(No Model.)

H. LIEPMANN.

CARBON ELECTRODE FOR ELECTROLYTICAL PURPOSES.

No. 330,247. Patented Nov. 10, 1885.

Fig. 1.

Fig. 2.

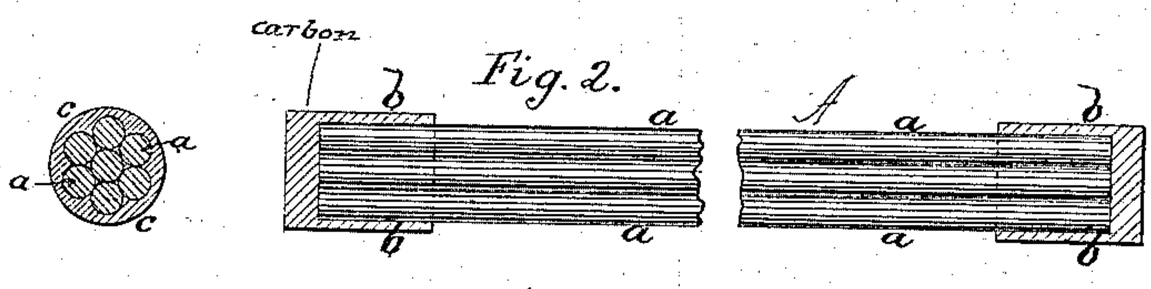


Fig. 3.

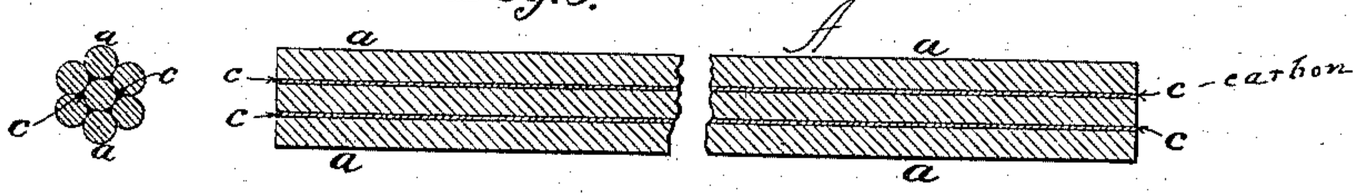
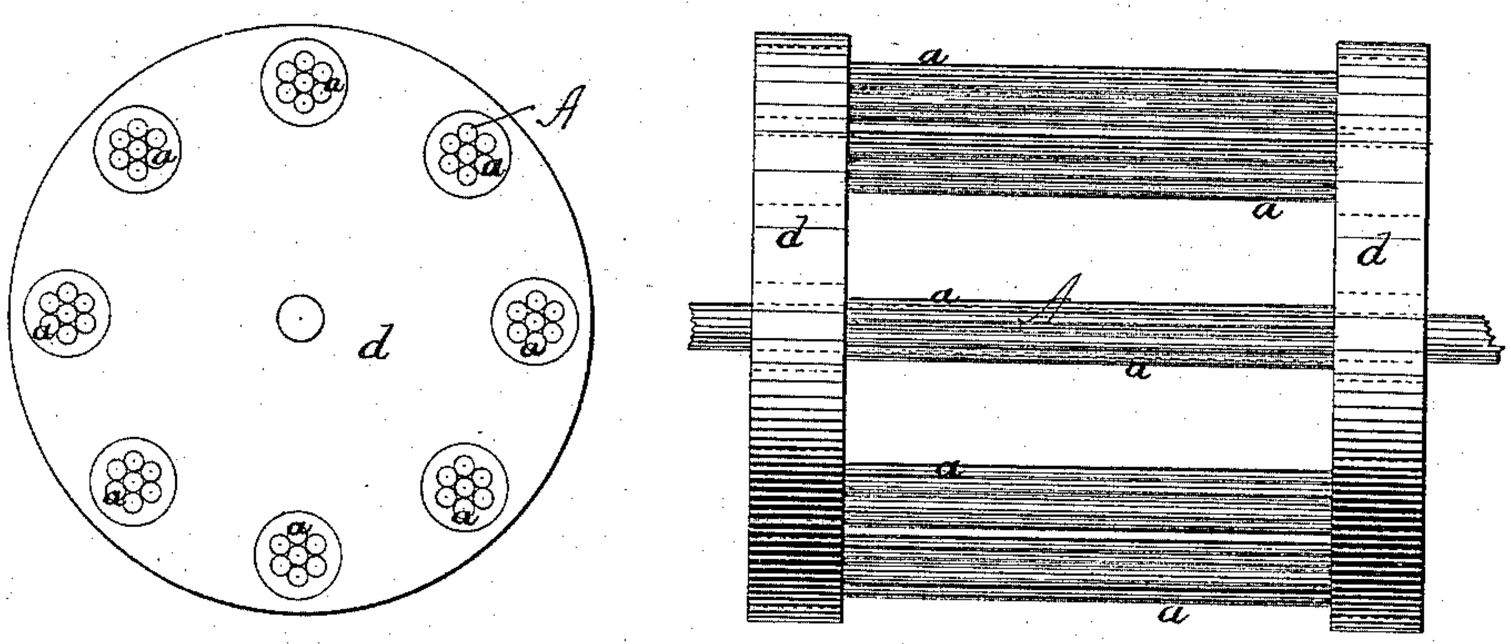


Fig. 4.



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UNITED STATES PATENT OFFICE.

HENRY LIEPMANN, OF LONDON, COUNTY OF MIDDLESEX, ENGLAND.

CARBON ELECTRODE FOR ELECTROLYTICAL PURPOSES.

SPECIFICATION forming part of Letters Patent No. 330,247, dated November 10, 1885.

Application filed July 21, 1885. Serial No. 172,233. (No model.) Patented in England February 25, 1884, No, 3,884.

To all whom it may concern:

Be it known that I, HENRY LIEPMANN, managing director of the Liepmann Carbon Company, (Limited,) Nelson Wharf, Millwall, London, in the county of Middlesex, England, chemist, Ph. D., F. C. S., &c., a subject of the Queen of Great Britain, residing at 40 Lexham Gardens, London, in the county of Middlesex, England, have invented Improved Carbon Electrodes for Electrolytical Purposes, (for which I have obtained a patent in Great Britain, No. 3,884, bearing date February 25, 1884,) of which the following is a specification.

In electrolytical processes—such, for instance, as the treatment of ores by electrolysis—it is frequently necessary or advisable to keep one or both of the poles or electrodes of the apparatus employed in motion, in order to maintain in as constant a state of agitation as possible the electrolyte or solution subjected to electrolysis, and also the material upon which the solution is to act, and it is also desirable to have as large a surface as possible. The substance employed in the construction of these electrodes must be of such a nature that it does not itself undergo any material electrolytical decomposition, and for this purpose carbon is generally employed. In the case where the poles or electrodes, instead of being stationary, are required to be actuated, so as to keep in motion the electrolyte and the material or substance to be acted upon, it is necessary that their size and strength be increased sufficiently to enable them to bear the strain to which they are subjected. The manufacture of carbon in one piece which shall have the necessary uniform density, homogeneousness of material, and strength throughout beyond a certain size and thickness presents, however, considerable difficulties.

The object of my invention is to devise means by which these essential qualities of size, combined with uniform strength, homogeneousness of material, and density shall be produced in the electrodes without the necessity of manufacturing them in one continuous piece or block, and also to give them at the same time as large a surface as possible. Furthermore, a thick and solid electrode manufactured in one piece is liable to be broken during the process of electrolysis, whereby it is rendered entirely useless, and even detrimental to the operation. My electrodes are manufactured with a view to minimize this defect. For this purpose I form the poles or electrodes of several carbon pieces of any convenient shape and of comparatively small sectional area, which can readily be produced of uniform density and strength throughout. These small carbon pieces are united together, so as to form a body which shall behave, as far as electrical conductivity is concerned, as nearly as possible as one homogeneous mass, and by its corrugated form will present a larger surface than one solid block would. The probability of all of these rods breaking at one and the same time is very remote, and should a single rod break the current would still be conveyed through the remainder, and after the operation the broken rod could easily be replaced. If necessary, a number of such bundles could be used as one electrode. For the purpose of making them act throughout the entire mass as one homogeneous piece, a thorough contact must be established between the individual pieces themselves, as the simple superposition is insufficient.

In the drawings, Figure 1 includes a longitudinal and a transverse section of the improved electrode having metallic caps at its ends. Fig. 2 includes a longitudinal and a transverse section of this improved electrode having carbon caps at its ends. Fig. 3 includes a longitudinal and a transverse section of this improved electrode having a carbon filling in the interstices between its separate carbon rods. Fig. 4 includes an end and a side elevation of a rotary drum having these improved electrodes mounted therein.

Similar letters of reference indicate corresponding parts in the different figures.

The electrode A comprises a series of separate carbon rods, *a*, bundled together and provided with a cap, *b*. The rods *a* before being bundled are preferably provided with a copper coating at their ends, deposited thereon electrolytically or otherwise, which coating assists in establishing a good metallic connection when they are united together. The so coppered carbon rods *a* are then assembled together in the form of a bundle, and copper is then deposited upon the ends of the bundle, which unites with the copper on the ends of

the individual rods and firmly binds the rods together, forming a cap, *b*, at each end of the bundle. The metal of the cap may also extend into the interstices between the rods. The metal of the caps may be cast around the ends of the bundle, over and between the ends of the individual rods, instead of being deposited thereon. The cap *b* may be composed of carbon instead of metal, if preferred. The interstices between the rods of the bundle may be filled in with a binding carbon material and baked therein, thereby practically constituting a solid composite carbon electrode. This carbon material is composed of a carbon paste made according to any of the preferred formulas for carbon paste for making battery-carbons. The interstices are filled with this paste and the bundle is subjected to a red or baking heat. These compound electrodes may be mounted between two disks, *d d*, forming a rotary drum for use in electrolytical apparatus.

In electrolytical decomposition care must be taken that the solution does not come in contact with the metal on the carbon either directly or by capillary action, as it would be liable to be dissolved or affected. Even when the metallic ends of the carbons are placed outside of the solution the capillary action is liable to attract sufficient solution to affect the metal and destroy the contact between it and the carbons. To prevent this I immerse the rods or bundle at those points where this capillary action would have such a detrimental effect upon the metallic covering, before being coppered or coated with metal, in a suitable insulating material, by means of which the interstices at the end are also filled, or these may be filled separately.

I am aware that separate carbon rods have heretofore been bundled together, and that they have also been mounted apart from each other in metallic rings; but in neither case were they united as herein described.

I am also aware that it is not new, broadly, to electroplate the connections between the carbon and the leading-in wires of an incandescent electric lamp.

Having fully described my invention, what I desire to claim and secure by Letters Patent is—

1. An electrode composed of a number of carbon rods or pieces and a filling between them of carbon material baked therein, the ends of said rods being insulated, substantially as described.

2. An electrode consisting of a number of single carbon rods arranged in the form of a bundle, the interstices of which are filled wholly or partly with binding and conductive carbon material, as described, and for the purpose specified.

3. An electrode composed of a number of carbon rods or pieces, and a filling between them of carbon material baked therein, the ends of said rods being insulated and coppered, substantially as described.

4. An electrode consisting of a number of carbon rods bundled together, with interstices filled with carbon material, and the ends of which are coppered, as described, and for the purpose specified.

HENRY LIEPMANN.

Witnesses:
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