This disclosure is directed to pipe fittings, systems, and methods. Specifically, this disclosure provides pipe fittings with pairs of circumferential sealing zones and a pressure-testing chamber between the sealing zones. This disclosure also provides pipe fittings with sensors for detecting a breach in one or more sealing zones. The disclosure also provides data trackers for collecting information about the pressure-testing chamber and/or breaches in the sealing zones. Finally, this disclosure provides a dormant power source that becomes powered upon an aqueous breach of one or more sealing zones.
Published: (88) Date of publication of the international search report: 20 October 2016

with international search report (Art. 21(3))
INTERNATIONAL SEARCH REPORT

International application No. PCT/US16/16851

A. CLASSIFICATION OF SUBJECT MATTER

IPC(8) * F16L 47/03 (2016.01)
        - F16L 47/03

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC(8) Classifications: B29C 65/34; F16L 47/02, 47/03 (201G.01)
CPC Classifications: B29C 65/34; F16L 47/02, 47/03; USPC Classifications: 219/535; 264/248

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

PatSeer (US, EP, WO, JP, DE, GB, CN, FR, KR, ES, AU, IN, CA, INPADOC Data); Google; Google Scholar; EBSCO; IP.com; keywords: valve, electrical, electronic, groove, chamber, annular, circumferential, valve, pressure, pipe, hose, duct, conduit, coupling, fitting, connector, electrofusion

C. DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
<thead>
<tr>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y DE 202 13 972 U1 (HENZEN GMBH); figures 1, 3, 4; page 3, paragraph 2; page 8, paragraphs 2, 3</td>
<td>1-5, 6/3-6/5, 7-9</td>
</tr>
<tr>
<td>Y US 7,259,684 B1 (MANAKKAL R.) August 21, 2007; figure 3; column 4, lines 55-65; column 5, lines 5-20; column 6, lines 45-55</td>
<td>1-5, 6/3-6/5, 7-9</td>
</tr>
<tr>
<td>Y CN 202937947 U (YEFENG X) 2013.05.15; figures 1, 2; paragraph [0019]</td>
<td>3-5, 6/3-6/5</td>
</tr>
<tr>
<td>P, X WO 2015019367 A1 (PROPER PIPE EHF) 12 February 2015 (12.02.2015); entire document</td>
<td>1</td>
</tr>
<tr>
<td>A US 20090167014 A1 (KWAK YS) June 2, 2009; entire document</td>
<td>1-5, 6/3-6/5, 7-9</td>
</tr>
<tr>
<td>A GB 2 391 598 A (UPONOR INNOVATION AB) 11 02 2004; entire document</td>
<td>1-5, 6/3-6/5, 7-9</td>
</tr>
<tr>
<td>A JIS 4,571 ,488 A (REEVES AV) February 18, 1986; entire document</td>
<td>1-5, 6/3-6/5, 7-9</td>
</tr>
<tr>
<td>A DE 102010029715 A1 (DAKU KUNSTSTOFF GMBH) December 8, 2001; entire document</td>
<td>1-5, 6/3-6/5, 7-9</td>
</tr>
</tbody>
</table>

Further documents are listed in the continuation of Box C. See patent family annex.

* Special categories of cited documents:
  "A" document defining the general state of the art which is not considered to be of particular relevance
  "E" earlier application or patent but published on or after the international filing date
  "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
  "O" document referring to an oral disclosure, use, exhibition or other means
  "P" document published prior to the international filing date but later than the priority date claimed
  "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
  "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
  "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
  "&" document member of the same patent family

Date of the actual completion of the international search 16 June 2016 (16.06.2016)

Date of mailing of the international search report 29 JUL 2016

Name and mailing address of the ISA/ PCT Helpdesk: 571-272-4300
Mail Stop PCT, Attn: ISA/US, Commissioner for Patents Facsimile No. 571-273 8300
P.O. Box 1450, Alexandria, Virginia 22313-1450

Authorized officer Shane Thomas

Form PCT/ISA/210 (second sheet) (January 2015)
INTERNATIONAL SEARCH REPORT

Box No. II  Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claim Nos.: because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.: because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☒ Claim Nos.: 17, 19, 24-2y because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III  Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

- "Continued Within the Next Supplemental Box.-".

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable items.

2. ☐ As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claim Nos.:

4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.: 1-5, 6/3-5/5, 7-9

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.

☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.

☐ No protest accompanied the payment of additional search fees.

Form PCT/ISA/2 10 (continuation of first sheet (2)) (January 2015)
"...Continued from Box No. III Observations where unity of invention is lacking..."

This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1. In order for all inventions to be examined, the appropriate additional examination fees must be paid.

Group I: Claims 1-9 are directed toward: a pipe fitting comprising a first valve and current connector.

Group II: Claims 10-16, 18 are directed toward: a pipe fitting comprising a sensor.

Group III: Claims 20-23 are directed toward: a pipe fitting comprising a data tracker.

The inventions listed as Groups I-III do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons:

The special technical features of Group I include: a first valve and current connector fluidically coupled to the first inlet and electronically connected to the first inner mill while are not present in Groups II and III.

The special technical features of Group II include: a sensor fluidically coupled to the first circumferential pressure-testing chamber, which are not present in Groups I and III.

The special technical features of Group III include: a data tracker disposed at or proximal to the exterior of the sleeve; and a dormant battery disposed in at least a portion of the first circumferential pressure chamber, the dormant battery comprising a dry electrolyte; an anode; a cathode; and circuitry electronically coupling the anode, the cathode, and the data tracker, which are not present in Groups I-II.

The common technical features of Groups I, II and III are: a pipe fitting comprising a hollow tubular sleeve comprising a first open end and a second open end, wherein the first open end is configured to receive a first pipe and the second open end is configured to receive a second pipe; a first pair of circumferential sealing zones proximal to the first open end of the sleeve comprising a first inner circumferential sealing zone and a first outer circumferential sealing zone, wherein the first inner circumferential sealing zone comprises a first inner coil (left coiled heating wire 8; figure 1, paragraphs [00032] and [00332]) to form a seal with an inserted pipe; a first circumferential pressure chamber arranged between the first inner circumferential sealing zone and the first outer circumferential sealing zone, wherein the first circumferential pressure chamber comprises a first inlet.

These common technical features are disclosed by DE 10 2010 029 715 A1 (DAKU) in view of DE 202 13 972 U1 (HENZE). Daku discloses a pipe fitting comprising a hollow tubular sleeve (5, figure 1) comprising a first open end and a second open end (left and right ends; figure 1), wherein the first open end is configured to receive a first pipe (2) and the second open end is configured to receive a second pipe (3); a first pair of circumferential sealing zones proximal to the first open end of the sleeve comprising a first inner circumferential sealing zone (seal created by melting via wire 8 adjacent 5; figure 1, paragraphs [0002] and [0032]) and a first outer circumferential sealing zone (seal created by melting via wire 8 adjacent 2a; figure 1, paragraphs [0002] and [0032]), wherein the first inner circumferential sealing zone comprises a first inner coil (left coiled heating wire 8; figure 1, paragraphs [0002], [0014], [0032]) to form a seal with an inserted pipe (via melting; paragraphs [0002], [0032]). Daku does not disclose a first circumferential pressure chamber arranged between the first inner circumferential sealing zone and the first outer circumferential sealing zone, wherein the first circumferential pressure chamber comprises a first inlet. Henze discloses a first circumferential pressure chamber (35; figure 2) arranged between the first inner circumferential sealing zone (left 28; figure 3) and the first outer circumferential sealing zone (right 28; figure 3), wherein the first circumferential pressure chamber comprises a first inlet (36). In order to improve the weld quality of sleeve with the pipe (Daku; paragraph [0005]), it would have been obvious to one of ordinary skill in the art to modify Daku’s sleeve to incorporate Henze’s first circumferential pressure chamber between between the first inner circumferential sealing zone and the first outer circumferential sealing zone, because as Henze discloses the pressure chamber is used for testing the leakage of the weld (Henze; page 8, paragraph 2), hence ensuring a leak proof weld.

Since the common technical features are previously disclosed by Daku and Henze, the common features are not special and so Groups I, II and III lack unity.