BOYLE'S LAW APPARATUS.

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There are many forms of Boyle's law apparatus. Most of them are open to various rather serious objections. They resolve themselves into two typical classes: those where the two tubes are connected by a rubber tube and the old-fashioned J form, where mercury must be added consecutively to the open tube in order to get a series of readings.

The first form always springs a leak in the rubber tube. The sliding attachments frequently become corroded and the reading scale is seldom conveniently placed. In the second form the mercury soon becomes impure, badly discolored the tubes. There is also the danger of spilling the mercury over the surrounding apparatus.

Desirable features in a Boyle's law apparatus are:

1. Elimination of all rubber tubing between the open and closed tubes.
2. No undue exposure of the mercury to dust or other sources of impurity.
3. Scales placed in immediate contact with the tubes.
4. Elimination of all pouring of mercury into the apparatus to obtain a series of readings.

A very satisfactory form of apparatus is shown in the diagram. The closed tube A and the open tube B are each about 1 m. long and 8mm. in diameter. They join below in a tube that extends to the bottom of a bulb C, some 5cm. in diameter, to which is attached a stop cock D. An ordinary bicycle pump is attached to D by means of a short piece of rubber tubing. The bulb is filled with mercury.

The air is compressed until the mercury almost fills the open tube. Readings of the volume of the compressed air and the difference in height of the mercury columns are then made. By momentarily opening the stop cock the mercury is slightly lowered and another group of readings made. A series of ten readings can thus be easily obtained.

The apparatus is mounted on a suitable board and fastened to the laboratory wall. A meter stick just fits between the tubes. A guard passes over the lower bulb and the bicycle pump is rigidly attached, so that no great strain can come on the stop cock tube. A small piece of cotton batting placed over the open tube prevents the admission of dust.

This was found to be the cleanest, most rapid, and on the whole most satisfactory form of Boyle's law apparatus that the writer has ever used.

PHYSICAL GEOGRAPHY VERSUS GENERAL SCIENCE.

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Those interested in the problem of first-year science in the high school will read the article by Mr. H. W. Fairbanks in *SCHOOL SCIENCE AND MATHEMATICS* for December with relish. As an ardent believer in a required course in general science in the first year of the high school, I cannot refrain from pointing out that Mr. Fairbanks's claim to have proved conclusively the futility of the general science idea, and to have shown the preëminent fitness of physical geography for the first-year course, is not at all substantiated by his arguments. In fact, his paper proves, if it prove anything, that physical geography is as ill-fitted as it could possibly be for this purpose, and that only a general science course can ever satisfactorily meet the present demand.

After stating that physical geography has failed to do its work because of "wrong ideas as to what physical geography should be, and because of the wrong attitude of most of the texts, and because of wrong conceptions of laboratory work," and after stating that the "conceptions behind general science are illogical," he says that general science and geography are closely related as to subject matter, but in treatment and viewpoint are as far apart as the east is from the west.

The distinction between the two methods of treatment is then described more fully by saying that the child has the "geographic" viewpoint, when he becomes interested in the various phenomena of the world as they occur in their natural relations; but that he is studying science for its own sake, when he begins to analyze the orderly aggregate of phenomena, and to separate