fabricated into a sheet-shape by using the method of dry etching. In this process, the stack of magnetoresistive layers is dry etched as far as a lower portion thereof, that is, to the lower gap layer **2**. The free layer width Twf as the track width is formed in this process. Subsequently, a magnetic domain control underlayer **10**, a magnetic domain control film **11** and an electrode film **12** are formed continuously, and then the resist is peeled. Subsequently, an upper gap film **13** and an upper shield film **14** are formed. Among the forming steps described above, a method of forming the multi-layered thin film or forming the track width adopts a dry process, and the thin film is formed by a method usually referred to as sputtering, while the track width is formed by a method of ion milling. Further, when the stack of magnetic domain control layers **11** and the electrode film **12** are formed after forming the track width, they are formed by utilizing sputtered particles with stronger directionality by applying the ion beam sputtering method thereby optimizing the shape and the deposition of the magnetic domain control film **11**.

[**0017**] The track width of the magnetoresistive head manufactured in accordance with the manufacturing method has been narrowed in recent years, and a resist refining technique or a technique of narrowing the size of the free layer has been developed. As shown, for example, in the Patent Document 1, application of a technique for forming a resist shape by electron beam exposure, improvement in the angle (α) at the end of the free layer to 45° or more by considering the resist shape, or a consideration of decreasing the gap between the free layer and the magnetic domain control film has been taken in order to improve the magnetic domain controllability.

[**0018**] However, in the course of progress of high recording density in recent years, narrowing for the lateral size of the free layer is required and, it is found that when the size is reduced to 200 to 100 nm or less, there is a limit in the existent stack structure of magnetic domain control films and that improvement in the manufacturing method is still insufficient.

[**0019**] Output Lowering, Formation of Dead Area and Output Fluctuation

[**0020**] Generally, reading head output intensity is in a substantially linear relation with the track width thereof and, when the size of the track width is narrowed, output is lowered in accordance with the extent of narrowing. By the way, it is a well-known fact that the output lowers more than the lowering of the output caused by the narrowing of the track width when the track width is about 300 nm or less. This is because a dead area not generating magnetization rotation is formed at the end of the free layer by the intense bias magnetic field applied by the magnetic domain control film to form a portion not causing magnetization rotation and not contributing to the output. As a result of various experiments and simulations, the size of the dead area is as large as about 60 to 80 nm being converted as the track width. Accordingly, while the lowering of the output is about 20% at the track width of 300 nm, the lowering of the output is as much as 60% at the track width of 100 nm and the output can be obtained scarcely.

[**0021**] It has been well-known that the track width size of the dead area depends on the intensity of the bias magnetic field generated from the magnetic domain control film and the output is improved when the bias magnetic field is decreased. However, when the bias magnetic field is decreased, reproducibility of the output waveform becomes poor because of insufficient magnetic domain control for the free layer and fluctuation of the output waveforms is generated, as well as this results in phenomenon of generating irregular Barkhausen noise or irregular noise after operation of the writing head. When the noise of this type is generated, an error rate of reading of the magnetic recording information increases and the head can no longer be used.

[**0022**] In the prior art, it is probable that the bias magnetic field depends greatly on the shape of the magnetic domain control film at the end of the stack of magnetoresistive layers and the amount of residual magnetization (Brt: product of residual magnetic flux density Br and the magnetic domain control film thickness t). With the view point described above, to optimize the bias magnetic field for suppressing noise or fluctuation of the output waveforms, three methods are conducted for optimizing the bias magnetic field, i.e., making the angle at the end of the stack of magnetoresistive layers abrupt, controlling the Co alloy composition used as the magnetic domain control film to control the saturation magnetic flux density Bs of a Co alloy thin film, and controlling the thickness of the Co alloy thin film used as the magnetic domain control film, thereby controlling the amount of residual magnetization (Brt) to control the effective bias magnetic field applied to the free layer.

[**0023**] As a result of an experiment, it has been made apparent that an increase of the residual magnetic flux density of the magnetic domain control film and a decrease in the thickness of the magnetic domain control film at the end angle of the stack of magnetoresistive layers of 60° is effective in increasing the bias magnetic field applied to the free layer and decreasing the residual magnetization amount but it has found that the effect is limited. In the experiment described above, in a case of a free layer with 100 nm in track width, fluctuation of the output waveforms was generated and irregular Barkhausen noses were generated at the amount of residual magnetization (Brt) of the magnetic domain control film of about 25 Tnm or less. The track length of the dead area of the free layer in this case was 60 nm and the length of the dead area could not be decreased further. Accordingly, it has been found that the bias magnetic field cannot be optimized completely and there is a limit to the improvement of the head output characteristics by this system.

Problem of Shape

[**0024**] The cause includes a problem with the shape of the magnetic domain control film disposed at the end of the stack of magnetoresistive layers. **FIG. 4** is a schematic view showing the shapes of, and the positional relationship between the magnetic domain control film and each of the free layer, the pinned layer and the shield film, as well as the state of magnetization. **FIG. 4**(*c*) corresponds to **FIG. 3** for the existent structure and **FIGS. 1, 2** showing the structure of the present invention correspond to FIGS. **4**(*b*) and **4**(*a*), respectively.

[**0025**] The method of decreasing the amount of residual magnetization of the magnetic domain control film can include a method of reducing the thickness of the Co alloy thin film of the magnetic domain control film. **FIG. 4**(*c*)