Device with liquid plastic component being supplied intermittently

The invention concerns a device having the features of the classifying portion of claim 1.

In order to provide constantly sufficiently liquid plastic component for the metering device it is already known to make available two sources which operate alternately intermittently. That involves a high level of structural complexity and expenditure. There is moreover the problem that the point of switching over from one source to the other has to be correctly selected so that no unwanted pressure drop occurs.

The object of the present invention is to provide a device which is improved over the state of the art and in which those problems are avoided.

That object is attained by a device having the features of claim 1. Preferred variants are recited in the appendant claims.

Accordingly it is provided according to the invention that arranged between the source for the at least one liquid plastic component and the metering device is a buffer device having a variable buffer volume and connected to the source by way of an inlet and to the metering device by way of an outlet. That makes it possible with a single intermittently operating source to make the liquid plastic component available to the metering device without interruption. In that respect the buffer device ensures that there is always sufficient material available, with an adequate preload pressure. The buffer device itself does not have to operate as a pump itself but is of a purely passive nature.

The term an intermittently operating source is used to denote not just a source whose delivery output drops to zero (for example a piston pump) but also a source whose delivery output is subjected in particular to pulsating fluctuations (for example a gear pump).

By virtue of inevitable frictional losses it is preferably provided that the preload pressure of the buffer device can be particularly preferably set by way of a preferably pneumatic proportional pressure valve.

Protection is also claimed for a device for producing foamed plastic parts, in particular sealing beads, having a device according to the invention.

Embodiments of the invention are discussed with reference to the Figures in which:

Figure 1 diagrammatically shows a device for producing foamed plastic parts,

Figure 2 shows a first embodiment of a piston pump in which the pistons are mechanically coupled in mirror-inverted relationship,

Figure 3 shows a variant of the embodiment of Figure 2,

Figure 4 shows an embodiment of the invention in which the pistons are mechanically coupled synchronously,

Figure 5 shows an embodiment of the invention in which the pistons are coupled electrically,

Figure 6 shows an embodiment of the invention, wherein the one piston pump and the other piston pump are respectively alternately in the form of an introduction device and a delivery device,

Figure 7 shows the buffer device in detail, and

Figure 8 shows an alternative variant of the buffer device.

Figure 1 diagrammatically shows in its entirety a device 100 for producing foamed plastic parts, in particular sealing beads. That device 100 in turn has a plurality of essential sub-units.

Such a sub-unit is formed by a device 16 for producing a mixture of at least one gas and at least one liquid plastic component. That device 16 in turn has at least one mixing device 17, an introduction device 19 for the at least one gas, that is connected to the mixing device 17 by way of a first line 18, and a delivery device 21 for the at least one liquid plastic component, that is connected to the mixing device 17 by way of a second line 20. In addition the device 16 has a container 53 for the plastic component and a gas source 54, in particular a compressed air generating device. Instead of the container 53 it would also be possible to provide a delivery pump.

In such a device 16, in contrast to the state of the art, it is provided that the introduction device 19 and the delivery device 21 are in the form of piston pumps 25 and 24 having pistons 22 and 23.

The piston 22 of the introduction device 19 (piston pump 25) and the piston 23 of the delivery device 21 (piston pump 24) are mechanically coupled in this example in mirror-inverted relationship by way of a pressure booster 26. That makes it possible to use a drive which operates at a relatively low pressure (for example pneumatic) as the necessary increase in force is effected by way of the force booster. It is also possible to see inlet valves 27, 28 and outlet valves 29, 30.

As shown in greater detail in Figure 2 those inlet valves 27, 28 and outlet valves 29, 30 are actuated by a control device 33 matched to the movement of the coupled

pistons 22, 23. The Figure also shows a sensor 31 which communicates with the control device 33 by way of a signal line 32 for signal transmission. The sensor 31 serves to determine the position of the pressure booster 26. In that way the position of the pistons 22, 23 is also determined. The position of the pistons 22, 23 can also be determined directly by way of the sensor 31 (see the further embodiments). In general, it is possible with such a sensor 31 to detect leakage, more specifically if the piston seals between the piston 23 and the cylinder 34 of the introduction device 19, the piston seals between the piston 22 and the cylinder 35 of the delivery device 21 and/or at least one of the valves 27 through 30 are worn. For leakage detection purposes for example the inlet valve 28 and the outlet valve 30 of the gas side are closed. Compression of the gas volume between the inlet valve 28 and the outlet valve 30 is effected by the piston 22. If there is a leak, the result is an irregular movement of the pressure booster 26 which is detected by the sensor 31, after compression has occurred. It is also possible to check whether there are irregular gas proportions in the liquid plastic component as when the inlet valve 27 and the outlet valve 29 are closed they lead to a movement of the piston 23 as the liquid plastic component is compressible due to the irregular gas proportions therein. That can possibly be compensated by the control device 33.

Figure 3 shows a single piston pump which simultaneously forms the piston pump 24 for the delivery device 21 and the piston pump 25 for the introduction device 19. This variant does not have a separate pressure booster, rather a piston forms both the piston 23 of the piston pump 24 and also the piston 22 of the piston pump 25. That system as shown in Figure 3 also operates mechanically in mirror-inverted relationship. This means that, when gas is discharged by way of the introduction device 19 (shown downwardly) liquid plastic component is introduced into the delivery device 21 and vice-versa.

In comparison Figure 4 shows a system in which the piston pumps 24 and 25 are mechanically coupled synchronously. In specific terms the piston 22 of the introduction device 19 and the piston 23 of the delivery device 21 are coupled by way of a coupling mechanism 63 in such a way that, when gas is discharged from the introduction device 19, liquid plastic component is discharged from the delivery device 21 and, when gas passes into the introduction device 19, liquid plastic component is introduced into the delivery device 21.

Figure 5 shows electronic coupling of the piston pumps 24 and 25. In this case the movement of the pistons 22 and 23 is controlled by a control device 64 which is

connected in signal-conducting relationship with drive devices of the two piston pumps 24 and 25. The pistons 22 and 23 can be moved synchronously or in mirror-inverted relationship. That can be set by way of the control device 64.

Figure 6 shows a piston pump 25 and a piston pump 24 which respectively alternately form the introduction device 19 or the delivery device 21. An advantage in that respect is that the seals are lubricated alternately on both sides by the liquid plastic component. A change is possible after a predeterminable number of cycles. The change is effected by way of switching devices 65 and 66 which can either be switched over manually or however can be preferably regularly switched preferably by way of a control device 67. In the first switching position the liquid plastic component is conveyed from the container 53 by way of a first line 68 to the piston pump 24 (shown upwardly) while the gas from the gas source 54 is conveyed to the piston pump 25 by way of the second line 69. In that respect the entire system in that first switching position is the same as in Figures 1 and 2. In the second switching position however a diversion is implemented. More specifically, in that second switching position, the liquid plastic component is conveyed from the container 53 to the piston pump 25 (shown downwardly) by way of a third line 70 while the gas is conveyed from the gas source 54 to the piston pump 24 by way of a fourth line 71. Accordingly – conversely relative to the first switching position – in that second switching position the piston pump 25 forms the delivery device 21 and the piston pump 24 forms the introduction device 19. Depending on the respective switching position then the liquid plastic component and the gas respectively is further pumped to the mixing device 17 by way of the first line 18 and the second line 20 respectively.

Going back to Figure 1 a further sub-unit of the device 100 is formed by a device 36 for providing a liquid plastic component, preferably mixed with gas, for a metering device 38. That device 36 has a source 37 for at least one liquid plastic component. Preferably that source 37 is formed by a line which leads away from the above-mentioned mixing device 17. In addition that device 36 has an intermittently operating forwarding device for the at least one liquid plastic component. The intermittently operating forwarding device is formed by the piston pumps 24, 25 but can also be any other device of any desired configuration, which is suitable for intermittently forwarding the liquid plastic component. The term intermittently operating source is used to mean not just a source whose delivery output falls to zero but also a source whose delivery output is subject to severe fluctuations.

The device 36 in addition has a metering device 38, preferably a metering pump, for which the plastic component is provided by the forwarding device. In addition the device 36 has a buffer device 39 with a variable buffer volume 40, that is arranged between the source 37 for the at least one liquid plastic component and the metering device 38, and by which the liquid plastic component intermittently delivered to the buffer device 39 is always made available in an adequate quantity and with a sufficient preload pressure for the metering device 38. Downstream of the metering device 38 the plastic component passes to a metering valve 60 whereupon the plastic component is discharged directly (see the nozzle 61 shown in broken line) – or as shown in Figure 1 indirectly by way of a further mixing element 58 – by way of a nozzle 61 and foams up by virtue of discharge thereof and the pressure drop that this entails.

In order to permit forwarding of the material, that is as uniform as possible, it is preferably provided that the pressure prevailing between the buffer device 39 and the metering device 38 in the liquid plastic component is controllable by the buffer device 39. The liquid plastic component passes by way of an inlet opening 41 from the source 37 into the buffer volume 40 of the buffer device 39. The buffer volume 40 is in turn connected to the metering device 38 by way of an outlet opening 42. In Figure 1 the inlet opening 41 is provided in a wall of a housing 43 of the buffer device 39. That can equally be seen in Figure 7. Alternatively however it is also possible to provide that the inlet opening 41 is provided in a piston rod 44, connected to a piston 45, of the buffer device 39 (see Figure 8). In addition an inlet valve 51 is arranged upstream of the inlet opening and an outlet valve 52 is arranged downstream of the outlet opening 42. A travel sensor 72 can also be provided, with which it is possible to determine at least selected positions of the piston 45 in the housing 43.

It is further provided that a pressure sensor 46 is arranged on the outlet side of the metering device 38. That pressure sensor 46 is connected to a control device 47 by way of a control line 48. The control device 47 controls the buffer device 39 in such a way that the pressure on the inlet side of the metering device 38 tracks the pressure prevailing on the outlet side of the metering device 38. In addition the control device 47 can be so adapted to close both the inlet valve 51 and also the outlet valve 52 and to compress the liquid plastic component in the buffer volume 40. In addition there can be a sensor (not shown) by which irregular compression of the buffer volume 40 can be detected.

In addition the buffer device 39 is connected to a device 49 for pressurizing the buffer device 39. That is actuable either by the control device 47 (conduit shown in broken line) or by an independent control device 50.

In principle the two devices 16 and 36 are already sufficient for the production of foamed plastic parts in the form of sealing beads. It can however additionally preferably be provided that a second plastic component foams up, preferably physically, in parallel with the first plastic component or mixed with the first plastic component to give the plastic part. Therefore a further sub-unit of the device 100 is formed by a device 62 for multi-component foaming (see once again Figure 1). That device 54 has a container 55 for a second plastic component, from which the second plastic component, preferably mixed with gas, is passed to the mixing element 58 by way of a metering device 56 and a metering valve 57. That second plastic component is mixed with the first plastic component in the mixing element 58. Then, downstream of a further metering valve 59, the mixture is discharged by way of a diagrammatically indicated nozzle 61 whereby the gas contained in the mixture foams out. Expressed in other terms, a pressure drop occurs due to discharge of the material, the gas causes the liquid plastic component to foam up and after hardening of the foamed plastic component the result is a plastic part provided with pores, for example in the form of a sealing bead 73.

Blocking valves can equally be provided in the metering valves 57 and/or 60, as shown in Figure 1 and identified by references 51 and 52, as the inlet and outlet valves.

List of references:

16	device
17	mixing device
18	first line
19	introduction device
20	second line
21	delivery device
22	piston
23	piston
24	piston pump
25	piston pump
26	pressure booster
27	inlet valve
28	inlet valve
29	outlet valve
30	outlet valve
31	sensor
32	signal line
33	control device
34	cylinder
35	cylinder
36	device for forwarding a liquid plastic component
37	source
38	metering device
39	buffer device
40	buffer volume
41	inlet opening
42	outlet opening
43	housing
44	piston rod
45	piston
46	pressure sensor
47	control device
48	control line
49	pressurizing device

50	control device
51	inlet valve
52	outlet valve
53	container for plastic component
54	gas source
55	container for second plastic component
56	mixing device
57	metering valve
58	mixing element
59	metering valve
60	metering valve
61	nozzle
62	device for multi-component foaming
63	coupling mechanism
64	control device
65	switching device
66	switching device
67	control device
68	first line
69	second line
70	third line
71	fourth line
72	travel sensor
73	sealing bead
100	device for the production of foamed plastic parts

CLAIMS

1. A device (36) comprising a source (37) for at least one liquid plastic component and a metering device (38), wherein the source (37) intermittently provides the at least one liquid plastic component for the metering device (38), characterised in that arranged between the source (37) for the at least one liquid plastic component and the metering device (38) is a buffer device (39) having a variable buffer volume (40) and connected to the source (37) by way of an inlet opening (41) and to the metering device (38) by way of an outlet opening (39).

2. A device (36) as set forth in claim 1 characterised in that the pressure prevailing between the buffer device (39) and the metering device (38) in the liquid plastic component is controllable by the buffer device (39) – preferably to a constant value.

3. A device (36) as set forth in at least one of the preceding claims characterised in that arranged on an outlet side of the metering device (38) is a pressure sensor (46) communicating with a control device (47), wherein the control device (47) controls the buffer device (39) by way of a control line (48) in such a way that the pressure on an inlet side of the metering device (38) tracks the pressure prevailing on the outlet side of the metering device (38).

4. A device (36) as set forth in at least one of the preceding claims characterised in that the source (37) of the buffer device (39) supplies or provides a liquid plastic component mixed with gas.

5. A device (36) as set forth in at least one of the preceding claims characterised in that the inlet opening (41) or the outlet opening (42) is disposed in a wall of a housing (43) of the buffer device (39).

6. A device (36) as set forth in at least one of the preceding claims characterised in that the inlet opening (41) or the outlet opening (42) is provided in a piston rod (44) of the buffer device (39), the piston rod being connected to a piston (45).

7. A device (36) as set forth in at least one of the preceding claims characterised in that the buffer device (39) is connected to a device (49) actuable by a control device (47, 50) for pressurizing the buffer device (39) that is preferably pneumatic.

8. A device (36) as set forth in at least one of the preceding claims characterised in that the device (36) is adapted to produce a physically foamed plastic part.

9. A device (36) as set forth in at least one of the preceding claims characterised in that the buffer device (39) has a piston (45) displaceable in a housing (43), wherein preferably a travel sensor is provided for determining at least selected positions of the piston (45) in the housing (43).

10. A device (36) as set forth in at least one of the preceding claims characterised in that arranged upstream of the inlet opening (41) is an inlet valve (51) and arranged downstream of the outlet opening (42) is an outlet valve (42), which valves are actuable by a control device.

11. A device (36) as set forth in claim 10 characterised in that the control device is adapted to close both the inlet valve (51) and also the outlet valve (52) and to compress the liquid plastic component disposed in the buffer volume (40) and that there is provided a sensor, by way of which an irregular reduction in size or compression of the buffer volume (40) can be detected.

12. A device (100) for producing foamed plastic parts, in particular sealing beads, having a device (36) as set forth in at least one of claims 1 through 11.