The fitted funnel (C) is inserted into the hole of the coupling. The metal side arm (D) is plugged with cotton wool, the excess cotton being burned away. The coupling (E) now is fitted onto a 1-in. Pyrex test tube (F) (different lengths are available). To insure an easy fitting, silicone stopcock grease is used. The top of the funnel is covered with aluminum foil for protection, and the assembly is autoclaved for sterilization.

After filtration, the coupling and funnel are removed, cotton plug from a sterile 1-in. test tube is used to plug the tube containing filtrate, and the funnel is put on the tube from which the plug was removed.

Standard Measures and the Economical Production of Graphs and Figures

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Notes by Gutsell and by Wainerdi, respectively, in SCIENCE (*3, 4*) emphasize the fact that standardizing of measures has not kept pace with advances in technology, and that the making of graphs continues to be a time-consuming task. This is particularly true of meteorology, where, for example, of the scales of 6 recording instruments, no 2 are alike and 6 different charts are used, whereas, by minor changes in the mechanisms of these instruments, not more than 2 charts would be necessary. The earlier meteorographs (*1*)—necessary for isolated stations and in aerological researches—were assemblies of familiar barographs, thermographs, hygrographs, etc., recording on a single chart, the 3 (or more) records occupying as many sections of the chart, all having separate time arcs and different scales. Accurate evaluation usually was a tedious process. In 1905, for work necessitating rigid economy, I devised meteorographs having a single time arc for all elements and using, for record charts, millimetric cross-section paper. Advantages possessed by this system are small cost, simplicity of operation and—of aerological instruments—small weight, but even the simple records obtained thereby are not always immediately useful, for graphs and copies must be made.

Some years ago, in a bulletin (*2*) prepared for the University of Nevada, records originally in different scales were, for ease of analysis, transposed into a common scale. Instead of the usual process of connecting reference points on coordinate paper, which would have required several weeks of valuable time, I used a form of pantograph with independent coordinates, by means of which graphs in drawing ink, ready for the engraver, were completed in one operation; the entire task was accomplished within a week. This instrument was described at a meeting of the American Meteorological Society in Boston, in December, 1946, but no description has been published.

Fig. 1 is an elevation of the instrument as it is seen by the operator, and Fig. 2 is a plan. The original figure or diagram, or a blank to receive the graph, may be attached to either cylinder (A or B) by a Richard spring clamp; or a belt of any desired length, bearing many figures, may be carried on A or B and over a separate cylinder C, which may be placed wherever convenient.

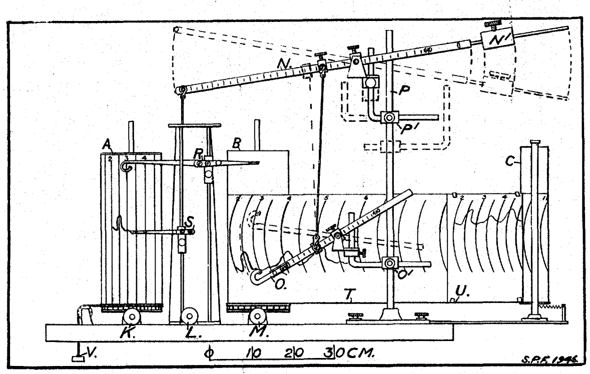

FIG. 1.

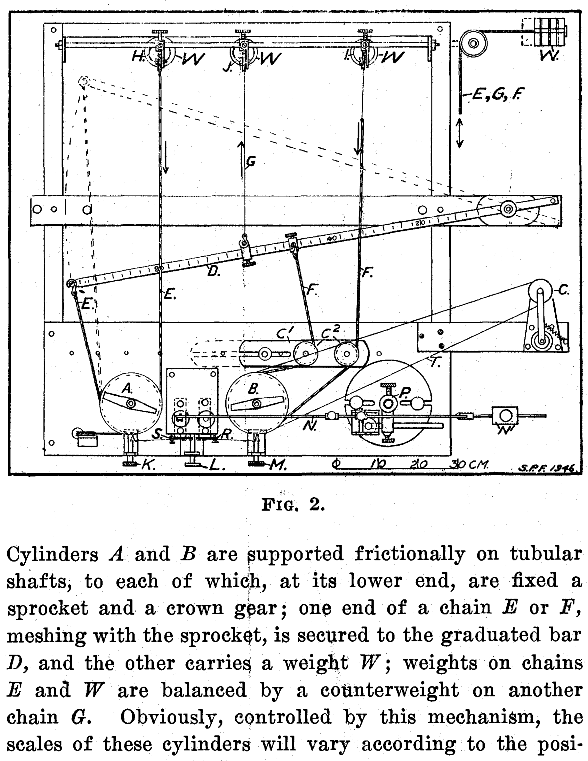

FIG. 2.

Cylinders A and B are supported frictionally on tubular shafts, to each of which, at its lower end, are fixed a sprocket and a crown gear; one end of a chain E or F, meshing with the sprocket, is secured to the graduated bar D, and the other carries a weight W; weights on chains E and W are balanced by a counterweight on another chain G. Obviously, controlled by this mechanism, the scales of these cylinders will vary according to the position of the chain F on the bar D; as shown, with F attached halfway between the axis of D and its outer end (carrying E), the time scale of B will be one-half that of A. The same scale for both cylinders is obtained by the use of the same chain over both sprockets. The cylinders are operated by the arbors K and M, on which, held by friction, are pinions meshing with the crown gears below the cylinders.

When both form and dimensions of a figure are to be duplicated, a stylus or tracer and a pen are attached to the same carrier R or S, which is clamped adjustably to

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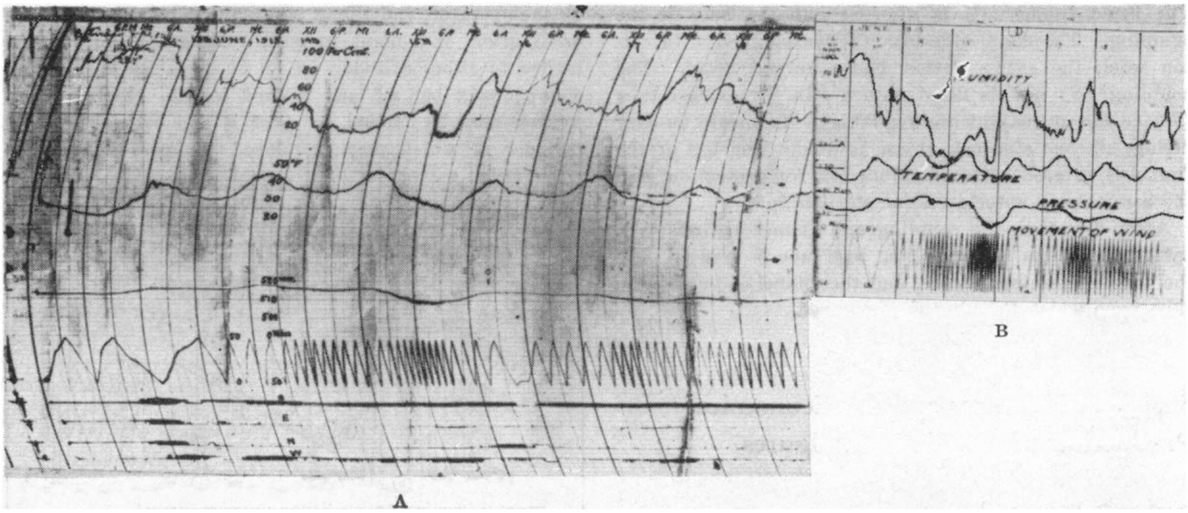

FIG. 3. Record by meteorograph on Mt. Rose, Nevada. *A*, photograph of original; *B*, a copy by the special pantograph, in one operation for each of the 4 elements: (1) Curved ordinates are changed to rectilinear, (2) Fahrenheit degrees to Absolute, (3) millimeters to millibars, (4) the time scale of 60 mm in 24 hr to 30 mm for the same period; (5) necessary corrections are applied.

a light chain connecting the bar *N* with the drum *L* over which it is wound; tension on the chain is maintained by a weight N^1. The stylus is caused to follow the outline of the original figure, and the copy is made simultaneously, in ink, by movements of the cylinders and carrier controlled by milled heads on the drums *K* or *M* and *L*.

When both graph and original figure are in rectilinear coordinates and the scales of the graph must be different from those of the original, the stylus and the pen are attached to separate carriers (*R* or *S*), one of which is supported by the bar *O* suspended adjustably from *N*. When curved ordinates of an original figure are copied as rectilinear, the stylus is attached directly to *O*, as shown in Fig. 1, where a diagram, *T*, is copied.

As indicated by dotted outlines in Fig. 1, the bars *N* and *O* can be placed in almost any convenient position on the upright *P*, and the ratio of movement of one bar to that of the other adjusted accurately. Accuracy of movement of the cylinders is secured by adjustment of the plate C^1 so that chains *E* and *F* are parallel between the rollers C^2 and the bar *D*. Since movements of cylinders and mechanisms are controlled by weights, there are no errors caused by looseness of bearings; backlash between pinions and crown gears is prevented by a separate weight *V*.

The instrument described occupies a space 1 m square, or about that necessary for a precision pantograph; larger or smaller models of the same accuracy can be produced at approximately the same cost. Paper 40 × 50 cm, or the belt mentioned (which may be several meters in length), can be used for originals and copies, and graps can be made from values read from text or tables without intermediate plotting on coordinate paper.

The operator of this instrument is comfortably seated facing the recording mechanisms, all adjustments of which are within easy reach, and all movements are controlled by means of two of the milled heads *K*, *L*, and *M*.

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A Miniature Pressure-recording Device

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The extensive use of intracardiac catheterization for diagnostic purposes and special problems in physiology stimulated the development of a manometer sufficiently small to permit its introduction into the circulatory system. From the theoretical point of view it is advantageous to reduce the dimensions of a manometer. Cutting down the mass of the moving parts actually improves the recording properties by increasing the natural frequency. In most elastic manometers for blood pressure measurements, the greatest part of the effective mass resides in the cannula and its connections. This condition is completely eliminated by putting the recording element at the tip of the instrument. Moreover, such a pressure pickup that is in direct contact with the pressure avoids artifacts due to, and corrections necessary for, the hydrostatic columns in the fluid-filled tubes that connect the circulatory system with commonly used external manometers.

A disadvantage of such a system is the necessity for using an amplifier. Among the various possibilities of constructing such a miniature manometer, the principle of a differential transformer, first outlined by Wetterer (*3*), seemed best suited to give a system having excellent recording properties with a minimum of amplification.