THE BALL DIAPHRAGM CAPILLARY-LEAK VARIOMETER

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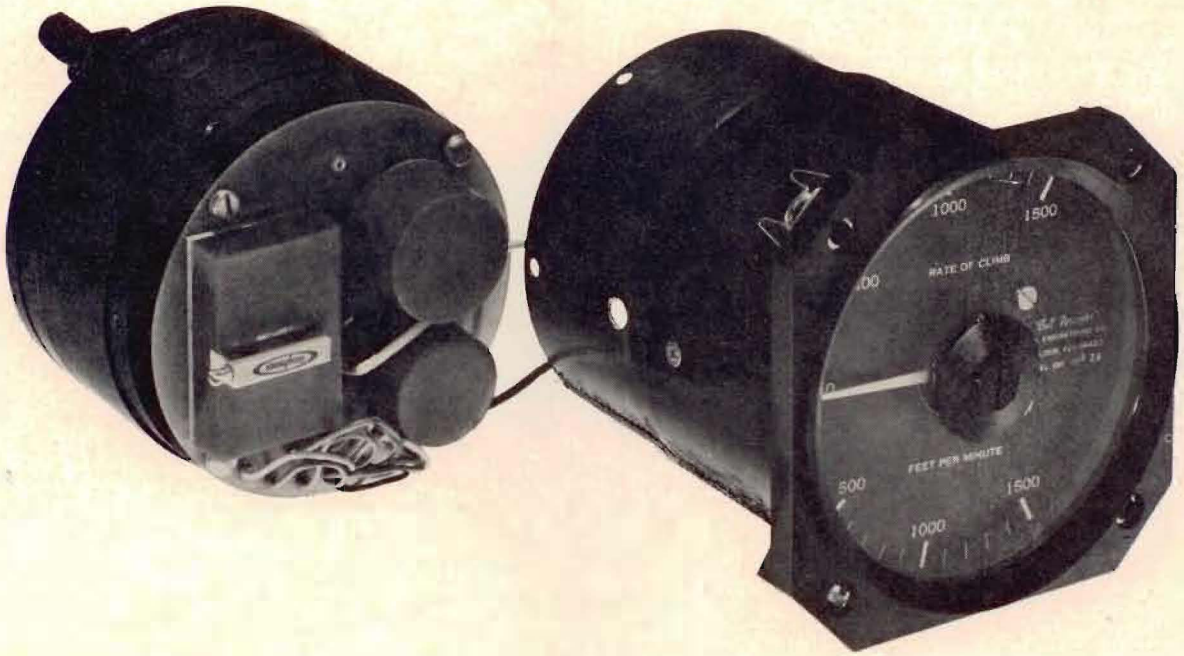

While making a couple of thermistor-type electric rate-of-climb indicators for our club gliders some years ago I got started on a tangent of trying to develop another type of electrical instrument. After considering a few methods such as the diaphragm-capacitance type, or taking the electrical derivative of an aneroid altitude transducer, I tried the diaphragm-variable-inductance system which seemed to work very well even for the first sample built (from a tin can). This development has taken a steady evolution for the last few years to the refined device which will be described.

Although the thermistor-type variometer works very well as proven by its wide acceptance, there are several difficulties in building one. It is seemingly impossible to achieve linear operation close to zero because of the characteristics of the air nozzles; the thermistors require matching or compensating; thermistors are extremely sensitive to ambient temperature change; sensitivity varies with altitude and temperature; and a separate air reservoir is usually required. On the positive side, the electric circuit can be very simple, and best of all, the response rate is quite fast because the air flow from the reservoir is almost instantaneous.

Before going further it is desirable to explain the principle of the variable - inductance diaphragm - type variometer as shown by the schematic diagram of Figure 1. Basically, there is a thin diaphragm with a magnetic iron center, and on each side of the diaphragm there is a U-shaped iron inductor core wound with many turns of wire. If the diaphragm is exactly centered, the inductance of each core is equal. One side of the diaphragm is connected to the atmosphere, and a small-diameter tube called a capillary is connected from atmosphere

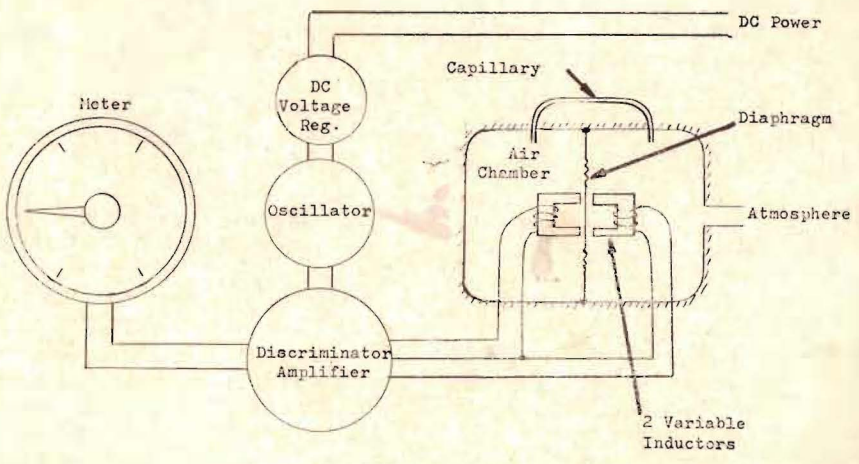

FIGURE 1: SCHEMATIC OF VARIOMETER