Nov. 15, 1955 C. R. FISHER ET AL 2,724,010

AIR-DEPOLARIZED CELL

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Fig. 1.

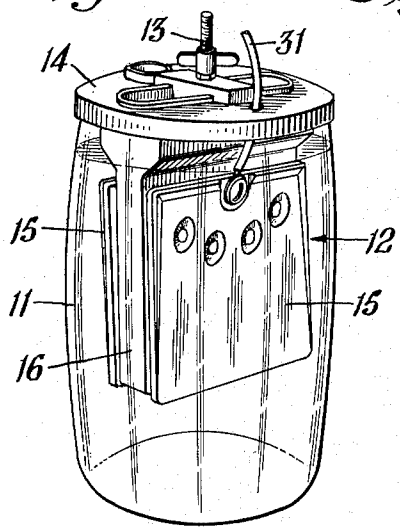


Fig. 2.

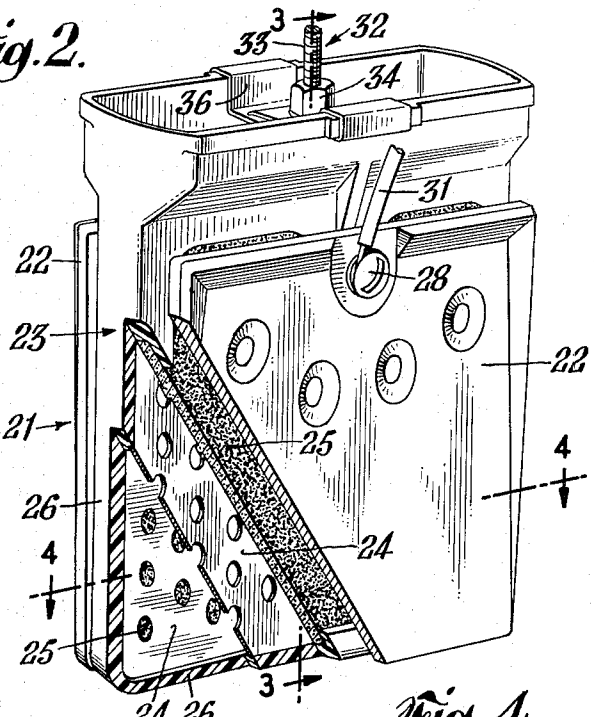


Fig. 3.

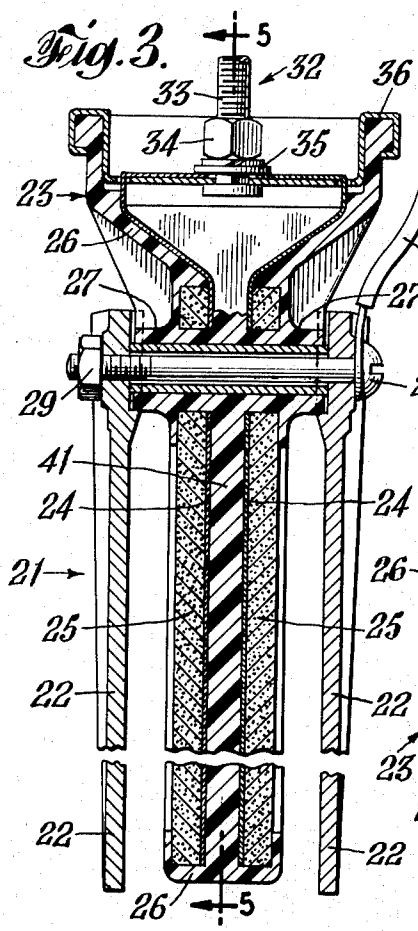
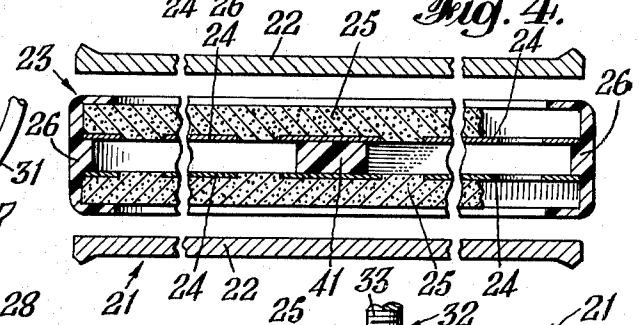


Fig. 4.



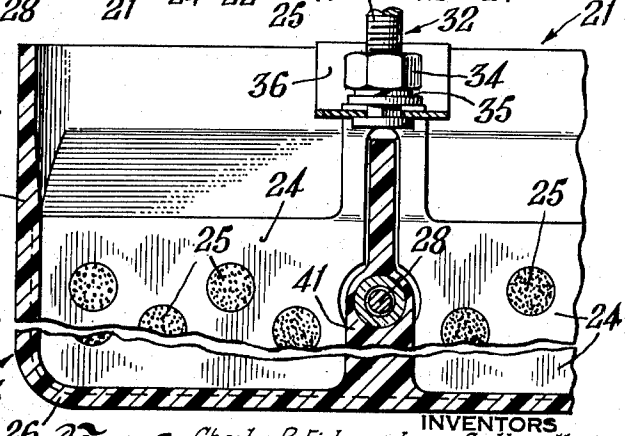


Fig. 5.

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AIR-DEPOLARIZED CELL

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Application September 21, 1953, Serial No. 381,388

7 Claims. (Cl. 136—102)

This invention relates to an air-depolarized cell and, more particularly, to a railway signal cell of the air-depolarized type.

Air-depolarized cells have proved to be particularly useful in connection with the operation of railway signal lights and similar equipment. Dependability under variable weather conditions and a relatively long life are attributes much to be desired in a cell to be used with such devices. This is true because cells having a short life require frequent servicing and those which operate improperly or unpredictably under a wide range of temperatures cannot be relied on.

It is the object of the present invention to provide a cell having a relatively long life. Another object is to provide a cell capable of withstanding a continuous drain of current for a long period of time. It is a further object of the invention to provide a cell which has improved operating characteristics over a wide range of temperatures and exceptionally good performance at low temperatures. The objects are accomplished by the signal cell shown in the accompanying drawing.

In the drawing:

Fig. 1 is a perspective view of a railway signal cell;

Fig. 2 is a perspective view, parts being broken away, of a replaceable anode and cathode unit;

Fig. 3 is a sectional view taken along the line 3—3 of the unit shown in Fig. 2;

Fig. 4 is a sectional view taken along the line 4—4 of the unit shown in Fig. 2; and

Fig. 5 is a sectional view taken along the line 5—5 of the unit shown in Fig. 3.

In the railway signal cell of the invention a container **11**, suitably of glass or plastic, is provided with a replaceable anode and cathode unit **12** which is attached, as by a bolt **13**, to the cover **14** of the container **11**. The cover and container are preferably those specified as standard for 500 ampere hour cells by the American Association of Railroads. The replaceable unit **12** comprises zinc anodes **15** and a carbon cathode **16**. An electrolyte is placed in the container **11** and the unit **12** suspended from the cover **14** of the container **11** so that the anodes **15** and cathode **16** are substantially submerged in the electrolyte. Channels or other hollow spaces extending from the top downward into the cathode **16** provide for the air depolarization of the cell. The cathode is made impermeable to liquids to prevent the filling of the channels or hollow spaces with electrolyte. The replaceable unit **12** may be discarded when the zinc anodes **15** have been consumed or a new unit rebuilt on the frame of the old.

In the preferred replaceable cathode and anode unit **21** shown in Fig. 2, zinc plates **22** are mounted on either side of a cathode unit **23**. The cathode unit **23** comprises two perforated steel panels **24** onto which a carbon composition **25** has been secured. A frame **26** extends around three sides of the steel panels **24** and the carbon composition **25** secured thereon, holding the two panels **24** apart. This frame sealingly engages the three

sides of the steel panels **24** and the carbon composition **25**. The frame **26** is open on the fourth or top side to provide access from the air to the space between the steel panels **24**.

The frame **26** is provided near the top or open side with projections **27**. An annular opening passing through these projections **27** permits the suspension of the zinc plates **22** from the frame **26** by means of a bolt **28** passing through the projections and the zinc plates **22**. Suitably, the bolt is held in the annular opening by the nut **29**. Preferably, the annular opening extends through the steel panels **24** and the carbon composition **25**. The zinc plates **22** are positioned one on either side of the frame **26** containing the steel panels **24** and carbon composition **25**. A wire **31** in electrical contact with the bolt **2** serves as one terminal of the cell.

As best seen in Fig. 3, the steel panels **24** extend above the zinc plates and carbon composition into the open end of the frame **26**. The extended portions of the panels **24** are in electrical contact with a terminal member **32**. The terminal member **32** comprises, for example, a bolt **33** passing through the extended portions of the plates and secured in place by a nut **34** and washers **35**. Preferably, a brace **36** extends across the open end of the frame **26** to strengthen this member.

The carbon composition used in the cell of the invention is a plastic bonded material which may easily be molded into shape and attached to the panels **24**. To fabricate a carbon covered panel such as is used in the cell of the invention, an air-depolarizable granular carbon is blended with polymerizable material. The polymerizable material is rendered plastic, suitably by the use of a plasticizer, and after the carbon composition has been applied to the steel plate the plasticizer or other softening influence is removed permitting the composition to harden in contact with the panel.

In a preferred embodiment of the invention, the carbon used is a granular activated charcoal. This activated carbon is mixed with a resin, suitably a vinyl resin and a plasticizer. The plasticizer causes the vinyl resin to become sticky and pliant. When this composition is applied to the steel panels and the plasticizer removed, as by heating, the carbon composition adheres tightly to the panel. To enhance the adhesion of the carbon composition, the panel may be etched slightly with an acid and coated with a resin compatible with the resin in the carbon composition. With the materials described herein this coating can be advantageously of a vinyl resin.

Since the carbon in the cell must be water-impermeable to insure the proper action of the cell, a waterproofing treatment must be given to the carbon composition. A preferred treatment comprises mixing with the carbon and resin, prior to the molding on the steel panel, waterproofing agents, suitably petroleum oils and rubber cements, i. e. a solution of rubber in toluol. The incorporation in the carbon composition of a small quantity of acetylene black has also been found to impart a desirable water-repellency to the carbon composition.

The carbon composition and the steel panel which has been joined as described above are secured in the frame with a resinous cement. Again care should be taken to see that the cement used is compatible with both the plastic material in the carbon composition and the material of which the frame is constructed. Good results have been obtained with a polystyrene frame and a cement consisting predominantly of a vinyl resin.

The preferred unit of the invention is provided with a divider **41**, as best shown in Fig. 4, which divides the space between the steel panels into two separate compartments. This divider in the preferred arrangement is a plastic strip extending upward from the bottom to the open end of the

frame and made integral with the frame. Should one section of the air space become flooded with electrolyte, water or other similar materials, the divider permits the continued operation of the cell at a somewhat reduced efficiency, but nevertheless prevents the total failure of the cell.

The electrolyte used in the cell of the invention may be an aqueous solution of sodium hydroxide. For best results at low temperatures an electrolyte of potassium hydroxide is preferred.

It will be understood that other provisions may be made in the construction of the cell for the access of air to the carbon cathode. This may be done, for example, by providing a solid carbon block of the composition described above in which the steel panels are embedded and extending holes into the carbon block from the top side so as to provide for the circulation of air in the block. While best results have been obtained with the arrangement shown in Figs. 2 to 5, which permits the maximum contact between air and the cathode, good results may be obtained with less than this maximum contact.

What is claimed is:

1. An anode and cathode unit for an air-depolarized cell comprising a pair of metallic panels spaced apart to form a channel therebetween, a carbon electrode bonded to and in electrical contact with each of said panels, each of said electrodes being positioned on a side of a panel opposite said channel a portion of each of said electrodes being exposed to said channel, said electrodes being liquid-impermeable, a frame supporting said panels and electrodes and extending around the periphery of said panels and electrodes enclosing said channel on all but one side which side opens on a passage through said frame, said panels extending into said passage and being electrically connected to a terminal, a pair of zinc plates each substantially parallel to and spaced from that side of an electrode most distant from said channel, said zinc plates being supported by said frame and electrically connected to a terminal.

2. An anode and cathode unit for an air-depolarized cell comprising a pair of metallic panels spaced apart to form a channel therebetween, a carbon electrode bonded to and in electrical contact with each of said panels, each of said carbon electrodes comprising granular, air-depolarizable carbon bonded together with a resin, each of said electrodes being positioned on a side of a panel opposite said channel a portion of each of said electrodes being exposed to said channel, said electrodes being liquid-impermeable, a frame supporting said panels and electrodes and extending around the periphery of said panels and electrodes enclosing said channel on all but one side which side opens on a passage through said frame, said panels extending into said passage and being electrically connected to a terminal, a pair of zinc plates each substantially parallel to and spaced from that side of an electrode most distant from said channel, said zinc plates being supported by said frame and electrically connected to a terminal.

3. An anode and cathode unit for an air-depolarized cell comprising a pair of metallic panels spaced apart to form a channel therebetween, a carbon electrode bonded to and in electrical contact with each of said panels, each of said carbon electrodes comprising granular, air-depolarizable carbon bonded together with a vinyl resin, each of said electrodes being positioned on a side of a panel opposite said channel a portion of each of said electrodes being exposed to said channel, said electrodes being liquid-impermeable, a frame supporting said panels and electrodes and extending around the periphery of said panels and electrodes enclosing said channel on all but one side which side opens on a passage through said frame, said panels extending into said passage and being electrically connected to a terminal, a pair of zinc plates each substantially parallel to and spaced from that side of an electrode most distant from said channel, said zinc plates being supported by said frame and electrically connected to a terminal.

4. An anode and cathode unit for an air-depolarized cell comprising a pair of perforated metallic panels spaced apart to form a channel therebetween, a carbon electrode bonded to and in electrical contact with each of said panels, each of said carbon electrodes comprising granular, air-depolarizable carbon bonded together with a vinyl resin, each of said electrodes being positioned on a side of a panel opposite said channel a portion of each of said electrodes being exposed to said channel, said electrodes being liquid-impermeable, a frame supporting said panels and electrodes and extending around the periphery of said panels and electrodes enclosing said channel on all but one side which side opens on a passage through said frame, said panels extending into said passage and being electrically connected to a terminal, a pair of zinc plates each substantially parallel to and spaced from that side of an electrode most distant from said channel, said zinc plates being supported by said frame and electrically connected to a terminal.

5. An anode and cathode unit for an air-depolarized cell comprising a pair of metallic panels spaced apart to form a channel therebetween, a carbon electrode bonded to and in electrical contact with each of said panels, each of said carbon electrodes comprising granular, air-depolarizable carbon bonded together with a resin, each of said electrodes being positioned on a side of a panel opposite said channel a portion of each of said electrodes being exposed to said channel, said electrodes being liquid-impermeable, a unitary frame supporting said panels and electrodes and extending around the periphery of said panels and electrodes enclosing said channel on all but one side which side opens on a passage through said frame, said panels extending into said passage and being electrically connected to a terminal, a pair of zinc plates each substantially parallel to and spaced from that side of an electrode most distant from said channel, said zinc plates being supported by said frame and electrically connected to a terminal.

6. An anode and cathode unit for an air-depolarized cell comprising a pair of metallic panels spaced apart to form a channel therebetween, a carbon electrode bonded to and in electrical contact with each of said panels, each of said electrodes being positioned on a side of a panel opposite said channel, a portion of each of said electrodes being exposed to said channel, said electrodes being liquid-impermeable, a frame supporting said panels and electrodes and extending around the periphery of said panels and electrodes enclosing said channel on all but one side which side opens on a passage through said frame, said panels extending into said passage and being electrically connected to a terminal, said frame defining a second opening passing through said frame at substantially right angles to said carbon electrodes through said channel and sealed therefrom, a pair of zinc plates each substantially parallel to and spaced from that side of an electrode most distant from said channel, said zinc plates supported and electrically connected by a conductive member extending from one plate through said passage to the other plate, said plates being electrically connected to a terminal.

7. An anode and cathode unit for an air-depolarized cell comprising a pair of metallic panels spaced apart to form a channel therebetween, a carbon electrode bonded to and in electrical contact with each of said panels, each of said electrodes being positioned on a side of a panel opposite said channel, a portion of each of said electrodes being exposed to said channel, said electrodes being liquid-impermeable, a frame supporting said panels and electrodes and extending around the periphery of said panels and electrodes enclosing said channel on all but one side which side opens on a passage through said frame, a member extending from said passage to a position on said frame opposite said passage, said member sealingly engaging said panels and said frame thereby

dividing said channel into a plurality of independent compartments, said panels extending into said passage and being electrically connected to a terminal, a pair of zinc plates each substantially parallel to and spaced from that side of an electrode most distant from said channel, said zinc plates being supported by said frame and electrically connected to a terminal.

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