draulic press, and the metal subjected to compression until its temperature had fallen below that at which bubbles would be reformed. We do not know whether or nor Messrs. Révollier and Co. are still using the compressing process, nor what success has attended their latest experiments with it, but we know that during their earlier use of it they produced some very compact sound ingots, but also many failures. Not content with treating ingots, Messrs. Révollier and Co., also compressed —with varying success—more complicated castings, such as tyres, rings for guns, etc., but in dealing with such a manufacture they had to contend against the difficulty of running the metal at a lower temperature than was consistent with efficient compression, the initial temperature of the metal on leaving the furnace being reduced by its transfer by the ladle, etc. The result was that, to obtain the necessary liquidity in the molds, they were compelled to resort to the use of a metal containing a higher percentage of carbon and hence a lower melting point, but this metal again was unfitted for tyres, etc., on account of its hardness and brittleness, and hence failures. One great difficulty connected with the affair thus was that by the Siemens-Martin process it was not possible to deliver a mild steel into the ladle at a temperature so much above its melting point as to allow of it at length reaching the molds at a temperature suitable for undergoing compression. With the Bessemer process less difficulty is experienced in this way, the initial temperature being higher; but even where Bessemer steel is compressed, as at the Neu erg Works in Austria, it is found to be very important to keep up the temperature of the steel before compressing by heating the ingot molds before the steel is teemed, and by getting the molds under the press as promptly as possible after they have been filled.

The arrangements for compressing steel which have for some years been in use at the Neuberg Works were planned by Herr Von Stummer-Traunfels, and they have proved very successful, while they are also very simple. At Neuberg the steel from the converters is run into a receiver which is lifted by a powerful hydraulic crane on to a suitable carriage, and is then run on to a bridge over the press pit. At the bottom of this pit is a line of rails, so that the ingot molds mounted on carriages can be brought under the bridge to be filled with steel from the receiver and then promptly run under the press.

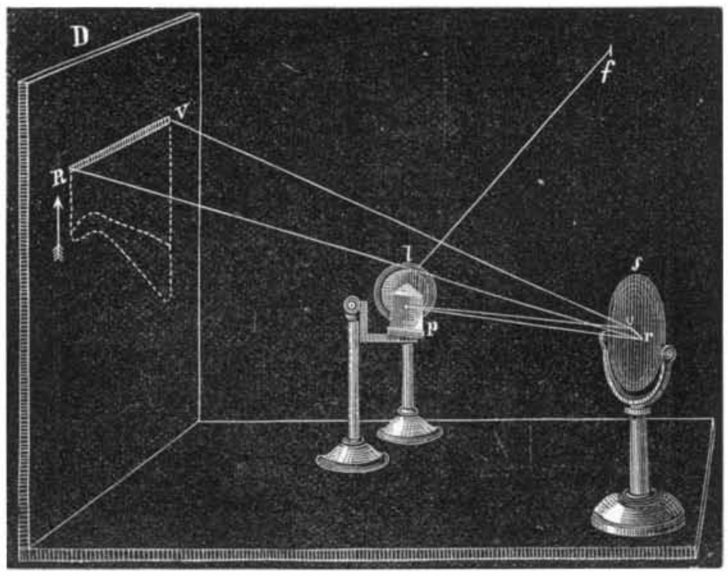
The ingot molds are, as usual, made for conical ingots, the section at the lower part being the ordinary one of an irregular octagon—or rather a square with the corners chamfered off—while at the upper part this section changes to circular, the upper portion of each mold being cylindrical, internally, for a length of about 6 inches, so as to form a guide for the press plunger. Externally the molds are circular, and they are turned slightly conical, while steel hoops are shrunk on them to enable them to resist the internal pressure. The conical form of the ingots would of course cause the fluid metal to exert an upward pressure, leading to separate each mold from its base, and to resist this the molds are furnished with strong flanges by which they can be secured to their bases. The mold bottoms, we may add, have a slight depression in the center, and in this is placed some fire clay on which the metal falls when teemed. This arrangement is employed to prevent the bottom from being injured by the pouring of the metal, it being important to keep the bottom sound, as it might otherwise give way under the action of the press.

Each ingot mold is mounted on its own carriage, the latter carrying it at such a hight that, when run under the press, the top plate of the carriage, on which the bottom of the mold rests, is clear of what we may term the anvil of the press, this being a strong casting fixed on firm foundations. The pressure imposed by the press varies from 400 to 700 tuns, and it is evident that the ingot carriages could never be made to resist such a pressure. To avoid the necessity for this, the lengths of rails on which a carriage rests when under the press are balanced so that, when they are merely loaded with the weight of the ingot, mold, and carriage, they are maintained on a level with the other rails; but when the press is brought to bear on the ingot, they descend and allow the top plate of the carriage to take a solid bearing on the anvil just mentioned. On the pressure being removed, the rails rise again and the carriage can then be run on to make room for another. The general arrangement of the press and press pit at Neuberg is shown by the annexed perspective view (Fig. 1.)

It should be mentioned that, when an ingot is being teemed in the press pit, a kind of funnel of wrought iron plate is placed in the mouth to prevent the latter from being injured by the molten metal. When the mold has been filled, this funnel is withdrawn, and a short plunger is inserted by means of tongs specially constructed for the purpose. The mold is then run under the press and subjected to pressure for from half a minute to one minute, it being found that this period is amply sufficient to insure the desired result. We may add that no difficulty is experienced from metal endeavoring to squeeze out around the plunger. Any metal so endeavoring to escape becomes at once so cooled as to solidify.

At the Vienna Exhibition of 1873, some excellent specimens of compressed steel were exhibited by the Neuberg Works, and amongst others the broken ingot from a photograph of which the annexed Fig. 2 has been prepared. This ingot was shown side by side with another broken ingot of the same steel, but uncompressed, an engraving prepared from a photograph of this second ingot being shown by Fig. 3.

If these two figures be compared, it will be seen that, whereas in the ingot represented by Fig. 3 there are a great number of bubbles near the outside—and in fact only protected by a thin skin, which might be injured in the reheating furnace—in the compressed ingot, shown by Fig. 2, there is one bubble only, and that at the center of the ingot, where it would most probably be thoroughly closed during the subsequent treatment of the ingot, or where, if it continued to exist, it could do little harm. Altogether we believe that the practice at Neuberg has been very successful.—*Engineering.*



RICCO'S EXPERIMENTS ON COLOR VISION.

Edward H. Tracy, C. E.

Edward H. Tracy, for several years past the Chief Engineer of the Croton Aqueduct of this city, died recently at Carmel, N. Y. He began his engineering career as a rod man, and from that humble position rose, by industrious attention to the duties assigned him, to be an assistant engineer under John B. Jarvis, on the Chenango canal in this State. Subsequently, under the same chief, he assisted in the construction of the main line of our great aqueduct. He was afterwards engaged in several other important works, involving dock and railway construction. For the last five years he has been Chief Engineer of the Croton aqueduct.

Chloroform as a Preservative.

At a recent session of the British Pharmaceutical Society, Mr. J. B. Barnes stated that vegetable infusions may be preserved indefinitely by the addition of a minute quantity of chloroform. A mucilage of gum acacia and a malt infusion have been satisfactorily experimented upon, and the action of the chloroform appears to be to destroy the ferments. Mr. Barnes considers that the discovery may be applied to preserving solutions of citrate of ammonia, lemon juice, and other very alterable organic substances.

Correspondence.

Bee Culture.

To the Editor of the Scientific American:

I can confidently recommend bee culture, as well adapted to the sphere of women both in city and country. I speak from experience, having been engaged in this pursuit for over twelve years. In my first attempts at bee culture, I used the old fasioned box hive. These hives were readily constructed with little or no reference to giving a profit in surplus honey obtained from them. The losses in such hives, from various causes, especially in winter, were very great, and profits were small at the best; $10 to $12 profit from the sale of surplus honey from such hives in one season was considered an extraordinary yield. I have for several years used a hive of my own invention. It is constructed with special reference to securing a good yield of surplus honey, in the most convenient marketable form. My hive is so arranged and constructed that I am able to prevent or contrive the natural swarming of bees, and, when desired, to turn their whole force to storing surplus honey in the parent stock instead of swarming out, as they often do (to their great damage) under ordinary management. It is surprising to note how much more honey will be stored by a stock that does not swarm (yet has the same increase of bees) than by one that casts one or more swarms. I often obtain from 200 to 300 lbs. honey in small glass boxes from a hive in a season.

There is in my opinion no pursuit which offers greater inducements to women as bee culture. There are very many whose occupation confines them indoors nearly the whole time, excluding them from the air and sunshine, to the great injury of their health; while at the same time, after this great sacrifice, they barely succeed in obtaining a livelihood. To such, bee culture offers special inducements, such as health and a greater recompense for labor performed. I hope that ere long bee culture will receive from my sex the attention it deserves. I am acquainted with many who have lately commenced in the business who are meeting with great success.

West Gorham, Me. LIZZIE E. COTTON.

On Color Vision.

To the Editor of the Scientific American:

It is known that a certain length of time is necessary to the perception of light, and that the sensation in the eye does not disappear instantaneously with the disappearance of the luminous object. It is also the opinion of physiologists that the perceptions of the different simple colors require different times; as does likewise the persistence of the sensation remaining in the eye. The laws of these phenomena have not however been yet determined, and the following experiments, in my opinion, may serve that purpose;

A ray of sunlight, *f l*, is made to enter a dark room through a narrow vertical slot, *f*, by means of a *porte lumière*. It falls in an horizontal direction and meets a lens, *e*, a flint prism, P, which disperses it, and a mirror turning about on a horizontal axis, which reflects the rays in the same direction, above the prism, on a white screen placed at a convenient distance to obtain an horizontal spectrum, R V, well enough developed to exhibit at least the principal Fraunhofer lines. The whole apparatus should be so arranged that, when the mirror is slowly made to oscillate, the spectrum may be displaced parallel to itself.

If now the mirror is made to oscillate with a certain velocity, the spectrum will be seen to become curved in an unexpected manner, the extreme red and, still more, the violet remaining behind. On moving the mirror in the opposite direction, the spectrum oscillates with it, gliding and darting like a fish in the water. It will be noticed that the convexity of the anterior outline of the spectrum is in the yellow, which color precedes the others in the motion. On keeping the eye fixed on a point of the screen, it will be observed that the spectrum widens, and that the expansion is greatest in the violet and decreases towards the red.

The same result is obtained by projecting the spectrum directly upon the screw and observing its image in a mirror oscillating in front of it. With the proper diaphragms, which should be black and opaque, some colors may be intercepted, and only two allowed to pass in coincidence with the Fraunhofer lines; this renders comparisons easier.

From this experiment it follows that yellow is the color which most quickly affects the eye; then come orange, red and green, blue, indigo, violet. The persistence of vision is greatest in the violet and successively diminishes in the indigo, blue, green, yellow, orange and red.

This may be verified also with white light. In fact, on moving a watchglass reflecting the sun before a black back ground, and keeping the eye fixed on it, the little solar image will be seen converted into an elegant colored curve, in which the following colors are usually found: yellow, green, blue, indigo, violet.

Modena, Italy, August, 1875. A. RICCO.

PRACTICAL MECHANISM.

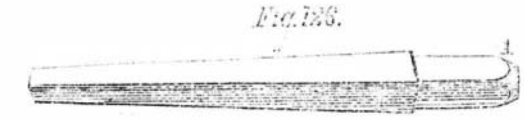
BY JOSHUA ROSE.

NUMBER XXXI.

REAMERS.

For reaming out taper holes, such as are employed to receive taper pins, the square reamer shown in Fig. 126 is em

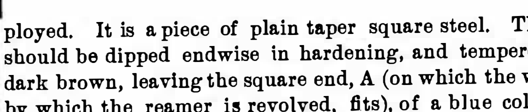
Fig. 126.



ployed. It is a piece of plain taper square steel. This tool should be dipped endwise in hardening, and tempered to a dark brown, leaving the square end, A (on which the wrench, by which the reamer is revolved, fits), of a blue color; because it is at times necessary to force it into its cut by striking it lightly with a hammer (a proceeding necessary with all reamers having appreciable taper upon them), which would break the edges of the square end off if they are left too hard. The edges are beveled off, as shown, to prevent the head of the square end buiging from being hammered. To sharpen it, the flat sides are ground, taking care to keep them straight and the thickness even on the two diameters, so that, the sides being straight and the reamer square, it will cut taper holes whose sides will be straight. If the reamer is not ground square, two only of the edges will be liable to cut, causing the reamer to wabble, and so impairing its cutting power and rendering it liable to break. This description of reamer is sometimes used to cut out holes in boiler plates which do not come fair after being puncbed.

The half round reamer shown in Fig. 127 will, however,

Fig. 127.

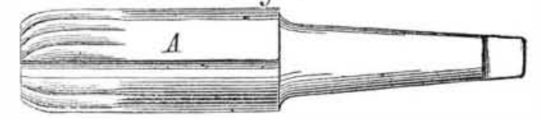


work much more steadily in holes which do not come fair, and will bore at all times more true, though it will not cut so rapidly as a square reamer, when employed to bore a straight hole into a taper one. The method of making this tool is to turn it up and cut away half the diameter, temper ing as directed for the square reamer.

MACHINE REAMERS.

Reamers for use in a machine or lathe are of the form hown in Fig. 128. The serrations forming the cutting edges are made at and near one end only, and do not run to the full length of the reamer. There are two and sometimes more flutes, A, provided to convey oil or water to the cutting edges and receive the cuttings. This description of reamer is employed to take out a very light cut only, and must run very true in the machine. Fewer cutting edges and flutes, running the entire length of the reamer, may be employed for heavier duty or for brass work, being much better qualified to

Fig. 128.

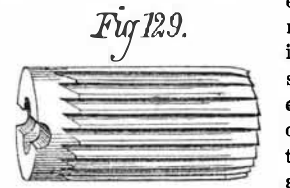


carry off the cuttings; but in that case, the backing off of the teeth should be performed at a distance from the end of the reamer equal to its diameter, so that no cutting duty will be performed by the teeth beyond that distance; otherwise, from spring, play in the spindle of the machine, or from other causes, the reamer will cut the holes of a diameter larger at the end at which it entered. All reamers should be well supplied with oil for heavy cuts on steel or wrought iron, and soapy water for fine finishing cuts on those metals; oil may also be used for brass work, providing the cut is very light and the cuttings can find very free egress.

SHELL REAMERS

Shell reamers, such as shown in Fig. 129, are excellent tools for sizing purposes, that is, for taking a very light cut intended merely to smooth out the hole, and insure correctness in its bore or size. They are short reamers, having a conical hole running through the center which is fitted to a cone mandrel as a stock; thus three or four different sizes of reamers may fit to one stock. Through such stocks there should always be bored a hole into which a pin may be driven, projecting at each side of the stock to nearly the diameter of the shell reamer, in which there should, on each side, be filed a semicircular groove to receive the pin. Thus the reamer will be prevented from slipping upon the mandrel, as it is otherwise very apt to do.

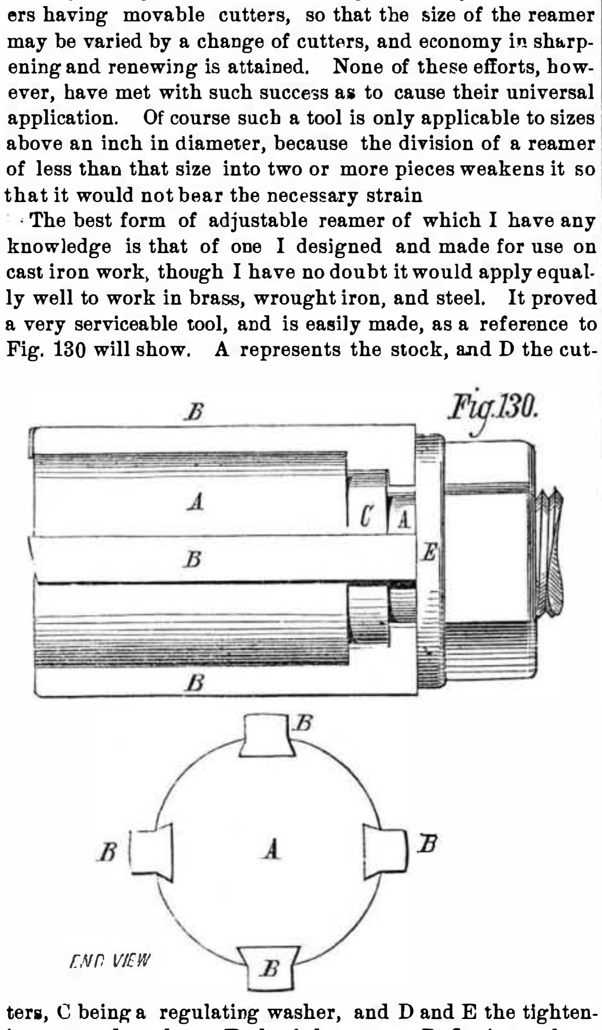
Fig. 129.



Many attempts have been made to produce adjustable reamers having movable cutters, so that the size of the reamer may be varied by a change of cutters, and economy in sharpening and renewing is attained. None of these efforts, however, have met with such success as to cause their universal application. Of course such a tool is only applicable to sizes above an inch in diameter, because the division of a reamer of less than that size into two or more pieces weakens it so that it would not bear the necessary strain

The best form of adjustable reamer of which I have any knowledge is that of one I designed and made for use on cast iron work, though I have no doubt it would apply equally well to work in brass, wrought iron, and steel. It proved a very serviceable tool, and is easily made, as a reference to Fig. 130 will show. A represents the stock, and D the cut-

Fig. 130.



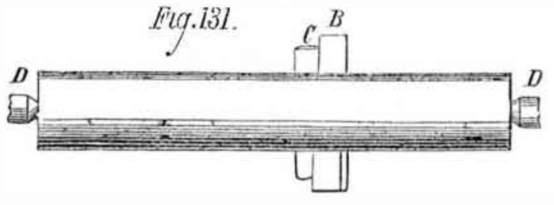
ters, C being a regulating washer, and D and E the tightening nut and washer. Each of the cutters, B, fits into a dovetail and taper groove in the stock, the shallow end of the groove being at the cutting end; so that, if the regulating washer, C, is reduced in width, the cutters will slide forward and enlarge in diameter. The washer, C, is thus a means of adjusting the diameter of the cutters; and when the same is once adjusted, the nut, D, will lock it always to that precise diameter If, therefore, several sets of cutters of different hights are fitted to one stock, and turned up, while in the stock, to the requisite diameter, with the washer, C, in its place, we have a set of standard cutters which may always be placed in position and locked up by the nut, D, without measurement, since their sizes cannot vary. By providing another washer, very slightly thicker than the standard, the reamer will, in the case of each set of cutters, bore a hole to a driving fit, while a washer a trifle thinner will cause the cutters to bore a hole of an easily working fit. Thus the sizes of the cutters are regulated by the washer, C, and not by measurement by the workman; they are therefore at all times positive and equal. The cutters are backed off on the ends only, their tops being merely lightly drawfiled after being turned up, or they may be left one thirty-second of an inch too large, and ground off after hardening, by the grinding process already described. The cutters should be forged of the best cast steel, and tempered to a straw color.

BORING BARS.

The boring bar is one of the most important tools to be found in a machine shop, because the work it has to perform requires to be very accurately done; and since it is a somewhat expensive tool to make, and occupies a large amount of shop room, it is necessary to make one size of boring bar answer for as many sizes of hole as possible, which end can only be attained by making it thoroughly stiff and rigid. To this end, a large amount of bearing and close fitting, using cast iron as the material, are necessary, because cast iron does not spring or deflect so easily as wrought iron; but the centers into which the lathe centers fit are, if of cast iron, very liable to cut and shift their position, thus throwing the bar out of true. It is, therefore, always preferable to bore and tap the ends of such bars, and to screw in a wrought iron plug, taking care to screw it in very tightly, so that it shall not at any time become loose. The centers should be well drilled and of a comparatively large size, so as to have surface enough to suffer little from wear, and to well sustain the weight of the bar. The end surface surrounding the centers should be turned off quite true to keep the latter from wearing away from the high side, as they would do were one side higher than the other.

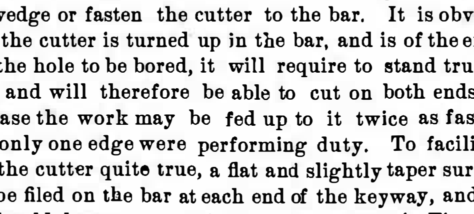
The common form of the smaller sizes of boring bar is that shown in Fig. 131, A A being the bar, D D the lathe cen-

Fig. 131.



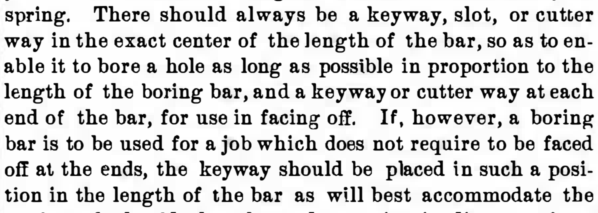
ters, B the cutter passing through a slot or keyway in the bar, and C a key tapered (as is also the back edge of the cutter) to wedge or fasten the cutter to the bar. It is obvious that, if the cutter is turned up in the bar, and is of the exact size of the hole to be bored, it will require to stand true in the bar, and will therefore be able to cut on both ends, in which case the work may be fed up to it twice as fast as though only one edge were performing duty. To facilitate setting the cutter quite true, a flat and slightly taper surface should be filed on the bar at each end of the keyway, and the cutter should have a recess filed in it as shown in Fig. 132,

Fig. 132



the recess being shown at A, and the edges, B B, forming the diameter of the cutters. The backing off is shown at C, from which it will be observed that the cutting duty is performed by the edge, C, and not along the edge, B, further than is shown by the backing off. The recess must be made taper, and to fit closely to the flat places filed on the bar. Such a cutter, if required to be adjustable, must not be provided with the recess, A, but must be left plain, so that it may be made to extend out on one side of the bar to cut any requisite size of bore; it is far preferable, however, to employ the recess and have a sufficient number of cutters to suit any size of hole, since, as already stated (there being in that case two cutting edges performing duty), the work may be fed up twice as fast as in the former case, in which only one cutting edge operates. This description of bar may be provided with several slots or keyways in its length, to facilitate facing off the ends of work which requires it. Since the work is fed to the cutter, it is obvious that the bar must be at least twice the length of the work, because the work is all on one side of the cutter at the commencement, and all on the other side at the conclusion of the boring operation. The excessive length of bar, thus rendered necessary, is the principal objection to this form of boring bar, because of its liability to spring. There should always be a keyway, slot, or cutter way in the exact center of the length of the bar, so as to enable it to bore a hole as long as possible in proportion to the length of the boring bar, and a keyway or cutter way at each end of the bar, for use in facing off. If, however, a boring bar is to be used for a job which does not require to be faced off at the ends, the keyway should be placed in such a position in the length of the bar as will best accommodate the work, and should then be made tapering in diameter from the keyway to the ends, as shown in Fig. 133, the end, A,

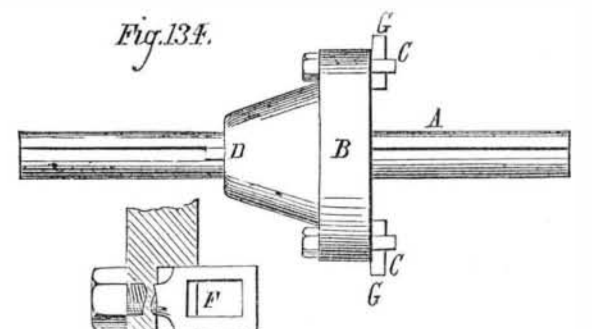
Fig. 133.



being made parallel to receive the driving clamp. A lug, however, by which to drive the bar, is sometimes cast at A. This form of bar is stronger in proportion to its weight, and therefore less liable to spring from the cut or to deflect than is a parallel bar. The deflection of a bar, the length of which is excessive in proportion to its diameter, is sufficient to cause it to bore a hole of larger diameter in the center of its length than at the ends, providing that the cutter is not recessed and does not cut on both sides, that is to say: when the cutter has the edges, B B, in Fig. 132, bearing against the diameter of the hole, they serve to steady the bar and prevent it from either springing away from the cut, or from deflecting in consequence of its own weight. The question of spring affects all boring bars; but in those which are used vertically, the deflection is of course obviated.

Here it may be mentioned that no machine using a boring bar should be allowed to stop while the finishing cut is being taken, for the following reasons: The friction, due to the severance of the metal being cut, causes it to heat to a slight degree, and to therefore expand to an appreciable extent; so that, when the cutter makes its first revolution, it is operating upon metal at its normal temperature, but the heat created has expanded the bore of the work, and hence the cut taken by the second revolution of the cutter will be slightly less in diameter. This heating and expanding process continues as the cutting proceeds, so that if (after the cutter has made any number of revolutions) the bar is stopped and the cylinder or other work being bored becomes cool, when the cutter makes the next revolution it will be operating upon the bore unexpanded by the heat, and hence will cut deeper into the metal until, the metal being reheated by the cut during the revolution, the boring proceeds upon expanded metal as before the stoppage; thus arresting the continuous progress of the cutter will have caused the cutting of a groove in the bore. Boring bars of this description, for use in bores of a large diameter, are made with a head of increased diameter, as shown in Fig. 134, A A representing a bar turned

Fig. 134.



true from end to end, and having a keyway cut along its entire length, and B the cutter head, held in upon any point in the length of the bar by being keyed to it at D. A number of cutting tools are carried by the head, B, and fastened to it by the strap, as shown at C, and enlarged at E, F being the slot to receive the tool. It will be observed that there is in the head a recess to receive the clamp, which recess should be made deep enough to leave a clearance between it and the shoulder of the clamp, to accommodate any variation in the thickness of the cutters. Several cutters may be provided to the head, so that the work may be fed up rapidly; in such case, however, great exactitude is required in setting them, because there is no practical method of making them with a recess to insure their even projection from the bar, since the cutters are narrow, and generally cut across the whole end face, G, so that each grinding affects their distance from the bar, and hence the size they bore.

A rude form of the head, B, may be made by simply cutting a slot or slots across it, and fastening the tool or tools therein, by means of wedges and packing pieces if necessary. The only advantage possessed by this bar is that it will bore a round hole, even though the bar may run out of true, by reason of either or both of the centers being misplaced, or even though the bar itself may have become bent in its length. In addition, however, to its disadvantage as to excessive length, it possesses the further one that, unless a line drawn from the two centers upon which it revolves is parallel both perpendicularly and horizontally to the lathe bed, the hole bored will be oval and not round; or if the bar is not parallel horizontally with the shears, the hole will be widest perpendicularly, and *vice versâ*. To remedy these defects, we have the boring bar with the feeding head, which is similar to that shown in Fig. 134, save that the work remains stationary while the cutters are fed to the work by operating the head, B, along the bar, which is accomplished as follows: Either along the keyway or groove, or else through and along the center of the boring bar, there is provided a feeding screw, passing through a nut which is attached to the sliding head, B. As the bar revolves upon its axis, the screw is, by means of suitable gearing, caused to revolve upon its own axis, as well as around the axis of the bar, thus winding the head along the length of the bar, and thus feeding it to the cut. If the screw runs along the center of the bar, it is usually operated by gear wheels, the movement of the feed being continuous at all parts of the revolution; but if the screw is contained in a groove cut in the circumference of the bar, a common star feed may be attached to the end of the bar, in which case the feed for the whole revolution is given to the sliding head during that portion only of the revolution in which the outer arm of the star is moved by the projecting bolt or arm which operates it. From these directions, it will be readily perceived that a bar of the latter form, but having the screw in its center, is the most preferable. Care must be taken, however, to keep these bars running quite true; for should either center run out of true, the hole bored will be larger in diameter at that end; while on the other hand, should the bar become bent so as to run out of true in the middle of its length, the hole bored will be large in the middle if the work was chucked in the middle of the length of the bar; and otherwise, it will be larger at one end.