PRACTICAL MECHANISM.

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DRILLING IN THE LATHE.

We have next to consider drilling tools as they are employed in the lathe. For boring very small holes, as in center drilling, it is usual and advisable to revolve the drill and use the dead center and its gear as a feed motion. For small lathes, a small chuck (shown in Fig. 114) is provided. The flat surfaces of such work as may require to be drilled are placed against the face, A A, and a small conical recess, denoted by the dotted lines, is cut in the center of the chuck to relieve the point of the drill when it emerges through the work.

It is obvious that, as a lathe possesses no facilities for chucking work upon the tail stock, work which requires

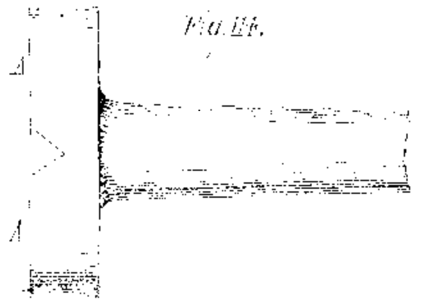
Fig. 114.

chucking, or is too heavy to be held conveniently in the hand, can only be drilled in the lathe by being chucked and revolved, the drill remaining stationary, and fitted into the socket in the tail stock spindle, or else suspended by being held by the work at the cutting end and by the dead center at the other end, and prevented from revolving by the aid of a drilling rest or a wrench. If the work revolves, it must of course be set to run true; and since the setting involves more work than would be required to hold it upon a drilling machine table, it follows that the lathe is only resorted to for drilling purposes in cases in which it is imperative to use it. These instances may be classified as follows

1. Those in which very straight and true holes are required, and in which the point of ingress and egress may be centerpunched, in which cases (the back center of the lathe being placed in the centerpunch mark, and the point of the drill in the other) the drilling is sure to be true.

2. Those in which the work, being very long, can be got into the lathe in consequence of the movable tail stock, when it could not be got into the drilling machine.

3 Those in which, there being turning to be done besides the boring or drilling, the whole may be performed in the lathe.

4. Those in which the holes require to be very true, the work being chucked in the lathe.

The class first mentioned refers to small and light work only, and requires no comment, save that the work should be slowly revolved on the lathe center while the drilling is progressing, so that the work will not drill out of true in consequence of its weight. The second will be treated of under the heading of the cone plate, or cone chuck, as it is sometimes termed; and the third (which usually comprises the fourth) we will proceed to discuss.

The spindle in the tail stocks of lathes are usually prevented from revolving by having a narrow groove along them, into which a small lug, stationary with, and projecting through, the bearing of the spindle, fits. If, therefore, a heavy strain, tending to twist the socket (as would be the case if a drill of a comparatively large size were held by it), is placed upon it, the groove, from its comparatively small wearing surface, soon gets worn as well as the lug, and the edge of the groove bulges, causing the socket to bind in its guide. Tail stock spindles are not, in fact, usually designed to perform such heavy duty; hence it is an error to assign it to them, unless, as is the case in some special lathes, the tail stock spindles, and hence their bearings, are made square to suit the spindles to carry drills for heavy duty. But drills above a half inch in diameter should be held by a center in the shank end of the drill, into which the back or dead center of the lathe may fit: the drill, if a round one, being held by a lathe dog fastened to it and resting against a piece of metal fastened in the tool post of the lathe, thus relieving the tail stock spindle of the torsional pressure. If the shank of the drill is square, a wrench may be substituted for the dog or carrier.

HALF ROUND BITS.

For drilling or boring holes very true and parallel in the lathe, the half round bit shown in Fig. 115 is unsurpassed.

The cutting edge, A, is made by backing off the end, as denoted by the space between the lower end of the tool and the dotted line, B, and performing its duty along the radius, as denoted by the dotted line in the end and top views.

It is only necessary to start the half round bit true, to insure its boring a hole of any depth, true, parallel, and very smooth. To start it, the face of the work should, if circumstances permit, be made true; this is not, however, positively necessary. A recess, true and of the same diameter as the bit, should be turned in the work, the bit then being placed in position, and the dead center employed to feed it to its duty; which (if the end of the bit is square, if a flat place be filed upon it, or any other method of holding it sufficiently tight be employed) may be made as heavy as the belt will drive. So simple, positive, and effective is the operation of this bit that (beyond starting it true and using it at a moderate cutting speed, with oil for wrought iron and steel) no further instructions need be given for its use. It is made as follows

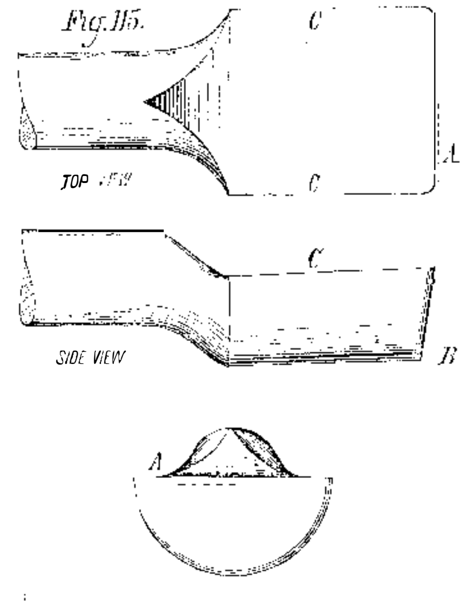
Fig. 115.

Forge it as near to the required size as possible, leaving stuff sufficient to true it up, and from square steel, if it is obtainable. Disregard the question of the cost of material, which, in a tool of this kind, does not represent six per cent of the cost of the finished tool; whereas the difference in quality is as three to one. In order to turn the cutting end between the lathe centers, so as to have the center at the shank end quite true with the turned pair, it must be forged at the end to more than half the diameter, so as to leave sufficient metal to receive the center hole and countersink whereon to turn it. The shank end should be forged square, and should, when center drilled, have a deep countersink. The cutting end must be turned true and smooth, being quite parallel, if to be used for parallel holes, and of the desired taper for taper holes. For parallel holes, all the cutting is performed by the end face, A; but in taper holes, the side edges, C, of the top face also perform cutting duty, and hence the necessity of having the turned end of an exact thickness of half a diameter. After turning, and before removing it from the lathe, a tool having a point should be fastened in the slide rest, its point being made to bear lightly against the turned face, close to one of the edges, C; and the rest should then be passed along so that the point will scribe a line true with the center upon which the tool has been turned, which line will form a guide for filing the top face down to make the tool of the required thickness of one half of its diameter. The edge, A, should be perfectly square with the side or diametrical edges, C C. The circumference of the turned part should have the turning marks effaced with a very smooth file, by drawfiling the work lengthwise, care being taken to remove an even quantity all over. The rake of the tool, as denoted at the dotted line, B, should not be greater in proportion than is there shown.

This tool should be tempered to a straw color and employed at a cutting speed of about 15 feet per minute, and fed at a coarse feed by hand. For use on parallel holes, no part should be ground save the end face; whereas, in the case of taper ones, the top face may be ground, taking as little off as will answer the purpose. It should be borne in mind that, as the steel expands (and therefore becomes larger in diameter) by the process of hardening, the necessary allowance, which is about the one hundredth of an inch per inch of diameter, should be made when turning it in the lathe. Tools of this description, which have a turned part to guide them, or those which depend upon the trueness of their outline or cutting edges to make them perform their duty, and which are apt, in the process of hardening, to get out of true (for all steel alters more or less during the operation of hardening), may be made true after the hardening or tempering by a process to be described in our future remarks on reamers, since it applies more directly to those tools than to half round bits.

To enlarge holes and true them out, the flat drill shown

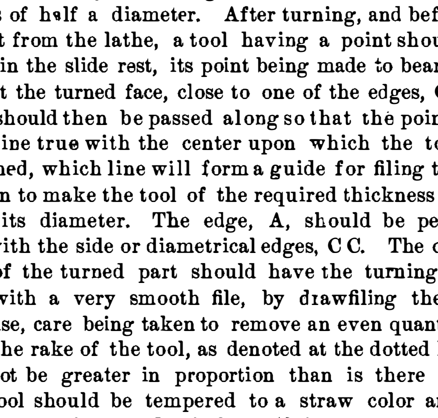
Fig. 116.

in Fig. 116 is employed. It is an ordinary drill made out of flat steel, having pieces of hard wood fastened to the cutting end, A being the steel, and B B the pieces of wood, held on by screws. When the drill has entered the hole, far enough to make it of the diameter of the drill, the pieces of wood enter and fit the hole, steadying the drill and tending to keep it true. It is necessary, however, to true out the hole at the outer end before inserting the drill; for if the drill enters out of true, it will get worse as the work proceeds. The drill is fed to its duty by the back lathe center, placed in the center upon which the drill has been turned up.

The pieces of wood should be affixed before the drill is turned up, and so trued up with the drill, which should then be lightly drawfiled on the sides; and the cutting end, having the necessary rake filed upon it, should be tempered to a straw color, the pieces of wood being, of course, temporarily removed. For use on conical holes, the sides must be made of the requisite cone, and the cutting speed in that case reduced (in consequence of the broad cutting surface) to about 10 feet per minute. (This speed will also serve in boring conical holes with a half round bit.) Such a drill is an excellent tool for ordinary work, such as pulleys, etc., because it will perform its duty very rapidly and maintain its standard size; and it requires but little skill in handling. It is more applicable, however, to cast iron than to any other metal. After the outer end of the hole has been turned true, and of the required size to receive the drill, and when the latter is inserted for operation, it is an excellent plan to fasten a piece of metal, such as a lathe tool, into the tool post, and adjust the rest so that the end of the tool has light contact with the drill, so as to steady it. The lathe should be started, and the tool end wound in by the screw of the rest, until, the drill being true, the tool end just touches it, as in Fig. 117.

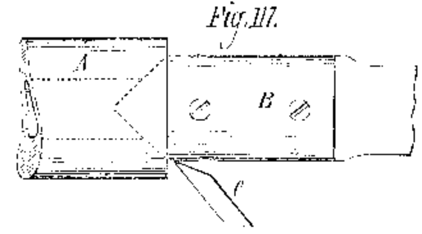
Fig. 117.

The dotted lines denote the hole in the work and the drill point; A represents the work, B the drill, and C the tool end, fastened in the lathe rest, and having its end beveled so as to have contact with the drill as close to the entrance of the hole as possible, in which position it is the most effective. In all cases, when a drill is used in the lathe and remains stationary while the work revolves, this steadying implement should be employed, since it operates greatly to correct any tendency of the drill to spring out of true.

To hold flat drills, or those having square ends, and prevent them from revolving, a hook may be employed, either at the front end of the drill immediately behind the wood, or at the other end near the dead center, the shape of the

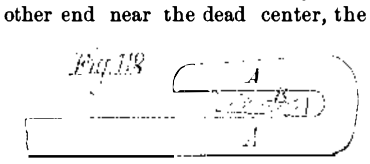
Fig. 118.

hook being as in Fig. 118. A A is the hook, and B the drill shown in section, and in the position in which it is held by the hook when in operation. The end, C, of the hook may be made to fit and be held by the tool post, or it may be made long enough to rest against the lathe rest saddle. It is as well to start the drill true with the guide, C, shown in Fig. 117, and, when the drill has entered, say to its full diameter for a quarter or three eighths of an inch in depth, to take out the guide from the tool post and insert the hook in its place, keeping it as near to the outer end of the hole as practicable.

Electric Fall Machines.

These are for demonstrating the laws of falling bodies. In one arrangement, a brass ball is hung by a thread some hight above the ground. Under it, at distance=1, are two metallic balls connected with the poles of an electric machine; they are so far apart that a spark cannot pass between them, but if the suspended ball drop between them a spark will pass. Further down, at distance=4, then=9, etc., are similar pairs of balls. The thread of the suspended ball being burnt, the latter falls between the successive pairs, giving passage at each pair to the current, and simultaneously the spark in another part of the circuit strikes a revolving soot-blackened drum, making a mark. The distances between successive marks are found to be equal. In a second arrangement, there are two cylindrical conductors, insulated and vertical, with a metallic ball suspended between them at the top, hardly filling the interval, and sufficient to enable a spark to pass between the cylinders, which are connected with the poles of an induction (secondary) coil. One of the cylinders has a coating of soot-blackened paper. The thread is burnt, and the ball falls; sparks are made to pass at regular intervals of time, by means of clockwork, interrupting the battery current. Each spark leaves its mark on the blackened surface; and thus are shown the spaces passed over in equal times.—*M. Waldner*.

The Silk Harvest of the World.

According to a report, just published by the Syndicate of the Lyons Union of Silk Merchants, the silk crop of Europe last year was, in round numbers, 9,050,000 pounds of raw silk, while there were exported from Asia, 11,500,000 pounds, making upwards of twenty and a half million pounds of raw silk available for European consumption. The countries included in the report are Italy, France (with her dependencies, Corsica and Algeria), Spain, Greece, the Turkish Empire, Georgia, Persia, India, Japan, and China. The first and the last together supply four fifths of the silk used in Europe. China exported, chiefly from Shanghai, upwards of 8,000,000 pounds. The crop of Italy amounted to 6,300,000 pounds. France supplied 1,600,000 pounds: Spain, about 310,000 pounds; Greece, less than 30,000 pounds; the Turkish Empire, 1,180,000 pounds; Georgia and Persia, together 880,000 pounds; India (from Calcutta), 935,000 pounds; Japan, something over 1,200,000 pounds.