

Specification No. 110440, Application No. 110440 dated 29th April, 1967. (Complete Specification left on 24th February, 1968. Application accepted 29th January, 1969.

Index at Acceptance 14D2—LVIII(1)

**OXYGEN DEPOLARISED PRIMARY WET CELLS**

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 invention by :

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**THIS INVENTION RELATES TO A NEW DESIGN FOR OXYGEN DEPOLARISED PRIMARY WET CELLS.**

It has been hitherto customary to use porous carbon elements in the form of solid cylinders or modifications almost resembling to cylinders or in the form of vertical plates with corresponding vertically mounted zinc elements in alkaline or ammonium chloride media. These suffer from the disadvantages that (a) in cylinder types the quantity of active carbon for each block is high and the ratio of breathing area to effective electrode area is small resulting in low drains; (b) in the vertical plate type of cathode although the ratio between the breathing area to the effective electrode area is unity the design is such that flooding of the breathing space is not entirely eliminated. In both the above designs the corrosion of zinc by differential aeration is severe necessitating the use of additional thickness of zinc near airline corrosion region and the spreading of a layer of oil to minimise oxygen entry but at the cost of impairing the cycle life of the carbon elements as the carbon element gets coated with oil when withdrawn for introducing fresh charges of zinc and electrolyte.

The objective of this invention is to obviate the above mentioned disadvantages by the use of a horizontal cathode element with a corresponding horizontal zinc anode placed suitably below the region of acute corrosion caused by differential aeration.

The following briefly describes the nature of the invention :

The cathode element is made by pressing either manganese-di-oxide mixed suitably for oxygen depolarised cathodes covered by our Indian patent specification No. 106807 or with any known depolariser mix stable in the presence of alkali and capable of also oxygen depolarisation such as Nickel oxide, Cupric oxide, Mercuric oxide or with any conventional mixes suitable for the same purpose on to a metallic matrix made according to our prior Indian Patent No. 98157. This horizontal cathode is supported with its bottom surface in contact with electrolyte. Since the electrolyte does not exert a positive pressure on the cathode, the latter cannot on any account get flooded.

The anode is placed horizontally and has got more or less the same geometry as the bottom of the cathode. It may be provided with perforations to allow free mixing of the electrolyte. Depending upon the current drain needed, the distance between the anode and cathode is adjusted to optimise zinc utilisation.

The following examples briefly illustrate the nature of the invention. The expressions "AW.", "AWC." are the usual notations used in both ISS and BSS.

**Example 1**

A cell fabricated to outer dimensions of AW. cells covered by BSS 1335:1946 is shown in sheet 1 (Figs. 1-5) of the accompanying drawings. The cathode element as shown in Figure 1 sheet 1 is made of a metallic substrate suitably treated to resist (Fig. 1) alkali attack and whose bottom is of expanded metal (Figure 2 sheet 1). The manganese-dioxide mix suitable for oxygen depolarised cathodes is pressed on to convenient height (Figure 1 (2) Sheet 1).

The anode which is of amalgamated zinc is of similar area as the bottom of the cathode with suitable perforations (Figures 3 and 4 of Sheet 1). This anode is supported at a convenient position

in the container (Figure 5 (8) Sheet 1). The connection is given by means of a wire (Figure 5 (10) Sheet 1).

The cathode is suspended from the perforated lid of the container. The perforations are made (Figure 5 (6) Sheet 1) to allow free ingress of air to the cathode only. The electrolyte that is used is a solution of Sodium or Potassium hydroxide of 30-50% concentration (Figure 5 (7) Sheet 1). The complete assembly is as shown in Figure 5, Sheet 1.

The Parts are ---

#### FIGURE 5:

- (1) Metallic Matrix
- (2) Manganese-di-oxide mix
- (3) Expanded metal bottom
- (4) Zinc anode
- (5) Connecting lead for cathode
- (6) Perforated lid
- (7) Electrolyte of Caustic alkali
- (8) Support for zinc, non reactive in alkali
- (9) Outer container,
- (10) Connecting lead for anode.

#### Example 2

The electrode assembly suitable for use in the same containers that are used for sac cells covered by ISI 268:1959 is shown in Figure 6, Sheet 2.

The cathode material is pressed to a metallic matrix as explained in example 1 and the anode is suspended from the cathode itself (Figure 6 Sheet 2).

The anode which is amalgamated zinc is suspended from the cathode by means of a central bolt (Figure 7 (6) Sheet 2) insulated by plastic bush (Figure 6 (3) Sheet 2) and held in position by the nut (Figure 6 (5) Sheet 2). This anode cathode assembly is suspended from a perforated lid of Plastic. The Cell assembly is shown in Figure 7 Sheet 2.

#### FIGURE 7:

- (1) Metallic matrix
- (2) Manganese-di-oxide mix
- (3) Insulating Bush
- (4) Zinc anode
- (5) Retaining nut
- (6) Central Bolt
- (7) Expanded metal bottom of the cathode matrix
- (8) Electrolyte
- (9) Outer Container
- (10) Cathode lead
- (11) Perforated lid
- (12) Cathode suspending bolts
- (13) Anode lead.

The same electrolyte mentioned in example 1 is used. Such a cell has the following characteristics as compared with NH<sub>4</sub>Cl, Leclanche type Sac cells covered by the above mentioned Indian Standards Specification

Container	Electrolyte	Anode	Cathode	Load in ohms	Voltage in volt	Life in hours	Electrolyte renewal Period
Same as is used for Sac. 1	NH <sub>4</sub> Cl	zinc	Sac. 1 covered by ISS268 1959	10	1.4 -0.8	1400	renewed once in 8 days.
Same as is used for Sac. 1	NaOH/ KOH	zinc	as described in eg. 2	10	1.35 to 1.175	1400	None

From the table it is clear that this cell has a superior performance compared to conventional cells by virtue of giving steady current at high voltages (1.35 to 1.175) instead of (1.35 to 0.75). This cell gives 1400 hours of service in one charge of electrolyte, eliminating the necessity of once a week electrolyte replacement.

Because of the smaller capacity of the container prescribed for use with Sac 2 elements covered by ISS 268:1959, employing such a container but with this design, the only difference noted is that the cell gives proportionately lower capacity, other conditions of discharge remaining the same.

#### Example 3

An electrode assembly suitable for use with glass containers of AWC<sub>2</sub> cells is indicated in Sheet 3. Here the anode is suspended from the cathode at two points. The method of making the cathode is appreciably the same as in previous examples but with using a rectangular matrix. The zinc anode is rectangular in shape preferably perforated and the assembly is as shown in (Figures 8 and 9, Sheet 3). The view of the matrix from

above with the position of the suspension bolts is indicated in Figure 8 Sheet 3

#### FIGURE 9, SHEET 3 PARTS:

1. Metallic grid
5. Manganese-di-oxide mix
3. Insulating bush
4. Zinc anode
6. Retaining nut
- 2, 8. Suspending Bolt
7. Expanded metal bottom.

This assembly can be used in AWC<sub>2</sub> containers already in use. The cell uses alkaline electrolyte as in previous examples and is capable of 2 amperes continuous drain at a voltage range 1.15 to 0.9 V and an ampere hour capacity of about 950 A hours as against a drain of 1 ampere at 1.1 to 0.9 V for conventional porous carbon electrode cells with an ampere hour capacity of 432 as covered by B.S.S. 1335:1946. This cell is also capable of intermittent drains of 4 amperes suitable for use in signal motors.

**Example 4**

An electrode assembly suitable for use with readily (commercially available) plastic containers with a wider top and a comparatively narrow bottom and of suitable height is indicated in sheet 4. This uses a three point suspension of the amalgamated perforated zinc anode and the cathode is made as in Example 1. The parts are indicated below :

**FIGURE 10, SHEET 4:**

- (1) Perforated lid
- (2) Expanded metal bottom
- (3) Metallic matrix
- (4) Insulating bush
- (5) Zinc anode
- (6) Retaining nut
- (7) Suspension bolt for anode
- (8) Plastic container
- (9) Manganese-di-oxide mix
- (10) Cathode lead
- (11) Anode lead

This cell is capable of delivering heavy currents of the order of 5 to 7 amperes suitable for use in point motors in Railways, and the ampere hour capacity is high of the order of 1000A hrs.

The following are among the advantages:—

(1) An effective utilisation of zinc anode viz., without sacrificing the possibility of high current drain but with the minimum consumption of zinc is made possible by the design referred to in this patent specification.

(2) With the minimum amount of the active material maximum current drains have been made possible with an indefinite life for the cathode element. The effective utilisation of oxygen of the air and the prevention of diffusion of oxygen into the electrolyte has been made simultaneously possible. This in effect also reduces the corrosion of the anode material and eliminates the need for special precautionary measures which are normally taken such as having maximum amount of zinc at places vulnerable to the attack by oxygen of the air by having a thin layer of the oil.

(3) As a result of the facts mentioned in (2) above, the cost of the cathode element is very much reduced for giving the same ampere hour capacity at the same current drains normally encountered in conventional cells. To give a specific example, a cathode containing about 300 gram of the common active material i.e., the manganese-di-oxide mix, as the depolariser gives in one cycle 1500 hours of service as compared to the entire life of a sac element which contains 2 kilograms of manganese-di-oxide to deliver the same ampere-hour. The idea of cost reduction further becomes clear when it is understood that the same cathode element can be used for several more cycles only by changing the zinc and the electrolyte. The cost of the cathode element is also reduced because it dispenses the use of costlier central carbon rod normally used with sac cells. Because of the large ratio of breathing to reaction area high current drains are possible and therefore the superiority of this cathode element over all conventional porous carbon elements.

(4) The cell which has been described in this patent specification under example 1, is superior to the following cells with respect to performance while having considerable cost advantage :

- (a) AW4 cells of BSS 1335 : 1945.
- (b) Dry cell 1R 40T; 1R 40I, IR 40G in both heavy duty and light intermittent type applications covered by ISS 586 : 1964.
- (c) Inert cell covered by ISS 267-1963.

(5) The cell which has been described in this patent specification under example 2, is superior to the following cells with respect to performance while having considerable cost advantage :

- (a) Leclanche type wet cell designated as sac 1 cell.
- (b) Leclanche type wet cell designated as sac 2 cell as per ISS 268 : 1959.

(6) The electrode assembly for example (3) is a fitting for use in already available AWC containers. This is capable of much heavier current drains and gives about thrice the ampere hour capacity of the conventional porous carbon cells.

Dated this 26th day of April, 1967.

(Sd.)

(R. BHASKAR PAL)

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**COMPLETE SPECIFICATION**

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

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This invention relates to a **NEW DESIGN FOR OXYGEN DEPOLARISED PRIMARY WET CELLS.**

It has hitherto been customary to use oxygen depolarised primary wet cells in the following forms :

(a) The active carbon cathode block with zinc anode surrounding it, the assembly being held vertically from the lid.

(b) The active carbon cathode made as a hollow rectangular block with side zincs also hanging vertically from the lid. In both the above cases, the reaction area of the electrodes is only the vertical portions.

(c) Cathodes other than the active carbon cathode but serving the same purpose, i.e. oxygen depolarisation such as the sintered nickel electrode, silver electrode and platinum/noble metal catalysed carbon electrodes, are used in oxygen depolarised hybrid fuel cells where a positive pressure of air is maintained by external means. This may be a compressed airline or oxygen cylinder. Here too the electrodes are held vertically hanging from the lid of the cell container.

These suffer from the disadvantages that in (a) there is (1) creepage of electrolyte through the carbon and subsequent carbonation, (2) excessive corrosion of zinc due to aeration and presence of peroxide ions as the zinc is within the region of airline attack, (3) the zinc anode must be cast in a tapered manner to avoid premature failure, (4) the amount of active carbon used for block is high leading to increase in cost, (5) the process of diffusion of air to the reaction site is hindered with the result only comparatively low currents can be attained.

In (b), though the cells use much less active material but can give high current densities, (1) the airline and peroxide ion attack on zinc exists and (2) the flooding of the breathing volume is not entirely avoided as there is always a positive pressure of liquid on the sides of the hollow block.

Also in (a) and (b), oil is used to minimise air entry so that the loss of zinc can be reduced. But this results in seriously impairing the cycle life of the cathode as it gets smeared with oil whenever a recharge is made.

The object of this invention is to obviate the above mentioned disadvantages by having a new design for oxygen depolarised primary wet cells.

Our prior Indian Patent No. 98157 describes an alkaline cell wherein a matrix electrode is used for making the cathode elements whereby the necessity of carbon rods for current collection is avoided. Thus, cathodes are made by fabricating flat matrix electrodes and pressing the depolariser mixture into them by simple methods.

Our prior Indian Patent No. 98158 describes an alkaline manganese dioxide wet cell which consists of an alkaline solution as electrolyte wherein zinc is used as anode and wherein the cathode is made by pressing a cathode mix comprising manganese dioxide/carbon mixture in the matrix electrode described in our prior Indian patent No. 98157.

The electrolyte consists of hydroxide of alkali and/or alkaline earth metals.

A further object of this invention is to develop a cell having a performance far superior to the cell covered by our prior Indian Patent No. 98158

Yet another object of the present invention is to develop an improved cell with particular reference to factors such as electrode disposition, design of the cathode to avoid flooding, optimising the reaction and oxygen access areas, and the avoidance of airline corrosion none of which factors are dealt with by our prior Indian Patent No. 98157.

According to the present invention, oxygen depolarised cell comprises of an anode and a cathode formed on a highly conducting matrix electrode claimed in the specification of our Indian Patent No. 98157 by pressing mixes suitable for air/oxygen depolarisation such as active or porous carbons or the manganese dioxide mix claimed in the specification of our co-pending Indian Patent application No. 106807 and the anode is of zinc, and is characterised in that the cathode and anode are both disposed horizontally, the bottom surface only of the cathode being in contact with the electrolyte in the cell, and the anode arranged below the cathode and facing the same and fully immersed in the electrolyte, the reaction areas of the cathode and anode being the bottom horizontal area of the cathode and the top horizontal area of the zinc anode respectively.

The cathode uses the highly conducting metal matrix electrode wherein a current collector is at the site of electro-chemical reaction, i.e., at the surface where the reaction takes place.

The anode may be independently hung by strips which also function as current collectors or hung as one unit suspended from the cathode by insulating washers.

The following briefly describes the invention :

The cathode is made as follows: A nickel plated or surface treated metal matrix electrode covered by the specification of Indian Patent No. 98157 entitled 'Improvements in or relating to a matrix electrode for use in alkaline primary cells' is taken. It is fabricated so as to have the metal matrix at the site of electro-chemical reaction and the bottom area is the reaction area of the cathode. Manganese dioxide mix suitable for oxygen depolarisation covered by the specification of Indian Patent No. 106807 entitled 'A new manganese dioxide mix for use in oxygen depolarised cells' or other hitherto well-known active carbon mix or any other powder capable of oxygen depolarisation (such as catalysed carbon, silver oxide, nickel oxide, cupric oxide and mercuric oxide carbon mixes) is mixed with a binder solution, that is non-wetting. The binder solution used must be such as not to introduce high resistance to the block but function as an effective wet-proofing agent. Solution may be of polystyrene in aromatic solvents like benzene, toluene and xylene or a solution of PVC or teflon or similar plastics to withstand the action of alkali.

This mixture is pressed into the cathode with the help of a press and allowed to dry either at ambient or at elevated temperatures. This horizontal cathode is supported from the lid with the bottom surface in contact with electrolyte and facing the anode that is placed below. The level of the electrolyte is lower than that of the pressed mixture in the cathode and thus the cathode cannot get flooded on any account.

The anode is placed horizontally and has got more or less the same geometry as the bottom of the cathode. It may be provided with perforations to allow free mixing of the electrolyte. Depending upon the current drain needed, the distance between the anode and cathode is adjusted to optimise zinc utilisation. The anode can be suspended as one unit suitably insulated from the cathode as given in the examples. The zinc can be independently hung from the lids similar to the arrangement in hitherto well-known cells by means of hanging strips that also function as anode current leads.

The following examples briefly illustrate the nature of the invention. The expressions 'AW', 'AWC', are the usual notations used in both ISS and BSS.

#### Example 1

A cell fabricated to outer dimensions of AW, cells covered by BSS 1335:1946 is shown in Figures 1-5 of the drawings accompanying the provisional specification. The cathode element shown in Fig. 1 is made of a metallic substrate suitably plated/treated to resist alkali attack and whose bottom (3) is of expanded metal (Figure 2). The manganese dioxide mix (2) suitable for oxygen depolarised cathodes or any other mix that can function as oxygen depolariser is pressed on to convenient height.

The anode (4) which is of amalgamated zinc is of similar area as the bottom of the cathode with suitable perforations (Figures 3 and 4). This anode (4) is supported at a convenient position in the container (9) by support (8). The connection is given by means of a wire (10).

The cathode is suspended from the perforated lid (6) of the container (9). Perforations are made on the lid to allow free ingress of air to the cathode only. The electrolyte (7) that is used is a solution of sodium or potassium hydroxide of 30-50% concentration. The complete assembly is as shown in Figure 5. The parts are:

#### FIGURE 5:

1. Metallic matrix
2. Manganese dioxide mix
3. Expanded metal bottom
4. Zinc anode
5. Connecting lead for cathode
6. Perforated lid
7. Electrolyte of caustic alkali
8. Support for zinc anode, non-reactive in alkali
9. Outer container
10. Connecting lead for anode

The performance characteristics as compared to the existing cells with similar overall dimensions are shown in Table 1 given hereinbelow.

#### Example 2

The electrode assembly suitable for use in the same containers that are used for sac covered by ISS 268:1959 is shown in Figure 6.

The cathode material (2) is pressed to a metallic matrix (1) as explained in example 1 and the anode (4) is suspended from the cathode itself.

The anode (4) which is amalgamated zinc is suspended from the cathode by means of a central bolt (6) insulated by plastic bush (3) and held in position by the nut. The anode-cathode assembly is suspended from a perforated lid (11) of plastic. The cell assembly is shown in Figure 7.

#### FIGURE 7:

1. Metallic matrix
2. Manganese dioxide mix
3. Insulating bush
4. Zinc anode
5. Retaining nut
6. Central bolt
7. Expanded metal bottom of the cathode matrix
8. Electrolyte
9. Outer Container
10. Cathode lead
11. Perforated lid
12. Cathode suspending bolts
13. Anode lead

The same electrolyte mentioned in example 1 is used. Such a cell has the following characteristics as compared with  $\text{NH}_4\text{Cl}$ , Leclanche type sac cells covered by the above mentioned Indian Standard Specification.

From the table given hereinbelow (Table 2), it is clear that this cell has a superior performance compared to conventional cells by giving a steady current at higher voltages (1.35 to 1.175) instead of (1.35 to 0.75). This cell gives 1400 hours of service in one charge of electrolyte, eliminating the necessity of once a week electrolyte replacement.

Because of the smaller capacity of the container prescribed for use with Sac 2 elements covered by ISS 268:1959, employing such a container but with this design, the only difference noted is that the cell gives proportionately lower capacity, other conditions of discharging remaining the same.

#### Example 3

An electrode assembly suitable for use with glass containers of AWC, cells covered by BSS 1335:1945 is indicated in Figure 9. Here the anode (4) is suspended from the cathode at two points. The method of making the cathode is appreciably the same as in previous examples but with using a rectangular matrix. The zinc anode (4) is rectangular in shape preferably perforated and the assembly is as shown in Figures 8 and 9. The view of the matrix (1) from above with the position of the suspension bolts is indicated in Figure 8.

#### FIGURE 9:

1. Metallic grid
- 2, 8. Suspending bolt
3. Insulating bush
4. Zinc anode
5. Manganese dioxide mix
6. Retaining nut
7. Expanded metal bottom

This assembly can be used in AWC containers already in use. The comparison of the performance of this cell with the porous carbon cell covered by BSS 1335:1946 using the same outer container is brought out in Table 3 given hereinbelow. This cell is also capable of intermittent drains of 4 amperes suitable for use in signal motors.

#### Example 4

An electrode assembly suitable for use with readily (commercially) available plastic containers with a wider top and a comparatively narrow bottom and of suitable height is indicated in Figure 10. This uses a three point suspension of the amalgamated perforated zinc anode and the cathode is made as in example 1. The parts are indicated below:

#### FIGURE 10:

1. Perforated lid
2. Expanded metal bottom
3. Metallic matrix
4. Insulating bush
5. Zinc anode
6. Retaining nut
7. Suspension bolt for anode
8. Plastic container
9. Manganese dioxide mix
10. Cathode lead
11. Anode lead

This cell is capable of delivering heavy currents of the order of 5 to 7 amperes suitable for use in point motors in Railways and the ampere hour capacity is high of the order of 1000 ampere hours.

The following are among the advantages:

1. An effective utilisation of zinc anode viz. without sacrificing the possibility of high current drain but with the minimum consumption of zinc is made possible by the design referred to in this patent specification. The air line corrosion of zinc and the peroxide ion corrosion are reduced to minimum.

2. With the minimum amount of the active material, maximum current drains have been made possible with an indefinite life for the cathode element. The effective utilisation of oxygen of the air and the prevention of diffusion of oxygen into the electrode have been made simultaneously

possible. This in effect also reduces the corrosion of the anode material and eliminates the need for special precautionary measures which are normally taken such as having maximum amount of zinc at places vulnerable to the attack by oxygen of the air by having a thin layer of the oil. The current drain capability as well as the life of the cathodes are clearly brought out in the tables.

3. As a result of the facts mentioned in item (2) above, the cost of the cathode element is very much reduced for giving the same ampere hour capacity at the same current drains normally encountered in conventional cells. To give a specific example, a cathode containing about 300 gms. of the common active material, i.e. the manganese dioxide mix as the depolariser, gives in one cycle 1500 hours of service as compared to the entire life of a sac element which contains 2 kilogram of manganese dioxide to deliver the same ampere-hour. The idea of cost reduction further becomes clear when it is understood that the same cathode element can be used for several more cycles only by changing the zinc and the electrolyte. The cost of the cathode element is also reduced because it dispenses the use of costlier central carbon rod normally used with sac cells. Because of the large ratio of breathing to reaction area high current drains are possible and therefore the superiority of this cathode element over all conventional porous carbon elements.

4. The cell which has been described in this patent specification, under example 1, is superior to the following cells with respect to performance while having considerable cost advantage:

- (a) AW. cells of BSS 1335:1945
- (b) Dry Cell IR 40T: IR 40I: IR 40G in both heavy duty and light intermittent type applications covered by ISS 586:1964
- (c) Inert cells covered by ISS 267:1963

5. The cell which has been described in this patent specification, under example 2, is superior to the following cells with respect to performance while having considerable cost advantage:

- (a) Leclanche type wet cell designated as sac 1 cell
- (b) Leclanche type wet cell designated as sac 2 cell as per ISS 268:1959

6. The electrode assembly for example 3 is a fitting for use in already available AWC containers. This is capable of much heavier current drains and gives about twice the ampere hour capacity of the conventional porous carbon cells.

TABLE 1

Container	Electrolyte	Anode	Cathode	Load in ohms	Voltage range	Life in hours	Electrolyte removal period
Same as is used for sac 1	NH <sub>4</sub> Cl	Zinc	Sac 1 covered by ISS 268:1959	10	1.4-0.8	1400	Once in 8 days
—do—	Na H KOH	Zinc	Equivalent developed here	10	1.35-1.175	1400	Nil

TABLE 2

Container	Electrolyte	Anode	Cathode	Optimum drain	A. H capacity	Cycles
Same as in AW <sub>4</sub> cells	NH <sub>4</sub> CL	Zinc	Covered by ISS 1335 : 1946	125 mA	125 A. H.	3
—do—	NaOH/KOH	Zinc	Equivalent element developed	750 mA maximum continuous	300 A. H.	3 (min.)

TABLE 3

Container	Electrolyte	Anode	Cathode	Drain	Voltage	A. H. capacity	Cycles
Same as in AWC <sub>2</sub> cells	NaOH	Zinc	Covered by BSS 1335 : 1946	1 A	1.1-0.9	432	3
—do—	NaOH	Zinc	Equivalent developed	2 A	1.15-0.9	650	3 (min.)

## WE CLAIM:

1. Oxygen depolarised cell which comprises of an anode and a cathode formed on a highly conducting matrix electrode claimed in the specification of our Indian Patent No. 98157 by pressing mixes suitable for air/oxygen depolarisation such as active or porous carbons or the manganese dioxide mix claimed in the specification of our co-pending Indian Patent application No. 106807 and the anode is of zinc, characterised in that the cathode and anode are both disposed horizontally, the bottom surface only of the cathode being in contact with the electrolyte in the cell and the anode arranged below the cathode and facing the same and immersed fully in the electrolyte, the reaction areas of the cathode and anode being the bottom horizontal area of the cathode and the top horizontal area of the zinc anode respectively.

2. Oxygen depolarised cell as claimed in Claim 1 wherein a current collector is arranged at the site of electrochemical reaction, i.e., at the surface where the reaction takes place.

3. Oxygen depolarised cell as claimed in claim 1 or 2 wherein the anode is either independently hung in the cell by strips which also function as current collectors or suspended from the cathode by insulating washers.

4. Oxygen depolarised primary wet cell substantially as hereinbefore described.

Dated this 22nd day of February, 1968.

(Sd/-)

PATENTS OFFICER,

Council of Scientific and Industrial Research.

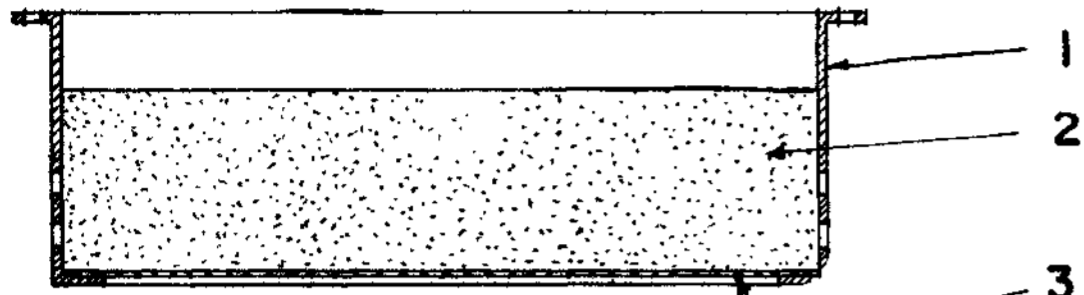


FIG. 1

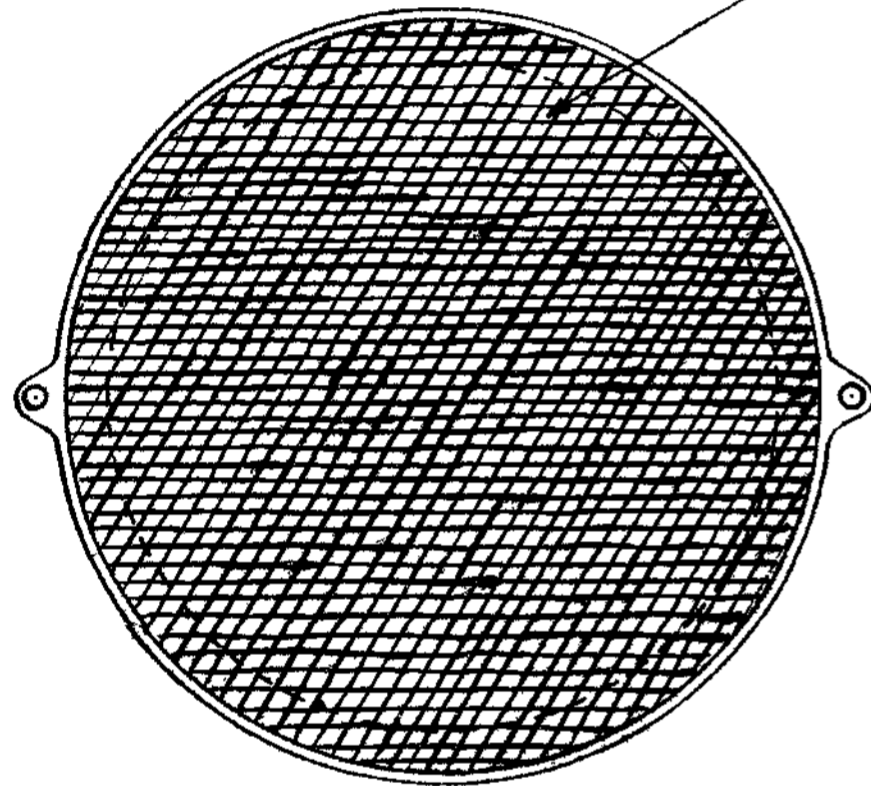


FIG. 2.

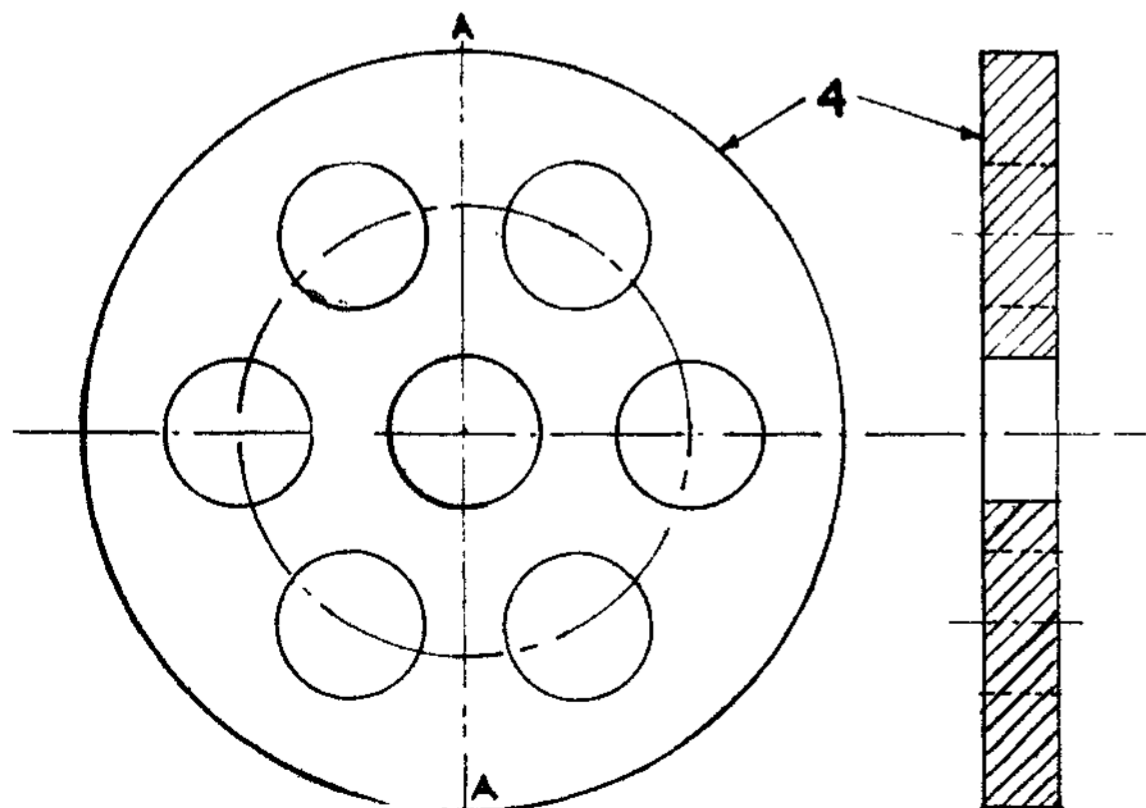


FIG. 3.

FIG. 4. (SECTION A)

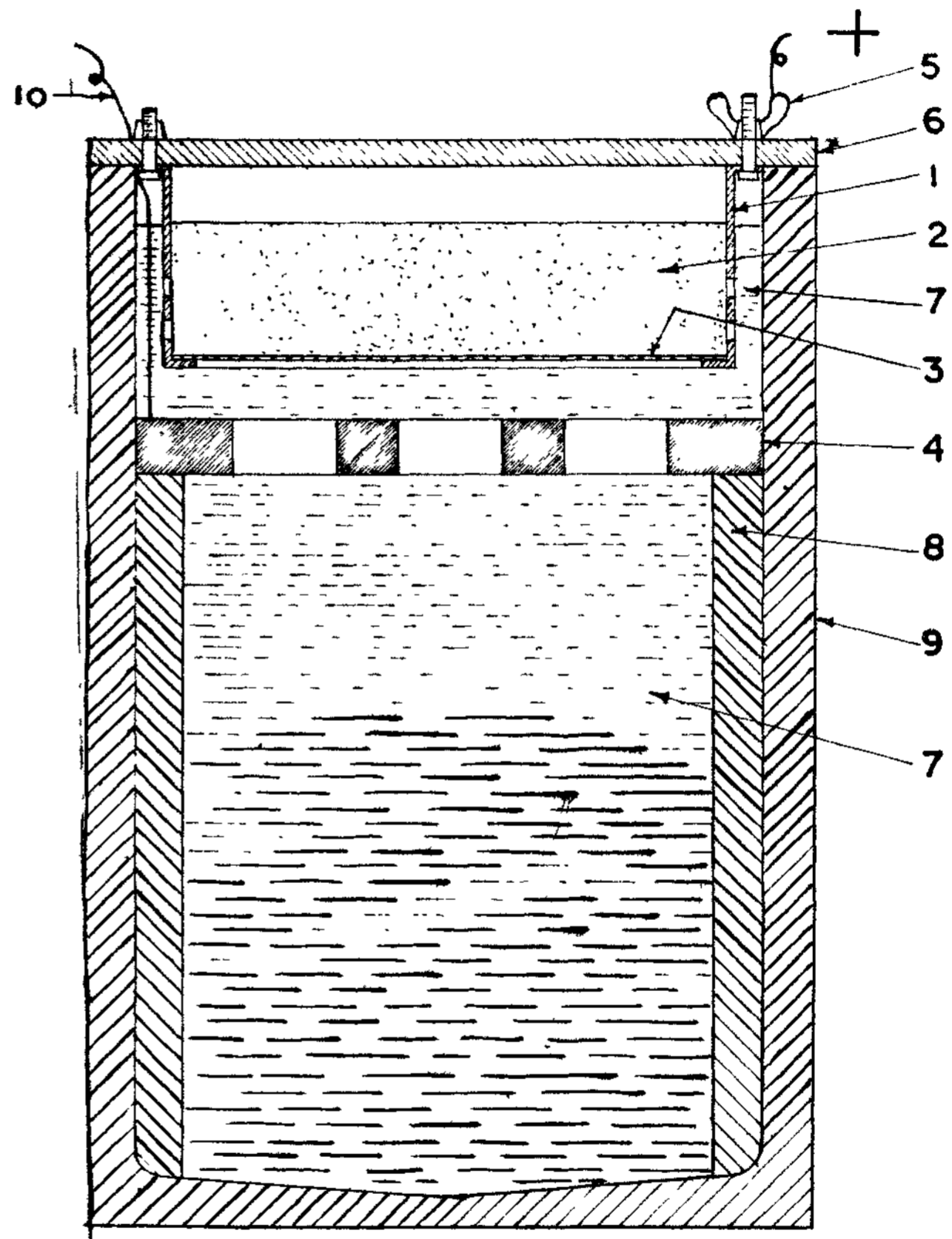


FIG. 5.

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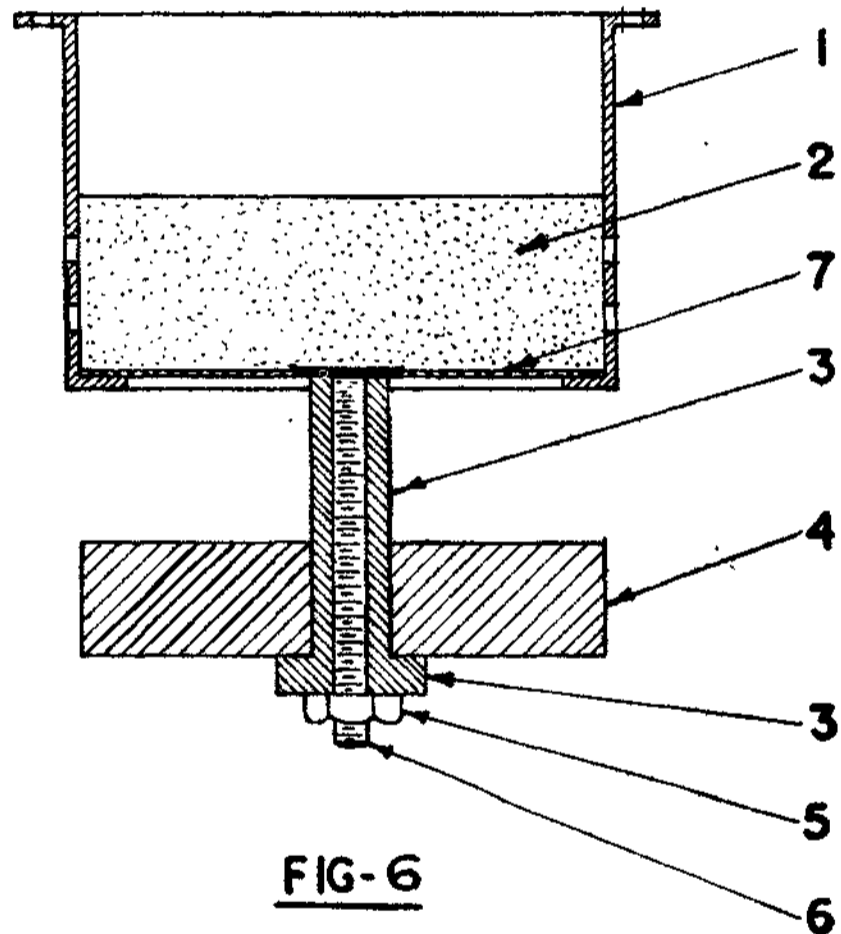


FIG-6

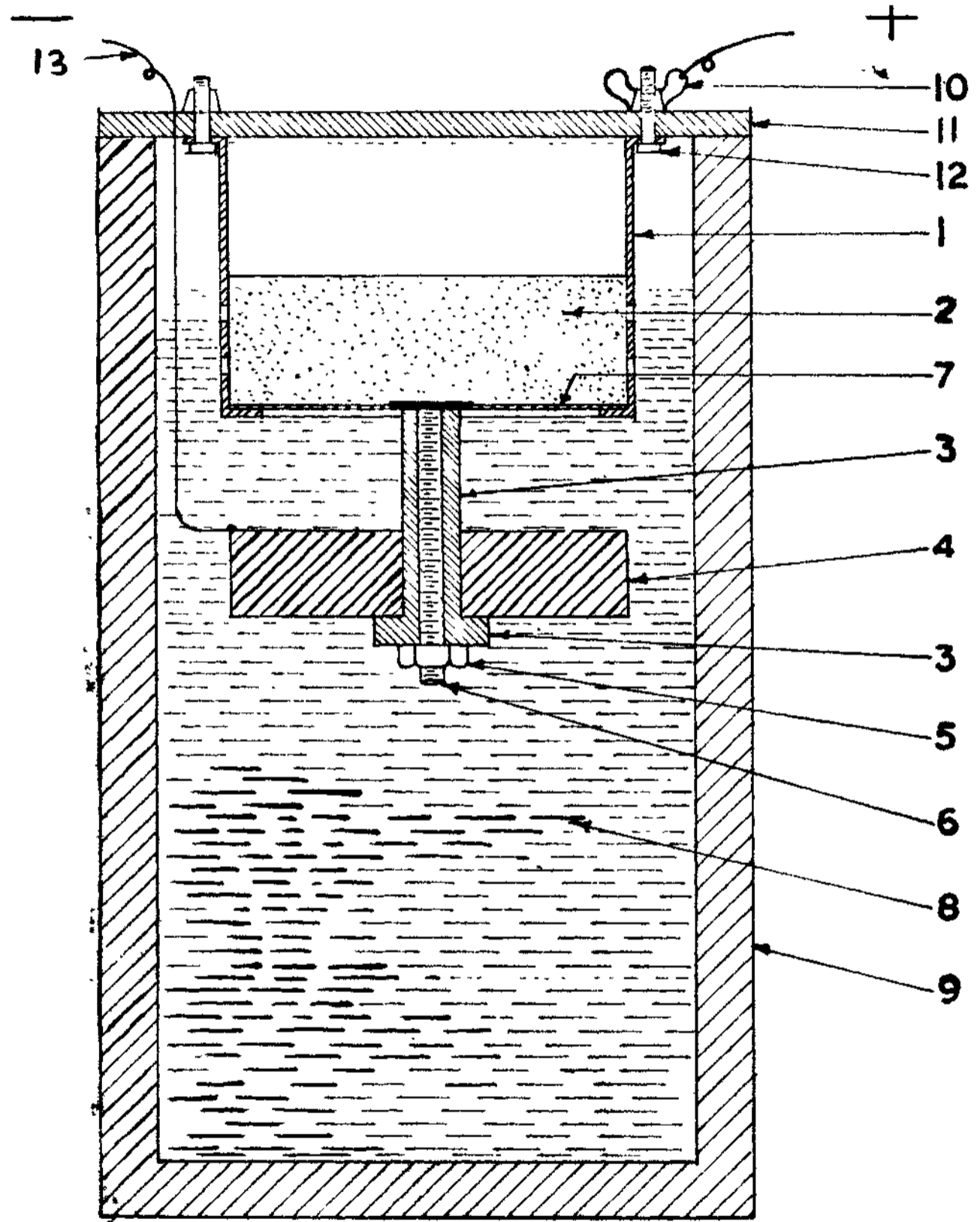


FIG-7

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PROVISIONAL

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NO OF SHEETS. 4

No. 110440.

SHEET NO: 3

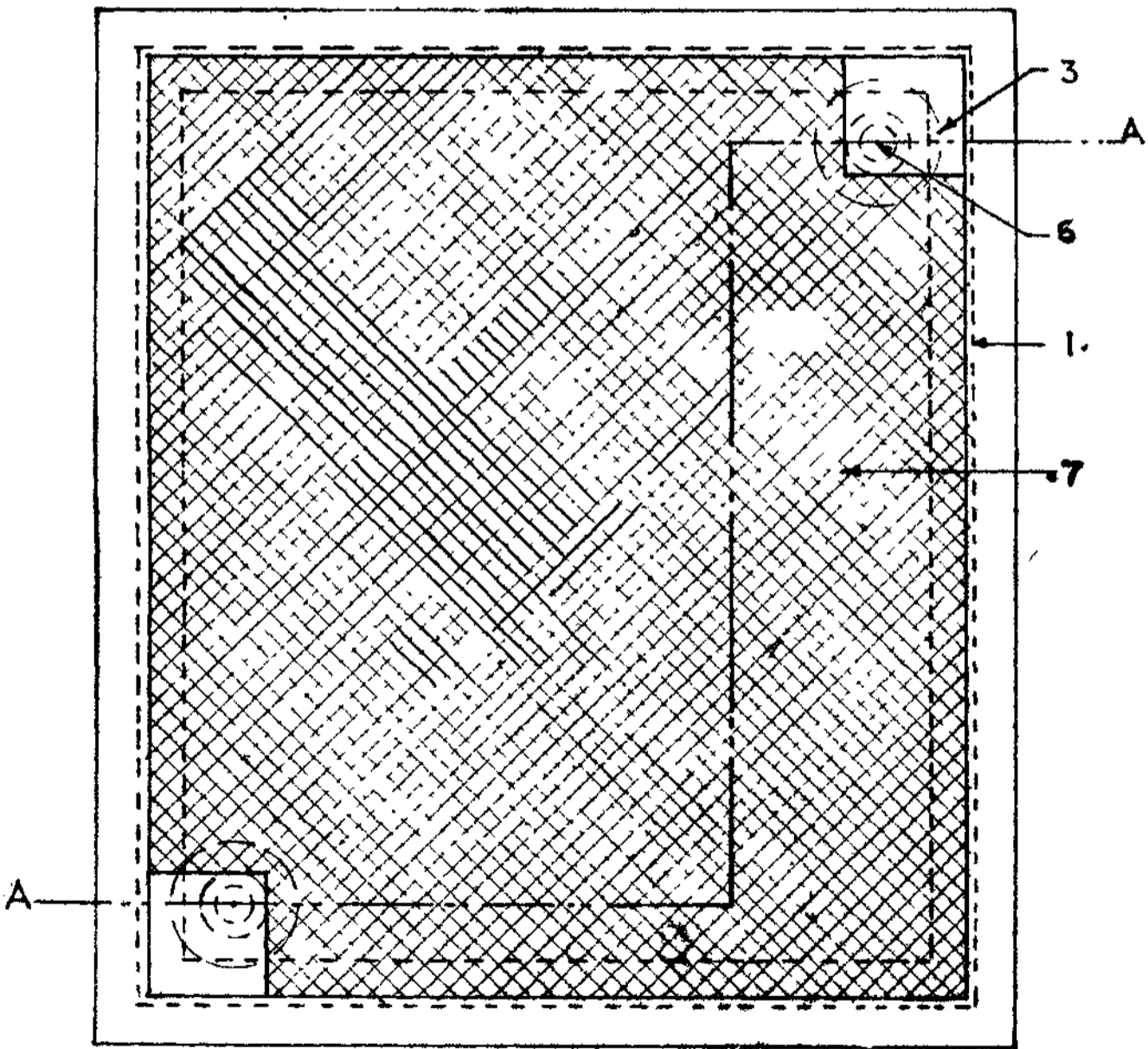
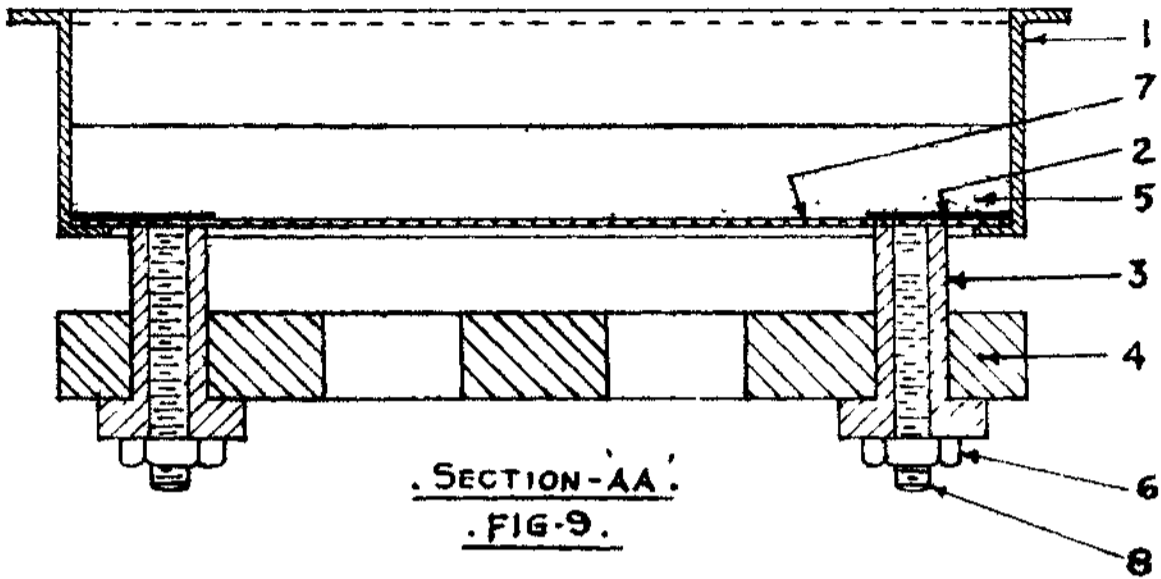


FIG-8

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No OF SHEETS:-4

No. 110440.

SHEET No :- 4

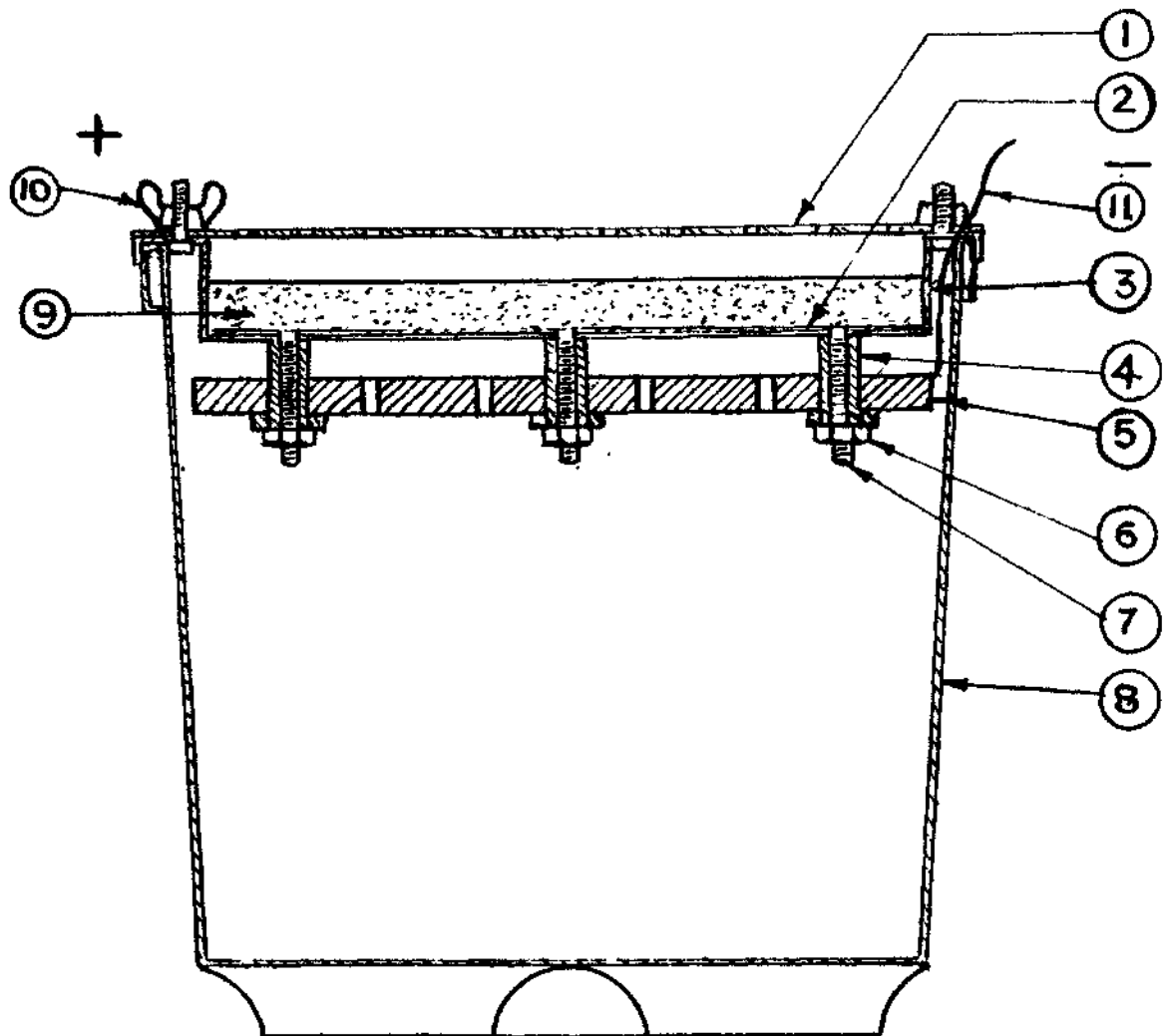


FIG. 10.

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