Antique Wireless Association of Southern Africa

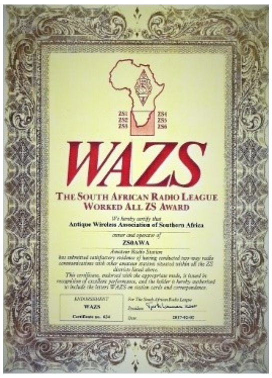
216 July 2024

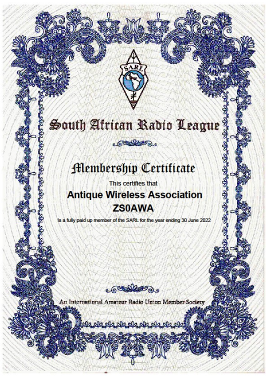
HAMMARLUND HQ180

Introduced in 1959, it is equipped with 18 tubes (17 model A), covers all frequencies from 540 Kcs to 30 Mcs and has bandspreads for Ham bands of 80, 40, 20, 15 and 10 meters of wavelength. **Triple conversion receiver: double on the 160, 80, and 40 meter bands, triple on the 20, 15, and 10 meter bands.** Three intermediate frequencies (1st IF at 3035 Kcs, 2nd IF at 455 Kcs, 3rd IF at 60 Kcs). The 1st IF stage only works on triple conversion, it includes a **crystal filter** whose output is injected into a converter that generates the 2nd IF. On double conversion ranges the first mixer directly generates the 2nd IF, 455 kcs, that is injected into a **gate amplifier**, its output is connected directly to the 2nd IF chain. On both cases signal is injected into the mixer that generates the 3rd IF, the mixing tube and its LO (that can be adjusted ± 3 Kcs on panel) conforms the **VERNIER TUNING**, which is a sideband fine tuning device especially for SSB. Is in this IF chain (60 Kcs) where is located the sideband tuning system and the selectivity circuitry, this circuit has a **Clapp-type BFO**, double-triode product detector, followed by an adjustable noise limiter.

To aid about interfering signals a **slot filter** covers the whole 455 Kcs IF output channel (± 5 Kcs), and whose frequency and depth can be adjusted on the front panel, but, as is usual in this circuits, it is very effective for carrier interference (or CW), but much less effective for modulated signals.

Operation with this receiver can be classified as excellent on sensitivity and very good on signal-to-noise ratio. Very good selectable selectivity steps, easy tuning on SSB either by sideband selection or without selecting sidebands, good audio, and remarkable stability after a short warm-up time that depends on the selected band (at higher frequencies more warm-up time is required). As usual on the Armstrong-type receivers (LO in 1st conversion - mixer stage) some drift always exists, especially on higher bands, and due the long frequency covering that the high bands have, frequency readout accuracy gets worse as frequency increases, that's why these radios should have a dual-frequency calibrator installed from scratch.





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Reflections:

Living here in the Northern Cape certainly has some advantages, but also some disadvantages.

When the wind blows in this part of the world, like it is today as I write this piece, it can gust up to 40kph and sometimes more. This brings with it an increase in noise levels, I have found, and it may well be induced by dust in the air. The wind here will blow like this anything up to 4 days a week.

Early morning propagation and late afternoon the bands, especially 40m, seem to settle down a bit and by the time the sun goes down have improved quite a bit.

Being off grid, this also has it's disadvantage in that by that time one is running off batteries, and so there is always the thought of preserving power as much as you can for household use.

Be that as it may, we have been enjoying life out in the country, the fresh air, the clear skies at night, no random gunshots, but have decided, with a heavy heart, to move back to the hustle and bustle of the city.

Some will say, "We told you to stay, "others will say "that was a silly move", but whatever, we had good reason for the decisions that were made, including this one.

So from the end of July we will be back and amongst friends and family again and am already looking forward to the visits to the SAIEE, the tea and cake Saturdays, flea markets and much better propagation.

I know this may not be of interest to many of the readers, but then doing it this way I don't have to tell the same story over and over.

ZS3ADY will go silent and ZS6ADY will be resurrected again. I am just thankful that I kept my call sign. Maybe there was an inkling somewhere in the back of mind.

I am sure I am not the first person in life to make such a decision and probably won't be the last. Given the same opportunity under different circumstances, I would make the swop again.

It would seem that there are many who have a desire to live in the rural area's of our fine country. Some like the call of thick bush and lots of wild life, others prefer the large water area's of our pleasant dams that are scattered around the country. Others like the wide open spaces of grassland such that are found in the Freestate area. Lots and lots of nothing. Don't forget of course the alure of the coastal area's which probably have the largest amount of pensioners than anywhere else in the country.

For us it was the hot dry area close to the Orange River, where the grape vineyards and pecan nut orchards are all along the river for miles on end. Some of the finest wines are produced in the area and of course agriculture is very high on the list.

Coupled with that we have been to some places that people have only ever heard of, like Prieska, Groblershoop, Grootdrink and Putsonderwater. Many more strange names of places that one only ever hears of in stories that make you wonder if they actually exist.

We have met people who have lived and farmed in the area all their lives and others like us, who have moved here from the cities to make a better life.

We shall sorely miss it all.

73

DE Andy ZS3ADY

Coronal Mass Ejection (CME) **Wikipedia**

First optical observations

The first optical observation of a CME was made on 14 December 1971 using the coronagraph of Orbiting Solar Observatory 7 (OSO-7). It was first described by R. Tousey of the Naval Research Laboratory in a research paper published in 1973.
The discovery image (256 × 256 pixels) was collected on a Secondary Electron Conduction (SEC) vidicon tube, transferred to the instrument computer after being digitized to 7 bits. Then it was compressed using a simple run-length encoding scheme and sent down to the ground at 200 bit/s.
A full, uncompressed image would take 44 minutes to send down to the ground. The telemetry was sent to ground support equipment (GSE) which built up the image onto Polaroid print. David Roberts, an electronics technician working for NRL who had been responsible for the testing of the SEC-vidicon camera, was in charge of day-to-day operations. He thought that his camera had failed because certain areas of the image were much brighter than normal. But on the next image the bright area had moved away from the Sun and he immediately recognized this as being unusual and took it to his supervisor, Dr. Guenter Brueckner, and then to the solar physics branch head, Dr. Tousey.
Earlier observations of *coronal transients* or even phenomena observed visually during solar eclipses are now understood as essentially the same thing.

NOW IT CAN BE TOLD
by
JOHN D. HEYS G3BDQ

(Thanks to Don Field G3XTT, editor of Practical Wireless for his kind permission to publish)

Forty-six years ago (May 1943) an event took place which deserves more than a passing mention in the annals of amateur radio. It is odd that one of the biggest stories relating to our hobby was kept a close secret for so long, but it appears that "security" and the natural wishes of the leading participants and organisers of the affair to remain anonymous has until now perpetuated the news "blackout". All the principals in the story which follows are now dead, so it is fitting that their actions, which have had a lasting and beneficial influence upon the amateur fraternity's fight to keep, guard and hold exclusively our precious bands, should be reported.

During 1935, the German High Command, which was already under the strict control of the ruling Nazi Party, sought a cheap but effective radio system that would enable small military units to keep a listening watch with the Abwehr HQ in Berlin. The system desired was to be free from jamming and enemy interference.

Eventually a scheme was approved and work began during the autumn. It soon started operations in a limited form and by the end of 1936 was virtually complete. It was essentially a radio system based upon s.s.b. transmitting techniques and simple receivers using what is now called "direct conversion".

Elegant in concept, the network used communications concepts far in advance of those extant at that time. The receivers were small, lightweight and basic. They had encapsulated pre-tuned " front-end" circuits with specially developed double-diode-triode valves to act as balanced detector and crystal-controlled oscillator. The detector was followed by a high gain twin-triode a.f. amplifier and suitable filter. The crystal oscillator could be "tweaked" a few hundred hertz about its nominal frequency, and this was the only tuning control. There were both battery and mains operated versions of the receiver, and all the valves were small metal types similar to the "Nuvistor" valves of the 1960's.

Being so simple the receivers were rugged, and with the exception of the crystals (which depended upon a secret mass importation of special quartz from Brazil) were cheap to produce. The transmitter station was high-powered and normally radiated a clean un-modulated carrier which was broken at minute intervals by the letters ABW in high-speed Morse.

Single sideband telephony with much reduced carrier could be transmitted when needed and also normal c.w. telegraphy. Reception of the s.s.b. was easily accomplished by unskilled personnel, who found its resolution simpler than tuning in broadcast stations on their home receivers. The receiver antennas suggested were just end-fed five metre wires, which could be slung up into any convenient tree or fixed to any suitable vertical support.

The transmissions were vertically polarised and the intent was to provide an extremely strong ground wave over the whole of Germany and most of Western Europe.

The High-Power Transmitters
Two transmitters were built and set up. Each had a staggering power output of 10MW on c.w. At that time this represented an unprecedented power level and showed that German technology was in some respects ahead of much of the world. The number one station was located on Hohen-Neuffen peak at an altitude of 742m. This mountain lies in the southern part of Germany and forms part of the Rauhe Alp in the part called Swabia.

The second or "stand-by" station was on an island in a lake to the east of Allenstein, in what was then East Prussia, and was almost identical in design to the first station. Both transmitters were linked by a unique system which enabled one discrete frequency to be generated (a caesium clock with suitable dividers was the frequency source and it ensured first-rate stability) and used by both stations, although they were separated by many hundreds of kilometres.

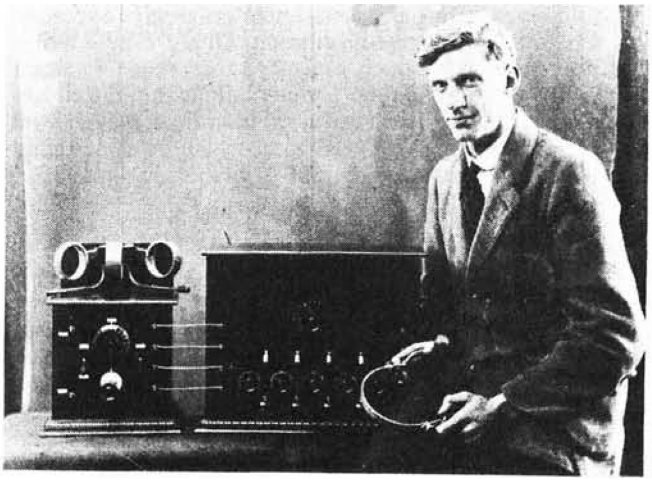
The enormous power levels needed special cooling arrangements. At the East Prussian site water from the lake was circulated around the many output and driver valves.

In addition, several hundreds of tonnes of salt were dumped into the lake to increase its effectiveness as a ground plane. It was rumoured that when the station was working the lake temperature rose dramatically, and that, together with its newly found salinity, the water acquired some of the characteristics of the dead Sea!

The transmitting antennas were simple, but massive, dipoles at the top of 270m towers and were fed by a special water-cooled coaxial cable, which was largely air spaced and had an outside diameter of a metre.

Drastic Effects

Unfortunately for all the amateur fraternity, the frequency chosen for the new ABW system was 14·141MHz! This was almost slap in the middle of the twenty-metre band, the chief DX band at that time.


Arabackle Oblifork. A rare study of the Albanian at his home station in Tirana 1926

Although the intent was to provide a powerful ground wave over the service area, much of the 10MW output power went skywards at low angles and returned hundreds or thousands of miles from Germany.

The years 1936 and 1937 were the peak points of Solar Cycle 17, and the effect upon the twenty-metre band only be imagined. The so-called "woodpecker" QR experienced at the present time is only a minor irritation by comparison. Anyone who has built and used a t.r.f. receiver must be aware of the swamp effect produced by strong signals. Fairly strong signals necessitated a judicious increase in the reaction or regeneration control and very strong signals (such as the pick-up from one's transmitter oscillator) prevented oscillation for many kHz on either side of the frequency and produced a "hole' in the band where nothing could be received.

A Rig of the Mid-Thirties

Many such rigs were used in the anti-ABW operation. The ABW megawatts killed straight receivers all over the world and made operation on 14 MHz only possible near the band edges. The rather more fortunate owners of superhets had similar problems, for the front ends of moderately priced receivers did not have an r.f. stage and big signal capabilities on even the highly priced imported American sets were limited.

The Abwehr transmitters virtually closed down the twenty-metre band for amateur use, and all over the globe desperate operators could not understand the reason for or what the intruder was. An official silence and a heavy veil of secrecy (which has never until now been lifted) fell over the whole business.

All seemed lost! The author, then a keen schoolboy s.w.l., was using a home-built I-V-1 receiver, and was mystified by his inability to make the detector stage oscillate over much of the twenty metre band. There were also funny noises which seemed impossible to resolve when the German stations switched over to s.s.b. It must have been particularly frustrating for the German amateurs who lived within 160km or so of the ABW sites.

The radiated power was so intense that a simple tuned circuit coupled to a half wave dipole could activate a 60W light bulb anywhere within a 30km radius from the transmitter positions. This knowledge was exploited by several experimenters, but their ability to acquire free illumination by night and day came to an end when some gaps in the transmitter radiation patterns were noticed. The freebooters were discovered and severely dealt with by the authorities.

The Meeting and a Plan

Fortunately for amateur radio, there was at that time someone who had the necessary scientific skills, drive and organising ability to counter the menace of the German Army radio system.

Arabackle Oblifork, Albanian National with a Georgian mother, polymath, electrical engineer and amateur radio expert, must be remembered with gratitude for all time as the saviour of the twenty-metre amateur band. Oblifork, licensed ZAIA0 (formerly AIA) was instrumental in interesting his Head of State, King Zog of Albania, in the hobby, and set up for His Majesty (call sign ZAIZ) one of the finest stations in the world.

The story of Oblifork's humiliation of the South African Railway Authority will serve to illustrate that he was a force to be reckoned with, and the tale is worth re-telling, for there must be many younger amateurs who know nothing of the affair. During the early 1920's, Oblifork was commissioned to plan the electrification of a particularly long stretch of railway line in South Africa.

For some now unknown reason, a bitter and mutual antagonism arose between Oblifork and his employers and he decided to

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teach the South African Railways a lesson they would never forget.

He proceeded with his work and eventually the overhead electrification was completed. At the first switching on of power with no trains on the track all the fuses blew. Oblifork was then in Switzerland and could not be called upon for advice.
Close examination of the 1460km of line revealed no faults or short circuits, so the Chief Engineer ordered that the fuse ratings be multiplied by the factor of four.
A little later when power was re-applied the effect was catastrophic. The alternators at the newly built power station blew up, although there was seemingly no load or fault on the line.

Arabackle had arranged that the total length of the overhead wires, allowing for velocity factor, made them an open-ended quarter wave stub at the Supply frequency of 50Hz !

The resultant replacement, of heavy power plant from Manchester helped the unemployment problems of that city during the depression. Oblifork arranged an urgent and secret meeting of the worlds leading radio amateurs which was to be held at his London laboratory. The only item on the agenda was the formation of a plan to counter and destroy the effects of the ABW transmitters which Oblifork had learned about from his German informants. The meeting took place in December 1936, and the small but influential band of amateurs there learned of Oblifork's plan.

Radio propagation and the mechanics of reflection and refraction had been a pet enthusiasm of Oblifork for many years, and his "Electron density/Radiation intensity" theorem was to prove the undoing of the German threat.

The now well-known impossibility of communication with returning astronauts is a phenomenon known to be brought about by re-entry friction and the generation of plasma. Oblifork's theorem can be used to determine the parameters of re-entry communications and the frequencies needed and it shows how he was many years ahead of his contemporaries in his thinking.

His assembled guests were told that nothing could be done to prevent the radiation of the ground wave signals from Germany but that with the adoption of his special measures the sky waves could be eliminated. He reckoned that the radiated power of an ABW transmitter plus a similar external power level on the same frequency would "take-out" the ionosphere and prevent all reflection and refraction of signals on that frequency for two months. After that period the effect should gradually disappear.

By organising most of the amateurs of the world (outside the Axis Block) into a massive combined jamming force the worst features of the Abwehr stations would be eliminated for a time, and this would without doubt reveal to the German High Command that even their uniquely high-powered transmitters could be interfered with.

Oblifork set a date for the operation and the meeting broke up on the evening of Friday, December 18. The International Freemasonry of amateur radio then secretly and without fuss swung into active preparation.

The Operation is Prepared

Unfortunately, many amateurs used crystal-controlled transmitters at that time and could not use their normally set up rigs on the ABW frequency. Most, however, had the skill to change their oscillators temporarily into self-excited jobs, and the old t.a.t.g. (tuned anode tuned grid) circuit came once more into its own. Some were fortunate in owning a Meissner "Signal Shifter", one of the first commercially available vfos. Others resurrected from attics and lumber rooms the high-power oscillators used in former days as one valve transmitters. Even more fortunate were the really high-powered stations.

For the most part they were American and even in the mid-thirties "Californian Kilowatts" were not uncommon. Here in the UK was Gerry Marcuse G2NM whose very high-powered (and at first unlicensed!) station initiated the Empire Broadcasting network.
Gerry, the " Caterham Wizard", was only too eager to take part in the exercise; indeed, he was one of the select few at the December meeting in London. A number of British and overseas amateurs held posts of responsibility at broadcasting and other commercial stations. They, together with many in charge of powerful military transmitters, agreed to help.

Perhaps our greatest contribution resulted from the efforts of Dr Eric Megaw G6MU (later to be GM6MU when Scotland was granted a distinctive prefix). Megaw was what would today be described as an electronic "whizz-kid". He was licensed when still a schoolboy, and was one of the leading British DX chasers. During the· early 30's Megaw was doing research into electron oscillators, and is now best remembered officially for work in developing the magnetron. Without the magnetron, high-powered pulse centimetric radar could not have been possible during the last war, and it was a British success story.
For this important work Megaw was awarded the CBE and at the time of his death in early middle age in 1956 was Chief

Officer in the Royal Naval Scientific Service. He, too, had been present at Oblifork's meeting and had promised help.

In an outbuilding at his research establishment Megaw built a crude but giant magnetron device. It filled the building, and was independent of the mains supply, using instead the mini power station on the site. It used enormous electro-magnets and when in operation could generate pulses with a peak power of 8MW at a p.r.f. (pulse repetition frequency) of 400Hz and a pulse width of 50s. Its effect later when used on the 14MHz band was devastating and contributed largely to the success of the final operation.
To test the magnetron oscillator, Megaw used a section of nearby salt marsh as a dummy load. It is said that for many winter nights the local poachers and wildfowlers were astonished at the un-seasonal night temperatures, and the thick mists which swirled around at knee height!

The Big Pile-Up
A little before 0500GMT on Thursday 1 April 1937 the author plugged in the twenty metre coils of his battery-powered t.r.f. receiver in yet another attempt to pick up Andrew Young VR6AY on Pitcairn Island. In s.w.1. circles it was well-known that VR6AY operated near the hf. band edge well away from the mid-band QRM which we now know was from the German Abwehr stations.

Andrew was reputed to QSL 100 per cent on receipt of useful reports and to log him was every young listener's dream.
That morning there was nothing heard from Pitcairn and the band (apart from the " thing" on 14·141MHz) appeared quite dead.
The logging of one of the Spanish Civil War "pirate" broadcasters down in the c.w. sector and an Italian operator calling seemingly endless CQ's proved that a radio blackout was not the reason for the band's emptiness.

At 0500 precisely a musical tone which was not strictly tuneable came up and it became much stronger near the middle of the band and could be heard even in the dead section caused by the powerful intruder.
This dead section rapidly extended and reached almost to each band edge. In desperation, the antenna, a simple dipole, was taken off the receiver and at once the reaction control had some effect. Without an antenna and with the detector in oscillation the amazed listener heard for about five minutes a fantastic cacophony of carriers, beat notes, clicks, hums and an all-prevailing 400Hz tone.
For those few minutes most of the amateur fraternity were on or near the frequency pumping out every watt they could muster.
There was also Megaw and his 8MW of pulse and hundreds of irregular transmissions from broadcast, military and other transmitters "borrowed" from their normal duties for just a few minutes and coaxed onto 14MHz. By 0505 the band suddenly was quiet and when the dipole was reconnected the receiver behaved normally. There was just one signal, a strong S9 c.w. carrier from the ground wave of ABW. Only its ground wave came in and it was possible to tune normally over the whole band.
A few brief minutes of fruitless tuning had to be followed by switch off, breakfast and preparations for school. That was the last day anything was heard from either of the two German transmitters. The massive welter or barrage of QRM on their frequency, which was, of course, fixed and could not be altered, had rapidly induced the Abwehr signals chiefs, on the advice of their technical experts, to stop all further operations. The system was fallible and could be jammed.

Development of another quite different system began soon after, but it is understood that when hostilities began in 1939 Germany had still not developed a satisfactory replacement for the ABW idea. Oblifork's plan had worked perfectly, but it was only some weeks later that an interesting fact came to light.
Experts concerned with m.u.f. (maximum useable frequency) observations using the new radio reflection techniques with frequency sweep transmitters-receivers discovered that no ionospheric reflections could be gained on one specific frequency.
This they deduced was on 14·141MHz. Even months later, indeed to this day, there remains a " dead spot" near the centre of the 14MHz amateur band where what goes up never comes down!
Modern frequency measurements show that the exact frequency of the " hole" is 14·141407MHz.
Oblifork's theorem specified that a total power radiation of approximately 20MW would produce a temporary cessation of ionospheric reflection at the ABW frequency. The total level of power hitting the ionosphere must have exceeded this amount, and after consultation, Oblifork admitted a rider to his theorem which suggested that above a certain critical power level the time became infinite and the effects would therefore be permanent.

This critical power level was computed as 25·7MW, a total which most certainly was achieved or exceeded on that April morning in 1937.

Conclusion

The train of events out of memory must seem bizarre or even incredible to many of the present generation of radio amateurs and swls; for the "hole" in the band is just 0·5Hz wide and is unnoticed by operators on the 14MHz band. The stability of our receivers and transmitters is not good enough to lock on to the "hole" frequency and for all practical purposes it may be ignored.

The unsophisticated may be prompted to wonder how the author gained this hitherto undisclosed information ? Confession is said to be good for the soul, and it must be admitted that all the details of the operation were gained second-hand and not from anyone actually involved in its inception.

There is no doubt in the authors mind that his late friend and near neighbour " Tommy"J Thomas G6QB would have had no reason to re-tell the Pile-up story if he did not himself believe it. For many years "Tommy" was the compiler of DX Commentary in The Short-Wave Magazine, and perusal of those columns will reveal many references to Arabackle Oblifork.

One day when the moment was propitious the author induced 'QB to tell something of that odd Albanian gentleman, and that was when the full story was revealed. It seems that Oblifork and "Tommy" met when both were working at one of the RAF coastal radar sites during the last war.

Oblifork was a "boffin" attached to the Royal Aircraft Establishment at Farnborough during much of the war and his work sometimes led to the out stations. The pair had a lot in common, both being pre-war amateurs for many years, and they soon began to reminisce over drinks at a village hostelry one evening.

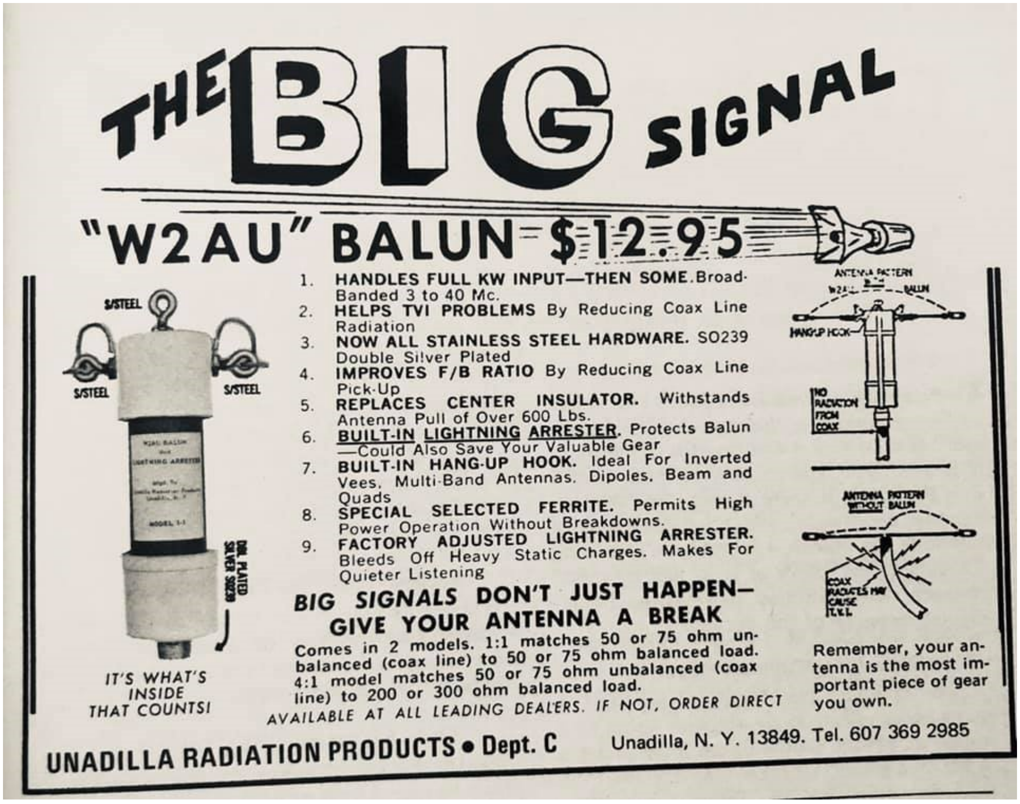
Later that night, Oblifork told his companion much of what has been re-told in these columns and made " Tommy" swear to its secrecy. After the war, Oblifork defected and slipped through the Iron Curtain to the USSR sometime during 1946. There he became actively engaged upon plasma physics, space communications, laser techniques and also surprisingly the setting up of the post-war network of Russian Klub stations over the USSR.

One day, "Tommy" showed me a QSL card relating to a contact in 1956 with Arabackle, who at that time was operating and testing a UL7K station. They kept in touch for many years and each Christmas '6QB received a card with scribbled greetings from him. Time runs on, and it must be assumed that ZAIAO has now joined the ranks of the silent keys.

Without doubt he must also be rated a Hero of the Soviet Union and we must belatedly hail the departed Albanian as the saviour of the twenty-metre band!

Practical Wireless, May 1983

(*I was prompted by a friend who had read the original article in PW to find this article again for interest sake….could it be ? Ed)*



SAIEE AN ONGOING WORK





A word of thanks to Dr Louis de Wet ZS6SK. He has been refurbishing the van der Bijl room at the museum in his spare time.

The room is still a work-in-progress, and next he will tackle the radar display in the corner.
He has scanned and reprinted many of the documents and photos as can be seen in the photo's above.

Remember the SAIEE open days once a month.
Bring the family along to see the history of radio and Electronics in South Africa.

The next open day is Saturday 20th July from 10am.

Do You Give an Accurate Signal Report?

Chris, ZS6GM

When another amateur station asks you to give a detailed signal report or an audio report are you able to be objective? This is particularly important when the operator is testing microphones or the setup of a radio.

When giving a signal report, it is important to distinguish between an 'S' meter reading and the readability or understandability of the other station's signal. Signal strength alone does not determine how understandable the station's transmission is, because there are other factors which determine the understandability of a transmission. These include, audio response, compression and distortion.

The goal of any amateur station is to be heard and understood, particularly under difficult communications situations. So, when providing a signal report try to address the main factors that affect understandability.

Audio Response

Does the voice sound balanced or natural? Remember that the more natural a voice sounds the better will be the intelligibility. The frequency spectrum of the human voice is complex and if too tailored or restricted you can affect the ability for the operator at the other end to understand what is being said.

The audio response of the radio system from microphone to RF output should, in the first instance, accurately reflect the voice of the operator. Additional effects can then be added to boost the high frequency response or cut low frequency response to improve the intelligibility.

The operator's voice plays a big role in the setup of a transmitter. A setup that works for one person will most certainly not work optimally for another.

When reporting, try and answer these questions.

- Does the voice sound natural?
- Are the higher frequency components crisp, clear and sharp or are they 'muddy' or indistinct
- Are the low frequencies dominant or overpowering?

Is there any harshness? Compression and Distortion can affect not only the balance of the sound but also the intelligibility.

Compression

Compression is a means to reduce the dynamic range of an audio signal thereby increasing the average power in the signal. In the professional radio broadcasting world, this is known as density, because when you look at the compressed signal the picture appears more dense. Applying too much compression causes third order intermodulation distortion which actually detracts from the intelligibility of the overall sound. Applying just the right amount of compression gives the audio a fuller sound without introducing distortion and has a similar effect to increasing the transmitter power output.

If there are too many low frequency components, compression will tend to cause the low frequency intermodulation components to dominate detracting from the overall understandability. This is why when setting up a compressor, one should high pass filter the audio before compressing. In other words the low frequencies should be rolled off. A good cutoff point for SSB communication is 300Hz.

When reporting, try to answer these questions.

- Is the audio clean or is there harshness ?
- Compression should be introduced to the point where the operator's voice sounds fuller and louder without introducing 'breathlessness' or heavy breathing, or lots of echo or room background noise.

Have the operator gradually increase compression until distortion or harshness become evident and then back off slightly.

Distortion

Distortion of the audio in a transmission can be caused by many factors. However, the most common are:

- Non-linearity in the transmitter chain and usually in the power amplifier caused by incorrect or faulty biasing
- Over-driving a linear amplifier
- Applying too much compression

RF feedback between the radiated signal and the audio input circuits and/or microphone.

Non-linearity can be fairly easily identified because the signal will break up on softer audio and become clearer as the gain is increased. With listening practice, the effect is quite easy to identify. Non-linearity can also be detected by how broad or how much bandwidth is occupied, in other words ‘spreading’ or spitting and spluttering sounds when listened to on adjacent frequencies.

Over compression usually manifests as harshness in the sound of the voice and a loss in naturalness as well as intrusive background noise.

RF feedback to a trained ear will be quite distinctive but similar to non-linearity. In the worst cases it causes squealing or howling on higher modulation peaks.

Conclusion

A well-adjusted and properly performing transmitter will sound clean and natural with a nice fullness to the voice without introducing distortion or harshness. When giving a signal report use these guidelines to help you describe the other’s audio / transmission.

Can You *Read* Me Now?

The RST code — more than just a signal report.

Steve Sant Andrea, AG1YK

Communication is a two-sided affair. When you send out a CQ you can't know how it is being received by another station far out across the ether. This problem became evident early on in radio. Once a signal leaves the antenna it moves from the clean and orderly environment inside your station to the wild and woolly wilderness of the ionosphere. Signals lose strength as they travel, become mixed with all sorts of noise and our fickle friend the ionosphere can cause all kinds of mischief.

Early in ham radio a number of schemes were devised for a receiving station to quantify how well they were hearing an incoming signal. By the 1930s this makeshift system resulted in what one writer described as "a mixture of plain language questions, QSA, R and T reports, and international abbreviations."[1]

It was in October of 1934 that Arthur Braaten, W2BSR, proposed the RST system (see sidebar) as a simple, less confusing and more accurate method for reporting the usability of a received signal.[2] His system consisted of three elements: readability, strength and tone.

A Measure of *Understanding*

One of the problems with earlier systems was confusion between how readable a signal was and its strength. The readability part of the RST code is used to define how *understandable* a signal is, not how *strong* it is. Readability is meant to describe to the transmitting station how well the receiving operator can understand what he is saying. It is not a matter of signal strength.

"How so," you ask? "If I'm receiving a 20-over signal it should be perfectly readable." It might not be readable if your neighbor's air conditioner is coming in 40-over. If the signal you are receiving is an R1 or R2, then you can't complete the contact regardless of how strong it is.

Signal strength is the second element of the RST system. Using nine steps it describes conditions from "Faint, barely perceptible" to "Extremely strong." The difference between an R1 and an S1 signal is worth considering. We have all been cruising a band, headphones on, listening intently for a certain DXpedition or special event when we come upon a frequency and stop short. You close your eyes and concentrate. You know you hear a signal. It's there down below the rush and rumble of the noise, the faintest trace of organization in the chaos.

From a readability standpoint this signal doesn't exist. Even though you are sure there is a signal there, you can't make out even the slightest scrap of information about it. From the signal strength standpoint, the signal is S1. You know it's there; there just isn't enough of it. Again an S1 or S2 signal is too weak to permit you to complete a basic contact.

"Then why have them at all?" you ask. Well, R and S values of 1 and 2 are useful in situations such as a net, roundtable or scheduled contact. Let's say you contact a DX station on 20 CW and arrange to meet on 40 phone. Down on 40 you can just barely make him out, an RS 21 signal. When you return to 20 meters you report this back to the DX, which lets him know that 40 meters isn't open to your area from his location.

The RST System

Readability

1. Unreadable
2. Barely readable, occasional words distinguishable.
3. Readable with considerable difficulty.
4. Readable with practically no difficulty.
5. Perfectly readable.

Signal Strength

1. Faint signals, barely perceptible.
2. Very weak signals.
3. Weak signals.
4. Fair signals.
5. Fairly good signals.
6. Good signals.
7. Moderately strong signals.
8. Strong signals.
9. Extremely strong signals.

Tone (CW only)

1. Sixty cycle ac or less, very rough and broad.
2. Very rough ac, very harsh and broad.
3. Rough ac tone, rectified but not filtered.
4. Rough note, some trace of filtering.
5. Filtered rectified ac but strongly ripple-modulated.
6. Filtered tone, definite trace of ripple modulation.
7. Near pure tone, trace of ripple modulation.
8. Near perfect tone, slight trace of modulation.
9. Perfect tone, no trace of ripple or modulation of any kind. If the signal has the characteristic steadiness of crystal control, add the letter X. If there is a chirp add the letter "C" and for a click, add "K."

Crystal Clear or For the Birds

The third element is tone. This is used for CW to describe how "clean" the Morse dits and dahs are. Tone is not that meaningful today using modern transmitters. But for those who like to "roll their own," or who like to operate using vintage equipment, the tone of the CW note can vary widely and values below T7 can indicate a problem.

What about digital? The RST code was developed long before the digital modes arrived. Some digital operators have proposed a new system for digital contacts, the RSQ system, replacing T (tone) with Q (quality). For more information go to **www.rsq-info.net**.

The RST system can provide you and the hams you contact with a useful description of the quality of the communications channel between you. For this reason, don't just parrot a "59" or 5NN" report. Take the time to listen and give an honest assessment of the quality of a signal. Be aware that the RST report you receive is telling you much about the usability of that frequency for whatever type of contact you wish to make, whether it is a long ragchew or a quick meteor scatter.

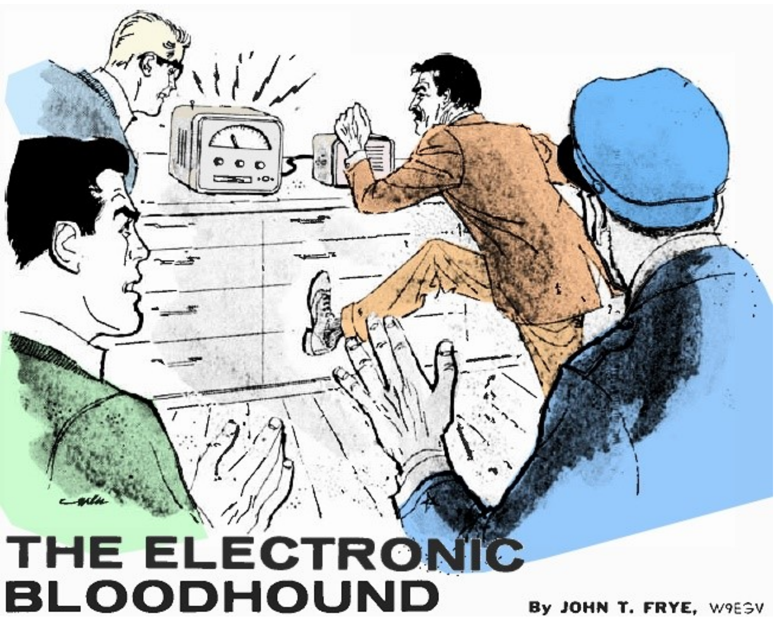
Steve Sant Andrea, AG1YK, is an Assistant Editor at QST. *He can be reached at* **ag1yk@arrl.org**.

[1]Lt D. C. Redgrave, KA1NA, "A New System of Signal Reports," *QST*, Aug 1934, p 55.
[2]A. M. Braaten, W2BSR, "A New Standard System of Reporting Signals," *QST*, Oct 1934, pp 18-19, 106, 108.

Carl & Jerry: The Electronic Bloodhound

November 1964 Popular Electronics

An Internet search for a perchlorethylene (PCE) detector made by Honeywell in the 1960s turned up nothing other than a reference to this John T. Frye Carl & Jerry article in *Popular Electronics* magazine. PCE is a toxic substance which was formerly (and possibly still is) used in the clothes dry cleaning business and as a degreaser. The substance is central to this "The Electric Bloodhound" technodrama™ in the September 1964 issue of *PE* magazine. In his typical style, Mr. Frye uses these stories as a teaching medium while entertaining with the exploits of a couple teenaged electronics junkies who by now are in college studying electrical engineering. This time, Jerry is in the lab admiring a new type of detector that monitors the concentration of certain particulates in the air, and sound an alarm if it exceeds a defined level. By an incredible coincidence, while explaining its operational principle to Carl, that device proves to be useful in collaring a thief who had just robbed a pedestrian.



A Carl and Jerry Adventure in Electronics

By John T. Frye W9EGV

Carl and J

The fall semester was well under way at Parvoo University. It was a beautiful autumn day, and while Jerry was straightening out an assignment with one of his professors, Carl rode around the campus looking at the new eight-story residence halls and the new ten-story graduate house. As an engineer, he was especially intrigued by the novel way more than ten thousand new seats had been added to the capacity of the football stadium. The floor of the stadium had been excavated to a depth of ten feet, thus making room for thirteen rows of new seats along both sides and one end.

Jerry was not in the room they shared in Residence Hall H3 when Carl returned, but Carl knew where to look for his friend. Sure enough, Jerry was in the Electronics Laboratory examining a new piece of equipment that had come in for study and evaluation. The device resting on the bench in front of him consisted of two units. One was a case with a couple of jeweled indicator lights and a meter reading 0-100 ppm on the front of it. Attached to this by a long, flexible, multiwire cable was a strange-looking object from which Jerry had removed a protective metal cover with ventilated ends.

Two small vertical chassis were mounted about a foot apart on a metal base plate, and a metal rod and a sealed glass tube about an inch in diameter reached across from one chassis to the other. A small glass tube was mounted on the outside of the left-hand chassis behind a round hole, and some sort of lamp bulb was mounted directly opposite behind a similar hole in the right-hand chassis. A combination reflector and protective shield was around this lamp, and directly beneath the shield were two small electric motors. One looked like a phono motor with a ventilating fan on its shaft; the other had the appearance of a timer motor.

"What the heck's that?" Carl asked, pulling a stool up to the bench.

"Can't you read ?" Jerry teased, pointing to the neatly lettered PER-TECTOR legend on the front of the instrument.

"So what's a 'Per-Tector'? What does it 'pertect' against?"

"It's a gadget brought out by the Apparatus Controls Division of the Honeywell Company in Minneapolis to detect the presence of perchlorethylene, a toxic gas used in dry cleaning. It'll be installed in coin-operated dry-cleaning plants and will automatically turn on extra exhaust fans whenever the gas concentration at this detector unit - which can be mounted away from the amplifier and control unit - reaches 40 ppm, well below the danger point for human beings."

"O.K. How?"

"This little tube behind the hole in the left-hand chassis is a sensitive ultraviolet radiation detector. Opposite it behind the matching hole in the right-hand chassis is a special ultraviolet lamp focused on the detector tube. The output of the detector is amplified and used in a kind of bridge circuit so that when the full and unobstructed radiation from the lamp falls on the detector the circuit is balanced and the meter reads zero.

"But this little fan is constantly drawing in air from the room and pushing it through the space between the lamp and the detector. Since perchlorethylene gas molecules have the ability to absorb ultraviolet radiation, if any of this gas is present in the air the instrument is 'sniffing,' even as little as one ppm, the presence of the gas will cut down on the radiation reaching the detector and produce a reading on the meter. This instrument is adjusted so that when the gas concentration reaches 40 ppm a relay turns on the ventilating fans. It could be adjusted, though, so that this would happen when the concentration was as low as 10 ppm." "What's the purpose of that long glass tube and the other stuff?"

"It's part of a really clever idea. Over a period of time, dust, dirt, and oily particles may collect on the lamp and sensor tube. To compensate for the loss of ultraviolet energy transfer this produces, the gadget automatically recalibrates itself. That long glass tube is filled with a specified concentration of perchlorethylene. Once every twenty-four hours, this little motor turns the steel shaft and rotates the gas-filled tube into place between the ultraviolet source and the detector and switches on calibrating circuits inside the amplifier.

"The balancing circuits adjust automatically for the proper reading for that concentration of the gas. After calibration, a latching mechanism that has been holding the tube in place releases and this counterweight pulls the tube out of the path of the ultraviolet beam. If the dirt accumulation is so heavy that proper compensation is impossible, this warning light on the amplifier comes on and tells the operator to clean the lamp and sensor."

"Don't other substances besides perchlorethylene absorb ultraviolet radiation?"

"Sure. The device can detect fumes from gasoline, paint, lacquer, ammonia, styrene, foam rubber, tear gas, acids, ripe bananas or apples, liquor, and even vodka! It can't tell the difference between these various odors the way the human nose can, but it can react quantitatively to any of them; and, up to a point, it can be made especially sensitive to a particular substance. For some reason, one fact that determines which gas the device will be most sensitive to is the distance between the detector and the source of radiation. Honeywell is experimenting along this line at the present time. The possibilities are limitless."

"Let's see it do something," Carl requested, intrigued in spite of himself.

"O.K. I'll put the cover back on the detector unit so air drawn in by the fan will pass between the detector and the lamp. Notice that this electric bell takes the place of the exhaust fans the unit would normally control. See? Nothing happens when the unit is turned on and inhales only room air, but watch as I uncork this little bottle of perchlorethylene down here at the end of the bench."

Only seconds after the bottle of cleaning fluid was opened, the meter pointer started to climb. As it went past the "40 ppm." mark, the bell started ringing and continued to ring while the meter pointer went over against the peg even though Jerry had corked the bottle again. Then, slowly, the pointer came back down, and around mid-scale the bell ceased to ring.

In the comparative quiet that followed, the boys heard loud voices outside the laboratory. When they went to a window, they saw a police squad car headed into the curb with its rotating top light still flashing. Two uniformed officers stood on the sidewalk holding the arms of a squirming little man so that he faced a well-dressed civilian getting out of the squad car. The boys rushed outside to see what was going on.

"Is this the man who robbed you, Mr. Garland?" one of the officers asked the well-dressed man. "Bugsy here has quite a record with us."

"Yeah, you dumb cops are always leaning on me," the squirming little man said, his weazened face distorted with hate. "What's the beef this time?"

"I-I can't be certain," Mr. Garland said, staring intently at the bat-eared hard -eyed man in dirty shirt and tattered trousers. "He had a handkerchief over his face, and all I could seem to see was that long, sharp, switch-blade knife in his hand. I've always had a kind of thing about knives, and I could almost feel it making shish kebab of my liver."

"Let's see if he has a knife, Mac," one of the officers suggested.

In spite of Bugsy's loud and profane protest, they turned his trouser pockets inside out. From the left pocket came a couple of crumpled dollar bills. The right pocket yielded a total of eighty dollars in neatly folded fives and tens. That was all. There was no knife.

"He could easily have gotten rid of it, Dolan," Mac said. "Mr. Garland, do you know how much money he took?"

"It happens I do," Mr. Garland answered. "While home for lunch I spilled some coffee on my trousers, and I changed into a suit the cleaner had just delivered. When I emptied my pockets I noticed I had exactly eighty dollars in bills. These were not in a wallet. I have a bad habit of carrying bills folded together and shoved down into my pocket.

"I drove downtown, parked the car in a parking lot, and took a shortcut through an alley toward my office. That's where the man stepped out from behind some packing cases with the knife in his hand and demanded my money. I gave it to him. He ran on into the alley, and I ran toward the street and hailed your squad car. This fellow looks very much like the one in the alley, but I can't be sure. I don't want to make a mistake."

"Bugsy," Officer Dolan demanded, "where did you get all that money?"

"Won it in a crap game!" the unkempt man snarled, "all eighty-two dollars of it. Why don't you two give up? Unless this character had his bills marked, you're out of luck. You heard him say he couldn't identify me. I don't have a knife. I'm carrying more money than he said he lost. If I'm rousted again by you dumb flatfeet, you're going to be up before the judge on false arrest charges."

Jerry suddenly plucked Officer Dolan's sleeve and whispered to him at some length. The policeman, with a puzzled look on his face, finally turned to his fellow officer and said, "Mac, this guy thinks maybe he has a way of telling if that money is Mr. Garland's or not. I don't understand how, but it's worth a try. Bugsy, come along with us into the laboratory and absorb some college atmosphere - you can use it."

As they reached the door of the laboratory, Jerry took Mr. Garland by the arm and stopped him. "Stay here by the door if you don't mind," he said. "You'll soon see why."

He switched on the Per-Tector and turned to the policemen who were still keeping Bugsy between them. "This is the machine that might tell us if any or all of the bills came from Mr. Garland's pocket," he said. "It's very sensitive to cleaning fluid such as may have been used in cleaning Mr. Garland's suit. Since that suit is fresh from the cleaner, I'm hoping anything carried in the pockets will have picked up enough of the cleaning fluid fumes to register on the meter. We'll soon know. First, let's try this handkerchief of mine which has not been exposed to cleaning fluid."

He placed the handkerchief directly in front of the air intake of the Per-Tector, but the meter pointer never budged.

"Now, Mr. Garland, let's have your handkerchief," he said. "I'll come get it. I don't want the machine to 'smell' your freshly cleaned suit."

Mr. Garland took a handkerchief from a hip pocket, and Jerry picked it up with a pair of plastic tongs and laid it in front of the sensor unit. Instantly the meter pointer moved clear to the right, and the electric bell began to ring.

"Looks like we're in business," Jerry said triumphantly, returning the handkerchief. "Now I wish one of you officers would place the bills from Bugsy's pockets, one at a time, in front of the air intake of the machine and watch what happens to the meter pointer. After each reading, remove the bill and let the pointer go back to zero before trying another."

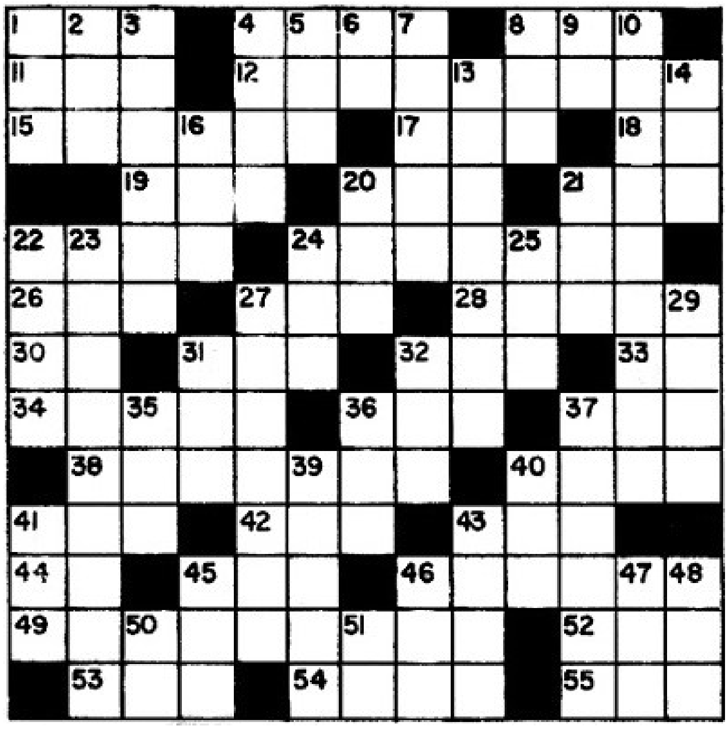
Officer Dolan did exactly as Jerry suggested, and the results were dramatic and damning. Each of the five and ten dollar bills caused the meter to peg and the bell to ring, but when the one dollar bills were offered to it one at a time, the meter pointer did not budge.

"We -I -I -I, Bugsy?" Officer Dolan said.

"O.K., O.K.! So I heisted the character. But you're not going to pin no armed robbery rap on me. That 'long, sharp, switchblade knife' he was yapping about was nothing but a rubber imitation they sell for kids to play with. You'll find it in a trash can back in that alley."

As he finished speaking, he suddenly lunged toward the bench holding the Per-Tector and tried to raise his foot high enough to kick the sensor unit, but the alert officers grabbed him in time. As they led him toward the door, he turned his head for a last malevolent look at the boys and the electronic bloodhound that had been his undoing. "You lousy, stinking finks!" he snarled at them.

As if in answer, there was a whirring of the motor and the glass tube moved into position for automatic recalibration. "The poor devil didn't even have the last word," Carl said softly as they heard the calibration tube rotate out of the ultraviolet beam.



Across

1. Resistor striped brown-black-green (colloq.).
2. Book of Bible (abbr.).
8. Word common to cps, rpm , and mph.
11. Feminine pronoun.
12. Animals who enjoy vegetables with their meat.
15. Source of power for home lighting in ancient Greece.
17. Unit in Morse Code.
18. Pitcher's dream (abbr.).
19. Old game revived for electronic brains.
20. Power ratio unit.
21. Wire size (slang).
22. Try to persuade.
24. Positive particles in atom.
26. Excessively.
26. Adjust meter readings (abbr.).
27. Main artery.
28. Prerequisite for some electronic jobs (abbr.).
31. Supplied with signal.
32. Past time.
33. "Either's" twin.
34. Scornful expression.
36. Raw metal.
37. Method of shipping (abbr.).
38. Obsolete sewing machine part.
40. Low audio frequency.
41. Compensation for signal variations (abbr.).
42. Wet soil.
43. Liable to cause misadjustment of ion trap.
44. Henrys times volts (abbr.).
45. American soldiers (slang).
46. Usually can't have built-in hi-fi.
49. Causing current to lag voltage.
52. Female deer.
53. Male progeny.
54. Time of orbital cycle.
55. Hobbyist who tunes in overseas broadcasts (abbr.)

Down

1. Transconductance of 200 6A U6's parallel.
2. Fish equipped with 600-volt "batteries."
3. Foreigner in Mexico (esp. Yankee).
4. Rhythmic utterance.
5. The d.c. equivalent of a.c.
6. Closed position of s.p.s.t. switch.
7. AM portion of TV wave.
8. Resistor with variable tap (colloq.).
9. One side of Ohm's Law equation.
10. Most numerous components in any kit.
13. Electromotive force.
14. Basic source of energy (colloq.).
16. Compete.
20. An Army Ordnance Re-search Group (abbr.).
21. Swank suburban apartment (phone-book abbr.).
22. Shoshonian Indian.
23. X-ray units.
24. Speaker volume control.
25. Result of too much registration.
27. Type of capacitor.
31. Charge for professional services.
32. Plural of "am."
35. Voltage drop across wave-shaping network (symbol).
36. Not the latest.
37. Units of capacitance.
39. Condition of many dim picture tubes.
40. Taboo.
41. Storybook user of R/C cave opener (first name).
43. Taunt.
45. Core of CRT.
46. Government agency producing electric power.
47. At present.
48. Wired communication (abbr.).
50. Auxiliary verb.
51. Equal conductance (symbol).

CONTACT US:

WA/Telegram +27824484368
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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; 14:20 10.115/14125

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