

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

Specification No. 101929, filed 8th October 1965. Post-dated to 5th August 1966 under Section 5 of the
Indian Patents and Designs Act, 1911].

(Accepted 19th April 1968)

Index at acceptance—14D2[LVIII(1)]

“IMPROVEMENTS IN OR RELATING TO SINGLE SHOT BATTERIES OF THE RESERVE TYPE”

COUNCIL OF SCIENTIFIC & INDUSTRIAL RESEARCH, RAFI MARG, NEW DELHI-1, INDIA, AN
INDIAN REGISTERED BODY INCORPORATED UNDER THE REGISTRATION OF SOCIETIES ACT
(ACT XXI OF 1960).

The following Specification particularly describes and ascertains the nature of this invention and the manner
in which it is to be performed.

This invention relates to improvements in or relating to single shot batteries of the reserve type comprising an anode separator and cathode and activating materials.

Hitherto it has been proposed to use silver oxide, cuprous chloride, mercuric oxide, lead dioxide as cathode materials for such batteries.

The use of these cathode materials is open to the following objections:

1. Silver oxide is very costly.
2. Cuprous chloride gradually gets oxidized in air to cupric chloride which necessitates the use of stabilizing agents along with it.
3. Lead dioxide requires activation by fluoboric acid which is costly and corrosive and requires special containers.

The object of this invention is to develop single shot batteries of the reserve type which will be free from these disadvantages.

We have found that this can be achieved.

- (i) by using halogens or materials which liberate halogens on activation as cathode material;
- (ii) that the halogen can be released on to the supporting electrode at the time of use, or the halogen can be absorbed on activated carbon, or the halogen can be produced *in situ* at the time of use.

The underlying principle of the invention is that halogens by virtue of their high reversible potential and fast electrode reactions are highly suitable as depolarizers in primary cells.

Single shot batteries of the reserve type comprise of an anode, separator, cathode and activating materials. According to the present invention the cathode consists of a mix consisting of conducting carbon with chemicals which on activation with water or sea water releases halogen for depolarisation as shown in Examples 1 and 2. Alternately, the cathode consists of a porous carbon electrode over which is placed a sealed glass capsule containing the halogen. The glass capsule is broken at the time of activation as shown in Examples 3 to 5.

The anode may be of magnesium or zinc or aluminium.

Thus, zinc, magnesium or aluminium in the form of a sheet is taken as the anode. Next to the anode is kept a separator which is porous and inert and capable of absorbing the electrolyte and holding the electrolyte in the dry state. Next to the separator is kept either a porous and conducting carbon electrode or a carbon electrode around which is packed the materials mentioned in the Examples given hereinbelow, which materials on activation, release the halogen. The activation may be done either by edding water, sea water or by breaking the ampule containing the halogen either alone or along with water and acid as illustrated in the Examples given hereinbelow.

The use of these halogens in single shot batteries of the reserve type makes possible cells of high voltage and high ampere hour output with light and cheap depolarizers in the place of cuprous chloride, lead dioxide and silver oxide. The merits of the halogen electrodes compared to those used at present are given in Table 1.

TABLE 1

Cathode material	Reversible electrode potential	Eq. wt.	Anode material	Cell voltage	Remarks
Silver oxide	-0.8V	116	Costly
Lead dioxide	-1.456V	130	Lead	2.5V	Requires activation by fluoboric acid which is costly and corrosive
8 Cuprous chloride	8 -.124V	4 98.5	12 Magnesium	4 1.6V	12 Not stable in air - low potential
Chlorine	-1.358V	35.5	Zinc Aluminium Magnesium	2V 2.5V 2.7V	
Bromine	-1.087V	80	Zinc Aluminium Magnesium	1.8V 2.4V 2.7V	

Price : TWO RUPEES.

By suitably combining the cathode of the present invention, as given in the Examples 1-5 with zinc, aluminium or magnesium whichever is suitable open circuit potentials of the order of 2.5V is obtained and currents of 10-50 mA/sq. cm. may be drawn without substantial polarisation and limited only by the amount of cathode and anode materials taken.

To these ends the invention comprises in packing anode, cathode and electrolyte in an inert container. The anode is separated from the cathode by diaphragm of cotton pad, absorbent paper or any other inert and porous material. The cell is activated at the time of use by any one of the following methods:

- (a) The anode, diaphragm, electrolyte and cathode are assembled in position in the dry state and activated by adding water at the time of use.
- (b) Anode, diaphragm, electrolyte solution and porous carbon electrode are packed suitably. In the porous carbon electrode which is in the form of a cup is placed a sealed glass capsule containing the depolarizer. The cell is activated by breaking the capsule just before use.
- (c) The anode, diaphragm, electrolyte and porous carbon, cathode are packed in the dry state. Over the porous carbon cathode is placed a sealed glass capsule containing the depolarizer and water. The capsule is broken just before use.
- (d) Anode, diaphragm, electrolyte solution and cathode container are suitably packed. In the cathode container is placed a glass capsule containing the depolarizer and an acid solution. The cell is activated by breaking the glass capsule just before use.

DESCRIPTION OF THE DIAGRAM AND WORKING OF THE CELL

The invention will now be described with the help of accompanying drawings wherein:

In Sheet No : 1

Fig. 1 is the front elevation of the cell. Fig. 2 is the section and Fig. 3 is plan wherein the parts indicated by number are given below:

No: 1	...	Inert container
No: 2	...	Lid of the container
No: 3	...	Capsule holder
No: 4	...	Sealed glass capsule containing halogen
No: 5	...	Anode terminal
No: 6	...	Cathode terminal
No: 7	...	Separator holding the electrolyte in dry state
No: 8	...	Porous carbon cathode
No: 9	...	Vent for activation

The anode, separator, cathode and capsule are assembled as shown in the diagram in an inert container. The cell is activated by breaking the tip of the glass capsule by inserting a rod through the vent provided in the lid.

In Sheet No: 2

Fig. 1 is front elevation. Fig. 2 is section and Fig. 3 is plan wherein the parts indicated by number are given below:

No: 1	...	Inert container
No: 2	...	Lid of the container
No: 3	...	Anode terminal
No: 4	...	Cathode terminal
No: 5	...	Separator holding electrolyte in dry state

No: 6	...	Cathode consisting conducting carbon and chemicals
No: 7	...	Vent for activation

The anode separator and cathode are assembled in an inert container as shown in the diagram. The cell is activated by adding sea water or water through the vent provided in the lid of the container.

EXAMPLE 1

Aluminium anode	Sodium chloride Mercuric chloride Sulphamic acid	Potassium permanganate, sodium chloride mixed with acetylene black and packed around graphite cathode.
-----------------	--	--

The cell is activated by adding water at the time of use. The cell gives an OCV of 2.2V and CCV of 2V at 10 mA/sq. cm. current density.

EXAMPLE 2

Aluminium anode	Potassium bromide Sodium chloride Mercuric chloride Sulphamic acid	Potassium bromate and acetylene black packed around graphite cathode
-----------------	---	---

The cell is activated by adding water just before use. The cell gives an OCV of 2.4V and CCV of 2V and 10 mA/sq. cm. current density.

EXAMPLE 3

Zinc anode	Ammonium chloride Mercuric chloride	Bromine capsule placed over porous carbon cathode
------------	--	--

The cell is activated by breaking the capsule just before use. The cell gives an OCV of 1.6V and CCV of 1.5V at 10 mA/sq. cm. current density.

EXAMPLE 4

Magnesium anode	Sodium chloride Sulphamic acid	Porous carbon cathode over which is kept a glass capsule containing bromine and water
-----------------	-----------------------------------	---

The cell is activated by breaking the capsule just before use. The cell gives an OCV of 2.7V and CCV of 2.4V at 10 mA/sq. cm. current density.

EXAMPLE 5

Zinc anode	Ammonium chloride Mercuric chloride solution	Porous carbon cathode over which is placed a glass capsule containing bromine and hydrochloric acid.
------------	--	--

The cell is activated by breaking the glass capsule at the time of use. The cell gives OCV of 1.9V and CCV of 1.7V at 10 mA/sq. cm. current density.

NOTEWORTHY FEATURES

1. A cathode material wherein halogens *in situ* are employed in single shot batteries (reserve type).
2. These cathode materials when combined with anodes such as zinc, aluminium and magnesium as in Examples 1-5 produce cell systems for single shot applications.
3. Cells using these cathode materials when assembled and activated as in Examples 1-5 give open circuit voltages and closed circuit voltages of the order given in the Examples.
4. Cells assembled and activated as in Examples 1-5 work at a current density of 10 mA/sq. cm.
5. The reagents used in making the cells as in Examples 1-5 are relatively cheap.
6. The cells assembled and activated as in Examples 1-5 take activation times of 5 to 10 seconds.

We Claim:

1. Single shot batteries of the reserve type comprising an anode, separator, cathode and activating materials, wherein the cathode consist of conducting carbon with chemicals which on activation with water or sea water releases halogen for depolarisation.
2. Single shot batteries of the reserve type as claimed in Claim 1 wherein the cathode consists of a porous carbon electrode over which is placed a sealed glass capsule containing the halogen, which sealed glass capsule is broken at the time of activation.
3. Single shot batteries of the reserve type as claimed in Claim 1 or 2 wherein the anode is of magnesium or zinc.
4. Single shot batteries of the reserve type as claimed in Claim 1 or 2 wherein the anode is of aluminium.
5. Single shot batteries of the reserve type substantially as hereinbefore described.

Dated this 1st day of August 1965.

Sd.

COUNCIL OF SCIENTIFIC & INDUSTRIAL RESEARCH
Parents Officer

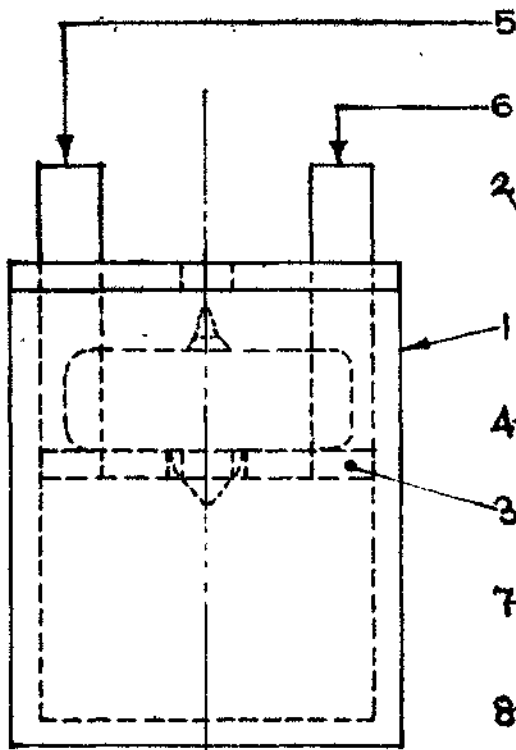


Fig. 1.

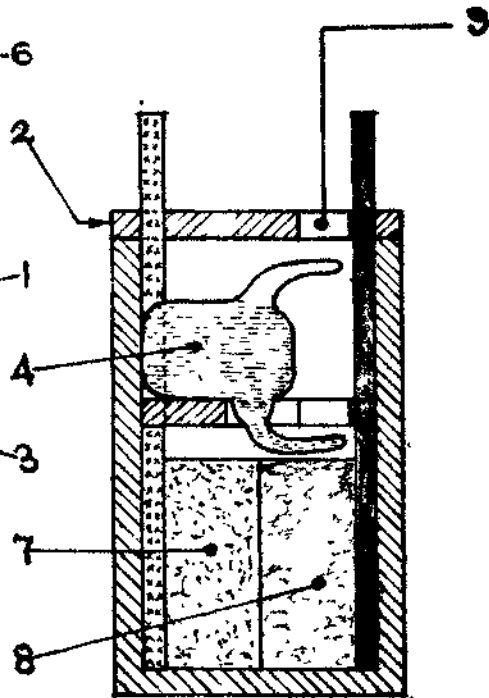


Fig. 2.
(Section 'AA')

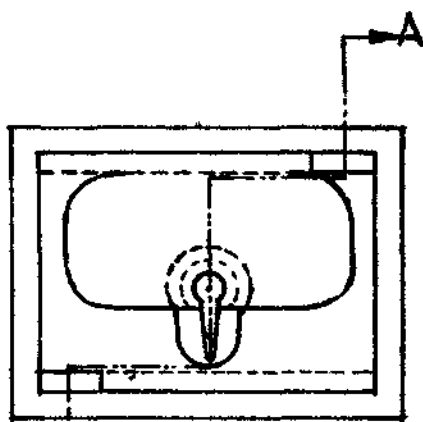


Fig. 3.
(No. 2 being removed)

R. B. Pai

(R. B. PAI)
PATENTS OFFICER,
C. S. I. R.

No. 101929

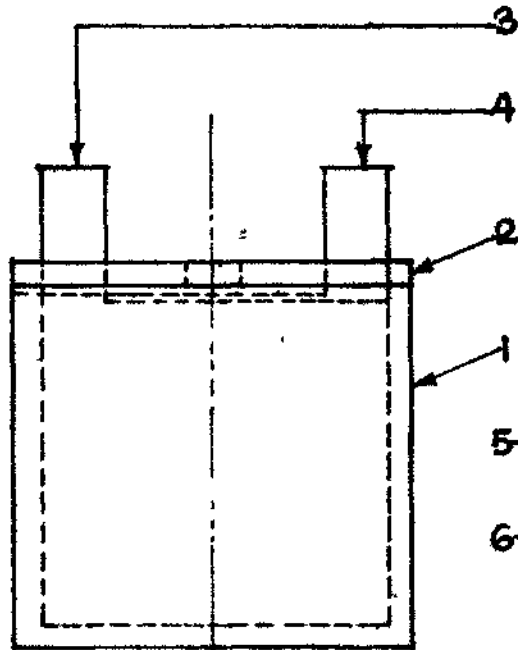


Fig. 1.

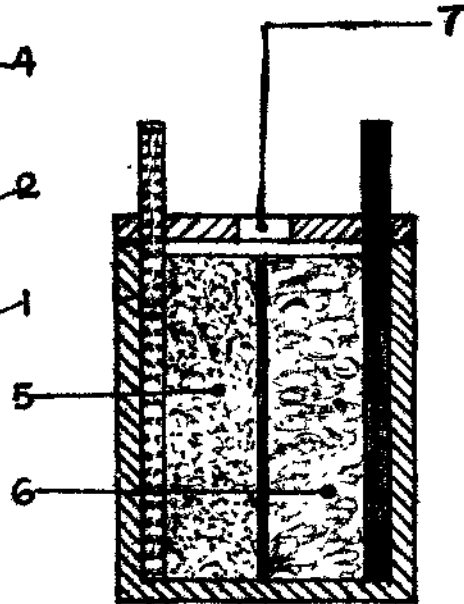


Fig. 2.
(Section AA')

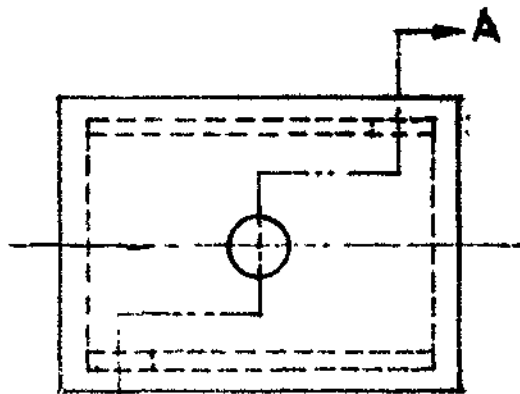


Fig. 3.

R. B. Pai
 (R. B. PAI)
 PATENTS OFFICER,
 C.S.I.R.