W. H. PAINE.

STRAIGHTENING IRON AND STEEL WIRE.

No. 182,468. Patented Sept. 19, 1876.

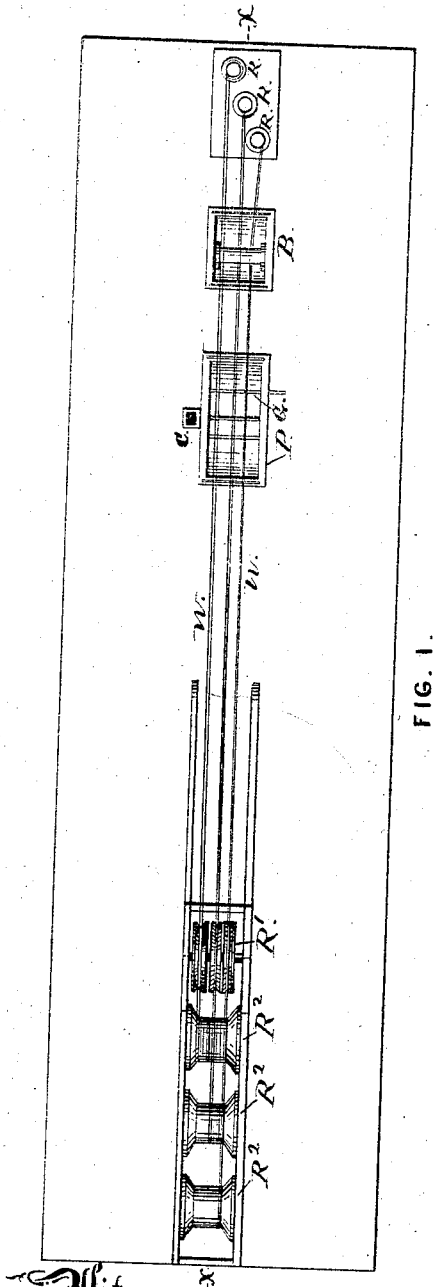

FIG. 1.

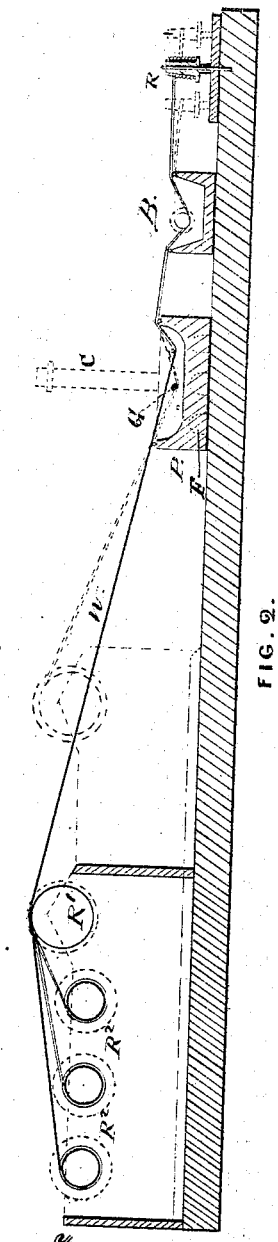

FIG. 2.

Witnesses:

William L. Miller

William Haas

Inventor:

William H. Paine

UNITED STATES PATENT OFFICE.

WILLIAM H. PAINE, OF BROOKLYN, E. D., NEW YORK.

IMPROVEMENT IN STRAIGHTENING IRON AND STEEL WIRE.

Specification forming part of Letters Patent No. **182,468**, dated September 19, 1876; application filed September 5, 1876.

To all whom it may concern:

Be it known that I, WILLIAM H. PAINE, of the city of Brooklyn, E. D., county of Kings and State of New York, have invented an improvement in machinery and in processes for straightening and coating iron and steel wire in continuous lengths of various sizes, and an improved article of manufacture produced thereby, which improvement is fully set forth in the following specification, reference being had to accompanying drawings.

Wire is now straightened in continuous lengths after having been manufactured, wound on winding-block, and thereby given the form of permanent curves by means of straightening-machines operating only mechanically, or by force operating only through mechanical devices. This treatment disturbs the original elastic limit of the wire, and impairs its ultimate strength and its value.

The object of my invention is to coat wire in continuous lengths with zinc, lead, tin, copper, or any other metal used to coat the surface of wire; or with oil, or any similar liquid, and at the same time, and in part by the means employed in that process, to produce wire which, in addition to its having a coating, as described, shall be straight, and still retain its natural elastic limit unimpaired. The wire to be so treated may be that which is coiled in rings and takes the form of spiral curves when set free; or it may be that which is already made straight by some process or treatment. When coated and treated in the manner now customary, both of these kinds of wire result in a finished product, which is coiled and set in the form of spiral curves. But when treated according to my invention the result in both cases is a product having the qualities previously ascribed to my invention.

The mechanical part of my invention consists in placing the guide-roller and winding-drum so far from the coating-bath that the wire between them, or between the guide-roller and winding-drum and some point within the coating material, shall become set while still in a straight line between them, and in making the winding-drum sufficiently large to draw the wire from the swift through the acid-bath, the coating-bath, and winding it upon the drum without resetting it thereby in spiral curves.

As wire is now coated, even if previously straightened, it becomes again fixed or set in spiral curves after being subjected to the coating process. The same result follows the treatment of wire not previously straightened. Consequently, after wire has been coated it is now subjected to treatment by straightening-machines operating by force applied only through mechanical devices, whereby it is injured, as previously described.

Figure 1 shows my invention in top view, and Fig. 2 in longitudinal sectional view on line *x x*.

R R are the usual swifts, upon which the rings of wire to be coated and straightened are placed; B, the usual acid-bath employed in the process of coating; P, the coating-bath, placed over the furnace F, provided with the chimney C, and in which the coating material is located; R^1 R^1, the guide-rollers which first receive the wire W W from the bath in a straight line therefrom, or from a guide, G, located within the body of coating material in the bath P; R^2 R^2, the winding-drums, upon which the wire is finally wound after it has become cooled and set while in a straight line.

The guide-rollers are elevated so that the wire may extend from the guide G within the bath P to the tops of the rollers in a continuous straight line. The drums R^2 R^2 are placed lower than the guide-rollers, requiring the wire to be bent over the latter in order to reach and be wound upon the former in the usual manner.

The location of the guide-rollers and drums is variable, according to the size of the wire, in any given temperature, and must be such that the wire will be sufficiently set while held in a straight line not to receive a new set from either of them.

The wire need not pass in a straight line through the coating-bath; and it will effect my object fairly well if it be held in a straight line only from the last guide on the pan to the guide-roller; but I obtain the best results by extending the straight line of the continuous

wire from a guide located within the coating material, and at about the center of the pan to the guide-roller R^1.

The wiping mechanism and process to remove the surplus coating material and give a smooth surface to the wire may be located at the outlet of the coating-bath. The winding-drum operates the wire, and, being resisted by sufficient friction applied in any known manner to the swift R or to the wire, at any point anterior to the straight line extension thereof, creates sufficient tension to remove any curves or kinks, and to hold the wire straight.

The wire may, however, be supported at points along the straight line extension, or along its whole length. The operation of straightening by tension may be assisted by employing pins placed either in the coating material or near the end of the coating-bath toward the winding-drum, between which the wire may be drawn after it is sufficiently heated and softened in the bath, so as to be in part straightened thereby. The wire passes from the swifts through the bath B and coating-bath P, being carried below the surface of the fluid contents of each by the guides located therein as usual for that purpose; and thereafter to the guide-roller and drum, either through the air of an ordinary or artificially-lowered temperature, or through any liquid cooling medium to hasten the setting of the particles of the wire by simply lowering its temperature, or, if desired, through any wiping or drying medium.

The material in the coating-bath may be molten zinc, lead, tin, copper, or any other metal used to coat the surface of wire, or oil or any similar liquid.

In some instances it is considered desirable to coat only a part of the article to be coated, leaving the rest uncoated, and by the use of of similar means the whole of the wire may be passed through the coating material, and yet be left uncoated. This means consists in omitting the treatment given in the acid-bath.

I contemplate the use of my invention under such circumstances, so as to straighten the wire thereby, although the usual means be employed to prevent the coating material from adhering to the wire in whole or in part.

The winding-drum I operate in the usual way, (not shown in the drawing,) and at the usual speed.

For No. 8 wire, and in an average temperature acting upon the straight extension of the wire, I make the drum four and a half feet in diameter, and locate the guide-roller and winding-drum eighty feet from the coating-bath.

For No. 14 wire I make the drum two and a half feet in diameter, and the distance from the coating-bath fifty feet.

For other sizes of wire I make sizes and distances in proportion.

These distances of the guide-roller and winding-drum from the coating-bath may be diminished by interposing in any ordinary manner an artificial cooling medium of a temperature less than the average atmospheric temperature; and this diminishment may be made in proportion as this cooling medium is lowered in its temperature.

I have represented in the drawing three systems, consisting of a swift, a guide-roller, and a winding-drum, with the intervening acid-bath and coating-bath, through which latter the three wires upon each system may pass or be passing at one and the same time. These systems may be increased to the usual extent.

The article produced by these combined processes has the following qualities: First, the wire is provided with a coating, except when the coating is not caused to adhere, as described; second, the natural limit of elasticity of coated wire is retained unimpaired; third, it is in continuous lengths; and, fourth, it is straight.

In using the term "natural limit of elasticity," I do not refer to any limit of elasticity existing in the wire at any time previous to the treatment herein described. In passing through the coating-bath such previous limit may be disturbed. I refer instead to the resulting limit of elasticity produced jointly by the heating of the coating-bath and the cooling and setting of the wire while straight. Since I pass the wire subsequently, and while too cold to be permanently bent thereby, over the guide-roller, and wind it upon a drum sufficiently large, this natural limit of elasticity is retained.

When the wire is left uncoated, as above described, the first quality mentioned is of course wanting, but the other qualities remain.

Each metal or liquid employed in the coating-bath having its own characteristic temperature when in the proper fluid condition to produce the intended effects, the wire in passing through it may be acted upon in a manner also characteristic, resulting in a more or less characteristic limit of elasticity in any given kind of wire. A similar result may be found in any given kind of wire when it has received the other parts of the treatment described, but has not been passed through the acid-bath, and when it is not desired to coat the wire.

I claim as my invention—

1. The combination of the process of coating and the process of straightening iron and steel wire in continuous lengths in one continuous process, consisting in passing the wire continuously from the swift through the acid-bath, thence to and through the coating-bath, thence in a straight line to the guide-roller and drum, these latter being placed so far from the coating-bath that the wire shall be cooled and set before reaching them, and then

winding it upon the drum made of such a size, according to the size of the wire, that it shall not be permanently set thereby.

2. The combination of the molten and liquid bath P and the winding-drum R^2 and guide-roller R^1, the two latter being placed so far from the former that the wire between them becomes cooled and set while extended in a straight line, the winding-drum R^2 and guide-roller R^1 being so proportioned that the wire shall not be reset in spiral curves upon its being wound or bent thereon.

3. As an improved article of manufacture, straight coated wire in continuous lengths, with its natural limit of elasticity unimpaired.

4. As an improved article of manufacture, straight wire in continuous lengths, with the limit of elasticity naturally imparted by the coating-bath unimpaired.

WILLIAM H. PAINE.

Witnesses:
WM. H. BUTTERWORTH,
HENRY J. FERGUSON.