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3,241,819

VANE FOR GAS CYLINDER

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FIG. 1

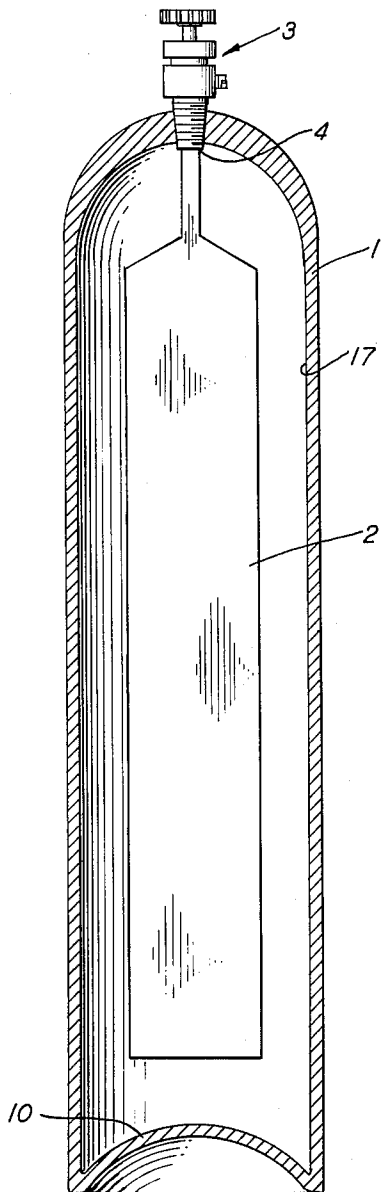


FIG. 2

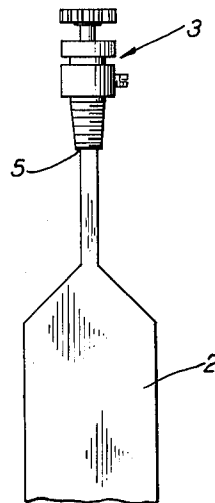
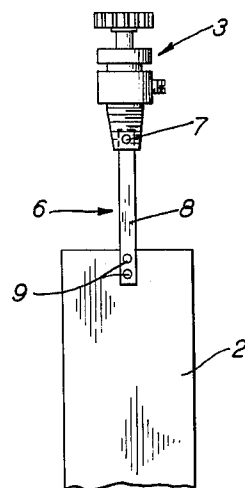


FIG. 3



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FIG. 4

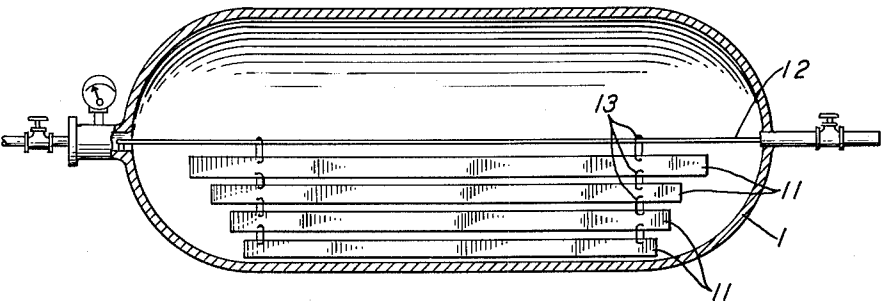
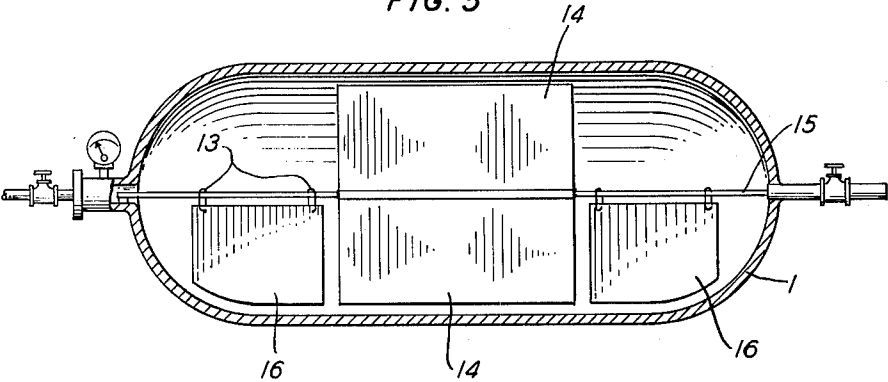


FIG. 5



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VANE FOR GAS CYLINDER

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2 Claims. (Cl. 259-72)

This invention relates to means for promoting the mixture of gases contained within a gas container.

More specifically, this invention relates to an internal vane or paddle structure for a gas container, normally a gas cylinder, used to promote, effect, or maintain the intermixture of the several gaseous components introduced into said gas container, with or without premixing.

The preparation and maintenance of accurately proportioned, homogeneous mixtures of two or more gases in a gas cylinder is a recurrent problem. For example, in one type of gas cylinder, gases under compression are supposed to be intermixed and maintained at a ratio of 75% argon and 25% carbon dioxide. There is a tendency for the gases to remain separated, since the gases are normally not introduced at the same time, but rather the heavier carbon dioxide is introduced into the cylinder first. When mixture does occur, it occurs very slowly, thus impeding the usefulness of the filled cylinder, since early withdrawal of gas will result in the gas not being in the proper mixture, which is in itself undesirable, resulting in an imbalance in the ratio of the gas constituents still in the cylinder.

There have been numerous proposals for promoting the more rapid mixture of gases of gas storage cylinders, of which the argon-carbon dioxide cylinder is one example. None of the previous proposals for effecting complete and rapid mixture of gases introduced into a cylinder have been completely successful. For example, it has been a common practice to roll the cylinder back and forth on a surface, after completing the filling operation of said cylinders with the gases contained therein, in order to effect said mixture of gases. However, said rolling operation is inefficient since it requires wide floor space, operator attention and much time. It is to be noted that when filled gas cylinders containing more than one gas therein are moved solely in a random manner, for example, as in transport, there is often insufficient motion to effect rapid or significant mixture of the gases.

Other methods for effecting mixture of various gases within a cylinder include: vibrating the cylinder, alternate heating and cooling of the cylinder walls, adding rods which roll inside the cylinder when the cylinder itself is rolled, moving hermetically sealed mechanically or magnetically actuated shafts in a cylinder, or simply allowing the cylinder to stand for long periods of time.

The above methods are either ineffective or extremely unsatisfactory, since, for example, they are slow to cause mixture of gases, and require deliberate manual action to accomplish whatever mixture is accomplished.

It is an object of this invention to provide means for aiding quick and effective mixture of the gases of a gas cylinder.

It is a further object of this invention to provide structure internally mounted in a gas cylinder for intermixing the various gases contained therein.

It is further an object of this invention to provide for hastening intermixture of gases contained within a cylinder as a result of utilizing structure mounted internally of the cylinder.

These and other objects will become more apparent in connection with the more detailed description and drawings relating thereto which follow.

The structure of the preferred embodiment of this in-

vention for affecting more rapid intermixture of gases is a vane or paddle placed within a gas cylinder in such a manner that it can move independently, continuously and randomly under the influence of gravity, whenever the cylinder is moved. Movement of the vane within the cylinder with respect to the confining cylinder walls continuously wafts or displaces the gaseous contents, thus promoting the formation of gas currents which promote mixing of the gases within the cylinder within a short period of time. The gas mixing vane may be mounted in any desired fashion within the cylinder; for example, mounted from the inner valve so as to swing freely and be moved by the action of gravity as a result of the flexibility of the mount, of the mounting material, or of the vane itself. The vane may be mounted in any desired manner, for example, so as to pivot, hinge or swing freely, or it may simply stand within the cylinder. Any variety of mechanical means may be used to mount the vane within the cylinder.

In a second embodiment, the vane structure comprises a series of slats not unlike a venetian blind, hung from a shaft in such a way as to displace the gases in the cylinder when the cylinder is moved, thus effecting intermixture.

In a third embodiment the vane structure is comprised of paddle elements, some of which are fixed to a shaft within the cylinder, and some of which are movable on said shaft. The fixed paddle elements rotate with the shaft and cylinder, thereby producing a movement of gas which is opposed by the movable paddles. The opposing action of the several paddles produces effective gas mixing.

The invention will now be described in further detail in connection with the following drawings:

FIGURE 1 shows a gas container with mixing vane or paddle structure mounted therein in accordance with the invention.

FIGURE 2 shows one method of mounting the vane structure of FIGURE 1.

FIGURE 3 shows a second method of mounting the vane structure of FIGURE 1.

FIGURE 4 shows a second form of vane structure mounted in a container.

FIGURE 5 shows another form of vane structure mounted in a container.

Within the interior of a gas container 1 in the shape of a cylinder is mounted vane structure in the form of a ribbonlike vane or paddle 2. Said vane 2 may be of any desired length, shape, and of any variation of width and thickness desired. For maximum results, due to maximum gas displaced, the vane should be almost as long as the interior length of the cylinder and mounted on the longitudinal axis of the cylinder. It is preferred that the vane 2 be relatively thin and flexible so that wafting action may occur. One vane of the type shown in FIGURE 1 constructed and satisfactorily used according to this invention was 6 inches wide x 48 inches long x 0.002 inch thick. The vane structure may be made of any one of a number of different materials, such as stainless steel, copper, tin, brass, plastic, or other synthetic material, etc.

The vane 2 may be mounted in the cylinder 1 in any desired manner, such as by attaching it to the valve 3 of the cylinder 1 as shown at 4 in FIGURE 1. Said method of attachment to the valve of the cylinder may be as the result of brazing, as shown generally at 5 in FIGURE 2 or as the result of a pin and strip connection as shown generally at 6 in FIGURE 3 (pin 7 attaching strip 8 to the valve 3, said strip 8 attached by pins or rivets 9 to the vane 2). The vane 2 may be flexible so as to waft and displace the surrounding gases, as vane 2 within the cylinder is held under the action of gravity upon movement of the cylinder. The strip 8 may be

flexible to allow for wafting of the vane 2, even if the vane 2 is rigid. Obviously, the vane structure may be attached to the valve 3 in any desired manner, FIGURES 2 and 3 merely illustrating two possible modes of attachment. As pointed out earlier, the vane structure, such as vane 2, may be flexible so as to promote mixture of the gases due to wafting, even if a rigid mounting of said vane to the cylinder is employed; or the mounting of the vane structure within the cylinder may be such as to allow the vane structure to move, even if the vane structure is rigid, such as by use of a flexible strip 8, so as to promote mixing.

One manner of inserting the vane 2 shown in FIGURE 1 into the cylinder 1 is by coiling it into a tight roll and passing it easily through the valve opening. Said vane then springs open to the flat fan-like structure shown in FIGURE 1. Other modes of introducing the vane into the cylinder may also be employed, and said method of introducing said vane into the cylinder is not the subject of this invention.

After the mixing vane shown in FIGURE 1 has been introduced into the cylinder, the vane fans or wafts about in random fashion, under the influence of gravity, upon the introduction of gas into the said cylinder or upon any movement of said cylinder, either because it is flexible or because of its flexible mount within the cylinder, thus causing intermixture of the gases. Even where the prior methods of intermixing the gases are still used, the mixing vane promotes more rapid intermixture of said gases, thus producing a more useable gas charged cylinder. The vane also insures that the mixed gases are remixed if they should become separated as for example when freezing weather causes liquefaction of one component (i.e. CO₂ in the CO₂-Argon example).

The following figures compare two samples of the gas obtained from a cylinder employing a 4 inch wide x 48 inch long x 0.002 inch thick mixing vane (mixer cyl.) according to FIGURE 1 to two samples of gas obtained from a cylinder without the vane (std. cyl.), seven days after the cylinders were 75% filled with argon gas and 25% filled with carbon dioxide gas. It is apparent from the figures that the heavier carbon dioxide gas more completely mixed with the argon gas where the mixing vane was employed.

(P.s.i.g.)	Percent CO ₂ (v./v.)	
	(Mixer cyl.)	(Std. cyl.)
(1) 2,500.....	24.5	19.6
(2) 2,500.....	25.3	19.6

Furthermore, a gas cylinder employing a vane of the construction shown in FIGURE 1 was compared to a cylinder not employing the vane structure at short intervals after filling said cylinders to determine the rapidity of the inter-mixture of gases. In this case both cylinders were 25% filled with carbon dioxide gas and 75% filled with argon gas and then said cylinders were tested at the time intervals indicated to determine the composition of the product gas. It will be noted that intermixture of the gases in a cylinder with the mixing vane (mixer cyl.) was effected at a faster rate than in the standard cylinder (std. cyl.) without the mixer vane. A 6 inch wide x 48 inch long x 0.002 inch thick vane was employed.

	Percent CO ₂ (v./v.)	
	(Mixer cyl.)	(Std. cyl.)
20 min. after filling to 2,500 p.s.i.g.	2	2
Roll on base 210 ft.	6	3.5
Roll on base additional 210 ft.	7.5	4.5
Five days after preparation.....	10	7
Cylinders trucked 57 miles—Analyzed following day (6th day).....	16	12
20 days after prepn. (stored vertically).....	22	17
Cylinders trucked approx. 80 miles.....	23	20

The above data indicates that the presence of the mixer vane improved the mixing of the standard cylinder contents, and speeded said mixing. It is apparent from the above figures that the mixer vane results in more rapid inter-mixture of the gases of a gas cylinder. The vane also aids the continued inter-mixture of the gases within the cylinder, reducing separation due, for example, to liquefying one component.

In the embodiment shown in FIGURE 4, the vane structure is comprised of a series of slats 11, the vane structure being not unlike a venetian blind in appearance, the slats being either flexible or rigid, as desired. The slats 11 are movably mounted to each other and finally to a centrally mounted shaft 12, by use of connecting structure 13, such as loops. The shaft 12 is fixedly mounted at its ends within cylinder 1. The connecting structure 13 allows for movement of the slats 11 under the influence of gravity in relation to the shaft 12 and the cylinder 1. When the container 1, shown as a cylinder, of FIGURE 4 is rotated or moved, the slats 11 move under the influence of gravity on shaft 12 in relation to the walls of container 1 and cause intermixture of gases contained within the container. This intermixture is increased as a result of the great area covered by the vane structure, and its flexible construction.

In the embodiment shown in FIGURE 5, the vane structure is comprised of vane or paddle elements 14 fixedly mounted in a centrally mounted shaft 15, which in turn is fixedly mounted on container 1, shown as a cylinder, and vane or paddle elements 16 movably mounted on shaft 15, as, for example, by the use of loops 13, such as described in relation to FIGURE 4. The movable vane or paddle elements 16 may be in the form of slats, as shown in FIGURE 4, and move under the action of gravity. The fixed vanes 14 rotate with the shaft and container, thereby producing a movement of gas which is opposed by the movement of gases directed by the movable vanes 16, the opposing action of the several vanes producing most effective gas intermixture.

The mounting of the shaft to the cylinder in FIGURES 4 and 5 is described above as a fixed mounting. However, it is within the spirit of this invention to make such mounting of such a type that rotational movement of said shaft in relation to the cylinder is possible. Limited rotational movement of vane or paddle elements mounted on a fixed shaft within a container so as to fan or stir the gas is also within the purview of my invention. The vane or paddle elements of FIGURES 4 and 5 may be formed of rigid or flexible material.

It is pointed out that many gas containers in existence at this time can be modified so as to facilitate the addition of mixing vane structure. Of course, containers made in the future can be constructed so as to include said mixing vane structure or said vane structure can be added at a future date.

As discussed previously, the vane or paddle structure of the embodiments of this invention may also be mounted in containers containing vapors, which, under certain conditions, may liquefy, effecting a separation of the mixture. Although the vane structure is shown as mounted on the longitudinal axis of the container in the figures, as is preferred because of maximum effect, the mounting does not necessarily have to be along said axis, but rather may be displaced.

The term "cylinder" is descriptive of the storage container generally known in the trade and is not limited to a cylindrical shape.

The subject matter of this invention is not limited to any apparatus or method of using said apparatus other than what is within the spirit of that set forth in the following claims.

I claim:

1. A container for a plurality of gases, mixing means consisting of a single flexible vane element, said container being cylindrical in shape and having a longi-

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tudinal axis, means rigidly mounting said single vane element to the container along the longitudinal axis thereof, said single vane element mounted within said container for wafting movement within the container with relation to said gases under the action of gravity as a result of its flexibility, said single vane element extending along the greater part of the length of said container, said single vane element of X width and substantially greater than X length, said single vane element being relatively thin, said thinness and said flexibility of said single vane element promoting mixture of the gases contained in said cylinder as the result of the said wafting movement of the single vane element therefor allowed.

2. A container for a plurality of gases as set forth in claim 1, the means for rigidly mounting the single vane

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element to the container including a thin flexible connecting strip, said strip rigidly attached at one end thereof to said single vane element and rigidly attached at the other end thereof to said container.

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