June 5, 1934. F. W. SPERR, JR 1,961,254

SEALING MEDIUM FOR GAS HOLDERS

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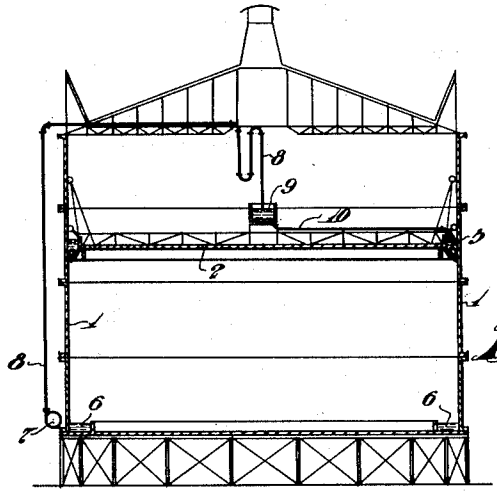

Fig. 1

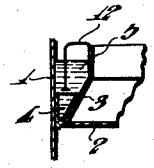

Fig. 2

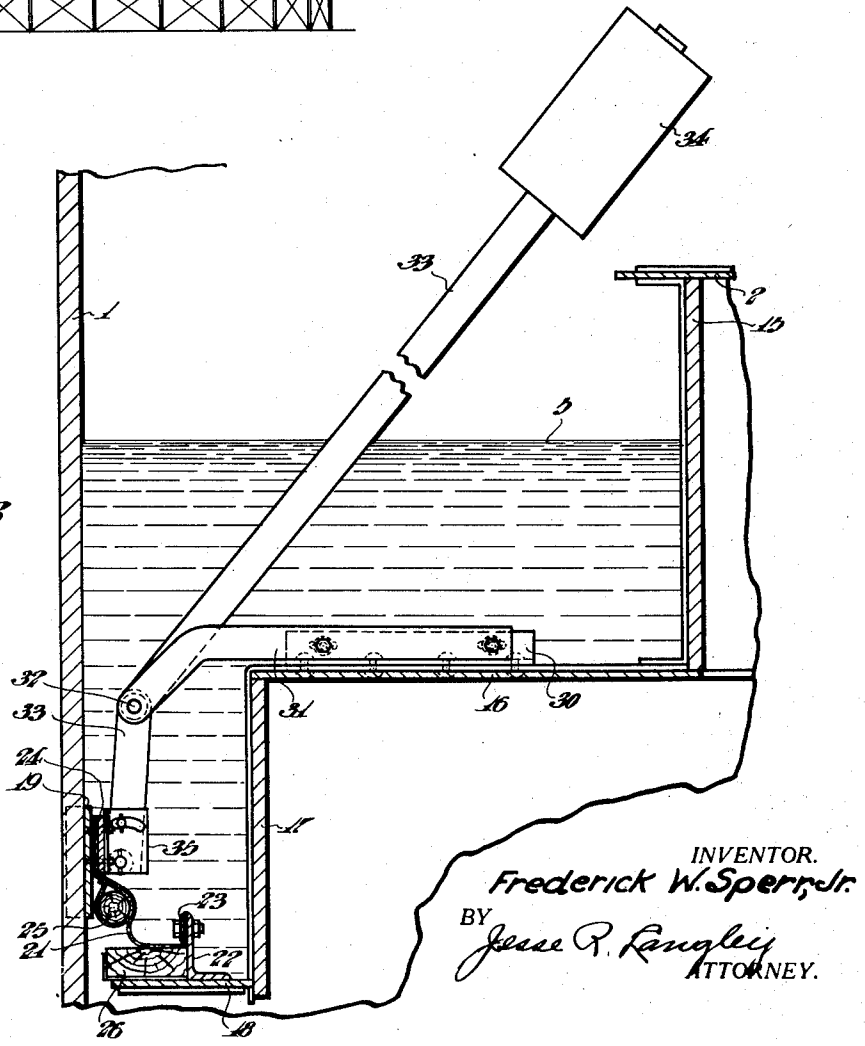

Fig. 3

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SEALING MEDIUM FOR GAS HOLDERS

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My invention relates to sealing fluids for gas holders and more particularly to gas holders of the disc-closure type.

Such a gas holder is illustrated, for example, in U. S. Patent No. 1,275,696 to K. Jagschitz and numerous holders of this type have been built in this country in recent years.

In all of these holders some suitable sealing fluid must be employed to seal the sliding joint between the movable disc and the sides of the casing in which it moves.

While in the aforesaid patent the use of water as sealing fluid was mentioned, so far as I am aware water has never actually been employed in this type of holder by reason of the fact that the sealing fluid as also pointed out in the aforesaid patent, should be of a relatively thick and viscous nature and should have a relatively low freezing point. So far as is known, the only sealing fluids which have been used in this country are tars or oils normally immiscible with water.

The use of such materials is attended with certain difficulties. Tars and oils frequently form emulsions with the water which is deposited in the gas holder either by infiltration of rain or snow, by condensation from the atmosphere, and by condensation from the gas itself. The formation of an emulsion of this sort diminishes the efficiency of the sealing medium, which must be re-distilled or otherwise treated to break up the emulsion and regain the oil or tar. Moreover, many non-aqueous liquids are subject to pronounced viscosity changes over comparatively narrow ranges of temperature variation and it is generally difficult to compensate for these temperature changes without discarding the old sealing liquid and introducing new material.

Many tars and oils are also subject to considerable viscosity changes due to absorption of light oils from the gas itself and sometimes, also, from the tendency possessed by some of these materials to thicken and deteriorate.

Another difficulty, is the fact that in very cold weather the water which is deposited along the inner sides of the gas holder casing often freezes, forming either a thick and heavy sludge or even masses of ice. Such freezing impairs the freedom with which the disc moves up and down within the casing.

An object of the present invention is to provide a sealing medium for charging the sealing means of gas holders of the aforesaid type which is not subject to various difficulties encountered in the use of prior sealing fluids.

A further object of my invention is to provide a sealing medium for gas holders of the aforesaid type which, while aqueous, is more viscous and possessed of a lower freezing point than water alone.

My invention has for further objects such other operative advantages or results as may hereinafter be found to obtain.

My invention contemplates the use as a medium for charging the sealing means of gas holders of the disc-closure type solutions which are predominantly aqueous and which, while viscous and possessing lower freezing points than water alone, are stable at low temperatures. Such solutions may be prepared by dissolving suitable inorganic materials in water either alone or together with other materials of either inorganic or organic nature.

In general I prefer to employ solutions of inorganic salts in amount sufficient to substantially increase the viscosity and lower the freezing point of the solution containing them, while at the same time being stable at such low temperatures as are likely to be encountered in actual use.

As examples of suitable solutions I may cite aqueous solutions of calcium chloride, calcium thiocyanate, and sodium silicate. Solutions may also be employed which contain mixtures of these and other inorganic substances, for example, a solution of calcium chloride and magnesium nitrate, or a solution of sodium thiocyanate and sodium thiosulphate, or a solution of sodium thiocyanate and calcium nitrate.

I may also employ solutions of inorganic salts which have relatively high molecular weights or which hydrate strongly, thus forming relatively large molecules, for example, sodium thiosulphate.

These solutions may, in many cases, be improved by adding thereto organic materials such as sugar, glycerine, and the like, and by adding suitable corrosion inhibitors such as formaldehyde, sodium dichromate, and the like.

With respect to the amount of dissolved substances in these solutions, I prefer in general to employ solutions which are stable at the lowest temperatures likely to be encountered in practice. For example, in the eastern central portion of the United States a water solution containing approximately fifty parts by weight of calcium chloride and one hundred parts by weight of water may be employed, and this solution may be improved by adding thereto as much sugar as can be dissolved therein without producing crystallization at, for example, 10° F. below zero.

As stated hereinabove, I prefer to employ solutions which are predominantly aqueous and by this is meant that the solution is predominantly aqueous although the amount of solution may in certain instances exceed the amount of solvent.

My invention also contemplates the provision of aqueous solutions which are hygroscopic in character, for example, solutions of hygroscopic inorganic materials such as calcium thiocyanate and calcium chloride. Such solutions, in addition to their other advantages, are advantageous for the reason that they do not impart moisture to the gas confined in the gas holder. For example,

when the gas has previously been dehydrated the use of a hygroscopic solution as sealing fluid in the gas holder in which the gas is stored enables the gas to be maintained in a dry condition without requiring the use of either relatively very expensive materials or the use of tars and oils which, while relatively cheap, are known to possess numerous disadvantages as outlined hereinabove.

Such solutions as I have described are viscous and stable enough to permit their use under many conditions and are advantageous with respect to prior sealing media by reason of the fact that they do not form emulsions, they have low freezing points and low temperature co-efficients viscosity, are not materially affected by the gas, and reduce or entirely prevent dangerous ice formation within the gas holder.

In employing these solutions, I prefer to introduce them to the gas holder in such a manner that the inner sides of the casing above the disc-closure are substantially entirely and continuously subjected to a flow of the liquid. This result may readily be secured by providing a sufficient number of distributors around the upper part of the gas holder to insure that the liquid is distributed to all portions of the inner sides of the casing above the disc-closure.

Moreover, when a hygroscopic liquid is employed, means for occasionally or continuously evaporating the liquid should be provided, in order that the hygroscopicity of the liquid may be maintained in spite of absorption of moisture from the atmosphere or from the gas.

In the accompanying drawing there are shown for purposes of illustration several forms of disc-closure type gas holders and sealing means therefor. In this drawing,

Figure 1 is a more or less diagrammatic vertical sectional view of a gas holder of the "waterless" or disc-closure type which may be sealed according to the present invention;

Fig. 2 is a similar view on an enlarged scale of a modified form of seal for the device shown in Fig. 1; and

Fig. 3 is a view partly in elevation and partly in vertical section of one form of sealing means which has been employed in gas holders of the disc-closure type.

Similar reference numerals designate similar parts in each of the views of the drawing.

The gas holder and seal shown in Figs. 1 and 2 are substantially those shown in U. S. Patent No. 1,275,696 granted August 13, 1918 to Konrad Jagschitz. As shown in these figures, the gas holder comprises principally a wall or reservoir 1 having a disc-shaped closure 2 which is vertically movable as the volume of gas in the holder increases or decreases. The disc 2 is provided with a peripheral wall 3 arranged obliquely to the reservoir wall 1, and a series of wedge-shaped members 4 are arranged end-to-end to form a complete annular member and are slidable on said peripheral wall 3 in free engagement with the reservoir wall 1. These wedge-shaped members 4 are displaceable or movable relatively to each other and thus automatically adjust themselves to all variations or inequalities to the reservoir wall and thereby reduce the space between the disc 2 and the wall 1 to a minimum at all times.

The sealing liquid 5 which is indicated at 5 in the drawing is supplied to the space between the wall 1 and the peripheral wall 3 of the disc 2 lying above the wedge shaped member 4 and serves to complete the seal between the disc 2 and the wall 1 so that the space within the reservoir and below the disc 2 is at all times sealed against the atmosphere. Whatever sealing liquid trickles through between the space between the disc 2 and the wall flows downwardly along said wall and may be located in an annular channel 6 located at the bottom of the reservoir. From this channel 6 this liquid or mobile medium may be pumped back or raised by means of a pump 7 and a conduit 8 into a vessel 9 located above the disc-closure 2 and from which the liquid may be conducted back to the annular sealing ring in any convenient manner, as for example by means of a conduit 10.

In the instance shown in Fig. 2, the wedge-shaped members 4 are provided with resilient supports 12 which exert a pressure on said members 4 in such a direction as to augment the pressure of the sealing fluid 5.

The sealing device shown in Fig. 3 is substantially that disclosed in U. S. Patent No. 1,711,392, granted April 30, 1929 to Paul M. Kuehn, and closely approximates the sealing means actually used in practice with holders of this type.

In this instance, the moving disc-closure 2 is provided with a depending wall 15, a shelf 16, a second depending wall 17 and an outwardly extending circumferential support or bracket element 18, the edge of which extends somewhat away from the inner face of the wall 1.

As in other types of holders of this general character, this structure together with elements to be described below provides a well or trough adapted to contain a mobile sealing medium such as that described hereinabove.

Supported by the closure and urged outwardly against the inner wall of the tank is a series of inter-engaging rubbing shoes or plates 19, and cooperating with the plates 19 is a flexible member 21 formed of canvas or equivalent material. The inner edge of this material is clamped between an upstanding angle 22 secured to the member 18 and a plate 23 attached by bolts or the like to the angle 22. The canvas is doubled upon itself and the bolted portion bears against the rubbing shoes or plates 19, being clamped against the latter by suitable plates 24.

As will be seen upon reference to Fig. 3, the canvas member 21 is carried down and around bars 25, preferably of wood, one fold of the canvas being doubled back around the bars 25 to secure the same. These bars act as spacers and serve to hold the canvas out of contact with the wall of the holder and thus prevent wearing of the canvas against the wall as the closure or piston is moved up and down. Suitable wooden elements 26 form a rest for the lower portion of the canvas and hold such portion out of contact with metal which would have a tendency to chafe it.

By reason of the construction above outlined, there is produced an expansible or dilatable trough or channel, the lower portion whereof is flexible and which extends entirely around the structure between the inner face of the wall and the outer portion of the piston or closure proper. As above indicated and as shown in Fig. 3, this trough is designed to be filled with a liquid sealing medium, such for example as an aqueous viscous solution.

In order to hold the rubbing shoes 19 in close contact at all times with the wall 1, there is provided one or more angle bars 30 attached to the shelf 16. Adjustably secured to said angle bars are one or more arms 31, the outer ends of which extend downwardly. The shaft or bar 32 is

mounted in said ends and forms a pivot for one or more lever arms 33. The upper portion of the arms 33 has secured to it a weight 34, while the lower portion of the arms 33 is suitably connected to a bracket or brackets 35 secured to the rubbing bar or shoe 19.

As will be noted, the weighted levers are connected to and coact with the rubbing shoes adjacent the ends thereof. Hence any tendency to spring is obviated and the shoes are held closely to the wall. The liquid of course seals the joints and at the same time reduces friction between the surfaces.

It will be obvious to those skilled in the art that my invention is susceptible of various modifications and, consequently, it is not limited to the specific examples given hereinabove by way of explanation but may be variously practiced and embodied within the scope of the claims hereinafter made.

I claim as my invention:

1. The method of preventing the escape of gas confined within a gas holder of the disc-closure type which comprises sealing the disc against the walls of the holder with a viscous aqueous solution of at least one of the group consisting of calcium chloride, calcium thiocyanate, sodium silicate, sodium thiosulphate, sodium thiocyanate and sodium thiosulphate, calcium chloride and magnesium nitrate, sodium thiocyanate and calcium nitrate.

2. The method of preventing the escape of gas confined within a gas holder of the disc-closure type which comprises sealing the disc against the walls of the holder with a viscuous aqueous solution containing a hygroscopic calcium compound of high solubility.

3. The method of preventing the escape of gas confined within a gas holder of the disc-closure type which comprises sealing the disc against the walls of the holder with a viscous aqueous solution containing a hygroscopic calcium compound.

4. The method of preventing the escape of gas confined within a gas holder of the disc-closure type which comprises sealing the disc against the walls of the holder with a viscous aqueous solution containing calcium chloride.

5. The method of preventing the escape of gas confined within a gas holder of the disc-closure type which comprises sealing the disc against the walls of the holder with a viscous aqueous solution containing an hygroscopic inorganic salt and sugar.

6. The method of preventing the escape of gas confined within a gas holder of the disc-closure type which comprises sealing the disc against the walls of the holder with a viscous aqueous solution containing an hygroscopic inorganic salt and an organic water soluble substance, and being free from crystallization at a temperature 10° F. below zero.

7. The method of preventing the escape of gas confined within a gas holder of the disc-closure type which comprises sealing the disc against the walls of the holder with a viscous aqueous solution containing an hygroscopic inorganic salt and glycerine.

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