

tools or for groups of tools. In either event, we arrive at a complete solution of the question of using power only when something is to be done with it, for even with group-driving, the groups may be made relatively small and of such a nature that it will rarely be necessary to drive a whole group in order to employ a single tool.

There are undoubtedly numerous special requirements which can best be fulfilled by use of the individual drive, but in the vast majority of cases the application of an individual motor to each tool carries the matter altogether too far. Small motors, like small engines, are less efficient than large ones, besides costing very much more in proportion to the power delivered. The general plan which meets with the approval of the best machine shop engineers, is to employ individual drives for tools which require variable speed drive. These conditions are most often met with on machines with direct application of a cutting tool to the rotating work, provision being made if the machine is to accommodate a work piece of large diameter. When cutting on the periphery of such a piece of work a slower speed of drive is necessary than when the cut is on a part near the centre of the work, the same maximum cutting speed of the tool being maintained in both instances. Even where these factors do not enter the calculation it is often desirable to drive individually on account of the comparatively large amount of power involved in a single machine, or where convenience of location of the machine is promoted by divorce from any relation to existing lines of shafting.

Probably the first application of electricity to machine shop needs was in the form of lighting. The second use was for the cranes, which are to-day in universal use in all large shops; and it is hardly an exaggeration to say that the existence of the great plants of the present time would be impossible without the electric crane.

The shop of the immediate past, with the hand or mechanical crane, and a Corliss engine driving a main shaft, which drives all the machine tools, is now being equipped with electric generators, delivering current to motors driving a group of machines or individual drives; and increased productive capacity and lower cost are resulting. At the present time, the travelling electric crane, with its flexibility of design, is really an indispensable power tool in a machine shop.

Until very recently the method of power transmission in general use in good shops consisted of a system of shafts and belting, taking power from the engine or turbine as a prime mover and transmitting it to individual tools. The application of this system was, of course, limited to the case of a single shop where the dimensions were not too great. In the case of such an establishment as a