

Device for exchanging a die plate of a prilling tower and process for automated exchange

5

The invention relates to a device for exchanging a die plate of a prilling tower, wherein molten bisphenol A is introduced into the prilling tower through a plurality of dies located in the die plate and is cooled to room temperature with a view to the production of prills, and also to a process for automated exchange by means of such a device.

10

Bisphenols are chemical compounds with two phenol groups, obtained by causing phenol to react with ketones, whereby bisphenol A (2,2-bis(4-hydroxyphenyl)propane) is formed as a result of the reaction of phenol and acetone. Bisphenol A is processed further into epoxy resins, polycarbonates and polysulfones. With a view to facilitating
15 filling, transport and storage, granular material, flakes or prills are produced from a bisphenol melt by cooling, whereby prills present advantages over granular material or flakes by reason of their lower proportion of dust and better flow properties.

A process for producing bisphenol A prills is known from JP-6-107 581, wherein
20 molten bisphenol A is charged in the top region of a prilling tower and cooling gas, which abstracts the heat of fusion from the falling droplets of melt, is introduced in counter-flow at the bottom of the prilling tower. The solidified prills are removed at the bottom of the prilling tower.

25 Charging of the bisphenol melt in the top of the prilling tower is effected in this case by means of a die plate which is arranged on the top of the prilling tower. With a view to uniform distribution of the bisphenol melt, the die plate is preferably spherically domed. In the die plate a plurality of bores is uniformly distributed on the surface of the die plate.

30

The object underlying the invention is therefore to create a device for exchanging such a die plate that enables the initial pressure of the die plate to be maintained within a

defined range for variable load ranges of a prilling tower. Moreover, it is desirable that the die-exchanging device can be operated automatically from outside and causes no unnecessary stoppage times of the prilling tower in the event of a change of the load range.

5

With regard to the device, the object is achieved in that at least two die plates are provided that are capable of being brought in linear manner along a guide into an operating position or an exchange position by means of a suitable drive mechanism.

10 As regards the process, the object is achieved by virtue of the following steps:

- redirection of the bisphenol melt from the prilling tower into the melt container,
- feeding of nitrogen into the prilling tower over a predetermined period,

15

- relaxation of the pressure in the prilling tower,
- release of the contact pressure on the die plate,

20 - actuation of the displacement cylinder with a view to displacing a die plate from the exchange position into the operating position,

- application of contact pressure onto the die plate,

25 - feeding of nitrogen into the prilling tower over a predetermined period and

- redirection of the bisphenol melt from the melt container into the prilling tower.

In order to create a particularly high degree of flexibility in the course of the production
30 of prills, working takes place with differing die plates, depending on various throughputs, which each comprise a different number and/or distribution of through bores. In this way an automatic adaptation to the load is achieved. At the same time it

is possible that, through the choice of the suitable die plate, load ranges from 0.5 to 8 t of bisphenol melt per hour are possible without departing from an initial pressure of the die plate within a previously defined range from, preferably, 0.1 to 0.3 bar.

- 5 In further development of the invention, slide rails that have a length of at least twice the die-plate length, preferably four times the die-plate length, are provided for the guidance of the die plates.

With a view to improving the exchange operation, the slide rails consist, at least on their
10 surface, of a copper bronze, preferably a CuSn₃ alloy. This alloy is reliably resistant to bisphenol vapours.

A further development of the invention provides that the slide rails and/or the die plates exhibit a polished surface on their contact region. Here a depth of roughness of 0.8 µm
15 has proved particularly expedient.

By way of drive mechanism for displacing the die plate, according to a further teaching of the invention at least one displacement cylinder is provided. Preferred is the use of a single-piston system in which the displacement cylinder is capable of being pressurised
20 pneumatically. The constructional effort in the case of a single displacement cylinder engaging centrally is distinctly lower than that of two or more pistons operating in parallel, by reason of the problems of synchronisation.

Finally, with a view to sealing the die plate on the opening in the top of the prilling
25 tower, a contact cylinder is provided which is preferably capable of being pressurised hydraulically. With such a contact cylinder the die plate that is active in the given case is pressed onto the opening in the top of the prilling tower with a pressure of preferably 200 bar. Sealing of the die plate is effected on the product side via an O-ring seal, made of Viton B for example, and on the gas side towards the prilling head by metallic means.

30

The invention is elucidated in more detail below on the basis of preferred embodiment examples. Shown in the drawing are:

Fig. 1 a first embodiment of the die-exchanging device according to the invention in top view,

5 Fig. 2 a further embodiment example of the die-exchanging device in schematic representation and

Fig. 3 a schematic diagram of the feeding of melt for the purpose of elucidating the exchange operation of the die-exchanging device.

10

The device according to the invention for exchanging a die plate 1 of a prilling tower is shown in Fig. 1, the die plate 1 comprising a die 2 consisting of concentrically arranged bores (only represented schematically), which in the operating position of the die plate 1 is located centrally above the opening, which is not represented, of a prilling tower 3
15 which is only indicated schematically.

Now, in accordance with the invention, several die plates 1 are provided which are capable of being brought in linear manner along a guide into an operating position or an exchange position by means of a suitable drive mechanism. To this end, slide rails 4 are
20 provided as a guide, which in the embodiment example represented have approximately $2\frac{1}{2}$ times the length of a die plate 1. As already stated, the slide rails 4 exhibit a surface made of copper bronze, preferably a CuSn₈ alloy. With a view to further facilitating the linear displacement of the die plates 1, the slide rails 4 and/or the die plates 1 are provided, at least in their contact region, with a polished surface which preferably
25 amounts to a depth of roughness of 0.8 μm .

By way of drive mechanism for displacing the die plates 1, use is made of a pneumatically operable displacement cylinder 5 which is arranged in such a way that it is arranged parallel to the slide rails 4 and engages the die plates 1 centrally. With a
30 view to tilt-free guidance of the die plates 1, the slide rails 4 are preferably provided with a substantially U-shaped profile.

Now in Fig. 2 a preferred die-exchanging device is represented in which the length of the slide rails 4 amounts to approximately four times the die-plate length. This is particularly preferred for automated operation, since in this way four different positions arise. A cleaned die plate 1 is firstly brought into position IV (reserve position) and
5 from there is brought by means of the displacement cylinder 5, from position A thereof, into position III (preheating position) by the displacement cylinder moving into position B. Now, after the displacement cylinder has again moved into position A, a new die plate 1 can be inserted which then, again with the aid of the displacement cylinder 5, is brought from the reserve position IV into the preheating position III. In the process the
10 die plate 1 which has been provided for operation and which in the meantime has been preheated moves from position III into position II (operating position). In the operating position the die plate is pressed in sealing manner, by a contact cylinder 6 which is only indicated, into the opening of the prilling tower 3, which is likewise only indicated. With a view to renewed exchange of the die plate, the latter is brought, as previously
15 described, from position II into position I (removal position) after the pressure of the contact cylinder 6 has been removed.

With a view to cleaning, the contaminated die plate 1 can be removed from position I and, after cleaning has taken place, can be transferred again into the reserve position IV.

20

The entire exchange operation is elucidated in more detail below on the basis of an example which is represented in Fig. 3:

In normal operation of the prilling tower 3 the valves 7 and 8 are switched in such a way
25 that the bisphenol melt is conveyed to the prilling tower 3 in temperature-controlled and quantity-controlled manner by means of a melt pump 9. In this connection the flushings with nitrogen to the die plate 1, that is to say the valve 8, and the recirculation to the melt container 10, that is to say the valve 7, are shut off. The die plate 1, which is only represented schematically, is hydraulically sealed by a contact cylinder, which is not
30 represented here, and by a pressure of 200 bar, on the product side via an O-ring seal made of Viton B and on the gas side towards the prilling tower 3 by metallic means. The pneumatic displacement cylinder 5 (cf. Fig. 2) is in position A. Three die plates

are inserted in the device, one in position II (operating position), one in position III (preheating position) and one in position IV (reserve position). The "ejection space" for the die plate to be exchanged (that is to say, position I) is free.

- 5 By way of preparation for the exchange of dies, the valve 7 is switched in such a way that the bisphenol melt is rerouted from the prilling tower 3 to the melt container 10. The valve 8 is switched, it closes the path of the melt and simultaneously opens the supply of nitrogen to the prilling tower 3 in order to initiate the N₂ flushing. In order that the pipeline between valves 7 and 8 can drain clean, an adjustable timing element is
- 10 provided for the purpose of switching the valve 8. By switching the valve 8 over, the N₂ flushing operation is concluded and the N₂ circuit ventilator is switched off. The pressure in the prilling tower 3 is reduced to a P_a of less than 4 mbar by relaxation downstream of the circuit filter.
- 15 The actual die-exchange operation is initiated by relieving the load on the hydraulic contact cylinder 6. As soon as the hydraulic pressure has been reduced, the pneumatic displacement cylinder 5 moves from position A into position B and in the process displaces all three die plates 1. In this process the die plate that was previously in operation moves to the free ejection space (from II to I), the preheated die plate 1 moves
- 20 into the operating position (from III to II) and the reserve plate moves into the preheating zone (from IV to III). As soon as the displacement cylinder 5 has reached position B, the hydraulic contact cylinder 6 is again placed under pressure, so that imperviousness in the region of the die plate 1 is guaranteed. Subsequently the displacement cylinder moves again into its initial position A.
- 25
- With a view to resuming the operation of the prilling tower, the operating pressure is set to about 50 mbar as a result of a feed of nitrogen N₂. Subsequently the nitrogen circuit ventilator is switched in and the hydraulic contact cylinder 6 is pressurised. In the process the pressure of the contact cylinder 6 unlocks the valve 7 which has to be
- 30 switched over for the purpose of resuming the operation of the prilling tower 3. After the operating speed of the ventilator has been attained, the supply of melt to the prilling tower 3 is enabled by switching the valve 7. Prilling of the bisphenol melt now takes

place automatically, corresponding to the predetermined quantity and the selected die plate 1, in a range from 500 to 8,000 kg/h.

5 With a view to cleaning the die plates 1, the latter are cleaned after operation in an ultrasound bath in dilute caustic-soda solution (6.5 % NaOH) at ambient temperatures for about 30 min. After this, the die plates 1 are vigorously rinsed with fully de-ionized water and are dried prior to re-use.

Claims

1. A device for exchanging a die plate of a prilling tower, wherein molten bisphenol A is introduced into the prilling tower through a plurality of dies located in the die plate and is cooled to room temperature with a view to the production of prills, characterised in that at least two die plates (1) are provided which are capable of being brought in linear manner along a guide into an operating position (II) or an exchange position (I) by means of a suitable drive mechanism.
2. Device according to Claim 1, characterised in that slide rails (4) which have a length of at least twice the die-plate length are provided as a guide.
3. Device according to Claim 2, characterised in that the slide rails (4) have a length of four times the die-plate length.
4. Device according to Claim 2 or 3, characterised in that the surface of the slide rails (4) consists of a copper bronze.
5. Device according to Claim 4, characterised in that the surface of the slide rails (4) consists of a CuSn₈ alloy.
6. Device according to any one of Claims 2 to 5, characterised in that the slide rails (4) and/or the die plates (1) exhibit a polished surface on their contact region.
7. Device according to Claim 6, characterised in that the depth of roughness of the polished surface(s) amounts to 0.8 µm.
8. Device according to any one of Claims 1 to 7, characterised in that at least one displacement cylinder (5) is provided by way of a drive mechanism for displacing the die plate (1).



9. Device according to Claim 8, characterised in that a single-piston system is provided in which the displacement cylinder (5) is capable of being pressurised pneumatically.
- 5 10. Device according to any one of Claims 1 to 9, characterised in that with a view to sealing the die plate (1) at least one contact cylinder (6) is provided on the opening in the top of the prilling tower.
11. Device according to Claim 10, characterised in that the contact cylinder (6) is
10 capable of being pressurised hydraulically.
12. A process for the automated exchange of a die plate (1) of a prilling tower by means of a device according to any one of Claims 1 to 11, characterised by the following steps:
- 15
- redirection of the bisphenol melt from the prilling tower into the melt container,
 - feeding of nitrogen into the prilling tower over a predetermined period,
 - 20 - relaxation of the pressure in the prilling tower,
 - release of the contact pressure on the die plate (1),
 - 25 - actuation of the displacement cylinder with a view to displacing a die plate (1) from the exchange position into the operating position,
 - application of contact pressure onto the die plate (1),
 - 30 - feeding of nitrogen into the prilling tower over a predetermined period and



- 10 -

- redirection of the bisphenol melt from the melt container into the prilling tower.
13. Process according to Claim 12, characterised in that through the choice of the
5 suitable die plate (1) load ranges from 0.5 to 8 t of bisphenol melt per hour are possible at an initial pressure of the die plate (1) within a defined range from 0.1 to 0.3 bar.

