# United States Patent

**Mitchell**

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## [54] CONFINEMENT OF DIFFERENT MISCIBLE LIQUIDS IN A SINGLE CONTAINER


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[51] **Int. Cl.**.....**B65d 25/00**

[58] **Field of Search**.....206/47 A, 47 R; 137/264, 262, 137/268, 266, 1, 588, 256; 114/74; 220/9, 85 B, 22; 23/271, 272.7, 272.8, 272.6, 267 R



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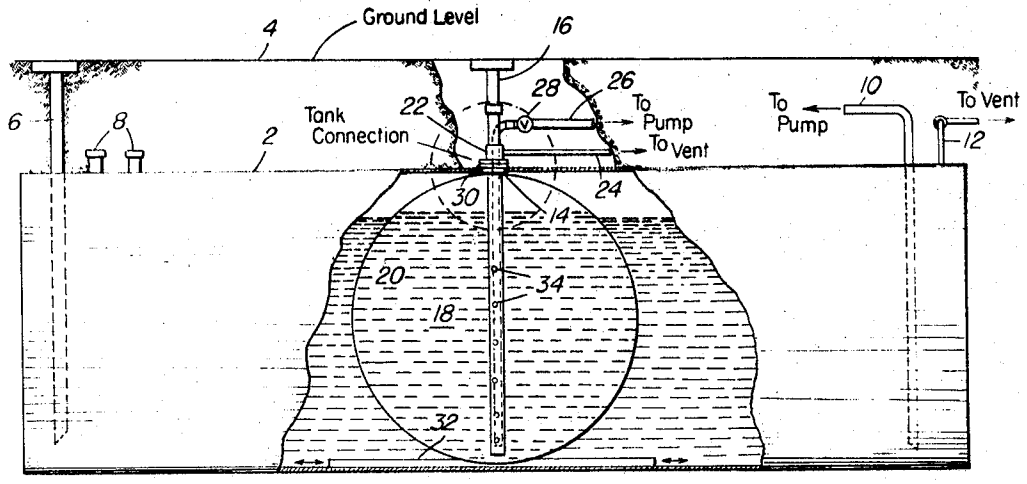
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[57] **ABSTRACT**

A method and arrangement of apparatus is described for adapting and modifying containers such as surface tanks and underground storage tanks to hold more than a single liquid material such as several different liquid materials which are miscible with one another by inserting into the container one or more assemblages comprising a flexible bag liquid storage container rigidly attached to liquid filling and withdrawal conduits arranged in a housing of limited dimensions and suitable for insertion through and attachment to an existing opening in the container.


**3 Claims, 2 Drawing Figures**



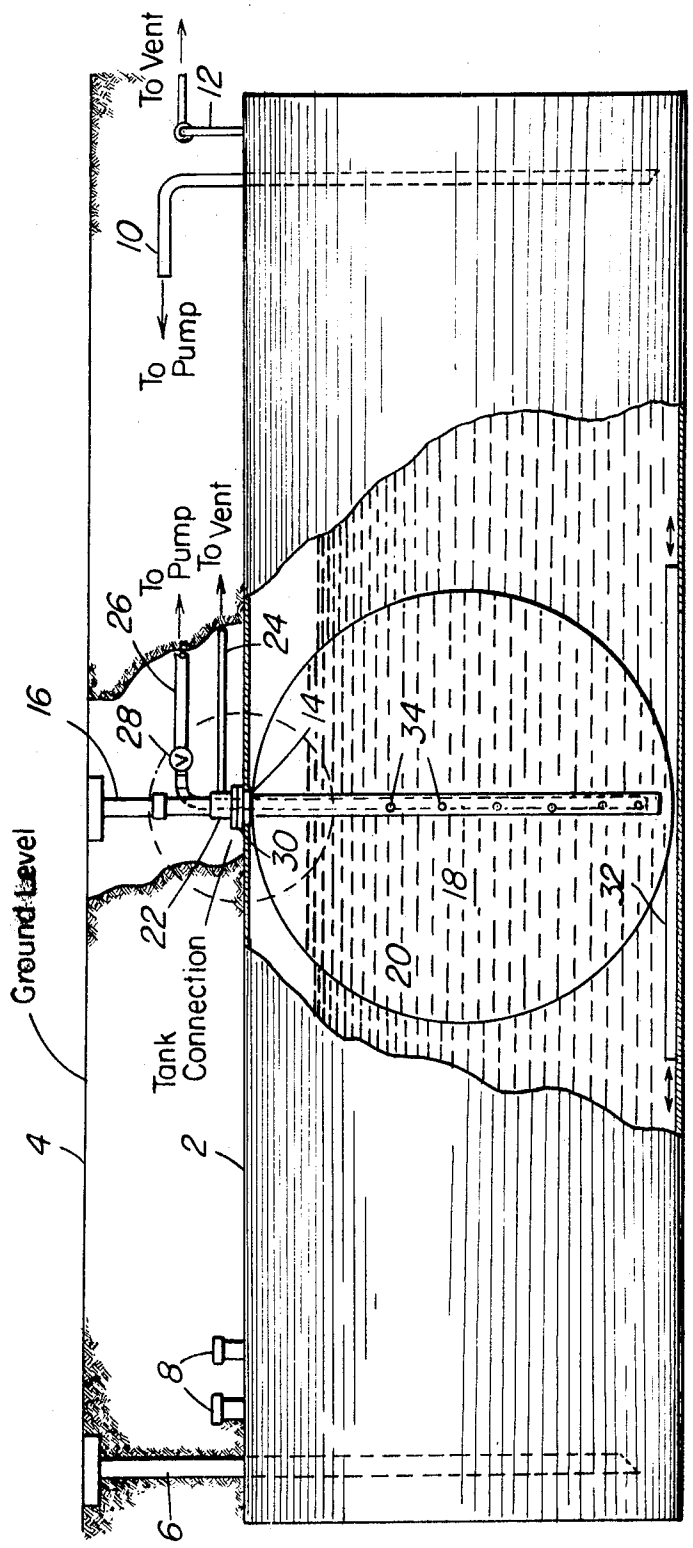
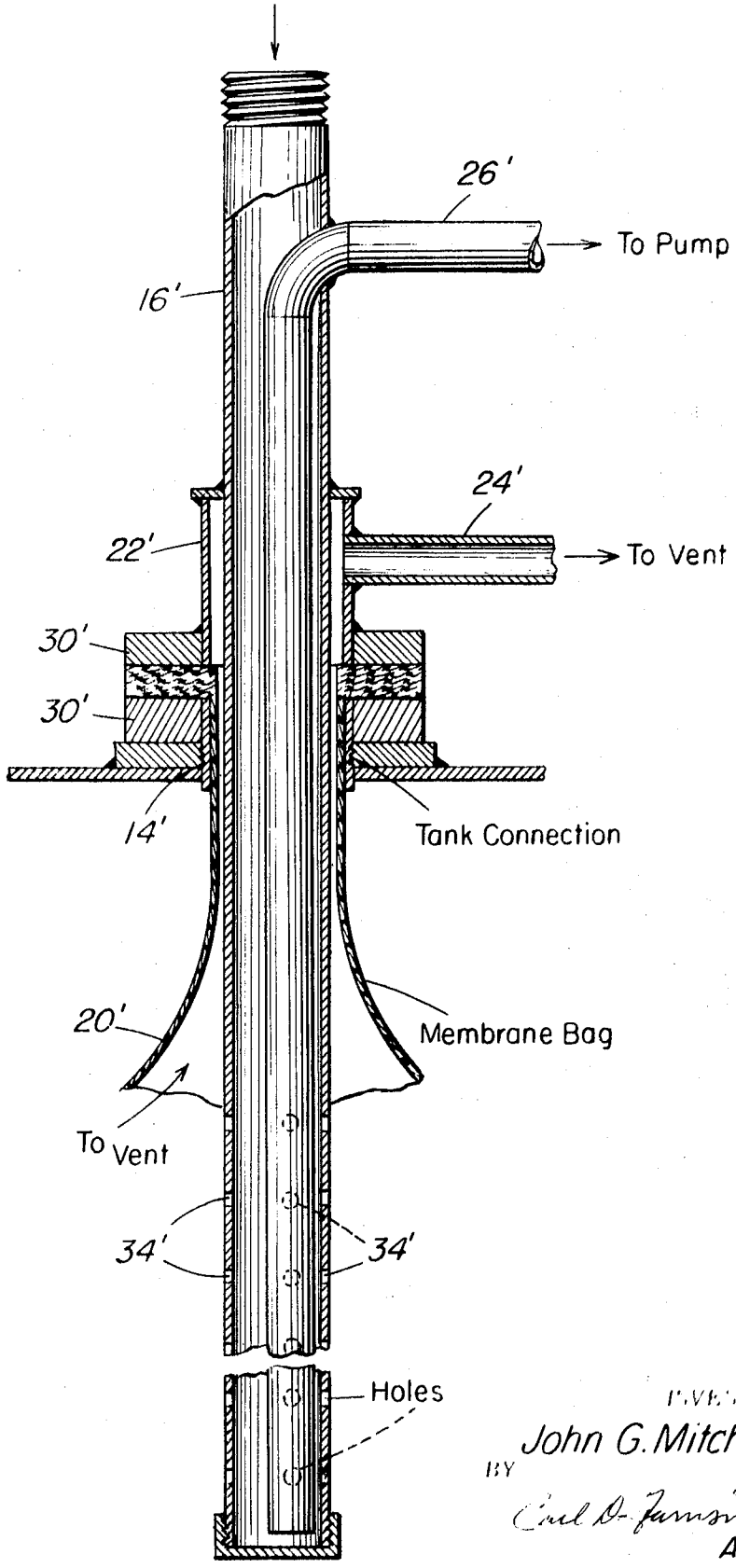



FIG. 1

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FIG. 2




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# CONFINEMENT OF DIFFERENT MISCIBLE LIQUIDS IN A SINGLE CONTAINER

## BACKGROUND OF THE INVENTION

The storage of liquids in rigid and semi-rigid containers has been practiced ever since the needs of man have dictated and demanded such storage facilities. Wooden tanks, animal skins and metal containers of many different sizes, shapes and configurations have been used for this purpose. Furthermore, flexible liners have been used in cavities of rigid dimensions to house liquids and powdered solids so that in the storage, handling and transportation of the different fluids, a single rigid container independent of its construction material can be used to confine or house different fluids without encountering the time and expense for cleaning between storage or confinement of the different fluid materials. Flexible liners have also been used in some considerable quantity to repair leaky containers thereby avoiding the expense of repairing the leaking containers. It is also known from the prior art that it is old to store and/or carry two or more different materials at different times or simultaneously within a single rigid cavity. Thus it is obvious from the prior art disclosures that any number of separate compartments can be provided within a single cargo carrying space depending upon the number, size and location of flexible membranes used to separate available cargo space. The above identified observations are made from U.S. Pat. Nos. 2,696,185, 3,085,708 and Re. Pat. No. 22,876 dated May 13, 1947.

## SUMMARY OF THE INVENTION

The present invention is concerned with the containment of two or more different miscible liquids. In one aspect the present invention is concerned with the method and facilities required to alter a single rigid vessel or container so that housing of one or more different miscible liquids can be accomplished within the same container. In a particular aspect the present invention is concerned with the method and means for adapting storage facilities such as an underground cylindrical container to provide for the storage of two or more miscible liquids. According to the present invention this is accomplished with one or more flexible membranes or envelopes such as bags to maintain a desired separation between the different liquid materials within the container. Thus the method and means of the present invention may be used for storing gasoline products of different octane rating, different grades of oil product and other liquid materials within a single cavity of rigid or semirigid dimensions.

## BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 diagrammatically depicts an underground storage tank provided with liquid fill and withdrawal pipes which has been modified by use of a flexible membrane and existing tank openings to provide for the separate storage of two different liquid materials within the tank assembly.

FIG. 2 diagrammatically depicts the apparatus relied upon to provide separate liquid storage capacity comprising a flexible bag attached to liquid fill and withdrawal conduits which may be inserted into tank structures such as depicted in FIG. 1.

## DESCRIPTION OF SPECIFIC EMBODIMENTS

The method and means of the present invention is particularly described as it may be applied to an underground storage cavity or cylindrical tank such as used to store liquid products including gasoline, fuel oil, or any other liquid petroleum product. It is to be understood, however, that the method and means of the present invention may be applied to or used in other existing rigid storage facility such as provided by dry and liquid cargo vessels and barges, as well as above ground storage facilities comprising rigid and semi-rigid confinement containers.



Thus the present invention relates to a method for adapting a storage container to house liquid materials by inserting into said container one or more liquid retaining assemblages comprising a relatively large flexible membrane such as an envelope or bag which is attached to and surrounds a liquid fill pipe closed at its bottom end and which will extend to the bottom of the container in which placed. The envelope or bag employed may be of such dimensions that it will fill or partially fill the entire container when filled a desired amount with liquid material. The fill pipe is provided with liquid flow-through holes and thus is perforated throughout a substantial portion of its length beginning from the bottom thereof and particularly that portion confined within the container. A liquid withdrawal pipe is provided in conjunction with the fill pipe and is in open communication with the bottom portion of the fill pipe. The withdrawal pipe may be adjacent to and positioned within or outside the fill pipe throughout substantially its vertical height to form the assemblage inserted in the container. Means are provided for venting vaporous material from either side of the bag in the container to the atmosphere. The assemblage comprising the bag, fill and withdrawal pipes and vent means above discussed may be used in a container equal in number to the number of different liquids to be stored in the container, or the number of assemblages used may be one less than the number of liquids to be stored. Although the drawings specifically described hereinafter show the pipe located within the liquid fill pipe as a matter of convenience to accommodate a relatively small existing opening in the upper surface of an underground tank, it is not essential that this arrangement be retained or employed sine other arrangements are also practical and readily identified. For example, the withdrawal pipe may be external to the fill pipe. In any event the pipes are adjacent to one another and they are arranged to fit through the opening provided in the container upper surface.

Referring now to FIG. 1, by way of example, a cylindrical tank 2 positioned beneath ground level 4 is typical of an underground storage tank for the confinement of liquid materials such as gasoline. In the specific arrangement of FIG. 1, the cylindrical tank is about 8 ft in diameter and is approximately 26 ft long. In normal use restricted to housing a single fluid material the cylindrical tank is provided with an inlet pipe 6 for filling the tank which extends from ground level downwardly to a lower portion of the tank and substantially to the bottom thereof. The tank of FIG. 1 is also provided with 2 adjacent openings 8 which are approximately 4 inch openings and comprise in some instances a welded pipe, threaded at its upper end and extending above the tank surface. These openings are closed off at the top by suitable screw on caps. On the opposite end of tank 2 there is provided a withdrawal stand pipe 10 provided for withdrawing liquid from the tank by a pump not shown which is used to pass the withdrawn gasoline, for example, to the dispensing pump on the gasoline island. A vent pipe 12 is also provided and attached to the upper surface of the tank which is used to vent vaporous material to the atmosphere. Cylindrical tank 2 is also provided with an opening 14 at substantially the center of the tank. This opening 14 may be similar to opening 8 discussed hereinbefore and will comprise a short length of pipe extending above the tank surface and threaded at the upper end thereof. On the other hand, the opening may be a bung hole which is threaded and sealed with a suitable plug. In any event, the assembly particularly described with respect to FIG. 2, and only very diagrammatically shown in FIG. 1, extends through the opening 14 and is connected thereto by suitable threaded members as required to fit the available type of openings. The particular assembly of FIG. 2, and applied to a tank as shown in FIG. 1, comprises a liquid fill pipe 16 which extends from substantially the ground level downwardly through the opening 14 and into the lower portion of the cylindrical tank. This fill pipe is closed at the bottom end such as by a threaded cap member or the pipe may be welded shut. This fill pipe 16 is provided with a plurality of holes spaced throughout a substantial por-

tion of the length thereof for passing liquid introduced by the pipe through the holes into a surrounding confined space or chamber **18** formed by a flexible member such as a bag or envelope **20**. As more clearly shown in FIG. **2**, pipe **16** is attached to and passes through a larger diameter housing **22** to provide an annular space therewith so that any vapors developing in the upper portion of the chamber **18** may pass upwardly through the annular space to vent withdrawal conduit **24**. To provide for the removal of liquid from chamber **18**, a pipe **26** containing a check valve **28** passes through the wall of pipe **16** external to the cylindrical tank **2** and then passes downwardly through pipe **16** to substantially the bottom thereof. Pipe **26** is open at its lower end and is used to withdraw liquid from pipe **16** fed thereto from chamber **18** by the holes provided in the periphery of pipe **16**. The flexible member or bag **20** is provided with an elongated neck which attaches at the end between two flanged baffle members **30**, as more clearly shown in FIG. **2**. The bag formed of the flexible membrane thus forms a second chamber **18** within the chamber formed by cylindrical vessel **2**. To assure that the bag assembly **20** does not interfere with the flow of liquids within cylinder **2** an open end conduit **32** is provided in the bottom of cylindrical tank and of a length sufficient to prevent the ends thereof being closed by flexible member **20** when liquid is withdrawn therefrom causing the membrane to sag to the bottom of the cylindrical tank **2**. The assembly of the containment device above discussed is achieved in a rather novel manner to avoid uncovering a buried tank to the extent that a large opening is provided and/or welding of the tank would be required. In the arrangement of FIG. **2**, the filling and withdrawal assembly, including the flexible membrane, is of such dimensions that it will pass through the existing 4 inch opening in the underground cylindrical tank. Thus the major connection required with cylindrical tank **2** is through the thread arrangement already provided in opening **14** of the cylindrical tank and the whole assembly after insertion through the hole is locked in place by the threads provided. Having thus made the above described modification to an existing underground tank, vent connection **24** needs to be hooked to suitable vent pipe and pipe **26** also needs to be connected to a suitable gasoline island pump. In some underground tanks known to have additional existing openings similar to opening **8** or **14** throughout the horizontal length of the underground storage tank, such openings, if properly spaced apart, will provide more than one inlet means for insertion of additional assemblies such as shown in FIG. **2** to provide additional separate liquid storage facilities within an existing tank. Thus the method and means above described permits the use of flexible membranes generally resembling the form of bags as means for housing different liquids which are miscible with one another in a single rigid cavity such as the cylindrical tank of FIG. **1**. Accordingly, depending upon the size of the tank, several different liquids could be housed in a single tank as the occasion demands. It is to be recognized that even though the facilities of FIG. **1** are discussed with respect to an underground storage tank, it is to be recognized that a similar application may be made to above ground storage facilities whether applied to a rigid container or a semi-rigid container.

Referring now to FIG. **2**, the assemblage inserted in opening **14** of FIG. **1** is diagrammatically shown in considerably greater detail. In the arrangement of FIG. **2**, the components comprising the assemblage are numbered corresponding to the numbers employed in FIG. **1**, wherein, for example, **16'** of FIG. **2** corresponds to pipe **16** of FIG. **1** and so forth. In FIG. **2**, with flexible membrane or envelope **20'** is shown extending as an elongated neck up through the housing to a collar which is bound between flanges members **30'**. The flange members **30'** may be secured or drawn together by bolts not shown, or they may be bonded to the collar of the flexible membrane. In any event, it is important to provide a leak-proof bond in this part of the assembly. The assembly depicted in FIG. **2** shows an annular vent space existing between housing **22'** and pipe **16'** through which vaporous material may pass to vent pipe **24'**. As discussed with respect to FIG. **1**, liquid material introduced by fill pipe **16** flows through the plurality of holes **34'** provided in the lower wall portion of the pipe into the envelope and thus more clearly shows the method for introducing liquid into the envelope or withdrawal therefrom into the bottom open end of withdrawal pipe **26'**. Thus the plurality of holes provided in the wall of pipe **16'** feed liquid into and out of the envelope as required to store and dispense stored liquid therefrom.

Installation of the assemblage comprising FIG. **2** in an underground storage tank such as tank **2** shown in FIG. **1** is accomplished with considerable ease since the flexible membrane forming the bag or envelope may be rolled to a size suitable for insertion through opening **14'**, and once the envelope is inserted the assemblage may be screwed in place at the threaded inlet **14** as provided and shown.

The flexible membrane or envelope forming the spherical bag depicted in FIG. **1** will not necessarily be restricted to the spherical shape shown, but, on the other hand, will be shaped by the liquid fill and surrounding liquid material and such shaping will depend upon the relationship existing between the density of the liquid materials inside and outside the bag. That is, with a high density liquid such as high octane gasoline placed inside the bag and using a low density low octane gasoline in the storage tank outside of the bag, the high density liquid will cause the bag to shape itself adjacent the bottom of the cylindrical tank in an attempt to float beneath the low density liquid material. On the other hand, with a low density liquid material within the bag and a higher density liquid material on the outside of the bag, the bag will then shape itself so as to float upon the high density liquid material. This latter positioning of the bag may not be a desirable arrangement since such an arrangement will cause considerable force to be exerted on the flexible membrane by the bottom end of pipe **16'** extending into the tank. Thus it is immediately clear that the strain placed on the flexible material used to form the bag can be considerably minimized by filling the bag with the same or a higher density material than that used in the tank outside of the flexible bag.

The method and system of the present invention permits the conversion of existing storage tank facilities to store more than one liquid material within any given tank. Furthermore, a wide variety of liquid hydrocarbon products may now be stored substantially adjacent to one another provided the products are of a composition which will be compatable with the flexible membrane material employed to form the envelope or bag membrane. Flexible materials suitably resistant to liquid hydrocarbons and chemical products are known at this stage of the art, and use of such material to fabricate envelopes of desired size, shape and strength are discussed in the literature.

Having thus provided a general discussion of the concept of this invention and described a specific example in support thereof, it is to be understood that no undue restrictions are to be imposed by reasons thereof except as defined in the appended claims.

I claim:

1. A method for modifying a liquid storage container to house more than one liquid material which comprises:

inserting through an opening in the upper surface of a container and rigidly attaching thereto an assemblage comprising a liquid retaining flexible membrane which will extend in substantial proportions to the bottom of the container, said assemblage further comprising a liquid fill pipe discharging into a cavity formed by said flexible membrane, said fill pipe closed at substantially its bottom end and being of a length extending to substantially the bottom of said container, said fill pipe provided with a plurality of liquid flow-through holes in a major portion of its lower length, a liquid withdrawal pipe in open communication with the bottom portion of said fill pipe and extending upwardly therefrom to permit withdrawal of

liquid confined within said flexible membrane cavity and a vaporous material vent pipe communicating between the vaporous space of said cavity and the exterior of said container.

2. A method for adapting a container to house liquid materials which comprises:

inserting into a rigid or semi-rigid container a liquid retaining assemblage comprising a large flexible membrane or bag surrounding a liquid fill pipe means close at its bottom end and extending to substantially the bottom of the container, said fill pipe means perforated with liquid flow-through holes throughout a substantial portion of the length thereof confined within the container, a liquid withdrawal pipe means in open communication with the bottom portion of said fill pipe and means communicating with said withdrawal pipe above said container upper surface for passing withdrawn liquid to a dispensing pump, means in said assemblage for venting vaporous material from said bag to the atmosphere and employing said assemblage in said container equal in number to or one less than the number of different liquids to be stored in the container.

3. A method for modifying a storage container to house one or more miscible liquid materials which comprises:

rigidly attaching to an opening in the upper surface of a confined container an assemblage comprising a flexible bag in combination with and surrounding a liquid filling and withdrawal integral pipe means which extends to substantially the bottom of said container vent, means in combination with said integral pipe means for venting vapors from the space within and external to the bag to the atmosphere above said container, and the number of assemblages used in said container being equal to one less than the number of separate liquid materials stored in said container.

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