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(54) **Method and apparatus for putting out fires fed by a pressurized medium having a high degree of inflammability, in particular fires of oil wells**

Verfahren und Vorrichtung zum Löschen von durch einen unter Druck stehenden, hochentflammbaren Brennstoff genährten Bränden, insbesondere Bränden von Ölbohrungen

Méthode et dispositif pour l'extinction de feux alimentés par un combustible sous pression ayant un degré d'inflammabilité élevé, notamment de feux de puits de pétrole

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Description

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 fuel (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.

It is known from WO -A-80/01987, a fire extinguisher comprising a container with halogen hydro-carbons as extinguishing means and adapted to open by an inner

overpressure, in such a way that the gas generated by heating is released to fill the surrounding room and suffocate 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.

Therefore this invention consists according to claim 1 of a method of putting out fires fed by a pressurised medium having a high degree of inflammability, in particular fires of oil wells, wherein a shock wave is used to dispense an extinguishing composition at once and homogeneously over the whole front of the fire, the method including the use of a container of an extinguishing composition or with a mixture of extinguishing an/or inert compositions alone or in any combination with one another, said container being adapted to collapse at 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, thereby creating said shock wave, whereby a preferential and effective distribution of said composition(s) over the front of the fire to be put out is obtained thus causing concurrently the fire to be put out.

The invention consists also of an apparatus according to claims 3 and 4.

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, 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 suitably placed over 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 broken sheet. As illustrated in fig. 1, 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. This upper part of the container above the predetermined break line remains integral after the collapse of the container and prevents the vapours from dissipating upwards so that said vapours are conveyed downwards to attack the flames and put fire out.

In order to avoid that parts of the broken sheet are

thrown all around the place of operation, it is useful to put said apparatus into a cage made of any material having a mesh pattern resistant to the operating conditions.

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, and has a predetermined break line at the section of largest diameter.

Claims

1. A method of putting out fires fed by a pressurized medium having a high degree of inflammability, in particular fires of oil wells, wherein a shock wave is used to dispense an extinguishing composition at once and homogeneously over the whole front of the fire, the method including the use of a container of an extinguishing composition or a mixture of extinguishing and/or inert compositions alone or in any combination with one another, 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, thereby creating said shock wave, whereby a preferential and effective distribution of said composition(s) over the front of the fire to be put out is obtained thus causing concurrently the fire to be put out.
2. The method of the preceding claim 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.
3. Apparatus for putting out fires fed by a pressurized medium having a high degree of inflammability, in particular fires of oil wells, including a container of extinguishing compositions, whereby the container is of a 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, characterized in that the container consists of a hemisphere (8) to which a conical body (6) is overlapped, the walls of the hemisphere having a lesser thickness (d1) than that (d2) of the overlapped conical body, whereby the collapse occurs at the lower portion of the container.
4. Apparatus for putting out fires fed by a pressurized medium having a high degree of inflammability, in particular fires of oil wells, including a container of extinguishing compositions, whereby the container

is of a 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, characterized in that the container has a spherical form, whereby it is comprised of two hemispheres (8,8a) of different wall thicknesses (d1,d2) and in that it has a predetermined break line (5') at the section of largest diameter.

5. The apparatus of claim 3 or 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 3 or 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 3 or 4, and followings, 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 3 or 4 and followings, 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 broken sheet are thrown all around the place of operation.

9. The apparatus of claims 3 or 4 and followings, characterized in that it is made of unflammable material.

10. The apparatus of claims 3 or 4 and followings, characterized in that it provides input and sealing means for filling inert and/or extinguishing liquids into the container under safety conditions.

Patentansprüche

1. Ein Verfahren zur Löschung von Bränden, die von einem unter Druck befindlichen Medium mit hohem Grad an Entflammbarkeit gespeist werden, insbesondere von Bränden in Ölbohrungen, wobei eine Schockwelle zur sofortigen und homogenen Verteilung einer Löschverbindung über die gesamte Feuerfront verwendet wird, wobei das Verfahren die Verwendung eines Containers einer Löschverbindung oder eines Löschgemisches und/oder einer Inertverbindung alleine oder in jeder Kombination miteinander umfaßt, wobei besagter Container der-

art ausgeführt ist, daß er bei einem vorbestimmten Druckwert gemäß einer vorbestimmten Sollbruchlinie bezüglich der Form des Containers als Resultat der Erhöhung des inneren Drucks der eingeschlossenen Verbindung(en) aufgrund des Temperaturgradienten, der durch das zu löschende Feuer erzeugt wird, kollabiert, wodurch besagte Schockwelle erzeugt wird, wobei eine bevorzugte und effektive Verteilung der besagten Verbindung(en) über die Front des zu löschenden Feuers erreicht wird, so daß das Feuer gleichzeitig gelöscht wird.

2. Das Verfahren nach dem vorstehenden Anspruch, dadurch gekennzeichnet, daß die Verbindung oder der Prozentanteil besagten Verbindungsgemisches, welches in besagtem Container enthalten ist, entsprechend den Merkmalen des zu löschenden Feuers gewählt ist.

3. Vorrichtung zur Löschung von Bränden, die von einem unter Druck befindlichen Medium mit hohem Grad an Entflammbarkeit gespeist werden, insbesondere von Bränden in Ölbohrungen, mit einem Container, der Löschverbindungen enthält, wobei der Container von einer Form, Größe und einem Material ist, welche zum Kollabieren bei einem vorbestimmten inneren Druck, und nach dem Kollabieren zur sofortigen und homogenen Verteilung der Löschverbindungen geeignet ist, dadurch gekennzeichnet, daß er eine Hemisphäre (8) umfaßt, an die ein konischer Körper (6) überlappt, wobei die Wände der Hemisphäre eine geringere Dicke (d1) als die Dicke (d2) der Wände des überlappenden Körpers haben, wobei das Kollabieren im unteren Bereich des Containers erfolgt.

4. Vorrichtung zur Löschung von Bränden, die von einem unter Druck befindlichen Medium mit hohem Grad an Entflammbarkeit gespeist werden insbesondere von Bränden in Ölbohrungen, mit einem Container, der Löschverbindungen enthält, wobei der Container von einer Form, Größe und einem Material ist, welche zum Kollabieren bei einem vorbestimmten inneren Druck, und nach dem Kollabieren zur sofortigen und homogenen Verteilung der Löschverbindungen geeignet ist, dadurch gekennzeichnet, daß der Container eine sphärische Form hat, wobei er zwei Hemisphären (8, 8a) mit unterschiedlichen Wanddicken (d1,d2) umfaßt, und daß er eine vorbestimmte Sollbruchlinie (5') im Bereich des größten Durchmessers hat.

5. Die Vorrichtung nach Anspruch 3 oder 4, dadurch gekennzeichnet, daß die Löschverbindungen zu der Klasse der Halogenderivate, hauptsächlich Methan und Ethan mit Löscheigenschaften gehört.

6. Die Vorrichtung nach Ansprüchen 3 oder 4 und 5,

dadurch gekennzeichnet, daß die Verbindungen alleine oder in Kombination miteinander mit verschiedenen Verhältnissen oder als Beimischung zu flüssigen Inertverbindungen, wie beispielsweise flüssiger Stickstoff, verwendet werden.

7. Die Vorrichtung nach Ansprüchen 3 oder 4 und folgenden, dadurch gekennzeichnet, daß nur eine Menge von Stickstoff oder anderen Inertgasen alleine oder miteinander zusammengemischt mit hoher Ausdehnungskapazität als Löschverbindung verwendet wird.

8. Die Vorrichtung nach Ansprüchen 3 oder 4 und folgenden, dadurch gekennzeichnet, daß diese in einer Ummantelung eingeschlossen ist, die aus Metall oder anderen Materialien gefertigt ist, welche gegen die Betriebsbedingungen widerstandsfähig sind und ein derartiges Gittermuster haben, daß das Umherfliegen von Bruchteilen der Schicht um den gesamten Einsatzort herum vermieden wird.

9. Die Vorrichtung nach Ansprüchen 3 oder 4 und folgenden, dadurch gekennzeichnet, daß diese aus nichtentflammaren Material gefertigt ist.

10. Die Vorrichtung nach Ansprüchen 3 oder 4 und folgenden, dadurch gekennzeichnet, daß diese Befüllungs- und Dichtungsmittel umfaßt, zur Befüllung des Containers mit Inertstoffen und/oder Löschlösungen unter sicheren Bedingungen.

Revendications

1. Un procédé pour l'extinction de feux alimentés par un combustible sous pression ayant un degré d'inflammabilité élevé, notamment de feux de puits de pétrole, dans lequel on utilise une onde de souffle pour distribuer une composition d'extinction en une seule fois et de manière homogène sur tout le front du feu, le procédé comprenant l'utilisation d'un récipient d'une composition d'extinction ou d'un mélange d'une composition d'extinction et/ou d'une composition inerte, seule ou en combinaison quelconque l'une avec l'autre, ledit récipient étant prévu pour s'écraser à une valeur de pression prédéterminée selon une ligne de rupture prédéterminée par rapport à la forme du récipient à la suite d'une augmentation de la pression interne de la ou des compositions contenues du fait du gradient thermique créé par le feu à éteindre, en créant ainsi ladite onde de souffle, de sorte qu'une distribution préférentielle et efficace de la ou desdites compositions sur le front du feu à éteindre est obtenue en provoquant en même temps l'extinction du feu.

2. Le procédé de la revendication précédente, caracté-

térisé en ce que ladite composition ou le rapport en pourcent dudit mélange de compositions contenu dans ledit récipient est choisi selon les caractéristiques du feu à éteindre.

3. Dispositif pour l'extinction de feux alimentés par un combustible sous pression ayant un degré d'inflammabilité élevé, notamment de feux de puits de pétrole, comprenant un récipient de compositions d'extinction, par lequel le récipient est d'une forme, d'une dimension et d'une matière prévues pour s'écraser à une valeur prédéterminée de pression interne et qui, après son écrasement, distribue les compositions d'extinction en une seule fois et de manière homogène sur tout le front du feu, caractérisé en ce que le récipient se compose d'une hémisphère (8) recouverte par un corps conique (6), les parois de l'hémisphère présentant une épaisseur (d1) plus faible que celle (d2) du corps conique de recouvrement, de sorte que l'écrasement se produit à la partie inférieure du récipient.

4. Dispositif pour l'extinction de feux alimentés par un combustible sous pression ayant un degré d'inflammabilité élevé, notamment de feux de puits de pétrole, comprenant un récipient de compositions d'extinction, par lequel le récipient est d'une forme, d'une dimension et d'une matière prévues pour s'écraser à une valeur prédéterminée de pression interne et qui, après son écrasement, distribue les compositions d'extinction en une seule fois et de manière homogène sur tout le front du feu, caractérisé en ce que le récipient présente une forme sphérique, par laquelle il se compose de deux hémisphères (8, 8a) d'épaisseur de parois différentes (d1, d2), et en ce qu'il présente une ligne de rupture prédéterminée (5') au niveau de la section de plus grand diamètre.

5. Le dispositif de la revendication 3 ou 4, caractérisé en ce que lesdites compositions d'extinction appartiennent à la classe des dérivés halogénés, principalement le méthane et l'éthane, ayant des caractéristiques d'extinction.

6. Le dispositif des revendications 3 ou 4, et 5, caractérisé en ce que lesdites compositions sont utilisées seule ou en combinaison l'une avec l'autre à des proportions variées ou mélangées à des compositions inertes liquéfiées, telles que de l'azote liquide.

7. Le dispositif des revendications 3 ou 4, et suivantes, caractérisé en ce que seulement une quantité d'azote ou d'autre gaz inerte, seul ou mélangé l'un à l'autre, ayant un pouvoir de dilatation élevé est utilisée en tant que composition d'extinction.

8. Le dispositif des revendications 3 ou 4, et suivantes,

caractérisé en ce qu'il est contenu dans une cage qui peut être réalisée en métal ou en une autre matière présentant un maillage résistant aux conditions de fonctionnement dans le but d'éviter que des parties de tôles brisées soient projetées tout 5
autour du lieu de fonctionnement.

9. Le dispositif des revendications 3 ou 4, et suivantes, caractérisé en ce qu'il est réalisé en matière ininflammable. 10

10. Le dispositif des revendications 3 ou 4 et suivantes, caractérisé en ce qu'on prévoit des moyens d'entrée et d'obturation pour remplir de liquides inertes et/ou d'extinction le récipient sous des conditions de sécurité. 15

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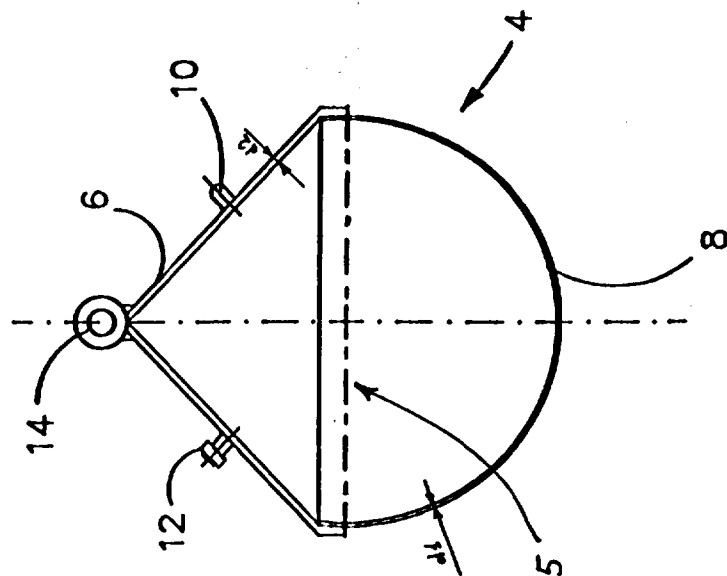


FIG. 1

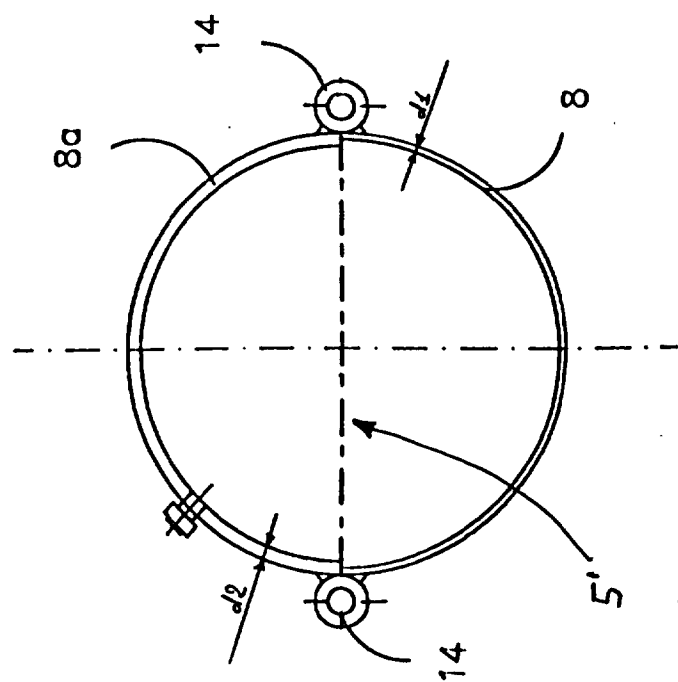


FIG. 2