

## WATCH CRYSTALS.

Our illustration shows a hollow sphere of glass now in possession of L. Royer, in Paris. The diameter is not stated, but the size can be judged from the fact that three hundred watch crystals have been cut out of it. The cut is taken from Ackermann's *Gewerbe Zeitung*, and is from an actual photograph. The same paper gives the following interesting account of the manufacture of watch crystals.

The first pocket watches in use in Germany were oval in form, and hence called "Nuremberg eggs" (like our "bulls eyes") Only a few of them had a glass cover over the hands. These covers were flat or slightly convexed pieces of crystal cut out and polished on a primitive kind of grindstone. Of course they were very expensive.

These oval watches were succeeded by flattened spheres, and the glasses had the form of segments of a sphere, or spherical caps, made as follows: Small glass bulbs were blown on very small gas-blowers' pipes, and from each bulb two of these caps were cut with the aid of two red hot iron rings, the sudden expansion causing a circular crack. The edges of these glasses were polished either on a grindstone or with sand on a cast-iron plate.

This process was very expensive, owing to the necessity of blowing as many bulbs as they wanted crystals, for two could be rarely cut out of one sphere. Moreover, the glasses, owing to their spherical shape, were very high in the middle, while the ends of the hands near the edge of the dial had a very narrow space to move in.

As the thick watches of the last century gave place to thinner ones, and the high convexed glasses became inconvenient and unhandy, flat glasses were made which were but slightly curved near the edges. They were made from thick, flat glass hollowed out in the centre and rounded off around the edges. Owing to their high price, they were only used on fine watches.

The concave watch glasses of the present day are not hollowed out on a grindstone, but made by a method invented in 1791 by a skillful watch-glass maker in Paris named Pierre Royer. The Geneva manufacturers imitated his method, and succeeded in developing it into an important branch of industry.

Before Royer's process had been perfected and came into general use, various interesting experiments were made in the glasshouse in Goetzeubuch, in 1830. Little phials were blown, each with a slightly curved bottom, and this bottom when cut off formed a concave glass; but as it required a new phial for every watch crystal, this made them too expensive also.

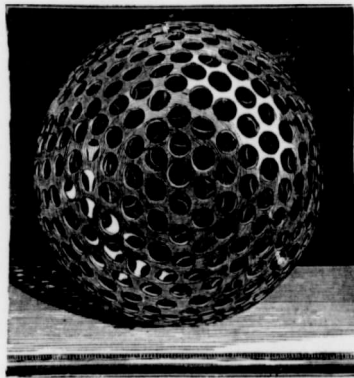
One improvement followed another until finally they are made in wonderful perfection and with surprising rapidity, which is due principally to the skill of the glass-blower, so that now very thin glasses of enormous size can be made.

The glass-blower takes up several pounds of glass on the wide end of his pipe in that plastic state in which it can be worked like wax, and rounds it off by rolling it on a damp block of wood and first blowing into it gently. He then blows a little harder and swings it to and fro, which lengthens it out, and with proper tools he gives it a long pear-shape. Having acquired the approximate form required, it is re-heated in the furnace, and then blown out to a larger size, a steam blast being employed to finish the blowing. The finished ball, which resembles a balloon, is cut from

one hand, the other draws a little white hot tube around the edge of the pattern. This circle is immediately moistened with cold water, and the sudden contraction that follows the previous expansion causes the piece to crack off, forming a more or less hemispherical crystal.

This process has, however, been superseded by the so-called *tournelette*, a tool that resembles a carpenter's compass (dividers), one leg being provided with a diamond.

First, ten circles are cut on the ball with the point of the diamond of this little instrument. As these little scratches do not go through the glass, the next and most tedious part of the operation is to break loose one of the separate crystals. This is accomplished by little strokes or taps all around the circle. After one has been taken out, the workman can put



A GLASS GLOBE FROM WHICH THREE HUNDRED WATCH CRYSTALS WERE CUT.

the pipe and placed on a wooden work-bench upside down.

In some glasshouses they have succeeded in blowing balloons from 12 to 32 inches in diameter with ease. Sometimes they exceed 40 inches, and the walls of such colossal balls do not exceed 1-25 or at most 1-16 of an inch in thickness.

These enormous balls can be designated as truly industrial works of art. About 600 watch glasses can be cut from one such sphere, by a method which we will describe below. As these large balls, owing to their great size, are liable to break, and cannot be handled rapidly, it is customary to make smaller ones and cut them in two. First a metallic pattern of a watch is made, and either pressed on the sphere or on a strip cut out of it. While this is held in place with

his thumb through the opening into the sphere; and then taking the next one between the thumb and fore-finger, he presses gently outward, and thus separates the second, after which the rest are taken out in the same way.

After they have been cut out, and before they are ground to the proper form, the glass must be subjected to another operation, the object of which is to improve and shape the rim so that it may fit accurately into the crease around the watch case.

The glasses are put into muffles of refractory clay heated with coke. When sufficiently heated, they are placed on a cast-iron plate in front of the muffle and pressed down on the moulds with a wooden lid of conical form. The projecting edge of the glass getting heated first is softer, so that it alone is pressed down by the lid. This method is more

rapid, and only the edges need polishing. This is done on grindstones of hard material, which produce the bevelled, slightly projecting edge that holds it in the case. It is finely polished with cork.

The last method has been still further simplified by grinding the disks as soon as they are cut out with the diamond. The bevelled edge is formed on sandstone wheels, and then the glass is put in a muffle without polishing to give it the arched or curved form. The ground edges are rounded by the heat, and rendered smooth and brilliant, and at the same time are harder and firmer, so that they can be set more easily.

At the watch crystal factory of Trois-Fontaines in Lothringen, there are 52 gross (74,880) manufactured daily, each glass passing through thirty-five distinct operations.

After the watch glasses have acquired the requisite shape by pressing the warm and softened glass on to or into moulds, they are taken to a large room fitted with grinding and polishing lathes. The grinding is of three kinds. The first consists in grinding away the convexed portion so that the outside is nearly all flat, and the glass is thin in the middle, but near the rim retains its original thickness. The second is similar to the first, but only the centre is ground, forming a small circular spot that is slightly concave.

The third is grinding the edge to a proper bevel, so that it will fit into the crease of the case accurately, which is absolutely necessary for holding it securely. This operation is performed on lathes driven by steam, and one man can tend eight or ten of them, as it is only necessary to put them on and take them off.

After a final polishing with pumice, measuring, sorting and inspecting they are ready for packing and shipping.

A Boy of thirteen came to New York to seek his livelihood. The first opportunity that offered was a position in a drug store. For a few days everything seemed satisfactory, but after a few weeks' experience, he exclaimed earnestly: "I can't stay in that place. I am willing to work all day, to work nights, and to work hard; but to work Sundays, that's what I won't do. If people only came in to buy medicine, that would be one thing; but to stay there and sell perfumery, and soda water, and mineral water, things they don't need at all! I never felt so mean in all my life." It was only by a strong effort that the brave little fellow kept back the tears as he felt that his moral nature had received a shock and his sense of right had been outraged.—*Christian Intelligencer*.