his mind, "Why did I place myself upon the wrong side of the pulley, when I well knew what would be the consequence?" It is, and will probably always be to him, a mystery how he came to commit such a reckless act.

The foregoing incidents are all true, and a great many other similar ones might be added, but we trust that those herein recorded are sufficient to illustrate the frequency of the casualties brought about by absent-mindedness.

SPIRAL FLUTED IVORY CUP AND COVER.

(*For Illustration, see Supplement.*)

WE are again indebted to General Clarke for another specimen of ornamental turnery. The object which is illustrated by the accompanying photograph has been described in the journal of the Amateur Mechanical Society. The following particulars concerning its production will suffice for those who have some general knowledge of the tools employed in such work.

The engraving from which I got the idea of the ivory cup and cover shown in the illustration, may be found in the volume of the "Art Journal" for 1849, at page 59. The original represented there was in wood. The article shown here is about 9in. in height.

The base was formed from a round piece of ivory, about 3⅜in. in diameter, and ⅜ths of an inch in thickness. One face of this being made smooth and flat, a hole was made in the centre about ⅝ths of an inch in diameter, and a screw cut in it. The piece was then reversed, and, by means of the screw, chucked upon a wooden chuck somewhat smaller in diameter than the ivory, so as to leave the edge projecting beyond the wood. A screw having been formed in the centre to receive the stem supporting the cup, and the piece roughly turned to a conical form, the slide-rest was placed in front of the work, with the universal cutting-frame, set to cut vertically downwards, carrying a broad flat-ended tool, well sharpened. The tool being brought opposite the outer edge of the ivory, a series of twelve cuts was made all round, to as great a depth as the material would allow without making it too thin. The tool was then shifted $\frac{1}{10}$th of an inch to the right, and a second series of cuts made all round with the right corner of the tool, the depth of the cuts being diminished by about $\frac{1}{16}$th of an inch. The same operation was repeated till seven series of cuts had been made besides the broad one at the outer edge, each series being $\frac{1}{16}$th of an inch less deep than the last, till the whole was cut into steps, leaving a flat space in the centre of about 1¼in. in diameter. The slide-rest was then brought round, not quite parallel with the lathe-bed, but at an angle of about 30° with it, and, with the same tool as before, with the same settings of the division-plate, the outer edge had twelve scollops cut in it, corresponding with the steps.

The piece above this is a flat washer of ivory, having its edges cut into beads, which project beyond the upper steps of the base. It fits over the shoulder of the next piece. This was shaped by the universal cutting frame, working horizontally, and carrying a < shaped tool. The cutter being placed so that the sweep of the tool in its revolution would give the curve, was then drawn along by the slide-rest screw, so that the upper portion of each cut or fluting was straight. This piece has a male screw at each end the lower one screwing into the base, and the upper one into the next piece above. This screws into another of the same shape reversed, with a small washer with serrated edges between them. These two pieces were shaped by the universal cutter, the sweep of the tool giving the curve. The upper one has a male screw on the top, to which is screwed the conical body of the cup, in the bottom of which is a screwed circular groove to receive the upper screwed portion of the piece with scolloped edges seen below it. The scollops were made by drawing a pattern drill across the face of the ivory, after it had been reduced to a thin shell.

The body of the cup was made from a piece of ivory about 2¾in. long and 3in. in diameter at the larger end. The ivory being firmly chucked by its smaller end, was hollowed out and had the screw cut upon the larger end, to which the scolloped rim was to be attached. The hollowing out was done, or rather finished, with the strong right side cutter-bar, the slide-rest being set at the proper angle. The piece was then chucked by the upper screw, and brought to the proper conical form. The screws at the bottom were also made—that in the centre to receive the upper part of the stem, and that in the circular groove to which the lower rim is attached.

The spiral flutings on this piece were produced by the universal cutting-frame with a round-ended tool working vertically downwards, the spiral apparatus being employed to give the necessary twist to each cut. In order that the cuts might follow the slope of the cone, the curvilinear apparatus was used, but instead of a curved template a piece of sheet brass or iron was filed up into the shape shown in the cup, with a circular slot near one end, which enabled it to be set to any angle, so that, though the slide-rest remained parallel to the lathe-bed, the tool was guided in a direction corresponding with the required slope.

The scolloped rim at the top of the cup was shaped by cutting out circular portions just meeting each other round the edge, with the eccentric cutter, and then making suitable holes with the drill. This completes the cup itself.

The principal part of the cover, having spiral grooves on a curved surface, was, after being roughly turned to shape, finished by employing the spiral apparatus in combination with a template of the required form in the curvilinear apparatus, with the same tool as before in the universal cutting-frame. The slope of the curve in approaching the narrower part of the piece being very rapid, it was necessary to move the handle on the slide-rest screw very slowly and carefully, and with all the care I could use, there were more tool marks left on the ivory than I could wish. Some slide-rests are fitted with a worm-wheel and tangent screw to the micrometer head of the long screw, and this arrangement would be very useful in such work as I am now describing. The lower portion of this piece was formed with a screw for the convenience of chucking it while being shaped, and this screws into a plain piece which fits into the cup.

Above the piece with the spiral flutes rises a short stem, with a washer below it with a beaded edge. This stem is formed in the same manner as the portion into which it screws, with a spiral apparatus and a suitable template in the curvilinear apparatus. Next comes a piece shaped on the dome or spherical chuck with flutes cut with the vertical cutter carrying a Λ shaped tool. Into this is screwed the double spiral stem which carries the finial. This stem was made on the eccentric chuck. It is rather delicate work, and requires a good deal of care. In fact, what with accidents while working, and the action of energetic housemaids since I am afraid to say how often I have had to make the piece in question. A piece of good ivory, having been brought to the required length, including an allowance for a male screw at each end, was chucked by what was to be the smaller or upper end. It was then bored throughout its length with a pipe-boring tool, made from a long steel wire into a half-round borer about $\frac{1}{8}$th of an inch in diameter. The screw by which the piece was to be attached to that below it was next formed, and then the bore was enlarged at the free end and made conical internally, the larger end of the hole being made as large as the screw would allow. The piece was then attached by that screw to a chuck on the eccentric chuck and reduced to the conical form externally. A small portion at the outer end was made into a fine screw of as small a diameter as the bore would allow, for the purpose of carrying the finial, and then the double spiral was commenced at the right-hand end, leaving a very small interval between the first steps and the screw. The tool in the slide-rest with which the steps were cut was about $\frac{4}{100}$ths of an inch wide. The eccentric chuck slide was thrown down about $\frac{8}{100}$ths of an inch. The tool being placed for cutting the first pair of steps, was advanced on both sides alternately until it was seen that the two corresponding cuts at each side had entered the bore of the ivory. After the first cuts, the click-wheel of the eccentric chuck was shifted round six teeth, and so on for the remainder, the tool each time being allowed to penetrate till the cuts at each side had shown themselves in the bore of the ivory.

The finial, which screws on the top of the double spiral stem, is formed of two pieces—the lower having its edge cut into little teeth by cuts made by a tool bevelled on the left side in the eccentric cutting-frame. The part above this is plain. The two together bear some resemblance to an acorn.

G. C. C.

Cleaning Screws from Rust.—Screws that are too small for separate treatment may be cleaned as follows: Take, say, one pound of screws, and place them in a small box; a cigar box will do. Put a small quantity of oil on them and shake for a minute; then put a piece of cotton waste in the box, and repeat for a minute; finally put a handful of sawdust in the box and shake for another minute or so, and remove the sawdust by sifting it from the screws in a fine sieve. The screws will be found to be as good as new. Larger quantities are apt to be ruined in a "churn," and sharp corners, threads and points rapidly disappear in a churn.

Gauge of Firearms.—The bores of fowling pieces are named from the number of spherical lead bullets to the pound, Avoirdupois, that they will carry. The curious in such matters will find the diameters by calculation in Act 18 and 19 Vict. cap. 148, lead being taken at 2,870 grains to 1 cubic inch. There is a difference between the proof-house gauges and the calculated sizes, as *e.g.* a 12-bore by calculation is .729in. diameter, while the gauge gives .739 or one-hundredth of an inch larger, and the same difference almost exactly exists from No. 8 size to No. 20, which are about the limits of ordinary shot-guns. An easy rule for finding the weight of a ball is to take the diameter in thousandths, and having cubed it strike off all but the first three figures, and take once and a half that number for the grains weight. Thus No. 12 gauge is ·729 diameter, of which the cube commences with ·3874, and $\frac{3}{2}$ times that is 581½, which is only two grains short of the calculated weight. Since spherical bullets have been discarded for military arms, those are usually spoken of by their measured diameters as ·577 Enfield, ·451 military small bore, and ·5 Express, &c.

BREAKING OF GLASS WATER GAUGES.

ONE of the greatest annoyances that I ever had to contend with since I took charge of a stationary engine has been the frequent breaking of glass water gauges. After breaking a glass I at once endeavoured to trace out the cause. The individual who sold me the glass maintained that it was all right, that no fault was there; while a competitor argued that Bohemian glass was not the best kind to use, and that common sense ought to have taught me to purchase Scotch flint. Still another asserted that he used a German glass that had been annealed several times, which made it so tough that the tube might be dropped upon the floor without breaking. I finally came to the conclusion that those men wanted to sell gauge glasses rather than to find out the cause of their breaking, so I went into an investigation with the determination to find out the true cause of the trouble. I found that my neighbour would often use glasses for six months without breaking, then he would break several in succession before getting one to stand.

A general practice for making tight joints in the stuffing boxes at each end of the gauge glass is to use rubber washers.

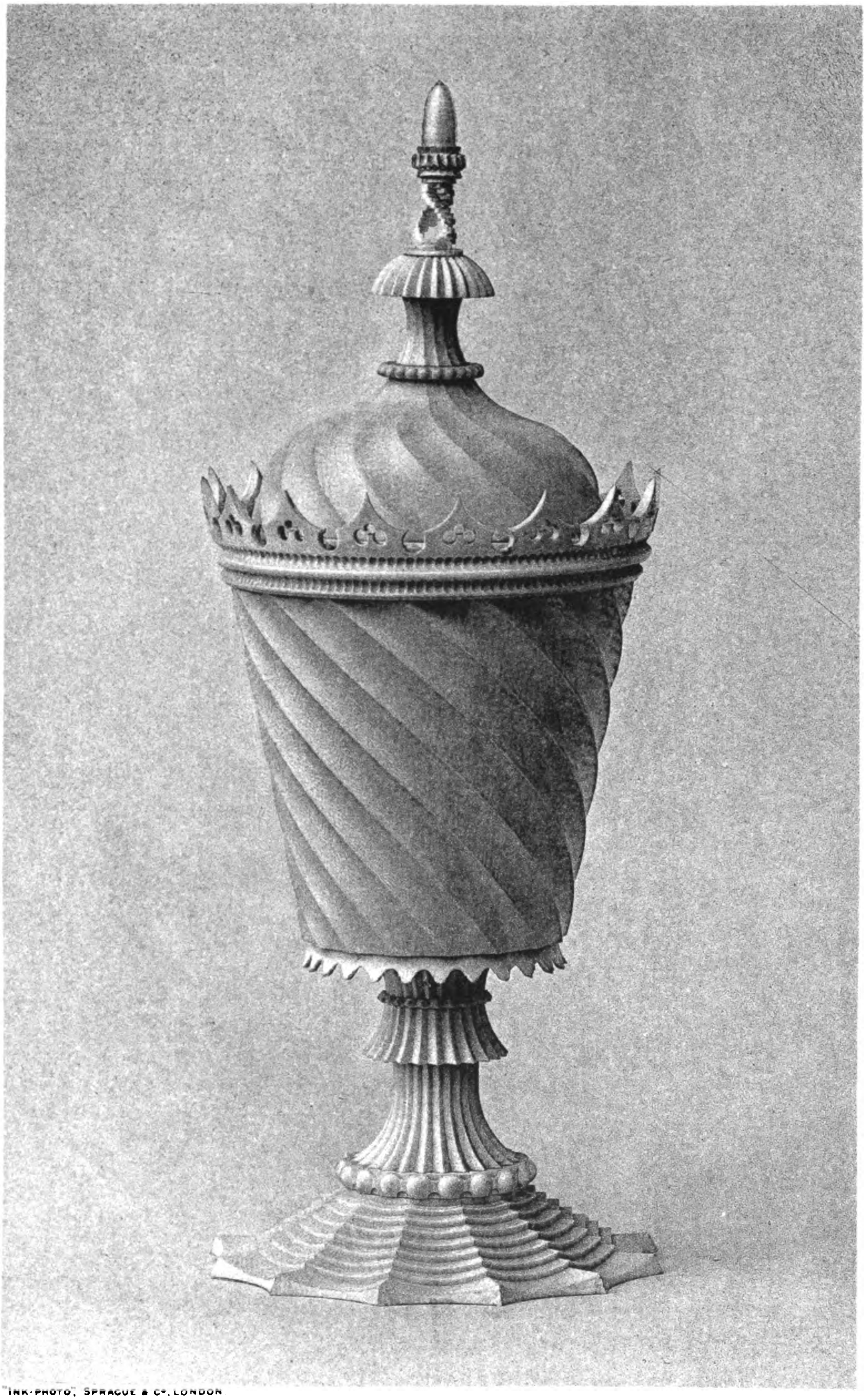
In many instances these washers, which are made and sold for this purpose, are too large for the glass, so that the nut upon the stuffing box has to be screwed down very tight to stop leaks, while in other cases the washers are cut from a sheet of rubber with a jack-knife. Everyone who has attempted to cut out a round washer with a pocket-knife knows it to be a positive fact that a round, smooth hole cannot be cut through a sheet of rubber by any such process; therefore, when these washers are put upon the glass and pressure applied, there must necessarily be an unequal pressure upon the glass, which will tend to collapse the tube. The best rubber washers for this purpose are composed of a nearly pure gum, with a hole of sufficient size to fit tightly over the glass tube; then, when the nut upon the stuffing box is tightened, a very little pressure will make a tight joint.

Almost all engineers who have had any experience with gauge glasses prefer the latter method. I maintain that rubber is not a proper substance to use for making the joints upon a glass water gauge. I never use it in making steam or hot water joints about engines or boilers. I will endeavour to support my assertion by quoting from facts that have been demonstrated by experience.

When a gauge glass has been inserted and the joints made by rubber washers, a few hours' exposure to the heat will stick the rubber firmly to the glass, after which the gum will gradually vulcanise, becoming as hard as a stone, and being so firmly attached to the glass that it is almost impossible to remove the glass without breaking it.

After the rubber becomes hardened up to a certain degree it will leak, then when the nuts upon the stuffing boxes are moved "pop" goes the glass, bringing forth an expression from the operator not found in the revised New Testament. The man who sold the glass to this party can hardly be blamed for the accident, so the loss is attributed to bad luck, and a new glass is purchased and applied.

Frequently, when glass gauges are used upon boilers, and without any apparent reason, the glass tube will snap like a pipe-stem; then the dealer has to take the blame. The true case generally is that the rubber sticks to the glass, as described, so that an excessive expansion of the glass or boiler will eventually break the tube, as the sticking of the gum prevents a free end movement



SPIRAL FLUTED IVORY CUP & COVER.