

1815 infers a greater specific gravity for them. Thus, as given in his book :

9 lb. cannon ball was of 4,00 in. diameter.	
18 " " " " " "	5.04
32 " " " " " "	6.11

Now the weight of spherical bodies is in proportion to the cube of their diameters, and calculating according to that rule I find the actual weight of these shot would be only 8.69 lbs., 17.22 lbs., and 20.70 or considerably less than their reputed weight, unless the castings were of greater specific gravity than is now reckoned. A difference of $1\frac{1}{4}$ lb. in a 32-lb. ball is of consequence, and could scarce arise from any mistake in so expert and learned an author as Sir Howard, who is precise to a fault."

STEPHEN ROPER gives the following rule for finding the safe working pressure of steam boilers : Multiply the thickness of the iron .56, if single riveted, and .70, if double riveted; multiply this product by 10,000 (safe load); then divide the last product by the external radius (less thickness of iron); the quotient will be the safe working pressure in pounds, per square inch. Example :

Diameter of boiler, 42 inches.	
Thickness of iron, $\frac{3}{8}$ of an inch.	
$2 \div \frac{3}{8}$	
121 external radius.	
.375	
20.625 internal radius.	
Thickness of iron, $\frac{3}{8}$ = .375	
.56 single riveted.	
.21000	
10000 safe load.	
20 625 \div 2100.00000	
101.81 lbs. safe working pressure.	

SURGERY BY THE ELECTRIC LIGHT.—Dr. Berkeley Hill, of London, recently operated for vesico-vaginal fistula in University College, while the vagina was lighted up by Coxeter's application of the glowing platinum wire. The apparatus consisted of a fine wire twisted into a knot. Through this knot was sent a continuous galvanic current, strong enough to maintain the wire at a white heat. The wire was enclosed in a glass chamber, which was itself also enclosed in another glass cover. Through the space between the glasses, a current of water was allowed to flow, in order to preserve a low temperature around the light. A strong light was maintained for over an hour, close to the margin of the fissure, without impeding the operator's manipulations.

PAPER BOXES.—By a recent invention, paper boxes are made in Boston directly from paper pulp. The boxes are turned out of any size or shape perfectly seamless and of uniform thickness. After drying, the boxes are run through a second machine at the rate of 60 per minute, receiving, under a pressure of 4,000 pounds, such embossing as may be necessary. From the time the paper stock is taken from the bales until the perfect box is turned from the machine, manual labor is entirely avoided. By the use of one set of these machines, 30,000 boxes can be produced per day, at less than one-third of the lowest market price of hand-made goods, and doing the work of 200 hands as the process is ordinarily conducted.

A CHANCE FOR INVENTORS.—There has been less inventive genius displayed in the production of machinery in the pottery business than in any other branch of manufacture under the sun. The creation of pottery is almost entirely dependent upon the manual skill of the operative potter, and the only improvement that has been made in 4,000 years is in the substitution of steam power for the hand and foot in revolving the "jigger" and throwing wheel.

RECOVERY OF TIN FROM TIN-PLATE SCRAPS.—According to a patent by Larocque, tin scraps are mixed with finely powdered charcoal and one-half per cent. of salt, and placed in a kettle that can be closed, supplied with a horizontal perforated diaphragm in the middle. The upper portion is then heated red-hot, whilst the lower is cooled with water, when the tin melts, and runs through.

TO RESTORE OLD OIL-PAINTINGS.—Take the painting out of the frame, lay it on a table, face up, and keep a wet cloth on it for two or three days, changing or cleaning the cloth as often as it becomes soiled. When the painting is clean, wash it with a sponge or brush dipped in oil. This is much better than varnishing.

Cabinet Work.

PRACTICAL HINTS.

CLAMPING PICTURE FRAMES.—An excellent arrangement for fastening the corners of picture frames can be made in a few minutes, which, if we are to believe a correspondent, will be all that can be desired, and answer admirably in the case of frames that will not bear marring on the edges. Take a piece of wood 9 in. or 10 in. long and $2\frac{1}{2}$ in. square, and rebate one angle $1\frac{1}{2}$ in. deep and wide, then round off the opposite angle, and cut into four pieces of equal length. Having accurately mitred the frame, lay it upon the bench and put one of the pieces of wood at each corner, the rebate, of course, fitting upon the angle; next wind a piece of quarter-inch cord twice around the frame over the corner pieces, and tie it at one corner. Then take four pieces of smooth wood 6 in. long and twice as thick as a carpenter's pencil, insert them between the cords, one on each side of the frame, and by twisting the cord with them it can be made as tight as desired; and having seen that the mitres are good and that the frame does not wind, lay it upon the bench and pull out the bits of wood without disturbing the cord or corner pieces, lift out the frame, put a little glue upon the mitres, and replace as quickly as possible in the same position as before. Now replace the pieces of wood and give the cord a few turns, adjust the angles, and tighten up. Braces can then be put across the corners on the back of the frame, or, where the edges will admit, a saw kerf can be made in the corners and a piece of veneer glued in.

IMITATION EBONY.—The following is a useful receipt for imparting to oak a black color that shall make it resemble ebony. The wood is immersed for forty eight hours in a hot saturated solution of alum, and then brushed over several times with a logwood decoction prepared as follows :—Boil 1 part of best logwood with 10 parts of water, filter through linen and evaporate to a gentle heat until the volume is reduced one half. To every quart of this add from 10 to 15 drops of a saturated solution of indigo, completely neutral. After applying this dye to the wood, rub the latter with a saturated and filtered solution of verdigris in hot concentrated acetic acid, and repeat the operation until a black of the desired intensity is obtained.

TO CLEAN ENGRAVINGS.—Put the engraving on a smooth board, cover it thinly with common salt finely pounded; squeeze lemon-juice upon the salt so as to dissolve a considerable proportion of it; elevate one end of the board, so that it may form an angle of about 45 or 50 degrees with the horizon. Pour on the engraving boiling water from a tea-kettle until the salt and lemon-juice be all washed off; the engraving will then be perfectly clean, and free from stains. It must be dried on the board, or on smooth surface, gradually. If dried by the fire or the sun it will be tinged with a yellow color.

BLACK WALNUT STAIN FOR PINE.—Put pulverized asphaltum into a bowl with about twice its bulk of turpentine and set where it is warm, shaking from time to time until dissolved; then strain and apply with either a cloth or a stiff brush. Try a little first, and if the stain be too dark, thin it with turpentine. If desirable to bring out the grain still more give a coat of boiled oil and turpentine. When the wood is thoroughly dry, polish with a mixture of two parts shellac varnish and one part boiled oil. Apply by putting a few drops at a time on a cloth and rubbing briskly over the wood.

GILDING—BLACK AND GOLD WORK.—The incised lines and ornaments receive several coats of size (boiled parchment cuttings) and whitening. They are allowed to dry, and touched up with a chisel or gouge, and then receive a coat of "oil gold size"; and when that is tacky the gold leaf is dabbed on in small pieces with a large camel-hair pencil, wetted first to make the gold adhere. When the gold is dry, wipe off bits gently with cotton-wool; hold the gold on a little "hod" with a screen around three sides of it to prevent the gold leaf blowing away.

PAINTING IN SEPIA ON WOOD.—Rub the wood carefully with fine emery or sand paper, and this will make the color spread evenly instead of with the grain. You cannot work with too much color on your brush; the amount necessary must be tested by the way it spreads. If it runs too much, mix a little gum arabic with it. White wood is the best to use. The prepared sepia can be used with a pen. Use any good steel pen, or what is technically called a mapping pen.