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THE GOOD SWISS WATCH.

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When Switzerland is mentioned in other countries, nine out of ten people think either of the holiday country lying in the heart of Europe, or of Swiss cheese and chocolate, or of the Swiss watch. For this last there is good reason, since the watch is not only the most representative of Swiss export industries, but also certainly the oldest. It is true that watchmaking did not originate in Switzerland, but was brought into West Switzerland towards the end of the 16th century, principally by Huguenot refugees, and from there it rapidly spread along the Jura chain. A second centre arose at Le Locle where Daniel-Jean Richard from La Sagne established a watchmaking business in 1705 and instructed, as the first workers in the new art, people from the immediate neighbourhood, so that in this district already about 500 independant watchmakers could be counted by 1750. At that time, every watchmaker built his own watches himself right from the start: marvellous small masterpieses were created, which still to-day arouse the astonishment of experts who see them in various private and public collections.

Progressive technical development, particularly after the introduction of the first machine tools, was accompanied by a steady fall in price for the separate products. At the beginning of the 19th century, this led to an extensive distribution of work within the branch. To-day there are only a few undertakings — the manufacturers — who make the individual parts of their watches in their own business. Alongside these, there are very many small businesses — the " Etablisseurs " — who purchase ready-made all the parts necesary for making a watch and in this manner, as specialists in workmanship and in finishing, create products of the very highest quality. Other undertakings, again, finish only individual parts, such as the " Ebauches ", i.e. the rough movements without balance, main spring, dial or hands, whilst the last parts, — the casting and other accessories, bearing jewels, springs and spirals — are again produced in special businesses.

The present-day Swiss watchmaking industry is often described as " the precision industry with 1,000 tools an 1,650 operations "; it could, however, when one considers its economical structure, be just as well named " the manual work — in the best sense of the term — of 150 branches and 2,500 small businesses ". In these businesses about 50,000 workers are employed, in other words about one-fifth of all the persons occupied in the metal and engineering industry in the whole of Switzerland. From this the extreme importance of the watchmaking industry for Swiss national economy can at once be recognised.

When the manufacturing program of the Swiss watchmaking industry is examined, one is first of all struck by its richness; all types of watches and clocks are to be found there, from the inexpensive everyday watch, up to the small and costly masterpieces which are intended on the one hand as jewelled finger-rings to beautify tender ladies' hands, or on the other hand as ships and aircraft chronometers which are absolutely essential for navigation on the high seas and in the air. Nearly every firm has its pronounced specialities in one branch or the other. One characteristic, however, is common to all undertakings and that is the endeavour to obtain the highest possible accuracy of time-keeping in the range of the different classes of quality and price. In addition to that, some purchasers have numerous other wishes and desires to be compiled with in a good Swiss watch, and these wishes are to-day regarded as matters of course, although their technical fulfilment appears by no means self-evident when the history of the development is more closely studied.

First of all, it is to be noted that a watch of good quality must be as inssensitive as possible to temperature changes, even within wide limits. Thorough researchwork, undertaken for decades, has been necessary to finally produce a regulator for pocket and wrist watches which is practically uninfluenced by temperature flucutations within normal climatic limits; the Swiss watchmaking industry can claim the credit of contributing greatly to this development.

Also magnetic fields may disturb the accuracy of timekeeping of a watch, and to-day, in this age of electricity, it is hardly possible to prevent a watch being influenced every day by such magnetic fields. Also this source of error has been eliminated with the creation of non-magnetic movements as the result of very careful research in connection with material.

Enemy number one of every watch is the dust which penetrates into it, since it settles particularly at the lubricated spots and causes the fine oils to resinify. Now, even microscopically fine particles of dust — however improbable this fact may at first appear — are able to penetrate even where the less dangerous watch enemy, i.e. moisture, can find no admittance. Thus the watchmaking industry, on the thorny path of endeavour to create a dust-tight watch, has been so-to-say presented with the watertight watch as a reward for its efforts.

In every machine, lubrication plays a very important part, and regarded mechanically a watch is nothing other than a machine — even if a very fine one. Lubrication must be not only perfect and ample, although it is a question of bearings with pivot pins measuring often only a few tenths of a millimetre in diameter, and under some conditions even only a few hundredths of a millimetre, it must also ensure reliable running of the axles for a period of at least two years. Every good watch should be overhauled, cleaned and freshly oiled at least after that interval of time. Very

often, however, the purchaser neglects this important rule and the Swiss watchmaking industry has found it necessary for reasons of prestige to provide for a certain safety. Because of the constant supervision by officially supported laboratories of the quality of the lubricants coming into question, in conjunction with the constant endeavours to improve the design of the bearings themselves, the problem of lubrification may be to-day regarded as solved.

By far the most difficult problem to be solved was, however, that of making the watch insensitive to external mechanical influences, such as knocks, shocks and vibrations. In the first place this affects the wrist watches, which are in any case carried in an exposed position and, in spite of being relatively lighter and above all smaller than pocket watches, are naturally exposed to rougher treatment. The Swiss watchmaking industry has the indisputable credit of having discovered the practical solution of the shock-proof watch, in the form of yielding bearings, the suggestion for which was first made about 150 years ago by A. L. Breguet of Neuchâtel.

Automatic winding has to be regarded as one of the latest novelties, and this too has gone through a long period of development. It is certainly not absolutely necesary, but the wearer of a watch often regards it as a great convenience. Nevertheless, automatic winding is also technically justifiable, because it keeps the driving torque of the spring practically constant and thus favourably influences the accuracy of timekeeping. The automatic winding which A. L. Perrelet (of Le Locle), had already endeavoured to introduce about 1800 for pocket watches, has already become a standard, particularly for wrist watches, while it has proved to be not very suitable for pocket watches.

Concerning the formation of the case, watches and chronometers generally keep to practical quiet shapes in precious metal or stainless steel, the latter of which has practically displaced the silver cases formerly much used. On the other hand, ladies' watches still remain the spoiled creatures of fashion, and come out year by year in new and partly more refined shapes.

Whilst it is impossible to think of doing without the good everyday watch with an average daily variation in timekeeping of a few seconds, the actual timekeeper, the "chronometer", whose accuracy must comply with strict official rules, plays an important part in science and technique and in marine and aircraft navigation. It must certainly be regarded as a technical curiosity, that the Swiss watchmaking industry should have taken up the construction of marine chronometers not only at a very early date, in spite of Switzerland not being included among the seagoing nations until World War II, but that it has also developed the chronometers so highly that its products can compete successfully with leading British and French makes. At present the outstanding performances of some old-established firms are considered indisputably as being the best in the world, and are highly appreciated by the navies, merchant and war, of all seagoing nations. The accuracy of timekeeping of Swiss marine chronometers is officially tested in the observatories at Neuchâtel, Geneva and elsewhere, and each chronometer receives its own individual certificate which shows any variations in timekeeping under fluctuating climatic conditions. One rigorous rule for obtaining a certificate of timekeeping as chronometer is that at all temperatures between +4 and +32° C. no measurable fluctuations in time-keeping may occur. How highly the Swiss marine chronometers are to be regarded with respect to quality can be seen alone from the fact that the average daily fluctuation in timekeeping of the approximately 2,300 chronometers submitted to the Neuchâtel observatory for testing in the years 1923 to 1942, amounted on the average to only +0.07 seconds.

Navigation chronometers for aircraft must satisfy similar strict conditions in order to entitle their being described as chronometers. In the case of these timekeepers there is a further restriction, i.e. that they must work with the same exactitude and be tested, not only in a horizontal position as maintained on board ship by means of Cardan suspension, but also in all sorts of different positions.

Pocket and wrist chronometers are used practically for all sorts of different timekeeping problems. As chronographs (stop watches), they allow of supervising the time taken in unequal intervals, determining the time taken in piecework in industries, and of determining running times in athletics, to mention only a few of the most important uses. Equiped with telemeter scale, they are used for measuring distances on the basis of the knowledge of the speed of sound, particularly for military purposes in the artillery. Other executions are fitted with scales to determine the speed direct, as well as with special minute and hour counters. There is hardly a task in connection with the measuring of time for which the Swiss watchmaking

industry is not able to supply a suitable chronometer. Standard stop watches and chronographs can as a rule be read to within 1/5th of 1/10th of a second, but special executions are also obtainable with still finer graduations to 1/100th of a second.

A further category of chronometers comprises that large group of timekeepers with calendar movement-indication of the phases of the moon, striking mechan, ism, alarm mechanism, etc., which we would only just meition here, since these are pronounced luxury articles for fastidious demands. But on the other hand we would refer to an interesting design which will certainly be particularly appreciated in technical and military circles. This is a combination of a chronograph and slide-rule scale, which allows, without the use of any further accessories, the results of a time measurement to be evaluated with sufficiently practical accuracy, and with which also simple slide-rule calculations (multiplication, division, etc.) can be performed quickly and reliably.

In spite of any occasional discriminations as " non essentials ", what the Swiss watchmaking industry has to offer its business friends and clients abroad are precision instruments for daily use, which are reliable companions that last a whole lifetime if properly attended to. This only possible because their construction and continual technical improving are based on centuries of tradition which still regards watchmaking more as an art than as a trade, and therefore forces it always to maintain the highest possible quality.

H.M.