Success in the art of bronzing greatly depends on circumstances, such as the temperature of the alloy or of the solution, the proportions of the metals used in forming the alloy, and the quality of the materials. The moment at which to withdraw the goods, the drying of them, and a hundred little items of care and manipulation, require attention which experience alone can impart.

To avoid giving any artificial colour to brass, and yet to preserve it from becoming tarnished, it is usual to cover properly cleaned brass with a varnish called "lacquer." To prepare the brass for this, the goods, after being annealed, pickled, scoured and washed, as already explained, are either dipped for an instant in pure commercial nitrous acid, washed in clean water, and dried in sawdust, or immersed in a mixture of one part of nitric acid with four of water, till a white curd covers the surface, at which moment the goods are withdrawn, washed in clean water, and dried in sawdust. In the first case, the brass will be bright; in the latter, a dead flat, which is usually relieved by burnishing the prominent parts. Then the goods are dipped for an instant in commercial nitric acid, and well washed in water containing some argol (to preserve the colour till lacquered), and dried in warm sawdust. So prepared, the goods are conveyed to the lacquer room, where they are heated on a hot plate and varnished.

The varnish used is one of spirit, consisting, in its simple form, of one ounce of shellac dissolved in one pint (imperial) of methylated spirits of wine. To this simple varnish are added such colouring substances as red sanders, dragon's blood, and annatto, for imparting richness of colour. To lower the tone of colour, turmeric, gamboge, saffron, Cape aloes, and sandarac are used. The first group reddens, the second yellows the varnish, while a mixture of the two gives a pleasing orange.

A good pale lacquer consists of three parts of Cape aloes and one of turmeric to one of simple lac-varnish. A full yellow contains four of turmeric and one of annatto to one of lac-varnish. A gold lacquer, four of dragon's blood and one of turmeric to one of lac-varnish. A red, thirty-two parts of annatto and eight of dragon's blood to one of lac-varnish.

Lacquers suffer a chemical change by heat and light, and must, therefore, be kept in a cool place and in dark vessels. The pans in use are either of glass or earthenware, and the brushes of camel's hair, with no metal fittings.—*Ironmongers' Review.*

DRILLING SQUARE HOLES.

To drill a square hole with a rotary motion at one operation may seem to many a novelty in mechanics, but Mr. J. Hall, of Chancery Lane, has obtained a patent for a method of accomplishing the feat. For this purpose he employs a three-sided drill, either flat or fluted, which, in cross section, is of the form of an equilateral triangle. He makes the bottom or cutting edges of the drill perfectly flat, and three in number, each cutting edge extending from one of the outer corners to the centre of the triangle. The proposed method of using such drills in an ordinary vertical drilling-machine is as follows: A special drill chuck, forming part of the invention, is provided, and attached to the lower end of the drilling spindle. The chuck is constructed in such manner as to admit of the drill travelling automatically in a horizontal plane some little distance. This is rendered necessary by the peculiar movement of the cutting edges of the drill, which does not operate or rotate on a fixed central point, but diverges somewhat in proportion to the size of the hole.

The drill chuck is constructed in the following manner: The upper part of the cavity of a metal cylinder is bored out circularly, so as to fit on to the drilling spindle, to which it is screwed by one or more screws. Below the circular bore a square recess is made, and below this latter, and coming well within the limits of the square recess, there is a circular hole passing through the end of the cylinder. The drill holder or socket is in a separate piece, the bottom portion of which is provided with a square or round recess for holding the shank or upper end of the drill, which is held firmly in its place by means of a set screw. The device is shown in the accompanying engraving, which we take from the *English Mechanic*. The upper part consists, first, of a screw, S, at the top, Fig. 1; secondly, of a square shoulder, B; thirdly, of a circular shoulder, D; and, fourthly, of another but much larger circular shoulder, E. Through the circular hole at the bottom of the hollow cylinder the upper portion of the drill holder is inserted until the large circular shoulder meets the bottom of such cylinder. A loose square collar, A (Figs. 1 and 2), provided with an oblong rectangular slot, is then placed within the cylinder and over the square above mentioned, above and on to which is screwed down a nut, N, from the inside of the cylinder. The loose square is of such thickness that when the nut is tightened down on to the square shoulder the loose collar is left to work freely. When this is done the drill holder will readily travel in a horizontal plane such distance as the play between two of the sides of the loose collar, and two of the sides of the square recess, in one direction, and in another direction the distance of the play between two of the sides of the small square shoulder of the drill holder and the ends of the rectangular slot in the loose collar. The horizontal travel or play is proportionate to the size of the hole to be drilled. Near to the lower end or cutting edges of the drill is fixed rigidly a metal guide bar or plate, F. The guide bar is provided with a square hole similar to the hole it is required to drill, the dimensions of the three sides of the drill being such that the distance from the base to the apex of the triangle, which such three sides form, is the same as of the sides of the square holes it is required to drill.

Mr. Hall prefers to make the guide bar of steel, which he hardens at that part where the guide hole is made. The method of operation is then as follows: The three sided drill being fixed in the self-adjusting chuck, the guide bar with the square guide hole therein rigidly fixed above the point where it is required to drill, the drilling spindle carrying the chuck drill is made to revolve, and is screwed or pressed downwards, upon which the drill works downwards through the square guide hole, and drills holes similar in size and form to that in the guide. The triangular drill for drilling dead square holes may also be used without the self-adjusting drill chuck in any ordinary chuck, when the substance operated upon is not very heavy nor stationary; then, instead of the lateral movement of the drill, such lateral movement will be communicated to the drill by the substance operated upon.

Although the patentee only cites the case of a vertical drilling machine in connection with this invention, he declares that the specified improvements are equally applicable to lathes, ordinary braces, ratchet braces, and all other descriptions of drilling apparatus. In making oblong dead square cornered holes, either the substance to be operated upon must be allowed to move in one direction more than another, or the hole in the guide plate must be made to the shape required, and the drill chuck made to give the drill greater play in one direction. Fig. 1 shows a vertical section of the improved chuck, in which A is the hollow cylinder, which may be attached to any ordinary drilling machine; H is the drill holder; S is a screw; B is a square shoulder; D is a circular shoulder; E is a circular shoulder of a larger dimension; N is a screw nut for tightening on to the square shoulder, B, and the loose square collar. Fig. 2 is a plan view of Fig. 1. Fig. 3 is an elevation of the improved chuck; C showing the three-sided drill and the guide bar, F, complete. Fig. 4 is a plan of the guide bar, F, showing the three-sided drill in cross section.

PLUMBAGO AS A LUBRICANT.

Blacklead has long been used for producing a smooth and slippery surface on wood, and mixed with grease it forms an excellent lubricant for many purposes. The success of the metalline bearings appears to have directed the attention of engineers and mechanics to the utility of finely powdered plumbago as a general lubricating agent, and it has been successfully employed even in steam cylinders. On this branch of the subject Mr. J. H. Cooper, of New York, writes:—Mr. W. J. Williams, Philadelphia, has called my attention to the successful use of dry pulverized graphite for lubricating steam cylinders. He applies 137 grains twice a day, introducing it into the cylinder through the usual form of tallow-cup. Six months of continuous use, in a horizontal cylinder, 11 in. diameter, 30 in. stroke, working to its full capacity, prove this lubricant superior in every way to oils or tallow, both of which he had used for years. No oil whatever is introduced with the graphite. At 30 cents per pound, this engine would require 1⅛ cents worth per day. After a run of four months following the above tests, Mr. W. says: "I took off the cylinder head of my engine to examine the interior. I found the piston perfectly clean, with no appearance of wear or abrasion. I feel very positive that had I been using animal or vegetable oils, the parts would be in a much worse condition to-day. The working part of the cylinder is everywhere covered with a coat of plumbago, readily soiling the fingers. The conclusion I have come to about the choking up of passages is, that plumbago alone will not do it; but wherever there is friction of one or more moving parts, some of it will adhere to them."