by the drive coils **1-2**, **1-3**, **1-4** and **1-5**. Therefore, drive signals **1-7** frequency is only 0.5 Hz. in the preferred embodiment of the invention. Even with such a low frequency drive signal **1-7**, the eddy current amplitude is typically twice the amplitude of the magnetic signal from the magnetic layer **1-15** of the the sample discl-**21**. The magnetic signal produced by the eddy currents in the substrate **1-19** are calibrated out of the magnetic signal **1-13** which also includes the magnetic signals from the magnetic layer **1-15** of the sample disc **1-21**. The calibration procedure uses a dummy disc identical to the sample disc **1-21** except that it does not have a magnetic film. The dummy disc is placed in the testing position and the resulting magnetic signal is measured. The calibration procedure subtracts the dummy disc magnetic signal from the magnetic signal **1-13** emanating from sample discs **1-21** with a magnetic layer **1-15**. This subtraction process also subtracts out the H term in last equation above. The dummy disc measurement is done both before and after the sample measurement and the average of the before and after signals are subtracted. This removes errors due to the linear drifting of the balance.

If the electrical resistivity of dummy disc's substrate differs from the the sample disc's substrate **1-19**, then the dummy disc's eddy current signal will differ substantially from the sample disc **1-21** substrate's eddy current signal. In this case, an additional procedure eliminates the eddy current's contributions to the magnetic signal **1-13** of the sample disc **1-21**. This procedure reduces the amplitude of the drive signal **1-7** so the peak value of the applied magnetic field, H, is well below the coercivity, H_c, of the magnet layer **1-15** of the sample disc **1-21**. The resulting eddy current signal imbalance between the sample and the dummy is measured. A computer use this measurement to obtain a correction term for the subsequent M-H hysteresis loop measurements.

The calibration of the M axis of the M-H hysteresis loop must include the effects of the fringing magnetic fields. These unwanted fringe fields are the magnetic fields that are not directly over the gap **1-11**, but are in the near vicinity of the gap. These fringe fields are smaller than the field directly over the gap, and therefore partially switch some extra magnetization of the sample film. This contributes a small error term that must be calibrated out. The size of this error term depends upon the coercivity H_c of the sample. If H_c is low, then the fringe field switches more of the sample thin film **1-15**. Conversely, if H_c is high, the fringe field switches less of the sample. This error term can be removed by calibrating with two or more standard discs having different H_c values. Then a calibrating factor that depends linearly upon H_c, can be determined and this factor used by the computer to plot each M, H data point on the hysteresis loop.

The successful implementation of the invention depends upon the correct choice of several design parameters. The dimensions of the air gaps **1-11**, **1-12** must be carefully chosen. The ratio of the length of each gap **1-11**, **1-12** and the cross-sectional area of the magnetic core **1-1** at the gaps **1-11**, **1-12** must be very nearly equal. The imbalance of the air gaps **1-11** and **1-12**, is described as the difference between the ratios for each gap divided by the ratio of one of the gaps:

$$\text{Imbalance} = \frac{\frac{\text{gap 1-11 length}}{\text{gap 1-11 area}} - \frac{\text{gap 1-12 length}}{\text{gap 1-12 area}}}{\frac{\text{gap 1-11 length}}{\text{gap 1-12 area}}} < 10^{-6},$$

This imbalance must be very small, roughly 1 part in 1 million or less. In order to meet these stringent requirements, a very stable clamping arrangement has been devised. The clamps have a fiberglass frame with fine adjustment screws. The screws are tightened or loosened to alter the length of the gaps **1-11** and **1-12**.

It is also important that the top and bottom parts are made of the same block of material so the temperature will tend to be the same top-to-bottom. If two separate magnetic cores **1-1** are used, one for top gas **1-11** and one for bottom gap **1-12**, there would be temperature differences between the two cores **1-1**. A temperature difference would introduce errors into the sense coil **1-19** readings.

The electronic balance circuity shown in FIG. **4** achieves further precision in the balance equation. The electronic balance circuitry adjusts the magnetic flux in the magnetic core **1-1** so that the total magnetic flux through the sense coil **1-9** is very nearly zero when a sample disc **1-21** is not being treated. The balance circuitry contains balance coils **4-1** and **4-3**. Balance coils **4-1**, **4-3** are wound in opposite directions so that the magnetic flux created by these coils has the same polarity in the center arm of the magnetic core **1-1** upon which the sense coil **1-9** is wound. The voltage of the sense coils **1-9** is measured without a sample disc **1-21** in place. If a voltage is detected, the signal through the balance coils **4-1** and **4-3** is adjusted by means of attenuator **4-4** to eliminate the voltage at the sense coil **1-9** outputs. Further precision in the balance is obtained by using the computer to subtract the remaining unbalance from the test results. Thus, the effect of the imbalance of air gaps **1-11** and **1-12** is corrected out, so that the imbalance is less than 1×10^{-6}.

I claim:

1. An apparatus for measuring the M-H magnetic hysteresis loop characteristics of a magnetic data storage disc under test including a substrate and a magnetic film layer mounted to the substrate, where M is a magnetization characteristic of the magnetic film and H is a magnetic field intensity characteristic of a magnetic field inducing the magnetization M of the magnetic film, the apparatus comprising:

a. a generator means,
   i. for generating and applying a magnetic field having a known intensity H to a magnetic disc to be characterized,
   ii. positioned close enough to the disc so that the generated magnetic field H induces a desired magnetization M in the disc, the magnetization including
      (1) a desired component induced in the magnetic film, and
      (2) an undesired component in the form of a plurality of eddy currents induced in the substrate, the eddy currents in turn inducing undesirable eddy magnetic fields that interefere with a correct determination of M;

b. a sensor means
   i. for determining the magnetization M of the magnetic film alone,