WHAT IS CLAIMED IS:

1. An eddy current sensor for measuring a film thickness of a conductive film formed on a circular substrate, comprising:

a core made of a magnetic material including a base portion, and outer legs that are provided to the base portion at both end portions in a first direction of the base portion, respectively;

an excitation coil that is arranged on the core and forms an eddy current in the conductive film; and

a detection coil that is arranged on the core and detects the eddy current formed in the conductive film, wherein a length of the base portion in the first direction is not less than a length of the base portion in a second direction that is substantially orthogonal to the first direction,

wherein in an edge region of the substrate a length of the core in a direction orthogonal to a radial direction of the substrate is shorter than the length of the core in the radial direction of the substrate,

the outer legs extend from the both end portions in a third direction away from the both end portions,

the third direction is substantially orthogonal to the first direction, and

the second direction is substantially orthogonal to the third direction.

2. The eddy current sensor according to claim 1, wherein the core is an E-shaped core having a middle leg that is provided to the base portion at a center in the first direction of the base portion, the excitation coil is arranged on the middle leg, and the detection coil is arranged on the middle leg.

3. The eddy current sensor according to claim 2, wherein the core has side legs that are provided to the base portion at both end portions in the second direction of the base portion respectively, the side legs are connected to the outer legs, and the middle leg is surrounded by the side legs and the outer legs.

4. The eddy current sensor according to claim 1, wherein the core is a U-shaped core, the excitation coil is arranged on the outer legs, and the detection coil is arranged on the outer legs.

5. A polishing apparatus comprising:

a polishing table configured so that a polishing pad for polishing the substrate is attached to the polishing table;

a driver configured to rotationally drive the polishing table;

a holder configured to press the substrate against the polishing pad while holding the substrate;

the eddy current sensor according to any one of claims 1 to 4 that is arranged inside the polishing table and configured to detect the eddy current formed in the conductive film as the polishing table rotates; and

an endpoint detection controller configured to calculate film thickness data for the substrate from the detected eddy current.