cause increasing increment values and differing bits to cause decreasing increment values. The increment can be decreased to zero for small errors, as only the proportional part of the servo is needed. If the signal is indeed digitized, the processing can then be carried out digitally.

FIG. **7** is a block diagram illustrating a portion of a Bell-Bloom magnetometer in accordance with an embodiment of the present invention. For purposes of clarity, the portions of the system needed only during the start up phase of operation are not included in this figure. The interconnections between components shown as heavy lines represent multiple signals or signals represented as digital numbers.

The signal from the photocell is often too small to be used directly. Therefore, an amplifier **700** may be used before further processing done. The amplifier **700** may also contain an automatic gain control (ACG). A Larmor Oscillator **702** is a voltage controlled or numerically controlled oscillator that produces a signal that the system will make equal to the Larmor frequency. In the improved Bell-Bloom magnetometer of the present invention, this circuit also creates a signal or group of signals at one half of the Larmor frequency. The multiple signals may represent different phases in the cycle. A frequency modulator **704** takes the Larmor frequency as input, as well as a modulating signal that produces a frequency modulated signal where the modulation is performed symmetrically about the Larmor frequency. A sampling circuit **706** may sample the amplified signal from amplifier **700** at various points in the cycle of the signal from the frequency modulator **704**. The values of these samples may be assumed to be held until the frequency modulator's output returns to that point in the cycle.

There are also four interconnect servo loops. These include a laser center servo **708**, a Larmor servo **710**, a laser temperature servo **712**, and a cell temperature servo **714**. The laser center servo **710** uses some of the signals from the sampling circuit **706**. For example, samples representing four points may be used. The points where the laser is only slightly detuned from the center of the line are of primary importance. If the process by which the laser's wavelength is controlled did not also affect the brightness of the laser, the difference between these points would indicate any misalignment between the center of the laser's modulation and the absorption line. Since the brightness is changed, the difference needs to be corrected by examining samples from points where the laser is displayed.

The Larmor servo **712** may cause the Larmor signal to track the ideal Larmor. A counter may be fitted with a circuit that causes repeated bits of the same value to cause increasing increment values and differing bits to cause decreasing increment values. The increment can be decreased to zero for small errors, as only the proportional part of the servo is needed.

A laser temperature servo **714** may be used to modify the laser temperature using data from the sampling circuit **706**. Likewise, the cell temperature server **716** may be used to modify the cell temperature using data from the sampling circuit **706**.

While the invention has been particularly shown and described with reference to specific embodiments thereof, it will be understood by those skilled in the art that changes in the form and details of the disclosed embodiments may be made without departing from the spirit or scope of the invention. For example, it will be understood that the various propensity-to-click metrics referred to herein are merely examples of metrics which may be employed with embodiments of the invention, and that embodiments are contemplated in which a wide variety of metrics may be employed in various combinations. In addition, although various advantages, aspects, and objects of the present invention have been discussed herein with reference to various embodiments, it will be understood that the scope of the invention should not be limited by reference to such advantages, aspects, and objects. Rather, the scope of the invention should be determined with reference to the appended claims.

What is claimed is:

1. A magnetometer comprising:

a light emitter;

an absorption cell containing a material that absorbs light from the light emitter at an increased amount when light from the light emitter has a wavelength equal to a center point of an absorption line; and

wherein the light emitter is configured to vary the wavelength of the light it emits at a frequency equal to one half of a Larmor frequency and vary the wavelength such that a center point of the variation is at the center point of the absorption line.

2. The magnetometer of claim **1**, wherein the light emitter is configured to vary the wavelength at a rate that is optimized to excite sub-lines within the absorption line.

3. The magnetometer of claim **1**, further comprising:

a detector configured to utilize measured light from extremes of the variation of the wavelength in order to correct for variation in light intensity.

4. The magnetometer of claim **1**, wherein the light emitter is configured to vary the wavelength at a rate that makes an absolute value of the magnetometer insensitive to minor mistunings of the light emitter.

5. The magnetometer of claim **1**, further comprising a temperature detecting component configured to utilize a vapor pressure within the absorption cell and an amount of light absorbed by the absorption cell to determine a temperature of the absorption cell.

6. The magnetometer of claim **5**, further comprising a servo system configured to utilize the temperature of the absorption cell to maintain the temperature of the absorption cell at approximately a specific temperature.

7. The magnetometer of claim **1**, further comprising a servo system configured to maintain a sweep rate of the light emitter centered at one half the Larmor frequency.

8. The magnetometer of claim **7**, wherein the servo system is configured to be insensitive, to an angle of a magnetic field in which the magnetometer is placed, by using an amplitude of even harmonics of a Larmor modulation frequency caused by modulating the rate of sweeping of the light to either side of the absorption line.

9. The magnetometer of claim **1**, further comprising a measurement component configured to obtain a measurement of an angle between a magnetic field and direction of the light by using an amplitude of even harmonics of a Larmor modulation frequency caused by modulating the rate of sweeping of the light to either side of the absorption line.

10. The magnetometer of claim **1**, wherein the light emitter is configured to vary the wavelength at a rate that makes an absolute value of the magnetometer insensitive to minor mistunings of the light emitter and the magnetometer further comprises a measurement component configured to obtain a measurement of an angle between a magnetic field and direction of the light by using an amplitude of even harmonics of a Larmor modulation frequency caused by modulating the rate of sweeping of the light to either side of the absorption line.

11. The magnetometer of claim **10**, wherein the light emitter is further configured to make frequency response less dependent on angle by using the amplitude of even harmonics.