

leadscrew was cut. The planer in use in that shop was a Scotch-built machine, and, of course, had a table of sufficient length to plane this bed without a shift. This lathe was finished in about six months, and a large portion of the small turning was finished by hand tool turning, as at that time there were few self-acting lathes, and certainly none in this shop. All the gears had cast teeth made from wood patterns, and even the change gears for screw-cutting had cast teeth moulded up in the same manner. The castings for this lathe were made in the Gurney Foundry, Hamilton. From this small beginning the partners of that business were encouraged to develop their business, and others also embarked in the same line, with more or less success. Mr. John Bertram was a mechanic of advanced ideas, and was never satisfied unless the development of his designs and the organization of his shop were ever on the advance. He at once adopted standards for shop use, in the way of Whitworth standard threads for taps and dies, and also inaugurated male and female, or what are now known as plug and ring gauges, for sizing the bore of wheels and pulleys, and for the turning of shafts. He also saw the necessity of cutting gears, and finally designed and built a gear-cutter. This machine was of the most simple form, consisting of a bracket bolted to the shop wall, carrying a mandril and a dividing plate. A man was trained to feed the cutter slide up and down. During the operation he very often made a slip and spoiled the gear. In those early days Brown & Sharpe cutters were developed, and from that time until the present day B. & S. cutters have been in constant use there for gear-cutting. All key-ways at that time were cut by hand, and it was remarkable how well this was done, and the time taken for small keys was not as far away from present-day methods, when setting up and preparing a machine to do the work is considered. To duplicate the key-ways in change gears for screw-cutting, a broaching tool was used. After the keyway was roughed by hand, the broach was driven through, thus producing a standard finish, which served the purpose.

His next step was to design a milling machine, Fig. No. 1, for cutting keyseats in shafts. All the movements were by hand, and the machine and its cutters are herewith shown. Since this date, in the early sixties, many changes have taken place toward improving the turning lathe. Then it was considered satisfactory to furnish a 24" lathe with a flat shear bed, having single ribs connecting the ways together, a headstock having a four-step cone, with a 2½" belt and a gear ratio of about 5 to 1. The spindle front bearing, 1¾ inches diameter, running in cast-iron bearings, all the gearing having cast teeth; a carriage or saddle with no power cross-feed, and a front apron fitted with running gears of the most simple