

**CONTROL FLOW, INC.**  
**PATENTS**

**COVER PAGES**  
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US006817422B2

(12) **United States Patent**  
**Jordan**

(10) **Patent No.:** US 6,817,422 B2  
(45) **Date of Patent:** Nov. 16, 2004

(54) **AUTOMATED RISER RECOIL CONTROL SYSTEM AND METHOD**

(58) **Field of Search** ..... 166/355, 335, 166/352, 381; 175/5, 7, 27, 85

(75) **Inventor:** Larry Russell Jordan, Houston, TX (US)

(56) **References Cited**

(73) **Assignee:** Cooper Cameron Corporation, Houston, TX (US)

**U.S. PATENT DOCUMENTS**

(\*) **Notice:** Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 3 days.

3,653,635 A	4/1972	Bates, Jr. et al.	
4,121,806 A	10/1978	Iato et al.	254/172
4,351,261 A	9/1982	Shanks	114/264
4,432,420 A	2/1984	Gregory et al.	166/355
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4,501,219 A	2/1985	Bates, Jr.	114/264
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4,759,256 A	7/1988	Kovit et al.	91/29
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5,209,302 A	5/1993	Robichaux et al.	166/355

(21) **Appl. No.:** 10/276,411

(22) **PCT Filed:** May 15, 2001

(86) **PCT No.:** PCT/US01/15623

§ 371 (c)(1),  
(2), (4) **Date:** Nov. 14, 2002

(87) **PCT Pub. No.:** WO01/88323

**PCT Pub. Date:** Nov. 22, 2001

(65) **Prior Publication Data**

US 2003/0205383 A1 Nov. 6, 2003

**Related U.S. Application Data**

(60) **Provisional application No.** 60/204,442, filed on May 15, 2000.

(51) **Int. Cl.<sup>7</sup>** ..... E21B 19/00; E21B 23/00

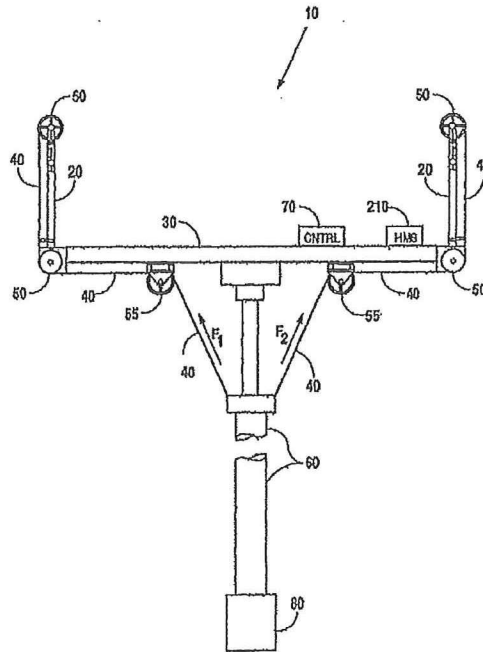
(52) **U.S. Cl.** ..... 166/381; 166/355; 175/7; 175/27

*Primary Examiner*—David Bagnell  
*Assistant Examiner*—Jennifer Gay  
(74) *Attorney, Agent, or Firm*—Michael P. Hartmann; Peter J. Bielinski

(57) **ABSTRACT**

An automated riser recoil control system (10) including a plurality of riser tensioners (20), a vessel heave measurement system (210) and a control processor (70) with each tensioner (20) having a piston travel indicator (27) which signals the processor (70) and a method of operation is disclosed.

15 Claims, 4 Drawing Sheets





US007163054B2

(12) **United States Patent**  
**Adams**

(10) **Patent No.:** **US 7,163,054 B2**  
(45) **Date of Patent:** **Jan. 16, 2007**

(54) **BREECHBLOCK CONNECTORS FOR USE WITH OIL FIELD LINES AND OIL FIELD EQUIPMENT**

(75) Inventor: **James Murph Adams**, Cypress, TX (US)

(73) Assignee: **Control Flow Inc.**, Houston, TX (US)

(\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 170 days.

3,442,536 A	5/1969	Fowler	
3,800,869 A	4/1974	Herd et al.	
3,895,829 A	7/1975	Manson, Jr.	
3,948,545 A	4/1976	Bonds	
4,165,891 A	8/1979	Sullaway et al.	
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4,540,053 A *	9/1985	Baugh et al.	166/382
4,807,705 A	2/1989	Henderson et al.	
5,069,288 A *	12/1991	Singetham	166/382

**FOREIGN PATENT DOCUMENTS**

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GB	2 114 631 A	8/1983

\* cited by examiner

*Primary Examiner*—David Bagnell  
*Assistant Examiner*—Matthew J. Smith  
(74) *Attorney, Agent, or Firm*—Bracewell & Giuliani LLP; Anthony F. Matheny

(21) Appl. No.: **10/827,653**

(22) Filed: **Apr. 19, 2004**

(65) **Prior Publication Data**

US 2004/0256096 A1 Dec. 23, 2004

**Related U.S. Application Data**

(63) Continuation-in-part of application No. 10/601,946, filed on Jun. 23, 2003, now Pat. No. 7,040,393.

(51) **Int. Cl.**  
**E21B 17/02** (2006.01)

(52) **U.S. Cl.** ..... **166/75.13; 166/242.6; 285/18**

(58) **Field of Classification Search** ..... **166/360, 166/380, 382, 75.13, 242.6; 285/18**  
See application file for complete search history.

(56) **References Cited**

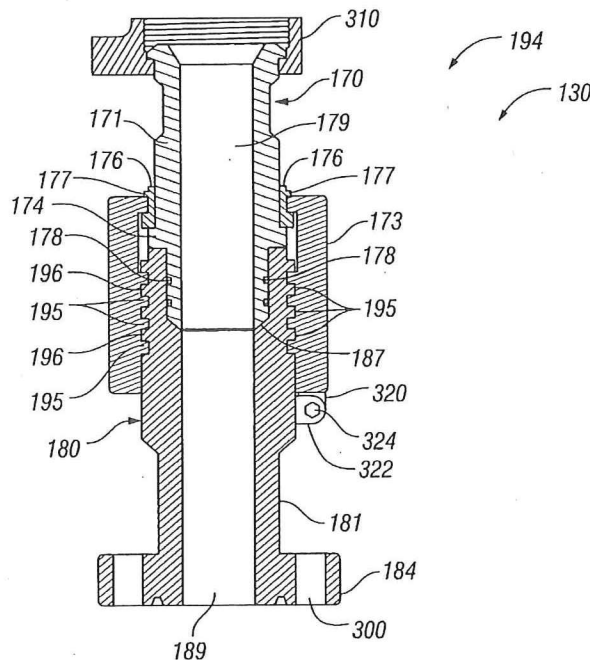
**U.S. PATENT DOCUMENTS**

3,421,580 A 1/1969 Fowler et al.

**ABSTRACT**

The invention is directed to breechblock connections to and between oil field equipment and oil field lines for use with oil field equipment associated with oil and gas exploration, drilling, and production. The oil field lines and oil field equipment of the invention include a breechblock connection for quick and easy removal and installation of the oil field lines to oil field equipment and to other oil field lines, and connections between different pieces of oil field equipment. Methods of connecting lines to oil field equipment and connecting one piece of oil field equipment to a second piece of oil field equipment are also disclosed.

**29 Claims, 7 Drawing Sheets**



THE REGISTRY OF PATENTS  
SINGAPORE

THE PATENTS ACT  
(CHAPTER 221)

**CERTIFICATE OF GRANT OF PATENT**

In accordance with section 35 of the Patents Act, it is hereby certified that a patent having the P-No. 116624 has been granted in respect of an invention having the following particulars:

Title : BREECHBLOCK CONNECTORS FOR USE WITH  
OIL FIELD LINES AND OIL FIELD EQUIPMENT

Application Number : 200502347-8

Date of Filing : 18 April 2005

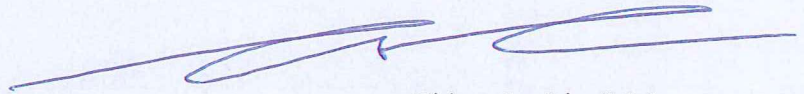
Priority Data : 19 April 2004 - PATENT APPLICATION NO.  
10/827,653 (UNITED STATES OF AMERICA)

Name of Inventor(s) : JAMES M. ADAMS

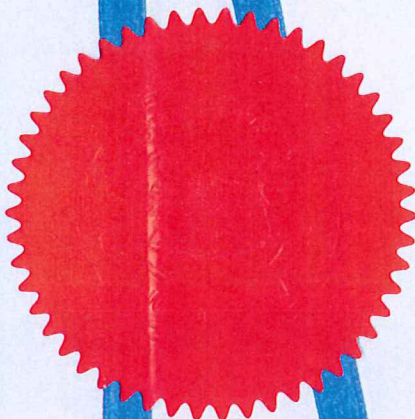
Name(s) and Address(es) of  
Proprietor(s) of Patent : CONTROL FLOW INC.  
9201 FAIRBANKS NORTH HOUSTON ROAD  
HOUSTON,  
TEXAS 77064  
UNITED STATES OF AMERICA

Date of Grant : 31 August 2007

Dated this 31st day of August 2007



Chiam Lu Lin (Ms)  
Deputy Registrar of Patents,  
Singapore.





(12) PATENT

(19) NO

(11) 336548

(13) B1

NORGE

(51) Int Cl.

F16L 23/00 (2006.01)  
E21B 33/038 (2006.01)  
E21B 33/064 (2006.01)  
E21B 33/076 (2006.01)

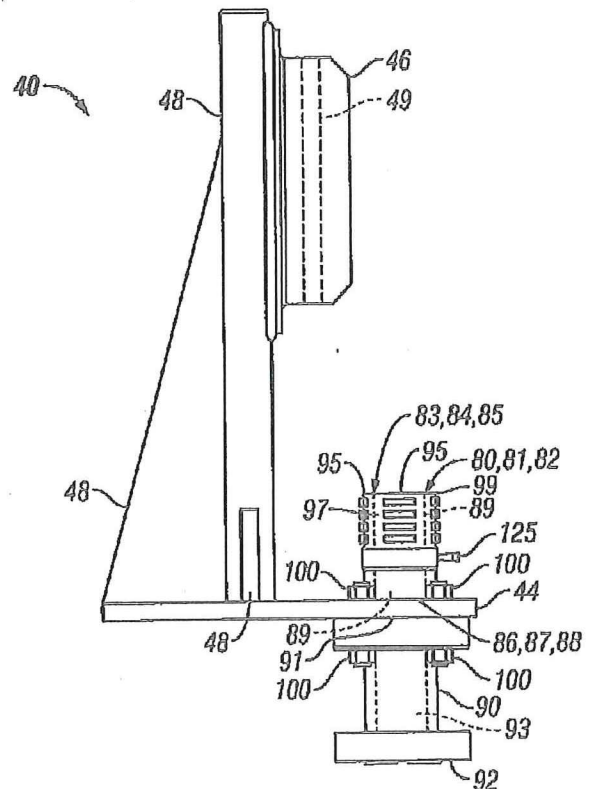
✓ Breechblock Connectors for use with Oil Field Lines and Oil Field Equipment

Patentstyret

(21)	Søknadsnr	20051701	(86)	Int.inng.dag og søknadsnr	
(22)	Inng.dag	2005.04.06	(85)	Videreføringsdag	
(24)	Løpedag	2005.04.06	(30)	Prioritet	2004.04.19, US, 827653
(41)	Alm.tilgj	2005.10.20			
(45)	Meddelt	✓ 2015.09.21			
(73)	Innehaver	Control Flow Inc, 9201 Fairbanks North Houston Road, US-TX77064 HOUSTON, USA			
(72)	Oppfinner	James M Adams, 12418 Winding Lane, US-TX77429 CYPRESS, USA			
(74)	Fullmektig	Tandbergs Patentkontor AS, Postboks 1570 Vika, 0118 OSLO, Norge			

(54)	Benevnelse	<b>Koplingsystem for tilkoping av ledninger til utrustning på oljefelt</b>
(56)	Anførte publikasjoner	GB 2114631 A US 5069288 A US 4540053 A
(57)	Sammendrag	

Oppfinnelsen retter seg mot låseblokkkoblinger til og mellom oljefeltutstyr og oljefeltledninger for bruk med oljefeltutstyr forbundet med olje og gassutforskning, boring og produksjon. Oljefeltledningene og oljefeltutstyret ifølge oppfinnelsen omfatter en låseblokkkobling for hurtig og enkel fjerning og installasjon av oljefeltledninger til oljefeltutstyret og til andre oljefeltledninger, og tilkoblinger mellom ulike deler oljefeltutstyr. Fremgangsmåter for å tilkoble ledninger til oljefeltutstyr og tilkobling av en del av oljefeltutstyr til en andre del av oljefeltutstyr er også omtalt.



(19)



(11)

**EP 1 491 717 B1**

(12)

**EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:  
**03.10.2007 Bulletin 2007/40**

(51) Int Cl.:  
**E21B 33/038<sup>(2006.01)</sup> E21B 33/06<sup>(2006.01)</sup>**

(21) Application number: **04076680.0**

(22) Date of filing: **08.06.2004**

**(54) Choke and kill line systems for blowout preventers**

Choke und Kill-Leitungen System für ein Backenausbruchsventil

System de connecteur de conduite d'injection pour un obturateur anti-éruption

(84) Designated Contracting States:  
**FI FR GB NL RO**

• **Curtiss, Jason P. III**  
**Houston,**  
**Texas 77065 (US)**

(30) Priority: **23.06.2003 US 601946**

(74) Representative: **Newstead, Michael John et al**  
**Page Hargrave**  
**Southgate**  
**Whitefriars**  
**Lewins Mead**  
**Bristol BS1 2NT (GB)**

(43) Date of publication of application:  
 — **29.12.2004 Bulletin 2004/53**

(73) Proprietor: **Control Flow Inc.**  
**Houston, TX 77064 (US)**

(56) References cited:  
**US-A- 4 668 126 US-A- 6 089 321**  
**US-A1- 2003 024 705 US-A1- 2003 136 927**  
**US-B1- 6 470 975**

(72) Inventors:  
 • **Adams, James M.**  
**Cypress,**  
  
**Texas 77429 (US)**

**EP 1 491 717 B1**

Note: Within nine months from the publication of the mention of the grant of the European patent, any person may give notice to the European Patent Office of opposition to the European patent granted. Notice of opposition shall be filed in a written reasoned statement. It shall not be deemed to have been filed until the opposition fee has been paid. (Art. 99(1) European Patent Convention).



US007040393B2

(12) **United States Patent**  
**Adams et al.**

(10) **Patent No.:** **US 7,040,393 B2**

(45) **Date of Patent:** **May 9, 2006**

(54) **CHOKE AND KILL LINE SYSTEMS FOR BLOWOUT PREVENTERS**

4,668,126 A 5/1987 Burton  
4,807,705 A 2/1989 Henderson et al.  
4,848,472 A 7/1989 Hopper

(75) Inventors: **James M. Adams**, Cypress, TX (US);  
**Jason P. Curtiss, III**, Houston, TX (US)

(Continued)

**OTHER PUBLICATIONS**

(73) Assignee: **Control Flow Inc.**, Houston, TX (US)

RetroSearch Search Results with Abstracts, Mar. 24, 2003, pp. 1-8.

(\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 204 days.

*Primary Examiner*—Jennifer H. Gay  
*Assistant Examiner*—Matthew J. Smith  
(74) *Attorney, Agent, or Firm*—Andrews Kurth LLP; Anthony F. Matheny

(21) Appl. No.: **10/601,946**

(22) Filed: **Jun. 23, 2003**

(57) **ABSTRACT**

(65) **Prior Publication Data**

US 2004/0256107 A1 Dec. 23, 2004

(51) **Int. Cl.**  
**E21B 23/02** (2006.01)

(52) **U.S. Cl.** ..... **166/77.51**; 166/85.4; 166/85.5; 285/401; 285/391

(58) **Field of Classification Search** ..... 166/77.51, 166/85.4, 85.5, 338, 344, 345, 368, 363; 285/124.4, 124.5, 360, 378, 401, 391  
See application file for complete search history.

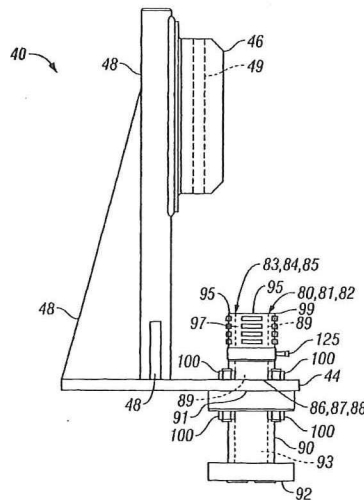
The invention is directed to pressure lines for use with equipment associated with drilling and production risers, and in particular, pressure lines having breechblock connections with the equipment and with choke and kill lines for use in connection with different sized blowout preventer stacks ("BOP stacks"). The pressure line systems and choke and kill line systems of the invention include a breechblock connection for quick and easy removal and installation of the pressure lines to riser equipment and the choke and kill lines to BOP stacks. Additionally, the choke and kill lines of the invention may include a coupling system having a BOP connector, or plate assembly, for permitting one set of choke and kill lines to be used on various sized BOP stacks. The plate assembly is in fluid communication with a first choke or kill line connector. Each of the choke and kill lines, or hoses, include a second choke or kill line connector, preferably as part of a line assembly, which is capable of being releasably secured to the first choke or kill line connector. Therefore, by installing a plate assembly on different sized BOP stacks, one set of choke and kill lines can be used in connection with multiple sized BOP stacks. Methods of replacing BOP stacks and installing and removing choke and kill lines and pressure lines are also disclosed.

(56) **References Cited**

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- 3,877,520 A 4/1975 Putnam
- 3,974,875 A \* 8/1976 Herd et al. .... 166/367
- 4,053,023 A 10/1977 Herd et al.
- 4,210,208 A 7/1980 Shanks
- 4,319,637 A \* 3/1982 Wilson ..... 166/340
- 4,488,740 A 12/1984 Baugh et al.
- 4,540,053 A 9/1985 Baugh et al.
- 4,597,448 A 7/1986 Baugh
- 4,615,544 A 10/1986 Baugh
- 4,618,314 A 10/1986 Hailey

**26 Claims, 5 Drawing Sheets**



THE REGISTRY OF PATENTS  
SINGAPORE

THE PATENTS ACT  
(CHAPTER 221)

**CERTIFICATE OF GRANT OF PATENT**

In accordance with section 35 of the Patents Act, it is hereby certified that a patent having the P-No. 118286 has been granted in respect of an invention having the following particulars:

Title : CHOKE AND KILL LINE SYSTEMS FOR  
BLOWOUT PREVENTERS

Application Number : 200404133-1

Date of Filing : 11 June 2004

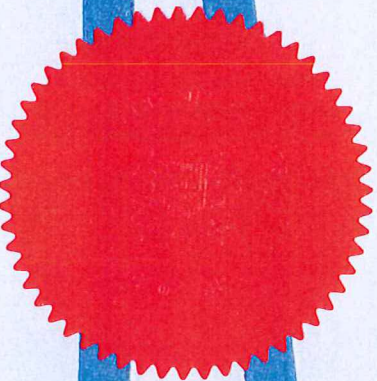
Priority Data : 23 June 2003 - PATENT APPLICATION NO. US  
10/601,946 (UNITED STATES OF AMERICA)

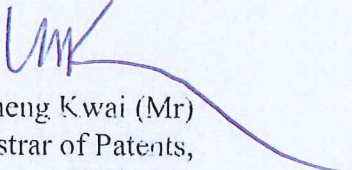
Name of Inventor(s) : JAMES M. ADAMS; JASON P. CURTISS, III

Name(s) and Address(es) of  
Proprietor(s) of Patent : CONTROL FLOW INC.  
9201 FAIRBANKS NORTH HOUSTON ROAD,  
HOUSTON, TEXAS 77064.  
UNITED STATES OF AMERICA

Date of Grant : 29 December 2006

Dated this 29th day of December 2006.



  
Wong Sheng Kwai (Mr)  
Acting Registrar of Patents,  
Singapore





NORGE

(51) Int Cl.  
E21B 33/038 (2006.01)  
E21B 33/064 (2006.01)  
E21B 33/076 (2006.01)

Patentstyret

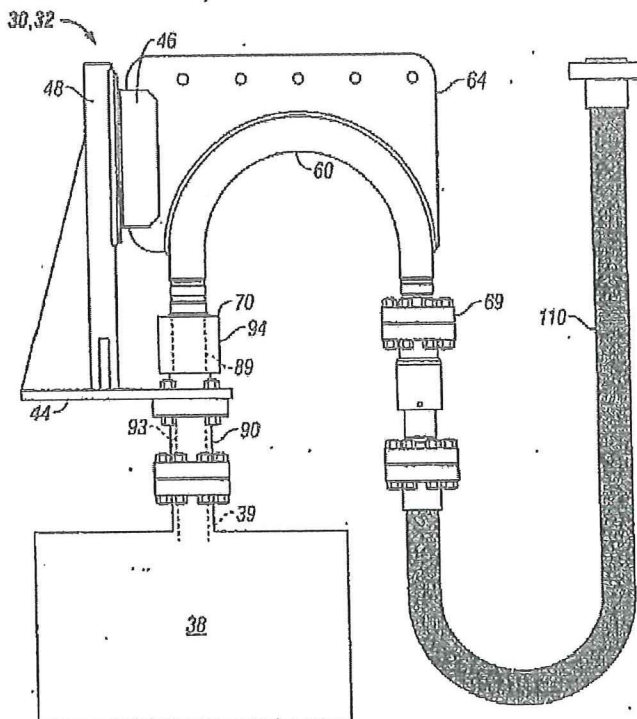
✓ Choke and Kill Line Systems for Blowout Preventers

(21)	Søknadsnr	20042458	(86)	Int.inng.dag og søknadsnr	
(22)	Inng.dag	2004.06.14	(85)	Videreføringsdag	
(24)	Løpedag	2004.06.14	(30)	Prioritet	2003.06.23, US, 601946
(41)	Alm.tilgj	2004.12.27			
(45)	Meddelt	→ 2015.07.13			
(73)	Innehaver	Control Flow Inc, 9201 Fairbanks North Houston Road, US-TX77064 HOUSTON, USA			
(72)	Oppfinner	James M Adams, 12418 Winding Lane, US-TX77429 CYPRESS, USA Jason P Curtiss III, 12519 Brants Way Court, US-TX77065 HOUSTON, USA			
(74)	Fullmektig	Tandbergs Patentkontor AS, Postboks 1570 Vika, 0118 OSLO, Norge			

(54)	Benevnelse	<b>Strupe- og drepeledning og koplingsystem for en utblåsingssikring.</b>
(56)	Anførte publikasjoner	US 6089321 A US 2003024705 A1 US 2003/136927 A1
(57)	Sammendrag	

Oppfinnelsen vedrører trykkledninger for anvendelse sammen med utstyr tilknyttet bore- og produksjonsstigerør, særlig stigerør som har låseblokkoplinger til utstyret og med strupe- og drepeledninger for anvendelse med utblåsingssikringer av forskjellige størrelser (UBIS-stakker).

Trykkledningssystemene og drepe- og strupeledningssystemene ifølge oppfinnelsen omfatter en låseblokkopling for hurtig og enkel fjerning og installasjon av trykkledningene til stigerørsutstyret og strupe- og drepeledningene til UBIS-stakkene. Dessuten kan strupe- og drepeledningene omfatte et koplingsystem som har en UBIS koplingsanordning, eller en plateenhet for å muliggjøre anvendelse av ett sett strupe- og drepeledninger i forbindelse med en første strupe- og drepeledningskoplingsanordning. Hver strupe- og drepeledning eller -slange, omfatter en andre strupe- eller drepeledningskoplings-anordning, fortrinnsvis som del av en ledning, for løsgjørbar festing til den første strupe- eller drepeledningskoplingsanordning. Ved å installere en plateenhet for UBIS-stakker av forskjellig størrelse kan det derfor ett sett strupe- eller drepeledninger sammen med UBIS-stakker av flere forskjellige størrelser. Fremgangsmåter for utskifting UBIS-stakker og installering og fjerning av strupe- og drepeledninger beskrives.





(12) PATENT

(19) NO

(11) 330579

(13) B1

NORGE

(51) Int Cl.  
E21B 19/00 (2006.01)

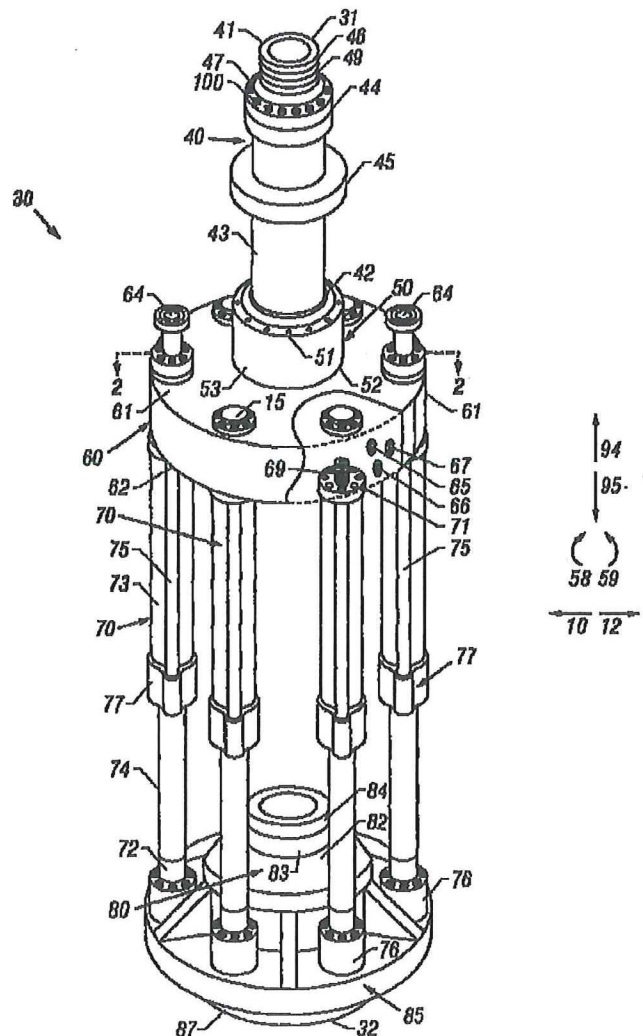
Patentstyret

✓Co-Linear Tensioner and Methods for Assembling Production and Drilling Risers using same

(21)	Søknadsnr	20025468	(86)	Int.inng.dag og søknadsnr	
(22)	Inng.dag	→ 2002.11.15	(85)	Videreføringdag	
(24)	Løpedag	2002.11.15	(30)	Prioritet	2001.11.30, US, 000393
(41)	Alm.tilgj	2003.06.02			
(45)	Meddelt	2011.05.16			
(73)	Innehaver	Control Flow Inc, 9201 Fairbanks North Houston Road, US-TX77064 HOUSTON, USA			
(72)	Oppfinner	Graeme E Reynolds, 2053 Western Village, Houston, TX 77043, USA Timothy I Mournian, 4237 Olive Avenue, Long Beach, CA 90807, USA			
(74)	Fullmektig	Acapo AS, Postboks 1880 Nordnes, 5817 BERGEN, Norge			

(54)	Benevnelse	<b>Anordning ved koblingsorgan for stigerørssystemer</b>
(56)	Anførte publikasjoner	GB 2358032 A, US 4934870 A, US 20010041096 A1
(57)	Sammendrag	

Foreliggende oppfinnelse vedrører en strekkmodul for å skaffe en rørledning, for eksempel bore- og produksjons-stigerør, fra et drivende fartøy på vannoverflaten til sjøen til utblåsningssikringen, produksjonstre, eller en annen anordning som er koblet til brønnhodet på sjøbunnen. Strekkmodulen kompensere for fartøysbevegelse forårsaket av bølgenes virkning, og hiv, og opprettholder en variabel strekk på stigerørstrengen, og reduserer dermed potensialet for kompresjon og således knekking eller sammenbrudd av stigerørstrengen. Strekkmodulen ifølge foreliggende oppfinnelse omfatter fortrinnsvis minst én røropphengsforing som omfatter minst en opphengsring, minst én øvre fleksibel dreieskjøtsammenstilling, minst én manifold med radiale åpninger, og minst én strekksylinder, kolineær kombinert i en enhet. Fremgangsmåter for å sammenstille stigerør omfattes også.



(19)



Europäisches Patentamt  
European Patent Office  
Office européen des brevets



(11)

**EP 1 316 671 B1**

(12)

**EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention  
of the grant of the patent:  
**01.06.2005 Bulletin 2005/22**

(51) Int Cl.7: **E21B 19/00**

(21) Application number: **02258242.3**

(22) Date of filing: **29.11.2002**

(54) **Co-linear tensioner and methods for assembling production and drilling risers using same**

Kolineare Spannvorrichtung und Verfahren zur Montage von Bohrloch- und Produktionssteigrohren unter Verwendung desselben

Dispositif tendeur co-linéaire et méthode d'assemblage de colonnes montantes de forage et de production utilisant ce dispositif

(84) Designated Contracting States:  
**AT BE BG CH CY CZ DE DK EE ES FI FR GB GR  
IE IT LI LU MC NL PT SE SK TR**

• **Mournian, Timothy I.**  
**Long Beach, California 90807 (US)**

(30) Priority: **30.11.2001 US 393**

(74) Representative: **Newstead, Michael John et al**  
**Page Hargrave**  
**Southgate**  
**Whitefriars**  
**Lewins Mead**  
**Bristol BS1 2NT (GB)**

(43) Date of publication of application:  
**04.06.2003 Bulletin 2003/23**

(73) Proprietor: **Control Flow Inc.**  
**Houston, TX 77064 (US)**

(56) References cited:  
**EP-A- 0 390 728**                      **GB-A- 2 358 032**  
**US-A1- 2001 041 096**

(72) Inventors:  
• **Reynolds, Graeme E.**  
**Houston, Texas 77043 (US)**

**P 1 316 671 B1**

Note: Within nine months from the publication of the mention of the grant of the European patent, any person may give notice to the European Patent Office of opposition to the European patent granted. Notice of opposition shall be filed in a written reasoned statement. It shall not be deemed to have been filed until the opposition fee has been paid. (Art. 99(4) European Patent Convention)



US006554072B1

(12) **United States Patent**  
**Mournian et al.**

(10) **Patent No.:** **US 6,554,072 B1**

(45) **Date of Patent:** **\*Apr. 29, 2003** ✓

(54) **CO-LINEAR TENSIONER AND METHODS FOR ASSEMBLING PRODUCTION AND DRILLING RISERS USING SAME**

(75) **Inventors:** **Timothy I. Mournian, Long Beach, CA (US); Graeme E. Reynolds, Houston, TX (US)**

(73) **Assignee:** **Control Flow Inc., Houston, TX (US)**

(\*) **Notice:** Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

This patent is subject to a terminal disclaimer.

4,317,586 A *	3/1982	Campbell	285/145.4
4,367,981 A *	1/1983	Shapiro	166/355
4,379,657 A *	4/1983	Widiner et al.	405/168.4
4,615,542 A	10/1986	Ideno et al.	
4,712,620 A	12/1987	Lim et al.	
4,787,778 A *	11/1988	Myers et al.	166/367
4,808,035 A *	2/1989	Stanton et al.	166/355
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5,727,630 A	3/1998	Brammer	
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6,419,277 B1 *	7/2002	Reynolds	166/367

**FOREIGN PATENT DOCUMENTS**

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WO	WO 97/43516	11/1997
WO	WO 00/24998	5/2000

\* cited by examiner

(21) **Appl. No.:** **10/000,393**

(22) **Filed:** **Nov. 30, 2001**

**Related U.S. Application Data**

(63) Continuation-in-part of application No. 09/881,139, filed on Jun. 14, 2001.

(60) Provisional application No. 60/211,652, filed on Jun. 15, 2000.

(51) **Int. Cl.<sup>7</sup>** ..... **E21B 29/12; E21B 41/04**

(52) **U.S. Cl.** ..... **166/355; 166/346; 166/367; 405/224.2; 405/224.4**

(58) **Field of Search** ..... **166/350, 359, 166/367, 355, 346; 405/224.4, 224.2**

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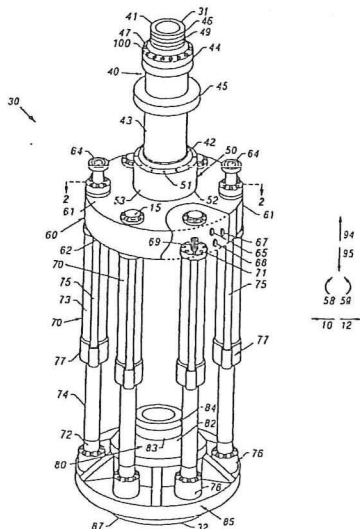
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*Primary Examiner*—Robert E. Pezzuto  
*Assistant Examiner*—Thomas A. Beach  
(74) *Attorney, Agent, or Firm*—Anthony F. Matheny; Andrews & Kurth L.L.P.

(57) **ABSTRACT**

A tensioner for providing a conduit, e.g., drilling and production riser strings, from a floating vessel at the surface of the ocean to the blowout preventer stack, production tree, or other assembly which is connected to the wellhead at the sea floor. The tensioner compensates for vessel motion induced by wave action and heave and maintains a variable tension to the riser string alleviating the potential for compression and thus buckling or failure of the riser string. The tensioner of the present invention preferably includes at least one mandrel having at least one hang-off donut; at least one upper flexjoint swivel assembly, at least one radially ported manifold, and at least one tensioning cylinder co-linearly combined in a single unit. Methods for assembling risers are also disclosed.

**47 Claims, 7 Drawing Sheets**



THE REGISTRY OF PATENTS  
SINGAPORE

THE PATENTS ACT  
(CHAPTER 221)

CERTIFICATE OF GRANT OF PATENT

In accordance with section 35 of the Patents Act, it is hereby certified that a patent having the P-No. 98499 has been granted in respect of an invention having the following particulars:

Title : CO-LINEAR TENSIONER AND METHODS FOR ASSEMBLING PRODUCTION AND DRILLING RISERS USING SAME

Application Number : 200207166-0

Date of Filing : 27 November 2002

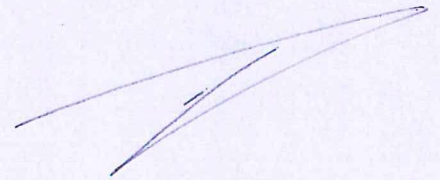
Priority Data : 30 November 2001 - PATENT APPLICATION NO. 10/000,393 (UNITED STATES OF AMERICA)

Name of Inventor(s) : GRAEME E. REYNOLDS;  
TIMOTHY I. MOURNIAN

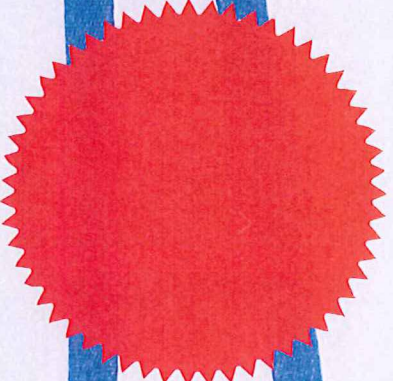
Name(s) and Address(es) of Proprietor(s) of Patent : CONTROL FLOW, INC.  
9201 FAIRBANKS NORTH HOUSTON ROAD  
HOUSTON, TEXAS 77064  
UNITED STATES OF AMERICA

Date of Grant : 30 December 2005

Dated this 30th day of December 2005.



Liew Woon Yin (Ms)  
Registrar of Patents,  
Singapore.





**REPÚBLICA FEDERATIVA DO BRASIL**  
**MINISTÉRIO DO DESENVOLVIMENTO, INDÚSTRIA E COMÉRCIO EXTERIOR**  
**INSTITUTO NACIONAL DA PROPRIEDADE INDUSTRIAL**

## CARTA PATENTE Nº PI 0205824-3

O INSTITUTO NACIONAL DA PROPRIEDADE INDUSTRIAL concede a presente PATENTE DE INVENÇÃO, que outorga ao seu titular a propriedade da invenção caracterizada neste título, em todo o território nacional, garantindo os direitos dela decorrentes, previstos na legislação em vigor.

✓ Co-Linear Tensioner and Methods for Assembling Production & Drilling Risers Using Same

(21) Número do Depósito: PI 0205824-3

(22) Data do Depósito: 27/11/2002

(43) Data da Publicação do Pedido: 28/10/2003

(51) Classificação Internacional: E21B 17/01

(30) Prioridade Unionista: 30/11/2001 US 10/000,393

(54) Título: TENSOR CO-LINEAR E MÉTODOS PARA MONTAGEM DE COLUNAS DE TUBOS ASCENDENTES DE AÇO DE PRODUÇÃO E DE PERFURAÇÃO COM O USO DO MESMO

(73) Titular: CONTROL FLOW, INC.. Endereço: 9201 Fairbanks North Houston Road, Houston, Texas 77064, Estados Unidos (US).

(72) Inventor: TIMOTHY I. MOURNIAN; GRAEME E. REYNOLDS

Prazo de Validade: 10 (dez) anos contados a partir de 21/01/2015, observadas as condições legais.

Expedida em: 21 de Janeiro de 2015.←

Assinado digitalmente por:

**Liane Elizabeth Caldeira Lage**  
Diretora de Patentes Substituta

15 de Novembro  
REPÚBLICA FEDERATIVA DO BRASIL  
de 1889



US007337849B2

(12) **United States Patent**  
**Williams**

(10) **Patent No.:** US 7,337,849 B2  
(45) **Date of Patent:** Mar. 4, 2008

(54) **CO-LINEAR TENSIONER AND METHODS OF INSTALLING AND REMOVING SAME**

(75) **Inventor:** Richard D. Williams, Sugar Land, TX (US)

(73) **Assignee:** Control Flow Inc., Houston, TX (US)

(\* ) **Notice:** Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) **Appl. No.:** 11/487,270

(22) **Filed:** Jul. 14, 2006

(65) **Prior Publication Data**

US 2006/0254776 A1 Nov. 16, 2006

**Related U.S. Application Data**

(63) Continuation of application No. 11/060,660, filed on Feb. 17, 2005.

(51) **Int. Cl.**  
**E21B 29/12** (2006.01)

(52) **U.S. Cl.** 166/355; 166/359; 166/367

(58) **Field of Classification Search** 166/355, 166/346, 367, 359; 405/224.2, 224.4  
See application file for complete search history.

(56) **References Cited**

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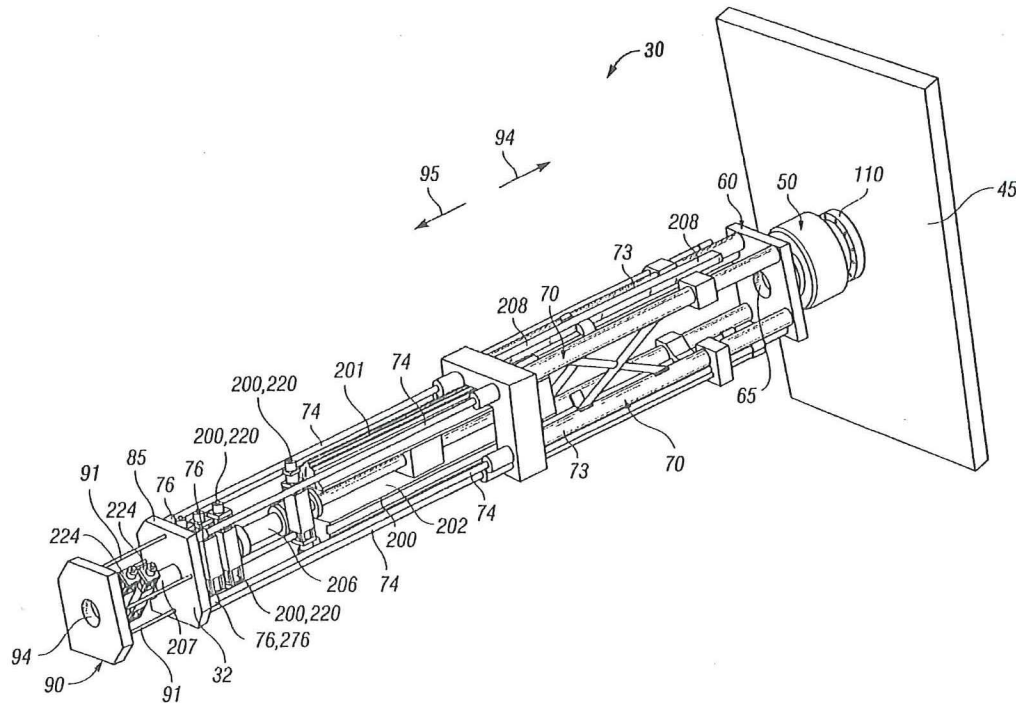
*Primary Examiner*—Thomas A Beach

(74) *Attorney, Agent, or Firm*—Greenberg Traurig LLP; Anthony F. Matheny

(57) **ABSTRACT**

The invention is directed to a tensioner for providing linear and angular movement of a drilling or production facility relative to a conduit or riser secured to the tensioner and to the wellhead in offshore operations. The tensioner compensates for vessel motion induced by wave action and heave and maintains a variable tension to the riser string alleviating the potential for compression and thus buckling or failure of the riser string. The tensioner of the present invention preferably includes at least one top load plate that facilitates easy and quick installation and removal of the tensioner from the rig floor of the vessel or platform. The tensioner also facilitates the placement of at least one piece of equipment disposed within the area formed by the tensioning cylinders. The tensioner may also include one or more pieces of equipment, e.g., a rotary table, integrally formed with the tensioner to further increase the ease and speed of installation and removal of the tensioner from the rig floor. Methods for installing and removing tensioners from the rig floor are also disclosed.

**25 Claims, 6 Drawing Sheets**



[54] HYDROPNEUMATIC CABLE TENSIONER  
 [75] Inventor: Larry B. Jordan, Houston, Tex.  
 [73] Assignee: Retsco, Inc., Houston, Tex.  
 [21] Appl. No.: 516,102  
 [22] Filed: Jul. 22, 1983  
 [51] Int. Cl.<sup>3</sup> ..... B25B 25/00; B66D 1/50  
 [52] U.S. Cl. .... 254/228; 254/277;  
 254/386; 254/392  
 [58] Field of Search ..... 254/228, 272, 277, 386,  
 254/392; 92/143

919768 2/1963 United Kingdom ..... 254/228

Primary Examiner—Stuart S. Levy  
 Assistant Examiner—Joseph J. Hail, III  
 Attorney, Agent, or Firm—Baker & Kirk

[57] ABSTRACT

A hydropneumatic cable tensioner is comprised of an enclosed cylinder featuring a plurality of annular chambers. A fixed cable sheave is mounted to one end of the cylinder. A movable cable sheave is mounted to a piston rod connected to a piston which reciprocates in the innermost or piston bore chamber of the cylinder. Regulated compressed gas is connected to the outer chamber of the cylinder thereby exerting high pressure forces on oil found in the middle or high pressure oil chamber of the cylinder. Pressurized oil forces a piston to move outwardly thereby increasing the distance between the two sheaves and tensioning a cable. Restriction means within the piston bore chamber regulate movement of the piston and prevent uncontrolled acceleration should a cable failure occur.

[56] References Cited

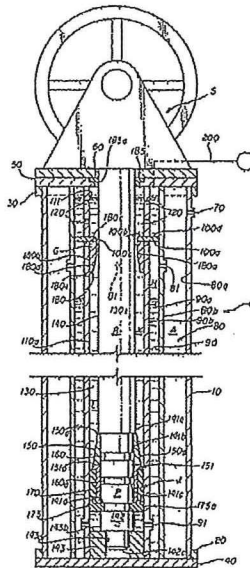
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12110 of 1884 United Kingdom .

8 Claims, 5 Drawing Figures







**REPUBLIC OF SINGAPORE  
THE PATENT ACT (CHAPTER 221)  
CERTIFICATE ISSUED UNDER SECTION 35**

*I HEREBY CERTIFY that under the provisions of the Patent Act, a patent has been granted in respect of an invention having the following particulars:*

**TITLE** : LINEAR PIPE RECOVERY/LAY TENSIONERS AND METHODS OF USING SAME

**APPLICATION NUMBER** : 2013004718

**PATENT NUMBER** : 192370

**DATE OF FILING** : 21 JANUARY 2013

**PRIORITY DATA** : 24 JANUARY 2012 - PATENT APPLICATION NO. 13/357,007 (UNITED STATES OF AMERICA)

**NAME OF INVENTOR(S)** : PATRICK K. ALLOWAY;  
KEVIN L. PRESTON;  
LOREN D. SKILES

**NAME(S) AND ADDRESS(ES) OF PROPRIETOR(S) OF PATENT** : CONTROL FLOW INC.  
9201 FAIRBANKS NORTH HOUSTON ROAD,  
HOUSTON, TEXAS 77064  
UNITED STATES OF AMERICA

**DATE OF GRANT** : 16 February 2017

DATED THIS 16<sup>th</sup> DAY OF FEBRUARY 2017



Daren Tang Heng Shim  
Registrar of Patents  
Singapore



US008821069B2

(12) **United States Patent**  
**Alloway et al.**

(10) **Patent No.:** **US 8,821,069 B2**  
(45) **Date of Patent:** **Sep. 2, 2014**

(54) **LINEAR PIPE RECOVERY/LAY TENSIONERS AND METHODS OF USING SAME**

(75) Inventors: **Patrick K. Alloway**, Magnolia, TX (US); **Kevin L. Preston**, Houston, TX (US); **Loren D. Skiles**, Tomball, TX (US)

(73) Assignee: **Control Flow, Inc.**, Houston, TX (US)

(\*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 116 days.

(21) Appl. No.: **13/357,007**

(22) Filed: **Jan. 24, 2012**

(65) **Prior Publication Data**

US 2013/0189035 A1 Jul. 25, 2013

(51) **Int. Cl.**  
**F16L 1/23** (2006.01)  
**E21B 19/22** (2006.01)

(52) **U.S. Cl.**  
USPC ..... **405/168.4; 226/173**

(58) **Field of Classification Search**  
USPC ..... 405/166, 168.1, 168.4, 184; 226/172, 226/173, 188; 166/77.3; 74/162  
See application file for complete search history.

(56) **References Cited**

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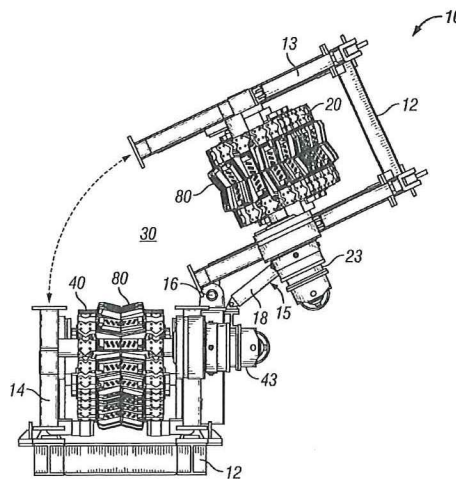
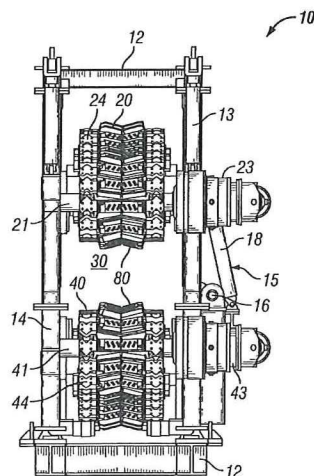
*Primary Examiner* — John Kreck

*Assistant Examiner* — Kyle Armstrong

(57) **ABSTRACT**

Linear pipe recovery/lay tensioners can include one or more pivot assemblies for rotatably moving an upper track away from a lower track to facilitate placement of a pipe segment between the two tracks. In addition, or alternatively, the tensioners can include one or more hydraulic cylinders that provide flexible suspension to the upper and lower tracks so the tracks can move and rotate as necessary due to differing pipe segment shapes. In addition, or alternatively, the upper and lower tracks include one or more gripping pad having one or more gripping member that is sheathed by a compliant member until such time as the pipe segment compresses the compliant member causing the gripping member(s) to protrude from the compliant member and bite into the pipe segment. Rotation of the tracks is controlled by a hydraulic pump capable of rotating the tracks at the same rate or at different rates.

**14 Claims, 6 Drawing Sheets**





US009671044B2

(12) **United States Patent**  
Alloway et al.

(10) Patent No.: **US 9,671,044 B2**  
(45) Date of Patent: **\*Jun. 6, 2017**

(54) **LINEAR PIPE RECOVERY/LAY TENSIONERS AND METHOD OF USING SAME**

(58) **Field of Classification Search**  
USPC ..... 405/166, 168.1, 168.4, 184; 226/172, 226/173, 188; 166/77.3; 74/162  
See application file for complete search history.

(71) Applicant: **Control Flow, Inc., Houston, TX (US)**

(56) **References Cited**

(72) Inventors: **Patrick K. Alloway, Waller, TX (US); Kevin L. Preston, Tomball, TX (US); Loren D. Skiles, Tomball, TX (US)**

**U.S. PATENT DOCUMENTS**

(73) Assignee: **Control Flow, Inc, Houston, TX (US)**

(\*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 29 days.

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This patent is subject to a terminal disclaimer.

*Primary Examiner* — Kyle Armstrong

(21) Appl. No.: **14/475,334**

(57) **ABSTRACT**

(22) Filed: **Sep. 2, 2014**

Linear pipe recovery/lay tensioners can include one or more pivot assemblies for rotatably moving an upper track away from a lower track to facilitate placement of a pipe segment between the two tracks. In addition, or alternatively, the tensioners can include one or more hydraulic cylinders that provide flexible suspension to the upper and lower tracks so the tracks can move and rotate as necessary due to differing pipe segment shapes. In addition, or alternatively, the upper and lower tracks include one or more gripping pads having one or more gripping members that can be sheathed by a compliant member until such time as the pipe segment compresses the compliant member causing the gripping member(s) to protrude from the compliant member and engage the pipe segment. Rotation of the tracks is controlled by a hydraulic pump capable of rotating the tracks at the same rate or at different rates.

(65) **Prior Publication Data**

US 2014/0369763 A1 Dec. 18, 2014

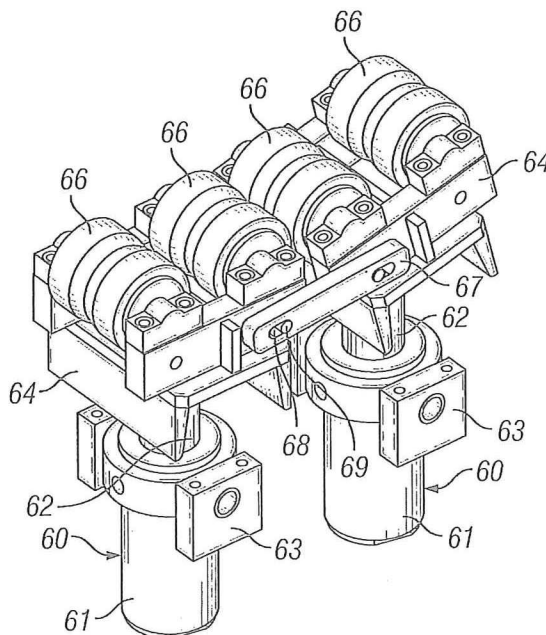
**Related U.S. Application Data**

(63) Continuation-in-part of application No. 13/357,007, filed on Jan. 24, 2012, now Pat. No. 8,821,069.

(51) **Int. Cl.**  
*F16L 1/23* (2006.01)  
*E21B 19/22* (2006.01)  
*B65H 51/14* (2006.01)

(52) **U.S. Cl.**  
CPC ..... *F16L 1/23* (2013.01); *B65H 51/14* (2013.01); *E21B 19/22* (2013.01)

**16 Claims, 8 Drawing Sheets**





US 20090008513A1

(19) **United States**  
(12) **Patent Application Publication**  
**Preston et al.**

(10) **Pub. No.: US 2009/0008513 A1**  
(43) **Pub. Date: Jan. 8, 2009**

(54) **PIPE ROLLER ASSEMBLY**

**Publication Classification**

(75) Inventors: **Kevin L. Preston**, Tomball, TX (US); **H. Paul Reinhardt, JR.**, Houston, TX (US); **Loren D. Skiles**, Tomball, TX (US)

(51) **Int. Cl.**  
*F16L 3/16* (2006.01)  
(52) **U.S. Cl.** ..... 248/55; 242/397.3; 242/615.2; 248/371

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Houston, TX 77002 (US)

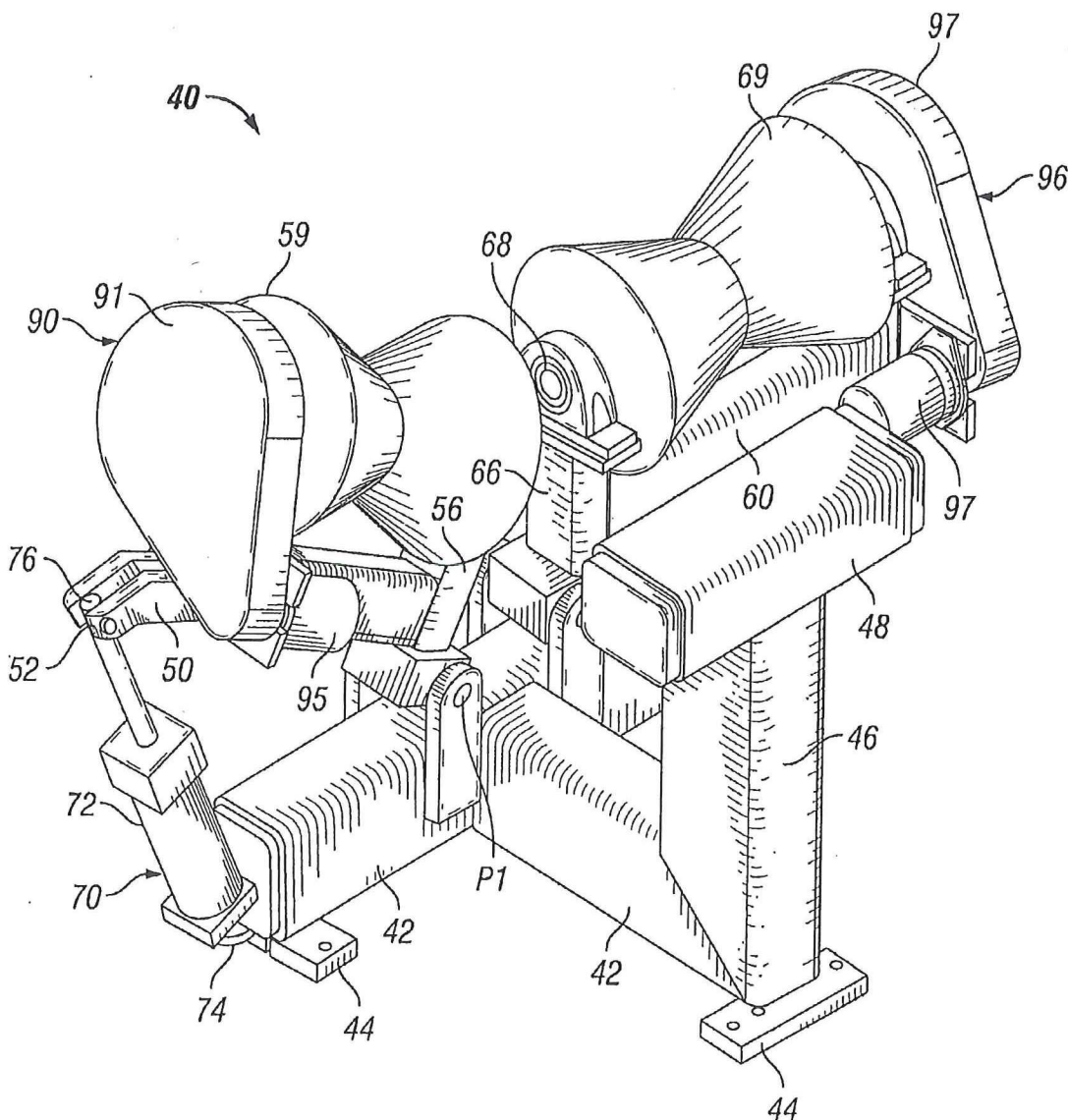
(57) **ABSTRACT**

Roller assemblies for transporting and laterally shifting pipe section, or joints, on oil and gas exploration and production laybarges, drilling/production vessels and platforms, and pipe spooling yards are disclosed. The roller assemblies comprise rollers that are capable of being tilted to facilitate lateral shifting of the pipe sections or joints. The roller assemblies comprise a frame, a tilting assembly, a roller frame pivotally connected to the tilting assembly and the frame, and a roller rotatably connected to the roller frame by an axle. The tilting assembly lifts one end of the roller frame to tilt the roller.

(73) Assignee: **CONTROL FLOW INC.**

(21) Appl. No.: **11/824,640**

(22) Filed: **Jul. 2, 2007**





US007815032B2

(12) **United States Patent**  
**Preston et al.**

(10) **Patent No.:** ✓ **US 7,815,032 B2**  
(45) **Date of Patent:** **Oct. 19, 2010**

(54) **PIPE ROLLER ASSEMBLY**

(75) Inventors: **Kevin L. Preston**, Tomball, TX (US); **H. Paul Reinhardt, Jr.**, Houston, TX (US); **Loren D. Skiles**, Tomball, TX (US)

(73) Assignee: **Control Flow Inc.**, Houston, TX (US)

(\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 649 days.

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(21) Appl. No.: **11/824,640**

(22) Filed: **Jul. 2, 2007**

(65) **Prior Publication Data**

US 2009/0008513 A1 Jan. 8, 2009

(51) **Int. Cl.**  
**B65G 47/46** (2006.01)

(52) **U.S. Cl.** ..... **198/369.6**; 198/369.3; 198/370.09; 198/463.2

(58) **Field of Classification Search** ..... 198/370.04, 198/370.09, 597, 598, 369.3, 369.4, 369.6, 198/782, 786, 463.2, 463.3; 414/22.65, 745.4, 414/746.7, 746.4

See application file for complete search history.

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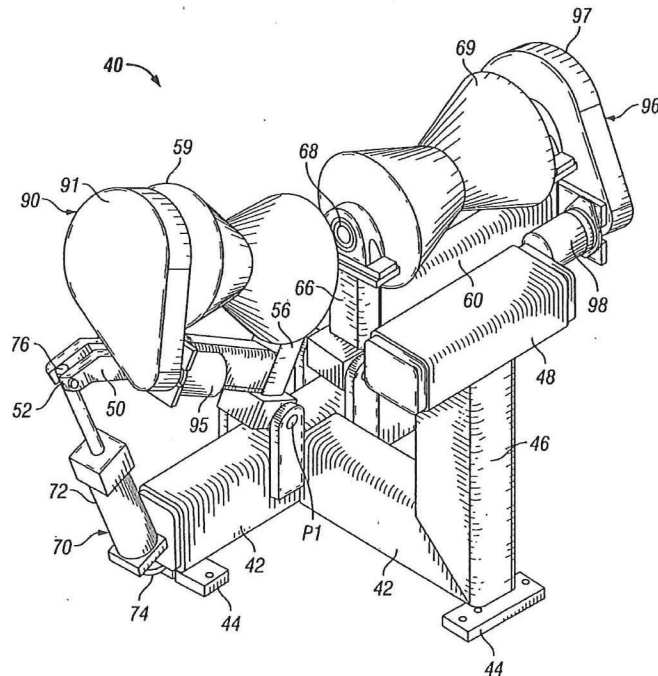
*Primary Examiner*—James R Bidwell

(74) *Attorney, Agent, or Firm*—Greenberg Traurig LLP; Anthony F. Matheny

(57) **ABSTRACT**

Roller assemblies for transporting and laterally shifting pipe section, or joints, on oil and gas exploration and production laybarges, drilling/production vessels and platforms, and pipe spooling yards are disclosed. The roller assemblies comprise rollers that are capable of being tilted to facilitate lateral shifting of the pipe sections or joints. The roller assemblies comprise a frame, a tilting assembly, a roller frame pivotally connected to the tilting assembly and the frame, and a roller rotatably connected to the roller frame by an axle. The tilting assembly lifts one end of the roller frame to tilt the roller.

**21 Claims, 2 Drawing Sheets**





THE REGISTRY OF PATENTS  
SINGAPORE

THE PATENTS ACT  
(CHAPTER 221)

CERTIFICATE OF GRANT OF PATENT

In accordance with section 35 of the Patents Act, it is hereby certified that a patent having the P-No. 148984 has been granted in respect of an invention having the following particulars:

Title : PIPE ROLLER ASSEMBLY

Application Number : 200804979-3

Date of Filing : 02 July 2008

Priority Data : 2 July 2007 - PATENT APPLICATION NO.  
11/824,640 (UNITED STATES OF AMERICA)

Name of Inventor(s) : KEVIN L. PRESTON; H. PAUL REINHARDT, JR.,;  
LOREN D. SKILES

Name(s)  
and Address(es) of  
Proprietor(s) of Patent : CONTROL FLOW INC.  
9201 FAIRBANKS NORTH HOUSTON ROAD  
HOUSTON, TEXAS 77064  
UNITED STATES OF AMERICA

Date of Grant : 15 March 2011

Dated this 15th day of March 2011.

Liew Woon Yin (Ms)  
Registrar of Patents  
Singapore



(12) PATENT

(19) NO

(11) 329534 ✓

(13) B1

NORGE

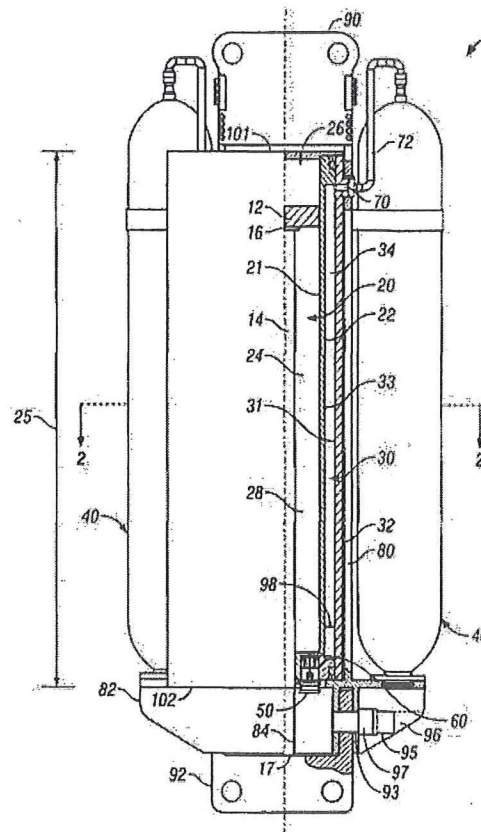
(51) Int Cl.  
E21B 19/09 (2006.01)

### Patentstyret

(21)	Søknadsnr	20035286	(86)	Int.inng.dag og søknadsnr	
(22)	Inng.dag	→ 2003.11.28	(85)	Videreføringsdag	
(24)	Løpedag	2003.11.28	(30)	Prioritet	2002.12.09, US, 314747
(41)	Alm.tilgj	2004.06.10			
(45)	Meddelt	2010.11.08			
(73)	Innehaver	Control Flow Inc, 9201 Fairbanks North Houston Road, US-TX77064 HOUSTON, USA			
(72)	Oppfinner	Lacey C Coffey, Houston, TX, US-, USA Richard D Williams, Sugar Land, TX 77008, US-, USA			
(74)	Fullmektig	Acapo AS, Postboks 1880 Nordnes, 5817 BERGEN, Norge			

(54)	Benevnelse	<b>Bærbar borestrengkompensator</b>	✓(Portable Drill String Compensator)
(56)	Anførte publikasjoner	US4799827, US4638978, US3841607	
(57)	Sammendrag		

Det omtales et lukket borestrengkompensatorsystem med en hydraulisk fluidakkumulator, minst én lufttrykkbeholder, og et stempel og en stempelstang glidbart innkoblet i en sylinder. Borestrengkompensatoren frembringer strekkkrefter for å støtte en borestreng og muliggjør at et borefartøy kan bli værende koblet til borestrengen under havnivåendringer forårsaker av bølgebevegelse eller hiv. I én utførelse omgir akkumulatoren sylindere og minst én lufttrykkbeholder er radially anordnet rundt akkumulatoren og sylindere. I en annen utførelse omgir akkumulatoren sylindere og omfatter 2 porter, én port for å muliggjøre fluidkommunikasjon mellom sylindere og akkumulatoren og en andre port for å muliggjøre fluidkommunikasjon mellom akkumulatoren og lufttrykkbeholderen, hvor den første porten omfatter en avstengningsventil anordnet deri. Det er også omtalt en fremgangsmåte for kompensering av en borestreng.





US006968900B2

(12) **United States Patent**  
**Williams et al.**

(10) **Patent No.:** **US 6,968,900 B2**  
(45) **Date of Patent:** **Nov. 29, 2005**

(54) **PORTABLE DRILL STRING COMPENSATOR**

(75) Inventors: **Richard D. Williams**, Sugar Land, TX (US); **Lacey C. Coffey**, Houston, TX (US)

(73) Assignee: **Control Flow Inc.**, Houston, TX (US)

(\*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 255 days.

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4,479,550 A	10/1984	Kühn et al.
4,487,150 A	12/1984	Shanks

(Continued)

(21) Appl. No.: **10/314,747**

(22) Filed: **Dec. 9, 2002**

(65) **Prior Publication Data**

US 2004/0108117 A1 Jun. 10, 2004

(51) **Int. Cl.**<sup>7</sup> ..... **E21B 43/01**

(52) **U.S. Cl.** ..... **166/355; 405/224.4; 405/224.3**

(58) **Field of Search** ..... **166/355; 405/224.3, 405/224.4, 223.1, 224.1**

(56) **References Cited**

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3,680,644 A	8/1972	Doughty
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3,841,607 A	10/1974	Larralde et al.
3,897,045 A	7/1975	Butler
3,955,621 A	5/1976	Webb
4,004,532 A	1/1977	Reynolds
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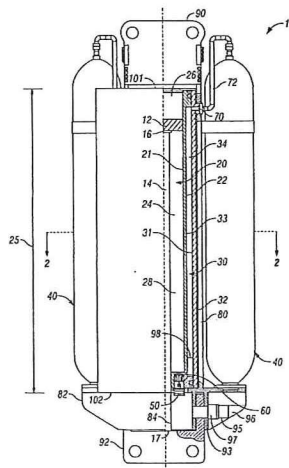
*Primary Examiner*—David Bagnell

(74) *Attorney, Agent, or Firm*—Andrews Kurth LLP; Anthony F. Matheny

(57) **ABSTRACT**

A closed system drill string compensator having a hydraulic fluid accumulator, at least one air pressure vessel, and a piston and a piston rod slidably engaged within a cylinder. The drill string compensator provides tensioning force for supporting a drill string and permits the drilling vessel to remain connected to the drill string during ocean level changes caused by wave action or ocean heave. In one embodiment, the accumulator surrounds the cylinder and at least one air pressure vessel is radially disposed around the accumulator and the cylinder. In another embodiment, the accumulator surrounds the cylinder and includes two ports, one port for permitting fluid communication between the cylinder and the accumulator and a second port for permitting fluid communication between the accumulator and the air pressure vessel, the first port including a shut-off valve disposed therein. Methods of compensating a drill string are also disclosed.

**17 Claims, 3 Drawing Sheets**





THE REGISTRY OF PATENTS  
SINGAPORE ✓

THE PATENTS ACT  
(CHAPTER 221)

**CERTIFICATE OF GRANT OF PATENT**

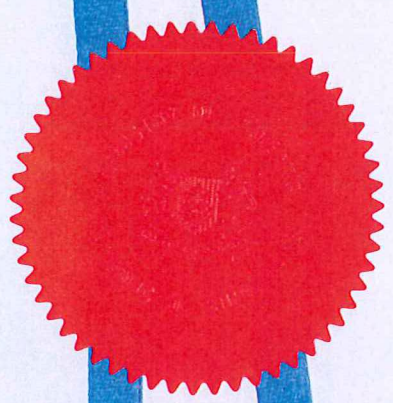
In accordance with section 35 of the Patents Act, it is hereby certified that a patent having the P-No. 115591 has been granted in respect of an invention having the following particulars:

Title : PORTABLE DRILL STRING COMPENSATOR  
Application Number : 200306898-8  
Date of Filing : 19 November 2003  
Priority Data : 09 December 2002 - PATENT APPLICATION NO.  
US 10/314,747 (UNITED STATES OF AMERICA)  
Name of Inventor(s) : RICHARD D. WILLIAMS; LACEY C. COFFEY  
Name(s) and Address(es) of Proprietor(s) of Patent : CONTROL FLOW, INC.  
9201 FAIRBANKS NORTH HOUSTON ROAD  
HOUSTON, TEXAS 77064  
UNITED STATES OF AMERICA  
Date of Grant : 31 August 2006

Dated this 31st day of August 2006.



Liew Woon Yin (Ms)  
Registrar of Patents,  
Singapore.





US007131496B2

(12) **United States Patent**  
**Williams et al.**

(10) **Patent No.:** **US 7,131,496 B2**  
(45) **Date of Patent:** **\*Nov. 7, 2006**

(54) **PORTABLE DRILL STRING COMPENSATOR**

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5,392,853 A \* 2/1995 Toon ..... 166/187

(75) Inventors: **Richard D. Williams**, Sugar Land, TX (US); **Lacey C. Coffey**, Houston, TX (US)

**OTHER PUBLICATIONS**

(73) Assignee: **Control Flow Inc.**, Houston, TX (US)

U.S. Appl. Ser. No. 10/314,747, filed Dec. 9, 2002, last amended May 23, 2005.\*

(\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

\* cited by examiner

This patent is subject to a terminal disclaimer.

*Primary Examiner*—David Bagnell  
*Assistant Examiner*—G M Collins  
(74) *Attorney, Agent, or Firm*—Bracewell & Giuliani LLP; Anthony F. Matheny

(21) Appl. No.: **11/182,636**

(57) **ABSTRACT**

(22) Filed: **Jul. 15, 2005**

(65) **Prior Publication Data**

US 2005/0247452 A1 Nov. 10, 2005

**Related U.S. Application Data**

(63) Continuation of application No. 10/314,747, filed on Dec. 9, 2002, now Pat. No. 6,968,900.

A closed system drill string compensator having a hydraulic fluid accumulator, at least one air pressure vessel, and a piston and a piston rod slidably engaged within a cylinder. The drill string compensator provides tensioning force for supporting a drill string and permits the drilling vessel to remain connected to the drill string during ocean level changes caused by wave action or ocean heave. In one embodiment, the accumulator surrounds the cylinder and at least one air pressure vessel is radially disposed around the accumulator and the cylinder. In another embodiment, the accumulator surrounds the cylinder and includes two ports, one port for permitting fluid communication between the cylinder and the accumulator and a second port for permitting fluid communication between the accumulator and the air pressure vessel, the first port including a shut-off valve disposed therein. Methods of compensating a drill string are also disclosed.

(51) **Int. Cl.**  
**E21B 43/01** (2006.01)

(52) **U.S. Cl.** ..... **166/355; 405/224.2; 405/224.3**

(58) **Field of Classification Search** ..... **166/355; 405/224.1, 224.3, 224.4, 223.1**

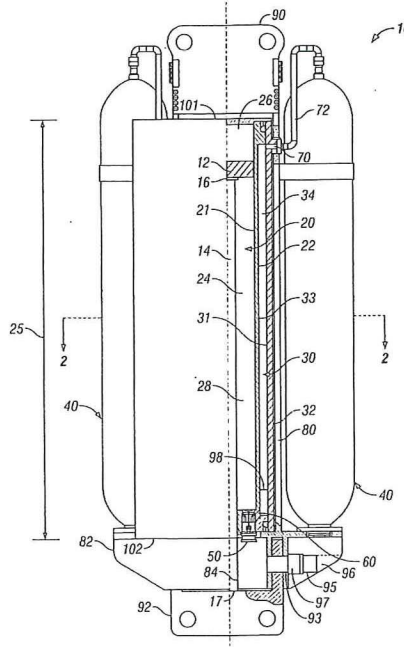
See application file for complete search history.

(56) **References Cited**

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**14 Claims, 3 Drawing Sheets**





Assinado  
Digitalmente

**REPÚBLICA FEDERATIVA DO BRASIL**  
**MINISTÉRIO DA INDÚSTRIA, COMÉRCIO EXTERIOR E SERVIÇOS**  
**INSTITUTO NACIONAL DA PROPRIEDADE INDUSTRIAL**

## CARTA PATENTE Nº PI 0307860-4

O INSTITUTO NACIONAL DA PROPRIEDADE INDUSTRIAL concede a presente PATENTE DE INVENÇÃO

(21) Número do Depósito: PI 0307860-4

(22) Data do Depósito: 01/12/2003

(43) Data da Publicação do Pedido: 07/12/2004

(51) Classificação Internacional: E21B 19/09

(30) Prioridade Unionista: US 10/314,747 de 09/12/2002

(54) Título: COMPENSADOR PORTÁTIL DE COLUNA DE PERFURADOR E PROCESSO DE UTILIZAÇÃO DO MESMO (Portable Drill String Compensator) ✓

(73) Titular: CONTROL FLOW, INC. Endereço: 9201 Fairbanks North Houston Road, Houston, Texas 77064, ESTADOS UNIDOS DA AMÉRICA(US)

(72) Inventor: RICHARD D. WILLIAMS; LACEY C. COFFEY

Prazo de Validade: 10 (dez) anos contados a partir de 21/02/2017, observadas as condições legais ✓

Expedida em: 21 de Fevereiro de 2017.

Assinado digitalmente por:  
**Júlio César Castelo Branco Reis Moreira**  
Diretor de Patente

REPÚBLICA FEDERATIVA DO BRASIL  
INSTITUTO NACIONAL DA PROPRIEDADE INDUSTRIAL

(19)



Europäisches Patentamt  
European Patent Office  
Office européen des brevets



(11)

**EP 1 428 973 B1**

(12)

**EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention  
of the grant of the patent:  
31.05.2006 Bulletin 2006/22

(51) Int Cl.:  
*E21B 19/09 (2006.01)*

(21) Application number: 03078680.0

(22) Date of filing: 19.11.2003 ←

(54) **Portable heave compensator**

Tragbarer Tauschwingungskompensator  
Compensateur de pilonnement portatif

(84) Designated Contracting States:  
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR  
HU IE IT LI LU MC NL PT RO SE SI SK TR

(30) Priority: 09.12.2002 US 314747

(43) Date of publication of application:  
16.06.2004 Bulletin 2004/25

(73) Proprietor: **Control Flow Inc.**  
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(72) Inventors:  
• **Williams, Richard D.**  
Sugar Land, 77478 Texas (US)

• **Coffey, Lacey C.**  
Houston, 77075 Texas (US)

(74) Representative: **Newstead, Michael John et al**  
**Page Hargrave**  
**Southgate**  
**Whitefriars**  
**Lewins Mead**  
**Bristol BS1 2NT (GB)**

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US-A- 3 841 607                   US-A- 4 449 854  
US-A- 4 638 978                   US-A- 4 799 827

**EP 1 428 973 B1**

Note: Within nine months from the publication of the mention of the grant of the European patent, any person may give notice to the European Patent Office of opposition to the European patent granted. Notice of opposition shall be filed in a written reasoned statement. It shall not be deemed to have been filed until the opposition fee has been paid. (Art. 99(1) European Patent Convention).



(12) PATENT

(19) NO

(11) 324759 ✓

(13) B1

NORGE

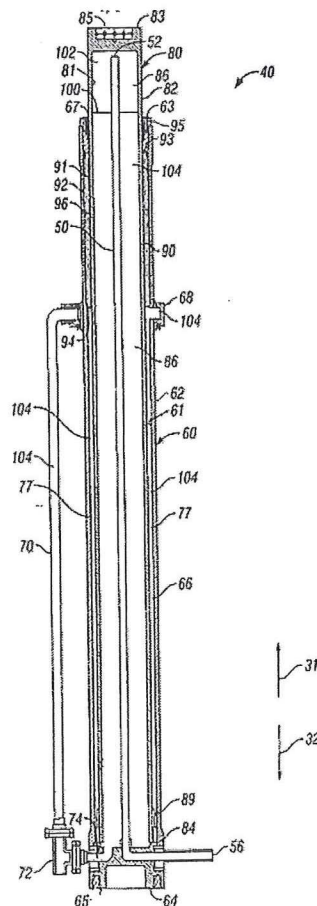
(51) Int Cl.  
E21B 19/09 (2006.01)

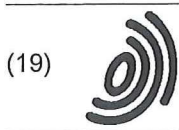
Patentstyret

(21)	Søknadsnr	20035285	(86)	Int.inng.dag og søknadsnr	
(22)	Inng.dag	2003.11.28 ←	(85)	Videreføringdag	
(24)	Løpedag	2003.11.28	(30)	Prioritet	2002.12.09, US, 314710
(41)	Alm.tilgj	2004.06.10			
(45)	Meddelt	2007.12.10			
(73)	Innehaver	Control Flow Inc, 9201 Fairbanks North Houston Road, TX77064 HOUSTON, US			
(72)	Oppfinner	Lacey C Coffey, Houston, TX, US Richard D Williams, Sugar Land, TX 77008, US			
(74)	Fullmektig	Acapo AS, Postboks 1880 Nordnes, 5817 BERGEN			

(54)	Benevnelse	<b>Strekkanordning med integrert hydraulisk fluidakkumulator</b>
(56)	Anførte publikasjoner	US 3897045, US 4638978, US 5252004
(57)	Sammendrag	

Oppfinnelsen er rettet mot en strekksammenstilling for å frembringe strekk-krefter fra et flytende fartøy ved overflaten av havet til utblåsningssikrings-stack'en, eller produksjonstreet, som er koblet til brønnhoder på sjøbunnen. Strekksammenstillingen kompenserer for fartøybevegelser påført av bølgebevegelse og hiv og opprettholder et variabelt strekk på stigerørstrengen som reduserer mulighet for sammentrekning og således knekking eller feil på stigerørstrengen. Strekksammenstillingen ifølge oppfinnelsen omfatter en sylinder, et stopprør anordnet i sylindern og et slagstempel glidbart i kontakt med stopprøret. Strekksammenstillingen omfatter også minst ett gass- eller luft-overføringsrør for å frembringe et trykksatt luft-over-hydraulisk fluid-arrangement for å frembringe strekk-krefter til strekksammenstillingen.





Europäisches Patentamt  
European Patent Office  
Office européen des brevets



(11) **EP 1 428 971 B1**

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention  
of the grant of the patent:  
**03.05.2006 Bulletin 2006/18**

(51) Int Cl.:  
**E21B 19/00 (2006.01)**

(21) Application number: **03257691.0**

(22) Date of filing: **08.12.2003**

(54) **Tensioner assembly having integral hydraulic fluid accumulator (Ram-Type) ✓**

Spannanordnungsvorrichtung mit integriertem Druckmittelspeicher

Ensemble de tension ayant un accumulateur de fluide sous-pressure intégré

(84) Designated Contracting States:  
**AT BE BG CH CY CZ DE DK EE ES FI FR GB GR  
HU IE IT LI LU MC NL PT RO SE SI SK TR**  
Designated Extension States:  
**AL LT LV MK**

(72) Inventors:  
• **Williams, Richard**  
**Sugarland, Texas 77478 (US)**  
• **Coffey, Lacey**  
**Texas 77075 (US)**

(30) Priority: **09.12.2002 US 314710**

(74) Representative: **Brown, David Leslie**  
**HASELTINE LAKE,**  
**Redcliff Quay**  
**120 Redcliff Street**  
**Bristol BS1 6HU (GB)**

(43) Date of publication of application:  
**16.06.2004 Bulletin 2004/25**

(73) Proprietor: **Control Flow Inc.**  
**Houston, TX 77064 (US)**

(56) References cited:  
**US-A- 3 897 045** **US-A- 4 638 978**  
**US-A- 5 252 004**

**EP 1 428 971 B1**

Note: Within nine months from the publication of the mention of the grant of the European patent, any person may give notice to the European Patent Office of opposition to the European patent granted. Notice of opposition shall be filed in a written reasoned statement. It shall not be deemed to have been filed until the opposition fee has been paid. (Art. 99(1) European Patent Convention).



US007008340B2

(12) **United States Patent**  
**Williams et al.**

(10) **Patent No.:** **US 7,008,340 B2**  
(45) **Date of Patent:** **Mar. 7, 2006**

(54) **RAM-TYPE TENSIONER ASSEMBLY  
HAVING INTEGRAL HYDRAULIC FLUID  
ACCUMULATOR**

(75) Inventors: **Richard D. Williams**, Sugar Land, TX  
(US); **Lacey C. Coffey**, Houston, TX  
(US)

(73) Assignee: **Control Flow Inc.**, Houston, TX (US)

(\*) Notice: Subject to any disclaimer, the term of this  
patent is extended or adjusted under 35  
U.S.C. 154(b) by 238 days.

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4,215,950 A	8/1980	Stevenson	
4,222,341 A	9/1980	Larsen et al.	
4,272,059 A	6/1981	Noerager et al.	
4,317,586 A	3/1982	Campbell	

(21) Appl. No.: **10/314,710**

(Continued)

(22) Filed: **Dec. 9, 2002**

**FOREIGN PATENT DOCUMENTS**

(65) **Prior Publication Data**

FR 2484352 A1 \* 12/1981

US 2004/0110589 A1 Jun. 10, 2004

(Continued)

(51) **Int. Cl.**  
**F16H 7/08** (2006.01)  
**F16H 7/18** (2006.01)  
**F21B 29/12** (2006.01)

*Primary Examiner*—Marcus Charles  
(74) *Attorney, Agent, or Firm*—Andrews Kurth LLP;  
Anthony F. Matheny

(52) **U.S. Cl.** ..... **474/101; 474/110; 166/355;**  
405/224.4

(57) **ABSTRACT**

(58) **Field of Classification Search** ..... 474/101,  
474/110, 109; 175/5, 7, 8; 91/4 R, 4 A;  
166/355, 350, 346, 367; 405/224.3, 224.2,  
405/224.4

The invention is directed to a tensioner assembly for providing tensile force from a floating vessel at the surface of the ocean to the blowout preventer stack, or production tree, which is connected to the wellhead at the sea floor. The tensioner assembly compensates for vessel motion induced by wave action and heave and maintains a variable tension to the riser string alleviating the potential for compression and thus buckling or failure of the riser string. The tensioner assembly of the present invention includes a cylinder, a stop tube disposed with the cylinder, and a ram slidably engaged within the stop tube. The tensioner assembly also includes at least one gas, or air, transfer tube to create a pressurized air over hydraulic fluid arrangement to provide tensile force to the tensioner assembly.

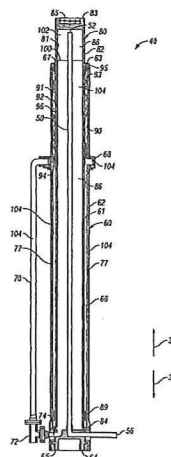
See application file for complete search history.

(56) **References Cited**

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3,280,908 A	10/1966	Todd	
3,313,345 A	4/1967	Fischer	
3,643,751 A	2/1972	Crickmer	
3,680,644 A	8/1972	Doughty	
3,718,316 A	2/1973	Larralde et al.	
3,793,835 A	2/1974	Larralde	

**6 Claims, 4 Drawing Sheets**



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THE REGISTRY OF PATENTS  
SINGAPORE

THE PATENTS ACT  
(CHAPTER 221)

CERTIFICATE OF GRANT OF PATENT

In accordance with section 35 of the Patents Act, it is hereby certified that a patent having the P-No. 125097 has been granted in respect of an invention having the following particulars:

Title : RAM-TYPE TENSIONER ASSEMBLY HAVING  
INTEGRAL HYDRAULIC FLUID  
ACCUMULATOR

Application Number : 200306913-5

Date of Filing : 19 November 2003

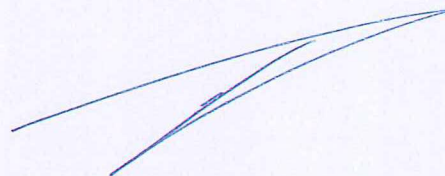
Priority Data : 9 December 2002 - PATENT APPLICATION NO.  
US 10/314,710 (UNITED STATES OF AMERICA)

Name of Inventor(s) : RICHARD D. WILLIAMS; LACEY C. COFFEY

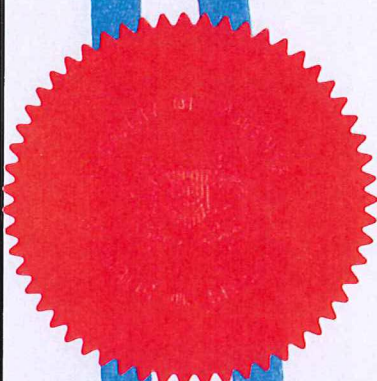
Name(s)  
and Address(es) of  
Proprietor(s) of Patent : CONTROL FLOW, INC.  
9201 FAIRBANKS NORTH HOUSTON ROAD  
HOUSTON, TEXAS 77064  
UNITED STATES OF AMERICA

Date of Grant : 31 October 2006

Dated this 31st day of October 2006.



Liew Woon Yin (Ms)  
Registrar of Patents,  
Singapore







US007131922B2

(12) **United States Patent**  
**Williams et al.**

(10) **Patent No.:** **US 7,131,922 B2**  
(45) **Date of Patent:** **Nov. 7, 2006**

(54) **RAM-TYPE TENSIONER ASSEMBLY  
HAVING INTEGRAL HYDRAULIC FLUID  
ACCUMULATOR**

(75) Inventors: **Richard D. Williams**, Sugar Land, TX  
(US); **Lacey C. Coffey**, Houston, TX  
(US)

(73) Assignee: **Control Flow Inc.**, Houston, TX (US)

(\* ) Notice: Subject to any disclaimer, the term of this  
patent is extended or adjusted under 35  
U.S.C. 154(b) by 0 days.

(21) Appl. No.: **11/368,076**

(22) Filed: **Mar. 3, 2006**

(65) **Prior Publication Data**

US 2006/0154764 A1 Jul. 13, 2006

**Related U.S. Application Data**

(62) Division of application No. 10/314,710, filed on Dec.  
9, 2002, now Pat. No. 7,008,340.

(51) **Int. Cl.**

**F16H 7/08** (2006.01)

**F16H 7/18** (2006.01)

**F21B 29/12** (2006.01)

(52) **U.S. Cl.** ..... **474/101; 474/110; 165/355;**  
405/224.5

(58) **Field of Classification Search** ..... **474/109-110,**  
474/101, 117; 405/224.3, 224.4; 166/346,  
166/350, 367, 355; 175/5-6  
See application file for complete search history.

(56) **References Cited**

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3,841,607 A \* 10/1974 Larralde et al. .... 254/392  
3,912,227 A \* 10/1975 Meeker et al. .... 254/271  
3,955,621 A \* 5/1976 Webb ..... 166/355  
4,272,059 A \* 6/1981 Noerager et al. .... 254/392  
4,432,420 A \* 2/1984 Gregory et al. .... 166/355  
4,479,550 A \* 10/1984 Kuhn et al. .... 173/112  
4,638,978 A \* 1/1987 Jordan ..... 254/228

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WO WO 97/43516 A1 \* 11/1997

\* cited by examiner

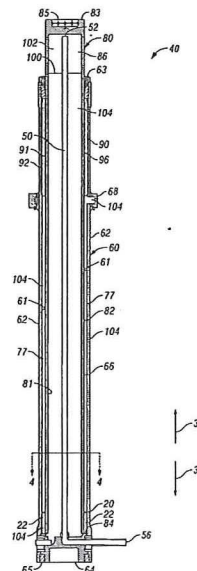
*Primary Examiner*—Marcus Charles

(74) *Attorney, Agent, or Firm*—Bracewell & Giuliani LLP;  
Anthony F. Matheny

(57) **ABSTRACT**

The invention is directed to a tensioner assembly for providing tensile force from a floating vessel at the surface of the ocean to the blowout preventer stack, or production tree, which is connected to the wellhead at the sea floor. The tensioner assembly compensates for vessel motion induced by wave action and heave and maintains a variable tension to the riser string alleviating the potential for compression and thus buckling or failure of the riser string. The tensioner assembly of the present invention includes a cylinder, a stop tube disposed with the cylinder, and a ram slidably engaged within the stop tube. The tensioner assembly also includes at least one gas, or air, transfer tube to create a pressurized air over hydraulic fluid arrangement to provide tensile force to the tensioner assembly.

**17 Claims, 4 Drawing Sheets**



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**REPÚBLICA FEDERATIVA DO BRASIL**  
MINISTÉRIO DO DESENVOLVIMENTO, INDÚSTRIA E COMÉRCIO EXTERIOR  
**INSTITUTO NACIONAL DA PROPRIEDADE INDUSTRIAL**

## CARTA PATENTE Nº PI 0306552-9

O INSTITUTO NACIONAL DA PROPRIEDADE INDUSTRIAL concede a presente PATENTE DE INVENÇÃO, que outorga ao seu titular a propriedade da invenção caracterizada neste título, em todo o território nacional, garantindo os direitos dela decorrentes, previstos na legislação em vigor.

(21) Número do Depósito: PI 0306552-9 ←

(22) Data do Depósito: 04/12/2003

(43) Data da Publicação do Pedido: 05/10/2004

(51) Classificação Internacional: E21B 17/00

(30) Prioridade Unionista: 09/12/2002 US 10/314,710

(54) Título: CONJUNTO TENSOR TIPO ÊMBOLO COM ACUMULADOR DE FLUIDO HIDRÁULICO INTEGRADO

(73) Titular: CONTROL FLOW, INC. Endereço: 9201 Fairbanks North Houston Road, Houston, Texas 77064, Estados Unidos (US).

(72) Inventor: RICHARD D. WILLIAMS

Prazo de Validade: 10 (dez) anos contados a partir de 13/01/2015, observadas as condições legais.

Expedida em: 13 de Janeiro de 2015. ←

Assinado digitalmente por:

**Liane Elizabeth Caldeira Lage**  
Diretora de Patentes Substituta

REPUBLICA FEDERATIVA DO BRASIL  
15 de Novembro  
de 1889



(12) **United States Patent**  
**Jordan**

(10) **Patent No.:** **US 6,834,723 B2**  
(45) **Date of Patent:** **Dec. 28, 2004**

→ (54) **SYSTEM AND METHOD FOR RISER RECOIL CONTROL**

(75) **Inventor:** Larry Russell Jordan, Houston, TX (US)

(73) **Assignee:** Cooper Cameron Corporation, Houston, TX (US)

(\*) **Notice:** Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 64 days.

(21) **Appl. No.:** 10/258,512

(22) **PCT Filed:** Apr. 27, 2001

(86) **PCT No.:** PCT/US01/13800

§ 371 (c)(1),  
(2), (4) **Date:** Oct. 24, 2002

(87) **PCT Pub. No.:** WO01/81164

**PCT Pub. Date:** Nov. 1, 2001

(65) **Prior Publication Data**

US 2003/0205382 A1 Nov. 6, 2003

**Related U.S. Application Data**

(60) **Provisional application No. 60/200,398, filed on Apr. 27, 2000.**

(51) **Int. Cl.<sup>7</sup>** ..... E21B 19/09

(52) **U.S. Cl.** ..... 166/355; 114/264; 166/367; 175/5

(58) **Field of Search** ..... 175/5, 7; 166/355, 166/354, 367; 114/264; 405/224.1, 224.2, 224.3, 224.4, 195.1

(56) **References Cited**

**U.S. PATENT DOCUMENTS**

4,351,261 A	9/1982	Shanks	114/264
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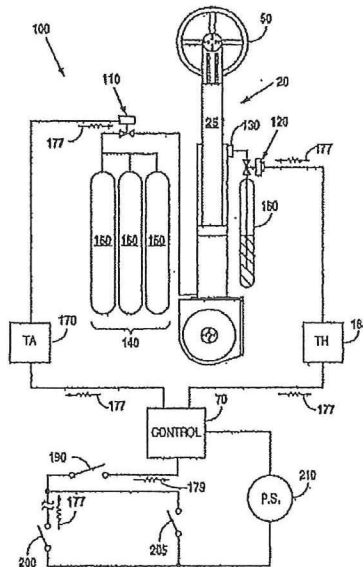
*Primary Examiner*—William Neuder

(74) *Attorney, Agent, or Firm*—Michael P. Hartman; Peter J. Bielinski

(57) **ABSTRACT**

A riser recoil control system (10) adjusts tension forces (F1, F2) applied to a marine riser (60), which is attached to an anchored, floating vessel (30) and a wellhead (80). The riser (60) is attached to the vessel (30) using tension forces (F1, F2) asserted by riser tensioners (20). Each tensioner (20) has an air shutoff valve (110), and an orifice-controlled fluid valve (120). A disconnection sensing means (200) provides a disconnect signal when the riser (60) is disconnected from the wellhead (80), which closes the valves (110, 120) and adjusts the tension forces (F1, F2) applied by the tensioners (20). The invention includes a method for adjusting the tension forces (F1, F2) applied to the riser (60), including sensing the disconnect signal and adjusting the tension forces (F1, F2) supplied to the riser (60) by closing the air shutoff valves (110) and partially closing the orifice-controlled fluid valves (120).

12 Claims, 3 Drawing Sheets





(12) PATENT

✓ Tensioner/Slip Joint Assembly

(19) NO

(11) 330547

(13) B1

NORGE

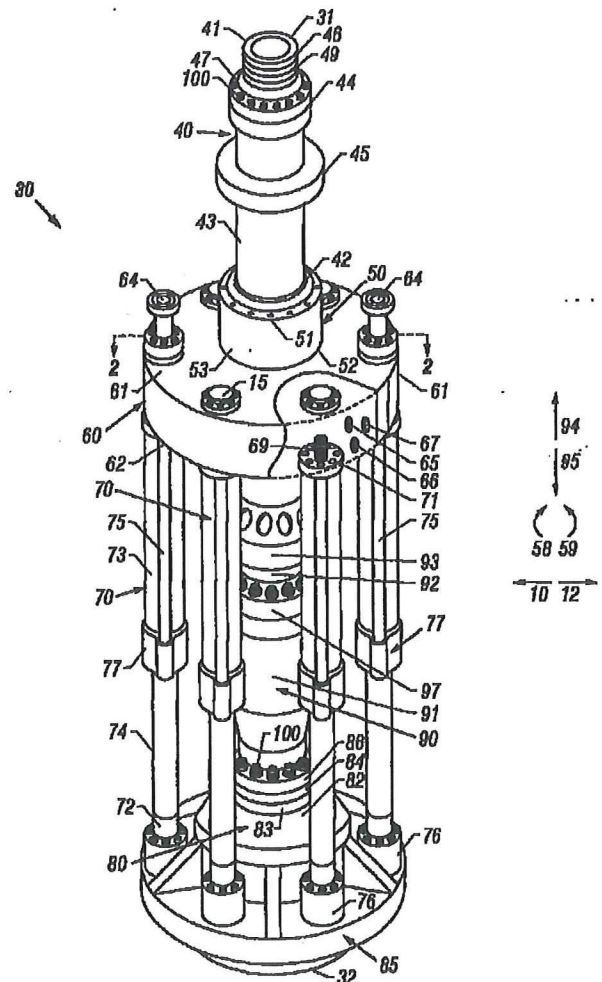
(51) Int Cl.  
E21B 19/00 (2006.01)

Patentstyret

(21)	Søknadsnr	20025469	(86)	Int.inng.dag og søknadsnr	2001.06.14 PCT/US2001/19371
(22)	Inng.dag	2002.11.15	(85)	Videreføringsdag	2002.11.15
(24)	Løpedag	2001.06.14 ←	(30)	Prioritet	2000.06.15, US, 211652
(41)	Alm.tilgj	2003.02.12			
(45)	Meddelt	2011.05.16			
(73)	Innehaver	Control Flow Inc, 9201 Fairbanks North Houston Road, TX77064 HOUSTON, USA			
(72)	Oppfinner	Graeme E Reynolds, 2053 Western Village, Houston, TX 77043, USA			
(74)	Fullmektig	Acapo AS, Postboks 1880 Nordnes, 5817 BERGEN, Norge			

(54)	Benevnelse	<b>Anordning ved glidekobling</b>
(56)	Anførte publikasjoner	US 4712620 A, US 5846028 A, US 5951061 A, US 4068868 A, US 5727630 A
(57)	Sammendrag	

Oppfinnelsen vedrører en strekk/glideskjøtmodul for å frembringe en rørledning fra et drivende fartøy på havets overflate til utblåsningssikringen, eller produksjonstøret, som er koblet til brønnhodet på havbunnen. Strekk/glideskjøtmodulen (30) kompensere for fartøyets bevegelse forårsaket av bølgenes påvirkning og løft og opprettholder en variabel strekk på stigerørsstrengen, som reduserer potensialet for kompresjon og således knekking eller sammenbrudd av stigerørsstrengen. Strekk/glideskjøtmodulen (30) i foreliggende oppfinnelse omfatter foretrukket minst en røropphengsforing (40) med minst en opphengsring (45); minst en øvre fleksibel dreieskjøtsammenstilling (50), minst en manifold med radiale åpninger (60), minst en strekksylinder (70) og minst en glideskjøtsammenstilling (90), satt sammen som en enhet.





US006739395B2

(12) **United States Patent**  
**Reynolds**

(10) **Patent No.:** **US 6,739,395 B2**  
(45) **Date of Patent:** **\*May 25, 2004**

- (54) **TENSIONER/SLIP-JOINT ASSEMBLY**
- (75) **Inventor:** **Graeme E. Reynolds, Houston, TX (US)**
- (73) **Assignee:** **Control Flow Inc., Houston, TX (US)**
- (\*) **Notice:** Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

3,848,668 A	*	11/1974	Sizer et al. ....	166/72
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4,808,035 A	*	2/1989	Stanton et al. ....	405/224.4
4,883,387 A	*	11/1989	Myers et al. ....	405/224.4
6,419,277 B1	*	7/2002	Reynolds .....	285/123.1

This patent is subject to a terminal disclaimer.

(21) **Appl. No.:** **10/342,996**

(22) **Filed:** **Jan. 15, 2003**

(65) **Prior Publication Data**

US 2003/0102134 A1 Jun. 5, 2003

**Related U.S. Application Data**

- (63) Continuation of application No. 09/881,139, filed on Jun. 14, 2001, now Pat. No. 6,530,430.
- (60) Provisional application No. 60/211,652, filed on Jun. 15, 2000.
- (51) **Int. Cl.<sup>7</sup>** ..... **E21B 29/12; E21B 12/01**
- (52) **U.S. Cl.** ..... **166/346; 166/355; 166/367**
- (58) **Field of Search** ..... **166/350, 359, 166/367, 355, 346; 405/224.4, 224.2**

(56) **References Cited**

**U.S. PATENT DOCUMENTS**

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*Primary Examiner*—Robert E. Pezzuto

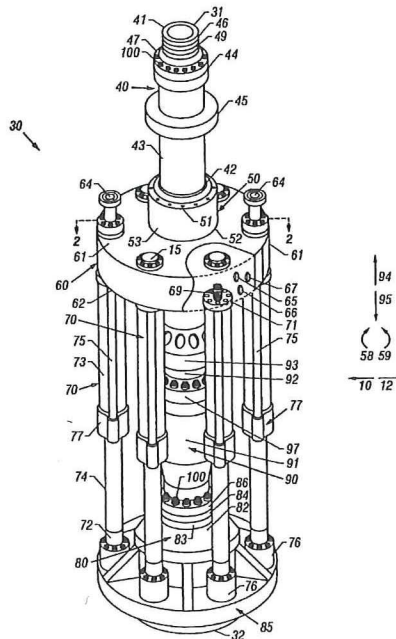
*Assistant Examiner*—Thomas A Beach

(74) *Attorney, Agent, or Firm*—Anthony F. Matheny; Andrews Kurth LLP

(57) **ABSTRACT**

The invention is directed to a tensioner/slip-joint module for providing a conduit from a floating vessel at the surface of the ocean to the blowout preventer stack, or production tree, which is connected to the wellhead at the sea floor. The tensioner/slip-joint module compensates for vessel motion induced by wave action and heave and maintains a variable tension to the riser string alleviating the potential for compression and thus buckling or failure of the riser string. The tensioner/slip-joint module of the present invention preferably includes at least one mandrel having at least one hang-off donut; at least one upper flexjoint swivel assembly, at least one radially ported manifold, at least one tensioning cylinder, and at least one slip-joint assembly combined in a single unit.

**24 Claims, 5 Drawing Sheets**





US006530430B2

(12) **United States Patent**  
**Reynolds**

(10) **Patent No.:** **US 6,530,430 B2**  
(45) **Date of Patent:** **Mar. 11, 2003**

(54) **TENSIONER/SLIP-JOINT ASSEMBLY**

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4,787,778 A	*	11/1988	Myers et al. .... 166/367
4,808,035 A	*	2/1989	Stanton et al. .... 166/355
4,883,387 A	*	11/1989	Myers et al. .... 166/367
5,727,630 A		3/1998	Brammer
5,846,028 A		12/1998	Thory
5,951,061 A		9/1999	Arlt, III et al.
6,419,277 B1	*	7/2002	Reynolds ..... 166/367

(75) **Inventor:** **Graeme E. Reynolds, Houston, TX (US)**

(73) **Assignee:** **Control Flow Inc., Houston, TX (US)**

(\* ) **Notice:** Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 30 days.

**FOREIGN PATENT DOCUMENTS**

(21) **Appl. No.:** **09/881,139**

GB	2141470 A	12/1984
WO	WO 97/43516	11/1997
WO	WO 00/24998	5/2000

(22) **Filed:** **Jun. 14, 2001**

(65) **Prior Publication Data**

\* cited by examiner

US 2002/0000321 A1 Jan. 3, 2002

**Related U.S. Application Data**

*Primary Examiner*—Thomas B. Will  
*Assistant Examiner*—Thomas A. Beach  
(74) *Attorney, Agent, or Firm*—Andrews & Kurth L.L.P.;  
Anthony F. Matheny

(60) **Provisional application No.** 60/211,652, filed on Jun. 15, 2000.

(51) **Int. Cl.<sup>7</sup>** ..... **E21B 29/12; E21B 12/01**

(52) **U.S. Cl.** ..... **166/346; 166/355; 166/367**

(58) **Field of Search** ..... 166/350, 359,  
166/367, 355, 346; 405/224.4, 224.2

(57) **ABSTRACT**

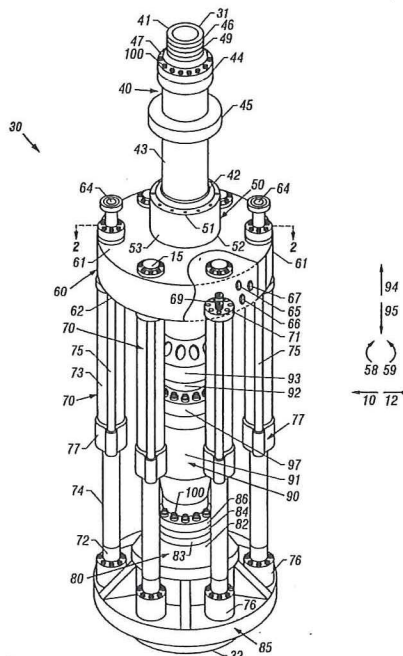
A tensioner/slip-joint module for providing a conduit from a floating vessel at the surface of the ocean to the blowout preventer stack, or production tree, which is connected to the wellhead at the sea floor. The tensioner/slip-joint module compensates for vessel motion induced by wave action and heave and maintains a variable tension to the riser string alleviating the potential for compression and thus buckling or failure of the riser string. The tensioner/slip-joint module preferably includes at least one mandrel having at least one hang-off donut; at least one upper flexjoint swivel assembly, at least one radially ported manifold, at least one tensioning cylinder, and at least one slip-joint assembly combined in a single unit.

(56) **References Cited**

**U.S. PATENT DOCUMENTS**

3,280,908 A	*	10/1966	Todd	.....	166/340
3,313,345 A	*	4/1967	Fischer	.....	166/355
3,643,751 A		2/1972	Crickmer		
3,955,621 A	*	5/1976	Webb	.....	166/355
4,068,868 A		1/1978	Ohrt		
4,215,950 A	*	8/1980	Stevenson	.....	114/264
4,317,586 A	*	3/1982	Campbell	.....	285/145.4
4,367,981 A	*	1/1983	Shapiro	.....	166/355
4,379,657 A	*	4/1983	Widiner et al.	.....	405/168.4

**24 Claims, 5 Drawing Sheets**



THE REGISTRY OF PATENTS  
SINGAPORE

THE PATENTS ACT  
(CHAPTER 221)

**CERTIFICATE OF GRANT OF PATENT**

In accordance with section 35 of the Patents Act, it is hereby certified that a patent having the P-No. 93649 [WO 01/96706] has been granted in respect of an invention having the following particulars:

Title : TENSIONER/SLIP-JOINT ASSEMBLY

Application Number : 200207553-9

Date of Filing : 14 June 2001

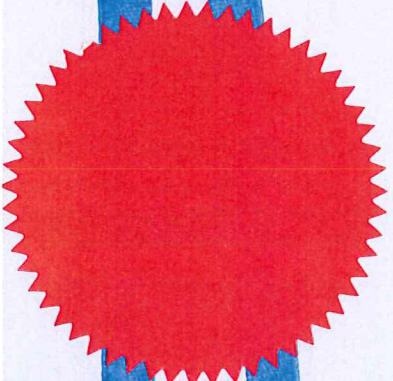
Priority Data : 15 June 2000 - PATENT APPLICATION NO.  
60/211,652 (UNITED STATES OF AMERICA)

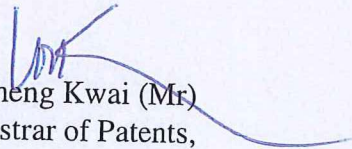
Name of Inventor(s) : REYNOLDS, GRAEME, E.

Name(s) and Address(es) of Proprietor(s) of Patent : CONTROL FLOW, INC.  
9201 FAIRBANKS N. HOUSTON ROAD,  
HOUSTON, TEXAS 77064  
UNITED STATES OF AMERICA

Date of Grant : 31 January 2005

Dated this 31st day of January 2005.



  
Wong Sheng Kwai (Mr)  
Acting Registrar of Patents,  
Singapore.



SUOMI - FINLAND  
(FI)

PATENTTI- JA REKISTERIHALLITUS  
PATENT- OCH REGISTERSTYRELSEN

✓ Tensioner/Slip-Joint Assembly

- (12) EUROOPAN PATENTTIJULKAISUN KÄÄNNÖS  
ÖVERSÄTTNING AV EUROPEISK PATENTSKRIFT
- (10) **FI/EP1295009 T3**
- (45) Käännöksen kuul. pvm - Övers. kungörelsedag 14.07.2006
- (80) Euroopan patentin myöntämispäivä -  
Meddelandedatum för det europeiska patentet ✓ 29.03.2006
- (51) Kv.lk. - Int.kl.  
**E21B 19/00 (2006.01)**
- (86) Euroopan patentihakemus - Europeisk patentansökan EP01948420.3
- (86) (24) Alkupäivä - Löpdag 14.06.2001
- (87) EP-hakemuksen julkiseksi tulo pvm -  
EP-ansökans publiceringsdag 26.03.2003
- (86) Kv. hakemus - Int. ansökan PCT/ US2001019371
- (30) Etuoikeus - Prioritet  
15.06.2000 US 211652 P

(73) Haltija - Innehavare

1 •Control Flow Inc., 9201 Fairbanks N. Houston Road, Houston, TX 77064, AMERIKAN YHDYSVALLAT, (US)

(72) Keksijä - Uppfinnare

1 •REYNOLDS, Graeme, E., 2053 Western Village, Houston, TX 77043, AMERIKAN YHDYSVALLAT, (US)

(74) Asiamies - Ombud: Papula Oy  
Mechelininkatu 1 a, 00180 Helsinki

(54) Keksinnön nimitys - Uppfinningens benämning

**Kiristin/liukuliitoskokonaisuus  
Spänningsanordning / glidförbandsuppsättning**

(56) Viitejulkaisut - Anförda publikationer

WO-A 00/24998, WO-A 97/43516, GB-A 2141470, US-A 3643751, US-A 4068868, US-A 4615542, US-A 4712620, US-A 5727630,  
US-A 5846028, US-A 5951061





REPÚBLICA FEDERATIVA DO BRASIL



Ministério do Desenvolvimento, Indústria e Comércio Exterior  
Instituto Nacional da Propriedade Industrial

## CARTA PATENTE N.º PI0111376-3 *Patente de Invenção*

O INSTITUTO NACIONAL DA PROPRIEDADE INDUSTRIAL concede a presente PATENTE, que outorga ao seu titular a propriedade da invenção caracterizada neste título, em todo o território nacional, garantindo os direitos dela decorrentes, previstos na legislação em vigor.

(21) Número do Depósito : PI0111376-3

(22) Data do Depósito : 14/06/2001

(43) Data da Publicação do Pedido : 20/12/2001

(51) Classificação Internacional : E21B 19/00

(30) Prioridade Unionista : 15/06/2000 US 60/211,652

(54) Título : CONJUNTO TENSOR/JUNTA DESLIZANTE.  
✓ (Tensioner/Slip-Joint Assembly)

(73) Titular : Control Flow, Inc.: Endereço: 9201 Fairbanks North Houston Road, Houston, Texas 77064, Estados Unidos (US).

(72) Inventor : Graeme E. Reynolds. Endereço: 2053 Western Village, Houston, TX 77043, Estados Unidos.

Prazo de Validade : 10 (dez) anos contados a partir de 06/09/2011, observadas as condições legais.

Expedida em : 6 de Setembro de 2011.

Júlio César Castelo Branco Reis Moreira  
Diretor de Patentes



(19)



Europäisches Patentamt  
European Patent Office  
Office européen des brevets



(11)

EP 1 295 009 B1

(12)

EUROPEAN PATENT SPECIFICATION

(45) Date of publication and mention  
of the grant of the patent:  
29.03.2006 Bulletin 2006/13

(51) Int Cl.:  
E21B 19/00 (2006.01)

(21) Application number: 01948420.3

(86) International application number:  
PCT/US2001/019371

(22) Date of filing: 14.06.2001

(87) International publication number:  
WO 2001/096706 (20.12.2001 Gazette 2001/51)

(54) TENSIONER/SLIP-JOINT ASSEMBLY

TELESKOPISCHE SPANNVORRICHTUNG FÜR EINE STEIGRÖHRVERBINDUNG  
ASSEMBLAGE JOINT COULISSANT/TENSIONNEUR

(84) Designated Contracting States:  
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU  
MC NL PT SE TR

(74) Representative: Newstead, Michael John et al  
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Southgate  
Whitefriars  
Lewins Mead  
Bristol BS1 2NT (GB)

(30) Priority: 15.06.2000 US 211652 P

(43) Date of publication of application:  
26.03.2003 Bulletin 2003/13

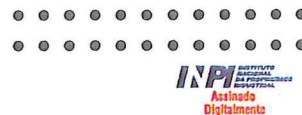
(56) References cited:  
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GB-A- 2 141 470 US-A- 3 643 751  
US-A- 4 068 868 US-A- 4 615 542  
US-A- 4 712 620 US-A- 5 727 630  
US-A- 5 846 028 US-A- 5 951 061

(73) Proprietor: Control Flow Inc.  
Houston, TX 77064 (US)

(72) Inventor: REYNOLDS, Graeme, E.  
Houston, TX 77043 (US)

EP 1 295 009 B1

Note: Within nine months from the publication of the mention of the grant of the European patent, any person may give notice to the European Patent Office of opposition to the European patent granted. Notice of opposition shall be filed in a written reasoned statement. It shall not be deemed to have been filed until the opposition fee has been paid. (Art. 99(1) European Patent Convention).



**REPÚBLICA FEDERATIVA DO BRASIL**  
MINISTÉRIO DO DESENVOLVIMENTO, INDÚSTRIA E COMÉRCIO EXTERIOR  
**INSTITUTO NACIONAL DA PROPRIEDADE INDUSTRIAL**

## CARTA PATENTE Nº PI 0306552-9

O INSTITUTO NACIONAL DA PROPRIEDADE INDUSTRIAL concede a presente PATENTE DE INVENÇÃO, que outorga ao seu titular a propriedade da invenção caracterizada neste título, em todo o território nacional, garantindo os direitos dela decorrentes, previstos na legislação em vigor.

(21) Número do Depósito: PI 0306552-9 ←

(22) Data do Depósito: 04/12/2003

(43) Data da Publicação do Pedido: 05/10/2004

(51) Classificação Internacional: E21B 17/00

(30) Prioridade Unionista: 09/12/2002 US 10/314,710

(54) Título: CÔNJUNTO TENSOR TIPO ÊMBOLO COM ACUMULADOR DE FLUIDO HIDRÁULICO INTEGRADO

(73) Titular: CONTROL FLOW, INC. Endereço: 9201 Fairbanks North Houston Road, Houston, Texas 77064, Estados Unidos (US).

(72) Inventor: RICHARD D. WILLIAMS

Prazo de Validade: 10 (dez) anos contados a partir de 13/01/2015, observadas as condições legais.

Expedida em: 13 de Janeiro de 2015. ←

Assinado digitalmente por:

**Liane Elizabeth Caldeira Lage**  
Diretora de Patentes Substituta

REPÚBLICA FEDERATIVA DO BRASIL  
15 de Janeiro de 2015