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(54) **Method of and apparatus for putting out fires under pressure, in particular fires of oil wells.**

(57) A method of putting out fires under pressure is disclosed, in particular fires of oil wells, which method is based upon the use of an apparatus having a suitable geometry and containing a composition or a mixture of liquefied extinguishing and/or inert compositions, which apparatus is placed at a distance from the hole of the burning oil well and collapses because of the internal pressure so that pressure vapours burst out and hit at once and homogeneously the whole front of the fire so as to put fire out.

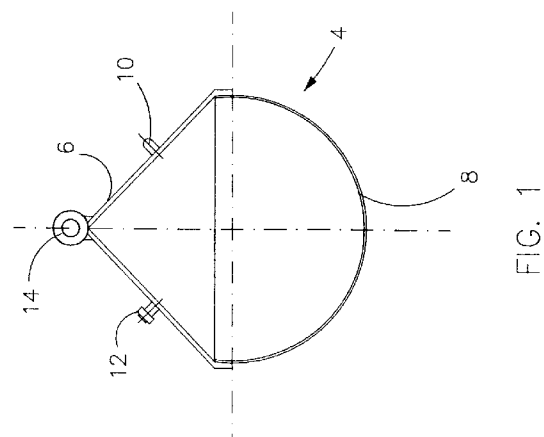


FIG. 1

The present invention relates to a method of and an apparatus for putting out fires under pressure, in particular fires of oil wells and the like.

The main feature of such a system is that of using in combination the extinguishing effect of suitable compositions and the pressure wave directed to the fire so as to dispense instantaneously and homogeneously such compositions on the whole area on fire causing fire to extinguish at once.

Techniques and devices for putting fires out are well known and tested. Generally, difficulties and failures are due to the particular conditions of the supporter of the combustion (shape and size, pressure in case of a fluid, a.s.o.) rather than to the inefficiency of the used compositions, which extinguishing features in the specific application field are very good.

Putting out a burning oil well, where the favourable circumstance of the limited extension of the burning area is made useless by the particular violence of the fire fed by a pressure liquid with high degree of inflammability, is particularly complex.

Under such conditions putting out systems using extinguishing compositions do not find any application because unlike "extended" fires, (where it is possible to put out fire "progressively" by a continuous, progressive extinguishment of the flames), in case of burning oil wells it is necessary to extinguish fire at once so that the oil continuously fed from the well does not fire any longer.

Methods and means known at the present status of art for putting out burning oil wells envisage the following three different categories of operations:

- 1) blowing up the well with dynamite to put out the fire by the explosion shock wave and removing the latticework damaged by the fire;
- 2) boring the soil up to the oil body and providing a new well through which the oil flow is turned so that the geologic pressure at the fire spot is dropped;
- 3) pumping baryta or similar solid material and water into a side pipeline reaching the bottom of the oil well so that the well is choked.

Such techniques, however, are expensive from the economical and operational point of view.

Therefore, the present invention seeks to solve the problem of easily and economically putting out fires under pressure avoiding the drawbacks involved by the present methods. The object is attained by releasing at once a predetermined amount of an extinguishing composition or mixture of compositions at a suitable pressure and in such a position as to be effective against the fire.

Unlike the known systems, the present method is based upon the combination of the extinguishing effect of the used compositions and the homogeneous, effective, instant distribution of said compositions over the whole front of the fire because of a shock wave.

This has been achieved according to the invention through the combined use of a composition or a mixture of liquefied compositions having extinguishing and/or inert capability and a container of such compositions having two peculiar operation features:

- a) if the container is suitably placed over the fire spot, it can collapse because of the increase of the internal pressure due to the thermal gradient, thus releasing simultaneously the contained compositions; and
- b) the container is able to dispense at once the above mentioned compositions homogeneously and effectively over the whole solid angle covered by the fire.

In practice, both the shape and size of the container may be varied and fitted to the characteristics of the fire to be put out provided that the cone of diffusion formed as a result of the collapse is able to cover the whole front of the fire.

Further features and advantages of this invention will be made apparent from the following detailed description with reference to the accompanying drawings illustrating, by way of a non-limitative example, two preferred embodiments. In the drawings:

Fig. 1 shows schematically a section view of a container according to the invention having the form of a cone with a hemispherical bowl;

Fig. 2 shows a section of an alternate container having a spherical form.

With reference to Figure 1, the empty container 4 is formed as a hemisphere 8 having walls of thickness d1 and a conical body 6 of thickness d2 overlapped thereto and provided at the top with a hook means 14.

The thicknesses d1 and d2 are designed as a function of the material of which the container is made so that the container collapses under the effect of the increasing pressure generated by the temperature gradient causing the expansion of the compositions contained therein and it releases at once and at a predetermined pressure the extinguishing mixture which is conveyed to the whole front of the fire.

The container may be formed of any material provided that it is unflammable. By way of example, containers of aluminum and alloys thereof with copper and bronze have been used in the experimental tests.

The loading of the compositions to be used is carried out through common sealing input means 10 and 12 which are usually provided under safety conditions.

All of the extinguishing compositions alone or in combination with one another and with inerts may be used. The best results have been achieved by the use of compositions having a very low boiling point, i.e. under liquefied form. Among the latter there are the halogen derivatives of methane and ethane, in particular  $C_2F_5Cl$ ,  $CHClF_2$ ,  $CCl_2F_2$ ,  $CHF_3$ , used alone or in combination with one another, at varying relative proportions and with or without liquid nitrogen which

besides the extinguishing characteristic has also a propellant effect causing a more effective diffusion of the used compositions.

Also the effectiveness of liquid nitrogen or other inert gas with high expansion capacity alone or in combination with said compositions has been tested.

The putting out method according to the present invention is extremely easy and immediate: after having partially filled the container with the composition or mixture of extinguishing compositions, the sealed container is placed at a distance from the fire by any known means. As a result of the high thermal gradient the inner pressure of the container is quickly increased, and when the value determined by the characteristics of the material and by the thickness of the thinner walls is reached, the container collapses and spreads vapours of the contained compositions under pressure onto the fire through the rent sheet. The upper part of the container above the predetermined rent remains integral after the collapse of the container and prevents the vapours from dissipating upwards so that the latter are conveyed downwards to attack the flames and put fire out.

An alternate embodiment of the device of the invention is shown in figure 2. In such case the container has a spherical geometry without prejudice to the difference in the thicknesses d1 and d2 of the two hemispheres 8 and 8a, respectively.

The present invention has been illustrated and described with reference to two preferred embodiments but it should be understood that construction modifications directed to achieve the same results of this invention may be made by those skilled in the art without parting from the scope of the present industrial invention.

## Claims

1. A method of putting out fires under pressure, in particular fires of oil wells or the like, characterized in that a shock wave is used to dispense an extinguishing composition at once and homogeneously over the whole front of the fire, thus causing concurrently the fire to be put out.
2. The method of the preceding claims, characterized in that a container of an extinguishing composition or a mixture of extinguishing and/or inert compositions alone or in any combination with one another is used, said container being adapted to collapse at a predetermined value of pressure according to a predetermined break line relative to the shape of the container as a result of the increase of the internal pressure of the contained composition(s) due to the thermal gradient created by the fire to be put out, whereby a preferential and effective distribution of said composition(s) over the front of the fire to be put out is obtained.
3. The method of the preceding claims characterized in that said composition or the percentage ratio of said mixture of compositions included in said container is selected according to the characteristics of the fire to be put out.
4. Apparatus for putting out fires under pressure, in particular fires of oil wells, characterized in that it includes a container of any form, size and material which is adapted to collapse at a predetermined value of internal pressure, and after collapsing to dispense the extinguishing compositions at once and homogeneously over the whole front of the fire.
5. The apparatus of claim 4, characterized in that said extinguishing compositions belong to the class of halogen derivatives, mainly methane and ethane, having extinguishing features.
6. The apparatus of claims 4 and 5, characterized in that said compositions are used alone or in combination with one another at varying proportions or admixed to liquefied inert compounds such as liquid nitrogen.
7. The apparatus of claims 4 to 6, characterized in that only an amount of nitrogen or other inert gases alone or admixed to one another having high expansion capacity is used as extinguishing composition.
8. The apparatus of claims 4 to 7, characterized in that it is contained in a cage which can be made of metal or other material having a mesh pattern resistant to the operating conditions with the function of avoiding that parts of the rent sheet are thrown all around the place of operation.
9. The apparatus of claim 4, characterized in that it is made of unflammable material.
10. The apparatus of claims 4 to 9, characterized in that it provides input and sealing means for filling inert and/or extinguishing liquids into the container under safety conditions.
11. The apparatus of claims 4 to 10, characterized in that it consists of a hemisphere to which a conical body is overlapped.
12. The apparatus of the preceding claims, characterized in that the collapse occurs at the lower portion of the container as the walls of the hemisphere have a lower thickness than that of the

overlapped conical body.

- 13.** The apparatus of claims 4 to 10, characterised in that it has a spherical form with a predetermined break line at the section of largest diameter.

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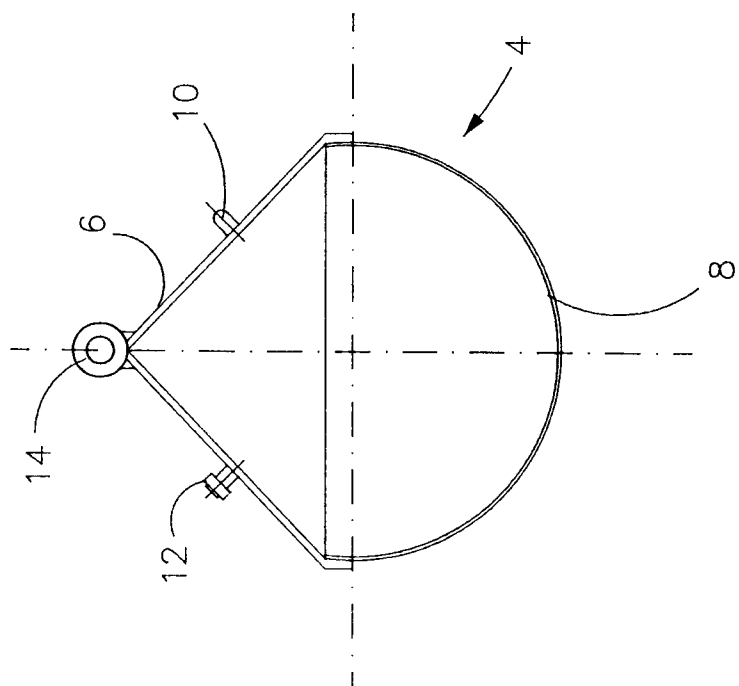


FIG. 1

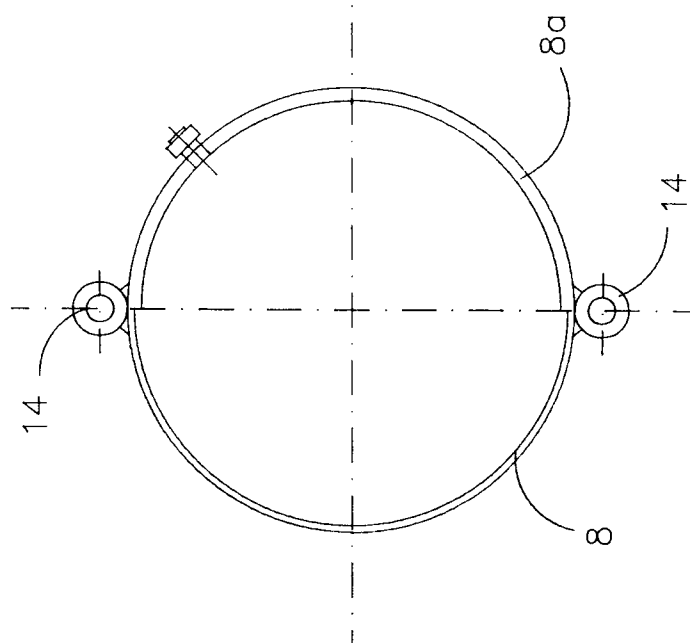


FIG. 2



European Patent  
Office

# EUROPEAN SEARCH REPORT

Application Number

EP 92 83 0034

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
X	WO-A-8 001 987 (SPERLING)	1-6	E21B35/00 A62C35/10
Y	* the whole document *	7, 10	
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Y	EP-A-0 302 797 (LEMONNIER) * column 6, line 38 - line 41 *	7	
	---		
Y	DE-A-4 000 010 (DÖRR) * column 3, line 1 - line 3; figure 1 *	10	
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X	US-A-3 918 526 (HATTORI) * abstract; claims 1-3 *	1-4, 9, 10	
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X	US-A-4 830 114 (JESSICK)  * abstract; figures 1, 2 * * column 3, line 33 - line 43 *	1-6, 8, 9, 12	
	---		TECHNICAL FIELDS SEARCHED (Int. Cl.5)
X	US-A-3 833 064 (RANNEY) * column 2, line 27 - line 31 *	1	
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X	GB-A-2 159 707 (ABG SEMCA) * abstract *	4, 7	
	---		E21B A62C
A	US-A-4 337 831 (THAXTON) * column 1, line 7 - line 9 *	1, 4	
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A	EP-A-0 390 384 (KIDDE-GRAVINER) * abstract *	2	
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The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 30 JUNE 1992	Examiner FONSECA Y FERNANDEZ
<p><b>CATEGORY OF CITED DOCUMENTS</b></p> <p>X : particularly relevant if taken alone  Y : particularly relevant if combined with another document of the same category  A : technological background  O : non-written disclosure  P : intermediate document</p> <p>T : theory or principle underlying the invention  E : earlier patent document, but published on, or after the filing date  D : document cited in the application  L : document cited for other reasons  .....  &amp; : member of the same patent family, corresponding document</p>			

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