(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
5 November 2009 (05.11.2009)

PCT

(10) International Publication Number
WO 2009/132382 A1

(51) International Patent Classification:
F16L 37/08 (2006.01) *F16L 37/28* (2006.01)
F16L 37/38 (2006.01) *F16L 37/46* (2006.01)

(21) International Application Number:
PCT/AU2009/000522

(22) International Filing Date:
27 April 2009 (27.04.2009)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
2008902046 28 April 2008 (28.04.2008) AU

(71) Applicants and
(72) Inventors: **AUSTON, Murray** [AU/AU]; 2/15 Advantage Avenue, Morisset, New South Wales 2264 (AU). **AUSTON, Lindsay** [AU/AU]; 2/15 Advantage Avenue, Morisset, New South Wales 2264 (AU).

(74) Agent: **GRIZIOTIS, George**; Peter Maxwell & Associates, Level 6 60 Pitt Street, Sydney, New South Wales 2000 (AU).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— *with international search report (Art. 21(3))*

(54) Title: PNEUMATIC SAFETY COUPLER

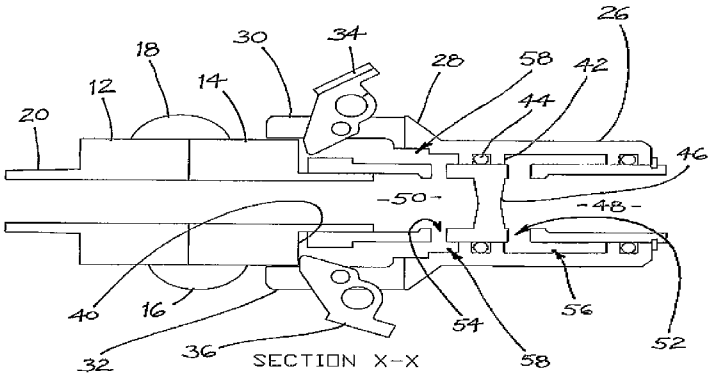


Fig. 5

(57) Abstract: A coupling assembly for a compressed air circuit has locking means (16,18) for releasably engaging first and second sub-assemblies (12,14) located at respective ends of first and second air lines. The first air line is connected to a tool adapted for compressed air operation, and the second air line is connected to a supply of compressed air. A valve means (24) controls the flow of compressed air between the first and second air lines. The valve means is connected to the second sub-assembly (14) and is slidably movable between a first position where it allows compressed air flow, and a second position where it prevents compressed air flow. The coupling assembly has stop means (30,32) for preventing disengagement of the first and second sub- assemblies (12, 14) when the valve means (24) is in the first position.

WO 2009/132382 A1

PNEUMATIC SAFETY COUPLER

TECHNICAL FIELD

The present invention relates to safety couplers for compressed air lines and, in particular, to a coupling assembly that has an air isolation valve for local shut off and venting of compressed air from a compressed air circuit.

BACKGROUND ART

It is common practice to supply compressed air to mines, building sites and through manufacturing plants via an air line of interconnecting pipes and hoses. Compressed air is used to operate machinery, such as packaging machines, rock drilling machines, and portable tools, and for starting some diesel mobile plant. It is a convenient, flexible, high energy source that can be quickly installed, used and dismantled as required.

The connection of the air line of pipes and hoses is via a range of quick connect couplers or bolted joints. A common coupler is a "claw" coupler, which allows an operator to "twist and lock" a hose onto an air supply valve, connect two hoses together, or connect a hose to a machine.

Air is controlled (i.e. turned on and off) by the use of isolation or control valves. These valves can be manually operated by hand, can be electrically controlled, or can be operated by other methods.

However, there are numerous problems and dangers associated with the use of compressed air. This is largely due to the flexible, high energy nature of compressed air which, when combined with poor practices, have, in the past, resulted in major injury and death.

Death has been attributed to impact injury (disconnected hoses flailing around), and compressed air injection into the bloodstream. Injuries associated

with compressed air include air injection, and both temporary and permanent hearing loss.

The following method is an example of the use of compressed air as commonly occurs on a building site, and indicates some problems and dangers that exist both in normal use and when operators fail to follow normal practice.

A mobile air compressor is located adjacent a pit requiring excavation and remote from an operator. The problem here is that the source of compressed air and the control valve associated with the compressor are not located where the work is being carried out at the free end of the hose, and so if a fault arises, such as when a flexible hose ruptures, the compressed air cannot be quickly turned off.

The compressor is connected via a 50m hose to a portable jack hammer. The operator connects the hose firstly to the compressor, then holds the free end of the hose whilst compressed air is used to purge or clean the flexible line.

This process requires the operator to connect the hose to the compressor and then fit a secondary (separate) locking clip. This locking clip is used to prevent inadvertent unlocking of the hoses caused by hose tension when turning on air supply. This can be due to the fact that hoses are delivered neatly coiled and, when air pressure is applied, the hose naturally untwists thus causing the "twist and lock" couplers to disconnect.

To purge or clean the hose requires the operator to travel to the compressor (where the air control valve is fitted) whilst holding the free end of the hose, or to involve another person near the compressor to turn the air supply on and off.

Although a 50m hose is used in this example, in practice the compressor and jackhammer or other tool may be connected by 500m or more of hose.

After purging the line, the operator connects the jack hammer, and turns on the air supply in order to remove the rock.

This process requires that, if the operator is by himself, he has to drag the hose to the jackhammer, connect up the tool using the secondary locking clip for safety, and then travel back to the compressor, once again, to turn the compressed air on, so work can begin. Whilst he is turning on the air supply, the operator is not at the tool site and therefore cannot see if any problems exist, e.g. air leaks or hose problems.

At completion of the job, the operator turns off the air, operates the jack hammer to dissipate the trapped air in the hose, or releases the air through a drain valve, then proceeds to disconnect the tool and hose from the compressor.

This process requires the operator to travel to the compressor and turn off the air, then travel back to the tool to release the trapped air in the hose, or release the air through the drain valve. Using the drain valve releases air at a high velocity, resulting in noise that may permanently damage hearing. This high velocity air, when directed at the ground, can cause loose debris (rocks and dust) to be violently blown around, sometimes resulting in impact injuries to the body or to the eyes in particular.

Once the tool is disconnected, there is a danger that the air supply may be unknowingly turned on allowing the free end of the hose to flail around uncontrollably.

Aside from the problems and dangers associated with the above method, operators may take shortcuts which can also give rise to problems and dangers. These shortcuts include:-

(a) use of a screwdriver or similar pointed tool to force the seal of the "claw" coupler apart to relieve the trapped pressure (instead of returning to the tool and operating it to exhaust air);

(b) engaging a second person to crimp off the hose using their hands whilst the operator disconnects and reconnects the hose. This is particularly hazardous as air is only isolated for the time the second person can continue to maintain the crushing force on the hose. If that person trips or their hand grip slips whilst holding the hose, then air is released with uncontrolled force and speed.

Both (a) and (b) above can allow air to be released from a pressurised state quite rapidly, which will have the effect of generating a noise level that can cause permanent hearing loss.

Other steps taken to overcome the problems identified above are:-

(c) Some operators fit control valves with manual lever handles at hose ends. This can create problems when air is turned off and not released out of the hose, as there is no indication that the hose contains trapped air under pressure. This can only be identified by operation of the machine, which can cause unexpected or unwanted movement. Also, when the hose is dragged from one site to another, the lever handle can be caught and the air unexpectedly turned on.

(d) Some operators fit venting valves at the compressor or source end of the air supply system. This does relieve the operator of some travel when removing the equipment from service, but still requires the operator to travel back to the source.

(e) Some operators fit control valves with provision for padlocking the valve in a closed position. This solves the problem when the

distance between the source and the tool is relatively short, but does not fix it when there is considerable distance between the source and the tool.

(f) Some operators fit silencers to the fixed venting valves located at the compressor end of the hose, which effectively eliminates the hearing damage risk. This solves part of the problem but is impractical to fit in all situations.

In summary, the problems encountered in the prior art include:-

1. Control valves and tools are often a considerable distance apart, leading to shortcuts and non-adherence to normal practice.
2. Twist and lock couplers can become separated if the locking clip is not installed.
3. Locking clips are a separate item requiring the operator to carry them to safely do the job.
4. Hoses can be inadvertently uncoupled under pressure, as the presence of air pressure is not apparent and there is no interlock requiring the operator to release the pressure.
5. Venting devices fitted are sometimes remote from the tool.
6. Silencers fitted are sometimes remote of the tool.
7. Additional operators required if considerable distance between compressor and tool.

It is, therefore, an object of the present invention to overcome at least some of the aforementioned problems of the prior art.

DISCLOSURE OF INVENTION

According to the present invention, there is provided a coupling assembly for a compressed air circuit comprising:-

(a) locking means for releasably engaging first and second sub-assemblies located at respective ends of first and second air lines, the first air line being connected to a tool adapted for compressed air operation, and the second air line being connected to a supply of compressed air, and

(b) valve means for controlling the flow of compressed air between the first and second air lines, the valve means being connected to the second sub-assembly and being slidably movable between a first position where it allows compressed air flow, and a second position where it prevents compressed air flow.

Preferably, the coupling assembly further includes stop means for preventing disengagement of the first and second sub-assemblies when the valve means is in the first position.

In a preferred form, the locking means includes first and second locking claws being twistable between locked and unlocked positions, and the stop means includes a pair of stop arms which, when the valve means is in the first position, prevent the locking claws being twisted to their unlocked positions.

It is preferred that the coupling assembly further includes latch means for selectively preventing movement of the valve means from the second position to the first position.

In a further preferred form, the latch means comprise a pair of latch pins which are pivotally mounted to the stop arms.

BRIEF DESCRIPTION OF THE DRAWINGS

In order that the invention may be more readily understood and put into practical effect, reference will now be made to the accompanying drawings, in which:-

Fig. 1 is a front perspective view of a coupling assembly for a compressed air circuit according to a preferred embodiment of the invention, with the valve means of the coupling assembly shown in the second position where it prevents compressed air flow,

Fig. 2 is a front perspective view of the coupling assembly of Fig. 1, with the valve means of the coupling assembly shown in the first position where it allows compressed air flow,

Fig. 3 is a rear perspective view of the coupling assembly as shown in Fig. 1,

Fig. 4 is a plan view of the coupling assembly as shown in Fig. 1,

Fig. 5 is a simplified sectional view through X-X of the coupling assembly as shown in Fig. 4,

Fig. 6 is a plan view of the coupling assembly as shown in Fig. 2, and

Fig. 7 is a simplified sectional view through Y-Y of the coupling assembly as shown in Fig. 6.

MODES FOR CARRYING OUT THE INVENTION

The coupling assembly shown in the drawings has a first sub-assembly 12 and a second sub-assembly 14 which are releasably engaged by locking means which, in this embodiment, are in the form of a first locking claw 16 of the first sub-assembly 12 and a second locking claw 18 of the second sub-assembly 14. The first and second locking claws 16, 18 are twistable between locked and unlocked positions.

The first sub-assembly 12 is located at one end of a first air line, and at the other end of the first air line is connected a tool adapted for compressed air operation, such as a jackhammer. An outwardly threaded tube 20 of the first sub-assembly 12 is adapted for connecting to an inwardly threaded nut at the adjoining end of the first air line.

The second sub-assembly 14 is located at one end of a second air line, and at the other end of the second air line is connected a supply of compressed air, such as an air compressor machine.

Also connected to the second sub-assembly is a valve means for controlling the flow of compressed air between the first and second air lines. The valve means is, in this embodiment, in the form of a sleeve 24 having a body portion 26 and a flared collar 28. Stop means which, in this embodiment, are in the form of stop arms 30, 32, are integrally connected to the flared collar 28 of the sleeve 24. Latch means which, in this embodiment, are in the form of latch pins 34, 36 are pivotally mounted to respective stop arms 30, 32.

The sleeve 24 is slidably movable between a first position (as shown in Fig. 2) where it allows compressed air flow between the first and second air lines, and a second position (as shown in Fig. 1) where it prevents compressed air flow between the first and second air lines. The valve-like control of compressed air flow provided by the movement of the sleeve 24 relative to the second sub-assembly will be described in detail later in the specification.

The stop arms 30, 32 prevent disengagement of the first and second sub-assemblies 12, 14 when the sleeve 24 is in its first position, because the stop arms 30, 32 are located in a position where they prevent the locking claws 16, 18 being twisted to their unlocked positions. Disengagement of the first and second sub-assemblies can only be achieved by manually moving the stop arms 30, 32 to a position where they no longer prevent twisting of the locking claws to their unlocked positions.

The latch pins 34, 36 selectively prevent movement of the sleeve 24 from its second position to its first position, because the latch pins 34, 36 are biased to pivot to a position where they abut against an obstructing wall of the second sub-assembly when the sleeve 24 is in its second position. Restoration

of compressed air flow can only be achieved between the first and second air lines by manually pivoting the latch pins 34, 36 to respective positions where they no longer abut against the obstructing wall and then sliding the sleeve 24 to its first position.

The above described coupling assembly, when including the aforementioned stop means and latch means, can provide an air isolation valve for local shutoff and venting of compressed air from a compressed air circuit, as well as a noise dampening effect when venting compressed air, and a high level of safety against accidental disengagement of the first and second sub-assemblies and accidental restoration of compressed air flow therebetween.

In use, the first and second sub-assemblies are engaged by a user twistably locking the first and second locking claws 16, 18 together. The sleeve 24, which is connected to the second sub-assembly, is in its second position as the claws are locked together, whereby compressed air flow through the air lines is prevented. The sleeve 24 is prevented from slidably moving to its first position by the latch pins 34, 36 which abut against the wall 40 of the second sub-assembly. This position of the latch pins is shown in Figs. 4 and 5, as is the position of the sleeve. A padlock may be engaged through one of the latch pins to prevent their pivotal movement.

The sleeve 24 has an annular air flow cavity 56 and an annular air vent cavity 58 that are divided by an isolator wall 42 that includes O-ring seal 44 which, when the sleeve is in its second position, provides an airtight sealing against a dividing wall 46 of the second sub-assembly. The dividing wall 46 separates an air-in, pressurised chamber 48 of the second sub-assembly from an air-out, unpressurised or atmospheric chamber 50 of the second sub-assembly, and the two chambers 48, 50 have air flow ports 52, 54 respectively. The airtight sealing of the isolator wall 42 against the dividing wall 46 prevents

compressed air flow from the pressurised chamber 48 to the atmospheric chamber 50 via their respective air flow ports 52, 54.

To allow compressed air flow through the air lines, the user presses down on the latch pins so that they pivot to respective positions where they no longer abut against the wall 40, and simultaneously grips the body portion 26 of the sleeve 24 before sliding the sleeve 24 forward to its first position, whereby compressed air flow through the air lines is allowed. The new position of the latch pins and the sleeve is shown in Figs. 6 and 7, as is the position of the isolator wall 42 relative to the pressurised chamber 48 and atmospheric chamber 50.

Compressed air can now flow from the pressurised chamber 48 to the atmospheric chamber 50 unimpeded by the isolator wall 42 which has moved forward with the sleeve 24, thereby also moving the air flow cavity 56 forward to allow air flow communication between the ports 52, 54. The tool is then supplied with compressed air via the air lines from the air compressor machine, and can be operated.

Sliding the sleeve 24 forward to its first position also allows the stop arms 30, 32 to locate between interlocking pairs of first and second locking claws, whereby the locking claws are prevented from being twisted to their unlocked positions.

Should a problem arise, such as with the operation of the tool or with the integrity of the air lines from the air compressor machine, the user can quickly isolate or shut off the flow of compressed air to the tool by simply sliding the sleeve rearwardly to its second position. This shut off of compressed air is done locally at the site of operation of the tool. As soon as the supply of compressed air through the coupling assembly to the tool is shut off, the compressed air isolated in the first air line between the tool and the coupling

assembly is quickly vented to atmosphere by safely escaping through air flow port 54 and then through the air vent cavity 58 which are located under the front of the body portion and the flared collar 28 of the sleeve 24. The sleeve 24 thus serves as a silencer because of the noise dampening effect provided by the body portion and flared collar during venting of compressed air.

A padlock may then be engaged through one of the latch pins to prevent their accidental pivotal movement back to a position where the sleeve can dangerously slide forward before the tool is ready for operation.

The locking claws 16, 18 may also now be twisted to their unlocked positions, if required, to release the first and second sub-assemblies from their engagement, because the stop arms are no longer located between the interlocking pairs of first and second locking claws. This will allow the air lines to be disconnected.

If the user wants to use the second air line from the air compressor machine to "blow down" a tool for cleaning or maintenance purposes, the first and second sub-assemblies can be disengaged or uncoupled without any escape of compressed air from the second air line, and the sleeve 24 on the second sub-assembly can then be slid forward to allow compressed air to flow from the pressurised chamber 48 to the atmospheric chamber 50, before it blows out of the open end of the second sub-assembly.

It will be readily apparent to persons skilled in the art that various modifications may be made in details of design and construction of the coupling assembly for a compressed air circuit described above without departing from the scope or ambit of the present invention.

CLAIMS:

1. A coupling assembly for a compressed air circuit comprising:-
   (a) locking means for releasably engaging first and second sub-assemblies located at respective ends of first and second air lines, the first air line being connected to a tool adapted for compressed air operation, and the second air line being connected to a supply of compressed air, and
   (b) valve means for controlling the flow of compressed air between the first and second air lines, the valve means being connected to the second sub-assembly and being slidably movable between a first position where it allows compressed air flow, and a second position where it prevents compressed air flow.

2. The coupling assembly of claim 1 further including stop means for preventing disengagement of the first and second sub-assemblies when the valve means is in the first position.

3. The coupling assembly of claim 2 wherein the locking means includes first and second locking claws being twistable between locked and unlocked positions.

4. The coupling assembly of claim 3 wherein the stop means includes a pair of stop arms which, when the valve means is in the first position, prevent the locking claws being twisted to their unlocked positions.

5. The coupling assembly of claim 4 further including latch means for selectively preventing movement of the valve means from the second position to the first position.

6. The coupling assembly of claim 5 wherein the latch means comprise a pair of latch pins which are pivotally mounted to the stop arms.

7. The coupling assembly of claim 6 wherein the valve means is a sleeve having a body portion and a flared collar.

8. The coupling assembly of claim 7 wherein the stop arms are integrally connected to the flared collar.

9. The coupling assembly of claim 8 further including means for manually moving the stop arms to a position where they no longer prevent twisting of the locking claws to their unlocked positions.

10. The coupling assembly of claim 9 wherein the latch pins are biased to pivot to a position where they abut against an obstructing wall of the second sub-assembly when the sleeve is in its second position.

11. The coupling assembly of claim 7 wherein the sleeve has an annular air flow cavity and an annular air vent cavity that are divided by an isolator wall that includes a sealing means which, when the sleeve is in its second position, provides an airtight sealing against a dividing wall of the second sub-assembly.

12. The coupling assembly of claim 11 wherein the dividing wall separates an air-in pressurised chamber of the second sub-assembly from an air-out, atmospherically pressured chamber of the second sub-assembly, and each of the two chambers have air flow ports, and wherein the airtight sealing of the isolator wall against the dividing wall prevents compressed air flow from the pressurised chamber to the atmospherically pressured chamber via the air flow ports.

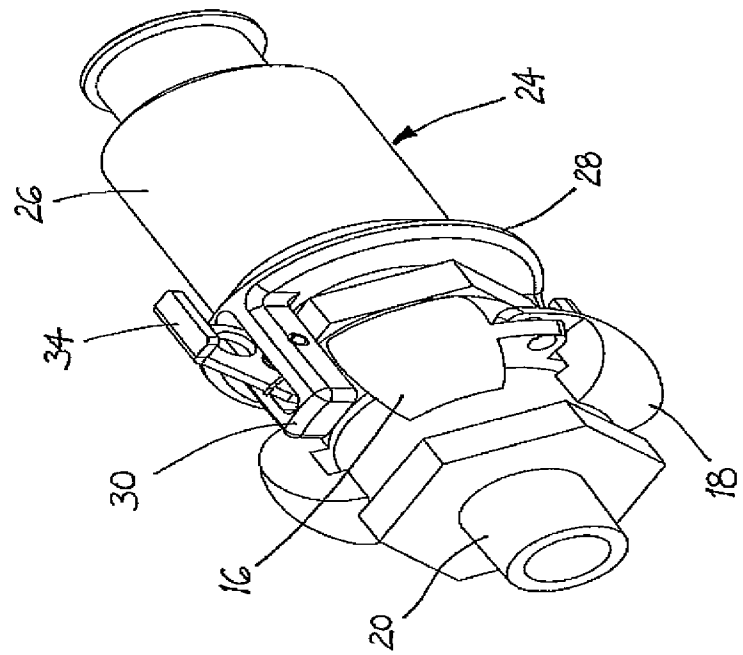


Fig. 2

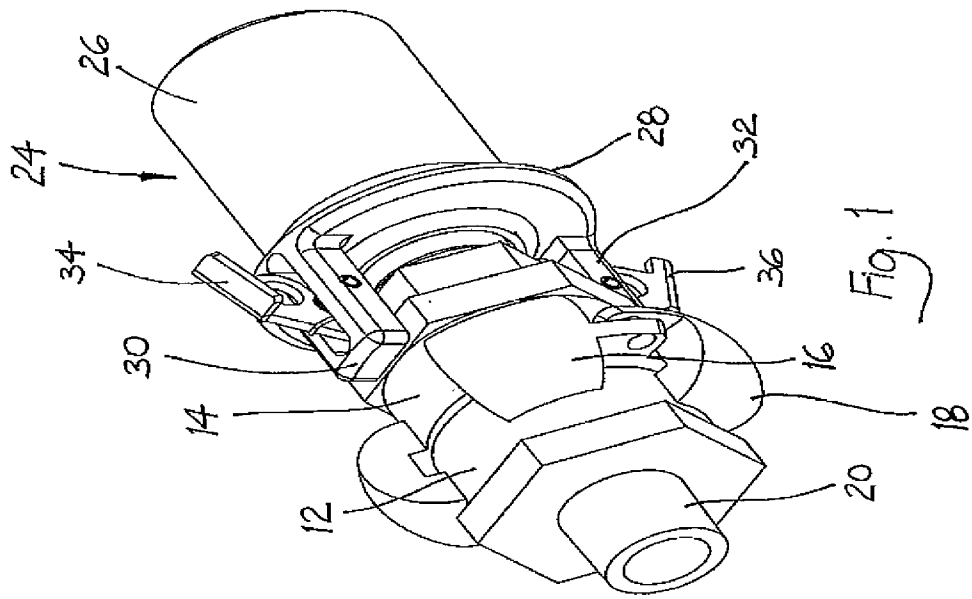


Fig. 1

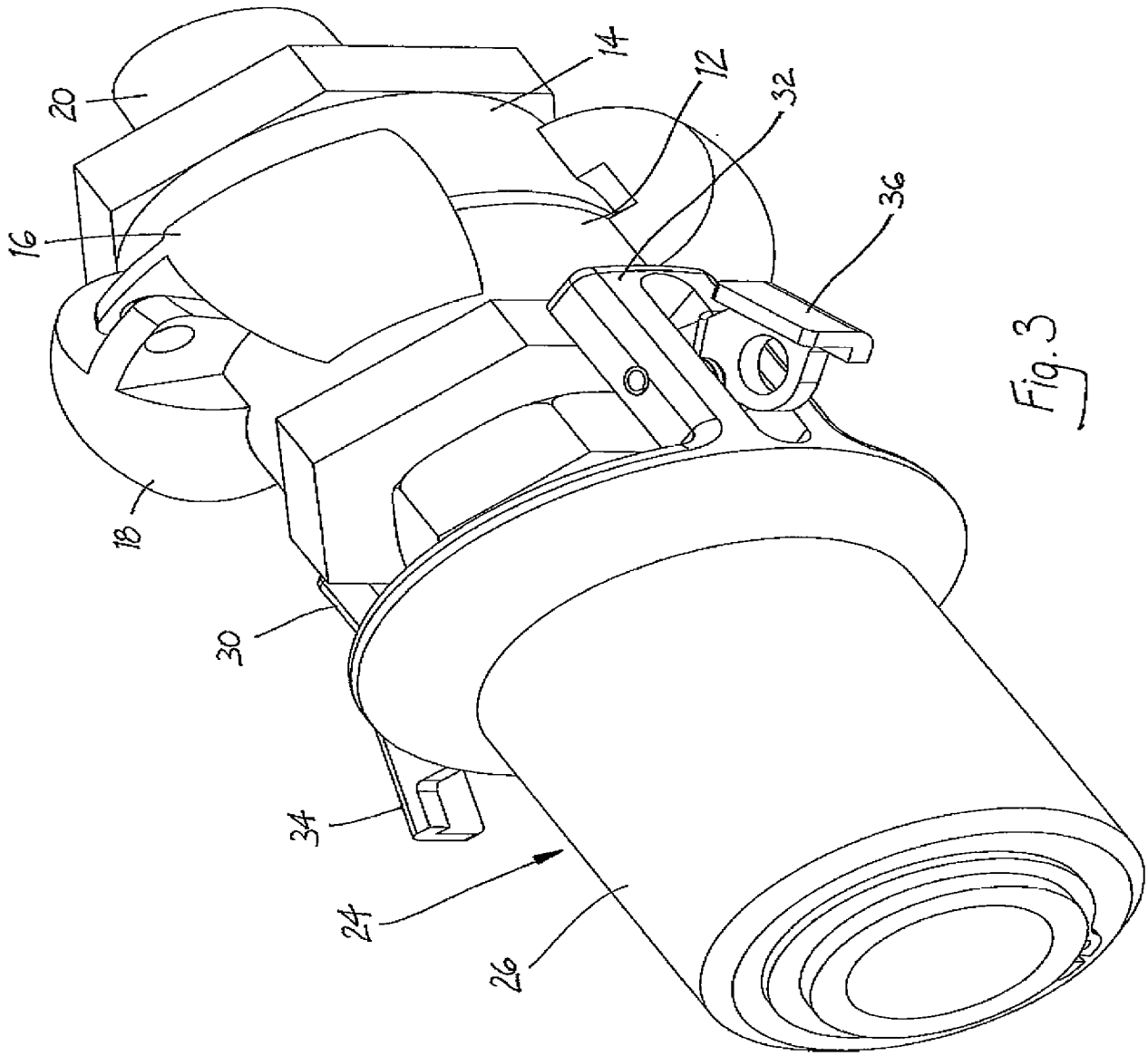
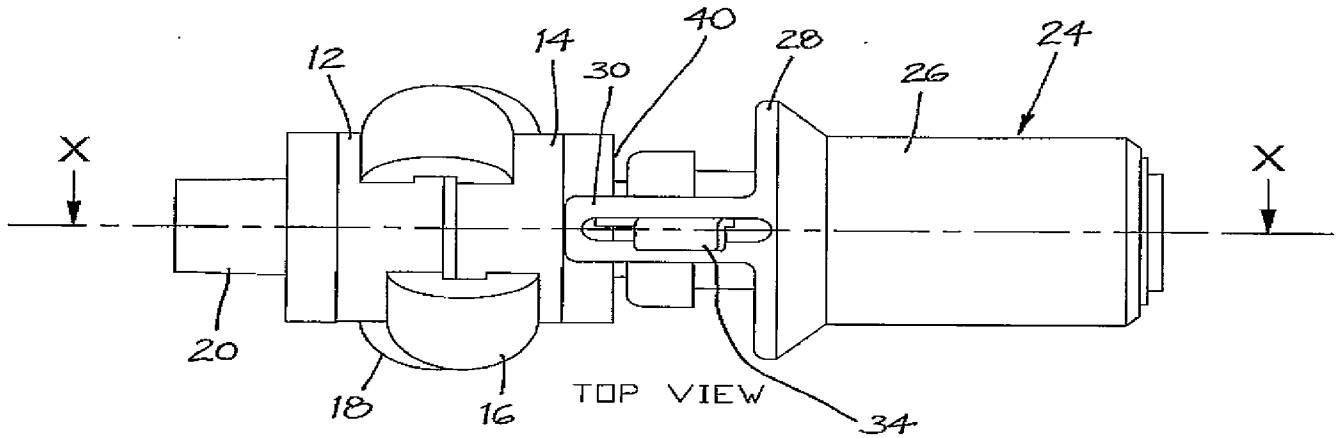


Fig. 3

Fig. 4


X
X
12
14
40
28
24
30
26
20
18
16
TOP VIEW
34

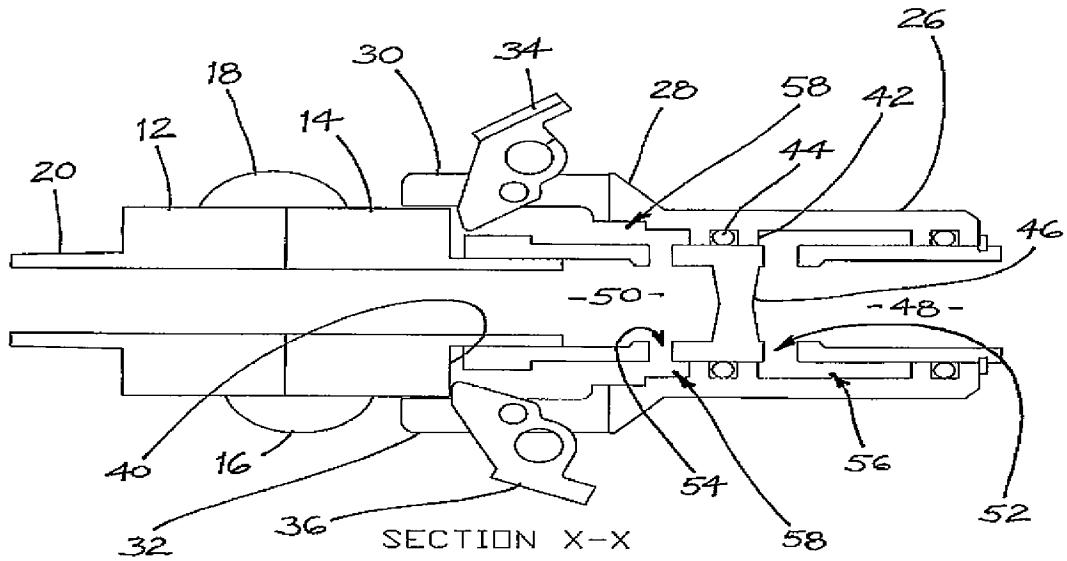
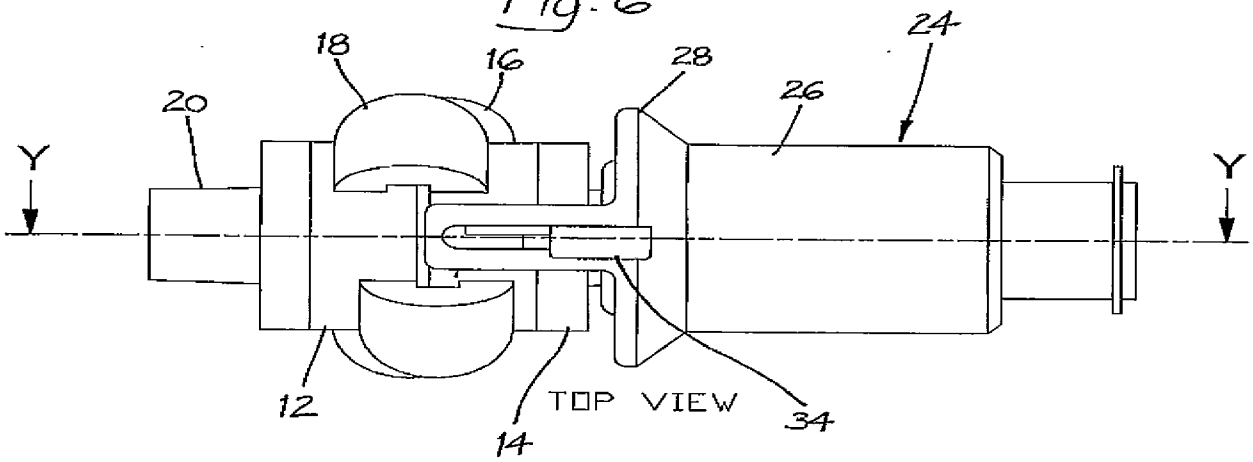

26
18
30
34
28
58
42
12
14
44
20
46
-50-
-48-
40
16
54
56
52
32
36
SECTION X-X
58

Fig. 5

Fig. 6


18
16
28
24
20
26
Y
Y
12
14
TOP VIEW
34

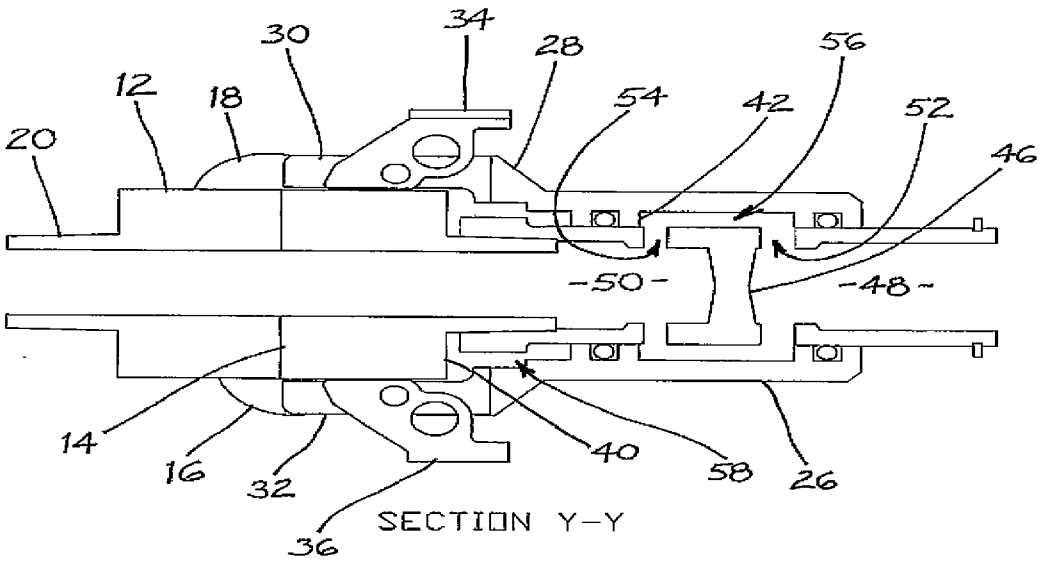

34
30
28
56
12
18
54
42
52
20
46
-50-
-48-
14
16
32
40
58
26
36
SECTION Y-Y

Fig. 7

INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU2009/000522

A. CLASSIFICATION OF SUBJECT MATTER

Int. Cl. ***F16L 37/08*** (2006.01) ***F16L 37/38*** (2006.01)
F16L 37/28 (2006.01) ***F16L 37/46*** (2006.01)

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

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

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPODOC & WPI: IPC F16K 3/02, 3/16, 3/30, 27/04, 31/44, F16L 21/08, 21/02, 27/12, 37/08, 37/28, 37/38, 37/46, 47/06, 37/12, 37/20 & Keywords (Couple, Connect, Toggle, Lever, Claw, Arm, Lug, Lock, Latch, Arrest, Secure, Engage, Clamp, Retain, Slide, Shuttle, Translate, Dislocate, Displace, Twist, Rotate, Turn, Vent, Bleed, Discharge, Purge, Diffuse)
ESP@CENET Keywords: Coupler, Compressed, Air, Lock, Latch, Whipping

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 6279874 B1 (NYBERG) 28 August 2001 See especially column 2, lines 50-57 and figures 1&4	1, 2
X Y	EP 0233766 B1 (SWAGELOK QUICK-CONNECT CO) 10 October 1990 See especially column 5, line 53 to column 6, line 47 and figure 1 See especially figure 1	1, 2 3
Y	US 5779277 A (STREET) 14 July 1998 See column 7, line 55 to column 8, line 54 and figures 3&4	3

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

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

Date of the actual completion of the international search	Date of mailing of the international search report
23 June 2009	14 JUL 2009
Name and mailing address of the ISA/AU AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA E-mail address: pct@ipaustralia.gov.au Facsimile No. +61 2 6283 7999	Authorized officer **DANIEL ATHYSAYARAJ** AUSTRALIAN PATENT OFFICE (ISO 9001 Quality Certified Service) Telephone No : +61 2 6225 6131

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
PCT/AU2009/000522

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report		Patent Family Member					
US	6279874	EP	0886742	SE	9601127	WO	9735143
EP	0233766	AU	24930/84	AU	68666/87	CA	1248992
		CA	1260984	EP	0132440	EP	0325305
		GB	2144193	GB	2172365	GB	2172366
		GB	2172367	GB	2172368	JP	8086390
		JP	8285160	JP	62266292	US	4637432
		US	4685490	WO	8402967		
US	5779277	AU	40790/97	WO	9810214		

Due to data integration issues this family listing may not include 10 digit Australian applications filed since May 2001.

END OF ANNEX