

for repairs, in case repairs are necessary. It is usual, in establishments employing the individual drive, to keep on hand one or two extra motors of the various sizes employed, and, in case of any breakdown, the motor is immediately taken off the machine and replaced by another, the displaced motor being repaired at convenience and where repairs can be effected advantageously. Manufacturers using the group drive hardly ever feel justified in purchasing spare motors of large sizes, and, consequently, if repairs are necessary, they must be performed in a hurry and under very disadvantageous conditions, in respect to the location of the motor and its accessibility for working at it.

It has become a well-settled rule of conduct with nearly all progressive manufacturers to make liberal investments for machinery and power wherewith to push the rate of production per hour to the limit, and thus reduce the pro rata labor charge all that is possible. One of the most prominent objects to be kept in view by a manufacturer is maximum production from a given investment in plant and machinery, and this end is most frequently achieved by the use of the individual drive. The use of the individual drive provides a separate motor for each machine, and, therefore, the speed of the machine can be brought up to and maintained at the highest productive capacity without regard to the speed of adjacent machines. Its operation will also be continuous, irrespective of any accident that may happen to the adjacent machine or its motive power. The use of overhead belts and heavy distributing shafting will be eliminated, thereby improving the ventilation and light in the room in which the work is carried on and eliminating a large element of fire risk.

Further, the machines may be located, when individually driven, in most advantageous position relative to each other and for receiving the work which is to be wrought on them, and, finally, if it is desired to move a machine to a new location, temporarily or permanently, it is only a matter of running wires, which can be accomplished far more cheaply and quickly than when shafting has to be extended or a new line of shaft installed.

And when the individual drive is used, a plant may be extended and added to at a minimum cost, for the changing of the electrical circuits is cheaply and quickly accomplished, whereas the rearrangement of the mechanical drive is frequently very expensive and often entails great delays.

Until within a few years, manufacturers contended that the adoption of the individual drive necessitated much greater charges to capital account than when the group drive was used. With the reduction in cost of motors during recent years, however, and the improvement in their output, the difference between the cost of the group drive with its expensive shafting and belting and frequent inefficiency of operation, and the individual drive with its wire supply circuits and capabilities of maximum production is rapidly vanishing, and at present the difference is very frequently so small that it can be ignored in favor of the large advantages usually secured by the somewhat elaborate initial installation.

Both alternating and direct current motors and controllers are now made of such design as to enable them to be mounted on a great variety of machines and machine tools with little difficulty. It is no longer necessary to have special motors built for such work, and, consequently, the extra charges for direct connection have been largely eliminated in electric power installations.

It is advantageous in mounting a motor to keep it slightly up, from the floor, where it will be free from

sweepings and dirt, and when possible it should be directly and securely fastened to the frame of the machine which it drives. Gear, chain, belt, and direct drive are all available, the choice lying with the character of service and the speed requirements of the driven machine. The so-called silent chains are very efficient and satisfactory when transmission involving chain speeds of 1,200 revolutions per minute or less are involved. Gears, or chains, however, are rarely used in connection with woodworking machinery, for the reason that the speeds of the cutter-heads are very high, and under these circumstances the use of moderately short belts or direct connected motors is favored. It has been pretty well demonstrated that in equipping machines like stickers and planers the use of two or more motors is desirable. It is advantageous to carry the cutting head at a uniformly high rate with a constant speed motor, and to obtain the necessary variations of total cut largely by means of the feed, which can well be controlled by a variable speed motor.

In case the group drive is selected, it is advisable to use moderately large and light pulleys, moderately high shaft speeds, and thin, light belts, and the use of an approved form of roller or ball-bearing for supporting the line and distributing shafts is advocated.

Among the minor advantages of the electric drive must not be overlooked the ease with which a check may be kept on the condition in which the producing tools or machines are maintained. Woodworking tools, when out of alignment or carrying dull cutters, may easily absorb 200 per cent. more power than they normally require, and this excess power is not only wasted, but absorbed in friction and strains which are very damaging to the machinery.

Under such conditions, the operating niceties of adjustment and smooth running are speedily deranged and the machine permanently damaged. By placing an indicating watt meter in circuit with the motor and observing its reading when the driven tool is known to be in perfect adjustment and alignment with the cutters in good order and comparing that reading with subsequent readings taken from time to time, an abnormal use of power is immediately made known and corrective measures may be applied before serious damage has been done or much power uselessly wasted.

No fixed rules for the laying out of the electric drive in a box or other woodworking shop can be annunciated. There is one method better than any other for every shop and every combination of circumstances, and this method can only be determined upon after a survey of the establishment to be equipped and a careful study of the imposed conditions. The metal working industries have employed motors in the past much more freely than the woodworking industry, and this seems rather remarkable for the reason that the woodworking industries as a rule require high speeds, and it is for high-speed work that motors are particularly adaptable and relatively cheap, whereas the metal working industries, as a rule, require slow-speed motors, which are more expensive to build and install. Within the past two years, however, manufacturers of woodwork have begun to appreciate the advantages of the electric drive, and a number of notable and satisfactory installations have been effected, with more constantly coming under contract.

ADJUSTING MACHINE KNIVES.

As, in machine construction, we are pretty rigidly confined to rotary motion for high-speed and continuous action,