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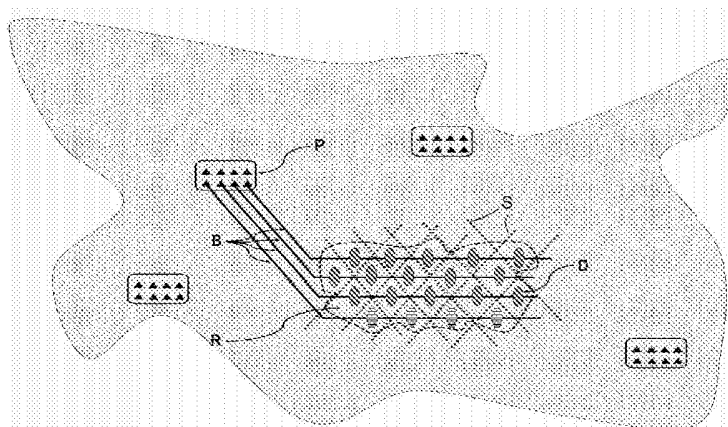
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Method for counteracting land subsidence in the vicinity of an underground reservoir.

57

The invention relates to a method for counteracting land subsidence due to activities, such as production of resources, involving transport of materials to or from an underground reservoir (R) through a well (P) having a well bore (B) running in the direction of the reservoir. The method comprises the step of bringing reinforcing material into a casing present in the wellbore (B) and making the reinforcing material flow out through perforations in the casing for forming a number of reinforcing objects (D) of reinforcing material around the wellbore (D).



METHOD FOR COUNTERACTING LAND SUBSIDENCE IN THE VICINITY OF AN UNDERGROUND RESERVOIR

The present invention generally relates to a method for counteracting land
5 subsidence in the vicinity of an underground reservoir accessible through a number
of wellbores.

Land subsidence is a known negative side effect of production of natural
resources, for example hydrocarbons, from an underground reservoir through a well.
Extraction of hydrocarbons causes compaction of the reservoir rock leading to
10 subsidence at ground level. Land subsidence causes environmental damage and
effects water management. When earth layers are compacted near a natural fault,
tension may build up and the earth layers will start shifting in a disruptive manner
causing earthquakes. In recent years production of gas from the Groningen gas field
in the north eastern part of The Netherlands has led to numerous claims for
15 damages to buildings resulting from earthquakes caused by the gas production.
Many buildings in the area show visible damage, such as cracks in the walls.

The present invention has for its object to provide a method to prevent or
minimize land subsidence due to activities, such as production of (natural) resources,
involving transport of materials to and/or from an underground reservoir through a
20 well having a well bore running in the direction of the reservoir.

According to the invention this object is achieved by the method steps of
bringing reinforcing material into a casing present in the wellbore and making the
reinforcing material flow out through perforations in the casing for forming a number
of reinforcing objects of reinforcing material around the wellbore.

25 The reinforcing objects reinforce the reservoir soil surrounding the well bore
and adequately prevent land subsidence. Furthermore, the reinforcing material
replaces the fluids extracted from the reservoir to prevent the compaction of the
reservoir rock.

According to a first preferred embodiment the reinforcing objects have a
30 dome shaped cross-section. Advantageously the dome shape enables the reinforcing
objects to withstand high loads from surrounding layers, for instance salt layers, and
consequently attribute to prevent land subsidence.

According to a further preferred embodiment a suitable type of reinforcing
material comprises grout.

35 In another preferred embodiment the reinforcing objects are formed around a

substantially horizontal part of the wellbore to maximally support the well bore and to create an enhanced supporting surface in the surrounding soil.

In order to create reinforcing objects that completely surround the well bore the perforations are present in circumferential patterns in the casing.

5 Advantageously use is made of production perforations present in the casing for production of resources, such as hydrocarbons. Optionally additional perforations are made to the production perforations present in the casing for production of resources, such as hydrocarbons.

10 Suitable equipment for use in the method includes a pump being used to bring the reinforcing material into the casing. In a practical preferred embodiment tubing provided with a nozzle head is used to make the reinforcing material flow out through the perforations in the casing.

In an optimized preferred embodiment the casing is dividable in sections by seals.

15 According to a second preferred embodiment the method comprises the step of forming cracks in the reservoir surrounding the wellbore and filling the cracks with the reinforcing material for forming the reinforcing objects. The second embodiment is specifically suitable for use in a reservoir of non-permeable soil, such as shale or rock.

20 According to a preferred elaboration of the second preferred embodiment the cracks are formed using the reinforcing material. The two separate steps of forming the cracks and forming the reinforcing objects are then effectively combined.

According to an alternative elaboration of the second preferred embodiment the cracks are formed using fracking liquids.

25 In an efficient elaboration of the second preferred embodiment the reservoir is hardened, for example by Nitrogen injection, prior to forming the cracks.

According to a general preferred embodiment the wellbore remains intact for production of the resources.

30 When performing the method according to the invention for reinforcing a number of adjacent wellbores, a pattern of reinforcing objects is defined around the adjacent wellbores creating a foundation platter. Such a foundation platter can support a plurality of buildings, such as a village, while leaving enough space for flow movements in the reservoir.

35 The invention will now further be described referring to the appending figures,

in which:

Figure 1 shows a schematic overview of a land area in which several well bores run in the direction of a reservoir, wherein the method according to the invention has been applied;

Figure 2 schematically shows a cross section through part of a first reservoir, including a well bore, to illustrate a first embodiment of the method according to the invention;

Figure 3A schematically shows a cross section through part of a second reservoir, including a well bore, to illustrate a second embodiment of the method according to the invention in a first time period;

Figure 3B schematically shows a cross section through the well bore of figure 3A to illustrate the second embodiment of the method according to the invention in a second time period; and

Figure 3C schematically shows a cross section through the well bore of figure 3A to illustrate the second embodiment of the method according to the invention in a third time period.

In all figures equal reference numerals denote equal features.

20

Figure 1 shows a schematic overview of a production site for natural resources, such as hydrocarbons, in which several well bores B run from production wells P in the direction of a reservoir R. Parts D of the reservoir R are reinforced using the method according to the invention. A resulting foundation platter is created defining a pattern of reinforcing objects D around adjacent wellbores B. The dashed lines S indicate free space between the reinforcing objects D that leaves room for flow movements of the hydrocarbons in the reservoir.

Figure 2 schematically shows a cross section through a well bore B1 of an underground reservoir R1 that has permeable soil to illustrate a first embodiment of the method according to the invention. Figures 3A through 3C schematically show a cross section through a well bore B2 of an underground R2 that has non-permeable soil to illustrate a second embodiment of the method according to the invention in different time periods. In each of the figures 3A through 3C a section is cut out and shown in more detail.

35 In both reservoirs R1, R2 the well bore B1, B2 comprises a casing 10 that is

inserted into a recently drilled section of the wellbore. The casing 10 is typically held into place with cementation 12. Casing 10 normally has a tubular shape receiving an internal elongate hollow tubing 11 that in the position of use runs in the direction of the reservoir. An annulus A surrounds the tubing 11 and is itself surrounded by the well wall formed by the casing 10 and the cementation 12.

In tubing 11 production equipment is received. An example of suitable production equipment is a Wireline Retrievable Oil Production (WROP) system of which a nipple 20 is shown. The WROP system has been described in the international patent application WO2014/011043 of the same applicant. Herein a so called Wireline Retrievable Oil Production (WROP) system is described for the production of hydrocarbons.

Seals or packers 21 are present to close off sections of the casing 10.

Perforations 14 connect the interior of the casing 10 with the surroundings of the casing 10, i.e. the reservoir soil. Consequently, the perforations 14 also extend through the cementation 12. Typically, the perforations 14 are production perforations for production of resources, such as hydrocarbons. Optionally additional perforations are made in the casing. Preferably the additional perforations are alternate to the production perforations. The preferred pattern for the perforations is a circumferential pattern.

In general the method according to the invention for counteracting land subsidence due to activities involving material transport, such as production of resources, through wellbores comprises the step of bringing reinforcing material into the casing 10 present in the wellbore B1 or B2. A pump may be used to bring the reinforcing material into the casing 10.

The reinforcing material is made to flow out through the perforations 14 in the casing 10 to form a number of reinforcing objects D1 respectively D2 around the wellbore B1 respectively B2. Dedicated equipment provided with a nozzle head may be used.

Suitable reinforcing materials are injectable materials that will attach to the reservoir area and the outer well wall and will harden as a result of a reaction, for example a chemical reaction or a thermal reaction. The reinforcing material may comprise grout, resin, such as epoxy resin, polyurethane resin or polyester resin, glass fibre, silicon rubber, starch or any combination thereof. Several choices are available to the person skilled in the relevant art.

The reinforcing objects D are formed around a substantially horizontal part of

the wellbore B.

Optionally a sliding sleeve valve 30 is used to control fluid flow between the tubing 11 and the annulus A. Suitable sliding sleeve valves are known in the field of gas and oil exploration and production.

5 When applying the method according to the invention the wellbore remains intact for production of the resources. The resources flow out of the reservoir into the casing 10 in a direction of flow F that is substantially transverse to the casing 10. As seen in the direction F the reinforcing objects D1 and D2 have a dome shaped cross-section. As seen in longitudinal direction of the casing 10 the reinforcing objects D1
10 and D2 have a general ring shape.

The first embodiment of the method according to the invention comprises the steps described above and is suitable for a reservoir R1 of permeable soil, as illustrated in figure 2.

The second embodiment comprises additional steps prior to the steps
15 described above and is suitable for a reservoir R2 of non-permeable soil, such as shale or rock, illustrated in figures 3A – 3C.

These additional steps relate to creating fracked reservoir areas FR2. According to the second embodiment the method comprises the steps of forming cracks in the reservoir R2 surrounding the wellbore B2 and filling the cracks for
20 forming the reinforcing objects. The cracks can either be formed using the reinforcing material itself or using fracking liquids. Suitable fracking liquids comprise water and proppants, such as sand or plastic. Prior to forming the cracks the reservoir R2 may be hardened, for example by Nitrogen injection.

The fracked reservoir areas FR2 are preferably alternately used for
25 production of resources. In figure 3A as an example four fracked reservoir areas FR2 are shown in a first time period of which the second and the fourth FR2 (seen from left to right) are production areas and provided with arrows F. In the first and the third FR2 passageways from the perforations 14 to the tubing 11 are closed by dedicated equipment. An example of suitable equipment are sleeve valves or side doors 30 that
30 are slideable over the outer surface of the tubing 11, preferably under wireline control. By way of illustration next to some of the perforations 14 areas C are drawn to indicate closed passageways. The areas C are imaginary areas and have no physical embodiment.

Figure 3B shows the view of figure 3A in a second time period that is later
35 than the first time period. The second and the fourth FR2 are no longer used as

production areas, but have been transformed into reinforcing objects D2 using the method according to the invention. Optionally the passageways to perforations 14 are closed by dedicated equipment, for example the sleeve valves 30. Now the first and the third FR2 have become production areas.

5 Figure 3C shows the view of figure 3B in a third time period that is later than the second time period. The first and the third FR2 are also no longer used as production areas, but have also been transformed into reinforcing objects D2 using the method according to the invention. Optionally the passageways to perforations 14 are closed by dedicated equipment, for example the sliding sleeve valves 30. Water
10 can be injected into the thus treated well bore to use the well bore as heat exchanger for geothermal application. Optionally a WROP - HEX is a Heat Exchanger Plug-in device 40 as described in WO2014/011043 is used.

The invention is based on the general inventive thought to actively reinforce a well bore running towards an underground reservoir using reinforcing material and
15 transporting it through the well bore to form reinforcing objects around the well bore.

Although the invention has been illustrated in the context of reinforcing well bores on a hydrocarbon production site, the invention is not limited to well bores for transport of hydrocarbons or other materials out of an underground reservoir. The method according to the invention can also be used to reinforce well bores used for
20 transport of materials into an underground reservoir, for instance for the purpose of underground storage. Some examples of underground storage include disposal of nuclear waste or filling salt cavities with fluids. The method according to the invention can then also be used to reinforce well bores used for (continuous) transport of materials into and out of an underground reservoir, for instance for geothermal
25 applications.

The invention is consequently not limited to the described and shown preferred embodiment. The invention relates generally to any embodiment falling within the scope of protection as defined in the claims and as seen in the light of the foregoing description and accompanying drawings.

30

CONCLUSIES

1. Werkwijze voor het tegengaan van landverschuiving ten gevolge van activiteiten, zoals productie van grondstoffen, welke activiteiten omvatten transport
5 van materialen naar en/of uit een ondergrondse reservoir (R; R1; R2) door een put (P) met een boorgang (B; B1; B2), die in de richting van het reservoir verloopt, waarbij de werkwijze de stappen omvat van het brengen van versterkingsmateriaal in een behuizing (10) aanwezig in de boorgang en het laten uitstromen van het versterkingsmateriaal via perforaties (14) in de behuizing voor het vormen van een
10 aantal versterkingsobjecten (D; D1; D2) van het versterkingsmateriaal rond de boorgang.

2. Werkwijze volgens conclusie 1, waarbij de versterkingsobjecten (D; D1; D2) een koepelvormige dwarsdoorsnede hebben.

- 15 3. Werkwijze volgens conclusie 1 of 2, waarbij het versterkingsmateriaal een mengsel van water en cement omvat.

4. Werkwijze volgens één of meer van de voorgaande conclusies, waarbij de
20 versterkingsobjecten (D; D1; D2) zijn gevormd rond een in hoofdzaak horizontaal deel van de boorgang (B; B1, B2).

5. Werkwijze volgens één of meer van de voorgaande conclusies, waarbij de perforaties (14) aanwezig zijn in omtrekpatronen in de behuizing (10).

- 25 6. Werkwijze volgens conclusie 5, waarbij gebruik wordt gemaakt van productieperforaties, die aanwezig zijn in de behuizing (10) voor productie van grondstoffen, zoals koolwaterstoffen.

- 30 7. Werkwijze volgens conclusie 6, waarbij additionele perforaties worden gemaakt in aanvulling op de productieperforaties, die aanwezig zijn in de behuizing (10) voor productie van grondstoffen, zoals koolwaterstoffen.

8. Werkwijze volgens één of meer van de voorgaande conclusies, waarbij een
35 pomp wordt gebruikt om het versterkingsmateriaal in de behuizing (10) te brengen.

9. Werkwijze volgens één of meer van de voorgaande conclusies, waarbij

buisvormige elementen (11) voorzien van een spuitkop worden gebruikt om het versterkingsmateriaal te laten uitstromen door de perforaties (14) in de behuizing (10).

5 10. Werkwijze volgens conclusie 9, waarbij de behuizing (10) is onder te verdelen in secties door middel van afdichtingen (21).

11. Werkwijze volgens één of meer van de voorgaande conclusies, waarbij de werkwijze de stap van het vormen van scheuren omvat in het reservoir (R2), dat de
10 boorgang (B2) omgeeft, en het vullen van de scheuren met het versterkingsmateriaal voor het vormen van de versterkingsobjecten (D2).

12. Werkwijze volgens conclusie 11, waarbij de scheuren worden gevormd onder gebruikmaking van het versterkingsmateriaal.

15 13. Werkwijze volgens conclusie 11, waarbij de scheuren worden gevormd onder gebruikmaking van scheurvormende vloeistof (fracking liquid).

14. Werkwijze volgens conclusies 11 tot en met 13, waarbij het reservoir wordt
20 verhard, bij voorkeur middels stikstof injectie, voorafgaand aan het vormen van de scheuren.

15. Werkwijze volgens één of meer van de voorgaande conclusies, waarbij de boorgang (B; B1; B2) intact blijft voor productie van de grondstoffen.

25 16. Werkwijze volgens één of meer van de voorgaande conclusies, waarbij een patroon van versterkingsobjecten (D; D1; D2) wordt gedefinieerd rond aangrenzende boorgangen (B; B1; B2) waardoor een funderingsplateau wordt gevormd.

Fig. 1

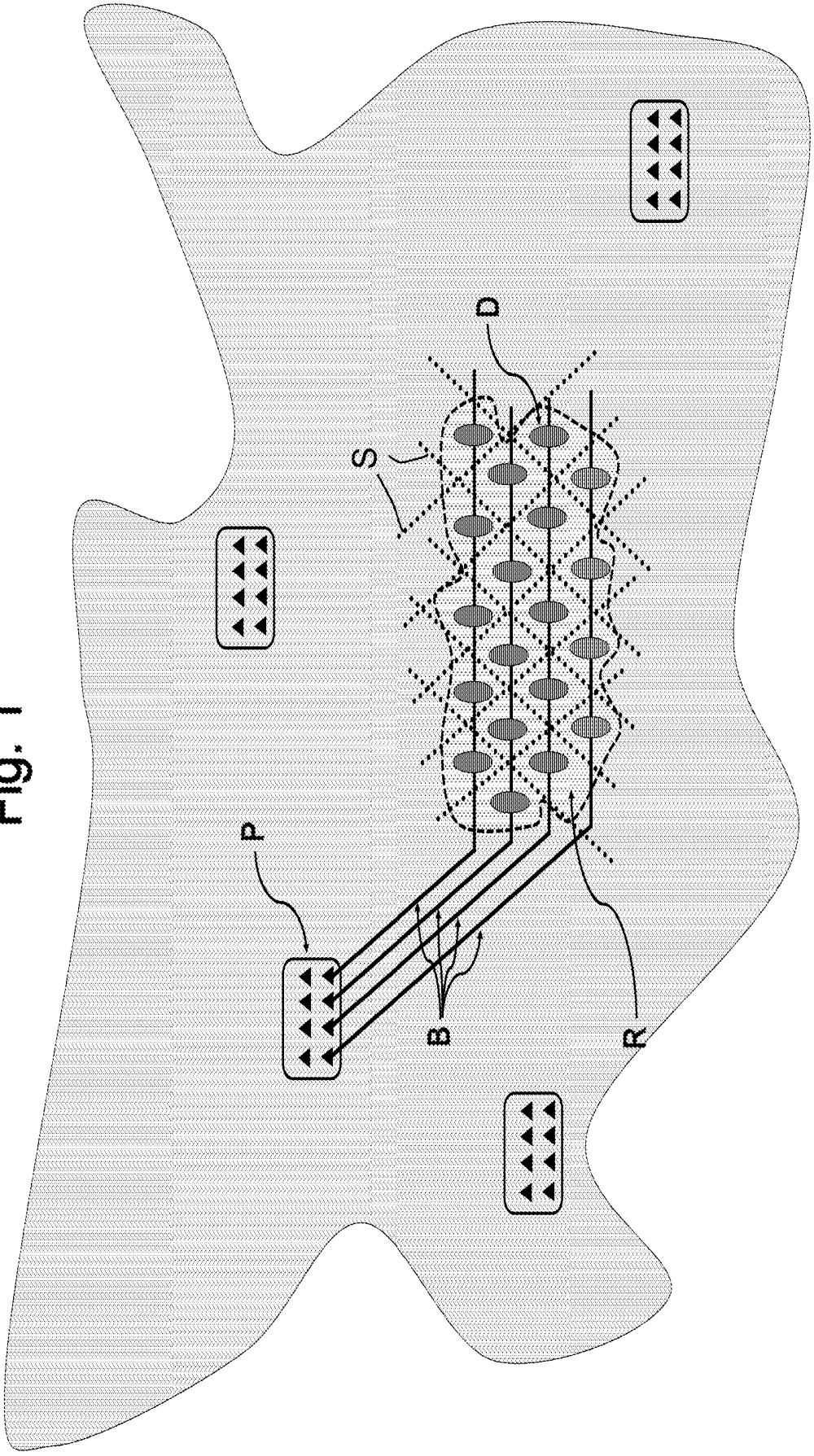


Fig. 2

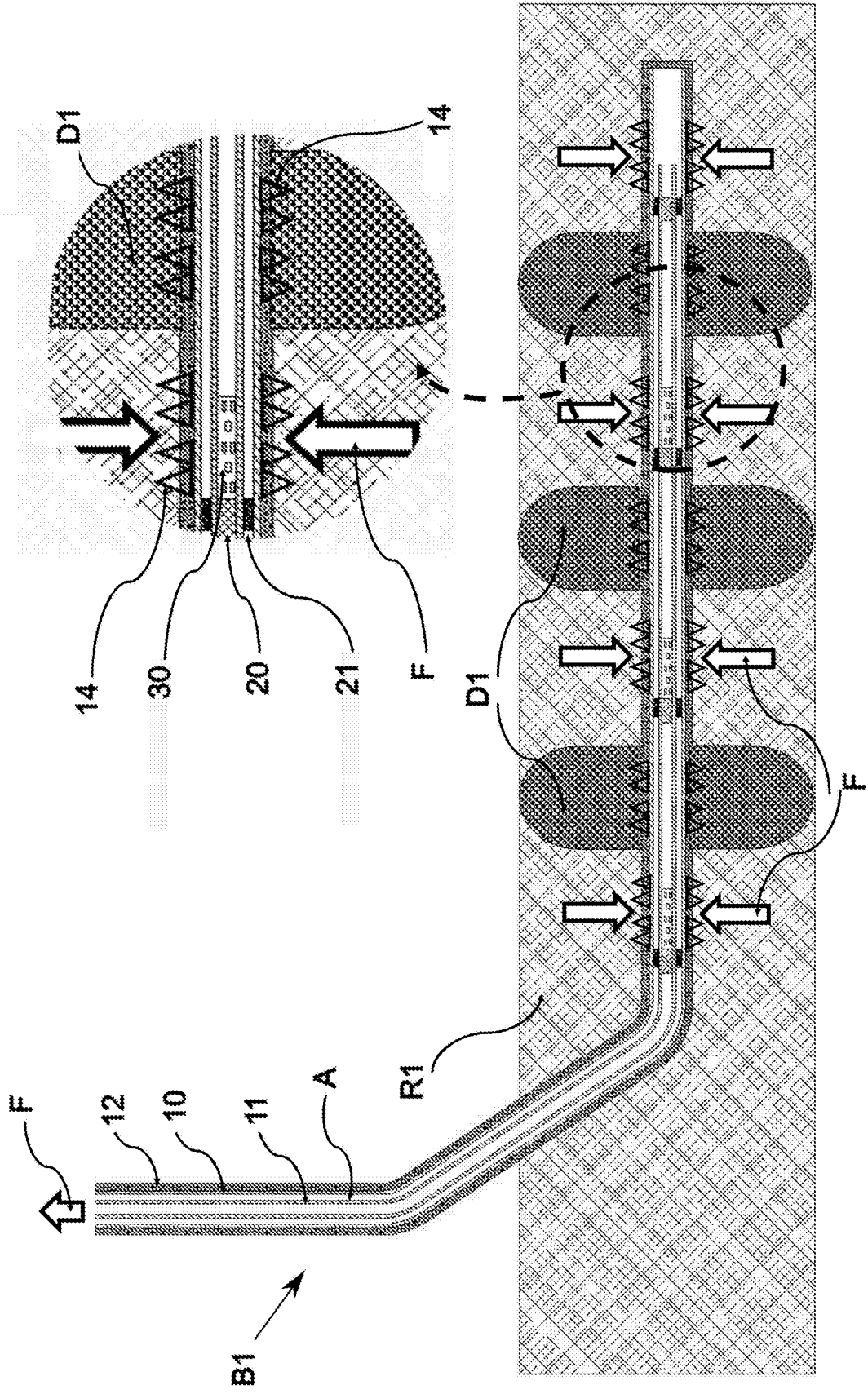


Fig. 3A

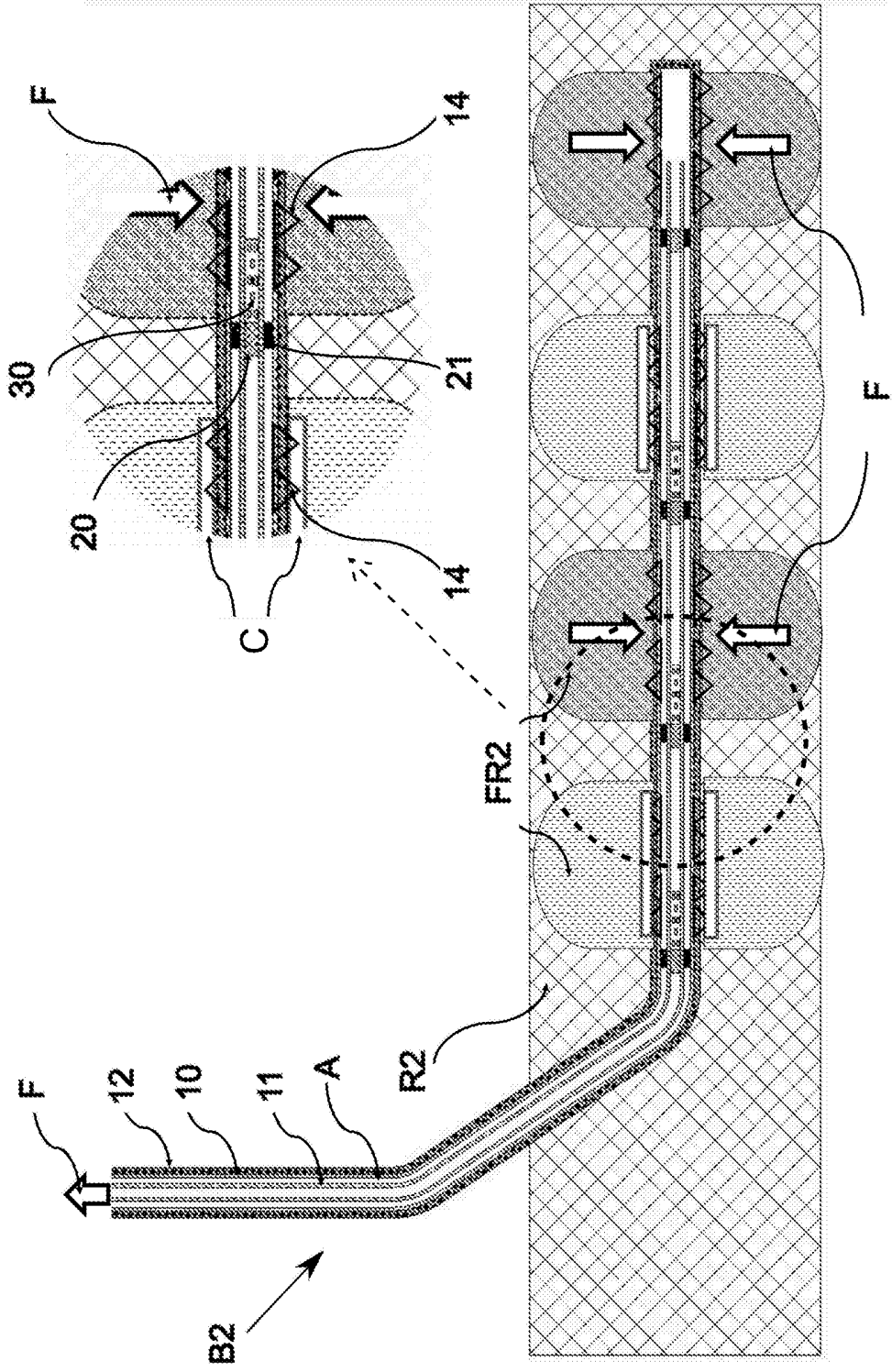
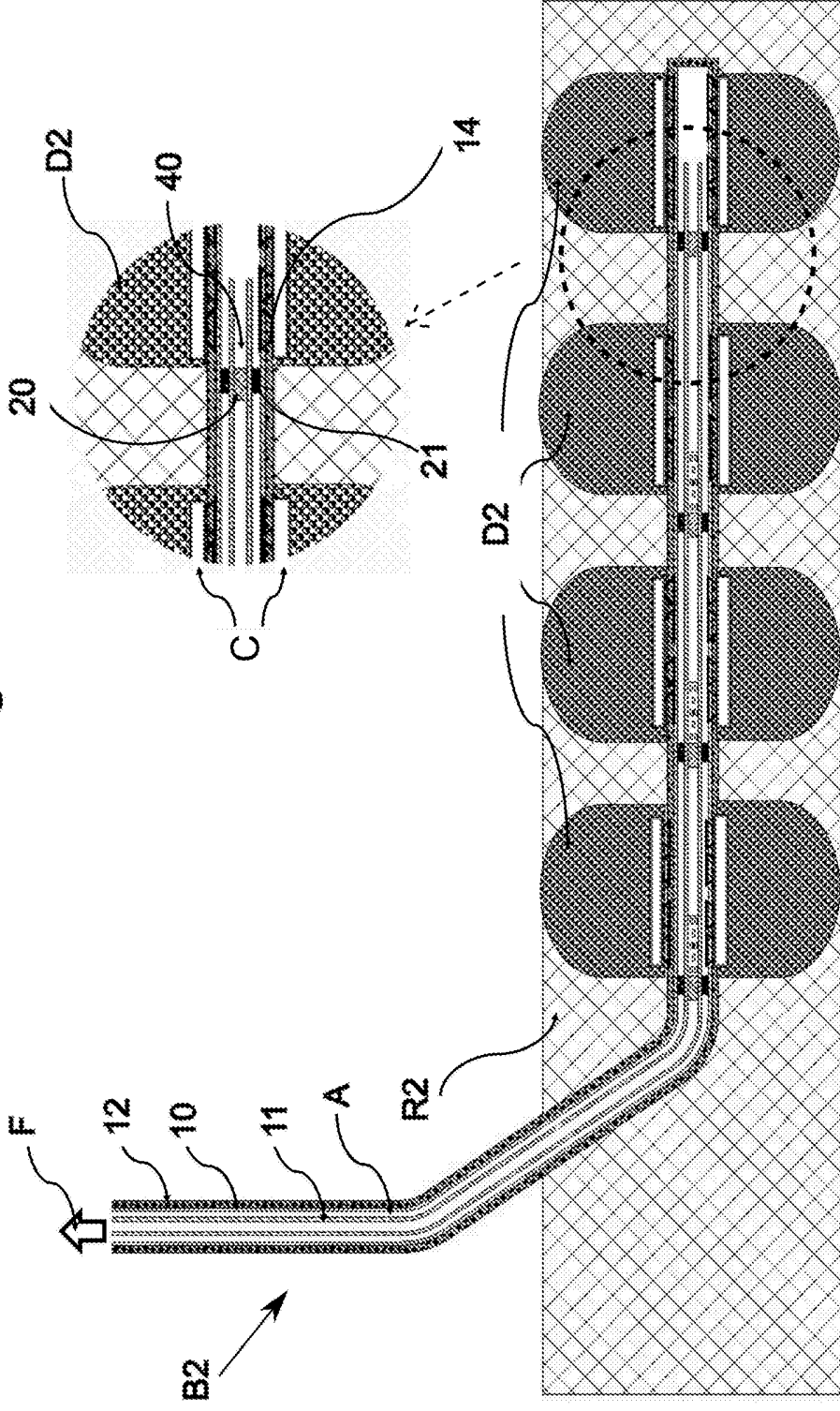


Fig. 3C



ABSTRACT

The invention relates to a method for counteracting land subsidence due to activities, such as production of resources, involving transport of materials to or from
5 an underground reservoir (R) through a well (P) having a well bore (B) running in the direction of the reservoir. The method comprises the step of bringing reinforcing material into a casing present in the wellbore (B) and making the reinforcing material flow out through perforations in the casing for forming a number of reinforcing objects (D) of reinforcing material around the wellbore (D).

10

Fig. 1

15



ONDERZOEKSRAPPORT

BETREFFENDE HET RESULTAAT VAN HET ONDERZOEK NAAR DE STAND VAN DE TECHNIEK

RELEVANTE LITERATUUR			
Categorie ¹	Literatuur met, voor zover nodig, aanduiding van tekstgedeelten of figuren.	Van belang voor conclusie(s) nr.	Classificatie (IPC)
X Y A	US 3 718 189 A (TERRY W) 27 februari 1973 (1973-02-27) * kolom 3, regel 63 - kolom 4, regel 14; figuur 1 *	1-8,15 9,10 11-14,16	INV. E21B33/138 E21B43/02
A	US 2015/068747 A1 (HWANG CHIH-CHAU [US] ET AL) 12 maart 2015 (2015-03-12) * alinea [0080] *	4	
Y A	WO 2016/011327 A2 (SCHLUMBERGER CA LTD [CA]; SCHLUMBERGER SERVICES PETROL [FR]; SCHLUMBER) 21 januari 2016 (2016-01-21) * alinea [0031] - [0038] *	9,10 4	
A	EP 1 653 042 A1 (SCHLUMBERGER SERVICES PETROL [FR]; SCHLUMBERGER TECHNOLOGY BV [NL]; SC) 3 mei 2006 (2006-05-03) * alinea [0010] *	9,10	
T	BOUATECA M ET AL: "LES SUBSIDENCES PROVOQUEES PAR LA PRODUCTION DES FLUIDES SOUTERRAINS", OIL & GAS SCIENCE & TECHNOLOGY: REVUE DE L'INSTITUT FRANCAIS DU PETROLE, EDITIONS TECHNIP. PARIS, FR, deel 51, nr. 3, 1 mei 1996 (1996-05-01), bladzijden 349-364, XP000596379, ISSN: 1294-4475 * chapter "Introduction" *	1-16	Onderzochte gebieden van de techniek E21B
Indien gewijzigde conclusies zijn ingediend, heeft dit rapport betrekking op de conclusies ingediend op:			
Plaats van onderzoek: München		Datum waarop het onderzoek werd voltooid: 10 augustus 2016	Bevoegd ambtenaar: Beran, Jiri
¹ CATEGORIE VAN DE VERMELDE LITERATUUR			
<p>X: de conclusie wordt als niet nieuw of niet inventief beschouwd ten opzichte van deze literatuur</p> <p>Y: de conclusie wordt als niet inventief beschouwd ten opzichte van de combinatie van deze literatuur met andere geciteerde literatuur van dezelfde categorie, waarbij de combinatie voor de vakman voor de hand liggend wordt geacht</p> <p>A: niet tot de categorie X of Y behorende literatuur die de stand van de techniek beschrijft</p> <p>O: niet-schriftelijke stand van de techniek</p> <p>P: tussen de voorrangsdatum en de indieningsdatum gepubliceerde literatuur</p> <p>T: na de indieningsdatum of de voorrangsdatum gepubliceerde literatuur die niet bezwarend is voor de octrooiaanvraag, maar wordt vermeld ter verheldering van de theorie of het principe dat ten grondslag ligt aan de uitvinding</p> <p>E: eerdere octrooi(aanvraag), gepubliceerd op of na de indieningsdatum, waarin dezelfde uitvinding wordt beschreven</p> <p>D: in de octrooiaanvraag vermeld</p> <p>L: om andere redenen vermelde literatuur</p> <p>S: lid van dezelfde octrooifamilie of overeenkomstige octrooipublicatie</p>			

**AANHANGSEL BEHORENDE BIJ HET RAPPORT BETREFFENDE
HET ONDERZOEK NAAR DE STAND VAN DE TECHNIEK,
UITGEVOERD IN DE OCTROOIAANVRAGE NR.**

NO 139520
NL 2016185

Het aanhangsel bevat een opgave van elders gepubliceerde octrooiaanvragen of octrooien (zogenaamde leden van dezelfde octroofamilie), die overeenkomen met octrooischriften genoemd in het rapport.

De opgave is samengesteld aan de hand van gegevens uit het computerbestand van het Europees Octrooibureau per
De juistheid en volledigheid van deze opgave wordt noch door het Europees Octrooibureau, noch door het Bureau voor de Industriële eigendom gegarandeerd; de gegevens worden verstrekt voor informatiedoeleinden.

10-08-2016

In het rapport genoemd octrooigeschrift		Datum van publicatie	Overeenkomend(e) geschrift(en)	Datum van publicatie
US 3718189	A	27-02-1973	GEEN	
US 2015068747	A1	12-03-2015	GEEN	
WO 2016011327	A2	21-01-2016	GEEN	
EP 1653042	A1	03-05-2006	AT 370310 T	15-09-2007
			CA 2582941 A1	20-04-2006
			DK 1653042 T3	27-12-2007
			EP 1653042 A1	03-05-2006
			GB 2433530 A	27-06-2007
			US 2008093077 A1	24-04-2008
			WO 2006040147 A2	20-04-2006

SCHRIFTELIJKE OPINIE

DOSSIER NUMMER NO139520	INDIENINGSDATUM 29.01.2016	VOORRANGSDATUM	AANVRAAGNUMMER NL2016185
CLASSIFICATIE INV. E21B33/138 E21B43/02			
AANVRAGER HALPA INTELLECTUAL PROPERTIES B.V.			

Deze schriftelijke opinie bevat een toelichting op de volgende onderdelen:

- Onderdeel I Basis van de schriftelijke opinie
- Onderdeel II Voorrang
- Onderdeel III Vaststelling nieuwheid, inventiviteit en industriële toepasbaarheid niet mogelijk
- Onderdeel IV De aanvraag heeft betrekking op meer dan één uitvinding
- Onderdeel V Gemotiveerde verklaring ten aanzien van nieuwheid, inventiviteit en industriële toepasbaarheid
- Onderdeel VI Andere geciteerde documenten
- Onderdeel VII Overige gebreken
- Onderdeel VIII Overige opmerkingen

	DE BEVOEGDE AMBTENAAR Beran, Jiri
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SCHRIFTELIJKE OPINIE

Aanvraag nr.:
NL2016185

Onderdeel I Basis van de Schriftelijke Opinie

1. Deze schriftelijke opinie is opgesteld op basis van de meest recente conclusies ingediend voor aanvang van het onderzoek.
2. Met betrekking tot **nucleotide en/of aminozuur sequenties** die genoemd worden in de aanvraag en relevant zijn voor de uitvinding zoals beschreven in de conclusies, is dit onderzoek gedaan op basis van:
 - a. type materiaal:
 - sequentie opsomming
 - tabel met betrekking tot de sequentie lijst
 - b. vorm van het materiaal:
 - op papier
 - in elektronische vorm
 - c. moment van indiening/aanlevering:
 - opgenomen in de aanvraag zoals ingediend
 - samen met de aanvraag elektronisch ingediend
 - later aangeleverd voor het onderzoek
3. In geval er meer dan één versie of kopie van een sequentie opsomming of tabel met betrekking op een sequentie is ingediend of aangeleverd, zijn de benodigde verklaringen ingediend dat de informatie in de latere of additionele kopieën identiek is aan de aanvraag zoals ingediend of niet meer informatie bevatten dan de aanvraag zoals oorspronkelijk werd ingediend.
4. Overige opmerkingen:

SCHRIFTELIJKE OPINIE

Aanvraag nr.:
NL2016185

Onderdeel V Gemotiveerde verklaring ten aanzien van nieuwheid, inventiviteit en industriële toepasbaarheid

1. Verklaring

Nieuwheid	Ja: Conclusies 2-4, 7, 9-14, 16 Nee: Conclusies 1, 5, 6, 8, 15
Inventiviteit	Ja: Conclusies 11-14, 16 Nee: Conclusies 1-10, 15
Industriële toepasbaarheid	Ja: Conclusies 1-16 Nee: Conclusies

2. Citaties en toelichting:

Zie aparte bladzijde

Onderdeel VII Overige gebreken

De volgende gebreken in de vorm of inhoud van de aanvraag zijn opgemerkt:

Zie aparte bladzijde

Onderdeel VIII Overige opmerkingen

De volgende opmerkingen met betrekking tot de duidelijkheid van de conclusies, beschrijving, en figuren, of met betrekking tot de vraag of de conclusies nawerkbaar zijn, worden gemaakt:

Zie aparte bladzijde

Re Item V

Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

Reference is made to the following documents:

- D1 US 3 718 189 A
- D2 US 2015/068747 A1
- D3 WO 2016/011327 A2
- D4 EP 1 653 042 A1

- 1 The present application does not meet the criteria of patentability, because the subject-matter of claim 1 is not new.
 - 1.1 D1 discloses:

een werkwijze voor het tegengaan van landverschuiving ten gevolge van activiteiten, zoals productie van grondstoffen, welke activiteiten omvatten transport van materialen naar en/of uit een ondergrondse reservoir door een put met een boorgang, die in de richting van het reservoir verloopt, waarbij de werkwijze de stappen omvat van het brengen van versterkingsmateriaal in een behuizing aanwezig in de boorgang en het laten uitstromen van het versterkingsmateriaal via perforaties in de behuizing voor het vormen van een aantal versterkingsobjecten van het versterkingsmateriaal rond de boorgang [p.4, l.7 -18].
 - 1.2 This renders the subject-matter of claim 1 not new.
- 2 Dependent claims 2-10,15 & 16 do not appear to contain any additional features which, in combination with the features of any claim to which they refer, meet the requirements of novelty and/or inventive step, the reasons being as follows:
 - 2.1 Insofar, the dependent method-type claims 2, 3, 5, 10 en 15 have been understood, they relate to several technical feature without defining any procedural steps pertinent to the method-type claim and said claims are there not clear.
 - 2.2 Furthermore, claim 2 does not meet the requirement of clarity because the matter for which protection is sought is not clearly defined. The claims attempt to define the subject-matter in terms of the result to be achieved (dome-

shaped cross-section of reinforcement bodies) , which merely amounts to a statement of the underlying problem, without providing the technical features necessary for achieving this result.

- 2.3 The feature dome-shaped cross-section (koepelvormige dwarsdoorsnede) of claim 2, the feature of dome shaped cross-section does not present any advantage against other cross-sections (i.e. catenary arch, elliptic arch) and the subject-matter of claim 2 is therefore considered not inventive.
- 2.4 The feature aqueous mixture of cement (i.e. cementitious binder) according to claim 3 is merely one of several straightforward possibilities from which the skilled person would select, in accordance with circumstances, without the exercise of inventive skill. This renders the subject-matter of dependent claim 3 not inventive.
- 2.5 D2 as well as D3 disclose a formation consolidation in vertical as well as horizontal wells. It would be obvious to the person skilled in the art to employ the method according to claim 4 in horizontal wells, without having to exercise an inventive skill.
- 2.6 The feature production perforations of claim 5 & 6 has already been disclosed in D1 [c.3,l.63 - c.4,l.14], hence the subject-matter of said claims is not new. It would be obvious to the person skilled in the art to add some perforation when required by the local condition, hence rendering the subject-matter of claim 7 not inventive.
- 2.7 The feature using a pump according to claim 8 is not new [see D1, Fig.1].
- 2.8 The features a coil tubing injection with injector shoe and sealing elements of dependent claims 9 & 10 have already been employed for the same purpose in a similar injection method (see D3 or D4 with relevant passages cited in the search report). It would therefore be obvious to the person skilled in the art to apply these features with corresponding effect to a method according to D1, thus arriving at a method according to claims 9 & 10 without having to exercise an inventive skill.
- 2.9 Claim 11-14 relate to a using the formation consolidation fluid to fracture a formation when creating support bodies in said formation. It appears that said features have not yet been disclosed in combination with a mitigating subsidence. There is no hint in the cited prior art to apply fracturing of a formation by consolidating fluids.
- 2.10 The feature of leaving the well producing after the treatment by method of claim 15 is not new (see D1, c.8, l.8-9).

- 2.11 The feature of forming a foundation from several support bodies is not disclosed in the cited prior art.

Re Item VII

Certain defects in the application

- 1 The relevant background art disclosed in D1- D4 is not mentioned in the description, nor are these documents identified therein.
- 2 Independent claim 1 is not in the two-part form, which in the present case would be appropriate, with those features known in combination from the prior art being placed in the preamble and the remaining features being included in the characterising part.

Re Item VIII

Certain observations on the application

- 1 Claim 1 (relating to land slides, in Dutch "landverschuiving") appears to be inconsistent with the description geared towards a land subsidence mitigation.