(Again see FIG. 3*b* which illustrates these functions for a particular cross-sectional curve x_i).

The exponential component of function (1) provides a smooth transition to the $Z_{n(x)}$ function.

Parameter $C_{(x)}$ is very small in order to suppress the contribution of this component in the central portion of the curve. Typically, it will change from a value of 10^{-4} at x=0 to a value of about 10^{-10} at x=maximum.

Parameter $n_{(x)}$ is responsible for the smooth connection of the curve $Z_{m(x,y)}$ to the curve $Z_{n(x,y)}$ at points $-y_1$ and $+y_1$. This condition is fulfilled if the first derivative of the function $Z_{m(x,y)}$ equals the first derivative of the function $Z_{n(x,y)}$ at points $+y_1$ or $-y_1$. Consequently, the value for $n_{(x)}$ is found by solving the following equation:

$$\frac{dZ_{m(x,y)}}{dy} = \frac{dZ_{n(x,y)}}{dy} \text{ for } y = \pm y_1 \quad (2)$$

The peripheral curve $Z_{n(x,y)}$ is defined by the following function:

$$Z_{n(x,y)} = Z_{no(x)} + R_{p(x)} - \sqrt{R_{p(x)}^2 - y^2} \quad (3)$$

This function defines a circle with its vertex located on curves defined by the parametric function $Z_{no(x)}$ (See FIG. 3*c*).

The parametric function $Z_{no(x)}$ is given by the following conic expression:

$$Z_{no(x)} = \frac{1}{BL}\left(\sqrt{R_L{}^2 + B_{L(x)}^2} - R_L\right) \quad (4)$$

Constants B_L and R_L are chosen so as to provide the desired width for the reading portion and to minimize the astigmatism in the area adjacent to the distance portion.

Parameter $R_{p(x)}$ represents a modified distance between the point x_1y_1 on the curve and the line parallel to the x axis and intersecting the center of the distance portion C_d (See FIG. 3*b*). It is defined by the formula:

$$R_{p(x)} = R_{(x)}(1 - A_{(x)}) \quad (5)$$

where $R_{(x)}$ is the exact value of the above distance (FIG. 3*b*) and $A_{(x)}$ is a modifying factor which typically assumes the value of 0.2 at x=maximum and is 0 at x=minimum. This modifying component is needed to correct the distortion of horizontal and vertical lines in the temple side of the peripheral portion after rotation of the lens to accommodate for left or right eye, as will be explained further hereinafter.

By designing a lens in accordance with the parametric equations described above, it becomes possible to provide a lens in which astigmatism errors are eliminated in the lower part of the temporal peripheral zone while at the same time distortion of horizontal and vertical lines is substantially reduced. The design permits this to be done without it being necessary to aspherize the distance portion of the lens as is done in certain prior art designs. Also, it is not necessary to provide a concentration of very strong astigmatism in narrow zones as is the practice in other designs.

An especially important feature of the present invention is that the design allows distortion of horizontal and vertical lines to be corrected on the temple side of the peripheral zone after the lens has been rotated to accommodate the lens for the right or left eye. Specifically, FIG. **4** schematically illustrate progressive lenses **41** and **42** inserted in a pair of eyeglass frame fronts **43**. As can be seen by the schematic representation of the progressive corridor and reading portions of the lenses, both lenses are tilted inwardly as this is necessary because of the convergence of the eyeballs when viewing near objects. Typically, these lenses are rotated 8°–10° from the vertical.

In many prior art designs, although the lens may be corrected for distortion of horizontal and vertical lines in the peripheral zone for one central orientation, it loses the correction after being rotated. The present invention provides a unique geometry which allows the correction of distortion of horizontal and vertical lines to be retained below detectable levels at the temporal peripheral zone for both left and right rotation of the lens. This is illustrated in FIGS. **5***a* and **5***b* wherein a pair of lenses **51** and **52**, rotated to accommodate the left and right eye, are positioned on a grid pattern. Specifically, the lenses have a zero distance power and a two diopter add power. These Figures clearly show that distortion of horizontal and vertical lines is not really detectable in temporal peripheral zones of the lenses.

As a matter of information, outlines **53** and **54** in FIGS. **5***a* and **5***b* indicate the outline of eyeglass frames indicating the shape of the lenses after being edged for insertion into frames.

The progressive lens according to the present invention can be manufactured from either glass or plastic as is well-known in the art. Preferably, however, it is a plastic lens made from CR-39, the polymer conventionally used in the manufacture of plastic ophthalmic lenses. Such a lens can be cast in a mold defined by two mold members separated from one another by an appropriate gasket. One of the mold members will be provided with a progressive surface on its concave surface so as to transfer that progressive surface to the convex surface of the plastic lens cast thereagainst.

The progressive mold surface can also be made in a variety of ways known in the art. Preferably, it is formed by sagging a circular piece of glass against a block of refractory material or metal that has been provided with a progressive surface by machining. The refractory block can, of course, be used many times to make molds while the mold members can also be used a number of times to cast lenses.

While what has been described above constitutes the presently most preferred embodiment of the invention, it should be understood that various changes and modifications are possible. Accordingly, it should be understood that the invention should be limited only insofar as required by the scope of the following claims.

We claim:

1. A progressively variable focal power lens, said lens having a progressive power surface comprising a distance portion, a reading portion, a progressive corridor and peripheral portions, whereby at least a portion of said surface can be defined in parametric form with reference to a three-dimensional coordinate system in which the origin of said coordinate system is at the vertex of the lens surface, the z axis is perpendicular to said surface at the vertex, the x axis is vertical relative to said surface, and the y axis is horizontal relative to said surface, wherein each cross-section of said portion parallel to the yz plane is defined as a two-dimensional curve having a central portion defined by the paramet-