

The invention relates to a plasticising unit according to the introductory part of Patent claim 1.

In a known plasticising unit of this type (DE 36 26 345 C1) the reinforcing skeleton of the plasticising cylinder has skeleton members in the form of tracks for guiding and supporting the plasticising cylinder, as well as in the form of control units for storage of the plasticising cylinders when out of operation, and as means for handling the plasticising cylinder when it is moved away. A guard of U-shaped cross-section, partially surrounding the plasticising cylinder, is connected to the plasticising cylinder by means of clamping members and girder webs. In order to produce the connection, the horizontal girder webs penetrate with their free ends through the vertical U-shaped legs of the guard. Along its lower bend lines, said guard forms horizontal and vertical track surfaces for the stationary rollers. To this extent the guard represents a fixed component part of the reinforcing skeleton, and which cannot be removed without the help of the manufacturers' specialist personnel. Should repairs be necessary, or should a changeover be necessary, access to the functional elements of the plasticising unit located inside the guard, and particularly to the heating elements, is rendered extremely difficult.

It is further known to support the plasticising cylinder of a comparable plasticising unit on the track rods of the injection unit, by means of skids (DE-AS 29 07 557).

It is further known to enclose a plasticising cylinder rigidly mounted in the central bore of the receiving body in a sheet metal shell in order to protect it (US-PS 3, 068, 521).

The purpose underlying the invention is further to develop a plasticising unit of the type already mentioned in such a way that the plasticising cylinder, having improved guidance means, during its cyclic mounting upon and removal from the injection mould, can be assembled from its components with reduced assembly cost, and essential functional elements, particularly those relating to heating, are more easily accessible with the associated attachment members and the plug connector for purposes of interchange, repair and inspection.

This purpose is fulfilled according to the invention by the features named in Patent claim 1.

In this solution, the guard undertakes no support and guidance functions during injection moulding operations. These named functions are transferred to more stable skeleton members of the reinforcing skeleton. For this

reason the parts of the guard may be simply removed by operating personnel, independently of location or relationship to the injection moulding unit. The design according to the invention has the added advantage that the track bars, as stable skeleton members, are usable simultaneously as handling members for the transport devices when the plasticising cylinder is being moved away, as, due to their disposition in a gap between the upper and lower halves of a guard, they are accessible for this handling. The plasticising unit, which may be dismantled at very low assembly cost, can, as a standardised module, contain varying sizes of plasticising cylinder, the external dimensions of the reinforcing skeleton remaining unaltered. Claim 6 indicates an extremely simple guidance means for the plasticising cylinder, because the stationary rollers are mounted in a U-shaped bracket which is secured at the bottom, at least indirectly, on the machine pedestal and at the top on axially fixed track rods of the injection moulding unit. In this single U-shaped bracket, the plasticising cylinder, accommodated according to Patent claim 6 by a receiving body of the injection moulding unit at the rear with a sliding fit, along with its reinforcing skeleton on the mounting beams of the legs of the 'U', may be deposited in stable equilibrium (Patent claims 7, 8). The plasticising cylinder, previously axially fixed so as to be releasable from the receiving

body by the locking pin, is released from this storage position for removal by raising it.

The invention will be explained in the following by means of an example given by way of example, and with reference to the drawings, which show:

- Fig. 1: the plasticising unit of the injection moulding unit, disposed in the operating position on the pedestal of a plastics injection moulding machine;
- Fig. 2: a plan view on a reduced scale of the arrangement according to Fig. 1, supplemented by the drive and injection cylinders;
- Fig. 3: a side elevation in partial cross-section through the vertical plane of symmetry of the plasticising unit supported on a supporting deck of the pedestal of a plastics injection moulding machine;
- Fig. 4: the arrangement according to Fig. 3, without a receiving body for the plasticising cylinder, and without a support deck for the injection moulding unit, and without the U-shaped bracket carrying the rollers;

- Fig. 5: a perspective view of the plasticising cylinder of the plasticising unit, provided with the reinforcing skeleton;
- Figs. 5a and 5c: the parts of the guard forming the quadrangular-section tube of the plasticising unit;
- Fig. 5b: reinforcing members of the plasticising unit;
- Fig. 6: a cross-section along line VI-VI of Fig. 1 (the receiving body is provided with drive and injection cylinders);
- Fig. 7: a cross-section along line VII-VII of Fig. 1 (without the stationary fixing plate of the plastics injection moulding machine);
- Fig. 8: a perspective view on an enlarged scale of the casting forming the U-shaped bracket of the plasticising unit, with associated rollers, bearing and support members;
- Fig. 9: a plan view in partial section of a cut-out section of the plasticising unit, taken in the region of the locking bolt for providing axial

locking.

As Figs. 1, 2 in particular show, the plasticising unit is a component of a plastics injection moulding unit (injection unit) disposed on a support deck 15. The support deck, as Fig. 2 shows in conjunction with Fig. 1, is displaceably mounted on rods 15b mounted vertically to the injection axis a - a of the injection unit in bearing brackets 14a of the pedestal 14. In this way alternate injection moulds may be inserted for use, whose sprues are each located at different positions. The stationary mould carrier 13 of the clamping unit accommodating the injection mould is shown at the left-hand side of Figs. 1, 2.

The plasticising unit as such comprises as essential components a plasticising cylinder 11 provided with heater 41 (Figs. 3, 4), a rotatable and axially displaceable plasticising screw 40 disposed in said plasticising cylinder 11, a reinforcing skeleton 16; 17; 18; 18' partly enclosing the plasticising cylinder 11 and a stationary bearing portion (U-shaped bracket 12), in which are mounted rollers 23;24. Skeleton members of the reinforcing skeleton form tracks 17c;17d which, in order to guide the plasticising cylinder 11 during the cyclic axial movements of the injection unit, bear on the stationary rollers 23;24. As is particularly apparent

from Fig. 5, the tracks 17c;17d are formed by roller surfaces of track bars 17, which are connected in the axial central portion of the plasticising cylinder 11 with said cylinder 11 via radial spacer members. In this case a spacer member (plate 16) sits securely upon the plasticising cylinder 11. Two centering spacer members 18;18' enclose the plasticising cylinder with a clearance, forming a sliding fit. Two rectangular-section track bars 17 disposed diametrically relative to the plasticising cylinder 11 lie in a horizontal plane passing through the injection axis a - a. The spacer member sitting securely on the plasticising cylinder is formed by a plate 16, approximately quadrangular in plan shape, penetrated by the plasticising cylinder and provided with a radial slot 16a. The plate 16 bears radially on a radial flange 11a (Fig. 5) of the plasticising cylinder 11, said flange 11a lying in the rear portion of the plasticising cylinder. The plate 16 is clamped to the shell of the plasticising cylinder with the aid of a clamping screw 31 which bridges over the vertical slot 16a. During the clamping operation there takes place a reversible deformation of the plate 16, the areas located on either side of the slot 16a approaching one another. In the forward axial portion of the plasticising cylinder, two spaced-apart centering spacer members 18;18' enclose the plasticising cylinder. They are formed by U-shaped bent stamped sheet metal parts. The track bars 17 are secured at one end on

the vertical legs of the 'U' 18c, 18c' of the sheet metal parts forming the centering spacer members 18; 18', and at the other end on vertical side edges of the plate 16 by means of screw bolts 17e' (Fig. 1, 4) which pass through fixing bores 17e (Fig. 5) in the track bars 17, and engaging in tapped bores 16d, 18d, 18d' (Fig. 5b) of the spacer members. The circular cut edges of the centering spacer members 18;18' adjacent to the shell of the plasticising cylinder 11 form sliding bearings for the slight axial movements of the plasticising cylinder occurring during heating of the same. It is particularly apparent from Figs. 5 to 7 how two U-shaped bent guard plates 20, 21 are combined into a quadrangular-section tube enclosing the plasticising cylinder 11 and its reinforcing skeleton 16;17;18;18' in the central portion. Here the guard plates 20,21 are supported on the spacer members, webs of the guard plates 20 and 21 bearing on the horizontal upper and lower U-shaped legs, and their vertically bent-over legs, with their fixing bores 20a, 21a at the vertical side edges of the plate 16 and at the vertical U-shaped legs 18c;18c' of the centering spacer members 18;18'. As is particularly apparent from Figs. 6 and 7, the longitudinal edges of the guard plate 20 rest on the upper sides, and the longitudinal edges of the lower guard plate 21 rest on the lower sides of the two track bars 17. The track bars 17 project to a certain extent out of the quadrangular-section tube 20, 21,

leaving free the remainder of their horizontal underside and their vertical outer side as respective tracks 17d or 17c for bearing the rollers 24 and 23. As Fig. 5b shows in particular, the track bars 17 are interlockingly lowered into recesses 18a, 18a', 16b in the vertical U-shaped legs 18c, 18c' or of the vertical lateral edges, in order to stabilise the reinforcing skeleton. In Fig. 5b, the fixing bores 18d, 18d' may be seen on the U-shaped legs 18c and on the plate 16, said bores serving for securing the screw bolts 17e'. The axial section 11b of the plasticising cylinder 11 projecting rearwards over the quadrangular-section tube is accommodated in the central bore 10b of a receiving body 10 of the plasticising unit with an axial sliding fit. In this position the plasticising cylinder 11 may be locked on a clamp device 37 with the aid of sliders 37a, 37b which are guided at the rear on the receiving body 10, and in the locking position penetrate into corresponding recesses in the plasticising cylinder (Fig. 3). Attached to the underside of the plate 16 is a plug connector plate 19, which projects downwards over the underside of the plate 16, and is secured in locking slots 21b (Fig. 5c) in the lower guard plate 21. The plug connector plate 19 is designed to operate in an axial plug-in direction. Its plug connectors 19a co-operate with matching plug connectors in the receiving body 10, in order to supply power for heating the plasticising cylinder or its nozzle

22, and for the associated thermosensors and the like. In the concrete embodiment, the unlocked plasticising cylinder 11 is released from the receiving body 10 by the fact that the latter is withdrawn from the rearward section of the plasticising cylinder by a hydraulic backward stroke. By means of the reverse movement of the receiving body from the plasticising cylinder 11, which is axially locked for this purpose, the plug sockets in the receiving body 10 are automatically withdrawn from the plugs 19a in the plug connector plate, the power circuit having been previously interrupted by switching it off. The receiving body 10 is supported at the rear on the supporting deck 15 by means of a support device 32.

The plasticising cylinder 11, together with its quadrangular-section tube 20, 21, is accommodated between the U-shaped legs 12a; 12b of a U-shaped bracket 12 which is supportable on the pedestal 14, said bracket 12 being located approximately in the centre of the plasticising cylinder. The design of the bracket 12, in the form of a casting, is particularly visible in the perspective view in Fig. 8: the two U-shaped legs 12 a and 12b, which are of different lengths, are interconnected by a horizontal crosspiece 12c. The free ends of the U-shaped legs 12a; 12b are clamped by clamping sleeves 12e to track rods 28 of the injection moulding unit, said rods 28 being axially secured in the stationary mould carrier 13. Each

of the U-shaped legs 12a; 12b is provided with a mounting beam 12d parallel with the injection axis a - a. In each mounting beam 12d there are mounted two rollers 23, which operate in conjunction with the vertical track 17c of the adjacent track rod 17, and which are at a spacing apart corresponding almost to the length of the mounting beam 12d. A further roller 24 on each mounting beam 12d, located on its forward end, bears on a horizontal track 17d of the adjacent track bar 17. In order to support the plasticising cylinder 11, which has been released from the receiving body 10 and deposited by means of its reinforcing skeleton 16; 17; 18; 18' in a state of stable equilibrium on the mounting beam 12d, a bearing member 34 is anchored in a recess 12h at the rear end of each mounting beam 12d. In this case the plasticising cylinder 11 rests via its track bars 17 on the rollers 24 and the bearing pins 34. The bracket 12 is adjustably supported and secured on the support deck 15 by means of support members 29 (Fig. 8).

As Figs. 7 and 9 in particular show, a locking pin 25 is horizontally displaceably mounted in a horizontal through bore 12k in the mounting beam 12d of the shorter U-shaped leg 12b. The locking pin 25 may be shifted with the aid of a magnet 26 against the force of a spring 27 into a locking opening 17a in the adjacent track bar 17. The magnet 26 is supplied with power through a plug 26a. A

switch 29 controlling the magnet 26 is connected to the locking pin 25 by an actuating pin 25a. Finally, there is located in the mounting beam 12d accommodating the locking pin 25 a switch 38, which indicates the presence of the plasticising cylinder 11 via the track bar 17, by appropriate control signals, to the associated computer. The receiving body 10 is provided with a feed hopper 10a.

As Figs. 1 and 3 to 5 show, the bolts 33 for radially securing the reinforcing skeleton of the plasticising cylinder 11 penetrate partly into corresponding centering bores 17b (Fig. 5) in the track bars 17, and partly into corresponding centering bores in the receiving body 10. A radial pin 16e on the plasticising cylinder secures the plate 16 against rotation (Fig. 6).

It may be seen in particular from Fig. 7 in conjunction with Fig. 8, that the rollers 23, 24, each provided with a threaded shaft, are accommodated in cylindrical recesses 12f, 12g in the mounting beams 12d in such a way that a relatively small section of their bearing shell projects from the members of the mounting beams 12d, for contact with the adjacent track 17c or 17d.

With appropriate dimensions of the clear width of the receiving bores 16c; 18b' and 18b (Fig. 5b) of the spacer members, various sizes of plasticising cylinder may be

alternatively accommodated in the plasticising unit P, which is designed as a standardised module, without the external dimensions of the reinforcing skeleton and thus also of the guard plates 20, 21 having to undergo any alteration. Such standardisation can be of great significance in the case of correspondingly-standardised changeover devices for changing the plasticising unit.

Patent Claims

1. Plasticising unit (P) for a horizontal plastics injection moulding unit (injection moulding unit) with a heatable plasticising cylinder (11) in which is located a rotatable and axially displaceable plasticising screw (40), and with a reinforcing skeleton (16;17;18) which partly encloses the plasticising cylinder (11) and which, by means of at least one skeleton member, forms at least one track (17c;17d) bearing on a stationary roller in order to guide the plasticising cylinder (11) during the cyclic axial movements of the injection moulding unit during injection operations, said track (17c;17d) being located at a spacing from the plasticising cylinder (11), characterised in that the track (17c; 17d) is formed by the track surface of a track bar (17) which is connected to the latter by radial spacer members, of which one spacer member (plate 16) is securely mounted on the plasticising cylinder (11) and at least one further centering spacer member (18; 18') encloses the plasticising cylinder (11) with a degree of clearance, forming a sliding fit.

2. Plasticising unit according to claim 1, characterised in that two track bars (17), of rectangular or quadrangular cross-section, are disposed diametrically relative to the plasticising cylinder (11), and lie on a



horizontal plane passing through the injection axis (a - a), and in that the spacer member securely mounted on the plasticising cylinder (11) is formed by a plate (16), of approximately square plan projection, penetrated by the plasticising cylinder (11), provided with a radial slot (16a), and secured against rotation by a pin (16e in Fig. 6).

3. Plasticising unit according to claim 1 or 2, characterised in that spaced-apart centering spacer members (18;18') are formed by U-shaped bent stamped sheet metal members, and in that the track bars (17) are secured at one end on vertical U-shaped legs (18c, 18c') of the sheet metal members, and at the other end on vertical lateral edges of the plate (16), the cut edges of the centering spacer members (18;18') adjacent to the shell of the plasticising cylinder (11) forming sliding bearings.

4. Plasticising unit according to claim 2 or 3, characterised in that two U-shaped bent guard plates (20, 21) bear on the spacer members (plate 16 or centering spacer members 18; 18') and the track bars (17), forming a quadrangular-section tube enclosing the plasticising cylinder (11) and its reinforcing skeleton (16; 17; 18; 18') in the central portion.



5. Plasticising unit according to claim 4, characterised in that the portion (11b) of the plasticising cylinder (11) projecting out of the quadrangular-section tube (20;21) is accommodated in the bore (10b) of a receiving body (10) of the injection moulding unit with a sliding fit, and the plate (16) is provided with a plug connector plate (19) designed for an axial plug-in direction.

6. Plasticising unit according to claim 4 or 5, characterised in that the plasticising cylinder (11), together with its quadrangular-section tube (20, 21) is accommodated approximately at its centre between the U-shaped legs (12a; 12b) of a U-shaped bracket (12), supportable on the pedestal, of the plasticising unit (P).

7. Plasticising unit according to claim 6, characterised in that The U-shaped legs (12a; 12b) of the bracket (12) in the form of a casting, and connected at their free ends to track rods (28) of the injection moulding unit, each have a mounting beam (12d) parallel with the injection axis (a - a), in each of which are mounted two rollers (23, 24) operating in conjunction with a vertical and a horizontal track (17c or 17d) respectively.

8. Plasticising unit according to claim 7, characterised in that there is provided, in each mounting beam (12d)



for stable support of the plasticising cylinder (11), which has been released from the receiving body (10) and deposited by means of the reinforcing skeleton (16, 17, 18), a bearing element (34) which is located at a spacing from the roller (24) operating in conjunction with a horizontal track.

9. Plasticising unit according to one of claims 6 to 8, characterised in that there is horizontally displaceably mounted in one of the U-shaped legs (12a; 12b) a locking pin (25) which, with the aid of a magnet (26) may be shifted against the force of a spring (27) into a locking opening (17a) in the adjacent track bar (17), and is connected by an actuating pin (25a) to a switch (39) controlling the magnet (26).

10. Plasticising unit according to one of the foregoing claims, characterised in that, in the composite injection moulding unit, it is displaceable to a limited degree transversely to the injection axis (a -a) by means of a motor-driven support deck (15) supported on the pedestal of the plastics injection moulding machine, the bracket (12) being adjustable into and securable to the support deck (15) in an appropriate operating position by means of support members (29).

