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(54) Title: A DEDICATED FIXING COUPLING/FLANGE DESIGN AIMING TO CONNECT PIPE AND FITTINGS BEING IN A VARIETY OF MATERIAL TYPE IN REUSABLE AND EASY ATTACHABLE MODEL WITH HIGH RIGIDITY

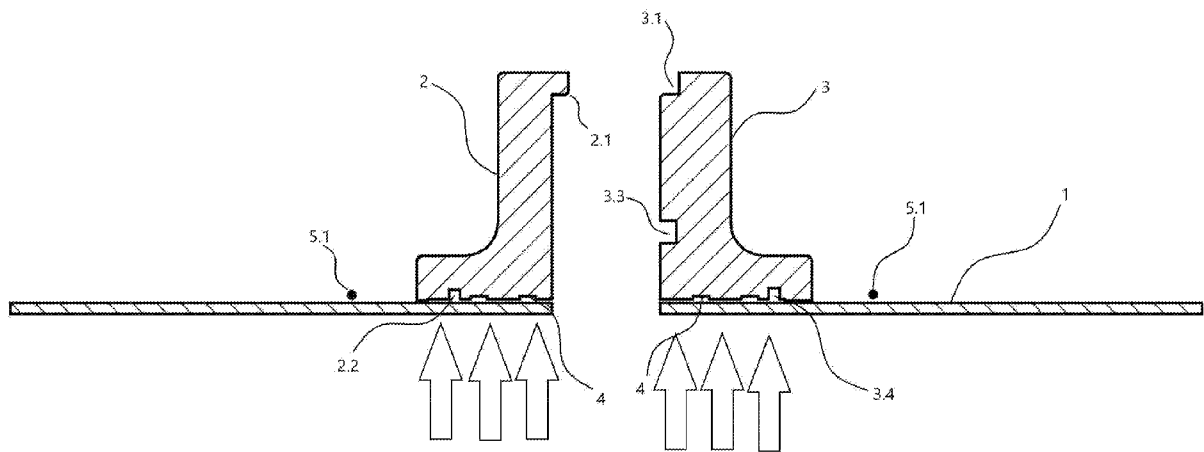


Figure-3

(57) Abstract: Method of connecting a first pipe (1) to a second pipe (1), the method comprising the following steps: - connecting the first pipe to the second pipe (1) by means of a female flange (2) and a male flange (3) after having centrally aligned the first and the second pipe to each other, - wherein, before the step of connecting the first pipe to the second pipe (1), each flange (2, 3) is rigidly and mechanically fixed to the respective pipe (1) by expanding the pipe wall of each pipe (1) towards the inner surface of each flange (2, 3), the expanding step being performed by applying pressure from the inside of the pipe by means of an expanding machine provided with rollers which rotate along the circumference of the pipe inner wall while they generate the expanding pressure, - bringing together the female flange (2) and the male flange (3) after that they are rigidly fixed to the respective pipes (1).

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**A DEDICATED FIXING COUPLING/FLANGE DESIGN AIMING TO CONNECT PIPE AND
FITTINGS BEING IN A VARIETY OF MATERIAL TYPE IN REUSABLE AND EASY
ATTACHABLE MODEL WITH HIGH RIGIDITY**

TECHNICAL SCOPE

This invention is about a pipe connection element aims to connect any kind of pipe, elbow or
Te metal pieces manufactured of steel, aluminum, copper materials or any of these in
combination that are usually used for solid, liquid or gas transfer with a rigid, easy installed
and leakage free connection features.

This invention especially aims to connect pipes and its fittings (elbows, tee's etc.) with a fast,
easy and fault free method that is different than commonly known processes like welding,
threaded connections etc. It enables the possible connection of items manufactured in
different material types while ensuring straight and smooth transition surfaces in between
each pieces, which is very important for especially solid and fragile material transfers inside
the pipe aiming for lowest product degradation possibility.

CURRENT TECHNOLOGY

Below, you may follow the basic functional details of most commonly used techniques in
current standard and specific applications.

- 1- Pipe and fittings connection with direct welding process. Connection with direct welding
generally ensures rigid mechanical fixing. However, it leads to long welding duration, high
labor cost and material expenses while technically necessitating welding activity in
usually difficult conditions in the installation areas. On the other side, as welding process
heats up the connections and melts additional metal over these connecting surfaces, it
usually ends with partial penetration of this melting metal into the inner surface of pipes
that are seen as uneven and protruding surfaces internally. This is a crucial weak point

especially for fragile solid material transfers passing through these connections that usually ends up with high product quality deterioration and degradations.

Also, for welding process, designers are to select high wall thickness piping materials to ensure proper connection in between items. This leads higher purchasing & investment cost for companies.

- 2- Pipe and fittings connection with additional flange welding offline and their connection via bolts/nuts in the field. Flanges outsourced from another manufacturer are to be welded onto the both pieces of piping in advance and connected in the installation area with bolts/nuts. This leads similarly high cost in welding process and risk of deformation and mis-alignment of pipe surfaces due to thermal deformations during offline installations. This has the same high purchasing and investment cost of the operations while having extra technical risks over.

- 3- Pipe and the fittings (which may be of different material types) connection via threaded ends. These connection details are only enabled with special machines preparing the pipe ends in advance in special forms together with dedicated & outsourced material purchases like nipples, conical couplings etc.

Similar to welding process, grooves and threaded surfaces are to be also opened in thick pipe walls. This has the same high purchasing cost of items as well as long preparation works of the items in the field leading to high labor cost expenses for the companies.

- 4- Pipe and the fittings connection with a small outer surface groove opening on the pipe, a dedicated special design conical & teeth-end ring and with outer fixing elements.

Initially, a groove is opened over the pipe. Special metal ring is slipped over the pipe and a sealing gasket is placed underneath. Pipe with groove, ring, gasket and external flange are all together pressed over their conical surfaces in a special machine to build up the connection flange. Once the counter part is prepared similarly, another specially designed conically surfaced outer clamp is used to fix both flanges together. In this implementation, there are many specially manufactured parts needed. Those are; 3 x sealing gasket, 2 x inner ring, 2 x outer ring and 1 clamp. Besides, 2 x special installation machines are to be assigned for the work. Even though many parts are installed for each single connection, main fixing/holding power is only loaded over conical surfaces of parts leading to easy/unexpected opening risk as well as leakage risk through the parts in general. Beyond that, due to many special part's usage in this connection method, the

total owning cost of this connection as well as installation machine purchases directly increases the investment cost of the companies.

- 5- Pipe and the fittings connection with a special flange having movable extensions at the back end for the purpose of friction surface generation, a tightening clamp over this flange extensions and with specially designed outer conical fixing element.

A sealing gasket and flange is initially slipped over the straight pipe or fittings and the clamp is tightened to fix the flange over the pipe. Once the counter part is also prepared with the same method, an outer conically surfaced clamp is used to fix them to each other. In this implementation, there are all specially manufactured parts needed. Those are; 3 x sealing gasket, 2 x flanges, 2 x screw clamps and 1 x conic inner surfaced clamp. Due to the limited friction surface over the flanges as well as the lower friction surface availability over the pipe, this solution does not generate required holding power in long term and leads to risk of loosening and consequently leakage. Besides, due to many special materials usages, the first purchase and the investment cost of the companies are directly increased.

- 6- Pipe and fittings connection with a long external clamp having tightening screws over and sealing gasket all over the surface in between clamp and pipe. Long external clamp having interior full covering surface of sealing material slipped over 2 connecting piping element. It holds both parts at the same time. Once clamp center is positioned in between two pipes, screws are tightened to squeeze the flange & gasket underneath. This gasket acts as both for sealing purpose as well as friction surface to hold the parts in place. In this process, there is no power generation in pipe's length. In this sense, the potential gap appears during installation in between pipes and fittings are never closed. This jeopardize smooth transition in between inner surfaces of the pipes for high quality product transfer. This relatively low costed implementation is commonly used but not preferred solution/implementation for valuable product transfers with the piping systems.

Among the 6 different applications described above, 1st and 2nd methods are widely used and they definitely require same type of material connection necessity while the other 4 methods enable different type of material connection flexibility while they have many other weaknesses in connections.

Due to all these weaknesses / disadvantages being clearly pointed out in above paragraphs, a new designed connection system became necessary.

THE PURPOSE OF INVENTION

- 5 This invention is related to the pipe fittings which ensures all requirements against hardships, eliminates disadvantages while bringing lots of advantages.

10 An objective for this invention is; To connect the piping network of industrial processes with a new mechanical fixing method without welding or time consuming and costly activities while similar mechanical strength is ensured in all connection points.

An objective for this invention is; to provide strong connection of pipes and other fittings which might be manufactured of distinct materials.

- 15 An objective for this invention is; to ensure the industrial piping network has a straight, smooth and accurately tolerated inner surface dimensions while minimizing human & installation related mistakes those minimize the product degradation during pneumatic transfer of especially fragile & delicate materials that duly supports factories processes and quality expectations.

20

An objective for this invention is; to provide a firm mechanical connection of the piping network applying the same strength in axial and radial directions with no deterioration in its life time by means of such flange's geometry.

- 25 An objective for this invention is; to ensure sealing in between the piping and fittings with minimum additional items necessity.

30 An objective for this invention is; to simplify and accelerate the labor works during preparation and installation activities in the field and generate efficiency and expenditure saving opportunity.

An objective for this invention is; to ensure easy and fault free pre-installation of the piping network and guarantee flawless and high-quality installation works are always in place with no human effect.

- 5 An objective for this invention is; to minimize the quantity of the items necessary for a piping network installation and reflect this opportunity as cost saving opportunity in general.

An objective for this invention is; to enable opportunity to avoid high wall thickness piping material usage necessity. Thus, allow system to be as light as possible while ensuring lowest
10 investment cost is always in place during such material selections.

Below is the detailed explanation of the invention with referring figures for easier and clear understanding of all infrastructural and characteristic details with all mentioned advantages. Hence, it is requested to evaluate the invention through the following expressions and
15 figures.

BRIEF EXPLANATION OF FIGURES

Figure 1 ; The subject of the invention (Flanges - as pair female & male parts) and the
20 disassembled view of these flanges with the pipes or the fittings that might have made of different raw materials.

Figure 2 ; Side view of the flanges and the pipes being positioned inside the flange in center line.
25

Figure 3 ; Cross sectional view of the flanges unique inner geometry and the pipe's expansion direction inside the flange.

Figure 4 ; Cross sectional view of flanges and the pipes after expansion, permanent
30 deformation and its outer surface penetrating into flange grooves done by its dedicated machine tool

Figure 5 ; Cross sectional view of flanges and the pipes after pre-installation that is being prepared for final connection.

5 **Figure 6** ; Side view of the flanges & the pipes positioned before final connection and the sealing gasket located in between.

Figure 7 ; Cross sectional view of the flange's centering geometry after they are fully connected to each other.

10

Figure 8 ; Front view of the flanges after they are fixed to each other with removable connection items (bolts & nuts)

Figure 9 ; Perspective view of the flanges and the pipes after they are fixed to each other.

15

REFERENCE NUMBERS

1. Pipe
2. Female flange
 - 20 2.1 Female flange installation/centering teeth
 - 2.2 Female flange sealing gasket channel (Flange to Pipe)
3. Male flange
 - 3.1 Male flange installation/centering teeth
 - 3.2 Male flange connecting/fixing slot
 - 25 3.3 Male flange sealing gasket channel (Flange to Flange)
 - 3.4 Male flange sealing gasket channel (Flange to Pipe)
4. Flange grooves
5. Sealing gasket (Flange to flange)
 - 5.1 Sealing gasket (Flange to pipe)
- 30 6. Removable fixing items (Bolts & Nuts)

DETAILED EXPLANATION OF THE INVENTION

This detailed explanation gives further information about the mentioned flange fittings element in piping systems and enlightens the working principle of the design leading to the technical advantages mentioned on the “purpose of invention” section of this application.

5

Figure 1 shows the pieces of the design which forms the pipe connection system. Since the pipes (1) used for the transfer of products cannot be monolithic along the whole length, flanges or any similar additional items are to be used as connecting elements in between each item on the line.

10

Using flanges for the connection of pipes is a common implementation method as mentioned under the title of “current technology.” However, due to negative features & results in both preparation and installation phases of this or similar technologies, a new design for such fittings became mandatory. Patent applied system so called Flanges consist of two main pieces as female flange (2) and male flange (3).

15

Figure 2 shows flanges (2, 3) that are slipped over the pipes (1). Pipes (1) and flanges (2, 3) are fixed to each other with the help of special pipe expansion machine that ensures steady pipe expansion in circular form around flange inner surface and assures the center line's match in between 2 pieces.

20

Figure (3) shows the sectional view of flange-pipe connections and pressure application direction over the pipe, which is initially centered with the flange, pipe expansion surface, physical and permanent deformation direction with the power applied to the entire pipe circumference with equal intensity. The place where the arrows are located is the pipe's (1) interior section.

25

Dedicated pipe expanding machine and its rollers generate pressure from the inside of the pipe (1) in equal power while they are rotating all along the pipe surface and expand the pipe wall towards the wall of flange (1) and to the grooves (4) exist around the internal surface of the flange (1).

30

Prior this, Sealing gaskets (Flange to Pipe) (5.1) are fit into the both Female flange sealing gasket channel (Flange to Pipe) (2.2) and Male flange sealing gasket channel (Flange to Pipe) (3.4).

5 Figure (4) shows the cross-sectional view of the pipe (1) expanded as mentioned in the paragraph above and the details of its mechanical fixation to the flange by the help of grooves (4). Expanding pipe (1) surface penetrates into the grooves (4) that physically connects pipe (1) and the flange (2, 3) to each other. Whole surface pipe penetration into the flange grooves (4) as well as Sealing gaskets (Flange to Pipe) (5.1) in both Female flange
10 sealing gasket channel (Flange to Pipe) (2.2) and Male flange sealing gasket channel (Flange to Pipe) (3.4) detailed in Figure 3 ensures air tightness as well as perfect mechanical fixation of two pieces in both radial and alongational directions.

As the pipe is expanded all in circular form of flange internal surface, exactly the same
15 dimensioned pipe connection points are generated. This eliminates the potential degradation of the product passing through the piping network and materials inside.

Figure 5 shows the cross-sectional view of the pipes (1) and the two flanges (2,3) where their center lines are already matched to each other with the help of pipe expanding machine.
20 After this preparation, two flanges (2, 3) are brought together. Flange fixing slots (3.2) exist in both flanges (2, 3) are used for the installation of Removable fixing items (Bolts & Nuts) (6) to get through them and tightened the system to build up rigid connection.

Figure 6 shows the pipes (1), flanges (2, 3) and the Sealing gasket (Flange to Flange) (5).
25 Male flange Sealing Gasket channel (3.3) holds the sealing gasket (Flange to Flange) (5) that is used for the purpose of air tightness in between two flanges (2, 3). The depth of the Sealing gasket channel (3.3) is normally less than the diameter of the Sealing gasket (5) so that it ensures required level of tight connection in between flanges (2, 3) are built up for perfect air tightness in this connection.

30

Figure 7 shows the cross-sectional view of the final connection in between female flange (2) and male flange (3) in detail. Flanges (2, 3) which are pre-manufactured with sensitive tolerances (2, 3), have both female and male endings (2.1, 3.1) as shown in figure 3. Thanks to the correctly matching tolerances in between both flange endings (2.3, 3.1) detailed in

figure 3, centering of two flanges (1, 2) are ensured with no risk of any mistake occurs during installation. Such precision in dimensions and fault free installation features of the flanges (2, 3) leads to the achievement of the goals mentioned in the purpose of the invention.

- 5 Figure 8 shows the side view of the pipes (1) which are connected by flanges (2, 3). Both flanges have flange fixing slots (3.2) in circular form where the standard removable fixing items (Bolts & Nuts) (6) are used to build for rigid connection.

- 10 Flange fixing slots (3.2) over the flanges have special dimensioning enables free rotation opportunity of 2 pieces independently. Especially during direction changes over the piping network, fittings especially elbows with flanges pre-installed requires full flexibility in rotation at any angle. Flange Fixing slots (3.2) on both flanges (2, 3) ensures 360° rotation flexibility of any part connected with the new flanges (2, 3)

- 15 Figure 9 shows the perspective view of two pipes (1) completely connected with the flanges (2, 3) and fixed with removable fixing items (Bolts & Nuts)

CLAIMS

1. This invention is related with industrial piping systems used for any type of material transfer and referring pipes (1) connecting method and the items consist of Female flange (2) and Male Flange (3) having the features of;
5
 - Each pipe (1) to be connected with full central alignment to each other by means of Female & Male flanges (2, 3)
 - Pressure application from internal surface of the pipe and the expansion of the pipe walls in circular towards the inner surface of the flanges (2, 3) leading to an
10 air tight and rigid mechanical fixing feature to each other
 - The installation of female flange (2) and male flange (3) to each other after they are rigidly fixed to the pipes (1)
2. Flanges (2, 3) according to claim 1; having the features of flange grooves (4) over the
15 internal surface of both flanges (2, 3) with minimum 1 groove where the expanding pipe (1) walls via internally applied pressure in circular is penetrating inside, leading to a permanent holding and fixing connection in between pipes (1) and the flanges (2, 3)
3. Flanges (2, 3) according to claim 1; to connect pipes (1) to flanges (2, 3) and flanges (2, 3) to each other with full air tightness, having the Sealing gaskets (5, 5.1) where all
20 gaskets are installed into the sealing gasket channels (2.2, 3.3, 3.4) on Flanges (2, 3),
4. Flanges (2, 3) according to claim 1; after pipes (1) and flanges (2, 3) are connected to each other, having the features of those flanges with flange installation/centering
25 teeths (2.1, 3.1) in order to ensure centered connection in between each other
5. Flanges (2, 3) according to claim 1; Female flange (2) and Male flange (3) having the
30 slots (3.2) surrounding the outer sections enable to fix flanges to each other while having the flexibility to rotate the flanges (2, 3) and the pipes (1) in 360° freely around its center line with no further adjustment necessity.

Figure-1

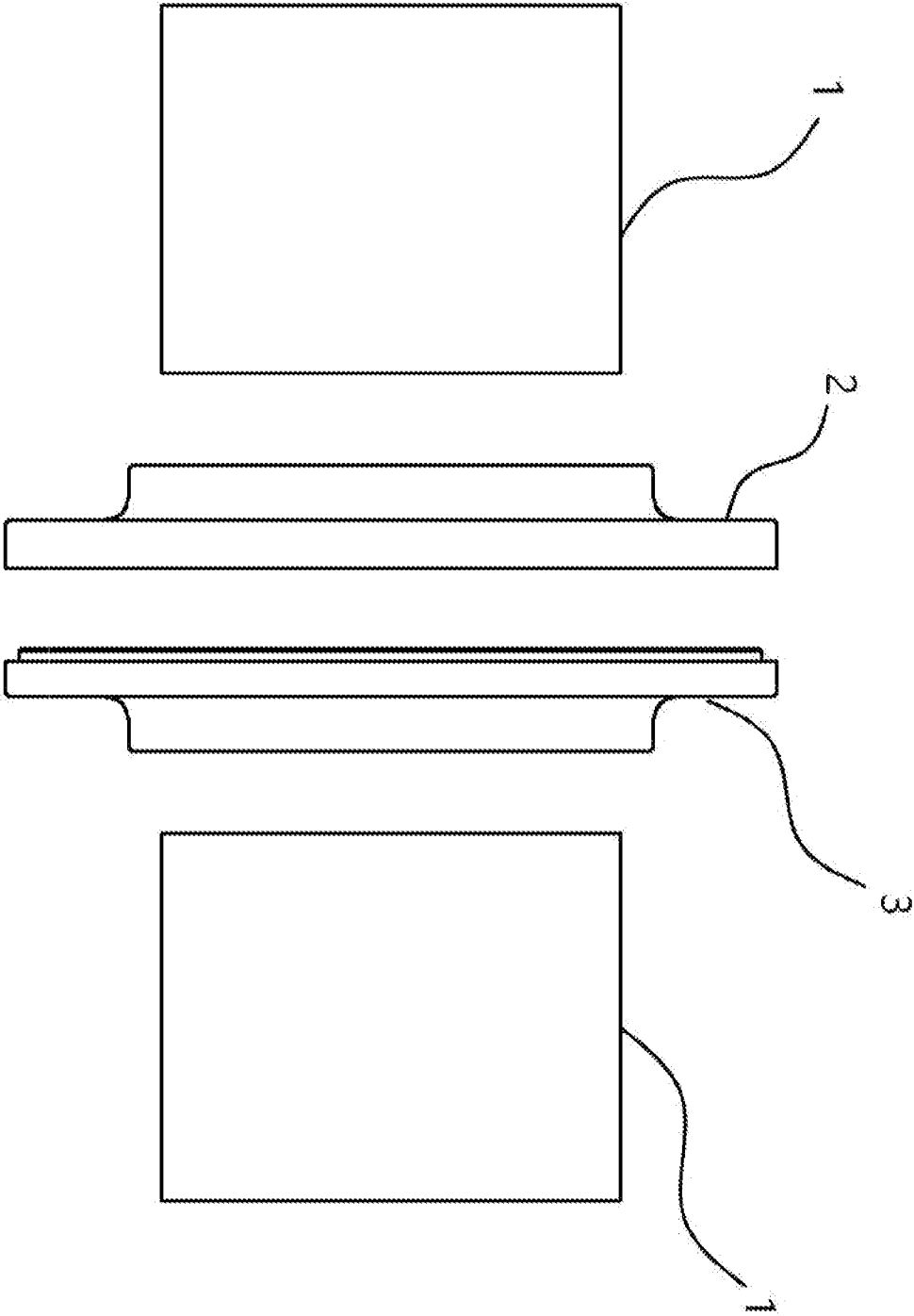
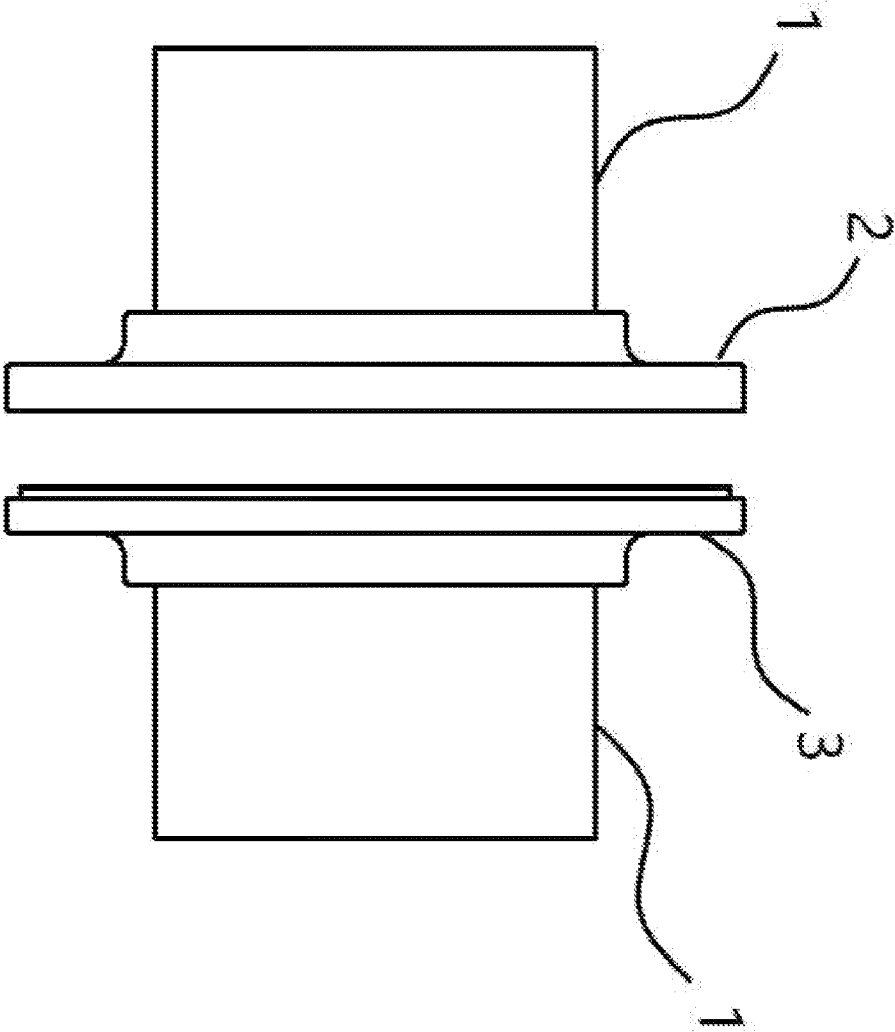
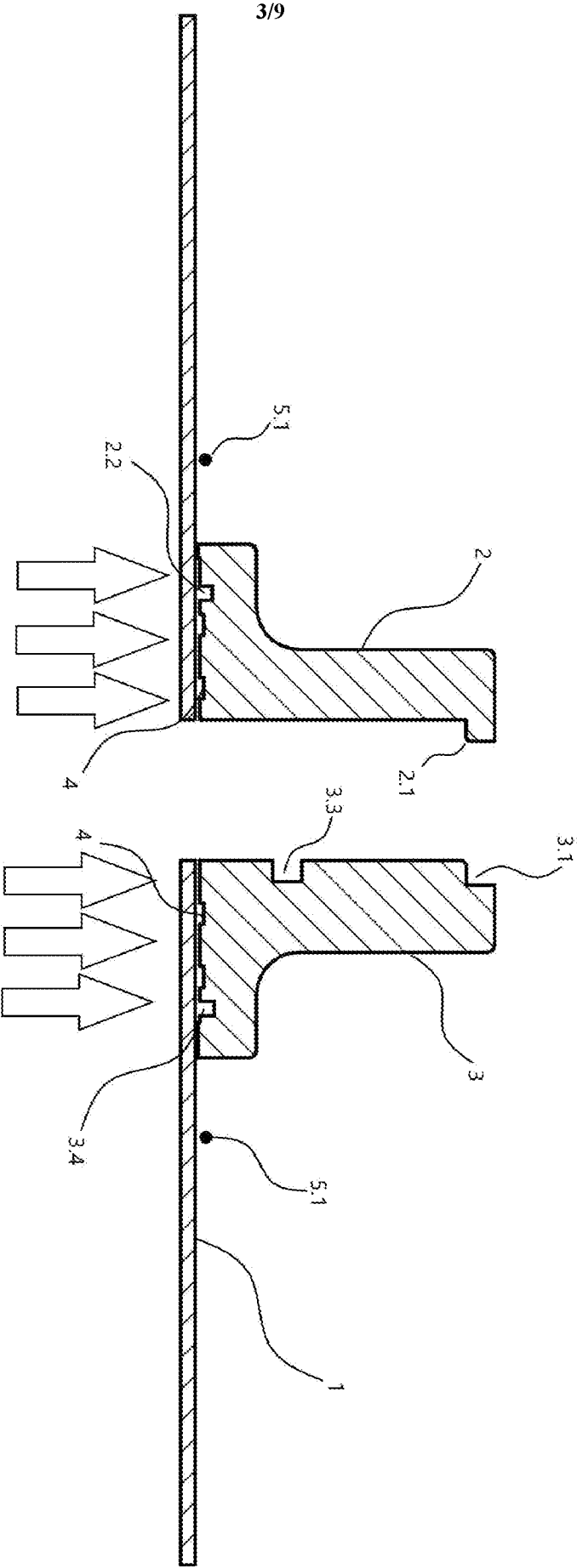
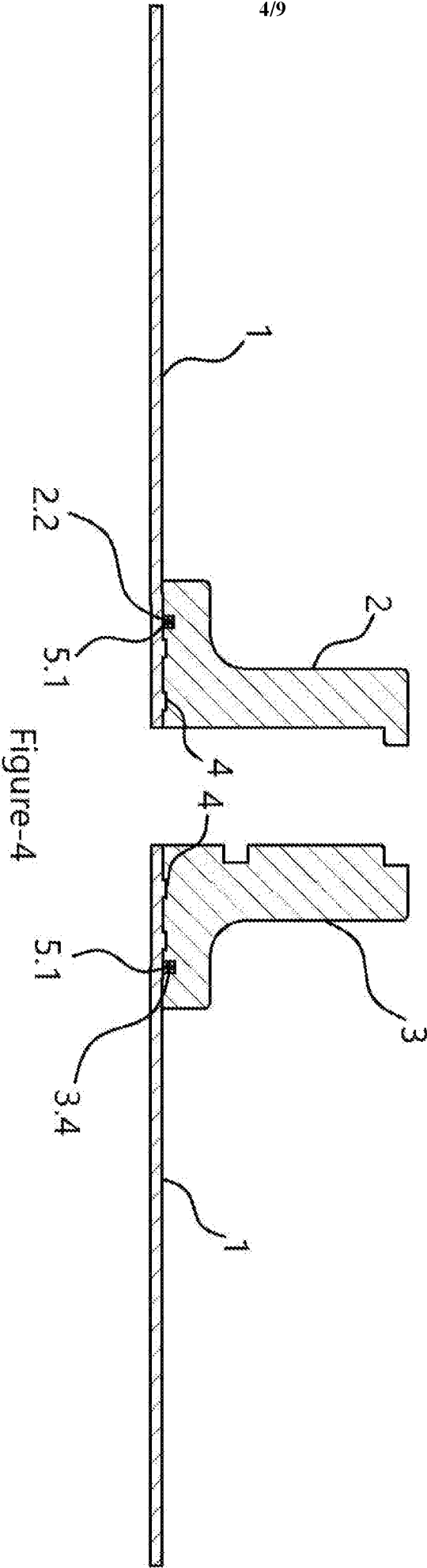


Figure-2







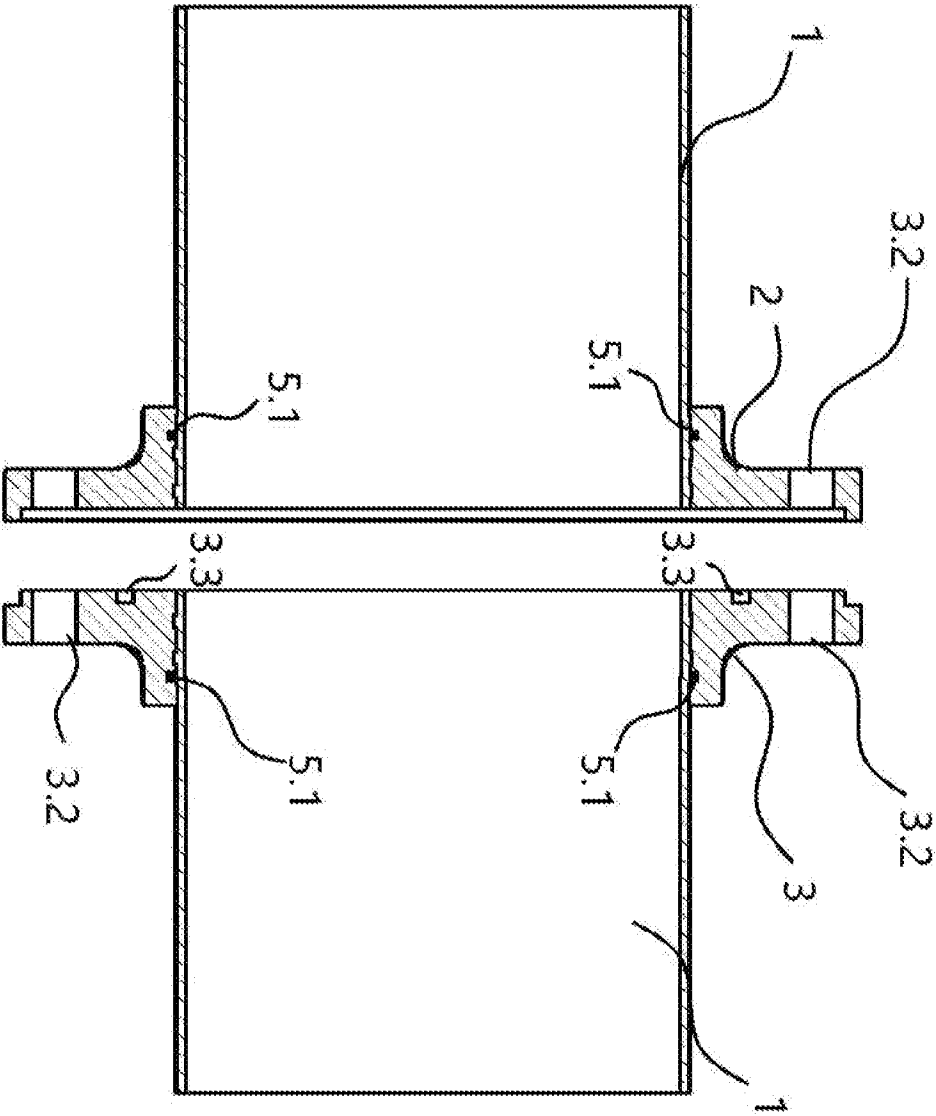
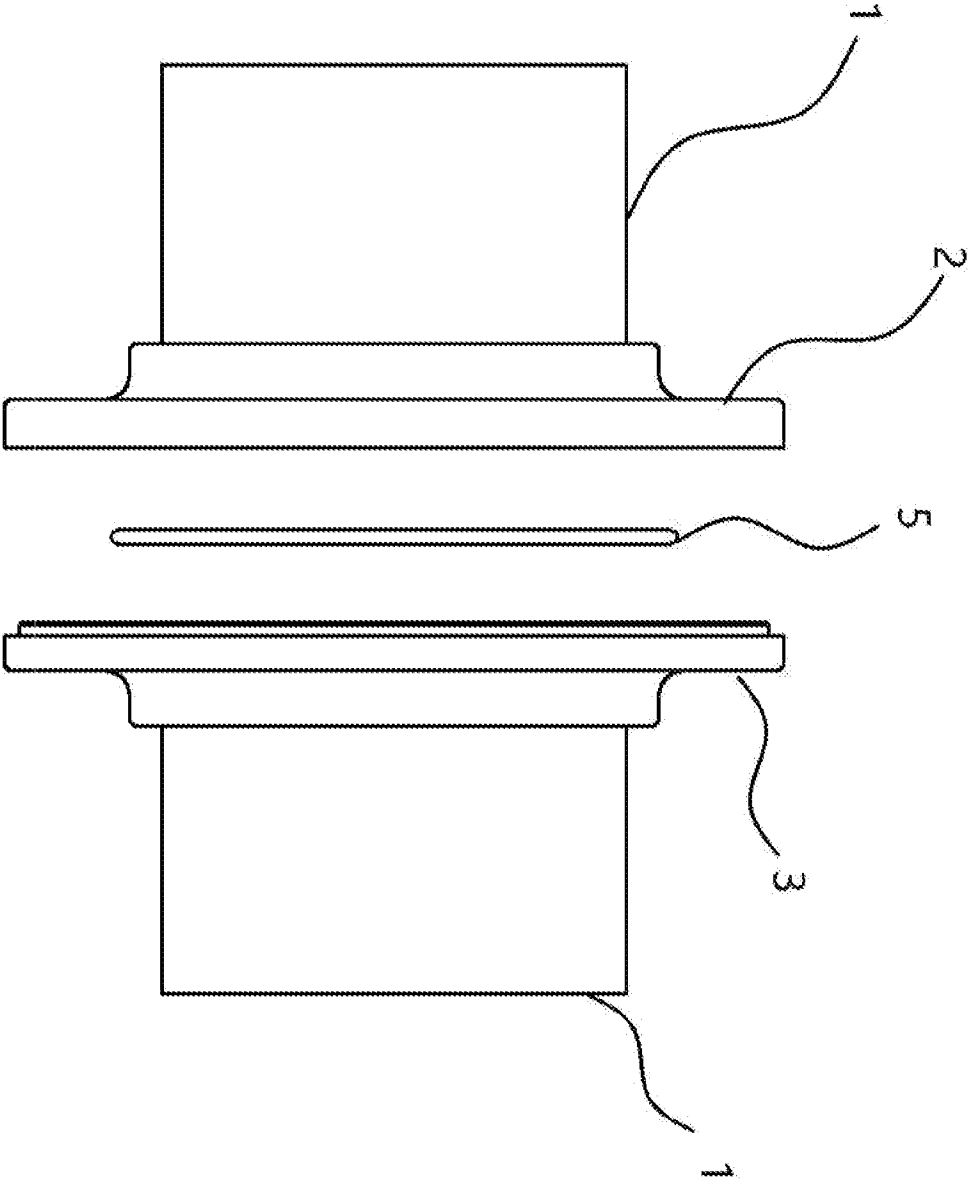


Figure-5

Figure-6



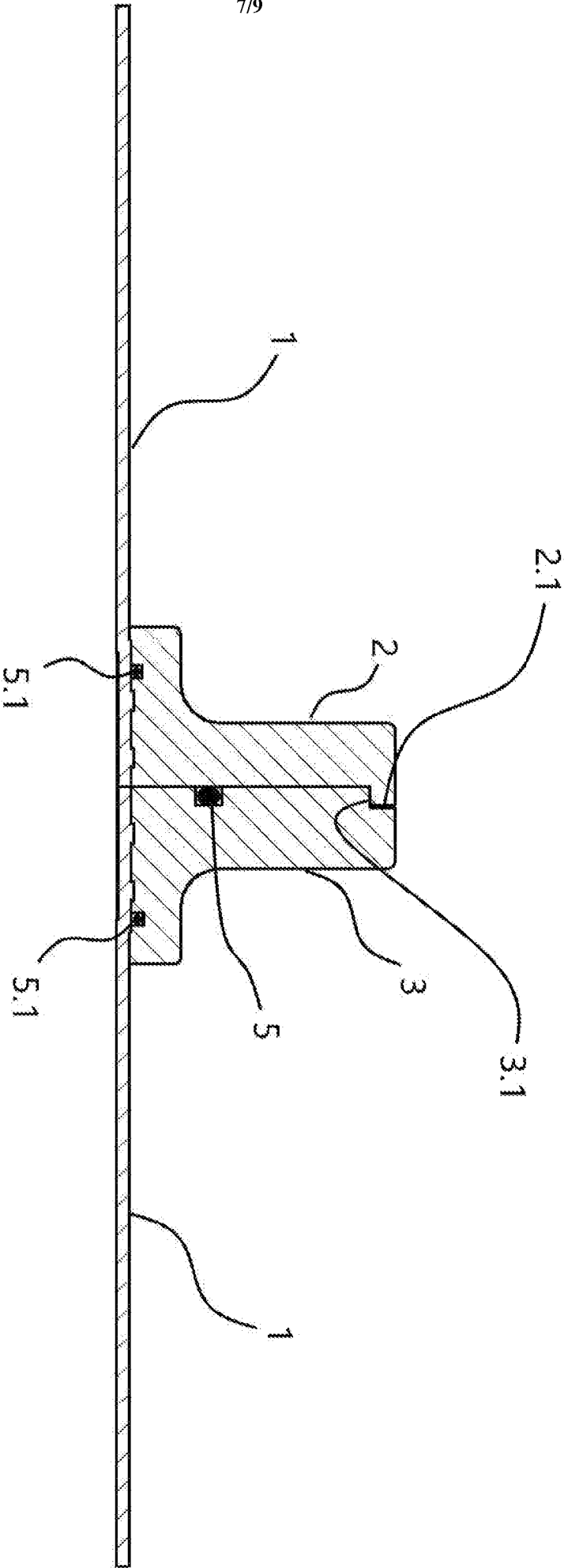


Figure-7

Figure-8

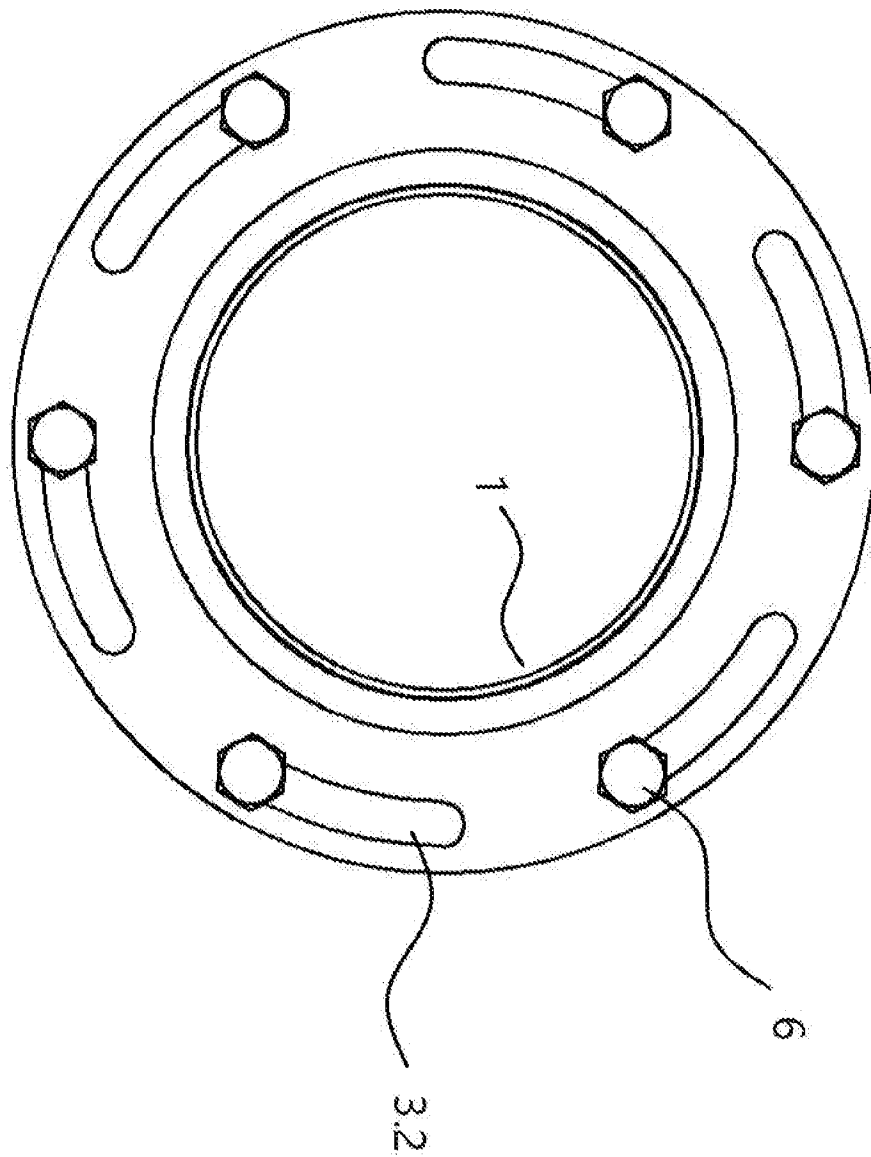
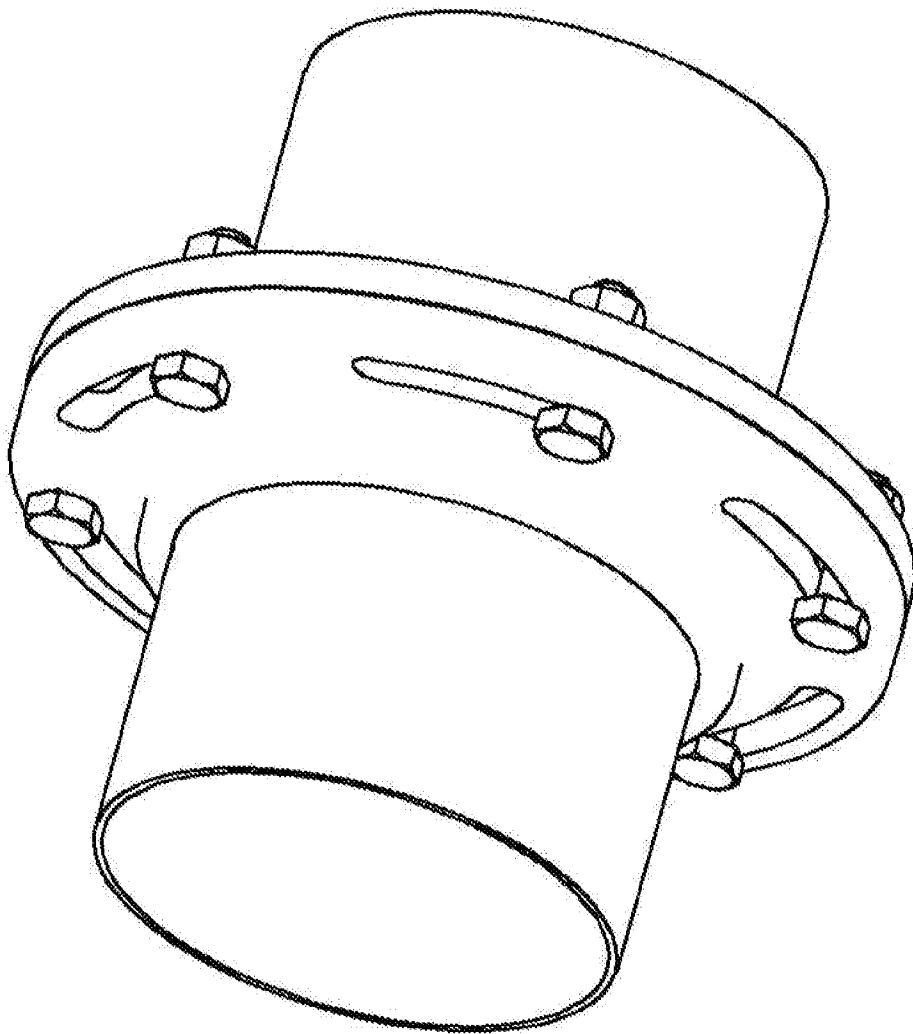


Figure-9



INTERNATIONAL SEARCH REPORT

International application No
PCT/TR2020/050137

A. CLASSIFICATION OF SUBJECT MATTER
INV. F16L23/024 F16L23/032
ADD.

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)
F16L

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)

EP0-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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A	page 1, line 24 - page 2, line 4; figure 1 -----	5
X	FR 1 127 184 A (STEELS ENGINEERING INSTALLATIO) 10 December 1956 (1956-12-10)	1,2,4
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A	the whole document -----	3,5
Y	DE 20 2005 020958 U1 (K DIETZEL GMBH DIPL ING [DE]) 26 April 2007 (2007-04-26)	5
A	paragraph [0013]; figures -----	1-4
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Further documents are listed in the continuation of Box C.



See patent family annex.

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Date of the actual completion of the international search

30 June 2020

Date of mailing of the international search report

10/07/2020

Name and mailing address of the ISA/

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INTERNATIONAL SEARCH REPORT

International application No
PCT/TR2020/050137

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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A	----- FR 2 008 741 A1 (CATERPILLAR TRACTOR CO) 23 January 1970 (1970-01-23) page 3, line 20 - line 33; figures -----	1-5

INTERNATIONAL SEARCH REPORT

Information on patent family members

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