CLAIMS:

1. A magnetron, comprising an inner magnetic pole and an outer magnetic pole with opposite polarities, wherein the outer magnetic pole are formed of three spiral lines, which are respectively a first outer magnetic pole spiral line, a second outer magnetic pole spiral line and a third outer magnetic pole spiral line, the second outer magnetic pole spiral line is the farthest spiral line from a spiral center, and an open gap is provided between the first outer magnetic pole spiral line and the third outer magnetic pole spiral line, the spiral lines of the inner magnetic pole are surrounded by the spiral lines of the outer magnetic pole, and a gap is provided between the inner magnetic pole and the outer magnetic pole; and the gap has different widths at different positions from a spiral center to a spiral periphery; and

the spiral lines of the outer magnetic pole and the spiral lines of the inner magnetic pole satisfy the following polar coordinate equation:

$$r = a \times \theta^{n} + b \times (\cos\theta)^{m} + c \times (\tan\theta)^{k} + d$$

where r and θ are polar coordinates; a, b, c, d are constants; $0 \leqslant n \leqslant 2$, $0 \leqslant m \leqslant 2$, $c = 0$ or $k = 0$.

2. The magnetron according to claim 1, wherein the width of the gap gradually decreases or gradually increases from the spiral center to the spiral periphery.

3. The magnetron according to claim 1, wherein the width of the gap gradually decreases from a spiral intermediate part to the spiral center, and the width of the gap gradually decreases from the spiral intermediate part to the spiral periphery as well; or

the width of the gap gradually increases from a spiral intermediate part to the spiral center, and the width of the gap gradually increases from the spiral intermediate part to the spiral periphery as well.

4. The magnetron according to claim 1, wherein the width of the gap ranges from 10mm to 60mm.

5. The magnetron according to any one of claims 1 to 4, wherein quantities of the spiral lines forming the inner magnetic pole are three.

6. The magnetron according to claim 5, wherein polar coordinate equations for the three spiral lines of the inner magnetic pole are, respectively:

$r = 4.875 \times \theta^{1.701} + 1.46 \times (\cos\theta)^{1.244} - 26.72$, where $1.5\pi \leqslant \theta \leqslant 2.6\pi$;