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ACTIVATOR FOR RESERVE-TYPE ELECTROCHEMICAL BATTERIES

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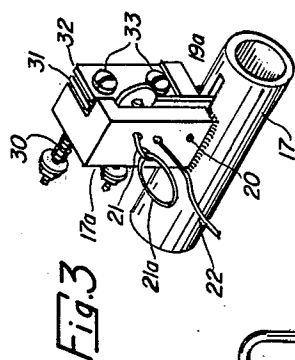
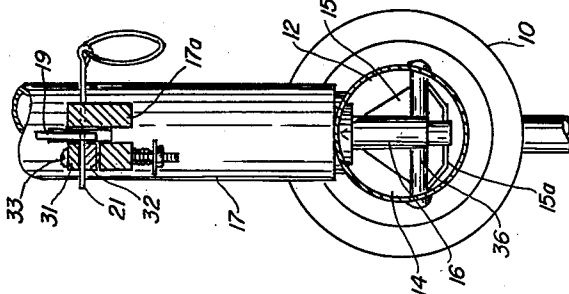
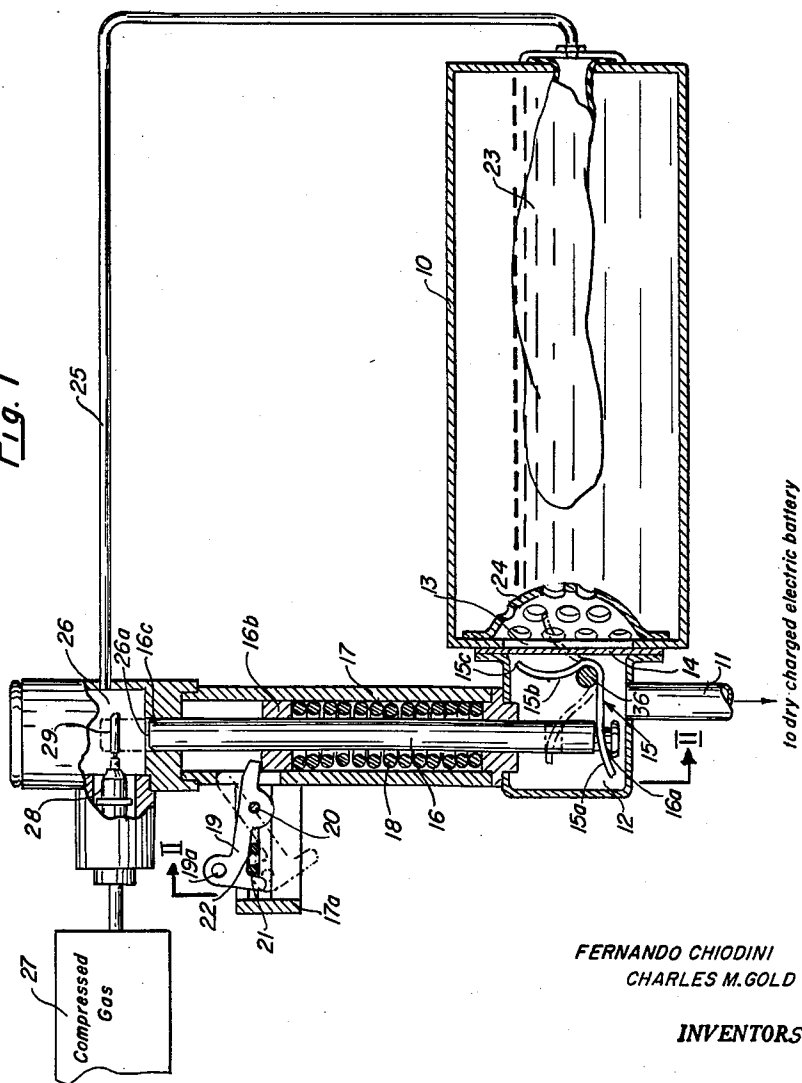


Fig. 2

Fig. 1



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ACTIVATOR FOR RESERVE-TYPE ELECTRO-CHEMICAL BATTERIES

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The present invention relates to a device for activating electrochemical batteries of the deferred-action or reserve type wherein one or more dry-charged cells are supplied with electrolyte liquor in response to a predetermined signal.

Various systems have been proposed heretofore wherein a frangible diaphragm, originally blocking the passage of electrolyte from its storage container to the battery, is pierced or shattered in response to the activating signal so that the liquor can flow through the breach. In order to reduce the activation delay to a minimum, it is desirable to place the liquor under sufficient pressure to make its irruption into the battery substantially instantaneous. Such pressure, however, should come into existence only at or immediately prior to the time of intended activation so as not to cause premature rupture of the diaphragm.

In one prior system, disclosed in pending application Ser. No. 416,468 filed March 16, 1954, now Patent No. 3,018,314, by Emanuel Cooper and Charles M. Gold, the activating signal releases a charge of compressed gas which then acts upon the electrolyte and through it upon the diaphragm, urging the latter into contact with a stationary puncturing device. This system performs satisfactorily with certain types of flexible diaphragms, especially plastic membranes having an inwardly facing bulge which reverses its curvature in response to pressure from the electrolyte, but is not readily adaptable for use with, for example, a metallic diaphragm designed to be ruptured by a pivoting cutter as disclosed in co-pending application Ser. No. 4,806 filed on even date herewith by Charles M. Gold, one of the present joint inventors.

In another simultaneously filed application, by Leon Kardorff and the aforesaid Charles M. Gold, there is disclosed an activator system utilizing a pivoted cutter for the rupturing of a metallic diaphragm as described above. In that system the detonation of an explosive charge serves to actuate the cutter and, after a short delay designed to enable an incipient rupture of the diaphragm before the onset of electrolyte pressure, causes the release of a compressed gas into a duct leading to a piston (e.g. an inflatable bladder) which acts upon the liquor to promote its discharge through the rupture.

It is an object of the present invention to adapt a system of this general type for use with a mechanical activator replacing the explosive charge.

Another object of the invention is to provide an improved safety device designed to prevent premature activation of such system.

In accordance with this invention there is provided, in a battery activator having a cutter movably positioned adjacent a diaphragm blocking the outflow of an electrolytic liquor from a reservoir, and further having piston means such as an inflatable bladder for exerting pressure upon the liquor in the reservoir, a spring-loaded operating member and retractable stop means engaged by this member to prevent its displacement toward the cutter in a diaphragm-piercing sense, the operating member being linked via a delay device with a gas-releasing element associated with a source of compressed gas which, upon being liberated, acts upon the aforementioned pis-

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ton means to force the liquor out of the reservoir, past the ruptured diaphragm, and thence into the cell or cells of a dry-charged battery to be activated.

The stop means, in accordance with a more particular feature of the invention, may include two independently withdrawable elements of which one is a safety stop to be removed when the activator is to be armed, i.e. readied for operation; the other of these elements is an end of an elongated rod or cable, hereinafter referred to as a lanyard, adapted to be pulled out from a remote location. Preferably, the stop means acts upon the operating member not directly but through the intermediary of a transmission device stepping up the applied holding force, such as a lever.

The invention will be described in greater details with reference to the accompanying drawing in which:

FIG. 1 is a side-elevational view, partly in section, of an activator embodying the invention;

FIG. 2 is a cross-sectional view taken on line II-II of FIG. 1; and

FIG. 3 is a perspective view of a detail.

The drawing shows a cylindrical reservoir 10 containing a liquid electrolyte, such as a concentrated aqueous solution of potassium hydroxide, for the cell or cells of a dry-charged electric battery (not shown) whose housing can be reached through a tube 11, extending from a chamber 12. This chamber is positioned externally of reservoir 10, adjacent an outlet 13 thereof which is originally blocked by a metallic diaphragm 14, e.g. a disk of stainless steel a fraction of a millimeter thick. A bell-crank lever 15, having an operating arm 15a and a generally triangular cutting arm 15b terminating in a knife point 15c, is swingable about a pivot pin 36 within chamber 12. Arm 15a is bifurcated and straddles the neck 16a of an operating member 16 having the form of a plunger axially slidable in a cylinder 17; a shoulder 16b on that plunger is under pressure from a helical spring 18 within cylinder 17, tending to drive the member 16 upwardly into a position (illustrated in dot-dash lines in FIG. 1) in which cutter 15 swings about its fulcrum 16 to pierce the diaphragm 14. Such movement is, however, initially prevented by a latch lever 19 which is swingable about a pin 20 in a lateral extension 17a of cylinder 17; rotation of latch lever 19 into its own dot-dash position, to liberate the plunger 16, is in turn blocked by a stop rod 21 and a lanyard wire 22 which engage the longer arm of the lever and are independently removable from the mounting 17a. The latch lever 19 thus serves as a transmission element for magnifying the holding force of stop rod 21 and lanyard wire 22.

The reservoir 10 is further provided, opposite its outlet 13, with an inlet occupied by an inflatable bladder 23 floating within the electrolyte; a shield 24, in the form of a perforated cap curving toward the bladder, prevents contact between the latter and the cutter point 15c and/or the jagged edge of the ruptured diaphragm when the lever 15 is rotated into its dot-dash position. Bladder 23 communicates with a gas duct 25 which opens into a chamber 26 atop the cylinder 17, this chamber being provided with an aperture 26a which leads to the interior of the cylinder and is traversed by the upper end 16c of plunger 16. A cartridge 27, containing a compressed gas, has an outlet nozzle 28 terminating in a closed nipple 29 which is located in the path of the plunger top 16c; it should be noted that the distance between this top and the nipple 29 is greater than the path of plunger motion required to initiate the attack of cutter 15 upon diaphragm 14.

The proximal end of lanyard 22 is clamped, under pressure of springs 30, between two platelets 31, 32 which are relatively movable on mounting bolts 33 carrying these springs. The bolts 33, threadedly received

in cylinder extension 17a, are adjustable to vary the clamping pressure acting upon lanyard 22, thereby determining the force necessary to pull the lanyard from its moorings.

In operation, the activator is first armed by the withdrawal of stop rod 21 which to this end is provided with a ring 21a. If re-insertion of this safety stop prior to activation should become necessary, the lever 19 may be slightly raised out of its mounting, against the force of spring 18, with the aid of a suitable tool inserted into a hold 19a thereof; the same technique may be used in the initial assembly of the device. If, after the withdrawal of rod 21, the lanyard 22 is pulled out, lever 19 rotates counter-clockwise (as viewed in FIG. 1) so that it, the plunger 16 and the cutter 15 are moved by the spring 18 into the position illustrated in dot-dash lines. When this occurs, and after the cutting point 15c has begun to penetrate the diaphragm 14, the top 16c of plunger 16 breaks off the nipple 29 to release the gas from cartridge 27, this gas thereupon streaming through chamber 26 and duct 25 into bladder 23. Plunger 16 therefore serves as an operating member which is coupled with said cutter means 15 and also, via a lost motion connection, with nipple 29 of the compressed gas cartridge 27. The latter connection is a lost motion connection since the top of the plunger 16 must traverse the distance shown in dotted line before it effectively engages nipple 29. As the bladder becomes inflated, it exerts pressure upon the electrolyte within reservoir 10 and forces it through the widening breach in diaphragm 14 (which by this action is further enlarged) and chamber 12 into the tube 11 leading to the battery to be activated.

Various modifications of the system described and illustrated are possible and intended to be included within the spirit and scope of the invention as defined in the appended claims.

What is claimed is:

1. An activator for a dry-charged battery, comprising a reservoir containing a quantity of liquid electrolyte for said battery, normally inoperative pressure means adapted to act upon said electrolyte, said reservoir having an outlet leading to said battery, a diaphragm extending across said outlet and blocking the passage of said electrolyte therethrough, cutter means for rupturing said diaphragm, an operating member coupled with said cutter means and adapted to consecutively operate said pressure means and activate said pressure means with said pressure means, spring means urging said operating member into successive actuation of said cutter means and said pressure means, and removable stop means holding said operating member inoperative against the force of said spring means.

2. An activator according to claim 1 wherein said stop means includes a stop-rod and a lanyard wire independently removable from engagement with said operating member.

3. An activator according to claim 1 wherein said stop means includes a lanyard wire provided with adjustable clamping means for varying the force necessary for its removal.

4. An activator according to claim 1 wherein said pressure means comprises an inflatable bladder in said reservoir and a source of compressed gas for inflating said bladder, said source being provided with a nipple blocking the discharge of said gas into said bladder and adapted to be broken off by said operating member, upon a movement of the latter sufficient to initiate the rupture of said diaphragm by said cutter means.

5. An activator for a dry-charged battery, comprising a reservoir containing a quantity of liquid electrolyte for said battery, normally inoperative pressure means adapted to act upon said electrolyte, said reservoir having an outlet leading to said battery, a diaphragm extending across said outlet and blocking the passage of said electrolyte therethrough, cutter means for rupturing said diaphragm, an operating member coupled with said cutter means and adapted to consecutively operate said cutter means and activate said pressure means with said pressure means, spring means urging said operating member into successive actuation of said cutter means and said pressure means, latch means bearing upon said operating member, and stop means engaging said latch means for holding said operating member inoperative against the force of said spring means.

6. An activator according to claim 5 wherein said latch means comprises a transmission element adapted to magnify the holding force of said stop means.

7. An activator according to claim 6 wherein said transmission element is a lever having a shorter arm in contact with said operating member and a longer arm engaged by said stop means.

8. An activator according to claim 7 wherein said stop means comprises a stop element and a lanyard wire bearing alongside each other.

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