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WIRE COATING

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My invention relates generally to metal wire stock, and more specifically concerns both a lubricant for the same and a method for uniformly applying it as a coating on the wire stock. Additionally, my invention concerns a coated wire stock in which the coating serves as a lubricant.

An object of my invention is to provide metal wire stock admirably suited for a variety of cold-forming uses and having a thin coating of lubricant of uniform thickness closely and tenaciously adherent thereto, and this through a wide variety of diversified forming operations, the coating at all times displaying requisite thinness and uniformly adequate lubricating qualities, its use permitting minimum treatment of the wire preparatory to forming operations, both before and after coating the wire.

Another object is to provide, in ready, simple and direct manner, at minimum of investment both in plant, materials and labor, a coating of the general type described, displaying excellent lubricating qualities, and which is tenaciously adherent upon the wire stock, serving adequately as a lubricant in subsequent cold-heading, extruding, forming and generally like operations, and materially facilitating ejection of the wire from heading or generally similar dies.

Another object is to provide a coating composition, which, simple in itself, is readily, inexpensively and easily prepared in direct and certain manner, requiring only readily available and inexpensive materials, and capable of being easily and rapidly applied in direct, simple and certain manner to metal wire stock of the type described.

Yet another object is to provide a method of applying a thin, tenacious and adherent coating of uniform depth upon metal wire stock, which method is both simple, direct, certain, positive and predictable in results, and is readily and quickly applied with minimum investment in labor, plant and materials and involving only the use of materials which are readily available on the market at low cost.

All the foregoing, as well as many other highly practical objects and advantages, attend upon the practice of my invention, which in part will be obvious and in part more fully pointed out hereinafter during the course of the following description.

Accordingly, my invention resides in the various materials and ingredients and in the mixture and composition thereof, in the products treated therewith, and in the several manipulative and procedural steps and the combination of each of the same with one or more of the others, the scope of the application of all of which is more fully set forth in the claims at the end of this specification.

To permit a more thorough understanding of my invention it may be noted at this point that in the production of a great variety of metal articles, of which screws, bolts and studs are typical it is most advantageous,

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where at all possible, to form these articles, known generally to the trade simply as fasteners, by cold-heading, cold-drawing or extruding operation followed by a thread-rolling operation. Nuts are formed by punching and threading. Savings of utmost importance are realized in both time, labor and material.

In general, much greater stresses are involved and much greater forces are required in the cold-deformation of stainless steel stock than is true in the treatment in generally similar manner of the carbon grades of steel. They are far more resistant to cold-deformation than are the ordinary steels. Illustratively, stainless steel requires 30% to 40% more energy to draw them through the dies, or in applying them against the heading dies, than do the usual carbon grades. It is apparent, therefore, that important savings attend upon any easing and facilitation of the heading operations. For by so doing important increase in tool life can be achieved, while head shapes of difficult contour can be followed closely with improved finish detail, sharper corners and the like.

Typically, in such forming technique wire is fed into the heading machine where a blank of desired length is cut off. This blank is then moved into a retaining slot leaving a small portion exposed. And in either a single or double operation as desired the exposed portion is sharply struck by one or more heading dies. The headed blank then is ejected from the retaining slot by an ejecting pin extending through the base of the slot.

Very often it is found that ejection is difficult because of the swelling of the main portion of the blank as a result of the heading operation, the swollen blank then binding against the walls of the retaining slot. To minimize the binding action a lubricant is used. But it frequently happens that certain lubricants will scale off from the surface of the blanks and clog the ejecting mechanism.

Following the heading operation, any thread which may be required is thereupon rolled onto the headed blank. And the headed and threaded fastener is finished by removing the lubricant. Where certain coatings of the prior art are employed the fastener, upon removal of the coating, is found to be undersize.

Usually the coating is applied by the wire manufacturer. Wherever applied, be it at the production mill or at the fabricating plant, this coating serves as a lubricant for the forming dies as noted. And, typically, these coatings comprise a film of oxide together with lime or soap. In some cases a copper coating is first plated onto the wire, this in itself contributing as a lubricant.

Over a period of time many variants of such coatings have been suggested. For one reason or another, however, they have fallen short of the desired result. A typical defect is that these coatings are not uniform. And in many instances they are too thick. Thus in copper-coated wire, the copper frequently is found to adhere too thickly, this on the order of 0.0015 inch, and lacking uniformity as well. When the lubricant is subsequently removed the resulting fasteners are found to be irregular and undersized.

Similarly, where the wire is dipped into molten lead a coating is produced which is moderately good, and remains through a limited number of fabrication steps. Such coating, however, is much too thick for practical use in upsetting operations.

In other instances, known lubricants do not display sufficiently advantageous lubricating qualities. In such cases rapid die wear results, the production costs mount, both the coating operation and subsequent fabrication are

unduly prolonged, energy requirements increase, and close adherence to finish detail is no longer practical.

Accordingly, an important object of my invention is to avoid in large measure the several disadvantages and defects heretofore confronting the art, and at the same time to provide both a coating composition, a method of coating metal wire stock, and a coated wire stock on which a thin and uniform lubricating coating is closely and tenaciously adherent at all times, providing adequate lubrication during complicated cold-forming practices, and permitting close adherence to finish detail with low dimensional tolerances all in the absence of undue mechanical stressing and all through the use of both a coating composition and a method of applying the same which are of low cost and are direct and simple in application.

In practicing my invention I have found excellent results to attend upon preliminarily treating stainless steel wire either by annealing, pickling and lime-coating the same, on the one hand, or annealing, pickling and thereafter copper-coating and then lime-coating the wire, on the other hand. The stainless steel wire thus prepared is then cold-drawn on the conventional draw bench, supplied however with a draw box in which I provide a lubricant coating composition consisting of an intimate admixture of substantial quantities of metal stearate powder, powdered lead, and common soap powder.

In general, I find a satisfactory composition to contain by volume, up to 50% metal stearate powder selected from the group consisting of lead stearate, calcium stearate, aluminum stearate and zinc stearate, up to 100% powdered lead, and the balance common soap powder (sodium stearate). I provide these ingredients, intimately admixed into a composition of uniform consistency, in a draw box located in advance of the drawing die. With the metal wire stock preliminarily treated in the manner set forth hereinbefore I draw the same, passing it through this draw box, and pulling it through the final reduction die so as to provide a final reduction of say 5% in cross-sectional area.

The proportions of lubricant coating composition which I presently prefer, and which I find to produce highly advantageous results comprises equal parts by volume of: common soap powder, calcium stearate powder and powdered lead. The powdered lead is readily obtainable on the market, and I have found to be most satisfactory that grade known as MD101, supplied by Metal Disintegrating Company, Elizabeth, New Jersey, to which no mesh size has yet been given. The calcium stearate used is known to the trade as Metasap 50-DT supplied by Metasap Chemical Company, a subsidiary of Nopco Chemical Co., Harrison, New Jersey. This comprises almost 100% calcium stearate.

In a typical example I provide a composition comprising equal parts by volume of Ivory soap powder, calcium stearate and powdered lead. With this intimate admixture in the draw box, and with the draw-bench set for a 5% reduction in cross-sectional area, I pass an 81 pound coil of 0.248 inch type 304 lime-coated wire through the box and die, cold-drawing the wire to an 0.242 inch diameter. As a further example I pass 74 pounds of type 304 uncoated wire through draw box and die with the same reduction in diameter. The resulting wire stock was found in both instances to have an exterior lubricant coating of uniform thickness and displaying excellent lubricant qualities in the drawing die and in subsequent cold-heading and like operations. Both samples of wire were readily formed into precision machine screws when subjected to cold-heading and threading practices; and in general, the material cold-headed with a high degree of satisfaction. After removing the lubricant no size loss was observed.

While in the foregoing I have suggested both typical and preferred coating compositions, it is apparent that following my invention the percentage composition of

the intimate admixture of ordinary soap, metal soaps, and lead can be widely varied with admirable results, dependent upon the final use to which the finished wire is put. Moreover, where a heavier coating is permissible I have found that a lubricant coating particularly desirable in cold-heading, extrusion, punching or drawing, is provided by preliminarily coating the wire with any one or combination of several coatings, such as oxide, lime, metallic copper and the like. In point of fact, I find this combination to provide excellent results.

While I cannot explain just why it is that the preliminary lime-coating contributes advantageously to the practice of my invention, I suggest that this is due to the lime holding the soap added during the passage of the wire through the draw box. It may be that this helps retain the soap to give improved cold-drawing. In any event, I have found that where the wire is preliminarily lime-coated, the soap closely adheres to the wire while passing through the drawing die and a desired thin lead coating on the drawn wire is had.

The high pressure lubricant which I employ, being applied while and as an incident to the final light reduction pass in the draw bench, is thereby caused to form a thin and tenaciously adherent coating on the wire, uniform in cross-section, and which is removable only with considerable difficulty, in subsequent processing. Moreover, I find such coating to be substantially insoluble in water. The coating is durable, and its lubricating qualities are long-retained.

It is worthy of note that during the course of my investigation I found that the metal coatings alone are not satisfactory. Thus when lead powder alone was used in the draw box, it was inclined to pack and the wire tunnel through. The coating thereby produced on the wire stock was not uniform. Although the coating at first appeared to give adequate lubricating results, with subsequent fabrication many bare spots were observed. With the lead powder intimately admixed with the powdered soaps, however, the powdered soap appears to keep the powdered lead loose in the draw box. In addition, the passage of the wire through the draw box uniformly agitates the lead powder throughout the coating operation, and tends further to loosen fluff the same. The resulting coating had is uniform throughout the length of the wire, as is apparent from inspection of the wire after cold-drawing.

My new coating is thin, is of uniform cross-section, is closely tenacious and displays close adherence to final dimensional requirements. Tolerances are reduced to a minimum. Mechanical resistance to draw is appreciably reduced with minimized strain; and the forming operation can be carried out in rapid and certain manner, with appreciable savings in die wear. Production costs are substantially reduced. The coating, thin and tenacious, remains firmly adherent to the wire stock until intentionally removed upon the completion of the fabricating operations. The materials employed are readily available and of comparatively low cost. They can be readily commingled into the required intimate admixture. The quantity of coating composition employed per unit of wire length is small.

All the foregoing advantages, along with many other highly practical results, attend upon the practice of my invention.

Although my invention has principal application to the production of stainless steel wire and is largely intended therefor, I find it to have advantageous application in the manufacture of carbon steel wire. Where employed for this purpose, I find it preferable to permit the wire stock to rust slightly. When the wire is thereupon limed and passed through the draw box, a closely adherent lubricating coating is formed.

It is apparent from the foregoing that once the broad aspects of my invention are disclosed, many embodiments of the invention will readily suggest themselves to those

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skilled in the art, all falling within the scope thereof. Accordingly, I intend the foregoing disclosure to be considered simply as illustrative, and not as limitative.

I claim as my invention:

1. A coating composition for improving the cold-forming properties of metal wire, consisting essentially of an intimate admixture of approximately equal parts by volume of powdered lead, calcium stearate powder and common soap powder.

2. Stainless steel wire of improved cold-forming properties having thereon a thin layer of cold-forming lubricant consisting essentially of about equal proportions by volume of common soap, lead and metal stearate selected from the group consisting of calcium stearate, aluminum stearate, lead stearate and zinc stearate.

3. A coating composition for improving the cold-forming properties of metal wire, comprising an intimate admixture consisting essentially of roughly equal parts by volume of metal stearate powder, not exceeding 50% by volume, selected from the group consisting of calcium stearate, aluminum stearate, lead stearate and zinc stearate; powdered lead; and common soap powder.

4. A coating on metal wire for improving the cold-forming properties of the wire, comprising an intimate admixture consisting essentially of roughly equal parts by volume of calcium stearate, not exceeding 50% by volume; lead; and sodium stearate.

5. A method of providing a lubricant coating on stainless steel wire to improve subsequent cold-forming opera-

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tions of the wire, comprising preliminarily subjecting the wire to a treatment comprising annealing, pickling and lime-coating; and thereupon cold-drawing the treated wire through an approximate 5% final reduction, after passing the same through an intimate admixture of roughly equal parts by volume of metal stearate powder, not exceeding 50% by volume, selected from the group consisting of calcium stearate, aluminum stearate, lead stearate and zinc stearate; powdered lead; and common soap powder.

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