lime more uniformly, but at best it is very difficult to obtain a uniform lime coating on coils of rod and wire.

For certain applications such as two-draft wire it is desirable to have a very thick uniform lime coating. This cannot be obtained by simply increasing the concentration of lime in the suspension, because the lime coating would not be uniform and would also tend to flake off. This can be overcome to a certain extent by the costly expedient of using a thin suspension of lime and repeatedly dipping the coils of rod in it, the coils being dried between each dip.

In drawing heavier lime coated rod through the die, considerable amounts of lime drop off into the die box, diluting the lubricant and reducing its lubricating properties so that more lubricant must be added and more is therefore consumed in drawing the wire.

Although for certain wire products such as bright welding wire, it is desired to obtain a lime-free surface, this result can only be approached with lime, by the use of a very light lime suspension in the lime tank and by drawing through a wet type lubricant like grease which rubs off most of the lime. For other products, such as electroplated wire, hot dipped galvanized wire, and enameled wire, where a lime-free surface is also desired, it is generally customary to dissolve off the lime before plating, hot dipping or enameling—the solvent as a rule being a hydrochloric acid solution. Since a limed coating is not very readily soluble, mainly because lime forms a rather insoluble compound with the lubricant, some limed deposits may remain in pits and crevices in the steel and prevent proper plating, galvanizing or enameling. For electroplated wire a minimum of two drafts through the die is customary in order to remove as much of the lime as possible before cleaning in the hydrochloric acid solution. If it were not desired to remove the lime, one draft would be sufficient.

We have found that a sodium silicate solution can be used instead of a lime suspension. Sodium silicate serves as well as lime as a base for the lubricant, in neutralizing any remaining acidity, and in retarding rusting. Moreover, sodium silicate is not subject to many of the disadvantages encountered when using lime.

Sodium silicate is commercially procurable as a chemical free of abrasive impurities so that a coating formed from it gives longer die life. Sodium silicate goes into solution in water. Not being in suspension like lime, it does not form a sediment; it does not need to be agitated; rods and wire dipped in sodium silicate solution are coated with a film which is more uniform than a lime coating. The fact that the base for the lubricant is uniform has a most important effect in uniformly distributing the lubricant, giving improved die life and easier drawing. Unlike lime coatings, sodium silicate coatings do not flake off and dilute the lubricant in the die box.

For welding wire where traces of lime may be detrimental to welding, the use of sodium silicate offers a means of obtaining a surface entirely free of lime. Moreover, we have found that the sodium silicate coating is of itself beneficial to welding. In zinc-electroplated, galvanized, and enameled wire, difficulty in subsequently dissolving off the lime tends to give local bare spots in

the finished product. The coating obtained on wire drawn from rod dipped in sodium silicate solution on the other hand, and drawn through a soluble lubricant like sodium stearate, gives a coating which is readily soluble, so that a clean surface is obtained which can be electroplated, galvanized, or enameled without bare spots. For zinc electroplated wire it is customary with limed rods to use a minimum of two light drafts, in order to remove as much of the lime as possible, and then clean with hydrochloric acid solution. We have found that with rods for such electroplated wire dipped in sodium silicate solution and drawn through a soluble lubricant, no more than a single draft need be applied and yet the surface is very readily cleaned.

With lime it is desirable to bake the rod after liming to dry it. The coating obtained by dipping in a hot sodium silicate solution on the other hand, dries rapidly in air without baking.

With lime it is desirable to sull the rod before liming. The sull helps to avoid scratching of the wire and wear of the die. We have found that with sodium silicate excellent results can be obtained without sulling. The sodium silicate seems to perform the same function as sull in producing a good base for the lubricant, so that a very effective base is obtained without sull. One reason why sull appears to be beneficial is that it adheres tightly to the steel surface. Sodium silicate appears to adhere even more tightly than sull. Moreover, the amount and uniformity with which sodium silicate can be applied is much more closely controllable than in sulling. Being able to omit the sulling operation while still obtaining the best result, is an important advantage.

One object of this invention, therefore, is to produce a welding wire with a lime-free surface.

Another object is to produce a wire for electroplating, galvanizing, and enameling which has an easily soluble coating after drawing.

Another object of this invention is to produce a high quality coating for wire drawing without sulling.

Another object is to eliminate the need of baking the coating.

Another object is to obtain a more adherent and uniform coating.

Still another object is a coating which will give longer die life with ordinary lubricants.

Other and further objects, purposes and advantages of this invention will appear hereinafter in the specification and in the appended claims.

According to this invention, the coils of rod are first cleaned in dilute acid, and then dipped in an aqueous solution containing approximately 1 to 5 per cent of sodium silicate, heated to a temperature of about 200° F. The coating dries very rapidly, so that the coils do not need to be baked, and is hardly visible on the coils of rod, which therefore are much darker in appearance than lime coated rod.

The rod is then drawn as desired with any suitable lubricant such as soap powder, the coating of the glossy wire thus obtained consisting of sodium silicate and soap.

For types of wire which ordinarily require very heavy lime coatings, such as two-draft wire, for example, we have found that dipping first in a sodium silicate solution without sulling, followed by dipping once in another separate rather light lime suspension, gives a uniform very tightly adherent coating. Such a coating is satisfactory for two-draft wire, for example, and also for all kinds of wire which may require as many as four or more drafts in wire drawing.

Although we have thus described our invention in considerable detail, we do not wish to be limited strictly and narrowly to the exact particulars so disclosed but may use such substitutions, modifications, or equivalents thereof as are embraced within the scope of the invention or pointed out in the appended claims.

Having thus described this invention, what we claim as new and desire to secure by Letters Patent is:

1. The method of drawing coils of metal rod into wire, which consists in dipping the coils into a 1 to 5 per cent aqueous solution of sodium silicate only at about 200° F. temperature, and then drawing the rod.

2. The method of drawing metal rod and wire to form wire, which consists in dipping the rod into a hot solution consisting solely of sodium silicate and water to deposit a coating on the rod, allowing the rod to dry to harden the coating, passing the rod through a soap powder lubricant, and drawing the coated and lubricated rod and wire through a die.

3. The method of drawing metal rod and the like to form wire, which consists in applying to the metal rod a primary coating of sodium silicate only and a secondary coating of lime, and drawing the coated metal rod through a die.

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