

DESCRIPTION

TITLE OF THE INVENTION: IMPROVED CLOSING AND DRAINING ASSEMBLY FOR A CHEMICAL REACTOR

Technical Field

The invention relates to the general technical field of chemical reactors, for example enamelled or not, generally used in the chemical industry, the pharmaceutical industry or the agribusiness industry.

The invention relates more specifically to a closing and draining assembly intended to be mounted on an outlet orifice of a chemical reactor. The invention can be applied both to new chemical reactors and to chemical reactors already in use. The term “chemical reactor” should be understood to mean any reactor or mixing reactor used in the chemical industry, the pharmaceutical industry or the agribusiness industry.

The closing and draining assembly constitutes, for example, a valve with an upward opening, which is equipped with a movable valve head bearing on a seat part in the closing position of the outlet orifice and displaced upwards in the open position of said outlet orifice. Such valves are known as such and are therefore not described in detail for all their constituent elements in the present description.

According to another example, the closing and draining assembly constitutes a valve with a downward opening, which is equipped with a movable valve head bearing on a seat part in the closing position of the outlet orifice and displaced downwards in the open position of said outlet orifice. Such valves are also known and are therefore not described in detail for all their constituent elements hereinafter.

In general, such a closing and draining assembly is associated with a seat part which is sandwiched by virtue of a mechanical mounting between the end of the outlet orifice and a counterpart for mounting the valve.

Prior art

With chemical reactors equipped with known closing and draining assemblies, it can happen, according to the nature of the product prepared and/or mixed in the chemical reactor, that a deposit or an accumulation of an additive forms in the lower part of said chemical reactor, in the vicinity of the outlet orifice. Such deposits or accumulations can rise very rapidly in temperature and lead to accidents or explosions. This is the case in particular during the preparation of the graphene.

Furthermore, solid accumulation or clogging in the vicinity of the outlet orifice of the reactor can alter the operation of the valve and in particular the displacement of the valve head, which can lead to sealing defects.

Such an accumulation very often causes a decrease in the overall stirring performance, as a concentration of solid particles in the lower part can disrupt the hydrodynamic effects and also degrade the coefficient of homogeneity of the reaction medium.

Disclosure of the invention

An aim of the invention is to overcome the disadvantages of the prior art by proposing a new closing and draining assembly making it possible to avoid the appearance of solid deposits or accumulations in the bottom of chemical reactors.

The invention also aims to propose a novel closing and draining assembly capable of being mounted on various types of chemical reactors, in particular of the so-called pipe outlet type or of the so-called thick flange outlet type.

Another aim of the invention is to propose a novel closing and draining assembly capable of equipping either new chemical reactors or second-hand chemical reactors by replacing the existing closing and draining assembly.

The assigned aims of the invention are achieved by using a closing and draining assembly intended to be mounted on the outlet orifice of a chemical reactor, comprising an opening/closing valve comprising a valve body and a displacement valve, closing said outlet orifice by a downward or upward displacement of a valve head, which is bearing in a sealed manner on a seat part in its closing position, characterised in that the seat part is removable and comprises an annular chamber, an opening for supplying fluid to said annular chamber and at least one set of bores distributed homogeneously over the annular extension of said seat part so as to open out into the chemical reactor and thus form fluid communication channels between the annular chamber and the inside of the chemical reactor, independently of the position of the valve head.

According to one embodiment example, the seat part is intended to be placed in a sealed manner against a front face delimiting the free end of the outlet orifice and against an annular flat face of a counterpart for mounting the valve body, so as to sandwich said seat part by means of mechanical mounting and to ensure, on the one hand, the immobilisation of said assembly on the chemical reactor and, on the other hand, the sealing with respect to the outside.

According to one embodiment example, the closing and draining assembly is applied to a

chemical reactor with a so-called pipe outlet.

According to another embodiment example, the closing and draining assembly is applied to a chemical reactor with a so-called thick flange outlet.

According to one embodiment example, the closing and draining assembly comprises a first annular flat seal and a second annular flat seal constituting the sealing interface between the seat part and, respectively, the front face of the outlet orifice and the annular flat face of the valve body.

According to one embodiment example, the seat part comprises an inner annular part and an outer annular part, assembled in a sealed manner by complementarity of shapes and each partially delimiting, once assembled together, the annular chamber.

According to one embodiment example, the inner annular part comprises an upper annular portion fitted into the outlet orifice and one end of which constitutes a seat for the valve head.

According to one embodiment example, bores are machined in the inner annular part.

According to one embodiment example, the set of bores comprises at least one first series of vertical bores machined in the inner annular part to open out, on the one hand, into the annular chamber and, on the other hand, into a sealed annular space partially delimited by the inner annular part, the annular flat seal and the end of the outlet orifice, and at least one second series of oblique bores passing through the upper annular portion to place the sealed annular space and the inside of the chemical reactor in fluid communication.

According to another embodiment example, the set of bores comprises at least one first series of vertical bores machined in the inner annular part to open out, on the one hand, into the annular chamber and, on the other hand, into a sealed annular space partially delimited by the inner annular part, the annular flat seal and the end of the outlet orifice, and at least one series of horizontal bores passing through the inner annular part to place the annular chamber and the inside of the chemical reactor in fluid communication.

According to one embodiment example, a series of complementary vertical bores forming complementary and vertical openings or half-bores are provided at the interface of the upper annular portion and the inner periphery of the outlet orifice against which said upper annular portion comes into contact, said complementary and vertical openings or half-bores being machined in the outer periphery of the upper annular portion.

According to one embodiment example, the seat part is made of a material chosen from a family of materials comprising stainless steels, metal alloys and fluorine-based materials.

The assigned aims of the invention are also achieved by means of a chemical reactor

equipped with a closing and draining assembly such as presented above and with a fluid supply pipe, said closing and draining assembly being connected to the fluid supply pipe, which is mounted on the seat part so as to open out onto the supply opening.

An great advantage of the invention resides in the obtaining of homogeneous stirring in the bottom of the chemical reactor. Such stirring, obtained by injecting pressurised gas, thus makes it possible to avoid any accumulation or sedimentation of potentially dangerous additives.

Another noteworthy advantage of the invention resides in a substantial reduction in the deposits, accumulations or sedimentations and consequently in the clogging of the closing and draining assembly. Such a clogging could ultimately alter the proper functioning of said assembly and/or the sealing of the chemical reactor.

Brief description of the figures

Other characteristics and advantages of the present invention will be more clearly understood upon reading the following description, given with reference to the appended drawings, which are provided as non-limiting examples, in which:

[Fig. 1] Figure 1 shows one embodiment example of chemical reactor comprising a closing and draining assembly according to the invention.

[Fig. 2] Figure 2 shows an enlarged detail of Figure 1 with the closing and draining assembly according to the invention before its attachment to the chemical reactor.

[Fig. 3] Figure 3 shows the closing and draining assembly of Figure 2 in its mounting and attachment position on the chemical reactor.

[Fig. 4] Figure 4 shows an enlarged detail of Figure 1 where the closing and draining assembly according to the invention is shown in its mounting and attachment position on a chemical reactor of a different type.

[Fig. 5] Figure 5 is an enlarged, vertical cross-sectional view of one embodiment example of a removable seat part of a closing and draining assembly according to the invention.

[Fig. 6] Figure 6 is a vertical, cross-sectional view and a top view of one embodiment example of the removable seat part of a closing and draining assembly according to the invention.

[Fig. 7] Figure 7 is a vertical, cross-sectional view of another embodiment example of the removable seat part of a closing and draining assembly according to the invention.

Detailed description of the invention

Structurally and functionally identical elements present in several separate figures are assigned with one same numerical or alphanumerical reference. Figure 1 shows one embodiment example of a chemical reactor 1. The chemical reactor 1 is known as such and is therefore not further described herein. The chemical reactor 1 conventionally comprises a motorisation 3 intended to actuate a stirrer 4 immersed in a product to be mixed and/or to be prepared. This chemical reactor 1 is equipped with a closing and draining assembly 2. Figure 2 shows an enlarged detail of Figure 1. The chemical reactor 1 of Figure 2 is a chemical reactor 1 with a so-called thick flange outlet 1a.

The closing and draining assembly 2 comprises an upward openable opening/closing valve 5. This valve 5 comprises an upward opening valve which makes it possible to open and close an outlet orifice 6 of the chemical reactor 1. The opening of the outlet orifice 6 is obtained by an upward displacement of a valve head 7.

The valve head 7 is connected via a rod 8 to an actuating mechanism, for example electrical, mechanical and/or pneumatic. Such a valve 5 is also known and its operation will consequently not be described in further detail.

The valve head 7 makes it possible to block the outlet orifice 6 by a downward displacement and by a sealing bearing of a lower base 7a of said valve head 7 on a seat part 9 centred on the outlet orifice 6.

As an example, the seat part 9 has an annular shape and a central opening. The latter is delimited, for example, by a cylindrical face 9' and a frustoconical face 9'' thus forming the periphery of a discharge channel.

The cylindrical face 9' advantageously has, in its upward extension, the frustoconical face 9'' the diameter of which decreases downwards, i.e. in the direction of the discharge.

Figure 2 shows the closing and draining assembly 2 before its attachment to the chemical reactor 1. The closing and draining assembly 2 advantageously has a valve body 10, which is provided with a side discharge orifice 11.

The valve body 10 advantageously has a mounting counterpart in the form of a flange of an attachment 10a, having bores, not shown, intended to be passed through by attachment bolts (not shown), which are intended to be screwed into the thick flange 1a. Bores and corresponding threads 1e, formed in the thick flange 1a, are distributed around the outlet orifice 6. Such an assembly of the valve body 10 on a chemical reactor 1 is known.

The fixing flange 10a advantageously has an flat annular face 10b on which a first annular flat seal 12 rests. A second annular flat seal 13 is disposed on the seat part 9 so as to come

into sealed contact with the thick flange 1a when said seat part 9 is sandwiched between said thick flange 1a and the attachment flange 10a.

The valve head 7 is shown, on the one hand, in a low position A bearing in a sealed manner on the seat part 9 and, on the other hand, in a high position B disengaged from the seat part 9 upwards. This high position B corresponds to an opening of the outlet orifice 6 and consequently to the discharge of the product contained in the chemical reactor 1 through the discharge channel formed by the seat part 9 and through the side discharge orifice 11. Figure 3 shows the closing and draining example 2 of Figure 2 in its position of mounting and attachment on the chemical reactor 1. In this mounting position, the seat part 9 is partially fitted into the outlet orifice 6 thanks to a sliding mounting.

The attachment bolts passing through bores in the mounting counterpart and screwed into the threads 1e of the thick flange 1a are not, for reasons of simplicity of presentation, shown. When the valve body 10 is attached to the chemical reactor 1, the seat part 9 is sandwiched between the thick flange 1a and the counterpart for mounting the valve body 10. The valve body 10 is thus immobilised in a sealed manner on the chemical reactor 1.

The first annular flat seal 12 and the second annular flat seal 13 respectively constitute sealing interfaces between the seat part 9 and a front face 1b of the thick flange 1a and between the seat part 9 and an annular front face 10b of the counterpart for mounting the valve body 10. The front face 1b is advantageously flat. According to other embodiments, the front face 1b can also be conical or spherical.

The seat part 9 intended to be immobilised between the chemical reactor 1 and the valve body 10, is preferably removable.

The seat part 9 has an annular chamber 14 and a fluid supply opening 15, preferably radial. Advantageously, a fluid injection pipe 16 is connected, for example by screwing or welding, to the supply opening 15 and makes it possible to supply the annular chamber 14 with pressurised fluid, for example a gas or a liquid.

The seat part 9 also comprises at least one set of bores 17, 17a and 18 formed in its upper part and distributed homogeneously over the annular extension of said seat part 9.

Complementary vertical bores 17a and oblique bores 18 open out into the chemical reactor 1 and thus form fluid communication channels between the annular chamber 14 and the inside of the chemical reactor 1, independently of the high or low position of the valve head 7. The complementary vertical bores 17a form complementary vertical openings made, for example, in the form of half-bores.

The seat part 9 comprises, for example, an inner annular part 9a and an outer annular part

9b. These inner 9a and outer 9b annular parts are assembled in a sealed manner and each partially delimit, once assembled together, the annular chamber 14. These annular inner and outer parts 9a and 9b are obtained, for example, by machining operations and are assembled together by a sliding mechanical mounting.

Figure 4 shows an enlarged detail of Figure 1 where the closing and draining assembly 2 is disposed in its mounting and attachment position on the chemical reactor 1. The latter is a chemical reactor 1 with a so-called pipe outlet 1c. The mechanical mounting of the seat piece 9 in the pipe 1c is also a so-called sliding mounting mechanical mounting.

The seat part 9 is also sandwiched between the annular flat face 10b of the counterpart for mounting the valve body 10 and between the annular front face 1b of the end of the pipe 1c. To this end, the end of the pipe 1c has a radial extension 1d to constitute a bearing for a mounting flange 19 which is intended to be passed through by mounting bolts. The latter also pass through the clamping flange 10a. Such an assembly is known.

The inner annular part 9a advantageously comprises an upper annular portion 9d fitted into the outlet orifice 6 and the end S1 of which constitutes a seat for the valve head 7. The upper annular portion 9d is engaged in the outlet orifice 6 thanks to a sliding mechanical mounting.

The seat part 9 is advantageously shown without hatching so as to better identify its constituent parts, namely the inner annular part 9a and the outer annular part 9b.

Figure 5 is an enlarged, vertical cross-sectional view of an embodiment example of the seat part 9. The injection pipe 16 is also shown in Figure 5. The seat part 9 has all of the vertical bores 17 and 17a and oblique bores 18 formed in its inner annular part 9a.

A first series of vertical bores 17 are machined in the inner annular part 9a to open out, on the one hand, into the annular chamber 14 and, on the other hand, into a sealed annular space 20 partially delimited by the inner annular part 9a, the annular flat seal 13 and the end of the pipe 1c forming the outlet orifice 6.

The complementary vertical bores 17a in the form of a series of complementary and vertical openings are formed at the interface of the upper annular portion 9d and the inner periphery of the outlet orifice 6 against which said upper annular portion comes into contact. These complementary and vertical openings are presented, for example, in the form of grooves or half-bores machined in the outer periphery of the upper annular portion 9d.

Advantageously, the annular inner part 9a also comprises a second series of oblique bores 18 passing through the upper annular portion 9d in order to place the sealed annular space 20 and the inside of the chemical reactor 1 in fluid communication.

The inner annular part 9a also has an annular flat and horizontal face 9e on which the annular flat seal 13 rests. The complementary vertical openings or half-bores also make it possible to place the inside of the chemical reactor 1 and the sealed annular space 20 in fluid communication. The complementary vertical openings or half-bores 17a and the oblique bores 18 open out directly into the chemical reactor 1 and constitute two series of fluid injection orifices which are concentric and distributed homogeneously around the outlet orifice 6. Reference can be made, for example, to Figure 6.

The inner and outer annular parts 9a and 9b are assembled by complementarity of shapes, for example by using a staircase shape. O-ring seals 21 are advantageously disposed at the interface of certain parts in mutual contact with the inner 9a and outer 9b annular parts.

Once mechanically assembled, thanks to a sliding mounting, the inner 9a and outer 9b annular parts have joints 22 and 23 produced by PFA welding. The latter ensures the adhesion and the sealing of said assembly of the inner 9a and outer 9b annular parts.

Such a PFA welding is also used at an interface 24 of the fluid supply pipe 16 and the outer annular part 9b.

Figure 6 comprises a vertical cross-sectional view and a top view of an embodiment example of the seat part 9.

The frustoconical portion 9'' preferably extends from the upper end of the seat part 9 to a substantially central part 9f of the inner wall delimiting the discharge channel of the central opening.

In the embodiment example shown in Figure 7, the closing and draining assembly 2 comprises a downward opening opening/closing valve 5. This valve 5 comprises a valve opening downwards, which makes it possible to open and close an outlet orifice 6 of the chemical reactor 1. The opening of the outlet orifice 6 is obtained by a downward displacement of the valve head 7 (position B).

The valve head 7 makes it possible to close the outlet orifice 6 by an upward displacement and by a sealing bearing of an upper base 7b of said valve head 7 on the seat part 9 and more specifically on the lower end S2 of the inner annular part 9a.

The seat part 9 also has horizontal bores 18a provided in the inner annular part 9a to provide a fluid communication channel between the annular chamber 14 and the inside of the chemical reactor 1. The horizontal bores 18a consequently extend above the upper closing position A of the valve head 7.

The upper S1 or lower S2 ends of the inner annular part 9a of the seat part 9 advantageously have a bevelled annular face on which the lower 7a, respectively upper 7b base of the valve

head 7, can bear in its closing position A.

The vertical bores 17, the oblique bores 18 and the horizontal bores 18a advantageously have a diameter of 4mm. The complementary and vertical openings machined in the form of half-bores advantageously have a diameter of 4mm. The supply opening 15 advantageously has a diameter of 15mm.

According to one example embodiment, the number of vertical bores 17, oblique bores 18, horizontal bores 18a and complementary vertical openings or half-bores is preferably equal to eight.

The dimensions, as well as the number of bores mentioned above are, for example, adapted for a 12500l reactor and having a diameter of 2400mm. The choice of the number of bores and of their diameters is made in order to favour a fluid injection speed which is as high as possible in order to avoid sedimentation and in order to avoid having to establish too great a differential pressure between the annular chamber 14 and the inside of the chemical reactor 1.

The fluid supply pipe 16 is intended to be connected to a fluid supply device, for example a nitrogen supply device, making it possible to establish a permanent counter-pressure in the annular chamber 14 and thus to avoid leakages of the product contained in the chemical reactor 1 through said seat part 9 when said chemical reactor 1 is pressurised.

As an example, the fluid used can also be water or a solvent, for example in the liquid phase. The seat part 9 is constituted by a material advantageously chosen from a family of materials comprising stainless steels, metal alloys of the C, Zirconium, Inconel type and fluorine-based materials of the PTFE, PVDF and PFA type.

Clearly, the present description is not limited to the explicitly described examples, but also comprises other embodiments. Thus, a technical characteristic described can be replaced by an equivalent technical characteristic, without exiting from the scope of the present invention such as defined by the claims.

CLAIMS

1. Closing and draining assembly (2) intended to be mounted on the outlet orifice (6) of a chemical reactor (1), comprising an opening/closing valve comprising a valve body (10) and a displacement valve, closing said outlet orifice (6) by a downward or upward displacement of a valve head (7), which is bearing in a sealed manner on a seat part (9) in its closing position, characterised in that the seat part (9) is removable and comprises an annular chamber (14), an opening (15) for supplying fluid to said annular chamber (14) and at least one set of bores (17, 17a, 18, 18a) distributed homogeneously over the annular extension of said seat part (9) so as to open out into the chemical reactor (1) and thus form fluid communication channels between the annular chamber (14) and the inside of the chemical reactor (1), independently of the position of the valve head (7).
2. Closing and draining assembly (2) according to claim 1, characterised in that the seat part (9) is intended to be placed in a sealed manner against a front face (1b) delimiting the free end of the outlet orifice (6) and against an annular flat face (10b) of a counterpart for mounting the valve body (10), so as to sandwich said seat part (9) by means of a mechanical mounting and to ensure, on the one hand, the immobilisation of said assembly on the chemical reactor (1) and, on the other hand, the sealing with respect to the outside.
3. Closing and draining assembly (2) according to claim 1 or 2, characterised in that it applies to a chemical reactor (1) having a so-called outlet with a pipe (1c).
4. Closing and draining assembly (2) according to claim 1 or 2, characterised in that it is applied to a chemical reactor (1) with a so-called thick-flanged outlet (1a).
5. A closing and draining assembly (2) according to any one of claims 1 to 4, characterised in that it comprises a first annular flat seal (12) and a second annular flat seal (13) constituting the sealing interface between the seat part (9) and respectively the front face (1b) of the outlet orifice (6) and the annular plane face (10b) of the valve body (10).
6. Closing and draining assembly (2) according to any one of claims 1 to 5, characterised in that the seat piece (9) has an inner annular part (9a) and an outer annular portion (9b), assembled together in a sealed manner by complementarity of shapes and each partially

delimiting, once assembled together, the annular chamber (14).

7. Closing and draining assembly (2) according to claim 6, characterised in that the inner annular part (9a) comprises an upper annular portion (9d) fitted into the outlet orifice (6) and one end (S1, S2) of which constitutes a seat for the valve head (7).

8. Closing and draining assembly according to claim 6 or 7, characterised in that bores (17, 17a, 18, 18a) are machined in the inner annular part (9a).

9. Closing and draining assembly (2) according to claim 8, characterised in that the set of bores (17, 17a, 18) comprises at least one first series of vertical bores (17) machined in the inner annular part (9a) so as to open out, on the one hand, into the annular chamber (14) and, on the other hand, into a sealed annular space (20) partially delimited by the inner annular part (9a), the annular flat seal (13) and the end of the outlet orifice (6), and at least one second series of oblique bores (18) passing through the upper annular portion (9d) so as to place the sealed annular space (20) and the inside of the chemical reactor (1) in fluid communication.

10. Closing and draining assembly (2) according to claim 8, characterised in that the set of bores (17, 17a, 18a) comprises at least one first series of vertical bores (17) machined in the inner annular part (9a) to open out, on the one hand, into the annular chamber (14) and, on the other hand, into a sealed annular space (20) partially delimited by the inner annular part (9a), the annular flat seal (13) and the end of the outlet orifice (6), and at least one series of horizontal bores (18a) passing through the inner annular part (9a) to place the annular chamber (14) and the inside of the chemical reactor (1) in fluid communication.

11. Closing and draining assembly (2) according to claims 7 and 8 and one of claims 9 or 10, characterised in that a series of complementary vertical bores (17a) forming complementary and vertical openings or half-bores are provided at the interface of the upper annular portion (9d) and the inner periphery of the outlet orifice (6) against which said upper annular portion (9d) comes into contact, said complementary and vertical or half-bore openings being machined in the outer periphery of the upper annular portion (9d).

12. Closing and draining assembly (2) according to any one of claims 1 to 11, characterised

in that the seat piece (9) is made of a material chosen from a family of materials comprising stainless steels, metal alloys and fluorine-based materials.

13. Chemical reactor (1) equipped with a closing and draining assembly (2) according to any one of claims 1 to 12 and with a fluid supply pipe (16), said closing and draining assembly (2) being connected to the fluid supply pipe (16), which is mounted on the seat piece (9) so as to open out onto the supply opening (15).