Automatic Control for Evacuating Anaerobic Jars

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Displacement of oxygen by an inert gas is a method for attaining anaerobiosis which is preferred by many bacteriology laboratories because of the low cost of the process, and because of the small but real danger of explosion when the alternative, hydrogen with ignition, is used. Several cycles of evacuation and filling are necessary; usually, oxygen-free nitrogen is used with a final charge of a nitrogen-carbon dioxide mixture. Such a system has been used for many years in the diagnostic laboratory of the Boston City Hospital with excellent results, including the growth of fastidious organisms such as Bacteroides. As currently practiced, however, the procedure is time-consuming and tedious, and there is a danger of explosion from overinflation unless the system is constantly attended. It takes approximately 9 min to evacuate and fill a standard Brewer jar (BBL) six times, 20 min to do the same for a large desicator-type jar, and 40 min for the De Laval milk tank that is recommended by R. W. Schaedler et al. (J. Exptl. Med. 122:59, 1965).

Study of anaerobic cultures in this laboratory has led to the development of a control (Fig. 1) which automatically evacuates the unattended anaerobic container six times and refills it with any desired gas for five cycles. A different gas mixture, if required, may be supplied for the sixth and last charge, after which the system shuts off at 10 inches of Hg vacuum as recommended by Schaedler et al. Evacuation begins as the control is turned on. Adjustable mercury pressure switches alternate operate a vacuum pump and regulate gas flow through solenoid valves attached to standard gas regulators (Fig. 2). One of six neon lights indicates the filling cycle. If the filling process on a previous run has been prematurely interrupted, the proper starting cycle may be obtained by flicking the mode selector on and off during the filling phase of the cycle. Overfilling in cases of control failure is prevented by a low-pressure safety valve. A "Manual" mode and separate switches permit independent operation of tank valves and vacuum pump.

Components for construction of the control are readily available from commercial sources. Total retail cost of the parts was $150, with a construction time of about 4 hr. The chassis layout and the circuit diagram are shown in Fig. 3 and 4, respectively, and a complete parts list is given below.

Parts List

Chassis (3 × 14 × 10 inches) BUD AC-414
Bottom plate (14 × 10 inches) BUD BP-514
Merkoid control, DA-32-156, range 2
Merkoid control, DA-32-2, range 2
Stepping switches (2), P & B SA-IN-12A
SPDT relay (2), P & B type W88, no. AX4, 110VAC
3PDT switch, A, H & H 82614
SPST switch (3), A, H & H 82600
Neon pilot light, Omniglow 1010A1
Indicator lights (6), Tineon 36N1313-6
Fig. 3. Construction and assembly diagram.

Fig. 4. Circuit diagram.
Fuse, 32V, 15A, Fusetron MDL15
Fuse holder, Buss HKP341001A with \( \frac{1}{16} \)-inch locking key
Power cord, 9 ft. 18 Ga. 3-conductor, Alpha 619
2-Conductor sockets (2), Amphenol 61-F
3-Conductor grounded socket, Amphenol 160-10
Cable connector, \( \frac{1}{2} \) inch, Sears 34H5400
Bracket (2 \( \times \) 2 inches), Sears 9H72808
Brass elbow, \( \frac{3}{4} \) inch NPT
Brass tee, \( \frac{3}{4} \) inch NPT
Tubing couplers (3), \( \frac{3}{4} \) inch inside, \( \frac{1}{4} \) inch outside
Copper tubing (1 ft), \( \frac{3}{4} \)-inch inner diameter, \( \frac{5}{8} \)-inch outer diameter
Solenoid valves (2), Airmatic B 24187-25G, N.C.

2-way with 115VAC type D coil, Teflon seats, vacuum service, \( \frac{5}{8} \)-inch NPT ports
Rubber 2-conductor plugs (2), Sears 34G5636
Barbed fittings (2), Imperial Eastman KA04-04MB, \( \frac{3}{8} \)-inch Male NPT
Low-pressure safety valve, Consolidated type no. 1471 Manning, Maxwell and Moore, set at \( \frac{3}{4} \) inch psi
Miscellaneous nuts, bolts, and washers

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