tire protein contents of cells, especially upon chloroplasts.

A complete account of the work with illustrations will be published soon.

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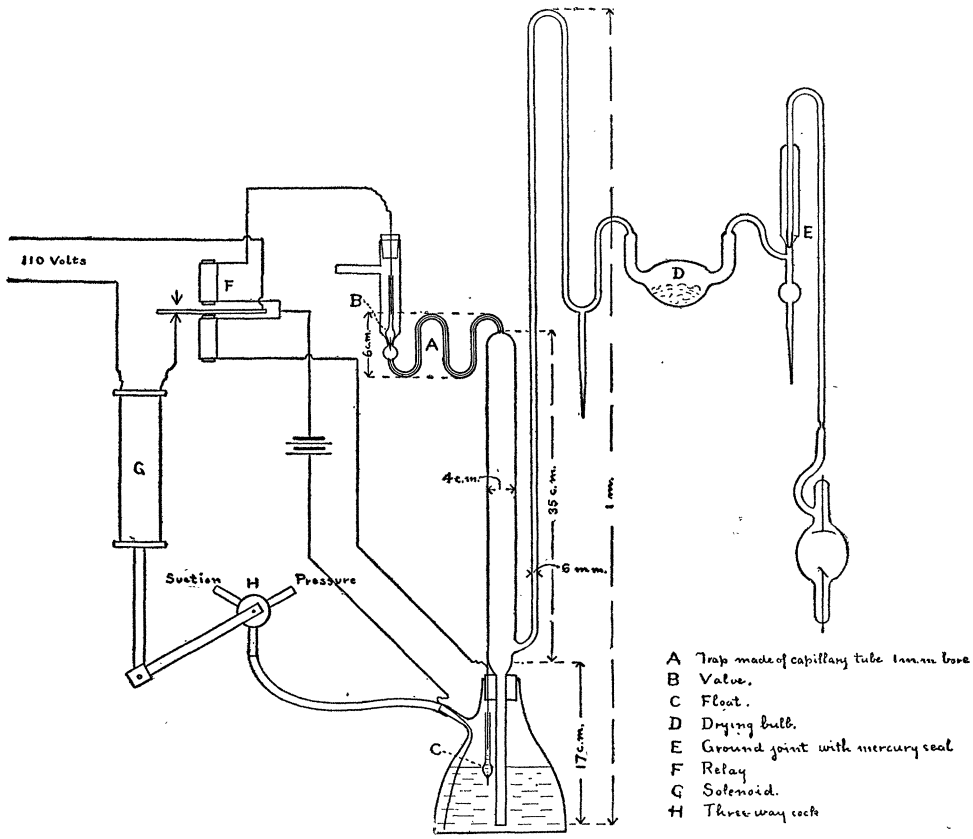
AN AUTOMATIC MERCURY PUMP.

ALTHOUGH there is nothing especially new in regard to the pump proper, the method of electrical control may be sufficiently novel to warrant a brief description. The pump proper is a modification of a common form of Geissler pump. It consists of a long glass tube, about $1\frac{1}{4}$ inches in diameter, which has a mercury trap and a small glass valve at the top. The bottom of the tube is drawn down and dips into a flask filled with mercury. A tight joint is made between the flask and pump by a rubber stopper. This stopper also serves as a flexible support for the body of the pump. The exhaust tube is sealed into the pump just above the point at which the pump passes into the flask. The arrangement is best shown by the figure.

The tube to be exhausted is attached to the pump, through a drying bulb filled with anhydrous phosphoric acid, by a simple ground joint with a mercury seal. The valve at the top of the pump is ground to fit its seat and so weighted by filling with mercury that it closes, leaving sufficient mercury above it to form a tight joint. Dimensions which give very satisfactory results are shown on the figure. Suction is applied permanently to the top of the pump



above the valve. The mercury in the pump is raised or lowered by applying atmospheric pressure or suction to the flask. The suction necessary to operate the pump is obtained by a small water-jet pump giving a vacuum of about 28 inches. A pump with the valve alone will work fairly well, except that occasionally, when the quantity of air taken out at each stroke becomes small, a little bubble will cling to the valve and refuse to pass out of the pump. To avoid this, a trap is added below the valve to prevent any air which might fail to pass the valve from returning to the pump.

The only requisite to make the pump automatic is to have some means of controlling a three-way cock which will apply either pressure or suction to the flask. This control is obtained electrically by making and breaking a circuit in the valve at the top, and in a float in the flask at the bottom. A permanent electrical connection is made with the mercury in the flask at the bottom. A platinum wire sealed into the tip of the valve serves to connect electrically the mercury in the valve with that in the pump. An iron wire dips into the stem of the valve and serves as a final contact. The mercury rising in the pump first makes contact with the inside of the valve through the platinum wire. As it continues to rise the valve opens floats and completes the circuit by the iron wire. It will be seen that the final contact is made in the valve, and any sparking that may occur can in no way foul the mercury in the pump. When the mercury in the pump reaches its lowest level a float in the flask similar to the valve at the top closes another circuit. These two circuits control a relay which in turn controls a solenoid connected to the three-way cock. The solonoid is wound for 110 volts and takes only a small current. One or two Leclanché cells are sufficient for the relay. The electrical connections are shown in the figure.

A pump of this form has been in use at the Massachusetts Institute of Technology for over two years, and has proved very satisfactory. It works quickly, and will give high Crookes vacuum without trouble.

In starting the pump, the pump and whatever may be attached to it are first exhausted by the water pump to about two or three inches' pressure. For the first few strokes, which are make by hand, the mercury is allowed to rise only part way in the pump. After this the necessary electrical circuits may be closed and the pump will take care of itself. In this way the dangerous hammering of the mercury occurring when the quantity of air taken out at each stroke is large can be avoided.

I am indebted to Mr. C. L. Norton for valuable assistance in developing this pump.

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SCIENTIFIC BOOKS.

The Wonderful Century. By ALFRED RUSSELL WALLACE.

As the human mind is more wonderful than anything else that we find in nature, so the greatest and most significant difference between the 'Wonderful Century' and all that had gone before is an intellectual difference.

It is not invention and discovery and the extension of man's dominion over nature, but the establishment of the conviction that we know no limit to this movement, that is the chief distinction of our century.

Among those who have, in our day, guided the thoughts of men to this conviction, future historians will give the highest place to Lyell, and Wallace and Darwin; for no one in our century has done more than they to assure us that the scientific method is adequate; even if successive generations of 'philosophers' still continue to teach that the very top and perfection of human wisdom is the assertion that we know, and can know, nothing.