THE WATCH, AND HOW TO USE IT.

Clocks had been in use for centuries, and most excellent and ingenious clocks had been constructed and domiciled all over Europe, before any one ventured upon the attempt to make a clock for the pocket, or a watch. Before a watch could exist at all, it was necessary that some substitute should be discovered in place of the weight, whose gravity was the moving power in clocks. This desideratum was supplied by the invention of the mainspring, which made its appearance about the middle of the sixteenth century, and was first used, not for watches, but in the manufacture of small portable clocks, which the rich carried about with them on their travels, and sometimes even on their persons.

The main-spring is an elastic coil of thin steel, highly tempered. It is out of sight in the watch, being inclosed in a small barrel, to whose inner side the outer end of the coil is fixed, while the inner end is fastened to an axis at the centre, and round which it may be wound so as to cause the barrel to make as many revolutions as the coiled spring makes turns in unwinding. Here, then, is the mechanical force which keeps the machinery of a watch in motion. But it is plain that if this power were thus applied, it would vary greatly in its action on the wheels. When the spring was tightly coiled, the wheels would be dragged rapidly round; and when the force of the coil was diminished, they would move very slowly. This would never do. To obviate this defect, and supply a power that shall act with equal force during the whole uncoiling of the spring, comes in the beautiful invention of the fusee. The fusee is a cone with a spiral groove attached to the side of the first wheel of the watch, and connected with the barrel by a chain, hooked at its ends to both. When the watch is wound up, the key is placed on the axis of the fusee, and the chain wound off the barrel on to the cone. Thus wound up, the spring is at its greatest power of recoil: but the chain, pulling then near the point or smallest part of the cone, acts with the shortest lever power; as the spring uncoils and its elasticity diminishes in force, the chain, being gradually wound on the outside of the barrel, gradually descends the cone and lengthens the leverage. By this ingenious adjustment of increased lever power to diminished force, an equality of power is maintained, and the influence of the spring on the wheels is the same during the whole period of the recoil, or until the watch needs winding up again. Perhaps there is not a more beautiful contrivance than this of the fusee, in the whole domain of mechanics, or one which more efficiently answers the end for which it was designed. Those watches, now very common, which go while winding up, have a spring, called the going fusee, contained in the interior of the fusee-wheel, by which the works are kept in motion while the fusee itself is turned by the key.

The invention of the fusee, however, important as it was, did not insure the production of serviceable watches. Two centuries ago watches were a luxury, possessed by few; and, as is generally the case with articles of utility so long as they are luxuries, were good for little. The works were a rude modification of clock-works—the chain round the fusee was a piece of cat-gut—and for want of a balance-spring, or some efficient substitute for the pendulum, their performance could not be relied on. In fact, the first watchmakers did not pretend to more than showing an approximation to the hour of the day, and modestly withheld the minute-hand from their dials, being hopeless of measuring the minutes by such miniature machines.

But an immense improvement was impending. In 1658, that most irritable and acrimonious of English philosophers, Dr. Robert Hooke, applied for a patent for the balance-spring. It is this little instrument, which is scarcely thicker than a hair, that was destined to transform the watch from a comparatively worthless and luxurious toy, into the faithful friend and servant of millions. Let us see if we can recognise its function.

If the reader will open his modern English watch, he will see the balance, which is a wheel finely poised on its axis, vibrating with a regular and equal motion. Unlike all the other wheels in the watch, it never moves completely round, but backwards and forwards. This peculiarity of motion is imparted to it by means of certain contrivances, some of them very elaborate, varying in watches of various descriptions, called escapements. Beneath the balance-wheel he will see the balance-spring, coiled like a minute hair round the axis, which it surrounds four or five times. The balance itself was intended as a substitute for the pendulum; but it never was an efficient substitute for that, until the balance-spring was invented and brought to its aid. It had been perceived that in clocks, the pendulum absorbed in its own more or less extended oscillation every inequality in the rotation of the wheel-work; and analogy suggested to Hooke, and experience afterwards proved, that the balance-spring would do the same thing. In its application to the balance of a watch, one extremity of the spring is fastened to a point independent of the balance, while the other is attached near its axis. The balance-spring is generally flat in watches, coiling concentrically; but in chronometers for naval or scientific purposes, the cylindrical form is preferred, as affording the most perfect isochronism. A recent improvement has been effected by electro-gilding the balance-springs, thus preserving them from rust—an invention which was patented by Mr. Dent.

This balance-spring, above all other manufactured things, shows the extraordinary value which may be conferred on raw material by human labour. Four thousand hair-springs scarcely weigh more than a single ounce, but often cost more than a thousand pounds! "The chisel of the sculptor," says Mr. Thomson, "may add immense value to a block of marble, and the cameo may become of great price from the labour bestowed; but art offers *no* example wherein the value of the material is so greatly enhanced by human skill as in the balance-spring."

The introduction of the balance-spring, which was rightly regarded as the crowning invention in

the mechanism of the watch, put the watch-makers in possession of all they wanted in order to enable them to produce a really serviceable article, and may be said almost to have created the trade of watch-making. Within a single generation after the publication of the invention, watches had increased in number a hundred-fold, and have gone on increasing from that day to this in more than an arithmetical ratio.

In their first popular form, watches assumed a shape nearly globular; they were on the average even smaller in diameter than they are at present, but they were turnip-shaped and heavy, and it was the fashion to inclose them in ponderous double cases of guinea gold, covered with elaborate chasing, and which more than doubled their weight and size.

The superiority of one description of watch over another consists in the comparative excellence of the escapement, which is an apparatus contrived for securing and maintaining equal vibration of the balance: of course, we infer that the other parts of the watch are constructed with good materials and by a skilful workman. In all cases it is the escapement which gives a specific designation to the watch, among the watch-makers and dealers. The oldest description of watch now in common use among us is the vertical, so called from its old vertical escapement. It is the simplest contrivance, and probably the most readily manufactured, but in principle it is least reliable for accuracy; although, where the workmanship and material are both of the highest quality, vertical watches are found to act satisfactorily.

Superior to the vertical is the horizontal or cylinder watch, so called from its horizontal escapement, introduced by Graham in the beginning of the last century. In this form of escapement, the impulse is given to a hollow cut in the cylindrical axis of the balance, by teeth projecting from a horizontal crown-wheel. These watches may be, and are, made remarkably flat and portable, and are, from their neatness, great favourites with the public. If well made, they will perform admirably; but they are subject to much wear by the very nature of their construction, and are consequently less durable than any other description of watch now made.

The lever watch, named after the lever escapement invented by Mudge, by which the impulse is given to the balance by a lever attached to anchor-pallets, is now considered the best and most useful watch manufactured. At its first appearance it was very imperfect; but the principle was recognised as sound, and it has been made, for many years past, the subject of so many improvements as to leave little further to be desired.

There are various other descriptions of watches which might be mentioned; but each and all of them would be found to consist of some variation, modification, or combination of the mechanisms of those already mentioned. There is no end to the ingenuity of watch-makers, or their enterprise either. Watches are made that will strike the hour, the half-hour and the quarters—to play sweet tunes—to sound an alarm—to wind themselves up without a key, by simple pressure of a spring at the edge of the case, or even, without the volition of the wearer, by the motion of the body in walking. Again, some will show the time in any longitude, as well as that of Greenwich, and some will mark the progress of the hours by small protrusions on their edges, so that a man may feel what o'clock it is in the dark. Moreover, watches are made of all sizes, from five or six inches in diameter down to the diameter of the third of an inch, or the size of a silver three-penny piece. A lever watch of this diminutive size was exhibited by Mr. Funnel, of Brighton, at the Crystal Palace, in 1851. But we cannot dilate on these curiosities of the art.

One word on the subject of compensation. On whatever principle a watch is constructed, it will not keep time with anything like *perfect* accuracy unless a provision be made for compensation. The reason is, that all substances in nature are liable to expansion by heat and contraction by cold. Just as a long pendulum vibrates slower than a short one, so an expanded balance-wheel vibrates slower than a contracted one. Hence it is that even the best made watches, whatever the form of their construction, are found, if uncompensated, to go faster, or gain time, in cold weather, and slower, or to lose time, in hot weather. This defect is met by the adoption of what is called the compensation-balance. This contrivance substitutes for the common steel balance-wheel a balance-wheel in two halves, united together by a cross-bar; the outer part of the wheel is brass, and the inner part steel, and its flat outer edge is loaded with weights. The compensation is effected in this way:—The heat which expands the balance-spring diminishes its elastic force, and would cause the watch to lose; but the same heat expands the outer or brass part of the wheel more than it does the inner or steel part—brass expanding more than steel by heat and contracting more by cold; a curvature inwards of the whole arm of the ring ensues, which lessens the checking power of the balance, so that the spring requires less force to influence it. On the other hand, the cold, which contracts the balance-spring, increases its elastic force, and would cause the watch to gain; but the same cold contracts the brass more than the steel, and, by curving the arm outwards, increases the checking power of the balance, so that the spring has no more influence over it than it had before. The weights on the balance are moveable, and may be adjusted with such accuracy as to cause a close approximation, in watches of first class workmanship, to perfect time. The compensation-balance is, however, an expensive article, and is found attached only to high-priced watches.

A few words of advice on the subject of watches, and then we have done. In purchasing a watch for wear and service, it may be wise to give the preference to one of English manufacture. Englishmen have led the van in the art of watch-making all along: they have been the authors of all the most valuable inventions, and to this hour they produce the best watches in the world. Buy, then, an English watch; choose a lever if you can afford it, and let it be as good as you really can afford. Buy it of a man who has a character to lose, and to whom you can look for redress in case of failure. Be suspicious of cheapness, and do not put too much

faith in guarantees for a year or two years; because a flimsily made watch may go for a year or two tolerably well, and yet, before you have worn it five, may have cost you twice its value in repairs, and prove a torment and a deluder instead of an honest friend and guide. In making your selection, do not be led by ornament—by fancy backs or dials, or "jewelling in ten holes." Ten holes may be jewelled for a guinea, and the watch be none the better for it. With a respectable maker, the absence of needless ornament is often a concomitant of superior work.

Having bought your watch, remember that it is worth taking care of. Wind it, as nearly as possible, at the same time every day, preferring the morning to the evening. Avoid sudden jerks in winding, and do not turn the watch while you are turning the key, but hold it firm and steady. Keep the key in good condition, free from dust and cracks: it is not a bad plan to plug its orifice: a particle of dust or rust in the key may get into the watch, and put you to the expense of an extra cleaning. Keep the key in your bed-room, not in your pocket.

When a watch is hung up, it should be supported and *at rest*: when laid horizontally, it should rest on a soft substance for support, or the motion of the balance may generate a pendulous motion of the wheels, causing a variation in time.

When a watch varies from atmospheric influences, or from some change in the mode of wearing it, the hands may be occasionally set right, but the regulator should not be touched; if the watch gains or loses continuously, then the regulator should be altered; but it should be delicately handled, and moved but a little at a time. In setting the hands, it is best to set them forwards. In watches set or regulated at the back, the glass should not be opened at all. The watch-pocket should at all times be kept free from dust and accumulations of every kind.

Two years is quite long enough to keep a watch without cleaning. If you cannot consign it for that purpose to the hands of the maker, intrust it only to some respectable and responsible person. The very best watches are often ruined by the hands of blundering and incapable workmen, while even a bad watch may be made, by the treatment of a clever artist, to perform tolerably well.

Lastly, take a lesson from your watch. That little machine, if you have taken the above advice regarding it, will be found constantly doing its duty. Do you the same; work on with your life's work as that does, "unhasting and unresting." Let it teach you regularity and punctuality; so shall you not be ashamed to look it in the face, and be enabled, when your hours are all numbered, to give a good account of the time intrusted to your keeping.

THE SOVEREIGNTY OF THE SEAS.

THE grand truth embodied in the majestic lines—

> "Let us be back'd with God, and with the seas,
> Which he hath given for fence impregnable,
> And with their helps alone defend ourselves;
> In them, and in ourselves, our safety lies,"

seems to have been a heartfelt conviction in the breasts of all true Englishmen, long centuries before the poet was born.

King John, whom history has generally branded as a very unworthy monarch, had some redeeming kingly qualities—not the least of which was his determined assertion of England's sovereignty of the seas. He ordered his sea-captains to compel all foreigners to salute his flag by "striking" their own national flags, and, probably, by also lowering their topsails, (as was the practice at a subsequent period,) in acknowledgment of England's maritime supremacy. If any foreign ship, even though belonging to a friendly power, refused compliance, it was to be seized, and adjudged a lawful prize. This and other facts lead to the conclusion that John only enforced an ancient claim to dominion of the seas, which had been asserted and enforced occasionally time out of mind.

Edward III, during his wonderfully long reign of fifty-one years, was a most jealous asserter of his sovereignty of the seas, over which he claimed a judicial power. Dr. Campbell says that Edward, "in his commissions to admirals and inferior officers, frequently styles himself sovereign of the English seas, asserting that he derived this title from his progenitors, and deducing from thence the grounds of his instructions, and of the authority committed to them by these delegations. His parliaments, likewise, in the preambles of their bills, take notice of this point, and that it was a thing notorious to foreign nations that the king of England, in right of his crown, was sovereign of the seas." In old "Hakluyt's Voyages" is printed a very curious poem, called "De politia conservativa maris," supposed to have been written in the time of Edward IV. It contains a number of separate chapters, each of which is full of most valuable and instructive information concerning the commerce of England with various countries. The unknown author, who must have been a man of very extensive information in his day, urges most strongly his countrymen to maintain inviolate the sovereignty of the seas, as the only means to preserve their prosperity and safety.

In the reign of Charles I, both the French and Dutch began to express great jealousy of the British claim to dominion of the seas, and Hugo Grotius endeavoured very learnedly to prove that Albion had no better natural right than Holland, or any other maritime nation, to such a title. Our own equally learned and eloquent Selden retorted by his celebrated treatise "Mare Clausum." We need not quote any of his arguments, which are generally profound, and, if not always impregnable to impartial criticism, are at any rate patriotic and singularly striking and ingenious. Suffice it that the general conclusion to which he arrives is conveyed in one very impressive sentence: "That they (the English) have an hereditary, uninterrupted right to the sovereignty of their seas, conveyed to them from their earliest ancestors, in trust for their latest posterity." Mainly with a view to enforce his claim to the sovereignty of the narrow seas, did Charles I endeavour to provide a naval force sufficient to overawe both French and Dutch, and therefore issued his writs for levying