

SPECIFICATION

Device for locking and unlocking plates or plate packs of injection or compression moulds

The invention relates to a device for locking and unlocking plates or plate packs of injection or compression moulds, which plates or plate packs are capable of mobility such that they can be joined together, or separated from one another, in at least two separating regions, which device has a control bar with its one end rigidly secured to a first plate, a coupling bar oppositely directed to the control bar and with its one end secured to a third plate and, additionally, having a coupling pin arranged, in manner resistant to tensile and pressure forces in the direction of plate movement, on a second plate arranged between the first and third plate and which coupling pin is mounted in a link slot which is bounded by at least the coupling bar, which link slot merges to become a coupling recess, provided in the coupling bar, for the accommodation of the coupling pin, and the control bar on its lateral surface facing the coupling bar has a control surface running obliquely to the plate movement direction and has, adjacent to this control surface, a locking surface running parallel to the plate movement direction.

In the case of the prior described known device (German Auslegeschrift 1 215 876) the coupling bar forms in its free end region a link slot extending approximately in plate movement direction, which link slot merges at its inner end region to become a unilaterally arranged coupling recess which is closed laterally in the direction of the control bar. At its end region facing away from the link slot the coupling bar is pivotably mounted on the third plate. In the closed state of the arrangement, the coupling bar lies with an outer edge (control edge) of its free end region against the locking surface, which runs parallel to the plate movement direction, in the region of the free end of the control bar which with its other end is rigidly secured to the first plate (in the known arrangement, a clamp-on plate). In the closed position of the known arrangement, the coupling pin is accommodated in the coupling recess.

The function of the known device can be described as follows: the moving apart of the plates is initiated via the third plate, which moves. There opens first of all a first separating region between the first and second plate, since the second plate is motion-linked to the third plate by means of the coupling pin rigidly secured to it via the coupling recess of the coupling bar. The first plate, on the other hand, is arranged space-fixedly. Second and third plates are motion-linked to one another until the control edge of the coupling bar which initially lies against the locking surface

of the control bar leaves the locking surface of the control bar and touches its control surface. As soon as this happens, the coupling bar with its link slot moves relative to the coupling pin and is horizontally swung in the direction of the control bar. The second plate comes to a standstill and the coupling link between the second and the third plate is eliminated, while the second separating region opens between the second and third plate. The running together of the plates occurs in reverse manner. The second, i.e. middle, plate together with its coupling pin is initially space-fixed. While the second separating region closes, the link moves relative to the coupling pin, i.e. the coupling recess nears the coupling pin. In the course of the further approximation, the control edge at the free end region of the coupling bar runs against the control surface of the control bar, whereby the coupling bar with its coupling recess is horizontally swung towards the coupling pin. At the same time, a join which is resistant to tensile and pressure forces is produced between the coupling pin and the coupling recess, which join is maintained in that the control edge of the coupling bar lies against the locking surface of the control bar. During this time, the second separating region has closed. It is self-evident that, in the further course of this movement, the first separating region too closes, with which the starting point of the function description would again be reached.

The known device is used in connection with an injection or compression mould in which first a core is drawn (first separating region) and then, in order to eject the article, the lower and upper mould are spaced from one another (second separating region).

In the case of the known device, it is considered to be disadvantageous that the components participating in the actual locking and unlocking movement are subject to relatively heavy wear. Moreover, the locking and unlocking movement in the known device is associated with an annoying noise development.

Starting from the device according to German Auslegeschrift 1 215 876, the invention, in awareness of the disadvantages of that which is known, is based on so designing the device that, with retention of a simple mode of construction, it works in particular with as little wear as possible. According to the invention, this problem is solved in that the coupling pin is mounted freely movably at least indirectly on the second plate in manner substantially transverse to the plate movement direction and is accommodated directly between the coupling bar and the control bar whose control surface between itself and the front end region of the coupling bar which is rigidly secured to the third plate forms the link slot, and, in the locked position, the locking

surface of the control bar lies against the coupling pin.

By virtue of this arrangement, only the coupling pin moves during the actual locking and unlocking process; it moves freely, transverse to the plate movement direction. The degree of freedom along the plate movement direction is taken from the coupling pin. The particular advantage combining itself with the invention consists in that the mass moved during the actual locking and unlocking process is kept as small as conceivable. During the actual locking and unlocking process, therefore, only the comparatively small mass of the coupling pin need be turned round at the control surface of the control strip. As a result of the small mass turn-round, the direction-changing forces occurring between control surface and coupling pin are only very small, as a result of which the device according to the invention works in particularly advantageous manner with little wear and noise. In contrast to this, in the known device (German Auslegeschrift 1 215 876), during the actual locking and unlocking process a substantially greater mass, namely the entire coupling bar, is moved or pivoted, with the disadvantageous consequence that the forces occurring during the mass turn-round, and thus wear and noise, as mentioned above are comparatively great.

In order that the invention may be more readily understood, reference is made to the accompanying drawings which illustrate diagrammatically and by way of example an embodiment thereof, and in which:—

Figures 1–4 show the function of the device by means of in each case a more schematic partial side view of an injection mould whose mould plates are capable of being separated or closed in two separating regions, and

Figure 5 is a perspective exploded view of the device.

In Figs. 1 to 4 there is shown in side view, and generally designated with the reference numeral 10, the lower half of an injection mould clamped horizontally in an injection moulding machine which is not shown.

The device for latching and unlatching, hereinafter briefly referred to as "coupling device", is generally designated with the reference numeral 11 in the drawings.

The injection mould 10 has a space-fixed clamp-on plate 12 and a clamp-on plate 13 which is movable on the machine side.

The clamp-on plate 12 characterises the sprue side and the movable clamp-on plate 13 characterises the ejection side of the injection mould 10.

To the clamp-on plate 12 there is rigidly joined a mould plate 14 in which, for example, a mould core or several mould cores, not shown, may be held. Adjacent to the mould plate 14 there are further mould plates 15a

and 15b which, rigidly joined to one another, form a mould plate pack 15.

Adjacent to the mould plate 15b is a mould plate 16 on the ejection side.

Between the mould plate 14 and the mould plate pack 15 there is present, characterising a first partition region, a partition plane I, while, likewise represented by dash-dot lines, a partition plane II characterising the second partition region extends between the mould plate pack 15 and the ejection-side mould plate 16.

Rigidly joined to both the mould plate 16 and the movable clamp-on plate 13 is an intermediate plate 17.

The coupling device 11 substantially comprises a control bar 18, a coupling bar 19, a bracket 20 and a cylindrical coupling pin 21.

The control bar 18 is rigidly secured with its region pointing to the left in Figs. 1 to 4 to the mould plate 14, the so-called first plate.

The coupling bar 19 which, and this is essential, is located in one vertical plane with the control bar 18, is rigidly secured, with its region pointing to the right in Figs. 1 to 4, to the mould plate 16, the so-called third plate.

The bracket 20 is rigidly secured by means of screws 22 to the mould plate pack 15, the so-called second plate.

The screw fastenings of the control bar 18 and the coupling bar 19 are provided generally in Figs. 1 to 4 with reference numeral 23.

As can be seen from Fig. 5, the bracket 20 carries a cover plate 24 and, together with the latter, is secured to the plate pack 15 by means of the screws 22. For better representation of the function of the coupling device, a part of the bracket 20, namely its bridge region or bridge plate 25 according to Figs. 2 to 4 has been broken away so that the lateral guide blocks 26, which are moulded in one piece, of the bracket 20, and the cover plate 24, are clearly visible.

The control bar 18, on its free end region's side facing the coupling bar 19, has a control surface 27, adjacent to which is a locking surface 28 running parallel to the plate movement direction x. The control surface 27 extends obliquely to the plate movement direction x.

On its side facing the control bar 18 the coupling bar 19 has a recess 29 in which the coupling pin 21 is partially accommodated.

The coupling pin 21 is freely movable transverse to the plate movement direction x. However, the coupling pin 21 is not movable in the plate movement direction x. For achieving the free mobility of the coupling pin 21 transverse to the plate movement direction x, the two stepped bearing ends 30 of the coupling pin 21 are respectively accommodated in elongated bearing openings 31. The longitudinal axis y of the bearing opening 31 extends transverse to the plate movement direction x. For mounting at both ends the

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cylindrical coupling pin, there is provided an elongated bearing opening 31 in the bridge plate 25 of the bracket 20 and—in mirror-symmetrical arrangement hereto—a further elongated bearing opening 31 in the cover plate 24 is provided.

The bracket 20 with its bridge plate 25 and its two lateral guide blocks 26 forms a substantially U-shaped recess with guide surfaces 32, 33 extending substantially parallel to the plate movement direction x. The control bar 18 and the coupling bar 19 which are of substantially cuboid basic shape, lie with counter guide surfaces 34, 35 in particular against the guide surfaces 33 formed by the lateral guide blocks 26. With their broad surfaces, not visible, pointing into the plane of the drawings (cf. Figs. 1 to 4), control bar 18 and coupling bar 19 can be guided on the guide surface 32 formed by the bridge plate 25. The visible broad surfaces 36, 37 of control bar 18 and coupling bar 19 are guided on the inner surface of the cover plate 24.

The function of the coupling device is now best described first of all by reference to Figs. 1 to 4.

According to Fig. 1, the injection mould 10 is in its run-together position, i.e. in its closed position. When the clamp-on plate 13 is now moved to the right (Fig. 2), the first separating region opens according to separating plane I so that for example the cores, not shown, can be drawn. Among other things, a guide bolt 38 becomes visible. According to Fig. 2 the locking surface 28 of the control bar 18 continues to lie against the peripheral surface of the coupling pin 21 so that the latter is held in its latching position, i.e. in the coupling recess 29. This has the result that the motion link between the plate pack 15 (second plate) and the mould plate 16 (third side) still exists. When the motion-linked plates according to Fig. 2 move further to the right, away from the space-fixed plate 14 (first plate), there finally results the state according to Fig. 3. Fig. 3 shows that the coupling pin 21 has already travelled over the locking surface 28, rises in part laterally obliquely upwardly out of the coupling recess 29 with the result that the distance between the plates 14 (first plate) and the plate pack 15 (second plate) in the region of the separating plane I has almost reached its maximum while, in the region of the separating plane II, a gap already forms, since the coupling join between the plate pack 15 (second plate) and the mould plate 16 (third plate) already gives way. From Fig. 3 it can now also be seen how a link slot 39 forms between the front free end region of the coupling bar 19 and the control surface 27 of the control bar 18.

According to Fig. 4 the coupling between the plate pack 15 (second plate) and the mould plate 16 (third plate) is wholly elimi-

nated. The movement is ended; the spacing distances in the region of the separating planes I and II have their maximum value.

The return stroke occurs in analogous manner. Starting from Fig. 4, the coupling bar 19 would therefore first of all move so far to the left until the link slot 39 formed between the unlocking control surface 43 (coupling bar 19) and the control surface 27 (control bar 18) moves the coupling pin 21 into the coupling recess 29. In the course of the further return stroke the locking surface 28 of the control bar 18 then travels over the coupling pin 21 so that the latter is firmly locked in the coupling recess 29.

The coupling device according to the invention has a further particular feature. In the bracket 20 and also in its cover plate 24 there is arranged a U-shaped sliding catch 40 transverse to the plate movement direction x. The sliding catch 40 has an abutment surface 41 extending transverse to the plate movement direction x. With this surface 41 there corresponds a counter surface 42 on the control bar 18. In this context, attention is drawn in particular to Fig. 5. The coupling bar 19, on the other hand, has an unlocking control surface 43. The sense and function of this arrangement can best be explained by means of Fig. 5; in the event of an unforeseen defect, for example in the ejection system of the injection mould, it would be conceivable that, during the running together of the mould, the gap in the region of the separating plane II does not immediately close, with the possible consequence that the plate pack 15 (second plate) would move in the direction of the space-fixed plate 14 (first plate). This could, if the invention had not provided the sliding catch 40, lead to the control bar 18 being able to penetrate unhindered into the U-shaped accommodating space between the guide blocks 26 of the bracket 20. However, as soon as the catch between the plate 16 and the plate pack 15 was released, the coupling bar 19 likewise would subsequently or immediately penetrate into the U-shaped internal space. This, in the event of the locking surface 28 already lying against the coupling pin 21, would result in a jamming of the coupling bar 19 between the coupling pin 21 and the guide surface 33 on the lower guide block 26. This disadvantageous jamming is not possible through the arrangement according to the invention. In any case the sliding catch 40 run out towards the U-shaped internal space under the action of a spring 44 would, with its stop surface 41, lie against the counter surface 42 of the control bar 18. There would result approximately the state according to Fig. 4, according to which there is, however, still a slight distance between the abutment surface 41 and the counter surface 42. Not until the coupling bar 19 has penetrated into the U-shaped internal space of the

bracket 20 does the unlocking control surface 43 which runs obliquely to the plate movement direction x strike against an appropriate unlocking control surface 45 on the catch 40 in such a manner that the coupling bar 19 puts the sliding catch 40 into its unlocked position.

The arm 46 of the sliding catch 40, which arm forms the abutment surface 41, is slidably mounted in a groove 47, represented by broken lines in the drawings, in the upper guide block 26. This groove 47 accommodates in case of need the compression spring 44 too. In the arrangement chosen, however, the compression spring 44 may be dispensed with, depending on the case in which the invention is applied, since the sliding catch 40 also falls into its locking position under the action of gravity. Moreover, the bridge 48 of the U-shaped sliding catch 40 is mounted slidably in a guide groove 49 extending transversely to the plate movement direction. The guide groove 49 open towards the U-shaped internal space is machined into the cover plate 24.

The coupling device according to the invention may not only, as represented by means of the present embodiment, be used in connection with mould plates of an injection or compression mould, but the device may also be applied with the same advantages in the case of a two-step ejector device in which, for example, between two ejector plates and a further plate there are two separating regions which are intended to be opened and closed successively.

The cylindrical coupling pin 21 is mounted rotatably about its longitudinal centre axis in the bearing openings 31 by means of its end spigots. This rotatable mounting enables a rolling movement which additionally reduces wear.

CLAIMS

1. A device for locking and unlocking plates or plate packs of injection or compression moulds, which plates or plate packs are capable of mobility such that they can be joined together, or separated from one another, in at least two separating regions, which device has a control bar with its one end rigidly secured to a first plate, a coupling bar oppositely directed to the control bar and with its one end secured to a third plate and, additionally, having a coupling pin arranged, in manner resistant to tensile and pressure forces in the direction of plate movement, on a second plate arranged between the first and third plate and which coupling pin is mounted in a link slot which is bounded by at least the coupling bar, which link slot merges to become a coupling recess, provided in the coupling bar, for the accommodation of the coupling pin, and the control bar on its lateral surface facing the coupling bar has a control

surface running obliquely to the plate movement direction and has, adjacent to this control surface, a locking surface running parallel to the plate movement direction, characterised in that the coupling pin is mounted freely movably at least indirectly on the second plate in a manner substantially transverse to the plate movement direction x and is accommodated directly between the coupling bar and the control bar whose control surface between itself and the front free end region of the coupling bar which is rigidly secured to the third plate forms the link slot, and, in the locked position, the locking surface of the control bar lies against the coupling pin.

2. Device according to claim 1, characterised in that the coupling pin forms a roller-shaped body, at least one of whose ends is arranged in an elongated bearing opening extending with its longitudinal axis (y) transverse to the plate movement direction (x).

3. Device according to claim 2, characterised in that on the second plate there is provided at least indirectly a sliding bar which is movable transverse to the plate movement direction (x) and is capable, preferably with spring force, of being shifted into the closure position, and is provided with a stop surface extending transversely to the plate movement direction (x), with which stop surface a counter stop surface on the control bar corresponds, and the coupling bar has an unlocking control surface which puts the sliding bar into its unlocked position.

4. Device according to claims 1 to 3, characterised in that the elongated bearing is formed in a bracket detachably secured to the second plate.

5. Device according to claims 3 and 4, characterised in that the bracket constitutes mounting and securing means for the sliding bar.

6. Device according to claims 4 and 5, characterised in that the bracket forms a substantially U-shaped recess with guide surfaces which extend substantially parallel to the plate movement direction (x) and against which guide surfaces there lie the control bar and the coupling bar, which in each case are of substantially cuboid basic shape, with counter guide surfaces.

7. Device according to claim 6, characterised in that a cover plate which engages under the U-shaped recess is detachably secured under the bracket.

8. Device according to any one of claims 2 to 7, characterised in that the roller-shaped coupling pin is mounted at each end in an elongated bearing opening provided in a bridge plate forming the bridge region of the U-shaped recess, and a further elongated bearing opening is provided in the cover plate in mirror-symmetrical arrangement hereto.

9. Device according to any of claims 3 to 8, characterised in that the bridge plate or



bracket 20 does the unlocking control surface 43 which runs obliquely to the plate movement direction x strike against an appropriate unlocking control surface 45 on the catch 40 in such a manner that the coupling bar 19 puts the sliding catch 40 into its unlocked position.

The arm 46 of the sliding catch 40, which arm forms the abutment surface 41, is slidably mounted in a groove 47, represented by broken lines in the drawings, in the upper guide block 26. This groove 47 accommodates in case of need the compression spring 44 too. In the arrangement chosen, however, the compression spring 44 may be dispensed with, depending on the case in which the invention is applied, since the sliding catch 40 also falls into its locking position under the action of gravity. Moreover, the bridge 48 of the U-shaped sliding catch 40 is mounted slidably in a guide groove 49 extending transversely to the plate movement direction. The guide groove 49 open towards the U-shaped internal space is machined into the cover plate 24.

The coupling device according to the invention may not only, as represented by means of the present embodiment, be used in connection with mould plates of an injection or compression mould, but the device may also be applied with the same advantages in the case of a two-step ejector device in which, for example, between two ejector plates and a further plate there are two separating regions which are intended to be opened and closed successively.

The cylindrical coupling pin 21 is mounted rotatably about its longitudinal centre axis in the bearing openings 31 by means of its end spigots. This rotatable mounting enables a rolling movement which additionally reduces wear.

CLAIMS

1. A device for locking and unlocking plates or plate packs of injection or compression moulds, which plates or plate packs are capable of mobility such that they can be joined together, or separated from one another, in at least two separating regions, which device has a control bar with its one end rigidly secured to a first plate, a coupling bar oppositely directed to the control bar and with its one end secured to a third plate and, additionally, having a coupling pin arranged, in manner resistant to tensile and pressure forces in the direction of plate movement, on a second plate arranged between the first and third plate and which coupling pin is mounted in a link slot which is bounded by at least the coupling bar, which link slot merges to become a coupling recess, provided in the coupling bar, for the accommodation of the coupling pin, and the control bar on its lateral surface facing the coupling bar has a control

surface running obliquely to the plate movement direction and has, adjacent to this control surface, a locking surface running parallel to the plate movement direction, characterised in that the coupling pin is mounted freely movably at least indirectly on the second plate in a manner substantially transverse to the plate movement direction x and is accommodated directly between the coupling bar and the control bar whose control surface between itself and the front free end region of the coupling bar which is rigidly secured to the third plate forms the link slot, and, in the locked position, the locking surface of the control bar lies against the coupling pin.

2. Device according to claim 1, characterised in that the coupling pin forms a roller-shaped body, at least one of whose ends is arranged in an elongated bearing opening extending with its longitudinal axis (y) transverse to the plate movement direction (x).

3. Device according to claim 2, characterised in that on the second plate there is provided at least indirectly a sliding bar which is movable transverse to the plate movement direction (x) and is capable, preferably with spring force, of being shifted into the closure position, and is provided with a stop surface extending transversely to the plate movement direction (x), with which stop surface a counter stop surface on the control bar corresponds, and the coupling bar has an unlocking control surface which puts the sliding bar into its unlocked position.

4. Device according to claims 1 to 3, characterised in that the elongated bearing is formed in a bracket detachably secured to the second plate.

5. Device according to claims 3 and 4, characterised in that the bracket constitutes mounting and securing means for the sliding bar.

6. Device according to claims 4 and 5, characterised in that the bracket forms a substantially U-shaped recess with guide surfaces which extend substantially parallel to the plate movement direction (x) and against which guide surfaces there lie the control bar and the coupling bar, which in each case are of substantially cuboid basic shape, with counter guide surfaces.

7. Device according to claim 6, characterised in that a cover plate which engages under the U-shaped recess is detachably secured under the bracket.

8. Device according to any one of claims 2 to 7, characterised in that the roller-shaped coupling pin is mounted at each end in an elongated bearing opening provided in a bridge plate forming the bridge region of the U-shaped recess, and a further elongated bearing opening is provided in the cover plate in mirror-symmetrical arrangement hereto.

9. Device according to any of claims 3 to 8, characterised in that the bridge plate or

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cover plate forms a guide groove, which is open towards the inside and extends transverse to the plate movement direction (x), for the bridge of a U-shaped sliding bar.

- 5 10. Device according to claim 9, characterised in that one arm of the U-shaped sliding bar is mounted laterally in the bracket and forms the stop surface, while the other arm forms a counter control surface which co-operates with the unlocking control surface of the coupling bar.

- 10 11. Device according to any of claims 2 to 10, characterised in that the coupling pin is mounted rotatably about its longitudinal central axis.

- 15 12. A device for locking and unlocking plates or plate packs of injection or compression moulds, substantially as herein described with reference to and as shown in the accompanying drawings.

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