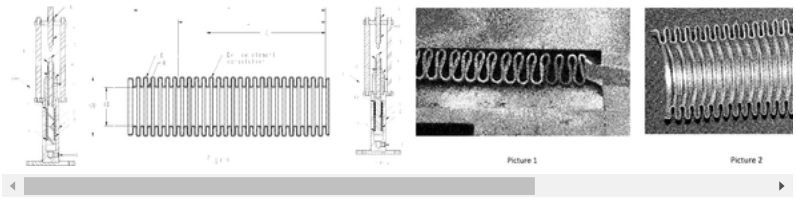
Back to results Inventor: **Zlatko Salihbegovic**;

Bellow internal-external pressure crimping method and crimping-compressing device

Abstract

Bellows are devices used to compensate linear, thermal, or angular movement/expansion. In oil and gas industry bellows are used in gas lift valves as a slidable seal between two gases. Gas lift valves are used in process of oil artificial lift from wells. Bellows having very thin walls are not well suited for pressures higher than approximately 200 PSI. To withstand much higher pressures bellows are being crimped, process that compresses the bellow to shorter length which increases bellow mechanical toughness. This patent application refers to bellow crimping method that uses initially balanced internal and external pressure to crimp bellow to desired length and maintain perfect bellow elements-convolution Ω geometry using custom designed crimping device.

Images (6)



Classifications

B21D15/02 Corrugating tubes longitudinally

View 1 more classifications

US20210086248A1
United States

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Inventor: Zlatko Salihbegovic

Current Assignee : Individual

Worldwide applications

2020 US

Application US17/108,491 events

2020-12-11	Application filed by Individual
2020-12-11	Priority to US17/108,491
2021-03-25	Publication of US20210086248A1
Status	Pending

Info: Patent citations (1), Legal events, Similar documents, Priority and Related Applications

External links: USPTO, USPTO PatentCenter, USPTO Assignment, Espacenet, Global Dossier, Discuss

Claims (2)

Hide Dependent

1. A method for bellow crimping/compressing/shortening comprising of initially balanced internal pressure **7** and external gas or fluid pressure **6** to crimp/compress/shorten bellow to desired length L while maintaining bellow element/convolution Ω geometry thereby preventing walls collapse by providing internal convolution surface support by applying internal pressure **7** against externally applied pressure **6** comprising of following steps:

a. Simultaneously applying internal **7** and external pressure **6**, to said 500 PSI depending on bellow material, shape and size against bellow which keeps said bellow pressure balanced from inside and outside.

b. Closing internal pressure **7** and increasing external pressure **6** to said 5000 PSI which depends on bellow material, size and shape until bellow is compressed to desired length LC where differential pressure between external and internal pressure would compress/shorten bellow from length LC to desired length L.

c. Releasing external pressure **6** until it equalizes with internal pressure **7** of said 500 PSI, depending on bellow material size and shape.

d. Simultaneously releasing internal **7** and external pressure **6** to atmospheric pressure at which point bellow would partially spring back from length LC to desired length L.

2. A crimping device/apparatus A, see FIG. 2 of claim #**1** wherein bellow is not welded/soldered against mating parts that comprises of major parts as housing item #**2** bellow constraining members, a slidable internal guide item #**3** , an upper adapter item #**4**, and slidable rod item #**5**, sealing members in form of O-rings items #**9**, #**10**, and #**13**, adjustable bellow travel constraining members, travel limiter item #**8** and jam nut item #**12**. Travel limiter item #**8** prevents bellow over-compression beyond desired value LC.

a. Wherein said steps as per 1a, 1b 1c and 1d are used in exactly said order.

b. The crimping device/apparatus from claim #**2** using method of claim #**1** that can crimp/compress below to desired length LC wherein bellow is welded/soldered against mating parts. For this purpose, sliding internal guide item #**3** and upper adapter item #**4** are replaced by actual valve parts. Device/apparatus from claim #**2** must be equipped with expansion tank/accumulator that will provide constant internal pressure **7** to be maintained at said 500 PSI depending on bellows material, shape and size.

a. Wherein said steps as per 1a, 1b 1c and 1d are used in exactly said order.

Description

BACKGROUND OF THE INVENTION

(1) Field of the Invention

[0001] Oil and gas, artificial gas lift systems. Current bellow crimping-compressing method performed in traditional way is a process where bellows in free length LF are welded/soldered against mating parts and exposed to high external pressure of approximately 5000 PSI, depending on material, size and type of bellow, with internal pressure at atmospheric value. Process is performed in appropriate fixture/device. This crimping process does not provide convolution wall support from inside. Bellow subassembly features internal stop where mating parts touch each other after external pressure is applied preventing bellow over compression. However, purpose of said internal stop pertains to bellow functionality in gas lift valve, expansion and compression limitations after crimping process. Existing crimping process as described above assumes that bellow is properly crimped-shortened which is not the case. Because internal stop engages prematurely at bellow length that is not sufficiently compressed to desired length LC and lack of internal bellow wall pressure support results in severely damaged bellow convolution shapes after crimping-compressing where bellow radiuses R are deformed. See picture #1 that shows deformed bellow cross section after crimping. This damage negatively affects bellow pressure rating, cycle life and causes premature failures. Another method is mechanical crimping wherein bellows are compressed to length LC by applying compression force inside appropriate device/fixture. Said method provides better as crimped bellow, however convolution geometry is somewhat deformed, OD convolution having slightly triangular shape because of lack of internal wall support and convolution radiuses are not kept in original shape. See picture #2 that shows bellow cross section after mechanical crimping. Typical bellow used in 1.5" nominal size gas lift valves has free length of 4", OD 1.170", ID 0.755" and is made from Monel 400 material. Bellows for gas lift valve applications are usually made from material used for spring manufacturing as Monel 400, Inconel 625 and Inconel 718 material that are corrosion resistant and have 3 plys/layers. Bellows can have one or more plys/layers. Plys for gas lift valve bellows are usually 0.005" thick. See FIG. 1 for reference.

(2) Description of Related Art including information disclosed under 37 CFR 1.97 and 1.98

[0002] Not applicable

[0003] BRIEF SUMMARY OF THE INVENTION

[0004] Bellows are mechanical devices used to compensate linear, thermal, or angular movement/expansion. Said bellows can be made in different shapes, sizes, using different materials. One typical example of bellows application is in pipelines to compensate for thermal expansion between solid supports. In oil and gas industry bellows are used as a slidable seal between two gases in gas lift valves. Gas lift valves are used in process of oil artificial lift from wells. Currently only two nominal bellows sizes are used in oil gas lift systems, 1.0" and 1.5". However, as manufactured bellows having very thin walls are not well suited for pressures higher than approximately 200 PSI depending on bellows type, size and material used. To withstand much higher pressures bellows are being crimped, method that compresses the bellow to shorter length which increases said bellow overall mechanical toughness. In addition, bellows in gas lift valves must be pressure balanced inside and outside as much as possible to withstand high pressures up to 2500 PSI. This patent application refers to free standing bellow crimping method that uses initially balanced internal and external pressure to crimp bellows to desired length and maintain perfect bellow elements-convolution Ω geometry. Applied internal pressure supports bellow/convolution wall internal surface preventing wall collapse. In another embodiment of this patent application bellows can be crimped after welding/soldering against mating parts in custom built device. If bellows are crimped while welded/soldered per said process/method against mating parts internal solid stop between mating parts is not used. This is made possible by using custom designed bellow crimping device described herein.

[0005] BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWING(S)

[0006] FIG. 1 shows general bellow geometry

[0007] FIG. 2 shows bellow pressure crimping device/fixture used foe said crimping method

[0008] Picture 1 shows bellow cross section crimped using standard/current crimping method

[0009] Picture 2 shows cross section of bellow crimped mechanically

[0010] Picture 3 shows bellow cross section having perfect Ω shape using new method that is described in this patent application

DETAILED DESCRIPTION OF THE INVENTION

[0011] Bellows are devices used to compensate linear, thermal, or angular movement/expansion in different applications like pipelines that are exposed to temperature changes and thermal expansion. Bellows can be also used as actuators in different machinery applications. For this purpose, bellows are built from thin materials and have specific element/convolution shapes in form of radiuses R which allow for linear or angular movement/compensation. Different techniques are used for bellows manufacturing as rolling, hydraulic forming, chemical vapor deposition and 3D printing. In oil and gas industry bellows are used as a slidable seal between two gases in gas lift valves. Said gas lift valves are used in process of oil artificial lift from wells. Requirements for these bellows are to withstands high differential pressures, high cycle numbers, temperatures and to be sufficiently corrosion resistant. However, as manufactured bellows having very thin walls are not well suited for pressures higher than approximately 200 PSI depending on materials used, geometrical shapes and sizes. To increase bellow pressure rating bellows are crimped/compressed to reduce overall length. It is generally recommended by bellows manufacturers to compress bellows up to 70% of free length LF. Said crimping process increases bellow overall mechanical toughness. For bellows to work properly it is essential to maintain bellow element/convolution radiuses/geometry during crimping process.

Proposed Internal-External Pressure Below Crimping Method

[0012] Bellow crimping method described herein is performed using custom designed crimping device A, see FIG. 2. Bellow is not welded/soldered against mating parts but in another embodiment of this device bellow can be welded/soldered against mating parts without internal stop mechanism thereby allowing free bellow compression. This would allow bellow to be properly compressed to desired length LC that depends on bellow type, size and materials used. Said bellow is installed in free length LF against mating parts, a slidable internal guide item #**3** and an upper adapter item #**4**. Sealing between internal pressure **7** and external pressure **6** is provided by means of O-Rings item #**9** and **10**. A jam nut item #**11** is snug tightened against a slidable rod item #**5** which will engage O-Rings items #**9** and **10**. A travel limiter item #**8** is set to appropriate height by tightening jam nut #**12** thereby preventing bellow over compressing beyond length LC. Internal pressure #**7** and external pressure #**6** against bellow are applied simultaneously to multitude values, for example 500 PSI depending on bellow material, shape, and wall thicknesses. This does not create any differential pressure across bellow at this point. The bellow internal pressure **7** is now set to constant value, said 500 PSI, and valve that controls it is closed. All three bellow plys/layers are internally and externally supported by internal/external pressure and compressed against each other with no gap between them. Next external pressure **7** to bellow item #**1** is slowly increased to desired value, for example **5000** PSI, depending on bellow type, size and material used. The Bellow is compressed until slidably rod item #**5** touches travel limiter item #**8** whereby O-Ring item #**13** provides sealing of Internal pressure **7** inside bellow item #**1**. At this point bellow is compressed to length LC which will yield bellow desired as crimped length L once pressure is released and bellows springs back from length LC to said length L. Parameters LC and L are determined by experimenting. Next step is to slowly release external pressure **6** to equalize it to internal pressure **7** of said 500 PSI and then release both pressures simultaneously to atmospheric pressure. Either gas or fluid pressure can be used for this crimping process. Appropriate expansion vessel/accumulator should be used to maintain bellow internal pressure **7** at desired/constant value of said 500 PSI when bellow external pressure **6** is applied, which is not shown herein to simplify this application. Said crimping device shown on drawing #**2** can be used to crimp bellows that are welded soldered against appropriate valve mating parts. In this embodiment slidable internal guide item #**3** and upper adapter item #**4** would be replaced by actual valve parts. Slidable internal guide item #**3** provides bellow ID guide and housing item #**2** provides bellow item #**1** OD guide by means of tight clearances. See picture 3 that shows bellow cross section after crimping per new method described above.

Sequence Listing (See MPEP § 2424 and 37 CFR 1.821-1.825

[0013] A “Sequence Listing” is required on paper if the application discloses a nucleotide or amino acid sequence as defined in 37 CFR 1.821(a) and if the required “Sequence Listing” is not submitted as an electronic document either on compact disc or as a text file via the Office electronic filing system (EFS-Web.)

[0014] None

Patent Citations (1)

Publication number	Priority date	Publication date	Assignee	Title
US20010039822A1 *	1997-11-28	2001-11-15	Tadahiro Minamidate	Method and device for producing bellows
Family To Family Citations				

* Cited by examiner, † Cited by third party

Similar Documents

Publication	Publication Date	Title
CN100549472C	2009-10-14	The black box that is used for materials having different thermal expansion coefficient
US8162286B2	2012-04-24	Piezoelectric driven control valve
DK2554787T3	2018-05-22	GAS LIFT VALVE WITH EDGE WELDED BELOW AND FIXED SLIDE SEAL
US5516122A	1996-05-14	Ultra high vacuum elastomer seal
KR101702170B1	2017-02-03	Clamp ring for welded diaphragms
US10274088B2	2019-04-30	Closure element for a vacuum valve with pressed-off, vulcanized-on seal
US9845875B2	2017-12-19	Ring seal with sealing surface extension
US11333289B2	2022-05-17	Decompression heat-insulating pipe structure
TW201825817A	2018-07-16	Valve device, flow rate control method using said valve device, and method of manufacturing semiconductor
WO2016182066A1	2016-11-17	Trunnion-type ball valve, sealing structure of valve, and packing for valve
US20210086248A1	2021-03-25	Bellow internal-external pressure crimping method and crimping-compressing device
US7588077B2	2009-09-15	Downhole tubular seal system and method
US8066256B2	2011-11-29	Valve actuator assembly
Bills et al.	1955	Ultra-high vacuum valve
US4457213A	1984-07-03	Bellows structure and method
US11313479B2	2022-04-26	Non-pressure relieving ball valve
Salihbegovic	2022	Gas Lift Valve Bellow Protection from High Injection and Dome Pressure
JP2017053405A	2017-03-16	Valve with actuator
RU2349817C2	2009-03-20	Pipeline valve o-ring
JP2020045917A	2020-03-26	Fluid control valve
US20220155178A1	2022-05-19	Gas sensor
EP3557363A1	2019-10-23	Gas pressure regulator
CN102596450A	2012-07-18	Gas spring for sliding refractory gate valve
US20220282812A1	2022-09-08	Highly Elastic Metal Seal
US20220307354A1	2022-09-29	Gas lift valve with two simultaneous mechanical stops

Priority And Related Applications

Priority Applications (1)

Application	Priority date	Filing date	Title
US17/108,491	2020-12-11	2020-12-11	Bellow internal-external pressure crimping method and crimping-compressing device

Applications Claiming Priority (1)

Application	Filing date	Title
US17/108,491	2020-12-11	Bellow internal-external pressure crimping method and crimping-compressing device

Legal Events

Date	Code	Title	Description
2021-08-21	STPP	Information on status: patent application and granting procedure in general	**Free format text**: DOCKETED NEW CASE - READY FOR EXAMINATION
2022-06-22	STPP	Information on status: patent application and granting procedure in general	**Free format text**: NON FINAL ACTION MAILED
2022-09-16	STPP	Information on status: patent application and granting procedure in general	**Free format text**: RESPONSE TO NON-FINAL OFFICE ACTION ENTERED AND FORWARDED TO EXAMINER
2022-11-10	STCB	Information on status: application discontinuation	**Free format text**: FINAL REJECTION MAILED

Concepts

machine-extracted

Download Filter table

Name	Image	Sections	Count	Query match
crimping		title,claims,abstract,description	50	0.000
material		claims,description	30	0.000
conjugation with cellular fusion		claims,description	22	0.000
mating		claims,description	22	0.000
unidirectional conjugation		claims,description	22	0.000
compression		claims,description	10	0.000
sealing		claims,description	6	0.000
fluid		claims,description	4	0.000
shortening		claims	2	0.000
gas		abstract,description	42	0.000
method		abstract,description	28	0.000

Show all concepts from the description section