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PACKAGE

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This invention relates to improvements in the packaging of anhydrous alkali metal hydroxide. The past and present practices of packaging anhydrous caustic soda, or like alkali metal hydroxide, involve filling steel drums with molten anhydrous caustic soda at temperatures ranging from about 640° F. to about 700° F. and permitting the molten caustic soda to solidify. These drums are then closed, welded, and shipped to the ultimate user. Since the drums used for packaging anhydrous caustic soda cannot be re-used, they must be constructed at low cost.

In performance of the actual packing operation, the drums are substantially filled with molten anhydrous caustic soda and the contents are allowed to cool and solidify over a period of approximately 24 hours. Normally, the lids are applied to the drums immediately after the drums have been filled, in order to prevent contamination of the caustic during solidification, and also in the interests of safety. After the caustic has solidified, the lids are crimped in place, the drums washed and painted, and finally the drum lid is anchored securely in place by spot-welding or by the use of metal screws. If the drum lids have been inserted before the molten anhydrous caustic has had an opportunity to solidify, they must be removed and the void space in the drum blown out with air in order to remove hydrogen gas which forms when molten anhydrous caustic comes in contact with the steel drum. If this step is not taken, there is danger to the workmen when the lids are spot-welded, because of the explosive mixture of hydrogen and air in the drum. Also, it is unsafe to ship drums which contain such an explosive mixture.

After painting, the drums of anhydrous caustic soda are ready for shipment and/or storage. Drums which have been held in storage for several weeks have been found to require re-painting before shipment, due to corrosion of the exposed surface. Especially is this true on the bottoms of the drums where it is difficult to apply a well-bonded impervious coating, and on the seams of the steel drum where the drum has been crimped. Because of this corrosion, many drums of anhydrous caustic soda must be rejected for shipment and these drums so rejected must be split open and the contents of the drum returned for re-processing. This procedure is an added expense because of the re-processing cost and the cost of the wasted container.

A more serious difficulty arises from the fact that molten anhydrous caustic soda, when packaged in the presently used steel containers, becomes contaminated with iron. This iron contamination usually results from iron flaked from the drum steel because the high packaging temperatures cause establishment of stresses in the steel, or from chemical reaction between the molten anhydrous caustic and the drum steel.

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The following data show the contamination which occurs when anhydrous caustic of low iron content is packaged molten, in ordinary steel drums:

Table I

Drum No.	Iron Content, Percent based on Anhydrous Caustic	
	Before Packaging	Average of Drum after Packaging
1	0.0015	0.0027
2	0.0011	0.0016
3	0.0012	0.0020
4	0.0020	0.0045
5	0.0011	0.0033
6	0.0009	0.0021
7	0.0012	0.0023

From the above table, it will be apparent that upon packaging anhydrous caustic soda of low iron content in steel drums, the iron content increases as much as 50 to 300 percent. This increase is not serious in anhydrous caustic of high iron content, such as is normally produced by evaporation of caustic to anhydrous state in open iron pots, since the iron content of such caustic already is so high that further increase during the packaging operation is an immaterial factor. On the other hand, where caustic soda is concentrated to the anhydrous state under conditions such as to prevent establishment of any serious concentration of iron therein, this iron increase becomes quite serious.

In accordance with the present invention, it has been found that the above difficulties may be minimized to a very substantial degree and without substantial increase in the cost of packaging anhydrous caustic soda. According to this invention, it has been found that when anhydrous caustic soda is packaged molten and allowed to solidify in steel drums constructed from hot or cold rolled strip steel ranging in thickness from 24 to 28 gauge and having a thin flash coating of nickel not in excess of 0.001 inch and preferably less than 0.0005 inch, very little iron or nickel contamination occurs as a consequence of the packaging operation. The anhydrous caustic can be packaged molten and the lids applied to the

drums without establishment of dangerous concentrations of hydrogen in the drum during solidification of the caustic. Thus, whereas in ordinary steel drums the gas in the drum is found to contain as much as 10 percent of hydrogen, the hydrogen content of the gas in the nickel-plated drums herein contemplated is found to be substantially under 1 percent, usually of the order of 0.2 to 0.6 percent. Such a low concentration of hydrogen is not explosive and thus no precautions for elimination of hydrogen need be taken.

This invention is particularly valuable in the packaging of anhydrous caustic soda and like alkali metal hydroxide wherein the iron content before packaging is low, preferably below 0.005 percent.

The nickel flash coating must be quite thin since otherwise, the cost of coating the drum will be prohibitive. Normally, the thickness is maintained below 0.001 inch, preferably in the range of 0.0001 to 0.0005 inch in thickness. Both the interior and exterior of the drum, including the lid, normally are coated. The coating operation may be effected in any convenient way, such as by conventional electroplating methods.

Notwithstanding the unusual thinness of the nickel plate, and the corrosive character of anhydrous caustic, the nickel plate has been found to reduce iron pickup and hydrogen generation to a surprising degree without being itself seriously attacked. The following table tabulates average results which were obtained using drums coated with a nickel plate ranging from 0.0001 to 0.0005 inch in thickness.

Table II

Thickness of Nickel Plate, Inches	Iron Content, Percents by weight	
	Before Packaging	After Packaging
0.0001	0.0011	0.0013
0.00025	0.0011	0.0012
0.0005	0.0011	0.0013

It will be noted that no significant amount of iron contamination occurs. Further analysis has revealed the fact that notwithstanding the substantial solubility of nickel in caustic soda, no appreciable contamination of nickel occurs.

After loading the drums with anhydrous molten caustic, permitting the caustic to solidify, and crimping and welding the lids, the drums normally are coated with a clear lacquer in order to increase their stability against corrosion. Conventional lacquers and clear unpigmented paints are normally used for this purpose.

Although the present invention has been described with respect to the specific details of certain embodiments thereof, it is not intended that such details shall be regarded as limitations upon the scope of the invention except insofar as included in the accompanying claims.

The term "solid anhydrous sodium hydroxide" or "solid anhydrous alkali metal hydroxide," as used herein, is intended to include anhydrous and substantially anhydrous hydroxides which are solid at room temperature and contain not more than 15 percent by weight of water.

I claim:

1. A package comprising solid anhydrous alkali metal hydroxide in a steel drum the interior of which is lined with a nickel plate not in excess of 0.001 inch in thickness.

2. A package comprising solid anhydrous sodium hydroxide in a steel drum the interior of which is lined with a nickel plate not in excess of 0.001 inch in thickness.

3. A package comprising solid anhydrous sodium hydroxide in a non-reusable steel drum the interior of which is lined with a nickel plate having a thickness of 0.0001 to 0.0005 inch in thickness.

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