these bores is also connected to control means **31** which is designed so that fluid in gasket **24** can be exchanged with fluid in gaskets **27** and **28**. That is to say, the operation of pump P in control means **31** will extract fluid from gasket **24** and add a corresponding amount of fluid to gaskets **27** and **28**. By proper design of the sizes of the bores in the various conduits, pump P can be used for the purpose of varying the space between the peripheral edges of membranes **1** and **6**. This change in spacing is independent of the volume of fluid in enclosed volume **9A** between the membranes.

In order to decrease the spacing between the peripheral edges of the membranes, pump P is operated to withdraw auxiliary fluid from the bore in membrane **24** and to supply the withdrawn fluid to the bores of gaskets **27** and **28**. When the reverse is desired, fluid is withdrawn from gaskets **27** and **28** and added to the fluid in gasket **24**.

The smaller the spacing between the peripheral edges of the membranes, the larger is the pressure inside the enclosed volume. As a consequence, the surface curvature of the resilient membrane adjusts accordingly and is increased. When the spacing between the peripheral edges of the membranes is reduced, the pressure is reduced in the enclosed volume and the surface curvature of the resilient membrane is reduced. Thus, the focal length of the lens decreases when the spacing between the membranes is reduced, and the focal length increases when the spacing between the membranes is increased. The focal length can be changed beyond infinity so as to become negative.

In the arrangement shown in FIG. **5***a*, pressurizing of the fluid in the enclosed space is achieved by operation of control means **31**, i.e., by changing the spacing between the peripheral edges of the membranes. As a consequence, the viscosity of the refractive fluid trapped in enclosed space **9A** is not important because no pumping of this fluid is involved. Thus, a large number of conventional refractive fluids can be used in the lenses.

Another advantage of the arrangement shown in FIG. **5***a* is that the volume and viscosity of fluid required to be transferred in order to effect changes in the focal length are significantly smaller than would be the case were the refractive fluid pressurized in the conventional manner by a pump. Thus, the time required to effect a change in focus is shorter with the arrangement shown in FIG. **5***a* than in the conventional arrangement described previously. In addition, because the volume of auxiliary fluid is so small, a lower energy requirement is involved with the present invention.

Another advantage in the present invention is that the maximum thickness of the variable power lens according to the present invention is minimized over the whole range of focal length changes. The lens can be designed to have a small distance between the membranes, either near the periphery or near the center, at the extreme focal settings. As a consequence, the variable power lens of the present invention has a minimum-weight design.

Because the auxiliary fluid used with control means **31** is separate from the refractive fluid, a low viscosity auxiliary fluid can be used to facilitate operation. Furthermore, the total volume of fluid required to be transferred to effect a given change in focal length is very small compared with the volume changes that are required for pumping the refractive fluid. This permits a compact and light-weight design.

The embodiment shown in FIG. **5***b* is similar to the embodiment shown in FIG. **5***a* except that the frame shown in FIG. **5***b* has bulbous leg **25***a* which provides a fixed support that directly engages a peripheral edge of membrane **1**. The peripheral edge of the other membrane is gripped by annular gasket **28**. In the embodiment shown in FIG. **5***b*, the internal gasket **24** is the same as in the previous embodiment. By way of example, membranes **1** and **6** may have either an annular depression or an edge lip along their peripheral edges creating a space into which annular gasket **24** fits as shown in FIG. **5***c*. Such a design allows minimization of the overall thickness.

However, control means **31***a* is effective to control the exchange of fluid between the central bores in each of these two gaskets thereby controlling the spacing between the peripheral edges of the membranes.

Referring now to FIG. **6**, an automated embodiment of the invention is disclosed. In this embodiment, rangefinder **50**, which operates either optically or ultrasonically, provides a signal indicative of the distance of an object from the viewer. Converter **51**, responsive to the signals produced by range finder **50**, converts these signals into a pressure control signal applied to pressure regulator **52**. Responsive to the pressure control signals, regulator **52** controls the fluid pressure in lens **53** which is constructed in accordance with the previous embodiments. That is to say, pressure regulator **52** may be designed as shown in FIGS. **5***a* or **5***b* for the purpose of changing the spacing between the peripheral edges of the membranes in order to control the internal pressure in the enclosed volume between the membranes.

The advantages and improved results achieved by the method and apparatus of the present invention are apparent from the foregoing description of the preferred embodiment of the invention. Various changes and modifications may be made without departing from the spirit and scope of the invention as described in the claims that follow.

In a special case, a lens according to the present invention can be converted into a mirror having a variable focus by arranging for the flexible membrane to have a coating on either the inside surface or the outside surface. Alternatively, a flexible metallic membrane may be used; and in such case, a coating is not needed because the metal acts as a reflector.

I claim:

1. A variable power lens comprising:

(a) a pair of optical membranes at least one of which is flexible;

(b) a frame for clamping the periphery of one membrane to the periphery of the other so that an enclosed volume is created between the surfaces of the membranes;

(c) a refractive fluid filling said volume;

(d) means associated with said frame for applying forces and/or torques to the periphery of the membranes at selected locations therealong such that the pressure of the fluid in said enclosed volume is responsive to such forces and/or torques for displacing the surface of the flexible membrane in a substantially spherical manner.

2. A lens according to claim **1** wherein the pressure of said fluid, and thus the curvature of the membranes, is carried out without changing the volume of the refractive fluid by changing the spacing between the membranes along their periphery.