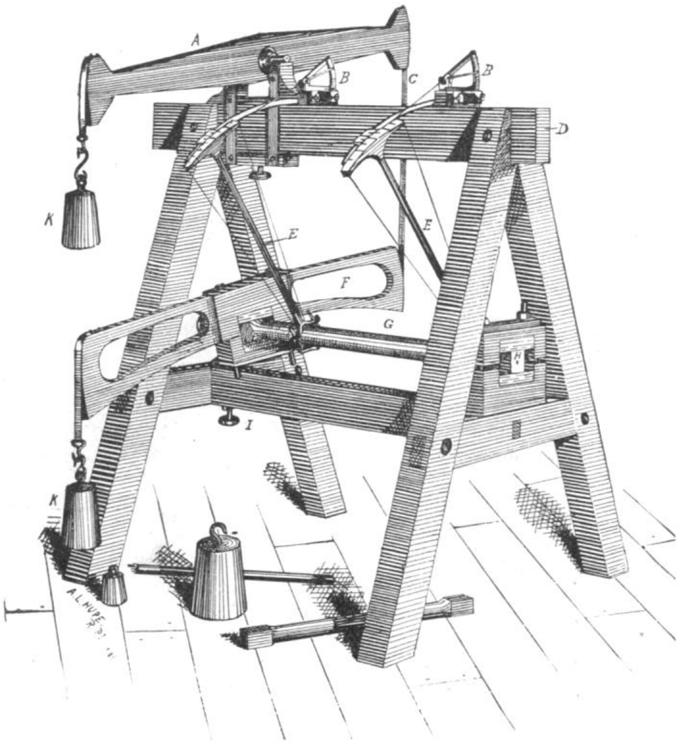
GRAY'S TORSIONAL TESTING-MACHINE.

THE accompanying figure illustrates an apparatus recently designed by Professor Thomas Gray of the Rose Polytechnic Institute, Terre Haute, Ind., for the purpose of testing the torsional rigidity of different kinds of materials.

The figure has been prepared from a photograph of a rough and



GRAY'S TORSIONAL TESTING-MACHINE.

inexpensive form of the machine, which was somewhat hurriedly made in the workshops of the institute by students, for use in the engineering laboratory course of the current year.

The apparatus, as here shown, consists of a wooden trestle, on the top bar, *D*, of which there is mounted a cross-beam *A*, about four feet in length, which rests, through knife-edges at its centre, on a support which can be clamped at any point of the bar *D*. The ends of this beam are cut to circles having the knife-edges as centre; and to one end a thin steel trap, *C*, is fixed, the lower end of which is attached to a cross-beam, *F*, of the same length as *A*. The beam *F* is clamped to one end of the specimen, *G*, which is being tested by means of strong clamps, which take different forms, and are made of different materials, according to the form and nature of the specimen. The other end is held in a similar clamp at *H*, and this clamp is firmly fixed to the trestle.

The end of the specimen to which the beam *F* is attached is kept in position by means of an attachment similar to the tail-stock of a lathe, the clamping-screw for which is shown at *I*.

This centre-bearing also prevents any cross-bending force being applied to the specimen by the weight of *F*. The torque, or twisting-couple, is applied to the specimen by hanging weights, *K*, *K*, on the free ends of the beams *A* and *F*. These weights should be of equal amount, as they then produce a pure twisting-couple without applying any force to the centre-bearing.

The amount of distortion produced by any torque applied to the specimen is measured by means of two indices *E*, *E*, which are clamped to the specimen at a measured distance apart. The outer ends of these indices carry a graduated arc, on which the angular displacement can be read by means of a fixed mark or vernier. For specimens of such large diameter that the limit of elasticity is exceeded before a sufficiently large deflection can be given to the indices *E*, *E* to render this method sensitive enough, the deflection is indicated by a multiplying index, *B*. An important feature of this apparatus is the elimination of any uncertainty as to effect of the clamps by measuring the relative twist at two sections a short distance from the ends.

This same method was adopted some years ago by Professor Gray, in a series of experiments on the elastic constants of rocks, but the apparatus was not then made in a permanent form. A considerable extension of the experiments is now contemplated in connection with investigations in seismology, under the direction of Professor Mendenhall, in which it is intended to determine the elastic constants of a number of rocks, for the purpose of ascertaining the theoretical velocity of a seismic wave.

In the more complete design of the testing-machine above described, both ends of the beam *A* are connected by straps or links to the beam *F*. The tail-stock centre-bearing is then omitted, and cross-bending stresses are avoided by mounting the clamp *H* on gimbals, which allow freedom to transverse motion. A graduated disk is then substituted for one of the indices *E*, *E*; and the other index is carried on a bar which extends from the clamp, in a direction parallel to the axis of the specimen, up to the front of the graduated disk. The relative distortion is thus read off direct when that method is sufficiently sensitive, or by means of a second index attached to the disk when higher sensibility is desirable. For some purposes the gimbals are mounted on a worm-wheel, which turns round an axis parallel to the direction of the specimen, which thus allows an unlimited amount of twist to be given to the specimen. This becomes necessary when torsional strength is the object of investigation.

With the apparatus here illustrated, specimens of any length up to three feet can be included between the clamps; while specimens of any length can be tested in sections of three feet or less, the ends being simply allowed to project beyond the clamps, and the tail-stock bearing modified to a V instead of a centre-bearing. As regards the power of this machine, it is capable of testing a three-inch steel shaft up to its limit of elasticity.

THE MACRÆON SECONDARY BATTERY.

THERE is no field in which experiment is being more actively prosecuted than in that of the storage of electrical energy. From the experience which has been gained in the last five or six years, the failings of secondary batteries have become pretty well under-

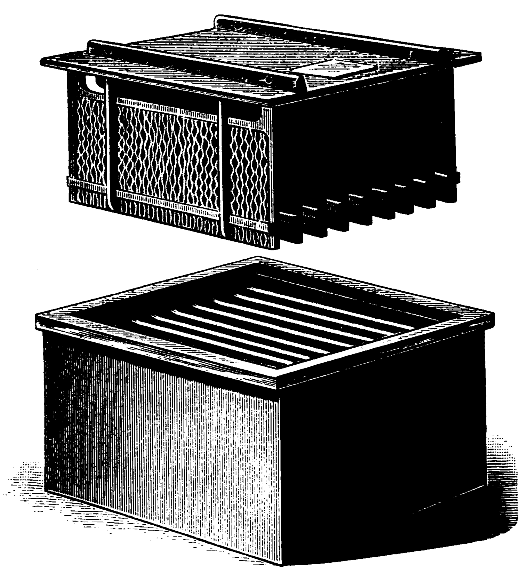


Fig. 1. — The Macræon Storage-Battery.

stood, and many inventors are trying to remedy them. The two types of battery which have been at all generally used are the Faure and the Planté. In the former a support-plate is provided, and some salt of lead is mechanically applied to it, which forms the active material. In the latter the active material is obtained from the support-plate by reversing the current passing between two lead plates in dilute sulphuric acid. The Faure cells take but a very short time to manufacture: the Planté type takes several