UNITED STATES PATENT OFFICE.

M. SOREL, OF PARIS, FRANCE.

METHOD OF PRESERVING IRON AND STEEL FROM RUST OR OXIDATION.

Specification forming part of Letters Patent No. **510**, dated December 7, 1837.

To all whom it may concern:

Be it known that I, M. SOREL, of the city of Paris, in the Kingdom of France, have invented or discovered a process, method, or methods by which various articles made of iron or steel may be effectually preserved from oxidation or rusting by the galvanic action produced by zinc; and I do hereby declare that the following is a full and exact description thereof.

It is well known to chemists and to all persons versed in the physical sciences that a galvanic action is produced by the contact of two metals different in their natures, and that the most oxidizable of these two metals so brought into contact becomes positively electrified, while that which is least oxidizable becomes negatively electrified; and also that when brought into this state the most oxidizable or positively electrified metal has a tendency to become oxidized and will abstract oxygen from compounds containing this agent, while the least oxidizable of the two metals will be protected from oxidation although exposed to agents which would oxidize it but for the contact of the negative metal. My process depends for its efficiency in protecting iron and steel from oxidizing or rusting upon the manner in which I apply this principle.

The process of covering articles of iron with tin is well known, and is exemplified most largely in the manufacture of what is usually known under the name of "sheet-tin" or "tin-plate," which consists of thin sheets of iron coated with tin. In this material there is necessarily a galvanic action between the two metals; but it is to the disadvantage of that which it is proposed to protect—namely, the iron—which, being more oxidizable than tin, becomes positively electrified, and has its tendency to rust increased, the protecting effect of the tin depending in this case entirely upon the perfectness with which the iron is coated by it, as is clearly evinced by the rusting of the iron whenever any portion of this coating is removed and the iron is exposed to the action of air and moisture. Were the galvanic action in favor of the iron, it would be protected notwithstanding the abrasion of the tin, as its protecting influence is not limited to the mere point of contact, but extends far beyond it. In the scale of the oxidability of the different metals, commencing with those which are the most oxidable, it has been found that zinc stands before iron, and it follows, therefore, that when these two metals are brought into contact a protecting influence will be exerted upon the iron by the zinc, and that the rusting of the former metal will be thereby prevented.

It might be supposed from the fact that zinc is more oxidable than iron that this metal, if employed to protect iron, would itself soon become oxidized or rusted, and would consequently leave the iron unprotected; and such reasoning would undoubtedly be just but for another fact, well known to chemists, that there are certain metals (of which zinc is one) which, after they have acquired a thin superficial coat of oxide, are thereby effectually protected from the further absorption of oxygen under ordinary exposure.

Having thus fully exemplified the principle upon the application of which my process is dependent for its efficacy, I will now proceed to give the necessary details and the various modes which I have devised for carrying the same into operation. These modes which I have essayed are five in number, and are as follows: first, applying the zinc to the iron or steel in the manner in which tin is applied in the process of tinning; second, applying a galvanic powder in the manner of paint, which consists in mixing the zinc, reduced to fine powder, with oils or various materials, so as to form a paint or varnish, with which the substances to be protected are to be covered in the ordinary manner of painting or varnishing; third, covering the articles to be protected with the galvanic powder, consisting of zinc finely comminuted; fourth, wrapping the articles to be protected in what I denominate "galvanic paper;" fifth, anointing or covering the articles with a galvanic paste, consisting of any suitable fatty matters—such as purified lard—in which the galvanic powder has been freely mixed.

The first process—that of coating the articles to be protected with metallic zinc—is to be effected much in the same manner in which tinning is performed—that is to say, the articles to be coated must be rendered clean and free from oxide by processes analogous to those followed in preparing them for ordinary tinning, such as immersing them in diluted sul-

phuric or muriatic acid, scouring them, &c., which processes, being well known, need not be described. The zinc in like manner must be poured in proper crucibles or other convenient vessels adapted to the nature and size of the articles to be operated upon, special care being taken to keep the metal covered with sal-ammoniac or other proper flux, and to regulate the heat in such way as is required by the volatile nature of the metal. The articles to be coated, after being dipped into the melted zinc, are to be withdrawn slowly, that too much of the metal may not adhere to them. They are then to be thrown into cold water, rubbed with a sponge or brush, and dried as quickly as possible, as otherwise they may be injured by the appearance of dark spots, which it is desirable to avoid. When chains for cables or for other purposes are being withdrawn from the zinc they must be shaken until sufficiently cooled to prevent the links from being soldered together by the melted metal. The coating of small chains requires careful management; but by the following procedure it is effected without difficulty: While in the dilute acid they are to be moved about to expose all their parts equally to its action. They are then to be dipped into muriatic acid and immediately dried in a reverberatory furnace. The melted zinc being ready and covered with sal-ammoniac, the chains are to be put into it and suffered to remain there about a minute. They are next slowly taken out by means of an iron skimmer or other convenient instrument, which will allow as much of the zinc to drop from them as can be got rid of in that way. The links, however, will still retain too much zinc, and will be soldered together. To correct this they are to be put into a reverberatory furnace, to be covered with charcoal, and retained at a red heat for about a quarter of an hour, during which time they are to be moved about by means of an iron poker. By this treatment the excess of zinc will be discharged. They are then to be drawn toward the mouth of the furnace, where they are kept in motion until the zinc is solidified. When small nails and such like articles are to be coated the process should be performed in small crucibles, this being necessary to prevent the danger of spoiling a considerable portion of zinc, which results when iron has been kept in it for a considerable length of time, as it is thus rendered unfit for the purpose of a protective coating. In all cases the purest zinc should be employed. Wire may be coated by passing it through the melted zinc as it is wound off from one drum or reel onto another.

When articles of wire have been coated with zinc it is sometimes desirable to cover this coating with one of tin, more especially when culinary vessels are the subjects of the operation. It may also be resorted to when it is desired to give a bright and more handsome surface than the zinc affords. Such a coating of tin will not destroy the galvanic effect of the zinc, and it is to be effected in the ordinary way of tinning, particular care being taken not to heat the tin too highly or to keep the articles in it so long as to remove any portion of the coating of zinc. The galvanic powder, consisting of zinc reduced to that state, may be obtained by various means. The following, however, I have found to be the most economical of any which I have essayed. The zinc is put into a reverberatory furnace and brought nearly to a red heat, care being taken to prevent the access of a current of air. It is then carefully skimmed and covered with sal-ammoniac. Iron filings equal in weight to about one-tenth part of the zinc are to be moistened with muriatic acid and thrown on the fused zinc. The whole is to be covered with finely-pulverized charcoal and the heat of the fused metal raised to whiteness, and so retained for a quarter of an hour, agitating it at intervals by means of an iron poker. The melted mass is then to be run off into a brick or cast-iron reservoir, which is covered with a plate of cast-iron to prevent the combustion of the zinc. Through an aperture in the cover a poker or stirrer is to be introduced to agitate the alloy, which is to be done until it is cool, when it will be in fine powder. The galvanic paint is prepared by grinding this powder with the fluid which is to be employed to form it into a paint or varnish. Various fluids may be used for this purpose. I have sometimes employed the oil distilled from coal-tar. Coal-tar itself answers well, with the addition of one-third of spirits of turpentine, or of a sufficient quantity to bring it to a proper consistence. For purposes where the odor of this mixture would be objectionable others may be substituted. Articles of polished steel or iron packed in this galvanic powder so as to be covered thereby will be preserved from oxidation even should they become moistened from any accidental cause.

Galvanic paper may be prepared either by the mixing of the powder with the pulp in the manufacturing of the article or by taking the ordinary wrapping-paper, coating it with any suitable adhesive substance, and sifting the galvanic powder over it. Polished or other articles wrapped in such paper will be effectually protected from rust by the galvanic action.

The preparation of the galvanic paste has been sufficiently explained, and its operation in protecting the articles coated with it will be readily understood, as it is analogous in this respect to those previously described.

Having thus fully explained the principle upon which my process of protecting iron and steel from rusting or oxidating is dependent, and having also given the various modes in which I have contemplated the carrying the same into effect, I do hereby declare that what I claim as of my invention, and wish to secure by Letters Patent, is—

The employment of zinc in various forms as a

covering to the respective articles to be thereby protected, as herein set forth.

I do not claim to be the discoverer of the principle of the protection of metals from oxidation by galvanic action; nor do I claim to be the first to have proposed the employment of zinc for the preserving of iron therefrom, masses of zinc having been applied, or it having been proposed to apply it in masses to steam-engine boilers and probably to other articles with this intention; but from this my plan or mode of procedure differs as obviously as it surpasses it in efficiency and in its applicability to numerous purposes in the arts where the application in masses would be impossible or altogether unavailable.

SOREL.

Witnesses:
W. THOMPSON,
THOS. P. JONES.