THE "HOW-TO-DO-IT" BOOKS

PRACTICAL MECHANICS FOR BOYS

In language which every boy can understand and so arranged that he may readily carry out any work from the instructions given.

WITH MANY ORIGINAL ILLUSTRATIONS

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CARPENTRY FOR BOYS ELECTRICITY FOR BOYS

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CHAPTER II: HOW TO GRIND AND SHARPEN TOOLS

It is singular, that with the immense variety of tools set forth in the preceding chapter, how few, really, require the art of the workman to grind and sharpen. If we take the lathe, the drilling machine, as well as the shaper, planer, milling machine, and all power-driven tools, they are merely mechanism contrived to handle some small, and, apparently, inconsequential tool, which does the work on the material.

Importance of the Cutting Tool.—But it is this very fact that makes the preparation of that part of the mechanism so important. Here we have a lathe, weighing a thousand pounds, worth hundreds of dollars, concentrating its entire energies on a little bit, weighing eight ounces, and worth less than a dollar. It may thus readily be seen that it is the little bar of metal from which the small tool is made that needs our care and attention.

This is particularly true of the expensive milling machines, where the little saw, if not in perfect order, and not properly set, will not only do improper work, but injure the machine itself. More lathes are ruined from using badly ground tools than from any other cause.

In the whole line of tools which the machinist must take care of daily, there is nothing as important as the lathe cutting-tool, and the knowledge which goes with it to use the proper one.

Let us simplify the inquiry by considering them under the following headings:

1. The grinder.

2. The grinding angle.

The Grinder.—The first mistake the novice will make, is to use the tool on the grinder as though it were necessary to grind it down with a few turns of the wheel. Haste is not conducive to proper sharpening. As the wheel is of emery, corundum or other quickly cutting material, and is always run at a high rate of speed, a great heat is evolved, which is materially increased by pressure.

Pressure is injurious not so much to the wheel as to the tool itself. The moment a tool becomes heated there is danger of destroying the temper, and the edge, being the thinnest, is the most violently affected. Hence it is

desirable always to have a receptacle with water handy, into which the tool can be plunged, during the process of grinding down.

Correct Use of Grinder.—Treat the wheel as though it is a friend, and not an enemy. Take advantage of its entire surface. Whenever you go into a machine shop, look at the emery wheel. If you find it worn in creases, and distorted in its circular outline, you can make up your mind that there is some one there who has poor tools, because it is simply out of the question to grind a tool correctly with such a wheel.

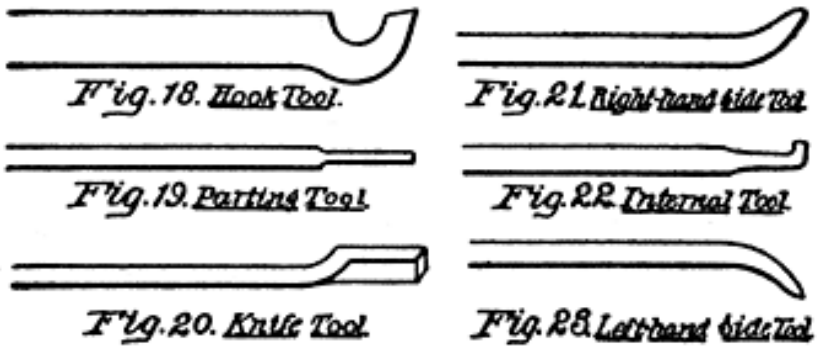


Fig. 18-23. Tools.

Coarse wheels are an abomination for tool work. Use the finest kinds devised for the purpose. They will keep in condition longer, are not so liable to wear unevenly, and will always finish off the edge better than the coarse variety.

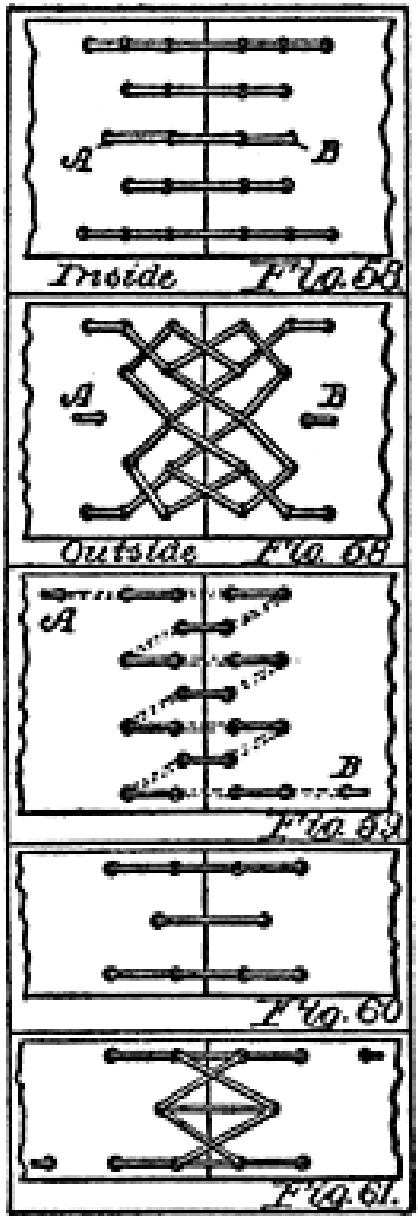
Lathe Bits.—All bits made for lathes are modifications of the foregoing types (Figs. 18-23, 19, 20, 21, 22, 23).

As this chapter deals with the sharpening methods only, the reader is referred to the next chapter, which deals with the manner of setting and holding them to do the most effective work.

When it is understood that a cutting tool in a lathe is simply a form of wedge which peels off a definite thickness of metal, the importance of proper grinding and correct position in the lathe can be appreciated.

Roughing Tools.—The most useful is the roughing tool to take off the first cut. As this type of tool is also important, with some modifications, in finishing work, it is given the place of first consideration here.

CHAPTER VI: ILLUSTRATING SOME OF THE FUNDAMENTAL DEVICES



There are numerous little devices and shop expedients which are desirable, and for which the boy will find uses as he progresses.

We devote this chapter to hints of this kind, all of which are capable of being turned out or utilized at various stages.

Lacing Belts.—To properly lace a belt is quite an art, as many who have tried it know. If a belt runs off the pulley it is attributable to one of three causes: either the pulleys are out of line or the shafts are not parallel or the belt is laced so it makes the belt longer at one margin than the other.

In Fig. 58 the lacing should commence at the center hole (A) of one belt end and lace outwardly, terminating at the hole (B) in the center of the other belt end, as shown in Fig. 58.

In Fig. 59 the lacing commences at A, and terminates at the hole (B) at the edge. This will be ample for all but the widest belts.

Fig. 60 is adapted for a narrow belt. The lacing commences at one margin hole (A), and terminates at the other margin hole (Z)

Fig. 61 shows the outside of the belt.

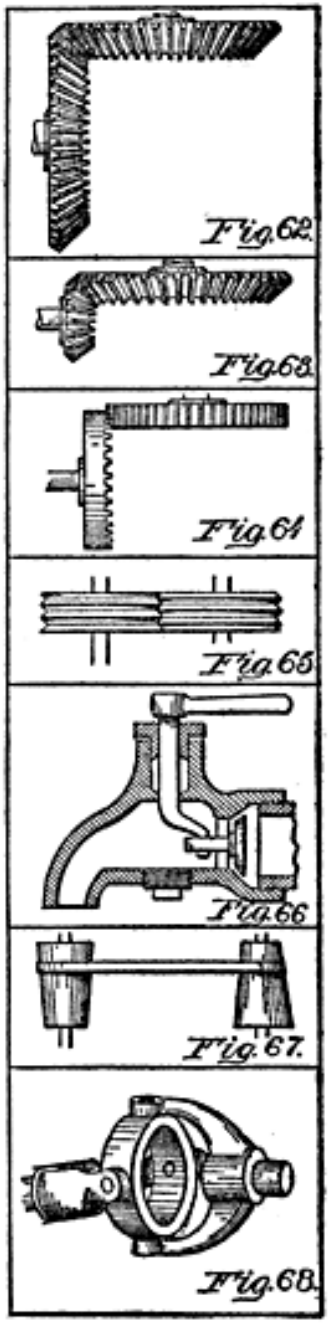


Fig. 62. Gears.—This is something every boy ought to know about. Fig. 62 shows a pair of intermeshing bevel gears. This is the correct term for a pair when both are of the same diameter.

Miter Gears.—In Fig. 63 we have a pair of miter gears, one being larger than the other. Remember this distinction.

Fig. 64. Crown Wheel.—This is a simple manner of transmitting motion from one shaft to another, when the shafts are at right angles, or nearly so, without using bevel or miter gears.

Fig. 65. Grooved Friction Gearing.—Two grooved pulleys, which fit each other accurately, will transmit power without losing too much by friction. The deeper the grooves the greater is the loss by friction.

Fig. 66. A Valve Which Closes by the Water Pressure.—The bibb has therein a movable valve on a horizontal stem, the valve being on the inside of the seat. The stem of the handle has at its lower end a crank bend, which engages with the outer end of the valve stem. When the handle is turned in either direction the valve is unseated. On releasing the handle the pressure of the water against the valve seats it.

Fig. 67. Cone Pulleys.—Two cone pulleys of equal size and taper provide a means whereby a change in speed can be transmitted from one shaft to another by merely moving the belt to and fro. The slightest change is available by this means.

Fig. 68. Universal Joint.—A wheel, with four projecting pins, is placed between the U-shaped yokes on the ends of the approaching shafts. The pins serve as the pivots for the angles formed by the two shafts.

CHAPTER X: ON GEARING AND HOW ORDERED

The technical name for gears, the manner of measuring them, their pitch and like terms, are most confusing to the novice. As an aid to the understanding on this subject, the wheels are illustrated, showing the application of these terms.

Spur and Pinion.—When a gear is ordered a specification is necessary. The manufacturer will know what you mean if you use the proper terms, and you should learn the distinctions between spur and pinion, and why a bevel differs from a miter gear.

If the gears on two parallel shafts mesh with each other, they both may be of the same diameter, or one may be larger than the other. In the latter case, the small one is the pinion, and the larger one the spur wheel.

Some manufacturers use the word "gear" for "pinion," so that, in ordering, they call them *gear* and *pinion*, in speaking of the large and small wheels.

Measuring a Gear.—The first thing to specify would be the diameter. Now a spur gear, as well as a pinion, has three diameters; one measure across the outer extremities of the teeth; one measure across the wheel from the base of the teeth; and the distance across the wheel at a point midway between the base and end of the teeth.

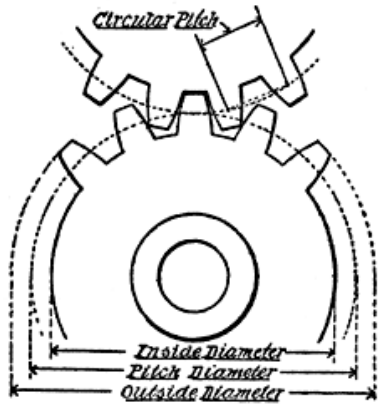


Fig. 121. Spur Gears

These three measurements are called, respectively, "outside diameter," "inside diameter," and "pitch diameter." When the word *diameter* is used, as applied to a gear wheel, it is always understood to mean the "pitch diameter."

Pitch.—This term is the most difficult to understand. When two gears of equal size mesh together, the pitch line, or the *pitch circle*, as it is also called, is exactly midway between the centers of the two wheels.

Now the number of teeth in a gear is calculated on the pitch line, and this is called:

Diametral Pitch.—To illustrate: If a gear has 40 teeth, and the pitch diameter of the wheel is 4 inches, there are 10 teeth to each inch of the pitch diameter, and the gear is then 10 *diametral pitch*.

Circular Pitch.—Now the term "circular pitch" grows out of the necessity of getting the measurement of the distance from the center of one tooth to the center of the next, and it is measured along the pitch line.

Supposing you wanted to know the number of teeth in a gear where the pitch diameter and the diametral pitch are given. You would proceed as follows: Let the diameter of the pitch circle be 10 inches, and the diameter of the diametral pitch be 4 inches. Multiplying these together the product is 40, thus giving the number of teeth.

It will thus be seen that if you have an idea of the diametral pitch and circular pitch, you can pretty fairly judge of the size that the teeth will be, and thus enable you to determine about what kind of teeth you should order

How to Order a Gear.—In proceeding to order, therefore, you may give the pitch, or the diameter of the pitch circle, in which latter case the manufacturer of the gear will understand how to determine the number of the teeth. In case the intermeshing gears are of different diameters, state the number of teeth in the gear and also in the pinion, or indicate what the relative speed shall be.

This should be followed by the diameter of the hole in the gear and also in the pinion; the backing of both gear and pinion; the width of the face; the diameter of the gear hub; diameter of the pinion hub; and, finally, whether the gears are to be fastened to the shafts by key-ways or set-screws.