copied from other authors; acknowledgment is made for two of them.

Case 3. An article of not less than thirty pages, with not less than ten illustrations; four of these are copied from other authors; acknowledgment of source is given for one illustration.

Case 4. An article of not less than twenty pages, with not less than ten figures; at least five of these are copied (one from a deceased author); source is stated for one, not stated for three; one of these figures is copyrighted by another publisher.

Case 5. A specimen was sent by a collector to a certain specialist for determination. The determination was made and a detailed drawing of it was prepared, involving certainly many hours of intensive work. The collector asked to borrow the drawing and the specialist was delighted to lend it to him. In a few weeks this drawing was published by the collector in a copyrighted journal with no reference as to its source.

Case 6. The prize case for "absent-mindedness" is an article of not less than fifty pages, with not less than twenty-five illustrations, all given as "original." Some of these figures bear a remarkable resemblance to old friends, but there is something unnatural about them. The artist explained this interesting puzzle. He said (in effect): When Dr. X— wants an illustration, and finds one to suit him, I photograph it, then draw the negative [reversed] view; for instance, a left view now shows as a right view, and *vice versa;* of course the illustrations thus become original drawings.

Many other cases might be cited, but the foregoing are sufficient to remind us all that possibly none of us is entirely free from absent-mindedness. A story is making the rounds of Washington that a man of non-scientific training heard of "professional ethics" and expressed surprise when he learned that this was not some sort of a skin disease. Is it possible he had in mind the condition known as pachydermia?

C. W. STILES

U. S. PUBLIC HEALTH SERVICE

SCIENTIFIC APPARATUS AND LABORATORY METHODS

A MODIFIED FORM OF NON-ABSORBING VALVE FOR POROUS-CUP ATMOMETERS

As was first pointed out by Livingston,[1] the porous-porcelain atmometer must be provided with an arrangement to prevent water absorption through the porous evaporating surface in periods of rain, fog or dew formation. This necessitates the presence of a valve in the tube that connects the porous cup with the water reservoir below, the valve being so constructed as to allow movement of water upward while it practically prevents downward flow. Livingston's original mercury valve[1, 2] has been modified in various ways, and several forms of it are now in use.[3] Another form of valve is that of Livingston and Thone,[4] which is now generally used.

In all these valves excepting the one last mentioned, the downward hydrostatic pressure of the water column in the supply tube is balanced by a mercury column of equivalent hydrostatic pressure acting in the opposite direction when free water is in contact with the outside of the porous cup above, as in times of rain. Although differing in detail these all consist essentially of a U-tube containing mercury inserted in the water-supply line from reservoir to cup. When water is moving upward it forces the mercury into one arm of the U-tube and then passes around it. When absorption through the atmometer wall begins mercury rises in the other arm until the mercury column in that arm balances the downward pressure of the water, when absorption and backward flow are halted. With each closure of this type of valve a small amount of water enters the reservoir. If a number of valve reversals occur in a period of operation (as when periods of absorption and evaporation follow each other on a day of frequent showers) the error thus introduced may be considerable,[5] but its magnitude is so small as to be practically negligible in most instances. The absorption error for each reversal of a value of this type is, of course, a volume of water equal to the volume of mercury held in the second arm of the tube when the valve is closed, and the bore of the tube used for this arm should therefore be as small as is practicable.

The Livingston-Thone valve consists of two porous plugs a centimeter or two apart in the vertical supply tube, with a small mass of mercury enclosed between them and resting on the lower plug. As water moves upward it passes around the mercury, the column of which is only a few millimeters high, but downward flow is prevented because the mercury mass acts like an ordinary poppet valve, seating itself on the lower

[1] B. E. Livingston, "A Rain-correcting Atmometer for Ecological Instrumentation," *Plant World,* 13: 79–82, 1910.

[2] B. E. Livingston, "Atmometry and the Porous Cup Atmometer," *Plant World,* 18: 21–30, 51–74, 95–111, 143–149, 1915.

[3] Frank Thone, "Rainproofing Valves for Atmometers: A Résumé," *Ecology,* 5: 408–414, 1924.

[4] B. E. Livingston and Frank Thone, "A Simplified Non-absorbing Mounting for Porous Porcelain Atmometers," SCIENCE, 52: 85–87, 1920.

[5] E. M. Harvey, "The Action of the Rain-correcting Atmometer," *Plant World,* 16: 89–93, 1913.

plug, into the pores of which mercury does not enter to any considerable extent with the low hydrostatic pressure involved. The plugs are now commonly made of sheep's-wool yarn, and the absorption error of a valve of this type, when well made, is much smaller than the corresponding error in a valve of the U-tube type. However, this type of valve requires some attention from time to time, especially because the pores in the plugs are likely to become closed by algal growth or bacterial slime, which may accumulate rapidly at summer temperatures. When the upper plug becomes partially sealed the operation of the instrument may be prevented by the accumulation of gas between the two plugs. When the lower plug is too loose mercury may escape downward.

In the extensive evaporation survey now being carried on in Ohio, atmometers equipped with valves of the plug type required frequent inspection by an expert, and the valve described below has been used throughout the past season. It is of the U-tube type and is much like the valve used in the Shive mounting,[6] but is constructed to pass through the opening of an ordinary thirty-two-ounce bottle with small mouth.

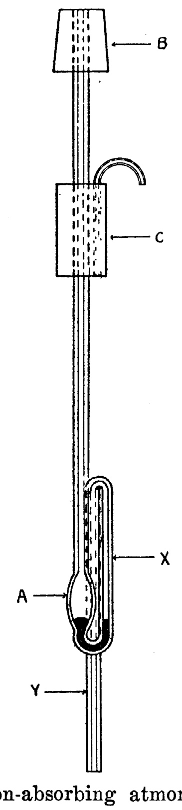

FIG. 1. Non-absorbing atmometer valve.

The accompanying diagram shows an atmometer mounting equipped with the new device. The rubber stopper B carries the atmometer sphere, and the cylindrical cork stopper C fits tightly in the bottle mouth. The cork carries a bent copper tube by which air is allowed to enter the bottle without danger of water entrance in rainy periods. The valve itself is continuous with the supply tube, the whole being made of glass barometer tubing having an outside diameter of 6 mm and a bore of about 1.5 mm. A piece of tubing about 41 cm long is used for each mounting. The valve consists essentially of a narrow loop made by two sharp bends, each of 180°, with a bulb A at the lower end of the long portion that leads directly to the atmometer sphere above. The first ascending part X is about 7 cm long, and the descending part Y is long enough so that the whole mounting is about 30 or 31 cm long. The bulb A has an internal diameter of at least 5 mm and a total length of about 2 or 2.5 cm. The capacity of the bulb is about 1 cc. The X and Y portions must be very close to the bulb, in order that the valve may pass through the 18-mm mouth of the bottle reservoir. The bend below the bulb should also be as close to the latter as possible so that the absorption error inherent in valves of this type may be small. The error in this valve is about 0.1 cc.

When evaporation is going on and water is ascending through the valve, the mercury (indicated as black in the diagram) all lies in the bulb A but does not fill it, and water flows upward around the mercury. As soon as absorption exceeds evaporation some of the mercury in the bulb passes around into the portion X, which has a small bore, until the hydrostatic pressure that produces absorption is balanced by the narrow mercury column extending above the level of the mercury meniscus in the bulb. It is seen that the parts A and X constitute the essential U-tube mentioned above.

To install this mounting the bulb is first filled about one third full of mercury. Then a piece of flexible rubber tubing, about 10 cm long and supplied with an open pinch cock, is attached to the lower end of the Y portion. The free end of this piece of tubing is then placed in water and gentle suction is applied at the upper end of the mounting until all gas in the system has been displaced by water. The pinch cock is then closed, the mounting inverted and the rubber stopper B tightly seated in the neck of the atmometer sphere, the latter being completely full of water. Finally, the mounting is returned to the upright position (with the sphere above), the rubber tube is removed and the mounting is quickly set into the reservoir bottle, which has been previously filled or nearly filled with water. After a few hours the reservoir may be filled to the mark on its neck for the beginning of a period of observation.

[6] J. W. Shive, "An Improved Non-absorbing Porous Cup Atmometer," *Plant World*, 18: 7–10, 1915.

About a hundred spherical atmometers with mountings like the one here described were in operation, in the Ohio survey mentioned above, during a nineteen-week period in 1929. With the exception of two, the valves of which were accidentally broken, all the instruments operated perfectly throughout the period without the attention of persons specially trained in caring for them.

J. D. WILSON

OHIO AGRICULTURAL EXPERIMENT STATION,
WOOSTER

THE USE OF N-BUTYL ALCOHOL IN DEHYDRATING WOODY TISSUE FOR PARAFFIN EMBEDDING

THE common procedure in dehydrating, clearing and embedding tissue for cytological examination is, first, to replace the water normally present in the specimen with ethyl alcohol. The alcohol is then replaced by some volatile fluid soluble both in it and in paraffin. In the preparation of plant material for sectioning this fluid is nearly always xylene, which is in turn replaced by melted paraffin. On solidification the paraffin holds and supports the tissue so that it can be sectioned properly.

There are certain limitations to the above technique which make it unsuited for animal cells and for any plant material which contains lignified elements. The higher concentrations of alcohol harden any specimen left in them too long, often before it is completely dehydrated. All the water must be extracted from the specimen before the xylene will penetrate, and this involves the use of absolute alcohol. The xylene itself causes animal cells to shrink and become brittle and so hardens the wood elements that they can not be cut but break and chip the edge of the microtome knife. These disadvantages have been overcome in the preparation of small zoological specimens by using clove oil, cedar oil, chloroform, etc., in place of xylene. Painter[1] has developed a method of substituting aniline oil for the higher concentrations of alcohol, replacing the aniline oil with methyl salicylate (oil of wintergreen) and passing from the latter into paraffin. This method does not harden wood provided the specimen is carried through very gradual changes. The several liquids diffuse so slowly, however, into half-inch cubes composed of xylem, cambium and phloem that the method is impractical for this material.

Mlle. Larbaud[2] has dehydrated and cleared with a mixture of ethyl and n-butyl alcohols. Butyl alcohol is soluble in paraffin in all proportions, but only 8.3 grams are soluble in 100 cc of water. A mixture of equal parts of ethyl and butyl alcohol, however, is completely miscible with water. Larbaud based her technique upon the ethyl alcohol-xylene series: 30 per cent., 60 per cent., 80 per cent., 95 per cent., absolute alcohol, 2 pts. absolute alcohol-1 pt. xylene, 1 pt. absolute alcohol-2 pts. xylene, xylene. She shortened the above eight stages to six by using equal parts of ethyl and butyl for the alcohol of the first four stages followed by two changes of pure butyl alcohol.

Small cubes of wood with cambium and phloem attached require more gradual dehydration. The following series of mixtures of water, ethyl and butyl alcohol has been satisfactory:

Water	95–89–82–70–50–30
Ethyl alcohol	5–11–18–30–40–50
Butyl alcohol	0– 0– 0– 0–10–20

One hour is generally enough for each step except the last. The material should remain over night in this solution which contains a total of 70 per cent. alcohol. It should be emphasized here that alcohol not only dehydrates the tissue but also, as a powerful reducing agent, completes chrome fixation by reducing the chromate ion ($^{-}CrO_4$) to the chromic (Cr^{+++}). Keeping the specimen in alcohol over night eliminates certain irregularities in the fixation images of various chromic compounds (Zirkle[3]).

The dehydration is completed by the stages:

Water	15– 5– 0– 0– 0
Ethyl alcohol	50–40–25– 0– 0
Butyl alcohol	35–55–75–100–100

An hour in each stage is generally sufficient except that the tissue should remain in the pure butyl alcohol until *all* the water is extracted.

As butyl alcohol dissolves solid paraffin extremely slowly, nothing is gained by placing chips of paraffin in the vial of alcohol that contains the specimen and by waiting for them to dissolve in the cold. A simple method is to fill a vial two thirds full of paraffin, let the paraffin harden and place the material to be embedded upon it. Cover the specimen with butyl alcohol and place the vial in the oven. As the paraffin melts, the tissue sinks. Butyl alcohol, being lighter than melted paraffin, does not sink with the specimen which consequently comes into intimate contact with almost pure paraffin. Two changes of paraffin are generally sufficient, the length of each change depending upon the size of the specimen.

In spite of the fact that butyl alcohol diffuses into paraffin more slowly than does xylene, it has several advantages over the latter as a clearing agent. Its specific gravity is less, being .810 at 20° C. compared with .881 for orthoxylene and .866 for metaxylene.

[1] *Anat. Record,* 27: 77–86, 1924.

[2] *Compt. Rend. Acad. Sci. Paris,* 172: 1317–1319, 1921.

[3] *Protoplasma,* 4: 201–227, 1928; 5: 511–534, 1929.