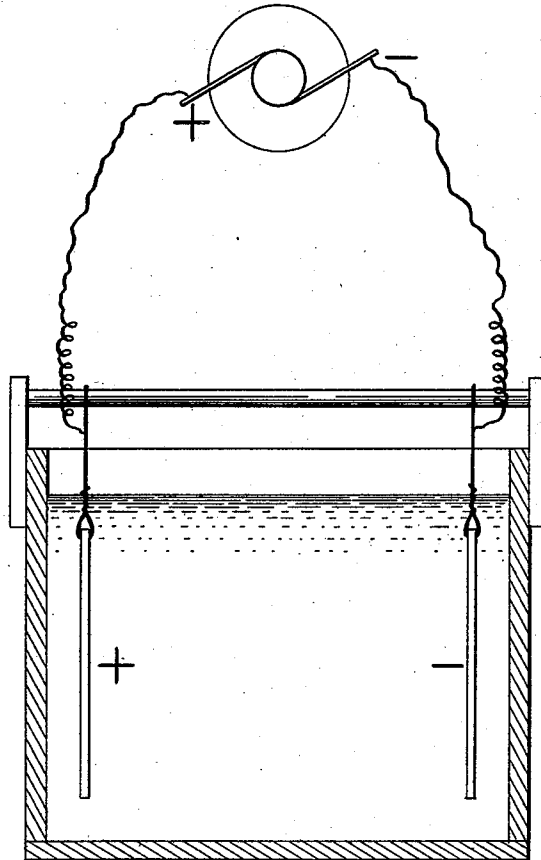


(No Model.)

A. S. RAMAGE.
PROCESS OF PICKLING METALS.

No. 568,412.

Patented Sept. 29, 1896.



Witnesses:

J. Halpenny
A. W. Cooper,

Inventor:

Alexander S. Ramage
By his Attorneys,
Gibbs & Hopkins

UNITED STATES PATENT OFFICE.

ALEXANDER SYDNEY RAMAGE, OF CHICAGO, ILLINOIS, ASSIGNOR OF TWO-THIRDS TO PECK & ROBERTS, AND V. P. SHERWIN, OF SAME PLACE.

PROCESS OF PICKLING METALS.

SPECIFICATION forming part of Letters Patent No. 568,412, dated September 29, 1896.

Application filed April 9, 1894. Serial No. 506,842. (No specimens.)

To all whom it may concern:

Be it known that I, ALEXANDER SYDNEY RAMAGE, a citizen of the United Kingdom of Great Britain and Ireland, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in the Processes of Pickling Metals, of which the following is a specification, reference being had to the accompanying drawing, which is made a part hereof, and which shows a vertical section of the apparatus used in carrying out the improved process.

In order to successfully coat one metal with another, as, for example, in tinning or galvanizing sheet metal, it is necessary to first prepare the surface of the metal to be coated for receiving the coating metal, and this preparatory process is technically known as "pickling." It is to this process that the present invention relates; and the object of the invention is to provide a process by which the pickling can be effected at a very much less cost than it can be by any other process with which I am familiar.

The process at present extensively used consists in immersing the article to be pickled in a bath of acid, such as vitriol or muriatic acid, and permitting it to remain in the bath until the acid dissolves its surface. If the metal being pickled is iron and muriatic acid be used in the bath, the dissolved iron will unite with the acid, forming chlorid of iron, and if vitriol be used in the bath sulfate of iron will result. Hence the character of the bath is constantly changing during the process, and eventually such a quantity of the acid combines with the dissolved iron that the efficiency of the bath is destroyed. When this takes place, the bath is no longer of any value and is allowed to go to waste, resulting in the complete loss of the acid originally used and of the iron with which it has combined. It has also been proposed to pickle by the process of electrolysis, making the article to be pickled the anode and using an acid electrolyte, but this is objectionable, because with an acid electrolyte hydrogen gas is liberated at one of the electrodes and polarization results. In such process, moreover, the proportion of acid employed in

actual practice was from five to six per cent., which is even stronger than that used in the ordinary picklers's vat, wherein it is present in the proportion of three to four per cent. 55

In addition to the polarization above referred to the acid electrolytic process is accompanied with the further disadvantage that on removing the anodes (or plates being pickled) the free acid attacks the cathodes with great avidity, so that not only is the iron which has collected on the cathodes during the operation again dissolved and lost, but the acid itself is consumed. In the attempt to compensate for this loss of acid it has been proposed to employ additional carbon anodes in the bath, thus liberating free acid at a large expense of electrical energy; but even this additional and costly expedient does not avoid the loss of the iron when the plates are removed and all the evils due to polarization are still present. 60

According to the process which forms the subject of the present invention there is no waste either of the materials of which the bath is originally formed or of the metal which is removed from the surface of the article which is pickled. 65

According to my process where iron is to be pickled I provide a bath consisting of a solution of iron and hydrochloric acid wherein the free acid does not exceed one-quarter of one per cent., and which bath is therefore nearly neutral, and preferably maintained at a temperature of 100° Fahrenheit. In this bath I immerse the article to be pickled, and I also immerse a second piece of iron (preferably a sheet) and connect them, respectively, with the positive and negative poles of a source of electricity which is capable of giving a current of from two to three volts between the anode and cathode. The effect of the current is to decompose the solution, sulfion being liberated over the surface of the article to be pickled (the anode) and the iron being liberated at the cathode and deposited over the surface thereof. The sulfion thus liberated over the surface of the anode while in a nascent state attacks and dissolves the iron of the anode and immediately combines with the iron which it dissolves, and thus the solution is reformed. 70 75 80 85 90 95 100

This is continued until the article is sufficiently pickled, when it is removed and another one put in its place.

5 The nearly neutral solution employed by me is without action upon the cathode, and does not have the effect of stripping the recovered iron from them when the anodes are removed, nor is there any liability to polarization.

10 In this process there is scarcely any waste, because as fast as the iron of the original solution is deposited upon the cathode an equal quantity of iron is dissolved from the anode and combines with the sulfion which dis-
15 solves it, and the iron which is deposited on the cathode is perfectly pure and may be used for making the finest steel. The only waste incident to the process is due to the fact that a small quantity of the solution will
20 necessarily be removed with each article.

Of course it will be understood that the invention is not limited to the pickling of a single article at a time. As a matter of fact in the commercial carrying out of the invention
25 a large number of articles are pickled at the same time. It is also found desirable to agitate the solution, and this may be done by moving the article being pickled.

30 Having thus described my invention, the following is what I claim as new therein and desire to secure by Letters Patent:

1. The process of pickling metal, which consists in immersing the article to be pickled
35 in a nearly neutral solution of the salt of the metal to be pickled, such solution being acidi-

fied to substantially the extent described, and passing a current of electricity from the article to be pickled into and through the solution, substantially as set forth.

2. The process of pickling iron, which con- 40
sists in immersing the article to be pickled in a nearly neutral solution of a salt of iron, such solution being acidified to substantially the extent described, and making said article the anode in the process of electrolysis, so
45 that the current passes from said article into the solution, said solution being so nearly neutral that the current decomposes it into iron and sulfion, the sulfion being liberated
50 over the surface of the anode and while in a nascent state attacking and dissolving the iron of said anode and then immediately combining with the iron which it has dissolved, thus re-forming the solution, substantially as
55 set forth.

3. The process of pickling metal, which consists in immersing the article to be pickled in a nearly neutral solution of the salt of the metal to be pickled, such solution being acidified to substantially the extent described, 60
maintaining the solution at a temperature of about 100° Fahrenheit, and passing a current of electricity from the article to be pickled into and through the solution, substantially as set forth.

ALEXANDER SYDNEY RAMAGE.

Witnesses:

E. S. PECK,

L. M. HOPKINS.