Is it not true that there are many boys in our classes who would find a study of the simple mechanical powers not only entertaining but of very great value on account of the relation of these to the lives that the boys will live?

THE LEVER

NOTE.—In these problems omit the weight of the plank.

Exercise 1.—6. (*a*) 4 ft. and 12 ft. (*b*) 12 ft. and 4 ft. (*c*) 9 ft. and 7 ft. **8.** (*a*) 2 to 1. (*b*) 2 to 1. (*c*) No. **9.** (*a*) 8 ft. and 4 ft. (*b*) 3 ft. and 9 ft. (*c*) 7 ft. and 5 ft. **10.** (*a*) 4 to 5. (*b*) 2 to 1. (*c*) 13 to 5. (*d*) 7 to 11. **11.** (*a*) 6 ft. and 9 ft. from ends. (*b*) 10 ft. from end. (*c*) 8 ft. from end or 7 ft. from end. (*d*) 9 ft. from one end. (*e*) At centre. **12.** This is an effort to discover the general law of the lever. **13.** $35\frac{5}{7}$ lb. **14.** 8 ft. **15.** 4 ft. from the 5 lb. wt. **16.** 3 ft. from the shoulder of the one carrying the greater load.

Exercise 2.—8. 250 lb. **9.** P = 50 lb. An advantage of 10. **16.** 3 ft. **17.** P = 20 lb. **18.** $122\frac{1}{2}$ lb. **19.** 60 lb. **20.** 40 lb. **21.** $\frac{1}{5}$ of W. **22.** (*a*) DW = $3\frac{3}{4}$ in. (*b*) DP = 24 ft. (*c*) P = $642\frac{6}{7}$ lb. (*d*) W = 270 lb.

THE WHEEL AND AXLE

Exercise 3.—1. (*a*) $8\frac{1}{3}$ lb. (*b*) 20 lb. (*c*) 75 lb. **2.** P = 50 lb. **3.** $62\frac{1}{2}$ lb. **4.** 2688 lb. **6.** (*a*) "Relative lengths" here mean lengths of radii. The wheel must have a radius equal to 20 times the radius of the axle. (*b*) 10 to 1. **7.** 8 in. **9.** 120 lbs. **10.** Friction. **11.** $20\frac{5}{8}$ lb. **12.** 14400 lb.

WORK

Exercise 4.—1. (*a*) 120 foot-pounds. (*b*) 240 foot-pounds. **2.** (*a*) 15 foot-pounds. (*b*) 600 foot-pounds. **3.** (*a*) 14 ft. (*b*) 8 ft. **4.** (*a*) 16 lb. (*b*) 12 lb. **5.** (*a*) 4500 foot-pounds. (*b*) 4500 foot-pounds. **6.** 3600 foot-pounds. **7.** 1280000 foot-pounds. **8.** In this and in the preceding, very interesting work may be covered in the effort to obtain the average height