

UNITED STATES PATENT OFFICE.

ARTUR HERRMANN, OF LEIPZIG, GERMANY.

PROCESS FOR ELECTROLYTIC CLEANSING.

1,041,790.

Specification of Letters Patent.

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No Drawing.

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To all whom it may concern:

Be it known that I, ARTUR HERRMANN, engineer, a subject of the German Emperor, residing at Leipzig, Germany, have invented certain new and useful Improvements in Processes of Electrolytic Cleansing; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention refers to an electrolytic cleansing of metal products, by which such products are to be prepared for electroplating.

More especially my improved cleansing process is adapted for preparing steel or iron wire, iron tape, sheet iron, wire netting, chains, etc., for galvanization in electrolytic baths or in baths of molten zinc.

According to the electrolytic processes hitherto known for like purposes the article that is to be cleansed is made to form the cathode in an electrolytic bath the electrolyte of which is an alkaline solution. In these known processes sheet metal is drawn through the bath continuously. It has also been suggested to treat the article that is to be cleansed as the anode in an acid or neutral bath, but in this particular method, the article was not continuously fed into and out of the bath, but was rather only immersed for a certain time and then withdrawn, so that the process was not continuous and therefore was comparatively expensive. Moreover all known processes hitherto practised have not been really successful in completely removing thick scale from iron or steel products that had undergone a previous treatment in fire or which, in drawing, had been covered with greasy substances employed to facilitate the drawing process. To get good results, it was found necessary to subject the articles to some preliminary process of mechanical cleansing such as scraping, scouring or to analogous chemical processes preparatory to electrolytic cleansing.

Another serious drawback of alkaline electrolytic processes in which the goods treated formed the cathode has only been recently recognized. It consists in that the hydrogen liberated at the surface of the iron is partly absorbed by the iron and seriously deteriorates its mechanical qualities.

My invention comprises electrically connecting the article that is to be cleansed so as to make it form an anode and to draw it continuously through an alkaline or neutral solution at a very high speed using at the same time very high current densities.

While I shall hereinafter speak more specifically of wire, the present process is applicable to sheets or any other steel or iron materials in lengths. By increasing the speed of travel of the steel or iron wire sheet or band and also increasing the current density I find that it is possible to obtain perfect cleansing though, only a very short length of the metal is under treatment at any given time, and this again permits a considerable reduction of the distance between the electrodes. By this means I succeed in producing the high current densities required though the potential employed may be hardly higher than what was usual in the processes hitherto practised.

By my process an especially clean and bright surface is produced without any preparatory mechanical or chemical treatment and the mechanical qualities of the iron remain completely uninjured. The residue of impurities and the products of electrolysis which still adhere to the surface of the metal can be easily removed by a simple washing or rinsing process and the articles are then ready for electroplating or for galvanizing by heat and can indeed be immediately fed from the cleansing bath into the coating bath.

The speed of travel which I prefer to employ in carrying out my process varies somewhat with the nature of the impurities that I desire to remove from the surface. Some wire before electroplating is treated in annealing furnaces in a reducing atmosphere and, in consequence of this treatment in some types of furnace, the wire may acquire an almost pure metallic surface which however is covered by a more or less thick coating of carbon. In other types of annealing furnace as in pot annealing, however, the material may become coated with scale. Other wire, especially such as is to be plated immediately after drawing, that is without being first subjected to an annealing process, is covered with greasy matter derived from the drawing tool.

In my electrolytic cleansing process carbon coated wire having a metallic surface

can be drawn through the electrolyte at a higher rate of speed than wire coated with greasy matter. Where scale occurs the rate of speed may be somewhat slower. The preferable speed also should vary somewhat with the diameter of the wire operated upon, in this sense that, with larger diameters smaller speeds become necessary. Thus, with medium diameters, say, of 2 to 3.5 millimeters, I find that speeds of 4 to 15 meters per minute give good results, using higher or lower speeds according to the quality of the wire, the nature and thickness of the impurities and the temperature of the electrolyte. By immersing only a small length of the wire, say a meter, at a time I can easily succeed in reducing the distance between the treated wire and the cathode to about 6 to 8 centimeters and in raising the current density to 30 or 40 amperes per square decimeter and upward.

As cathodes I may employ any insoluble indifferent conductive substance but preferably sheet iron, sheet lead or carbon. The cathodes are best at a distance not over 6 to 8 centimeters from the material under treatment. The electrolyte may also be any solution that chances to be handy, the only essential feature being that it should not be acid and should possess a sufficient conductivity to permit the high current densities required for producing the desired effect at the exceedingly high speed of operation which is peculiar to my process.

The best results technically and economically are obtained by a highly concentrated solution of chlorate of soda at temperatures that may vary between 30° and 70° centigrade. But concentrated solutions of sulfate of soda or of any other neutral or alkaline salt possessing the required conductivity may be used as well.

The process produces no soluble substances and the electrolyte can therefore be effectually regenerated, so as to be capable of being repeatedly employed, by filtration or by allowing the impurities to settle down and drawing the purified liquid off the sediment thus formed. For this purpose I prefer to employ means for causing a continuous circulation of the solution, by which that part of the liquid which comes from the electrolytic bath is led into vessels where it is permitted to remain at rest or settle, until the insoluble impurities have sunk to the bottom and the clear liquid may be thence pumped back into the electrolytic bath. Such circulating means I prefer to arrange in such manner that the purified solution is introduced into the vat in which the electrolytic process is being carried on, in the location where the wire or band, in traveling through the bath, is emerging from between the cathodes. The energetic flow of liquid, thus produced at this place, I find to be in

most cases quite sufficient to rinse off all impurities still adhering to the surface. After emerging thus cleansed from the bath, the wire can be immediately introduced into an electroplating bath and an especially bright and strongly adhering coating may thus be obtained.

I find that my improved cleansing process is not only adapted to be used in combination with electroplating processes, but is also especially suitable for preparing the surface of steel or iron wire or tape for so called galvanization in a bath of zinc molten by means of heat. For this purpose it has hitherto been usual to cause the raw wire after drawing to travel through an annealing furnace and then lead it into an acid bath, usually diluted hydrochloric acid, before it had time to cool. The sudden and violent formation of steam on the hot surface of the wire served to assist the cleaning effect of the acid and thus to effectually loosen and partly remove the scale and carbon coating formed in the annealing oven. But before allowing the wire to pass into the molten zinc or into an electrolytic zinc plating bath, it has always hitherto been necessary to apply means for mechanically removing that not inconsiderable part of the impurities which, though loosened or softened by the effect of the acid bath, still adhered to the surface.

By combining my improved electrolytic cleansing process with this usual method for preparing iron goods for galvanization, I avoid all necessity of mechanical cleansing. According to my invention I pass the hot wire, emerging from the annealing furnace, immediately into the above described electrolytic cleansing bath, in which it is subjected to the action of exceedingly high current densities for a very short period of time and can then immediately, without any further preparation beyond a slight rinsing, which may be performed by the circulation of the cleansing solution itself, allow it to pass into an electrolytic zinc plating vat or into a bath of molten zinc.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:—

1. A process for electrolytically cleansing metal goods such as wire tape, wire fabric, sheet iron and the like which process comprises rapidly and continuously passing the goods through an electrolytic bath containing a non acid solution and during the passage subjecting them to very high current densities, the said goods being connected to form the anode.

2. A process for electrolytically cleansing wire, metal tape, wire fabric, sheet metal and the like which process comprises continuously passing the goods a short distance

through a highly concentrated non acid electrolytic bath at high speed and applying high current densities, the goods to be cleansed being connected to form the anode.

5 3. A process for electrolytically cleansing metal wire, tape, sheet metal and such like goods which process comprises continuously passing the goods for a distance not exceeding one meter at a speed of 4 to 15
10 meters per minute through a highly concentrated non acid electrolytic bath and therein subjecting them to current densities of 30 amperes and upward per square decimeter, the goods to be cleansed being connected to form the anode and the cathode
15 being made of an indifferent conducting substance and being arranged at a distance not exceeding 6 to 8 centimeters from the goods.

20 4. A process for electrolytically cleansing the surface of metal goods such as iron wire, bands, sheets or fabric which process comprises passing the said goods through a neutral conductive solution such as chlorate of sodium having a temperature between 30°
25 and 70° centigrade, the goods traveling continuously through the bath at speeds between 4 and 15 meters per minute and being electrically connected to form an anode in
30 such solution, as cathode using an indifferent conductor such as sheet iron placed at a distance not exceeding 8 centimeters from the anode and applying current densities exceeding 30 amperes per square decimeter.

35 5. A process for electrolytically cleansing metal wire, bands, sheets and such like goods, which process comprises continuously passing said goods rapidly through a non-acid electrolytic bath and subjecting them to
40 high current densities, the goods being connected to form the anode and the solution being made to continuously circulate into vessels in which it remains at rest until the impurities have sunk to the bottom and
45 thence back to the electrolytic vat.

6. A process for electrolytically cleansing metal wire, bands, sheets and similar goods, which process comprises rapidly and continuously passing the said goods through a
50 non acid solution and applying high current densities, the said goods forming the anode, and causing the solution to circulate from the electrolytic vat to a vessel provided with purifying means and thence leading it
55 back into that part of the electrolytic vat where the said goods emerge from the proximity of the cathode.

7. A process for zinc plating iron wire, bands, sheets and similar goods which process consists in continuously and rapidly passing the said goods through an annealing
60 furnace preferably provided with a reducing atmosphere, then before cooling passing them through a non acid conductive solution, the immersed part of the goods being

electrically connected to form the anode, applying to them high current densities by means of an indifferent cathode and then passing them immediately into a zinc plating bath.

8. A process for galvanizing iron goods which process comprises rapidly and continuously passing lengths of the material through an annealing furnace, then passing the still hot material through a non acid electrolytic solution the immersed part of the material being connected to form an anode and a cathode of indifferent material being provided, applying high current densities and continuously drawing off the solution and allowing it to remain at rest until the impurities separated from the wire have settled down and then reintroducing it into the electrolytic vat at the place where the material emerges from the proximity of the cathode and finally passing the material into a zinc plating bath.

9. The process of electrolytically cleansing steel and iron wire, sheets, etc., which comprises continuously and rapidly passing such material through a non-acid electrolytic bath while transmitting a suitable current from such material as an anode to a suitable cathode, the area of material under immersion in said bath, and the strength of the current being so correlated as to give current densities of 30 amperes or more per square decimeter of immersed area.

10. The process of electrolytically cleansing steel and iron wire, sheets, etc., which comprises continuously passing such material at speeds between 4 and 15 meters per minute through a non-acid electrolytic bath wherein such material forms an anode, the immersed area of material and the current density employed being so correlated as to give current densities of 30 amperes or more per square decimeter of immersed area.

11. The process of electrolytically cleansing steel and iron wire, sheets, etc., which comprises continuously and rapidly passing such material through a non-acid electrolytic bath wherein such material forms an anode and transmitting electrolytic current between such anode and suitable cathodes at a current density of not less than 30 amperes per square decimeter of anode surface.

12. The process of electrolytically cleansing steel and iron wire, sheets, etc., which comprises continuously and rapidly passing such material through a non-acid electrolytic bath wherein such material forms an anode and transmitting electrolytic current between such anode and suitable cathodes at a current density of not less than 30 amperes per square decimeter of anode surface, said cathodes being at a distance from said anode not exceeding 8 centimeters.

13. The process of electrolytically cleansing steel and iron wire, sheets, etc., which

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comprises continuously and rapidly passing such material through a non-acid electrolytic bath of suitable liquid wherein such material forms an anode and transmitting electrolytic current between such anode and suitable cathodes at a current density of not less than 30 amperes per square decimeter of anode surface while continuously circulating such liquid through clearing means and back

to the bath to a point of discharge in proximity to the emerging cleansed material. 10

In testimony, that I claim the foregoing as my invention, I have signed my name in presence of two subscribing witnesses.

ARTUR HERRMANN.

Witnesses:

D. WILHELM PFAUHAUSZ,

WALTER BOSINZ.