that a cardboard could be obtained which is exceedingly uniform in thickness. Furthermore, ten different grades of thickness are available.

This cardboard comes in sheets 22 × 28 inches in area and they are called "ruby blanks." The five-ply is .547 millimeters in thickness. The one-ply is one half as thick and the ten-ply twice as thick. The other grades are intermediate. I have obtained our supply from Bradner Smith and Company, 333 S. Des Plaines Street, Chicago. A recent order for one hundred five-ply blanks cost $3.15.

These ruby blanks are easier to cut with a smooth edge than blotting paper and, being harder, the pieces stand up better in patterns involving small parts. The variety of thicknesses is a great advantage, as it is possible to choose a thickness adopted to the magnification desired.

So far, we have used only the five-ply grade, which happens to have been convenient for the type of work we have been doing. Drawings are made directly on this paper, and the less complicated features are cut with shears. When the pattern is complicated, a scroll saw is employed.

In order to determine the effect of paste on the thickness of a model, a number of small squares of the paper were pasted together and dried in a paper press. The total thickness of the dried pack, when divided by the number of pieces, gives the exact thickness value of each piece in a finished model, if reasonable care is used in the application of the cementing medium and in the amount of pressure applied in the press.

The scroll saw used is made by the Delta Manufacturing Company, 3775 N. Holton Street, Milwaukee, Wisconsin, and it has the catalog number 700. A large variety of saw blades is available. We have found blade No. 16054-24J to be a convenient and durable size for cutting cardboard. Files and sandpaper pads are made for this outfit, and they save much labor in polishing surfaces of the "piled" model. We have used plastic wood to fill in large irregularities. Lacquers are convenient for painting, as they dry in a few moments, and one can pass rapidly from one color to another. The scroll saw mentioned above can not be set so quickly for interior cutting as the "cutawl" used by Professor Miller, though it takes only a moment or so to do it. The "cutawl" has only one end of the blade mounted, the other end being free, whereas both ends of the scroll saw blade are locked, and one must be freed to make the change. I believe the scroll saw is a more useful machine because of the greater variety of work it can do both in making models and in other laboratory work.

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AN IMPROVED THERMOREGULATOR

THE chief requirements which the expansible fluid in a thermoregulator must possess are: (1) A high coefficient of thermal expansion; (2) good heat conduction; (3) a low specific heat per unit volume; (4) chemical stability; (5) inexpensiveness; and (6) a low density. In thermoregulators for precise temperature control, mercury has been the fluid of choice, although it fails to meet requirements 5 and 6 and is only fair regarding 1. Organic solvents, especially toluene, and gases have been used for less sensitive regulators. The objection against these fluids is that they are poor heat conductors.

During the past year, an improved toluene regulator was employed in this laboratory to control the temperature of a gas-heated thermostat to ± .01° C. (the precision with the usual toluene regulator is ± .05° C.). The increased precision is due to placing a rapidly conducting metal foil, such as copper, in the bulb of the ordinary regulator, as shown in Fig. 1. This

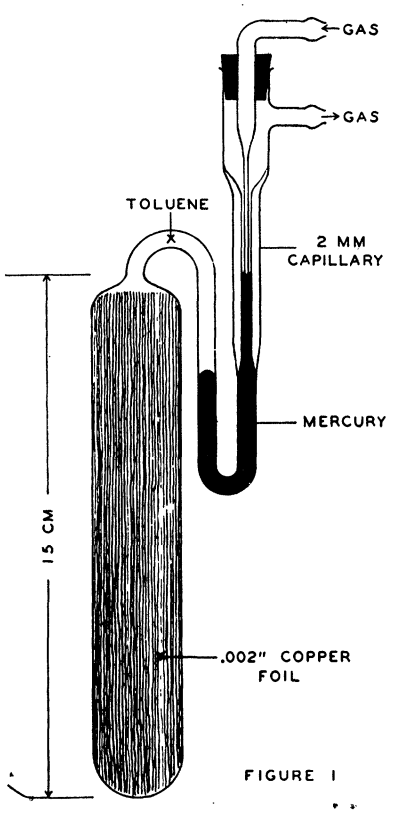

FIGURE 1

principle can be extended to any regulator using an inert organic solvent or gas. By the use of a smaller capillary and electrical control a degree of sensitivity should be attained which equals or surpasses the best mercury regulators.

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