



Antique Wireless Association of
Southern Africa
Newsletter



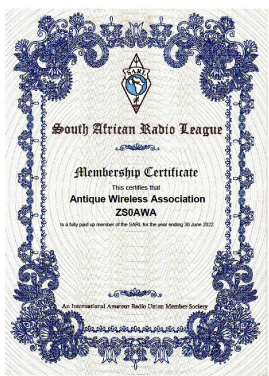
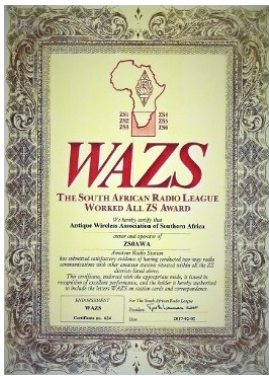
236

March 2026

EG1912T

THE TITANIC MEMORIAL





Inside this issue:

Reflections	2
The Wireless History of the Titanic	3-11
Electronics Dilemmas and Paradoxes	12-13
Notices	14-15

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Reflections:

As a CW op, still in training, I have read and heard many stories and watched movies where CW is the hero. The times that it has saved the day because of messages that have been transmitted at just the right time.

Behind all of these messages, the hero really has to be the operators that have sat diligently making the time to get the message out, their own safety not being a factor and the story of the radio operators in the Titanic is one of those.

Messages that were relayed by spies during the war always seem to spark the greatest enthusiasm because of the nail biting times where being discovered played a role. The small QRP radio's that were so disguised to avoid detection and the lengths that opposite parties went to, to search out the transmissions.

Also the receiving stations that were scattered throughout the UK, manned by so many people who were so expert at reading Morse.

I'm sure there are many of you who have your favourite movie with these exact kind of scenarios being played out.

The role of the operators on the titanic is not something as nail biting as many of these war stories and spy movies were, but none the less they were as heroic as any.

Lets face it, CW is not just anyone's cup of tea. I know that personally it took quite some effort to learn to read CW, as I am sure with many of you who went through the process. I could send at 20 wpm long before I could read at that speed, and that is why I could appreciate more and more, the skills of those who sat behind radios deciphering codes and getting it all perfectly right each time.

There are many photo's of the rows of radio's that were in use at Bletchley Park during WWII, mostly manned by women (if you can understand that one), each one with headphones, just receiving messages.

Someone who has never done CW cannot really appreciate the intricacies that were developed during the war. That's my opinion and I don't mean it to be insulting to

those who never learned morse code, so please don't take it as such.

I remember in my days of CW there were many who were quite prepared to remain ZR stations and stay only on VHF/UHF. They all had their reasons, mostly being that it was a dying means of communication and had no use in amateur radio.

Here we are, 40 years down the road, from when I started, and CW still holds its own with many new and young hams learning how to do the code. As well as the old timers who have never used a microphone.

Just go to the CW edge of the band when things are running well, and listen to all the stations still out there pounding brass.

I tried to get the 3YOK station on freq in CW the other day and there was such a pile up, I eventually gave up. That's why I say, "Still in training". I am hoping that by some stroke of luck I may still get the opportunity to log them in CW.

In this issue is a tribute to the radio ops of the Titanic which has been written by Carlos Reboreda, EA1PJ after gathering data and putting it all together. I am sure you will all enjoy reading this article reprinted with permission after they approached me to include it in our Newsletter. I am sure there will be many other publications that will include it.

To those of you out there still pounding brass or paddling away on electronic keyers, keep up the good work. I am sure that CW will still be around in another 40 years, because some people just wont allow it to die.

Here's wishing you more strength to your arm and may the Morse be with you.

Best 73

Andy ZS6ADY

EG1912T - Titanic Memorial

From April 10 to 15, 2026, **EG1912T** will recreate every moment of the Titanic's 1912 voyage. The Union de Radioaficionados de Vigo-Val Miñor aims to honor the passengers and crew aboard the ship, especially the two men in charge of communications, the Titanic's telegraph operators. This tribute will honor those individuals from the early 20th century who embarked on the "journey of their lives," many of whom met their fate on this voyage.

Those who contact **EG1912T** on any band or mode will receive a QSL card via the QSL bureau managed by the URE (Unión de Radioaficionados Españoles). They will also receive electronic confirmation through the usual methods. Amateur radio operators who communicate using Morse code will receive a special QSL card in honor of the Titanic's telegraph operators. This card is also a reward for those who hams work tirelessly to preserve the world's oldest mode of radio transmission.

EG1912T will begin transmitting on April 10, the day the ship set sail from Southampton, and will cease transmissions on April 15, the fateful day the Titanic sank off the coast of Newfoundland after her hull broke in two.

The document you are about to read is a compilation of data extracted from various sources, which was not an easy task to verify.

The result of this modest investigation is the account we now present to you. In it, we recount the events that took place in the radio rooms of the Titanic and the Carpathia—the ship that was the first to come to the rescue.

Written by Carlos Reboreda, EA1PJ

The Wireless History of the Titanic

The Shack

The Titanic's radio room, also known as the Marconi Room, was located within the officers' cabin section and consisted of three rooms.

The layout of the radio suite is as follows: The Marconi Room

The Marconi Room was the height of luxury and technology at the time. It was the envy of any radio amateur. However, in 1912, amateur radio was in its infancy and unregulated. Professional telegraph operators tended to look down on the "radio amateurs" of that era. They accused us of causing interferences, even deliberately, and of being poor telegraph operators.

In any case, the early devices and antennas used by the precursors of amateur radio were nothing like the Titanic's magnificent 5 kW spark transmitter. Marconi "T" antennas ran across the ship from bow to stern to carry the transmitter signal as strongly and far as possible. This antenna, or something similar, is still in use today. DL8LAS has one of the strongest 160-meter signals with one of these "Marconi T" antennas.

At the frequencies used by the Titanic at that time—between 500 and 1,000 kHz (or between 300 and 600 meters)—communications could reach 800 kilometers during the day and just over 3,000 kilometers at

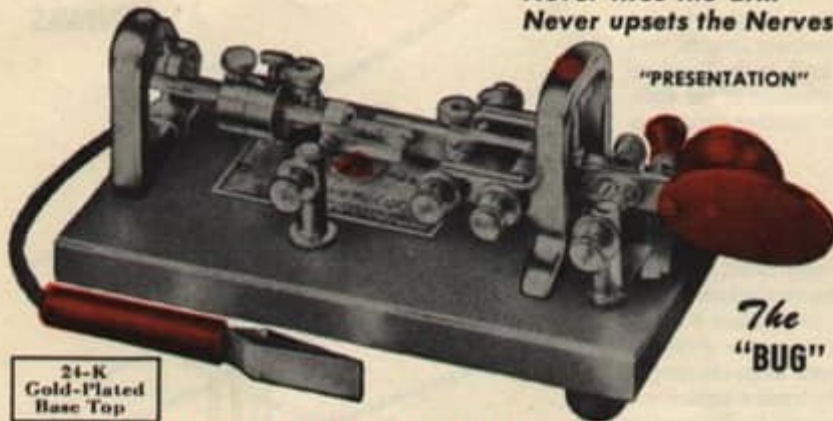


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night. Such capabilities were beyond the imagination of amateur radio operators of that era.

In addition to housing the transmitter and receiver sections, the Marconi room housed the most important element for Marconi: a tube through which large numbers of telegrams sent by passengers to their friends on land arrived. This is a key issue in the history of the shipwreck, as we will see later.

In addition to the telegraph keys, the radio room had several synchronized clocks because the Titanic crossed different time zones during its voyage.

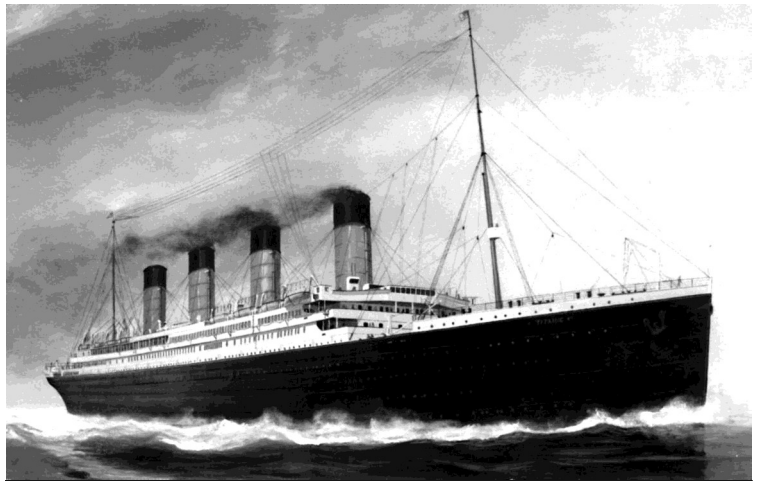
Finally, there was a spare battery-powered transmitter in case the ship's main power failed.

Radio Suite Layout: The Silent Room

One of these facilities' many new features was the construction of a soundproof room. This room was built to isolate the noise generated by the 5 kW rotary spark transmitter and the transformers that powered the equipment.

Radio Suite Layout: The Operators' Cabin

After working endless days and sending hundreds of "Marconigrams" (telegrams sent from Marconi transmitters), the operators were given a small cabin next to the radio room. The place was equipped with bunk beds, a wardrobe, and a sink so that the operators could rest near their workstations.



Detail of the Marconi T-Antenna on the RMS Titanic

The First Radio Contacts

The Titanic was built in Belfast, Northern Ireland, and set sail from there on April 2, 1912, to conduct tests with the radio station. According to Jose Davila Dorta, EA8EX (RIP; today, his son Ruca retains the call sign), that same afternoon, local low-power contacts were made to begin adjusting the antenna, transmitters, and receivers in an article kept in the EA4DO historical archive. The sea trials were so successful that the captain decided to continue on to Southampton without returning to port.

The next day, once the adjustments were complete, a full-power test was carried out: "V V V CQ DE MGY."

The Tenerife Radiotelegraph Station answered this first call. The distance reached was 2,000 nautical miles (about 3,700 kilometers).

This makes Tenerife part of Titanic's "wireless history."

Another contact with the Port Said radio station in Egypt, 3,000 nautical miles (about 5,500 kilometers) away, confirmed to the telegraph operators that the Titanic's radio station was ready for the voyage. The Titanic set sail for New York on April 10, 1912.

MGY

The Titanic's radio station was initially given the official call sign "MCU," but it was discovered a few days later that MCU had already been assigned to the U.S. ship "Yale," so the call sign was changed to "MGY." The "M" indicated that the radio was built by Marconi (a "T" would have indicated Telefunken). The second letter identified the ship's country; in this case, G stood for Great Britain. The Y identified the Titanic.

Let's talk about three telegraph operators from the early 20th century: John George "Jack" Phillips, the officer in charge of the Marconi room; Harold Sydney Bride, his second operator; and Harold Thomas Cottam, the telegraph operator on the RMS Carpathia, the first ship to come to the aid of the Titanic. This is the story of the last "dots" and "dashes" transmitted by MGY: the RMS Titanic.



Jack Phillips, head of the Titanic's radio room.



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TYPICAL OPERATION

	Class AB ₁	Class C Phone
D-C Plate Voltage	1000 volts	1000 volts
D-C Screen Voltage	400 volts	250 volts
D-C Plate Current	250 ma	200 ma
D-C Screen Current	30 ma	20 ma
D-C Grid Current	0 ma	15 ma
Driving Power	0 watts	2 watts
Plate Power Input	250 watts	200 watts
Plate Power Output	150 watts	150 watts

The plate power output shown does not allow for circuit losses. The 4X150A may be operated at maximum ratings up to 500mc.

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Harold Bride, second operator
in the radio room

The first warnings

April 12, 1912, the second day of sailing. The Titanic receives at least 12 warnings of blocks of ice floating in the Atlantic from other ships in its vicinity. The messages are forwarded to the bridge, the course is changed to less cold areas before heading towards New York. The Captain orders that the lookout posts be reinforced.

The radio breaks down

That same night, on the 12th, the radio station experienced a problem. A breakdown rendered the radio unusable. Phillips and Bride, ignoring Marconi's instructions, tried to locate the fault, which they would not find until many hours later.

Full speed ahead!!

The Titanic maintained its speed of 22 knots, and the lookouts scanned the horizon on a clear night with calm seas. Were those good conditions to detect an iceberg?

Definitely not, and even less so without being able to use binoculars. The calm sea makes it difficult to see the icebergs because there are no waves that hit them, and the characteristic foam is not produced, which would allow the lookouts to suspect the existence of a mass of ice floating in the water.

Why couldn't they use binoculars? Because the person accountable for them was replaced and did not board. Incomprehensibly, he did not report the place where he kept the binoculars or hand over any key.

The radio works again!

13:40 UTC on April 14. Finally, the fault appears. A very long repair, but it must be said in protection of Phillips and Bride that they were not radio technicians, although they had knowledge, they were just telegraphy operators; Marconi specifically had specialized technicians who were the only ones authorized to perform repairs on its radio stations.

Many hours have passed with Titanic's radio unable to transmit or receive. Up to that point, over 250 telegrams had been transmitted, and they had another 200 more telegrams piled up on their desk waiting to be sent. Messages, mostly inconsequential, but meant a good source of income for Guglielmo Marconi's company.

However, that is not the worst consequence of the breakdown. During all those hours without radio, the Titanic stopped receiving a good number of messages from various ships, warning of masses of ice floating in those waters.

With the radio working again, two more ships, the RMS Mesaba and the SS Californian, warned the Titanic of how close their ships were to large masses of ice, but for unknown reasons, those messages were never considered.

MGY (Titanic), we stopped the engines, we are surrounded by ice!

The SS Californian, barely 20 miles away from the Titanic, warns that they are in the middle of large masses of floating ice. The telegraphist of the Californian, on the orders of his captain, insists on reporting the seriousness of the situation. Jack Phillips confirms that he has received the message and asks the Californian telegraph operator not to bother him anymore so that he can continue with his passenger telegrams.

At 23:30 UTC on April 14, 1912, Cyril Evans, the Californian's radio operator, tired after a long shift at work, certain that the Titanic had already been informed of the danger and seeing that the Titanic's only concern was to transmit messages to passengers, turned off the radio and went to sleep.

Iceberg in sight!

23:40 on April 14, 1912. A lookout alerts of an iceberg ahead. Captain Smith was resting in his cabin, replaced on the bridge by the first officer, William McMaster Murdoch, who ordered a desperate turn to port (left) to try to avoid the iceberg to starboard (right), but it was too late, they were sailing at 22 and a half knots, almost 42 kilometers per hour. The Titanic collides with the iceberg.

The collision

Some researchers currently question the long-accepted account that the iceberg opened large cracks in the starboard side of the ocean liner. Instead, they believe that the Titanic dragged its bottom over a submerged part of the iceberg, creating countless small holes that allowed water to seep into the hull. This theory is supported by new 3D models and was suggested in the National Geographic documentary *Titanic: The Digital Resurrection*. The discoverer of the Titanic, Dr. Robert Ballard, referenced this theory long before his death and revealed his conviction that the Titanic's hull had serious structural problems and construction material quality issues.

There are other conspiracy theories, in which the sunken ship was not the Titanic but the "Olympic", with an alleged strategy to collect the "Olympic" insurance.

Another, even more extreme theory, suggests that J.P. Morgan planned to put an end to the millionaire John Jacob Astor, the mining magnate Benjamin Guggenheim, and the co-owner of Macy's Isidor Straus. This was allegedly done because they were blocking the creation of the North American central bank, which we know today as the Federal Reserve of the United States, created a year later. However, we will not delve into those depths.

Be that as it may, after the collision, the captain of the Titanic returns to the bridge and requests a damage report. He then goes to the Marconi room, gives Jack Phillips a background on what happened, and alerts him to the possibility of having to transmit a distress call.

35 minutes lost

For 35 minutes, life does not change much aboard the transatlantic, in fact, in the radio room, Jack Phillips, overwhelmed by the amount of unsent messages, continues transmitting the usual telegrams of the passage to Cape Race.

00:15 UTC April 15, 1912. Jack Phillips wearily transmits one more telegram:

"TITANIC TO CAPE RACE: GEORGE SIMUND. NEW YORK. DELICIOUS TIME. IT FEELS GOOD TO ME. I HOPE EVERYONE."



Harold Cottam,
telegraph operator
on the Carpathia

We sink!

Captain Smith bursts into the radio room and orders the "CQD" signal (Marconi's maritime distress call) to be transmitted. The following message that is sent drastically changes its content:

CQD DE MGY (Titanic call sign)

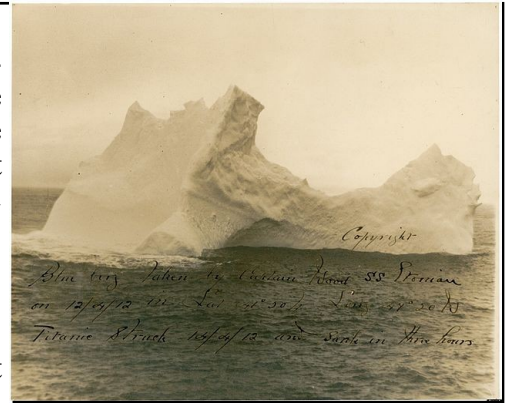
(Like this up to 6 times)

POSITION: 41.44N 50.24W (The position would be corrected minutes later to 41.46N 50.24W and later to 41.46N 50.14W, probably due to the ship's drift).

First responses to the "CQD"

The first ship to answer the distress call was the RMS Frankfurt, a slow ship far from the area. Phillips continued transmitting "CQD" until shortly afterward when he received a reply from telegraphist Harold Cottam, of the RMS Carpathia, which was the first ship to arrive at the wreck site, four hours later.

Starting at 00:45, Harold Bride proposes to his boss to transmit "SOS", the new maritime distress call that, since 1908, began to be used to the detriment of Marconi's "CQD".



The iceberg that the Titanic allegedly collided with. Photo taken on April 12, 1912, by W.F. Wood, Captain of the S.S. Etonian.

“SOS”, of German origin, is faster to transmit and more recognizable than “CQD”, especially in unfavorable reception conditions. Contrary to what many people think, that is the only reason why those three letters were chosen. It does not mean “Save Our Souls” or “Save Our Ship” and they were already used for several years before. It was the RMS Slavonia, in 1909, the first ship to broadcast an SOS. It is simply a very recognizable sound, even for people who do not know Morse code.

What the hell happened to the Californian?

The SS Californian was 11 miles from the site where the Titanic collided with the iceberg, as established by subsequent judicial investigations conducted after the sinking of the liner. The Californians saw the white flares launched from the Titanic at 00:55 UTC.

The captain of the SS Californian, Stanley Phillip Lord, who was sleeping in his cabin, was informed and asked how to proceed. The captain responded that these were not distress signals but identification signals from the shipping company. At trial, Captain Lord claimed that he did not remember that conversation, perhaps because he was asleep.

The commanding officer, Herbert Stone, ordered that an attempt be made to communicate with the "ship in sight" using the "Morse lamp", light signals, to which the Titanic did not respond.

Why such a nonsense?

The reason Stone didn't wake up the Californian's radio operator is unclear for the justice system. The sailors on duty observed that the ship next to them was getting smaller and smaller, so they concluded that it was moving away under its own power. The truth is that what was being witnessed was probably the sinking of the Titanic.

The justice system considered these events as a serious act of negligence. Captain Lord was fired from the Leynard Line shipping company, and Second Officer Stone took responsibility for being the one on watch on the bridge.

Phillips, Bride, abandon the Titanic now!

Given the imminent sinking of the Titanic, at 02:10, Captain Smith relieved the two radio operators of their duties. However, Jack Phillips insisted on continuing to transmit as many distress calls as possible until the radio stopped working. In reality, they did not have to wait long: seven minutes later, at 02:17 UTC, the generators room flooded, and the Titanic went into permanent “radio silence.”

Every person for himself

With no possibility of recovering the transmitter, Jack Phillips and Harold Bride quickly left the Marconi room. The panorama they found when they came out on deck was devastating: the bow of the Titanic was already visibly sunk in the water, so much so that the stern, very high above the sea, showed off the gigantic propellers of the ocean liner. Music sounded, emanating from somewhere at the height of the third chimney, and it mixed with the terrified screams of people running from one side to the other, looking for a boat to get on and save themselves from certain death.

The lifeboat

Bride hears someone yelling at him. He recognizes the voice immediately, it was that of the Titanic's second officer, Charles Lightoller, who was asking him for help to put a folding lifeboat into the water. Together, with other members of the crew, they deployed the ship, just at that moment, at 02:18 UTC, the hull of the Titanic split in two. One of the davits supporting the boat breaks, causing it to turn and land face down on the deck of the Titanic.

According to various sources, Jack Phillips, ran to the stern of the Titanic at that moment, looking for an alternative to that apparently useless boat. That was the last time Bride saw Jack.

The two miracles

Harold Bride was trapped under the lifeboat that had just fallen onto the deck. The fate of the Titanic's second telegraph operator seemed written; however, fate can be very capricious, and on this occasion, it played in Bride's favor. When the hull splits in two, water floods that part of the ocean liner's deck. The boat floats upside down and slowly moves away from the Titanic because of the waves caused by the chimneys that collapsed on the surface of the sea.

Bride, still under the lifeboat, saved his life thanks to the air bubble that remained under it. Up to fifteen

people then got on top of that boat, which Bride himself later climbed onto, with clear signs of hypothermia and frostbite.

Charles Lightoller, who unsuccessfully helped prepare another lifeboat, jumped into the water at the last moment, miraculously ending up in the same boat as Bride. From there they witnessed how the Titanic disappeared in the cold waters of Newfoundland at 02:20 UTC, after breaking the hull in two, with hundreds of people on board. Charles Herbert Lightoller, second officer of the RMS Titanic, was the last survivor to be rescued by the Carpathia.

The wrong place to be

The stern of the Titanic was the last part of the ship to sink. Some of the engineers who designed the Titanic did not tell passengers the whole truth during the sinking. They told them not to worry because the ship was divided into independent, unsinkable compartments, making the stern seem like a safe place. It was not.

Even if such a theory were true under those conditions, the hull fracture was not clean and part of the Titanic's bow was left pulling the stern towards the seabed. Inevitably, the stern sank, killing hundreds of people from drowning or trauma from falling from the stern into the water.

The legend

Right at that precise moment, at 02:20 on April 14, 1912, a telegraphist named Jack Phillips became a legend.

Nothing was heard from him again, his body was not rescued or identified. Jack was not as lucky as his subordinate. The irony of fate meant that the person who got a multitude of ships to respond to his requests for help, including the RMS Carpathia, which was the first to arrive at the site of the shipwreck, was unable to help him, nor the hundreds of other people who had already sunk with the Titanic two hours before.

Jack Phillips remained at his radio position above and beyond the call of duty. He wanted to send every last "dit" and "dah" that the Titanic allowed him to transmit, without caring about his life.

In teamwork with Bride, he ignored Marconi's orders and repaired the Titanic's radio, without any fear of reprisals for disobedience.

The other hero

Harold Bride was later transferred to the Carpathia, where, very affected both physically and emotionally, he assisted the steamship's telegraphist in sending messages to the families of the people who had survived the most memorable maritime accident in history.

Mysteries at 3800 meters of depth

The reason why the iceberg warnings received and supposedly sent to the bridge by Jack Phillips were not taken into account, the reason why the SS Californian did not give aid to the Titanic despite having it in sight, are mysteries that sank with the ocean liner and the 1,496 people who could not be saved on April 14, 1912, at 02:20 UTC. Seven hundred and twelve persons saved their lives thanks to the sailors and three telegraphists, whose pulses did not tremble until the last "dit," until the last "dah."

Manifesto for Telegraphy

This memorial honors three telegraph operators: Jack Phillips and Harold Bride from the Titanic and Harold Cottam from the Carpathia. It serves as a reminder to administrations, amateur radio associations, and amateur radio operators around the world that Morse code and CW are fundamental to the heritage of amateur radio operators and society as a whole. We must safeguard this heritage and pass it on to future generations.

We should respect all modes of transmission but not abandon the first. If administrations do not require training for telegraph operators, associations and individuals must rebel against that decision and generate interest in telegraphy to train future CW operators.

You may believe that telegraphy deserves to be considered an intangible cultural heritage. Various bodies have promoted this proposal since 2011, including the International Amateur Radio Union Region 1 (Europe, Africa, and the Middle East). In 2014, associations such as the Deutscher Amateur Radio Club



(DARC) succeeded in having Morse code included in Germany's National Register of Intangible Cultural Heritage, which was a necessary preliminary step for UNESCO candidacy.

In the Netherlands, the VERON (Vereniging voor Experimenteel Radio Onderzoek) is also working toward this goal.

Several communities in Belgium have joined this petition and achieved acceptance of this recognition at the national level.

In Spain, members of the Spanish Radio Amateurs Union (URE) strongly support raising awareness among governments about Morse code's place in history. One example is the Radio Club Liria, which carries out outreach work to raise awareness of the importance of Morse code as a shared heritage.

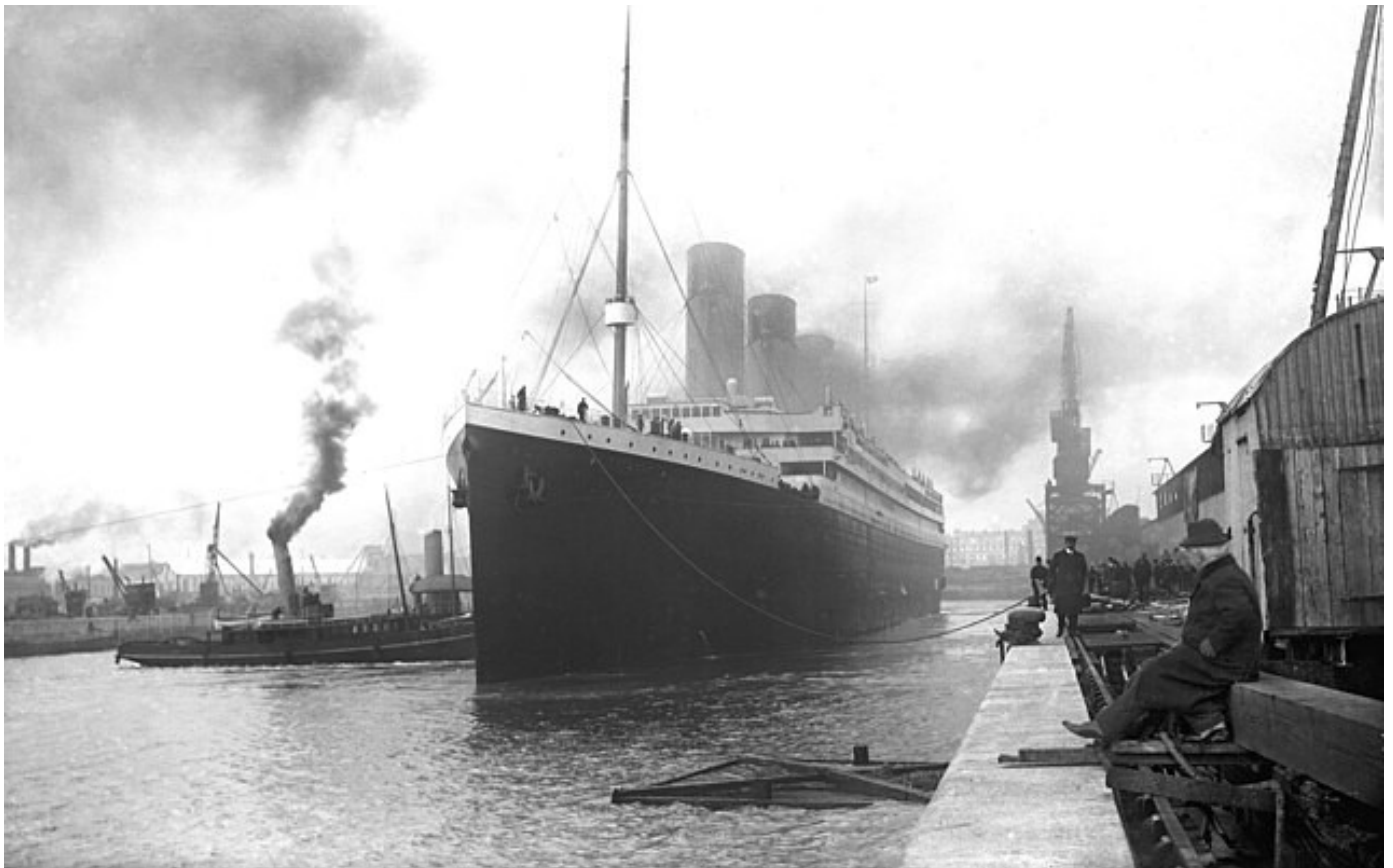
The memorial of these three telegraphists, Jack Phillips and Harold Bride of the Titanic, and Harold Cottam of the Carpathia, serves to honour their memory. It also reminds us, the administrations, the radio amateur associations, and the radio amateurs worldwide, that Morse code and CW must be safeguarded as a fundamental heritage for radio amateurs. We must strive to transmit this heritage to future generations, from generation to generation.

Let's respect all modes of transmission, but let's not neglect the first of them all. If administrations do not mandate the training of telegraphy operators, let the associations themselves, and all of us, stand against that decision. Let us strive to generate interest in telegraphy and train future CW operators.

The Titanic Memorial Organization wholeheartedly support this initiative. We want to raise awareness among the Spanish amateur radio community, the URE, and all relevant institutions so that this initiative can be debated in Spain as it already has been in other countries.

As telegraph operators, we do not want to be like the Titanic orchestra. This cannot be our last song before we disappear.

There is still a collective memory of telegraphy. Do not allow this to happen to our history. Telegraphy deserves to be recognized as part of humanity's heritage.



The RMS Titanic departing Southampton on April 10, 1912.

Conceptual dilemmas in electronics (and other fields) often arise from foundational misunderstandings that can be resolved through rigorous analysis. This *Popular Electronics* magazine article addresses three primary paradoxes that frequently confuse beginners. First, the "plus-and-minus" debate regarding current direction is clarified as a semantic convention: while electrons physically flow from negative to positive, the historical definition of current often assumes the opposite direction, provided one remains consistent. Second, the capacitor-charging paradox, which seems to contradict the near-light-speed transmission of electrical energy, is explained by accounting for hidden resistances in circuit components, which regulate the charging rate. Finally, the "sky-rocketing voltage" phenomenon in transformers is revealed not as a violation of energy laws, but as a product of saw-tooth waveforms and self-induction during rapid field collapse. Ultimately, these electronic mysteries are rarely true contradictions, but rather incomplete observations that dissolve once all physical variables are correctly identified and applied to established electrical principles.

Electronics Dilemmas and Paradoxes



The disturbing thing about logical quandaries is that they often form an insecure foundation for knowledge that is later to come. Start with one wrong concept and you are likely to find that your entire superstructure is unsound. The way to avoid a tragedy like this is to think your way through conceptual problem situations at the very beginning.

Let's peek in at some electronic dilemmas and paradoxes to observe how they fall to pieces under the right kind of attack. We'll begin with one of the simplest of all, yet one that can cause no end of trouble for the beginner.

Plus-and-Minus Dilemma

Does an electric current flow from plus to minus or from minus to plus? Some textbooks read one way on this subject and others state the opposite case. To resolve this question once and for all, it is essential that the phrase "electric current" be properly defined and - what is more important - that this definition be accepted by everyone. We know that an electric current is a movement of electrons in a conductor. Since electrons are negatively charged particles, they must flow toward a more positively charged region if they flow at all, in accord with the law of charges which states that unlike electrical charges attract each other. Thus, electrons must flow from minus to plus.

When an electrical engineering textbook speaks of an electric current as movement from plus to minus, the author is referring to the original convention (attributed to Benjamin Franklin) that was adopted before the discovery of the electron. Hence, he is defining an electric current not as a flow of electrons but as a motion of electrical energy in a direction opposite from that of electron drift.

The surprising part of this dilemma is that either approach may be used with perfect safety as long as you are consistent. There is nothing wrong with defining the direction of an electric current as opposite from that of electron flow. If one wishes to stretch the imagination a bit, it can be shown that something does seem to travel backward as electrons travel forward (Fig. 1).

Suppose that a row of pennies - simulating electrons - are laid end to end in a straight line. The penny at the right is moved further to the right over a distance equal to its own diameter, leaving an equal-size gap behind it. The next penny is then moved to fill the gap, the third is displaced to fill the newly formed space, and so on. Obviously, as the pennies travel in one direction, the gap proceeds just as rapidly in the other! (This may seem to suggest an explanation of the motion of "holes" in transistors to some of you; actually, transistor action is considerably more complicated.)

Thus, the "plus-and-minus dilemma" resolves itself into a question of words. Most people in electronics prefer to deal with electron flow, particularly when working with vacuum tubes where the space current consists only of electrons. But the principal thing to remember is that either way of looking at it will work out in careful hands.

Capacitor-Charging Paradox. When a capacitor is set up in a circuit like that of Fig. 2, it is readily evident that the voltage - as read by the voltmeter connected across its terminals - builds up slowly. If the capacitor is on the order of several thousand microfarads, it may require two or three seconds to acquire a full charge equal to that of the battery potential.

This time lag, however, appears to contradict the fact that electrical energy is transmitted through wires at close to the speed of light! With this velocity involved, the battery voltage should appear across the capacitor instantaneously with the closing of the switch. Here, as we see, fact appears to contradict observation.

The solution to this riddle, as with so many others, lies in the omission of a not -

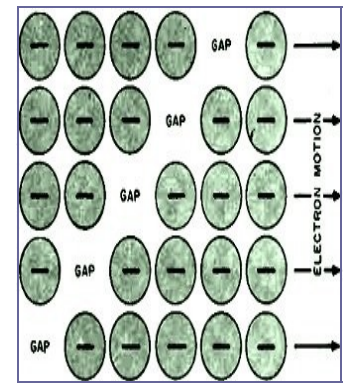


Fig. 1 - Gaps between electrons in electric current flow have an apparent travel direction opposite from that of electrons.

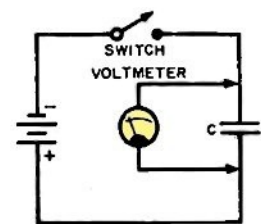


Fig. 2 - Theoretical circuit for measuring voltage drop across a capacitor.

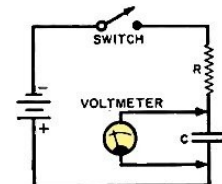


Fig. 3 - Circuit of Fig. 2 with "hidden" resistances of circuit shown as R.

too -evident fact: no electrical circuit can ever be entirely free of ohmic resistance. The internal resistance of the battery, the resistance at the connections and in the wires must be added to the total picture. Symbolizing these "hidden" resistances, as shown in Fig. 3, we can now explain the apparent paradox without difficulty.

Resistance R represents the internal battery opposition, that of the switch contacts and other circuit connections, plus the resistance of the connecting wires. The voltmeter is clearly measuring the potential drop across one portion of the voltage divider comprising R and C. When the switch is first closed, the capacitor offers no opposition to the charging current because it has not yet taken on a charge that could buck the applied e.m.f.; also, the small magnitude of R permits a large initial charging current to flow.

A large voltage drop therefore develops across R, leaving almost nothing for the capacitor. This explains why the voltmeter reads negligible voltage at the beginning of the process. As the current flows into C, however, the latter begins to build up a charge and, consequently, starts to develop a back-e.m.f. that opposes the charging current. Hence, the current diminishes slightly, the voltage drop across R likewise decreases, and the voltmeter now reads a higher potential across the capacitor.

This process continues until the counter e.m.f. in the capacitor becomes equal to the battery voltage. At this point, the charging current ceases, the voltage drop across R becomes zero, and the capacitor shows the same potential as the battery. Thus, although the transfer of electrical energy from the battery may take place at high velocity, the charging of a capacitor is a matter of quantity of charge rather than speed of particle motion.

Sky-Rocketing Voltage

To the novice in electricity, an ordinary power transformer at first appears to violate the fundamental law of energy conservation because it can "step up" voltage and thereby seems to give "something for nothing." Later, when he finds that the current output of a transformer diminishes in the same proportion as the voltage is stepped-up, the beginner is ready to accept the turns -ratio-voltage-increase relationship:

$$\text{secondary voltage} = \text{primary voltage} \times \text{number of secondary turns} / \text{number of primary turns.}$$

Now our beginner is satisfied that a transformer can step up 100 volts to 500 volts if the secondary has five times as many turns as the primary. The current in the primary will be greater than five times the secondary current, and thereby makes up for the voltage gain.

But once having understood all of the above, imagine his discomfiture when he reads about a circuit (Fig. 4) that will produce more than 1000 volts across the secondary with only 1-1/2 volts applied across the primary winding, the transformer having a turns ratio of only 1 to 20! According to his figures, the output voltage ought to be about 30 volts, not 1000 or more. That is:

$$\text{secondary voltage} = 1.5 \times 20/1 = 30 \text{ volts.}$$

"No!" he says, "This can't be! But wait a minute ..." he adds as a thought strikes him, "the frequency of the a.c. in this circuit is 3000 cycles per second. Can that be the answer?"

Looking back at the turn-voltage equation, it is evident that frequency has nothing to do with the question since it does not even appear in the relationship. This leaves him in a real quandary. Is the equation wrong or is the author of the circuit trying to pull someone's leg?

The answer lies in neither of these possibilities. The author committed the unforgivable blunder of omitting to mention that the waveform of the input voltage was a sawtooth rather than a sine wave. In the circuit upon which this discussion is based, a transistor blocking oscillator was employed as the source of primary e.m.f. The d.c. source was a 1.5-volt dry cell. The setup ratio is actually 20 to 1, and the transformer-induced secondary voltage is only 30 volts as predicted by the transformer equation. But the sawtooth waveform is the secret of the sky -rocketing output voltage that appears across the load resistor R. It works this way:

Line AB in Fig. 5 shows how the voltage across the primary slowly climbs from zero to its peak value during time t_1 . The same waveform appears in the secondary winding, only it is amplified 20 times by the step-up turns ratio. When the applied potential reaches its peak at B, it drops sharply down to zero once again, this time in a very short interval (t_2). The magnetic field built up in the transformer during t_1 , therefore cuts swiftly back through the turns of the windings and induces a new voltage of much greater magnitude than existed there before.

This voltage of self-induction has nothing to do with the turns-ratio of the transformer. Its size is dependent only upon the sharpness of magnetic field cutoff; the smaller the interval t_2 is, the greater will be the self-induced voltage in any given transformer. Thus, it is perfectly practical to obtain a voltage gain which far exceeds that predicted by the transformer equation when the primary a.c. has sawtooth or rectangular waveform. Perhaps you, as a reader, have never been bothered by the dilemmas and paradoxes we have just described. It is more than likely, however, that you have been bewildered by others (and maybe still are).

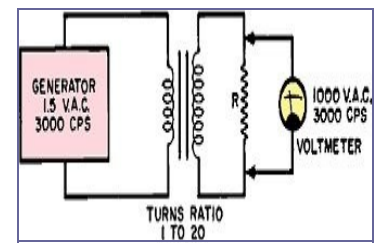


Fig. 4 - This circuit appears to defy the turns-ratio rule of transformer voltage output. See text.

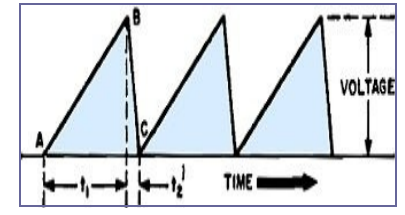


Fig. 5 - Sawtooth waveform output of the generator which utilizes self-induction for voltage boost.

Antique Wireless Association
of Southern Africa

CONTACT US:

WA/Telegram +27 82 448 4368
email: andy6s6ady@vodamail.co.za

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Mission Statement

Our aim is to facilitate, generate and maintain an interest in the location, acquisition, repair and use of yesterday's radio's and associated equipment. To encourage all like minded amateurs to do the same thus ensuring the maintenance and preservation of our amateur heritage.

Membership of this group is free and by association. Join by logging in to our website.

Notices:

Net Times and Frequencies (SAST):

Saturday 07:00 (05:00 UTC) — Western Cape SSB Net — 7.140; Every afternoon during the week from 17:00

Saturday 08:30 (06:30 UTC) — National SSB Net — 7.125;

Echolink — ZS0AWA-L;

ZS6STN Sandton repeater — 145.700

Kempton Park Repeater — 145.6625

Relay on 10.125 and 14.135 (Try all and see what suits you)

Saturday 14:00 (12:00 UTC) — CW Net — 7025

AWASA Telegram group:

Should you want to get on the AWA Telegram group where a lot of technical discussion takes place, send a message to Andy ZS6ADY asking to be placed on the group. This is a no-Nonsense group, only for AWA business. You must download the Telegram App first.+27824484368

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FRG7 Receivers (2) working condition uncertain – Asking R550 each or R1k for both.

“**Transworld**” transmitter, and separate matching “**Transworld**” receiver, with built-in power supply, and five page user manual.

Both units cosmetically good, but working condition uncertain .

R1k Not Neg

Swan TV2B transverter is a vintage 2-meter (144 MHz) amateur radio transverter. Cosmetically good, but working condition uncertain.

R150 ONCO

Kenwood TS-830S transceiver

Includes mic, and power cable, cosmetically good, and in good working condition .
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Foster Portable Potentiometer

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Eddystone 6 volt Old Classic Receiver

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R700 ONCO

Pics available on request.

Courier costs to your account.

Items will only be released upon receipt of POP and payment has been verified.

Please contact Eldred ZS1DJ on Whatsapp 072 4374789

Old Marconi Military FM deviation Meter.



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