Franklin G. Tingley, late Chief of the Marine Division of the United States Weather Bureau, therefore be it

Resolved, That the American Geophysical Union record its profound regrets over this loss not only to its own personnel but also to the world of science in general, and especially to oceanography and meteorology, and be it further

Resolved, That a copy of this resolution be sent to Mr. Tingley's family.

The joint committee entrusted with the work involved in the resolution on international cooperation in the study of tidal waves consists of H. F. Reid, *Chairman,* Perry Byerly, N. H. Heck, and H. A. Marmer.

J. A. Fleming was reelected general secretary of the union to June 30, 1934.

The scientific session following the business session was devoted to a symposium on time-signals sponsored by the sections of Geodesy and Seismology. This symposium included the following papers and discussion:

(a) United States Naval Observatory time-service, by J. F. Hellweg; the Chairman expressed the thanks of the meeting to Captain Hellweg for his paper and his expressed desire to do everything possible in meeting the needs for more frequent time-signals.

(b) Time-signals for electrical and physical measurements, by Frank Wenner; discussed by Messrs. Bowie and Heyl.

(c) Time-signal needs for geodetic work, by Edwin J. Brown; discussed by Messrs. Bowie, Hubbert, Hellweg, and Brown.

(d) H. E. McComb, Secretary of the Section of Seismology, then read short communications from Messrs. James B. Macelwane (expressing regret that because of illness he could not prepare the paper "Time-signal needs of the seismologist"), H. O. Wood (two), and B. Gutenberg, all emphasizing the need of broadcasting time-signals at more frequent intervals and the necessity of carefully controlling wave-lengths to prevent variation from day to day; Messrs. Heck and Hellweg made detailed comments on these communications which were further discussed by Messrs. Brown, Sollenberger, and Reid.

(e) Establishment of world-time, by F. W. Lee (read by Frank Wenner); discussed by William Bowie.

(f) The service available from the standard-frequency transmitters of the Bureau of Standards, by J. H. Dellinger.

(g) The accuracy of the primary-frequency standard of the Bureau of Standards, by C. G. McIlwraith.

(h) Informal communications—Upon invitation of the Chairman, informal communications with particular reference to the papers presented in the symposium were given by Messrs. C. W. Horn of the National Broadcasting Company and H. A. Affel and Warren A. Marrison of the American Telephone and Telegraph Company and Bell Telephone Laboratories.

The marked success of the meetings of the sections and of the union hinged largely upon the excellence of the program developed and the arrangements made by the Committee on Meetings, consisting of Messrs. Frank Wenner, *Chairman,* H. A. Marmer and F. W. Sohon.

JNO. A. FLEMING,
General Secretary

SCIENTIFIC APPARATUS AND LABORATORY METHODS

A SIMPLE AUTOMATIC PRESSURE REGULATOR FOR FILTRATION

IN biology especially definitely controlled pressures on filters are very desirable in as much as the nature of the filtrate is determined not only by the kind of filter used but also by the pressure on the filter. In many instances biologists have neglected to state the pressure at which the filter was operated. The pressure may be regulated to some extent by the pump itself or by a hand-operated air leak. By neither of these means is a pressure obtained which is constant for any length of time. To improve the situation a simple pressure regulator has been devised by means of which a filter may be operated at any pressure for any length of time.

The whole apparatus is so simple that it can be made by any one whose ability at glass blowing does not much exceed the making of a T-tube. Fig. 1 shows a drawing of the apparatus. A 10 cc or 20 cc syringe (a partially broken one may be used) is cut off at one or both ends. The plunger is also cut off. The longer the plunger is, however, the less oil will leak past it at high pressure. A glass tube *b* is fitted with a side arm and a guide as shown in Fig. 1. The guide is just a piece of heavy walled glass tubing cemented in place in tube *b*. Paraffin makes a satisfactory cement. Tube *b* is also provided with a slight flare at the top. Tube *a* may be either a solid or a hollow glass rod, preferably of such diameter that it fits snugly into the guide, but moves freely. If the rod is hollow, holes may be drilled above and below the guide to insure rapid equalization of the pressure throughout the system. If tube *a* fits loosely in the guide, no such holes are necessary. If tube *a* is solid, a groove may be cut along one side. The tube *a* is enlarged as shown in the illustration, and it is ground into tube *b* as a stopper is ground into a bottle. Over the ground end of tube *a* is fitted a piece of thin, soft rubber tubing. A very effective air valve is thus formed. To keep the valve closed a spring is placed

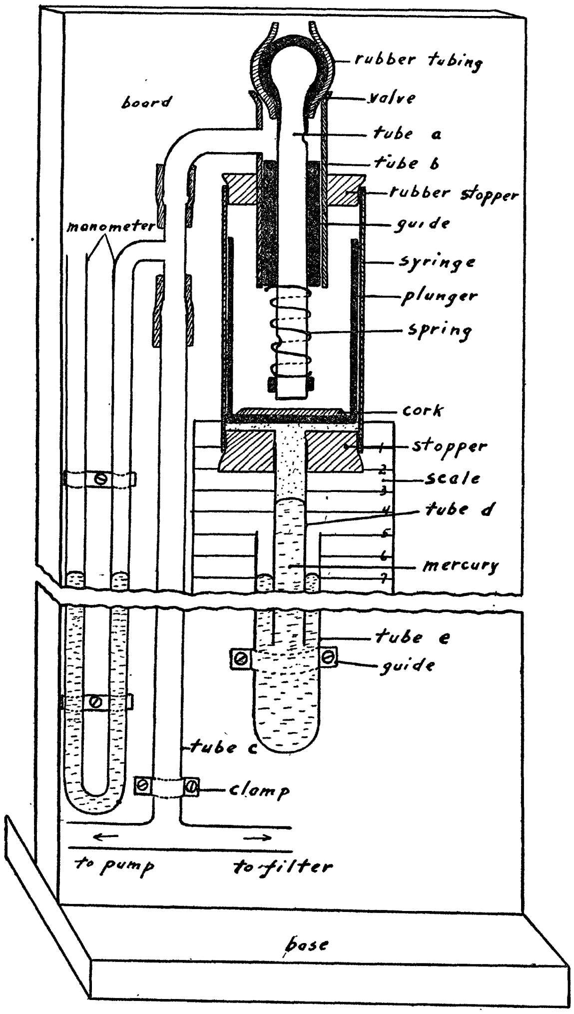

FIG. 1

over the lower end of tube a and held in place by a piece of rubber tubing, or any other convenient means. Into the lower end of the syringe is fitted a stopper with a glass tube d. This stopper should preferably be of some other material than rubber for the reason that oil will gradually cause the disintegration of rubber. A tight fitting cork stopper will do. Tube d should be 40 to 50 cm long depending upon the maximum filter pressure desired. An outer tube e is placed over tube d. Tube e should be about the same length as tube d. Tube c has on the end a T-tube one arm of which connects with the pump and the other arm with the filter. The apparatus is most conveniently mounted on a board about 10 cm wide and 80 cm to 100 cm tall. This board may be fitted with a base or screwed to a tall ring stand. The syringe and attachments may be clamped firmly to the board but tube e must be movable. It is best to have tube e in a guide, and also a clamp to hold it in any desired position. An open mercury manometer should also be connected with the apparatus. This may be conveniently done as shown in the illustration.

When the apparatus is all made tube e is partially filled with mercury and a few cubic centimeters of oil is poured on top of the mercury which has risen in tube d. The quantity of oil should be sufficient to keep the level of the mercury in tube d always visible and below the stopper in the syringe. Tube d is now lowered into tube e until the oil is visible above the stopper. The syringe, with the plunger protruding slightly from the lower end, can now be fitted over the stopper on tube d so that little if any air is trapped inside the syringe between the plunger and the stopper. The top part may now be put in place and the apparatus is ready for use.

The principle upon which the regulator works is similar to that of a hydraulic press. As the pressure falls in the syringe the plunger is forced upwards and tube a is forced downwards. The forces on these two are proportional to the cross sectional areas of the plunger and of the valve. If the cross sectional area of the plunger is twice that of the valve the upward force on the plunger will be twice the downward force on tube a. If the mercury level in tube d is above that in tube e there will be a downward pull on the plunger proportional to this difference of levels. At equilibrium the downward force on tube a by the outer air and the spring is equal and opposite to the upward force on the plunger by the outer air minus the weight of the column of mercury between the levels in tubes d and e. When the upward force on the plunger becomes greater than the downward force on tube a, tube a is forced up and the valve is opened. Equilibrium is thus maintained by the opening and closing of the valve. It is obvious that the greater the difference in mercury levels in tubes d and e the lower the pressure in the syringe must be to attain equilibrium. It may also be seen that the difference in mercury levels in tubes d and e is a linear function of the pressure in the syringe. By moving tube e up or down the equilibrium pressure in the syringe may be made equal to any desired pressure. Behind tube e may be placed a scale which measures the difference of the mercury levels in tubes d and e but which is graduated to read the pressure in the syringe directly in centimeters of mercury. To make the scale the apparatus is first connected to an open mercury manometer as shown in Fig. 1. Place tube d at a certain level. When equilibrium is attained read the manometer and also the difference of the mercury levels in tubes d and e. Repeat by moving tube e to different levels. Plot the results. The points should fall on a straight line. If the points are not on a straight line there is some leak or the pump is incapable of producing the desired pressure. One such curve is shown in Fig. 2. The point at

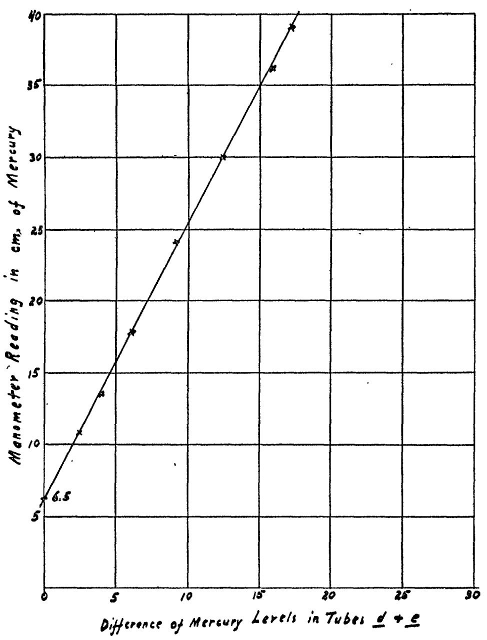

FIG. 2

which the curve crosses the ordinate represents the pressure to operate the spring. The stiffer the spring the greater this pressure will be and *vice versa*. The slope of the curve is equal to the ratio of the difference in levels of the mercury in the open manometer and in tubes *d* and *e*. In Fig. 2 it may be seen that if the difference of the mercury levels in tubes *d* and *e* is changed .55 cm that in the manometer is changed 1 cm. Therefore, if a scale is constructed with divisions equal to the slope of the curve (in this case .55 cm) but marked 1, 2, 3, etc. cm the scale will read the pressure in the system directly in centimeters of mercury. The scale is fastened behind tube *e* so that the level of the mercury in tube *d* (at equilibrium pressure in the syringe) is opposite to the pressure reading equal to that at which the curve crosses the ordinate axis, in this case 6.5 cm.

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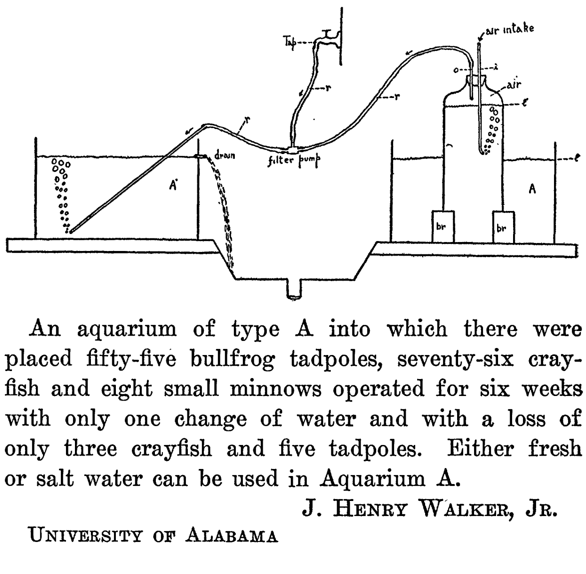
INEXPENSIVE AERATED AQUARIA

FOR several years the writer has been using an economical method of aerating aquaria suitable for high schools and institutions which can not afford the more expensive pressure systems used in the larger research laboratories.

The system of two aquaria (A and A′), as set up in the text figure, can be aerated efficiently at a low cost. The apparatus includes two aquaria, one bell jar (open top high form), one suction filter-pump, three pieces of glass tubing, three sections of rubber hose, one two-hole rubber stopper, and two half bricks.

It is necessary in aquarium A to place the bell jar on two pieces of brick in order to facilitate circulation of water currents. The glass tube (i) can be adjusted so that air will bubble continuously into the jar. In starting the apparatus it is necessary to have the lower end of tube (i) below the water surface (1). When the water level (1′) within the jar almost reaches the lower end of the tube (o), the tube (i) should be raised above the water level (1). The suction from the outlet (o) creates a partial vacuum in the top of the jar. This causes the water in the bell jar to approximate a level which will tend to equalize the atmospheric pressure on the water inside and outside the jar. When these two pressures are equalized the water in the jar maintains a constant level and air will bubble intermittently in the water. This causes aeration and circulation of water sufficient for the whole aquarium.

The second aquarium A′ can be used in cities where the water is not acid nor chlorinated, since the water passing into aquarium A′ is tap water. This second system was devised and used by one of the Hertwig brothers in his German laboratory.



An aquarium of type A into which there were placed fifty-five bullfrog tadpoles, seventy-six crayfish and eight small minnows operated for six weeks with only one change of water and with a loss of only three crayfish and five tadpoles. Either fresh or salt water can be used in Aquarium A.

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DIFFERENTIAL FILTRATION AS A MEANS OF ISOLATING BACTERIUM GRANULOSIS

IT is often difficult to separate very small slowly growing from larger more rapidly growing bacteria. This is especially true in the attempts to obtain *Bacterium granulosis* in a pure growth from cultures of conjunctival suspensions.

Bacterium granulosis usually requires four or five days for a growth sufficient for ordinary transfer. By this time, contaminating organisms such as staphylococci and diphtheroids have been multiplying rapidly, making it difficult, and frequently impossible,