

made in 1650, and said to have been the property of Oliver Cromwell. One bears the Cromwell family crest, and the inscription, "John Midnall, Fleet street." There is also another watch in the Ashmolean Museum, which without doubt was the great Protector's.

South Kensington has several watches of seventeenth-century make. One is of silver, fluted, and shaped like a pecten shell. It has a chased and engraved dial, and bears the name of the maker, "Pierre Combrel à Lyon." Its size is two and a half by one and three-quarters inches. Another watch is in the form of a fleur-de-lis, with gilt dial plate and outer case of plain silver. It dates about 1650, and its maker's name is "G. Senez, Orologier du Roy à Rouen."

The greatest improvements in the art of watchmaking are due to the seventeenth century, when the studious minds of Huygens and Dr. Hooke were directed into this channel. Dr. Hooke, an irrepressible and cosmopolitan "scientist," originated the spiral or pendulum spring, and this was improved upon by Thomas Tompion, who had been a farrier, and tried his prentice hand at watch-work by regulating the wheels of meat-jacks. Tompion was a famous watchmaker of the day, and Dr. Hooke induced him to construct a watch upon the new principle for Charles II. From this period watches became real timekeepers, and the improvements introduced since have been mainly to counteract the varying effects of cold and heat upon the metal of which the works are constructed, and in rendering the working parts less liable to friction, until the precision and mathematical accuracy of these machines justly entitled them to the eulogy of Paley, who selected watches as exhibiting the highest specimens of human ingenuity.

At one time it was fashionable to wear two watches, to compare the one with the other. In the "Universal Magazine" for 1777, we find a "Receipt to make a Modern Pop," which includes, among other ingredients,

"A lofty cane, a sword with silver hilt,
A ring, two watches, and a snuffbox gilt."

Some, too poor or too niggardly to sport the usual couple of watches, wore a *fausse montre*, or dummy watch, in one pocket, and the real watch in the other. This carrying of two watches at one time was as nothing compared to the whimsicality of a Saxon Minister, Count Bruhl, in whose wardrobe, when the Prussians took Dresden in 1757, were discovered suits of clothes for each day of the year, and 365 watches, sticks, and snuffboxes, respectively.

We have seen that striking watches were of an early date, and stories are told of the detection of thieves in a crowd by the watches they had abstracted striking the hour at a *mal-a-propos* moment. Charles XI. of France discovered a *chevalier d'industrie*, who had eased him of his watch in this manner. When "repeaters"—which strike the hour at any time by pressure upon a certain part of the watch—came in, seems to be unknown. They are mentioned in Bolingbroke's "Letters on the Study of History" (written about 1711, thus: "When you press a watch, or pull a clock, they answer your question with precision, for they repeat exactly the hour of the day, and tell you neither more nor less than you desire to know.")

At South Kensington there are some beautiful specimens of seventeenth and eighteenth century repeaters. One is of metal gilt, in size $5\frac{1}{8}$ by $4\frac{1}{8}$ inches. Upon the dial plate is engraved the entombment, after Lucas Van Leyden. This watch is dated 1630, and the name of the maker, "Nicholas Lemandre à Blois," is added. Here is also a gold repeater in a shagreen case, by "J. Trubsham, London," the property of Miss Gerard, and said to have been formerly in the possession of Bishop Berkeley. Another in the same collection is believed to have been worn by George I. It is a repeating watch in a double case, the inner one being pierced and engraved, and on the back are the royal arms, surmounted by a crown. The outer case is *repoussé* and chased, with a horseman hunting a boar. It is $2\frac{3}{4}$ by $1\frac{1}{2}$ inches in size, of German manufacture, the maker's name being "George Albrecht." A contrivance called a "pulse piece," and by the French a "deaf piece" (*sourdine*), was subsequently added to repeaters. In these watches a small button projected from the rim, nearly opposite the pendant, and when the watch was made to repeat the time, and the finger was pressed upon the button, the number of strokes upon the bell could be distinctly felt. The touch watch (*une montre de touche*) was a later invention by Brequet, a famous French maker. Here the hours were indicated by eleven buttons, or studs, projecting from the rim of the case, and the pendant marked twelve o'clock. There was an index hand at the back which, moved forward, stopped at the time shown upon the dial; this, combined with the studs, enabled one to feel the time.

Some of the last century watches are highly ornamented, and other specimens display great ingenuity. South Kensington has a French lyre-shaped watch, set with pearls and enameled, and surmounted by an image of the sun. Another, in the form of a very small apple, has a gold enameled case, and is surrounded by a belt of seed pearls. This was made at Geneva about 1760. In the Gardner collection at the same museum is a watch in an oval gold case, highly decorated with pearls and diamonds, set in enamel, the hands of which contract and elongate to suit the form of dial. This is by "W. Anthony, London." The clock of the cathedral of Lyon, made by Lippius de Basle, had a similar dial, and the single index became longer or shorter to suit its form. To return to the collection at South Kensington, there is a watch, the property of T. Dyer Edwards, Esq., originally belonging to the Duke of Marlborough, by

whom it was given to Sir Isaac Newton in 1714. It is of silver, with *repoussé* and open work cover, and is of German make. Another watch presented to the great astronomer is in the possession of the Royal Society.

Miniature watches are little thought of now; precision is everything, as it should be; and this has culminated in the chronograph, a wonderful invention of our own day, by which the great horse races are usually timed. The precise moment the starter's flag is lowered is indicated upon the dial by a spot of ink, and another dot shows with equal exactitude the time at which the first horse passes the judge's chair.—Reprint from *Leisure Hour* in *Illustrated Christian Weekly*.

The Care of Steam Boilers.

INSTRUCTIONS TO BOILER ATTENDANTS.*

Getting Up Steam.—Warm the boiler gradually. Do not get up steam from cold water in less than six hours. If possible, light the fires over night. Nothing turns a new boiler into an old one sooner than getting up steam too quickly. It hogs the furnace tubes, leads to grooving, strains the end plates, and sometimes rips the ring seams of rivets at the bottom of the shell.

Firing.—Fire regularly.—After firing open the ventilating grid in the door for a minute or so. Keep the bars covered right up to the bridge. Keep as thick a fire as the quality of the coal will allow. Do not rouse the fires with a rake. Should the coal cake together, run a slicer in on the top of the bars and gently break up the burning mass. It has been found by repeated trials that under ordinarily fair conditions no smoke need be made with careful hand firing.

Cleaning Fires and Slacking Ashes.—Clean the fires as often as the clinker renders it necessary. Do not slack the clinkers and ashes on the flooring plates in front of the boiler, but draw them directly into an iron barrow and wheel them away.

Feed Water Supply.—Set the feed valve so as to give a constant supply, and keep the water up to the height indicated by the water level pointer. There is no economy in keeping a great depth of water over the furnace crowns, while the steam space is reduced thereby, and thus the boiler rendered more liable to prime. Nor is there any economy in keeping a very little water over the furnace crowns, while the furnaces are thereby rendered more liable to be laid bare.

Glass Water Gauges and Floats.—Blow through the test tap at the bottom of the gauge hourly, as well as through the tap in the bottom neck, and the tap in the top neck twice daily. These taps should be blown through more frequently when the water is sedimentary, and whenever the movement of the water in the glass is at all sluggish. Should either of the thoroughfares become choked, clean them out with a wire. Work the floats up and down by hand three or four times a day to see that they are quite free. Always test the glass water gauges and the floats thoroughly the first thing in the morning before firing up.

Blow-Out Taps and Scum Taps.—Open the blow-out tap in the morning before the engine is started, and at dinner time when the engine is at rest. Open the scum tap when the engine is running, before breakfast, before dinner, and after dinner. If the water be sedimentary, run down half an inch of water at each blowing. If not sedimentary, merely turn the taps round. See that the water is at the height indicated by the water level pointer at the time of opening the scum tap. Do not neglect blowing out for a single day, even though anti-incrustation compositions are put into the boiler.

Safety Valves.—Lift each safety valve by hand in the morning before setting to work to see that it is free. If there is a low water safety valve, test it occasionally by lowering the water level to see that the valve begins to blow at the right point. When the boiler is laid off, examine the float and lever and see that they are free, and that they give the valve the full rise. If safety valves are allowed to go to sleep, they may get set fast.

Shortness of Water.—In case the boiler should be found to be short of water, draw the fires if practicable, and draw them quickly, beginning at the front. In some cases it may be more convenient to smother the fires with ashes or with anything else ready to hand. If the fires are not drawn leave the furnace doors open, turn on the feed, lower the dampers, shut down the stop valve if the boiler be one of a series, and relieve the weight on the safety valves so as to blow off the steam. Warn passers-by from the front of the boiler.

Use of Anti-incrustation Compositions.—Do not use any of these without a thorough knowledge of their effects. If used, never introduce them in heavy charges at the man hole or safety valve, but in small daily quantities along with the feed water.

Emptying the Boiler.—Do not empty the boiler under steam pressure, but cool it down with the water in; then open the blow-out tap and let the water pour out. To quicken the cooling the damper may be left open, and the steam blown off through the safety valves. Do not on any account dash cold water on to the hot plates. But in cases of emergency, pour cold water in before the hot water is let out, and mix the two together so as to cool the boiler down gradually and generally, and not suddenly and locally.

Cleaning Out the Boiler.—Clean out the boiler at least every two months, and oftener if the water be sedimentary. Remove all the scale and sediment as well as the flue dust and soot. Show the scale and sediment to the manager. Pass through the flues, and see not only that all the soot and flue dust have been removed, but that the plates have been

*Sheet of instructions to boiler attendants recently issued by the Manchester Steam Users' Association.

well brushed. Also see whether the flues are damp or dry, and if damp find out the cause. Further, see that the thoroughfares in the glass water gauges and in the blow-out elbow pipes, as well as the thoroughfares and the perforations in the internal feed dispersion pipe and the scum pipes are free. Take the feed pipe and scum troughs out of the boiler if necessary to clean them thoroughly. Take the taps and the feed valves to pieces; examine, clean, and grease them, and if necessary grind them in with a little fine sand. Examine the fusible plugs. Do not put any blocks under the pipes in the hearth pit.

Preparation for Inspection.—Have the boiler cooled and carefully cleaned out as explained above. Show both scale and sediment to the inspector, as well as the old cap of the fusible plug, and tell him of any defects that may have manifested themselves in working, and of any repairs or alterations that may have been made since the last examination.

Fusible Plugs.—Keep these free from soot on the fire side, and from incrustation on the water side. Change the fusible metal once every year, at the time of preparing for annual examination.

General Keeping of Boiler.—Polish up the brass and other bright work in the fittings. Sweep up the flooring plate frequently. Keep water out of the hearth pit below the flooring plates. Keep the space on the top of the boiler free, and brush it down once or twice a week. Take a pleasure in keeping the boiler and the boiler house clean and bright, and in preventing smoke.

MECHANICAL INVENTIONS.

A device for trimming tenons of wagon and carriage wheels, and also tenons of bars composing or forming part of the framework of wagon bodies, has been patented by Mr. Andrew P. Almquist, of New Windsor, Ill. It consists, essentially, of a wooden block having a cutter pivoted thereto for trimming the spoke tenons, and suitable gauges for supporting the spokes while being trimmed.

An improvement in power looms has been patented by Mr. Polydore Dorgeval, of Paterson, N. J. The invention consists in a lay or batten constructed in two portions, one portion consisting of the shuttle rail supported on arms that are vibrated by power, the other portion consisting of the reed carried by side arms hung on a shaft, which arms are moved to beat up by a weight. The reed frame is behind the shuttle rail, so that the backward movement of the reed is given by contact of the shuttle rail; also in a cam and link connection of peculiar construction for vibrating the batten and resting the same to give time for the passage of the shuttle. Fingers are pivoted on the shuttle rail and connected with slide blocks in the shuttle boxes, for movement by the shuttle to raise and hold the weft thread taut during the movement of the batten.

An improved sand band for vehicles has been patented by Mr. Jonathan Hitchcock, of St. Paul, Minn. The construction of this device cannot be clearly described without engravings.

Mr. John Ladner, of Charlestown, Mass., has patented an improved car starter, which is so constructed that the first effort of the horses will be applied to the wheels near their rims in such a direction as will roll the wheels forward, and will be withdrawn from the wheels automatically as soon as the wheels begin to move.

Mr. Joseph Curson, of Lyons, France, has patented an improved machine for shaving wool or hair from hides, which is provided with an endless knife passing over two pulleys and through suitable guides, to the cutting edge of which the hide is fed by a series of reciprocating and oscillating claws, and is pressed down upon the cutting edge by a roller.

An improved bark mill has been patented by Mr. Dennis O'Brien, of Oswayo, Pa. The invention consists in combining a radially-slotted stationary plate provided with grinding teeth on one edge of each slot with a wheel having teeth on the under side.

Mr. Theodore Naish, of Birmingham, County of Warwick, England, has patented an improved variable feed for rock and other drills. The inventor employs two friction disks, connected respectively with a shaft and the drill, which are arranged at right angles to each other, the edge of one disk working in frictional contact with the face of the other, but made adjustable along its shaft to vary its distance from the drill, so as to vary the rapidity of motion of the driven wheel.

Messrs. Arthur L. Bigsby and Charles L. Bigsby, of Trenton, Mo., have patented an improvement in positive motion looms, in which the shuttle is operated upon and moved continuously during its entire passage across the fabric being woven. The object of these improvements is to construct a loom in which two or more shuttles or colors may be used, and such shuttles shifted at each opening of the shed or longer intervals, as may suit the pattern being woven, and to furnish a more easy and positive motion to the shuttle, accelerating and diminishing its speed without any sudden start or stop.

An improved post-hole borer, patented by Mr. Henry Landin, of Forest, O., which consists in a yoke having toes, in combination with a divided nut and slotted bench and gearing. The operator sits on the bench and operates the borer by turning the cranks.

Mr. James S. Schoonover, of Titusville, Pa., has patented a compound crank, consisting of several cranks or eccentrics arranged spirally at equal distances apart upon a central shaft so as to form a complete spiral.