

UNITED STATES PATENT OFFICE.

GARDNER WILLARD, OF NEW YORK, N. Y.

IMPROVEMENT IN PROCESSES FOR LINING OR COATING IRON AND OTHER PIPES.

Specification forming part of Letters Patent No. **153,695**, dated August 4, 1874; application filed July 22, 1874.

To all whom it may concern:

Be it known that I, GARDNER WILLARD, of the city of New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Processes for Lining or Coating Wrought-Iron, Cast-Iron, or Steel Pipes with Tin and Zinc, of which the following is a specification:

It has been considered impracticable to prepare a smooth metallic surface on the interior of long lengths of iron pipe, so that it would be perfectly free from scales or oxides and indentations which necessarily occur in the manufacture of it. There have been various inventions, secured by patents, for approximating to such a result, with various but imperfect success. These have been confined generally to, first, the use of acid solutions, termed "pickling," and second, to processes of scouring with sand and emery, by means of ropes, straps, and sticks passing through the bore of the pipe.

I have discovered that, with little alteration of the machine known to manufacturers of guns or rifles as a nut-boring machine, I can turn off any desired thickness from the interior of the pipe, in lengths of fifteen or more feet, and produce throughout its length a perfectly smooth and polished surface of clear metal ready to receive a coating of tin or zinc, which not only firmly adheres, but is also itself smooth, corresponding to the surface to which it is attached.

To carry out my improvement, I have the machine above referred to extended in length corresponding to that of the pipe to be bored, and also extending the rod turning the cutting-tool. The pipe to be bored is then adjusted precisely as is practical in boring the barrels of rifles, and the cutting-tool rapidly revolved while the pipe is automatically drawn over it. The next operation is that of reaming by revolving the reamer, which is attached to a rod precisely as that of the cutting-tool. The reamer consists of a square piece of steel, ground on its sides a little concave. It is about twelve inches long, and on one of its sides is placed a square stick of similar dimensions. These being well-known tools in metal-working, need not more particularly be described. This device is also now employed for

reaming and smoothing rifle-barrels, the only change required being that of lengthening the rod working the reamer to correspond with the length of the pipe. The lubricant employed is soap and water, while the pipe is kept cool by a current of water on the outside of the pipe. The pipe having been bored and reamed is placed on a frame, where it may be heated to the melting-point of the metal to be used as a coating. Any suitable furnace for the purpose, in which the tube may be kept in an inclined position, will answer. A gas-burner furnace is convenient. This may be constructed as follows: A frame of wood or other material, with supports for the tube, so as to rest at, say, an angle of forty-five degrees inclination. Under the pipe is placed a series of gas-jets, with a series of jets for conveying a forced blast of air, the jets of gas issuing around the air-jets. A series of Bunsen burners, or blow-pipe jets, or gas-burners will answer. The supports on which the pipe rests, and also those for the gas and air pipes, may be arranged so as to be adjusted to any required inclination. The next operation is to coat the pipe with the required metal. To do this the gas is ignited and the interior of the pipe thoroughly dried from moisture, and then coated with tallow. A cork of such diameter as to leave a space entirely around it when inserted in the pipe is attached to an iron wire. Tow or cotton-waste is then wrapped around it so that it will fill the space between the cork and the pipe. The end of the wire is then run through the pipe, and the cork and tow drawn a few inches within the tube. Metallic tin or zinc is then poured into the top of the pipe, and a piece of tallow to cover the surface is placed over it, and by means of the wire the cork is slowly drawn downward. The melted tin or zinc in its passage downward coats the pipe. During the tinning or zincing the pipes must be kept sufficiently hot by the gas-jets to prevent the metal from cooling. The pipes after having been bored and reamed may be coated also by dipping them into a bath of melted tin or zinc, sufficiently deep to allow one end of the pipe to be considerably higher than the other, but the method I have described is attended with less difficulty and expense than the use of a bath.

My method of coating the pipe presents for galvanizing pipe the two advantages of forming a more durable coating, in consequence of the removal of all scales of oxide of iron and the preparation of a clear metallic surface for it to adhere to, and further, a smoother surface and thereby lessening the friction of liquids or gas in passing through the pipe. For coating pipe with tin it is essential that a metallic surface should be presented to it for a proper adhesion of the tin.

The pipe coated by my process is made much more durable than that made by the ordinary process of tinning and galvanizing, since no acid or corrosive chemical is used in removing the scale or oxide; for it is well known that small particles of acid will enter the pores of the metal in such a way as to make it exceedingly difficult to entirely remove it. When it remains, a slight corrosive action, once set up, soon destroys the pipe.

Any kind of metallic pipe capable of being bored can be coated by my process, but it is especially applicable to lap-welded wrought-iron pipes and tubes. For this kind of pipe, heretofore, there has been no process by which a smooth and truly-cylindrical bore could be obtained, and this feature especially distinguishes articles of lap-welded iron pipe, made by my process, from such as are now known. The same is true, but not in so marked a degree, of solid pipe. By this feature my pipe may be always recognized.

The method of boring and reaming prepares

the metal pipe for coating with other metals, and by other methods of applying the coating, as by electroplating, the special operations required for coating with such metals being in such case substituted for those described above. Nickel, copper, silver, and other metals may be so applied.

Having thus described my invention, what I claim, and desire to secure by Letters Patent, is—

1. The process herein described, for lining iron, steel, and other metal pipes, the same consisting in boring and reaming so as to produce a smooth, clean interior, and then applying to said surface melted tin, zinc, or other coating-metal, substantially as described.

2. A welded or solid iron pipe having a smooth cylindrical bore and an interior coating of tin or zinc, the same being a new article of manufacture.

3. The method herein described for lining and coating iron and other pipes, consisting in boring and reaming the pipe so as to produce a clean cylindrical surface, and then depositing from a solution a coating of silver, copper, nickel, or other protecting metal, substantially as set forth.

In testimony that I claim the foregoing, I have hereunto set my hand this 18th day of July, 1874.

GARDNER WILLARD.

Witnesses:

D. D. PARMELEE,
C. EDWARD RIVES.