

The invention relates to a plastic injection moulding machine corresponding to the main preamble of claim 1.

In a known plastic injection moulding machine of this type (German Patent Application 36 37 612) both the conveyor belt and the disintegrator means are removable as separate units from the injection moulding machine. The functional elements of the sorting means are individually and permanently integrated in the machine frame which, particularly in small plastic injection moulding machines, is because there is only a confined space between the injection mould and the disintegrator means. The sprues must be transported horizontally to reach the cutting mechanism. It is also known that the consecutively ejected mouldings, on the one hand, and sprues and rejects, on the other hand, can be directed into various collecting containers by means of a sorting flap, the drive means of which is permanently installed in the injection moulding machine (German Patent Application 31 26 520), the sorting flap in this case only having a guiding function in one guiding position. In this case also the sorting means and the collecting containers occupy the entire space below the injection mould.

In another known plastic injection moulding machine (US Patent 3,776,675) the sorting means also occupies the entire space in the machine frame under the injection mould. The guide flap causes the mouldings, on the one hand, and the sprues, on the other hand, to move directly out of the machine over inclined surfaces.

It is also known (US Patent 4,608,008) to design a conveyor belt with a frame and drive means as one unit that can be removed from the machine pedestal and to arrange it in such a way that the mouldings can be transported out of the machine pedestal at the front end thereof parallel to the plane of symmetry of the injection moulding machine. In this case, however, separating the rejects off is neither contemplated nor possible.

In a relatively large injection moulding machine of a comparable kind the rejects and the usable mouldings fall out of the mould in spaced apart regions (US Patent 4,321,027, column 1, lines 18 to 29 and column 2, lines 32 to 38). The rejects fall into a disintegrator means which can be removed out of the machine pedestal.

It is the object of the invention to improve a plastic injection moulding machine, of the kind referred to in the main preamble of claim 1, in such a way that the various financial resources of the potential customers and the various production processes employed by them can be better taken into account, by it being possible to manufacture plastic injection moulding machines with differing degrees of automation economically and it being possible to convert these to higher degrees of automation without incurring large costs for the construction work.

This object is achieved through the characteristics given in claim 1.

In such an arrangement the handling of the machine is greatly simplified: when the injection moulding operation has to be changed for producing mouldings with a different shape or different colour, hardness, toughness and the like and that change requires the use of a different cutting mechanism or requires a cleaning of the cutting mechanism, it is no longer necessary to remove the entire disintegrator means but is sufficient to remove just the cutting mechanism from the machine pedestal, which only involves a small amount of work. The same is true in the case of repairs.

In such an arrangement it is also possible, particularly in small injection moulding machines, to accommodate the sorting means, the conveyor belt and the disintegrator means in the machine pedestal, in such a way that cutting mechanisms are used that are specifically suited to the respective mouldings, according to their shape, hardness and toughness, for example operating at relatively low speeds and having a large overall axial length, because the drive motor is disposed outside the vertical projection of the cutting mechanism.

By designing the sorting means and the cutting mechanism as respective units which can be removed from the machine pedestal, the downtimes are greatly reduced as each unit can be replaced quickly. Besides, a customer who has relatively small financial resources can first purchase a plastic injection moulding machine having the lowest degree of automation, that is without sorting means, conveying means and disintegrator means, having only a collecting bin, and as his financial resources increase that machine can be equipped later in consecutive stages with said means.

For example, in this way, the customer can use various manufacturing processes with increasing degrees of automation.

- a) No sorting means or cutting mechanism: simple collection of unsorted mouldings in a container; delivery of unsorted mouldings using a conveyor belt.
- b) No cutting mechanism: sorting the mouldings using a sorting unit and delivery of usable mouldings using a conveyor belt and collection of rejects and sprues in a container.
- c) With sorting means, conveyor belt and cutting mechanism: sorting the mouldings and delivery of the usable mouldings and disintegration of the rejects and sprues.

The arrangement according to the invention provides advantages in production also. This is principally in the fact that the sorting means consists of a functional unit which can be tested for operability out of the plastic injection moulding machine before said unit is inserted into the machine pedestal or after it has been serviced or repaired.

In addition to this, when the operable sorting means is pre-assembled outside the injection moulding machine and is then inserted into the machine pedestal, the total assembly work involved is much less compared to a manufacturing process where the majority of the components of the sorting means have to be inserted individually into the machine pedestal. Finally, the sorting unit may be installed selectively in the machine pedestal, with a small amount of assembly work, in such a manner that the swivel axle of the sorting unit extends at right angles to the plane of symmetry of the injection moulding machine or runs parallel to it (Fig. 13).

A further development according to claim 2 provides the principals for a space-saving arrangement for the cutting mechanism and the sorting unit. Rejects and sprues fall directly into the cutting mechanism without having first to be conveyed across. This provides a simple space-saving design of the cutting mechanism. An automatic coupling between the cutting mechanism and the motor-transmission unit is guaranteed.

A further development according to claims 3 and 4 guarantees a sturdy construction of the disintegrator means formed from two units which are each individually removable or detachable from the machine pedestal and are couplable with one another purely by inserting or withdrawing the one unit (cutting mechanism).

According to claim 5, depending on the shape and type of plastic used, mouldings that are particularly hard to disintegrate can be ground down with relatively little noise. In another refinement according to claims 6 and 7, the sorting unit, which can be released from the machine pedestal relatively easily, can be produced particularly economically. It can also be arranged in the machine pedestal in various working positions.

A development according to claim 8 provides a particularly space-saving arrangement for the sorting means, conveyor belt and disintegrator means by discharging the usable mouldings through the front end wall of the machine pedestal.

In a refinement according to claim 9, when the cutting mechanism has been removed, the conveyor belt can be displaced parallel to the plane of symmetry of the injection moulding machine in such a way that the mouldings, falling out of the injection mould, directly reach the conveying surface of the conveyor belt via a drop chute defined by sheet metal guides.

In another refinement according to claim 10, the sorting means, conveyor belt and disintegrator means can be arranged in such a way that the usable mouldings, on the one hand, and the rejects and sprues, on the other hand, are each driven in a direction, that extends at right angles to the plane of symmetry of the injection moulding machine, whereby the cutting drive shaft is parallel to this plane of symmetry. In this way, if a customer so requires it, the mouldings can be discharged laterally.

The invention will be described below with reference to two embodiments shown in the drawing.

In which:

- Figure 1 is a diagrammatic side view of the plastic injection moulding machine,
- Figure 2 is a rear view of the injection moulding machine of Figure 1 without a conveyor belt,
- Figure 3 is a horizontal section of the injection moulding machine along the line III-III in Figure 1,
- Figure 4 is an enlarged segment from Figure 1,
- Figure 5 is an enlarged segment from Figure 2 with the cutting mechanism uncoupled from the drive motor,
- Figures 6,7 are sections along the line VI-VI of Figure 8 with the sorting unit in the bad part position or the good part position,
- Figure 8 is an enlarged section along the line VIII-VIII of Figure 1,
- Figure 9 is a segment from Figure 8 with the housing of the sorting unit partly cut open,
- Figure 10 is a partial horizontal section through the drive shaft of the cutting mechanism showing the cutting mechanism of the disintegrator means,
- Figure 11 is a view according to Figure 5 of the motor-transmission block cut open,
- Figure 12 is a top plan view of the motor-transmission unit of the disintegrator means and
- Figure 13 is another embodiment of an arrangement of a sorting unit, conveyor belt and disintegrator means.

The sheet steel machine pedestal M, which supports the injection moulding machine S, is U-shaped in cross-section. Its vertical U legs form the longitudinal walls 18c, 18d which have inturned flanges 18e. The latter are provided with track rails 33.

Unusable mouldings that have been detected as such by the computer of the injection moulding machine because one or more of their parameters is outside a predetermined range are described herein as "bad parts".

The injection mould, which is accepted in the clamping unit F (Fig. 1), is provided with an ejector for consecutively ejecting usable mouldings 73 and bad parts 73', on the one hand, and sprues 73'' (Figure 6) on the other hand. Under the injection mould 13, sorting means are disposed in the machine pedestal M. These comprise a plate which can be swivelled on a horizontal axle 35 and which has slide faces on both sides. The plate serves to separate the bad parts 73' and the sprues 73'' from the usable mouldings 73. The sorting means, which is designed as one constructional unit (sorting unit E), also comprises a motor-operated swivel drive 36a, 36d for swivelling the plate in intervals of time between ejecting the usable parts 73 and ejecting the bad parts 73' or sprues 73'' in two inclined positions. In the following when talking of these positions, the first is referred to as the good parts position (Figure 7) and the other as the bad parts position (Figures 1, 4, 6). In the inclined positions the mouldings slide on each of the upper sliding surfaces of the plate 36 to be separated off in opposite directions. The sorting unit E comprises a housing 36i and can be removed from the machine pedestal M as an operable unit. It can be arranged in the parallelepipedic machine pedestal M with the swivel axle 35 extending at right angles to the plane of symmetry b-b of the injection moulding machine. The housing 36i comprises two vertical and parallel walls 36i' which carry the swivel bearings 35a for the plate 36 and two section bars 36i'', which connect the walls 36i' at their top, and an angle plate 78, which connects these walls 36i' at the bottom. The plate 36 extends almost completely to the one side of the swivel axle 35 supporting it. The slide surfaces of the plate are extended by the top surfaces of the angle plate 78, which is disposed symmetrically to the swivel axle 35. The walls 36i' are horizontally flanged at their top edge to each form a supporting flange 36 l. The supporting flanges 36 l support the sorting unit E on stationary supporting elements 74. As can be seen in particular in Figure 9 in conjunction with Figures 6-8, these supporting elements 74 are arranged in rows on vertical legs of supporting plates 70a'. The supporting plates 70a' are permanently fixed to a stationary funnel T. The funnel T is constituted by metal elements 70a, 36m with the help of fasteners 72' and is secured by additional fasteners 72 to the flanges 18e of the machine pedestal M. The supporting elements for the plate 36 are designated by 36h. The special features of the first embodiment according to Figures 1 - 9 are:

A conveyor belt 17, for conveying the mouldings 73 parallel (Figure 13) to the plane of symmetry b-b, is associated with the sorting unit. The conveyor belt 17 and its frame 17b can be removed from and inserted into the machine pedestal M as one constructional unit. The disintegrator is composed of a motor-transmission unit A and a cutting mechanism G, which is designed as one constructional unit. When the fixing screws 170 have been loosened, the motor-transmission unit can be removed from the machine pedestal through the exit opening 10 or 76. The cutting mechanism G is coupled to the motor-transmission unit A by a plug coupling. If, after a locking screw 169 (Figure 5) has been loosened, the cutting mechanism G is moved axially, the coupling to the motor-transmission unit is automatically broken. In the embodiment shown in Figures 1-12, the motor-transmission unit A comprises a motor-transmission block, which is disposed outside the machine pedestal M. This motor-transmission block is supported by a leg 163 on the floor of the machine pedestal M, which floor is formed by a bottom plate 18f. When the cutting mechanism G is being uncoupled, it is guided on the leg 163 and can be centred on and locked to this leg 163 in the working position. The motor-transmission block comprises a motor 120, standing at right angles to the drive shaft 131 of the cutting mechanism G, and a transmission 124 with a housing 124e. The transmission 124 comprises a worm gear train with an output shaft 124a which extends coaxially to the cutting drive shaft 131. This output shaft 124a has a coupling socket 160a. The drive shaft 131 of the cutting mechanism is terminated by a gear 160b. This constitutes a coupling part with the coupling socket 160a (Figures 5, 11, 12). The worm 124c is driven by gears 124d. The worm wheel 124b is supported on the drive shaft 124a. As is particularly apparent from Figures 5-7, 11, the foot 163 is formed by a U-shaped curved sheet, the vertical legs of which are bent in along their top flanges so that they form rail-like supporting surfaces 163a for the cutting mechanism G. The cutting mechanism is supported on the supporting surfaces 163a by means of crossbeams 165 and is axially guided, whereby vertical guide edges 20 (Figures 5-7) of the crossbeams 165 slide on the cut edges 19 (Figures 6, 7, 12) of the flanges of the foot, which form the supporting surfaces 163a. A fixing bar 166, which is secured to the crossbeam 165, can secure the cutting mechanism G, through the intermediary of a locking screw 169, to a mounting bar 163b which is secured to a leg 163, as is particularly apparent from Figures 4, 5. To centre the cutting mechanism G in the working position, centring pins 167 of the crossbeam 165 on the transmission side or of the fixing bar 166 extend into centring bores of a stationary centring bar 168 or of the mounting bar 163b. The container 161 can be removed from and inserted into the open leg 163 by means of a handhold 161a. When the container 161 is inserted,

a connecting piece 162a of the container 161 extends sealingly into a suction pipe 162 which is secured to the motor-transmission unit A. To form a vacuum which is sufficient to suck out the disintegrated material, the interior spaces of the cutting unit G and of the container 161 form a common evacuated space, which is reasonably sealed by means of strip-shaped cover plates 171, the crossbeam 165, the mounting bar 163b and a stiffening bar 163c.

The motor-transmission block and the leg 163 of the motor-transmission unit A are interconnected by means of a vertical mounting plate 164 (Figure 8). The mounting plate 164 is inserted positively into the U-shaped plate of the leg 163 in such a manner that its narrow edges positively fit both the horizontal bar and the vertical legs of this plate. The motor-transmission block is carried by and protrudes from the mounting plate 164.

The longitudinal wall 18c of the machine pedestal M has a recess 10 in the region of the disintegrator, through which recess 10 both the cutting mechanism G and the motor-transmission unit A can be removed from the machine pedestal M after the fixing screws 170 have been loosened. The conveyor belt 17 with the frame 17b can be removed from the machine pedestal M through the front end exit opening 76 (Figures 1,3). Once the conveyor belt 17 has been removed, the sorting unit E can be removed as a functional unit through this exit opening 76 or also through the exit opening 10 in the longitudinal wall 18c.

Two large cutters 130a for crushing large plastic pieces and also small cutters 130b are disposed on the cutting drive shaft 131 of the cutting mechanism G, which is designed to operate at a speed of 20 to 25 revolutions per minute. The distance from the large cutters 130a to the bearing flanges 128a corresponds to the distance by which the large cutters are spaced apart. All cutters 130a, 130b cooperate with the stationary counter cutters of the diametrically disposed counter cutter blocks 133.

When they rotate, the cutters 130a, 130b move through annular grooves in the counter cutter blocks. The material which has been crushed, disintegrated and ground by the cutting mechanism passes from the cutting mechanism G into the container 161 and is sucked off from there through the suction pipe 162.

In the embodiment shown in Figures 1 - 9, the swivel axle 35 of the sorting unit E and the cutting drive shaft 131 of the cutting mechanism G each extend at right angles to the plane of symmetry b-b. The conveyor belt 17, which conveys the mouldings 73 parallel to the plane of symmetry b-b, can be removed from the machine pedestal through the front end exit opening 76. The cutting mechanism G, which is disposed symmetrically to the plane of symmetry b-b, can be removed from the machine pedestal M through the exit opening 10 in the longitudinal wall 18c. The motor transmission block of the motor-transmission unit A is disposed outside the machine pedestal M.

Another embodiment is illustrated in Figure 13: in this embodiment the disintegrator and the sorting unit are disposed in the machine pedestal M in a position turned by 90° compared to the embodiment shown in Figures 1 to 9. Consequently, the swivel axle 35 and the cutting drive shaft 131 are parallel to the plane of symmetry b-b. The conveyor belt 17', which conveys the mouldings at right angles to the plane of symmetry b-b, can be removed from the machine pedestal M through the exit opening 76' in the longitudinal wall 18d. However, the cutting mechanism G can be removed from the machine pedestal M through the exit opening 10 in the longitudinal wall 18c, as shown in the example in Figures 1 - 9, but first a short axial uncoupling movement is required to uncouple the unit as the cutting drive shaft 131 is parallel to the plane of symmetry b-b. When the fixing screws 170 have been loosened, the motor-transmission unit A with the leg 163 can be removed or inserted through the exit opening.

The arrangement of the sorting unit E with the housing 36i, the plate 36 and the swivel axle 35 is indicated in Figure 13 by broken lines.

In series production the injection moulding machine can be supplied in either version (Figures 1-9 and Figure 13) without incurring any appreciable additional expenditure, for both versions only differ from each other essentially in the arrangement of the motor-transmission block, which in one case is mounted on the left-hand bearing flange (Figure 10) and in the other case is mounted on the right-hand bearing flange 128a of the cutting mechanism. In addition to this, there is a difference in that in the embodiment in Figure 13, the sorting unit is supported not by the supporting flanges 36 l of the walls 36' but by supporting means of the section rails 36i'' of the housing 36i on the stationary supporting elements 74. In both embodiments, the supporting elements 74 extend into

recesses in the supporting flange 36 l or in the supporting means of the section rails 36i'' to lock the sorting unit in position. To remove the sorting unit E, it must be slightly raised first to release it, then moved out of the region of the supporting elements 74 parallel to the plane of symmetry b-b and then removed out of the machine pedestal M through the exit opening 76 or the exit opening 10. Finally, it must be pointed out that the degrees of automation referred to in the introduction to the specification (page 3, lines 4-10 of the translation) can be achieved equally with either version and can be easily converted from one of said degrees to the other. In both versions the cutting mechanism is symmetrical to the centre plane a-a (Figures 9, 13) of the sorting unit E, so that with a simply designed disintegrator, the sorting unit and the disintegrator can be accommodated in a small space, thereby allowing the mouldings to fall directly into the cutting mechanism without there being any need to transport the mouldings transversely.

Claims

1. Plastic injection moulding machine with an injecting unit (S) and a clamping unit (F) on a machine pedestal (M) with a substantially rectangular charging surface, comprising an injection mould (13) arranged for consecutively ejecting usable mouldings (73) and sprues (73''), sorting means, arranged under the injection mould, having a swivel plate (36), which is swivelable into two inclined positions (good parts position and bad parts position) by means of a motor-operated swivel drive (36a;36d), in which positions the usable mouldings and the useless rejects and sprues (73';73'') slide off the plate (36) in opposite directions, means for receiving the mouldings (73), over which the plate (36) in its good part position opens out, and disintegrator means with a drive motor (120), a transmission (124), a cutting mechanism with a cutting drive shaft (131) and a container (161), over which disintegrator means the plate (36) in its bad part position opens out, characterized in that the disintegrator means is made up from a cutting mechanism (G), that is designed so as to be removable as one unit from the machine pedestal (M), and from a motor transmission block (120,124) of a motor transmission unit (A), which block is disposed outside the vertical projection of the cutting mechanism (G), and the sorting means is designed as one single unit (sorting unit E) provided with a housing (36i) and functioning correspondingly and is removable from the machine pedestal (M).

2. Plastic injection moulding machine according to claim 1, characterized in that the cutting mechanism (G), which is coupled to the motor transmission unit (A) by means of a plug coupling and is removable from the machine pedestal (M) via an exit opening (10 or 76), is uncouplable by lifting out the motor transmission unit (A) and the cutting mechanism is disposed symmetrically to a vertical centre plane (a-a in Figures 9,13) of the sorting unit (E).



3. Plastic injection moulding machine according to claims 1 or 2, characterized in that the motor transmission unit (A) has a motor transmission block disposed outside the vertical projection of the cutting mechanism (G), which motor transmission block is supported by its leg (163) on the floor of the machine pedestal (M), and in that the cutting mechanism (G) is guidable on the leg (163) when it is removed from the machine pedestal (M) and can be centred and locked in the working position.

4. Plastic injection moulding machine according to one of the claims 1 to 3, characterized in that the motor transmission block has a motor standing at right angles to the cutting drive shaft (131) and a worm gear with an output shaft (124a) which extends coaxially to the cutting drive shaft (131) and is provided with a coupling socket (160a) and in that the cutting drive shaft (131) is terminated by a gear (160b) that corresponds as a plug-coupling member with the coupling socket (160a) (Figures 5,11,12).

5. Plastic injection moulding machine according to one of the preceding claims, characterized in that at least two large cutters (130a) for disintegrating large plastic pieces and also small cutters (130b) are disposed on the drive shaft (131) of the cutting mechanism (G), which is designed to operate at a speed of 20 to 25 revolutions per minute, whereby the distance from the large cutters (130a) to the bearing flanges (128a) of the cutting mechanism (G) corresponds to the distance by which the large cutters are spaced apart and all cutters (130a,130b) cooperate with stationary knife edges of diametrically disposed cutter blocks (133).

6. Plastic injection moulding machine according to one of the preceding claims, characterized in that the plate (36) of the sorting unit (E) is arranged almost totally on the one side of the swivel shaft (36) carrying it and the sliding surfaces of the plate (36) are extended by the surfaces of an angle plate (78) arranged symmetrically to the swivel shaft (36).

7. Plastic injection moulding machine according to claim 6, characterized in that the housing (36i) of the sorting unit (E) comprises two vertical and parallel walls (36i'), which carry the swivel bearings (35a) for the plate (36), which walls (36i') have horizontal supporting flanges (36l), and additionally two section bars (36'') connecting the walls (36') above and the angle plate (78) connecting the walls (36') below and in that the sorting unit (E) is supported by the supporting flanges (36l) on stationary supporting elements (74).



8. Plastic injection moulding machine according to one of the preceding claims, characterized in that the swivel shaft (35) of the sorting unit (E) and the drive shaft (131) of the cutting mechanism (G) are disposed vertical to the plane of symmetry (b-b) of the plastic injection moulding machine, whereby a conveyor belt (17), which conveys the mouldings (73) parallel to the plane of symmetry (b-b), is removable from the machine pedestal (M) as one operable unit via a frontal exit opening (76) for the mouldings (73) and the cutting mechanism (G), which is arranged symmetrically to the plane of symmetry (b-b), is removable from the machine pedestal (M) via an exit opening (10) in the longitudinal wall (18c), and whereby the motor transmission block of the motor transmission unit (A) of the crushing means is disposed outside the machine pedestal (M).

9. Plastic injection moulding machine according to claim 8, characterized in that the conveyor belt (17) is received between two parallel and vertical sheet metal elements (70) on horizontal bars (75), which sheet metal elements (70) form, by means of cross plates (70b), a displaceable carrier unit defined in the machine pedestal (M) (Figures 6-8).

10. Plastic injection moulding machine according to one of the claims 1 to 7, characterized in that the swivel shaft (35) of the sorting unit (E) and the cutting drive shaft (131) of the cutting mechanism (G) are parallel to the plane of symmetry (b-b) of the plastic injection moulding machine, whereby the conveyor belt (17') is removable from the machine pedestal (M) via an exit opening (76') in the longitudinal wall (18d).

