Citation List

Patent Document 1: JP-A 2010-110850

Patent Document 2: JP-A 2010-110851

Patent Document 3: JP-A 2010-110966

Patent Document 4: JP-A 2011-156655

Patent Document 5: JP-A 2011-156863

Patent Document 6: JP-A 2012-000708 (US 2011/0312255 A1)

DISCLOSURE OF INVENTION

Embodiments of the invention seek to provide a magnet block fastening jig for use in a method for cutoff machining a rare earth sintered magnet block having a substantial height into a multiplicity of pieces at a high accuracy, by using a plurality of thin cutoff abrasive blades having a reduced effective diameter, while controlling formation of a step between cutoff surfaces.

According to a first aspect of the present invention, there is provided a fastening jig for securing the a magnet block suitable for a method for multiple cutoff machining a rare earth sintered magnet block by using a multiple blade assembly comprising a plurality of cutoff abrasive blades coaxially mounted on a rotating shaft at axially spaced apart positions, rotating and feeding the cutoff abrasive blades to cutoff machine the magnet block into a multiplicity of pieces, the fastening jig comprising a first clamp on which the magnet block is rested, a second clamp disposed on the magnet block, and a press unit for pressing the first and second clamps to apply a pressing force to the magnet block from one or both of its upper and lower surfaces, wherein a portion of at least one clamp which is disposed adjacent to the magnet block is provided with a generally horizontal channel extending inward from a position corresponding to a work surface of the magnet block, to define a resilient cantilever, whereby the magnet block is held between the first and second clamps by the repulsion force created by vertical movement of the resilient cantilever.

Embodiments of the invention are directed to a method for multiple cutoff machining a rare earth sintered magnet block using a multiple blade assembly comprising a plurality of cutoff abrasive blades coaxially mounted on a rotating shaft at axially spaced apart positions, each blade comprising a core in the form of a thin disk and a peripheral cutting part on the outer periphery of the core. The cutoff abrasive blades are rotated and

fed to cutoff machine the magnet block into a multiplicity of pieces. The inventors have found that the object is achievable by setting the multiple blade assembly such that it is movable parallel to the plane of rotation of the blades, rotating and feeding the blades, starting the machining operation of the magnet block on one side to form cutting grooves in the magnet block, interrupting the machining operation before the magnet block is cut into pieces, moving the multiple blade assembly to the other side of the magnet block parallel to the plane of rotation of the blades, with the magnet block kept fixed, restarting the machining operation of the magnet block on the other side to form cutting grooves in the magnet block until the cutting grooves formed from the one side and the other side merge with each other, thereby cutting the magnet block into pieces. Then a rare earth sintered magnet block having a substantial height can be cutoff machined or sawn into a multiplicity of pieces at a high accuracy and productivity, by using the multiple blade assembly comprising a plurality of thin cutoff abrasive blades having a reduced effective diameter, and feeding the multiple

to opposite work surfaces of the magnet block so that the clamp contacts only at its pads with the opposing surface of the magnet block.

In a preferred embodiment, the portion of at least one clamp which is disposed adjacent to the magnet block is provided with rims at positions corresponding to opposite work surfaces of the magnet block, the rims being engaged with the magnet block for preventing the magnet block from separating apart.

In a further preferred embodiment, only the first clamp is provided with the resilient cantilever, and the surface of the second clamp which is disposed adjacent to the magnet block is flat so that the second clamp is in plane contact with the entire opposing surface of the magnet block.

ADVANTAGEOUS EFFECT OF INVENTION

Using a plurality of thin cutoff abrasive blades having a reduced effective diameter, a rare earth sintered magnet block having a substantial height can be sawn into a multiplicity of pieces at a high accuracy. Embodiments of the invention may also be effective for controlling formation of a step on cutoff surface.

BRIEF DESCRIPTION OF DRAWINGS

FIG. 1 is a perspective view illustrating one exemplary multiple blade assembly used in the invention.

FIGS. 2A to 2F are elevational views schematically illustrating one exemplary multiple cutoff machining method according to the invention, FIG. 2A showing the multiple blade assembly placed on one side of the magnet block, FIG. 2B showing the step of machining the magnet block on the one side, FIG. 2C showing the completion of machining of the magnet block on the one side, FIG. 2D showing the multiple blade assembly moved to the other side of the magnet block, FIG. 2E showing the step of machining the magnet block on the other side, and FIG. 2F showing the completion of machining of the magnet block on the other side.

FIGS. 3A to 3C illustrate one exemplary multiple blade assembly combined with a coolant feed nozzle, FIG. 3A being an elevational front view, FIG. 3B being an elevational side view, and FIG. 3C being a bottom view of the nozzle showing slits.

CLAIMS:

1. A fastening jig for securing a magnet block suitable for a method for multiple cutoff machining a rare earth sintered magnet block by using a multiple blade assembly comprising a plurality of cutoff abrasive blades coaxially mounted on a rotating shaft at axially spaced apart positions, rotating and feeding the cutoff abrasive blades to cutoff machine the magnet block into a multiplicity of pieces,

the fastening jig comprising a first clamp on which the magnet block is rested, a second clamp disposed on the magnet block, and a press unit for pressing the first and second clamps to apply a pressing force to the magnet block from one or both of its upper and lower surfaces, wherein

a portion of at least one clamp which is disposed adjacent to the magnet block is provided with a generally horizontal channel extending inward from a position corresponding to a work surface of the magnet block, to define a resilient cantilever, whereby the magnet block is held between the first and second clamps by the repulsion force created by vertical movement of the resilient cantilever.

2. The fastening jig of claim 1 wherein the portion of at least one clamp which is disposed adjacent to the magnet block is partially raised to form pads near positions corresponding to opposite work surfaces of the magnet block so that the clamp contacts only at its pads with the opposing surface of the magnet block.

3. The fastening jig of claim 1 or 2 wherein the portion of at least one clamp which is disposed adjacent to the magnet block is provided with rims at positions corresponding to opposite work surfaces of the magnet block, the rims being engaged with the magnet block for preventing the magnet block from separating apart.

4. The fastening jig of any one of claims 1 to 3 wherein only the first clamp is provided with the resilient cantilever, and the surface of the second clamp which is disposed adjacent to the magnet block is flat so that the second clamp is in plane contact with the entire opposing surface of the magnet block.