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(54) **METHOD OF SEALING SUBTERRANEAN ZONES**

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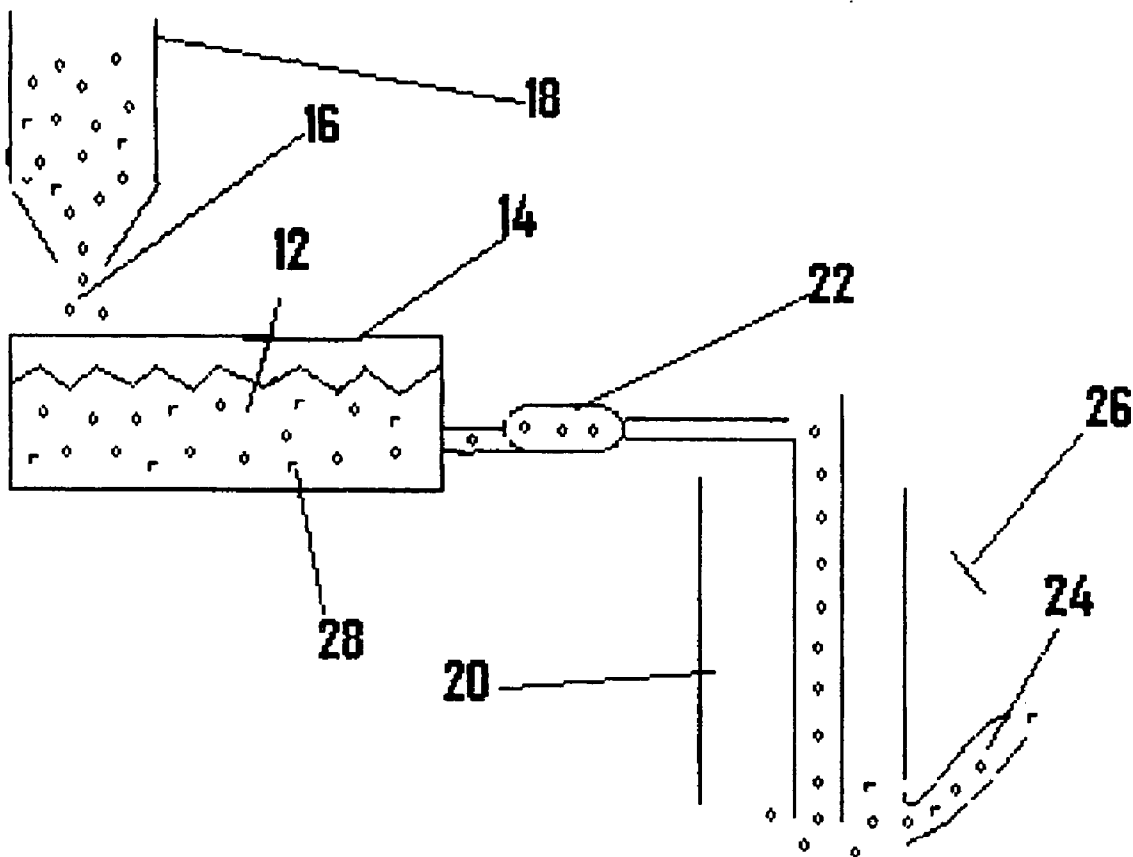
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(57) **ABSTRACT**

A method of sealing subterranean zones is described. A first step involves preparing a liquid slurry. A second step involves mixing bits of rubber from recycled tires into the liquid slurry. A third step involves pumping the liquid slurry containing the bits of rubber down a well.

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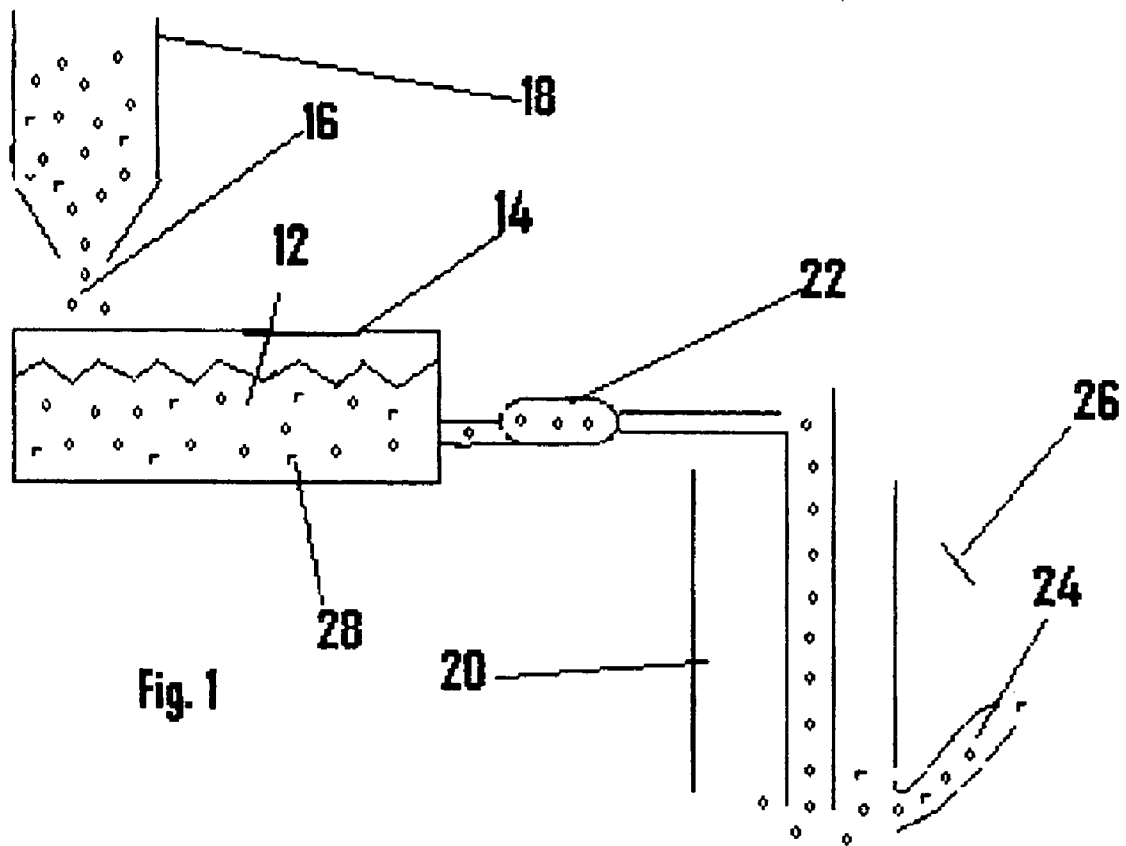
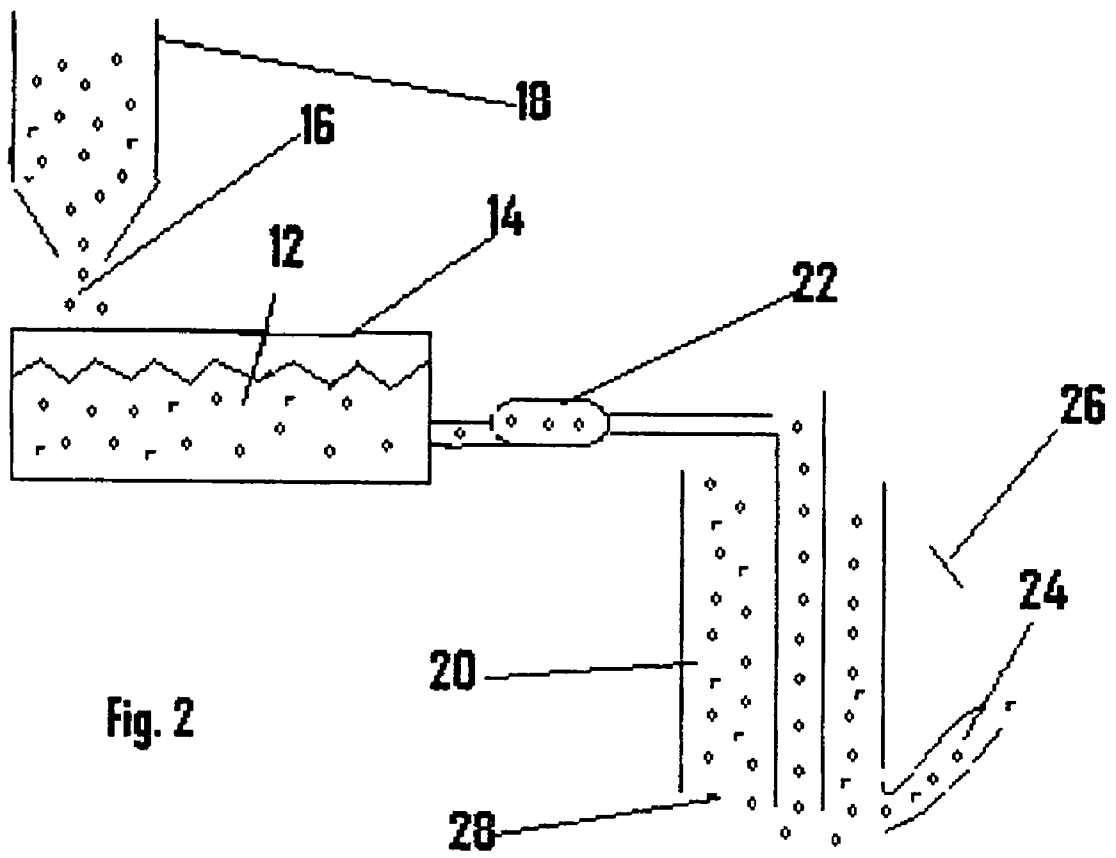


Fig. 1



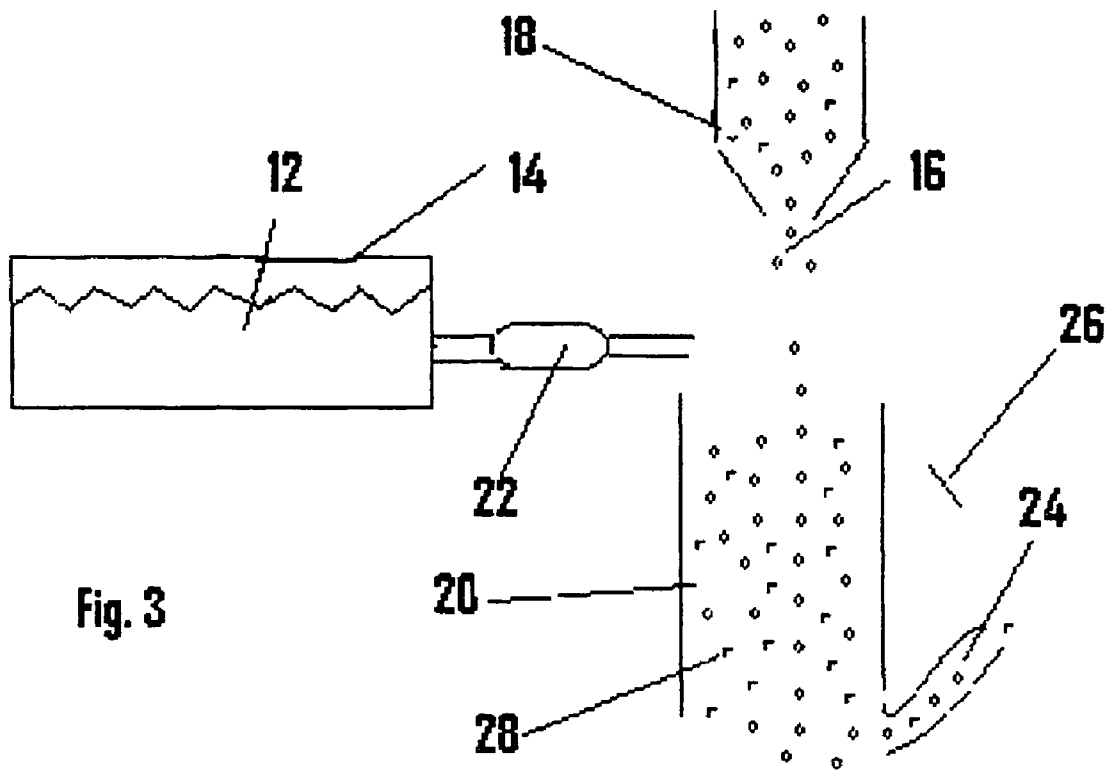


Fig. 3

## METHOD OF SEALING SUBTERRANEAN ZONES

### FIELD OF THE INVENTION

[0001] The present invention relates to a method of sealing subterranean zones where there is loss of circulation during drilling or a need to seal in the well during abandonment.

### BACKGROUND OF THE INVENTION

[0002] U.S. Pat. No. 6,448,206 (Griffith et al 2002) relates to an aqueous rubber latex composition and a method of using that composition to seal subterranean zones. During drilling, circulation of drilling fluid is sometimes interrupted when drilling fluid is lost into fractures in subterranean zones. When this occurs, drilling operations must be terminated until circulation is restored. The Griffith et al patent is an example of the sophisticated technology which has been developed to address this problem.

### SUMMARY OF THE INVENTION

[0003] The present invention relates to an alternative method of sealing subterranean zones, which is also suitable for use in sealing in a well which is to be abandoned.

[0004] According to the present invention there is provided a method of sealing subterranean zones. A first step involves providing bits of rubber from recycled tires. A second step involves using a liquid to carry the bits of rubber down a well.

[0005] As will hereinafter be further described, there are two ways that this can be done. One way is to mix bits of rubber from recycled tires into the liquid. Another way is to insert the bits of rubber directly into the well and then use the liquid to wash the bits of rubber down the well. Which approach is used depends upon the requirements and limitations of the particular application.

[0006] The method, as described above, concurrently addresses two problems. The first problem is the sealing of subterranean zones. The second problem is that of finding a useful end purpose for used vehicle tires. There are mountains of used vehicle tires, which have been collected and are awaiting recycling. The used vehicle tires are either ground to form rubber crumb bits or chopped into somewhat larger bits. Although one can use either the rubber crumb bits or the larger chopped bits, a mixture of the two sizes is preferred. The rubber crumb bits can fit into smaller spaces. The larger chopped bits can fill larger spaces. When the bits of rubber are placed under pressure, they compress and are forced into fractures in the subterranean zone. When pressure is reduced, the bits of rubber expand to fill voids and more securely engage the fractures.

### BRIEF DESCRIPTION OF THE DRAWINGS

[0007] These and other features of the invention will become more apparent from the following description in which reference is made to the appended drawings, the drawings are for the purpose of illustration only and are not intended to in any way limit the scope of the invention to the particular embodiment or embodiments shown, wherein:

[0008] **FIG. 1** is a side elevation, in section, depicting the sealing of fractures in a subterranean zone of well in accordance with the teachings of the present method.

[0009] **FIG. 2** is a side elevation, in section, depicting the sealing in of well which is to be abandoned in accordance with the teachings of the present method.

[0010] **FIG. 3** is a side elevation, in section, depicting the sealing in of an open hole well which is to be abandoned in accordance with the teachings of the present method.

### DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0011] The preferred method of sealing subterranean zones will now be described with reference to **FIGS. 1 through 3**.

[0012] Referring to **FIG. 1**, a first step involves preparing a liquid slurry **12**. It is preferred that the slurry be a mixture of drilling fluid and cement. It will be appreciated that drilling fluid alone could be used or a liquid cement could be used alone. In the illustrated embodiment, the mixing is taking place in the mud tanks **14** of the drilling rig. A second step involves mixing bits of rubber **16** from recycled tires into liquid slurry **12**. It is preferred that the bits of rubber be a mixture of rubber crumb bits and larger chopped bits of a size between  $\frac{1}{8}$  of an inch and  $1\frac{1}{2}$  inches. It will be appreciated that rubber crumb bits alone could be used or larger chopped bits alone could be used. The rubber crumb bits are capable of fitting into smaller spaces. The larger chopped bits are capable of filling larger spaces. In the illustrated embodiment, bits of rubber **16** are supplied out of a hopper **18**. A third step involves pumping liquid slurry **12** containing bits of rubber **16** down a well **20** under pressure. In the illustrated embodiment, this is done with a high pressure pump **22**. Every drilling rig is equipped with such a high pressure pump **22**. When pumped down well **20**, bits of rubber pack **16** under pressure into fractures **24** in subterranean zone **26**. When pressure is reduced, the bits of rubber **16** expand and more effectively fill fractures **24**. It is desirable to include reinforcing fibre **28** from the recycled tires with the larger chopped bits of rubber. The reinforcing fibre **28** helps to bind the bits of rubber in position.

[0013] Referring to **FIG. 2**, there is illustrated another application for the method. In this application, well **20** is to be abandoned. In such an application, liquid cement is used in liquid slurry **12** and all of well **20** is filled. As with the first application, bits of rubber **16** are compressed when under pressure and expand when pressure is reduced.

[0014] Referring to **FIG. 3**, with open holes there is sufficient room to modify the method somewhat. With an open hole, bits of rubber **16** can be inserted directly into well **20**. It need not be mixed into liquid slurry **12**. Liquid cement is used in liquid slurry **12** and used to push bits of rubber **16** down well **20**. The process of doing so mixes liquid slurry **12** containing cement with bits of rubber **16**. Although the end result is essentially the same, dropping bits of rubber **16** into well **20** first is believed to result in a greater density in the bits of rubber **16** down well **20**. The reason for this is that there are limits as to the proportion of bits of rubber **16**, which can be passed through pump **22** without clogging pump **22**.

[0015] In this patent document, the word "comprising" is used in its non-limiting sense to mean that items following the word are included, but items not specifically mentioned are not excluded. A reference to an element by the indefinite

article "a" does not exclude the possibility that more than one of the element is present, unless the context clearly requires that there be one and only one of the elements.

[0016] It will be apparent to one skilled in the art that modifications may be made to the illustrated embodiment without departing from the spirit and scope of the invention as hereinafter defined in the Claims.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A method of sealing subterranean zones, comprising the steps of:

providing bits of rubber from recycled tires; and

using a liquid to carry the bits of rubber down a well.

2. A method of sealing subterranean zones, comprising the steps of:

preparing a liquid slurry;

mixing bits of rubber from recycled tires into the liquid slurry; and

pumping the liquid slurry containing the bits of rubber down a well.

3. The method as defined in claim 2, wherein the bits of rubber are rubber crumb bits.

4. The method as defined in claim 2, wherein the bits of rubber are larger chopped bits of a size between  $\frac{1}{8}$  of an inch and  $1\frac{1}{2}$  inches.

5. The method as defined in claim 4, wherein reinforcing fibre from the recycled tires is mixed in with the larger chopped bits of rubber.

6. The method as defined in claim 2, wherein the liquid slurry is a drilling fluid.

7. The method as defined in claim 2, wherein the liquid slurry is contains cement.

8. A method of sealing subterranean zones, comprising the steps of:

preparing a liquid slurry of drilling fluid and cement;

mixing bits of rubber from recycled tires into the liquid slurry, the bits of rubber being a mixture of rubber crumb bits and larger chopped bits of a size between  $\frac{1}{8}$  of an inch and  $1\frac{1}{2}$  inches; and

pumping the liquid slurry containing the bits of rubber down a well under pressure, such that the bits of rubber pack under pressure into fractures in the subterranean zone and, when pressure is reduced, expand.

9. The method as defined in claim 7, wherein reinforcing fibre from the recycled tires is mixed in with the larger chopped bits of rubber.

10. A method of sealing subterranean zones, comprising the steps of:

inserting bits of rubber from recycled tires into a well; and

pumping a liquid slurry into the well as a carrier fluid to wash the bits of rubber down the well.

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