DRILLS—FLAT AND TWIST.

Differences of opinion still exist amongst mechanics, with reference to the relative merits of the flat and twist drill. The following abstract from the "Mechanics' Tool Book," by Mr. W. B. Harrison, sums up the case for the twist drill. Perhaps some of our readers can show cause why the verdict should not be in favour of the twist as against the flat drill.

The machine-made twist drills are fast superseding the flat drill, and where they are once introduced into a machine-shop they are preferred to all other kinds. Let any mechanic compare the *cutting edge* of the flat with the twist drill, and the superiority of the latter will be apparent. The flat drill presents a *scraping* edge to the metal to be penetrated, while the twist drill has a *cutting* angle which very nearly approaches the form of the cutting edge of the lathe tool. When these tools are used in cast-iron it is observed with what ease and rapidity the twist drill penetrates, and when used in wrought-iron or brass, long and extended spiral chips will follow up the twist-drill grooves, showing that it is indeed a *cutting* tool; when if the same effort be made with the flat drill in the same material, no such spiral chips are the result, rough fragments of the metal being *forced* off, which shows that it is nothing more or less than the effect of a *scraping* process. It requires a nicely made flat drill to produce as true and smooth a hole as even a badly made twist drill will execute.

We have always found it advantageous and economical to cut up bars of ½ in. octagon steel into lengths of from six to eight inches and then turn up the shanks and fit to the chuck a dozen or two of these pieces at a time, and then they are ready fitted to be made into drills whenever occasion requires. If the drills are the size of the steel, they should be, when drawn down at the forge, of an average length of about eight inches. This length is a good proportion and better in practice than either a longer or shorter drill. If it be required to make a round or twist drill, it is convenient to take one of these pieces and turn the body to the size and then fashion it to suit the work

The flat drill should not only be flat at the point but have its body also flat, so that the chips or borings may be carried around with the rotation of the drill, and not be ground between its sides and the metal which the point is penetrating. The cutting point must be made thin so as to more easily penetrate, and in process of working this point must be kept thin and sharp, otherwise a ragged hole will be the result. The form of the point of the drill should be such that the two lines should meet at 90°, or, what is more explicit, exactly fit the inner angle of the fitting or try-square, which is an angle of 90°, or one-fourth of the circle. There is another advantage in shaping the points of drills in this way with the square; a measurement from the body of the drill to the arms of the square, when the square is applied, will give an index of the proportion of the lines of the point as regards their equal length, and this measurement is easily ascertained by the eye. This exactness is important in a good cutting drill, as both sides must perform their proportion of the work. The *cutting* angle should meet the face at 60°, but a variation may be made in regard to this according to the hardness or other characteristics of the metal to be penetrated; a harder metal requiring less acuteness of cutting angle. When the drills are dull and are ground, let the square be applied to ascertain the form of point.

Another method of using the drill is to insert the back or dead centre in the countersink at the end, and hold it fast with a wrench, and apply it to the work which rotates in the lathe chuck or some other fixture. These drills may conveniently be made of bars of flat steel about eight inches long and of a width and thickness to correspond with the work. The centre or countersink which is to enter the centre of the lathe should be made large, so that there will be no danger of its slipping out of place if it should be found necessary to slightly turn the centre back, as is often done to free the drill from chips. We have seen old files used for these drills, and also seen old files drawn down to make common flat drills, but we must express a hearty contempt for such a slovenly method of producing a tool, which when made may well be regarded with disgust by every mechanic of taste who has any pride in the appearance or working of his tools.

The step from the old-fashioned flat drill to that of the improved twist drill, is one of the boldest leaps in mechanical science, and may be compared to a single stride from a tool of an ignorant age to the finished implement of the enlightened period. When we take a look at their forms and compare them, we see at a glance the imperfections of the flat drill and the superior qualities of the twist drill In the flat drill, as it revolves in the metal that it has to penetrate, it *forces* a portion of the material before it by a direct action, rubbing it off, as it were, by the applied power; the cutting lip presenting an edge at a right angle with the work. Give a lathe tool to a mechanic, with the same form and angle, to "turn up" a piece of iron work, and if he understands the nature of the material he is to operate upon, he will throw the tool from him as if you had offered him a premeditated insult. He knows very well that there is no "cut" in that form of tool. It may, by *abrasion*, reduce the work upon which it is employed, but it will not cut it. But give the same mechanic a drill made with the very same angle of cutting lip, and he will use it in his work with no feeling of a detraction of his dignity. He probably never gave a thought to the *effect* of the form of the cutting edges, as presented to the resisting metal. He knows the best shape of a good turning tool, and his experience tells him that the point of the instrument *must* run under the metal like a wedge, and *lift it off* as the cutting point advances, and not *scrape* it away by direct applied force against the *resisting face*—not cutting edge—of the tool.

Show a twist drill to the mechanic, and compare the cutting angles of the two instruments, and he will readily see that the cutting lip of the twist drill is almost the exact shape of his well-made turning tool. In operation he will observe that, instead of the abraded chip of the flat drill, it will be a clean and smooth-cut ribbon of the metal that is thrown up the spiral grooves of the drill as it penetrates into the material The peculiar advantages of the twist drill are not generally known throughout the country, but where they are once introduced they are soon appreciated, and applied to the exclusion of the flat drill. Some of the advantages of the twist drill are that it will always bore a hole that is perfectly cylindrical, whereas the flat drill will not always do this. The ease with which a twist drill cuts is another recommendation, and its strength, compared to that of the flat drill, is still another good quality. When the twist drill is broken, it can be easily put in order at the grindstone, if it has been properly made, and will operate as well and be of the same size as when first employed.

The flat drill is quickly and easily made. The twist drill requires time and some skill to form. The flat drill can be made larger by *spreading* the cutting point by means of the forge fire, but the twist drill once made is a tool of a constant size; it cannot be enlarged or reduced without spoiling it So we see why, in many shops where miscellaneous work is done, the flat drill has the preference, but in shops where gauges and constant sizes of work are made and expedition is a requisite, the twist drill may be used to great advantage.

Within a few years the manufacture of twist drills has become an established business, and any one wishing such drills can purchase them at the stores where tools are kept and sold. Some of these drills increase by the sizes of the wire gauge, so that the holes made will fit the wire purchased if such a fit should be needed. They are also made to increase by sixty-fourths of the inch, but as an improvement on those sizes we would recommend that they be made of sizes increasing by the decimal divisions of the inch, or by tenths and hundredths, &c.

The larger sizes of these drills as manufactured have taper shanks which are inserted in chucks made to fit the lathe, but the smaller sizes are not thus made; the shanks are of cylindrical form, of the same size as the drill, and as they vary thus small concentric chucks are needed to hold them when used for drilling.

If the mechanic desires to make a twist drill for himself, there are two methods by which to accomplish it—by forging or by cutting it from the solid metal A good drill may be formed by either method. One thing must be borne in mind if too little twist be given, it will approach too near to the flat drill and will be but little more effective than that form, while, on the other hand, if too much twist be given, the cutting edge presented will be too acute—breaking or crumbling away before the resisting metal. Some years ago, a manufactory employed one of its workmen to make a set of costly twist drills which were intended as standards of size for the series of holes in a sewing machine; but unfortunately the mechanic who made them formed them with too much