CLAIMS

1. A lifting device comprising:

a lifting beam linkable to a crane load;

at least four slings configured to link the lifting beam and a lifting equipment of a crane;

attachment parts provided on the lifting beam, the at least four slings being respectively attached to the attachment parts;

an inclined angle measuring device provided on at least one of the crane load and the lifting beam, the inclined angle measuring device being configured to measure an inclined angle relative to a horizontal plane;

distance adjusting devices provided only on (N-1) number of the slings among the at least four slings when number of the slings is N, the distance adjusting devices being configured to adjust distances between the lifting equipment and the attachment parts attached to the slings; and

a control device configured to adjust an attitude of the crane load by controlling the distance adjusting devices based on the inclined angle measured by the inclined angle measuring device, wherein

the inclined angle measuring device is configured to be capable of measuring the inclined angles about an X-axis and a Y-axis that are perpendicular to each other, and

the control device adjusts:

an attitude of the crane load about the X-axis to the predetermined attitude, based on the inclined angle about the X-axis, by holding distances between the lifting equipment and all of the attachment parts provided on a first side of a first vertical plane as a boundary and by controlling a plurality of the distance adjusting devices in parallel such that distances between the lifting equipment and all of the attachment parts provided on a second side of the first vertical plane as the boundary are respectively reduced or increased,

the first vertical plane being parallel to the X-axis, perpendicular to a horizontal plane, and including a center of gravity of the crane load; and

an attitude of the crane load about the Y-axis to the predetermined attitude, based on the inclined angle about the Y-axis, by holding distances between the lifting equipment and all of the attachment parts provided on a first side of a second vertical plane as a boundary and by controlling the plurality of the distance adjusting devices in parallel such that distances between the lifting equipment and all of the attachment parts provided on a second side of the second vertical plane as the boundary are respectively reduced or increased, the second vertical plane being parallel to the Y-axis, perpendicular to the horizontal plane, and including the center of gravity of the crane load,

a plurality of the attachment parts provided on the first side of the first vertical plane as the boundary include the attachment part attached to the sling that is not provided with the distance adjusting device, and

a plurality of the attachment parts provided on the first side of the second vertical plane as the boundary include the attachment part attached to the sling that is not provided with the distance adjusting device.

2. The lifting device according to claim 1, wherein

the control device adjusts:

the attitude of the crane load about the X-axis by controlling the distance adjusting devices such that the inclined angle about the Y-axis is maintained within the predetermined inclined angle range; and

the attitude of the crane load about the Y-axis by controlling the distance adjusting devices such that the inclined angle about the X-axis is maintained within the predetermined inclined angle range.

3. A lifting device comprising:

a lifting beam linkable to a crane load;

at least four slings configured to link the lifting beam and a lifting equipment of a crane;

attachment parts provided on the lifting beam, the at least four slings being respectively attached to the attachment parts;

an inclined angle measuring device provided on at least one of the crane load and the lifting beam, the inclined angle measuring device being configured to measure an inclined angle relative to a horizontal plane;

distance adjusting devices provided on at least (N-1) number of the slings among the at least four slings when number of the slings is N, the distance adjusting devices being configured to adjust distances between the lifting equipment and the attachment parts attached to the slings; and

a control device configured to adjust an attitude of the crane load by controlling the distance adjusting devices based on the inclined angle measured by the inclined angle measuring device,

a load detection device configured to detect load applied to each of the at least four slings, wherein

the inclined angle measuring device is configured to be capable of measuring the inclined angles about an X-axis and a Y-axis that are perpendicular to each other, and

the control device adjusts:

an attitude of the crane load about the X-axis to the predetermined attitude, based on the inclined angle about the X-axis, by holding distances between the lifting equipment and all of the attachment parts provided on a first side of a first vertical plane as a boundary and by controlling a plurality of the distance adjusting devices in parallel such that distances between the lifting equipment and all of the attachment parts provided on a second side of the first vertical plane as the boundary are respectively reduced or increased, the first vertical plane being parallel to the X-axis, perpendicular to a

horizontal plane, and including a center of gravity of the crane load; and

an attitude of the crane load about the Y-axis to the predetermined attitude, based on the inclined angle about the Y-axis, by holding distances between the lifting equipment and all of the attachment parts provided on a first side of a second vertical plane as a boundary and by controlling the plurality of the distance adjusting devices in parallel such that distances between the lifting equipment and all of the attachment parts provided on a second side of the second vertical plane as the boundary are respectively reduced or increased, the second vertical plane being parallel to the Y-axis, perpendicular to the horizontal plane, and including the center of gravity of the crane load, and

the control device adjusts:

an attitude of the crane load about the X-axis by controlling the distance adjusting devices such that the load applied to each of the at least four slings is maintained within a predetermined load range, the load being detected by the load detection devices; and

an attitude of the crane load about the Y-axis by controlling the distance adjusting devices such that the load applied to each of the at least four slings is maintained within a predetermined load range, the load being detected by the load detection devices.

4. The lifting device according to any one of the preceding claims, wherein a first end of the distance adjusting device is attached to the lifting beam and a second end of the distance adjusting device is attached to the sling, the distance adjusting device being configured to adjust a distance between the attachment part and the lifting equipment by pulling an attached portion to the sling and bending the sling.

5. A method of adjusting an attitude of a crane load by a lifting device provided with: a lifting beam linkable to a crane load; at least

four slings configured to link the lifting beam and a lifting equipment of a crane; attachment parts provided on the lifting beam, the at least four slings being respectively attached to the attachment parts; an inclined angle measuring device provided on at least one of the crane load and the lifting beam, the inclined angle measuring device being configured to measure an inclined angle relative to a horizontal plane; and distance adjusting devices provided only on (N-1) number of the slings among the at least four slings when number of the slings is N, the distance adjusting devices being configured to adjust distances between the lifting equipment and the attachment parts attached to the slings,

the attitude of the crane load being configured to be adjusted based on the inclined angle measured by the inclined angle measuring device, and

the inclined angle measuring device being configured to be capable of measuring the inclined angles about an X-axis and a Y-axis that are perpendicular to each other,

the method comprising:

a first attitude adjustment step of adjusting an attitude of the crane load about the X-axis to the predetermined attitude, based on the inclined angle about the X-axis, by holding distances between the lifting equipment and all of the attachment parts provided on a first side of a first vertical plane as a boundary and by operating a plurality of the distance adjusting devices in parallel such that distances between the lifting equipment and all of the attachment parts provided on a second side of the first vertical plane as the boundary are respectively reduced or increased, the first vertical plane being parallel to the X-axis, perpendicular to a horizontal plane, and including a center of gravity of the crane load; and

a second attitude adjustment step of adjusting an attitude of the crane load about the Y-axis to the predetermined attitude, based on the inclined angle about the Y-axis, by holding distances between the lifting equipment and all of the attachment parts provided on a first side of a

second vertical plane as a boundary and by operating the plurality of the distance adjusting devices in parallel such that distances between the lifting equipment and all of the attachment parts provided on a second side of the second vertical plane as the boundary are respectively reduced or increased, the second vertical plane being parallel to the Y-axis, perpendicular to the horizontal plane, and including the center of gravity of the crane load, wherein

a plurality of the attachment parts provided on the first side of the first vertical plane as the boundary include the attachment part attached to the sling that is not provided with the distance adjusting device, and

a plurality of the attachment parts provided on the first side of the second vertical plane as the boundary include the attachment part attached to the sling that is not provided with the distance adjusting device.

6. The attitude adjusting method for the crane load according to claim 5, wherein

in the first attitude adjustment step, the attitude of the crane load about the X-axis is adjusted by the distance adjusting devices such that the inclined angle about the Y-axis is maintained within the predetermined inclined angle range, and

in the second attitude adjustment step, the attitude of the crane load about the Y-axis is adjusted by the distance adjusting devices such that the inclined angle about the X-axis is maintained within the predetermined inclined angle range.