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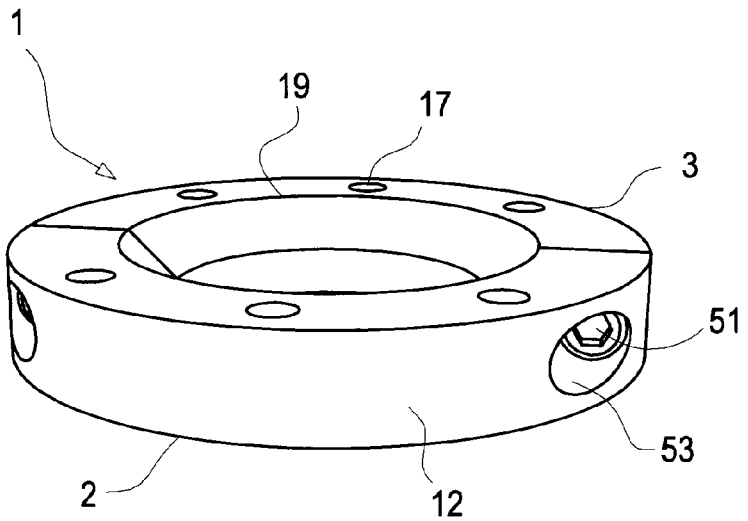

Fig. 3

(57) **Abstract**: The present invention relates to a clamping collar for end flanges of pipes, composed of an annular element (1) comprising a radially innermost annular edge (11) and a radially outermost annular edge (12), a head side faced towards the end flange of the pipe and a side opposite to the head side. The head side is further composed of a radially inner annular band (13) by means of which the head side is connected to the radially innermost annular edge and of a radially outer annular band (14) oriented according to a plane substantially perpendicular to the axis of the annular element. Further the annular element (1) constituting the clamping collar is divided into two complementary semi- annular elements, according to a transverse plane, preferably a diametral one. Such semi -annular elements can be coupled/uncoupled by removable fasteners.

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DESCRIPTION

The present invention relates to a clamping collar for end flanges of pipes, composed of an annular element comprising a radially innermost annular edge and a radially outermost annular edge.

The radially innermost annular edge is intended to surround the pipe and it is connected to the radially outermost annular edge by a head side faced towards the end flange of the pipe and by a side opposite to the head side.

The head side is in turn composed of a radially inner annular band and of a radially outer annular band.

The head side is connected to the radially innermost annular edge by the radially inner annular band, while it is connected to the radially outermost annular edge by the radially outer annular band, at least the radially outer annular band being oriented according to a plane substantially perpendicular to the axis of the annular element.

The radially inner annular band cooperates with the side of the end flange of the pipe, which flange faces said head side, overlapping the flange in the clamping condition.

Currently for assembling plants that provide pipes to be connected clamping collars are used which are

fitted to the ends of each pipe at the end flanges of the pipe prior to the final positioning of the pipe within the plant, such to allow the flange to be clamped and at the same time to allow a pipe and another one to be connected.

Therefore such solution requires collars to be assembled before definitively positioning the pipes in the plant, so that, especially with plants having pipes with a great dimension, as well as with a complex geometry, such as bends or passage curves of pipes, it is particularly disadvantageous and complex to pre-assemble the collars.

Moreover in some plants the pressure forces involved are high, therefore there is the need for collars able to exert a considerable clamping force that requires pre-assembled collars of great dimensions that increase the difficulties in mounting and positioning pipes in case of small spaces and complex geometries.

The solution that provides to pre-assemble collars has also drawbacks related to the maintenance of the plant and to the replacement of one or more of the plant components in case of failures or malfunctions of the plant.

Moreover, with a particular reference to plants that convey food products, a particular shape both of pipes and of the components intended for connecting them is required, that makes prior art known collars unusable.

Under such conditions pipes have end flanges that

provide the pipes with a greater diameter and which are put side by side by interposing a gasket. The interfacing region is a critical region since it is very important that dust or other external agents do not gather near it which otherwise would cause food to be deteriorated.

Moreover the convey of some food inside the pipes, such as for example the chocolate, can be performed only by melting the food to be conveyed by arranging, around the main pipe intended for conveying the food, conditioning pipes, particularly heating ones, inside which hot water flows, that keeps the food in the liquid condition by the dissipation of heat.

A further problem to be solved is therefore the fact of using clamping collars having small overall dimensions, while guaranteeing a high force in clamping the pipe.

There is the need therefore to provide a clamping collar that by relatively simple and inexpensive means can solve the drawbacks mentioned above.

The invention achieves the above aims by providing a clamping collar as described hereinbefore wherein the annular element constituting the clamping collar is divided into two complementary semi-annular elements, of which a first semi-annular element and a second semi-annular element, according to a transverse plane, preferably oriented perpendicular to the plane of the head side and passing by the diameter of the annular element. Moreover the semi-annular elements can be coupled/uncoupled by removable fasteners in a condition

with the annular element clamped or open with respect to the pipe respectively. At the ends of each one of the two semi-annular elements there are provided two interfacing surfaces which are in contact each other when the two semi-annular elements are in the coupled condition.

The coupling of the first and second annular elements is such that the radially outermost edge when said two elements are in the coupled condition is composed of a continuous surface and/or a surface free from radial projections or protrusions.

Advantageously such constructional form allows the clamping collar to be fastened to the pipe after positioning the pipe itself into the plant and it does not necessarily require it to be pre-assembled as it occurs according to prior art known clamping collars. The pipe is arranged in a predetermined position then the two semi-annular elements in the uncoupled and open condition are placed around the pipe, particularly at the end flange of the pipe, then they are coupled and brought in the clamping condition by using the removable fasteners. In the clamped condition the two semi-annular elements surround the pipe clamping it by the action of the removable fasteners and the head side of the annular element, composed of the two semi-annular elements, cooperates with the end flange of the pipe.

Due to the above advantageously at least one screw is used as removable fasteners which engages a corresponding engaging seat, which is at least

partially threaded, provided within the thickness of the annular element, secant to the radially outermost annular edge, which has an aperture for the insertion of the screw into the engaging seat. Due to the configuration of the annular element, the engaging seat is divided into two equal parts, one part for each semi-annular element, such that when the semi-annular elements are coupled, the two parts are coaxial such to form a single seat engaging the screw.

The use of a screw as the removable fastener allows the coupled condition of the two semi-annular elements to be easily obtained and allows the clamping action exerted by the latter on the pipe surrounded by them to be regulated.

Moreover the provision of a continuous outer surface and the particular configuration of the seat housing the fasteners just described lead to several advantages.

Firstly a surface is obtained that if attacked by external agents or by dusts prevents them to gather on it, keeping the interfacing region of pipes as more clean as possible.

Moreover the material flowing into the pipes, generally pushed by a pressure, leads to vibrations that have the tendency of unscrewing fasteners generally used in the known systems of the prior art, such as for example in the document DE 3702949: vibrations affecting the clamping collar tend to unscrew the nut securing the screw.

This does not occur in the clamping collar of the

present invention since the nut is integrated into the seat housing the fasteners, that is it is integral with the body of one of the two semi-annular elements and therefore it is more resistant to vibrations, which thus do not lead to the screw being unscrewed.

According to an improvement of the clamping collar of the present invention the engaging seat obtained into the thickness of the two semi-annular elements has, in the semi-annular element where the aperture for the insertion of the screw is provided, an abutment element for the head of the screw, while at least the other part of the engaging seat, provided in the thickness of the remaining semi-annular element, is threaded. Upon the abutment of the screw, the fact of screwing it allows a semi-annular element to move near the other one in order for them to be coupled as well as it allows the pipe to be clamped.

Preferably there are provided two screws with two corresponding engaging seats for guaranteeing the coupled and clamped condition of the two semi-annular elements; in this case the two seats will be one opposite each other into the thickness of the annular element, secant to the radially outermost annular edge near the ends of the two semi-annular elements.

The use of the screws and the aperture for their insertion on the radially outermost annular edge allows the user to have an easy access in order to regulate the clamping action and to screw the screws, making the assembly of the collar of the present invention more easy.

To this end the apertures of the engaging seats are both provided at the same part, such that, once the clamping collar is fitted on the pipe, the screwing and clamping action of the screws is more easy.

Moreover the apertures of the engaging seats of the screws are preferably provided at the same part and oriented downwardly such to prevent dust and agents from gathering in order to keep the environment surrounding the interfacing connection region of the pipes as more clean as possible and in order not to affect the operation or wear the screws.

Moreover the use of two screws increases the strength of the overall annular element, mainly at the interfacing regions provided between the two semi-annular elements, further allowing a greater clamping force of the two semi-annular elements exerted on the pipe.

As an alternative the removable fasteners can be composed of a screw with a corresponding engaging seat as described previously, arranged near one of the two ends of the semi-annular elements, while at the other end there is provided an engaging hinge allowing the two semi-annular elements to pivot about an axis passing by the second end and consequently allowing the two semi-annular elements to be coupled by such pivotment.

According to an improvement of the present invention the radially innermost annular band, provided at the head side faced towards the end flange, has a radially outermost peripheral edge and a radially

innermost peripheral edge, such that the radially inner annular band is connected by a projecting step to the radially outer band, such that the radially outer band projects with respect to the radially inner band by a specific amount towards the side of the end flange of the pipe facing said head side of the annular element.

Such improvement allows the collar to better adhere around the end flange of the pipe, since the projection of the outer annular band gives the head side a profile like that of the side of the end flange of the pipe faced towards said head side.

Generally the size of the projection of the radially outer band with respect to the radially inner band is equal to or slightly smaller than the thickness of the flange, the projection during the clamping action allows the collar to adhere against the end flange and the pipe not only by the radially innermost annular edge, but also by a portion of the head side such that such portion follows the profile of the side of the flange with which it cooperates that is faced towards the head side of the annular element.

As it will be described below such improvement is particularly advantageous when coupling pipes having an end flange, since the clamping action is exerted not only between the two collars connecting the pipes, but even by the interaction between the radially inner annular band of each collar and the outer surface of the end flange of the corresponding pipe.

To this end the clamping collar of the present invention can have different shapes of the head side,

since a portion of such side can have a profile exactly complementary to that of the end flange of the pipe with which it cooperates.

As it will be noted in the detailed description of the figures, a preferred embodiment provides the clamping collar of the present invention to have a circular section and to have specific dimensions on the basis of the diameter of the pipe with which it will cooperate and/or on the basis of the dimensions of the inner diameter of the collar.

According to a variant embodiment the clamping collar of the present invention has at least one through hole peprpendicular to the head side, which through hole passes through the head side and through the side opposite to said head side. This allows the annular element, constituting the collar, to be coupled to a further annular element having at least one through hole in a position corresponding to the hole of the previous annular element for the passage of a removable fastener.

Once the collar is tightened around the pipe, by a removable fastener passing through the hole provided on the head side of the annular element it is possible to fasten a further annular element surrounding a subsequent pipe in order to couple two pipes for generating plants, such that the two annular elements are in a coupled condition with their head sides in contact with each other.

According to such arrangement the annular element overlaps the pipe and tightens the pipe by a diametral

clamping action, that is by a force directed along an axis parallel to or passing by the diameter of the annular element, which axis is further perpendicular to the outer surface of the pipe, since the annular element preferably surrounds the pipe such that its diameter is perpendicular to the outer surface of the pipe.

Differently the coupling of an annular element provided at one end of a pipe with a further annular element provided at one end of a further pipe occurs by a clamping force directed perpendicularly to the head sides of the annular elements and consequently directed according to an axis parallel to the outer surface of the successively arranged pipes by the coupling of the two annular elements.

The removable fastener acting for coupling the two annular elements is preferably composed of the combination of a screw with a nut allowing the two different head sides of the annular elements associated to two different pipes to be in contact with each other.

Similarly the head side and the side opposite to said head side can have at least one through hole for coupling the annular element to a further structure, such as a wall or a pipe supporting structure, having at least one through hole in a position corresponding to the hole of the annular element for the passage of a removable fastener.

Advantageously the number of holes provided on the heas side can change and particularly such number can

depend on the mechanical strenghts and on the clamping forces required, both relating to the connection of the pipes and to the force required for clamping the annular element to the end flange of the pipe.

Preferably the annular element, and consequently the two semi-annular elements are made of a metal material, that gives the collar of the present invention the mechanical properties necessary to accomplish the action clamping an end flange of a pipe and the action connecting different pipes.

It has to be specified that the collar of the present invention is aside from the shape of the pipe cross-section, the annular element can surround pipes having circular section and/or with any other shapes, said annular element having said radially innermost edge with a shape corresponding to the shape of the section of said pipe.

Accordingly to what described previously the present invention relates also to a system for fastening pipe ends comprising at least two pipes, each of which pipes having an end with an end flange.

Each end flange cooperates with a corresponding clamping collar. The clamping collar surrounds the pipe end to which it is associated and it is tightened around the corresponding flange. At the same time the clamping collars act for keeping said at least two pipes in the connected position by means of removable fasteners that allow the clamping collars to be coupled.

Such system further provides the clamping collars

to be made according to the characteristics described above and related to the clamping collar of the present invention.

The invention relates also to other characterstics further improving the clamping collar for end flanges of pipes mentioned above and that are the object of the subclaims.

These and other characteristics and advantages of the present invention will be more clear from the following description of some embodiments shown in the annexed drawings wherein:

fig.1 is a view of the clamping collar of the present invention for end flanges of pipes according to a plane parallel to the head plane,

fig.2 is a section of a view of the clamping collar of the present invention for end flanges of pipes according to a section horizontal plane parallel to the head side,

fig.3 is a perspective view of the clamping collar of the present invention,

fig.4 is a perspective view of the clamping collar of the present invention,

fig.5 is a sectional view of an installation of the clamping collar of the present invention, intended for the connection of two pipes,

figs. 6a and 6b are a view of the installation of the clamping collar of the present invention for the connection of two pipes, particularly two pipes intended for conveying food.

Figures 1 to 4 show different views of the

clamping collar of the present invention, composed of an annular element 1 comprising a radially innermost annular edge 11 and a radially outermost annular edge 12.

The radially innermost annular edge 11 is intended to surround the pipe and it is connected to the radially outermost annular edge 12 by a head side faced towards the end flange of the pipe and by a side opposite to said head side.

The head side is composed of a radially inner annular band 13 and a radially outer annular band 14.

The head side is connected to the radially inner annular edge 11 by the radially innermost annular band 13, while it is connected to the radially outermost annular edge 12 by the radially outermost annular band 14, the latter being oriented according to a plane substantially perpendicular to the axis of the annular element 1. The radially inner annular band 13 cooperates with the side of the flange facing the head side, by overlapping the flange in the clamped condition.

The annular element 1 is divided into two complementary semi-annular elements 2 and 3, of which a first semi-annular element 2 and a second semi-annular element 3, according to a transverse plane, particularly a plane passing by the diameter of the annular element 1 perpendicular to the head side and particularly to the radially outer annular band 14.

Such transverse plane divides the annular element 1 into two semi-annular elements 2 and 3 that are equal

to each other and symmetrical with respect to the plane itself.

The semi-annular elements 2 and 3 can be coupled/uncoupled with respect to each other and, with a particular reference to figures 1 to 4, the two semi-annular elements 2 and 3 are coupled in a clamping condition in relation to the pipe 4 in which clamping condition the ends of each of the two semi-annular elements, composed of interfacing surfaces, are in contact by means of removable fasteners.

In such coupling condition figures 1 to 4 show how the two semi-annular elements 2 and 3, by the connection of the respective radially outermost annular edges, are fastened in place such that the whole surface of the radially outermost annular edge 12 of the annular element 1, is composed of a continuous surface, having no discontinuity elements that can cause dust to be collected and the size of the collar to increase.

Removable fasteners are composed of two screws 51 engaging into corresponding engaging seats 52.

Each engaging seat 52 is at least partially threaded and is provided within the thickness of the annular element 1, secant to the radially outermost annular edge 12, which has an aperture 53 for the insertion of the screw 51 into said engaging seat 52.

Moreover the engaging seat 52 is divided into two equal parts 521 and 522, a part for each semi-annular element 2 and 3 such that with the semi-annular elements 2 and 3 in the coupled condition the two parts

521 and 522 are coaxial such to form a single engaging seat 52 to house the screw 51 into the thickness of both the semi-annular elements 2 and 3.

Particularly there is provided an aperture 53 on the radially outermost annular edge 12 of the semi-annular element 2, having an abutment element 523 for the head of the screw 51, while the part of the engaging seat 522 provided in the thickness of the semi-annular element 3 is threaded such that upon the abutment of the screw 51, the fact of screwing it allows a semi-annular element 2 or 3 to move near the other one, such to lead to the coupling condition of the two semi-annular elements 2 and 3 and to the action clamping the pipe.

Particularly figure 2 shows a section of the collar of the present invention according to a section horizontal plane parallel to the head side. The two semi-annular elements 2 and 3 are in the coupled condition and the annular element 1 provides two engaging seats 52 and two screws 51.

The engaging seats 52 are divided into two equal parts 521 and 522 one for each semi-annular element 2 and 3, one 522 of them is threaded, while the other part 521 has an abutment element 523 fot eh head of the screw 51.

The position of the engaging seats 52 with the corresponding screws 51 can be any position within the thickness of the annular element 1, particularly in the figures the two engaging seats 52 are provided with the axis passing through the interfacing surfaces provided

at the ends of the two semi-annular elements 2 and 3, which axis is perpendicular both to the interfacing surfaces and to the transverse axis that divide the annular element 1 into two equal semi-annular elements 2 and 3.

As it will be described below in figure 5, the annular element 1 has a radially inner annular band 13, provided on the head side faced towards the end flange, which annular flange 13 has a radially outermost peripheral edge connected to a projecting step 19, such that the radially outer annular band 14 projects with respect to the radially inner band 13 by a specific amount towards the side of the flange facing said head side.

Moreover the radially outer band 14 of the annular element 1 has six through holes 17 perpendicular to the head side, passing through the head side and the side opposite thereto such to allow the annular element 1 to be coupled to a further annular element 6.

Figures 1 shows six diametrally opposite holes that are symmetrical in pairs and evenly arranged, that is in a manner that the distance between any hole 17 and the closest one is equal and corresponding to the distance between the holes closest to the ends of the semi-annular elements 2 and 3 and the ends themselves.

The semi-annular elements 2 and 3 are made of metal material and the radially outer band 14 is mirror polished by a mechanical treatment such to lead to the greatest contact surface between the annular element 1 and a further annular element 6.

Figures 1 to 4 show the clamping collar of the present invention always with a circular section, but it can be provided of any shape, particularly with the shape of the pipe it cooperates with.

In the variant embodiment shown providing a circular shaped section, it is possible preferably for the clamping collar to have precise dimensions, that is to have a ratio of the outer diameter to the inner diameter that changes on the basis of the size of the pipe.

With a particular reference to figure 1, a fixed ratio of the inner diameter A of the collar, the diameter B of the radially outermost annular band 13 and the diameter C of the radially outermost annular band 14 that coincides with the outer diameter of the annular element 1 is defined.

Preferably the size of the inner diameter A corresponds to the size of the diameter of the section of the pipe that cooperates with the clamping collar.

Advantageously the ratio of the inner diameter A to the diameter B of the annular band 13 is a number ranging from 1,2 to 0,4, preferably from 1 to 0,6, particularly from 0,9 to 0,7.

Moreover the ratio of the diameter B of the radially inner annular band 13 to the diameter C of the annular element 1 is a number ranging from 1,2 to 0,2, preferably from 1 to 0,4, particularly from 0,8 to 0,6.

Such constant ratios are intended for achieving the best compromise between the overall dimensions of the clamping collar and the sealing effect thereof.

Figure 5 shows a sectional view of the clamping collar of the present invention where the annular element 1 is coupled to a further annular element 6 and surrounds a pipe 4, particularly the end flange of a pipe 41.

The semi-annular elements 2 and 3 are coupled one with the other in the condition clamping the pipe 4 by the use of the screws 51 engaging into the corresponding engaging seats 52 and bring the interfacing surfaces provided at the ends of the semi-annular elements 2 and 3 in contact such that the radially innermost annular edge 11 surrounds the pipe 4 and particularly the head side with the radially inner annular band 13 cooperates with the end flange 41 of the pipe 4, in the clamping condition, following the profile thereof.

As described above the radially inner annular band 13, has a radially outermost peripheral edge connected to a projecting step 19, such that the radially outer band 14 projects with respect to the radially inner band 13 by a specific amount towards the side of the flange 41 facing said head side.

The dimension of the projection of the radially outer band 14 with respect to the radially inner band 13 is equal to the thickness of the flange 41, the projection during the clamping action allows the collar to adhere against the end flange 41 and the pipe 4 not only by the radially innermost annular edge 11, but also by a portion of the head side such that such portion follows the profile of the flange 41 with which

it cooperates.

The coupling of the annular element 1 with a further annular element 6 is made possible by the removable fasteners passing through the holes 17 provided in the two annular elements 1 and 6 respectively.

Once the collar is clamped around the pipe 4, by a removable fastener passing through the hole 17 provided at the head side of the annular element 1 it is possible to fasten a further annular element 6 surrounding a following pipe in order to couple pipes when assembling plants, such that the two annular elements 1 and 6 are in a coupled condition with their head sides in contact with each other and the two pipes 4 in communication with each other.

According to such arrangement the annular element 1 overlaps the pipe 4 and tightens the pipe 4 by a diametral clamping action, that is by a force directed along an axis parallel to or passing by the diameter of the annular element 1, which axis is further perpendicular to the outer surface of the pipe 4, since the annular element 1 surrounds the pipe 4 such that its diameter is perpendicular to the outer surface of the pipe 4.

Differently the coupling of the annular element 1 provided at one end of a pipe 4 with a further annular element 6 provided at one end of a further pipe 4 occurs by a clamping force directed perpendicularly to the head sides of the annular elements and consequently directed according to an axis parallel to the outer

surface of the successively arranged pipes 4 by the coupling of the two annular elements 1 and 6.

Particularly in figure 4 the removable fasteners are composed of the connection of a screw 20 with a nut 21 allowing two different head sides of the annular elements 1 and 6 associated to two different pipes to be in contact with each other.

A variant embodiment provides the screw 20 and the nut 21 to pass through the thickness of the clamping collars 1 and 6, and to be "flush" , namely the ends of the screw 20 and of the nut 21 are coplanar to the plane identified by the side opposite to the head side of each clamping collar 1 and 6.

The number of such holes 17 is variable and it depends on the mechanical strengths and on the clamping forces required, both relating to the connection of the pipes and to the force required for clamping the annular element to the end flange of the pipe, therefore the even arrangement of the holes 17 in figure 1 allows in turn the forces acting between the two annular elements 1 and 6 to be evenly arranged along the whole volume of the annular elements.

As a consequence of what described previously a variant embodiment of the collar of the present invention provides a system for fastening ends of pipes 4 comprising at least two pipes 4, each of which pipes 4 having an end with an end flange 41.

Each end flange 41 cooperates with a corresponding clamping collar. The clamping collar surrounds the pipe end to which it is associated and it is clamped around

the corresponding flange 41. At the same time the clamping collars act for keeping said at least two pipes 4 in the connected position by means of removable fasteners 20 and 21 that allow the clamping collars to be coupled.

Such system further provides the clamping collars to be made according to the characteristics described above and related to the clamping collar of the present invention.

Figures 6a and 6b show a view of the installation of the clamping collar of the present invention for the connection of two pipes, particularly two pipes intended to convey food, figures 6a is a section taken along the longitudinal plane of the pipe 4, like figure 5, while figure 6b is a perspective view of said installation.

Pipes 4 intended to convey food are often put beside conditioning pipes, particularly heating pipes 8, inside which hot water flows intended to maintain the food flowing into the pipe 4 in the liquid condition such that it can flow more easily inside the pipe.

It is also possible to further provide an outer casing 9 surrounding the whole plant and preventing heat from being dissipated too much.

Figures 6a and 6b show how the clamping collar of the present invention is installed for piping plants intended to convey food. The semi-annular elements 2 and 3, in the coupling condition surround the pipe 4, forming the annular element 1 that cooperates with the

end flange 41 of the pipe 4 by the radially innermost annular band 13.

The small dimensions of the annular element 1, and particularly, the small radial thickness of the collar, that is the small dimension of the radially outermost annular band 14 and the continuous surface of the radially outermost annular edge 12, allow the conditioning pipes 8 to be placed at such a distance that food flowing into the pipe 4 is properly heated.

The small dimensions of the annular element 1 and the proper positioning the conditioning pipes 8, allows the dimensions of the outer casing 9 enclosing the whole plant to be optimized.

It is possible to provide different arrangements of the pipes 8, preferably they are arranged with their longitudinal axis parallel to the longitudinal axis of the pipe 4 and around the circumference of the pipe 4, or equidistant one another, as in figure 6b, or underneath the pipe 4.

Finally figures 6a and 6b show a system for fastening pipe ends, wherein each one of the end flanges 41 of pipes 4 are surrounded by at least a conditioning pipe 8, arranged substantially parallel to the pipe 4 at a certain distance therefrom.

The distance of pipes 8 from the pipe 4 is such that it is slightly greater than the thickness of the collar, that is greater than the dimension of the head side of the collar.

Particularly the distance of the pipe 4 from the pipes 8 will be calculable on the basis of the

dimensions mentioned above that relate the dimension of the inner diameter of the annular element 1 constituting the collar, to the outer diameter thereof.

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CLAIMS

1. Clamping collar for end flanges of pipes, composed of an annular element (1) comprising a radially innermost annular edge (11) intended to surround said pipe (4) and a radially outermost annular edge (12),

said radially innermost annular edge (11) being connected to said radially outermost annular edge (12) by a head side faced towards said end flange (42) of the pipe (4) and by a side opposite to said head side,

said head side being composed of a radially inner annular band (13) by which radially inner annular band (13) said head side is connected to the radially innermost annular edge (11) and of a radially outer annular band (14) oriented according to a plane substantially perpendicular to the axis of said annular element (1), by which radially outer band (14) said head side is connected to the radially outermost annular edge (12)

and the radially inner annular band (13) being intended to cooperate with the side of the flange (41) facing said head side by overlapping said flange in the clamped condition,

characterized in that

said annular element (1) is divided into two complementary semi-annular elements (2, 3) of which a first semi-annular element (2) and a second semi-annular element (3), according to a transverse plane, preferably a diametral one,

said semi-annular elements (2, 3) can be coupled/uncoupled by removable fasteners (5) in a clamped and opened condition respectively of said annular element (1) with respect to said pipe (4),

there being provided two interfacing surfaces at the ends of each one of said two semi-annular elements (2, 3), which interfacing surfaces are in contact each other when said two semi-annular elements (2, 3) are in the coupled condition

and said radially outermost annular edge (12) being composed of a continuous surface and/or a surface free from radial projections or protrusions, when said firsdt and said second semi-annular elements are in the coupled condition.

2. Clamping collar for end flanges of pipes according to claim 1, wherein said removable fasteners (5) are composed of at least a screw (51) engaging into a corresponding engaging seat (52), which is at least partially threaded, provided within the thickness of said annular element (1), secant to said radially outermost annular edge (12), which radially outermost annular edge (12) has an aperture (53) for the insertion of said screw into the corresponding engaging seat (52),

said engaging seat (52) being composed of two parts, of which a first part is provided within the thickness of said first semi-annular element (2) and of which a second part is provided within said second semi-annular element (3),

such that the two parts form a single engaging

seat (52) for said screw (51) when said two semi-annular elements (2, 3) are in the coupled condition.

3. Clamping collar according to claims 1 and 2, wherein said first part constituting said engaging seat (52) has an abutment element for the head of the screw (51), while at least the other part constituting said engaging seat is threaded,

such that in the engaged position by screwing said screw (51) said two semi-annular elements (2, 3) can be coupled.

4. Clamping collar according to one or more of the preceding claims, wherein said removable fasteners are composed of two screws (51) engaging into two corresponding engaging seats (52),

said engaging seats (52) being provided one opposite to the other within the thickness of said annular element (1), secant to said radially outermost annular edge (12) near the interfacing ends of said two semi-annular elements (2, 3).

5. Clamping collar according to one or more of the preceding claims 1 to 3, wherein said removable fasteners are composed of a screw (51) engaging into a corresponding engaging seat (52) provided within the thickness of said annular element (1), secant to said radially outermost annular edge (12) near a first one of the two interfacing ends of said semi-annular elements (2, 3), while at the second end there is provided an engaging hinge allowing said two semi-annular elements to be coupled by pivoting them about an axis passing by said second end.

6. Clamping collar according to one or more of the preceding claims, wherein said radially inner annular band (13) has a radially outermost peripheral edge connected to a projecting step, such that the radially outermost annular band (14) projects with respect to said radially inner band (13) by a specific amount towards the side of the flange facing said head side.

7. Clamping collar according to one or more of the preceding claims, wherein the radially outer band (14) projects by such an amount with respect to the radially inner band (13) equal to or slightly smaller than the thickness of said flange (41).

8. Clamping collar according to one or more of the preceding claims, wherein said head side and the side opposite to said head side have at least one through hole (17) for coupling said annular element (1) to an identical second annular element (6),

said second annular element (6) having at least one through hole (67) in a position corresponding to the hole (17) of said annular element (1) for the passage of a removable fastener (18).

9. Clamping collar according to one or more of the preceding claims 1 to 7, wherein said head side and the side opposite to said head side have at least one through hole (17) for coupling said annular element (1) to a further structure,

said further structure having at least one through hole in a position corresponding to the hole of said annular element for the passage of a removable fastener.

10. Clamping collar according to one or more of the preceding claims, wherein the number of through holes (17) provided on said head side and on the side opposite to said head side can change and it is determined by mechanical strengths and by the clamping force required.

11. Clamping collar according to one or more of the preceding claims, wherein said two semi-annular elements (2, 3) are made of metal material.

12. Clamping collar according to one or more of the preceding claims, wherein said annular element (1) surrounds a pipe (4) having a circular section and/or any other shape, said annular element (1) being provided with said radially innermost annular edge (11) with a shape corresponding to the shape of the section of said pipe (4).

13. System for fastening ends of pipes comprising at leat two pipes,

each end of at least said two pipes being provided with an end flange

and each end flange cooperating with a clamping collar such that said clamping collar surrounds said pipe end,

characterized in that

said at least two pipes are kept in the connected position with the respective end flanges in contact with each other, by coupling said clamping collars,

each clamping collar exerting a clamping mechanical force on the pipe end to which it is associated,

and there being provided removable fasteners for said clamping collars intended to keep said two clamping collars in the coupled condition.

14. System for fastening ends of pipes according to claim 13, wherein said clamping collar is made according to one or more characteristics of the previous claims 1 to 12.

15. System for fastening ends of pipes according to claim 13 or 14, wherein each one of said end flanges of pipes are surrounded by at least a conditioning pipe (8), arranged substantially parallel to said at least two pipes (4) at a certain distance therefrom,

said distance being such that it is slightly greater than the thickness of said collar, that is greater than the dimension of said head side of said collar.

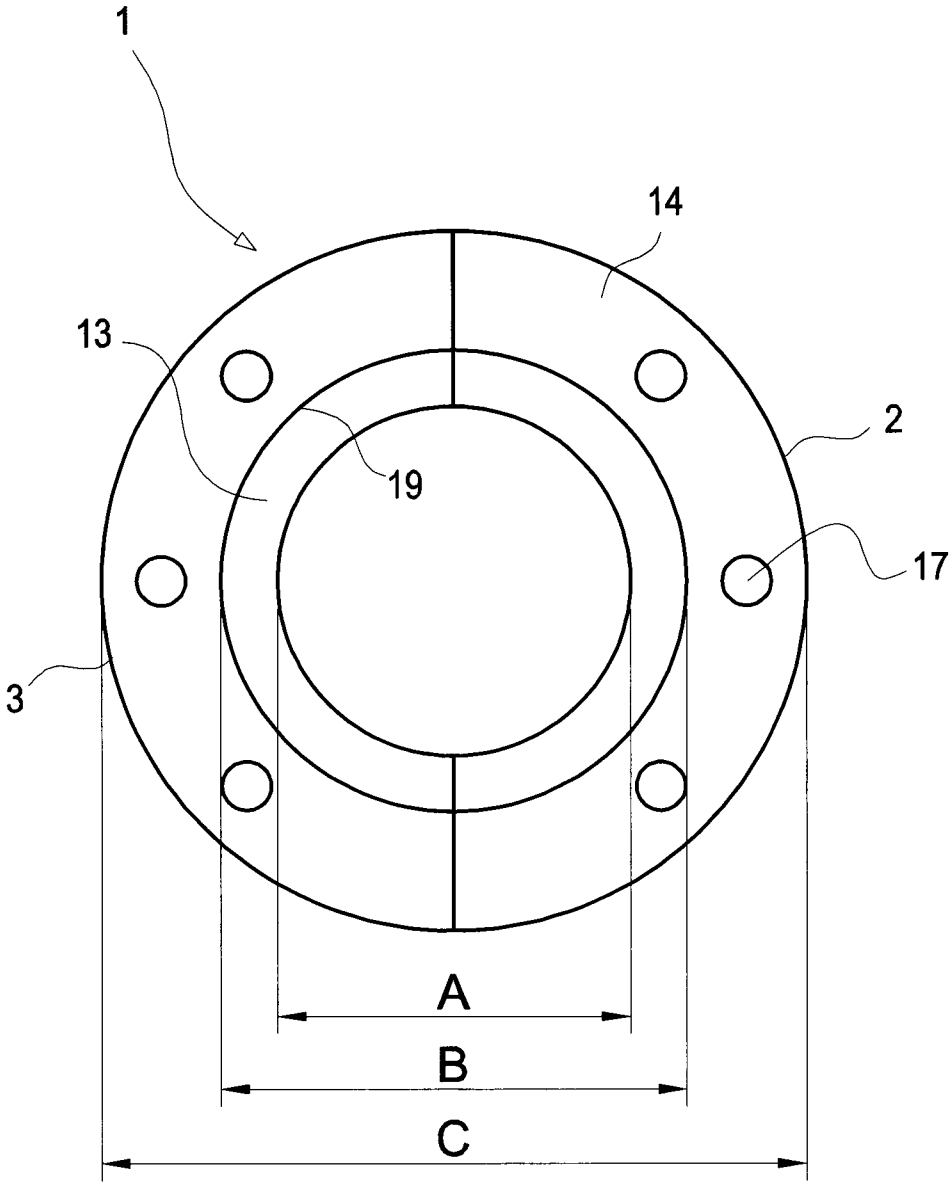

Fig. 1

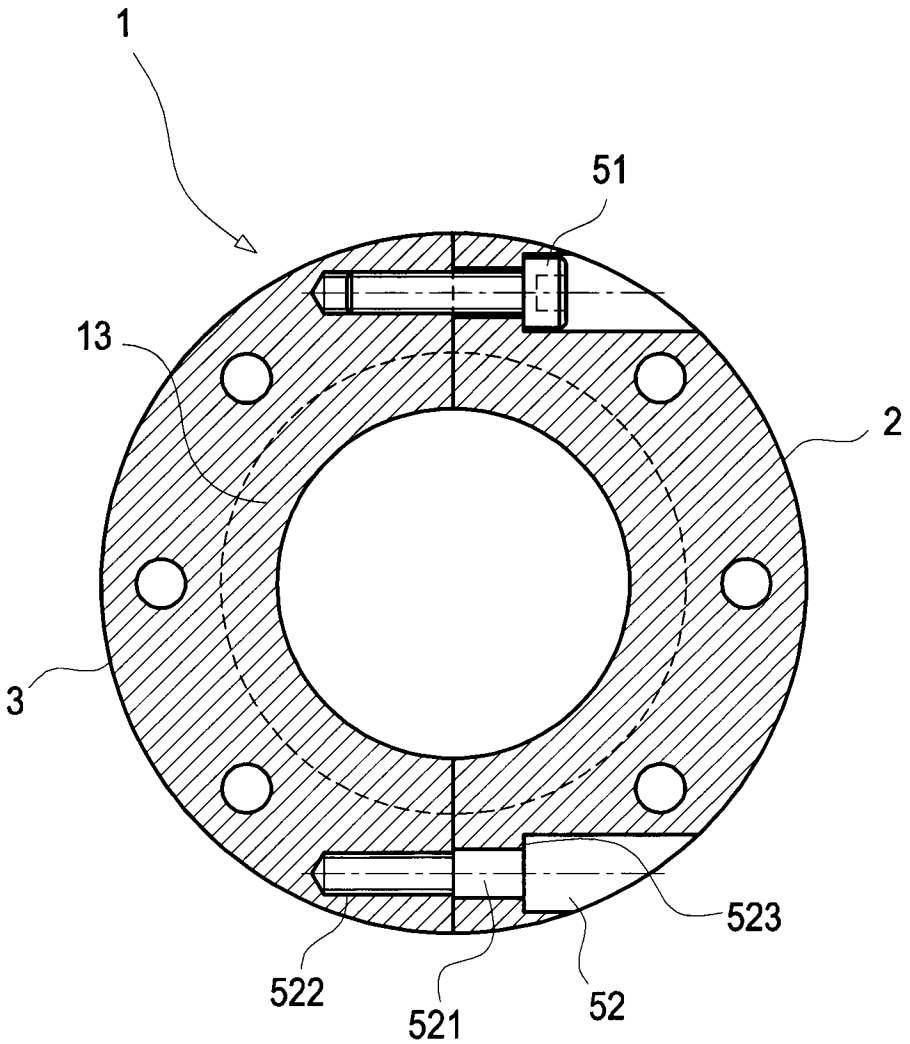

Fig. 2

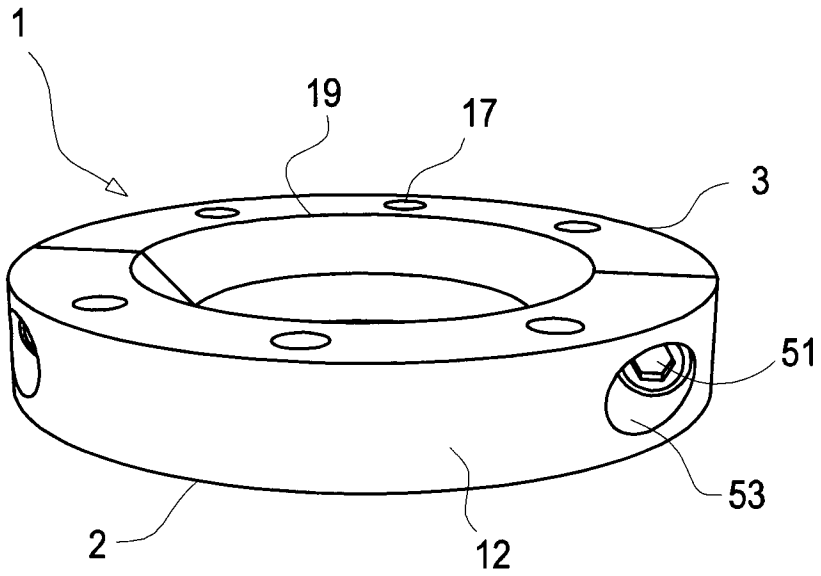

Fig. 3

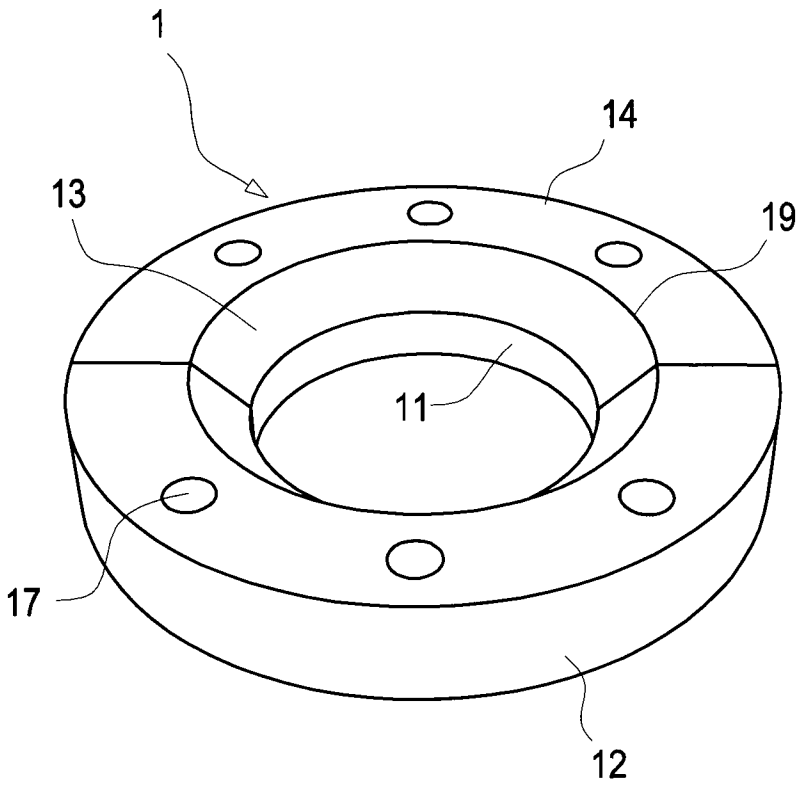

Fig. 4

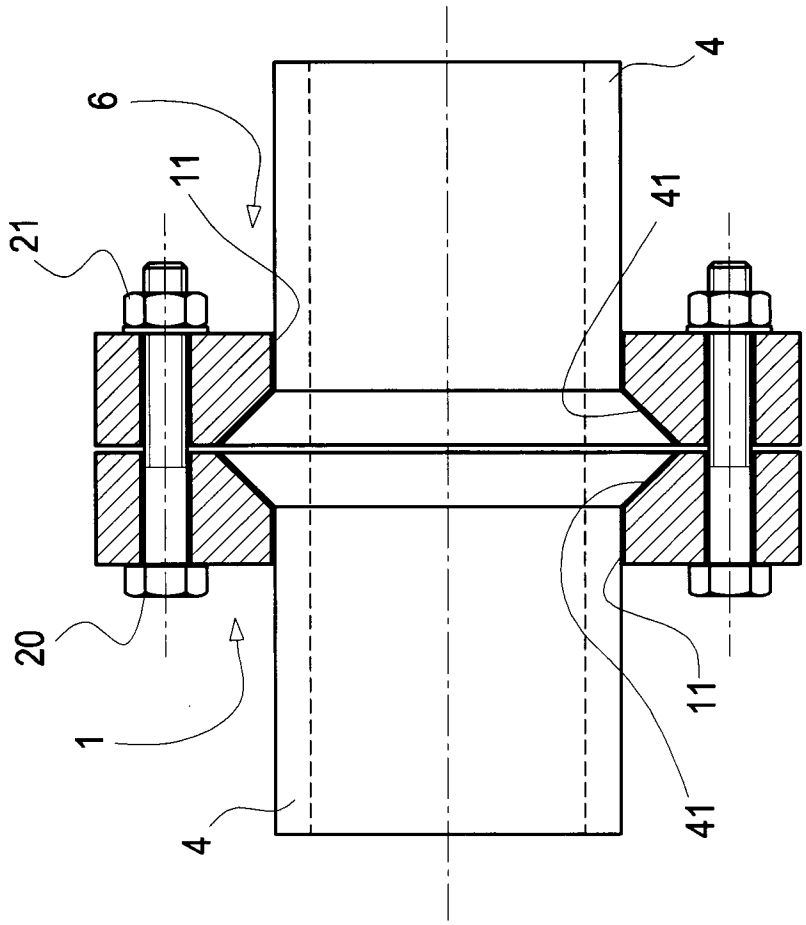

Fig. 5

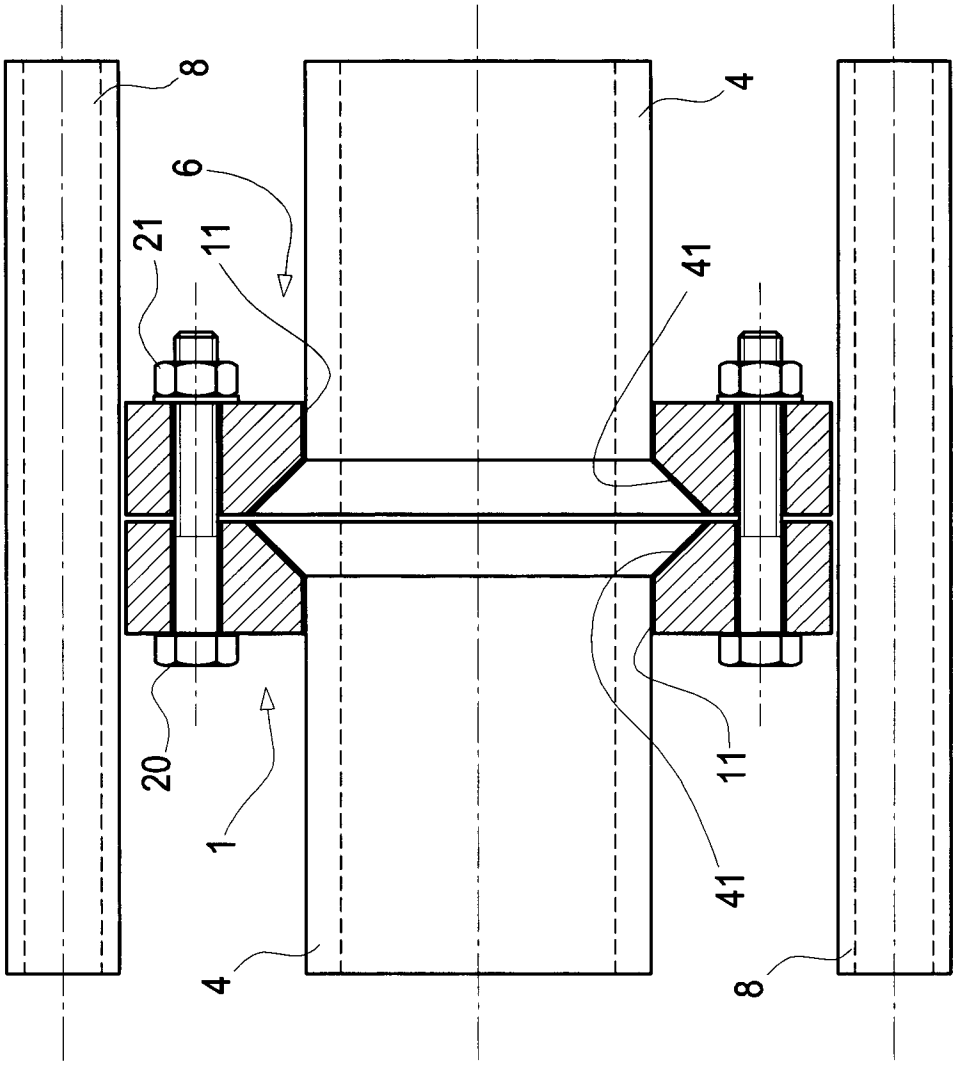

Fig. 6a

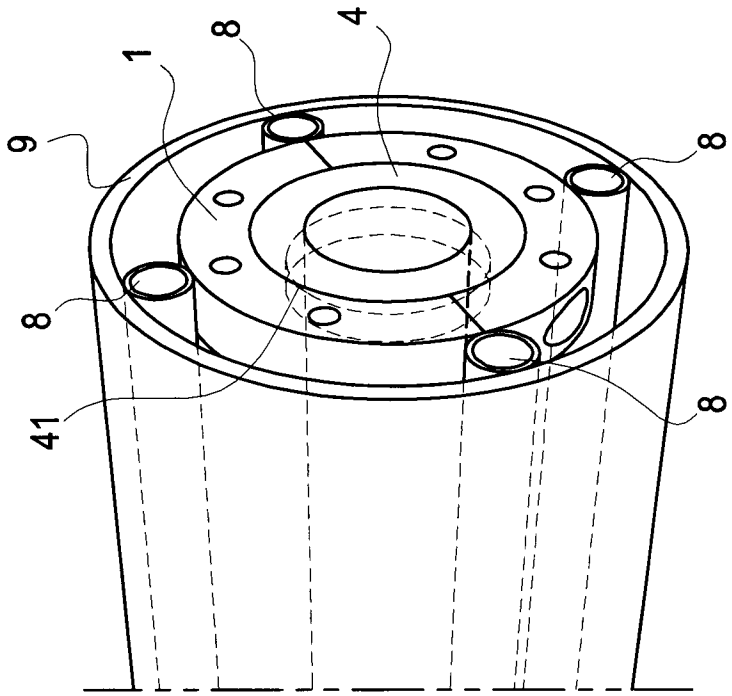

Fig. 6b

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2011/053408

A. CLASSIFICATION OF SUBJECT MATTER
INV. F16L23/028 F16L23/032 F16L53/00
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 practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DE 37 02 949 A1 (AGINTEC AG [CH]) 11 August 1988 (1988-08-11) cited in the application	1,4,6-15
A	abstract figures 1-4	2,3,5

X	WO 2007/123306 A1 (FIXON CONSTRUCTION CO LTD [KR]; JUNG SUNG-MAN [KR]) 1 November 2007 (2007-11-01)	1,4,6-14
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Y	column 2, line 29 - line 57	5
A	figures 1-3,6,7	15

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[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
8 November 2011	15/11/2011

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Vecchio, Giovanni

Form PCT/ISA/210 (second sheet) (April 2005)

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2011/053408

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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A	column 3, line 41 - column 4, line 19 figures 1-6	2,5,15

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A	column 6, line 2 - line 15 figures 2,6,10	1-3, 5-12,14, 15

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