# CLAIMS

1. A method for manufacturing a glass substrate that includes an opening, comprising:

forming a line of an inner circumferential portion and a line of an outer circumferential portion that are irradiated with a laser beam along substantially concentric circles in a surface of a glass blank from which the glass substrate is obtained;

separating a portion on an inner side of the line of the outer circumferential portion of the glass blank and a portion on an outer side of the line of the outer circumferential portion from each other by heating the portion on the outer side of the line of the outer circumferential portion by a radiant heat to cause thermal expansion of the portion on the outer side of the line of the outer circumferential portion relative to the portion on the inner side of the line of the outer circumferential portion and form a gap in the line of the outer circumferential portion; and

separating a portion on an inner side of the line of the inner circumferential portion of the glass blank and a portion on an outer side of the line of the inner circumferential portion from each other by heating the portion on the outer side of the line of the inner circumferential portion by the radiant heat to cause relative thermal expansion of the portion on the outer side of the line of the inner circumferential portion and form a gap in the line of the inner circumferential portion.

2. The method for manufacturing a glass substrate according to claim 1, wherein heating the portion on the outer side of the line of the outer circumferential portion by the radiant heat or heating the portion on the outer side of the line of the inner circumferential portion by the radiant heat is performed in a non-contact manner between a heat sources of the radiant heat and the glass blank.

3. The method for manufacturing a glass substrate according to claim 2, wherein the heat sources are provided on both main surface sides of the glass blank.

4. The method for manufacturing a glass substrate according to any one of claims 1-3, wherein the irradiation of the laser beam is a processing of forming holes intermittently at discrete portions on the line of the inner circumferential portion and the outer circumferential portion.

5. The method for manufacturing a glass substrate according to claim 4, wherein cracks are formed so as to develop from each hole toward adjacent holes.

6. The method for manufacturing a glass substrate according to claim 4 or 5, wherein holes are through-holes.

7. The method for manufacturing a glass substrate according to any one of claims 1 to 6,

wherein the glass blank has a thickness not larger than 0.6 mm.

8. The method for manufacturing a glass substrate according to any one of claims 1 to 7, further comprising a step of grinding or polishing of the main surfaces of the glass substrate.

9. The method for manufacturing a glass substrate according to any one of claims 1 to 8, wherein the glass substrate that includes an opening is a glass substrate for magnetic disk.

~~2. A method for manufacturing a glass substrate comprising:~~

~~forming a defect on a line having a predetermined annular shape in a surface of a glass blank from which the glass substrate is obtained, by irradiating the line with a laser beam; and~~

~~separating an outer portion and an inner portion of the glass blank from each other by heating the outer portion more than the inner portion, the outer portion and the inner portion being respectively on an outer side and an inner side of the line of the glass blank in which the defect has been formed.~~

~~3. The method for manufacturing a glass substrate according to claim 2,~~

~~wherein the glass substrate has an annular shape including an opening,~~

~~in the forming of the defect, the defect is formed using the laser beam, taking the shape of an outer edge of the annular shape to be the annular shape, and~~

~~in the separating of the outer portion and the inner portion from each other, first heating processing is performed in which a first outer portion of the glass blank is heated more than a first inner portion of the glass blank is, the first outer portion and the first inner portion being respectively on an outer side and an inner side of the outer edge of the annular shape.~~

~~4. The method for manufacturing a glass substrate according to claim 3,~~

~~wherein in the separating of the outer portion and the inner portion from each other, the first outer portion and the first inner portion are separated from each other with a length of 0.1% to 5% of an outer diameter of the annular shape left as a margin for the annular shape of the glass substrate.~~

~~5. The method for manufacturing a glass substrate according to claim 3 or 4,~~

~~wherein in the forming of the defect, the defect is formed using the laser beam, taking the shape of an inner edge of the annular shape including the opening to be the predetermined shape, and~~

~~in the separating of the outer portion and the inner portion from each other, second heating processing is performed in which a second outer portion of the glass blank is heated more than a second inner portion of the glass blank is, the second outer portion and the second inner portion being respectively on an outer side and an inner side of the inner edge of the annular shape including the opening.~~

~~6. The method for manufacturing a glass substrate according to claim 5,~~

~~wherein the second heating processing is performed after the first heating processing when separating a portion that is formed into the glass substrate from the glass blank.~~

~~7. A method for manufacturing a glass substrate that includes an opening, comprising:~~

~~forming a defect on a line having a predetermined annular shape in a~~

surface of a glass blank from which the glass substrate is obtained, by irradiating the line with a laser beam; and

separating an outer portion and an inner portion of the glass blank from each other by heating the outer portion more than the inner portion, the outer portion and the inner portion being respectively on an outer side and an inner side of the line of the glass blank in which the defect has been formed, wherein the outer portion and the inner portion of the glass blank are separated from each other by simultaneously heating the outer portion from both main surface sides of the glass blank to heat the outer portion more than the inner portion, and the inner portion is removed to form the opening.

8. The method for manufacturing a glass substrate according to any one of claims 1 to 7,

wherein in the separating of the outer portion and the inner portion from each other, the outer portion and the inner portion are separated from each other by making the temperature of the outer portion higher than the inner temperature to cause thermal expansion of the outer portion relative to the inner portion and form a gap along the line.

9. The method for manufacturing a glass substrate according to any one of claims 1 to 8,

wherein irradiating the surface of the glass blank with the laser beam includes forming spot-like through-holes at a plurality of discrete points on the line using a pulsed laser beam, and thereafter emitting a laser beam that is different from the pulsed laser beam while continuously moving an irradiation position along the line so as to connect the discrete points on the line.

10. The method for manufacturing a glass substrate according to any one of claims 1 to 9,

wherein the heating includes heating both main surfaces of the glass blank with radiant heat from heat sources that are provided on both main surface sides of the glass blank.

11. The method for manufacturing a glass substrate according to any one of claims 1 to 10,

~~wherein a ratio of the area of a main surface of the glass blank to the area of a main surface of the glass substrate is 101% to 160%, and~~

~~in the separating of the outer portion and the inner portion from each other, the single glass substrate is taken out from the single glass blank.~~

~~12. The method for manufacturing a glass substrate according to any one of claims 1 to 11,~~

~~wherein the glass blank has a thickness not larger than 0.6 mm.~~

10~~3~~. A method for manufacturing a magnetic disk, further comprising a step of:

~~manufacturing a magnetic disk by~~ forming at least a magnetic layer on the main surfaces of the glass substrate for a magnetic disk obtained by the method manufacturing a glass substrate according to ~~any one of~~ claim~~s~~ 9~~1 to 12~~.