piston should be from 2 to 3 times the diameter of cylinder. The depth of piston for high-pressure engines will be found by multiplying the diameter of cylinder by ·25, but for marine purposes the depth is usually $\frac{1}{5}$ to $\frac{1}{6}$ the cylinder's diameter. The piston for all horizontal engines should be strong and light in construction, fitted with a packing ring, or two packing rings for pistons of large diameter. A simple form of piston is a plain casting, recessed for light steel springs, and is much used for small pistons,

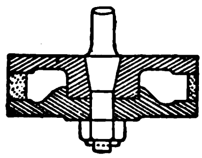


Fig. 2.—Section of Piston.

although, when the piston is supported by means of the piston rod passing through each end of the cylinder, it works well for cylinders of large diameter.

A simple and good piston is shown in fig. 2, and is suitable for cylinders up to 12in. in diameter. The rod where it enters the piston is made a little larger in diameter than the working part, and is tapered $1\frac{1}{4}$in. to the foot, and secured by means of a nut, which should be locked with a D pin. The packing rings are of cast iron, and should be turned about $\frac{1}{16}$in. larger than the cylinder up to 5in. diameter, $\frac{3}{32}$in. up to 8in., and $\frac{1}{8}$in. up to 12in. diameter. These rings should be made thicker on one side than the other, and cut on the thin side, which causes the ring to bear equally round the cylinder.

There are many styles of pistons, but the one just mentioned, or the block piston with three steel springs, are about the simplest for small engines and work well. The diameter of the piston rod is found by multiplying the diameter of the cylinder by ·15 or $\frac{1}{10}$ diameter of cylinder for condensing engines, and $\frac{1}{6}$ to $\frac{1}{7}$ for high-pressure engines.

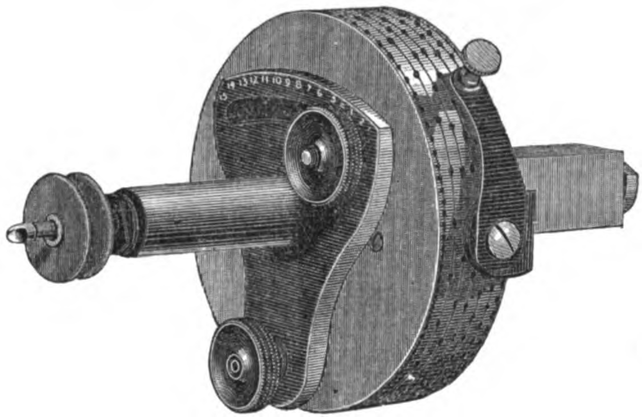
The following table of cylinders is from actual practice, the stroke of the piston being twice the diameter:—

Diameter of Cylinder. *inches.*	Thickness of Metal.	Size of Steam Port.	Size of Exhaust Port.	Depth of Piston.	Diameter of Piston Rod.	Diameter of Valve Spindle.
$2\frac{1}{2}$	$\frac{5}{16}$	$\frac{1}{4} \times 1$	$\frac{7}{16} \times 1$	1	$\frac{1}{2}$	$\frac{3}{8}$
3	$\frac{5}{16}$	$\frac{5}{16} \times 1\frac{1}{4}$	$\frac{1}{2} \times 1\frac{1}{4}$	$1\frac{1}{4}$	$\frac{5}{8}$	$\frac{3}{8}$
4	$\frac{3}{8}$	$\frac{3}{8} \times 1\frac{1}{2}$	$\frac{5}{8} \times 1\frac{1}{2}$	$1\frac{1}{2}$	$\frac{3}{4}$	$\frac{7}{16}$
5	$\frac{3}{8}$	$\frac{7}{16} \times 1\frac{7}{8}$	$\frac{3}{4} \times 1\frac{7}{8}$	$1\frac{3}{4}$	$\frac{7}{8}$	$\frac{7}{16}$
6	$\frac{9}{16}$	$\frac{9}{16} \times 2\frac{1}{2}$	$1 \times 2\frac{1}{2}$	$2\frac{1}{2}$	$1\frac{1}{4}$	$\frac{5}{8}$
7	$\frac{5}{8}$	$\frac{5}{8} \times 3$	$1\frac{3}{16} \times 3$	3	$1\frac{3}{8}$	$\frac{3}{4}$
8	$\frac{5}{8}$ $\frac{1}{32}$	$\frac{3}{4} \times 3\frac{1}{2}$	$1\frac{3}{8} \times 3\frac{1}{2}$	$3\frac{1}{4}$	$1\frac{5}{8}$	$\frac{7}{8}$
10	$\frac{11}{16}$	$\frac{7}{8} \times 4\frac{1}{2}$	$1\frac{5}{8} \times 4\frac{1}{2}$	$3\frac{1}{2}$	$1\frac{3}{4}$	$\frac{7}{8}$
12	$\frac{3}{4}$	$1 \times 5\frac{1}{4}$	$1\frac{3}{4} \times 5\frac{1}{4}$	$3\frac{3}{4}$	2	1

MACHINE FOR DOUBLE COUNTING ON THE CYLINDER.

THE enclosed photo. is of a machine for double counting on the cylinder. It has been sent to me by Mr. Jesse Lowe, with the request that I would photograph it for insertion in "Amateur Mechanics," in which journal, I may say, he has taken a lively interest from the commencement, and has always done the best in his power to further its success.

He has now arrived at that time of life when to undertake to write about even what has been to him a life's pleasurable study is found to be irksome; but it shows he has still a kindly feeling to the younger generation of amateur turners, and has set an example which might be followed by many under similar circumstances, not only with credit to themselves, but helping considerably to the success of "Amateur Mechanics." Not having used the machine under notice, I am not in a position to say much about its respective merits, so, necessarily, I shall confine myself to a description of the machine itself, but I have no doubt it will be readily understood from the engraving. It is so constructed as to suit his own peculiar lathe, which is only provided with one slide rest to answer for all purposes. The index plate has seven rows of divisions, containing 24, 28, 36, 48, 50, 72, and 120 holes respectively. The index pointer is attached by means of a brass bracket to the square stem which fits the tool post of slide-rest. Attached to the index plate is a round spindle, on one end of which is welded a flat disc; this disc is $2\frac{1}{4}$in. in diameter by $\frac{3}{16}$in. thick; at the junction of the spindle with the disc is a short cone; the spindle is $\frac{1}{2}$in. diameter and 4in. long; the end is screwed for a $\frac{3}{8}$in. nut, and the spindle is reduced to the same diameter for about $\frac{3}{8}$in. further, after allowing for thickness of the nut—the object of which will be explained shortly—on the tool post stem there is also a disc corresponding with the one on the spindle; this stem is bored right through, and coned on the disc end to fit the spindle just described. Before the nut is screwed on a short spiral spring is put on the reduced part of the spindle mentioned above—this is a favourite plan of Mr. Lowe's for mechanism of a similar nature as the one under discription, and is what he calls a spring-tight fit; it certainly gives a much freer action to the movement than would be the case if fitted solid up to the shoulders. I forgot to mention that the division plate is attached to the tool post spindle by means of six $\frac{1}{4}$in. set screws, which are screwed from the front of division plate, one of which is seen to the right hand of drill spindle plate. In fixing these screws care must be taken to see that none stand above the front of plate, or they will interfere with the working of the plate carrying the drill spindle. This plate is of a triangular shape, $\frac{7}{32}$in. thick by $3\frac{1}{4}$in. deep; from the centre of pivot stud to the centre of slot it is $2\frac{5}{8}$in. Cast solid with this plate is a round boss $2\frac{1}{8}$in. long by $\frac{11}{16}$in. diameter, which is bored right through with



MACHINE FOR DOUBLE COUNTING ON THE CYLINDER.

a ¼in. hole. Secured to the plate end is a female hardened steel cone. The pulley end is enlarged, and screwed ⅝in. brass tube thread. Fitted to this screw is another female adjustable hardened steel cone, made a tight fit, with two sides filed flat, deep enough to allow a screw key to be used for adjusting the spindle, which is a straight piece of steel, coned at both ends. The end next to the driving pulley, of course, is extended to allow room for latter, and the necessary portion for attaching the drills.

The top of the triangular plate is made a true segment of a circle from the centre of lower stud; it is 2¼in. across, and is divided into 15 equal parts. The drill spindle is concentric to the tool post spindle, as shown in the engraving; but by slacking out the two circular milled headed thumb screws, and bringing the drill spindle towards you, the amount of eccentricity obtained is in proportion to the number of divisions used.

The following is the maker's description of how to use the double counter:—

"Fix the counter in the rest so that the centre of cutter is the same height as the lathe centres, and if you want six loops to go round a cylinder or edge of a box, use a circle of holes on the counter that will divide any circle of holes on division plate of lathe; the 144 on the latter and 24 of tool will do this. To commence, set index pointer of lathe to the 144, and pointer of tool to 24, and take the first cut; now change a hole in each division plate, and cut again; and when you have gone once round the 144 circle the division plate of tool will have made six revolutions, and repeated the loops six times in going once round the cyclinder; or, suppose you want ten loops, take the 180 circle of holes and 18 on counter; the latter will then go 10 times round to the one revolution of the former; or, if the 24 circle in the counter was used, then it will have to make 2 revolutions to obtain 15 loops; but, in the latter case, the loops will have crossed one another."

In conclusion, I don't see why the machine should not be used with advantage on surface work. It sometimes happens, in ornamenting a surface, some very awkward spaces are left, which are often filled up by the use of the elliptical or epicycloidal cutting frames. In such cases the double counter could be substituted, as it could be brought to operate on any portion of the surface; and by using the division plate of counter a circle of beads or eccentric patterns could be obtained. The diameter of circle would depend on the amount of eccentricity given to drill spindle, so that circles within circles, or crossing each other, could be readily done, and with a judicious use of division plate of lathe and slide-rest some curious patterns, no doubt, would be obtained.

G. B. M.

TO RESTORE A SILVER WATCH DIAL.

WE proceed to describe several methods of doing this, but would at once observe that when the earlier ones are adopted, the hours, if they are painted, necessarily disappear. They can be retained by resorting to the third method, although great caution must in that case be taken; moreover, it is much more difficult to accomplish than the others.

FIRST METHOD.—This is the most expeditious system, and at the same time the most certain of success. If the hours are in enamel, there need be no fear; if engraved and filled with black composition, this will disappear, but it can be replaced without difficulty. There remains the case of painted hours to be considered. First make thin marks with a fine point along the lines of all the figures, taking care not to pass beyond their ends, and do the same for the dots and lines that indicate the seconds. Begin by cleaning the dial with a brush and fine pumice-stone, so as to remove spots and slight scratches.

To Frost the Surface.—In order to frost the surface of the dial, take a spirit lamp with a large wick, and direct a blowpipe flame from it against the under side of the dial, which is held by one hand with a hooked support. If the flame is gently directed over the entire surface of the back, a good dead surface is obtained that resists a moderate degree of friction either in soaping with a fine sponge, or washing in a large quantity of water, or in applying soft bread and oil of lavender to erase irregularities or marks made in painting the figures. The application of the flame is several times repeated, so as to obtain a decisive and even frosting; but it is necessary, with a view to avoid distorting the thin metal, to place an iron or copper plate behind the dial. The flame oxidizes the surface of the metal; that is to say, it causes the oxygen of the air to combine with the copper which is alloyed with the silver.

Pickling or Bleaching the Dial.—Introduce sufficient warm water into a suitable flat vessel to completely cover the dial, and gently pour into it a few drops of sulphuric acid (oil of vitriol), so that the two liquids are in the proportion of about 1 to 10; then lay the dial in this dilute acid for a period that varies from half to one or two minutes. The frosting will first become yellow, and then of a beautiful white colour. Wash it in a large quantity of water, wipe with a fine linen rag, and apply the flame momentarily to the back, in order to prevent the formation of spots