

The invention relates to a device for the machining of curved surfaces, in particular of mould plates by means of the operating path of the machining tool or tools via curved slideways of controlling templates, wherein at least one of the templates is arranged so as to be pivotable about a pivot.

Devices of the type in question have long been known (DE-OS 2544604, DE-OS 2800525) and are suitable for forming multiply curved surfaces of large dimensions, such as are used for example as mould plates in slab moulds for the continuous casting of steel. Moulds of this type generally consist of individual plates made of copper (longitudinal and transverse plates) assembled in the form of boxes, into which the molten metal is poured at the upper open end, where the metal, at the time of its passage through the mould and corresponding cooling, forms a metal bar which is solidified at least at the outer surfaces and which issues from the mould at the lower, likewise open end. In the majority of continuous casting plants, so-called circular arc moulds are used which cause the solidifying cast bar to issue from the mould along a circular path with a large radius, e.g. of 6 to 15 m. This necessitates appropriate shaping of the surfaces of the mould plates which delimit the cast bar so that said surfaces are curved over their entire surface area in the forwards direction. As - on account of the dimensional accuracies and qualities demanded by the consumers of cast products - the operators of continuous casting plants require appropriately accurately dimensioned mould plates from the manufacturers, it is essential for the manufacturers to carry out the machining of plate-like workpieces with sufficient dimensional accuracy and reproducibility that the manufactured mould plates always comply with the high requirements demanded by the continuous casting plant operators.

Where these requirements have already been fulfilled by known means, difficulties nevertheless arise when a funnel-shaped pouring-in zone is required in the moulds. As already known (EP 0149734 A2), the funnel-shaped pouring-in zone is formed by the mould longitudinal plates, said zone for the introduction of the melt being reduced to the format of the cast bar towards the narrow sides of the mould and in the casting direction. The funnel-shaped extension is on the one hand to lead to a more uniform distribution of the melt and on the other hand is to avoid longitudinal tears and openings. A pouring-in zone of this kind requires that the longitudinal plates of the mould plates which form the moulding cavity comprise a correspondingly funnel-shaped recess in the upper zone. In the case of circular arc type moulds, the machining of a recess of this kind means, for example, that the recess in the singly or multiply curved surface of the longitudinal plate must be adapted in its geometric dimensions to the path of the delimiting surfaces. This is because the pouring-in zone is also be entirely or partially of arcuate formation. This has not yet been possible using known operating means with the result that it has been obligatory to manually adapt the funnel-shaped pouring-in zone to the shape of the plates either entirely or partially.

Commencing from the prior art according to DE-A 25 44 604, the aim of the invention is to discover a possibility whereby even multiply curved surfaces, including the junctions between such surfaces, can be completely produced, with precise dimensions, in one operating step.

This aim is fulfilled in the case of a device of the type defined in the introduction, in accordance with the invention, in that the template which is pivotable about a pivot is actively connected with a further template which defines the pivoting movement of the said first template in terms of its magnitude and direction. In accordance with the magnitude and direction of the pivoting which is performed, this measure allows arbitrary surface configurations to be formed by the machining tool or tools. In this way procedures comprising the continuous processing of the funnel-shaped component can be carried out in a workpiece having a large surface area and a multiply curved surface even without partial manual processing in a precise and reproducible form.

By virtue of the fact that the template which is pivotable about a pivot is actively connected with a further template which defines the pivoting movement of the first template in terms of its magnitude and direction, not only is a precise shaping of the surfaces to be processed achieved but at the same time automation of the operating steps and thus a mode of operation substantially independent of personnel is facilitated.

Here the template which is actively connected with the pivotable template can directly transfer the pivoting movement in accordance with a predetermined curvature. If the non-pivotable template possesses, for example, a concave contour, the pivotable template is raised or lowered about the pivot depending upon that part of the concave contour in which the respective sensing takes place.

For particularly complicated curve formations of the surfaces to be processed, as a modification of the foregoing it can be advantageous to proceed such that further movement components are superimposed upon the pivoting movement effected by the predetermined curvature. This can be achieved, for example, in that the surfaces of application for the transfer of force to the pivotable guide plate (template) have the form of curved slideways. In this way, for example in the case of a fixed template with a concave contour, the pivotable guide plate is not only simply raised or lowered about the pivot, but at the same time is moved along an additional curved path. In this way no problems are presented by the transfer of arbitrary curves in three-dimensional form to the workpiece to be processed.

In a further development of the principle of the invention, another possibility of more precise tool guidance consists in changing the position of the pivot of the pivotable template.

The invention is to be explained in further detail in the form of the exemplary embodiment illustrated in Figures 1 and 2.

These Figures schematically illustrate the mode of operation of a device according to the invention in two views.

The templates 1 and 2, also referred to as guide plates, are actively connected with one another as shown in the Figures. This is achieved by means of a rod 3 which is arranged at right angles to the template 2 and is guided in the bearings 4 and 5. The template 1 is guided in the recess or groove 7 by means of a pin 6 of the rod 3. This template is mounted so as to be pivotable about the pivot 8, the direction of movement 9 being indicated by arrows.

The predetermined contour 10 of the template 2 is tapped for example by a sensing wheel 11 which, following the contour in the direction of the arrows, continuously raises and lowers the rod 3 and thus by which, via the pin 6, the template 1 is deflected upwards in the direction of the arrow about the pivot 8 or is pivoted back downwards, when the local position of the sensing wheel 11 along the contour 10 changes accordingly.

With its contour 12 and with the curved path of movement, the template 1 directly controls the movement sequence of the machining tool (not shown), for example a planing tool for the processing of planar workpieces, in the manner predetermined by the template 2.

The contours 10 and 12 of the templates 1 and 2 can naturally differ from the illustrated formation, and indeed must do so since they define the respective desired curvature of the workpiece surface.

It is also possible to use force transfer means other than those illustrated for the implementation of the invention. Thus, for example, the pivoting movement of the template 1 can be effected by electrical, electromagnetic or also pneumatic or hydraulic drive means. Equally the continuous sensing of the contours 10 and 12 of the templates in the course of the progressive machining can be carried out by optical or electro-optical means.



Claims

1. A device for the machining of curved surfaces, in particular of mould plates, by means of the operating path of the machining tool or tools via curved slideways of controlling templates, wherein at least one of the templates is arranged so as to be pivotable about a pivot, characterised in that the template (1) which is pivotable about a pivot (8) is actively connected with a further template (2) which defines the pivoting movement of the first template in terms of its magnitude and direction.
2. A device as claimed in Claim 1, characterised in that the further template (2) which is actively connected with the pivotable template (1) directly produces the pivoting movement in accordance with a predetermined curvature (10).
3. A device as claimed in Claim 2, characterised in that by means of the further template (2), which is actively connected with the pivotable template (1), further movement components can be superimposed upon the pivoting movement effected by the predetermined curvature.
4. A device as claimed in Claim 3, characterised in that for the superimposition of a further movement component, the surface of application for the transfer of force to the pivotable template (1) has the form of a curved slideway.
5. A device as claimed in one of Claims 2 to 4, characterised in that a lifting rod (3) is provided for the transfer of force for the pivoting movement, which rod (3) guides the pivotable template (1) in a longitudinal groove (7) which is arranged at the end opposite the pivot (8).
6. A device as claimed in Claim 5, characterised in that the delimiting surfaces of the longitudinal groove (7) are curved.
7. A device as claimed in one of Claims 1 to 6, characterised in that the position of the pivot (8) of the pivotable template (1) can be changed.
8. A device as claimed in Claim 7, characterised in that the change in position of the pivot (8) is dependent upon the respective position of the pivotable template (1).
9. A device as claimed in Claim 7 or 8, characterised in that the change in position of the pivot (8) takes place during the movement of the pivotable template (1).



10. A device as claimed in one of Claims 7 to 9, characterised in that the change in position of the pivot (8) is programme-controlled.