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FLUID TRANSFER MEDIUM AND METHOD

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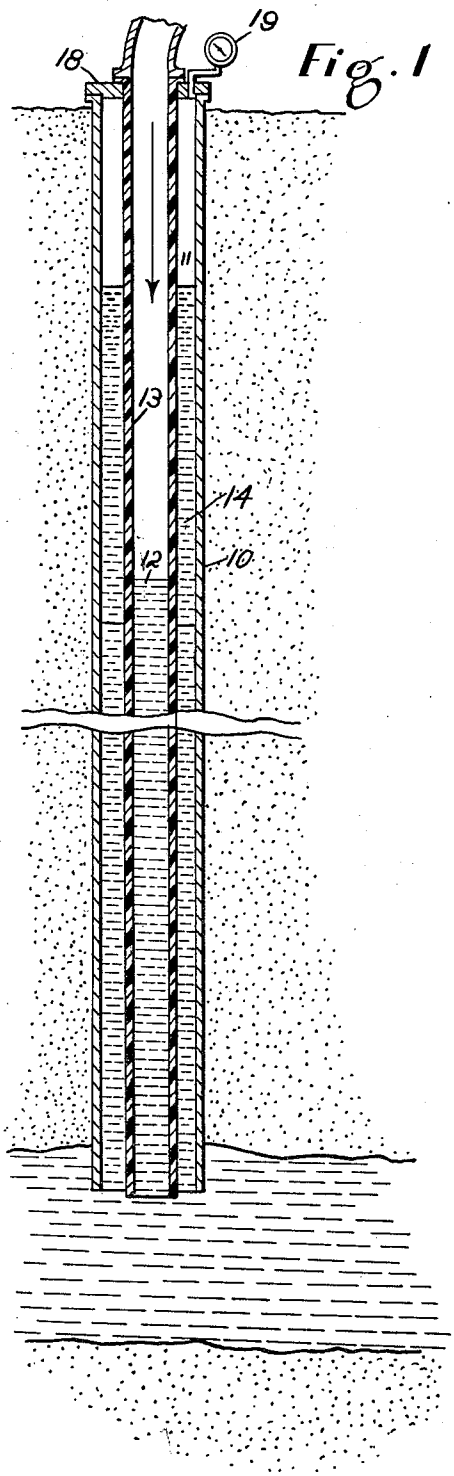


Fig. 1

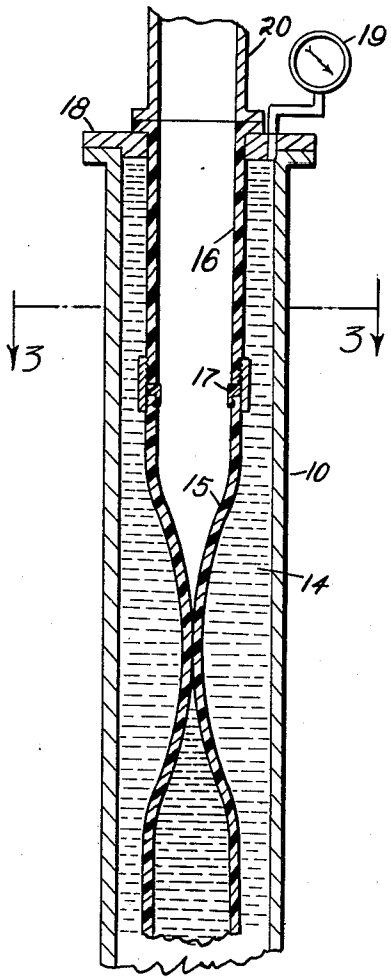


Fig. 2

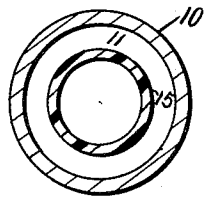


Fig. 3

INVENTORS
BRIGHAM BRITTON and
WALTER S. PRENDERGAST
BY Bates, Teare, & McBean
Attorneys

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FLUID TRANSFER MEDIUM AND METHOD

Brigham Britton, Cleveland, and Walter S. Prendergast, Macedonia, Ohio, assignors to Carlon Products Corp., Cleveland, Ohio, a corporation of Ohio

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This invention relates generally to a fluid transfer medium and method and more particularly to an improved medium and method for salt water disposal and the like.

Various applications in the field of fluid transfers require apparatus in the form of fluid guide mediums which may be subjected to external and internal hydrostatic pressures. In the case of rigid transfer mediums, the development of a differential between the external and internal pressures is likely to destroy the medium.

By way of exemplary explanation of such an application, the withdrawal of products from the earth below ground level usually involves additional processing to remove impurities. For example, in the production of oil, it is necessary to separate brine or waste salt water from crude oil by means of separating tanks. Various methods and apparatus have been developed for disposing of such waste salt water after separation. The most convenient way of disposing of the waste salt water is to feed it back into the ground by returning it into old metallic oil well casings or other wells especially drilled for the purpose. Usually, such return is made through a special rigid noncorrosive inner casing which is continuously subjected to an external hydrostatic pressure of non-corrosive fluid between the well casings.

It is an object of this invention to provide an improved flexible fluid transfer medium which will readily collapse under differential, external pressure and return to a normal non-collapsed state upon equalizing of such external pressure with an internal pressure without suffering structural impairment.

Another object of this invention is to provide an improved method of producing a salt water disposal well or the like which will protect the outer well casing against corrosion and the inner well casing against destruction under operating conditions.

Briefly, in accordance with this invention, there is provided a method of producing a salt water disposal well and the like which consists of inserting a non-corrosive collapsible inner casing into an outer well casing and sealing a non-corrosive, lighter than salt water fluid in the annular space between the casings under pressure to displace the salt water therefrom and further providing for the introduction of waste salt water and the like into the inner casing. The inner casing is a flexible fluid transfer medium which will collapse when subjected to differential pressures resulting from the application

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of a continuous external hydrostatic pressure and a non-continuous inner hydrostatic pressure and which will automatically return to its normal non-collapsed state upon the equalizing application of the inner hydrostatic pressure. The invention also contemplates the provision of a non-collapsible plastic inner casing section at the top of a disposal well or the like which is connected at its lower end to a collapsible inner casing in order to insure an introductory passage and development of sufficient initial internal hydrostatic pressure to equalize the external pressure acting on the collapsed section.

In the drawings, Fig. 1 is a diagrammatic cross-sectional illustration of a salt water disposal well having an inner disposal medium or guide and a non-corrosive liquid under pressure in the space between the inner and outer well casings; Fig. 2 illustrates a portion of a salt water disposal well embodying in combination coupled non-collapsible and collapsible plastic inner casings which are the subject of this invention; and Fig. 3 is a view taken along the line 3—3 of Fig. 2.

In practice, as shown in Fig. 1, most oil wells embody a hole in the ground lined by a metallic outer casing 10. The salt water is highly corrosive and if poured directly into the well casing, the casing would rapidly deteriorate. Hence, when disposing of salt water by returning it to the well, it is desirable to provide some non-corrosive inner guide or medium which will prevent contact of the salt water with the main or outer metallic well casing. One way of overcoming this difficulty is to provide an inner casing or salt water disposal medium 13 of some non-corrosive material which would extend within the well throughout its entire distance and guide the salt water 13 down into the subterranean basin, which may be several thousand feet below the ground level.

If the space 14 between the inner and outer well casings of such a disposal well were not blocked off in some manner, the salt water introduced into the inner medium or casing would eventually back up into the space between the casings and corrode the outer casing so as to offset any benefit in the use of the non-corrosive inner casing. Accordingly, the space between the inner and outer well casing is filled with a non-corrosive fluid, such as gasoline, which is lighter than salt water, and is of a lesser specific gravity, so that it will float on top of and displace the salt water at the bottom of the well. This fluid, which forms an annulus about the

inner casing, is introduced and sealed under pressure by means of suitable cap 18 into the space between the two casings and will displace the salt water that may have existed at a static level between the inner and outer casings. The static surface level of salt water in the well would, of course, vary with the area and depth of the well but, for exemplary purposes, may be considered to be anywhere from 500 to 1000 feet below ground level. As a result of the displacement of salt water from the annular space between the casings, the static level of the fluid is usually somewhat higher than that of the salt water within the well, and in many cases, may reach the ground level and completely fill the annular space between the two well casings.

During non-disposal periods, the differential hydrostatic pressure heads resulting from the difference of the static levels of the fluid and the salt water within the well acts on the inner casing above the salt water static level without opposing pressure within the casing and with sufficient external pressure to collapse and destroy a rigid inner casing. For this reason, rigid plastic casings, which would otherwise be desirable due to ease of installation, economy, and extremely long lived resistance to corrosion, are in most cases unsatisfactory for this purpose due to the possibility of destruction by the hydrostatic pressure of the non-corrosive fluid.

Accordingly, as shown in Fig. 2, this invention contemplates the use of a tubular, flexible or collapsible noncorrosive plastic casing 15 as a salt water disposing medium in a well. A portion of such an inner casing is illustrated in Fig. 2 and, as indicated therein, when the disposal well is not in use the flexible plastic inner casing 15 is in a collapsed condition due to the differential pressure of the fluid 14 above the salt water static head. However, due to the flexible nature of the plastic casing, no damage will result and the annulus pressure is balanced through the collapsed inner plastic casing. In operation, when the waste salt water is introduced into the inner casing by gravity, the weight of the salt water head will force open the inner casing and allow the waste salt water to flow and disperse unobstructed into the subterranean basin. Thus, in normal operation during periods of salt water flow, the inner casing is open to the subterranean basin and collapsed during periods of non-flow.

The collapsible inner casing 15 may be formed from any suitable plastic material. However, I prefer to form such a casing from either a vinyl-chloride, elastomeric type plastic or a vinyl-chloride-vinyl-acetate, co-polymer plastic which provide the desirable characteristics of resiliency, long-lived resistance to corrosion, and ease and economy of manufacture and installation.

It may develop in some fluid transfer application such as salt water disposal wells that the differential head between the fluid and the salt water static level is sufficient to create a pressure near the top of the well sufficiently great so that it will not be overcome by the head pressure of the waste salt water introduced for disposal into the well. Accordingly, this invention contemplates a modified disposing medium for use in a well wherein the top casing section would be a rigid non-flexible plastic casing section 16 which would not collapse and which would nevertheless withstand the relatively slight pressure exerted by the annulus fluid near the top of the well. Such a non-collapsible inner casing section may extend from fifty to several hundred feet into the well, depending on the existing conditions and circumstances. The collapsible, non-corrosive plastic inner casing would be joined to the lower end of the non-collapsible section and extend throughout the remaining distance of the well. In this way a sufficient head pressure would develop in the non-collapsible section to overcome the annulus pressure on the inner casing and open the remaining collapsible casing to guide the salt water into the lower basin.

In a preferred form the collapsible plastic inner casing may comprise a plurality of collapsible plastic sections connected in end-to-end relation throughout the disposal well distance. Suitable couplings of corrosion resistant metal, such as stainless steel or rigid non-corrosive plastic such as vinyl-chloride, would be provided to connect the sections together as they are inserted into the well as noted at 17 in Fig. 2. The cap 18 which seals the space between the inner and outer well casings and allows the annulus fluid to be maintained in the space between the casings under pressure may have provision for connecting a suitable pressure gauge 19 to indicate the annulus fluid pressure. Thus, it would be possible to control the annulus pressure if necessary as conditions within the well change, although, in most instances, the dispersal area for the salt water is sufficiently great so that the static level of the salt water within the well would not increase to such an extent as to require any change in the initial determined conditions of operation. The rate of flow of the waste salt water through the supply casing 20 can be controlled at an optimum rate which would balance the dispersal rate to the subterranean basin under the initially determined optimum annulus pressure.

We have shown and described what we consider to be the preferred embodiment of our invention along with suggested modified forms, and it will be obvious to those skilled in the art that other changes and modifications may be made without departing from the scope of this invention, as defined by the appended claims.

We claim:

1. The method of disposing waste salt water into a well having an outer metallic casing and a smaller inner non-corrosive flexible plastic casing spaced from the outer casing comprising introducing a lighter than salt water non-corrosive fluid into the space between the casings to displace the static salt water level in the space, maintaining the fluid in the space under pressure to prevent reentry of salt water in the space, absorbing any differential pressure between the fluid head and salt water static level head in the well by means of the collapsible plastic inner casing, and then introducing waste salt water into the inner casing with a sufficient pressure head to overcome the differential pressure and open the inner casing in the subterranean basin of the well.

2. In a salt water disposal well having an outer metallic casing and a smaller inner casing defining an annular space with a lighter than salt water liquid therebetween, said inner casing comprising a rigid hollow tubular plastic member joined to a plurality of flexible hollow tubular plastic members each joined in end to end relation to form a continuous transfer medium having a uniform opening throughout its length, means for joining the free end of said rigid tubular member to the fluid receiving end of the well, each of said flexible plastic tubular members being capable of collapsing under ex-

ternal hydrostatic pressure of the liquid in the annular space and being capable of automatically returning to a non-collapsed state when said excess external pressure is balanced or exceeded by an internal hydrostatic pressure resulting from the introduction of waste salt water therein.

3. In a salt water disposal well having an outer metallic casing and a smaller inner casing defining an annular space with a lighter than salt water liquid therebetween, said inner casing comprising a plurality of non-corrosive flexible hollow tubular plastic members coupled in end to end relation throughout the distance of the well, a plurality of rigid plastic coupling members joining adjacent ends of said plastic tubular members to form a continuous transfer medium having a uniform opening throughout its length each plastic tubular member being capable of collapsing radially under excess external hydrostatic pressure of the liquid in the annular space and being capable of automatically returning to a normal non-collapsed state when said excess external pressure is balanced or exceeded by the internal hydrostatic pressure resulting from the introduction of waste salt water therein.

4. The method of disposing waste salt water to a subterranean disposal basin through a well having an outer metallic casing consisting of protecting the metallic casing from corrosion by introducing a smaller inner hollow flexible plastic casing and a lighter than salt water non-corrosive liquid therebetween, absorbing the external annular hydrostatic pressure of the non-corrosive liquid by collapsing the flexible plastic inner casing, and opening the inner casing to the subterranean basin by the introduction of waste salt water therein having a hydrostatic pressure equal to or greater than the external hydrostatic pressure of said non-corrosive liquid.

5. The method of disposing waste salt water to a subterranean basin through a well having a metallic casing consisting of, protecting the metallic casing from corrosion by introducing a smaller inner casing therein and a lighter than salt water non-corrosive liquid therebetween, absorbing the external annular hydrostatic pressure of the non-corrosive liquid by collapsing the inner flexible casing, opening the inner casing to communication with the subterranean basin by the introduction of waste salt water therein having a hydrostatic pressure equal to or greater than the external hydrostatic pressure of the non-corrosive liquid, and maintaining the non-corrosive liquid under pressure between the outer and inner casing sufficient to prevent reentry of salt water from the subterranean basin into the annular space therebetween.

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