2½ Million to 1 Gear Ratio

Turn the Handle for a Month and Driven Shaft will Revolve Once!

By "Spanner"

IF I had been asked to design a gear box measuring 2½ ins. wide, 2½ ins. long, and 1½ ins. deep, to give a difference in speed between the driving and driven shafts of 2½ million revolutions, I would have declared the task utterly impossible. Yet I have just seen a gear box that complies with these conditions—at least, to be absolutely correct, it gives a ratio of 2,476,099 to 1! And—what is still more astounding—it is constructed entirely from standard Meccano parts.

Mr. Hornby showed me the model and explained its operation. Pointing to the small handle on the driving shaft, he told me that if I turned this handle at 60 revolutions per minute night and day without losing a moment of the 24 hours, I should succeed in making the driven shaft complete one revolution after 28 days 15¾ hours. But I did not accept his offer to test the truth of this, for I felt that long before the driven shaft completed a tenth part of its revolution, I should be winding imaginary handles in a padded cell!

The gear box is illustrated on this page and as will be seen it consists merely of an arrangement of Meccano Worms and Pinions. Before proceeding any further I had better give a list of the parts of which it is composed, in case some keen Meccano boy wishes to build it and test the accuracy of the above figures without delay. The list includes the parts necessary to construct the mechanism and also the framework and supports as shown in the illustration:—

2 of No. 3; 4 of No. 5; 4 of No. 9f; 2 of No. 15a; 3 of No. 16; 1 of No. 17; 5 of No. 26; 5 of No. 32; 18 of No. 37; 1 of No. 45; 1 of No. 48a; 1 of No. 48b; 9 of No. 59; 1 of No. 62; 1 of No. 115.

The Rod 1 is only 2 ins. long. In addition to the handle it carries a Worm 2, and its inner end, protruding about ¼ in. from the Worm, is inserted in the centre bore of a ½ in. Pinion secured to the driven Rod 3, a Washer being placed between the Worm and the Pinion. The Rod 3 is journalled in the 2½ in. × ½ in. Double Angle Strip 4 and in a Double Bent Strip bolted to the Strip 4. The Worm 2 engages with a ½ in. Pinion secured to Rod 5, which carries another Worm 6 meshing with another ½ in. Pinion on a Rod 7. Rod 7 carries a third Worm that, in turn, engages with the ½ in. Pinion 8 on the Rod of the fourth Worm 9. This Worm engages with yet another Pinion that is secured to the Rod 10, and a Worm 11 on the latter drives the Pinion (already mentioned) on the driven Rod 3.

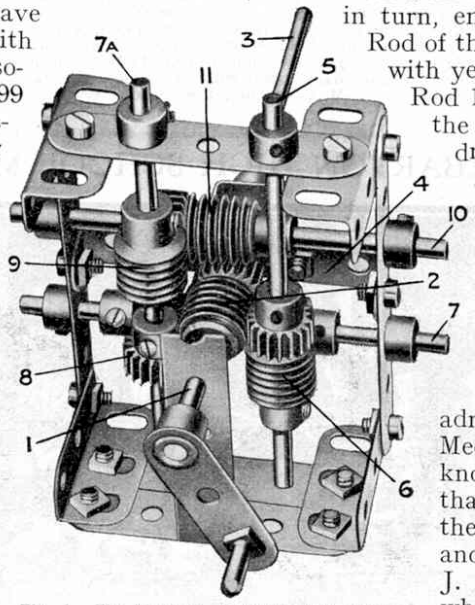

Fig. 1. The Meccano Gear Box that provides the amazing speed ratio of nearly 2½ millions to 1.

As every Meccano boy knows, a single Meccano Worm engaging with a ½ in. Pinion (19-teeth) provides a speed ratio of 19 : 1, and since this gear is repeated five times, a simple multiplication sum will show any Meccano boy that the gear box illustrated affords a ratio of 2,476,099 to 1.

After a few moments spent in silent admiration of this truly marvellous Meccano mechanism, I naturally wanted to know the history of the model. I learnt that it was constructed by Major Hatcher, the inventor of this type of gear box, and it was sent to Meccano Limited by J. Stone and Co. Ltd., of Deptford, who specialise in the manufacture of such gear boxes. They are known as the "H-R Gears" and are designed for all purposes and are obtainable in numerous different sizes.

The H-R gear is the smallest speed reducer for a given output in the world. *"M.M."* readers will have no difficulty in believing this statement after examining the Meccano model; indeed I think the model should convince anyone, from the least mechanically-minded to the skilled engineer, of the value and adaptability of the actual device. As a comparison with the Meccano model, Fig. 4 shows an actual H-R gear box capable of providing a reduction of 10,000 to 1. The gears are of the worm type and the principles involved are similar to those in the Meccano model.

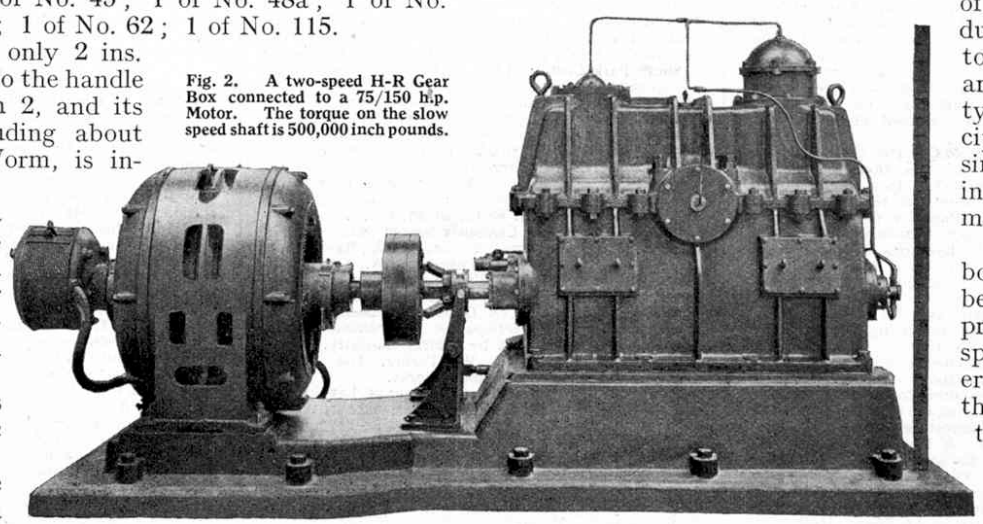

Fig. 2. A two-speed H-R Gear Box connected to a 75/150 h.p. Motor. The torque on the slow speed shaft is 500,000 inch pounds.

The H-R gear box can, of course, be designed to provide various speed ratios greater or smaller than the example illustrated, and it may be applied with advantage in all cases of