tilt settings for the two wafers are within about 0.1° of each other.

The present method has several attractive features, one of which is the simplicity of procedure and instrumentation. Any double-crystal diffractometer with a precise Θ range of 5°–10° can be used without the need for full-circle accuracy on either Θ or 2Θ. A second feature is the speed and economy with which secondary standards can be obtained. The data reported here were gathered on a manually-operated system at the rate of approximately one hour each, after relatively inexpensive modifications of a Blake double crystal instrument and using a novel procedure for the simultaneous alignment of both the standard and test crystals. It is estimated that an automated version of the present manual prototype will be able to perform individual measurements in about 15–20 minutes, and even faster if a series of data points on the same crystal are needed. These modifications expanded the capabilities of the instrument to other high resolution measurements. All other customary uses of the double diffractometer such as rocking curve analysis and spectrometry are also simplified with these modifications.

Obviously, many modifications and variations of the present invention are possible in light of the above teachings. It is therefore understood that within the scope of the appended claims the invention may be practiced otherwise than as specifically described.

What is claimed and desired to be secured by Letters Patent in the United States is:

1. A method of measuring the lattice parameter in an unknown single crystal by comparing said unknown single crystal's diffraction angle to a standard single crystal, on a double-crystal diffractometer, which method comprises the steps of:

mounting said unknown and standard crystals on a mounting block of the second stage of a double-crystal diffractometer such that a tilt axis of the crystal surface is in line with an x-ray beam and the azimuth axis of the second stage crystal mount;

rotating the mounting block until the normals of said crystals have equal vertical components;

tilting the crystals about the azimuth axis of the mounting block until the crystal normals lie in the horizontal plane in line with the x-ray beam, such that the same point on the crystal surface remains fixed in the x-ray beam;

sequentially measuring the angle of the sharpest diffraction peak from each crystal while moving the crystals laterally across the beam;

rotating the mounting block assembly by 180 degrees about the azimuth axis while maintaining the relative tilt between the two wafers, such that the same area of the crystal surface remains in the x-ray beam during the 180 degrees rotation;

sequentially measuring the angle of sharpest diffraction peak of both crystals after rotation which point of measurement is the same as the first sequential measurement; and

calculating the diffraction angle of the unknown crystal from the standard crystal diffraction angle by using the diffraction angles measured before and after rotation by 180 degrees, thereby removing any misorientation between the respective crystal normals in the horizontal plane.

2. The method of claim **1** wherein a Laue back-reflection technique is used to determine the orientation of the tilts of the two arbitrarily mounted crystals on the mounting block prior to placing the mounting block on the second stage of the double-crystal diffractometer such that the angle of rotation about the azimuth axis, to give equal vertical components to the respective crystal normals, is determined.

3. The method of claim **1** where the unknown crystal is mounted on the surface of the standard crystal.

4. A method of removing the tilt errors between two arbitrarily mounted crystal on a mounting block comprising the steps of:

mounting an unknown crystal and a standard crystal on a mounting block such that a tilt axis of the crystal surface is in line with an azimuth axis of the crystal mount;

rotating the mounting block until the normals of the crystals have equal vertical components; and

tilting the crystals about the azimuth axis of the mounting block until the crystal normals lie in the horizontal plane, such that the same point on the crystal surface remains fixed with respect to the azimuth axis of the crystal mount.

5. A device, mounted on a second stage of a double-crystal diffractometer, for removing tilt errors between two arbitrarily mounted crystals, thereby allowing measurement of the lattice parameter in an unknown single crystal by comparing its diffraction angle to a standard single crystal, on a double-crystal diffractometer, which device comprises:

a mounting block for mounting said unknown and standard single crystals;

means for positioning said mounting block of the second stage of a double-crystal diffractometer such that a tilt axis of the crystal surface is in line with an x-ray beam and the azimuth axis of the second stage crystal mount;

first rotating means for rotating the mounting block until the normals of said crystals have equal vertical components which first rotating means is behind the crystal mount;

means for tilting the crystals about the azimuth axis of the mounting block until the crystal normals lie in the horizontal plane in line with the x-ray beam, such that the same point on the crystal surface remains fixed in the x-ray beam; and

second rotating means for rotating the crystal mounting block assembly by 180 degrees about the azimuth axis while maintaining the relative tilt between the two wafers, such that the same area of the crystal surface remains in the x-ray beam during the 180 degrees rotation; and

means for translating the crystals laterally in the horizontal plane such that their respective diffraction peaks can be measured both prior to and after rotation by 180 degrees.

6. The device of claim **5** wherein the means for tilting the crystals about the azimuth axis comprises a goniometer.

7. A device for removing tilt errors between two arbitrarily mounted crystal on a mounting block comprising:

a mounting block for mounting an unknown crystal and a standard single crystal;

means for positioning said mounting block such that a tilt axis of the crystal surface is in line with the azimuth axis of the crystal mount;

first rotating means for rotating the mounting block until the normals of said crystals have equal verti-