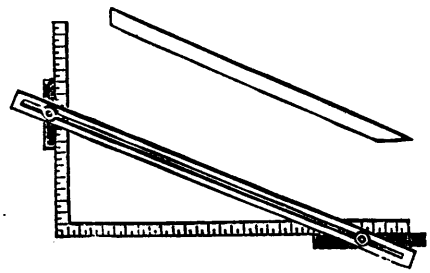
Constructive Carpentry.

MEASURING AND MAKING RAFTERS.

The difficulties of fitting rafters may be overcome by the following simple means: Take a strip of wood 2 inches wide, 24 to 30 inches long, and 1 inch thick; saw a slit in the center a quarter of an inch wide, as shown in the engraving; mark the inches and other divisions of the scale upon each edge. Make two strips of brass or steel 1 inch wide and 1-16th thick, and 6 inches or more in length. Connect these to the long strip by means of thumb screws. To use the gauge, lay it upon a square, as shown, with the zero (0) of the scale on the figure of the long arm of the square which shows half the width of the building in feet; and place the edge of the gauge upon the figure of the



APPARATUS FOR MEASURING RAFTERS.

short arm of the square, which marks the pitch of the roof. Thus, for a building 28 feet wide, and with a roof pitch of 10 feet, the 0 should come on the long arm and the edge of the gauge meet 10 on the short arm. The figures on the gauge will mark the length, 17 ft. 3 in., of the top side of the rafter. Then by tightening the thumb screws, and fixing the metal guides even with the arms of the square, the bevel of the ends of the rafter will be given. A rafter cut according to the gauge is represented at the top of the illustration. The projection of the rafter beyond the eave of the roof is to be added to the above length. This simple apparatus will enable any one handy with tools to cut rafters of the proper length and shape, and it will also facilitate the operations of an experienced workman.

Engineering, Civil & Mechanical.

GETTING A SHAFT IN THE LATHE.

J. J. Grant writes for the *American Machinist* his method of preparing a shaft for turning. Although he in the main describes the steps and precautions which good machinists usually observe, there are some points of practice which it will be worth while to read about and experiment with: As the centering of a shaft, or piece of work, is the first operation, and as all subsequent operations are dependent on the centers, it is, of course, necessary that they should be as perfect as possible. In the first place, *never* turn a piece of work, no matter how short the job, without drilling and countersinking the centers, as the lathe, or male centers, retain their accuracy for a much longer time than when work is done on them without being so made ready.

To center a piece of work properly it should be, if a long shaft, straightened as near as possible with the eye, which may be done either with a sledge or under a screw press, then with center punch, prick as near as possible, and only deep enough to hold on the centers; it can then either be revolved and marked with chalk on the full side, and drawn with the center punch, or it may be "square centered;" which is done by having a center ground square, leaving four cutting edges.

Care should be taken to put the square center into the tail stock of the lathe, so as to present two cutting edges to the front. A "crotch" tool made in the form of a V at the end of a common lathe tool, having an opening large enough to take in the shaft, is then clamped into the tool post, and set so that the center of the V is on a level with the lathe centers.

The shaft should be revolved at a speed as fast as practicable, say from 50 to 300 per minute, according to the size. The crotch tool should be forced against the revolving shaft, and, at the same time, the square center must be gradually worked in, care being taken not to make the center too large before the shaft has become true. A little practice will enable a beginner to center a shaft true and quickly.

Never drill or ream a center too large or out of proportion with the work, as nothing looks worse to a mechanic than to see centers in a piece of work one-half its diameter.

The size of center drills for different diameters of shafts should be about as follows:—¼ in. to ½ in., inclusive, 1-32; ⅝ in. to 1 in., inclusive, 1-20; 1¼ in. to 3 in., inclusive, ⅛; 3½ in. and above, 5-32. The largest or outside diameter of the countersink should be about three times the diameter of the drills, but these proportions must, of course, be inversed if the shaft is to run on centers, and not in journal boxes.

Having now centered the shaft, the next operation is to straighten it. There are various appliances for this purpose, but the best is a screw press, made to traverse the bed of the lathe, and in the best make having wedge blocks with a V on the top that can be raised, and also moved close together, or far apart, as the crook in the shaft is short or long.

Now, while the shaft is revolving, mark the full side with a piece of chalk every three or four inches for the full length, as by so doing you get the proper place to begin. Sometimes it should be bent more than is necessary to bring the exact spot true, as when the full side or crooks are on opposite sides, when by bending the other crooks it will bring it back.

It is always necessary to loosen the centers when using the press; the wedges should only be brought to bear and not forced under the shaft too tight. To become an expert at this part of the work requires long practice, and can only be attained by closely noticing the effect of each blow or strain of the sledge or press upon each part of the shaft. I have seen a shaft, when pronounced finished by a good hand, run as true as a turned shaft.

When we have the shaft properly straightened, it must be squared true with a side tool, and the centers re-reamed with the square center, care being taken to have the center *exactly* 60° angle. Drill the centers with the proper sized drill only about one-eighth inch deep, and the shaft is ready for the next operation, which is turning.

COLOURING AND POLISHING BRASS WORK.

To prevent the every-day rusting of brass goods, the trade has long resorted to means for protecting the surface from the action of the atmosphere, the first plan of which is to force a change to take place. Thus, if brass is left in damp sand, it acquires a beautiful brown colour, which, when polished with a dry brush, remains permanent and requires no cleaning. It is also possible to impart a green and light coating of verdigris on the surface of the brass by means of dilute acids, allowed to dry spontaneously. The antique appearance thus given is very pleasing, and more or less permanent. But it is not always possible to wait for goods so long as such processes require, and hence more speedy methods became necessary, many of which had to be further protected by a coating of varnish. Before bronzing, however, all the requisite fitting is finished, and the brass annealed, pickled in old or dilute nitric acid till the scales can be removed from the surface, scoured with sand and water, and dried. Bronzing is then performed according to the colour desired; for although the word means a brown colour, being taken from the Italian "*bronzino*," signifying burnt brown, yet in commercial language it includes all colours.

Browns of all shades are obtained by immersion in solutions of nitrate or the perchloride of iron; the strength of the solutions determining the depth of colour. Violets are produced by dipping in a solution of chloride of antimony, or of permuriate of iron. Chocolate is obtained by burning on the surface of the brass moist red oxide of iron, and polishing with a very small quantity of black lead.

Olive green results from making the surface black by means of a solution of iron and arsenic in muriatic acid, polishing with a black-lead brush, and coating it, when warm, with a lacquer composed of one part lac-varnish, four of turmeric, and one of gamboge.

A steel-grey colour is deposited on brass from a dilute boiling solution of muriate of arsenic; and a blue by careful treatment with strong hydrosulphite of soda.

Black is much used for optical brass work, and is obtained by coating the brass with a solution of platinum, or with chloride of gold mixed with nitrate of tin. The Japanese bronze their brass by boiling it in a solution of sulphate of copper, alum, and verdigris.