PRACTICAL MECHANISM.

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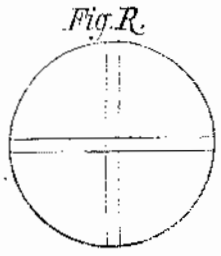
LATHE WORK.

The centers of a lathe should be turned both to an equal taper, a gage being used for the purpose. The running center should be tempered to a blue and the standing center to a brown color. If the holes in the headstock or tailstock of the lathe into which the centers fit are out of true, as is sometimes the case, a center punch mark should be made upon the diameter of the exposed part of the center, and another upon the end face of the spindle, and the center always placed so that the two "center pops" are opposite to each other; thus the centers will run true whether the taper holes into which they fit are true or not.

After the centers are hardened, care should be taken to properly clean their taper parts so that there may be no dirt or grit upon them to cause them to run out of true. If the running center is removed from the headstock, as is sometimes necessary in boring and for other purposes, the hole into which the center fits should be plugged with a piece of waste or rag to prevent it from becoming filled, or partly so, with shavings.

Plain work that is not easy to handle may be marked off for the center punch by a pair of compass callipers, and light work as follows: Place upon a planed surface a pair of parallel strips or pieces, one being under one end, the other under the other end, of the work; then set the point of the scribing block scriber as near the center of the work as the eye can determine, and draw a line across the end of the work; then turn the latter upside down and mark another line across its end; the work must then be turned a quarter revolution, so that the next line marked by the scriber will be at about right angles to the two lines already drawn, which being done and the line drawn, the work must again be turned upside down and the final line drawn, when the end of the work will be marked as shown in Fig. R, an illustration

Fig. R.



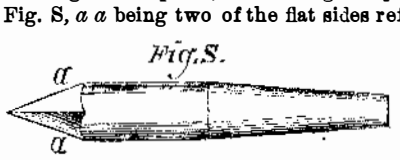
of an end view of a piece of round iron so scribed, in which case the center of the small square formed by the lines around the center of the work will be the center of the latter. It is obvious, however, that, if the scriber be placed at the center of the iron, only two such lines will be visible, the point of their intersection being, in that case, the center of the work.

The centers of all lathe work should be cleared at the extreme central part, so that such part will not revolve against the points of the lathe centers, which would cause the work to run out of true after running a short time in the lathe.

Such clearance is best accomplished by drilling a small hole in the central part of the work centers; it may, however, be done by using a center punch of a more acute taper than is the lathe center, or by cutting out the centers by means of a square center, as will be hereafter described. The drilling is, however, the preferable plan, being the least liable to cause the centers of the work to wear out of true.

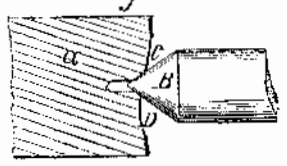
If, however, the work requires to run very true, as in the case of recentering work which has once been turned, the square center must be employed to cut the center of the work true to its circumference. A square center is a center fitted to the latbe in the same manner as the common center, but having four flat sides ground upon its conical point, all four sides meeting at the point, and having sharp edges as shown in Fig. S, *a a* being two of the flat sides referred to:

Fig. S.



the taper of these sides should be more acute than is the taper of the lathe center, so that the center cut in the work by the square center shall not bear upon the point of the lathe center, and cause it to run, in time, out of true. The square center should be hardened to a straw color, and may then be used to simply countersink centers which have been center-drilled, in which case it is put into the center hole of the head of the lathe and revolved at a high speed by the lathe) while the work is forced up to it by winding out the back center, the work being between the two centers. To center work very truly, it is employed as follows: The square center is put in the tailstock spindle of the lathe, in the same way as the ordinary center is placed, the work having a dog or driver placed on it, as if the intention were to turn the work; it must then be placed in the lathe between the centers. A piece of iron or steel, having a hollow or flat end (as, for instance, the butt end of a tool) must then be fastened in the tool post of the lathe; then the lathe may be started and the tool end wound against the end of the work (close to the square center) until it touches it and forces it to run truly, in which position the tool end is left, while the square center is fed up and into the work until the latter is true, when the operation will be completed. Before any turning is done to the diameter of any lathe work which runs between the centers, the ends of such work should be made true; because if there be a projecting part on the end, or if the latter is not quite true, the center gradually moves over to the lowest side, as explained by Fig. 41, *a* being a section of the work,

Fig. 41.



B the dead or standing center of the lathe, C, the high, and D, the low, part of the end of the work; to the latter the center gradually moves. All work which requires to be turned at both ends (and hence must be turned or placed end for end in the lathe) should be roughed out (that is, cut down to nearly the required size) all over before any part of it is finished, or, when turned end for end in the lathe, the part first turned up will run out of true with the part last turned up, though the lathe centers may be correctly placed. This may be caused by the centers of the work moving a little as they come to their bearings on the lathe centers, or in consequence of breaking the skin of the work; for nearly all work alters in form as its outside skin is removed, especially work in cast iron.

Lathe work requiring to be very finely finished and highly polished should be cut as smoothly as it can be by the tool, so as to leave as little as possible for the file to do, because a file used on lathe work cuts the softer parts of the metal more rapidly than it does the harder parts, and hence makes the work out of true. The file should therefore only be required to take off the fine marks left by the tool, and should be a dead smooth, used with chalk, applied in the same manner as already described for vise work. The emery cloth or paper should be moved rapidly back and forth so that the emery marks cross each other, which will remove the file marks quickly. Use finer emery paper as the finishing progresses, and conclude with the most worn of the finest emery used, moving it along the work very slowly and pressing it very lightly. The grades of emery paper should be the same as those given for vise work; and a finish and polish so fine may be given that it cannot be discerned whether the work was finished endwise or in the direction of its circumference. For finishing the faces of lathe work (in which case a file cannot be employed), the tool marks may be taken out by using grain emery applied with oil to the end of a wooden lever, fastening a tool or piece of iron in the tool post as a fulcrum for the lever. In this case, however, the lever must be kept continually moving, from the center of the work towards the periphery and *vice versa*, so that the emery marks cross each other; then when the tool marks are erased, emery paper (of finer and finer grade, as the finishing progresses) may be used, concluding as before with the most worn of the finest emery paper used and moving it slowly. The reason of the necessity of keeping the lever moving and the emery marks crossed is that, if the lever or emery cloth is kept in one position or nearly so, it will cut rings in the work; and wherever there may be a hollow spot or sand hole in the metal, the emery will accumulate and cut a groove in the work; especially is this the case in work of cast iron or brass. It is not possible, however, under any circumstances, to finish work so finely in the lathe as may be done by hand in the vise.

TURNING ECCENTRICS.

If an eccentric has a hub or boss on one side only of its bore (as in the case of those for engines having link motions, where it is desirable to keep the eccentries as close together as possible in order to avoid offset either in the bodies or double eyes of the eccentric rods), the first operation to be performed in turning it up is to chuck it with the hub side towards the face plate of the lathe, setting it true with its outside diameter (irrespective of the hole and hub running out of true), and to then face up the outside face. It must next be chucked so that the face already turned will be clamped against the face plate, setting the eccentric true to bore the hole out, and clamping balance weights on the face plate, opposite to the overhanging part of the eccentric. The hole, the face of the hub, the hub itself (if it is circular), and the face of the eccentric must be roughed out before any of them are finished, when, the whole of them may be finished, to the requisite sizes and thicknesses. The eccentric must then be turned about and held to the chuckplate by a plate or plates clamping the hub or boss only, the diameter of the eccentric being set true to the lines marked to set it by; then the diameter of the eccentric may be turned to fit the strap, the latter having been taken apart for that purpose. The reason for turning the strap before the eccentric is turned is (as may be inferred by the above) that the strap can be fitted to the eccentric while the latter is in the lathe, whereas the eccentric cannot be got into the strap while the strap is in the lathe. The strap should have a piece of thin sheet tin placed between the joint of the two halves before it is turned out, which tin should be taken out when the turning is completed, and the strap bolted together again. The size for the eccentric will then be from crown to crown of each half of the strap.

The object of inserting the tin is to make each half of the eccentric bed well upon the crown, and to prevent it from bearing too hard upon the points, as all straps do if the joint is not kept a little apart during the boring process. If the eccentric is already turned, an allowance may be made for the thickness of the sheet tin between the strap joint by placing a piece of the same tin beneath one of the calliper points when gaging the eccentric to take the size for the strap.

Eccentrics having a proportionally large amount of throw upon them are sometimes difficult to hold firmly, while their outside diameters are being turned to fit the strap, because the hub which is bolted against the face plate is so far from the center of the work that, when the tool is cutting on the side of the eccentric opposite to the hub, the force of the cut is at a considerable leverage to the plates clamping the eccentrics; and the latter are, in consequence, very apt to move if a heavy cut is taken by the tool. Such an eccentric however, usually has open spaces in its throw, which spaces are placed there to lighten it; the method of chucking may, under such circumstances, be varied as follows: The outside diameter of the eccentric may be gripped by the dog chuck, if the dogs of the chuck project far enough out to reach it (otherwise the dogs may grip the hub of the eccentric), while the hole is bored and the plain face of the eccentric turned. The eccentric must then be reversed in the lathe, and the hub and the face on that side must be turned. Then the plain face of the eccentric must be bolted to the face plate by plates placed across the spaces which are made to lighten the eccentric, and by a plate across the face of the hub. The eccentric being set true to the lines may then be turned on its outside diameter to fit the strap; to facilitate which fitting, thin parallel strips may be placed between the face plate and the plain face of the eccentric at this last chucking. It will be observed that, in either method of chucking, the outside diameter of the eccentric (that is to say, the part on which the strap fits) is turned with the face which was turned at the same chucking at which the hole was bored, clamped to the face plate. In cases where a number of eccentrics having the same size of bore and the same amount of throw are turned, there may be fitted to the face plate of the lathe a disk of sufficient diameter to fit the hole of the eccentric, said disk being fastened to the face plate at the required distance from the center of the lathe to give the necessary amount of throw to the eccentric. The best method of fastening such a disk to the face plate is to provide it with a plain pin turned true with the disk, and let it fit a hole (bored in the face plate to receive it) sufficiently tightly to be just able to be taken in and out by the hand, the pin being provided with a screw at the end so that it can be screwed tight, by a nut, to the face plate. The last chucking of the eccentric is then performed by placing the hole of the eccentric on the disk, which will ensure the correctness of the throw without the aid of any lines on the eccentric which may be set as true as the diameter of the casting will permit, and then turned to fit the strap. A similar disk, used in the same manner, may be employed on cranks, to ensure exactness in their throw.

New Spectroscope.

The instrument is the invention of Professor A. K. Eaton, of Brooklyn, N. Y., and is by himself named "a direct-vision spectroscope." It consists of a thick plate of glass with parallel sides, united to one of the faces of an ordinary bisulphide of carbon prism, or a prism of dense flint glass. According to the amount of dispersion desired, the light is made to enter either on the end of the glass plate, or on the opposite face of the bisulphide prism. The results obtained from this instrument are as follows: The dispersion of this compound prism is nearly four times greater than that of the ordinary 60° prism. The mean emergent ray is practically parallel to the incident ray. It does not deflect the ray from its original path. Many Fraunhofer lines are visible by this prism with the naked eye, while with the observing telescope all the prominent lines are clearly reversed, without the use of the slit or collimeter, by merely throwing a strong beam of light by means of a mirror.

When the usual appliances of slit-collimeter and telescope are employed, it widely resolves the D line, and shows the nickel line between these two lines—a result claimed as the best obtained by a four prism instrument of Browning.

It is stated that a simple bisulphide prism in this instrument gives a dispersion of 40° between the B and G lines; when it is used for projection, it gives a spectrum 8 feet long at a distance of 10 feet from the screen, enabling 100 dark lines to be counted.

It is evident, therefore, that this prism promises to become a most valuable instrument for projection in the lecture room, while either solar, electric, or oxyhydrogen illumination may be employed, having the great advantage of simplicity of adjustment, since it avoids the necessity of turning the lantern after the slit has been focussed on the screen.

The Louse a Substitute for the Compass.

The Great Dismal Swamp is partly in North Carolina and partly in Virginia. It is 40 miles long and 15 to 20 miles wide. Professor Webster, at the late meeting of the American Association, told the story of a party that divided in the swamp, one portion of the party having no compass. The latter portion of the party was lost, and after long wandering found their way out by a singular expedient. They made use of the insect for which fine tooth combs were invented. Putting the insect on a flat piece of wood, and leaving it to its own devices, it invariably began to move in a certain direction. This direction was followed out by the party, and they were thus led out to the northward. It is supposed that this instinctive movement of the insect is due to its seeking the way toward the greatest light.

EXTENSION OF UNDERGROUND RAILWAYS IN LONDON.—At the enormous cost of $12,500,000, the Metropolitan Inner Circle Railway Company is busily engaged in carrying out its plans. In addition to the construction of lines, stations, etc., this company is compelled to make an entirely new street, from Fenchurch street to King William street, and also to widen the streets right and left which branch therefrom. The importance attached to this enterprize may be gathered from the fact that the Metropolitan Board of Works and the corporation of the City of London have subscribed the sum of $2,500,000.