

(No Model.)

2 Sheets—Sheet 1.

W. S. RAWSON.

PROCESS OF AND APPARATUS FOR PICKLING IRON OR STEEL ARTICLES

No. 532,394.

Patented Jan. 8, 1895.

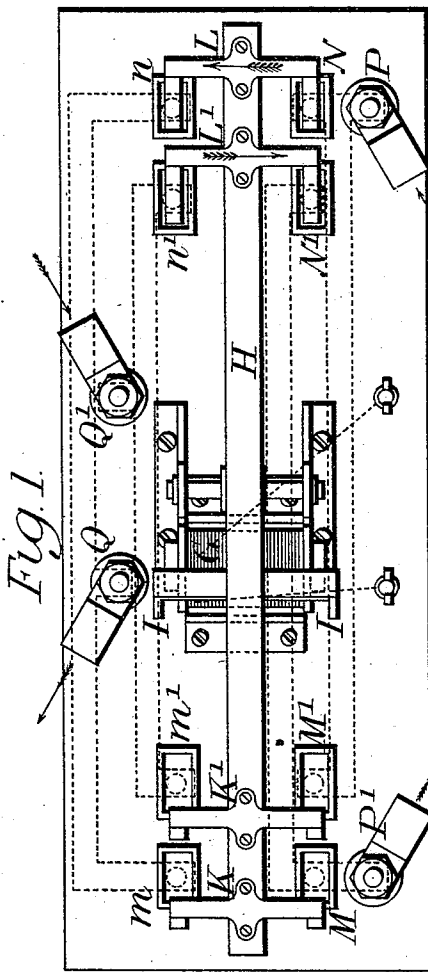


Fig. 1.

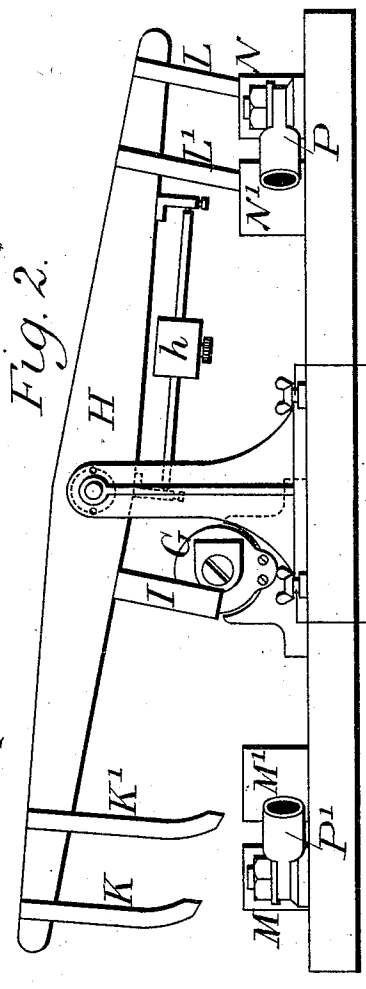


Fig. 2.

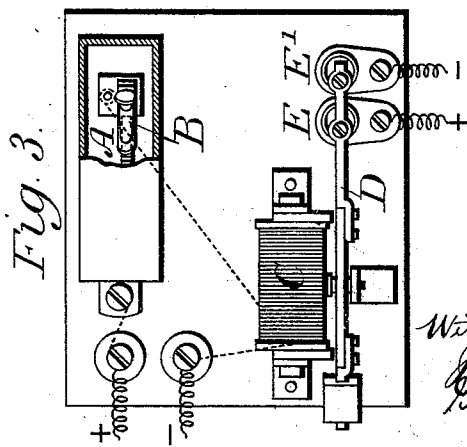


Fig. 3.

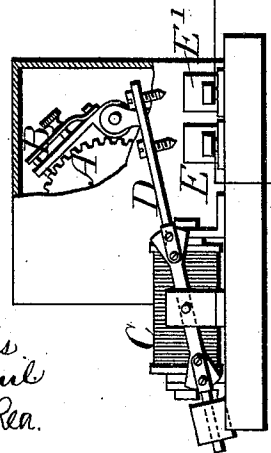


Fig. 4.

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(No Model.)

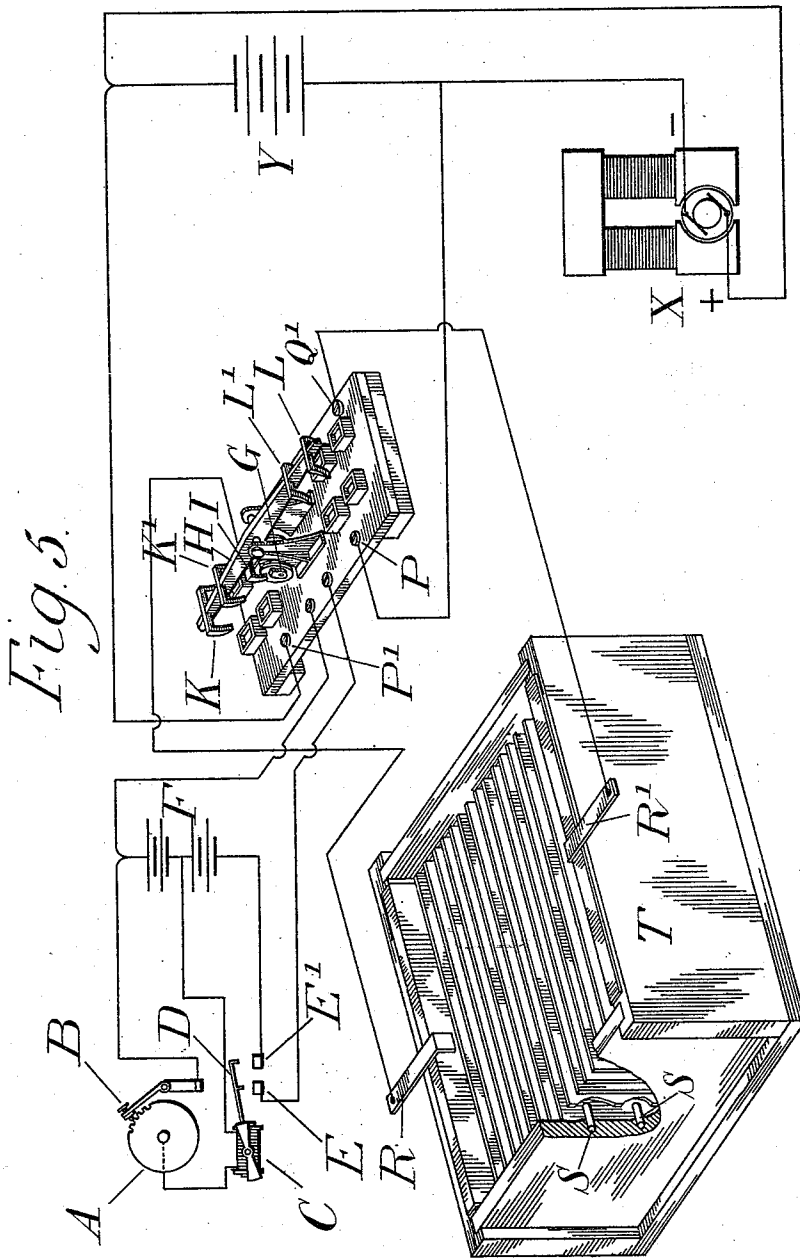
2 Sheets—Sheet 2.

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PROCESS OF AND APPARATUS FOR PICKLING IRON OR STEEL ARTICLES.

No. 532,394.

Patented Jan. 8, 1895.



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UNITED STATES PATENT OFFICE.

WILLIAM STEPNEY RAWSON, OF LONDON, ENGLAND.

PROCESS OF AND APPARATUS FOR PICKLING IRON AND STEEL ARTICLES.

SPECIFICATION forming part of Letters Patent No. 532,394, dated January 8, 1895.

Application filed January 13, 1894. Serial No. 496,781. (No model.) Patented in England January 5, 1893, No. 244; in France September 9, 1893, No. 232,729; in Belgium September 13, 1893, No. 106,350; in Germany September 14, 1893, No. 75,265; in Sweden October 14, 1893, and August 9, 1894, No. 5,373; in Italy October 30, 1893, LXVIII, 448; in Spain November 30, 1893, No. 15,064, and in Austria-Hungary August 21, 1894, No. 66,901 and No. 13,854.

To all whom it may concern:

Be it known that I, WILLIAM STEPNEY RAWSON, a citizen of England, residing at 88 Queen Victoria Street, in the city of London, England, have invented certain new and useful Improvements in the Pickling and Scrubbing of Iron and Steel Slabs, Plates, Wire Coils, and other Articles and Apparatus for that Purpose, (for which I have obtained Letters Patent in Great Britain January 5, 1893, No. 244; in Austria-Hungary August 21, 1894, No. 66,901 and No. 13,854; in Belgium September 13, 1893, No. 106,350; in France September 9, 1893, No. 232,729; in Germany September 14, 1893, No. 75,265; in Italy October 30, 1893, LXVIII, 448; in Sweden October 14, 1893, and August 9, 1894, No. 5,373, and in Spain November 30, 1893, No. 15,064,) of which the following is a specification.

My invention relates to processes and apparatus for the pickling and scrubbing of articles in iron and steel such as slabs, plates, coils of wire, &c., so as to prepare them for being coated with tin or other metal, the object which I have in view being to economize the time, labor and acid required for these operations and to avoid corrosion of the metal.

As the process of pickling and scrubbing is applied to plates which are to be tinned to a larger extent than to any other iron or steel articles, I may best illustrate my invention by describing my process as applied to such plates.

For what is known as black pickling I place a number of plates parallel or nearly so and near together, but without touching each other, in a tank containing dilute acid such as hydrochloric or sulphuric acid, and I connect the plate at the one end of the row with one terminal, say the +, of a dynamo machine or other source of electricity, and the plate at the other end of the row with the other or - terminal.

I usually employ about six per cent. of hydrochloric acid of specific gravity 1.140 or about three per cent. of sulphuric acid of specific gravity 1.750 but smaller percentages may be employed. I pass a current of electricity for some time through the liquid and

plates, and then, by means of a suitable switch or commutator, I reverse the direction of the current for a time. I usually reverse about four times per minute but, with deep plates, reversal should be less frequent, so as to give time for the hydrogen bubbles to sweep up the plate from the bottom where the scrubbing action begins. After several alternations of current during about ten minutes, when the acid is of the strength mentioned above, the scale is loosened from the surface of the plates and finally drops or is brushed off, the plates being thus pickled and scrubbed. After the scale is off there is no further action at the negative pole on the clean metal unless the acid is strong. In some cases I place at intervals in the tank in the place of some of the metal plates, plates of carbon which may be made up of comparatively small pieces of carbon fixed in wooden frames like the panes of glass in a window.

The switch or commutator for effecting reversals of current may be worked by clock-work or equivalent motor timed to periods suitable for reversal. The action is promoted by a little elevation of the temperature of the bath, say from 70° to 90° Fahrenheit or higher when the acid is weak.

For white pickling, I place the metal plates each against a carbon plate, holding it in a suitable frame by which it is in electric connection with the carbon. All the plates in the tank are placed so as to face one way. After passing the electric current for a time from the + terminal to the first carbon and to the - terminal from the last plate, the set of carbon and metal plates have become somewhat in the condition of a storage battery so that, if the current is to be reversed, only a portion of the electromotive force from the generator is required, the contents of the tank contributing the rest as a secondary battery. The conductors for the generator current may therefore for reversal be disconnected and the range of plates short circuited by connecting the first plate to the last, interposing if necessary a suitable resistance.

In both the black and the white pickling

processes the electric leads may be permanently connected to plates of carbon or iron fixed at the ends of the tank.

When sulphuric acid is employed, lead plates may be used for this purpose. When hydrochloric acid is employed, iron plates may be used, and these may be protected against dissolution by placing plates that are to be pickled in close contact with them.

In all cases care should be taken not to work with liquid too rich in salts of iron as there might be deposit which would interfere with the pickling action. The proportion of iron salts should not exceed fifteen per cent. by weight.

The process, above described as applied to plates, is conducted in a similar manner for the treatment of slabs, coils or hanks of wire and other articles, the boxes, frames or crates being suitably arranged for holding them in the tanks. A number of wires may be drawn slowly through the tank side by side but not touching each other the two outer wires being connected to the electric generator and having the current reversed from time to time.

The white pickling process above described may be applied for cleaning brazed joints of iron or steel. For this purpose the article may be immersed in a lead lined tank containing from one to two per cent. by bulk of sulphuric acid. One terminal of the electric generator is connected to the immersed article, the other to the lead lining and, the current being occasionally reversed, but preferably the article should be in the condition of cathode three or four times as long as it is anode.

Sometimes plates are clean on their one side. In such case I put two of them with their clean sides close together so as to form as it were a single plate, very little action on the clean sides taking place.

The reversals of current in the tank may be effected by any known switch worked by hand. I prefer however to employ a switch worked by clockwork as I shall describe referring to the accompanying drawings.

Figure 1 is a plan and Fig. 2 is an elevation of the switch for reversing the electrical current in the pickling tank. Fig. 3 is a plan and Fig. 4 an elevation of the switch and relay for determining the time of reversal. Fig. 5 shows diagrammatically an arrangement of apparatus for carrying out my process.

One pole of a small local battery is connected to an insulated toothed wheel A which is driven at constant or nearly constant speed by clock work. As this wheel slowly revolves a spring B meeting each successive tooth makes a contact by which an electrical current passes to the coil of an electro magnet C and thence to the other pole of the battery. The magnet C being excited by the current attracts a counter weighted armature lever D causing insulated pins upon it to dip into a

pair of cups E E' containing mercury. One of these cups E is connected to the one pole of a local battery F. The other cup E' is connected through the coil of an electromagnet G to the other pole of the battery F. A beam H provided with an adjustable counterweight *h* and with an armature I for each end of the magnet G has fixed on each end of it a pair of insulated forks K, K' and L, L' and underneath these are four mercury cups M, *m*, M', *m'*, under K, K' respectively and four cups N, *n*, N', *n'*, under L, L' respectively. There are four posts, two P P' connected through accumulators Y to the terminals of a dynamo machine X or other source of electricity, and two Q Q' connected to the terminals R R' of the pickling tank T, which tank is charged with plates held between pegs S projecting from its sides so as to hold these plates separate from each other. Into this tank the plates, slabs, or other articles to be operated on, are lowered; also P is connected to the cups N M', P' to the cups M and N', Q to the cups *m*, *n* and Q' to the cups *m'* *n'*. When the beam H is in the position shown at Figs. 1 and 2, an electric current passes by P, cup N, fork L, cup *n* to Q, from Q to R, through the tank T to R' and thence to Q', cup *n'*, fork L', cup N' and back by P'. When the spring B makes contact with a tooth of the wheel A, the pins of the lever D descend into the mercury in the cups E E', and a current excites the magnet G which attracts its armature I. The beam H is thereby moved so as to lift the forks L L' out of the mercury and to immerse the forks K K' in the mercury. The current then passes from P by cup M', fork K', cup *m'* and Q', from Q' to the tank to R and thence back by Q to cup *m*, fork K, and cup M to P', the direction of current through the tank being thus reversed, and so continuing until a hollow between two teeth of A is presented to B, contact being thus broken, rendering the magnets C and G inert, whereupon the beam H returns to the position shown in Fig. 2.

Having thus described the nature of my said invention and the best means I know of carrying the same into practical effect, I claim—

1. The herein described process of pickling or scrubbing metallic plates, consisting in immersing said plates in parallel rows in a dilute acid bath, the intermediate plates of each row being spaced apart and having no direct electrical connections, passing an electric current to the first plate of each row and then by means of the electrolyte through the intermediate plates and out at the last or end plate, and reversing said current at regular and successive intervals of time, for the purpose specified.

2. In apparatus for pickling and scrubbing metallic plates, the combination of a dilute acid bath, the plates arranged therein in parallel rows with the plates in each row spaced

apart, an electrical generator, conductors connecting said generator to the end plates of each row, the intermediate plates being without direct electrical connection, a reversing
5 switch arranged in the generator circuit, and a circuit-breaker actuated by clock work for periodically closing and breaking an electric circuit controlling the reversing switch, substantially as described.

10 In testimony whereof I have signed my name to this specification, in the presence of

two subscribing witnesses, this 29th day of December, A. D. 1893.

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