

UNITED STATES PATENT OFFICE.

OTTO DIEFFENBACH, OF DARMSTADT, GERMANY.

PROCESS FOR THE ELECTROLYTIC MANUFACTURE OF METAL TUBES.

No. 817,419.

Specification of Letters Patent.

Patented April 10, 1906.

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To all whom it may concern:

Be it known that I, OTTO DIEFFENBACH, doctor of philosophy, professor at the Technical High School of Darmstadt, and a resident of 8 H \ddot{u} gelstrasse, Darmstadt, in the Grand Duchy of Hessen, German Empire, have invented new and useful Improvements in Processes for the Electrolytic Manufacture of Metal Tubes and other Bodies, of which the following is a specification.

The process for the production of firmly-adherent smooth galvanic deposits forming the subject of German Patent No. 125,404 is based on the addition to the bath liquor of solid or liquid bodies such as will exert no chemical action and which are capable when a sufficiently active movement is imparted to the liquid by impinging against the cathodes both of removing the small bubbles of hydrogen which adhere thereto as well as of smoothing the metallic deposits. The specification mentions sand, pumice-stone, brick-dust, wood-flour, chaff, &c., as being solid substances suitable for the purpose. In some cases, however, these substances only effect their object in an imperfect manner. For example, if when using such additions as are designed to smooth the deposits it is attempted to produce copper tubes or other hollow bodies of copper by depositing the copper upon suitably-shaped cathodes revolving on a horizontal or inclined axis it is found that none of the substances cited are capable of effecting a sufficient smoothing action. Sand, pumice-stone, brick-dust, and so on, even when in the finest state of division, are too heavy to be sufficiently raised by the rotation of the cathodes, especially when the cathodes have a large periphery. Other bodies, such as wood-flour and so on, float on top of the liquid by reason of their small specific weight, and for this reason they will not serve for coating the rotating cathodes to the required extent. Furthermore, these bodies are not sufficiently fine and sharp-edged to cut up, and thereby remove, the small bubbles of hydrogen which are deposited on the surface of the metal and to the presence of which the formation of uneven deposits is chiefly due.

It is only possible to expect a perfectly smooth and uniform deposit when the added substances have a very fine granular texture and sharp edges and are of a nature such that they will be readily carried up by the rotary movement of the cathode on one side and

will with equal readiness slide down again on the other side.

It has been discovered by numerous experiments that the only substance capable of fulfilling all requirements in a perfect manner is comminuted kieselguhr, which by reason of its finely-porous nature becomes strongly impregnated or saturated with liquid, with the result that the specific weight of its smallest particles is considerably reduced as compared with that of other substances, such as sand and pumice-stone, which are not much heavier *per se*, but have a far smaller capacity for absorbing water. Consequently by the rotation of the cathodes it is carried up much more readily than the other substances referred to, while, on the other hand, it is heavy enough to be carried down again on the other side. Especially as regards pumice-stone, which is nearest to it as regards specific weight, kieselguhr has the further advantage of being much harder and sharper-edged, so that it is capable of cutting up, more readily than pumice-stone, the small bubbles of hydrogen that are deposited on the cathodes. Yet notwithstanding this greater hardness it is less brittle, and therefore more durable than pumice-stone. Whereas the latter is gradually broken up by the frequent impact against the hard metal surface into a gradually increasingly finer powder, which finally becomes absolutely useless, especially as its several grains become rounded by rubbing against one another, kieselguhr, by reason of its greater strength and toughness, undergoes only an inconsiderable amount of breaking up and does not become rounded at all, so that it retains its original activity for an unlimited period. This activity is such as cannot be obtained by any other known means, not even by means of the mechanical smoothing-tools that are used in many cases. This has been demonstrated by means of comparative tests relating to the strength of the different kinds of copper tubes, from which it has been seen that the tubes produced in accordance with the herein-described process were superior as regards strength to all others. A further advantage of this process is that it can be employed without difficulty for the manufacture of tubes of any desired dimensions, whereas when mechanical smoothing-tools are used the difficulties increase, especially with increase of length, because the great pressure of the smoothing-tools easily gives rise to deflections.

With the same success as in the manufacture of tubes or other hollow bodies of copper the herein-described process may also be utilized for the manufacture of similar articles of nickel and other metals. Likewise instead of using the process for the manufacture of deposits which are separated from their foundation after the completion of the electrolytic operation the process may also be used for producing permanent metal deposits upon metallic or non-metallic bodies which are caused to rotate on a horizontal or an inclined axis, it being understood that non-metallic bodies would be first suitably prepared for the metal deposit.

Now what I claim, and desire to secure by Letters Patent, is the following:

The process of producing galvanic deposits, which consists in mixing comminuted kieselguhr with a suitable electrolyte, passing an electric current through the mixture and simultaneously producing a relative movement between the electrolyte and the cathode to dislodge the hydrogen bubbles and to smooth the metallic deposit by the action of the kieselguhr.

In testimony that I claim the foregoing as my invention I have signed my name, in presence of two witnesses, this 27th day of December, 1905.

OTTO DIEFFENBACH.

Witnesses:

ROBERT BRÜHL,
JEAN GRÜND.