



(11) **EP 4 205 869 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:  
**05.07.2023 Bulletin 2023/27**

(51) International Patent Classification (IPC):  
**B08B 9/08 (2006.01)**

(21) Application number: **22217148.0**

(52) Cooperative Patent Classification (CPC):  
**B08B 9/0808; B08B 9/0804; B08B 9/0813**

(22) Date of filing: **29.12.2022**

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

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(30) Priority: **30.12.2021 BE 202106107**

(54) **METHOD FOR CLEANING AND REMOVING A RESIDUAL FRACTION OF SEALANTS AND/OR ADHESIVES IN MIXING VATS FOLLOWING A PRODUCTION AND FILLING PROCESS**

(57) Method for cleaning and removing a residual fraction of sealants and/or adhesives in mixing vats (6) following a production and filling process, comprising the steps in the following order: the mechanical scraping up and away of at least part of this residual fraction by means of an articulated operating scraper arm (1), which scraper arm is provided at its distal end with an at least partially elastic scraper lip (7) for scraping up in the mixing vat and then scraping away out of the mixing vat of this re-

sidual fraction, subsequent further manual removal of a still remaining part of this residual fraction, manually clearing an outlet mouth provided on the mixing vat, mechanical brushing of the mixing vat by means of axially rotating brushes (17), subsequently providing solvent for removing a final residual fraction, the draining and recycling of this solvent resulting in a solvent-free and completely cleaned mixing vat.

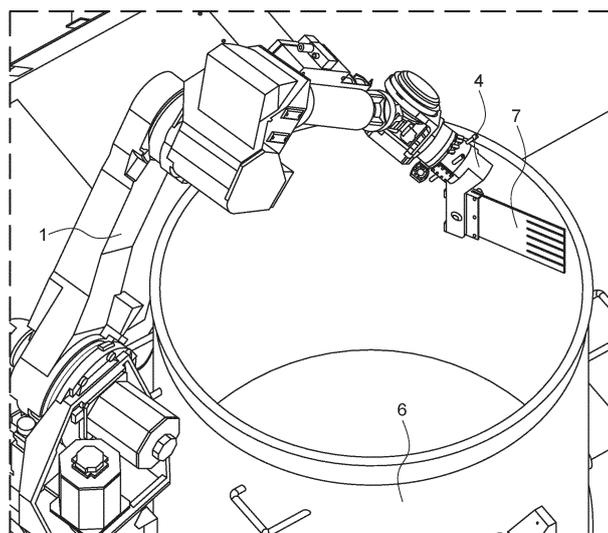


FIG. 2

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**Description****TECHNICAL FIELD**

5 **[0001]** The invention relates to a method for cleaning and removing a residual fraction of sealants and/or adhesives in mixing vats following a production and filling process.

**PRIOR ART**

10 **[0002]** A known method for cleaning and removing a residual fraction of sealants and/or adhesives in mixing vats following a production and filling process is known per se. A known method comprises a fully manual cleaning of the mixing vat, wherein the residual fractions are removed from the mixing vat by means of a hand scraper and/or brush. This known method involves some problems and drawbacks.

15 **[0003]** One of the disadvantages concerns the residual fractions of sealants and/or adhesives to be removed. Such residual fractions include, among other things, the properties that they are agents and/or substances with a high tack, high viscosity and a tendency to adhere to surfaces by means of adhesion. This complicates the cleaning of mixing vats and, in particular, complete manual cleaning, since such residual fractions stick to the mixing vats with a certain tack value. As a result, a certain physical force must be exerted to scrape off the residual fractions.

20 **[0004]** An additional disadvantage is that with fully manual scraping only a small partial surface is scraped off per manual scraping movement. As a result, a considerable number of manual scraping movements are required to clean the entire surface of a mixing vat. This results in the fact that the complete manual scraping is a labor-intensive and time-consuming process.

25 **[0005]** An additional disadvantage is that the sealants and/or adhesives, after a certain period of time, cure when exposed to atmospheric humidity. It is therefore of considerable importance that cleaning of the mixing vats takes place before the residual fractions have cured. A problem that the known method cannot avoid due to the time-consuming manual scraping. There is a need for a method in which cleaning proceeds sufficiently quickly to avoid curing as much as possible.

30 **[0006]** An additional disadvantage of the known method is that manual scraping is extremely physically demanding for a worker. The worker has to reach over the edge of the mixing vat to remove the residual fractions in an extremely unnatural position. An additional disadvantage of the known method is that manual scraping requires a considerable amount of solvent. As a result, there is a health risk for the worker when exposed to such amounts of solvent, as well as an economic disadvantage due to the frequent use of solvent.

35 **[0007]** There is therefore a need for a safe, ergonomic, economical and more practical method for cleaning mixing vats wherein residual fractions are present with such high tack and viscosity wherein the mixing vats can be easily reused after cleaning.

**[0008]** The blog post "How do you clean a forced action mixer?" of 01 August 2021 on the website [www.gclproducts.co.eu](http://www.gclproducts.co.eu) describes a method of cleaning a mixer. The method uses gravel for cleaning the mixer. The method is therefore not suitable for cleaning a mixing vat with an outlet mouth, because the gravel cannot be removed via the outlet mouth and the gravel will clog the outlet mouth.

40 **[0009]** EP 1 236 521 describes a device for cleaning the inside of containers. The device is provided with a brush-like element which can be inserted into the holder, and which can perform a translational movement and a rotation relative to the axis of the holder. This known device has the disadvantage that the brush-like element is quickly contaminated by the sealants and/or adhesives.

45 **[0010]** DE 94 06 714 U1 describes a tool for manually removing paint residues from a paint pot. The tool is not suitable for cleaning mixing vats with a residual fraction of sealants and/or adhesives.

**[0011]** DE 42 39 514 describes a cleaning and drying apparatus for containers. The apparatus has an internal cleaning device, a cleaning solvent discharge device and a drying device with supply and discharge lines for drying air. The cleaning device uses brushes for this purpose, with the same disadvantage that these brushes are quickly contaminated by the sealants and/or adhesives.

50 **[0012]** CN 101 970 190 describes a device for shaving an inside of a vessel. The device comprises a scanner for determining internal dimensions of the vessel and a cutter for shaving a layer on the inside of the vessel. The device is therefore not suitable for cleaning a mixing vat, because this would lead to unwanted damage to the mixing vat.

**[0013]** The present invention aims to find a solution for at least some of the above problems.

55 **SUMMARY OF THE INVENTION**

**[0014]** The invention relates to a method according to claim 1. In particular, the invention relates to a method wherein both machine and manual steps are performed with the aim of cleaning and removing a residual fraction of sealants

and/or adhesives in mixing vats following a production and filling process. The method comprises steps in a specific order.

**[0015]** In the first step, the method involves the mechanical scraping up and away of at least part of this residual fraction by means of an articulated operating scraper arm, which scraper arm is provided at its distal end with an at least partially elastic scraper lip for scraping up in the mixing vat and then scraping away out of the mixing vat of this residual fraction.

**[0016]** In a second step, a remaining part of this residual fraction is further removed manually. Subsequently, in a third step, an outlet mouth provided on the mixing vat is also manually cleared. A fourth step comprises mechanical brushing of the mixing vat by means of axially rotating brushes. In a fifth step, solvent is then provided for the removal of a final residual fraction. Subsequently, in a sixth step, the solvent is drained off and recycled so that it can be reused in a subsequent cleaning process, resulting in a solvent-free and fully cleaned mixing vat.

**[0017]** The invention relates to a method suitable for cleaning mixing vats in which a residual fraction is present, which residual fraction comprises a mixture of sealants and/or adhesives.

**[0018]** The invention relates to a method suitable for cleaning mixing vats in which a residual fraction is present with a tack value T which, measured in accordance with the tack test method, is equal to or greater than 50 Pa.

**[0019]** An advantage of the present invention is that in an ergonomically and economically advantageous and efficient manner, a residual fraction of sealants and/or adhesives can be removed from mixing vats. An additional advantage of the present invention is that a method is obtained suitable for cleaning and removing residual fractions in mixing vats with a tack value equal to or greater than 50 Pa, requiring a minimum of manual method steps.

**[0020]** An advantage of the present invention is that a minimum of solvent must be used for removing residual fractions since only the last remaining residual fractions are removed via solvent. An additional advantage is that the solvent can be easily recovered after draining from a mixing vat, as it contains only a small fraction of sealants and/or adhesives.

**[0021]** An advantage of the present invention is that the method is split into scraping on the one hand and brushing on the other hand. In this process, the mixing vat is mainly emptied during scraping, wherein residual fractions are scraped up and out of the mixing vat. As a result, brushing mainly comprises cleaning the mixing vat and to a lesser extent the removal of residual fractions, wherein brushes are more suitable for cleaning and a scraper lip is more suitable for removing residual fractions. This therefore results in a technical advantage because the emptying and cleaning of the mixing vat is split into separate method steps.

**[0022]** An additional advantage is that scraping is preferably suitable for removing residual fractions on the bottom, which residual fractions are mainly liquid and can therefore be easily scraped up and away. Brushing is preferably suitable for removing residual fractions on the wall. The separate method steps are intended to preferably clean a specific part and/or surface of the mixing vat.

**[0023]** In a second aspect, the invention relates to a use of a method according to the first aspect, for cleaning mixing vats in which a residual fraction is present with a tack value T which, measured in accordance with the tack test method, is equal to or greater than 50 Pa, preferably is equal to or greater than 1000 Pa, more preferably equal to or greater than 5000 Pa and most preferably greater than or equal to 10000 Pa.

**[0024]** In a third aspect, the invention relates to a use of a method according to the first aspect, for cleaning mixing vats in which a residual fraction is present, the residual fraction comprising a mixture of sealants and/or adhesives.

**[0025]** In a fourth aspect, the invention relates to a cleaning device suitable for carrying out a method according to the first aspect, comprising a scraping device, a brushing device and a solvent device.

## DESCRIPTION OF THE FIGURES

### **[0026]**

**Figure 1** shows a device suitable for carrying out a method according to an embodiment of the present invention for cleaning and removing a residual fraction of sealants and/or adhesives in mixing vats following a production and filling process.

**Figure 2** shows a detail of the device shown in Figure 1.

**Figure 3** shows in detail an attachment, in this case a scraper lip.

**Figure 4** shows an attachment, namely a shovel.

**Figure 5** shows an attachment, namely an alternative embodiment of the shovel.

**Figure 6** shows an attachment, namely a brush.

Figure 7 shows an attachment, namely a blade.

Figure 8 shows an attachment, namely a fork.

5 Figure 9 shows an attachment, namely a spray vessel.

Figure 10 shows a brush suitable for performing a method according to an embodiment of the present invention.

10 **DETAILED DESCRIPTION**

[0027] The invention relates to a method for cleaning and removing a residual fraction of sealants and/or adhesives in mixing vats following a production and filling process. Unless otherwise defined, all terms used in the description of the invention, including technical and scientific terms, have the meaning as commonly understood by a person skilled in the art to which the invention pertains. For a better understanding of the description of the invention, the following terms are explained explicitly.

15 [0028] 'Sealants and/or adhesives' in the context of this document means sealants or adhesives or a combination of both.

[0029] A mixing vat preferably comprises a cylindrical tub. The cylindrical tub comprises a bottom, a side wall and a top face, with the entire top face open. Such a mixing vat is suitable for mixing sealants and/or adhesives during a production and filling process. The mixing vat is fitted with an outlet mouth at the bottom. It is conventional to drain a mixing vat through this outlet mouth. Following a production and filling process, the mixing vats are cleaned since residual fractions of the sealants and/or adhesives remain on the inside of the mixing vat. Mixing vats are preferably reused for a subsequent production and filling process and it is important that the mixing vats are completely cleaned. In addition, sealants and/or adhesives cure over a period of time when exposed to moisture such as the humidity in ambient air. It is therefore important that the mixing vats are cleaned properly and quickly.

20 [0030] The outlet mouth preferably has a circular cross-section with a maximum diameter of 85 mm, more preferably a maximum diameter of 80 mm, even more preferably a maximum diameter of 75 mm and even more preferably a maximum diameter of 70 mm.

[0031] The outlet mouth preferably comprises a shut-off tap or shut-off valve. The shut-off tap or shut-off valve is preferably removable for easy cleaning of the outlet mouth.

30 [0032] The term "tack value" is understood under the present invention as an initial tack which is expressed by means of a tack value T, measured immediately after application of a mixture of sealants and/or adhesives, before cross-linking and/or curing of the mixture. A tack value T is measured by a tack test method which is determined by the procedure below.

[0033] The tack value T was determined by an oscillating rheological measurement where a sinusoidal voltage distortion is applied and the resulting voltage response is measured. A HR-2 Discovery Hybrid Rheometer from the TA Instruments company, operated by the TA instruments TRIOS software, was used with a stainless steel rotatable upper plate in combination with a 25 mm diameter fixed lower Peltier plate. This Peltier plate was connected to a Peltier Circulator Thermo Cube Model 10-300. The HR-2 Discovery Hybrid Rheometer was calibrated according to the manufacturer's procedure prior to commencing measurements or when the stainless steel rotatable upper plate was removed for cleaning. The samples, e.g. a mixture of sealants and/or adhesives, were free of visual impurities or air bubbles and were conditioned at room temperature ( $23 \pm 1^\circ\text{C}$ ).

[0034] Measurement parameters:

- Temperature =  $20^\circ\text{C}$
- 45 - Soak time = 10 seconds
- Frequency = 1 Hz
- Diameter of the stainless steel rotatable upper plate = 25 mm
- Shear stress range from 6.5 Pa to 20000 Pa

50 [0035] Method:

- A. The temperature of the lower Peltier plate was stabilized at  $20^\circ\text{C}$
- B. The gap between the two plates was closed by lowering the stainless steel rotatable upper plate
- C. In the software, the opening of the measuring system was set to zero
- 55 D. The stainless steel rotatable upper plate was raised and the sample was applied to the lower plate using a stainless steel spatula, the amount of sample was such as to completely fill a gap of  $1000 \mu\text{m}$  between the two plates
- E. The stainless steel rotatable upper plate was moved down to a gap of  $1010 \mu\text{m}$ , where the sample was trimmed by removing the excess sample squeezed out from the edges of the two plates, using a stainless steel spatula.

F. The stainless steel rotatable upper plate was moved further down to a gap of 1000  $\mu\text{m}$  and the measurement system was locked

G. A soak time of 10 seconds was used to allow the sample to equilibrate to the temperature of the lower Peltier plate, 20°C

H. A logarithmic graded change of shear stress was performed over a range from 6.5 Pa to 20000 Pa with 10 measurement points per decade

I. The tack value was read on the stress scale when the phase angle  $\delta$  reached 45°, when the sample showed no tack at all or the tack was too low to measure, a tack value of 0 Pa was assigned

J. The upper plate was raised and the plates were cleaned with a suitable solvent such as isopropanol or acetone.

**[0036]** In this document, "a" and "the" refer to both the singular and the plural, unless the context presupposes otherwise. For example, "a segment" means one or more segments.

**[0037]** The terms 'comprise', 'comprising', 'consist of', 'consisting of', 'provided with', 'have', 'having', 'include', 'including', 'contain', 'containing' are synonyms and are inclusive or open terms that indicate the presence of what follows, and which do not exclude or prevent the presence of other components, characteristics, elements, members, steps, as known from or disclosed in the prior art.

**[0038]** Quoting numerical intervals by endpoints comprises all integers, fractions and/or real numbers between the endpoints, these endpoints included.

**[0039]** In a first aspect, the invention relates to a method for cleaning and removing a residual fraction of sealants and/or adhesives in mixing vats following a production and filling process. The method comprises steps in the specific order of:

- the mechanical scraping up and away of at least part of this residual fraction by means of an articulated operating scraper arm, which scraper arm is provided at its distal end with an at least partially elastic scraper lip for scraping up in the mixing vat and then scraping away out of the mixing vat of this residual fraction;
- subsequent further manual removal of a still remaining part of this residual fraction;
- manually clearing an outlet mouth provided on the mixing vat;
- mechanical brushing of the mixing vat by means of axially rotating brushes;
- subsequently providing solvent for removing a final residual fraction;
- finally, the draining and recycling of this solvent resulting in a solvent-free and completely cleaned mixing vat.

**[0040]** Mechanical brushing preferably takes place with an axially rotatable cylindrical brush. The axially rotatable brush comprises bristles and a core. The core is made of wood, plastic or another suitable material. The bristles are stuck in the core. The core comprises a recess for housing a shaft for rotating the brush. The cylindrical brush has a diameter of at least 300 mm, preferably at least 350 mm and more preferably at least 375 mm. The cylindrical brush comprises two bases and a shell. Preferably, bristles are present both on the shell and on at least one base of the cylindrical shape, as a result of which brushing can take place simultaneously both with a shell of the cylindrical shape and with the said base. This is particularly advantageous for simultaneous brushing of a bottom and side walls of the mixing vat. The shell of the cylindrical brush is covered with bristles over a distance of at least 300 mm, preferably at least 325 mm, more preferably at least 350 mm, even more preferably at least 375 mm and even more preferably at least 400 mm. The distance is measured transverse to a base of the cylindrical brush. If bristles are present on at least one base of the cylindrical shape, the distance from the at least one base is measured. The shell of the cylindrical brush is preferably filled with at least 6 bristles per  $\text{cm}^2$ , more preferably at least 7 bristles, even more preferably at least 8 bristles and even more preferably at least 9 bristles. The bristles are preferably made of steel or stainless steel. The bristles preferably have a tensile strength of at least 2200  $\text{N}/\text{mm}^2$  and at most 2900  $\text{N}/\text{mm}^2$ . As a result, the bristles are sufficiently firm and wear-resistant. Preferably, the bristles are twisted bristles, wherein the bristles are bundled per 2 to 100 bristles, preferably per 10 to 50 bristles. The twisted bristles preferably fan out in bundles. The twisted bristles preferably have a diameter of at least 10 mm at a free end, more preferably at least 15 mm and even more preferably at least 20 mm. This is advantageous because it ensures that the twisted bristles are sufficiently stiff, so that the bristles do not lie flat when brushing the mixing vat and also have a large contact surface. The axially rotatable cylindrical brush is preferably rotated at a rotational speed between 200 revolutions per minute and 800 revolutions per minute, more preferably between 300 revolutions per minute and 700 revolutions per minute, even more preferably between 400 revolutions per minute and 600 revolutions per minute and even more preferably between 450 revolutions per minute and 550 revolutions per minute.

**[0041]** Because the cleaning steps are partly carried out by machine, cleaning is faster, which means that sealants and/or adhesives have less time to adhere to the mixing vat. As a result, less solvent has to be used and the solvent can be reused several times. The articulated operating scraper arm can exert higher forces than an operator on the residual fraction of sealants and/or adhesives in mixing vats. The articulated operating scraper arm can always start

cleaning immediately after the filling process. If harmful components were present in the mixing vat, the articulated operating scraper arm does not have to wait until the area was made safe. As a result, the residual fraction of sealants and/or adhesives in mixing vats does not cake as much, which again simplifies cleaning.

5 **[0042]** In an embodiment of the present invention, an articulated operating scraper arm comprises at least one elbow piece, which elbow piece is provided with at least one hinge. In a further embodiment, this scraper arm comprises an at least partially elastic scraper lip at its distal end for scraping up a residual fraction in the mixing vat and subsequently scraping it out of the mixing vat.

10 **[0043]** In an embodiment of the present invention, the modulus of elasticity of the scraper lip comprises a value equal to or less than 500 GPa, preferably equal to or less than 250 GPa, and most preferably equal to or less than 200 GPa. An advantage of an elastic scraper lip according to the current method is that the scraper lip can scrape over both the wall surface and the bottom surface. Moreover, by means of an elastic scraper lip, a residual fraction can be scraped up in the mixing vat and then scraped away out of the mixing vat.

15 **[0044]** An additional advantage is that the at least partially elastic scraper lip deforms elastically during the scraping up and away of the residual fraction under usual forces of up to 1000 N on a scraping edge of the at least partially elastic scraper lip and therefore does not break. The scraper lip preferably comprises a plate with parallel incisions. The parallel incisions extend transversely to a scraping edge of the scraper lip. The parallel incisions are advantageous for the elastic deformation of the elastic scraper lip.

20 **[0045]** Preferably, the at least partially elastic scraper lip is made of spring steel. Spring steel is a low-alloy steel comprising nickel and a relatively high carbon content, namely between 0.5% and 1.0% carbon. It therefore has a high structural strength compared to other types of steel, i.e. a high resistance to permanent deformation. Other possible alloying elements are silicon, manganese, chromium, vanadium and molybdenum. Low-alloy steel is steel with 1.5% to 5% alloying elements.

25 **[0046]** In an embodiment of the present invention, the step of mechanically scraping up and away at least part of the residual fraction occurs according to a diametrical scraping pattern. When scraping up and away in a diametrical scraping pattern, the scraper lip scrapes from a point on a first edge of the mixing vat to a point on an opposite edge, where both points lie on a diagonal of the mixing vat. An advantage of the combination of both a diametrical scraping pattern and an elastic scraper lip comprises the advantage for the current method that an entire diagonal of the mixing vat can be scraped in one scraping movement, resulting in an efficient scraping movement, requiring only one scraping over each diameter. This is an operation that is impossible to perform manually due to the size of the diameter of a mixing vat.

30 **[0047]** In an embodiment, during the mechanical scraping up and away of at least a part of the residual fraction, there is an angle of at least 5° and at most 20° between the at least partially elastic scraper lip and a wall of the mixing vat. The angle between the at least partially elastic scraper lip and the wall of the mixing vat is preferably at least 10° and preferably at least 12.5°. The angle between the at least partially elastic scraper lip and the wall of the mixing vat is preferably at most 17.5°. Smaller angles ensure that the at least partially elastic scraper lip does not protrude under the residual fraction and scrapes the residual fraction up and away. The at least partially elastic scraper lip slides along the residual fraction. Larger angles also ensure that the at least partially elastic scraper lip does not protrude under the residual fraction but protrudes into the residual fraction and blocks.

35 **[0048]** In an embodiment, the at least partially elastic scraper lip moves along a wall of the mixing vat at a speed of at least 200 mm/s and at most 600 mm/s. Preferably, the speed is at least 300 mm/s, more preferably at least 350 mm/s. Preferably, the speed is at most 500 mm/s, more preferably at most 450 mm/s. A lower speed is disadvantageous because it means that the at least partially elastic scraper lip has insufficient kinetic energy to scrape the residual fraction up and away. At a higher speed there is a greater risk of breakage of the at least partially elastic scraper lip.

40 **[0049]** In an embodiment of the present invention, during scraping, the height of the scraper arm is set relative to the height of a residual fraction in the mixing vat, the height of the residual fraction being measured from the bottom of the mixing vat. An advantage of such an embodiment is that scraping can take place in an efficient manner. If residues are not present on the entire surface of the mixing vat, it can be chosen to scrape only the surfaces where residues are present. A desired height is then set for the scraper arm, wherein the scraper arm is positioned at least partially below the height of the residual fraction at the desired height.

45 **[0050]** In an embodiment of the present invention, residual fractions that have been scraped up and away are removed from the mixing vat along the open top. These residual fractions are collected in a residual fraction collector, which residual fraction collector comprises a container provided with net-shaped metal wire along an open top. Such an embodiment has the advantage of efficiently collecting residual fractions that have been scraped up and away in a collector, which collector can be easily replaced or emptied if the maximum capacity is reached. In a further embodiment, this scraping up and away comprises an upward movement of the scraper lip along the wall surface of the mixing vat.

50 **[0051]** In an embodiment of the present invention, remaining residual fractions after mechanical scraping up and away are removed manually by means of a hand scraper and/or spatula. In particular, the outlet mouth provided on the mixing vat is manually cleared, since the outlet mouth is difficult to reach for the scraper lip during mechanical scraping. In a further embodiment, these residual fractions are either manually removed from the mixing vat along the open top or they

are pressed through the outlet mouth of the mixing vat.

**[0052]** In an embodiment of the present invention, during mechanical brushing of the mixing vat, the mixing vat is provided with a height-adjustable axially rotating shaft, which rotating shaft is provided with at least one brush, such that the height of the brushes can be adjusted relative to the height of a residual fraction in the mixing vat. An advantage of such an embodiment is that the height of the brushes can be changed in a simple manner without the mechanical brushing of the mixing vat having to be stopped.

**[0053]** In an embodiment of the present invention, during mechanical brushing of the mixing vat, the surface is brushed in a circular movement along the circumference of the mixing vat by means of one or more axially rotating brushes. In a further embodiment, the brushes rotate according to a planetary movement, whereby the brushes rotate both about their own axis and about the central height-adjustable rotating shaft.

**[0054]** A planetary movement entails that an object, in the case of the present invention a brush, rotates about its own axis as well as rotating about another object, in the case of the present invention a central axis.

**[0055]** In an embodiment of the present invention, during mechanical brushing of the mixing vat, the rotational speed of the brushes is set in a proportional relationship to the tack value T of the residues. The rotational speed can herein comprise both the rotational speed of the central shaft and the rotational speed of the brushes themselves. Specifically, this means that when a mixing vat has a residual fraction with a high tack value T, a higher rotation speed will be set. Evidently the reverse reasoning also applies. Such an embodiment has the advantage that the current method is flexible and a wide range of possible sealants and/or adhesives can be removed.

**[0056]** In an embodiment of the present invention, a brush pressure is set on the rotating brushes, which brush pressure is determined so that the brushes exert a required force to clean the surface of the mixing vat.

**[0057]** In an embodiment of the present invention, solvent is discharged via an outlet mouth of the mixing vat, so that the mixing vat is made solvent-free after cleaning.

**[0058]** In an embodiment of the present invention, the mixing vats are provided with wheels for moving the mixing vat. In this way, the mixing vat can, for example, be easily moved from under a scraper arm for manual removal of the remaining residual fractions.

**[0059]** In a preferred embodiment of the present invention, the mixing vat is placed immovably on a ground surface during each of the method steps described above. This entails that any wheels are fixed so that a mixing vat is immovable during a method step.

**[0060]** In a preferred embodiment, the step of mechanically scraping up and away at least part of the residual fraction by means of an articulated operating scraper arm is carried out in a first and a subsequent second substep.

**[0061]** A first substep is the mechanical scraping away of at least part of the residual fraction by means of an articulated operating scraper arm, which scraper arm is provided with a first attachment at its distal end, namely an at least partially elastic scraper lip for scraping away the residual fraction in the mixing vat.

**[0062]** A second substep is the mechanical scraping up of at least part of the residual fraction scraped away from the mixing vat by means of an articulated operating scraper arm, which scraper arm is provided with a second attachment at its distal end, namely a shovel.

**[0063]** The first substep and the second substep are preferably performed in an automated manner.

**[0064]** It will be apparent to one skilled in the art that the first substep and the second substep can be performed repetitively.

**[0065]** The articulated scraper arms are preferably robotic arms. The articulated operating scraper arm from the first substep and the second substep are preferably the same articulated operating scraper arm. This is advantageous because it means that a limited device can be used for cleaning the mixing vat. This embodiment is advantageous because the residual fraction from the mixing vat can be scraped up and away in a fully automated manner. No manual intervention is required to scoop the scraped-up residual fraction from the mixing vat. The attachments are preferably exchanged automatically between the first substep and the second substep. This is particularly advantageous as no operator intervention is required to change the attachments either.

**[0066]** In a preferred embodiment, the step of mechanical brushing the mixing vat is performed by means of a third attachment provided at the distal end of an articulated operating arm. The third attachment comprises an axially rotatable brush and a motor for axially rotating the brush. The motor is an electric, hydraulic or pneumatic motor. The step of mechanical brushing the mixing vat is preferably carried out in an automated manner.

**[0067]** This embodiment is particularly advantageous in combination with a previously described embodiment, wherein the step of mechanically scraping up and away at least part of the residual fraction by means of an articulated operating scraper arm is performed in a first and a subsequent second substep. The articulated operating arm is preferably one articulated operating arm for the first substep, the second substep and the mechanical brushing step. This is advantageous because it means that a relatively limited device can be used for cleaning the mixing vat. The first attachment, the second attachment and the third attachment are preferably exchanged in an automated manner. It will be apparent that a method performed with the aid of several articulated operating arms is also possible.

**[0068]** In a preferred embodiment, the step of providing solvent for removing a final residual fraction is performed by

means of a fourth attachment provided at the distal end of an articulated operating arm. The fourth attachment is a spray vessel. The spray vessel comprises a container for solvent and a spray nozzle for spraying side walls and a bottom wall of the mixing vat with the solvent. The spray vessel is advantageous because it means that conduits for solvent do not have to be guided along the articulated operating scraper arm. The spray vessel is also advantageous because it means that no operator has to apply solvent in the mixing vat, which avoids the risk of the operator becoming overcome by the solvent. The step of providing solvent for removing a final residual fraction is preferably carried out in an automated manner.

**[0069]** This embodiment is particularly advantageous in combination with a previously described embodiment, wherein the step of mechanically scraping up and away at least part of the residual fraction by means of an articulated operating scraper arm is performed in a first and a subsequent second substep. This embodiment is also particularly advantageous in combination with a previously described embodiment, wherein the mixing vat is mechanically brushed with the aid of a third attachment.

**[0070]** The articulated operating arm is preferably one articulated operating arm for the first substep, the second substep, the mechanical brushing step and the step of providing solvent. This is advantageous because it means that a relatively limited device can be used for cleaning the mixing vat. The attachments are preferably exchanged by automated means. It will be apparent that a method performed with the aid of several articulated operating arms is also possible.

**[0071]** In an embodiment, the method comprises the additional step, after mechanically scraping up and away the residual fraction and before manually removing a part of the residual fraction still remaining, of the mechanical stripping of cured sealants and/or adhesives. These cured sealants and/or adhesives were not removed by scraping up and away of walls of the mixing vat. The mechanical stripping is done by means of a fifth attachment, provided at the distal end of an articulated operating arm. The fifth attachment is a blade. The blade is a plate of steel. The plate is attached to the articulated operating scraper arm at a first edge. The plate has a sharp cutting edge on a second edge, lying opposite the first edge. The plate is made of steel. The plate is free of incisions. As a result, the blade is not elastic. The sharp edge and inelasticity of the blade is advantageous for stripping of cured sealants and/or adhesives. Stripping of cured sealants and/or adhesives is dangerous to an operator. Injuries are avoided by mechanical stripping. The step of mechanical stripping of cured sealants and/or adhesives is preferably performed in an automated manner.

**[0072]** This embodiment is particularly advantageous in combination with a previously described embodiment, wherein the step of mechanically scraping up and away at least part of the residual fraction by means of an articulated operating scraper arm is performed in a first and a subsequent second substep. This embodiment is also particularly advantageous in combination with a previously described embodiment, wherein the mixing vat is mechanically brushed with the aid of a third attachment. In addition, this embodiment is particularly advantageous in combination with a previously described embodiment wherein the step of providing solvent is performed by means of a fourth attachment.

**[0073]** The articulated operating arm is preferably one articulated operating arm for the first substep, the second substep, the mechanical brushing step, the step of providing solvent and the step of stripping of cured sealants and/or adhesives. This is advantageous because it means that a relatively limited device can be used for cleaning the mixing vat. The attachments are preferably exchanged by automated means. It will be apparent that a method performed with the aid of several articulated operating arms is also possible.

**[0074]** In an embodiment, before the step of mechanically scraping up and away at least part of this residual fraction, the method comprises the additional step of mechanically removing a protective foil by means of a sixth attachment, provided at the distal end of an articulated operating arm. The sixth attachment is a fork. The fork preferably comprises at least three prongs. The at least three prongs are preferably curved in the same plane. The at least three prongs are preferably pointed. The fork is advantageous for removing a plastic protective foil that was placed on top of the sealants and/or adhesives in the mixing vat to protect the sealants and/or adhesives. An operator does not have to bend over in the mixing vat to remove the protective foil. The protective film is preferably removed by making a circular movement of the fork in the mixing vat. The step of removing the protective film by machine is preferably carried out in an automated manner.

**[0075]** This embodiment is particularly advantageous in combination with a previously described embodiment, wherein the step of mechanically scraping up and away at least part of the residual fraction by means of an articulated operating scraper arm is performed in a first and a subsequent second substep. This embodiment is also particularly advantageous in combination with a previously described embodiment, wherein the mixing vat is mechanically brushed with the aid of a third attachment. In addition, this embodiment is particularly advantageous in combination with a previously described embodiment wherein the step of providing solvent is performed by means of a fourth attachment. This embodiment is moreover advantageous in combination with a previously described embodiment wherein cured sealants and/or adhesives are mechanically loosened.

**[0076]** The articulated operating arm is preferably one articulated operating arm for the first substep, the second substep, the mechanical brushing step, the step of providing solvent and the step of stripping of cured sealants and/or adhesives. This is advantageous because it means that a relatively limited device can be used for cleaning the mixing

vat. The attachments are preferably exchanged by automated means. It will be apparent that a method performed with the aid of several articulated operating arms is also possible.

**[0077]** In an embodiment, a rotatable cylindrical brush is used when manually clearing the outlet mouth provided on the mixing vat. The cylindrical brush has a diameter of at least 80 mm, preferably at least 82.5 mm and more preferably at least 85 mm. The cylindrical brush comprises two bases and a shell. The cylindrical brush comprises bristles with a diameter between 0.15 mm and 0.35 mm on its shell. The shell of the cylindrical brush is covered with bristles over a distance of at least 100 mm, preferably at least 120 mm, more preferably at least 130 mm, even more preferably at least 140 mm and even more preferably at least 150 mm. The distance is measured transverse to a base of the cylindrical brush. The shell of the cylindrical brush is preferably filled with at least 6 bristles per cm<sup>2</sup>, more preferably at least 7 bristles, even more preferably at least 8 bristles and even more preferably at least 9 bristles. The bristles are preferably wavy. The wavy bristles are advantageous for obtaining sufficient stiffness, so that the bristles do not lie flat when the outlet mouth is cleared. The bristles are preferably made of steel or stainless steel. The bristles preferably have a tensile strength of at least 2200 N/mm<sup>2</sup> and at most 2900 N/mm<sup>2</sup>. As a result, the bristles are sufficiently strong and wear-resistant for removing sealants and/or adhesives from the outlet mouth. The cylindrical brush comprises on one side a shaft transverse to a base for driving with the aid of, for example, a drill. The cylindrical brush is preferably rotated at a rotational speed between 200 revolutions per minute and 800 revolutions per minute, more preferably between 300 revolutions per minute and 700 revolutions per minute, even more preferably between 400 revolutions per minute and 600 revolutions per minute and even more preferably between 450 revolutions per minute and 550 revolutions per minute. The cylindrical brush is suitable for cleaning the outlet mouth of the mixing vat. This embodiment is advantageous for completely clearing the outlet mouth.

**[0078]** In a preferred embodiment, the solvent for removing the final residual fraction comprises methoxypropoxypropanol, preferably in a concentration of 20-70%. Preferably, the solvent comprises methoxypropoxypropanol and a dearomatized organic solvent, in a ratio of 2:1-1:2. A non-limiting example of a dearomatized organic solvent is Exxsol D100. Preferably, the solvent is used between 18°C and 22°C.

**[0079]** In an embodiment, after solvent has been provided for the removal of a final residual fraction, the step of mechanically brushing the mixing vat by means of axially rotating brushes is repeated. This is advantageous for accelerating the removal of a final residual fraction with the aid of the solvent.

**[0080]** In an embodiment, the solvent is recycled after draining using a filter cloth. The residual fraction of sealants and/or adhesives remains on the filter cloth and the solvent penetrates through the filter cloth. In this way, the recycled solvent is pure enough to be used during 10-1000 cleaning processes.

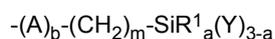
**[0081]** In an embodiment, solvent is provided in the mixing vat prior to the mechanical brushing step. This is advantageous for softening a final residual fraction in the mixing vat so that the final residual fraction is more easily detached from the walls of the mixing vat during mechanical brushing. The provision of the solvent can, but need not, be carried out by means of the fourth attachment, as in a previously described embodiment.

**[0082]** In a second aspect, the invention relates to a use of a method according to the first aspect, for cleaning mixing vats in which a residual fraction is present with a tack value T which, measured in accordance with the tack test method, is equal to or greater than 50 Pa, preferably is equal to or greater than 1000 Pa, more preferably equal to or greater than 5000 Pa and most preferably greater than or equal to 10000 Pa. Herein, the tack test method comprises the above-described oscillating rheological measurement for determining a tack value T.

**[0083]** In a third aspect, the invention relates to a use of a method according to the first aspect, for cleaning mixing vats in which a residual fraction is present, the residual fraction comprising a mixture of sealants and/or adhesives.

**[0084]** In an embodiment of the present invention, a mixture of sealants and/or adhesives comprises at least one silane-modified polymer.

**[0085]** A silane-modified polymer comprises at least one silane group of the general formula:



wherein:

- each A independently represents a divalent linking group selected from the group consisting of: -O-, -S-, -(R<sup>2</sup>)N-, -O-CO-N(R<sup>2</sup>)-, -N(R<sup>2</sup>)-CO-O-, -N(R<sup>2</sup>)-CO-NH-, -NH-CO-N(R<sup>2</sup>)-, and -N(R<sup>2</sup>)-CO-N(R<sup>2</sup>)-, where R<sup>2</sup> stands for hydrogen, C<sub>1-18</sub> alkyl, C<sub>2-18</sub> alkenyl or C<sub>1-6</sub> aryl group;
- R<sup>1</sup> is a C<sub>1-10</sub> alkyl, C<sub>2-10</sub> alkenyl, C<sub>1-10</sub> cycloalkyl or C<sub>6-10</sub> aryl group;
- each Y is each independently a hydroxyl or hydrolyzable group;
- a represents an integer in the range of 0 and 3;
- b represents an integer in the range of 0 to 1;
- m represents an integer in the range 0 to 6.

**[0086]** It should be understood that any silane group of the above general formula may act as a side group and/or an end group attached to at least one main chain of the silane-modified polymer.

**[0087]** The components of the at least one main chain of the silane-modified polymer as described above are not particularly limited.

5 **[0088]** In a preferred embodiment of the present invention, suitable backbone components of the silane-modified polymer are selected from one or more components selected from a group consisting of polyurethanes, polyureas, polyethers, polyesters, polyacrylates and polymethacrylates, polycarbonates, polyamides, polyvinyl esters, or a mixture of two or more thereof.

10 **[0089]** In another preferred embodiment, suitable backbone components of the silane-modified polymer are monomeric units selected from a group consisting of: acrylic monomers, silicone monomers, carboxylic acid monomers, alcohols, isocyanate monomers, epoxide monomers, allyl monomers, amine monomers, anhydride monomers, styrene monomers, vinyl monomers or mixtures of them.

**[0090]** In another embodiment of the present invention, a mixture of sealants and/or adhesives comprises one or more silicone polymers. An example of such silicone polymers are polysiloxanes and polysiloxane-urea/urethane copolymers.

15 **[0091]** In yet another embodiment of the present invention, a mixture of sealants and/or adhesives comprises a mixture of a polyol fraction with a diisocyanate fraction. Examples of diisocyanates are methylene diphenyl diisocyanate (MDI), isophorone diisocyanate (IPDI) or 2,4-toluene diisocyanate (TDI).

**[0092]** In yet another embodiment of the present invention, a mixture of sealants and/or adhesives comprises a dispersion, preferably an acrylate dispersion or a polyurethane dispersion.

20 **[0093]** In a fourth aspect, the invention relates to a cleaning device suitable for carrying out a method according to the first aspect, comprising a scraping device, a brushing device and a solvent device. A scraping device herein comprises at least one scraper arm as described above. A brushing device comprises at least one height-adjustable axially rotating shaft provided with at least one axially rotating brush as described above. A solvent device comprises a facility capable of supplying solvent in a mixing vat.

25 **[0094]** An advantage of the present invention is that in an ergonomically and economically advantageous and efficient manner, a residual fraction of sealants and/or adhesives can be removed from mixing vats. An additional advantage of the present invention is that the device is suitable for cleaning and removing residual fractions in mixing vats with a tack value equal to or greater than 50 Pa, requiring a minimum of manual method steps.

30 **[0095]** An advantage of the present invention is that the device comprises both a scraping device and a brushing device, so that cleaning can be split into scraping on the one hand and brushing on the other. In this process, the mixing vat is mainly emptied during scraping, wherein residual fractions are scraped up and out of the mixing vat. As a result, brushing mainly comprises cleaning the mixing vat and to a lesser extent the removal of residual fractions, wherein brushes are more suitable for cleaning and a scraper lip is more suitable for removing residual fractions. This consequently results in a technical advantage that both the scraping device and the brushing device are optimized for a specific task.

35 **[0096]** In concrete terms, the present invention concerns a flexible, economically advantageous and labor-efficient method for cleaning and removing a residual fraction of sealants and/or adhesives in mixing vats following a production and filling process, as the advantages described above and a device that allows this method. The mixing vats are made solvent-free and completely cleaned via method steps in a specific sequence. In addition, the current method comprises a minimum of manual processing steps, which manual operations include significant drawbacks as described in the prior art.

40 **[0097]** In an embodiment, the articulated operating scraper arm comprises a plurality of arm segments and a plurality of hinge points. Each arm segment extends in its own longitudinal direction. A hinge point comprises an axis of rotation transverse to the longitudinal direction of two adjacent arm segments. The two adjacent arm segments are rotatable relative to each other about the axis of rotation in the hinge point. The two adjacent arm segments are preferably rotatable relative to each other through at least 90°, more preferably at least 180° and even more preferably at least 270°. The articulated operating scraper arm preferably comprises three hinge points. The articulated operating scraper arm preferably comprises several rotary shafts. A rotary shaft is an axis of rotation along the length of an arm segment. Said arm segment is thus rotatable about its own longitudinal direction. Said arm segment is rotatable at least 180° about the rotary shaft, preferably 360°. The articulated operating scraper arm preferably comprises at least three rotation axes. A first rotary shaft is, for example, an axis of rotation transverse to a surface on which the articulated operating scraper arm is placed. This first rotary shaft makes it possible to rotate the articulated operating scraper arm about a base from and to the mixing vat. For example, a second rotary shaft is a rotary shaft in a penultimate arm segment viewed from the base. This rotary shaft makes it possible, for example, to orient the at least partially elastic scraper lip towards a bottom wall or a side wall of the mixing vat. For example, a third rotary shaft is a rotary shaft in a final arm segment. This rotary shaft makes it possible, for example, to align the at least partially elastic scraper lip with the bottom wall or the side wall of the mixing vat. The articulated operating scraper arm is preferably a robotic arm with several arm segments. This embodiment is advantageous because it allows the articulated operating scraper arm to reach all walls of the mixing vat.

**[0098]** It will be apparent to one skilled in the art that an articulated operating scraper arm is understood to mean an arm which comprises several arm segments and several hinge points.

**[0099]** In an embodiment, the articulated operating scraper arm comprises a coupling piece at a free end for connecting attachments. An attachment is a tool suitable for performing a cleaning step when cleaning a mixing vat. An attachment piece comprises a coupling element for coupling to the coupling piece at the free end of the articulated operating scraper arm. The coupling element is preferably disc-shaped with four bar-shaped protrusions. This embodiment is particularly advantageous because it allows the same articulated operating scraper arm to be used for all steps in a method for cleaning a mixing vat.

**[0100]** In a further embodiment, the device comprises at least three attachments. A first attachment is an at least partially elastic scraper lip. A second attachment is a shovel. A third attachment is an axially rotatable brush. The three attachments are placed within reach of the free end of the articulated operating scraper arm. The attachments can be exchanged by automated means. This embodiment is particularly advantageous because it enables a method according to the first aspect to be carried out almost fully automatically.

**[0101]** The scraper lip of the first attachment preferably comprises a plate with parallel incisions. The parallel incisions extend transversely to a scraping edge of the scraper lip. The parallel incisions are advantageous for the elastic deformation of the at least partially elastic scraper lip. Preferably, the at least partially elastic scraper lip is made of spring steel. Spring steel is a low-alloy steel with nickel and a relatively high carbon content, namely between 0.75% and 0.95% carbon. It therefore has a high structural strength compared to other types of steel, i.e. a high resistance to permanent deformation. Low-alloy steel is steel with 1.5% to 5% alloying elements. Preferably, the plate of the at least partially elastic scraper lip has a tensile strength between 1000 N/mm<sup>2</sup> and 2000 N/mm<sup>2</sup>, more preferably 1300 N/mm<sup>2</sup> and 1500 N/mm<sup>2</sup>. The second attachment is a shovel, comprising a shovel surface and two upright walls standing transversely thereto. The upright walls shield between 30% and 75% of a longitudinal side of the shovel surface, preferably between 40% and 60%. The coupling element is arranged between the upright walls at one end of the shovel surface. An alternative embodiment comprises the same elements, with the important difference that the coupling element is moved in a direction transverse to the upright walls next to the shovel surface. This is advantageous for scraping up the residual fraction of sealants and/or adhesives from a bottom wall along a side wall of a mixing vat with the articulated scraper arm, without touching the side wall of the mixing vat with the articulated operating scraper arm. The alternative shovel comprises extended upright walls. The extended upright walls are preferably plates mounted on the upright walls. The extended upright walls are made of a sheet material with a thickness of no more than 2 mm. The extended upright walls are advantageous in order to prevent the residual fraction of sealants and/or adhesives from falling out of the alternative shovel due to movements of the articulated scraper arm when the alternative shovel is removed from a mixing vat.

**[0102]** The third attachment comprises a brush coupled to a motor for axially rotating the brush. The motor is an electric, hydraulic or pneumatic motor. The brush comprises bristles and a core. The core is made of wood, plastic or another suitable material. The bristles are stuck in the core.

**[0103]** The core comprises a recess for placement of a shaft driven by the motor of the third attachment. The cylindrical brush has a diameter of at least 300 mm, preferably at least 350 mm and more preferably at least 375 mm. The cylindrical brush comprises two bases and a shell. Preferably, bristles are present both on the shell and on at least one base of the cylindrical shape. The shell of the cylindrical brush is covered with bristles over a distance of at least 300 mm, preferably at least 325 mm, more preferably at least 350 mm, even more preferably at least 375 mm and even more preferably at least 400 mm. The distance is measured transverse to a base of the cylindrical brush. If bristles are present on at least one base of the cylindrical shape, the distance from the at least one base is measured. The shell of the cylindrical brush is preferably filled with at least 6 bristles per cm<sup>2</sup>, more preferably at least 7 bristles, even more preferably at least 8 bristles and even more preferably at least 9 bristles. The bristles are preferably made of steel or stainless steel. The bristles preferably have a tensile strength of at least 2200 N/mm<sup>2</sup> and at most 2900 N/mm<sup>2</sup>. Preferably, the bristles are twisted bristles, wherein the bristles are bundled per 2 to 100 bristles, preferably per 10 to 50 bristles. The twisted bristles preferably fan out in bundles. The twisted bristles preferably have a diameter of at least 10 mm at a free end, more preferably at least 15 mm and even more preferably at least 20 mm.

**[0104]** In an embodiment, the device comprises a fourth attachment. The fourth attachment is a spray vessel. The fourth attachment comprises a disc-shaped coupling element with four bar-shaped protrusions adapted to connect to the coupling piece at the distal end of the articulated scraper arm. The spray vessel further comprises a container for solvent and a spray nozzle for spraying side walls and a bottom wall of a mixing vat with the solvent. The spray vessel is advantageous because it means that conduits for solvent do not have to be guided along the articulated scraper arm.

**[0105]** In an embodiment, the device comprises a fifth attachment. The fifth attachment is a blade. The fifth attachment comprises a disc-shaped coupling element with four bar-shaped protrusions adapted to connect to the coupling piece at the distal end of the articulated scraper arm. The blade is a plate of steel. The plate is attached to the coupling element at a first edge. The plate has a sharp cutting edge on a second edge, lying opposite the first edge. The plate is made of steel. The plate is free of incisions. As a result, the blade is inelastic compared to the at least partially elastic scraper lip. The sharp edge and inelasticity of the blade is advantageous for stripping of cured sealants and/or adhesives.

[0106] In an embodiment, the device comprises a sixth attachment. The sixth attachment is a fork. The sixth attachment comprises a disc-shaped coupling element with four bar-shaped protrusions adapted to connect to the coupling piece at the distal end of the articulated scraper arm. The fork preferably comprises at least three prongs. The at least three prongs are preferably curved in the same plane. The at least three prongs are preferably pointed. The fork is advantageous for removing a plastic protective film in a mixing vat.

[0107] In an embodiment, the articulated operating scraper arm is attached to a ground surface less than 3 meters from the mixing vat, wherein the attachments are placed at a distance of less than 4 meters from the mixing vat.

## DESCRIPTION OF THE FIGURES

[0108]

**Figure 1** shows a device suitable for carrying out a method according to an embodiment of the present invention for cleaning and removing a residual fraction of sealants and/or adhesives in mixing vats following a production and filling process.

The device comprises an articulated scraper arm (1). The articulated scraper arm (1) is a robotic arm. The articulated scraper arm (1) is equipped with an attachment (4) to clean a mixing vat (6) and to remove the residual fraction of sealants and/or adhesives from the mixing vat (6). Different types of attachments (4) can be connected to the articulated scraper arm (1). Other attachments (4) are suspended from a first table (5) and a second table (2). The loosened residual fraction is shoveled out of the mixing vat (6) by the articulated scraper arm (1). A final residual fraction is removed with solvent. The solvent is drained from the mixing vat (6) through the outlet mouth (3). A residual fraction collector (22) is placed next to the mixing vat for collecting the residual fraction of sealants and/or adhesives that has been scraped up and away. The residual fraction collector (22) comprises a container which is preferably provided with net-shaped metal wire along an open top.

**Figure 2** shows a detail of the device shown in Figure 1.

The articulated scraper arm (1) is provided with an attachment (4), in this case an elastic scraper lip (7), to scrape up and away the residual fraction of sealants and/or adhesives in the mixing vat (6).

**Figure 3** shows in detail an attachment, in this case a scraper lip.

The scraper lip (7) comprises a plate with parallel incisions (9) and a disc-shaped coupling element (8) with four bar-shaped protrusions, suitable for connection to a distal end of the articulated scraper arm (1). The parallel incisions (9) extend transversely to a scraping surface of the scraper lip (7).

**Figure 4** shows an attachment, namely a shovel.

The shovel (10) is an attachment (4) comprising a disc-shaped coupling element (8) with four bar-shaped protrusions, suitable for connection to a distal end of the articulated scraper arm (1). The shovel (10) comprises a shovel surface (12) and two upright walls (11) standing transversely thereto. The upright walls (11) shield approximately 60% of a longitudinal side of the shovel surface (12).

**Figure 5** shows an attachment, namely an alternative embodiment of the shovel.

The alternative shovel (20) comprises the same elements as the shovel (10). An important difference between the alternative shovel (20) and the shovel (10) is that the coupling element (8) has been moved in a direction transverse to the upright walls (11) next to the shovel surface (12). This is advantageous for scraping up the residual fraction of sealants and/or adhesives from a bottom wall along a side wall of a mixing vat (6) with the articulated scraper arm (1), without touching the side wall of the mixing vat (6) with the articulated operating scraper arm (1). The alternative shovel (20) comprises extended upright walls (21). The extended upright walls (21) are preferably plates that are mounted on the upright walls (11). The extended upright walls (21) are made of a sheet material with a thickness of at most 2 mm. The extended upright walls (21) are advantageous in order to prevent the residual fraction of sealants and/or adhesives from falling out of the alternative shovel (20) due to movements of the articulated scraper arm (1) when the alternative shovel (20) is removed from a mixing vat (6).

**Figure 6** shows an attachment, namely a brush.

The attachment (4) comprises a brush (17), coupled to a motor (23) for axially rotating the brush (17), and a disc-shaped coupling element (8) with four bar-shaped protrusions, suitable for connection to a distal end of the articulated scraper arm (1). The motor (23) is an electric, hydraulic or pneumatic motor.

**Figure 7** shows an attachment, namely a blade.

The blade (24) comprises a disc-shaped coupling element (8) with four bar-shaped protrusions, suitable for connection to a distal end of the articulated scraper arm (1). The blade (24) is a plate of steel. The plate is attached to the coupling element (8) at a first edge. The plate has a sharp cutting edge on a second edge, lying opposite the first edge. The plate is free of incisions (9). As a result, the blade (24) is inelastic compared to a scraper lip (7). The sharp edge and inelasticity of the blade (24) is advantageous for stripping of cured sealants and/or adhesives.

**Figure 8** shows an attachment, namely a fork.

The fork (13) is an attachment (4) comprising a disc-shaped coupling element (8) with four bar-shaped protrusions, suitable for connection to a distal end of the articulated scraper arm (1). The fork comprises three prongs (14a, 14b, 14c). The three prongs (14a, 14b, 14c) are preferably curved. The three prongs (14a, 14b, 14c) preferably taper. The fork (13) is advantageous for removing a plastic protective foil that was placed on top of the sealants and/or adhesives in the mixing vat (6) to protect the sealants and/or adhesives.

**Figure 9** shows an attachment, namely a spray vessel.

The spray vessel (15) is an attachment (4) comprising a disc-shaped coupling element (8) with four bar-shaped protrusions, suitable for connection to a distal end of the articulated scraper arm (1). The spray vessel (15) further comprises a container (16) for solvent and a spray nozzle for spraying side walls and a bottom wall of a mixing vat (6) with the solvent. The spray nozzle is not visible in Figure 9. The spray vessel (15) is advantageous because it means that conduits for solvent do not have to be guided along the articulated scraper arm (1).

**Figure 10** shows a brush suitable for performing a method according to an embodiment of the present invention. The brush (17) is suitable as an axially rotatable brush as with the attachment (4) from Figure 6. The axially rotatable brush (17) comprises bristles (19) and a core (18). The core (18) is, for example, a wooden core in which the bristles (19) are adhered. The wooden core (18) comprises a recess (25) for placement of a shaft driven by the motor (23) of the attachment (4) of Figure 6. The dimensions of the brush (17) are for (a) 430 mm, for (b) 400 mm, for (c) 75 mm and for (d) 20 mm. The brush (17) is cylindrical. An advantage of the brush (17) is that bristles (19) are present on at least one base of the cylindrical shape, as a result of which brushing can take place simultaneously both with a shell of the cylindrical shape and with the said base. This is particularly advantageous for simultaneous brushing of a bottom and side walls of a mixing vat (6).

**[0109]** The numbered elements in the figures are:

1. Articulated scraper arm
2. Second table
3. Outlet mouth
4. Attachment
5. First table
6. Mixing vat
7. Scraper lip
8. Coupling element
9. Parallel incisions
10. Shovel
11. Upright wall
12. Shovel surface
13. Fork
14. Prong
15. Spray vessel
16. Container
17. Brush
18. Core
19. Bristle
20. Alternative shovel
21. Extended upright wall
22. Residual fraction collector
23. Motor
24. Blade
25. Recess

## Claims

- 5
1. Method for cleaning and removing a residual fraction of sealants and/or adhesives in mixing vats following a production and filling process, comprising the steps in the following order:
- the mechanical scraping up and away of at least part of this residual fraction by means of an articulated operating scraper arm, which scraper arm is provided at its distal end with an at least partially elastic scraper lip for scraping up in the mixing vat and then scraping away out of the mixing vat of this residual fraction;
  - 10 - subsequent further manual removal of a still remaining part of this residual fraction;
  - manually clearing an outlet mouth provided on the mixing vat;
  - mechanical brushing of the mixing vat by means of axially rotating brushes;
  - subsequently providing solvent for removing a final residual fraction;
  - finally, the draining and recycling of this solvent resulting in a solvent-free and completely cleaned mixing vat.
- 15
2. Method according to claim 1, **characterized in that** during mechanical scraping up and away there is an angle of at least 5° and at most 20° between the at least partially elastic scraper lip and a wall of the mixing vat.
- 20
3. Method according to any of the preceding claims, **characterized in that** the at least partially elastic scraper lip moves along a wall of the mixing vat at a speed of at least 200 mm/s and at most 600 mm/s.
- 25
4. Method according to any of the preceding claims, **characterized in that** the residual fractions that have been scraped up and away are removed from the mixing tub along the open top, which residual fractions are collected in a residual fraction collector, which residual fraction collector comprises a container which is provided along an open top with net-shaped metal wire.
- 30
6. Method according to any of the preceding claims, **characterized in that** the step of mechanically scraping up and away at least part of the residual fraction is carried out in a first and a subsequent second substep, wherein the first substep is the mechanical scraping away of at least part of the residual fraction by means of a articulated operating scraper arm, said scraper arm being provided at its distal end with a first attachment, wherein the first attachment is an at least partially elastic scraper lip for scraping away the residual fraction in the mixing vat, the second substep being the mechanical scraping up of at least part of the residual fraction scraped away from the mixing vat by means of a articulated operating scraper arm, wherein said scraper arm is provided with a second attachment at its distal end, and wherein the second attachment is a shovel.
- 35
7. Method according to any of the preceding claims, **characterized in that** during mechanical brushing of the mixing vat a surface of the mixing vat is brushed in a circular movement along the circumference of the mixing vat by means of one or more axially rotating brushes.
- 40
8. Method according to any of the preceding claims, **characterized in that** the step of providing solvent for removing a final residual fraction is performed by means of a fourth attachment provided at the distal end of an articulated operating arm, wherein the fourth attachment is a spray vessel, wherein the spray vessel comprises a container for solvent and a spray nozzle for spraying side walls and a bottom wall of the mixing vat.
- 45
9. Method according to any of the previous claims, **characterized in that** the method comprises the additional step, after mechanically scraping up and away the residual fraction and before manually removing a part of the residual fraction still remaining, of the mechanical stripping of cured sealants and/or adhesives, wherein the mechanical stripping takes place by means of a fifth attachment provided at the distal end of an articulated operating arm, wherein the fifth attachment is a blade.
- 50
10. Method according to any of the preceding claims, **characterized in that** solvent is discharged via an outlet mouth of the mixing vat.
- 55
11. Method according to any of the preceding claims, **characterized in that** before the step of mechanically scraping up and away at least part of the residual fraction, the method comprises the additional step of mechanically removing

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a protective foil by means of a sixth attachment, provided at the distal end of an articulated operating arm, wherein the sixth attachment is a fork.

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12. Method according to any of the preceding claims, **characterized in that** a rotatable cylindrical brush is used when manually clearing the outlet mouth provided on the mixing vat, wherein the cylindrical brush is rotated at a rotational speed between 200 revolutions per minute and 800 revolutions per minute.
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13. Use of a method according to any of the preceding claims 1-12, for cleaning mixing vats in which a residual fraction is present with a tack value T which, measured in accordance with the tack test method, is equal to or greater than 50 Pa, preferably is equal to or greater than 1000 Pa, more preferably equal to or greater than 5000 Pa and most preferably greater than or equal to 10000 Pa.
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14. Cleaning device suitable for carrying out a method according to any of claims 1-12, comprising a scraping device, a brushing device and a solvent device.
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15. Cleaning device according to claim 14, **characterized in that** the articulated operating scraper arm comprises a coupling piece at a free end for coupling attachments.
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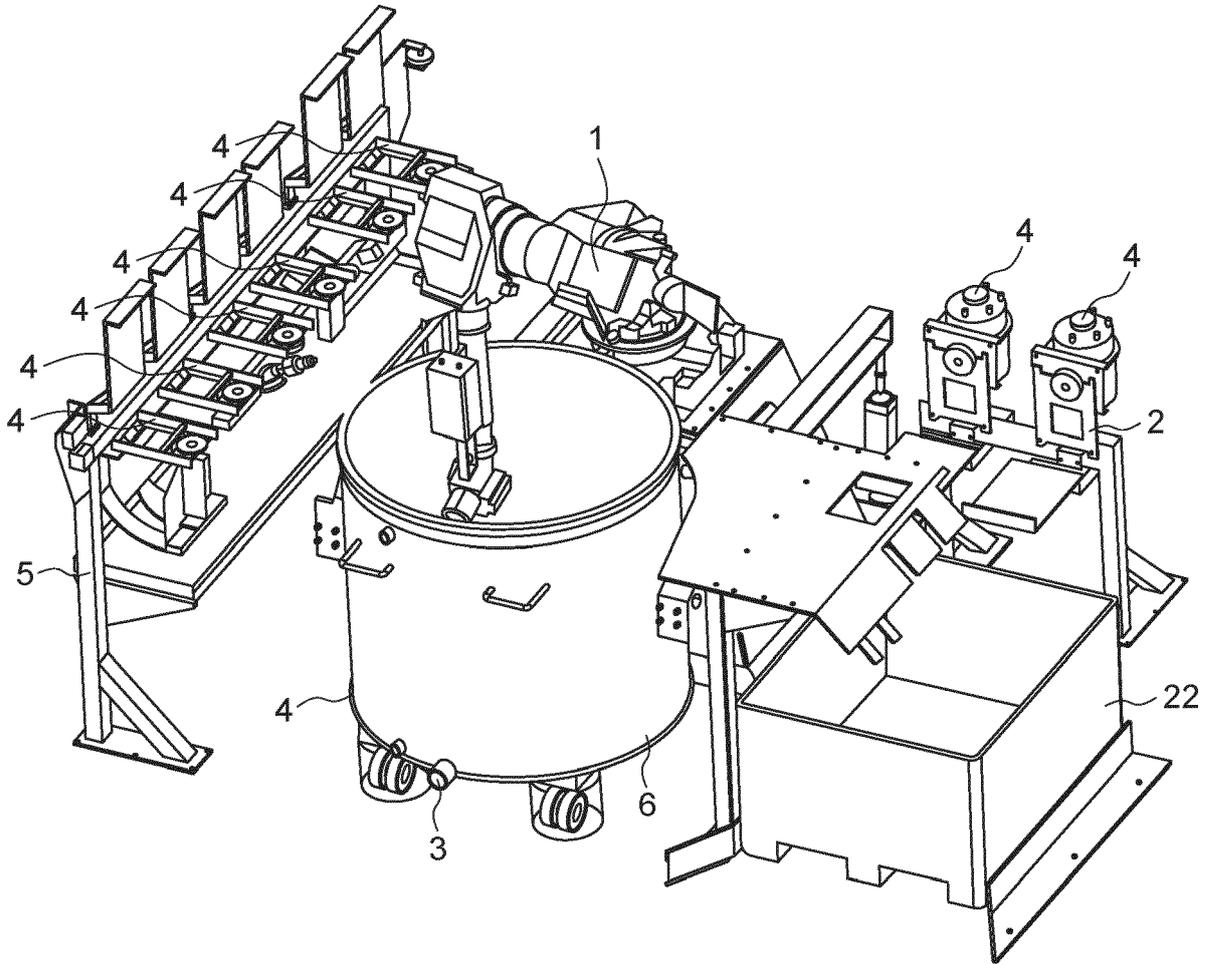


FIG. 1

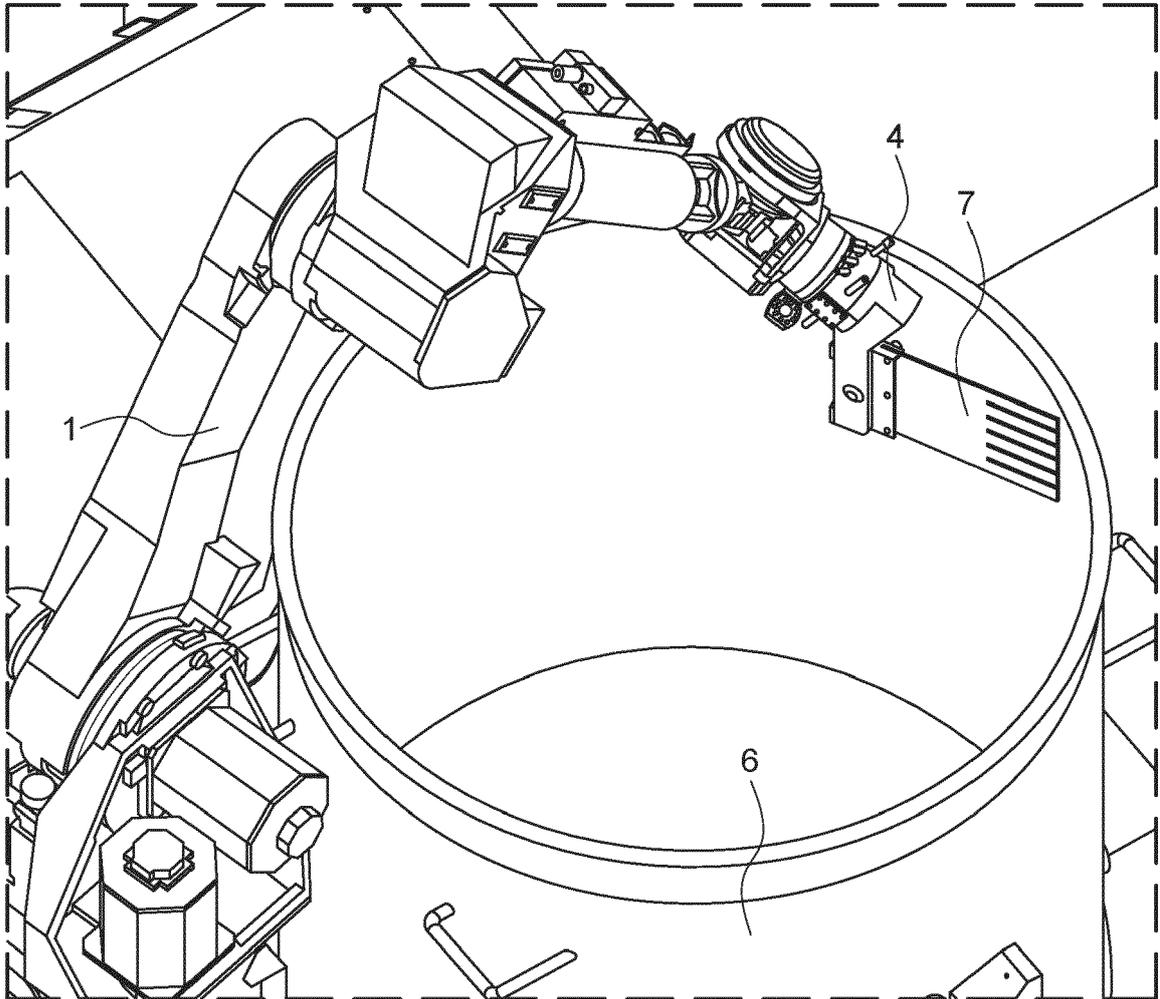


FIG. 2

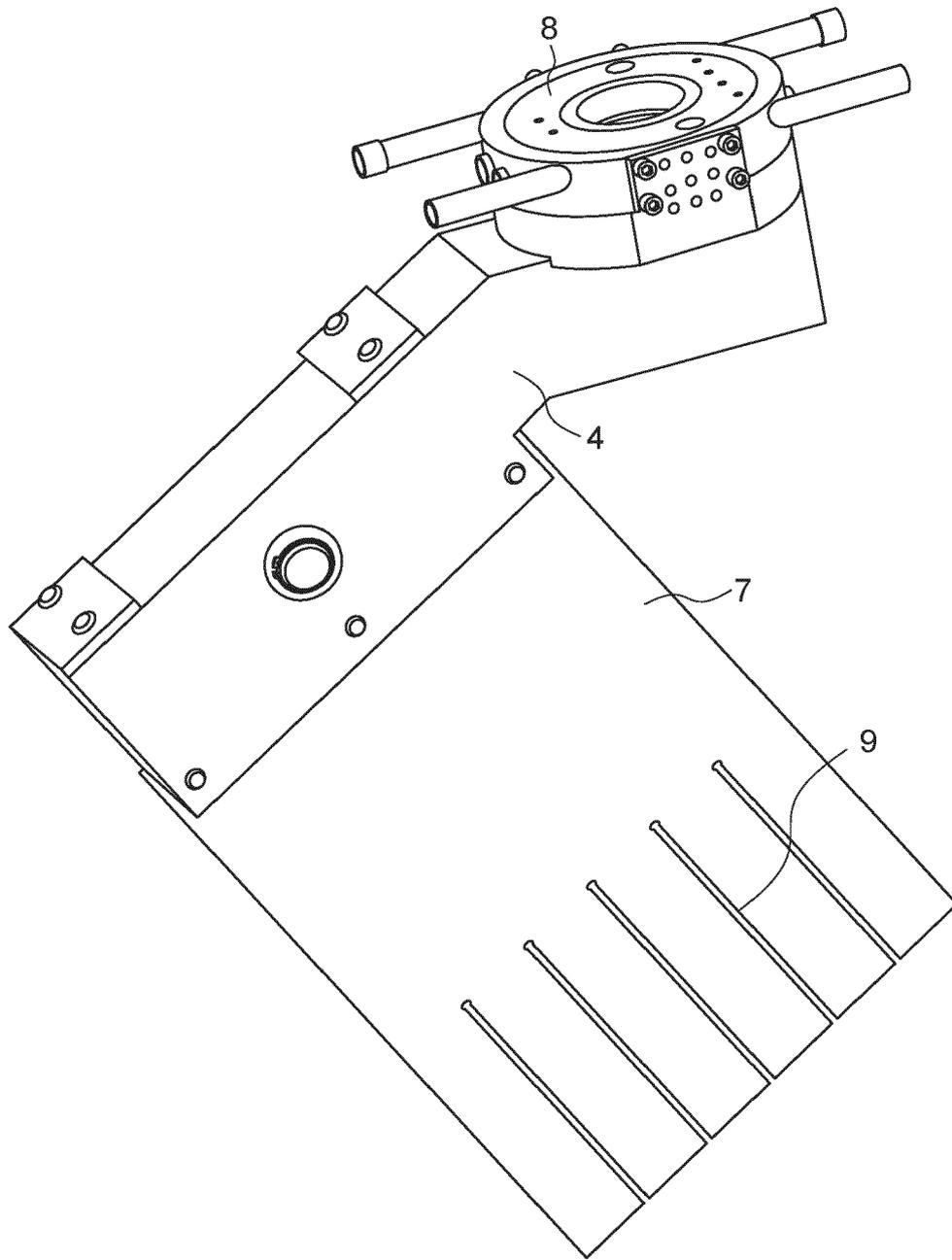


FIG. 3

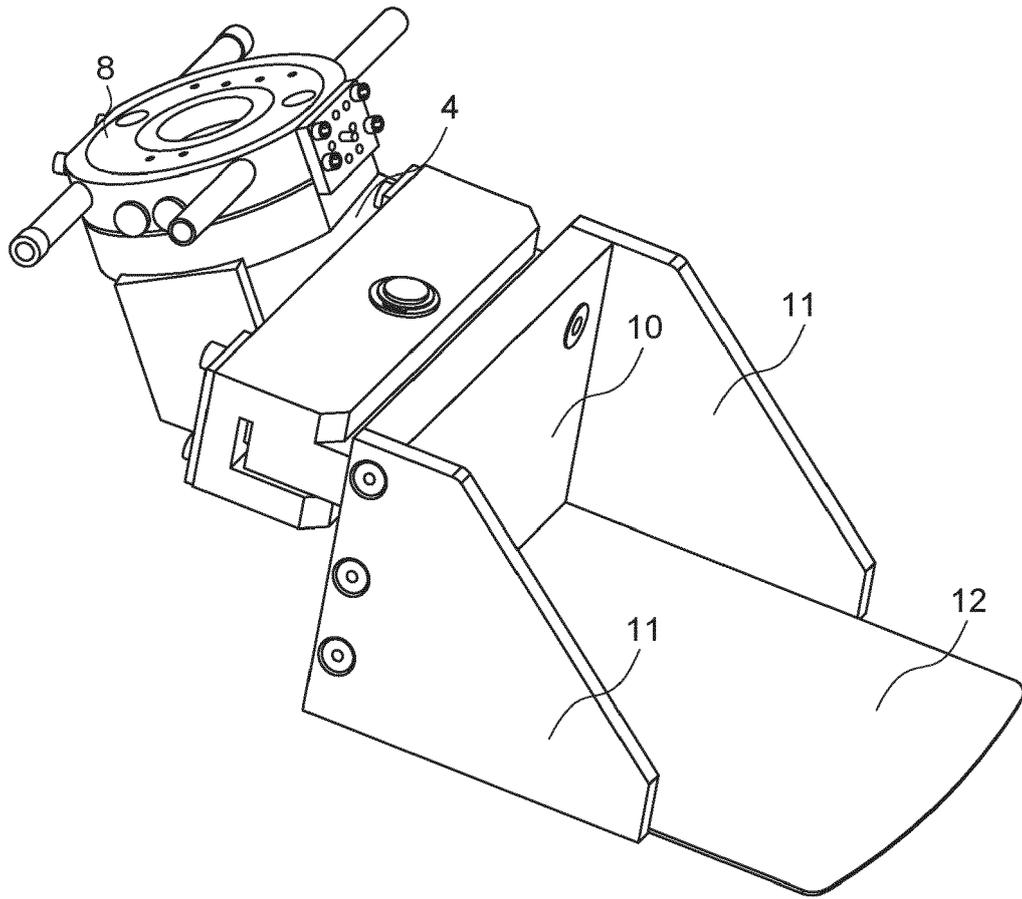


FIG. 4

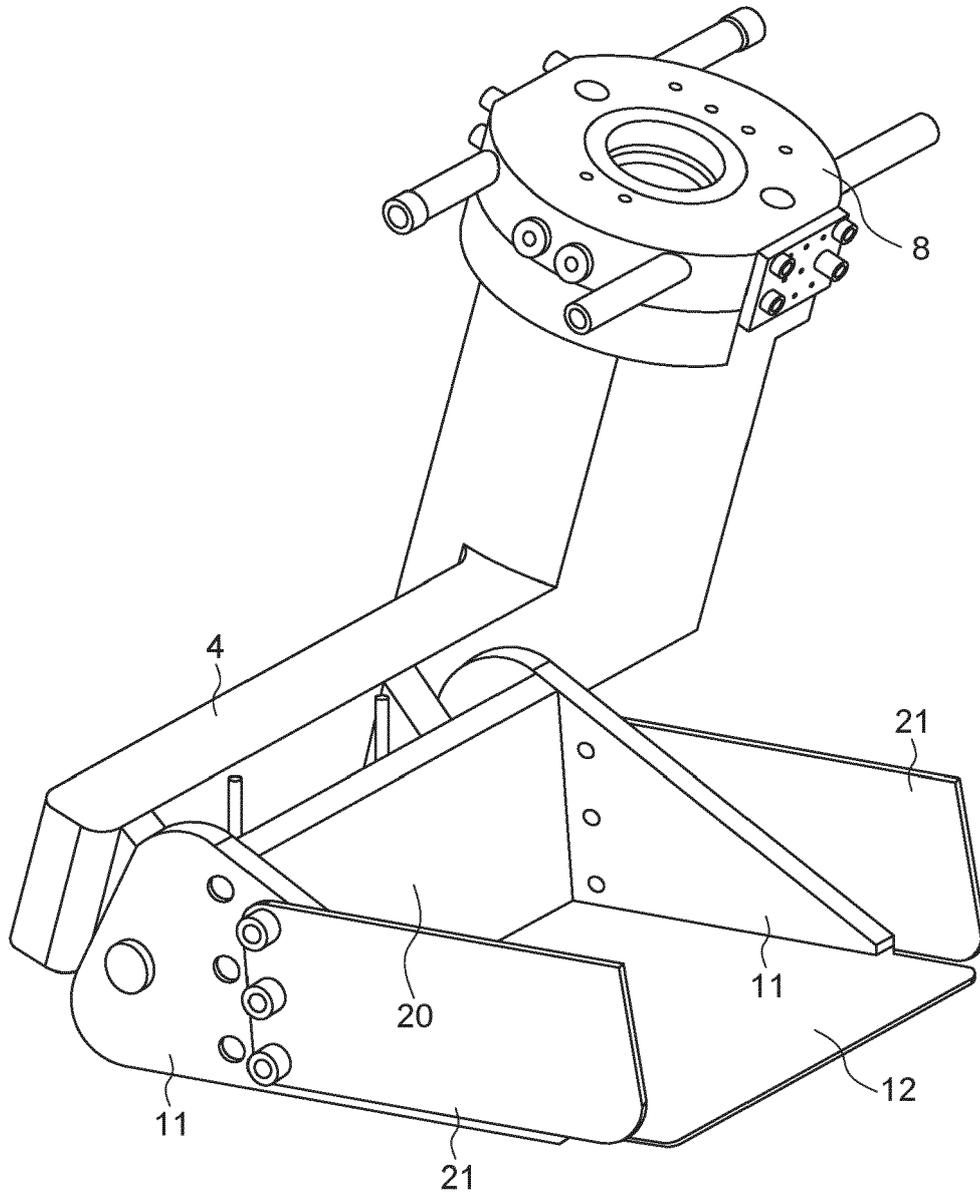


FIG. 5

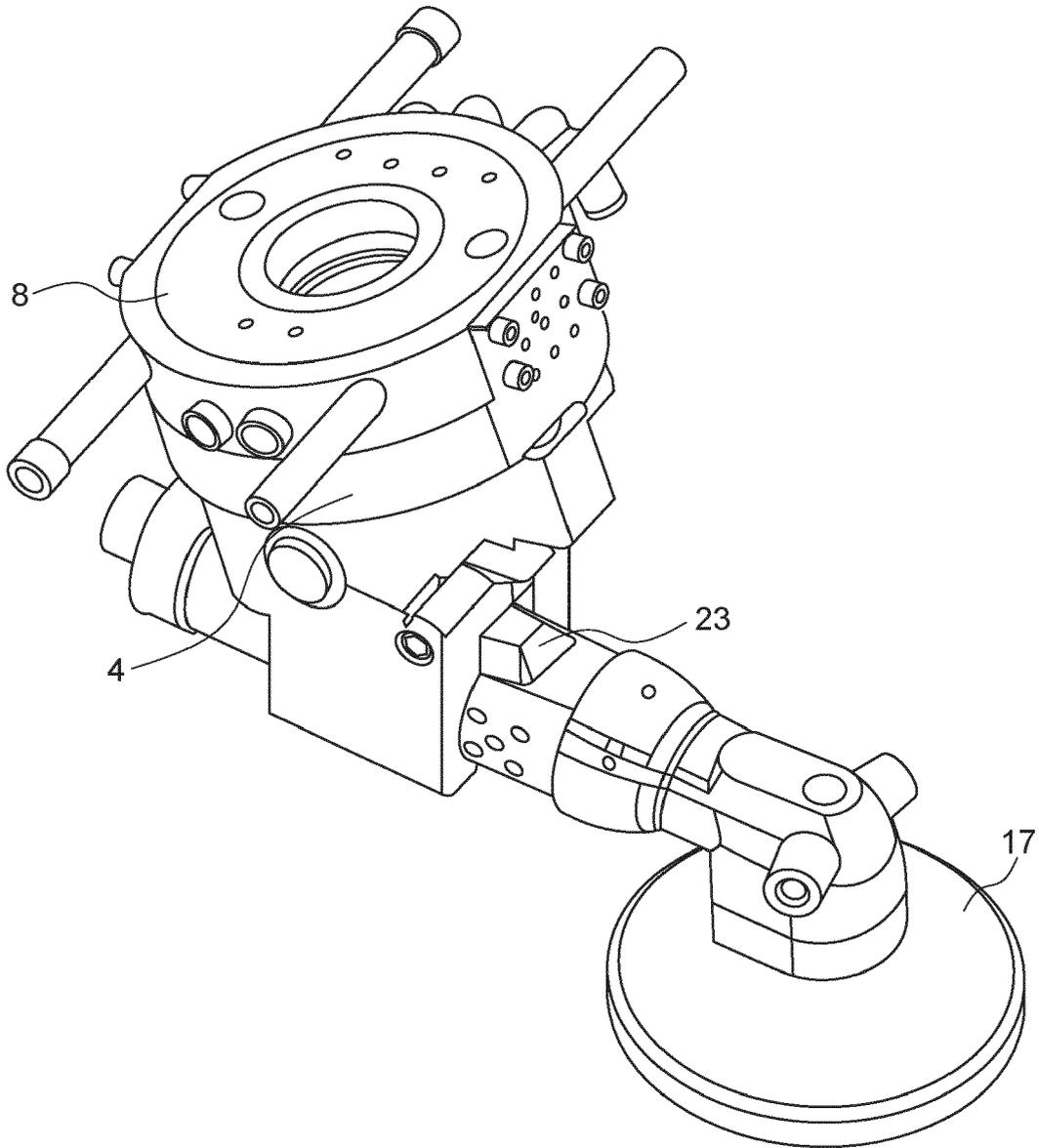


FIG. 6

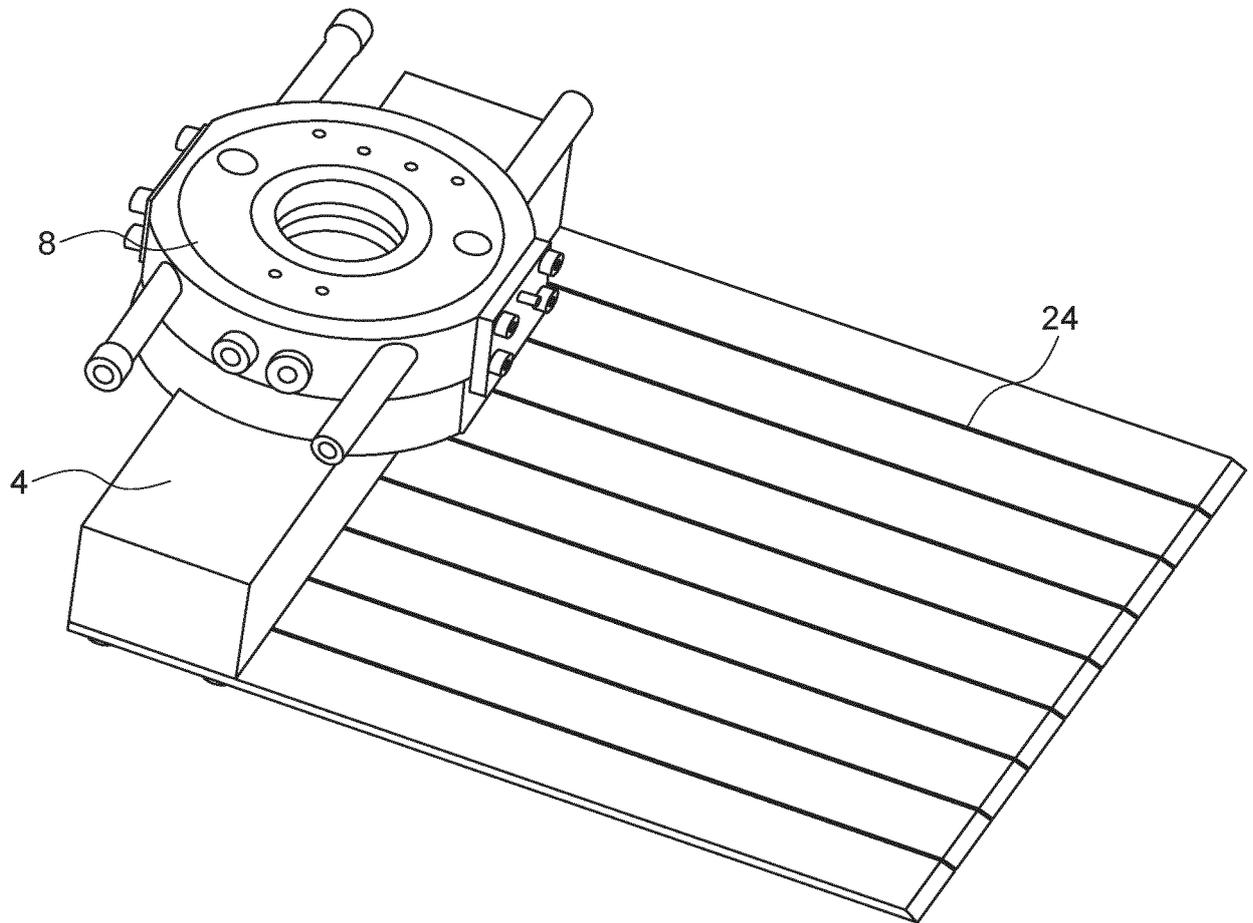


FIG. 7

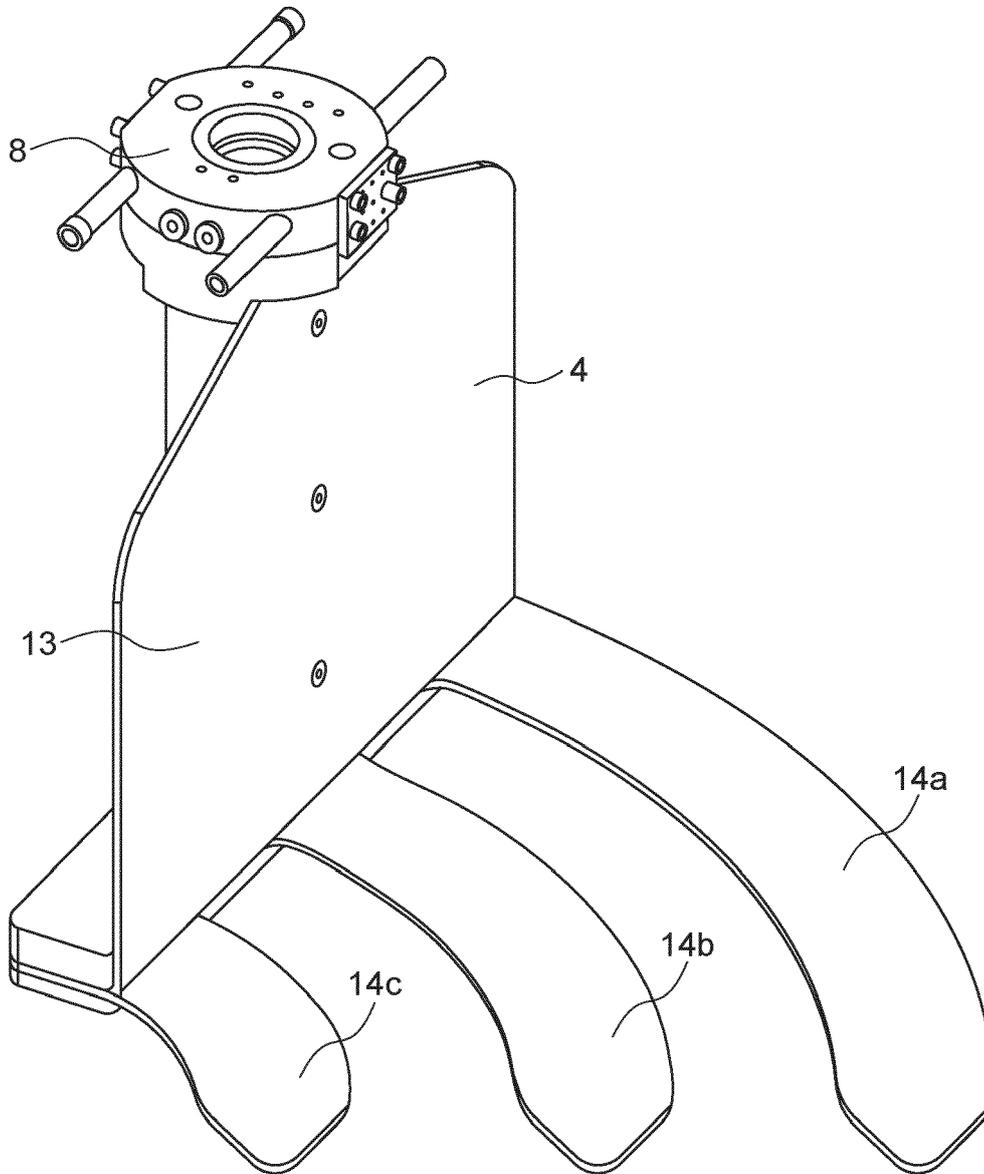


FIG. 8

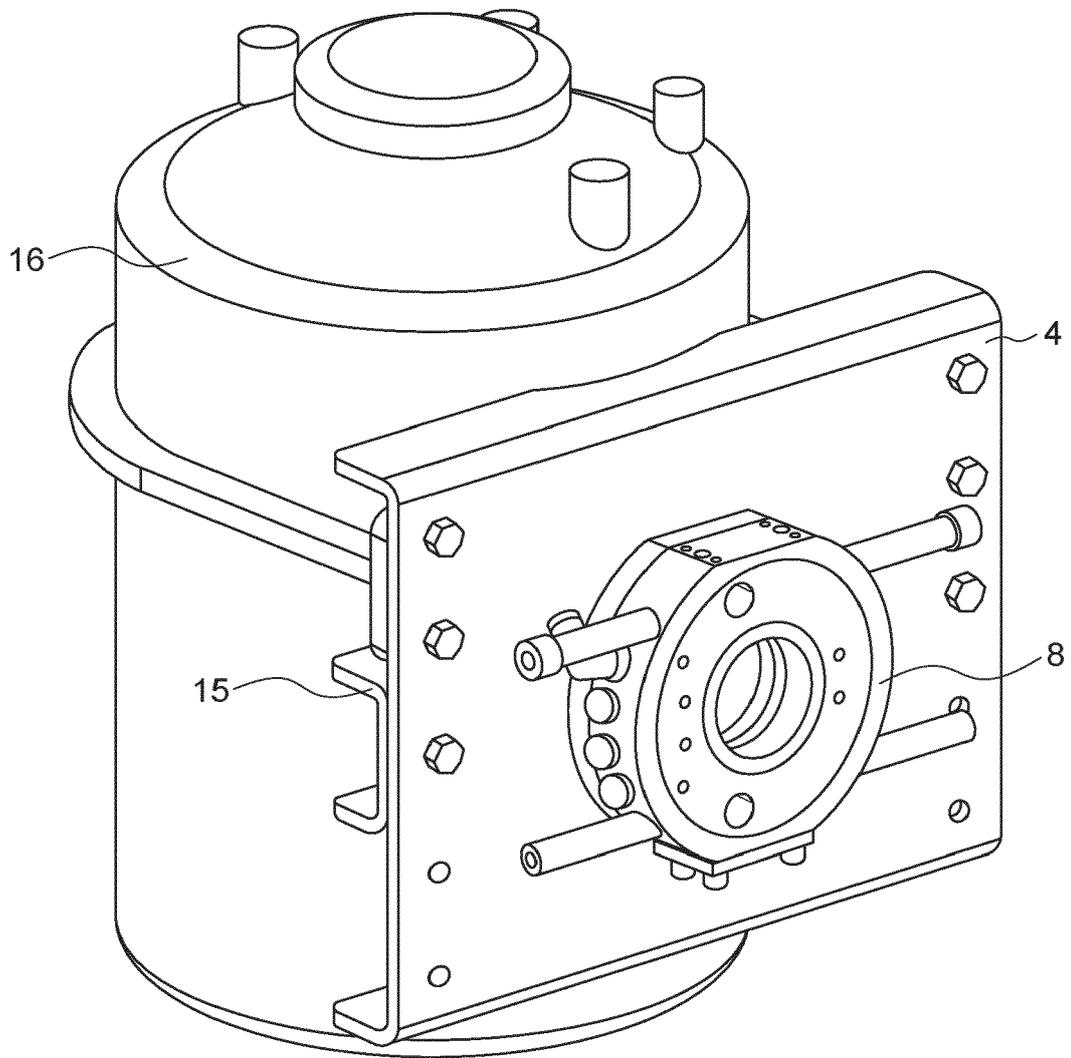


FIG. 9

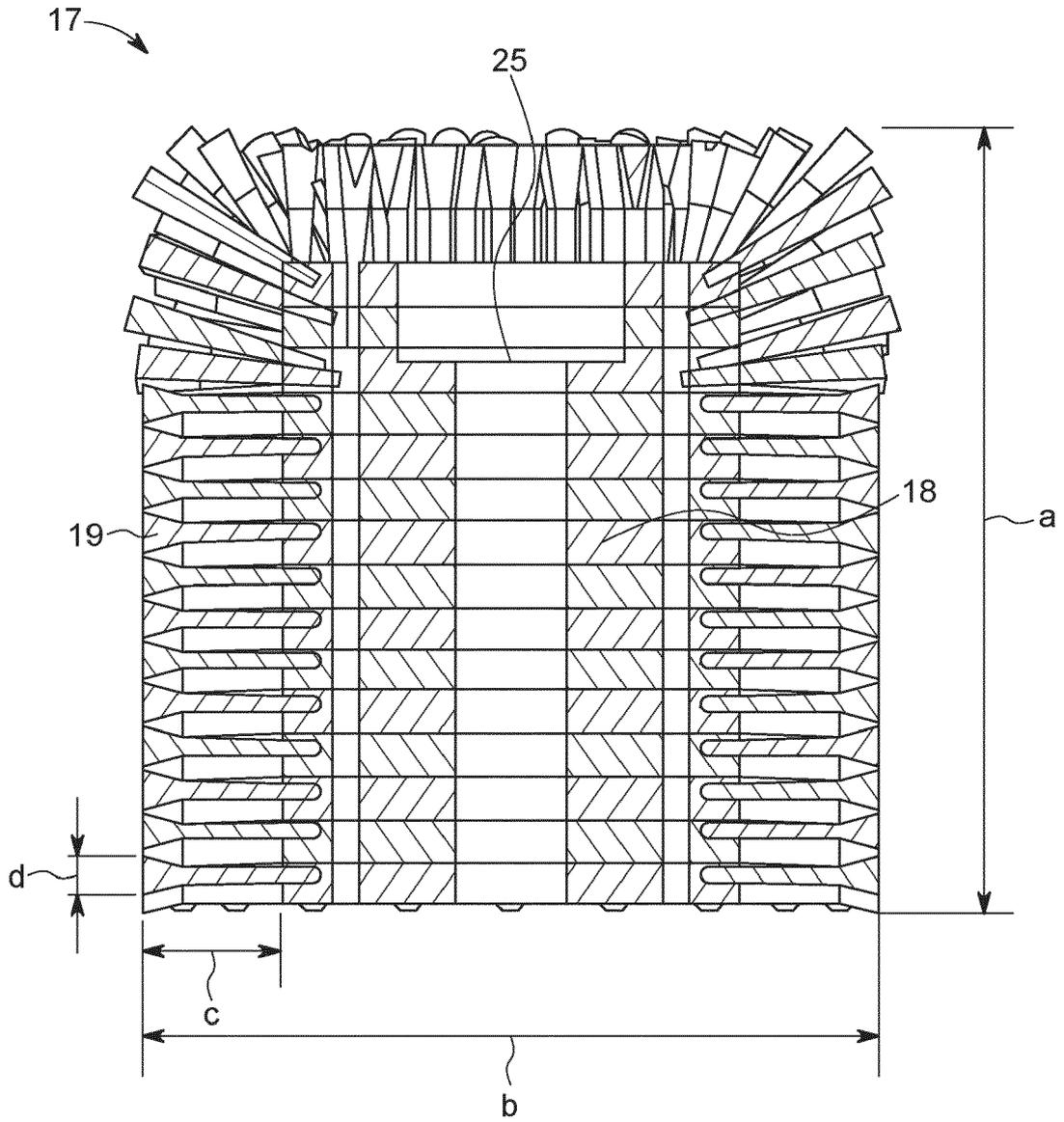


FIG. 10



EUROPEAN SEARCH REPORT

Application Number

EP 22 21 7148

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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Place of search <b>The Hague</b>	Date of completion of the search <b>9 May 2023</b>	Examiner <b>van der Zee, Willem</b>
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EPO FORM 1503 03/82 (P04C01)

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