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Clamp Connector for Clamping Together
Connecting Pieces on Pipelines

The invention relates to a clamp connector for clamping together connecting pieces on pipelines, with two clamping ring parts which are connected on one end by means of a joint arrangement and which can pivot around said joint arrangement between the spread positions and clamped positions in which said clamping ring parts are situated close to one another, and with a clamping device that is located on the end of the clamping ring parts opposite the joint arrangement, the clamping device having a clamping screw which is pivotable from an active position in which it works together with said clamping ring parts to generate a clamping force that forces the clamping ring parts into the clamped positions and a release position which is pivoted out therefrom.

Clamp connectors of this type are known. For example, according to DIN (© DIN: *Deutsches Institut für Normung e. V.* [German Institute for Standardization, Registered Association]) 32676, clamping connections with such clamp connectors for fittings for the food, chemical, and pharmaceutical industries are standardized and, in fact, for a relatively large range of nominal sizes. In the case of such clamp connectors, the clamping rings work together with clamping connection pieces that can be connected as, for example, welded connection pieces with corresponding pipe ends, in such a way that the axial force for clamping the connecting pieces together is generated by a radial clamping force acting on them by means of

oblique surfaces that are inclined on the connection pieces with respect to the longitudinal axis of the pipe.

Since, according to the applicable standards provisions, such clamp connectors are usable at pressures of up to 16 bar, even with large nominal widths, there are special requirements as regards operating safety.

Therefore, the stated object of the invention is to make available a clamp connector of the type under consideration that offers a high degree of operating safety during handling, especially when an elevated level of pressure is involved.

According to the invention, this object is accomplished by means of a clamp connector having the features of claim 1 in its entirety.

Accordingly, one essential particularity of the invention lies in the fact that the clamping device is equipped with a locking device that acts as a safety mechanism which allows the clamping screw to pivot away only when, during a working cycle in which the clamping connection is separated, the clamping ring parts are initially spread out from the clamping position through a predetermined opening angle. This avoids the risk that even a slight loosening of the effective tightening of the clamping screw could cause the screw to pivot out of the active position, thus leading to a sudden loosening of the connection under pressure, with the concomitant risks associated therewith.

In especially advantageous embodiments, the arrangement can be designed in such a way that the clamping screw that with its end is pivotally connected to the first clamping ring part by means of a pivot-out joint has an end-side threaded segment and a collar that is larger in diameter than the threaded segment and is adjacent to the pivot-out joint and that the second

clamping ring part has a passage through which the clamping screw passes in the active position and has an exit slot for the clamping screw that makes it possible for the clamping screw to pivot out, where the width of said slot, at least in the slot area adjacent to the first clamping ring part, is smaller than the diameter of the collar and larger than the diameter of the threaded segment of the clamping screw. The operating principle of the locking device accordingly consists simply of the fact that for its pivot-out motion the clamping screw can emerge from the exit slot only when an opening angle is reached at which the expanded collar of the clamping screw has left the exit slot, after which the threaded segment, which is smaller in diameter, can pivot out of the exit slot. This design of the locking device is characterized by an especially simple construction.

An especially high degree of operating safety is ensured in the case of embodiments in which on the second clamping ring part there are surface area parts that overlap associated surface area parts of a clamping nut located on the threaded segment of the clamping screw in the active position in such a way that loosening of the clamping nut causes the clamping ring parts to be spread apart. With this arrangement, the clamping ring parts are forced apart when the clamping nut is loosened. This avoids the risk that, in cases where sometimes, when the clamping nut is loosened, the clamping ring parts are wedged in the clamped position and do not immediately follow the motion of the clamping nut, a sudden spreading motion will occur under pressure. The spreading motion that is necessarily caused by the loosening of the clamping nut ensures that a controlled spreading and thus a controlled reduction of pressure will occur before pivoting-out of the clamping screw takes place.

In advantageous embodiments, the clamping nut has a longitudinal segment housed in the passage of the second clamping ring part with the clamping screw in the active position; on said longitudinal section are located the area that generates the spreading force when the nut is

loosened and the area over which the clamping force is transferred to step surfaces of the passage when the nut is tightened.

In this case, the arrangement can be designed in such a way that the nut in the area that can be accommodated in the passage has a round shank part and a ring body that protrudes radially therefrom like a flange, where one flange surface of the ring body forms the end of the shank part and the surface that transfers the clamping force and its other surface forms the surface that transfers the spreading force.

With the clamping nut designed in this way, the passage and its exit slot can be stepped in the second clamping ring part in such a way that the ring body can be moved into and out of the passage through an enlarged section of the exit slot, where at the end of the enlarged section the step surfaces that extend into the passage and that transfer the clamping force of the adjacent flange surface of the ring body of the nut are formed.

In order to transfer the spreading force acting on the second clamping ring part when the nut is loosened, the enlarged section of the exit slot can be formed by grooves made in the two side walls of the slot; the side walls of the grooves form a guide channel for the ring body of the clamping nut when pivoting into the active position and pivoting out into the release position, where the side surfaces of the grooves form the step surfaces in the passage that transfer the clamping force, as well as the surface area parts that transfer the spreading force.

The invention is detailed below by means of an embodiment which is illustrated in the drawings.

FIG. 1 shows a perspective side view, in approximately full scale, of an embodiment of the clamp connector according to the invention in the active operating position in

which said connector forms a clamping connection between welded pipe connection pieces, of which one connection piece is visible;

FIG. 2 shows a sectional view of FIG. 1 with a sectional plane running in the longitudinal direction, where the clamping connection that is created of the pipe connection pieces is shown;

FIG. 3 shows an oblique perspective view similar to that of FIG. 1, where the insides of clamping ring parts without pipe connection pieces are shown, and

FIG. 4 shows an oblique perspective view corresponding to that of FIG. 3, where the components that make it possible for a clamping screw to pivot out are shown.

FIGS. 1 and 2 show the embodiment in the active functional state, where a first clamping ring part 1 and a second clamping ring part 3 are in a clamping position, in which they are situated close to one another, in which two welded clamping connection pieces 5, of which only one is visible in FIG. 1, are clamped together. As FIG. 2 shows, a seal 7 shaped like an annular disk is located between the connection pieces 5. This seal is made of a plastic material that is compatible with the medium that is located in the pipeline system, for example, an ethylene-propylene-diene-rubber (EPDM) or other suitable plastic material. As FIG. 2 best illustrates, oblique surfaces 9 are located on the end flanges of pipe connection pieces 5 that are of like design. In cooperation with corresponding oblique surfaces on the insides of the clamping ring parts 1 and 3, radial clamping forces exerted by the clamping ring parts 1 and 3 generate an axial clamping force to ensure mutual clamping of the pipe connection pieces 5.

The clamping ring parts 1 and 3, which are connected via a joint arrangement 11, are designed alike in their path from the joint arrangement 11 up to the area near their opposite

ends; i.e., in their middle area their shapes correspond to a partial arc. The joint arrangement 11 has a connecting tab 13 (see FIG. 4) which, like clamping ring parts 1 and 3 themselves, is made of special steel and is in the shape of a flat, extended plate. This connecting tab 13 is flexibly connected in both its end areas to the clamping ring parts 1 and 3 via pivot pins 15.

The clamping device for generating the clamping force is located on the forward activation ends of the clamping ring parts 1 and 3, which are opposite the joint arrangement 11. As the figures show, on the corresponding end of the first clamping ring part 1, a clamping screw 19 is linked via a pivot-out joint 17 in such a way that the clamping screw 19 can be pivoted out of an active position, which is shown in FIGS. 1 and 3, into release positions, specifically around a pivot axis that is parallel to the longitudinal axis 21 of the pipe (FIG. 2), as FIG. 4 illustrates.

In the active position, the clamping screw 19 extends through a passage 23 (FIG. 4) that is formed on the activation end of the second clamping ring part 3 and that is opened toward the front on the activation end of the clamping ring part 3 with an exit slot 25 so that the clamping screw 19 can be pivoted outward to switch the clamping device to the release position through the exit slot 25 or can be pivoted into the passage 23 to switch into the active position via the exit slot 25.

Due to the special design of the clamping screw 19 and the exit slot 25, the clamping device is equipped with a locking device which allows the clamping screw 19 to pivot out of the active position shown in FIGS. 1 and 3 only when safety-related conditions have been fulfilled. As FIGS. 1, 3, and 4 show, and as FIG. 4 most clearly illustrates, in the end area adjacent to the pivot-out joint 17, the clamping screw 19 has a collar 27 whose diameter is larger than that of the threaded segment 29 of the clamping screw 19 that is adjacent to the collar 27. The above-mentioned locking device is formed by virtue of the fact that the diameter of the collar 27 is

larger than the width of the exit slot 25, while the outer diameter of the threaded segment 29 is in turn smaller than the width of the exit slot 25. This provides simple and reliable assurance that, with the clamping screw 19 in the active position when the screw is housed in the passage 23, the clamping screw 19 cannot exit through the exit slot 25 because of the diameter of the collar 27 keeps it from passing through the exit slot 25.

If, however, a clamping nut 31, which is engaged with the threaded segment 29 of the clamping screw 19 to generate the clamping force, is unscrewed to loosen the clamping device to the extent shown in FIG. 4, in which case the clamping ring parts 1 and 3 are separated from one another by an opening angle at which the collar 27 of the clamping screw 19 can leave the exit slot 25, then the clamping device switches to the release state since now the threaded segment 29, which is smaller in diameter, can move through the exit slot 25. In other words, pivoting-in of the clamping screw 19 into the passage 23 and pivoting-out to release the clamping ring parts of 1 and 3 are thus possible only as a function of the predetermined opening angle of the clamping ring parts 1 and 3. As the figures also illustrate, the passage 23 and the exit slot 25 are stepped in a special way. In cooperation with the special construction of the clamping nut 31, the clamping device not only has a locking device that prevents undesired pivoting-out, but a mechanism is also formed that forces the clamping ring parts 1 and 3 to open when the clamping nut 31 is unscrewed. For this purpose, on the end of a round shank part 33 the clamping nut 31 has a flange-like, radially projecting ring body 35. As a guide channel through which the ring body 35 moves when pivoting into the passage 23 and when pivoting out, the exit slot 25 forms an enlarged section 37 at the end area which is located at the top in the figures. In this enlarged section 37, grooves 39 are made in the two side walls of the slot 25. The side walls of the grooves 39 form not only a guide channel for the ring body 35 when the clamping screw 19 pivots in and pivots out, but also form step surfaces that are located opposite one another. When the clamping nut 31 is tightened, the clamping force of the corresponding end surface of the ring body 35 is transferred via the step surfaces of the grooves 39 that are

located at the bottom in the figures. Conversely, when the clamping nut 31 is loosened, the opposite upper end surface of the ring body 35 transfers a spreading force via the side walls of the grooves 39 that overlap the ring body 35, this spreading force necessarily causing an opening motion of the clamping ring parts 1 and 3 to occur when the clamping nut 31 is loosened. This prevents the risk that extensive unscrewing of the clamping nut 31 can occur without a corresponding opening motion of the clamping ring parts 1 and 3, thereby avoiding the risk that, if the clamping nut 31 is completely loosened, in the event that the clamping ring parts 1 and 3 are potentially wedged in the clamped position and initially do not follow the loosening motion of the nut 31, inner pressure might build up and cause abrupt spreading of the clamping ring parts 1 and 3, with the concomitant risks associated therewith. Conversely, the invention ensures that, if the clamping nut 31 is loosened, a corresponding, controlled opening motion of the clamping ring parts 1 and 3 will take place.

C l a i m s

1. A clamp connector for clamping together connecting pieces (5) on pipelines, with two clamping ring parts (1, 3) which are connected on one end via a joint arrangement (11) and which can pivot around said joint arrangement between spread positions and clamped positions in which said clamping ring parts are situated close to one another and with a clamping device that is located on the end of the clamping ring parts (1, 3) opposite the joint arrangement (11), the clamping device having a clamping screw (19) which is pivotable from an active position in which it works together with said clamping ring parts to generate a clamping force that forces the clamping ring parts (1, 3) into the clamped positions and into a release position which is pivoted out therefrom, in which the clamping ring parts (1, 3) are released, characterized in that the clamping device has a locking device (25, 27) which in its active state prevents the clamping screw (19) from pivoting out into the release position and, as a function of the spreading of the clamping ring parts (1, 3), passes through a pre-determined opening angle from the active state into a release state that makes it possible for the clamping screw (19) to pivot out.
2. The clamp connector according to claim 1, characterized in that the clamping screw (19) which is pivotally connected with its one end to the first clamping ring part (1) via a pivot-out joint (17) has an end-side threaded segment (29) and a collar (27) that is adjacent to the pivot-out joint (17) and that is larger in diameter than the threaded segment and that the second clamping ring part (3) has a passage (23) through which the clamping screw (19) passes in the active position and an exit slot (25) for the clamping screw (19) which allows the screw to pivot out, the width of this slot, at least in the slot area adjacent to the first clamping ring part (1), being smaller than the diameter of the collar (27) and being larger than the diameter of the threaded segment (29) of the clamping screw (19).

3. The clamp connector according to claim 2, characterized in that on the second clamping ring part (3) there are surface area parts (39) that in the active position overlap corresponding surface area parts of a clamping nut (31) located on the threaded segment (29) of the clamping screw (19) in such a way that loosening of the clamping nut (31) leads to a spreading of the clamping ring parts (1, 3).
4. The clamp connector according to claim 3, characterized in that the clamping nut (31) has a longitudinal section (33) that is housed in the passage (23) of the second clamping ring part (3) when the clamping screw (19) is in the active position, on which longitudinal section are located the surface that generates the spreading force when the nut (31) is loosened and the surface via which the clamping force is transferred to step surfaces of the passage (23) when the nut (31) is tightened.
5. The clamp connector according to claim 4, characterized in that in the area that can be housed in the passage (23) the nut (31) has a round shank part (33) and a ring body (35) that projects radially therefrom in the shape of a flange, one flange surface of this ring body forming the end of the shank part (33) and the surface that transfers the clamping force and its other surface forming the surface that transfers the spreading force.
6. The clamp connector according to claim 5, characterized in that the passage (23) and its exit slot (25) in the second clamping ring part (3) are stepped in such a way that the ring body (35) can be moved through an enlarged section (37) of the exit slot (25) into and out of the passage (23) and that at the end of the enlarged section (37) the step surfaces that extend into the passage (23) are formed that transfer the clamping force of the adjacent flange surface of the ring body (35) of the nut (31).

7. The clamp connector according to claim 6, characterized in that the enlarged section (37) of the exit slot (25) is formed by grooves (39) made in the two side walls of the slot (25), the side walls of the grooves forming a guide channel for the ring body (35) of the clamping nut (31) when pivoting into the active position and pivoting out into the release position and the side surfaces of the grooves (39) forming the step surfaces in the passage (23) that transfer the clamping force, as well as the surface area parts that transfer the spreading force.