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W. C. SIEFERT ET AL

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APPARATUS FOR HEATING A PICKLING SOLUTION

Filed Aug. 28, 1928

Fig. 1.

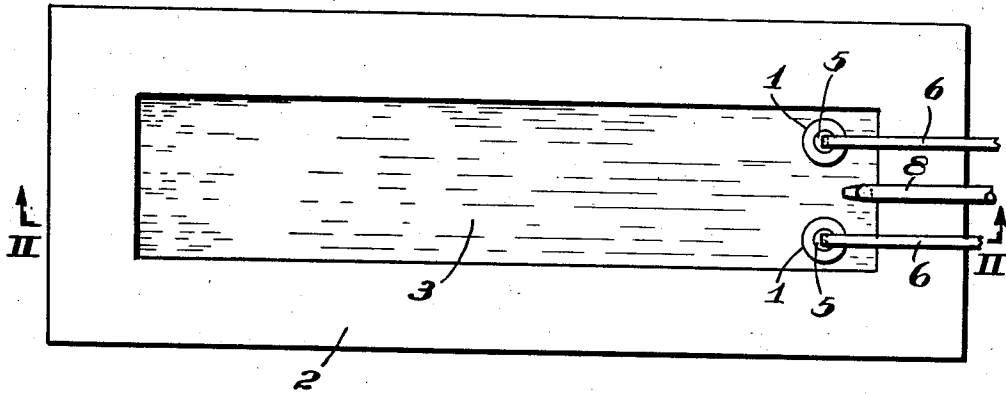
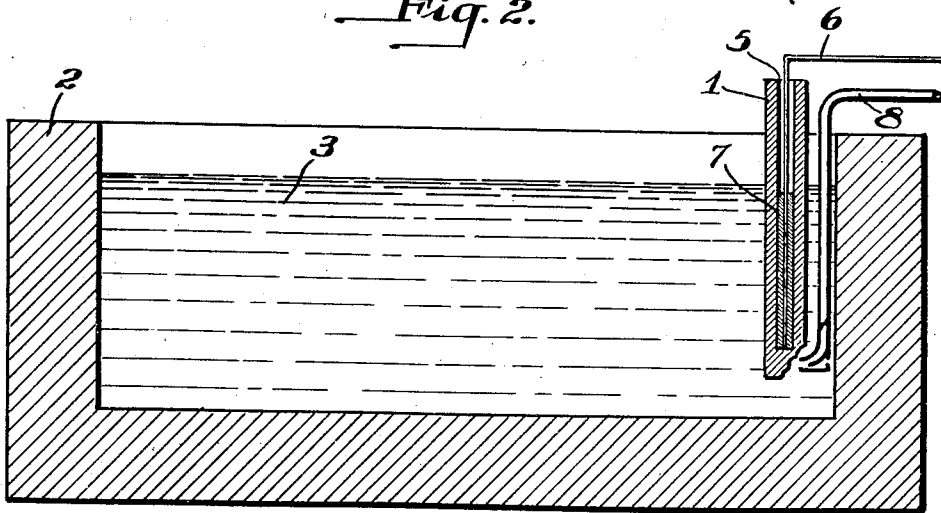


Fig. 2.



WITNESS

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UNITED STATES PATENT OFFICE

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APPARATUS FOR HEATING A PICKLING SOLUTION

Application filed August 28, 1928. Serial No. 302,530.

The invention relates to the heating of solutions used in the chemical pickling of metals.

Pickling solutions used for chemically cleaning metals are generally heated, either by introducing live steam into the bath, or by passing steam through coils of pipe disposed in the vat. The first-named manner of heating is objectionable because by it the solution is continuously diluted; and the second, in addition to its relatively low efficiency, is objectionable because the coils are usually attacked by the heated acid, and must be renewed frequently. Also, if the pipes are coated with acid-resisting material the heat transfer is reduced; and pipes made of acid-resistant material are open to the same objection, and are also expensive and fragile.

The objects of the invention are to provide a method of internally heating pickling solutions electrically, which is efficient, clean, easy to control, and which overcomes the disadvantages of prior methods of heating such solutions; and to provide simple, durable and effective apparatus for practicing the method.

In the accompanying drawings, Fig. 1 is a plan view of an apparatus for use in the practice of the invention; and Fig. 2 a sectional view taken on line II, Fig. 1.

The pickling agent generally used is an acid, usually a mineral acid. In some instances salts may be used, and after use, acid pickling solutions contain salts of the acid and the metal being cleaned. And in some cases, solutions of bases may be used. All of these solutions are electrolytes, and will conduct electric current. The resistance of such a solution to flow of current varies according to its concentration, temperature, purity, etc.

In accordance with this invention, the pickling solutions are heated by passing an electric current between spaced electrodes immersed in the solution. The current connection to the electrodes is preferably made below the level of the solution; and in order to

prevent electrolysis and possible deposition of metal from the solution, alternating current is used.

The electrodes used may be, and preferably are of a type not attacked or disintegrated by the acid or other pickling solution used. They may be graphite, carbon, silicon carbide, and the like. The resistance of these electrodes causes them to become heated when in use, and this heat is transferred to the solution.

One feature of the invention resides in the localization of such heat losses to the portions of the electrodes immersed in the solution. To this end the bus connections are made below the surface level of the liquid, and most suitably interiorly of the electrode. This may be done by providing the electrodes with a longitudinal bore extending from the top of each to a point short of its bottom inserting a bus bar or other conductor in the bore, and casting a metal, such as lead, in the bore to embed the bus up to a point below the normal level of the pickling solution. In this manner the heating of the electrode is confined chiefly to the portion immersed in the liquid, and the major portion of that heat becomes practically utilizable. Other means of accomplishing the same result may, of course, be used.

The heat developed by employing the pickling solution as a resistor in accordance with the invention varies in accordance with the current used and the resistance of the solution, the heat equivalent of electrical energy being given by the product of the resistance and the square of the current. That is, for a solution of given resistance the speed and degree of heating is increased by increasing the amperage. The voltage and amperage may be controlled from the power supply, and also by varying the number and disposition of the electrodes, these factors being within the knowledge of those skilled in the art. The voltage is preferably kept below

about 75 volts, the safest working range being from about 25 to 50 volts.

In the illustrative embodiment of the invention spaced electrodes 1 are disposed in a tank or vat 2 filled with pickling solution 3 to the level shown in Fig. 2. The tank is of a material, or lined with a material, not attacked by the pickling solution. For example, where acid solutions are used, the tank may be made from acid-resisting brick and acid-resisting cement firmly and properly put together.

Each electrode 1, preferably made from graphite, is provided with a longitudinal bore 5 which preferably extends substantially to the bottom of the electrode. A bus bar 6 is inserted in the bore, and the necessary intimate contact between the bus and electrode is secured by casting a metal 7 in the bore to embed the bus. As described previously, and as shown in Fig. 2, the contact between these two elements is preferably confined to the immersed portion of the electrode.

Although the heated solution tends to circulate, and thus to distribute the heat generated, it is generally desirable to mechanically agitate or circulate the solution. This may be done in a variety of ways, such as by blowing air into the solution through a jet or ejector 8 situated adjacent the electrodes.

According to the provisions of the patent statutes, we have explained the principle and mode of operation of our invention and have illustrated and described what we now consider to represent its best embodiment. However, we desire to have it understood that, within the scope of the appended claims the invention may be practiced otherwise than as specifically shown and described.

We claim:

1. An internally heated pickling apparatus comprising in combination a vat containing pickling solution, insoluble electrodes partially immersed therein and spaced to prevent arcing between the electrodes, each electrode having a longitudinal bore inwardly from its outer end, and buses disposed in said bores making complete contact therewith only along the portion of the electrode in contact with the solution.

2. An internally heated pickling apparatus comprising in combination a vat containing pickling solution, graphite electrodes disposed at spaced intervals therein and extending upwardly above the surface of said solution, each electrode having a longitudinal bore extending downwardly to a point short of the bottom of the electrode, and bus connections embedded in metal in said bores only below the surface level of the solution.

3. An internally heated pickling appara-

tus comprising in combination an open top vat containing pickling solution, insoluble electrodes partially immersed in the solution and spaced to prevent arcing between the electrodes, and bus connections between the electrodes and a source of alternating current, said buses being connected to the electrodes at points below the level of the solution.

In testimony whereof, we hereunto sign our names.

WILLIAM C. SIEFERT.
GEORGE W. PAWEL.

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