

# Illustrated Horological Glossary

The following pages are by no means an unabridged horological glossary, which could fill volumes. It is rather an easy reference guide for new watch enthusiasts, a helping hand as it were. The next 30 pages contain some of the more common vernacular used within the pages of our catalogues as well as approximately 350 illustrations. As we are firm believers in the old adage "A little knowledge is a dangerous thing", we are currently working on a constantly evolving horological lexicon and database which will be available at [www.antiquorum.com](http://www.antiquorum.com). We will be keeping you abreast of further developments on this project in future issues of the Vox magazine. Until then, we hope the following will be useful to those of you who have just joined us in the world of horology.

## Part I: General Terminology

### Argentan:

Alloy of copper, nickel and aluminium, used by jewellers and sometimes as the base material for watch cases.

### Belle époque:

French term meaning "beautiful era", referring to the period between approximately 1890 and 1920.

### Cabinet:

Closet, small room. In Geneva, a workshop, often on the 6th or 7th floor. Such cabinets (whence the name *cabinotier*, see below) have almost entirely disappeared.

### Cabinotier:

In Geneva, a craftsman working for the "Fabrique" in a cabinet. The Geneva *cabinotiers* were not necessarily watchmakers; they included jewellers, engravers, lapidaries, etc., the essential thing being that they worked for the "Fabrique", in a cabinet. The Geneva *cabinotier* was well known for his caustic disposition.

### Cabochon:

Precious stone, polished but unfaceted, usually domed. The term is also used for an embossed ornament on a dial.



Cabochon

### Carat: (U.S.A also karat)

Standard of fineness of gold. The fine-gold content of an alloy of 1 carat represents 1/24 of the weight of the alloy. An alloy of 12 carats contains 12/24 of gold; one of 18 carats 18/24. Pure gold is 24 carats. Unit of weight for precious stones, equal to 0.205 g. This unit is now superseded by the metric carat, which is equal to 0.200 g.



Cartel Clock

### Cartel Clock:

Small wall clock, usually of highly ornamental design.

### Cartouche:

Clockmaker's term denoting a raised ornament, on a dial, for instance, numerals painted on white enamel circles, with or without ornament. On cases an unfurled scroll shaped device often engraved with a monogram.



Cartouche dial

### Champlevé:

adj. Refers to an area hollowed out with a graver in a sheet of metal, to take enamel. Champlevé enamels.

### Chasing:

The art of the chaser; chased work: to carve decoration and or detail into metals using fine chisels.

### Chronometer:

Etymologically, any instrument for measuring time. In actual usage, however, the word has been given another sense, viz; a precision instrument. A very good watch is sometimes referred to as a regular chronometer. The Swiss Federation of Watch Manufacturers' Association (F.H.) defines the chronometer as follows: a watch that has obtained an official rating certificate. In Switzerland, the main issuing body is currently C.O.S.C.. In the past official rating certificates were issued only by the observatories at Geneva and Neuchâtel, and by the Swiss Institute for Official Watch Timekeeping Tests.

**Ship's chronometer:**

Large-sized watch (45 to 65 mm. in diameter), also called deck watch.



Ship's Chronometer

**Marine chronometer (box chronometer):**

Large-sized timepiece enclosed in a box, mounted on gimbals and used on board ocean-going ships to determine the longitude.



Marine Chronometer

**Shop chronometer:**

Chronometer enclosed in a box and displayed, always in the same position, in a shop window or other prominent position.



Shop Chronometer

**Chronometric observatory:**

An observatory which includes a chronometric department that takes in watches and clocks for observation, issues rating certificates and sometimes organizes annual contests at which prizes are awarded. In chronometry, observatory contests were major contributors to the progress of precision timing. The chief observatories at which timing contests were held

included: Geneva and Neuchatel in Switzerland; the observatory at Besançon in France; the National Physical Laboratory at Teddington in England; the Deutsche Hydrographische Institut at Hamburg in Germany; and the Naval Observatory at Washington in the United States.

**Cloisonné:**

adj. Divided into compartments, by means of partitions. Cloisonné enamels, in which the outline of the subject treated is formed of flat metal wires fixed onto the enamelled surface. The enamel is put into the compartments thus formed and is then fired. After polishing, the metal wires show off the design inlaid in the enamel.

Cloisonné enamels are now made industrially by treating with acid a copper plate covered with a sensitive film marked with the design. The acid eats into the copper, leaving the metal intact under the lines.



Cloisonné

**Daily rate:**

Term used by timers to denote the difference between two extreme states divided by the number of days.

Example:

States	AverageDaily rates	Equals 4.4
19th January .....	+ 6 .....	+ 14
20th January .....	+ 20 .....	- 10
21st January .....	+ 10 .....	- 12
22nd January .....	- 2 .....	- 6
23rd January .....	- 8 .....	- 6
24th January .....	- 16 .....	- 8
Average daily rate =		

$$+ \frac{14 - 10 - 12 - 6 - 8}{5} = \frac{-22}{5} = -4.4$$

Or, more simply:

$$\text{Average daily rate} = \frac{-16 - (+6)}{5} = \frac{-22}{5} = -4.4$$

**Dented, bruised:**

adj. Irregular in shape owing to dents. A dented, bruised dial.

**Enamel:**

Vitrifiable substance composed of siliceous sand to which oxides are added to give a very wide range of colours suitable for the decoration of metallic surfaces, especially gold, platinum, silver or copper.

When fired, enamel adheres to the metal and acquires the consistency of glass.

**Engine-turning (guilloché):**

Act and result of engine-turning. Engine-turning has made it possible to obtain shimmering patterns, the brightness of which is enhanced by transparent enamelling. Also known as guilloché, this process was done by hand on

dials from as early as the beginning of the 17th century, and for the decoration of watch cases from 1750/60. The first rose engine appeared circa 1780.



Engine-turning

#### Field:

Surface, space. background on which something is represented.

#### Flinqué:

Stamped decoration imitating engine turning.

#### Fluted:

Adj. Having flutes or grooves. Fluted steel, fluted button; tool with fluted handle.

#### Garde-temps (timekeeper):

Highly accurate instrument for measuring and keeping time. Astronomical clocks, quartz clocks and marine chronometers are types of timekeepers.

#### German silver (also nickel silver, or mallechort in French):

Alloy of 50% copper, 30% zinc and 20% nickel, less liable than brass to oxidation. Used by watchmakers for plates and bridges since the second half of the 19th century.

#### Gold:

Symbol Au.: specific gravity 19.26; melting point 1063° C. A very good conductor of heat and electricity. Highly malleable, stainless, precious yellow metal used for making jewellery, bracelets and watch cases. Gold is corroded by aqua regia and by potassium cyanide. When alloyed with copper; silver, platinum or nickel, gold takes on a fine polish, and a wide range of coloured alloys can be obtained (red, pink, green, yellow and white). Gold alloys are defined by their fine-gold content in carats or in thousandths (1000 thousandths = 24 carats).

#### Index, pointer:

Indicator formed of a mobile pointer, the end of which travels over a graduated scale. Sometimes the index may be fixed and the graduated part mobile. The regulator of a watch is type of index.

The French term heures indexes denotes the variously shaped symbols substituted for numerals on some dials. Device for alternating the daily rate of a watch by lengthening or shortening the active portion of the balance spring. The index is a steel part with two arms, the shorter of which carries the pins embracing the spring, the other one acting as a pointer, also called the tail or arrow, the end of which can move over a graduated scale. This is marked FS (fast, slow), or, in French, AR (avance, retard). The index is fitted friction tight on the upper endpiece. If the index is turned, the daily rate of the watch is altered; the divisions marked on the balance cock enable the effect of this correction to be judged approximately.

#### Key (screw, wrench, spanner):

A device made in a great variety of forms, for opening, locking, winding, clamping, making contacts, etc.

The chief types are:

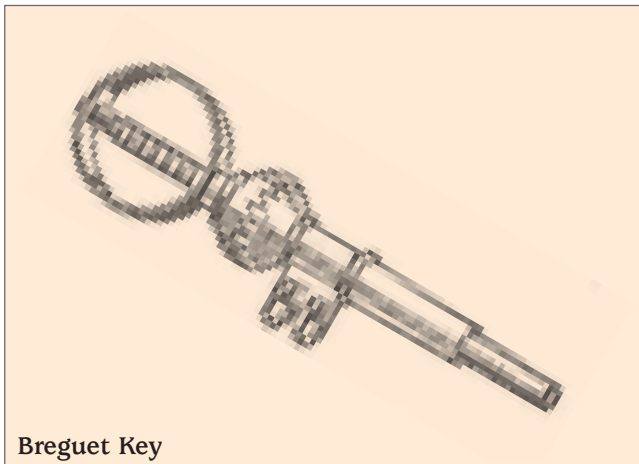
#### Winding keys:

A. Clock key

B. Multiple key

C. Watch key

D. Breguet key or ratchet key.



Breguet Key

#### Case keys:

A. Waterproof case wrench, for unscrewing.

B. Universal wrench for waterproof cases.

The adjustable jaws enable various types of case backs to be unscrewed.

C. Coach wrench or c-spanner

#### Lapidary:

Worker who cuts and polishes precious stones. Formerly, lapidaries also used to cut rock crystal for watch cases.

#### Longitude:

Angle between the meridian of a place and the meridian selected as the basic meridian (Greenwich meridian). The longitude is measured on the arc of the equator and is quoted in hours, minutes and seconds of time or in angular degrees, minutes, and seconds.

The longitude of a place is determined by the difference between the local time at that place and the local time at the starting point. An exact knowledge of the longitude is essential for air and sea navigation. One of the most important problems in the 17th century was that of longitude. In 1714 the British Parliament promised a prize of £ 20,000 to anyone who, after a voyage of 7 weeks, could determine the longitude to the nearest half degree. The winner was J. Harrison.

Nowadays the measurements of longitude that are made by means of marine chronometers and wireless time signals are 30 times more accurate.

#### Machine:

To work or form a raw material or an object, i.e. polishing, turning and cutting by means of machine .

#### Non-magnetic, anti-magnetic:

adj. Unaffected by magnetism. Non-magnetic watch, a watch in which the parts most affected by a magnetic field (balance, balance-spring and escapement) are made of non-magnetic metals or alloys, or in which the movement is protected by a magnetic screen (case, bow, dial).

#### Official rating certificate:

(Bulletin officiel de marche in French)

A detailed rating certificate issued by an observatory or by an official watch rating bureau. Only a watch for which an official rating certificate has been issued may be described as a chronometer. In the watch industry, this certificate is issued for watches of the chronometer class.



**Ogival:**

adj. Pertaining to, or having the form of, an ogive or pointed arch: ogival gear tooth profile.

**Opalescent:**

adj. Having the colour of an opal, a milky tint with changing reflections, popular during the Art Nouveau period.

**Osmium:**

Symbol Os.; metal of the same family as platinum. Of great hardness and liable to oxidation, it is one of the heaviest elements, heavier than platinum: specific gravity 22.5; melting point 2500° C. Osmium is found in platinum-bearing ores.

**Paillon (also spangle):**

Very thin shaped flake of gold or silver and used as a form of decoration in enamel work, when set between two translucent layers of enamel.



Paillon

**Painting on enamel:**

At the beginning of the 17th century, artists painted miniature portraits, landscapes, or other subjects on enamel dials or on the backs of watch cases. Painting on enamel originated in France and then developed in Geneva, Germany and England.



Painting on enamel

**Palladium:**

Symbol Pd.; specific gravity 11.5; melting point 1560° C. Very hard, brittle, stainless, non-magnetic white metal. Palladium alloys are used in the construction of physical instruments. Palladium has been used for making balance springs, and has recently come into use as a case material.

**Palmetto:**

A stylized palm leaf-shaped decoration or palm-shaped espalier, or a motif resembling an Egyptian lotus.

**Patina:**

Kind of tint or film that forms on certain things in the course of time.

Natural patina of copper or bronze, tint formed on these

metals in the course of time, owing to the action of copper sulphides and hydrocarbons (verdigris).

Artificial patina. For decorative purposes, various tints are given to metals and alloys (copper, brass, iron, steel, etc.) by chemical or electrolytic processes.

**Platinum:**

Symbol Pt; specific gravity 21.5; melting point, 1773° C. Precious metal. A heavy, stainless material that is only corroded by aqua regia. Used for making jewellery and watch cases, also in the chemical and electrical industries for making crucibles, contacts, etc.

Platinum alloyed with iridium was used in making the international standard metre (iridiumized platinum). Platinum is also used in the manufacture of thermoelectric couples for measuring high temperatures.

**Polished:**

adj. Made smooth and brilliant by very fine-grained abrasives or by rubbing with a burnisher. In a watch, all parts subject to friction must be smoothed and polished.

**Prototype:**

Original model or part on which manufacture is based. Before an article is put into serial production, a prototype is made to assess the defects and qualities of the article, as well as its commercial viability. The prototype is also kept for reference.

**Punch:**

Watchmakers use small punches, which are cylindrical tools of hardened steel, the ends of which may or may not be hollow. They are used for a great many repair jobs (riveting, pin-extracting, tightening holes, etc.) This type of punch is used in a staking tool or is held in the hand and struck with a hammer. Punches are also used for marking parts with figures, letters, or other symbols.

**Quartz:**

Silicon oxide, also called rock crystal. Quartz is used in manufacturing optical glasses; when fused in an electric furnace, it gives a transparent material comparable to glass. It is used in making watch glasses. In the 16th and 17th centuries, watch cases were made of it. Pure quartz is colourless (specific gravity 2.5 to 2.8, Mohs hardness 7). It is sometimes yellow (citrine) or violet (amethyst). Some stones used in jewellery are related to quartz: onyx, agate, opal and jasper. Flint is an impure variety of quartz.

**Radial:**

adj. Pertaining to, or in the direction of, the radius. Radial clearance.

**Ramolayé (in English, pounced ornament):**

Embossed ornament made with the graver, then smoothed with small files known as rifflers. Pounced ornaments closely resemble chasing.



Ramolayé

**Rating certificate (Bulletin de marche in French):**

Document containing a report, usually in summarized form, of the performance of a watch subjected to rating tests

**Repoussé:**

adj. high relief decoration formed by hammering the reverse of a surface to form a scene or pattern.



Repoussé

**Revolution:**

Whole turn of a rotating body. The centre wheel completes one revolution in an hour.

Movement of a body that describes a closed curve and returns to its starting point. The revolution of the earth round the sun is completed in one year.

**Rhodium:**

Hard, brittle metal which does not oxidize and is malleable only when red-hot. Specific gravity 12.33; melting point 1970° C. It is found in ores containing platinum, with which it is used in the manufacture of thermoelectric couples.

**Rhodium-plating:**

Protective coating of metal objects with a thin layer of rhodium.

**Ruby:**

Very hard natural stone, crystallized red oxide of aluminium (corundum). Ruby is the most suitable stone for the bearings of the escapement of a watch. Perforated rubies were first used by N. Fatio de Duillier, about 1700.

**Sand-blasting:**

Act and result of blasting sand. Glass is frosted by sand blasting. On metal parts, sand blasting has a scouring effect and removes burrs and rough edges.

**Setting of jewels:**

Act of setting jewels; Setting by hand or by machine. Setting was superseded (about 1923) by friction-jewelling, a simpler process necessitating very accurate fitting of the jewel.

**Skeleton or skeletonized watch:**

Watch in which various parts of the movement have been reduced to a minimum by removing the bulk of the metal or made from transparent material, enabling the main parts of the movement to be seen.

**Temperature coefficient of a watch or clock:**

Variation in the daily rate per degree C. Variation in temperature.

**Time:**

Value measured by comparison with a movement believed to be uniform and always constant, e.g. the flow of water or fine sand, the apparent motion of the stars, the oscillation of a pendulum, a sprung balance, a tuning fork, a quartz crystal, etc. Chronometry is the science of the measurement of time.

Time standard. This is the sidereal year (365.25636 days, average), which until recently was thought to be perfectly regular, however the differences are so small that they are of no practical importance.

The year has a certain number of days sub-divided into hours, minutes, and seconds.

Legal time. Time imposed by law on all the inhabitants of a country. In France, Belgium, Switzerland, Germany and Italy, the legal time is now one hour ahead of Greenwich Mean Time.

Greenwich Mean Time (G.M.T.); Mean time for the meridian of Greenwich Observatory, which is the universal meridian. It is a civil time system, counted from midnight to midnight.

Universal Time. (U.T.). Mean solar time for the Greenwich meridian, but counted from noon to noon. Universal Time and Greenwich Mean Time are often confused.

**Timed, regulated:**

adj. Having undergone timing tests and corrections, running well. A well-timed, well regulated, watch.

**Titanium:**

Blackish metal used in making certain special steels. Symbol Ti; specific gravity 4.5; melting point about 1800° C. The oxide is a colouring agent of sapphire. In modern watch making titanium is utilized in both case and movement manufacture.



Skeleton watches





## Part II: Case

### Watch Case:

n. Container that protects the watch movement from dust, damp and shocks. It also gives the watch an attractive appearance, subject to fashion and the taste of the public. The following form the main parts of a pocket watch case: The middle, into which the movement is fixed; the case-band. On the bridge side, the middle of the case is closed by the back cover (sometimes also by a dome). On the dial side, it is closed by the bezel, carrying the glass. There may also be a front cover.

Soldered to the case, in the line of the winding shaft, is the pendant, composed of a head, and a neck.

The bow or ring is fitted to the pendant. The back cover, dome and bezel may be of the snap-on, hinged or screw-on type. The modern pocket watch case (open face case) has a wide bezel opening and is made as thin as possible. The numeral 12 on the dial is in line with the winding shaft. This type of case, which was the most popular of all before the days of the wristwatch, is still used for all watches that are worn on a chain, brooch, clasp or clip. According to the shape of their casebands, bezels and covers, the various styles of cases are described in the trade as follows:



drum watch



oval



octagonal



cruciform



lobed rock crystal



skull watch



pair-cased



"oignon"

Early watch cases



*open-face*



*half open-face*



*hunting-cased*



*half hunting-cased*

Main types of pocket watch cases



*bassine*



*bassine  
carrure ronde*



*bassine  
pincée*



*demi-bassine*



*demi-bassine  
carrure plate*



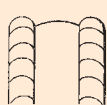
*demi-bassine  
carrure ronde*



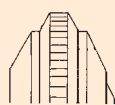
*Louis XV  
style*



*pomme et  
filet*



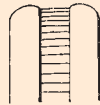
*baguette*



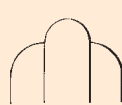
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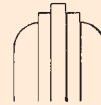
*Directoire*



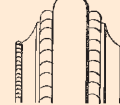
*Empire*



*etui*



*filet*



*gouge*



*knife  
edge*

Pocket watch case shapes from 1790 to the present



*asymmetrical*



*à volets*



*baguette*



*canted*



*circular*



*cuneiform*



*curved*



*cushion*



*driver's*



*hexagonal*



*hinged*



*lozenge*



*octagonal*



*oval*



*rectangular*



*reversible*



*square*



*tonneau*

## Wristwatch cases



**Band or frame:**

*n.* The central body of a watch case to which the movement, covers, bezel and pendant are fixed.

**Bezel:**

*n.* Ring snapped onto the middle of a watch case to hold the glass.

**Bezels****Bolt, slide:**

*n.* Piece of metal holding a part in position or enabling it to be shifted from outside so that it can perform some function such as stopping, starting, etc. In repeater watches, a part made of the same metal as the case and shifted along the case band with the fingernail. The repeating slide winds the spring of the striking mechanism. The repeater-silent slide prevents the watch from repeating.

**Bow:**

The suspension loop attached to the pendant of a watch.

**Case back:**

The bottom section of a watch case which covers the movement.

**Case backs****Châtelaine:**

*n.* Chain for suspending a Lady's watch or a piece of jewellery. The first examples of châtelaine watches appeared in the early 18th century.

**Corrector:**

*n.* Thing which corrects or restores to the proper place. In horology, a lever or pusher, usually accessible from the outside of a watch case, is used to bring a part back to a given position.

Date corrector, hand-operated lever or pusher used to correct the date shown by a calendar-watch.

**Crown:**

The button used for winding of the movement and setting of the time.

**Cuvette:**

A glazed or solid cover over the movement; a second case-back most commonly found in pocket watches and early wristwatches.

**Crystal:**

The protective transparent cover over the dial of a watch, commonly made from glass, plastic, synthetic sapphire or rock crystal.

**Dustproof:**

*adj.* Giving protection from dust. Dustproof case. Already in 1715, the English watchmaker Sully said that it was unwise to open the case of a watch, lest dirt, such as powder from the hair or wig, should fall inside.

**Dustproof band:**

*n.* Metal ring surrounding the movement of a watch. Around 1750, watches were fitted with covers on which the makers' names were engraved. This was the origin of the dustproof band.

**Dustproof case:**

A case in which the joints and openings are made to prevent dust from entering the watch movement. If protected by a dustproof case, a watch will last longer, while retaining its timekeeping qualities.

**Form watch:**

A watch whose case is modeled as an everyday object.



Form watch

**Gimbal Suspension:**

n. Girolamo Cardano (1501-1576), an Italian scientist, invented the gimbal suspension, which maintains an object in the horizontal position whatever the position of its support. The gimbal suspension comprises two independent concentric rings (gimbals) which can turn round their respective axes, these being at right angles to each other. The object is fitted to the inner ring, while the outer ring is fixed to the support, e.g. a chronometer box. Gimbal suspension is used for marine chronometers.

**Hallmark:**

Mark made on a product as a guarantee of quality or, in the case of gold, platinum, silver and palladium (watch cases), as an indication of the fine-metal content.

**Hinge, joint:**

n. Mobile connecting device. In a watch case, the joint is composed of two knuckles (charnières in French), in the form of small tubes soldered to the middle of the case. A third knuckle is soldered to the back cover or bezel. The knuckles are connected by a pin, which enables the case to be opened or closed.

**Lug:**

n. Curved attachment for holding or fastening an object. The lugs or loops of a wristwatch case are the attachments provided for fixing the bracelet. Projecting portion, small surface projecting from a thing, usually used as a support or means of fixing. Lug of the balance cock, projecting part of the cock, in the form of a lug, to which the balance spring stud is fitted.

**Masonic case:**

A watch whose case, frequently triangular, is decorated with masonic symbols and/or mottos.

**Olivette:**

n. Small projecting piece soldered to the case band of a watch to protect a push-piece. In old watches, the set-hands mechanism was operated by a push-piece protected by an olivette, which also made it easier for the fingernail to press the push-piece down.

**Pendant:**

n. In a pocket watch, the pendant is the part fixed to the middle of the case, to take the winding button and the bow. The pendant consists of the following parts: The pipe, the head and the neck, or body, of the pendant. The foot of the pendant (invisible) is the portion that is soldered to the middle of the case.

The pendant, the winding-button and the bow form a whole, whose forms and dimensions match the style of the case. In wristwatches, the pendant is reduced to a small cylindrical tube, in which the winding button turns directly.



traditional

thief-proof or swivel

Pendants

**Push-pieces or button:**

n. Button that is pressed to work a mechanism. The push-pieces of chronographs, striking watches, alarms, etc.



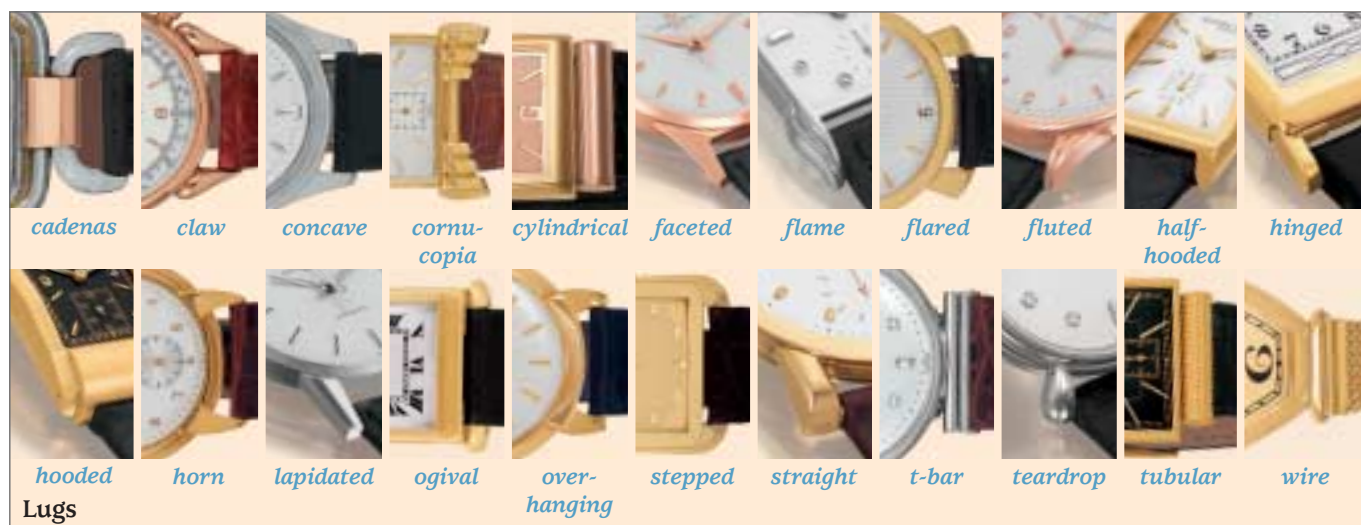
round

rectangular

olive

co-axial

Push-pieces or button



cadenas

claw

concave

cornu-  
copia

cylindrical

faceted

flame

flared

fluted

half-  
hooded

hinged

hooded

horn

lapidated

ogival

over-  
hanging

stepped

straight

t-bar

teardrop

tubular

wire

Lugs



**Repeating-slide:**

*n.* In a repeater, a slide on the outside of the case, which can be moved along the case band with the fingernail to rewind the repeating barrel.

**Snap:**

*n.* Term used by casemakers for the groove provided in the middle of the case for snapping on the bezel (or dome or back cover). In a well-fitted bezel, there should be no space between the flat rim and the snap-rim.

**Staybrite:**

*n.* Steel containing 0.2% carbon, 18% chromium and 8% nickel. A stainless alloy that takes a fine polish and is used for making watch cases.

**Water-resistant case, waterproof case:**

Case made to prevent the intrusion of moisture or dust, enabling a good quality watch to keep good time for several years without being cleaned.



Water-resistant cases

## Part III: Dial

**Dial:**

*n.* Indicating “face” or plate of metal or other material, bearing various markings to show, in ordinary watches and clocks, the hours, minutes and seconds. Dials vary greatly in shape, decoration, material, etc. The indications are given by means of numerals, markers, or symbols of various types.

**Metal dials:**

About 1500, these were made of copper or brass, with large engraved Roman numerals. The hours were indicated on two concentric circles (double chapter-ring or hour-circle), from I to VI and from 7 to 12, or from I to XII and from 13 to 24. In the late 17th century, there appeared magnificent Louis XVI dials of gilt metal, with enamel chapters showing the hours. Later, the numerals were very small and the minutes were shown by fine strokes.

Modern dials are very thin. They are coloured by an elec-

trodepositing process and are finished with machine-cut ornaments. The markings are added by a transfer method. In fine quality dials, the chapters are stamped in relief or applied to the surface.

**Enamel dials:**

They were introduced around 1625. They are thin plates of copper, gold or silver, covered with enamel and often richly ornamented. Enamel dials, which are comparatively thick and delicate, have the advantage of being more legible and do not oxidize. Metal dials are now more common, however, a sober, white enamel dial is still a mark of fine workmanship and suits the best quality watch.

**Snap-on dial:**

An enamel dial set in a fine brass ring known as the snap-ring. This ring is snapped onto the bottom plate and is held in position by a set-pin.



Dials

metal

enamel

snap-on



**Alarm indication:**

A hand, sector or aperture that shows the time of reveille.

**Angle hour:**

A dial with a graduated revolving disk or ring to assist aviators (360 degrees) and mariners (180 degrees) to calculate their position when no landmarks are available.

**Astrolabe:**

An instrument used to mark the altitudes, positions and movements of heavenly bodies.

**Automaton:**

A mechanically animated figure or scene, the most common on watch dials are "Jaquemarts" or striking jacks.

**Blind man's dial:**

A dial with raised sections at the outer edge to allow a visually impaired person to read the time by feeling which hour the hands are pointing to.

**Calendar:**

n. Body of conventions first adopted in 1852 by Pope Gregory The Great to reconcile the Julian calendar with the tropical year and to determine its subdivisions, viz. months, weeks and days. Religious festivals, the phases of the moon and the seasons are often added.



Alarm



Angle hour



Astrolabe



Automaton

**Date:** a calendar that displays the day of the month.

**Day-date:** a calendar that displays the day of the week and month.

**Triple calendar:** a calendar that displays the days of the week and month as well as the month of the year.

**Full calendar:** a triple calendar with phases of the moon.

**Annual calendar:** a calendar that automatically corrects for the differing duration of the months and needs correction only once a year.

**Perpetual calendar:** A calendar that automatically corrects for the differing durations of months and leap years.

**Perpetual with leap year indication:** A perpetual calendar that indicates the year of the four year cycle via a subsidiary dial or aperture.

**Secular perpetual:** A perpetual calendar that automatically corrects for leap centuries.

**Zodiac:** In western astrology, a belt of the sky 16 degrees wide, containing the sun, moon and the chief planets. The zodiac is divided into 12 signs, each 30 degrees wide and corresponding to a constellation.

**Calendar with holiday indication:** A watch which predicts and indicates the date of a movable holiday.

**Calendar with season indication:** A watch with indication for the four seasons on either a subsidiary dial or in an aperture.

**Revolutionary calendar:** A calendar based on the revolutionary calendar, in effect from October 5, 1793 to September 9, 1805, when it was officially abolished.

**American calendar:** A calendar in which the day, date and month are aligned in a row within a single aperture.

**Chapter Ring:**

A ring or circle bearing the hour and minute markers applied to or engraved into the dial plate.

**Counter (U.S.A. register):**

In a chronograph, the mechanism that shows on a dial the number of revolutions of the chronograph hand, i.e. the number of minutes and/or hours.

There are 3 types of counters:

**Continuous action counter:** in which the slow motion of the hand is continuous.

**Semi-instantaneous counter:** in which the hand starts to move at about the 58th second/minute and jumps suddenly at the 60th second/minute.



Types of calendar indications

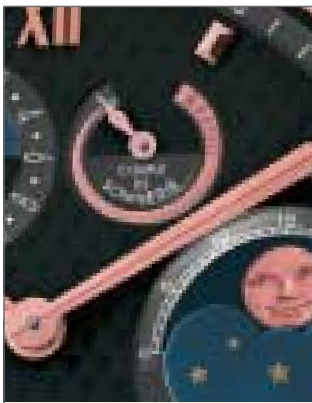
**Instantaneous counter:** in which the hand suddenly jumps forward at the 60th second/minute.



Counter

**Couple de sonnerie:**

A sector or aperture which indicates that the repeat function of a watch is engaged.



Couple de sonnerie



Day/night indication

**Day/night:**

Indication of the nocturnal and diurnal hours on a shaded dial or in an aperture.

**Equation of time:**

*n.* In astronomy, the equation of time is the quantity that must be added or subtracted daily to convert solar time to mean time. The equation of time varies from day to day; its value alternates between -14.59 and +16.15 minutes. The difference is indicated by either a sector or a hand.



Equation of time

**Foudroyante, diabolotone, flying seconds:**

A graduated subsidiary dial used in conjunction with a chronograph to time fractions of a second.



Foudroyante

**Hand:**

An indicating device made of a piece of metal. Generally thin and light, and of varying forms, it points to information on a dial or a sector.

Watches generally have three hands to indicate the hours, minutes, and seconds.

The first watches had only one hand, that of the hours. The introduction of the minute hand is usually attributed to the English horologist Daniel Quare, around 1691. It did not come into general use, however, until the beginning of the 18th century.

The earliest hands were thick and robust, for the dial was not yet protected by a glass. Toward the mid 18th century, they became thinner and more elegant; they were produced by hand and finished by filing and chiselling, and the holes were made by an archet. Around 1764 they began to be cut out from a metal band with a punch and hammer. Later, around 1800, they were produced by stamping. They were often decorated with paste stones. Louis XV and Louis XVI hands for very fine watches were made of finely chiselled gold. Today, the making of hands is automated, and their forms, quality and colours are highly varied, with over 100 types known.

**Indexes, numerals or chapters:**

The markers or divisions on the dial of a clock or watch used to read the hours and minutes in conjunction with the hands.

**Indelible:**

*adj.* Ineffaceable, unaltered by the passage of time. Indelible ink. For dial manufacturers, markings protected by a layer of cellulose varnish are indelible.

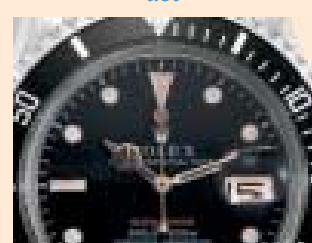
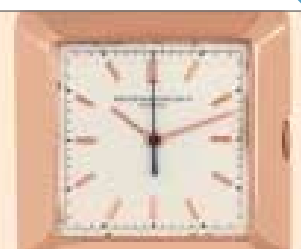
**Jump hour / digital dial:**

Dials provided with apertures in which the hours and/or minutes and seconds appear. This can either be separated or a single aperture showing the analogical hours and minutes. In electronic time keeping LCD are the most common type of digital display.

**Luminous dials:**

Dials which have the hours marked by means of numerals, strokes or dots painted with a luminous salt. Also called radium dials. They were introduced about 1912 and were popular during the 1914-1918 war, when they were fitted to 13''' wristwatches. The development of miniature batteries now makes it possible to light up the dial of a watch by means of tiny electric lamps concealed under the bezel.





**Indexes, numerals or chapters**



**Masonic dial:**

A dial which has Masonic symbolism, most commonly replacing the traditional hour markers, less often representing the Temple of the "Grand Architect of the Universe".



Masonic dials

**Minute track/divisions:**

Divisions on the dial of a clock or watch to mark the minutes.



Minute track

Minute divisions

**Moon phase:**

An aperture or subsidiary dial which shows the progression of the moon. A lunation is considered to be 29 1/2 days. To simplify the gearing a moon phase disk normally has two moons and is geared to make one complete revolution every 59 days.

**Planetarium:**

A representation of the planets as spheres revolving around the sun.



Moon phase

Planetarium

**Power reserve / up-down:**

A sector on the dial or the dial of a clock or watch which indicates the remaining energy in the spring or springs, power reserve sectors are most commonly associated with the going train, however they can also be for striking trains.



Power reserve

**Regulator dial:**

A dial usually arranged with a central minute hand and subsidiary dials for the hours and seconds, normally found on precision time keepers.

**Retrograde:**

A hand which passes through the arc of a graduated sector and upon reaching the end returns instantaneously to the first indication.



Retrograde

**Revolutionary time:**

After the French Revolution a new digital system was adopted that affected weights and measures as well as time. The system for time measurement was changed, with the day being divided into ten hours, each with 100 minutes, and each minute being subdivided into 100 seconds. Thus, for example, 12:30 PM was 5:20:83.3 in decimal time. The decimalization of time was introduced on November 24, 1793, but proved impossible to enforce because the traditional system was too deeply ingrained in people's minds. The provision for decimal hours was suspended on April 7, 1795, with the Revolutionary calendar remaining in effect for another ten years.

**Seconds:**

n. In horology, a device that indicates seconds: seconds wheel, seconds hand.

Center seconds (US.A. sweep seconds), seconds hand mounted at the centre of the main dial.

Subsidiary seconds, small offset seconds dial.



center seconds

subsidiary seconds

Seconds

**Second time zone:**

The indication of a secondary time-zone on the dial of a watch via a second hour hand, aperture or subsidiary dial.



Second time zone

**Sector:**

n. Portion of a circle, limited by two radii.

The pointer of the index moves over a graduated sector.



Sector

**Star chart:**

Revolving disk or disks containing representations of the celestial vault which rotate to show the heavens as visible from a fixed terrestrial position.



Star chart

**Sunrise, sunset:**

Indication of the changing hour of sunrise and sunset for a particular city or location throughout the year.

**Thermometer:**

n. Apparatus for measuring temperature. The most common is a Réaumur type, which utilises an arched strip of metal whose rate of expansion and contraction due to temperature change is constant and therefore measurable. This rate of change is measured and indicated via a sector on the dial.

**Timing scales:**

Scales used in conjunction with a chronograph for various calculations depending on their graduation.

**Asthmometer:**

n. Dial calibrated for measuring the rate of respiration. This type of scale is most often found in conjunction with a pulsometer scale on a medical chronograph.

**Pulsimeter, pulsometer, sphygmometer:**

n. Instrument for counting the beats of the heart. In horology,



Sunrise, sunset



Regulator dial and Réaumur thermometer



asthmometer

pulsometer



tachymeter

telemeter



yacht timer

multi-scale

Timing scales



a pulsometer is a timer or chronograph with a special dial calibrated on the basis of 15 or 30 beats. The hand is started, then stopped on the 30th beat; it then shows the number of beats per minute.

The scale of the pulsometer is usually based on a count of 30 beats. If the corresponding time is 24 seconds, for instance, there are 75 pulse beats per minute.

**Tachymeter, tachometer, for measuring speed:**

The speed may be indicated in km. per hour over a measured distance of 1000 metres (the distance between the kilometre-posts among the road). 1000 metres covered in 45 seconds = 80 km. per hour. For intervals exceeding 60 seconds, readings are taken on the central spiral. A time of 90 seconds (1 m. 30 sec.) = 40 km. per hour, and a time of 2 m. 30 sec. = 24 km. per hour, on the inner coil of the spiral. The tachymeter-scale may be based on another standard distance, e.g. 100 or 200 metres or a nautical mile. (1,852 metres).

Instrument for measuring speed. In watchmaking, a timer or chronograph with a graduated dial on which speeds can be read off in kilometres per hour or some other unit.

**Telemeter:**

n. Instrument for measuring distances. In horology, a timer or a chronograph with a graduated dial enabling distances to be read off on the basis of the speed of sound through the air at 0° C., viz. 333 metres per second, i.e. 1 km; every 3 seconds.

The time that elapses between the flash of an explosion (firing of a gun, lightning) and the hearing of the noise makes it possible to read on the dial the distance between the observer and the position of the flash.

Example: The hand of the timer is started when a flash of lightning is observed, and stopped when the thunder is heard. If the hand has been stopped at 18 seconds, for instance, the distance can be read opposite that figure, viz. 6 km. on scale

**Yacht timer:**

Yachts are given five minutes to "Toe the Line" before a race. The dial is calibrated so that the passing of the time limit can be seen at a glance, often in apertures on a plain dial. A gun is fired indicating that the five minute warning has started, at this instant the button of the chronograph is depressed. The counter successively passes from 5 to 1 and when the second hand reaches zero a second gun is fired and the race begins.

**Multi-scale:**

n. The combination of two or more of the above on a single dial.

**24-hour dial:**

A dial or subsidiary dial graduated for 24 hours.

**Wandering hour:**

The most common type of wandering hour dial is one on which the hour is represented by a numeral passing through or over a graduated sector or aperture. Another type is one where the hour is displayed within an aperture which revolves around the dial indicating the minutes on a graduated chapter ring.

**World time:**

A clock or watch showing the time in various global locations by means of a fixed or rotating bezel or ring.



24-hour dials

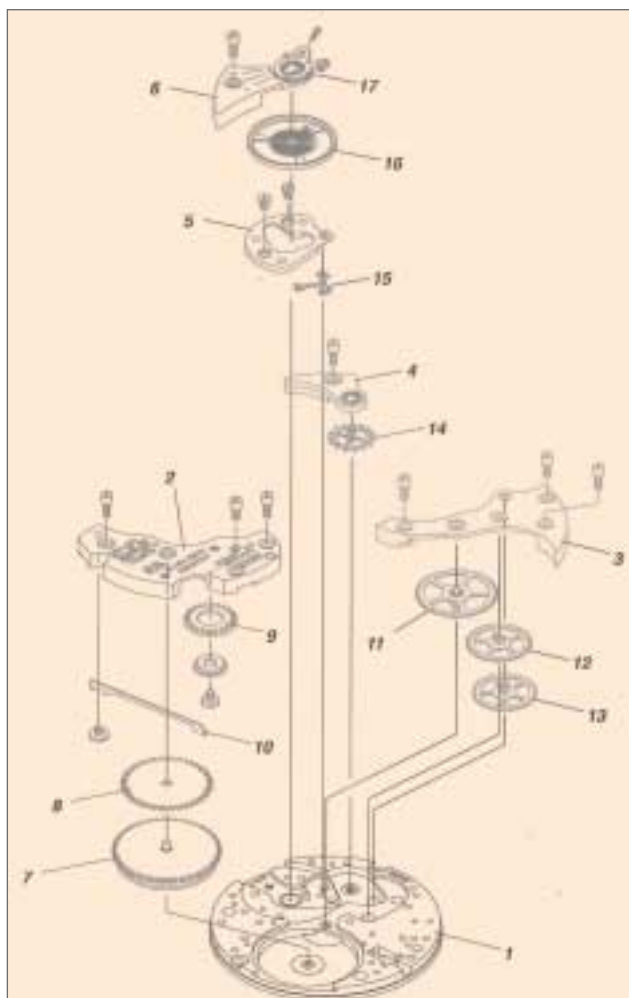


Wandering hour

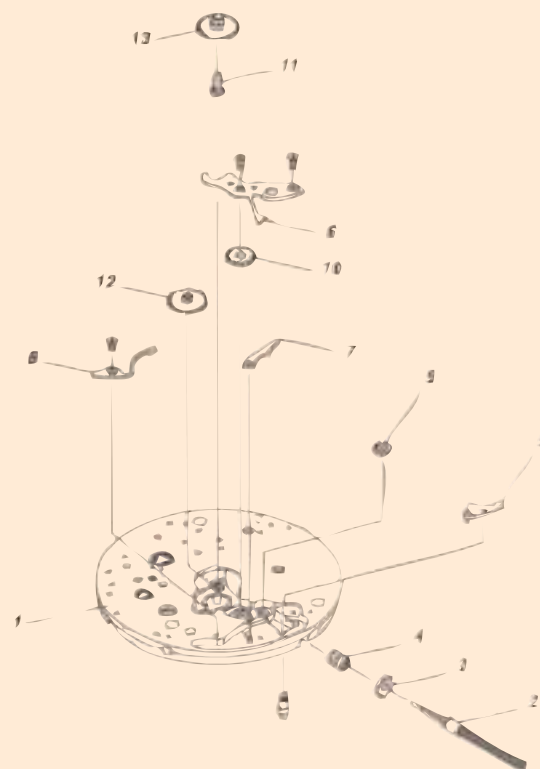
World time



## Part IV: Movement



1. Main Plate 2. Barrel Bridge 3. Gear train bridge 4. Escape wheel bridge 5. Pallet bridge 6. Balance bridge/cock 7. Barrel 8. Ratchet wheel 9. Crown wheel 10. Click spring 11. Center wheel 12. Third wheel 13. Fourth wheel 14. Escape wheel 15. Pallet fork 16. Balance and spring 17. Regulator



1. Main plate 2. Winding stem 3. Winding pinion 4. Sliding pinion 5. Setting lever 6. Setting lever spring 7. Yoke 8. Yoke spring 9. First intermediate wheel 10. Second intermediate wheel 11. Cannon pinion 12. Minute wheel 13. Hour wheel

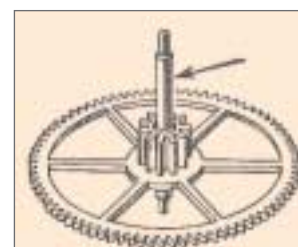
### Anibal (acier au nickel pour balanciers) :

An alloy invented by Dr. Charles Edouard Guillaume which exhibits unusual properties, both in terms of thermal expansion and changes in elasticity. Its properties are very different from those of two other alloys invented by Guillaume, Invar and Elinvar. At the end of the 1800s, Guillaume attempted to eliminate the so-called Middle Temperature Error, which is caused by the fact that the change of rate in a timekeeper with a steel-brass bimetallic balance is approximately a linear function of temperature, while the modifications caused by the change in elasticity of a balance spring is approximately a quadratic function. Thus, it equals zero at only two temperatures, causing secondary error. Countless attempts were made to

eliminate it, usually by adjoining auxiliary compensation devices. In 1899, Guillaume noticed that steel with an addition of 44.4% nickel has a negative square coefficient of thermal expansion. This, combined with brass in bimetallic lamina, makes its expansion close to quadratic.

### Arbor:

The shaft or axle on which a wheel, pinion or other revolving part or a watch or clock movement is carried.



Arbor

**Automatic, perpetual, self-winding:**

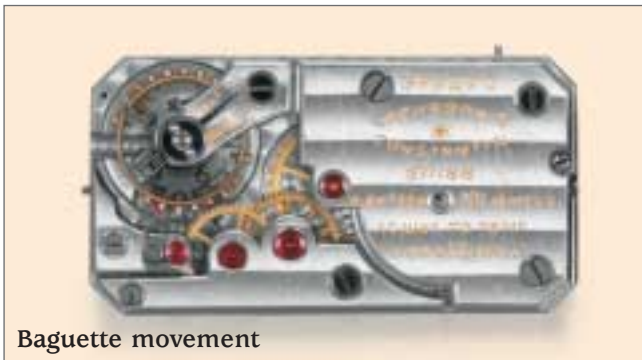
A watch in which the movements of the wearer's body wind the mainspring, by means of a rotor or hammer which turns or swings freely on its arbor.



Automatic movement

**Baguette:**

An elongated rectangular movement, the length of which is roughly three times as great as the breadth (fashionable between 1920 and 1930).



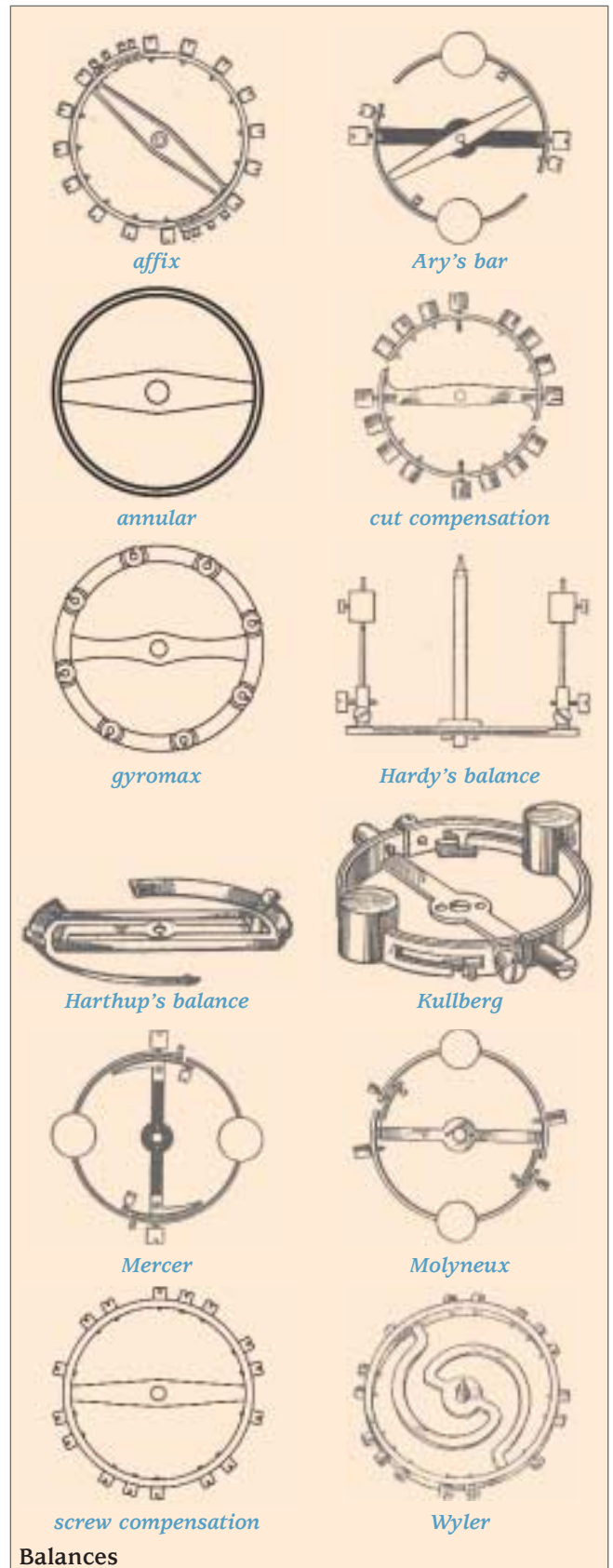
Baguette movement

**Balance:**

The device which, by oscillating, regularizes the movement of the going train of a watch or clock. In modern watch-making balances are almost exclusively circular and monometallic. In the past an infinite number of shapes and combinations of metals have been used in the manufacture of balances.

**Balance cock:**

n. Bar for the balance. Originally (16th century) balance cocks were very long and simple and were fixed by means of a key at the centre. In the 17th century, they were richly chased and adorned with precious stones, often covering almost the whole of the watch movement. There were many varieties of ornament, e.g. animals, flowers, leaves, human heads, etc.



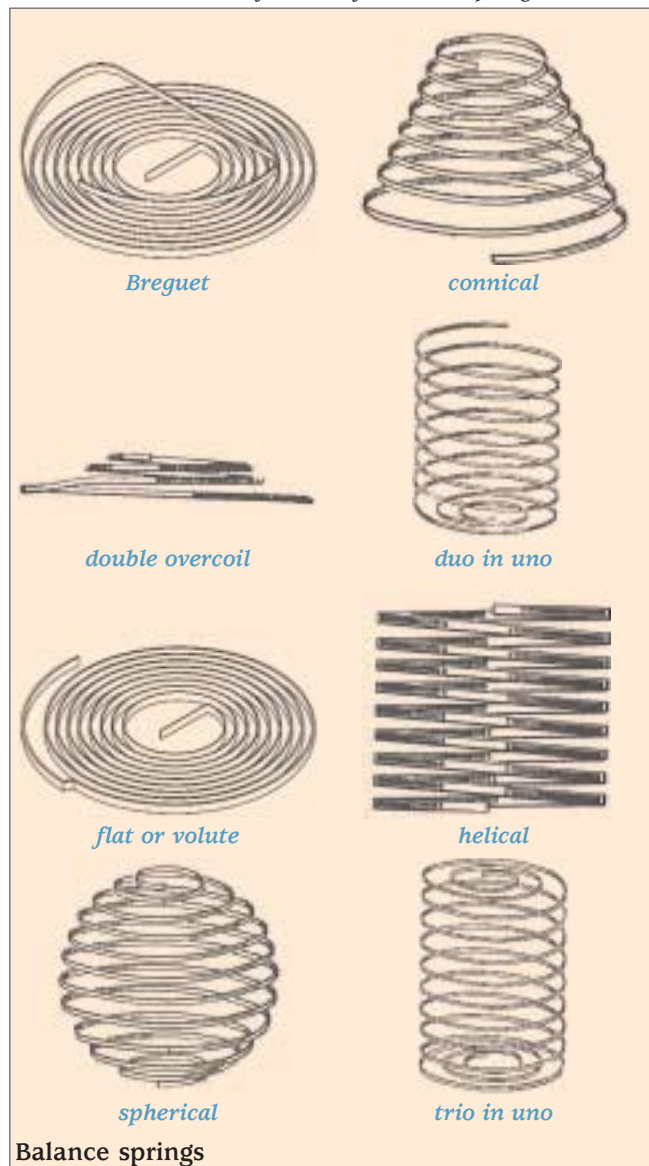
Balances

French balance cocks were round or oval, with lateral lugs to take fixing screws. English balance cocks were round, with a wide sector-shaped heel. Those made in the 18th century were the finest; some of them are masterpieces of chasing.

In the modern balance cock, the particularity of this bar is that it has an ear into which the balance spring stud is fitted. A scale marked in English with F (fast) and S (slow) or in French with A (avance) and R (retard) acts as a guide for shifting the index.

**Balance spring, hairspring:**

Small spiral spring fixed at the ends to the balance and its cock. An infinite number of combinations of shapes and materials, including glass and diamond ceramics, have been used in the manufacture of balance springs.



Balance springs

**Bar, bridge:**

n. Metal part in which at least one of the pivots of the moving parts of a watch usually turns. Strictly speaking, a bridge is a bar with two supports, and a cock is a bar with one support. A bar is fixed to the bottom plate by steady pins. Formerly, great importance was attached to the shape and layout of the bars for the sake of original or aesthetic effect.

Bars are generally named after the parts they support, e.g. barrel bar, centre wheel bar, set bridge, pallet cock, etc. Certain bars owe their names to various peculiarities: three quarter plate bar or bridge, covering about three quarters of the bottom plate and supporting the whole train, from the barrel to the fourth wheel.

**Barrel:**

n. Going barrel. Wheel composed of a toothed disc and a cylindrical box closed by a cover. The barrel turns freely on an arbor and contains the mainspring, which is hooked to the barrel at its outer end and to the arbor at its inner end. The barrel meshes with the first pinion of the train of a watch; it rotates slowly, its arc of rotation varying between one ninth and one sixth of a revolution per hour. The three most common types of barrel are hanging, standing and fixed.

**Beryllium, Glucidur, Berrydur:**

n. Glucinum bronze, an alloy of copper and 2 to 3% glucinum. A hard, highly elastic, non-magnetic and stainless alloy used for making monometallic balances, escapements and balance springs. Hardness 8.25. Coefficient of linear expansion  $17 \times 10^{-6}$  between  $20^\circ$  and  $200^\circ$ .

**Bi-Metallic:**

Composed of two metals or alloys, either independent of each other or in lamina; a bi-metallic balance utilises two metals to compensate for changes in temperature.

**Buffer:**

The buffer of the oscillating weight of a self-winding watch has two lateral recesses containing springs to dampen the shocks that occur when it is struck by the weight.



Buffer

**Caliber (U.S.A. calibre):**

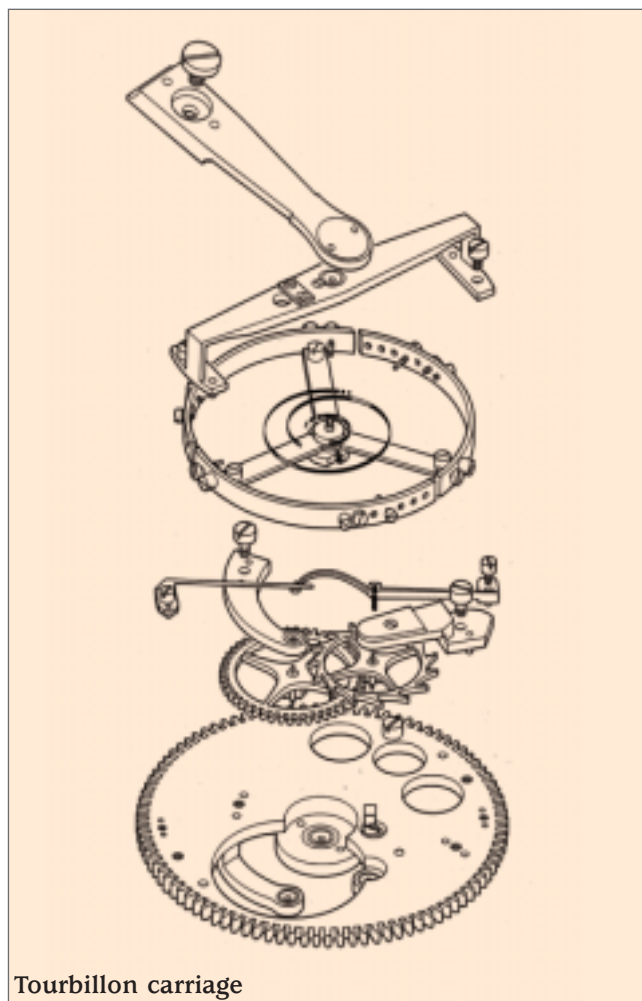
n. Size. In connection with watchmaking, the term was used by Sully, about 1715, to denote the lay-out and dimensions of the movement, wheels, etc.

The first bar caliber was made by A.L. Breguet at the beginning of the 19th century.

More recently, the term has been used to indicate the shape of the movement and its bars, the origin of the watch, the designer's name, etc.

**Carriage:**

n. In a tourbillon, the rotating frame that carries the escapement and the balance.



Tourbillon carriage

drawing by David Penney



**Chime:**

Strike work with a set of bells or gongs that can play a complete tune.

**Chronograph: (more properly chronoscope)**

A watch with hands showing the hours, minutes and seconds, together with a mechanism controlling a chronograph-hand mounted in the centre of the dial.

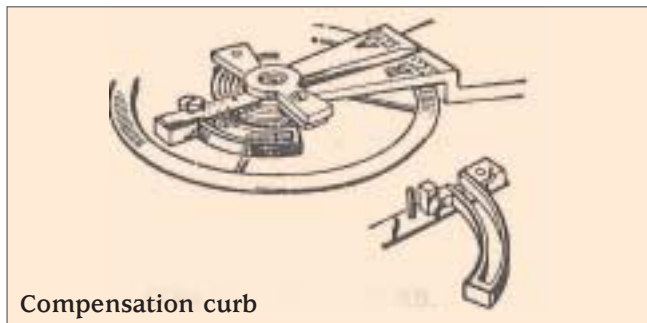
By the operation of push-pieces, the chronograph-hand can be set in motion, stopped and returned to zero.

**Compensation:**

n. Act of compensating. The problems of compensation consist in endeavoring to reduce the effects of variations in temperature or atmospheric pressure on the rate of a watch or clock.

**Compensation curb:**

A device invented by John Harrison in the 18th century where one index pin is fitted to the index (regulator) and the other is fitted to a bimetallic strip. The strip expands and contracts due to temperature changes, therefore lengthening or shortening the balance spring and thus compensating for changes in temperature.



Compensation curb

**Dart, guard-pin, safety-pin:**

n. Small metal pin fixed to the block at the base of the fork of a lever escapement. The dart works with the roller on the balance staff, its function being to prevent accidental movements of the fork while the balance is making its supplementary arc.

**Duoplan:**

n. Very narrow wristwatch movement in which the wheel-work and the escapement are placed on two superimposed levels, with a back wind crown.

**Douzieme:**

A term used in horology to measure the thickness of movements. One douzieme is a 1/12th of a ligne or 0.188 mm.

**Elinvar:**

n. Generic term for steel-nickel alloys whose thermoelastic coefficient is practically zero within the normal range of temperatures (- 10° to + 30° C.) to which watches are subjected.

**Endstone:**

n. or cap-jewel, jewel cap; undrilled jewel flat on one side and domed on the other. The endstone is placed on the balance jewel and the tip of the balance staff pivot rests against its flat surface. This device reduces pivot friction. Endstones are often used for the balance staff and sometimes for the pallet staff and escape wheel. In high quality watches of the 18th-20th centuries they were often diamond.

**Escapement:**

n. Mechanism fitted between the train and the regulating organ, i.e. the balance or pendulum, of most timepieces. Set of parts (escape wheel, lever, roller) which converts the rotary motion of the train into to-and-fro motion (the balance). The purpose of the escapement is to maintain the oscillations of the regulating organ.

**Fausses-côtes:**

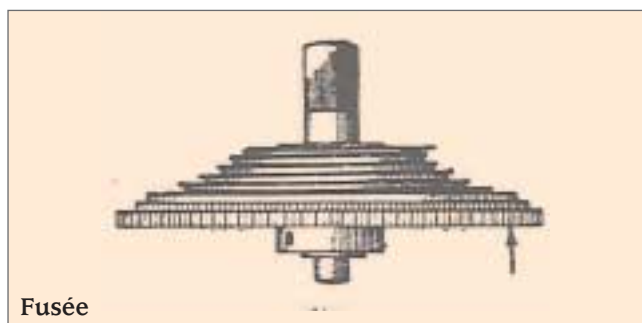
n. Wavy finished pattern usually to be found on Swiss, nickel and rhodium plated movements. Sometimes called the "côtes de Genève".

**Fusée:**

The spirally grooved pulley of varying diameter used to equalize the inconsistent pull of the mainspring in early watches. The earliest known surviving example of a watch with a fusee was made by Jacob Zech of Prague circa 1525. Drawings by Leonardo Da Vinci (1452-1519) show the fusee in principle. Prior to the invention of the fusee the stackfreed was used for the same purpose.



Fausses-côtes



Fusée

**Free-sprung:**

A balance whose air-spring does not have a means of post-assembly regulation.

**Guillaume Balance:**

Balances with bimetallic rims made of invar and brass are usually called Guillaume balances, or, as their inventor called them, integral balances. One of the distinguishing features of these balances are wings extending past the arm on the rim. Combined with special balance springs, they show amazing temperature stability, sometimes not exceeding 1/50 second per day per 1°C.

**Guillaume elinvar:**

An alloy suitable for the manufacture of compensating balance springs, giving a middle temperature error of 1 to 2 seconds for 30° C; it is a steel-nickel alloy containing chromium and tungsten to make it harder. Metalinvar, durival, nivarox and isoval balance springs are derivatives of Guillaume elinvar.

**Gong:**

Strip of hardened steel, firmly fixed at one end and struck by a hammer. The hours are struck on a gong of low pitch and the quarters on two gongs, one of high and the other of low, pitch. In a chime, three or more gongs are used. The first gongs appeared in Geneva circa 1780, and were used extensively by Breguet soon after.

**Hand setting:**

n. Term used by watchmakers for an operation and, by extension, for a piece of mechanism. Operation of correcting the position of the hands of a timepiece: "my watch keeps very bad time and needs frequent hand-setting".

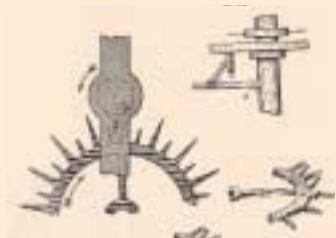
**(Hand-)setting or set-hands mechanism:**

Mechanism for altering the position of the hands of a watch. Originally, the hands had to be pushed directly by hand to set the watch to the right time; later, a key was used to set them.

**Push-pin setting:** If the button or push-pin on the case is pressed down with the fingernail, the return bar (U.S.A. yoke)



*Amand*



*American duplex*



*Arnold detent*



*Berthoud detent*



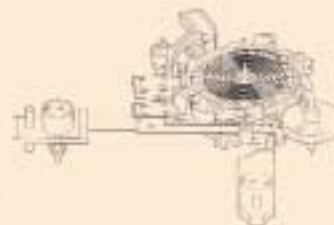
*Brocot*



*club foot lever*



*coaxial*



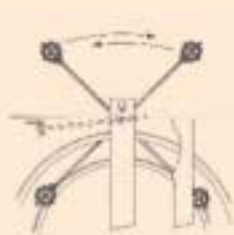
*constant force*



*counterpoised lever*



*crank roller*



*cross-beat*



*crown wheel*



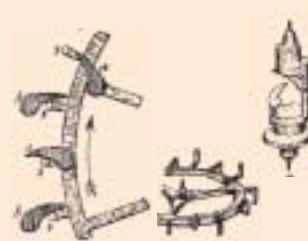
*cylinder*



*dead beat*



*detent sans ressort*



*double virgule*



*double wheel duplex*



*Dubautré*



*duplex*



*Earnshaw detent*



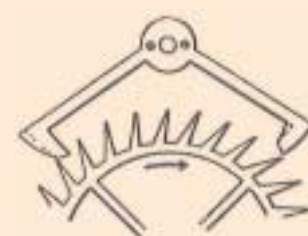
*English lateral lever*



*Graham cylinder*



*Grossmann detent*



*half dead beat*



*Hüning detent*



*Huygens*



*Jacot or Chinese duplex*



*Jacot star*

Escapements (continued on next page)





*Jean Renaud*



*lateral lever*



*Lepaute*



*marteau et clou*



*moustache lever*



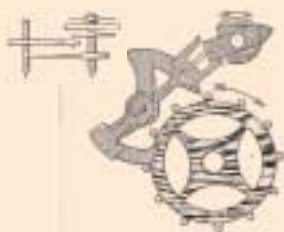
*Mudge lever*



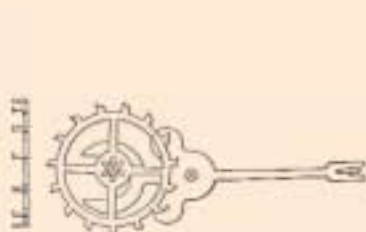
*naturel*



*Peto cross*



*pin lever*



*pin pallet (for watch)*



*pin wheel*



*pivoted detent*



*Pouzait*



*rack lever (type a)*



*rack lever (type b)*



*resilient lever*



*Robin*



*ruby cylinder*



*Savage*



*straight line lever*



*spring tail lever*



*star duplex*



*Swiss lateral lever*



*Tompion*



*verge*



*virgule*



*Vulliamy*



*Vulliamy cylinder*

## Escapements

causes the castle-wheel (U.S.A. clutch-wheel, clutch-pinion) to slide down the winding stem and to mesh with the intermediate wheel controlling the motion work and hands. The stem is turned to set the hands. Now obsolete.

**Push-bolt setting:** The functions are the same, but the return bar is operated by a bolt.

**Rocking-bar setting:** A simplified system consisting of a rocking bar operated by the push-pin, to cause the intermediate wheel to mesh with the minute wheel. The stem is turned to set the hands. The second intermediate wheel carried by the rocking bar meshes with the ratchet wheel to wind the mainspring.

**Positive setting:** If the winding stem is pulled in the direction of the arrow, the pull-out piece or bolt (U.S.A. setting-lever) causes the return bar to swing. The castle-wheel slides down the stem and meshes with the intermediate wheel to set the hands.

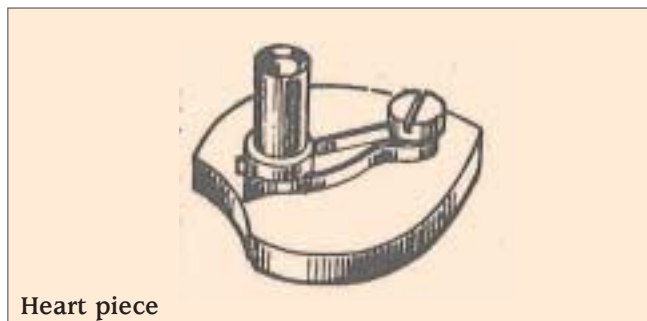
**Negative setting:** This system, used in America, has the advantage of making the movement independent of the case, for the winding stem can take up two positions in the clamp screwed inside the pendant-sleeve. According to its position in the sleeve, the square of the winding stem brings the castle-wheel to the "wind" or "set" position. The movement can be taken out of the case without removing the stem and its clamp.

**Modern setting:** An improved positive setting.

**Set-hands:** Position of parts for hand-setting.

#### Heart piece:

n. Heart-shaped cam; that is fixed to the arbor of the chronograph-hand, and returns the hand to zero when the return button is pressed.



Heart piece

#### Impulse:

n. Movement transmitted by a part of a machine. In a lever escapement, the impulse is the action of the escape wheel tooth on the impulse face of the pallet. In the Swiss lever escapement, the impulse is produced by the impulse face of the wheel tooth and that of the pallet.

#### Independent seconds:

Large seconds hand mounted at the centre of the dial, operated by a second independent train; it can be stopped without stopping the going-train of the watch.

#### Invar:

n. Abbreviation of "invariable". Alloy of nickel and steel containing 36% nickel. Invar has an extraordinarily low coefficient of expansion, about 15 times lower than that of steel. The low expansibility of this alloy was discovered by C. F.-E. Guillaume; the name "invar" was suggested by Professor Marc Thury.

#### Isochronous:

Adj. Occurring in equal periods of time. Horologists say that the oscillations of a pendulum or balance are isochronous when their duration is independent of their amplitude.

#### Jewel:

In a watch, a bearing, endstone or pallet of precious or semi-precious stone (ruby, sapphire or garnet). These jewels are used to reduce friction. A 15-jewel watch, for instance, has 10 jewel holes, 2 endstones, 2 pallet stones and 1 impulse-pin. The chief types of watch jewels are

the following:

A. Flat jewel hole, with cylindrical hole for a shouldered pivot.

B. Jewel hole with domed face.

C. Large jewel hole for the centre arbor.

D. Domed jewel with endstone (cap jewel).

E. For conical pivot.

F. Entry or exit pallet for a lever escapement, impulse pallet or locking stone for a detent escapement.

G. Impulse-pin (roller pin) for a lever escapement.

**Oriented jewels:** jewels in which the crystalline structure is taken into account to give maximum resistance to wear and pressure. Such jewels are required for the bearings of counters and other comparatively large appliances in which the pivot pressure is far higher than in a watch.

**Friction jewel (introduced about 1923):** jewel fitted directly and held by friction in the hole in the bar or plate; called a friction jewel to distinguish it from a set jewel. In good-quality watches, all the rubbing parts (train arbor bearings, parts of the escapement) are made of ruby. Formerly, diamond endstones were used for the pivots of the balance staff.

#### Karrusel:

n. Device similar to the tourbillon, but with the carriage driven not by the fourth wheel, but by the third wheel. This mechanism is stronger and less delicate than the tourbillon. Invented by Bonniksen, a Danish horologist, who worked in Spoon-End, Coventry and London, in 1893.



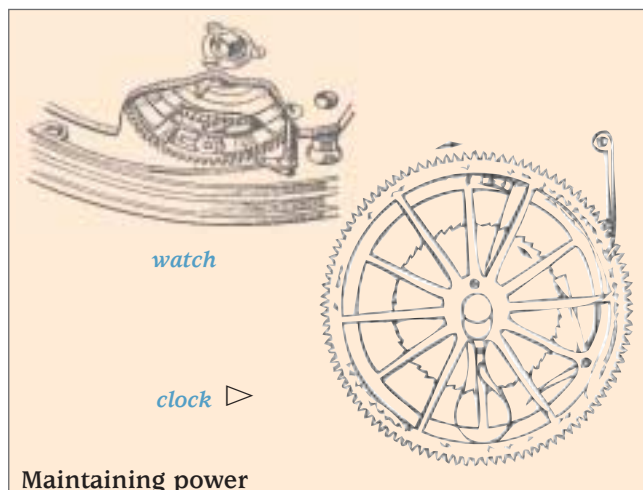
Karrusel

#### Ligne("):

In watch making lignes (or lines) are used to measure the diameter or surface dimension of the movement. A ligne is one 1/12th of a pouce or 2.255 mm.

#### Maintaining power.

The mechanism of a fusee watch or a clock which keeps the movement going during rewinding. There are spring and weight driven types of maintaining power. Without this



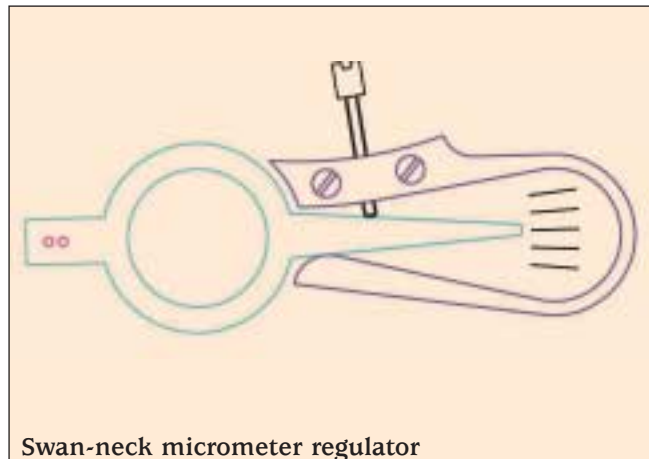
Maintaining power



mechanism the train of a fusee or weight driven timepiece reverses when the power of the mainspring or weight is taken off during winding.

#### **Micrometer Regulator:**

A form of regulator which allows very fine adjustment to the index pins and therefore to the active length of the balance spring allowing for superior adjustment of the watch.



Swan-neck micrometer regulator

#### **Monometallic:**

Adj. Composed of a single metal or alloy; a monometallic balance.

#### **Oscillation:**

n. Act and result of oscillating. When a pendulum or balance oscillates, it reaches two extreme positions. The swing from start to the extreme, and the return to the starting point, make one oscillation. A seconds pendulum makes one oscillation in two seconds. A watch balance usually makes 9,000 oscillations, or 18,000 vibrations, per hour.

#### **Pallets:**

n. pl. Part of the escapement of a watch or clock, made of steel, brass or ruby and shaped rather like a ship's anchor. The chief types of pallets used in horology are:

**Recoil pallets:** general term for the pallets of escapements in which the rotation of the pallets during unlocking causes the escape-wheel to recoil to some extent. The recoil or anchor escapement was invented by William Clement in 1675, though it is sometimes ascribed to Hooke (1666).

**Recoil pallets for clocks:** made of a single piece of steel. Clock-pallets with adjustable pads fixed to bushes so that their position can be modified.

**Dead-beat pallets for pendulum clock:** with adjustable nibs clamped between screwed plates. Also called Graham pallets.

**Rack-lever pallets:** one arm of which ends in a toothed segment meshing with a pinion on the balance-staff.

**Pin pallets for clock:** The arms carry two pins, which engage in the escape wheel.

**Watch-pallets:** The pallets used in a watch actually consist of two elements: the pallets proper and the fork. The arms are fitted with two pallet-stones; one is the entry pallet and the other the exit pallet. Other elements include the lever, the opening of the fork, the horns, the dart or guard pin fixed in the block, and the pallet staff.

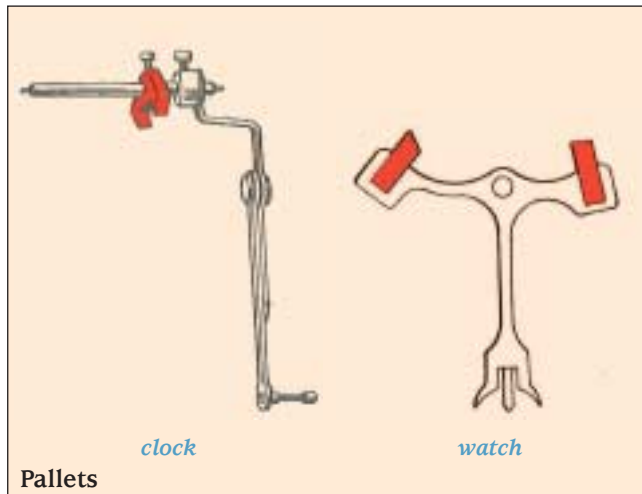
**Pallets with counterpoise:** In old watches, a counterpoise was screwed to the pallet-arms to balance the pallets and the fork. In well-made watches, the pallets and counterpoise were a filing and polishing job typical of the fine work devoted to the minutest details of watch construction.

**Jeweled pallets:** Watchmakers' term for the pallet arms complete with their stones.

**Straight-line lever:** short for straight-line lever escapement, in which the centers of rotation of the balance, escapement and pallets lie along a straight line.

**Right-angle lever:** in which the centers of rotation of the balance, escape wheel and pallets are the points of a triangle.

**Pin pallets:** with steel pins perpendicular to the plane of the lever, instead of the pallet-stones used in the Swiss lever escapement. The pin-pallet escapement is used in cheap watches.



#### **Parachute:**

n. Old term denoting an endstone fixed to the end of a spring blade on the balance cock. This device was invented by A. L. Breguet, its object being to protect the balance staff pivot from axial shocks.



Parachute

#### **Pendulum:**

n. Heavy body suspended from a fixed point round which it can swing. The small oscillations of a pendulum are approximately isochronous (of equal duration); they are used in clocks for the measurement of time.

A clock pendulum is also called the balance, but to avoid confusion, horologists reserve the latter term for the circular regulator of a watch.

The idea of using the oscillations of a pendulum for measuring time is due to Galileo (1564-2632). It was Huygens, in 1657, who built the first pendulum clock.

**Simple pendulum or mathematical pendulum:** Ideal pendulum, i.e. a mass concentrated in a single point, suspended on a thread of constant form. Length of the simple pendulum for a few vibration-values per hour (V. p. h.) and per second (V. p. s.):

V. p. h.	V. p. s.	Length of pendulum
3,600	1	994 mm. Seconds pendulum
7,200	0.5	248.5 mm. Half-seconds pendulum
14,400	0.25	62.1 mm.

#### Compound pendulum or physical pendulum:

A clock pendulum is formed of the following:

1. The suspension, of the spring, knife-edge, or thread type.
2. The metal or wooden rod, generally cylindrical.
3. The bob, or principal mass of the pendulum suspended at the end of the rod. It may be a circular disc, a cylinder or a sphere. The bob can be shifted slightly in order to correct the period of the pendulum.

**Grid-iron pendulum invented by Harrison:** A compensation-pendulum using the differences in the dilatation of metal rods. Certain of the rods are of steel; if the temperature rises, they expand; others are of brass and expand in the other direction, giving a compensating effect.

**Mercurial pendulum (Graham pendulum):** A hollow cylinder containing mercury is suspended on a steel rod. If the temperature rises, the steel rod lengthens, while the height of the mercury rises. These two opposite effects compensate for the influence of variations in temperature.

**Invar-rod pendulum:** The coefficient of expansion of invar alloy is extremely low, and this type of pendulum does not need a complicated system for compensating the effects of temperature. A cast-iron or brass bob is sufficient to compensate for the very slight errors due to expansion.

**Wooden-rod pendulum:** According to the direction of its fibers, wood has a coefficient of expansion low enough for it to be used for making pendulums for clocks of ordinary quality.

**Cycloidal pendulum:** invented by Huygens. Isochronism is ensured by a pair of cycloidal blades called chops or cheeks. These guide the suspension-thread during the oscillation of the pendulum.

**Foucault's pendulum:** a 30 kilogram copper ball suspended on a steel wire 68 meters long, inside the Pantheon, Paris, in 1851. The ball was fitted with a stylus, which traced lines in the sand covering the floor. The plane of oscillation of the pendulum being invariable, the lines in the sand thus demonstrated the rotation of the earth.

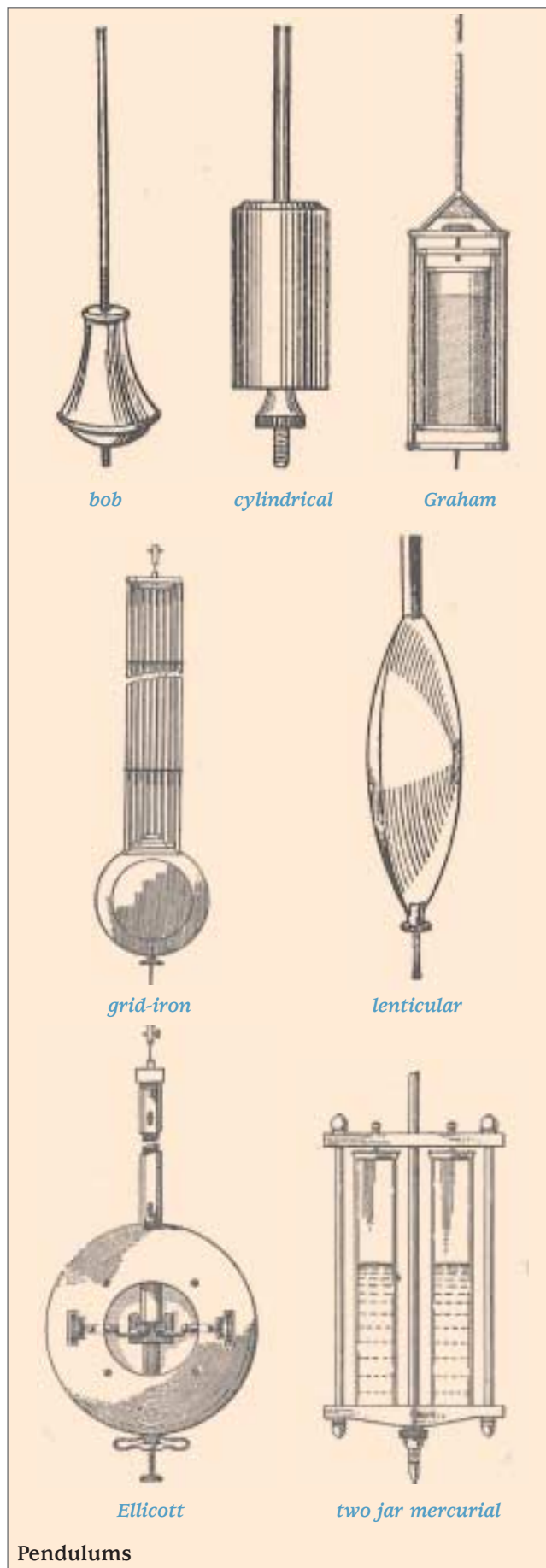
**Torsion pendulum:** consisting of a heavy weight attached to a fine wire (metal or quartz); the weight turns about the axis of the wire, which is twisted first in one direction, then in the other. The oscillations of this pendulum are isochronous. The torsion pendulum is most useful in the laboratory; it is also used in certain clocks designed to run for very long periods without rewinding. We should also mention a device that is called a pendulum, though it does not oscillate. This is the conical pendulum.

**Conical pendulum:** in which the weight, attached to a wire, revolves and describes a conical surface. When it is used in a clock, the hands have a continuous motion of constant speed, instead of the jerky movement characteristic of the hands of ordinary clocks.

**Gravity pendulum:** Oscillating system specially designed for determining the value of the acceleration of gravity. The principle on which the instrument works is as follows: a steel or quartz rod is fixed at its lower end to a strip of elinvar on a support; the upper end of the rod is free and oscillates freely in a vacuum. If certain precautions are taken, the oscillations of this pendulum are of constant amplitude and are particularly suitable for the rapid and accurate determination of  $g$ . The gravity pendulum for this special purpose was invented by the English surveyor Henry Kater and the horologist W. Hardy (1823). The instrument was perfected by F. Holweck and P. Lejay (1930).

**Horizontal pendulum (seismograph):** pendulum consisting of a very heavy weight fixed to a horizontal rod, one

end of which is pointed and turns in a heavy part anchored to the ground. A wire fixed to the other end prevents the rod from falling. Earth-tremors (seismic shocks) cause the pendulum to swing, and its slow oscillations are recorded (seismograms).



Pendulums



**Perpetual:**

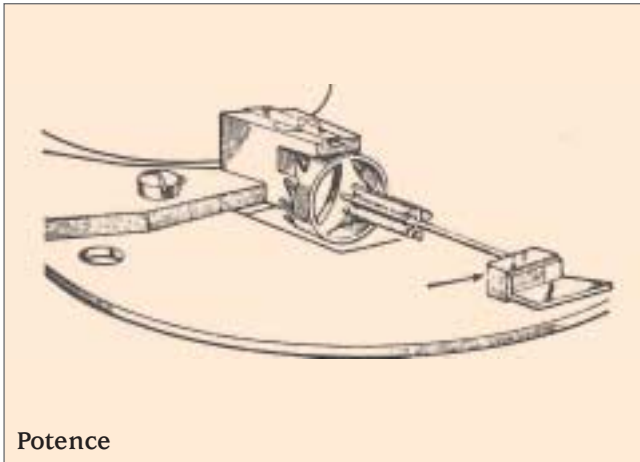
Perpetual watch, a self-winding watch thus named by its inventor, Abraham-Louis Perrelet.

**Pillar:**

n. Supporting piece. Antique watches had two plates connected by four cylindrical or conical pillars, with knobs and undercuts. From 1660, pillars were often tastefully decorated.

**Potence:**

A lower cock or bracket such as the lower support for the balance staff in a full plate movement.

**Power reserve:**

The going duration of a watch or clock.

**Regulation, adjustment, setting:**

n. Series of operations whose purpose is to put a machine into proper working order. In horology, the terms timing and rating are more usual. Prior to the actual timing of a watch, it undergoes the following operations: (1) pinning up the balance spring to the collet, centering and truing the spring; (2) poising the balance; (3) determination of the count point; (4) forming a terminal coil, if required; (5) pinning up the balance spring to the stud. Timing proper is the observation and correction of the rate in various positions and at different temperatures. In a factory, this is done in the timing department. There are various grades of timing, according to the precision required.

**Ordinary timing:** limited to observing the rate in only two positions, viz. dial up (D.U.) and pendant up (P.U.), and then correcting any marked errors.

**Réglage plat-pendu 30 secondes:** French term for ordinary timing in which the difference of rate between the D.U. and the P.U. positions does not exceed 30 seconds.

**Timing in positions:** timing of a watch in various positions. Also, timing in two, five or six positions.

**Timing at various temperatures (compensation):** in which the watch is observed for at least 24 hours in a refrigerator (4° C or 39.2° C.), then at ambient temperature (20° C. or 68° F.), and finally in an oven (36° C. or 96.8° F.). Watches are sometimes timed at higher or lower temperatures.

**Precision timing:** the quality of which corresponds to that required by the Swiss Official Watch-Testing Institutes. Watches are timed in 5 positions and at various temperatures, within prescribed limits.

**High-precision timing:** the quality of which corresponds to that required by an observatory. The tests are similar to those used by the Watch Testing Institutes, but the limits are closer and the tests themselves are of longer duration. Special tests are prescribed for marine chronographs, deck watches and clocks.

Precision timing is an art which demands a great deal of knowledge, as well as manual skill, for a watch must be free from any constructional defects if it is to have a stable, regular rate. Various functions of the watch, even though they are performed as perfectly as possible, affect the isochronism of the regulating organ (variations of motive power, irregular power transmission by the train and escapement, friction, bending of the balance spring, faulty poising, faulty fitting of the balance spring, etc.); it may also be affected by external influences (variations in temperature, pressure and density of the air, magnetism, shocks, jarring, dust, etc.) and by the thickening of the lubricants.

**Regulator:**

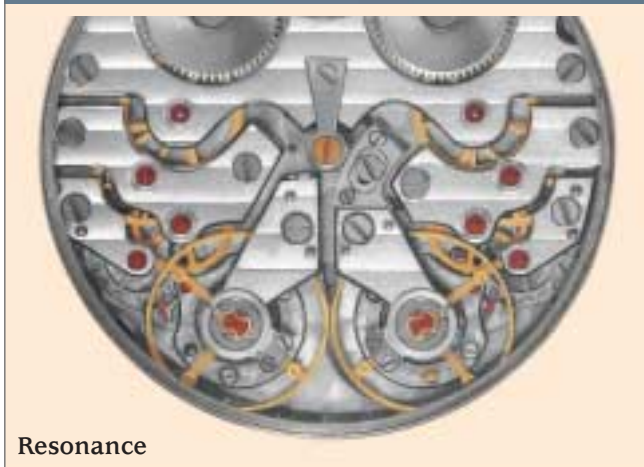
n. In chronometry, a precision clock used by watchmakers for verifying the rate of watches. Regulators first appeared in the late 17th century; they were fitted with seconds pendulums, and their only object was precision. For a long time, regulators were regarded as the most accurate of all timekeepers; they are now superseded by various types of clocks. In the late 19th century, the term regulator was used for a pendulum clock of poor quality, usually beating half seconds, with a wooden cabinet for hanging on a wall.

**Remontoire d'égalité.**

Old term used to denote the many mechanisms invented to obtain a constant transmission of driving power to the escape wheel. The modern term is "constant force device".

**Resonance:**

n. Phenomenon that occurs between two oscillating circuits or objects when the periods are equal or when one is an exact multiple of the other. The physical phenomenon of resonance forms an integral part of our daily lives, yet we scarcely pay any attention to it. When searching for a specific program on our radio, the radio crackles because the waves selected have not encountered other waves, those of the radio transmitter, until they become harmonized. Napoléon once forbade his troops to march in step over a bridge for fear of it collapsing from the effects of resonance! Although this phenomenon is proven and acknowledged, it is still difficult to explain. Until the recent years, the phenomenon of resonance was not well understood, but had already been pointed out as early as the 17th century by Christian Huygens, among other scientists. For instance, the highly precision Constant Pressure regulators, still in use less than 40 years ago at the Observatory of Paris for the Bureau International de l'heure and the radio broadcast time signal sent from the Eiffel Tower, were fitted in the Catacombs, at a depth of 26 meters to eliminate fluctuations in temperature and atmospheric pressure. They were also set in separate rooms, in order to avoid any resonance interference. However, as early as the end of the 18th century, only a few of the most eminent clockmakers found a way to take advantage of the



Resonance

phenomenon, by synchronizing the pendulums of regulators fitted with two independent movements. When applied to a watch, resonance ensures exceptional operating reliability and precision. When you make a sudden movement, the two movements clash in opposite directions and gradually come to operate in harmony as a result of the force of resonance. As they are inter-attracted, they oscillate together in union, an invisible wave linking the two balances.

#### Repeater:

n. Watch that strikes the hours by means of a mechanism operated by a push-piece or bolt.

There are various types of repeaters:

**Quarter-repeater:** sounding a low note for the hours and a "ting-tang" for each of the quarters.

**Five-minute repeater:** striking the hours, quarters, and five-minute periods after the quarter.

**Minute-repeater:** striking the hours, quarters and minutes.

**Grande sonnerie (grand strike):** striking the hours and quarters automatically and repeating when a push-piece is pressed down.

**Petite sonnerie (small strike):** striking the passing quarters only.

**Chiming repeater (Carillon):** in which the quarters are struck on three or four gongs or bells of different pitch.

#### Seal of Geneva:

Or "Poinçon de Genève", created in 1886 in order to identify watches made to Geneva's traditional watchmaking standards. There are twelve criteria that must be met before the seal of Geneva can be stamped on the movement of a watch.



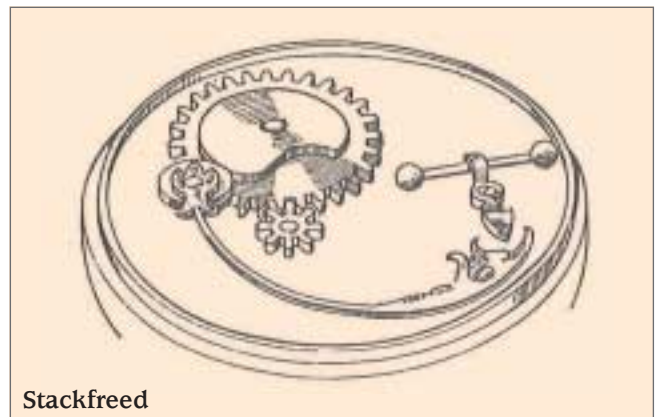
Seal of Geneva

#### Shock-resistant, shockproof:

Adj. Used of a watch whose movement is protected against shocks, i.e. fitted with a shock-absorber system. A.L. Breguet constructed an axial shock-absorber called the "parachute". (illustrated on next page)

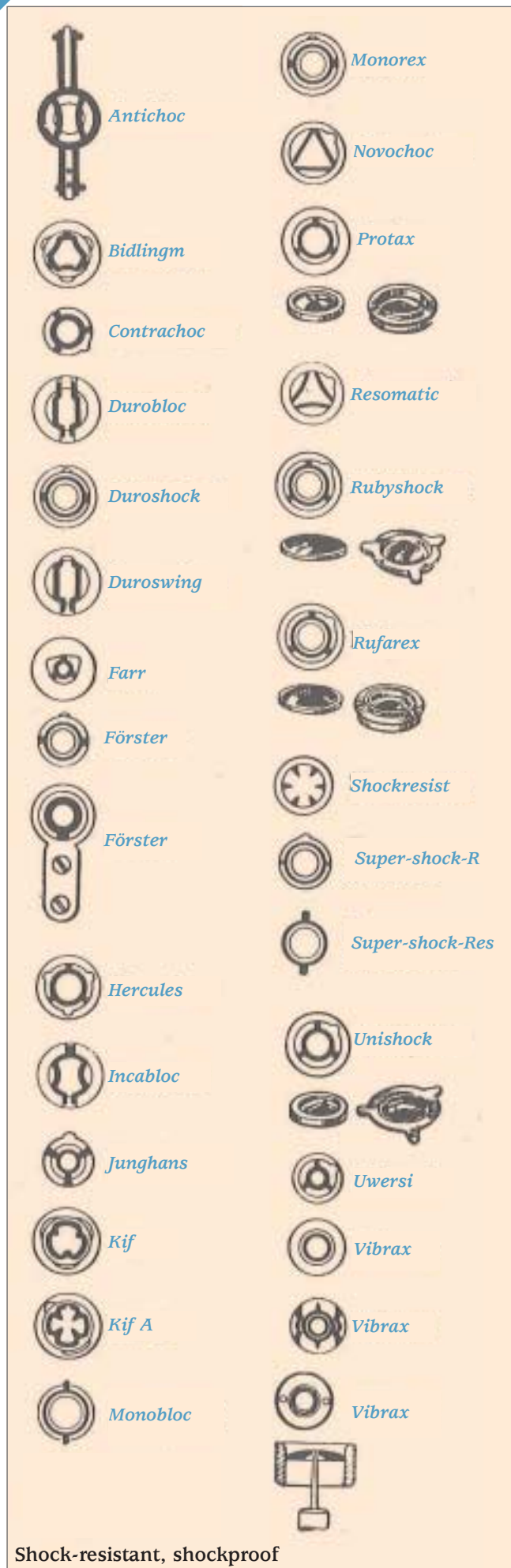
#### Stackfreed:

n. Mechanism utilized before the introduction of the fusée to watchmaking to equalize the driving power of watch springs, commonly found in German watches from the 16th and early 17th centuries. It consisted of a strip spring that was more or less deflected by a cam on the barrel arbor.



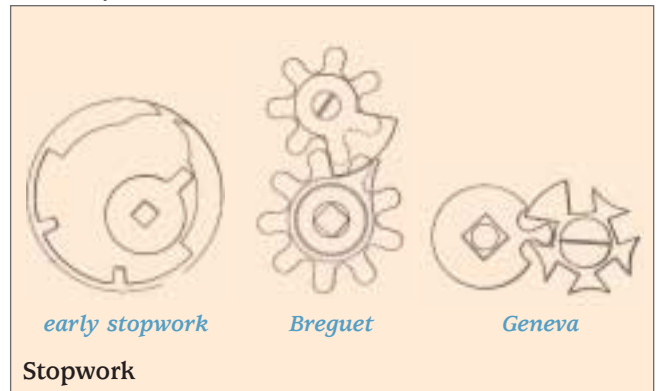
Stackfreed





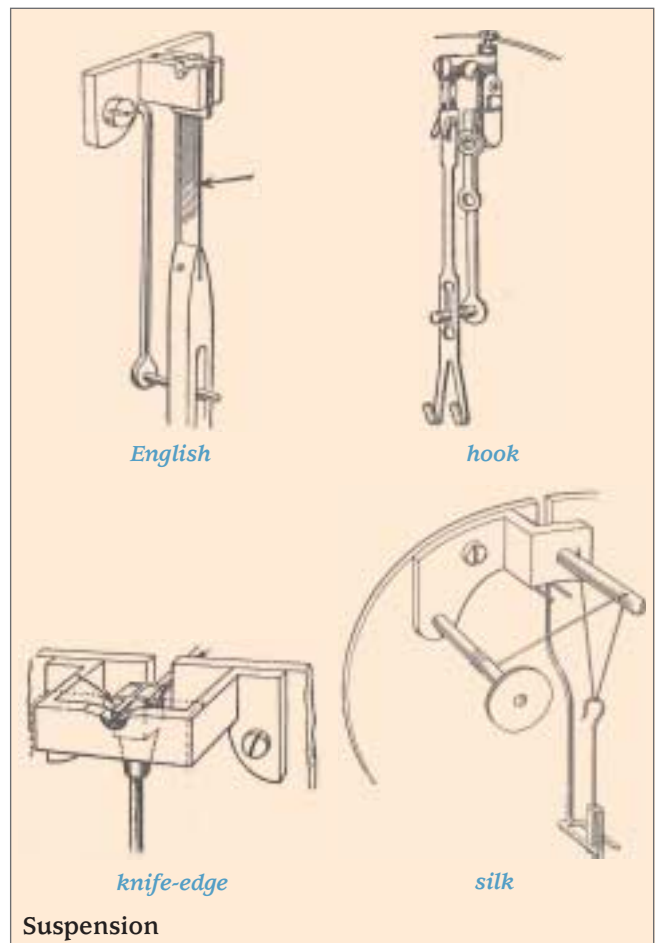
### Stopwork:

n. Device comprising a finger-piece fixed to the barrel-arbor and a small wheel called the Maltese cross, which is mounted on the barrel-cover. This mechanism limits the extent to which the barrel can be wound; it is almost obsolete today.



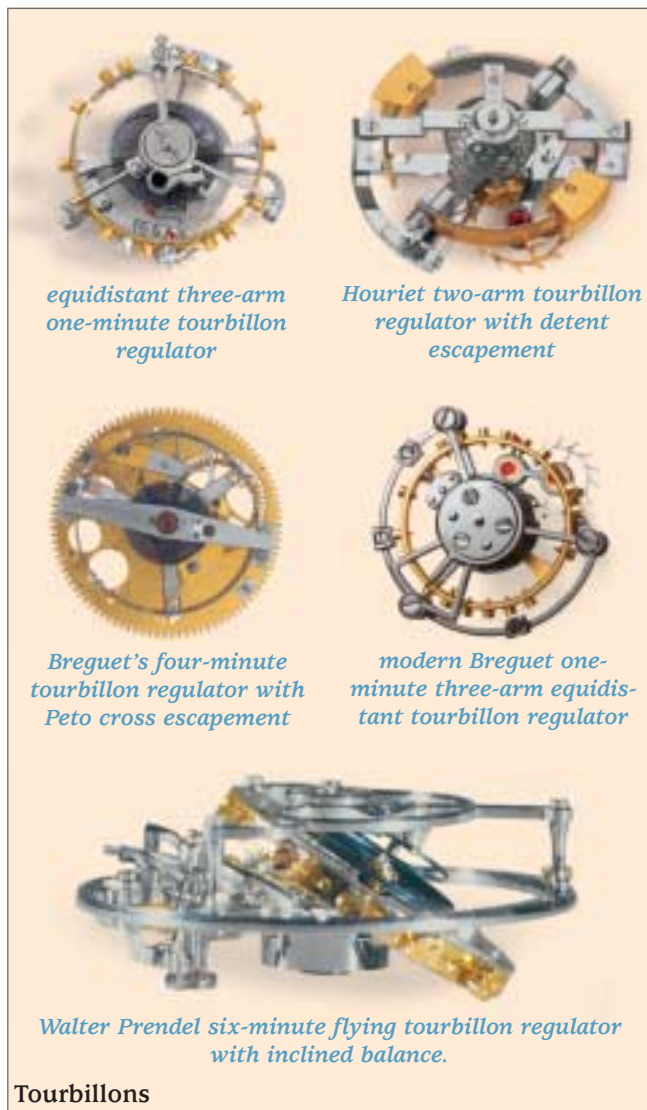
### Suspension:

Refers to the means by which the pendulum is hung, i.e. suspension spring or silk suspension.



### Tourbillon:

n. Device invented by A. L. Breguet in 1801 to eliminate errors of rate in the vertical positions. It consists of a mobile carriage or cage carrying all the parts of the escapement, with the balance in the centre. The escape pinion turns about the fixed fourth wheel. In most tourbillons, the cage makes one revolution per minute, thus annulling errors of rate in the vertical positions. This delicate, complex mechanism is one of the most ingenious mechanical devices invented by horologists. To simplify this mechanism and to make it sturdier, so-called karussel watches were designed, in which the carriage is driven by the third wheel, instead of the fourth wheel.



#### Train (gear train):

n. A mechanism formed of several successive gears. The timekeeping wheelwork of a watch or clock is the going train.

#### Trotteuse:

n. French term for a direct-drive seconds hand, especially a center seconds hand.

#### Undersprung:

Refers to the arrangement where the balance spring is fitted below the balance (in relation to the cock), frequently found in early English full plate watches.

#### Vibration:

n. Movement of a pendulum or other oscillating body, limited by two consecutive extreme positions. A pendulum that beats seconds makes one vibration per second. As a rule, a watch balance makes 5 vibrations per second, or 18,000 per hour. Two vibrations make up one oscillation.

#### Winding mechanism:

n. Mechanism that winds the mainspring or raises the weight of a timepiece.

**Winding and setting mechanism:** the two mechanisms are usually connected by common parts.

**Push-piece winding mechanism, imitating the push-pieces of repeater watches:** The repeated pressing and releasing of a push-piece on the pendant winds the mainspring. The movement is transmitted to the barrel by a rack and pinion (early 19th century).

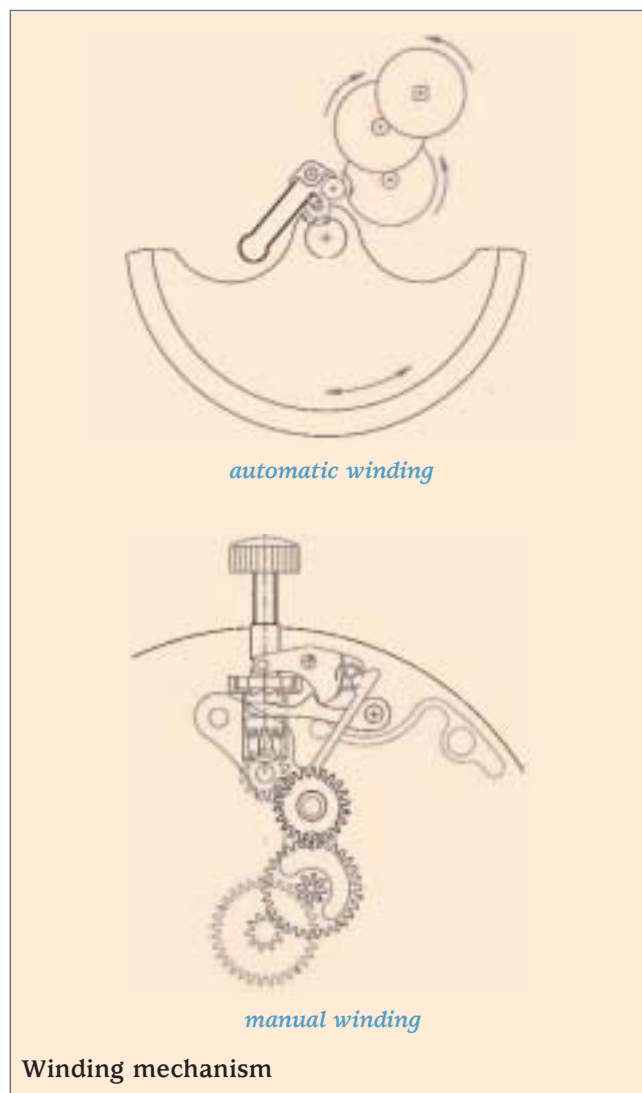
**Bezel winding mechanism:** A ring with teeth cut on

the inside is fitted free inside the bezel and can be turned from outside the case. It is geared to the barrel arbor. Invented by P. A. Caron de Beaumarchais in 1752.

**Pendant winding mechanism:** The ordinary "keyless" mechanism, in which the spring is wound by turning the winding button screwed to the winding stem.

**Automatic winding mechanism:** Mechanism for wrist-watches, used to wind the mainspring automatically, the driving power being supplied by the movements of the arm. Principle: the movements of the arm cause an oscillating weight to swing; this winds the mainspring by means of a gear train driven by a wheel.

**Endless rope winding mechanism:** This device invented by Huygens performs the same function as the maintaining power.



#### Literature:

Dictionnaire Professionnel Illustré de l'horlogerie, G.-A. Berner, 1961 edition.  
The Theory of Horology, C.-A. Reymondin, G. Monnier, D. Jeanneret & U. Pelaratti, 2003 edition.  
Watch & Clock Encyclopedia, Donald de Carle F.B.H.I., Third Edition 1983.  
Antiquorum database, [www.antiquorum.com](http://www.antiquorum.com).

#### Ills.

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Private collection.



## Part IV: Horological tools



*wheel dividing engine*



*brass face plate engine*



*rounding-up tool*



*fusée-cutting engine*



*wheel slotting engine*



*watchmaking bench equipped with face plate engine*