Émile Graupmann

The Finishing

of the

Watch Case

Le Finissage de la Boite de Montre

Translated by

Richard Watkins

Translator's note

This prize essay was first published by the *Journal suisse d'horlogerie* in 1910, and then reprinted by Rita Shenton in 1989. It is an interesting description of watch case repair and, although not an important work, it may be of some use as there are few books in which case repair is discussed.

In case the reader has also read the original French a few points about the translation may be useful.

Firstly, my translation is deliberately a little loose. In part this is unavoidable because some French terms do not have useful English equivalents (most notably *cran* and *battue*, both of which refer to the snap in different aspects), but also because of the need to produce reasonably good English.

Secondly, Graupmann's French is, at times, obscure and I have added a few notes where my translation is dubious or where I feel an explanation is warranted. In particular, he uses five words strangely:

Accuse has the English meaning, which is obviously wrong, as are *show up* or *accentuate*. I have presumed Graupmann means *restrain* or *lock*.

Definir is noted in Berner's *Dictionnaire Professionnel Illustré de L'horlogerie* as a misuse of the word to mean finish or complete, but Graupmann uses it to mean *disassemble* and likewise *finir,* finish, approximates to *assemble*. In both cases the action is part of the finishing process, *definir* specifically referring to disassembly in order to adjust parts.

Déjoint is most likely used in the sense of *loosen* or *se déjoindre*, *warp*, but Graupmann's use is not clear.

Relance is the most difficult. According to two dictionaries it means *to rouse a wild beast*, which may be strangely appropriate, but wrong! To throw again and hence *restart* or *re-release* is more likely, but this interpretation does not always fit and in some places I have interpreted it as *out of alignment*.

Finally *revider*, to empty again, is obscure and Berner is mute regarding the meaning of this word. However, *vider*, to empty, means to cut out (for example to make an internal corner sharp or undercut instead of rounded) and so Graupmann appears to use *revider* to mean to *re-cut*.

Richard Watkins, May 2004
Kingston, Tasmania, Australia
www.watkinsr.id.au
books@watkinsr.id.au

Notice

Here is a new booklet, the fourteenth in the collection which is titled *Manuel for the practical horologist*. This work, presented on the occasion of our competition for the year 1908 and which earned the first prize for its author (a worker in La Chaux-de-Fonds), was entitled *L'achevage de la montre*.

Actually it only treats the case, its defects and the means of fixing them even after final assembly. In accordance with the definition that the dictionaries give for the word *finissage*, we adopted the new title, which offers the advantage of distinguishing this study from that by Mr. U. Dubois-Sandoz on a similar subject; besides, it differs from that work by providing somewhat more complete details.

Editor of the Journal suisse d'horlogerie.

December 1909.

I Foreword

The subject that I propose to treat is vast and, to simplify it, I would have liked to speak particularly about the good case, strong and well assembled, in which all the principles have been rigorously observed, where the place of the dome, the distance between the 3/4 plate and the flat edge of the back, is at least 10 to 12 dixièmes for a 27 mm (12 L) case, and the snap of the dome is from 3 to 5 dixièmes; but unfortunately these cases are rare, especially in the small gold watch.

As it is relatively easy to finish a good case, but sometimes very difficult to finish a rather weak one, it is the latter that I will consider. We will see the defects which occur and how it is necessary to fix them. The processes which I will describe are those which I have used for many years, and I hope that my talk and the figures which accompany it will be sufficient for you to understand me.

I will divide this work into seven parts and we will successively review the dome, the band, the back, the hunter cover, the glass, the pendant and final adjustment.

II The dome

The dome must prevent dust from reaching the movement; consequently, it is necessary that it closes well and that the passage of the hinges is correct. The gold dome generally closes quite well, and if it suffered a little during polishing one can make it close properly without too much trouble, by retouching[1] the snap; we will see how that is done later.

But it is not the same with the metal dome, which too often opens at the same time as the back. Let us seek the causes: 1, the dome is too large for the snap of the case band; 2, it is distorted by polishing or gilding; 3, the hinge tubes do not hold it correctly.

1. If the dome is too large, it is easy to see that the flat edge of the back will cling to it, so that in spite of a very good snap it will always open at the same time as the back. To cure it, it is necessary to decrease not the snap of the back, but that of the dome by turning it, or, which is much simpler, by filing the edge. Then it is polished or gilt, but for the foreign case[2] one can be satisfied by smoothing it with a very soft emery buff and polishing it with a burnisher.

2. When the dome is distorted it cannot be closed; thus it is necessary that it is absolutely flat and that all its circumference rests well in the snap of the case band. If this is not the case, it is rectified by supporting it against the bench, or if it bends close to the hinge resting it on a plate, holding a buff-stick of skin over the band and striking the buff-stick lightly with a hammer until the flat edge of the dome rests well on the plate. It is necessary to take care not to strike too hard, because the snap would be removed. If the snap needs to be reinforced, one generally strikes the edge of the dome with a skin buff-stick around all the circumference, and if this operation is not sufficient, the following process makes it possible to do as much closing as is wanted:

I turn a piece of wood (fig. 1) conical inside and out, with a diameter larger than that of the dome, so that it can be used for all sizes. I introduce the dome into this wood, then I make another piece (fig. 2) fitting inside the dome and consequently a little smaller than it. I only have to give a small blow on this piece with a hammer for the snap to be tightened, and if the dome was distorted it will be rectified at the same time.

If the space between the interior circumference of the back and the dome is very restricted, I use a special piece cut out inside (fig. 3), which raises the dome a small amount, but only on the edge. If, on the contrary, there is too much space between the back and the dome and one wants to raise it so that it touches the back and resists more, I employ a convex piece (fig. 4) with the former part, and in order

---

1 *repiquage*, using a graver to adjust the snap of the bezel or back.

2 *mais à l'étranger ...*

not to mark the dome I interpose a disc of skin between it and the convex piece of wood, so that the operation does not leave any marks.

Fig. 1 *Fig. 2* *Fig. 3* *Fig. 4*

3. A last defect which often prevents the dome from closing consists of the hinge tubes not aligning, so that on putting in the pin it goes out of alignment again. It is very easy to rectify a hinge, either by pressing it against the bench or using a vice. In the latter case one will do well to put a pin into the hinge so as not to crush it, but each watch maker will easily find a way to do this fine work.

Fig. 5

Once the dome is in order the pin is put in, and here is how it is necessary to proceed so that the dome sits correctly. Figure 5 shows the two hinge tubes *ab* and *cd* of the case band. I place a pin in a hand vice and then, after inserting it from the right side into the hinge (that is to say in *a*) until it turns very stiffly, I mark the pin with a barrette file at the points *a*, *b*, *c* and *d*. Then taking the dome, I put the pin into the hinge tube and it must be, while forcing, between the marks *b* and *c*. If it goes beyond these marks it will be necessary to slightly increase the holes of the case band hinge tubes and to mark the pin again. But if, on the contrary, it does not reach the marks, one would increase the hole of the hinge tube of the dome. I then round the pin at *d* and make a deep notch at *a* with cutting pliers or a knife. I then put in the dome and insert the pin, with a little beeswax so that it does not seize up, and break it off once positioned.

A dome thus seated will never fail.

III The case band

If the dome still sits badly, it will be necessary to fix the case band; naturally the movement must be removed for this work.

The various parts of the band are the snaps for the back, dome and bezel, the two sets of hinge tubes and the pendant, about which I will speak later.

Here are some of the defects which can arise: 1, the case band is worn by polishing; 2, the snap is too tight; 3, the band is pressed in or dented.

1. If the band is worn by polishing, the snap groove should be repaired. One prepares a barrette file or a graver, giving it the shape of the tool in figure 6; the end is made very sharp, because the better it cuts the less one runs the risk of piercing the band. Part *a* is slightly lower than the snap to be mended and that part will be softened to avoid striping; it only remains to press the tool against snap, and it will form a small snap which will almost always be enough to ensure closing.

2. The snap which is too tight will be treated same manner.

3. Finally, there is the problem of the snap on a pushed-in or dented band. For that I built two tools to rectify it. I employ the first (fig. 7) especially to give the right shape to a snap which is very much pushed in; the two beaks have different thicknesses, the end being rounded and having the shape of the snap. To rectify it, I first introduce the small end, and then I use the other to give the final form. The end *b* has the exact thickness of the band. As almost all movements have the same height, except the extra-thin, two tools are enough for several kinds of watches.

The second tool (fig. 8) is intended either to rectify the snaps or to remove bumps from the band. It is made from an old polishing file; part *a* is rounded and polished, and has the shape of the band; the end *b* is flat and the opening *c* must be rather large so that it does not touch the band. The end *d* is also round and polished, but a little smaller, and it thus renders good service to remove all kinds of bumps, from the back as well as the band. The tool must be hardened and tempered yellow.

To rectify a bump, the band is taken in the left hand and one firmly presses on it at the desired spot with the end *a* which, having the form of the band, corrects it without leaving traces on the

outside. If, however, a small mark remains, one can smooth it with a very soft emery buff-stick and then polish it with rouge on a skin buff-stick.

The band being in good order and the dome closing, we will pass to the next part of our work.

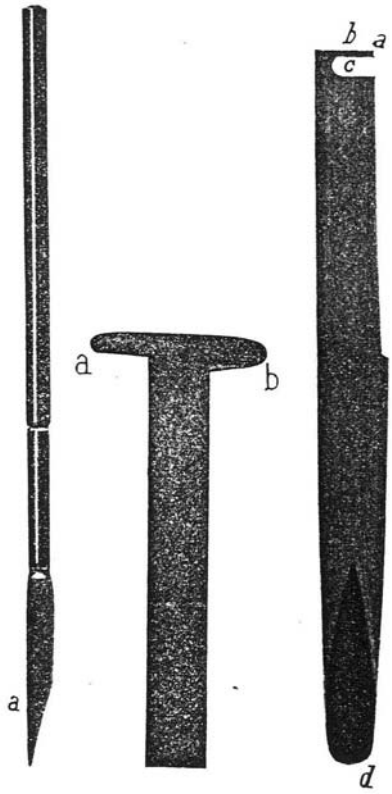

Fig. 6 *Fig. 7* *Fig. 8*

IV The case back

Before dealing with the closing of the back (which is made of three parts: the plate, the flat edge, which makes the back strong, and the hinge) it is wise to examine whether it is unblemished. That is, it does not have bad marks on it which would have to be rectified first, which one can do by using the preceding tool; but care should be taken that it is well polished and that there is no dust in the back. The back being set on a buff-stick of skin, one can fix the marks very well by pressing them; only the back is easily striped, and as it is always unpleasant to repolish it I found a system which I use with success.

I simply take a piece of peg wood, I cut the end square and rub it for a while on a plate with rouge. Then I clean it on a buff-stick of skin furnished with rouge, but so that it always remains in contact with the wood which will become almost polished. I hold the back in my hand without supporting it, and with the wood I work on the marks and rectify them easily; when the wood is well prepared it is not likely to stripe the back.

The back being in good order, before occupying ourselves with the closing we will check if it is loose, because in that case it should be retightened.

There are several ways to retighten a back. The case assembler proceeds in the following manner: he takes two cast iron plates, one larger and the other smaller than the back. The smaller is placed inside the back and the other outside, the back being thus between the two plates. Then the two plates are put in a vice, heated until red and then allowed to cool in the air.

For backs without enamel, the female polisher proceeds in almost the same way. But when a decoration must be spared, one is obliged to employ a preservative made of boric acid powder mixed in turpentine; it forms a paste that one spreads on the back.

Naturally it is necessary to clean and polish the back once it has been through the fire. It is very delicate work, because if too much heat is given the back will become a red colour.

Enamelled backs are even more delicate and one proceeds differently. Two plates are also used (fig. 9), but the largest, which is put outwards, is not heated; only the small one passes through the fire. When it is red, one puts it in the back after having taken care to interpose a piece of thick, soft paper between the decoration and the surface of the large plate; one tightens the whole in a vice while strongly pressing, but instead of letting the air cool it, a little water is dripped on the plate. This operation is known as “to retighten with water”. I do not need to add that the plates must be very clean and that they should be often cleaned on emery paper. One will not succeed on the first attempt at this work, which requires considerable practice.

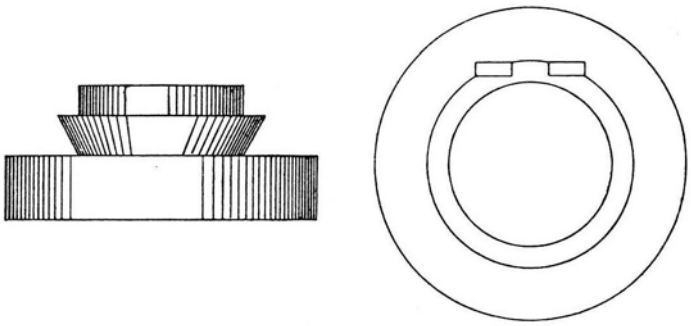

Fig. 9

The snap is sometimes too strong, even in rather weak cases, and if care is not taken to weaken it a rough hand will quickly crush the back. So that the snap is good, it is essential that the back locks well, but it is necessary to be able to open it with a finger nail without needing to resort to an accessory. There are several tools or scrapers to raise the fastening, and each workman has a particular system. I will give a description of some of these scrapers.

The first (fig. 10) is straight; one can make it from a worn barrette file. The two sides are very sharp and the end is smoothed so as not to stripe the interior of the back.

Making the second (fig. 11) is a little more difficult. I take a steel end 3mm wide and I file it like the model. The two corners of the ends must be well cut, so that one can remove solder which is on the flat edge.

The tool, of which figure 12 shows two models, is bent and is especially used to relieve the back close to the hinge.

Lastly, to make the space for the dial under the bezel, the scraper in figure 13 will render good service.

There are a number of other tools, but their description would take too long.

To have a good fastening it is necessary, as far as possible, to only scrape close to the hinge and on the sides, because if one relieves the closing near the pendant the back will no longer close well and will not lock as is necessary; moreover, in bassine style cases it creates a warp, the back having a tendency to open.

Having relieved the closing it is necessary to pass a waxed peg around the flat edge; the closing will be better. If however the back still does not lock well, it is wise to make sure that the hallmark on the band is not stamped too deeply: that often happens, and it is then necessary to rectify the place with pliers, which each watch maker can easily make. It is sufficient to take round-nosed pliers and to obliquely file the front of the two points. One can also correct this defect by filing the place, but only when the strength of the band allows it.

Another cause which prevents the back from closing well is a dome that is too high. To cure this defect, one can turn it; or, if there is only little to remove, file the flat edge, which is easy. After this operation the edge will be polished with a burnisher.

Another cause of warping often comes from the case maker, who makes the opening for the stem in the pendant too large, producing a slight bump; this can be removed by pressing it down or by filing with a small square file; in the latter case it is then necessary to polish it.

A bad fastening can also come from the flat edge of the back being sunken. This is rather difficult to rectify; I use for this work round-nosed pincers on which I file the two points obliquely, but so that one is longer than the other. I place shortest under the flat edge and the longest top, and by pressing hard I manage to raise the edge.

It is usually fairly easy to fix a back which has too much closing, but it is it much more difficult to make a back that is too large close. And yet this case often arises, especially with backs which are

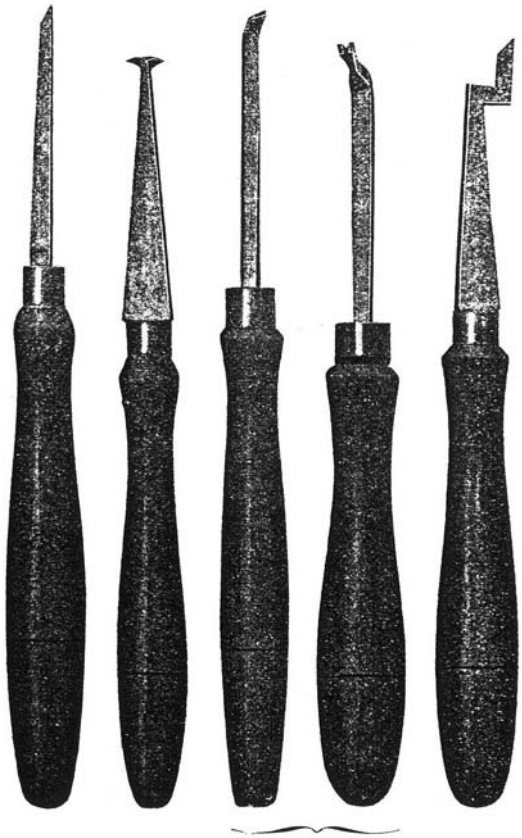

Fig. 10 *Fig. 11* *Fig. 12* *Fig. 13*

decorated with enamel paintings; and some even do not close at all. For these kinds, where it is necessary to pass the back two or three times through the fire, the gold is worked[3], especially the low quality gold in which there is more zinc or silver than in 0.583 (14 K).

The closing can be made by the case fitter before finishing, but I believe that each case finisher must be able to make it by himself. If closing is not very bad, it can be strengthened in the following way:

One sits the back on a wood base (fig. 14) hollowed out so that only the edge supports it, in order not to spoil the decoration, and with a burnisher one rubs the flat edge of the back. One thus produces a bur which is often enough to improve fastening.

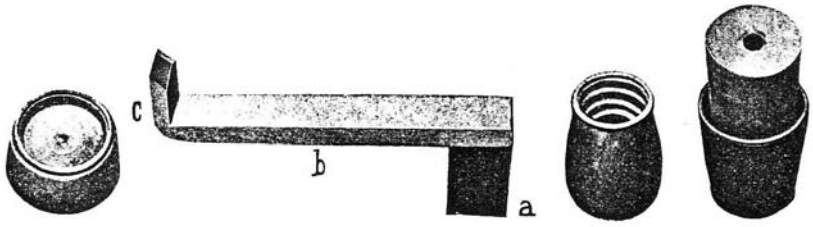

Fig. 14 *Fig. 15* *Fig. 16* *Fig. 17*

Another method makes it possible to achieve more, but it is necessary to build the tool represented figure 15. It is made of a heel *a* that one tightens in a vice, a blade *b* which rests on one of the jaws and the end *c*, bent at a right angle, is formed so that it can be inserted into the snap of the back. One supports the back on the end of *c*, taking care that it is well at the back of snap, and with a wood or lead hammer, one strikes the outside of the flat edge of the back which, being driven back, improves the closing.

3 *l'or travaille*, hardened and made brittle.

If, despite everything, the back is still too large, I use the following method. It is necessary to turn several wood pieces similar to that in figure 16, but of different sizes; the wood is hollowed out leaving a small step at the edge having exactly the size of the interior of the flat edge. In order not to crush the hinge, one makes a small opening marked by means of a pin; one can also make one for the olivette[4]. One then needs the second wood or brass tool of conical form, larger than the first and more deeply hollowed so that it can be useful for various sizes of back. The first piece, in which the back sits with the decoration visible, is introduced into the second tool (fig. 17), then one places the whole in a copy press[5] and tightens it with care; the back will become smaller and the operation will leave no trace, neither outside nor inside. And if the enamel is not absolutely to the edge there is no danger of it springing. I have practised this fine operation very often and I have never made the enamel spring. Naturally one should not tighten too much at once and one will have to do it in several steps, because it is to better test the closing often than to push the operation too far and spoil the back; with a little practice, this process takes less time than one might think from the description.

To do this work, the back should be removed. I think that any watch maker knows how to proceed, however I will give some information on the way of disassembling and assembling a back. Generally only one pin holds the back in silver cases, but in gold cases the hinge is almost always finished "with three ends", i.e. the central pin occupies two thirds of each hinge tube. It is always put in from the right-hand side to the left, or in other words, the workman who finishes a back turns it away from him and puts in the pin, furnished with a little wax, from the right side; then two small pins are put in to stop up the outside of the hinge tube holes. They are cut and the ends rounded with a barrette file, which one has carefully prepared for this work by rounding the two edges on an oil stone and then smoothing them with a very soft emery buff-stick. One can thus file the ends of the hinge without fearing to mark the band. One then polishes them with a burnisher and a buff-stick charged with rouge.

Now that it has been seen how to finish a back, it is very easy to disassemble it. I proceed as follows: I put the edge of a knife on the stopper of the small end of the pin and I press strongly outwards while putting the thumb against the band to avoid slipping. Once the left stopper is out, I take a joint pusher, which I made from a worn round file with a flat end, I introduce it into the hinge tube and a small blow of a hammer makes the pin come out of the other end.

There are several commercial tools for facilitating the use of the joint pusher. Some watch makers put in a vice a chuck that a point goes through; it is very lightly tightened and while striking it advances, so that one needs to hold neither the joint pusher nor the case.

V The hunter cover

A well completed hunter must satisfy several conditions. Let us examine the three principal ones. It is necessary: 1, that the cover locks well when closing; 2, that it opens without noise; 3, that it opens only two thirds of a right angle.

The first condition is easy to obtain if the head of the secret spring is well made. I will not speak about the various forms of heads (half-moon, head with two flats, *revidée* head, etc), but with any kind one can achieve correct operation. However, I prefer the *revidée* head, because one avoids making an opening through the bezel: the only defect which it presents is that it is too expensive, and also one rarely meets it in cheap watches. If another head is employed, care should be taken that the opening through the bezel is straight and that the spring of the secret spring does not touch there.

The flat edge of the back must be cleanly cut out; it is thus necessary to remove the solder which could be there, making use of a scraper (figure 11) which only cuts at the bottom of the flat edge. It is especially here that it is necessary to put into practice what I recommended previously, never to scrape a back close to the pendant, because by doing so the cover will no longer close well, and with bassine cases one will have a warping of the band that is very difficult to remove.

If the cover locks too tightly, one can file the head of the secret spring, but only if the cover exceeds the band, which can happen when the hinge is set too much to the inside. One can also make the lock less extreme by moving the cover, by striking close to the hinge with a wooden hammer if the strength of the band allows it; that is to say, by using a small steel tool which one supports on the hinge and which one strikes with a hammer, but not too hard because one would risk making it spring. It is best to remove the cover.

The second condition is more difficult to achieve, and there is sometimes much difficulty in making a cover open without noise. Let us examine some of the causes of this.

---

4 *olivette*, the guard for the hand setting push piece.

5 *presse à copier*.

It may be that the cover bows[6] close to the hinge. The secret spring is removed, the cover disassembled and, after having made sure there is no solder or bur, the holes of the hinge tubes are moved[7] a little by pressing the cover vigorously on the band, on the side of the pendant. The cover must close completely without resistance; if this result is obtained, one puts back the secret spring and finishes the cover.

If the lifting spring is too long, which also makes the cover bow, it should be shortened by decreasing the height of the head. Sometimes it is also too curved or too strong, i.e. it presses too hard against the hinge; it is in this case easy to weaken it by bending it in a clamp. A particular consequence of this defect is that the cover opens in two steps, initially a very little and then it starts again.

Also care should be taken that the head of the lifting spring is not too narrow, because then it could fit between the moving and fixed hinge tubes and the cover would not open. The secret spring can also touch the movement; the space for it should then be increased.

If the secret spring is in good order and the cover still makes a noise, it should be seen if it touches the screws of the secret spring or the band, because the cover should not rasp. It is then necessary to scrape the cover and to put on a little wax for removing the bur, considering that one sometimes needs only a little thing to produce a notable inconvenience.

The cover can also touch at the edge of the bezel. The bezel is filed or decreased with a scraper and then polished.

If the bezel is too high inside the cover it is necessary to turn it, or if that is not possible and if the snap of the glass is rather high, to file it.

Another cause of the noise produced by opening the cover occurs when the glass is too high; it is natural indeed that if the cover touches the glass it makes a noise. One will then change the glass for a lower one, and if it touches the hands they need to be lowered.

Finally it may be that the cover touches the hand setting push piece. One can in this case somewhat increase the opening on the flat edge of the cover, but only if that is absolutely necessary, because when the cover is closed, a push piece in good condition must always return at rest.

I said for the third condition that the cover should not open completely, and here is why: a watch is often opened and if the cover is too free the force of the lifting spring will tear off the hinge after a little time. It is thus necessary to drive out the pin or to change it, always putting some wax on it or else it could seize up.

VI The bezel

It is especially in hunters that the bezel is likely to come loose; there is nothing so unpleasant as a bezel which falls out when the cover is opened. Very often this defect comes from the dial being too thick, the bezel is pressed outward, and when the secret spring is operated the movement makes the bezel come loose. If a thinner dial can be found the remedy is very simple, but if one is not available it is necessary to turn the flange[8] to make space for the dial. For this operation, one can also use the tool

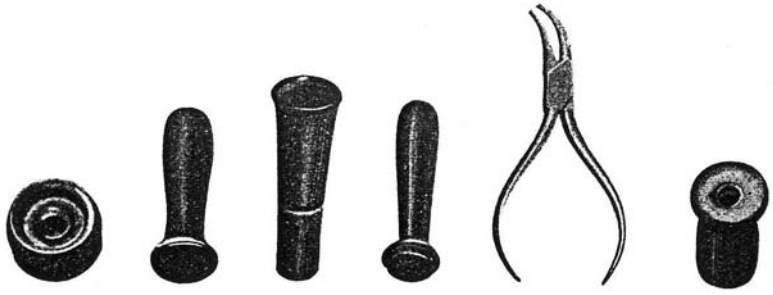

Fig. 18 *Fig. 19* *Fig. 20* *Fig. 21* *Fig. 22* *Fig. 23*

6 *tende*, I assume this is a misprint for *tendre*.
7 *agrandir*, *enlarged*, but moved seems more likely.
8 *réhaut*, the part of the bezel that covers the edge of the dial.

represented figure 13. If the bezel still loosens it is necessary to strengthen the closing - see the discussion of the back - and to mend the snap in the band.

In demi-hunters with a large opening, instead of turning the flange one pushes it back, or gives it to the case assembler, or one proceeds as follows: I take a wood piece similar to that which figure 18 represents; the bezel presses on the edge, and in order not to disassemble it, I make a small space for the hinge; the flange being on top, I take the second wooden piece (fig. 19), having a flat lower part, and I sit it on the flange; by a light blow of a hammer one gets the space necessary for the dial.

If the flange is, on the contrary, too high and the space between it and the dial is too large, I proceed in the same way, but in the contrary direction and with different wooden pieces. The first, that I put in a vice, has about the shape of a bezel (fig. 20). I sit the bezel on the piece, the flange to the bottom; the wood touches the back of the bezel, but the hollow is large enough that it does not touch the flange. I then take the second piece (fig. 21) which I sit on the outside of the flange; this piece, which also has the form of the flange, can be a little smaller. A very light blow with a hammer removes the gap; one will not see the change in the flange, except it is a little angled instead of being flat. It is naturally necessary to carry out some tests and to give the wooden pieces their necessary shapes.

To rectify marks or bumps on the flange, I made small pliers (fig. 22) with which one can easily do this operation. The two ends are curved and their insides are smoothed and well polished; one only has to put the flange between these ends and exert a small pressure.

If the bezel is dented it can be very difficult to rectify it; one can make use of the tool described previously (fig. 8) or make a similar steel tool and press on the bump. One can also use just a peg of wood; but if the bezel is extremely maltreated, for example it is crushed, one will succeed much better with a wooden tool, but of yet a different form. I use the wooden piece represented by figure 20; I sit the bezel on it, the flange on top, and I take another wooden piece (fig. 23) having the exact shape of the bezel; to do this work, it is necessary to have various sizes and shapes. The edge of wood is rather thin so that it touches very close to the flange, and the interior is hollowed out so as not to touch the flange itself; one can thus press on or strike the tool and the bezel is rectified. In this way I have often fixed bezels which I believed absolutely ruined.

These tools are made from hard wood and a wood turner or case assembler are given the job of making them.

Having spoken about the flange, we now occupy ourselves with the snap for the glass. It is sometimes very bad, and despite one's best efforts it is impossible to make it hold a glass. The snap should then be mended, using for this fine work several gravers of different sizes, similar to those which figures 24 and 25 represent; the face is slightly round and the end very sharp. According to the size of the snap a thicker or thinner graver will be used. The sharper the graver is, the better it works, because one does not need to press so much and one runs less risk of piercing the bezel.

VII The pendant

The pendant with collar or cannon is preferable, because the crown fits better and dust does not enter the movement as easily. It is necessary that it is quite straight with respect to the hole to the movement, and if the stem is in place it must be in the middle of the pendant; if it is not so it should be rectified with a pointed tool which exactly fits the pendant.

When the crown is too high, it should be pushed in lower, because it must be absolutely flush with the pendant. If it is not free, it is necessary to seek the causes, and there can be several. Thus the stem can touch the inside of the pendant; it is necessary in this case to turn it or increase its hole if the pendant is sufficiently thick to do that. The cannon of the crown can also touch the inside of the pendant; one then sets up the stem with the crown in a chuck and the cannon is decreased with a barrette file while it is turning.

In thin pendants, it can happen that the ring is too tight on the pendant, the ears touching against the crown, which is no longer free. To cure it, two kinds of cutters render excellent service.

The first is made from round steel having a diameter a little greater than that of the crown, and at the end of which I bore a hole larger than the cannon of the pendant. I file the sides in the shape of cone and I smooth them with a soft emery buff-stick. By pressing this cutter into the pendant I widen the interior of it and so gain space for the crown, since the cutter is larger and I remove the bur which could be in the housing for the crown while turning it.

If the crown is still tight, I employ another cutter of identical construction, but cut on the sides by means of a file or a cutter in order to form teeth there.

One can also make this cutter differently. For that, I take a steel rod and on one end I raise a conical pivot a little smaller than the cannon of the pendant. I bore a hole in another steel rod of diameter larger than the crown, and after having formed teeth on the end, I adjust it and firmly fix it

on the pivot. While turning this cutter between the fingers, one increases the space for the crown. It is naturally necessary to have these tools in several sizes and forms.

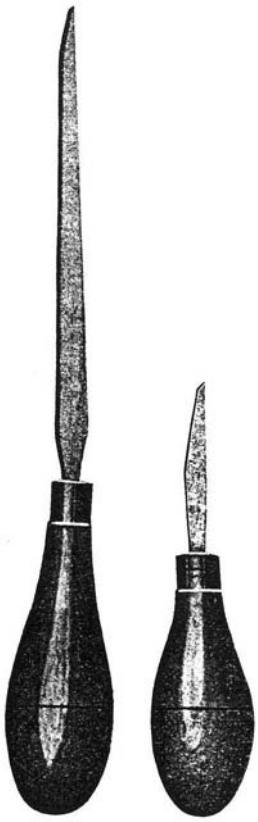

Fig. 24 *Fig. 25*

VIII The final tasks

We have now examined the various parts of the case and, if all perform well, the movement is put back, making sure before-hand that it is perfectly clean. If everything closes well the case is polished, because one had to stick pieces of paper on the backs so as not to spoil or dirty the decoration. The case is given to the polisher, who will remove the paper and will also polish the escutcheon and the interior of the backs, if that is necessary.

When the case is quite clean, one makes sure that everything performs as required and one examines whether or not there are small holes in the backs. If there are they must be filled up, because one cannot deliver a watch whose case has perforations in the bezel or backs. For this, I prepare a cement in the following way:

I take a few grams of gum arabic that I mix in water, and I add a little gold powder. The adhesive thus prepared is enough to stop small holes, for which work I use a very small brush, and this should be done once the watch is completely ready, because the cement would be removed in water. It is good to have two gold colours so that nothing on the back will be noticed.

Another, more durable cement is made from shellac. This is dissolved in pure spirits of wine, which it is necessary to leave for five to six hours; then gold powder is added. One puts the cement on the back and then very lightly passes it over a spirit lamp. The back can be cleaned with water and this cement will not be removed.

To finish, allow me to add that I do not claim that my system is the best, but after much research I arrived at the methods I have given. And I note that if one wants to do good work quickly, it is essential to have the necessary tools and not to regret the time taken to manufacture them; one is certain to regain it ten times over by the results obtained.
