GOVERNMENT OF INDIA : THE PATENT OFFICE, 214, ACHARYA JAGADISH BOSE ROAD, CALCUTTA-17.

Specification No. 113593. Application No. 113593 dated 14th December, 1967. Complete Specification left on 11th October, 1968. Application accepted 18th March, 1969.

PROVISIONAL SPECIFICATIONS

Index at acceptance—14A2[LVIII(1)]

IMPROVED CELL OR BATTERY SYSTEMS INCORPORATING COPPER OXALATE CATHODE

COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH, RAFI MARG, NEW DELHI-1, INDIA, AN INDIAN REGISTERED BODY INCORPORATED UNDER THE REGISTRATION OF SOCIETIES ACT (ACT XXI OF 1860)

The following specification describes the nature of this invention :—

This is an invenion by Dr. Prem Behari Mathur, Dr. Roshan Lal Seth, Shri Kanakarajan Dakshinamurthi and Shri Narasimhan Venkatakrishnan, all the four of the Central Electrochemical Research Institute, Karaikudi-3, India, all Indian citizens.

This invention relates to the development of a new battery system consisting of copper oxalate based cathode and an active metal anode.

Hitherto it has been the practice to use the well known cathode materials such as manganese dioxide, lead dioxide, silver chloride and cuprous chloride as depolariser in association with anodic elements like zinc, aluminium or magnesium.

The following are the drawbacks of the hitherto known cathodic elements used in cells :

1. Quick polarisation of manganese dioxide type cathode at heavy current drains.
2. Large weight in relation to its capacity of lead dioxide type cathode.
3. High cost of silver chloride cathode.
4. Relative unstable nature of cuprous chloride cathode resulting in its lower shelf life.

The object of the invention is,

1. To obviate the disadvantages of polarisation at comparatively heavier drainage of current.
2. To obviate the disadvantage of high weight of the power source.
3. To obviate the disadvantage of high cost of heavy duty battery system.
4. To obviate the disadvantage of comparatively short storage life.

To these ends the invention broadly consist in:

1. Using a new cathode element for batteries which consist of copper oxalate based cathode in conjunction with an active metallic anode that of like magnesium alloy or aluminium or zinc.
2. Using copper oxalate mixture which carries cuprous chloride and an organic binder.
3. Using a duplex electrode consisting of copper and the active metal in multi cell battery.
4. Applying the cathode paste on the copper foil or mesh grid or on the copper face of the duplex electrode for use in single cell and the multi cell battery respectively.
5. Sealing completely all the edges of the electrodes with insulating plastic material.
6. Using separators like treated cotton pad and other microporous separators.

Example I

Cuprous chloride is treated with oxalic acid solution in presence of mineral acid at elevated temperature (80°C). After the reaction is over the precipitate is washed and dried. This precipitated material is mixed with an organic binder and coated over copper foil or mesh in case of single cell and on copper face of the duplex electrode in the case of cell pack. The interfaces of the duplex electrode is coated with plastic insulating solution. Magnesium alloy (AZ 31) plate and the mix coated copper plate are placed facing each other and separated by a treated cotton separator. This cell system gives electrical energy on activation with water or salt water.

Example II

The cells are fabricated as per method described in example 1 with the difference in the method adopted for the preparation of the cathode material. The active material was obtained by mixing copper oxalate and lesser quantity of copper chloride with conducting materials like copper powder or acetylene black. Results were similar.

The incorporation of the earlier mentioned features in the fabrication of cells or battery renders the following advantages :

1. A new cell system possessing the following important performance characteristics.
   (a) Quick time of activation of the order of 1 or 2 seconds.
   (b) Appreciably high and steady discharge voltage of the order of 1.4 to 1.3 volts for over three fourth of the total capacity.
   (c) No deteoration of cathodic element on keeping; this helps in increasing the shelf life of the cell.
   (d) The cell system gives above 200 A.H. capacity per Kg. of the cathodic material at the material efficiency of above 80%.
   (e) Discharges at almost flat potential at different drains over about 3/4 of the capacity.
   (f) Capable of being discharged at as high drain as 8 amp/dm^2 or 0.08 amp/cm^2.

Dated this 12th day of December, 1967.

Sd/-
PATENTS OFFICER,
COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH.

Price : TWO RUPEES.

COMPLETE SPECIFICATION

"IMPROVED CELL OR BATTERY SYSTEMS INCORPORATING COPPER OXALATE CATHODE"

COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH, RAFI MARG, NEW DELHI-1, INDIA, AN INDIAN REGISTERED BODY INCORPORATED UNDER THE REGISTRATION OF SOCIETIES ACT (ACT XXI OF 1860)

The following specification particularly describes and ascertains the nature of this invention and the manner in which it is to be performed :—

This is an invention by Dr. Prem Behari Mathur, Dr. Roshan Lal Seth, Shri Kanakarajan Dakshinamurthi and Shri Narasimhan Venkatakrishnan, all the four of the Central Electrochemical Research Institute, Karaikudi-3, India, all Indian Citizens.

This invention relates to the development of a new battery system consisting of copper oxalate based cathode and an active metal anode.

Hitherto it has been the practice to use cathode materials such as cuprous and silver chloride as depolarisers in the water activated batteries in association with anode elements like zinc, aluminium or magnesium. These cells are themselves an improvement over the conventional battery employing depolarisers such as lead dioxide and manganese dioxide.

The following are the drawbacks of the hitherto known water activated cells,

1. Relative unstable nature of cuprous chloride cathode resulting in its lower shelf life.
2. High cost of silver chloride cathode.

The object of the invention is :

1. To obviate the disadvantages of high cost of heavy duty battery system.
2. To obviate the disadvantage of comparatively short storage life.

The battery system is several time economical than Magnesium-Silver chloride battery system; however, its cost is comparable to Magnesium-Cuprous chloride battery system.

This battery system can have special applications where comparatively continuous high current drains at fairly steady potentials are to be obtained which is not practicable with the conventional MnO_2 cells. The long shelf life in unactivated condition is another important feature of this battery system over the convenional systems.

This system overweighs the cuprous chloride system with regard to its utility as primary dry cell system as well as the activated type, whereas cuprous chloride system cannot be used as a dry cell owing to the generation of large heat during its operation and also owing to the high hydroscopic nature of the cuprous chloride. Hence, this battery system may find wide application as high energy density cell for transistor radios, hearing aids, electronic equipments, etc., where the longer life of the cell system is the desirable feature.

According to the present invention, the cell or battery system is characterised by incorporation of copper oxalate cathode and active metal anode.

The copper oxalate cathode is fabricated by pasting a mixture consisting of copper oxalate, copper chloride, a binder and conducting material powder like copper powder, active carbon, acetylene black, graphite over copper foil or mesh and enclosing the cathode element in a cotton pad or microporous material.

The cathode is used in conjuction with active metal anodes like magnesium, aluminium, zinc or their alloys.

The anode and cathode are separated by a separator material like cotton pad or other microporous separators.

The process for making copper oxalate cathode for a cell or battery consists in pasting of a mixture of copper oxalate copper chloride, an organic binder like polyvinyl alcohol and carboxymethyl cellulose and conducting materials like copper powder, graphite and acetylene black, over a copper foil or mesh enclosed in a cotton pad or microphorous material.

Noteworthy features :

1. Using a new cathode element for batteries which consist of copper oxalate based cathode in conjunction with an active metallic anode like that of magnesium alloy or aluminium or zinc.
2. Using copper oxalate mixture which carries cuprous chloride and an organic binder.
3. Using a duplex electrode consisting of copper and the active metal in multi-cell battery.
4. Applying the cathode paste on the copper foil or mesh grid or on the copper face of the duplex electrode for use in single cell and the multi cell battery respectively.
5. Sealing completely all the edges of the electrodes with insulating plastic material.
6. Using separators like treated cotton pad and other microporous separators.

The incorporation of the earlier mentioned features in the fabrication of cells or battery senders the following advantages.

1. A new Cell system possessing the following important performance characteristics.

(a) Quick time of activation of the order of 1 or 2 seconds.

(b) Appreciably high and steady discharge voltage of the order of 1.4 to 1.3 Volts for over three fourth of the total capacity.

(c) No deterioration of cathodic element on keeping; this helps in increasing the shelf life of the cell.

(d) The cell system gives above 200 A.H. capacity per Kg of the cathodic material at the material efficiency of above 80%.

(e) Discharges at almost flat potential at different drains over about 3/4 of the capacity.

(f) Capable of being discharged at as high drain as 8 amp/dm^2 or 0.08 amp/cm^2.

Example I

50 grams of cuprous chloride are treated with 30 grams of oxalic acid in 100 c.c. of water containing 10 c.c. of hydrochloric acid at 80°C. After the reaction is over the precipitate is filtered and washed with water and dried at 80°C. The precipitated material is mixed with binder like polyvinyl alcohol and coated over copper foil or mesh in case of single cell and on copper face of the duplex electrode in the case of cell pack. The interfaces of the duplex electrode is coated with plastic insulating solution. Magnesium alloy (AZ 31) plate and the mix coated copper plate are placed facing each other and separated by a treated cotton separator. This cell system gives electrical energy on activation with water or salt water.

Example II

The cells are fabricated as per method described in example I with a difference in the method adopted for the preparation of the cathode material. The active material was obtained by mixing copper oxalate and lesser quantity of copper chloride with conducting materials like copper powder or acetylene black. Results were similar.

Example III

To 20% copper sulphate solution acidified with sulphuric acid hot saturated oxalic acid is added till the copper is completely precipitated. The precipitated copper oxalate is filtered, washed and dried. The copper oxalate is mixed with conducted material like graphite, acetylene black, copper powder and an addition agent like ammonium chloride. This mixture is treated with an organic binder and cathode plates fabricated as cited in example I.

WE CLAIM :

1. A cell or battery system characterised by incorporation of copper oxalate cathode and active metal anode.

2. A cell or battery as claimed in claim 1 wherein the copper oxalate cathode is fabricated by pasting a mixture consisting of copper oxalate, copper chloride, a binder and conducting material powder like copper powder, active carbon, acetylene black, graphite over copper foil or mesh and enclosing the cathode element in a cotton pad or microporous material.

3. A cell or battery as claimed in claim 1 or 2 wherein the cathode is used in conjuction with active metal anodes like magnesium, aluminium, zinc or their alloys.

4. A cell or battery as claimed in any of the preceding claims wherein the anode and cathode are separated by a separator material like cotton pad or other microporous separators.

5. A cell or battery system incorporating copper oxalate cathode for generating electrical energy substantially as described in the examples.

6. A cell or battery incorporating copper oxalate cathode substantially as hereinbefore described.

7. A process for making copper oxalate cathode for a cell or battery claimed in any of the preceding claims which consists in pasting of a mixture of copper oxalate copper chloride, an organic binder like polyvinyl alcohol and carboxymethyl cellulose and conducting materials like copper powder, graphite and acetylene black, over a coper foil or mesh enclosed in a cotton pad or microporous material.

Dated this 18th day of September, 1968.

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GIPN—SV—(43) 15 C.P.&D. Cal./73—100