

ENERGY BEAM IRRADIATION DEVICE AND WORK TRANSPORT MECHANISM

TECHNICAL FIELD

[0001]

The present invention relates to an energy beam irradiation system for irradiating an energy beam, such as an ion implantation device or an electron beam irradiation device and a work transport mechanism used therefor.

RELATED ART

[0002]

In an ion implantation device of single-piece type disclosed in Patent Document 1, two wafer driving mechanisms are provided so as to orbit wafers independently of each other. Further, the orbits of two wafers are adapted to be matched with each other in an ion beam irradiation region and the orbiting speed or orbiting phase of each wafer is controlled. In this way, any one of two wafers always passes through the ion beam irradiation region. Accordingly, it is possible to increase the irradiation efficiency of ion beam on the wafers.

[0003]

And, in Patent Document 1, the orbits of the wafers are matched with each other in a straight orbit portion including a beam irradiation region and a portion other than the straight orbit portion is divided into two parts on both sides of the straight orbit portion.

[Related Art Documents]

[Patent Documents]

[0004]

[Patent Document 1] JP-A-10-134761

SUMMARY

[0005]

However, according to this configuration, there is a problem that a sufficient space for ensuring two orbits is required and thus it is difficult to achieve compactness of the ion implantation device beyond a certain level. And, such a problem is generally common to an energy beam irradiation system for irradiating an energy beam on a work as well as the ion implantation device.

[0006]

The present invention has been made to solve the above-described problem and an object of the present invention is to provide an energy beam irradiation system capable of enabling a remarkable compact configuration while effectively irradiating an energy beam on a work.

[0007]

That is, an energy beam irradiation system according to the present invention includes an energy beam emission mechanism and first and second orbiting mechanisms. The energy beam emission mechanism emits an energy beam toward a predetermined irradiation region to irradiate at least one first work and at least one second work as objects. The first orbiting mechanism orbits the at least one first work along a predetermined first orbit including the irradiation region. The second orbiting mechanism orbits the at least one second work along a predetermined second orbit including the irradiation region. A first region enclosed by the first orbit and a second region enclosed by the second orbit are at least partially overlapped, as viewed from a direction perpendicular to orbiting surfaces formed by the first and second orbits.

Herein, the phrase, "overlap" does not include a state where the first region enclosed by the first orbit and the second region enclosed by the second orbit are in contact with each other.

[0008]

As a specific embodiment, each of the first and second orbits includes straight orbits being parallel to each other and semi-circular orbits connecting between ends of the straight orbits. In the first orbit, one semi-circular orbit has a first center and the other semi-circular orbit has a second center. In the second orbit, one semi-circular orbit has a third center and the other semi-circular orbit has a fourth center. The first center of the first orbit and the third center of the second orbit are matched to each other, and the second center of the first orbit and the fourth center of the second orbit are matched to each other, as viewed from the direction perpendicular to the orbiting surfaces of the first and second orbits.

[0009]

According to this configuration, both orbits are matched to each other and thus it is possible to contribute to compactness. Further, turning radiuses of semi-circular orbits of both orbits can be approximated to each other even if both orbits are not matched to each other. Accordingly, it is possible to further contribute to compactness.

A preferred embodiment for most contributing to compactness has a configuration that each of the first and second orbits is matched to each other.

[0010]

In order to increase an irradiation efficiency of the energy beam using two orbits, it is preferable that the at least one second work enters the irradiation region before the at least one first work which entered the irradiation region completely passes through the irradiation region.

[0011]

In this case, when the at least one first work and the at least one second work are arranged in plural side by side along orbiting directions of the first orbit and the second orbit, respectively, the energy beam can be irradiated on one work of the at least one first

work or the at least one second work for longer time. In the meantime, it can afford to orbit and move the other work to a position behind the one work. Accordingly, it is easy to continuously irradiate the energy beam.

[0012]

In this case where each of the at least one first work and the at least one second work returns to its initial rotation angle when orbiting one time along a corresponding orbit, as viewed from the direction perpendicular to the orbiting surfaces, twisting of the wiring or disconnection due to the twisting can be prevented.

[0013]

In addition to the above effects, in order to reduce the influence of the energy beam when passing through the backside of the irradiation region of the energy beam, each of the at least first work and the at least one second work has an energy beam irradiation side facing to an energy beam irradiation direction and a backside of the energy beam irradiation side, and rotates by 180 degrees while moving from the irradiation region to a backside region where the backside faces to the energy beam irradiation direction. And, each of the at least one first work and the at least one second work rotates by minus 180 degrees while moving from the backside region to the irradiation region so that each of the at least one first work and the at least one second work turns to its initial rotation angle.

[Effect of Invention]

[0014]

According to the present invention thus configured, two orbiting mechanisms are provided and thus it is possible to improve the irradiation efficiency of the energy beam. In addition, since a region of the first orbit and a region of the second orbit in two orbiting mechanisms are at least partially overlapped with each other, dimensions of a size corresponding to two orbits is not required and thus it is possible to reduce the dimensions by the overlapped region. Accordingly, a compact configuration can be realized.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015]

FIG. 1 is a schematic perspective view illustrating an energy beam irradiation system according to one embodiment of the present invention.

FIG.2 is a front view illustrating an orbiting mechanism in the one embodiment.

FIG. 3 is a plan view illustrating an orbit in the one embodiment.

FIGS. 4A, 4B and 4C are schematic explanatory views illustrating a movement of wafers in the one embodiment.

FIGS. 5D, 5E and 5F are schematic explanatory views illustrating a movement of wafers in the one embodiment.

FIG. 6 is a plan view illustrating a movement of wafers in another embodiment of the present invention.

FIG. 7 is an explanatory view illustrating an orbiting mechanism seen in a front view and an orbit seen in a plan view in yet another embodiment of the present invention.

FIG. 8 is an explanatory view illustrating an orbiting mechanism seen in a front view and an orbit seen in a plan view in yet another embodiment of the present invention.

FIG. 9 is a schematic plan view illustrating wafer holding aspects of platen according to the present invention.

DETAILED DESCRIPTION

[0016]

Hereinafter, an energy beam irradiation system according to the present invention will be described by referring to the accompanying drawings.

[0017]

As illustrated in FIG. 1, the energy beam irradiation system 100 irradiates an ion

beam IB as an energy beam on wafers W as works to implant an ion thereon. The energy beam irradiation system 100 includes an ion beam emission mechanism (not-illustrated) for emitting the ion beam IB in an ion implanting room which is provided in a vacuum chamber (not-illustrated) and a wafer transport mechanism 10 for transporting the wafers W to a position in which the ion beam IB can be irradiated.

[0018]

The ion beam emission mechanism is configured to emit a ribbon-shaped ion beam IB, for example, toward an irradiation region P (see, FIGS. 4A to 4C etc.) which is set in the ion implanting room. Herein, the ion beam emission mechanism is well-known and therefore a detailed description thereof will be omitted.

[0019]

The wafer transport mechanism 10 includes a loading and unloading mechanism (not-illustrated), orbiting mechanisms 1, 2 and a transfer mechanism. The loading and unloading mechanism moves the wafers between a load lock chamber (not-illustrated) provided adjacent to the ion implanting room and a standby position provided in the ion implanting room. The orbiting mechanisms 1, 2 orbits the wafers W1 (W2) across a middle of the irradiation region P of the ion beam IB. The transfer mechanism transfers the wafers W1 (W2) between the loading and unloading mechanism and the orbiting mechanisms 1, 2.

[0020]

The configurations of the loading and unloading mechanism and the transfer mechanism are well-known from JP-B-4766156, for example, and therefore an illustration and description thereof will be omitted. Hereinafter, the orbiting mechanisms 1, 2 as a specific configuration of the energy beam irradiation system 100 of the present invention will be described in detail.

[0021]

In the present embodiment, two orbiting mechanisms 1, 2 are provided. Each of the orbiting mechanisms 1, 2 respectively includes struts 11, 21, arms 12, 22 projecting in a radial direction from the struts 11, 21, turning units 13, 23 for turning the arms 12, 22 around an axis of the struts 11, 21, plate-shaped wafer support members 14, 24 attached to an end portion of the arms 12, 22 and extending parallel to the axis of the struts 11, 21 and linear moving units 15, 25 for linearly moving the struts 11, 21 together with the arms 12, 22 and the wafer support members 14, 24 in a direction perpendicular to an axis thereof.

[0022]

First, the first orbiting mechanism 1 will be described in detail by referring to FIGS. 1 and 2.

The strut 11 of the first orbiting mechanism 1 is formed in a columnar shape standing upright from a base 16.

The arm 12 is formed in a plate shape projecting in a radial direction from an end portion 11b of the strut 11.

[0023]

The turning unit 13 is, for example, a motor and has a driving shaft (not-illustrated) connected to a base portion 11a of the strut 11. And, the turning unit is configured to turn the arm 12 by rotating the strut 11 around an axis thereof. The turning unit may be configured to directly turn the arm 12 without rotating the strut 11.

[0024]

The wafer support member 14 (hereinafter, also referred to as a platen) is formed in an approximately long plate shape, for example. The wafer support member 14 supports a plurality of wafers W1 on a surface thereof by an electrostatic chuck, for example. The wafer support member 14 is suspended from an end portion of the arm 12 in such a way that a longitudinal direction thereof is parallel to the axis of the strut 11 and a surface plate portion thereof is placed perpendicular to an extension direction of the arm 12.

In the present embodiment, since the platen 14 is pivotally supported on the arm 12, the platen can be rotated between a suspended state where the platen 14 is suspended with respect to the arm 12 and a parallel state where the platen 14 is placed parallel to the arm 12, as illustrated in FIG. 1, etc. This is intended for transferring the wafers between the transfer mechanism and the wafer support member. Specifically, the platen 14 is placed in the parallel state when transferring the wafers W1 between the transfer mechanism and the wafer support member and placed in the suspended state when orbiting the wafers W1.

[0025]

For example, the linear moving unit 15 includes a screw hole 151, a screw member 152 screwed into the screw hole 151 and an actuator 153 such as a motor for rotating the screw member 152. The screw hole 151 is formed to penetrate through the base 16 supporting the base portion 11a of the strut 11 in a direction perpendicular to the axis of the strut 11. The linear moving unit 15 is configured by a screw feeding type in which the base 16 is linearly moved forward and backward along an extension direction of the screw member 152 by rotating the screw member 152 in a forward-and-reverse direction. The linear moving unit 15 is not limited to the screw feeding type, but may employ various mechanisms such as a belt feeding type.

[0026]

Further, the first orbiting mechanism 1 includes a control unit (not-illustrated) which has an electrical circuit for controlling the turning unit 13 and the linear moving unit 15. More specifically, the control unit controls motors 13, 153 provided in each unit 13, 15. The control unit is configured to orbit and move the wafers W1 by repeatedly performing four operations, as illustrated in FIG. 3. Herein, the four operations include an operation for straightly moving the wafers W1 in one direction, an operation for turning the wafers W1 by 180 degrees, an operation for straightly moving the wafers W1 in a reverse direction and an operation for turning the wafers W1 by minus 180 degrees, as viewed from

an axial direction of the strut 11.

As shown in Fig. 3, an orbit (first orbit) O1 of the first orbiting mechanism 1 is an orbit which the platen 14 of the first orbiting mechanism 1 orbits to form, as viewed from the axial direction. That is, the orbit (first orbit) O1 of the first orbiting mechanism 1 includes straight orbits L11, L12 of equal length which are parallel to each other and semi-circular orbits C11, C12 which connect between ends of the straight orbits L11, L12. The semi-circular orbit C11 has a first center and the semi-circular orbit C12 has a second center, respectively.

[0027]

More specifically, when the wafers W1 is straightly displaced, the control unit actuates the linear moving unit 15 and further controls the turning unit 13 to fix an angle of the arm 12 perpendicular to the straight moving direction so that surfaces of the wafers face the outside of the orbit O1. The ion beam IB is vertically irradiated on the surfaces of the wafers W1 while the wafers are straightly moved in one side. That is, the irradiation region P of the ion beam IB vertically progressing on the surfaces of the wafers W1 is provided in the middle of the straight orbit L11 in one side.

[0028]

Meanwhile, when the wafers W1 are turned, the control unit stops the linear moving unit 15 and further actuates the turning unit 13 to turn the arm 12 by 180 degrees in a forward direction or a reverse direction. In this way, the turning angle of the arm during the turning operation is set to plus 180 degrees in one side and minus 180 degrees in the other side. This is intended for preventing the rotation of the wafers W1 due to the orbit of the wafers W1 when the wafers W1 are orbited one time. That is, by such a configuration, a rotation angle of the wafer support member 14 supporting the wafers W1, the arm 12 and the strut 11 is set so that the wafers return to its original position when being orbited one time. Furthermore, there is no problem that electric cables connected to the wafer support

member 14, the arm 12 and the strut 11 are twisted and disconnected due to the rotation thereof even when the wafers W1 are orbited several times.

[0029]

Next, the second orbiting mechanism 2 will be described in detail by referring to FIGS. 1 and 2.

The strut 21 of the second orbiting mechanism 2 is suspended from a suspended structure 27 and is placed so that an axis thereof is matched to the axis of the strut 11 and an end surface thereof is opposed to an end surface of the strut 11 of the first orbiting mechanism 1, as viewed from the straight displacement direction. The suspended structure 27 is formed in an approximately L-shape and includes a base 26, a standing member 271 standing from the base 26 and a suspension body 272 vertically extending from an end portion of the standing member 271. The strut 21 is suspended downward from an end portion of the suspension body 272 via the turning unit 23 (which will be described later).

The arm 22 is formed in a plate shape projecting in a radial direction from an end portion of the strut 21.

[0030]

The turning unit 23 is, for example, a motor and has a driving shaft connected to a base portion 21a of the strut 21. And, similar to the first orbiting mechanism 1, the turning unit is configured to turn the arm 22 and further the wafer support member 24 by rotating the strut 21 around an axis thereof. In the present embodiment, the turning radius of the wafer support member 24 is set to be equal to that of the wafer holding member 14 of the first orbiting mechanism 1.

[0031]

Similar to the first orbiting mechanism 1, the platen 24 is formed in an approximately long plate shape, for example. The platen 24 supports a plurality of wafers

W2 on a surface thereof by an electrostatic chuck, for example. The platen 24 is rotatably suspended from an end portion of the arm 22 in such a way that a longitudinal direction thereof is parallel to the axis of the strut 21 and a surface plate portion thereof is placed perpendicular to an extension direction of the arm 22. A wafer support region 24a of the platen 24 is set to be flush with a wafer support region 14a of the platen 14 of the first orbiting mechanism 1.

[0032]

The linear moving unit 25 includes a screw hole 251, a screw member 252 screwed into the screw hole 251 and an actuator 253 such as a motor for rotating the screw member 252. The screw hole 151 is formed to penetrate through the base 26 supporting the strut 21 via the suspended structure 27. Similar to the first orbiting mechanism 1, the linear moving unit 25 is configured so that the base 26 is moved forward and backward along an extension direction of the screw member 252 by rotating the screw member 252 in a forward-and-reverse direction. The extension direction of the screw member 252 is set to be parallel to the extension direction of the screw member 152 of the first orbiting mechanism 1.

[0033]

Furthermore, similar to the first orbiting mechanism 1, the second orbiting mechanism 2 includes a control unit which has an electrical circuit for controlling the turning unit 23 and the linear moving unit 25. Herein, the control unit is adapted to orbit the wafers W1, W2 in the same orbit and the same method as the first orbiting mechanism 1. As shown in Fig. 3, an orbit (second orbit) O2 of the second orbiting mechanism 2 is an orbit which the platen 24 of the second orbiting mechanism 2 orbits to form, as viewed from the axial direction. That is, the orbit (second orbit) O2 of the second orbiting mechanism 2 includes straight orbits L21, L22 of equal length which are parallel to each other and semi-circular orbits C21, C22 which connect between ends of the straight orbits

L21, L22. The semi-circular orbit C21 has a third center and the semi-circular orbit C22 has a fourth center, respectively.

This control unit may be physically common to the first orbiting mechanism 1 or may be provided as a separate body.

[0034]

Next, an operation of the energy beam irradiation system 100 thus configured will be described.

For example, a description will be started from a state before wafers (hereinafter, also referred to as first wafers) W1 orbited by the first orbiting mechanism 1 completely pass through the irradiation region P and where wafers (hereinafter, also referred to as second wafers) W2 orbited by the second orbiting mechanism 2 start to enter the irradiation region P, as illustrated in FIG. 4A.

[0035]

In a state illustrated in FIG. 4A, each of the wafers W1, W2 moves in a predetermined ion implantation speed, which are equal to each other. Thereafter, the first wafers W1 firstly leaves the irradiation region P and orbits in an increased movement speed, as illustrated in FIGS. 4A and 4B. Meanwhile, the second wafers W2 remaining in the irradiation region P continuously moves in the ion implantation speed.

[0036]

And, the first wafers W1 catch up with the second wafers W2 before the second wafers W2 completely pass through the irradiation region P, as illustrated in FIG. 5D. And then, the first wafers W1 enter the irradiation region P and the speed thereof is returned to the ion implantation speed. Thereafter, the second wafers W2 leave the irradiation region P and orbit in an increased movement speed, as illustrated in FIGS. 5E and 5F. Meanwhile, the first wafers W1 remaining in the irradiation region P continuously moves in the ion implantation speed.

[0037]

And, the second wafers W2 catch up with the first wafers W1 and this process is returned to the state of FIG. 4A.

In this way, each of the wafers W1, W2 orbits by a predetermined number of times and thus a predetermined dose of ions is implanted on the wafers W1, W2.

Each wafer W1 has an energy beam irradiation side facing to an energy beam irradiation direction of the ion beam IB and a backside of the energy beam irradiation side. As viewed from the direction perpendicular to the orbiting surface of the orbit O1, the wafers W1 rotate by 180 degrees while moving from the irradiation region P to a backside region where the backside faces to the energy beam irradiation direction. And, the wafers W1 rotate by minus 180 degrees which moving from the backside region to the irradiation region so that the wafers W1 turn to their initial rotation angles.

More specifically, the platen 14 has an energy beam irradiation side on which the wafers W1 are and which faces to the energy beam irradiation direction of the ion beam IB. And, the platen 14 has a backside of the energy beam irradiation side. When the platen 14 having the wafers W1 moves in the backside region, the wafers W1 on the energy beam irradiation side are not irradiated with the ion beam IB since the ion beam IB is irradiated to the backside of the platen 14, not irradiated to the energy beam irradiation side. Each wafer W2 has an energy beam irradiation side facing to the energy beam irradiation direction of the ion beam IB and a backside of the energy beam irradiation side. As viewed from the direction perpendicular to the orbiting surface of the orbit O2, the wafers W2 rotate by 180 degrees while moving from the irradiation region P to a backside region where the backside faces to the energy beam irradiation direction. And, the wafers W2 rotate by minus 180 degrees which moving from the backside region to the irradiation region so that the wafers W2 turn to their initial rotation angles.

More specifically, the platen 24 has an energy beam irradiation side on which the

wafers W2 are and which faces to the energy beam irradiation direction of the ion beam IB. And, the platen 24 has a backside of the energy beam irradiation side. When the platen 24 having the wafers W2 moves in the backside region, the wafers W2 on the energy beam irradiation side are not irradiated with the ion beam IB since the ion beam IB is irradiated to the backside of the platen 24, not irradiated to the energy beam irradiation side.

[0038]

According to this configuration, since two orbiting mechanisms 1, 2 are used to continuously send the wafers W1, W2 to the irradiation region P of the ion beam IB, basic effects of improving the implantation efficiency can be achieved.

[0039]

Furthermore, although two orbiting mechanisms 1, 2 are provided, the first orbit O1 and the second orbit O2 are matched to each other and therefore two orbiting mechanisms can be provided in dimensions corresponding to one orbit, as viewed from a direction perpendicular to orbiting surfaces. Accordingly, it is possible to realize a remarkable compact configuration.

More specifically, the first center of the semi-circular orbit C11 and the third center of the semi-circular orbit C21 are matched to each other, as viewed from the direction perpendicular to orbiting surfaces. And, the second center of the semi-circular orbit C12 and the fourth center of the semi-circular orbit C22 are matched to each other, as viewed from the direction perpendicular to orbiting surfaces. That is, a rotation axis of the semi-circular orbit C11 and a rotation axis of the semi-circular orbit C21 are matched to each other as shown in Figs. 2 and 3. And, a rotation axis of the semi-circular orbit C12 and a rotation axis of the semi-circular orbit C22 are matched to each other as shown in FIGS. 2 and 3.

[0040]

The present invention is not limited to the above embodiment.

For example, the number of wafer placed on the platen may be just one. Alternatively, a plurality of wafers may be placed on the platen. In this case, the throughput is improved. Additionally, the wafers W1 or the wafers W2 may be arranged in plural side by side along the axis direction of the struts 11, 21, as shown in FIGS. 1, 2, 7 and 8. The wafers W1 or the wafers W2 may be arranged in plural side by side along an orbiting direction of the first orbit O1 or the second orbit O2, which is perpendicular to the axis direction of the struts, as shown in FIG.9.

[0041]

Further, when the number of wafer mounted on one platen is increased, a time required for processing the wafers mounted on each platen becomes longer. Accordingly, it can afford to move one platen to a position behind the other platen and thus a continuous implant processing is easily realized. In this case, a longitudinal direction of the platen may be perpendicular to the axis of the strut, depending on a configuration of the platen.

[0042]

Since the number of platens to be transported may be two or more, the present invention may take a configuration that a plurality of platens is transported. In this way, it is possible to improve the throughput and to easily realize the continuous implant processing.

[0043]

The number of ion beams is not limited to one. For example, two or more ion beams IB may be irradiated, as illustrated in FIG. 6. When two ion beams IB are irradiated, it is preferable that the number of the platens is three or more in order to effectively use the ion beam IB. Herein, FIG. 6 illustrates three platens 14, 24, 34 and three wafers W1, W2, W3 mounted on the platens.

[0044]

Further, a region enclosed by the first orbit O1 and a region enclosed by the second

orbit O2 may be at least partially overlapped. In this case, it is not necessary that the turning axis of each orbiting mechanism 1, 2 is matched to each other. For example, as illustrated in FIG. 7, the turning axis may be different for each orbiting mechanism, as viewed from the straight displacement direction. Further, as illustrated in FIG. 8, a position of the turning axis is equal to each other, but a turning radius may be different from each other. In both cases, since a region enclosed by the first orbit O1 and a region enclosed by the second orbit O2 is at least partially overlapped, it is possible to realize a compact configuration by the overlapped region.

[0045]

The present invention may be applied to a system for irradiating an energy beam (for example, an electron beam, a light beam or a quantum beam as well as an ion beam) on a work. For example, the present invention may be applied to an electron beam irradiation system, a sputtering instrument or a plasma doping system, etc. In this case, the same effects can be achieved.

[0046]

In order to increase the irradiation efficiency of the energy beam, it is most desirable that at least one wafer is located in the irradiation region. However, the present invention is not limited to this configuration. For example, there is a case that at least one wafer is not located in the irradiation region depending on a size of the energy beam or a configuration of the platen. In this case, it is desirable to continuously move each wafer across the energy beam as long as possible.

[0047]

The shape of the beam is not particularly limited. For example, the beam may have a cross-sectional shape of a square or a spot-like. Further, the shape of the wafers may be circular or rectangular, for example. Herein, the transport of the wafers to the platen can be manually performed.

In addition, the present invention is not limited to the above-described embodiments and can be variously modified without departing from the scope thereof.

WHAT IS CLAIMED IS:

1. An energy beam irradiation system comprising:

an energy beam emission mechanism that emits an energy beam toward a predetermined irradiation region to irradiate at least one first work and at least one second work as objects;

a first orbiting mechanism that orbits the at least one first work along a predetermined first orbit including the irradiation region; and

a second orbiting mechanism that orbits the at least one second work along a predetermined second orbit including the irradiation region,

wherein a first region enclosed by the first orbit and a second region enclosed by the second orbit are at least partially overlapped, as viewed from a direction perpendicular to orbiting surfaces formed by the first and second orbits.

2. The energy beam irradiation system according to claim 1, wherein

each of the first and second orbits includes straight orbits being parallel to each other and semi-circular orbits connecting between ends of the straight orbits,

in the first orbit, one semi-circular orbit has a first center and the other semi-circular orbit has a second center,

in the second orbit, one semi-circular orbit has a third center and the other semi-circular orbit has a fourth center, and

the first center of the first orbit and the third center of the second orbit are matched to each other, and the second center of the first orbit and the fourth center of the second orbit are matched to each other, as viewed from the direction perpendicular to the orbiting surfaces of the first and second orbits.

3. The energy beam irradiation system according to claim 1 or 2, wherein

each of the first and second orbits is matched to each other.

4. The energy beam irradiation system according to any one of claims 1 to 3, wherein the at least one second work enters the irradiation region before the at least one first work which entered the irradiation region completely passes through the irradiation region.

5. The energy beam irradiation system according to any one of claims 1 to 4, wherein the at least one first work and the at least one second work are arranged in plural side by side along orbiting directions of the first orbit and the second orbit, respectively.

6. The energy beam irradiation system according to any one of claims 1 to 5, wherein each of the at least one first work and the at least one second work returns to its initial rotation angle when orbiting one time along a corresponding orbit, as viewed from the direction perpendicular to the orbiting surfaces.

7. The energy beam irradiation system according to claim 6, wherein, as viewed from the direction perpendicular to the orbiting surfaces,

each of the at least one first work and the at least one second work has an energy beam irradiation side facing to an energy beam irradiation direction and a backside of the energy beam irradiation side, and rotates by 180 degrees while moving from the irradiation region to a backside region where the backside faces to the energy beam irradiation direction, and

each of the at least one first work and the at least one second work rotates by minus 180 degrees while moving from the backside region to the irradiation region so that each of the at least one first work and the at least one second work turns to its initial rotation angle.

8. A work transport mechanism comprising:

a first orbiting mechanism that orbits at least one first work along a predetermined first orbit including an irradiation region of an energy beam; and

a second orbiting mechanism that orbits at least one second work along a predetermined second orbit including the irradiation region,

wherein a first region enclosed by the first orbit and a second region enclosed by the second orbit are at least partially overlapped, as viewed from a direction perpendicular to orbiting surfaces formed by the first and second orbits.