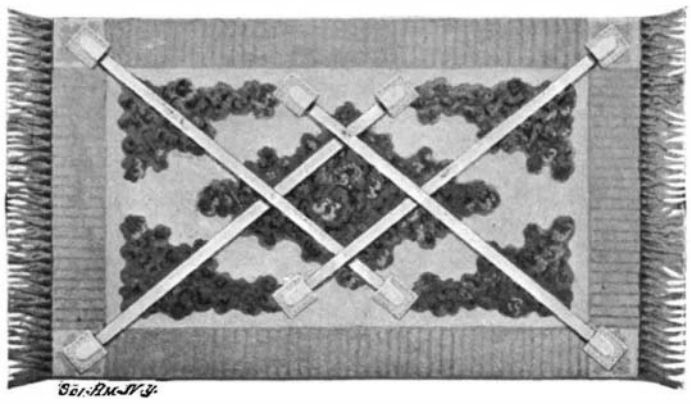
A DEVICE FOR STRAIGHTENING RUGS.

Our illustration pictures a simple device invented by George T. Weeks, of Edon, Ohio, for straightening rugs and door-mats and preventing the corners from turning up.

The straightener consists merely of stretcher-rods pivoted in pairs, the ends entering pockets secured to the rug or mat. The rods are stitched to the rug to hold them in place. By means of the light, extensible frame formed by each pair of stretcher-rods, the rug is kept flat and held in its place. Since the stretcher-rods are applied to the bottom of the rug, the straightening means are not visible.



THE STRAIGHTENER APPLIED TO THE BOTTOM OF A RUG.

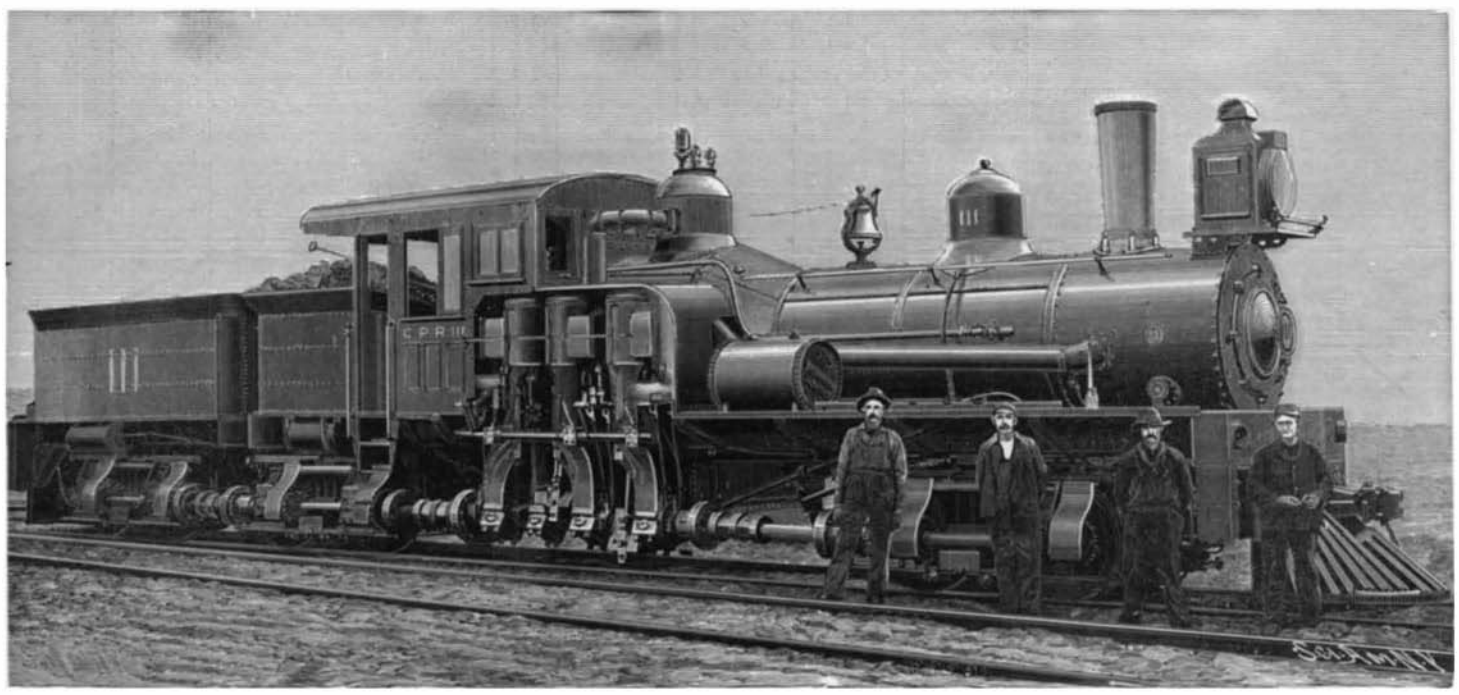
FREIGHT LOCOMOTIVE FOR HEAVY GRADES.

The accompanying illustration represents a successful attempt to provide a locomotive of great tractive power for use on grades of exceptional severity. It is owned by the Canadian Pacific Railroad, and is used on a stretch of road between the mining camps of Rossland, British Columbia, and the smelter at Trail. From Rossland to Trail the distance, on a direct line, is about 7 miles, whereas the distance by the railroad, owing to the excessive curvature used in securing as easy a grade as practicable, is more than 12 miles. The grades are in favor of the freight, which consists of heavy train-loads of ore; but on the return journey the excessive grade of 4½ per cent renders the work of hauling up to the mines the empty, but very heavy, ore cars a task of considerable difficulty.

It was with a view to increasing the load of empties that could be hauled at one trip that the Canadian Pacific purchased the engine which is herewith illustrated. It is known as the Shay locomotive, and is so called after its inventor. It was built at Lima, O., and has been in operation on the Canadian Pacific road since last fall. The locomotive is carried on two 4-wheeled trucks, one beneath the front end of the boiler, and the other beneath the coal-pocket, which is located immediately to the rear of the cab. The water-tender is carried on a single truck, and, as will be noticed, it is very short, serving merely for carrying water, for which it has a capacity of 2,900 gallons. The coal-box has a capacity of 6 tons. Although we have spoken of the water-tender as being separate, it might perhaps be more correctly described as incorporated with the locomotive, inasmuch as the weight of the tender is utilized for adhesion. In place of the customary two cylinders beneath the smoke-box, working direct upon the drivers, the engine consists of three high-pressure cylinders, 15 inches diameter by 17 inches stroke, which are carried upon the right-hand side of the boiler at the front end of the cab, and are arranged vertically above a longitudinal driving-shaft which extends the full length of the engine. This driving shaft, which is 6 inches in diameter, is arranged in sections, with two universal couplings between each of the three trucks, the arrangement being such as to give the trucks full flexibility for taking the curves. The flexibility, indeed, is such that the locomotive can round with ease much sharper curves than with the ordinary type, and it is claimed it is less liable to derailment. The wheels are all utilized as drivers. They are 40 inches in diameter, the width of the tire, including the flange, being 8 inches.

The crank-shaft is carried upon the frame of the engines, and the coupled-up lengths of the main shaft are carried in heavy journals, which are bolted to the frames of the trucks. Upon the driving shaft, opposite each wheel, is keyed a 20-tooth pinion, and on the outer face of each wheel is secured a heavy 41-toothed spur wheel. Particular care has been taken in the design of the main-shaft journals and in the cutting and fitting of the gears, with the result that when the engine is working at its full power, the teeth mesh smoothly, and, apparently, with a minimum of friction.

The total weight of the locomotive, when in working order, is 112 tons—a weight which is only exceeded by a few of the latest locomotives built for the ore-carrying railroads of the East. Results of operation show that, as the result of her whole weight being available for adhesion, and of the advantage gained by being geared down in the ratio of 2 to 1, this locomotive will haul about twice the load that can be hauled by the ordinary "consolidations" of the road. The speed, of course, is low on a grade of such a heavy character, the average rate with a full load, on a 4 per cent grade, being about 10 miles an hour. The engine is of such interest that we subjoin a few further particulars. The gage is the standard of the road—4 feet 8½ inches. The boiler is of the wagon-type pattern, and carries a working pressure of 180 pounds to the square inch. The tube-heating surface is 1,407 square feet; the firebox has a heating surface of 147 square feet, and the grate area is 27.8 square feet, making a total of 1,554 square feet.



FREIGHT LOCOMOTIVE FOR HEAVY GRADES.

Hygroscopic Movements in Plants.

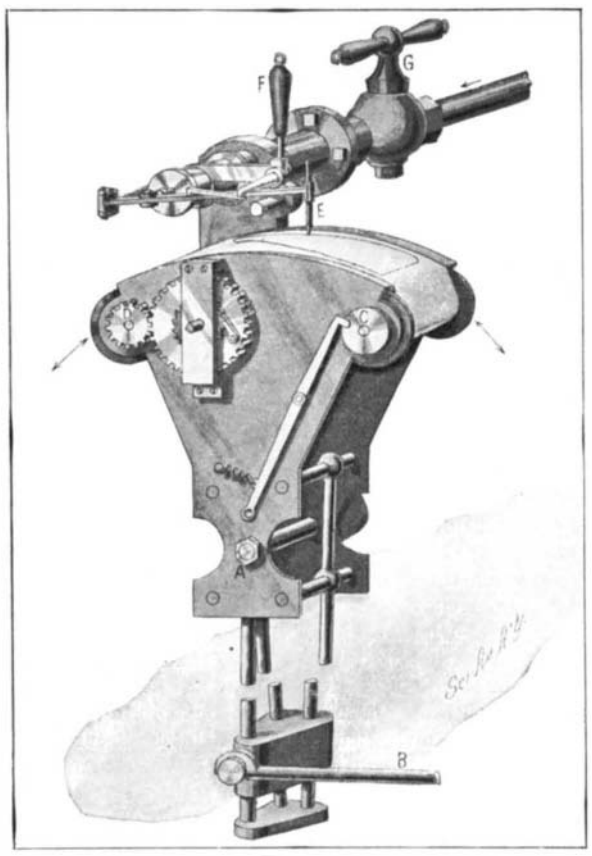
Dr. U. Giovannozzi classifies the various hygroscopic movements of plants under six heads, viz.: (1) Movements for the protection of pollen (bracts of *Cynaraceæ* opening and closing of anthers); (2) for protection against desiccation (thallus of *Hepaticæ*, mosses, grasses, etc.); (3) opening and closing of fruits; (4) for the dispersion or burying of seeds (torsion of the awns of *Geraniaceæ* and grasses); (5) for the dissemination of spores (annulus of ferns, fungi, lichens, *algæ*); (6) movements of the branches of conifers. The most common mechanism which produces hygroscopic movements is the superposition of two tissues, one of which has a greater capacity for swelling than the other. Compact tissues, composed of thick-walled, and especially of sclerenchymatous cells, have in general a greater capacity for absorbing water than those composed of thin-walled cells. Torsion, as in the awns of *Geraniaceæ* and *Stipa*, the legumes of *Papilionaceæ*, etc., results from the presence of a very hygroscopic tissue on the face which is internal in respect to the torsion. The protection of the pollen in the fruits of *Cynaraceæ* is effected by the movements of special organs, the bracts of the involucre. Hygroscopic movements may take place in dead as well as in living tissues.—Nuov. Giorn. Bot. Ital.

The construction of a railway under the Solent is planned. The railway, including the tunnel, would be about 7½ miles in length, and would in all probability be operated by electricity.

A SIMPLE LOCOMOTIVE ENGINE INDICATOR.

By means of a new indicator which has been invented by Eric Norden, of Wilmington, N. C., it is possible to take a succession of indicator-diagrams from steam engines without marking over the same card. The indicator is particularly serviceable for making locomotive engine charts without the necessity of the engineer's leaving his cab.

The card is in the form of a continuous strip of paper carried by a pendulum connected with the cross-head by a member, *B*, so as to swing and move the card in one direction, while the pencil is moved transversely by the cylinder pressure. The pendulum consists of two rigidly connected plates which are joined at their upper edges by an arc-plate struck from the center of oscillation of the pendulum. Between the plates two winding drums, *D* and *C*, are mounted, the card passing from one to the other over the arc-plate. The drum, *D*, is driven by a spring motor; the drum, *C*, is held at intervals against rotation by a spring-pressed lever which is arranged to enter a notch in a disk on the shaft of the drum, *C*. Thus the card is shifted after a diagram has been made and held stationary while the pencil is in operation.



THE NORDEN LOCOMOTIVE ENGINE INDICATOR.

The pencil, *E*, is carried on the end of an arm, connected with a piston-rod working in the reduced extension of the cylinder. The pencil-arm is connected by a system of links with a bracket pivotally mounted on the reduced extension. A handle, *F*, is secured to the bracket and is operated by a cord to swing the pencil into position. By adjusting the handle the pencil's position relatively to the card is regulated. To operate the device from the cab, the handle of the three-way cock, *G*, is provided with cords. The releasing lever of the winding drum is likewise provided with a cord. Thus there are four cords, two of which control the steam pressure, one the movement of the pencil to the card, while one releases the card to permit its onward movement.

The instrument is an indicator and reducing-motion in one, and takes consecutive cards at short intervals. It is the opinion of the Department of Tests of the Baldwin Locomotive Works that the device is of considerable value.