(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 2 604 353 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
19.06.2013 Bulletin 2013/25

(21) Application number: **12196664.2**

(22) Date of filing: **12.12.2012**

(51) Int Cl.:
B21C 3/08 *(2006.01)* ***B21C 3/14*** *(2006.01)*
B21C 9/00 *(2006.01)*

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME

(30) Priority: **13.12.2011 TW 100223494**

(71) Applicant: **Chen, Chih-Hung**
807 Kaohsiung City (TW)

(72) Inventor: **Chen, Chih-Hung**
807 Kaohsiung City (TW)

(74) Representative: **Arat, Dogan**
Dres. Weiss & Arat
Partnerschaftsgesellschaft
Zeppelinstr. 4
78234 Engen (DE)

(54) **Wire drawing apparatus with roller units**

(57) A wire drawing apparatus includes a wire pressing device (4) and a lubricating unit (5). The wire pressing device (4) includes a main body (41) and a plurality of roller units (42) assembled on the main body (41). The main body (41) has a hole (411) through which a metal wire (7) is extended, and the roller units (42) are assembled relative to the hole (411) for surrounding and applying compression forces on the metal wire (7). The lubricating unit (5) is disposed on the wire pressing device (4) and includes a lubricant inlet (51), a lubricant outlet (53), and a plurality of passages (52) formed respectively in the roller units (42) and in fluid communication with the lubricant inlet (51) and the lubricant outlet (53).

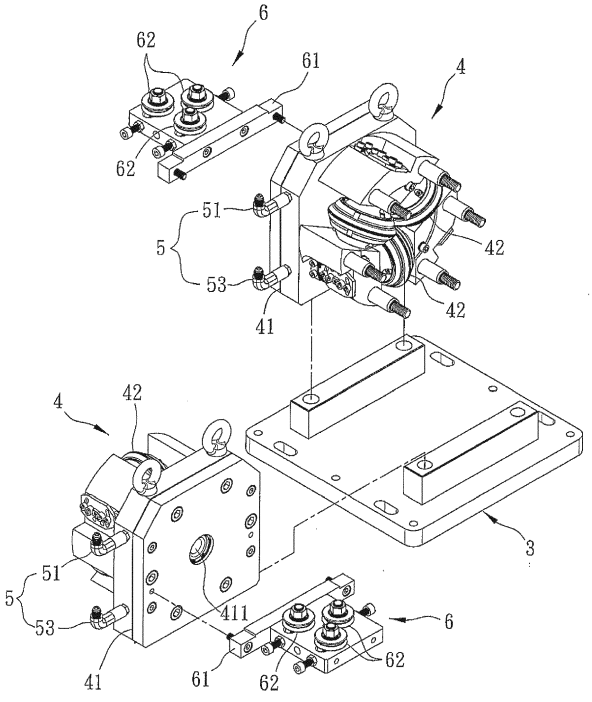

FIG. 2

EP 2 604 353 A1

Description

[0001] The present invention relates to a wire drawing apparatus including a plurality of roller units and a lubricating unit.

[0002] Metal wire drawing is commonly achieved with a wire drawing apparatus having a die that decreases the diameter of the metal wire. Figure 1 shows a conventional wire drawing apparatus disclosed in R.O.C. patent publication M380174. The wire drawing apparatus includes a main body 11, and a die 12 disposed on the main body 11. The main body 11 includes a lubricant storage 111 for storing lubricating powder, and the die 12 includes a tunnel 13. The tunnel 13 has an inlet 131 that decreases in diameter in the direction away from the lubricant storage 111, and an outlet 132 in spatial communication with the inlet 131. The surface of the metal wire (not shown in Figure 1) is first coated with the lubricating powder as the metal wire passes through the lubricant storage 111 before passing through the inlet 131 of the die 12. Since the diameter of the inlet 131 of the die 12 decreases gradually, the metal wire passing through the inlet 131 is pressed as it exits through the outlet 132, with the diameter of the metal wire reduced. Therefore, the objective of decreasing the diameter of the metal wire is achieved.

[0003] However, such wire drawing using the die 12 possesses the following drawbacks:

1. Quality of the metal wire drawn is unstable:

   Due to the large contact surface between the metal wire and the die 12, when the metal wire passes through the die 12, huge amount of friction and heat are produced. High temperature in the tunnel 13 after prolonged use causes the tunnel 13 to be worn and scratched, which causes the diameter of the tunnel 13 to increase, causing the quality of the wire drawn from the apparatus to be unstable.

2.Hugh amount of electricity consumed:

   Due to the friction between the die 12 and the metal wire, a motor (not shown in Figure 1) used for pulling the metal wire requires a huge amount of energy and therefore consumes a large amount of electricity, resulting in high manufacturing cost.

3.Slow production speed and frequent replacement of the die:

   In order to reduce the friction between the metal wire and the die 12, the diameter of the inlet 131 of the die 12 must decrease gradually in shape, and therefore the metal wire has to be drawn many times by passing through many dies 12 in order for the metal wire to be drawn to the required diameter. As mentioned hereinabove, the tunnel 13, after prolonged use, becomes worn and scratched, and the production line has to be stopped in order to replace the die 12, wasting unnecessary manpower and slowing production speed. Commonly, replacement of the die 12 is required for every 10 tons of metal wires.

4.pollution to the environment:

   In order to decrease the friction between the metal wire and the die 12, the metal wire is first cleaned using hydrochloric acid or sulphuric acid and the lubricating powder is then applied before passing the metal wire through the die 12 for wire drawing. However, using a large amount of lubricating powder and acidic cleaners raises manufacturing costs. Furthermore, the particles of the lubricating powder are harmful to the human respiratory system, and also can cause damage to electrical equipments. The acidic cleaners used in cleaning the metal wires also cause environmental pollution.

[0004] The object of the present invention is to provide a wire drawing apparatus for drawing a metal wire that is capable of alleviating the abovementioned drawbacks of the prior art.

[0005] According to the present invention, the wire drawing apparatus is characterized by:

a wire pressing device including a main body and a plurality of roller units assembled on the main body, the main body having a hole through which a metal wire is extended, the roller units being assembled relative to the hole for surrounding and applying compression forces on the metal wire; and

a lubricating unit disposed on the wire pressing device and including a lubricant inlet provided on the main body, a lubricant outlet provided on the main body, and a plurality of passages formed respectively in the roller units, each of the passages being in fluid communication with the lubricant inlet and the lubricant outlet.

[0006] Other features and advantages of the present invention will become apparent in the following detailed description of the preferred embodiment with reference to the accompanying drawings, of which:

Figure 1 is a cross sectional view of the wire drawing apparatus disclosed in R.O.C. patent publication M380174;

Figure 2 is an exploded perspective view of the preferred embodiment of a wire drawing apparatus according to the present invention;

Figure 3 is a cross sectional view of the preferred embodiment; and

Figure 4 is a cross sectional view illustrating the wire drawing apparatus of the preferred embodiment performing wire drawing on a metal wire.

[0007] Referring to Figures 2 and 3, the preferred embodiment of a wire drawing apparatus of the present invention includes a base 3, two wire pressing devices 4 disposed on the base 3, two lubricating units 5 respectively disposed on the wire pressing devices 4, and two guide units 6 respectively disposed on the wire pressing devices 4.

[0008] Each pressing device 4 includes a main body 41 assembled with the base 3 and three roller units 42 assembled on the main body 41. The main body 41 has a hole 411 through which a metal wire 7 is extended, and the roller units 42 are assembled relative to the hole 411 in an equiangularly displaced manner for surrounding and applying compression forces on the metal wire 7. Each roller unit 42 includes an eccentric shaft 421 installed on the main body 41, a bearing 422 sleeved on the eccentric shaft 421, a roller body 423 installed on the bearing 422 for contacting the metal wire 7, and a plurality of leak-proofing members 424 sleeved on the eccentric shaft 421 and positioned in between the eccentric shaft 421 and the roller body 423.

[0009] Each lubricating unit 5 includes a lubricant inlet 51 provided on the main body 41, a lubricant outlet 53 provided on the main body 41, and three passages 52 formed respectively in the roller units 42. The three passages 52 are in fluid communication with the lubricant inlet 51 and the lubricant outlet 53 (since all passages 52 have the same configuration, only one passage 52 is shown in Figure 3). Each passage 52 includes an inlet section 521 in fluid communication with the lubricant inlet 51 and disposed in the eccentric shaft 421, an outlet section 523 in fluid communication with the lubricant outlet 53 and disposed in the eccentric shaft 421, and a lubricating section 522 that is in fluid communication with the inlet section 521 and the outlet section 523 and that is formed through the bearing 422. Each guide unit 6 includes a base part 61 assembled to the main body 41 of the corresponding wire pressing device 4 and three guide wheels 62 that are disposed rotatably on the base part 61 and that provide a winding path for the metal wire 7. The guide unit 6 and the roller units 42 are disposed on opposite sides of the main body 41 of the corresponding wire pressing device 4, and the winding path provided by the guide wheels 62 is aligned with the hole 411 in the main body 41 of the corresponding wire pressing device 4.

[0010] Referring to Figure 4, a driver unit (not shown in the Figure), by pulling the metal wire 7, enables the metal wire 7 to first go around and through the three guide wheels 62 of one of the guide units 6, and then passes through the hole 411 of the main body 41 of one of the wire pressing devices 4. The metal wire 7 is then surrounded and pressed by the roller bodies 423 of the roller units 42 of one of the wire pressing devices 4, causing the diameter of the metal wire 7 to be reduced. The metal wire 7 is then pressed again by the roller bodies 423 of the other one of the wire pressing devices 4, and exits through the hole 411 of the main body 41 of the other one of the wire pressing devices 4. Finally, the metal wire 7 that goes around and passes through the three guide wheels 62 of the other one of the guide units 6 is reduced to a smaller diameter.

[0011] Preferably, the metal wire 7 in this preferred embodiment is made of low carbon steel, and the diameter of which is reduced from 5.5mm to 1.0mm through the wire drawing process. However, the material and diameter of the metal wire 7 are not limited to such.

[0012] Referring to Figure 3, at the same time the metal wire 7 is being pulled, a pump (not shown in the Figure) injects a lubricant into the lubricant inlet 51 of each lubricating unit 5 (see Figure 2), causing the lubricant to enter, in the direction as indicated by the arrow A in Figure 3, the eccentric shaft 421 through the inlet section 521 of the corresponding passage 52. The lubricant then passes through the lubricating section 522 to cool the eccentric shaft 421 and the bearing 422 of the corresponding roller units 42. Finally, the lubricant exits the eccentric shaft 421 through the outlet section 523 of the corresponding passage 52 in the direction as indicated by the arrow B in Figure 3 and exits the wire pressing devices 4 through the lubricant outlets 53 of the lubricating units 5. The leak-proofing members 424 prevent lubricant from leaking through the eccentric shaft 421 and the roller body 423.

[0013] Referring to Figures 3 and 4, in the pulling process of the metal wire 7, the guide wheels 62 of the guide units 6 enable the metal wire 7 to stably enter and exit the holes 411 of the wire pressing devices 4 and to be stably press rolled by the roller units 42. Since the roller units 42 of the wire pressing devices 4 press roll the metal wire 7 to reduce diameter of the same, the friction produced is minimal and the application of lubricating powder onto the metal wire 7 is therefore not required. Also, since the roller press method covers a large surface area of the metal wire 7, the number of times of wire drawing required for achieving a desired diameter is reduced and therefore the speed of manufacturing is increased.

[0014] Furthermore, when the lubricant passes through the passages 52 of the lubricating units 5, it lubricates and extends the life span of the bearings 422. The lubricant also provides a cooling effect by drawing heat away from the roller units 42 when they are rolling, reducing the likelihood of deterioration of the material of the roller units 42.

[0015] The design of the wire drawing apparatus as described hereinabove possesses the following advantages:

1. High production speed and requires no lubricating powder on the metal wire:

Since the roller bodies 423 of the roller units 42 utilize a press rolling process to reduce the diameter of the metal wire 7, the friction produced is small, and therefore lubricating powder that harms human respiratory system and manufacturing equipments is not used. Since the press rolling process can achieve a greater rate of change of the cross section on the metal wire 7, the required number of times of wire drawing on the metal wire 7 is reduced. In this embodiment, the press rolling process can achieve an output of 1000-1200 meters of the metal wire per minute. Furthermore, since the friction is significantly reduced, the power required by a motor (not shown in Figure 4) to draw the metal wire 7 can also be reduced significantly.

2. Longer life span:

The lubricant that circulates in the lubricating unit 5 enables the eccentric shaft 421, the bearing 422 and the roller body 423 of each roller unit 42 to be lubricated when press rolling. Furthermore, the heat produced in the roller units 42 can be cooled by the lubricant, and the deformation and the deterioration in the material of the roller units 42 due to high temperature can be prevented, thus prolonging the life span of the roller units 42. In the prior art, for every 10 tons of the metal wire 7 drawn, the die 12 (in Figure 1) has to be replaced with a new one. On the other hand, the wire drawing apparatus of the present invention only requires a replacement of the roller units 42 for every 2000-5000 tons of the metal wire 7 drawn, thereby reducing the frequency of replacement significantly.

Claims

1. A wire drawing apparatus **characterized by**:

a wire pressing device (4) including a main body (41) and a plurality of roller units (42) assembled on the main body (41), the main body (41) having a hole (411) through which a metal wire (7) is extended, the roller units (42) being assembled relative to the hole (411) for surrounding and applying compression forces on the metal wire (7); and

a lubricating unit (5) disposed on the wire pressing device (4) and including a lubricant inlet (51) provided on the main body (41), a lubricant outlet (53) provided on the main body (41), and a plurality of passages (52) formed respectively in the roller units (42), each of the passages (52) being in fluid communication with the lubricant inlet (51) and the lubricant outlet (53).

2. The wire drawing apparatus as claimed in Claim 1, **characterized in that** each of the roller units (42) includes an eccentric shaft (421) installed on the main body (41), a bearing (422) sleeved on the eccentric shaft (421), and a roller body (423) installed on the bearing (422) for contacting the metal wire (7), and each of the passages (52) of the lubricating unit (5) includes an inlet section (521) in fluid communication with the lubricant inlet (51) and disposed in the eccentric shaft (421), an outlet section (523) in fluid communication with the lubricant outlet (53) and disposed in the eccentric shaft (421), and a lubricating section (522) in fluid communication with the inlet section (521) and the outlet section (523) and formed through the bearing (422).

3. The wire drawing apparatus as claimed in Claim 2, **characterized in that** the wire pressing device (4) further includes a plurality of leak-proofing members (424) sleeved on the eccentric shaft (421) and positioned in between the eccentric shaft (421) and the roller body (423).

4. The wire drawing apparatus as claimed in any one of Claims 1 to 3, further **characterized by** a guide unit (6) including a base part (61) assembled to the main body (41) of the wire pressing device (4) and a plurality of guide wheels (62) disposed rotatably on the base part (61) and providing a winding path for the metal wire (7).

5. The wire drawing apparatus as claimed in Claim 4, **characterized in that** the guide unit (6) and the roller units (42) are disposed on opposite sides of the main body (41) of the wire pressing device (4).

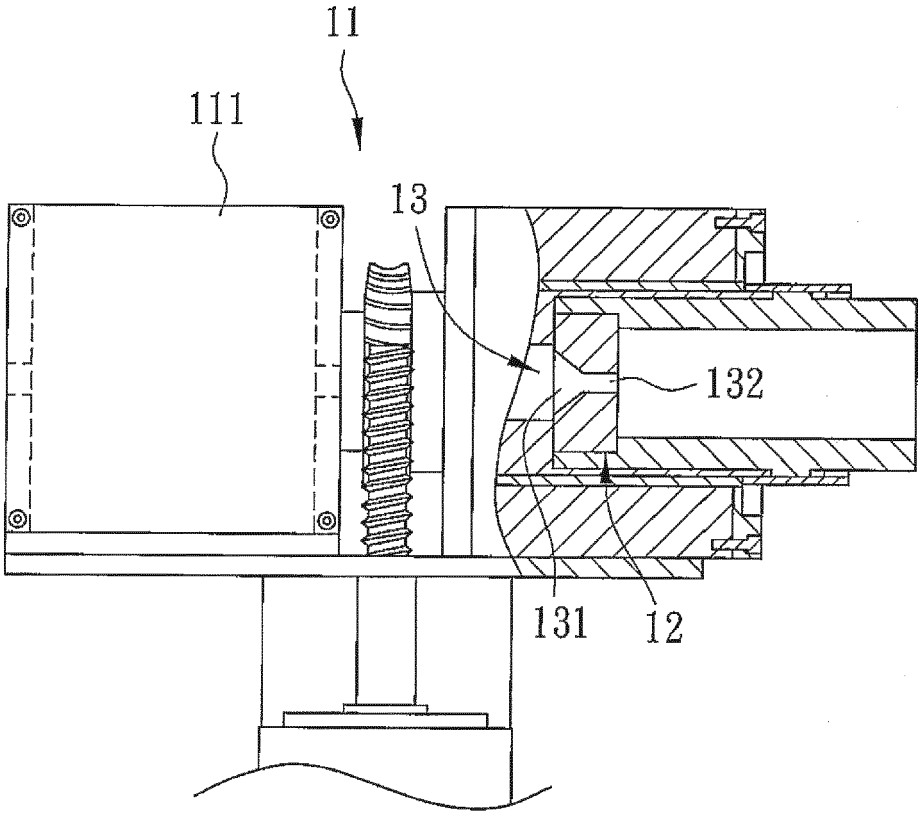

FIG. 1
PRIOR ART

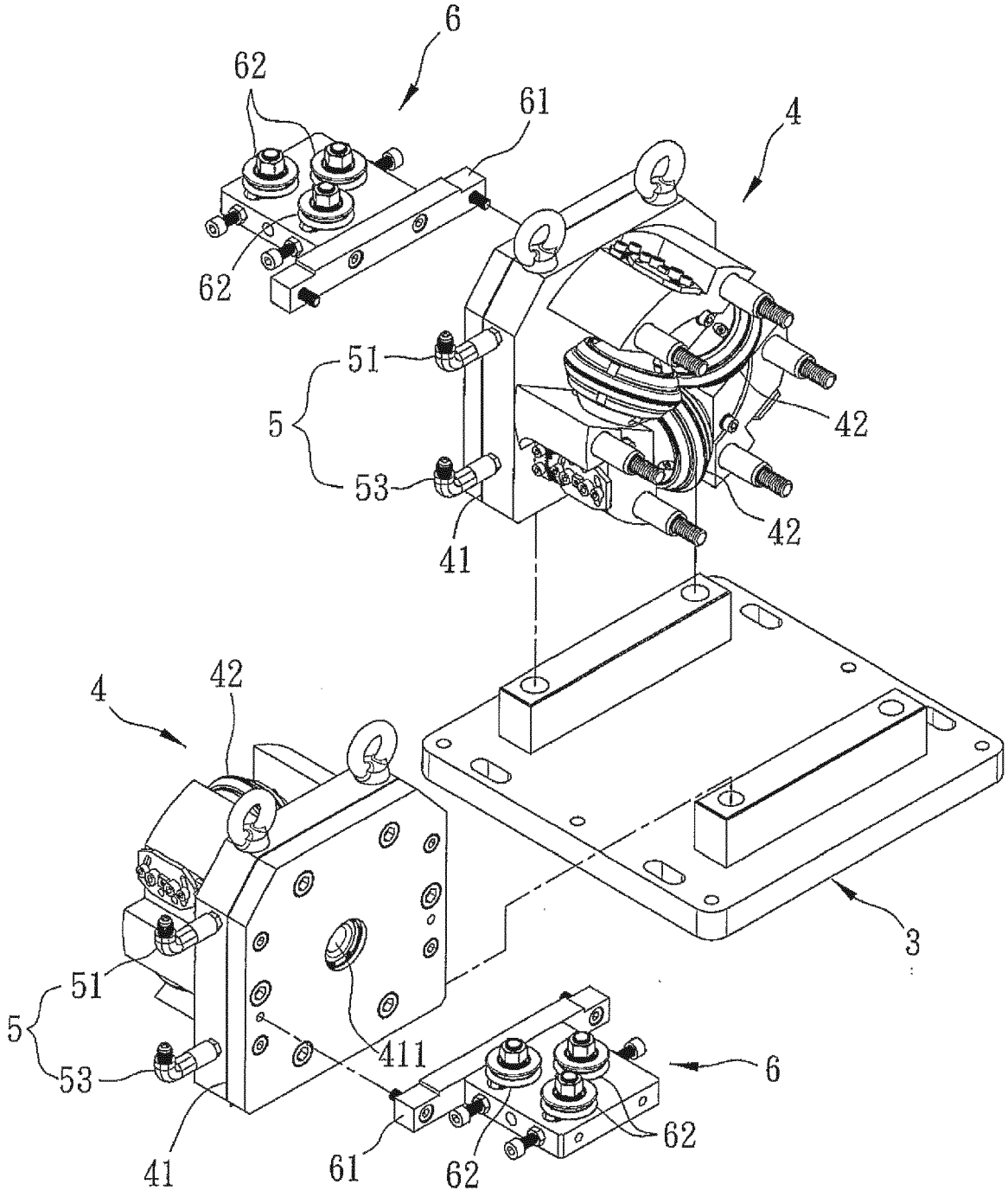

FIG. 2

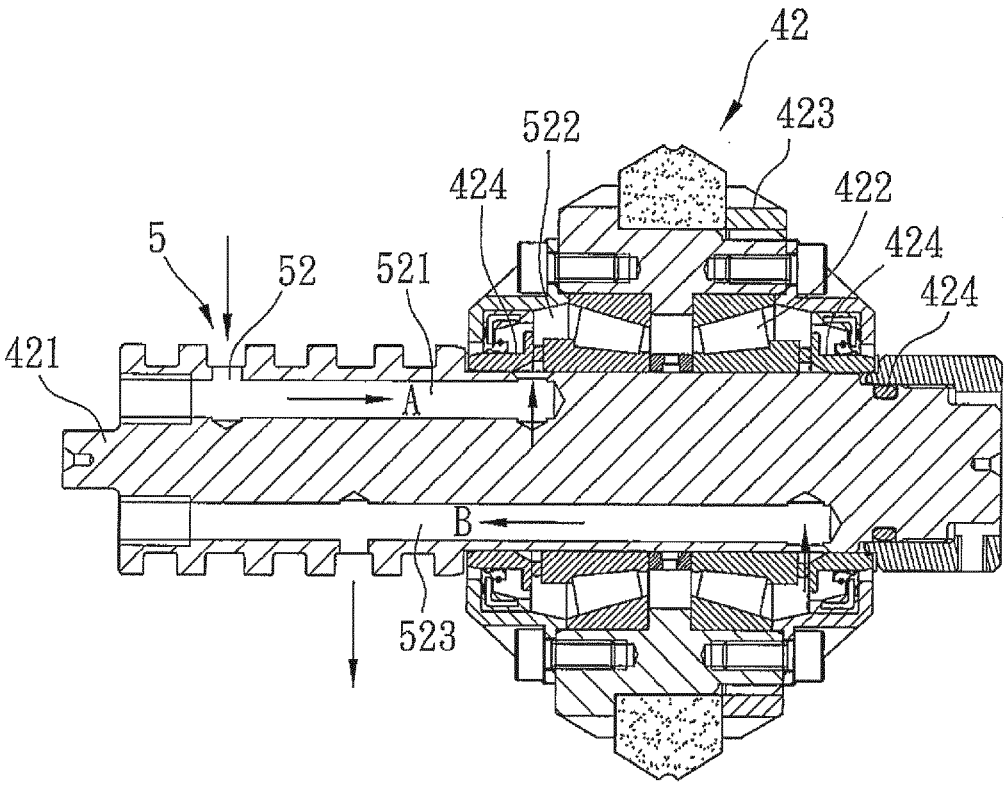

FIG. 3

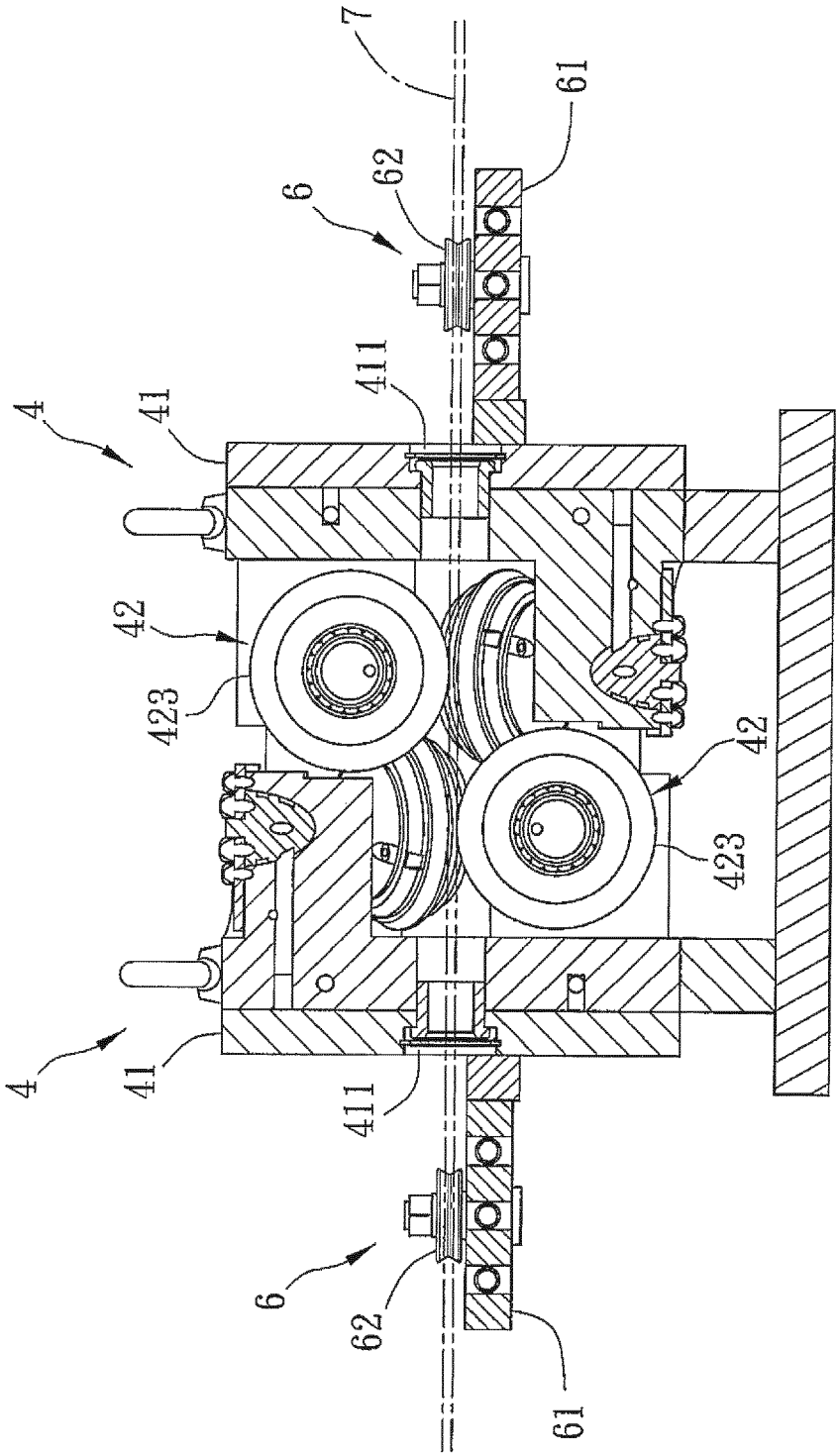

FIG. 4

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 12 19 6664

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	US 2 101 959 A (SCHULZ WALTER F) 14 December 1937 (1937-12-14) * page 3, column 1, line 37 - page 3, column 2, line 8; figures 1-8 *	1,2	INV. B21C3/08 B21C3/14 B21C9/00
A	GB 949 177 A (FISCHER & CO; HUFNAGL WALTER) 12 February 1964 (1964-02-12) * page 1, line 10 - line 40 * * page 1, line 77 - page 2, line 1 * * page 2, line 107 - page 3, line 27; figure 1 *	1,2	

TECHNICAL FIELDS SEARCHED (IPC)

B21C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	15 April 2013	Ritter, Florian

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

1 EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 12 19 6664

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

15-04-2013

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2101959 A	14-12-1937	NONE	
GB 949177 A	12-02-1964	AT 240314 B	25-05-1965
		AT 258841 B	11-12-1967
		AT 268183 B	10-02-1969
		BE 589879 A1	19-10-1960
		CH 377769 A	31-05-1964
		DE 1166138 B	26-03-1964
		FR 1281871 A	19-01-1962
		GB 949177 A	12-02-1964
		GB 954476 A	08-04-1964
		LU 38520 A	15-04-2013

EPO FORM P0459

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

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- WO M380174 A **[0002]**