

Process and fixtures for setting up workpieces for flow-guiding components in turbines or engines

The invention is a process for setting up workpieces for the manufacture of flow-guiding components for compressors or turbines, in particular for vanes for gas turbines, steam turbines, or engines, in which the workpieces for the flow-guiding components to be manufactured are clamped in a workpiece clamping fixture outside of the machine tool, in order to be subsequently loaded into the machine tool, in which they are to be shaped by milling.

In turbines or engines, gas is compressed by turbine or engine vanes that rotate about a rotating axis. The turbine and engine vanes typically have a complicated, three-dimensionally convoluted blade shape for their flow-guiding function, as well as a foot and head section. In particular, due to their complicated, relatively thin and long shape, as well as the very high precision required, they are particularly challenging to manufacture. This is made more difficult by the fact that the vanes typically need to be machined on all sides. This requires that the vanes be manufactured by machining in several setups.

Bar stock is typically used as the raw material for workpieces, from which blanks for the vanes are cut off, clamped, and processing is started in the machine tool. For the second setup, the workpiece is generally repositioned by hand, inside the machine tool. This manufacturing process, however, has the disadvantage of a relatively long idle time in the machine tool.

It is also previously known that the workpiece is set in the machine by a robot, and then processed in the first setup. In order to move the workpiece to the second setup, the workpiece is removed from the machine by the robot. After the clamping fixture for the second setup has been placed in the machine tool, then the workpiece can be replaced by the robot. This process has a risk of high manufacturing inaccuracies, and possible collision between the robot and the machine tool. If the collision risk is to be reduced, then generally larger machine tools must be used, which allow better handling of workpieces in the machine.

The traditional manufacturing process, in which operators insert blanks in the clamping fixture, is seldom seen anymore. A disadvantage is evident in the additional personnel requirements that occur for each workpiece. Since the workpiece is clamped in the clamping fixture in the machine tool, there are also disadvantageously long idle and overall processing times with this manufacturing process.

From DE 35 21 285 C1, a process is known that is not intended for flow-guiding components of compressors or turbines, in which mobile transport vehicles, driving on induction strips in the floor, bring workpiece magazines into the working area of gantry-style robots. Workpieces are manually placed into the workpiece magazines beforehand by operators. Depending on what the transport vehicles are to transport, these could be clamping fixtures for workpiece magazines, for workpiece clamping fixtures and for workpiece palettes. Robot grippers remove workpieces from the magazines, and move them to stations where the workpieces are stored, in the same spatial orientation, still without workpiece clamping fixtures. From here, the workpieces are transferred by the grippers to additional transport devices, which are located directly in front of the processing centres, preferably drilling and milling machines. Each of these transport devices is assigned to exactly one processing centre. The transport devices should have automatic clamping fixtures, in which the workpieces are automatically clamped. The workpieces are then transported into the working area of the processing centres and then processed. The processed workpieces then travel the same path in reverse.

It is therefore the object of the invention to develop a process of the type indicated, as well as a manufacturing system, such that high workpiece throughput per machine tool of flow-guiding components with complicated shapes, with the best possible manufacturing precision, can be achieved.

This objective is met by the invention with a process of the type indicated, in that the workpiece is automatically inserted in a clamping fixture outside of the machine tool, in a first setup, the workpiece is automatically clamped, then the workpiece and the clamping fixture together are loaded by the machine into a machine tool, in particular a 4-axis – preferably 5 or 6-axis – machine, the workpiece and the clamping fixture together are removed from the machine tool by the machine, the workpiece is also inserted in a clamping fixture for a second setup, different from the first setup, and then

loaded, together with the clamping fixture, into a machine tool for further processing. The objective is also met by a system per claim 16.

The invention provides, on one hand, that the handling steps required for clamping the workpiece in clamping fixtures, for typically at least two planned setups, are automated as much as possible and taken outside the machine tool. In particular, insertion of workpieces in the clamping fixtures can be done advantageously outside of the machine tool. This means that the machine tool is not unnecessarily blocked by unproductive setup steps. In addition, a buffer of already clamped workpieces, ready for immediate processing, can be generated in this manner, which also ensures production when no operator is available.

The workpieces, together with their clamping fixtures, can, for example, be loaded into one or more machine tools by the handling device or an additional special transport device. This requires only a little additional technical effort, and avoids the danger of collision that exists when handling the workpiece in the machine tool itself. Since vanes, which the invention particularly addresses, generally require two setups for complete processing, this measure is particularly advantageous.

It can therefore be planned, with the invention, that workpieces are loaded into clamping fixtures for their two or more setups outside of each machine tool, and, together with their clamping fixtures, are automatically loaded into the machine tool. The workpiece, together with its clamping fixture, should then advantageously also be automatically removed from the machine tool after the first process, and be loaded for repositioning into the same setup cell in which the first setup was previously carried out for the workpiece.

Although the state of the technology, e.g. in DE 35 21 285 C1, already suggests automatic clamping of workpieces, not further specified, in a workpiece clamping fixture for only one setup, such solutions do not exist for the application area addressed. In particular, complete automation throughout, as is planned in the invention, was considered to be impossible due to the complexity of the workpieces typical for the area of application, and the high manufacturing precision required. In addition to the advantages connected with this, the invention also allows a high degree of flexibility, since all clamping processes are preferably carried out in a setup cell, which can be

assigned to any number of machine tools. This allows the workpieces to be set up shortly before their manufacturing process, for which manufacturing capacity is free, or is about to be free, in one of the processing machines. This can keep to a minimum the number of clamping fixtures required.

As high a level of automation as possible is also supported by a setup cell that can be assigned to at least one machine tool for processing flow-guiding components of compressors or turbines, where the setup cell has at least one handling device for inserting the workpiece into the clamping fixture. In addition, the setup cell should also have an actuation device that is automatic and can be connected to the clamping fixture for closing and/or opening the clamping fixture, with which workpieces can be clamped and/or released. In contrast to DE 35 21 285 C1, in which the clamping fixtures are loaded once with a workpiece and can only be loaded into one pre-determined machine tool, the invention allows the handling device and actuation device to be integrated in a setup cell that is responsible for as many machine tools as desired. Within the setup cell, or at a setup location, different clamping fixtures can be loaded with workpieces, where the loaded clamping fixtures with the workpieces already clamped in place can be loaded into various machine tools. This also assigns the preferably single actuation device to several machine tools. In contrast to the solution in DE 35 21 285 C1, this allows achievement of a higher usage rate for the system components used for the setup steps, which is the same as having a lower level of investment. Because the clamping fixtures can be actuated by an actuation device assigned to the setup cell, passive clamping devices can also be planned, which also reduces the effort required.

Additional advantages can also be obtained in preferred versions, if the various clamping fixtures can be actuated by a rotating motion by the actuation device. At least one, preferably all of the clamping devices can be made, for example, as a vise, which can be automatically actuated by the rotary motion of a shaft. An additional advantage can be achieved if clamping jaws on the clamping device can also be changed out automatically. Such interchangeability can be achieved, for instance, by a simple one or several-dimensional insertion motion, as well as by a positive fit of the clamping jaw in its final position within the clamping fixture.

The repositioning of the workpiece from the first to the second setup causes a risk of processing inaccuracies, which can be caused by clamping inaccuracies. Differently

from most known processes, with the invention, the blade area can be generated on the workpiece first, in the first setup. Afterward, in a second setup, the foot and/or head area of the vane can be manufactured. This allows good clamping conditions for the second setup as well. In contrast to the usual manufacturing processes for flow-guiding vanes, this allows, in particular, parallel surfaces to be used as clamping surfaces in both the first and the second setups. This allows stable clamping conditions, which are in turn a prerequisite for high manufacturing accuracy. In addition, when handling the workpieces for clamping and repositioning, parallel surfaces of the head and/or foot area can be gripped, which allows simple and accurate handling of the workpiece. Finally, this method has the advantage of stable milling conditions, in particular for the manufacture of the particularly critical blade area.

In a preferred version, a workpiece segment can be used to clamp the workpiece in the first setup, on which a contour of the foot or head area of the vanes is generated by milling in the second setup. In contrast to previously known manufacturing processes, no "lost clamping end" exists here, which can further reduce the manufacturing costs of the parts due to material savings.

A common reason for the indicated manufacturing inaccuracies in turbine blades can be a deformation of the vane, in particular bending, due to their long, thin shape. In order to avoid such inaccuracies, it can be planned that, before repositioning the workpiece, at least one reference location is generated. Several reference locations can be planned advantageously. Since the workpiece segments for the foot and head areas have not yet been processed, the reference locations can be advantageously planned for these areas. In particular, one or more flat surfaces can be generated as reference locations, which indicate a predetermined position relative to the already manufactured contour of the workpiece, in particular the blade area. The reference surfaces are advantageously oriented in all three spatial directions, with at least one reference surface planned for each spatial direction. It can also be planned that the reference locations or surfaces are partially or completely removed in the next process.

In a preferred version of the invention, the position and orientation of at least one reference location is contacted by a measurement probe, generally previously known, in the second setup. Machine tools with additional measurement probes are known, for example, in the machine models ZT 1000, STC 1000, SC051, and STC 100, which are

provided by the applicant. If the data deviate from the intended data for the reference location in the second setup, then this information can be used by the machine tool controls as a correction value for manufacturing the geometry of the foot and/or head area. This means that, despite repositioning, the flow-guiding components can be manufactured with very high precision. The aspect of generating the reference location and detecting it is of independent significance with regard to flow-guiding components, independent of patent claim 1 and patent claim 16.

Additional preferred versions of the invention can be derived from the claims, the description, and the drawing.

The invention is described in more detail using the purely schematic application examples shown in the figures. Shown are:

- Fig. 1 a perspective representation of a setup cell per the invention and a machine tool to implement the process per the invention;
- Fig. 2 a setup station of a setup cell from Fig. 1;
- Fig. 3 a setup station of a setup cell from Fig. 1, in a further representation;
- Fig. 4 a clamping fixture with a clamped workpiece, in a first setup;
- Fig. 5 a second representation of the clamping fixture from Fig. 4;
- Fig. 6 the clamping fixture in a setup position in front of a screw device in the setup station;
- Fig. 7 a further representation of the setup position from Fig. 6;
- Fig. 8 a clamping fixture with a workpiece, after processing in the first setup;
- Fig. 9 the clamping fixture from Fig. 8 in a further representation;
- Fig. 10 a clamping fixture with a workpiece in a second setup;

- Fig. 11 the clamping fixture from Fig. 10 in a further representation;
- Fig. 12 a setup cell that is connected to several machine tools by a transport system;
- Fig. 13 a perspective representation of a turbine vane.

In Fig. 1, a milling machine 1 is shown as a machine tool, as well as a setup cell 2, in which the workpiece blanks 3 are prepared fully automatically for processing into turbine or engine vanes in the milling machine 1. Milling machine 1 is a 5-axis processing machine, with which even complicated three-dimensional shapes can be made, such as are found on the flow-guiding vanes, in particular in the blade area. Milling machine 1 could be, for example, the machine tool provided by the applicant under the designation STC 100. Both milling machine 1 and setup cell 2 are provided with typical machine and cell controls, by which all process steps in the machine or cell are controlled. In addition, an overarching control system 4, such as a PLC controller, is used for coordination of the subsequent process steps, described in more detail below, between the setup cell 2 and milling machine 1.

The setup cell 2, preferably located directly adjacent to the milling machine 1, includes a handling robot 5, a setup station 6, a storage area 7 for clamping fixtures 8, and a workpiece storage area 9. The handling robot 5, which carries out all transport handling steps within the cell in connection with the workpieces 3 and clamping fixtures 8, can be a robot provided by the Stäubli AG company, Seestrasse 238, CH-8810 Horgen, under the designation RX 170. The robot 5 is equipped with a two-jaw parallel gripper 10, with which both workpieces and clamping fixtures can be transported.

The vices 14 shown in Fig. 2 to 11 can be used as clamping fixtures, which have interchangeable parallel adjustable clamping jaws 15, 16 for clamping the workpieces. The clamping fixtures 14 can be provided with an interface for clamping jaws, for precise positioning, as well as for simple removal. In the application example shown, the interface is a screw connection 17 of jaw holders. One of the two clamping jaws 15, 16 is set onto one of the jaw holders from above, and screwed in place. This provides easy interchangeability, but also secure positioning of jaws 15, 16 when clamping

workpiece 3. The distance between the jaws 15 and 16 can be changed, in a previously known manner, by actuating a spindle 21, where a rotation of the spindle 21 changes the distance between the clamping jaw holders. One end of the spindle 21 protrudes out of the clamping fixture, and this end of the spindle can be hex-shaped 21a.

Each clamping fixture is equipped with a clamp holder 19, previously indicated, which is equipped with an additional interface for mounting the clamping fixture 8 in a workpiece holder, not shown in more detail, in a milling machine 1. The interface can be constructed in a previously known manner, such as is provided by the EROWA Company under the designation of Erowa ITS100 clamping system. Such an interface can be constructed, in particular, on the underside and on side surfaces of the clamp holder.

The setup station 6 also has a screw device 23, shown in Fig. 2, 3, 6, and 7, which is equipped with a shaft 25 that can be rotated about a longitudinal axis 24 and slid along its length. On one end of the shaft 25, protruding from the screw device 23, an internal hex 26 is formed, which can be slid onto the hex end 21a of the clamping device by sliding the shaft 25 longitudinally. The clamping fixture 8 is placed in a setup position 20 in front of the screw device 23 for this purpose, which aligns the longitudinal axis of the spindle 21 with the longitudinal axis 24 of the shaft 25.

For the first setup of the workpiece 3, the clamping jaws 28, shown in Fig. 4 and Fig. 5, can be used for the clamping fixture of the first model. These have parallel and mainly flat clamping surfaces 29. Each of the clamping jaws 28 for this model also has an offset surface 30, aligned orthogonally to the clamping surfaces (Fig. 4).

For the second setup of the workpieces, a second model of clamping jaws 32 can be installed in a second type of clamping fixture 18, which is shown in more detail in Fig. 10 and 11. This type of clamping fixture 18 can have a dovetail guide 27 as an interface for mounting clamping jaws. The two opposing dovetail guides 27 in a clamping device are arranged diagonally to each other, such that their distance increases in the direction toward the clamp holder 19 in the clamping device. The clamping jaws 32 of the second type can be provided with three clamping pins 33 each, which are intended to contact the vane blade, which has already been manufactured at the time this type of clamping

jaw is used. Similarly, clamping jaws with positive fit clamping surfaces (relative to the workpiece profile) can also be used for the second setup.

In other versions, not shown, only one clamping fixture type can be used, in which both clamping jaw models 23, 32 can be installed. One model of clamping jaws 28 can be exchanged for the other model of clamping jaws 32 in this type of clamping fixture. The exchange should be done preferably by the same handling robot with which the workpieces are handled in the setup cell.

To implement the invention's setup and manufacturing process, the handling robot 5 shown in Fig. 1 brings a clamping fixture 8 from its position in the clamping fixture storage area 7 to the setup position 20 in front of the screw device 28. Next the handling robot 5 removes a prepared, generally rectangular billet from the workpiece storage area 9, to be used as the blank workpiece 3 for a vane. Since the vane is milled as a solid, the minimum exterior dimensions of the workpiece 3 are defined by the maximum extents of the finished vane in three spatial directions. The workpiece 3 is then placed by the handling robot 5 in the clamping fixture 8, with its one of its ends 3a toward the offset surfaces 30 of the two clamping jaws 28.

As soon as the workpiece 3 contacts the offset surfaces 30, the controller 4 actuates the screw device 23, whose shaft 25 with its internal hex is slid onto the hex head 21a of the spindle. The rotation motion of the shaft 25 of the screw device is thus transferred to the spindle 21 of the clamping fixture 8, which leads to closing of the clamp jaws 28 and clamping of the workpiece in the clamping fixture. The workpiece 3 is clamped with its long dimension vertical to the contact surfaces 30, and parallel to the clamping surfaces 29, with a large contact surface in each case.

Now the handling robot 5 can transfer the workpiece 3 by transporting the clamping fixture 8 to the milling machine 1, or to a buffer (not shown), in which the clamping fixture remains until processed. As soon as the clamping fixture 8 is inserted in the workpiece holder in milling machine 1 by a handling device, preferably by the same handling robot 5, the milling machine carries out a milling process on workpiece 3. Generally, at least the geometry of the blade area 36 is created here, which is shown in Fig. 8 to 11. Other geometries of the component are not yet generated in this setup. In

particular, both the foot area 37 and the head area 38 of the vane being made are not yet processed.

In this milling process, however, one or more reference locations are also milled onto the workpiece using the milling tool. This could be, for instance, at least two flat surfaces 40, 41, 42; 40', 41', 42', aligned orthogonally to each other, which have a specified certain orientation to the geometry of the blade area 36. The reference surfaces 40-42, 40'-42', can be located directly adjacent to each other and border each other, such as in the area of an edge of the not yet processed head area 38. The reference surfaces can extend to a part of the side surface of the head area 38 and in particular extend over the entire length of the side surface.

Several reference locations would be preferred, however, which can also be located further from each other on the workpiece. Particularly good recognition, for example, of a deformation that often occurs in the blade area 36 directly after it is made can be made possible by reference locations on both the foot and the head area 37, 38. On the foot and head areas 37, 38, in particular, at least three reference surfaces 40-42, 40'-42' each can be provided, which are aligned orthogonally to the two other reference surfaces in the same area. Since the geometry of the foot and head areas have not yet been generated in this stage, the reference locations are generated in the blank areas of the workpiece intended for them.

In this stage of manufacturing, the workpiece 3, together with the clamping fixture 8, is removed from the milling machine 1 by the handling robot, and loaded into the setup cell 2 again. If the screw device 23 is occupied at this time, the clamping fixture can then end up in a buffer, before it is returned by the handling robot to the setup position 20 in front of the screw device. Here the screw device 23 engages the spindle 21 again, and opens the clamping jaws 28 by rotating the spindle in the opposite direction as was used to close it.

Subsequently, the handling robot 5 can remove the workpiece 3 from the clamping fixture 8 and, if needed, replace it in the clamping fixture storage area. Now the clamping fixture 8 is exchanged with a different clamping fixture 18, which already is equipped with the clamping jaws 32 shown in Fig. 10 and 11. These have either positive fit clamping surfaces, or the at least three clamping pins 33 that are not

arranged in a row. The positions and the geometry of the front clamping faces of the clamping pins are matched advantageously to the specified contour of the blade in the area of contact with the clamping pins 33.

The handling robot 5 can now remove the workpiece 3, which was already processed in the first setup, from the workpiece storage area 9 and insert it in the clamping fixture 8 in the manner shown in Fig. 10 and 11. By actuating the screw device 23 with a rotation in the closing direction, the workpiece is then clamped in the blade area 36 by the pins 33 or by the positive fit clamping surfaces. The workpiece is thus mounted and clamped in the clamping fixture 8 in a second setup, in which the head and the foot areas 37, 38 extend past the sides of the clamping jaws 32, and these areas are thus accessible for processing. In comparison to the first setup, the workpiece is tipped 90° about its longitudinal axis in the second setup.

The clamping fixture 8 can thus be moved by the handling robot 5 to the milling machine 1 or again into a buffer, where it remains until the milling machine 1 is free for processing. In both cases, in the illustrated application example of the invention, the handling robot 5 inserts the clamping fixture 8 by its interface into the workpiece holder of the milling machine. The milling machine now approaches the specified positions of the reference surfaces 40-42 with a measurement probe, not further described but previously known, and probes the actual positions and orientations of the reference surfaces 40-42. Deviations from the specified positions are determined by the controller 4 and used as correction values in further processing. This allows for compensation for various errors, in particular compensation for deformation due to the relatively thin and long geometry of the blade area 36, which can occur during manufacture of the blade area in the first setup.

Now the milling process can begin in the second setup, in which both the head area 38 and the foot area 37 are generated on the workpiece. Since compensation is made for any deformation of the workpiece, the geometries of the head and foot areas 37, 38 can be manufactured correctly relative to the blade area 36. After this processing, the clamping fixture 8 is removed from the machine tool and returned to the setup position 20. Using the screw device 23, the clamping fixture 8 is opened, so that the handling robot 5 can remove the completed workpiece, shown in Fig. 13, and set it down in a storage location for further transport.

In Fig. 12, another variation is shown, in which a setup cell 2, such as the setup cell 2 shown in Fig. 1, is assigned to several machine tools 1. Since the capacity of such a setup cell 2 is considerable higher than needed to supply only one machine tool 1 for production of turbine or engine vanes, the setup cell 2 can be connected to a transport device 44, with which workpieces and their clamping fixtures are moved to and from several machine tools. In the application example shown, an overhead transport device with two tracks 45 is shown, on which additional handling devices 46 are mounted for transport. If the production capacity of the machine tools 1 exceeds the setup capacity of the setup cell 2, then either several setup cells, or just one expanded setup cell, but with one or more handling robots 5 (Fig. 1), with one or more screw devices 23, or with additional storage areas, can be planned.

Reference List

1	Milling machine	27	Dovetail guide
2	Setup cell	28	Clamping jaws
3	Workpiece	29	Clamping surfaces
3a	Front side	30	Stand surface
4	Controller	32	Clamping jaws
5	Handling robot	33	Clamping pin
6	Setup station	36	Blade area
7	Clamping fixture storage	37	Foot area
8	Clamping fixture	38	Head area
9	Workpiece storage	40	Reference surface
10	Two-jaw parallel gripper	41	Reference surface
14	Vise	42	Reference surface
15	Clamp jaw	40'	Reference surface
16	Clamp jaw	41'	Reference surface
17	Screw connection	42'	Reference surface
18	Clamping fixture	44	Transport device
19	Clamp holder	45	Rail
20	Setup position	46	Handling device
21	Spindle		
21a	Hex head		

- 22 Clamp jaw holder
- 23 Screw device
- 24 Longitudinal axis
- 25 Shaft
- 26 Internal hex

Claims

1. Process for setup of a workpiece for the manufacture of a flow-guiding component for a compressor or a turbine, in particular a vane for a gas turbine, steam turbine, or engine, in which the workpiece (3) for the flow-guiding component to be manufactured is clamped in a clamping fixture (8, 18) outside of a machine tool (1), in order to be subsequently loaded into the machine tool, in which it is milled to shape, characterized in that the workpiece (3) is automatically inserted into a clamping fixture (8, 18) outside of the machine tool, the workpiece is automatically clamped in the clamping fixture (8, 18), the workpiece together with the clamping fixture (8, 18) is subsequently loaded into the machine tool (1) by a mechanical handling process, the workpiece together with its clamping fixture (8, 18) is removed from the machine tool by another mechanical handling process, the workpiece is then automatically inserted in a clamping fixture (8, 18) for a second setup, different from the first setup, and automatically clamped, then, together with the clamping fixture, is loaded into a machine tool for further processing.
2. Process as in claim 1, characterized in that a flow-guiding area, in particular at least a part of a blade area (36), is generated in the first setup.
3. Process as in claim 1 or 2, characterized in that an area of the workpiece in which the foot and/or head (37, 38) of the flow-guiding component will be generated in a subsequent setup is used for clamping the workpiece (3) in the first setup.
4. Process as in at least one of the prior claims, characterized in that the workpiece (3) is inserted into a clamping device (8, 18) with a two-jaw vice (14) with parallel, flat clamping surfaces for its first setup, in which the workpiece (3) is aligned with its side surfaces parallel to the clamping surfaces of the clamping fixture, and is clamped on these side surfaces.
5. Process as in at least one of the prior claims, characterized in that at least the foot and/or head (37, 38) of the flow-guiding component is shaped in the second setup.

6. Process as in at least one of the prior claims, characterized in that at least one reference location (40, 41, 42; 40', 41', 42') is generated in the first setup, the position of which is detected in at least one subsequent setup.
7. Process as in at least one of the prior claims, characterized in that after generation of the reference location (40, 41, 42; 40', 41', 42') and repositioning of the workpiece in a second setup, the position and/or orientation information of at least one reference location is detected, and this information is used for further processing.
8. Process as in at least one of the prior claims, characterized in that the clamping fixture (8, 18) is opened or closed by actuating a shaft on the clamping fixture by an actuation device that produces a rotary motion.
9. Process as in claim 8, characterized in that an actuation element of the actuation device is arranged relative to the clamping fixture (8, 18), creating a link to the shaft for opening and/or closing the actuation device, and a rotary motion of the actuation device opens or closes the clamping fixture.
10. Process as in claim 8, characterized in that the actuation device is a screw device (23).
11. Process as in at least one of the prior claims, characterized in that clamping jaws (28, 32) are exchanged with other clamping jaws (28, 32) on at least one of the clamping fixtures by a handling device.
12. Process as in at least one of the prior claims, characterized in that the workpiece is held in at least two setups with different clamping jaws (28, 32).
13. Process as in at least one of the prior claims, characterized in that both workpieces (3) and clamping fixtures (8, 18) are handled by only one handling device.

14. Process as in claim 13, characterized in that both workpieces and clamping fixture are placed in the same setup position (20) using the handling device.
15. Process as in at least one of the prior claims, characterized in that the workpiece, after removal from the machine tool for the subsequent setup step, is moved to the same setup position (20) at which it was previously inserted in a clamping fixture for the first setup.
16. System for setting up workpieces (3) from which flow-guiding components for compressors or turbines, in particular vanes for gas turbines, steam turbines, or engines, which are produced by milling processes, where the system has at least one clamping fixture (8,18) for holding a workpiece, characterized by at least one handling device for inserting the workpiece in the clamping fixture (8,18), as well as an automatic actuation device for opening and/or closing the clamping fixture (8,18), which can be connected to the clamping fixture for this purpose.
17. System as in claim 16, characterized in that the actuation device is intended to transfer a rotary actuation motion to the clamping fixture.
18. System as in claim 16 or 17, characterized by a storage area (9) for workpieces and a storage area for clamping fixtures (7), where both storage areas (7, 9) are within the reach of the handling device.
19. System as in at least one of the prior claims 16 through 18, characterized in that the clamping jaws (28, 32) of at least one of the clamping fixtures (8, 18) can be changed out.
20. System as in at least one of the prior claims 16 through 19, characterized in that the system has a transport device (44) with which a workpiece mounted in a clamping fixture (8, 18) can be moved to one of several machine tools.