

DESCRIPTION

TITLE OF THE INVENTION: STAGE DEVICE FOR LASER PROCESSING MACHINE

TECHNICAL FIELD

[0001]

The present invention relates to a stage device for a laser processing machine and relates specifically to a stage device to be used for performing fine laser processing on a thin metal sheet.

BACKGROUND ART

[0002]

A metal mask for use in, for example, printing solder cream on a printed wiring board can be manufactured by laser processing by moving a thin metal sheet and a laser processing head relative to each other and irradiating predetermined areas of the thin metal sheet with laser light. A stage for use in such processing is usually a stage disposed to be linearly movable by means of a linear guide, and a linear servomotor is used as a drive source for moving the stage (see Patent Document 1, for example).

PRIOR ART DOCUMENT

PATENT DOCUMENT

[0003]

Patent Document 1: Japanese Patent Application Publication No. 2004-112864

SUMMARY OF THE INVENTION

PROBLEM TO BE SOLVED BY THE INVENTION

[0004]

As means for moving the thin metal sheet and the laser processing head relative to each other, there are one that

involves fixing the laser processing head and moving the stage with the thin metal sheet held thereon, and one that involves fixing the thin metal sheet and moving the stage with the laser processing head mounted thereon. In the case of moving the thin metal sheet, increase in the surface area of the thin metal sheet leads to increase in the size and weight of the stage and thus leads to increase in the likelihood of vibration thereof. This may cause processing errors. For this reason, moving the laser processing head is preferable. In the case of moving the laser processing head, however, if the surface area of the thin metal sheet is large, the stage on which to mount the laser processing head needs to be long, and its weight increases as well. As a result, the stage bends downward in the center with its own weight in some cases. For ultrafine processing such as laser processing of a metal mask, even slight bend of the stage as small as several micrometers can possibly affect the product quality.

[0005]

In view of this, an object of the present invention is to provide a stage device for a laser processing machine capable of solving the downward bend of a stage in the center due to its own weight, and also capable of reliably performing ultrafine processing using laser light.

MEANS FOR SOLVING THE PROBLEM

[0006]

To achieve to the above object a stage device for a laser processing machine of the present invention is a stage device for a laser processing machine, including a stage which has lower portions thereof on opposite sides supported on linear guides including a pair of guide rails and sliders, and is

provided to be movable in a longitudinal direction of the guide rails, the guide rails being disposed in parallel with each other, the sliders being configured to be guided respectively by the guide rails to move along the guide rails, and linear servomotors which move the stage along the guide rails. A linear servomotor with a core is used as each of the linear servomotors, stators of the linear servomotors are disposed at outer sides of the guide rails at a higher level than the guide rails in parallel with the guide rails while facing the stage, and movers of the linear servomotors are disposed on opposite lateral side portions of the stage at such positions as to face the stage sides of the respective stators.

EFFECT OF THE INVENTION

[0007]

According to the stage device for a laser processing machine of the present invention, attractive force between the stators disposed at the outer sides of and above the pair of guide rails and the movers mounted to the opposite lateral side portions of the stage generates force that pulls the stage from the opposite sides at a higher level than the guide rails. Thus, it is possible to prevent the stage from bending downward in the center with its own weight.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008]

[Fig. 1] Fig. 1 is a front view of a main part showing an embodiment of a stage device for a laser processing machine of the present invention.

[Fig. 2] Fig. 2 is a front view of the same stage device.

[Fig. 3] Fig. 3 is a plan view of the same stage device.

MODE FOR CARRYING OUT THE INVENTION

[0009]

A stage device for a laser processing machine to be described in an embodiment includes, on each of opposite portions of a base 11, a linear guide 13 for movably supporting a gate-shaped stage 12, and a linear servomotor 14 as a drive source for moving the stage 12. The linear guides 13 include a pair of guide rails 15, 15 which are disposed in parallel with each other, and sliders 16, 16 which are guided respectively by the guide rails 15, 15 to move in the longitudinal direction of the guide rails 15. The sliders 16 are mounted to the lower surfaces of leg portions 12b of the stage 12 formed below opposite sides of a table portion 12a thereof, and are each provided in such a way as to straddle its guide rail 15 from above the guide rail 15.

[0010]

Each linear servomotor 14 is a linear servomotor with a core and includes a stator 17 in which different magnetic poles are laid alternately, and a mover 18 which is a core with a conductive wire wound therearound. The stator 17 is disposed on the inner surface (stage-side surface) of a support member 11a standing at an outer side of the guide rail 15, at a higher level than the guide rail 15 along the guide rail 15 and in parallel with the guide rail 15 over the entire length of the base 11 while facing the stage 12. Moreover, the mover 18 is mounted to an outer surface of an upper portion of the stage 12, specifically, one of opposite lateral side portions of the table portion 12a above the leg portion 12b, at a higher level than the guide rail 15 at such a position as to face the stage 12 side of the stator 17. A predetermined gap is provided between the guide rail 15 and the mover 18.

[0011]

As described above, the gate-shaped stage 12 is provided to be movable along the guide rails 15 of the linear guides 13 with the sliders 16 therebetween which are formed in such a way as to straddle the guide rails 15 from above. Also, the linear servomotors 14 with a core are disposed between the support members 11a of the base 11 and the table portion 12a of the stage 12 above the guide rails 15 while facing sideways such that their surfaces facing each other are oriented in the vertical direction. In this way, magnetic force between the stators 17 and the movers 18 of the linear servomotors 14 generates large attractive force in such a direction as to pull the stage 12 from the opposite sides at a higher level than the guide rails 15.

[0012]

Thus, the attractive force between the stators 17 and the movers 18 of the linear servomotors 14 can cancel out force applied to upper portions of the leg portions 12b toward the center of the stage 12 when the stage 12 bends downward in the center with its own weight. Accordingly, the leg portions 12b can be held upright, and thereby the stage 12 can be prevented from bending downward in the center with its own weight.

[0013]

As a result, the flatness of the stage 12 can be maintained, making it possible to maintain the vertical position of a laser processing head 22 which is mounted on the stage 12 and moved along a guide 21 in the longitudinal direction of the stage 12. Thus, the distance between the laser processing head 22 and a thin metal sheet placed below the laser processing head 22 remains constant regardless of where the laser processing head

22 is moved. Accordingly, it is possible to secure the accuracy of processing for metal mask formation involving performing ultrafine processing on the thin metal sheet, and achieve stable quality and an improved yield.

[0014]

The level of each linear servomotor 14 with a core from the guide rail 15 of the linear guide 13 can be set according to various conditions such as the weight and stiffness of the stage 12, the distance between the pair of guide rails 15, 15, the allowable amount of bend, and the attractive force between the stator 17 and the mover 18. However, each linear servomotor 14 is preferably disposed at such a position that the opposite ends of the table portion of the stage 12 can be pulled straight from the opposite sides.

[0015]

Note that position detecting means and motion controlling means for the stage device are not particularly limited, and the stage device can be used for any purpose as well.

EXPLANATION OF THE REFERENCE NUMERALS

11	base
11a	support member
12	stage
12a	table portion
12b	leg portion
13	linear guide
14	linear servomotor
15	guide rail
16	slider
17	stator
18	mover

21 guide

22 laser processing head

CLAIMS

[Claim 1]

A stage device for a laser processing machine, including a stage which has lower portions thereof on opposite sides in a horizontal direction supported on linear guides including a pair of guide rails and sliders, and is provided to be movable in a longitudinal direction of the guide rails, the guide rails being disposed in parallel with each other, the sliders being configured to be guided respectively by the guide rails to move along the guide rails, and

linear servomotors which move the stage along the guide rails,

wherein a linear servomotor with a core is used as each of the linear servomotors,

stators of the linear servomotors are disposed at outer sides of the guide rails at a higher level than the guide rails in parallel with the guide rails while facing the stage, and

movers of the linear servomotors are disposed on opposite lateral side portions of the stage at such positions as to face the stage sides of the respective stators, and facing surfaces of the stators and the movers are oriented in the vertical direction to generate the attractive force between the stators and the movers in the direction of cancelling out force which occurs when the stage bends downward in the center.