UNITED STATES PATENT OFFICE.

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IMPROVEMENT IN TINNING AND PLATING IRON SCREWS.

Specification forming part of Letters Patent No. **49,586**, dated August 22, 1865.

To all whom it may concern:

Be it known that we, DE GRASSE FOWLER and HERBERT E. FOWLER, both of Wallingford, in the county of New Haven and State of Connecticut, have invented certain new and useful Improvements in Tinning, Plating, and Galvanizing Wood-Screws; and we hereby declare that the following is a full, clear, and exact description of the same.

In the fitting or uniting of the parts of a large number of articles of furniture, the trimmings or fittings of railway-cars, burial-cases, and other articles too numerous to mention, iron wood-screws are used, of which, for the sake of ornament and durability, it is desirable to coat the surface with a metal which may be either highly polished or protect the iron against oxidation and deterioration, and, particularly for ornamental purposes, iron wood-screws have heretofore been silver-plated or galvanized; but the means heretofore known and used for effecting this were defective because of the want of durability or the impossibility of causing the silver to adhere to the surface of the iron. On the other hand, for useful purposes, it was attempted to coat iron wood-screws with tin; but neither the old tinning process nor the modern modes of depositing the tin or iron by galvanic action gave satisfactory results. As to the silvering, it could not be done without an intermediate deposit of copper, which it is difficult to cause to adhere to the iron, because the cyanide in excess dissolves the pellicle of copper, and the silver which takes its place can be removed by the touch of the finger. If the silvering be attempted directly on the iron, the oxide of iron formed behind the pellicle of silver will in very short time strike through the silver, and detach it from off the surface of the iron. For very temporary purposes, it is true, screws were silvered by rubbing upon its surface a temporarily-adhesive silver powder; but this is rather a fraud than a legitimate manufacture, and no special reference to this mode of operation is here needed. As to the tinning, the process universally employed for tinning small iron articles is that by dipping the said articles when chemically pure—that is to say, entirely deprived of foreign matter by thoroughly cleansing them in diluted sulphuric or hydrochloric acid—in melted tin. This process when applied to wood-screws produces bad results, and destroys the character of the screws, because the tin is liable to clog up the thread and form rugosities on the surface of the screw. The other processes by which tinning is effected consist in immersion of the article in a tin solution, producing a mere whitening of the surface of the article and presenting no durability, and in depositing the tin by galvanic action, neither of which commend themselves to manufacturers on account of great cost and length of operation and want of durability.

From this statement of the condition of the art, the object and nature of our invention will be understood to consist, first, in a ready and perfect means of tinning; second, in a durable and cheap method of silvering iron articles.

To enable others to make and use our invention, we shall now proceed to describe the manner in which the same is or may be carried into effect, and, for illustration, we shall describe the process as applied to wood-screws as the type of small articles designed to be tinned, plated, or silvered.

The screws are first thoroughly cleansed of any oxide or rust or other foreign matter that may adhere or have formed on their surfaces, by thoroughly washing the same in diluted hydrochloric or sulphuric acid. We have found that the following solution answers the purpose exactly: We take a given quantity of zinc and place it in a vessel in which muriatic or hydrochloric acid is poured in sufficient quantity to entirely dissolve the zinc. To this solution we add sal-ammoniac, say one-quarter pound for each gallon of the solution. In this solution the wood-screws are thrown in a quantity, constituting a "batch"—that is, the amount operated on at each operation—which, for ordinary purposes, is three pounds, more or less. The screws are allowed to remain in the solution but a few minutes, when they are taken out and allowed to drain.

While the cleansing operation is going on preparation is made for tinning. For this purpose we use a furnace of any known or suitable construction, consisting, for instance, of a cylindrical fire-chamber provided with grate-bars, upon which a charcoal, wood, or other fire is built. This fire-place is surmounted by a flue

or chimney to carry off the smoke or products of combustion. This fire-place is also provided with an opening in front and with supports to place the vessel or article to be heated upon them. It will be understood that any heating medium will answer the purpose, although we prefer a furnace expressly built for greater convenience. The screws, cleaned as before described, are then put into a cylindrical vessel, which, however, is previously heated red-hot in the furnace described before the screws are put into it. The cylinder containing the wood-screws is then put in the furnace and placed obliquely upon the supports, so that the operation and the effect of the heat can be watched by the operator.

While the screws are exposed to the heat in the cylinder the latter is constantly rotated or oscillated by hand or by suitable machinery, so as to shake the mass of screws and keep them in constant motion, whereby the heat is caused to penetrate the same more uniformly, and to expand, as it were, the pores of the iron. When the requisite degree of heat is attained fine scrapings of tin are added. The tin we prefer to scrape or "mill" by machinery consisting of revolving cutters, so that the scrapings or particles may be of as uniform size as possible, and the quantity of the scrapings added to each batch is calculated to be that which is to constitute the coating and which is to be absorbed or used up at one operation. In this way the thickness of the coating of tin may be regulated by the quantity or weight of scrapings added.

As soon as the tin is introduced into the cylinder and added to the screws the cylinder is violently agitated by oscillations or quarter-revolutions around its axis, or by any other motion which will insure motion and frictional contact of the surfaces of the screws while surrounded by the particles of tin in the cylinder. The effect of this operation is this: The tin particles in contact with the heated iron are melted, and penetrate, as it were, the pores of the iron, which are opened by the heat to which it is submitted, while the constant motion which simultaneously takes place has a tendency to remove all excess of tin and to polish or work off the cloggings or rugosities which may otherwise form over the surface and among the threads of the screws. All this is effected in about one minute, more or less, when the cylinder is taken away from the furnace, and immediately emptied into a separator or chute. This chute consists of a vertical box of as great a height as is possible, and provided with inclined planes arranged alternatingly on opposite sides of the box, so that when the screws are thrown into the chute they are caused to travel an extensive circuit before they reach the bottom of the chute, where the screws are emptied into a receiver containing cold water. We deem it important to make the chute or separator very high, because the arrival of the screws in the cold water should be retarded as much as possible. On the other hand, the falling of the screws upon the inclines and from one incline to the other not only completely separates the individual screws, but has a tendency to polish and give a peculiar finish to the screws. After a few seconds' immersion in cold water the screws may be taken out, and they will be found perfectly tinned, having a smooth and adhering coat of tin.

Should the surface by some defect in the operation be rough or have splinters, the defect may be remedied at once by repeating the operation upon the same batch without addition of tin. Again, if the tinning be insufficient, the operation may be repeated in the same manner, adding the quantity of tin of which the batch is deficient. Screws thus tinned are not liable to oxidize, and as the tin, when applied in the manner described, is peculiarly white and bright the screw-heads may be burnished to imitate silver-headed wood-screws. But this our invention is particularly useful and important as the preliminary step of silvering by galvanic action or by any other process known or in use; and the second part of our invention consists in the method of silvering directly upon the tinned surface of iron. This we believe is an important step in the art, as the expensive and tedious process of applying an additional coat of copper or brass is dispensed with. Moreover, the contrast between the white tin obtained according to this our invention and the silver is so little that if by wear or otherwise the silver should be removed from the surface, it will not show so conspicuously as when the copper or brass is laid bare.

Having thus described our invention, we claim—

1. The process herein described of tinning and silvering wood-screws or other like articles.

2. As a new article of manufacture, wood-screws or other like articles tinned in the manner herein described.

3. As a new article of manufacture, wood-screws or other like articles silvered in the manner herein described.

In testimony whereof we have signed our names to this specification before two subscribing witnesses.

DE GRASSE FOWLER.
HERBERT E. FOWLER.

Witnesses:
E. S. IVES,
A. POLLOK.