

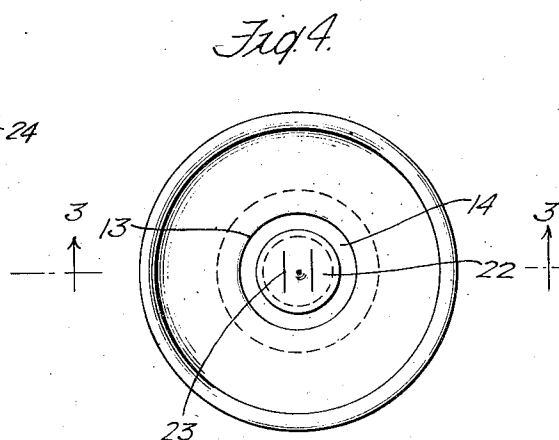
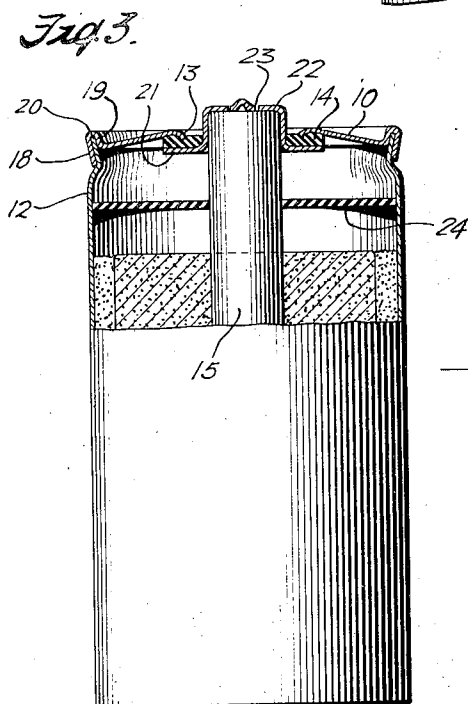
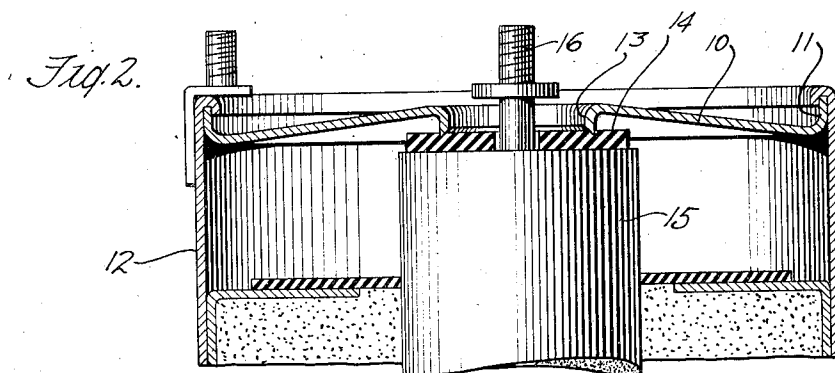
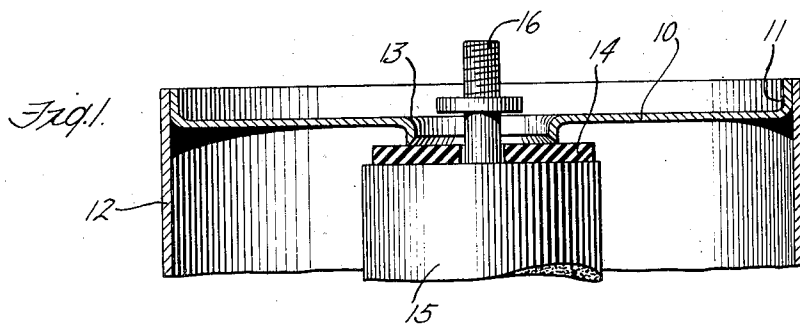
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R. R. SMITH

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DRY CELL

Filed May 27, 1930



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2,060,832

DRY CELL

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Application May 27, 1930, Serial No. 456,172

34 Claims. (Cl. 136—133)

This invention relates to dry cells and particu-
larly to improved means for closing and sealing
such cells. The present application is a continu-
ation in part of my application Serial No. 432,217
filed on February 28, 1930.

In the manufacture of dry cells it has been
common practice to close the cell by placing a
layer of sand over the top of the mix body and
then pouring a layer of sealing compound, such
as coal tar pitch or a rosin-base sealing wax, over
the sand. This type of closure is not altogether
satisfactory due to the manufacturing difficul-
ties experienced in handling the compound and
in applying it to the cells. The completed closure
is also quite brittle when cold and, consequently,
is easily broken during handling and shipment;
it becomes quite plastic when subjected to rela-
tively high summer temperatures; and bulges or
is forced from its proper location by internal gas
pressure.

Another objection to this type of closure is that
it must be made comparatively thick in order to
obtain the required strength, and this reduces
cell space and electrode area which otherwise
might be employed to increase the capacity of
the cell.

Another objection to this type of closure is that
the area of the gas vent is capricious and not
subject to manufacturing control. In dry cells
having this type of closure the gas generated
within the cell is vented through the joint be-
tween the sealing compound and the zinc con-
tainer or electrode. The fact that this joint is
not tight and that the cell gas is vented through
it is largely accidental and, as a consequence,
the vent varies in size according to variations in
conditions not readily controlled. As a result, the
size of the vent is too large in some cells and too
small in others, and in the majority of cases it
is effective for only a limited range of service
conditions.

Therefore, some of the objects of this inven-
tion are to provide an improved closure or seal
for dry cells which takes up very little of the
valuable space within the cell; is neat in appear-
ance; low in cost; easy to manufacture and apply;
uniform and effective to vent gas from the cell;
and avoids various objections encountered in the
use of wax and other types of closures.

These and other objects and the novel features
of this invention will be apparent from the fol-
lowing description and the accompanying draw-
ing, in which:

Figs. 1 and 2 are enlarged vertical sectional
views of the top end of a dry cell showing the

improved closure in place before and after the
cell is sealed, and

Figs. 3 and 4 are, respectively, enlarged sec-
tional and top views of a dry cell having a modi-
fied closure embodying this invention.

The improved closure may have a variety of
forms according to the size and shape of the cell,
its interior structure, and the use for which it is
intended. As shown in Figs. 1 and 2 of the draw-
ing, the improved closure comprises an annular
sealing member or cover 10 that is relatively hard
and resilient in comparison with the annular
washer or seat 14, formed for example from a
relatively thin resilient metal, such as sheet steel
from about .010 to .030 inch thick, having an
upturned flange 11 at its outer edge fitting snugly
within the upper rim of the zinc container, can
or cup 12, which rim is turned down over the
flange. The cover preferably has a downturned
flange 13 at its inner edge adapted to press
tightly against an annular insulating seat 14 that
is relatively soft and yielding in comparison with
the cover 10, for example, a washer of paper, rub-
ber, fiber, or similar material, mounted on the
upper end of the central carbon electrode 15.
The downturned flange may have a sharp edge
adapted to embed in the washer 14, as shown in
Figure 2. A metal dowel 16, embedded in and
extending upward from the center of the elec-
trode 15, projects through an opening in the
washer 14 and serves as the central circuit ter-
minal of the cell.

The inner and outer surfaces of the cover 10
are preferably coated with a layer or body of
enamel, varnish, lacquer, or similar material
which adheres to and insulates such surfaces and
protects them from corrosion. The joint between
the closure 10 and the container 12 may be further
sealed with asphalt paint, rubber cement, or simi-
lar plastic composition; and the joint between the
top of the electrode 15 and the bottom of the in-
sulating washer 14 may be sealed with a similar
plastic composition. However, a sealing composi-
tion in either of these joints is not essential to
the successful operation of the improved cell and
closure.

When the cover 10 is secured in place it is
pressed into effective sealing contact with the
washer 14 in order to insure a fluid-tight joint
between the cover, the washer, and the carbon
electrode. This pressure is preferably provided
by deforming the cover 10 during the final as-
sembling operation. Prior to this operation the
downturned flange 13 is resting on the washer 14
and the upper edge of the upturned flange 11 is

substantially flush with the top of the can 12 as shown in Fig. 1. The final assembling operation consists in rolling or crimping the upper edge of the can 12 inward and then down over the upturned flange 11, thus rigidly and permanently securing the outer edge of the cover to the container. In performing this operation the outer edge of the cover is preferably depressed so that the cover is dished and exerts some downward pressure on the washer 14.

It is obvious that the joint formed between the flange 13 and the seat or washer 14 is of such a nature that, while gas-tight at ordinary pressures, it is adapted to open and allow the escape of any gas that accumulates to produce a pressure sufficient to overcome the resilience of the cover 10. While this method of venting alone serves well in some cases, it is usually desirable that it be supplemented by the provision of another vent to operate at relatively lower pressure and of a more fixed nature.

The resulting combination is particularly efficient from the standpoint of cell quality, since any venting system must be a compromise between excessive loss of moisture from the cell and the accumulation of high gas pressures. In the present case the low pressure vent may be placed at a relatively lower capacity value than otherwise, since it must care only for normal operating conditions. This yields minimum loss of moisture from the cell, since the high pressure vent is normally closed and operates only under abnormal conditions such as, for example, may be introduced by excessive temperatures, or whenever abnormal quantities of gas are produced, causing excessive pressures within the cell.

It is practical to control the character of the venting valve provided by the washer 14 and the flange 13, and the pressure necessary to open it, by the regulation of several factors. The primary factor is the nature of the insulating washer, and the second is control of the pressure that the flange 13 exerts upon the washer by varying the distance that the outer edge of the cover is depressed during the sealing and assembling operation, or by varying the thickness or resiliency of the cover material.

While the washer itself may in some cases form a practical low pressure vent by using suitable material, such as oil-treated pulpboard, that is impervious to moisture but pervious to gas under the mechanical pressure sustained, it usually is preferable to use a carbon electrode that is sufficiently porous to vent the gas that normally occurs. A particular advantage of the latter procedure is that it facilitates the escape of gas generated in the lower regions of the cell. In such a case the electrode may be partially impregnated with a water-repellent substance such as lubricating oil or paraffin to yield the desired venting characteristics. It is then preferable to use an impervious seat or washer such as rubber, fiber or more cheaply a washer made from a bibulous material such as pulpboard thoroughly impregnated with a water-repellent mixture composed of 50 per cent rosin and 50 per cent paraffin by weight.

In six inch cells of the construction shown in Figures 1 and 2 suitable electrode impregnation covers a wide range according to the type of mix and paste used. At least one-tenth of the voids normally occurring in the carbon electrode are ordinarily filled with water-repellent impregnating material. More frequently the electrode impregnation is higher and may be such as to

fill half the voids or even more. In this case an impregnated pulpboard washer as described above, and about .04 inch thick is suitable. Under these conditions the normal preferred practice to obtain suitable flange pressure upon the washer is to depress the outer edge of the cover about $\frac{3}{8}$ inch during the assembling and sealing operation.

It is obvious that the conditions for this control will vary according to the materials selected, the purposes in view, and the type and size of cell, but it has been found that practical control can be readily achieved. This is true over a practical range of tolerances with respect to relative positions of the top of the can and the top of the electrode. The ability of the construction to accommodate itself to variations of this nature represents a point of very important practical value from a manufacturing viewpoint.

On some types of dry cells, such as the sizes for flashlights, it is advantageous to use the modified form of closure shown in Figs. 3 and 4, which embodies the principles of this invention and differs only in a few details from the construction shown in Figs. 1 and 2. In Figs. 3 and 4, the annular sheet metal closure 10 has a downturned flange 18 at its outer edge and is bent downwardly within this flange, as at 19, so that a groove 20 is formed at the outer edge of the closure. The upper end of the zinc container 12 is crimped into the groove 20 and these parts may be slightly inclined outwardly and upwardly, as shown, the closure being thus permanently secured to the container by a substantially gas-tight joint. The washer 14 is carried by the carbon electrode 15, being supported thereon by an outturned annular flange 21 at the lower edge of a metal cap 22 which fits the upper end of the electrode. The cap projects outwardly through the central opening in the washer and serves as the central circuit terminal of the cell. The top of the cap 22 is preferably provided with one or more openings, such as the slits 23, through which gas may escape after passing through the carbon electrode. A disk 24 of paperboard may snugly fit the outside of the electrode and the inside of the can in the space above the active material, sometimes designated as a cartridge, i. e., the mix body and the electrolyte, to prevent expanding electrolyte from contacting with the metal flange 21. In all other features the cell and closure shown in Figs. 3 and 4 may embody the same construction and operation as the one shown in Figs. 1 and 2.

It is also within the scope of this invention to vary the form of the central venting valve by omitting the flange 13, and by providing a flange or ridge on the upper side of the insulating washer 14 to make contact with a flat surface at the inner edge of the closure 10. Also, the outer edge of the closure 10 may be secured to the top of the container by other means such as soldering, and the flange 11 may be turned downward either inside or outside of the container 12. While the closure is preferably constructed of resilient sheet metal as described, other stiff sheet material, such as fiberboard, paperboard, hard rubber, bakelite, or the like may be substituted therefor. Various other changes may be made in the form and arrangement of the component parts, and well-known equivalent materials may be substituted, without departing from this invention or sacrificing its advantages.

I claim:

1. In a dry cell; the combination of means for venting the amount of gas normally generated therein without loss of a substantial amount of moisture; with means for venting abnormal amounts of gas to prevent the pressure thereof from injuring said cell.
2. In a dry cell; the combination of means for equalizing gas pressure in said cell and for venting the amount of gas normally generated therein without loss of a substantial amount of moisture; with means for venting abnormal amounts of gas to prevent the pressure thereof from injuring said cell.
3. In a dry cell wherein gas is generated at a varying rate during the operation of the cell, the combination of means whereby such gas is vented at a rate materially below the maximum rate of gas generation in the cell, to conserve the cell moisture and limit injurious effects for "breathing"; and means whereby additional gas is vented when the rate of generation exceeds the venting rate of the first mentioned means.
4. In a dry cell having a can; a carbon electrode in said can; a washer on said electrode having an opening; and a metal cover sealed to said can and having an opening therein with the edge thereof resting on said washer; the combination of means for venting a normal amount of cell gas through said electrode and the opening in said washer, with means for venting an abnormal amount of cell gas around said electrode through the opening in said cover.
5. A dry cell comprising a zinc container, a carbon electrode therein, a relatively soft and yielding insulating washer carried by said electrode, and a relatively hard and resilient annular closure having its outer edge permanently secured to the upper end of said container and its inner edge contacting with said washer yet free to flex upwardly to vent gas from the cell.
6. A dry cell according to claim 5 in which the carbon electrode is sufficiently porous to vent gas from the cell and has a portion thereof exposed to the outer atmosphere.
7. A dry cell comprising a container, an electrode therein, a washer of a relatively soft and yielding porous material carried by said electrode with a portion thereof exposed to the outer atmosphere, and a relatively hard and resilient annular impervious closure having its outer edge permanently secured to the upper end of said container and its inner edge contacting with said washer yet free to flex upwardly to vent gas from the cell.
8. A dry cell comprising a zinc container, a carbon rod electrode therein, a relatively soft and yielding insulating washer carried by said electrode, and an annular resilient sheet metal closure having its outer edge permanently secured to the upper end of said container and having its inner edge turned downwardly, said closure being so deformed that its inner edge presses tightly against said washer.
9. A dry cell comprising a container, an electrode therein and having a portion thereof exposed to the outer atmosphere, said electrode being sufficiently porous to vent gas from the cell at a rate below the maximum rate of gas generation in the cell while preventing the escape of moisture, a seat on said electrode, and a resilient annular closure for said container, said closure having its outer edge permanently secured to the upper end of said container and its inner edge contacting with said seat yet free to

flex upwardly to vent gas from the cell at a rate greater than the electrode.

10. A dry cell comprising a container, a porous electrode therein normally adapted to vent gas from said cell and having a portion thereof exposed to the outer atmosphere, a relatively soft and yielding washer carried by said electrode, and a relatively hard and resilient annular closure for said container, said closure having its outer edge permanently secured to the upper end of said container by a substantially gas-tight joint and having its inner edge pressing against said washer but separable therefrom to release excessive gas pressure in said cell.

11. A dry cell comprising a zinc container; a porous carbon electrode therein having a portion thereof exposed to the outer atmosphere and normally adapted to vent gas from said cell; a relatively soft and yielding insulating disk carried by said electrode; and an annular resilient sheet metal cover having its outer edge permanently secured to the upper end of said container by a gas-tight joint and having its inner edge contacting with said disk but free to separate therefrom to release abnormal gas pressure in said cell.

12. A dry cell comprising a container, an electrode therein carrying a metal circuit terminal, a relatively soft and yielding disk mounted on said electrode and having an opening through which said terminal projects, and a relatively hard and resilient annular cover for said container, said cover having its outer edge permanently secured to the upper end of said container and its inner edge contacting with said disk yet free to flex upwardly to vent gas from the cell.

13. A dry cell comprising a metal container, a carbon electrode therein carrying a metal circuit terminal, an insulating disk mounted on said electrode and having a relatively soft and yielding opening through which said terminal projects, and a relatively hard and resilient annular sheet metal cover for said container, said cover having its outer edge permanently secured to the upper end of said container and its inner edge contacting with said disk yet free to flex upwardly to vent gas from the cell.

14. A dry cell comprising a zinc container, a porous carbon rod electrode adapted to vent gas from said cell, a metal circuit terminal carried by said electrode, an insulating disk mounted on said electrode and having an opening through which said terminal projects, and an annular resilient sheet metal closure for said container, said closure having its outer edge permanently secured to the upper end of said container by a gas-tight joint and its inner edge turned downwardly, said closure being so deformed that said inner edge contacts with said seat but is displaceable therefrom to release abnormal gas pressure in the cell.

15. A dry cell comprising a container, an electrode therein, an annular closure member in contact with said electrode, and an annular closure member having its outer edge secured to the upper end of said container, one of said members being relatively hard and resilient and the other of said members being relatively soft and yielding, said relatively hard and resilient member having a free edge in contact with the upper surface of said relatively soft and yielding member and being free to flex upwardly to vent gas from the cell.

16. A dry cell as defined in claim 15 in which

the closure members make substantially a line contact with each other.

17. In a dry cell having a container with a carbon electrode therein; a seat upon the upper end of said electrode; and an annular resilient metal sealing member having the outer edge thereof attached to said container by means of a fluid-tight joint, and the inner edge thereof flanged downward and forming a fluid-tight joint with said seat that is free to open by gas pressure in said cell to vent the same.

18. In a dry cell having a container with a carbon electrode therein; a relatively soft and yielding preformed washer on the upper end of said electrode; a relatively hard and resilient annular sealing member having the outer edge thereof rigidly secured to the upper end of said container and the inner edge thereof provided with a downturned flange embedded in said washer.

19. In a dry cell having a container with a carbon electrode therein; a seat upon the upper end of said electrode; and an annular resilient metal sealing member having the outer edge thereof rigidly secured to said container and the inner edge thereof flanged downward and terminating in a sharp edge embedded in said seat but adapted for being raised therefrom by gas pressure within said cell for venting the same.

20. In a dry cell having a container with a carbon electrode and an electrolyte therein; a metal dowel extending upward from said electrode; a seat comprising a washer of material impervious to said electrolyte encircling said dowel and forming a joint with said electrode through which said electrolyte will not pass; and an annular resilient sealing member having an upturned flange at the outer edge thereof over which the upper edge of said container is crimped, and a downturned flange at the inner edge thereof terminating in a sharp edge embedded in said seat but adapted for being raised therefrom by gas pressure within said cell for venting the same.

21. In a dry cell having a container with a flat-topped carbon electrode therein; a preformed flat annular disc of bibulous material impregnated with waterproofing material on the flat top of said electrode; and a dished closure of resilient metal having the outer edge thereof rigidly secured to said container so that the inner edge thereof exerts a resilient pressure on said disc, said cover being free to raise from said disc to vent excessive gases and to return to said disc to form a tight seal.

22. In a dry cell having a container; a gas-pervious waterproof carbon electrode in said container with a portion exposed to the outer atmosphere so that gas normally generated in said cell may escape therethrough; an impervious bibulous washer on the upper end of said electrode; and a sealing member of resilient metal secured under stress between the upper surface of said washer and the upper edge of said container so that the pressure of more gas than can escape through said electrode will raise the sealing member and permit escape of gas between the inner edge thereof and said washer.

23. A dry cell comprising a zinc container, a carbon electrode therein having a metal dowel projecting centrally from its upper end, a relatively soft and yielding disk mounted on said electrode and having an opening through which said dowel projects, and a relatively hard and resilient annular cover for said container, said cover having its outer edge permanently secured

to the upper end of said container and its inner edge contacting with said disk yet free to flex upwardly to vent gas from the cell.

24. A dry cell comprising a zinc container, a carbon electrode therein, a metal cap mounted on the upper end of said electrode and having an outturned flange, a relatively soft and yielding washer mounted on said flange and having an opening through which said cap projects, and a relatively hard and resilient annular cover for said container, said cover having its outer edge permanently secured to the upper end of said container and its inner edge contacting with said washer yet free to flex upwardly to vent gas from the cell.

25. A dry cell according to claim 24 in which said washer consists of insulating material and said cover consists of sheet metal.

26. A dry cell according to claim 24 in which said electrode is sufficiently porous to vent gas from the cell, and the projecting part of said cap is slitted to expose a portion of said electrode to the outer atmosphere.

27. In a dry cell, a metal cup, a cartridge within said cup, an electrode arranged centrally of said cartridge, a resilient metal cover having a rigid gas-tight connection with said cup and having a central opening, a metal cap mounted on said electrode and projecting through said opening and having an annular shoulder, and an annular insulator resting on said shoulder and underlying said cover, the inner edge of said cover being turned at an angle to the remainder and pressed into sealing relation with said insulator by tension exerted solely by said cover.

28. A dry cell comprising a container electrode; an electrode member within and spaced from said container electrode; active material in the space between such electrodes; a closure for the cell comprising a metal cover member supported by said electrode member and having a marginal portion secured to said container electrode; said container electrode and said cover member consisting of dissimilar metals; and a coating of insulating material upon the interior surface of said cover member.

29. A dry cell comprising a container electrode; an electrode member within and spaced from said container electrode; active material in the space between said electrodes; a closure for the cell comprising an annular metal cover member having one margin thereof secured to said container electrode and having another margin thereof supported by said electrode member; said container electrode and said cover member consisting of dissimilar metals; and a layer of insulating material adhering to and coating the interior surface of said cover member.

30. A dry cell comprising a metal container electrode; an electrode member within and spaced from said container electrode; active material between said electrodes leaving a free space above said active material; a metal terminal cap carried by said electrode member, said cap having a portion thereof within said free space; an annular metal cover having its inner margin adjacent to but insulated from said cap and having its outer margin permanently secured to said container electrode; and a coating of insulating material upon the interior surface of said cover.

31. A dry cell comprising a container electrode; an electrode member within and spaced from said container electrode; active material in the space between said electrodes; a closure for the cell comprising a metal cover member supported by said

electrode member and having a marginal portion secured to said container electrode; said container electrode and said cover member consisting of dissimilar metals; and plastic material sealing the joint between said cover member and said container electrode.

32. A dry cell comprising a container electrode; an electrode member within and spaced from said container electrode; active material in the space between said electrodes; a closure for the cell comprising a metal cover member having a portion supported by said electrode member and having a marginal portion secured to said container electrode; said container electrode and said cover member consisting of dissimilar metals; a surface coating of insulating and protective material upon the interior surface of said cover member; and plastic material sealing the joint between said cover member and said container electrode.

33. A dry cell comprising a container; an electrode therein; a washer of a relatively soft and yielding porous material carried by said electrode with a portion thereof exposed to the outer at-

mosphere, the said washer being impervious to moisture but pervious to gas under the pressures developed in the cell; and a relatively hard and resilient annular impervious closure having its outer edge rigidly secured to the upper end of said container and its inner edge contacting the said washer yet free to flex upwardly to vent gas from the cell.

34. A dry cell comprising a metal container; a carbon electrode therein; a metal cap mounted on the upper end of said electrode and having an out-turned flange; a relatively soft and yielding washer mounted on said flange and having an opening through which said cap projects, the said washer being impervious to moisture but pervious to gas under pressures developed within the cell; and a relatively hard and resilient annular cover for said container, said cover having its outer edge permanently secured to the upper end of said container and its free inner edge contacting with said washer yet free to flex upwardly to vent gas from the cell.

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