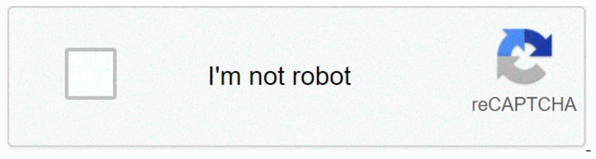

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Barolo atomic wall clock manual

The term atomic clock can evoke terrifying, 1950s-horror psychotic film: A Doomsday device, built by a lab coat wearing maniac in a mountain fortress, is ticking away seconds before it wipes out our entire planet. In fact, though, the atomic clock is one of the more benign inventions emerging from the explosion - unfortunately, perhaps not the best word choice - knowledge of the operation of the atom and its parts. That knowledge came after the Manhattan Project during World War II to develop the atomic bomb. Unlike bombs, though, atomic clocks do not divide atoms and they do not blow up. Instead, they use oscillation - that is, the change in the flow of the electric current - in between the nucleus of the atom and its surrounding electrons, in the same way an outdated grandfather clock could use a pendulum. Because the oscillation of an atom involves extremely small time units - a cesium atom, for example, has a frequency of 9,192,631,770 cycles per second - and is extremely consistent, a clock set to oscillating that can hold time much better than an old man clock [source: Britannica]. That is why, since the invention of them in the late 1940s, atomic clocks have become an important tool in a modern world dependent on technology. The atomic clock makes it possible to synchronize time on complex systems, from the Internet to global positioning satellite systems. But for something that has become a normal and useful part of our lives, the atomic clock remains a bit complicated and mysterious. Here are some strange and surprising facts about these useful devices. Back when humans began tracking the time that passed thousands of years ago, they did it by viewing the clear motion of the sun in the sky - which is actually due to the rotation of the Earth - and based on the time units on that journey. Traditionally, for example, a second is defined as 1/86,400 average length of a solar day. But with the advent of the atomic clock, which is much more reliable than the movement of the earth, it becomes necessary to change that standard. In 1967, the second period was re-defined as the time required for an atom of the isoe cesium 133 oscillating 9,192,631,770 cycles [source: Sciencemuseum.org.uk]. Advertising As we have explained before, electrons orbit the center of an atom, called a nucleus. Imagine an extremely small version of our solar system, with planets revolving around the sun, and you'll get the general idea. Est est scientists have discovered that electrons are often incredible in their motion - they tend to remain within a narrow orbital range, with distances from determined by the amount of radiation they release at a given time. The distance between the lowest orbit and the highest orbit that an electron moves is the frequency. In In of cesium, used in atomic clocks, scientists focused only on one of the element's 55 electrons - the outer one, which occupies a clear higher orbit than the rest. The difference in energy between the closest orbit of the outer electron along with the nucleus and its most distant orbit corresponds to a radio frequency of 9,192,631,770 cycles. That's one part that scientists actually use to calculate time and break it into extremely short units of less than a billionth of a second [source: Sciencemuseum.org.uk]. In 1948, the U.S. National Bureau of Standards built the world's first atomic clock. Instead of cesium, the first clock uses ammonia atoms, which are heated and fired out of a copper tube. While the first clock proved that the concept of atomic clocks worked, it was never really used to hold time. The first atomic clock is turned off about a second every four months. That makes it less reliable than an existing technology, quartz clock, which measures the oscillation of a piece of quartz when a electric current is applied to it. Eventually, scientists switched to cesium, which had shorter oscillation and improved design in a variety of ways. A 1959 model managed to keep time with an error of one second for every 2,000 years, and in 1964, the clock became so precise that it took 6,000 years for them to lose or achieve a second. Today, a modern atomic clock will be turned off for only one second after 6 million years of use [source: Sciencemuseum.org.uk]. Ads For beginners, it is sometimes spelled xêsi. Cesium was discovered in 1860 by Robert Bunsen, better known as the incinerator invented Bunsen. And it was strangely fascinating things that by the early 1990s it inspired the creation of an internet newsgroup, Alt.cesium, which was devoted to discussion, praise, reverence and admiration, posting songs, poems, stories and parables about and about the highest of elements [sources]. Nelson]. Commonly known as other gold metals, it is one of three non-glossy grey or silver metals (the other two are gold and copper) [source: Scientific American]. The type of cesium found in nature, cesium 133, is quite difficult to locate. The natural source of its largest quantity is a rare mineral called pollucit, which in the US is found in ores from Maine and South Dakota. Although it is metal, cesium melts at really low temperatures - 82 degrees Fahrenheit (22.7 degrees Celsius) - and explodes when exposed to cold water [source: Argonne National Laboratory]. In the air, it sometimes ignites naturally, burning with a brilliant blue flame [source: Nelson]. Ads You may be a little confused by this, given that we've spent all this time giving you much more accurate information Atomic clocks are caused by the fluctuating use of cesium. But part of the watch that actually holds the time is a standard quartz crystal oscillator, which objects a piece of crystal to the current to make it vibrate. The difference is that in most regular quartz clocks, the oscillating set is precisely adjusted when the watch is built, but its frequency is never checked or adjusted afterwards, which means that over time small variations develop that make the watch a bit fast or slightly slow. However, in an atomic clock, oscillation of cesium is used to check the frequency of quartz equipment, which is what gives the watch such great accuracy [source: Sciencemuseum.org.uk]. Advertising Just before 7:.m p.m. on December 31, 2008, scientists hurt atomic clocks around the world exactly one second in advance, to synchronize the International Coordinated Time (UTC), the international standard for atomic clocks, with Earth's rotation. It is not the clock that has been turned off, but the planet, whose rotational speed is slowed by about two milliseconds per day by a series of brakes: space dust, word storms, solar wind, resistance from its own atmosphere, and most importantly, pulling the gravity of the moon on Earth , which not only causes ocean tides, but also causes the entire planet to bulge. The effect of all that is to prolong the sun day, and throw it ever so slightly off compared to our super precision atomic clock. It will take hundreds of years for the difference to become noticeable, so that the position of the sun in the sky will differ from the time on the home clock, (which you may have set according to the exact time number, based on UTC). To prevent that from happening, in 1972, an international agreement decreed that the atomic clock would periodically be adjusted together [source: Dowling]. Advertising The idea that a person lives on a mountain ages faster than someone who lives on the beach may seem a bit ridiculous, but it is actually true. The concept was first advanced about a century ago by 2012 2012 by physicalist Albert Einstein, whose special theory of relativity suggests that time is not constant, but relative. (That's why they call it relatity theory.) In 2010, James Chin-Wen Chou and colleagues from the National Institute of Standards and Technology (NIST) conducted an experiment to test Einstein's reasoning. They placed the two atomic clocks about 30 cm apart from sea level, and found that the higher of the two clocks ran a little faster. However, in practical terms, the difference will not be noticeable; mountain dyn dyn people will be about 90 billion seconds faster during their 79-year life, according to Chow [source: Connor]. Ad If you've ever seen that scene in the movie Goldfinger in which the villain threatens to cut James In half with a laser, you may wonder why a laser won't burn a hole through an atomic clock, instead of making it run more accurately. But it can really do later. Endure with us because this becomes quite complicated. The atomic clock basically bombards cesium atoms with a microwave to stir up some action, which scientists can then measure. The limitation of ordinary atomic clocks is that they can only capture a small fraction of cesium atoms by microwave. By inserting atoms into a laser beam - a process known as laser optical pumping - you can slow down the speed of atoms, giving microwaves more opportunities to hit them. That, in turn, generates a more accurate signal, allowing scientists to use cesium oscillation to mark the time more accurately. Strangely, the process also cools the cesium atoms, right down to a few millionths of a degree above absolute air on the Kelvin Scale [source: Buell and Jaduszliwer]. Advertising These days, telecommunications companies transmit phone calls in bits and pieces called packets, allowing them to pump a large number of conversations through their wires at the same time. When you call someone in another city, your words are broken down and transmitted between computers at each end, swiping back and back between one conversation and another, thousands of times per second. For that to work, however, the two computers must stay in perfect sync, like an incredibly nimble pair of table football players who can hit the equivalent of a truckload of small balls into each other at brilliant speeds and never miss even one. If they miss, the calls will get messy and sound like nonsense. That's why telecommunications companies these days have their own atomic clocks to prevent this from happening, by keeping computers almost perfect in step together all the time [source: Sciencemuseum.org.uk]. Advertising Scientists continue to dream up ways to make atomic clocks more accurate, but researchers at the Georgia Institute of Technology and the University of Nevada recently proposed a truly mind-blowing advance. In immensely oversimplified terms, here's the deal: They want to use lasers to rearrange fragments of an atom, so that they can use a orbiting neutron, rather than an electron, the equivalent of a pendulum. The result can be a watch 100 times more accurate than any existing one, so precise that it will only take or achieve less than a twentyth of a second in 14 billion years. Consider this: The universe itself is about 14 billion years old, so if this clock can somehow be sent back in a time machine by the time the big explosion starts everything, it still will ticking along today, in almost perfect steps with every moment that has ever happened [source: Everyday Science]. Rolex's name is meant for luxury. But how did Watch company becomes one of the most famous brands in the world? HowStuffWorks explains. I have always been fascinated with holding time and clocks, and as an elementary school student in the 1960s, I first learned about the magic of atomic clocks that can measure small units of time with incredible accuracy. But until I started doing research for this piece, it never occurred to me that it was possible to build a clock that was more accurate at holding time than the rotation of the Earth. But since the atomic clock has been used to prove Einstein's theory that time is related to a person's position and velocity rather than constant, I have to wonder whether there really is such a thing as the exact time at all. I think I'll use that as an excuse the next time that I'm late for a deadline! Related article Atomic Clock. Sciencemuseum.org.uk. (April 17, 2012) Walter F. and Jaduszliwer, Bernardo. Atomic Clock Meet Laser Cooler. Cross-linking. Winter 1999. (April 17, 2012) David. Caesar. American science. March 13, 2012. (April 17, 2012) Steve. Lower life slows the ticking of the clock. New Zealand Herald. September 25, 2010. (April 17, 2012) . Argonne National Laboratory. August 2005. (April 17, 2012) Danielle. Why Wait a Second: Why 2008 Is a Long Year. Time. December 31, 2008. (April 17, 2012) 8599,1869250,00.htmlNelson, Randall. FREQUENTLY asked questions about Cesium and alt.cesium. Rochester.edu. (April 17, 2012) action. Merriam-Webster Dictionary. 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