

The invention relates to a plasticising unit according to the main preamble of claim 1.

There is a known plasticising unit of this kind (US-Pat. No. 3 026 567) where the hydraulic control cylinder is secured at the front end of the plasticising cylinder on the casing of the same. Its hydraulic stroke is converted through the intermediary of a two-arm lever into a backwards lift of the valve needle, which opens the nozzle. The pivot axis of the two-arm lever intersects the injection axis of the plasticising unit. By virtue of this arrangement, the lever of the two-arm lever, that engages the valve needle (working lever), is relatively short and accordingly in its pivot position portrays an arc with a relatively small radius. On the other hand, there is a plasticising unit of the abovementioned type where the plastics material is able to flow continuously through the shutoff nozzle and this, consequently, makes the drop in pressure which is normally noted in the shutoff valve substantially avoidable. The shutoff valve, consequently, has all the advantageous characteristics of an "open" valve and as such can be used when the shutoff needle is in a permanently open position. The term "open nozzle" in the above sense of the word refers to a nozzle which does not have any shutoff elements and where the body of the nozzle has a nozzle channel which is coaxial to the injection axis. Such open nozzles are used a great deal due to their versatility in processing various plastics and on account of their small susceptibility to faults. Shutoff valves, on the other hand, are indispensable for coping with special technical injection tasks, e.g. when processing polyamides. They enable a high injection speed in the initial phase of the injection process because the plastics material in the plasticising cylinder in front of the opening of the valve is under a corresponding overpressure.

Shutoff valves are also known having spring-loaded valve needles which are disposed in the nozzle body at an angle to the injection axis (French Patent No. 1,439,001 - Fig. 3). With such shutoff valves, the valve needle opens when the plastics materials exceeds a certain pressure limit. In this respect, the prerequisites for having the shutoff valve controlled by a computer program do not exist.

The object of the present patent differs in particular from the object of the former European patent application No. 87118610.2 in that a valve needle, enclosing an angle to the injection axis, can be closed with the help of the forward lift of the control cylinder.

The object of the invention is to join together the above described advantages of this type of plasticising unit with the added advantage of the control cylinder being able to remain on the carrier block of the injection moulding unit when the plasticising cylinder is changed and the valve needle being driven into the closed position when the rear piston area of the control cylinder is acted upon.

This object is achieved through the characteristics given in claim 1. With such an arrangement, the necessary automatic disengaging of the control cylinder is part of the computer program for changing the plasticising cylinder, whereby it is possible to close the nozzle opening reliably even when the pressure in the plastics material is extremely high, i.e. for example, the pressure can reach up to 2,800 bar.

The movement of the piston of the control cylinder can be transmitted with the hydraulic lift to the valve needle without distorting the system, if, in accordance with the arrangement in claim 2, the power is transmitted to some extent via a cardan pivot system.

Below the invention will be further explained by way of the drawings for one embodiment.

In which:

Figure 1 is a side view of the plasticising unit, showing a partial vertical section of a semi opened shutoff valve,

Figure 2 is an enlarged section from Figure 1,

Figure 3 is an enlarged section from Figure 2,

Figure 4 is the section as in Figure 3 after changing the nozzle body with an isomorphous nozzle body without a guide bore thus forming an open nozzle,

Figure 5 is a perspective view of the hollow screw for connecting the shutoff valve or the open nozzle to the plasticising cylinder,

Figure 6 is a perspective view of two of the power transmitting elements adjacent the valve needle before the mutual pivotal connection is produced,

Figure 7, 7a and 8 are all perspective views of the pivot ring holding the power transmitting elements and the valve needle,

Figure 9 is a front view of the shutoff valve with the power transmitting elements.

In the embodiment shown in the drawings, the plasticising cylinder 11 of the plasticising unit, provided with a heating device 30, is received with its rearward portion 11b in a central bore 10a of the carrier element 10, which is designed as a carrier block. It can be locked in the carrier block in its operating position by the locking device 33. The locking device 33 comprises slides or locking bolts 33', 33'', 33''', that are radially guided and vertically guided on the rearward end of the carrier block 10, from which locking bolts the lower locking bolt 33'', 33''' is formed in two parts. This bolt has a bore in which a piston-and-cylinder unit (control cylinder 14) is received to control the valve needle 73 of the shutoff valve (V). By virtue of this arrangement, the locking or unlocking movement at right angles to the injection axis can be utilized to couple or uncouple the control cylinder 14 to and from the adjacent power transmitting element. The carrier element 10, which is integrated into the injection moulding unit, is movable with the plasticising cylinder 11 in linear guides towards a firmly clamped injection mould assembly and can be engaged with or disengaged from the same. The closing stroke or opening stroke of the control cylinder 14 is transmitted to the valve needle 73 by means of a switch rod 82, an actuating rod 77 and an intermediate member 77. The switch rod 82 and the actuating rod 77 are connected with one another by means of a clamping member 80, as can be seen in particular in Figure 9. The switch rod 82 has at its end a thread 82a by means of which it is connected with the clamping member 80. By rotating the switch rod 82 with the aid of a wrench inserted into a hexagonal recess 82b, the switch rod 82 can be axially adjusted relative to the clamping member 80 and thereby the sliding path of the valve needle 73 may be adjusted to perform an optimal shutoff. The adjusted position may be fixed with the aid of a clamping screw 81 by tightening the thread in the area of penetration. To this end, the clamping screw 81 bridges a gap in the clamping member 80 from below up to the the switch rod 82. Figure 2, in particular, in

conjunction with Figure 9, shows that the actuating rod 77 passes through the clamping member 80 in the zone of a bore and a slot and may be tightened with the clamping member after appropriate adjustment by means of a screw which bridges the slot. A spherical head disposed at the frontal end of the actuating rod 77 is received in a spherical socket 88b of the rod-like force-transmitting intermediate member 88 thus forming a ball joint, which intermediate member 88 in its turn surrounds with its frontal end a rearward spherical head 73c of the valve needle 73 to form another ball joint. The spherical socket 88b in the rearward enlarged portion 88a of the intermediate member 88 is laterally open for the introduction or removal of the spherical head of the actuating rod 77. The spherical head of the actuating rod 77 is secured in the spherical socket 88b by means of a lateral locking element 88c. The intermediate member 88 extends approximately coaxially to the valve needle 73. The actuating rod 77 is held by means of a pivot ring 76 which surrounds the frontal end of the plasticising cylinder 11 with a clearance. The pivot ring is articulated to the plasticising cylinder 11 in the vicinity of its uppermost generatrix y-y (Figure 2) on either side thereof for a pivotal motion to make possible the closing and opening of the shutoff nozzle V. For this purpose, two threaded bolts 89 which are disposed radially to the plasticising cylinder 11 and which are threadedly connected with the pivot ring 76 extend by means of spherical heads 89a into corresponding spherical segment-like pivotal bearings 11c (Figure 3) of the plasticising cylinder 11. In this manner, the pivot ring 76 is pivotal between limits about an imaginary horizontal pivot axis. The distance m (Figure 9) of this pivot axis s-s to the approximately horizontally extending actuating rod 77 corresponds approximately to the diameter of the plasticising cylinder 11. In this manner, the pivot ring 76 forms a relatively long pivotal lever, so that when this pivotal lever 76 makes small opening or closing swinging movements, the actuating rod 77 moves approximately horizontally. The threaded bolts 89 are secured in their set working position by means of securing nuts 90. For support, the actuating rod 77 passes through a bearing bore 76b of the pivot ring 76 which is disposed in the vertical symmetry plane z-z (Figure 9). The bearing bore 76b has two frustoconical sections 76b' which merge into one another along an inner circumferential line 76b".

The nozzle body 70 with outer surface 70m has a coaxial nozzle channel 70a which extends to the nozzle opening 70a" and which permits an entirely free flow of plastics material. The valve needle 73 which shuts off the nozzle channel 70a at the nozzle opening 70a" is received in a guide bore 70e which extends at an acute angle to nozzle channel 70a.

The nozzle body 70 is a one piece component and is provided with a planar engagement surface 70 l. The diameter of the valve needle 73 corresponds to the inner width of the guide bore 70e, which intersects the nozzle channel 70a behind the nozzle opening 70a" at the frontal end of the narrowed outlet end portion 70a'. During the control movements of the valve needle 73, which has a valving part 73a and a guide part 73b (Figure 6), its outer needle surface glides directly on the inner surface of the guide bore 70e, which is located in the nozzle body. The plasticising cylinder 11 is provided with a radially symmetrical coupling bore 11e for accepting a radial flange 70k of the nozzle body 70. The inner diameter of the coupling bore 11e corresponds to the diameter of a coupling thread 72a of a hollow screw 72. The latter is provided with a radial flange 72c with an outer edge that can be engaged by a tool. The coupling thread 72a of the hollow screw 72 engages an inner thread of the coupling bore 11e. In this manner, an annular, precision-ground, planar sealing face 70 l of the radial flange 70k may be pressed in a sealing manner against a corresponding sealing face 11a of the plasticising cylinder 11, while the hollow screw 72 acts axially on the annular shoulder 70h of the nozzle body 70 via the engagement face. The radial flange 70k of the nozzle body 70 is axially clamped with the plasticising cylinder 11 after the nozzle body 70 has been correctly positionally adjusted, in such a way that the valve needle 73 and the power transmitting elements are oriented symmetrically to the vertical symmetry plane z-z (Figure 9). The nozzle bore 70a has a funnel-like tapering inlet portion 70a'''', into which the conical end 70a' of the nozzle channel 70a ends in the nozzle opening 70a".

The valve needle 73 can be controlled in both the closed position and the open position by the control cylinder 14. Additionally, as can be seen in Figure 1, a coil spring 26 surrounds the switch bar 82, which coil spring 26 engages the switch bar through a snap ring 87 and is supported on an arming element 51 of the plasticising cylinder. In this way, the spring-loaded valve needle 73 is held in its closed position, even when the switch bar 82 is disconnected from the control cylinder 14.

The plasticising cylinder 11, which can be locked in the bore 10a of the carrier block 10 by means of radially and vertically guided slides or locking bolts 33';33'';33'''', can be released following a rearward movement of the carrier block 10 for exchange with the feed screw. The control cylinder 14 is arranged at the carrier block 10 and during the releasing movement shifts in unison with this carrier block 10. The automatic coupling between the switch bar 82 and the piston rod of the control cylinder 14

comprises, as can be seen in Figure 1, a coupling portion 14b which is disposed on the switch rod 82, and a coupling portion 17 which is disposed on the piston rod of the control cylinder 14. In the coupled state the two coupling parts 14b and 17 interengage so that the coupling is automatically disconnected by the vertical movement of the locking bolt assembly 33;33";33'" during the unlocking movement. The coupling assembly is accommodated in a niche T of the carrier block 10. The switch bar 82 is guided approximately parallel to the injection axis a-a in arming elements 50,52 of the plasticising cylinder 11 by means of sliding bushings 57. The plasticising cylinder 11, which is provided with a heating device, has a two-part cover 18, the lower part 18'" of which shrouds the switch rod 82 and the upper part 18' of which has a hoist ring 53. Both parts are secured to the arming elements 51 of the plasticising cylinder 11. The head of the lower securing screw 54 is designed as a centring cone. When the plasticising unit is being transported, and for the purpose of being centrally secured, this cone can engage corresponding centring recesses in the setting faces of the transport devices. After a program controlled unlocking of the plasticising cylinder 11 and after it has been axially immobilized, the plasticising cylinder 11 can be released from the carrier block 10, by the latter being pulled off the plasticising cylinder 11 by a hydraulic mechanism. During this pulling off process, the connecting plugs 29', which are arranged on a connector plate 28' of the carrier block 10, are separated from the connecting plugs 29 which are secured to a connector plate 28 of the plasticising cylinder 11.

A nozzle body 170 that has an identical external configuration to the nozzle body 70 but has no guide bore may be provided for the plasticising cylinder 11. This nozzle body 170 can be exchanged with the nozzle body 70 if an open nozzle 0 is required. As can be seen in particular from Figures 3 and 4 in conjunction with Figure 8, the nozzle bodies selected 70;170 are secured in the working position by a pin 71, which extends at one end into the nozzle body 70 and at the other end into the plasticising cylinder 11 thus preventing rotations. The flow channels 70a of the nozzle bodies selected 70 or 170 are disposed concentrically to a heating coil 79, so that identical thermal conditions in the flow passage 70a are achieved. The rearward terminal portion 77a of the actuating bar 77 passes through an opening 50a (Figure 2) of the arming element 50.

Claims

1. Plasticising unit for a plastic injection moulding unit comprising an associated carrier block (10) with a central bore (10a) to enable the plasticising cylinder (11) to be securely centred, which cylinder (11) is provided with a nozzle (V) that can be automatically shut off, the nozzle body (70) of which is coaxially connectable to the plasticising cylinder (11) and the valve needle (73) of which closing the nozzle opening (70a") is controllable by a hydraulic piston-and-cylinder-unit (control cylinder 14), which is arranged parallel to the nozzle channel (70a), the piston of which unit is pivotally connected to the valve needle (73) through the intermediary of at least one power transmitting element (82;77;88), whereby the nozzle body (70) has a coaxial nozzle channel (70a) which extends up to the nozzle opening (70a") and which permits a free flow of plastics material, and whereby the valve needle (73) closing off the nozzle channel (70a) at the nozzle opening (70a") is received in a guide bore (70e) extending at an acute angle to the nozzle channel (70a),

characterized in that the plasticising cylinder (11), which can be locked in position in the bore (10a) of the carrier block (10) by means of slides or locking bolts (33';33";33'''), is releasable for replacement after the carrier block (10) has been moved rearwards and the control cylinder (14) is arranged on the carrier block (10).

2. Plasticising unit according to claim 1, characterised in that one of the power transmitting elements is a bar-shaped intermediate member (88) arranged approximately coaxially to the valve needle (73).

3. Plasticising unit according to claim 2, characterised in that the actuating bar (77), which is rigidly connected to a switch rod (82), is held by a pivot ring (76) surrounding the frontal end of the plasticising cylinder (11) with a clearance, which pivot ring (76) is pivotally supported on both sides of the plasticising cylinder (11) in the vicinity of its uppermost generatrix (y-y in Figure 22) for a pivotal movement enabling the closing and opening of the shutoff nozzle (V).



4. Plasticising unit according to claim 3, characterised in that two threaded bolts (89), that are arranged radially to the plasticising cylinder (11) and are threadedly connected to the pivot ring (76), extend by means of spherical heads (89a) into corresponding spherical-segment-type pivotal bearings (11c) in Figure 3) of the plasticising cylinder (11) forming an imaginary horizontal pivot axis (s-s in Figure 9), the distance of which (m in Figure 9) from the horizontally extending actuating bar (77) corresponds approximately to the diameter of the plasticising cylinder (11).

5. Plasticising unit according to claims 3 or 4, characterised in that the actuating bar (77) passes through a bearing bore (76b) in the pivot ring (76); the bearing bore (76b) is located in the vertical symmetry plane (z-z in Figure 9) and has two frustoconical sections (76b') which merge into one another along an inner circumferential line (76b'').

6. Plasticising unit according to one of the preceding claims, characterised in that the control cylinder (14) is fixedly connected to at least one slide or locking bolt (33", 33'') and is couplable to and uncouplable from the adjacent power transmitting element (switch rod 82) after the radial locking or unlocking movement of this slide or locking bolt, which element is connected to the actuating bar (77) by means of a clamping member (80) and is surrounded by the lower part (18") of a two-part cover (18).

7. Plasticising unit according to one of the preceding claims, characterised in that, if required, to form an open nozzle (0 in Figure 4), a nozzle body (170) which is identical to the nozzle body (70) with regard to the external configuration but without a guide bore, is connectable to the plasticising cylinder (11) in the place of a nozzle body with a nozzle bore.



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