UNITED STATES PATENT OFFICE.

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SPRING.

1,383,175. Specification of Letters Patent. Patented June 28, 1921.

No Drawing. Application filed October 23, 1919. Serial No. 332,795.

To all whom it may concern:

Be it known that we, (1) MARVIN J. UDY and (2) FRANK C. NICHOLSON, citizens of the United States, residing at Kokomo, in the county of Howard and State of Indiana, have invented certain new and useful Improvements in Springs, of which the following is a specification.

This invention relates to the protection of springs of all descriptions against rusting. It is generally known that springs which are originally not brittle, are brittle after being electroplated. This is especially true of relatively fine springs or sensitive springs, whether they be coiled or flat springs or spring blades.

We have discovered that springs of all descriptions and spring blades do not lose any of their original properties or are not materially affected as to their physical properties if they are coated with a metal which is electro-positive to the metal of which they are made. We have principally in mind steel springs covered with a coat of cadmium.

The coat is applied by electrodeposition and preferably by electrodeposition and subsequent heat treatment as described in my co-pending applications Serial No. 304,020 filed June 13, 1919, and Serial No. 332,796, filed October 23, 1919.

The treatment of the springs to be protected may be as follows:

1. Preparation of plating solution.

A solution containing about 25 grams of cadmium per liter of solution, we have found, is most convenient for the purpose. Enough of a salt cadmium such as the sulfate or chlorid to yield 25 grams of metallic cadmium is weighed and dissolved in as small amount of water as possible. If metallic cadmium is used, it may be dissolved in hydrochloric acid to form a neutral solution or it may be dissolved in nitric acid and evaporated to dryness with hydrochloric acid to remove the nitric acid. After the cadmium is dissolved and is in a neutral or nearly neutral solution, a solution of sodium or potassium hydroxid is slowly added until the cadmium is precipitated and the solution is red to phenolphthalein. Sodium or potassium cyanid is now slowly added until the precipitated cadmium oxid is all dissolved, an excess of cyanid being avoided. The solution as thus prepared constitutes the bath used for electroplating the spring. Other strengths of solution may of course be used, but a solution of 25 grams cadmium per liter we find preferable for use. The anode is metallic cadmium. A current density of 7 amperes to 50 amperes per square foot of cathode area can be used. About 7 amperes per square foot are preferred. Lower and higher current densities have been used and in fact the current density does not seem to affect the deposit. The time required for plating varies with the area of the spring and the current density used. Deposits from this plating solution are very smooth.

2. Cleaning of springs.

Before plating the springs or spring blades are cleaned of all rust and dirt by polishing with a very fine grade of emery cloth. If necessary, they may also be cleaned by dipping in dilute sulfuric acid or other chemical solutions and finally in water.

3. Electroplating.

After the springs are cleaned, they are immediately electroplated in the usual manner.

4. After the springs have received their coating, they are washed in water and placed in an oven and heated to about 150° C to 200° C. The maximum in an ordinary oven is about 200° C. The duration of the heating is not very material, but ordinarily it should take several hours. The temperature should be such that there is only a slight coating of cadmium oxid formed on the surface of the springs. Excessive oxidation must be avoided. By burying the springs or blades in calcium hydroxid, the temperature may be raised to about 250° C. without excessive oxidation. The degree of oxidation of course is governed by the temperature employed and the atmosphere in which the heating takes place.

The heat treatment has the purpose to alloy the cadmium with the metal of which the springs are made and also to harden the coating. It also serves the purpose of removing an excess of the coating metal by burning it to oxid.

5. After the heat treatment the springs are polished in any usual or preferred manner. If necessary another or other coatings may be given to the springs.

While the heat treatment is particularly advantageous and results in a superior product, a coat of protecting metal applied by the process of electro-plating alone affords considerable protection.

In the claims the term "springs" is intended to include springs of all descriptions and structures in the nature of springs such as spring blades.

We claim:

1. The process of protecting steel springs against rusting, which consists in coating the springs with cadmium and then subjecting the springs to heat to alloy the cadmium thereto.

2. The process of protecting steel springs against rusting, which consists in electroplating the springs with cadmium and then subjecting the springs to heat to alloy the cadmium thereto.

3. The process of protecting springs against rusting, which consists in electroplating the springs with a metal which is electro-positive to the metal of which the springs are made and subjecting the coated springs to heat under conditions preventing excessive oxidation of the coating metal.

4. The process of protecting steel springs against rusting, which consists in electroplating the springs with cadmium and subjecting the coated springs to heat under conditions preventing excessive oxidation of the cadmium coating.

5. A spring having a coat of a metal which is electro-positive to the material of which the spring is made alloyed therewith.

6. A steel spring having a coat of cadmium alloyed therewith.

In testimony whereof, we affix our signatures.

MARVIN J. UDY.
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