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**MA MD**

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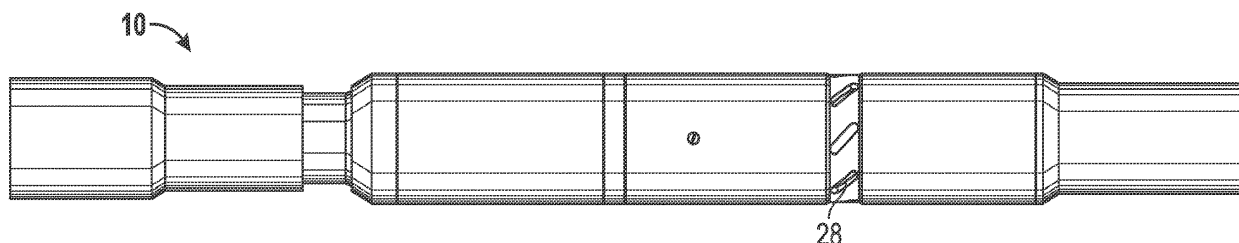
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(54) **HYDRAULIC DELAY TOE VALVE SYSTEM AND METHOD**

(57) An apparatus and method for providing a time delay in injection of pressured fluid into a geologic formation. In one aspect the invention is a toe valve activated by fluid pressure that opens ports after a predetermined time interval to allow fluid to pass from a well casing to a formation. The controlled time delay enables casing integrity testing before fluid is passed through the ports. This time delay also allows multiple valves to be used in the same well casing and provide a focused jetting action to better penetrate a concrete casing lining.



**FIG. 1A**

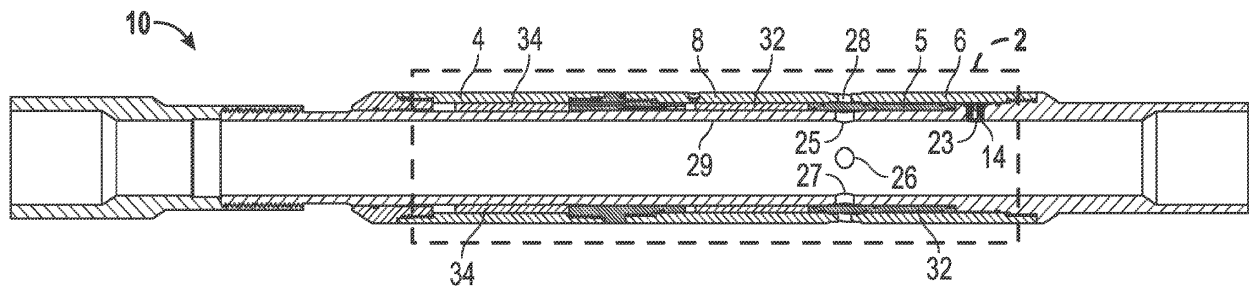


FIG. 1B

**PARTIAL EUROPEAN SEARCH REPORT**

Application Number

under Rule 62a and/or 63 of the European Patent Convention.  
This report shall be considered, for the purposes of  
subsequent proceedings, as the European search report

EP 16 18 5314

**DOCUMENTS CONSIDERED TO BE RELEVANT**

| Category | Citation of document with indication, where appropriate, of relevant passages  | Relevant to claim | CLASSIFICATION OF THE APPLICATION (IPC)     |
|----------|--|-------------------|---|
| X        | US 2014/251619 A1 (GEORGE K R; ROLLINS J A; WESSON D S)<br>11 September 2014 (2014-09-11)<br>* paragraph [0025] - paragraph [0027];<br>figures 1-4 * | 1-14              | INV.<br>E21B34/06<br>E21B34/10<br>E21B34/14 |
| X        | CA 2 892 128 A1 (GEODYNAMICS INC [US])<br>24 July 2015 (2015-07-24)<br>* paragraph [0022] - paragraph [0028];<br>figures 1-8 *                       | 1-14              |   |

TECHNICAL FIELDS  
SEARCHED (IPC)

E21B

**INCOMPLETE SEARCH**

The Search Division considers that the present application, or one or more of its claims, does/do not comply with the EPC so that only a partial search (R.62a, 63) has been carried out.

Claims searched completely :

Claims searched incompletely :

Claims not searched :

Reason for the limitation of the search:

see sheet C

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EPO FORM 1503 03 82 (P04E07)

|   |                                  |                 |
|---|----------------------------------|-----------------|
| Place of search   | Date of completion of the search | Examiner        |
| Munich  | 13 March 2017                    | Strømme, Henrik |
| <b>CATEGORY OF CITED DOCUMENTS</b><br>X : particularly relevant if taken alone<br>Y : particularly relevant if combined with another document of the same category<br>A : technological background<br>O : non-written disclosure<br>P : intermediate document<br>T : theory or principle underlying the invention<br>E : earlier patent document, but published on, or after the filing date<br>D : document cited in the application<br>L : document cited for other reasons<br>& : member of the same patent family, corresponding document |                                  |                 |



**INCOMPLETE SEARCH  
SHEET C**

Application Number

EP 16 18 5314

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Claim(s) completely searchable:  
1-14

Claim(s) not searched:  
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Reason for the limitation of the search:

In response to an objections according to Rule 62a(1) EPC, the applicant decided to have claims 1-14 searched.

ANNEX TO THE EUROPEAN SEARCH REPORT  
ON EUROPEAN PATENT APPLICATION NO.

EP 16 18 5314

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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.  
The members are as contained in the European Patent Office EDP file on  
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13-03-2017

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| Patent document<br>cited in search report | Publication<br>date | Patent family<br>member(s) | Publication<br>date |
|---|---------------------|----------------------------|---------------------|
| US 2014251619 A1                          | 11-09-2014          | NONE                       |                     |
| CA 2892128 A1                             | 24-07-2015          | NONE                       |                     |

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EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82