Chipping Chisels: How to Use Them

By James Tate

NO mechanic is fully trained until he has mastered the art of using the chisel. By this is meant not merely employing the chisel to cut off pieces of light steel or material of similar character. The good mechanic does, it is true, use the "cold" chisel for this occasionally, but the chisel is capable of an infinite variety of much finer and better work than this; indeed, in the hands of a mechanic of the old school, it frequently had to take the place of the shaper or the keyseater, the oil-grooving machine or the slotter. The chisel is one of the oldest tools known to man, and even in this age of machine tools it retains its usefulness to the worker in metals. The principal use of the flat chisel, aside from the minor one of cutting off stock (which, by the way, can usually be done better with a hacksaw) is that of preparing the surface of castings and similar work for finishing with the file or in a machine, to cut snags off castings, to fit punches and dies and to fit castings to each other. Suppose we are in a shop where there is no shaper, or that we are erecting a machine in the field far from the shop, and that we have to remove .125 in. of metal from the base of a bracket; how shall we go about the job? Here is a task for the flat chisel, and its companion, the cape chisel. Using the latter first, we chip a series of grooves across the face of the casting, to a depth of a little less than .125in., the grooves being not quite as far apart as the width of the flat chisel to be used. When this has been done, we use the flat chisel to remove the metal left by the cape chisel, and, when the face has been brought to a flat surface, finish the job and fit the casting to the machine with the file. A skillful wielder of hammer and chisel can do the job in less time than it takes to describe the operation, and the piece will be as well fitted as though the work had been done entirely on a machine.

Flat chisels are made in a variety of sizes of shank and blade, and of varying lengths also. The usual material is 70-point octagonal steel, and the usual shape as shown at A, Fig. 1. There is another shape that is favored by some machinists (B, Fig. 1 and perspective view) because it needs "dressing" or reforging less often than the common type. The chipping chisel should have a thin cutting edge or point, as it is usually called, and this is one reason why the mechanic who is careful of his tools is reluctant to use it as a cutting-off tool—the point is too apt to break, necessitating the dressing of the tool. The body of the tool, for average chipping, may be of ¾ or .875" octagonal steel. The cutting edge, if the tool is made of ¾-in. steel, should be .875" wide, and if of .875" steel should be 1 in. wide. The thickness of the point is a matter of taste, but it should not be allowed to become any thicker than 3/32 in. before reforging or regrinding. The cutting edge should be parallel with one of the flats on the shank of the tool (Fig. 1, C), to assist in keeping the surface being

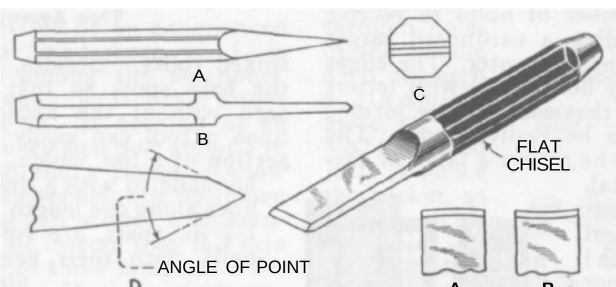


Fig.1 Fig.2

Two Forms of Flat Chisels, and Drawing Showing How Edge Is Ground chipped flat, and to prevent the chisel from twisting in the hand. It will be found that the thinner the cutting edge, the easier the chisel is to hold to the cut and the better it cuts; good work cannot be done with a thick edge.

The angle of the cutting edge (D, Fig. 1) varies for different metals, just as the angles of a lathe tool are ground to suit cast iron, brass, steel, etc. For cast iron, the angle should be from 60 to 70° ; for wrought iron and steel 50 to 60° ; for brass 40 to 50°, and for copper, babbitt and other soft metals 30 to 40°. The angle should be just as sharp as the chisel will stand for the metal on which it is to be used.

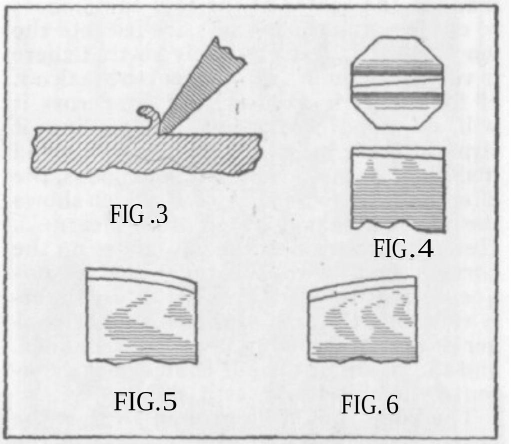
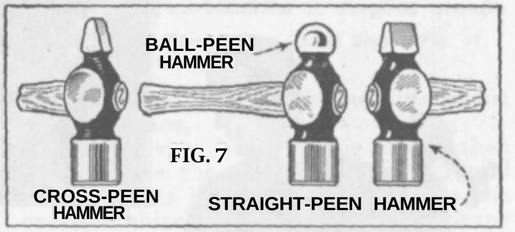


FIG.8



Above, Various Faults in Chisel Grinding; Center, Position for Chipping; Below, Types of Chipping Hammers

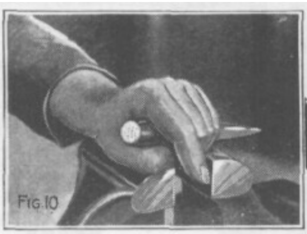
One finds chipping chisels ground in a number of ways in the shop, but in this, as in everything else, there is but one really correct way of grinding the tool. This is shown in Fig. 2, A, in which the cutting edge has a slight curve outward, the center being higher than the corners. There is a very good reason for this. When a chisel is ground in this manner, the center of the tool commences to cut first and the corners are fed into the work more or less gradually so that there is very little tendency for them to break off. If the chisel is ground straight across it will do good work, but in grinding it straight there may be a tendency to grind it slightly hollow. When this happens, the effect is as shown in Fig. 2, B, which shows the hollow exaggerated for clearness. Here all the strain of the cut comes on the corners first, with the invariable consequence that they are broken off. By slightly rounding the face of the chisel, the danger of hollow-grinding the edge is avoided, and the strain of the cut comes in the center of the chisel first, as it should.

The edge should be ground so that the bevels are parallel to each other and the edge, and at right angles to the sides of the chisel, or its centerline. If the bevel is rounded, as in Fig. 3, it will be found hard to keep the edge down to the work, and the chisel will have a tendency to ride over the surface, instead of biting into the work. Also, if the bevels are ground so that the cutting edge assumes an angle across the chisel, as in Fig. 4, the chisel will twist in the hand as it is struck. If ground as shown in Fig. 5, it will work to the left, and if ground as in Fig. 6, it will work to the right; in either case no good work can be done with the tool.

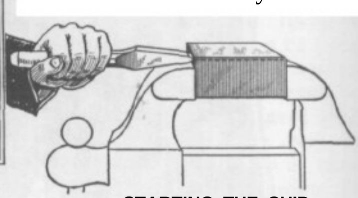
It will be seen from the foregoing that there is more to grinding a chisel than merely making the edge sharp, and that it will pay the budding mechanic to give it attention.

Three forms of chipping hammers are shown in Fig. 7. The weight of the chipping hammer depends to some extent on the work to be done, and on individual choice, and varies from ¾ to 1¾ lb. The apprentice will probably find a 1½-lb. ball-peen hammer about right for him. The face should be slightly "crowned" or rounded, and the handle should be a hickory one, about 10 in. long. The handle should not be too heavy at the "neck" but should be small enough here to give it a little spring, and thereby prevent too much shock to the wrist when the chisel is struck. This is a point that is little considered when fitting hammer handles, but it is surprising what a difference a little spring in it makes when a heavy job of chipping (or any other hammer work) has to be done.

Fig. 8 shows the proper method of standing at the vise and of holding the hammer and chisel when chipping. Grasp the hammer at the end, or as near the end as you can and still control the force of the blow. Swing the arm mainly from the elbow, and carry the hammer back as shown in Fig. 9. The first strokes should be short and light, then, as the chisel commences to cut into the work, they should be made long and heavy. Fig. 10 shows how the chisel should be held, and right here let me give the chipper a word of advice. Look at the cutting edge of the chisel when chipping. Don't watch the chisel head. If one gets into the habit of watching the edge, the hitting of the head of the chisel becomes second nature, and one need not be afraid of hitting the fingers. If, on the contrary, one becomes accustomed to watching the head of the chisel, beware of the moment of forgetfulness when one removes the eyes from



Left, End of Swing; Fig. 10, How the Chisel Is Grasped; Upper Right, Taking the Chip, and Lower Right, the Cape or Crosscut Chisel



STARTING THE CHIP
FIG. 11

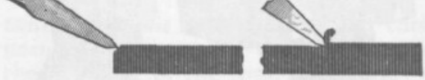


FIG. 12

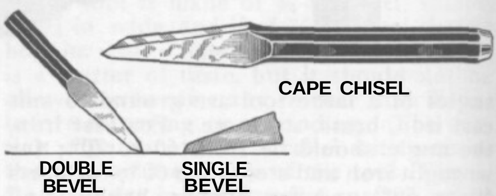


FIG. 13

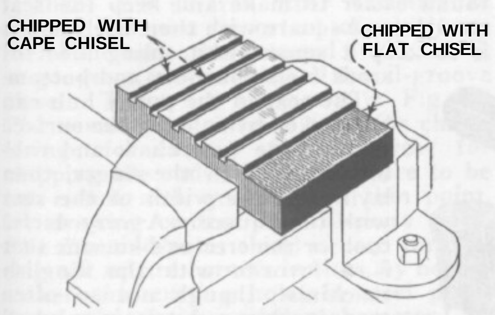


Fig.14

FIG.15

FIG.16

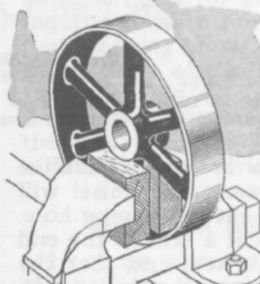


FIG.17

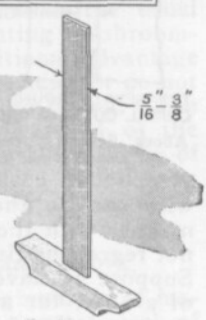


FIG.18

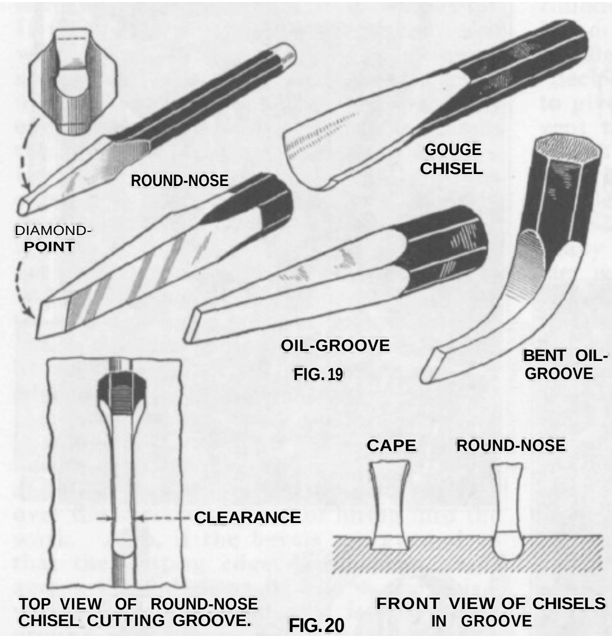
Fig. 14, Chipping a Broad Surface; Figs. 15 and 16, Laying Out and Cutting Keyseat on Shaft; Fig. 17. Holding Pulley for Keyseating and Fig. 18. Keyseat Square

it while striking a blow! The loose grip of the forefinger and thumb shown helps reduce the damage if they are accidentally struck.

To start a chip on a piece of work, hold the chisel in the horizontal position shown in Fig. 11, then strike a sharp blow with the hammer; this will break off a chip on the edge of the work and the chisel can then be held in the position shown in Fig. 12, so that the lower level is at a small angle to the surface. The depth of the cut taken by the flat chisel (or any other chisel with a double bevel) depends on the height of the hand holding it. Raising the hand permits a bigger cut to be taken and lowering it allows a light cut. Stop the cut when about .25 in. from the farther edge of the work, if the metal is cast iron, to prevent the edge from breaking off, and when the whole surface has been chipped from the near side, always stopping .25 in. from the farther edge, reverse the work in the vise and chip off the remaining part of the surface.

When a very heavy cut is to be taken off a surface, the cape chisel will be found handy. This is sometimes known as the crosscut chisel, and is forged to the shape shown in Fig. 13. It may be ground either with a double-beveled edge or with a single bevel, although for straight chipping work, as in the illustration given at the beginning of this article, the double bevel is the more usual. A series of grooves chipped across the work will help subsequently when chipping with the flat chisel (see Fig. 14). The grooves should be spaced apart a little less than the width of the cutting edge of the flat chisel used, so as to relieve the corners of the latter from danger of breaking.

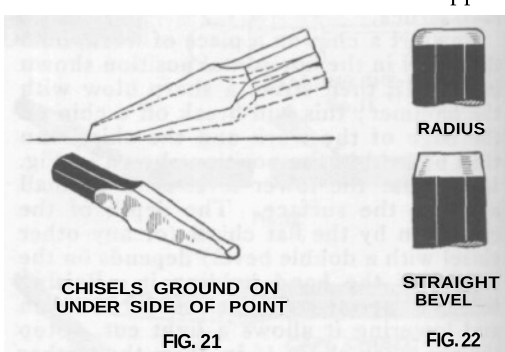
The cape chisel is also used for cutting seats for sunk and feather keys in shafts. Little of this need be done in the shop nowadays, of course, but in the field, when erecting machinery, it is occasionally necessary to cut a keyseat in a shaft or a keyway in a pulley hub, and the machinist



Above, Several Types of Special Chisels; Below, How Cape and Round-Nose Chisels Should Be Forged and Ground

who can do the job in a workmanlike manner with the hammer and chisel will not regret the time spent in learning how. Suppose we have to cut a seat at the end of a shaft for a sunk key, and that the corresponding keyway in the pulley hub must be cut also. Clamp the end of the shaft in the vise as shown in Fig. 15, and, by means of a keyseat rule, or a pair of keyseat clamps applied to a scale, mark off the width and length of the keyseat. If a shallow, flat-bottomed hole of the correct diameter can be drilled at the inner end of the keyseat so much the better, but if not, we will have to make the best of it. With a cape chisel a trifle smaller in width than the key, we are to commence chipping along the marked lines of the seat (Fig. 16). If the point of the chisel is rubbed on a piece of waste saturated with oil every few moments it will be found to cut better. At the end of the cut, if there is no hole there, make a vertical cut with a small flat chisel of the same width as the cape chisel. Continue cutting until the keyseat is of the proper depth, then fit the key in place with a safe-edge square file. The chisel should leave little stock for the file to remove; the filing should merely be a smoothing operation, as, with a little practice, it will be found easier to make and keep the seat straight and square with the chisel than it is to keep it square while filing a lot of stock from the sides and bottom.

The seat in the pulley hub can be marked by rubbing the surface of the hole with chalk and rubbing it in with the finger, then laying off the width of the seat with the square. A very useful tool for the erector's kit, one that is a favorite with the English machinist, though not so often seen in this country, is a small steel T-square (Fig. 18). This is handier than the common square for marking off keyseats in pulleys and gears, and, as the blade is usually only about .312 or .375 in. wide, it will enter almost any hole that the erector may encounter. With the lines laid out on the inside of the hole to guide us, we shall not be long in cutting the keyway. A word of warning is pertinent here. It will usually be found necessary to clamp the pulley in the vise by means of one of the arms, and a block of soft wood (Fig. 17) should always be placed on each side of the arm, to prevent breaking it if the chip taken from the hole is a fairly heavy one. Also, the cape chisel used should be ground with a single bevel, as, if a double-bevel chisel is used, it must be held too high in order to force it to cut; this, in a long hub, means that the chisel shank strikes the upper edge of the hole before the chisel has gone halfway through. The cut should be stopped before the chisel has reached the opposite side of the hole, the pulley reversed in the vise, and the remainder of the seat cut from the opposite side, to prevent the end of the seat from chipping off.



Left, Bevel on Underside of Chisel; Right, Radius and Straight Bevels on Chisel Heads

There are several other varieties of chisels, the most important of which are the round-nose, the diamond point, the C, or gouge or cow-mouth, and the oil-groove chisel. These are all shown in Fig. 19. The round-nose chisel is used for chamfering; for cutting small grooves; for chipping the ends of slots that are to be cut round, and, ground to a thin point, for drawing centers on drill-press work. The diamond-point chisel is used for cutting out square corners in slots, by boiler-makers for cutting holes in steel plate, and for work of a similar character. It might be used, for example, in squaring the corners of the keyseats in the pulley and shaft that we just finished. It may have a slight bevel on the underside or the underside may be perfectly straight, depending on the work. The C, gouge or cow-mouth chisel (it is known by all three names) is a large round-nose chisel, with the blade hollowed out on the upper side somewhat like the carpenters' gouge. It is used for larger chamfers and grooves than the round-nose chisel, but otherwise its use is the same. The oil-groove chisel is nothing more than a fine-point round-nose chisel, made straight, like the common round-nose, for straight grooves, and bent, as shown in Fig. 19, for circular grooves; when made in the latter form, the radius to which it is bent must be less than that of the bearing in which it is intended to be used.

In all these chisels the point or cutting edge must be wider than the portion of the blade back of it, Fig. 20, and the bottom wider than the top, to provide clearance so that the chisel will cut cleanly and not wedge itself in the cut. When cutting soft metal, if the point is not wider than the remainder of the blade, the latter will wedge and throw up a burr on each side of the cut; this is especially likely to happen with the oil-groove chisel, and the burr must then be scraped off. In grinding a cape, round-nose, cow-mouth or diamond-point chisel for ordinary work, the underside of the blade may be beveled, as shown in Fig. 21. This permits the angle of the cutting edge to be changed in relation to the surface of the work by merely raising or lowering the hand. As this makes the angle more obtuse, it lessens the liability of the point of the diamond-point chisel to break, which is a pronounced fault in this chisel. However, when the work is deep, this bevel is a disadvantage, for the reason mentioned in connection with the cape chisel used for the keyseat, and the bottom of the chisel should therefore be ground straight for deep holes or slots. Chisels should be tempered to a purple for steel, and to a dark purple for cast iron. These colors correspond to temperatures of 530 and 550° F., respectively. This must not be taken as a hard-and-fast rule, as many chisels will work well when tempered to a dark blue (600° F.). When in doubt, temper a trifle soft, as there will then not be as much danger of breaking the tool.

The end of the chisel opposite to the "business" end is not ordinarily given the attention it merits. The head is usually left soft, with the consequence that the end "mushrooms" and presently becomes a positive menace, due to the little slivers of steel that are apt to fly off when the head is struck with the hammer. Chisels should never be permitted to get into this condition, but the ends should always be beveled as shown in the upper drawing. Fig. 22. This form of head has been found by one of the large automobile-building companies to be better than the usual straight bevel for preventing mushrooming and to have the additional advantage that glancing blows of the hammer do not cause chips of the head to fly off. The radius should be from 1/8 to 1/4 of the diameter of the tool. A radius of .187 of the tool diameter has been found very satisfactory in service.