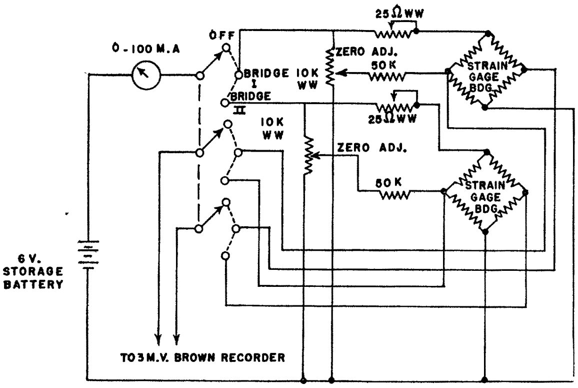

FIG. 2. Diagram of switch box for two strain gauge beams.

that the two gauges that will be in tension and the two that will be in compression are in opposite arms of the bridge. With the bridge connected in this manner maximum unbalance is obtained under strain. The use of four active gauges automatically provides temperature compensation. The leads from the gauges are extended with small flexible wires brought out to a terminal strip on the brass blocks, where connection is made through a four-wire cable to the switch box, the wiring diagram of which is shown in Fig. 2. This box provides for switching either of two beam outputs to the recorder. It also contains a 0–100-ma meter for reading the bridge currents, two balance or zero controls, and two current controls. The current for the bridges is supplied from a 6-v storage battery, normally set at 48 ma. This gives a sensitivity of 3 g full scale on the recorder, which has a voltage sensitivity of 3 mv full scale.

Fig. 1 shows the arrangement of the beams and the muscle in the ACH determination. The muscle is suspended in a 15-ml bath of eserinized amphibian Locke solution. One end is fastened to a hook in the bottom

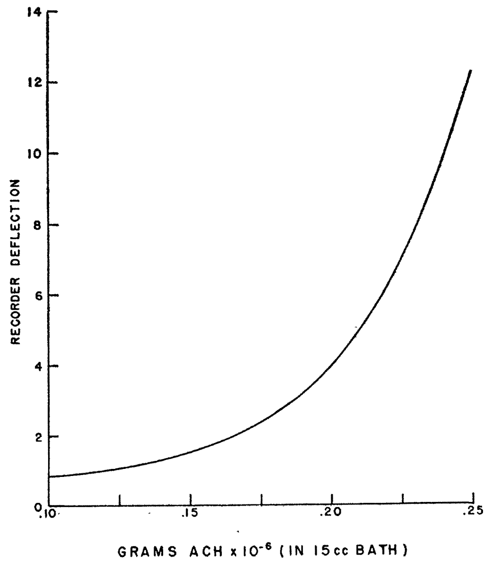

FIG. 3. Typical curve for *rectus abdominus* muscle.

of the bath, and the other by means of a silk thread to the end of the beam. Air is slowly bubbled through the bath at all times. When a solution is to be tested the Locke solution is drained by means of the pinch clamp and is replaced with the unknown. After the recorder reading has reached a maximum value the muscle is rinsed with the Locke solution and allowed to relax in the bath before the next determination is made. This requires 10–20 min. This relaxation may be speeded up by applying a small amount of tension to the muscle.

A typical curve is shown in Fig. 3. It should be noted that this method of determining ACH differs from the lever and smoked-drum method in that the latter keeps the muscle under a constant load (usually around 5 g) whereas with the cantilever beam the muscle is loaded by a spring. For purely analytical purposes, however, this difference does not influence the usefulness of the method described above.

Reference

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Barostat for High-Altitude Chamber

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A large low-pressure chamber (9′ × 22′, including lock) for investigations at high altitude has been in use at this laboratory since 1942. In order to maintain accurately a given pressure level in the chamber during a run, it was necessary to readjust the controls occasionally because of the fluctuation in the pressure caused by the exhaust from air-operated apparatus being used in the chamber, occasional operation of the small medical lock, and drift up and down, which was due to the difficulty of accurately balancing the vacuum pump pressure against the ventilation bleed. Practically all the early use of the chamber has been with human subjects; consequently the pressure levels at which the chamber was operated were manually controlled, and continuous attendance was necessary. During the past few years, however, the chamber has been used for animal work which required long exposures (up to 24 hr) at various altitudes. In order to obviate the need for continuous manual control during these tests, a type of barostat was devised to control automatically the pressure level after it had been set manually.

The barostat (Fig. 1) consists of a 30-gal cylindrical steel tank (*A*) located outside the altitude chamber and connected with 1-in. pipe through the chamber wall (*B*) to the stationary side of a bellows within the chamber. The bellows (*C*) consists of two 9-in. metal disks in parallel position, over which is sealed a section consisting of 3 convolutions (*D*) cut from a large rubber bellows (type used in waterless metabolism

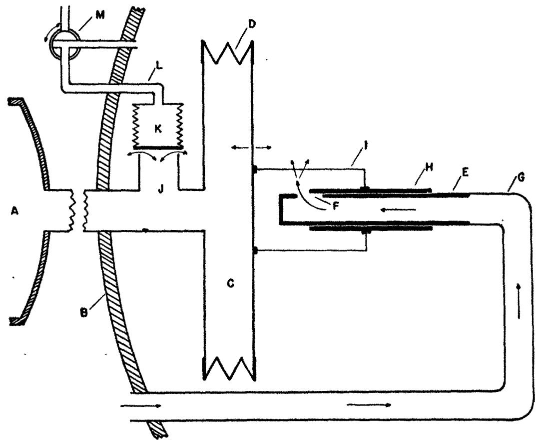

FIG. 1. Schematic drawing of barostat.

machines). In the relaxed position the metal disks are approximately 1½ in. apart. The pipe from the tank is sealed rigidly in a hole in the center of one disk of the bellows; the opposite disk is then free to move back and forth within the limitations of the rubber convolutions. Directly in the front and center of the movable disk of the bellows and at right angles to it is mounted a hard rubber or plastic tube (E) of approximately ¾ in. OD and ½ in. ID, with the end adjacent to the bellows occluded. A ½-in. hole (F) is drilled through the side of the plastic tube approximately 3/8 in. from the occluded end. The opposite end of the tube is sealed into a ½-in. pipe (G) which leads through the chamber wall to the outside. The OD of the plastic tube is machined so that it just turns or slides freely in the barrel of a 20-ml glass syringe. Both ends of the syringe barrel are cut off to produce a cylinder (H) approximately 3 in. long. This cylinder slides over the plastic tube and by means of a wire yoke (I) is flexibly linked to the movable disk of the bellows. The wires of the yoke are fastened to the glass cylinder by means of a plastic ring cemented to the cylinder. The wires are made of such a length as to have the glass cylinder cover half the side opening in the plastic tube when the bellows is in the relaxed position. A "T" (J) is placed in the 1-in. pipe between the bellows and the chamber wall and a small metal sylphon bellows (K) (approx 2″ diam × 1½″ length) is rigidly mounted directly over the open end of the "T." The closed, movable end of the sylphon bellows when it is in its relaxed position should be about ¼ in. from the open end of the "T." This end of the bellows is fitted with a rubber gasket which, when the bellows is expanded, forms a complete seal over the end of the "T." The stationary end of the sylphon bellows is connected by means of ¼-in. tubing (L) through the chamber wall to one leg of a three-way cock valve (M), or air switch, the second leg of which is connected back through the chamber wall and the third leg to the outside air.

Operation of the barostat is as follows. During the evacuation of the chamber the three-way valve is set, as indicated in Fig. 1, so that the pressure within the small bellows equalizes with that of the chamber and the bellows remains in the relaxed position. This allows equalization of the pressure in the chamber with that of the tank and the large bellows through the opening in the "T." The large bellows, remaining relaxed, maintains a static position of the glass cylinder over one half of the opening in the plastic tube, which allows a continuous flow of air into the chamber through this opening via the ½-in. line from the outside. When the desired altitude is reached and the chamber is "leveled off" as accurately as possible with the regular controls, the three-way valve is rotated clockwise a quarter turn so as to bring the small bellows into equilibrium with the outside or ground level pressure, which causes the bellows to expand and seal off the "T." The desired pressure in the tank and large bellows is thereby sealed off. A decrease in pressure within the chamber results in an expansion of the large bellows, which acts on the glass cylinder and causes it to move away, increasing the effective size of the tube opening. The resulting increase in air flow raises the pressure in the chamber. The reverse is true when for any reason the pressure in the chamber is increased. In this case a contraction of the bellows causes a closure of the tube opening, less air flow, and a consequent decrease in the chamber pressure. Before the pressure of the chamber is manually changed for any reason, the three-way valve must be in the position shown in Fig. 1. This is to prevent overexpansion or contraction of the bellows, since the opening in the plastic tube of the barostat can handle only a limited flow of air. This also places a limitation on the magnitude of the pressure changes it can correct. In our experience the ½-in. opening has been entirely satisfactory.

The dimensions given in this paper are for approximate guidance only, since they apply to the control of a specific apparatus. In general, the larger the opening at (F), the less sensitive will be the adjustment, and the larger the reservoir (A), the more sensitive will be the adjustment.

Determination of Radioactivity by Solution in a Liquid Scintillator

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The fact that certain solutions emit light when exposed to an externally placed radioactive source (*1, 2*) suggested that a simple and geometrically ideal counting system might be obtained by dissolving the material to be counted directly in such a liquid. This method would facilitate particularly the counting of soluble compounds labeled with a weak β-emitter, such as C^{14}. The homogeneous distribution of the radioactivity and the virtually complete absorption of the