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G. L. MEAKER.

PROCESS OF GALVANIZING WIRE.

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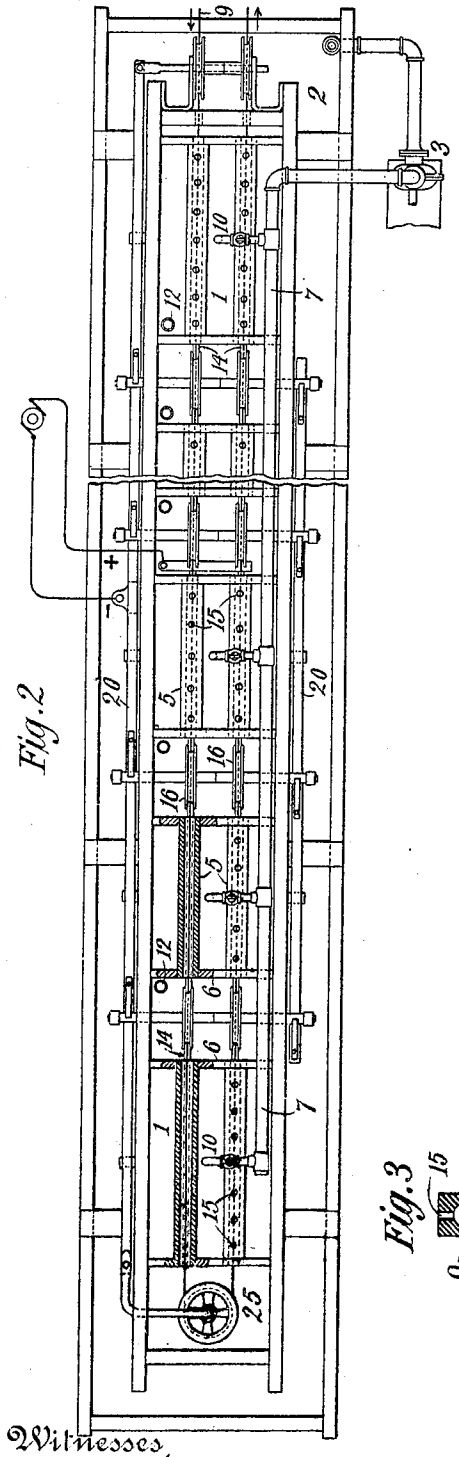


Fig. 2

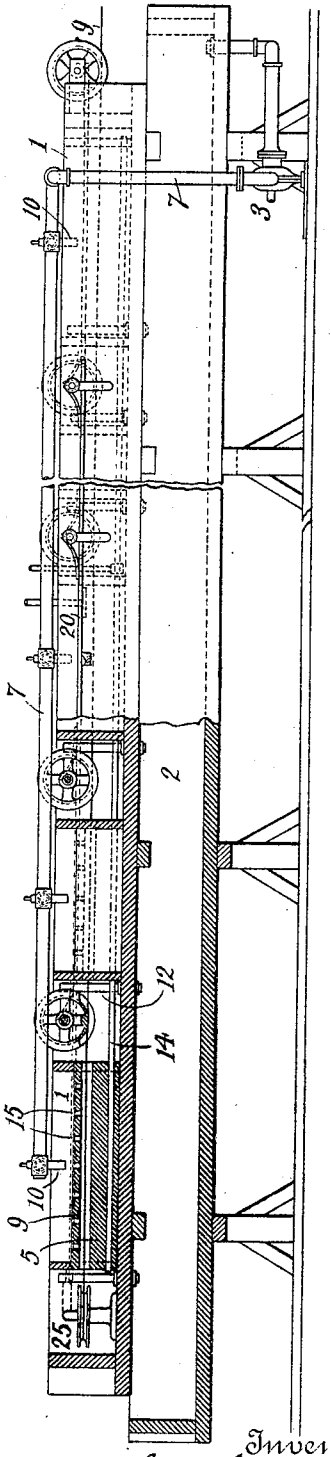


Fig. 1

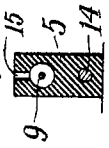


Fig. 3

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UNITED STATES PATENT OFFICE.

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PROCESS OF GALVANIZING WIRE.

No. 799,860. Specification of Letters Patent. Patented Sept. 19, 1905.

Application filed February 1, 1905. Serial No. 243,599.

To all whom it may concern:

Be it known that I, GUY L. MEAKER, a citizen of the United States, residing at Evanston, county of Cook, State of Illinois, have invented certain new and useful Improvements in the Processes of Galvanizing Wire, which are described in the following specification, while the accompanying drawings disclose as an illustration one form of apparatus suitable for putting into practice the principles of my invention.

In the drawings, Figure 1 is a vertical longitudinal section of an apparatus which may be used in carrying out my process. Fig. 2 is a plan of the same.

It is well known that the method of galvanizing wire now universally employed is that in which the wire is passed through a bath of molten zinc and coated by the adherence of the zinc to its surface. This may be designated as the "hot" process. There are well-recognized objections to this process. Thus the coating is not pure zinc, but is somewhat alloyed with iron, the amount of which increases from the surface inward to the point of union with the iron or steel of the wire. A large percentage of zinc is lost in the process by oxidization and in other ways, while the coating is liable to be uneven and to become separated from the wire, and unless a highly refined and expensive form of spelter is used it is liable to crack when bent if the coating is thick, as it must be in telegraph and other wires. It is, moreover, inapplicable to tempered wire, which will be annealed by the heat, and the results vary widely with the composition of the wire that is coated. It is also well known that serious efforts have been made for many years to produce a practicable method of galvanizing wire electrically, in which case the coating would be pure zinc, would adhere to the wire, could be applied without injurious heat, and would have other advantages. These efforts have heretofore failed. While a zinc coating on the wire could in some cases be secured, it was not of an adequate thickness and was applied so slowly and at such cost as to render it impracticable for commercial use.

I have succeeded in overcoming the difficulties heretofore encountered in electrogalvanizing wire and by my process can produce a perfect coating of any desired thickness at a rapid rate. Moreover, I am able to produce this coating from dross, skimmings, and other compounds of zinc which are now largely waste products, or from roasted ores which have not been refined. I have discovered that in these compounds of zinc the iron, which is the impurity that occasions difficulty in treating them electrically, may be eliminated by certain provisions germane to the electrolizing process, whereby the iron is rendered insoluble or neutral to the electrolytic action and is precipitated in the form of an ocherous powder which may be filtered out of the solution or left suspended therein and which is a basic ferrous or ferric form of iron insoluble in the electrolyte. The iron being thus disposed of, the zinc will, by the aid of the further steps I will hereinafter describe, be freely deposited on the wire which is arranged to form the cathode of the electrolytic apparatus.

My process is also a continuous one that may be carried on indefinitely and is free from any exactitude in chemical proportions and measurements, requiring only that the zinc compounds be shoveled into the regenerating-tank from time to time in as rough and ready a way as coal is shoveled into a furnace, while the addition of the acid is equally simple, so that the process may be placed in the hands of unskilled persons.

In my process I cause the wire which is to be coated to serve as the cathode of an electrolytic cell—that is, the wire is drawn from the annealing-furnace through a pickling-bath and thence enters the electrolytic bath, where it is brought into an electric circuit as the cathode of the cell. I provide, however, that the anode, which must be of carbon or other insoluble or neutral material, shall have an exposed surface area greatly in excess of that of the cathode-wire, this relation serving to change the condition of the iron, which may be in the solution from a ferrous to a ferric condition, while I also oxidize the bath by aeration, so that the iron compounds will take on oxygen and be converted into insoluble basic salts or under some conditions basic ferrous or ferric compounds. I moreover make the anode discontinuous or in sections, and at each section I furnish an electric connection to the cathode. I have found that under the conditions present in my process the zinc will tend to deposit in a granular form on these points of the cathode-wire which are in im-

mediate proximity to the points of electrical connection between the wire and the external circuit; but at points remote from such connections the deposit will be of a closer grain or texture. I therefore provide a multiplicity of electrical connection-points distributed along the length of the cathode-wire, so that any given spot on the wire will in passing through the bath be subjected alternately and repeatedly to the two different kinds of deposit. Then by giving the wire an adequate speed of travel, preferably one hundred feet per minute or more, which is five times the speed heretofore employed in previous attempts to electrogalvanize wire, the granular deposit, which if continued would tend to produce a mossy or spongy coating, is immediately succeeded and overlaid at each point of the wire by the finer deposit superposed thereon, so that the coating as a whole is uniform, and no spongy, mossy, or black oxid appears. If, however, the wire is stopped, such defective deposit will immediately occur. The current density should also be very much greater than has heretofore been considered possible. I am using with success one thousand amperes per square foot of cathode-surface and do not regard it feasible to use less than four hundred amperes per square foot. To produce the oxidation above referred to, I make the bath shallow and circulate the solution therein, so that it may be constantly aerated at the same time that it is regenerated. I may, however, force air into the solution or expose it to the air in other ways; but satisfactory results are secured by the exposure in the said shallow cell and at other points along the circulating route. I produce the solution by dissolving the zinc or its compounds in either sulfuric or hydrochloric acid. This takes place in a special regenerating-tank or at any suitable point in the circuit of the solution, whence the fresh solution is delivered to the bath at a series of distributed points and likewise withdrawn, preferably, at a series of points alternating with the delivery-points.

Referring to the drawings to more fully illustrate my process, 2 is a tank or receptacle into which the zinc or some ferriferous compound thereof is dumped. A solution of acid is then added. From this tank the liquid is drawn by a pump 3 and delivered to the electrolytic cell 1 by a pipe 7, having several spouts or openings 10 at distributed points along the cell. Within the cell are the several anode-sections 5 5, &c., each consisting of a rectangular block of graphitic carbon pierced longitudinally with a circular perforation or opening, through the center of which extends the traveling cathode-wire 9, which causes it to embrace the wire and present to it an anode-surface greatly in excess of the surface of the wire itself. I am using a surface ratio of seven to one with good results. A series of vertical openings 15 admit the solution from the upper side of the anode into the perforation therein traversed by the wire. A partition 6 is placed across the cell at each end of each anode-section, and one of the spouts or openings 10 delivers the circulating solution into each of the compartments which are formed around an anode-section by the partitions 6. The solution thus flows in a steady stream down into the longitudinal perforation occupied by the wire and thence out into the central compartment formed by partitions 6 between adjacent anode-sections. Here it accumulates until it flows over into the upper end of the outlet-pipe 12, these outlets thus alternating with the inlets 10, whence it is returned to the regenerating-tank 2. A rod 14, of copper, extends through all of the anode-sections 5 and connects them electrically. This rod is coated with insulation between each two adjacent sections, at which point also the cathode-wire takes a turn around a grooved sheave-wheel 16, which serves as a contact for making an electrical connection with the external circuit, while all of the wheels are connected to rod 20, leading to one brush of the dynamo, the opposite brush being connected to rod 14. Thus the current is withdrawn from the cathode-wire at a series of points distributed along the bath and the deposit formed at or adjacent to these connection-points will be overlaid by the superposed deposit formed at points intermediate between the said connection-points.

The wire 9 enters the bath at one end, then traverses in order the several succeeding anode-sections 5 5 along one side of the cell, taking a turn around each of the intervening contact-wheels 16, and at the opposite end of the cell turns around the grooved sheave 25 and returns through the several succeeding anode-sections on the opposite side of the cell. This gives a considerable travel of the wire in the bath.

What I claim as new, and desire to secure by Letters Patent, is—

1. The method of depositing zinc on a wire which consists in continuously passing the wire as a cathode through a ferriferous zinc solution in the presence of an insoluble anode, oxidizing the solution to render the iron neutral by giving the anode a surface larger than the surface of the cathode and superposing upon the deposit formed at connection-points of the cathode-wire the deposit formed at points intermediately between such connection-points.

2. The method of depositing zinc on a wire which consists in continuously passing the wire as a cathode through a ferriferous zinc solution in the presence of a series of anode-sections of insoluble material having a surface larger than the surface of the cathode, and conducting the current from the cathode-wire at a series of distributed connection-points so as to superpose upon the deposit formed at said connection-points the deposit

formed at points intermediate between such connection-points.

3. The method of depositing zinc on a wire which consists in continuously passing the wire as a cathode through a ferriferous zinc solution in the presence of a series of anode-sections of insoluble material having a surface area greater than that of the cathode, conducting the current from the cathode-wire at a series of distributed connection-points and superposing upon the deposit formed at the series of connection-points the deposit formed at points intermediate between such connection-points by giving the wire an adequate speed of travel.

4. The method of depositing zinc on a wire which consists in continuously passing the wire as a cathode through a ferriferous zinc solution in the presence of an insoluble anode having a surface area greater than that of the cathode, conducting the current from the cathode-wire at a series of distributed connection-points, superposing upon the deposit formed at the series of connection-points the deposit formed at points intermediate between the said connection-points, and continuously regenerating the solution by retaining therein the active dissolving agents and circulating it over a mass of zinc or zinc-bearing compound.

5. The method of depositing zinc on a wire which consists in continuously passing the wire as a cathode through a ferriferous zinc solution in the presence of a series of insoluble anode-sections having a surface area greater than that of the cathode, oxidizing the solution by aeration, regenerating it by retaining therein the active dissolving agents and circulating it over a mass of zinc or zinc-bearing compound, conducting the current from the cathode-wire at a series of distributed connection-points and superposing upon the deposit formed on the wire at its said points of connection with the external circuit the deposit formed at intermediate points between the said connection-points.

6. The method of depositing zinc on a wire from a ferriferous zinc compound, which consists in forming an electrolytic solution of said compound, rendering the iron component thereof insoluble by giving the anode a surface area exceeding that of the cathode and oxidizing the solution, passing the wire, serving as a cathode, through the said solution in presence of the anode which is of insoluble material, conducting the electric current from said wire-cathode at a series of distributed points, and regenerating the solution by retaining therein the active dissolving agents and circulating it over a mass of the ferriferous zinc compound.

7. The method of depositing zinc on a wire which consists in passing it as a cathode through a ferriferous zinc solution in the presence of a series of anode-sections of insoluble material having a surface area larger than that of the cathode, conducting the current from the moving cathode-wire at a series of points by contacts distributed along the length of wire subject to the electrolytic action, and regenerating the solution by retaining in it the active dissolving agents and circulating it over a mass of zinc compound.

8. The method of depositing zinc on a wire which consists in passing the wire as a cathode through an electrolytic bath of zinc solution at an adequate speed in the presence of an anode of insoluble material having a surface area greater than that of the cathode-wire, passing an electric current through the bath from anode to cathode at a current density of at least four hundred amperes per square foot of cathode-surface and constantly delivering to the bath the zinc solution formed by passing dissolving agents over a mass of zinc or zinc compound.

In witness whereof I have hereunto set my hand before two subscribing witnesses, this 14th day of January, 1905.

GUY L. MEAKER.

Witnesses:
J. W. MEAKER, Jr.,
F. A. MASON.