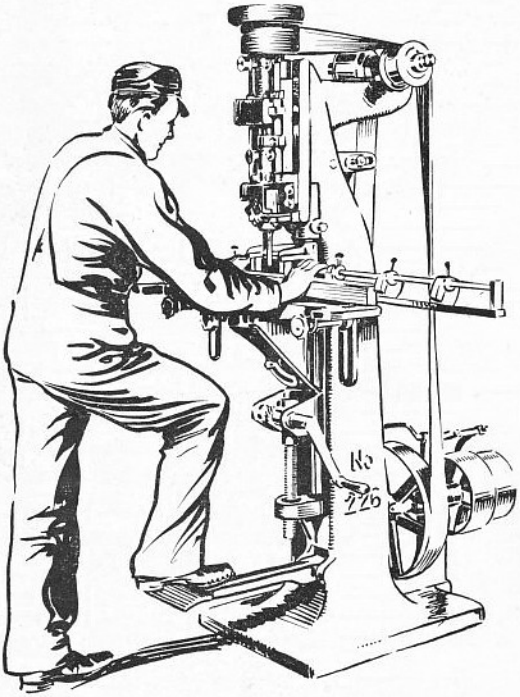
MORTISING

IN MANUAL TRAINING SCHOOLS



GREENLEE BROS & COMPANY
ROCKFORD · · · · ILLINOIS

Machine Mortising

A FEW IDEAS ON ITS APPLICATION To Manual Training Courses in Woodwork.

FEBRUARY No. 111 1915

FOR centuries the mortise and tenon pattern of joint for framing woodwork has been the one most used, and this seems to be true in all parts of the world and without much relation to the degree of civilization attained. It is a demonstration of the natural law of spontaneous development from a common need.

Probably the earliest method of making mortises was by burning with a red hot iron, and so slow was the progress in this line that after a lapse of several thousand years the art had advanced no further than the auger, chisel and mallet stage.

The first mortising machine of which there is any record was invented by Admiral Bentham in 1793 and machines of his design were in use by the British Admiralty previous to the year 1800.

Bentham's first machine was the parent of the reciprocating mortiser or "stabber" still used in some classes of work. The operation consisted of first boring a round hole and afterward elongating it by means of a vertically reciprocating chisel.

Bentham also designed a mortising machine in which a rotating tool or bit was made to produce an elongated mortise by mounting it in a spindle which not only revolved but had an oscillating motion, this being variable to give different lengths of mortises. This form of machine is still in use and is known as a "router."

The principal objections to the reciprocating mortiser are that in hard wood a hole must first be bored to start the cut, and the action of the chisel pounds the chips down into the mortise so that it requires as much time to clean it as to make it. Unless this machine is installed on a solid foundation on the ground the noise and jar of its operation are very annoying.

THE Router is more smooth and quiet in its operation but as the cutting is done by the sideways travel of the tool fast feeds cannot be taken. It leaves the mortise with round ends and these must either be squared out or the edges of the tenon must be rounded to make a fit. These supplementary operations add greatly to the cost of the work.

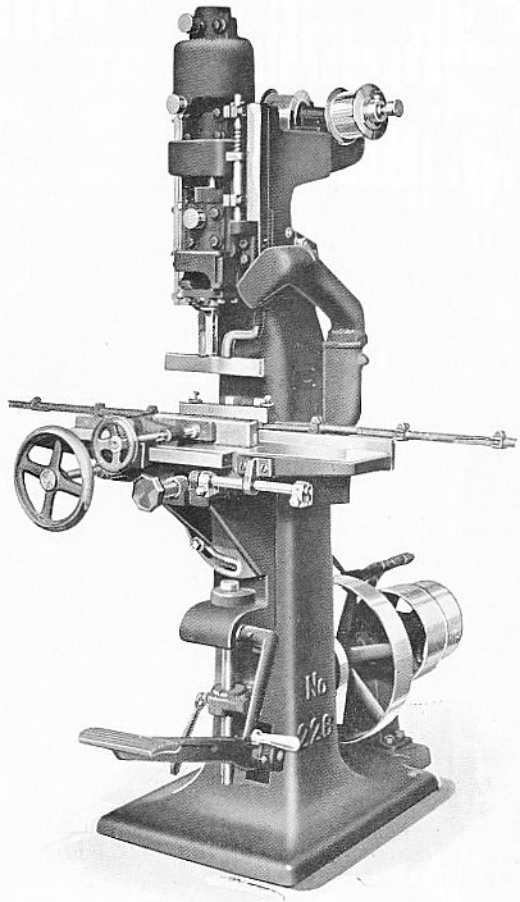
We have seen that it had taken more than a thousand years to work up through the red hot iron and auger and chisel stages in mortising. The stabber and router era had covered about three-quarters of a century when the next great forward step was made. This certainly shows an accelerating rate of progress.

Forty years ago Greenlee Bros. & Co. brought out the first Hollow Chisel Mortiser and one of the earliest machines was shown at the Centennial Exposition at Philadelphia in 1876 where it attracted much attention as "the machine that bores a square hole."

This had been the dream of inventors, and would-be inventors, for many years and wonderful were some of the mechanical appliances proposed for performing this very simple operation. Their failure was due to a lack of proper analysis of the problem.

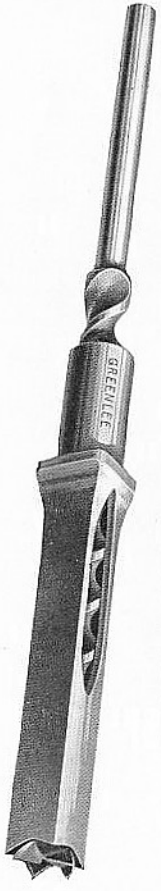
Previous to the introduction of Bentham's machines mortising practice consisted of the boring of round holes and then squaring them out with a hand chisel. This is exactly what the hollow chisel mortiser does only it performs both functions simultaneously and does at one stroke what was accomplished in the old way by the slow twisting of an auger and repeated blows on a chisel.

Simple as are the principles involved the actual working out of the details was attended in the early days with many disappointments. It was easy to take a bar of steel, drill a hole through its length, mill its four sides to size and temper it properly. It was also comparatively easy to make a simple machine for holding the chisel firmly and revolving the bit inside, and having a means of forcing the tools simultaneously into the wood.



No. 226-B Greenlee Foot Lever Feed Vertical Hollow Chisel Mortiser with Compound Table, Stop Rod and Auxiliary Back Support; Also Blower, Clamp and Stock Holding Devices

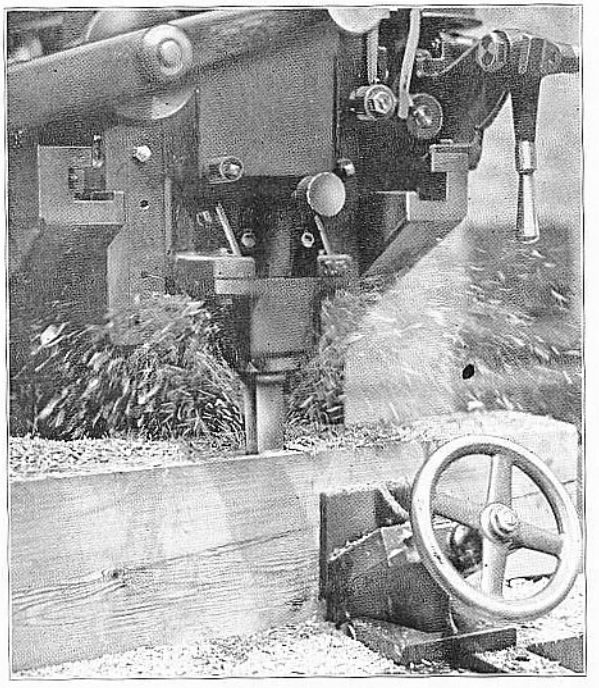
YES, this was easy, but the trouble was it wouldn't work—at most only a few strokes could be made before the bore of the chisel and the twist of the bit were filled with chips which would not discharge, and which the rapid revolution of the bit caused to heat the tools sufficiently to destroy their temper.



It was first attempted to correct the difficulty by putting a vent slot the blade of the chisel to aid the escape of the chips but still they refused to take advantage of the opportunity. It was then thought that the reason the chips would not come out was because the chisel bore was not smooth enough, and so a mirror polish was given it. It was worse than before and this at last located the difficulty. The bore was then serrated with longitudinal grooves and the chips discharged freely. This was the basis of our patent on the inside corner grooves.

The philosophy of the thing is this: if you take a bolt with a nut on it and revolve it, the nut will make no progress lengthwise unless you hold it from turning with the bolt. Now the twist of the bit in the hollow chisel corresponds to the screw thread on the bolt, and the wad of chips is the nut. When the chisel was smooth in the bore there was nothing to prevent the chips turning with the revolution of the bit and so no progress towards the vent was made. By grooving the chisel bore the chips were held from turning and were immediately carried along by the twist of the bit and properly discharged. Thus was developed the type of machine which has effected a complete revolution in mortising practice.

THE early machines were of small capacity and therefore a foot-lever was sufficient to force the chisel into the cut, but soon there was a demand for a machine to operate larger chisels than could be worked by the foot and the automatic power feed was developed. We now manufacture more than a dozen different sizes and styles of mortisers in both vertical and horizontal patterns and with foot and power feeds.



A Big Fellow

It is a long step from the primitive red hot iron to the modern automatic machines, the largest sizes of which will make a mortise 3 inches square and 10 inches deep in hard wood at each stroke.

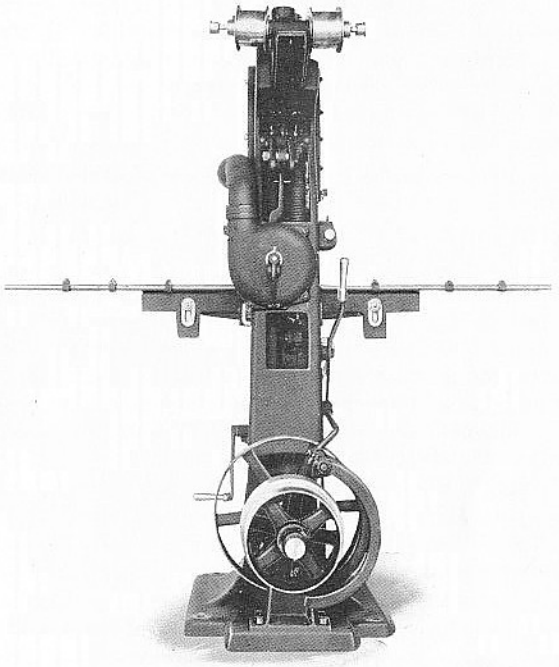
THERE are now very few woodworking shops of importance where a hollow chisel mortiser is not found, and as mortising is done in every branch of woodwork, a knowledge of the methods, and a familiarity with the machines used should be an important part of instruction in woodwork in every manual training school.

There is the same relative difference between hand and machine made mortises as between penmanship and typewriting. It is important to know the manual method but modern progress has made it necessary to know also some more rapid and efficient way of doing these things. The boy who is taught only one method, even if it is fundamental but which is now obsolete in the arts, is not being given what he is entitled to.

The age of hand work has gone by. One by one the crafts have had to yield to the superior accuracy, uniformity and cheapness of the machine made article, and while from the artistic standpoint these characteristics may not seem important nor perhaps desirable, from the position of the producer and the consumer they are vital. Machine production is the order of the day because it represents efficiency, and the aim of all education is the development of efficiency.

Educational value is rightly the standard by which all teaching methods must be judged, but the educational value of an exercise or project is no less because it is planned with a view to ultimate use, and follows a definite aim to a practical result. Indefiniteness and aimlessness are often disguised under such terms as "broadly cultural." We do not wish to imply that nothing is of value except what is utilitarian in character, for a purely ornamental object may serve a highly useful purpose because of its beauty alone. We are convinced however that "work for work's sake," with no other aim, ends where it begins and produces no results.

Mortising in Manual Training Schools



The Greenlee No. 226 Foot Lever Feed Vertical Hollow Chisel Mortiser Rear View

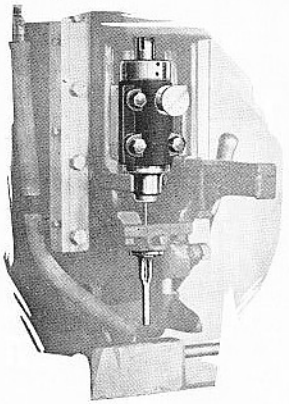
A peculiar fact in connection with the mortising of different varieties of wood is that the ease with which the work is done bears no definite relation to the hardness of the wood. For instance white oak is a very hard wood and red cedar is a soft wood but the oak is the easier to mortise and is less severe in its effect on the tools. White oak and mahogany work about the same although the oak is the harder wood, and chestnut and walnut are both easier to mortise than cottonwood. The difference seems to depend upon the nature of the wood fibre more than upon the density.

THE mortiser which is most popular for manual training work is our No. 226. This machine is of the vertical type which has many features to recommend it. The feed is by means of a foot lever and is adjustable for different depths of stroke. The capacity is for chisels from ¼-inch up to ¾-inch square and the table lowers to take stock 12 inches high. The maximum stroke is 4 inches.

To get a clear understanding of the design and operation of the machine let us take up its principal parts in detail.

The frame is of cast iron with an admixture of 20 to 25% steel, cored out to give the proper thickness to the walls. The spreading base is of generous dimensions and gives perfect stability. It is extended to the rear to receive the countershaft bearing or for attaching a motor base, thus making the machine a self contained unit. The top of the frame is also extended to the rear and carries a pair of angle idle pulleys over which the belt from the countershaft to the bit spindle pulley is run.

The front of the frame is planed in two places to form dovetail ways. The lower ways carry the table and permit its vertical adjustment, and the upper carry the reciprocating tool carriage. Lugs are cast integrally with the frame for added strength wherever shafts or studs pass through. At the back is cored out one half of the case of the fan blower, making this a part of the machine instead of being merely an attachment. The fan furnishes a blast of air directed towards the cutting point of the tools which keeps the face of the work clear of chips. If the chips are allowed to accumulate on the work and obscure the lay-out marks there is a constant temptation for the operator to put his fingers under the chisel to brush them away.



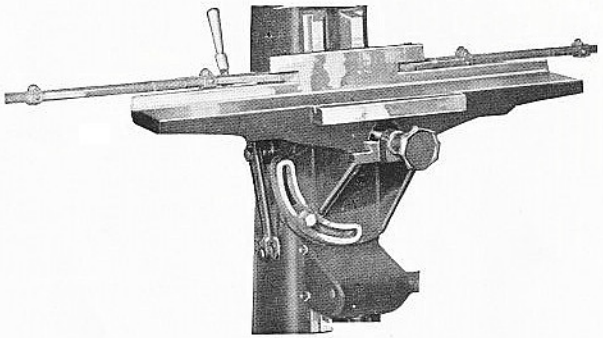
IT should be borne in mind that for the greatest convenience and accuracy of operation the tools should be fed to the work and not the work to the tools. It is a cheaper form of construction to carry the bit spindle in fixed boxes cast on the frame and to feed by raising the table which must have vertical adjustment anyway. But it is particularly annoying when trying to make a mortise near one end of a long stick, not to be able to support the long overhanging end because the stick must rise and fall as the table is fed up and down Troubles of this kind are not met with in the reciprocating tool carriage design.

The Tool Carriage or Ram is carefully planed to dovetail shape to fit the planing of the frame and is provided with an adjustable gib strip for taking up wear in both directions. The bit spindle runs in three long capped boxes, one being above the pulley, one just below and the other close to the bit chuck. The long hub of the pulley forms a sleeve which runs in the two upper boxes and the spindle is double splined and free to slide vertically through the pulley by which it is rotated. Ample thrust bearings and screw takeup collars are provided to compensate for the endwise wear.

The table of a mortiser is an exceedingly important part of its anatomy, for it is here that the operator lives, so to speak, and its arrangement, the facility with which adjustments can be made, and the appliances with which it is fitted have a great influence upon both the quality and the quantity of work produced. In designing our No. 226 Mortiser we have worked out the small details which make for convenience and accuracy to a high degree of refinement.

We have seen that the main column has planed dovetail ways to receive the table slide by which its vertical adjustment is obtained. The slide is of generous length and is carefully planed and fitted with an adjustable gib strip by which all play can be taken up. At its lower end is a lug which carries the end of a large coarse pitch screw which works through a split brass nut held in another lug cast on the machine frame.

AT its top end this screw is fitted with a pair of spiral gears and is operated by the crank which projects on the right hand side below the table. The spiral gears are covered by a protecting hood which prevents shavings from falling into them. The raising and lowering of the table is thus effected smoothly and with little effort.



Showing the "A" Pattern Table With Stop Rod Attachment

The upper part of the vertical slide described above is planed to a smooth surface on its front face and the table knee is mounted on it by means of a large stud bolt which forms the pivot upon which the table swivels for angle mortising.

The knee has a quadrant slot and binding bolt for holding it in any required position. The maximum angle is 45 degrees in either direction from the horizontal. Dovetail ways are planed upon the top face of the knee on which the cross adjustment of the table is secured. The ways are gibbed to take up wear and the table movement is obtained by a screw and hand wheel.

Up to this point the construction is the same for both styles of table, the plain and the compound. The difference between the two is that the compound, or "B" type table has a longitudinal feed by rack and pinion, and a clamp, which the plain table has not.

THIS compound table permits long mortises, or repeated short mortises to be made with one clamping of the stock. It is also possible with the compound table to spring warped material straight by the use of the clamp and to mortise it with perfect accuracy.

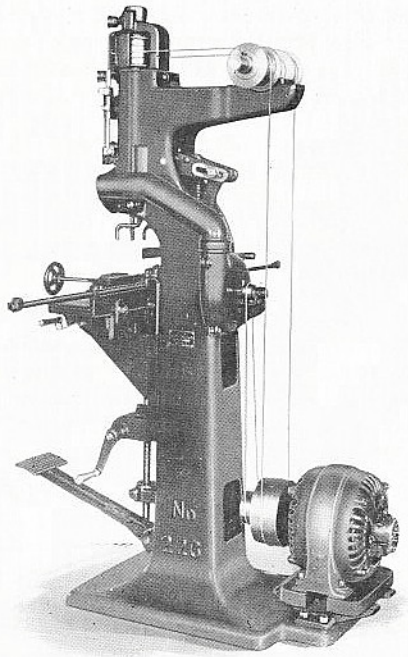
The auxiliary fittings of the table include a back fence having vertical adjustment, and a six foot stop rod with six adjustable spring stops. The use of the stops permits any number of pieces to be turned out which are exact duplicates. Much time is saved because only the first piece need be laid out.

In addition to the adjustable fence we provide a special back support or fence for extra high work which consists of a finished rectangular bar with a round shank at right angles which fits a lug cast on the machine frame. The stop can be moved in and out, and its free end may be dropped to meet any requirement of height.

The feed of the tool carriage towards the work is accomplished by means of a foot treadle which is made long enough to give the maximum power with the minimum of effort. The end of the treadle inside the frame actuates the pivoted rocker arm at the back of the tool carriage through a long connecting rod. The outer end of the rocker arm is slotted and the position of the connecting rod bolt is changed to vary the length of travel of the mortising chisel.

The depth of the mortise is exactly governed by stop collars adjustable upon a rod at the right hand side of the tool carriage. The reverse or upward stroke of the carriage is effected by a long helical spring.

The simplicity of this type of Mortiser makes it desirable for places where expert machine operators are not always found. The bit spindle is the only moving part that runs at any speed and this is thoroughly lubricated by compression grease cups which require only a slight turn of the caps once a day when in fairly constant operation. The tools are easily sharpened by following the printed instructions furnished by us.



THE drive of the No. 226 Mortiser may be by belt or by direct motor application. For belt drive a short countershaft is provided, one end being carried in a box on the frame and the other in a stand or pedestal mounted on the extended foot of the frame. Tight and loose pulleys with an attached belt shifter give simple control.

When motor drive is desired the rear countershaft is omitted and a motor base attached in its place. A 2 horse power motor is required and it may run at any speed between 900 and 1800 R.P.M. In ordering it is always advisable to give the size, type and speed of the motor to be used so that we may arrange our motor base to fit. We can furnish motors at as low a price as they can be bought directly from the electric companies.

IN addition to the No. 226 Mortiser described in the foregoing pages, we build several types and sizes of Automatic Power Feed Mortisers for use in Vocational and Trade Schools, Technical Schools and Colleges. Such are our No. 227 and No. 228 vertical machines and No. 207 of the horizontal type. They are in use in hundreds of commercial factories where their efficiency as high production tools has been demonstrated under the most rigorous competitive conditions.

We have recently brought out a simple and very inexpensive combination Bench Mortiser and Boring Machine which will operate mortising chisels up to ½-inch square in any kind of wood, and boring bits up to 1-inch diameter. A modified form of this machine is provided with back gears which reduce the speed and increase the power for metal drilling. Drills up to ⅝-inch diameter are easily operated.

In addition to our extensive line of woodworking machinery we are one of the largest manufacturers of auger bits, chisels, gouges, draw-knives, wood-turning tools, etc. We shall be glad to furnish catalogs of our products upon request.

In bringing this little Mortiser talk to a close we wish to emphasize one thought which it seems to us cannot be made too prominent when considered from the standpoint of the boys' best interest.

The bread and butter problem may not be of the first or highest importance but it is the most pressing with many of us, particularly with young men just starting in life. If the aim of the schools is to develop good citizenship they can best begin by helping the boy to become a self-supporting, self-respecting man, and any instruction and training he is given must be so practical in its nature and so directly connected with the problems he will encounter that he will be prepared to solve them with credit to himself and to the benefit of the community.