

MACHINING APPARATUS

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates to a machining apparatus.

Description of the Related Art

A workpiece machining apparatus such as those disclosed in JP 2020-003854A and JP 2016-002614A each have standard functions and optional functions added to the standard functions.

Such optional functions are added to the standard functions according to a request from a purchaser. A plurality of functions requested from a purchaser in the past is therefore implemented as optional functions in advance in a machining apparatus to be sold to the purchaser. One or more of these optional functions are made usable according the purchase status of the purchaser.

SUMMARY OF THE INVENTION

In general, a purchaser wishes to purchase an optional function after understanding its details. In this regard, in the past, it has been a practice for the

purchaser to understand the details of the optional function using a reference material supplied from an apparatus manufacturer or visiting the apparatus manufacturer and observing operations of an apparatus installed at the apparatus manufacturer. In other words, as to whether or not to purchase the optional function, the purchaser has heretofore made a decision while remaining unable to experience the optional function on its own in-house apparatus.

The present invention therefore has as an object thereof the provision of a machining apparatus that enables a purchaser, who has already purchased the machining apparatus, to purchase an optional function for the machining apparatus after experiencing the optional function implemented in advance in the purchased machining apparatus.

In accordance with an aspect of the present invention, there is provided a machining apparatus having standard functions, and one or a plurality of optional functions installed in advance as functions desired one or more of which are able to be selectively added to the standard functions. The machining apparatus includes a holding unit that holds a workpiece, a machining unit that machines the workpiece held on the holding unit, a

touch panel configured to enable displaying and inputting machining conditions under which the workpiece is to be machined, and configured to display a call button to be touched to call up an optional function table of the optional functions, a selection section that enables to select the desired optional functions from the optional function table called up via the call button and displayed on the touch panel, and a trial use term management section configured to enable using the selected desired optional functions for a preset term on a trial basis.

The touch panel may preferably be configured to further display a movie that represents operation details of the desired optional functions or a still image that describes the operation details of the desired optional functions.

The touch panel may preferably be configured to display both movies or both still images, the movies or the still images respectively representing or describing operation details of the standard functions when the standard functions are used alone and operation details of a combination of the standard functions and the desired optional functions when the standard functions and the desired optional functions are used in

combination such that a worker is able to compare the operation details of the standard functions and the operation details of the combination of the standard functions and the desired optional functions.

The selection section may preferably be configured to disable selecting the desired optional functions again after the desired optional functions have been once selected and used on a trial basis.

With the machining apparatus according to the aspect of the present invention, a worker can select the desired optional functions from the optional function table called up via the call button and displayed on the touch panel, and can use the desired optional functions for the preset term (trial use term) on a trial basis. Before purchasing the desired optional function, the worker can therefore experience it while using the in-house machining apparatus. As a consequence, it is possible to refrain from purchasing an unnecessary optional function.

Further, the worker may find a change or addition desired to be made to the optional functions or the desired optional functions during the trial use term. If this is the case, the worker may make an inquiry about such a change or addition to the manufacturer of the

machining apparatus, and may request the change or addition to the manufacturer of the machining apparatus. Consequently, the worker can purchase an appropriate optional function.

The above and other objects, features and advantages of the present invention and the manner of realizing them will become more apparent, and the invention itself will best be understood from a study of the following description and appended claims with reference to the attached drawings showing a preferred embodiment of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view depicting a machining apparatus according to an embodiment of the present invention;

FIG. 2 is a diagram presenting an example of an optional function table displayed on a touch panel; and

FIG. 3 is a diagram presenting an example of an operation detail display area displayed on the touch panel.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

With reference to the attached drawings, a

description will hereinafter be made about an embodiment of the present invention. FIG. 1 is a perspective view depicting a machining apparatus 1 according to an embodiment of the present invention. As depicted in FIG. 1, the machining apparatus 1 according to this embodiment is used to machine a wafer 100 as a workpiece.

The wafer 100 as the workpiece has a substantially circular shape, and includes streets 102 formed in a lattice pattern on a front side. Devices of the same type (undepicted) are formed in individual regions defined by the streets 102, respectively.

On a back side of the wafer 100, a dicing tape 103 is bonded. A ring frame 105 is bonded on an outer periphery of the dicing tape 103. In a state of a work set 107 supported on the ring frame 105 via the dicing tape 103 as described above, the wafer 100 is machined on the machining apparatus 1. The work set 107 is accommodated in an undepicted cassette, and is loaded in the machining apparatus 1.

A description will hereinafter be made about configurations of the machining apparatus 1.

The machining apparatus 1 can machine the work set 107 (wafer 100) fully automatically. The machining apparatus 1 includes a support base 10, a rectangular

cuboid housing 12 disposed upright on the support base 10, and a control unit 14 accommodated in the housing 12 and configured to control individual elements of the machining apparatus 1.

On the side of an end of the support base 10, a cassette stage 16 is disposed. A cassette (undepicted) with a plurality of work sets 107 held therein is mounted on the cassette stage 16.

Between the cassette stage 16 and a holding table 20, a push-pull mechanism 17 is disposed to transfer the work set 107. On the side of the housing 12 of the holding table 20, a temporary holding area 18 is arranged to temporarily place each work set 107. The push-pull mechanism 17 transfers the pre-machining work set 107 from the cassette on the cassette stage 16, and mounts it onto the temporary holding area 18. The temporary holding area 18 performs positioning of the work set 107 in an X-axis direction.

The work set 107 on the temporary holding area 18 is transferred to and mounted on the holding table 20 by an undepicted transfer mechanism.

The holding table 20 is an example of the holding unit that holds the workpiece, and is fixed on a movable plate 21. Together with a corrugated water splash cover

23, the movable plate 21 covers an opening in a center of an upper surface of the support base 10. Under the movable plate 21 and water splash cover 23, means for moving the movable plate 21 and the holding table 20 in the X-axis direction, for example, a cutting feed mechanism of a ball screw type (undepicted) is disposed.

The holding table 20 has a holding surface 201 made from a porous ceramic material. By a negative pressure produced on the holding surface 201, the wafer 100 of the work set 107 is held under suction. On a periphery of the holding table 20, four clamps 22 are disposed. The ring frame 105 of the work set 107 is fastened and fixed from four directions by the respective clamps 22.

On a front surface of the housing 12, a cutting unit 30 is arranged above the holding table 20. The cutting unit 30 is an example of the cutting unit that machines the workpiece held on the holding unit and, in this embodiment, applies cutting machining to the wafer 100 of the work set 107 held on the holding table 20.

The cutting unit 30 includes a first cutting mechanism 31 and a second cutting mechanism 33, both having a similar structure, and a Y-axis direction moving mechanism 35 configured to perform index feeding of the first cutting mechanism 31 and second cutting mechanism

33 along the Y-axis direction.

The first cutting mechanism 31 and the second cutting mechanism 33 are each provided at a lower extremity thereof with a cutting portion 37 having a cutting blade, and can each move the cutting portion 37 in a Z-axis direction.

In the cutting unit 30 having the configuration as described above, the positions of the cutting portions 37 in a Y-Z plane are adjusted by the first cutting mechanism 31, the second cutting mechanism 33, and the Y-axis direction moving mechanism 35. On the other hand, the holding table 20 is fed for cutting (fed for machining) in the X-axis direction by the undepicted cutting feed mechanism. As a consequence, the wafer 100 in the work set 107 held on the holding table 20 is subjected to cutting machining along each street 102 by the cutting blade of the cutting portion 37.

After the cutting machining, the work set 107 is fed by an undepicted transfer mechanism from the holding table 20 to a spin rinse dryer unit 24 on a rear side of the holding table 20. The spin rinse dryer unit 24 rinses the work set 107 while spraying rinse water toward the work set 107 spinning at high speed, and then blows dry air to dry the work set 107.

In addition, a touch panel 40 is arranged on a side surface of the housing 12. The touch panel 40 can display and input machining conditions for the workpiece.

Described specifically, various kinds of information such as machining conditions and the like relating to the machining of the wafer 100 is displayed on the touch panel 40. The touch panel 40 is also used to set the various kinds of information such as the machining conditions. As appreciated from the foregoing, the touch panel 40 functions as an input device for inputting information, and also functions as a display device for displaying the information.

The control unit 14 includes a processor such as a central processing unit (CPU), executes a variety of processing at the processor, and comprehensively controls the individual elements of the machining apparatus 1. The control unit 14 is inputted with, for example, detection results from various detectors (undepicted). The control unit 14 also controls the cutting feed mechanism, the first cutting mechanism 31, the second cutting mechanism 33, and the Y-axis direction moving mechanism 35 to perform cutting machining on the wafer 100 in the work set 107 by the cutting portions 37.

Moreover, the control unit 14 includes a storage

section 51 configured of, for example, a non-volatile or volatile semiconductor memory or the like in this embodiment. The storage section 51 stores programs for performing standard functions and programs for performing optional functions as functions to be added to the standard functions.

Described specifically, the control unit 14 can perform (can make the machining apparatus 1 perform) the standard functions and the optional functions on the basis of the programs stored (installed) in the storage section 51.

As described above, the machining apparatus 1 has the standard functions, and a plurality of optional functions installed in advance as functions one or more of which can be selectively added to the standard functions.

The term "standard functions" means such standard functions of the machining apparatus 1 as unloading the work set 107 from the cassette and holding it on the holding table 20, cutting the wafer 100 by the cutting portion 37, and rinsing and drying the work set 107 by the spin wash dryer unit 24.

On the other hand, the term "optional functions" means, for example, functions needed for a specific

worker. The optional functions can include a function that changes the cutting method for the wafer 100 from an ordinary method.

The control unit 14 also includes, in addition to the storage section 51, a selection section 53 and a trial use term management section 55. A description will hereinafter be made about an operation, which is associated with the optional functions for the machining apparatus 1 and is to be realized by the control unit 14 and the touch panel 40.

In this embodiment, the touch panel 40 depicted in FIG. 1 is provided with a call button 41. Via this call button 41, an optional function table of the plural optional functions stored in the storage section 51 is called up. In other words, the call button 41 is a button for displaying the table on the touch panel 40. This call button 41 is displayed on the touch panel 40, for example, by the control unit 14.

FIG. 2 is a diagram presenting an example of an optional function table displayed on the touch panel 40. When the worker touches the call button 41, the control unit 14, as presented in FIG. 2, reads an optional function table 60 stored in the storage section 51, and displays it together with a message display area 70,

where a message for the worker is displayed, on the touch panel 40.

As presented in FIG. 2, the optional function table 60 includes columns consisting of a select column 61, a title column 62, an overview column 63, and a price column 64, and a plurality of rows (10 rows in the example presented in FIG. 2) labeled with row numbers (1 to 10). Each row in the optional function table 60 corresponds to each one of the optional functions, and includes a select cell, a title cell, an overview cell, and a price cell.

In the title cell, the title of the optional function is displayed. In the overview cell, an overview of details of the optional function is displayed.

The selection section 53 (see FIG. 1) of the control unit 14 enables to select desired one or more of the optional functions from the optional function table 60 called up via the call button 41. In this embodiment, the selection section 53 sets select cells, which correspond to the individual optional functions, in the individual rows under the select column 61 in the optional function table 60. These select cells allow the worker to select one or more of the optional functions as desired.

The worker can select the desired optional function by touching the select cell corresponding to the desired optional function. A predetermined mark, specifically a circle mark is added to the select cell for the selected optional function. In the example presented in FIG. 2, the optional function of the row number 6 is selected as the desired optional function.

The control unit 14 also displays an operation detail display button 81, a trial use button 82, and a back button 83, all of which can be touched by the worker, below the optional function table 60 on the touch panel 40.

The back button 83 is used to return the display state of the touch panel 40 from a state, in which the optional function table 60 is displayed as presented in FIG. 2, to a preceding state. By touching this back button 83, the worker can return the display state of the touch panel 40 to its preceding state.

FIG. 3 is a diagram presenting an example of an operation detail display area 90 displayed on the touch panel 40. The operation detail display button 81 is used to display the operation details of each optional function. After selection of one of the optional functions, the worker can touch the operation detail

display button 81. If this is the case, the control unit 14 displays, in addition to the above-mentioned message display area 70, trial use button 82, and back button 83, the operation detail display area 90 on the touch panel 40 as presented in FIG. 3. At the operation detail display area 90, the control unit 14 then displays a movie or a still image representing or describing the operation details of the selected optional function.

As described above, the touch panel 40 further includes the operation detail display area 90 to display a movie, which represents the operation details of the optional function selected from the optional function table 60 called up and displayed via the call button 41, or a still image, which describes the operation details of the optional function.

Described specifically, movies or still images are displayed at the operation detail display area 90. These movies or still images represent or describe, for example, operation details when the optional function is not used and operation details when the operation function is used, respectively.

At the operation detail display area 90, still images, in other words, descriptions or movies are therefore displayed as presented in FIG. 3, concerning,

for example, operation details when the functions of the existing machining apparatus are used (as labeled "Before") and operation details when the optional function is additionally used, in other words, when the standard functions and the optional function are used in combination (as labeled "After"). The worker can be ensured to understand the displayed details of both of the still images or both of the movies through comparison.

Further, the trial use button 82 is used to make the optional functions usable over a specified term. After selection of one or more optional functions, the worker can touch the trial use button 82. If this is the case, the trial use term management section 55 of the control unit 14 enables to use the selected optional functions for a preset term, for example, a preset number of days (trial use term; for example, 7 days) on the machining apparatus 1. In other words, the worker can use the selected optional functions for the trial use term on the machining apparatus 1 by touching the trial use button 82 after the selection of the optional functions. The trial use term management section 55 can also disable the use of the selected optional functions on the machining apparatus 1 upon an elapse of the trial use

term.

As described above, the worker, in this embodiment, can use the desired one or more of the optional functions for the trial use term on a trial basis by selecting the desired optional functions from the optional function table 60 displayed on the touch panel 40 and then touching the trial use button 82. Before purchase of the desired optional function, the worker can therefore experience it, for example, using the in-house machining apparatus 1. As a consequence, it is possible to refrain from purchasing an unnecessary optional function.

In the optional function table 60, the operation detail display button 81 and the trial use button 82 may be arranged for every optional function.

As presented in FIG. 2, the optional function table 60 includes the price column 64 to display the prices of the individual optional functions. However, such a price column may be omitted.

The worker may find a change or addition desired to be made to the selected optional functions during the trial use term. If this is the case, the worker may make an inquiry about such a change or addition to the manufacturer of the machining apparatus 1, and may request the manufacturer of the machining apparatus 1 the

change or addition to the optional functions.

Consequently, the worker can purchase an appropriate optional function.

In this embodiment, the plurality of optional functions is stored in the storage section 51. In this regard, however, a single piece of optional function may be stored in the storage section 51.

Concerning the optional functions once selected and used on a trial basis, the selection section 53 may be configured to disable selecting and using them again on a trial basis in this embodiment.

The optional functions in this embodiment are realized by programs (in other words, software) stored in the storage section 51. In this regard, optional functions include those which are performed using additional hardware in combination with software. With respect to such optional functions, the worker can simulatively use them on a trial basis by selecting similar optional functions that are realized by software.

The selection section 53 and the trial use term management section 55 are incorporated in the control unit 14 in this embodiment, but may be incorporated in the touch panel 40. Further, the control unit 14 with the selection section 53 and the trial use term management

section 55 included therein may itself be incorporated in the touch panel 40.

The present invention is not limited to the details of the above described preferred embodiment. The scope of the invention is defined by the appended claims and all changes and modifications as fall within the equivalence of the scope of the claims are therefore to be embraced by the invention.

WHAT IS CLAIMED IS:

1. A machining apparatus having standard functions, and one or a plurality of optional functions installed in advance as functions desired one or more of which are able to be selectively added to the standard functions, the machining apparatus comprising:

a holding unit that holds a workpiece;

a machining unit that machines the workpiece held on the holding unit;

a touch panel configured to enable displaying and inputting machining conditions under which the workpiece is to be machined, and configured to display a call button to be touched to call up an optional function table of the optional functions;

a selection section that enables to select the desired optional functions from the optional function table called up via the call button and displayed on the touch panel; and

a trial use term management section configured to enable using the selected desired optional functions for a preset term on a trial basis.

2. The machining apparatus according to claim 1, wherein the touch panel is configured to further display a movie that represents operation details of the desired

optional functions or a still image that describes the operation details of the desired optional functions.

3. The machining apparatus according to claim 2, wherein the touch panel is configured to display both movies or both still images, the movies or the still images respectively representing or describing operation details of the standard functions when the standard functions are used alone and operation details of a combination of the standard functions and the desired optional functions when the standard functions and the desired optional functions are used in combination such that a worker is able to compare the operation details of the standard functions and the operation details of the combination of the standard functions and the desired optional functions.

4. The machining apparatus according to claim 1, wherein the selection section is configured to disable selecting the desired optional functions again after the desired optional functions have been once selected and used on a trial basis.