Antique Wireless Association of Southern Africa

 # 213 **April 2024**

COLLINS 75A-1 RECEIVER

Introduced in 1947, the Collins 75A-1 receiver was first with many new electrical and mechanical performance features covering the 160 thru 10 meter amateur bands.
It is a dual conversion design with fixed HFO IF.
Selectivity choices include five positions for the crystal filter (approximately 5 kc to 200 cps bandwidth) and that of the 455 kc IF transformers for AM operation.
Operating modes for the receiver include AM and CW. Accurate tuning is accomplished through the use of a slide rule dial and a vernier dial calibrated in 1 kc increments (2 kc increments on the 10 and 11 meter bands). Ten turns of the vernier dial cover each of the band ranges.
A series noise limiter is used for AM and CW operation.
Front panel controls include: Band Switch, Main Tuning, On-Off-Standby Switch, Crystal Selectivity Switch, Crystal Phasing Control, RF Gain Control, Audio Gain Control, CW Switch, CW Pitch Control, AVC Switch, and Noise Limiter Switch. Accessories include an external cabinet mounted speaker (270G-1).
The 75A-1 was the first really new amateur receiver since the advent of the superheterodyne circuit. Even with the addition of noise limiters and crystal filters, conventional receiver design had lacked any basic improvement. Recognizing the limitations of standard receivers, especially at higher frequencies, Collins engineers were determined to design a new and modern amateur receiver. With no restrictions imposed by prewar models that must be continued, no investment in tools and dies to be protected, and no urging to replace a product on the market until satisfactory in every detail, they were in an ideal position to design everything just as it should be.
And they did. The new and exciting 75A-1 was the result. It was modern in every respect, embodying recently developed and proved electrical circuits and mechanical design. It stood alone in it's field in that it performed equally well on all amateur bands. Extreme stability and precise calibration assured accurate visual tuning on all bands.
This receiver was engineered specifically for amateurs. It reflected Collins' successful experience in the design and manufacture of highest quality communication equipment for amateur, commercial and military applications. It contained many desirable features that were offered in no other receiver.

Reflections:

I have come to realise that a change in call sign is nearly like changing your whole life around.

You know, in the old days when you relocated, you had to change your banking details because the banks were not linked as they are today. You had to get a new postal address and then notify everyone of your change in address and telephone number. You had to register your car in the new town you had moved to and get a new registration number plate. It was really quite a schlepp.

Today of course those things have all become a lot easier because a bank is a bank and you have a number which is recognised by all of them. Postal address, well we won't talk about that one. Things like phone numbers and registrations just are not so much of a problem unless you move out of a province although with mobile phones, your number is your number no matter where you are.

I'm reminded of the fair headed lady who went from Brakpan to holiday in Cape Town. When her friend called on the cell phone, the first thing she said was "How did you know I was here ?"

When I first had my ZS4AC call sign and moved up to GT, I only had about 500 QSO's in my log book, the majority of which were CW and it really was not such a big thing to change over to a div 6 call. Now, 40 years later and with over 20,000 QSO's in the log, which is really not a lot when I look at some of the guys on QRZ.com, I find it a massive obstacle to change to a div 3 call sign, and start all over again.

My calls listed on LOTW now have to start again for my DXCC, my WAZS has to start again after nearly 700 confirmed and then on QRZ.com it's the same. It took a long time to get my WAZS100 in CW and I am sure I will never be able to get that again with the amount of CW ops in SA right now.

I am really not anywhere near an extraordinary ham, and the amount of calls I have listed are really not a great achievement, but I do find the change over is quite a big issue.

Maybe I'm making a mountain out of a molehill, but it seems quite a big issue for me.

Then I think of guys like OM Bushy, past President and now SK, who got to a stage where he had achieved nearly all there was to achieve in terms of awards, and then changed his call sign so he could start all over again from scratch. I wonder how many others could boast of something similar ?

I have held on to my Div 6 call sign, because I feel it would be sacrilege for some new ham to get his license and then choose my old call sign because his initials or first name is the same. Then every time he made a DX QSO the guys who I am listed in their log would think they know him. Not fair.

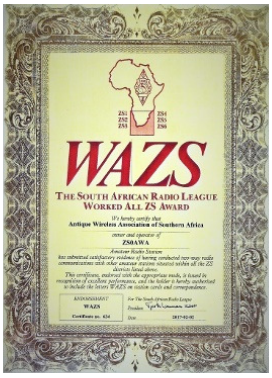
I guess some would shrug their shoulders at this and say "So what ?", but not me. I'm going to die with that call sign listed in my name.

Those who know me well enough would know that I can be quite pedantic in my views. Those who don't, just accept it as a learning point.

So here's to those who have spent many hours slaving over their log books in order to get recognition and pleasure for the amount of calls you have made, may your endeavours be richly rewarded.

73

DE Andy ZS3ADY



Inside this issue:

AWA Committee:

Visit our website:
www.awasa.org.za

Wikipedia

Coronal Mass Ejection (CME)

Effects on Earth

Only a very small fraction of CMEs are directed toward, and reach, the Earth. A CME arriving at Earth results in a shock wave causing a geomagnetic storm that may disrupt Earth's magnetosphere, compressing it on the day side and extending the night-side magnetic tail. When the magnetosphere reconnects on the nightside, it releases power on the order of terawatts directed back toward Earth's upper atmosphere. This can result in events such as the March 1989 geomagnetic storm.

CMEs, along with solar flares, can disrupt radio transmissions and cause damage to satellites and electrical transmission line facilities, resulting in potentially massive and long-lasting power outages.

Shocks in the upper corona driven by CMEs can also accelerate solar energetic particles toward the Earth resulting in gradual solar particle events. Interactions between these energetic particles and the Earth can cause an increase in the number of free electrons in the ionosphere, especially in the high-latitude polar regions, enhancing radio wave absorption, especially within the D-region of the ionosphere, leading to polar cap absorption events.

The interaction of CMEs with the Earth's magnetosphere leads to dramatic changes in the outer radiation belt, with either a decrease or an increase of relativistic particle fluxes by orders of magnitude. The changes in radiation belt particle fluxes are caused by acceleration, scattering and radial diffusion of relativistic electrons, due to the interactions with various plasma waves.

Marconi 365EZ

(I received an interesting message from a friend Matt ZS5PG, who found this key in a radio box donated to him, thought it may be of interest)

The M.I.M.C. Co. Ltd. Chelmsford. The Marconi 365 EZ. Developed from the 365A & 365B, it has ball races and lots of key click suppression, and even a set of spare contacts. This fine example is in pristene condition. The grey cover has "Eddystone 6908P" on the underside.

The Marconi 365EZ and Marconi's purchase of Eddystone Radio. By Ron Stringer.

"Marconi's had been shareholders for many years, but Eddystone Radio was wholly taken over by the Marconi Company (which itself was owned by the English Electric Company) in 1965.

A couple of years later English Electric was taken over by Arnold Weinstock's GEC-AEI conglomerate and both Eddystone and Marconi were part of the sale.
The company name was changed by dropping the word 'Communication' at around this time, to reflect the fact that the products offered to the Marine market (which included depth sounders, direction finders, radars, CCTV equipments, SRE products) were not adequately described by the original title.

The reason for the Eddystone name appearing inside the cover of the MIMCo 365EZ key (and probably inside the cover of its replacement, the Z50- etc) was that the brass cover of the earlier 365 series of keys was hand made and outrageously expensive to manufacture.

It only served to keep muck and foreign bodies out of the key, and to keep rfi inside the box, so it had to be replaced as a cost-cutting action.

Eddystone Radio had a sideline in making diecast aluminium boxes in standard sizes for use by amateurs and makers of machinery controls. (This was an offshoot of the way that Eddystone built the sensitive parts of their radio receivers as an assembly of screened diecast boxes, rather than by the more common method of bending and soldering compartments into a chassis made of tinplate.

Having invested in the dies, they maximised the return by selling the boxes to distributors of electronic components such as STC Components, Radio Spares and Maplin).

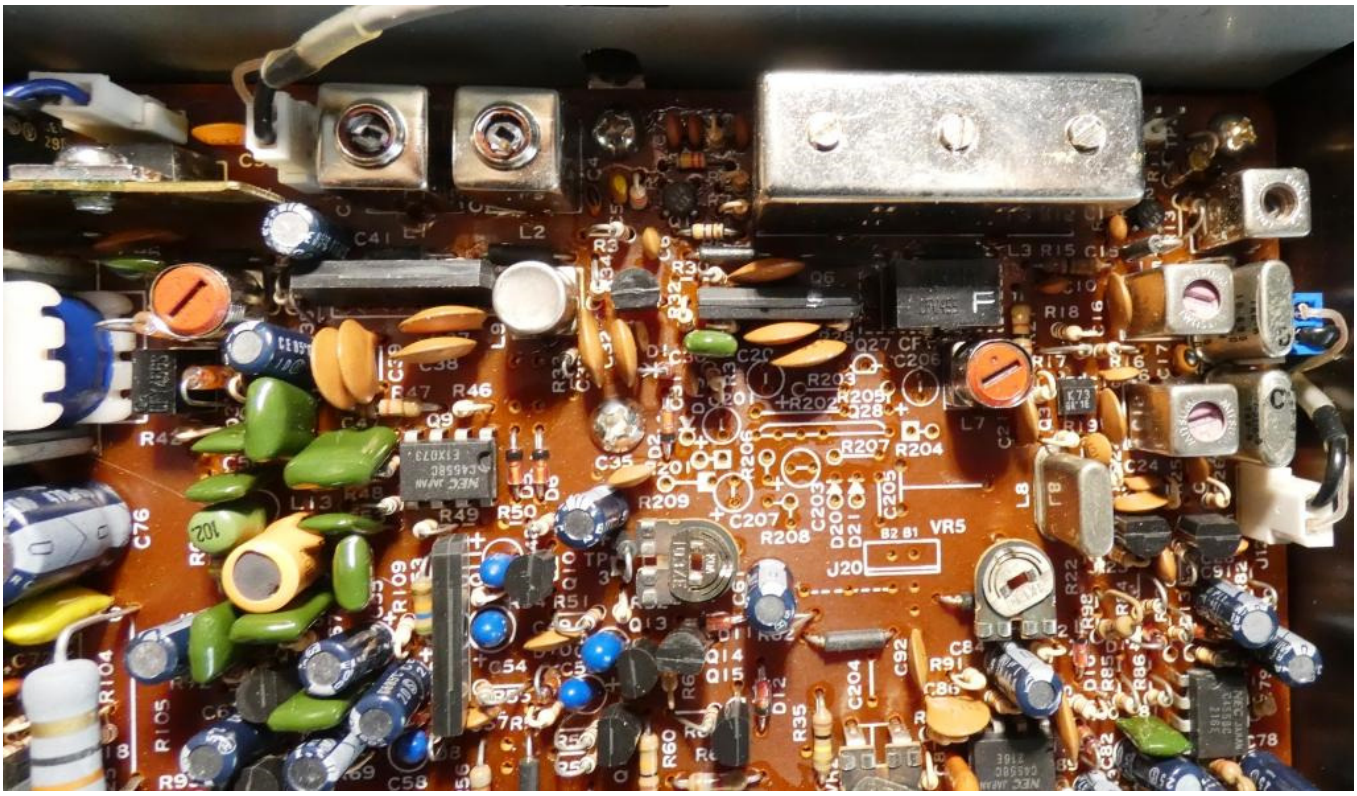
So at Marconi we designed out the very expensive brass cover and replaced it with a standard, diecast, Eddystone box.

The Z50- was designed some time in the 1980s when Marconi Marine (MIMCo) moved its drawing office nomenclature from the general one used by its parent, MWT, to one that was specific to MIMCo. All our drawings began with Z and the sequence Z50- was used not for major products but for ancillaries such as morse keys, battery chargers, antenna switching units and so on". Ron Stringer.

Ceramic screwdrivers

by Daniel Romila, VE7LCG

Many believe that the most vintage tool still in use by the radio amateurs today as being the hammer. Something doesn't work? Hit it a bit, and the shock will fix it. That was mostly OK for very old equipment, and it no longer works well for the today transceivers.
One can also argue that the screwdriver, too, is also a tool transmitted from many, many decades ago to the modern age of 2024.
Using a screwdriver might not give the same satisfaction like using a hammer, but the two tools are very different, although many radio amateurs can say that putting a transceiver and a hammer in the hand of a beginner is not less dangerous than putting a transceiver and a screwdriver in the hand of a beginner. The vintage transceivers have more analog parts than today's transceivers, require various sizes of screwdrivers to adjust capacitors, ferrites, adjustable resistors and so on.



I recently had to re-align an old Kenwood 7950. It is not that the old transceiver needed alignment, but it had not had one for many years. I was putting my hand in the drawer for tools, and I had the bad surprise to have only metallic screwdrivers there.

They could be from 50 years ago, and one calls them vintage. They could also be made in 2024, and there is no difference from the visual point of view, no difference for me as a light user.

Unfortunately, metallic screwdrivers are not the best for adjusting inductances, especially that many of them were working at 144 MHz One touches the ferrite, or the alloy that is in the middle of the coil for adjusting the inductance, and the tool itself gives a wrong frequency alignment. Take the screwdriver away, and the alignment is no longer good.

It was not urgent to do the alignment for my old Kenwood 7950 that already got replaced with a TYT TH-9800. So I ordered a set of ceramic screwdrivers, which themselves are around for so many years that many radio amateurs having ceramic screwdrivers call them vintage. The metallic screwdrivers are strong and they did an awesome job for taking apart the transceiver, but not for tuning.

I waited and waited for my ceramic screwdrivers to arrive in my mailbox, and they never came. So, I had to use an even more vintage plastic screwdriver that I had. I did the alignment, or – more precisely, I verified it and changed nothing – and I put back together my old transceiver.

Carl & Jerry: Pi in the Sky and Big Twist

February 1964 Popular Electronics

In this "Pi in the Sky and Big Twist" episode of John Frye's "Carl & Jerry" series, the boys are by now into their college years at Parvoo University. Having been a mix of electronics experimenters, Ham radio operators, and high tech sleuths since high school times, the two friends find themselves once again participating in an event that depends upon cool heads and quick thinking. As is typical of Mr. Frye's tales, more than one topic is woven into the story, and usually real-life products, companies, and scenarios are incorporated in an effort to inform his readers. The Midwest Program on Airborne Television Instruction (MPATI) mentioned was an out-of-the-box idea in the pre-satellite era for broadcasting educational programming to areas that otherwise did not experience good quality over-the-air reception. Purdue University (note the similarity to "Parvoo U."), in Indiana, played a key role in the program where DC-6 airplanes were outfitted with a transmitter and a hydraulically stabilized antenna, and would fly for many hours at a time to provide rural areas with classroom instruction via TV. MPATI is a obvious spin-off of the Stratovision system experimented with by Westinghouse Electric Corporation and The Glenn L. Martin Company in the mid 1940s.

See "Is Stratovision the Answer?," January 1950 *Radio & Television News; "Stratovision Goes Educational," January 1960 Electronics World*; "Stratovision," October 1945 *Radio-Craft*, and even a Carl & Jerry adventure entitled "Pi in the Sky and Big Twist," February 1964 *Popular Electronics.* Also see the article titled "MPATI - Its Problems & Solutions," in the May 1963 issue of *Radio & Television News* magazine.

A Carl and Jerry Adventure in Electronics

By John T. Frye W9EGV

The February afternoon was unseasonably warm. Low clouds scudded across the sky and a gusty, damp wind was blowing from the southwest as Carl parked the car at the Parvoo University Airport.

"There's Bill's Cessna parked on the apron," Jerry said, climbing out of the car, "but I don't see Bill. You sure he wanted us to fly up-river with him to see the ice jam this afternoon ?"

"Sure I'm sure," Carl retorted. "There he is now over by that hangar. He's motioning to us. Let's see what he wants."

Bill Vardon, a senior at Parvoo, had a wealthy father back in Texas who had the poor taste to make his fortune in neither cattle nor oil. Instead, he had piled up dimes from a chain of root beer and hot dog stands extending clear across the country, but those dimes had bought Bill his own airplane and had made him a BMOC. He was, though, a "very right guy" in both Carl's and Jerry's eyes.

"Before we take off, I thought you electronic buffs might like a close-up look at the DC-six MPATI plane in the hangar here," tall, lanky Bill drawled. "I've got permission for us to go inside."

"We sure would," Jerry said promptly.

Both boys, of course, knew about MPATI, the Midwest Program on Airborne Television Instruction, that now was in its third year of operation. They knew that every Monday through Thursday morning of the school year a big DC-6 took off from its base at the Parvoo University Airport and climbed to its station at 23,000 feet over the little town of Montpelier in northeastern Indiana. There, staying within a ten-mile circle, it flew for better than five hours in a shallow figure-eight pattern so that turns could always be made into the wind. During this time two complete UHF TV transmitters inside the plane telecast simultaneous but different programs on channels 72 and 76. The video-taped educational programs telecast had been prepared by the finest TV instructors discovered in a nationwide talent search, and they covered such subjects as English, French, Spanish, history, literature, music, dramatics, science, and math. Because of the last subject, some wag had dubbed the program "Pi in the Sky." The educational telecasts were picked up and used by schools in six states within a 200-mile radius of Montpelier.

There she is, fellows," Bill said as they stopped beneath the wing of the plane that looked much larger inside the hangar than it did outside. "This plane is kept standing by in case something goes wrong with the other one flying on station. It's stocked with duplicate tapes and could take over the telecast as soon as it takes off and climbs to position."

"What's that long thing in the plastic cover sticking back beneath the belly of the plane?" Carl wanted to know.

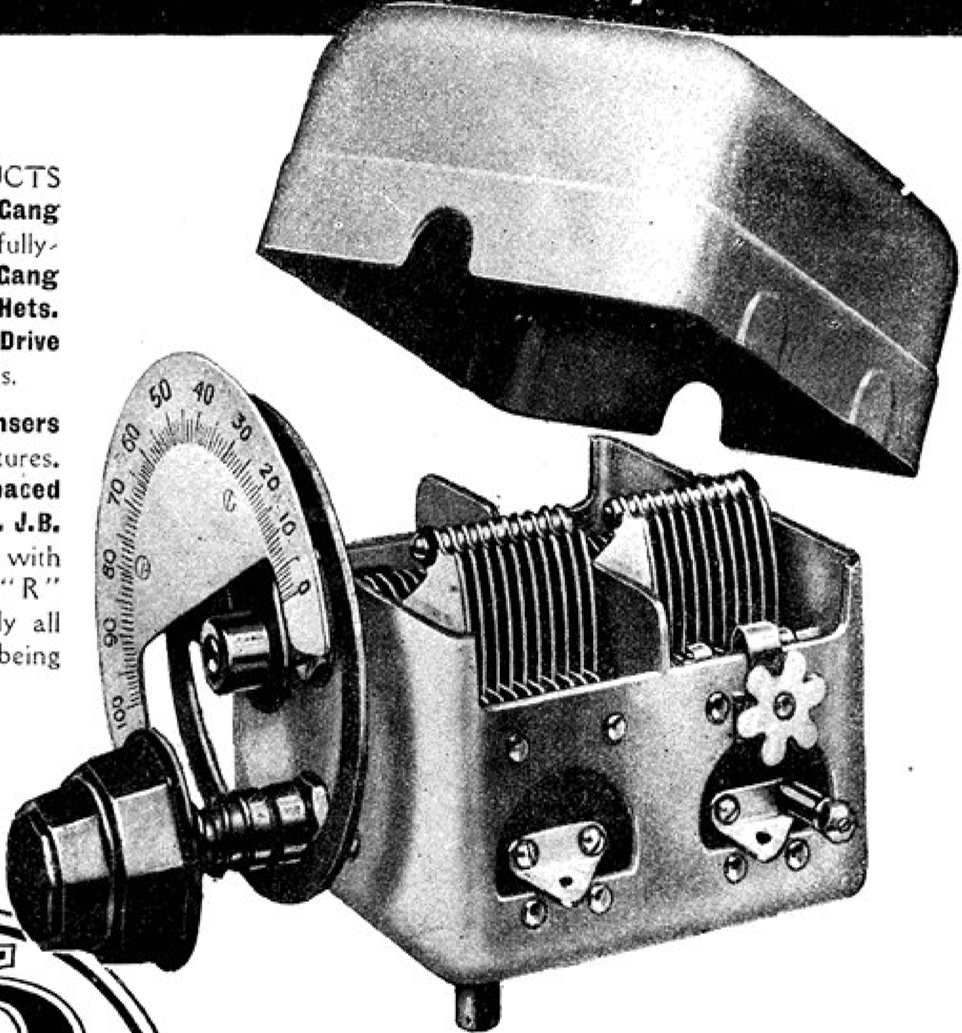
"That's the twenty-four-foot transmitting antenna," Bill answered. "When the plane is on station, this is moved hydraulically to a straight-down position and a gyro keeps it within one degree of the vertical during all normal flight maneuvers. If it wasn't for that, the transmitted signal pattern would be tilting all over the place when the plane banks or climbs, and reception in many places would be pretty bad."

NEW J.B. 'UNITUNE' CONDENSER — *a triumph of precision*

NEW J.B. PRODUCTS include entirely **new Gang Condensers** in semi- or fully-screened types. **New Gang Condensers for Super Hets. New Illuminated Disc Drive** for use with above gangs.

New Short Wave Condensers with many novel features. New capacities in **Air-Spaced Differential Condensers. J.B. "Illuminator"** for use with J.B. Chassimount and "R" Type gangs. Practically all existing J B. models are being retained.

STAND No. 204
NATIONAL RADIO EXHIBITION



REG TRADE MARK

J.B. "UNITUNE" Gang Condenser.

A pre-set trimmer is fitted to one half, while the other half has a trimmer which is operated from the front of the panel. The panel-trimmer control is concentric with the main tuning knob. Capacity ·0005. Complete with disc drive and bakelite escutcheon plate.

2 gang - - **18/6** 3 gang - - **27/-**

PRECISION INSTRUMENTS

Advertisement of Jackson Bros., 72, St. Thomas' Street, London, S.E.1. Telephone: Hop 1837.

"One antenna for two transmitters?" Jerry queried with raised eyebrows.

"That's right. The klystron final stages of both transmitters - which operate at about five kw each - feed the same antenna through a diplexer arrangement that prevents interaction. That's just one of some of the 'firsts' the MPATI engineers have worked out."

"Must be a lot of valuable electronic gear inside that plane," Carl observed wistfully.

"I'm sorry I couldn't wangle permission for us to go inside the plane today," Bill replied, "but it's really something to see. Six and a half tons of transmitters, video tape equipment, operating consoles, and test equipment are bolted down in there. I say 'bolted down' because every bit of equipment has to be mounted solidly enough to take the stress of a very rough landing. Aviation authorities insist on this. At the same time, the stuff has to be shock-mounted to prevent the vibration of the plane from knocking the sensitive, high-gain circuits out of whack."

"It must take a lot of power to feed two complete TV transmitters," Jerry said thoughtfully. "Where does it come from ?"

"Back in the non-pressurized tail section are gas-turbine-driven, four-hundred-cycle generators that put out seventy-five kw. The standard TV transmitters had to be modified to use the four-hundred-cycle a.c., but they had to do it - higher-frequency power means a lot less iron in the generators and transformers, and a lot less weight."

"How many guys does it take to man this flying TV station?" Carl asked.

"Six. Three are flight crew, and the other three are technicians who operate the transmitters and keep an eye on performance. The signals are monitored all the time by technicians right here in the hangar, and they keep in touch with the TV guys in the plane through a radio circuit entirely separate from the one used by the pilot and the control tower. Any time the received signal gets bad, it's seen by the technicians on the ground and corrected by those in the plane if possible. Right now no live programs are shown, but they have a camera in the plane for transmitting test patterns between programs and to make slide announcements on program changes, transmission quality, and so on."

"How would you like this kind of set-up for ham TV experiments?" Carl asked Jerry.

"Great, but a little expensive to operate," Jerry replied laughingly.

"Well, men, we'd better be shoving off for a look at that ice jam," Bill broke in. "The flying weather is not so hot, and I want to be back at the airport before dark. The air is unstable, and there's an alert out for possible tornadoes up until midnight. I don't think there's anything to worry about, or I wouldn't go up, but I don't want to be up there in the dark playing blindman's buff with some twisters I can't see."

A few minutes later the boys were in the Cessna four-place plane waiting for permission to take off. Jerry sat to the right of Bill; Carl took one of the seats behind them. Permission was given, and they were off down the runway, gathering speed as melted snow-water splattered from beneath the wheels of the tricycle landing gear up against the bottom of the plane.

Bill, an expert pilot, took the plane off the ground quickly and smoothly. He circled and then leveled off well below the clouds and set a northeast course that followed the twisting ribbon of the Wabash River. The air was rough and bumpy, but a tail wind sped them along upstream until they reached the jam in the river some thirty miles from their starting point.

As Bill dipped a wing and circled lower, the boys could see the jam was a big one. Great cakes of ice had humped up to a height of several feet above the normal level of the river, and the dammed-up water had spread out across the fields on either side and was cutting new channels back into the river below the jam. Broken cakes of ice stood on end as far upstream as the boys could see, and Bill flew on up-river to find out how far the jam extended. No open water was seen until they were almost to the town where Carl and Jerry lived, nearly seven miles above where the jam started.

"Guess I'll fly south a ways and then cut across to fifty-two and follow that back into Parvoo," Bill said, banking the Cessna away from the river. "Say, what school's that down there?"

"Lincoln Township Consolidated School," Jerry said, looking down at the brick school building surrounded by soggy cornfields. "Look at the parabolic antenna on top of the building pointing over to the east. They must watch the MPATI programs. "

"Hey, Bill, look over to the right!" Carl interrupted. "Is that what I'm afraid it is?"

Bill took one look at the dark funnel that had suddenly lowered from the clouds two or three miles to the southwest and then banked the plane sharply away from the course he had been flying.

"It's a twister, all right," he said grimly, "and we don't want to tangle with it."

With awe the. boys watched the slender, writhing column of the tornado and the path of destruction it was leaving behind it. "It's sure traveling in a straight line," Carl remarked. "Look at it chewing up that telephone line! Say, if it keeps going the way it's headed, that school is going to be right in its path!"

Bill was already on the plane's radio calling the control tower at Parvoo and asking the operator to call the school and warn them of the approaching tornado. In a few seconds-they seemed like minutes to the boys watching the relentless advance of the evil thing - the tower reported it was impossible to get through to the school. The telephone lines were down. Probably they were the same lines the boys had seen destroyed.

"Maybe I can buzz the school and get someone's attention," Bill suggested, heading back toward the building.

"Not a prayer of a chance," Carl said, shaking his head. "With that big SAC base only ten miles away, there's hardly a minute of the day or night without the sound of some kind of plane around here. Even if you got someone outside, that grove of trees southwest of the school screens off the sight of anything coming from there. Could you land, maybe?"

Bill shook his head. "I can't land along the road because of the power lines. The fields are so soupy with this thaw that we would flip over as soon as our wheels touched. I sure hate ... "

"Wait! There's still a chance!" Jerry exclaimed. "Call the control tower and lave them phone the guys in the MPATI hangar. Ask them to have the technicians in the plane put warning slides in front of the announcement cameras for both transmitters. It's a slim chance, rut it's all we've got."

Bill was on the radio before Jerry finished. The alert control tower operator immediately grasped the plan. By the time he radioed back to tell the boys the MPATI plane was telecasting the warning, the tornado was scarcely half a mile away. Bill flew away from the storm at right angles to its path, and the boys watched helplessly as the funnel cut through the grove of trees, uprooting them and tossing them about as though they were straws, and then advanced directly on the school building.

For several minutes after the funnel struck the building nothing could be seen but flying debris; then, suddenly, .the funnel was sucked back up into the clouds as though satisfied with the devastation it had wrought. As the dust settled, the boys saw that a whole wall of the upper story on the north side had been torn out. Most of the roof was gone. As Bill circled the building at a low level, the boys could not see a single unbroken pane of glass.

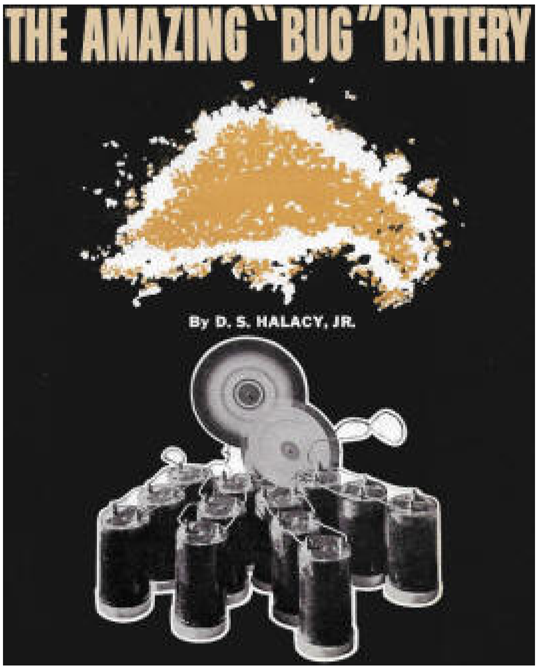
But even as they watched, sick at heart, students and teachers came pouring up an outside basement entrance and spread out over the brick-strewn yard. A young man, apparently the principal, noticed the plane flying anxiously overhead and suddenly began shoving the students into groups. At first the boys in the plane were puzzled; then they saw what he was doing. The groups of students spelled out in ragged letters: "O.K." The plane carried three light hearts as it turned toward Parvoo.

When the boys landed, they learned the rest of the story that had been relayed to the MPATI people by the principal as soon as he had been able to get through on the telephone. A class had been watching a French telecast when the hastily-printed warning flashed on the screen of the receiver. The teacher told the principal, and he immediately herded all students into the southwest corner of the basement according to a prearranged disaster plan. Not a single child received a scratch.

"Everything and everybody got into the act today," Carl mused as he and Jerry drove back to their residence hall. "Ice jam, Bill's Cessna, the DC-six, the airborne transmitters, the receiver in the school, two-way radio circuits, telephone lines, the three of us, the MPATI crew and technicians, the tower operator, the school teacher, the principal - take away anyone of these essential links, and I hate to think of the results.
"Yep," Jerry agreed. "Roles from the hero, Pi in the Sky, villainous Big Twist!"

The Amazing "Bug" Battery
February 1964 Popular Electronics

Contrary to the fantastic claim made by the author of this article from a 1964 issue of *Popular Electronics* magazine, the "bug battery," also known as a biobattery, did not revolutionize rechargeable battery technology. In the ensuing 55+ years we have seen nickel cadmium (NiCad), nickel metal hydride (NiMH), and now lithium polymer (LiPo) batteries, respectively, do the revolutionizing. It's not that bacteria-based energy production was a bad or impractical endeavor; it's just that advances did not proceed quickly enough to keep up wit the other technologies. Research and development efforts inevitably moved away from bug and onto chemicals. D.S. Halacy, Jr., of course had no way of knowing that at the time, so his enthusiasm might have been justified. I say might have been because then, as now, every new idea and technology has its die-hard evangelists who do their sincere best to convince others to join in on the effort. Often, through perseverance, the true believers prove the Doubting Thomases wrong and succeed in spite of being told their ideas will never work. A modern day example is someone like Elon Musk and his Tesla electric car line. As of this writing Tesla's market cap is $84B, while that of Ford is a mere $36B, and General Motors' is a paltry $50B.



By D.S. Halacy, Jr.

Want to build a biological fuel cell? Fantastically economical, they're the power source of the future.

Illustrated on this months' cover is a radically new kind of power converter called a biocell. To drive the electric motors, it is changing a fuel directly to electricity with no intermediate steps. As with any new system or device, there are "bugs" in the biocell. But engineers are not trying to eliminate all the bugs, or more accurately, the bacteria, because they are generating electricity. Far past the gimmick stage, a number of more refined biochemical fuel cells, to use their proper name, are demonstrating their potential as a new power source for the space age. Investigations are under way with a view toward using biocells in the "closed-cycle" of a spacecraft like Apollo to convert waste material into fresh water and food and, at the same time, generate electricity to power radios, radar and telemetry gear, and other on-board auxiliary equipment.

Land-based biocells have powered radio transmitters, driven model boats, and lighted fluorescent tubes. A Navy-sponsored design floats in the sea and generates a multi-watt output. Thus, although the biocell is not yet rolling off the production line for general use, the promise of this newest and most exotic fuel cell seems tremendous.

Up to the present time, man has produced the electricity he uses by mechanical or electrochemical means. Biochemistry now looms as a major producer of power for us, and it is not the science-fiction or Sunday supplement writers but scientists themselves who suggest such "way-out" possibilities as turning the Black Sea into a gigantic "bug battery" to light parts of the country surrounding it. A more modest idea is that of using sewage, garbage, or wastes like those from paper mills to feed bacteria. This not only produces power heretofore untapped; it also gets rid of the waste material much more efficiently than conventional means.

Whether or not the biocell will ever produce power for a mill per kilowatt-hour remains to be seen. One of the pioneer developers has predicted such a bonanza, and there is general agreement that bio-power will figure importantly in our future. After all, biochemistry has fed and clothed us all this time. Why not let it furnish the power too?

The Biocell's Past

Although even the ancient Romans were aware of electricity in living things and actually used the torpedo ray fish in shock treatment of the mentally ill, the idea of putting bacterial metabolism to work as an electrical power plant dates back only about 50 years. In 1912 a British botanist, M. C. Potter, put together a half-dozen "cells" using yeast around carbon electrodes. This primitive bacterial battery generated a current Potter measured at 1.25 milliamps.

The feat caused no sudden selling of utilities stocks. Other researchers conducted similar experiments at irregular intervals, however, and in 1931 B. Cohen at Johns Hopkins Medical School here in the United States reported on a bacterial battery that upped Potter's output to about 2 ma. It was not until about 1960 that biocell research got into high gear, with several groups pushing the idea at the same time.

In his work for the Department of Interior's Geological Survey, biologist Dr. Frederick Sisler became greatly interested in the fact that decomposition of organic matter on the ocean bottom, plus the chemical and physical conditions in the ocean, led to production of a weak electric current. He began to work toward developing a biocell exploiting this phenomenon.

Dr. John Welsh and his associates at Joseph Kaye and Company, a Cambridge, Massachusetts, research firm, noted that all fuel cells had certain common denominators - fuel, plus a catalyst to accelerate the electrochemical reaction. And since enzymes from living cells are the ultimate in catalysts, Welsh felt that biochemistry might speed some re-actions a million-fold.

A third group, Magna Industries, Inc. of California, came onto the biocell idea in a roundabout way. Investigating the corrosion of oil wells and pipe lines under the sea, they found that bacteria were the culprits. They found too that these bacteria were generating tiny amounts of electricity while doing the dirty work. So Magna began to investigate the possibility of setting these tiny workers at a more useful task: that of producing electric power for seagoing equipment.

So immediately successful was biocell work that predictions were made in 1961 that a 1-watt cell was feasible and that a radio might be powered with bacterial electricity within a few years. These things materialized even sooner than hoped for. In 1962, Sisler and his associates in a newly formed private firm demonstrated a small transmitter with a range of 15 miles, and also a model boat operating on biocells, tapping the water it floated in.

The first biocell conference was held in 1962 in Corvallis, Oregon. About a dozen firms were active by then in the new field, both with company-funded studies and work backed by the Army, Navy, Air Force, and NASA. In just a couple of years the biocell had jumped from laboratory test tube to serious contender as a new power source.

How It Works

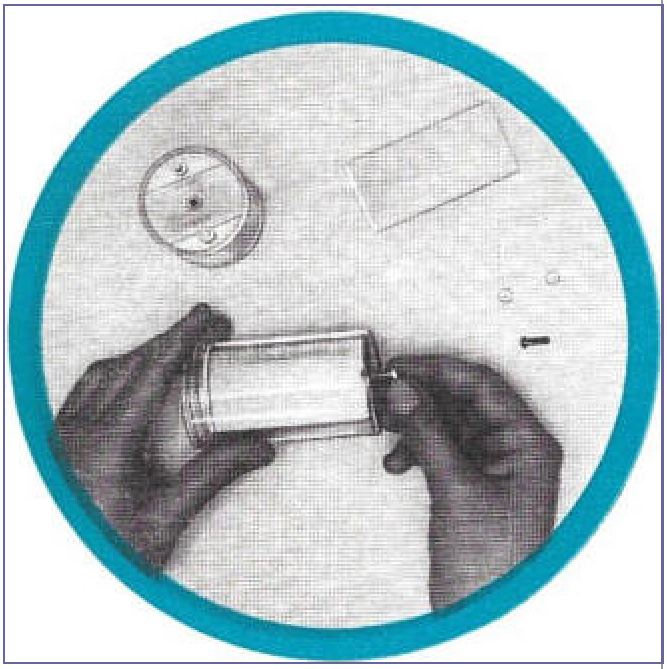
Every living thing, man, mouse, or microbe, is a biochemical fuel cell. It takes in food or "fuel" and breaks the material down to a lower form, extracting energy in the process. Some of this energy appears in the form of electricity. Luigi Galvani was intrigued by the animal electricity he found in frogs, but his countryman, Volta, turned scholars of electricity in another direction with his Voltaic pile, a device considered the original battery.

Make electrodes of two dissimilar materials, place an electrolyte between them, and current flows. This is the same "oxidation-reduction" process that goes on in living things that breaks down fuel into energy and waste. Oxidation, familiar as burning, is made, in a battery, to push electrons around a circuit instead.

The battery is a handy device, but expensive. It would be better to be able to "burn" cheaper fuel in it to produce electricity, and in 1839 an Englishman named Grove did just that. His battery used hydrogen gas instead of zinc or other metal as a fuel, and was the forerunner of today's "hydrox" fuel cells. Before the turn of the century other workers had improved Grove's idea and coined the name "fuel cell." But another means of generating electricity was making its debut. Called the dynamo, it ushered in the age of the mechanical production of electric power.

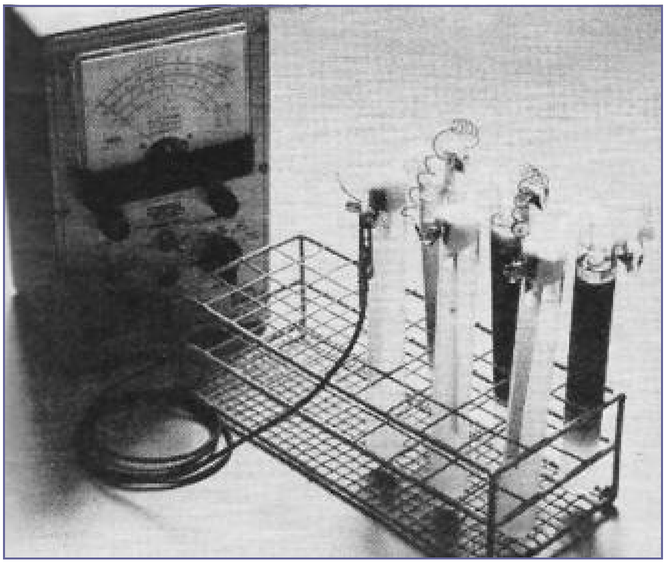
Since even the most efficient turbine generators are doomed by the inexorable laws of thermodynamics to waste more than half the fuel fed them, in the mid-1940's we turned belatedly again to the century-old idea of the fuel cell. Progress has been considerable, and today we have fuel cells powering everything from golf carts to the Apollo space vehicle.

In a typical fuel cell, hydrogen is fed to one electrode and oxygen to the other. Separated by an "ion exchange" membrane rather than the liquid or paste electrolyte of the storage battery, the fuel cell produces electricity - and water. This by-product is important on space missions, obviously. In theory, a fuel cell can be 100 per cent efficient. However, some energy is required to excite the molecules to an energy level necessary for the reaction producing current flow, and there

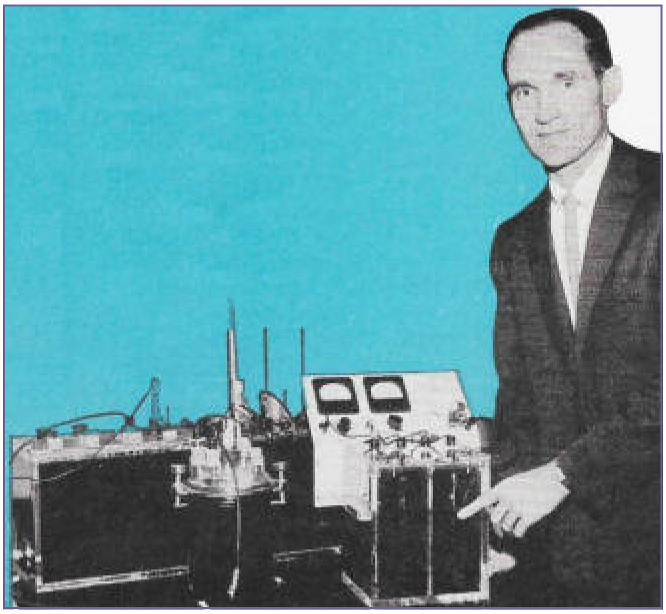


Build your own bug battery? It's perfectly feasible with the Electron Molecule Research kit illustrated in these two photos. Distributed by Allied Electronics (the industrial branch of Allied Radio Corp.), 100 N. Western Ave., Chicago 80, Ill., the kit sells for $16.95 under stock number 7E658, and includes material for 12 cells-plastic containers, copper and aluminum electrodes, harmless bacteria in a carrier, activator (powdered brown rice husks), hardware, wire.

The aluminum and copper electrodes are bolted in the plastic containers (left), which are then filled with the carrier. The biocells begin producing electricity when activator is added - 12 are enough to run a small electric motor, power a transistor radio, or light a small pilot lamp.



Another type of biocell kit is the one above made by Rowland Labs, 345 E. Forsyth St., Jacksonville. Fla. ($14.95). Making use of anaerobic sulphate-reducing bacteria (dark tubes) and artificial sea water (light tubes), the cells produce 1.5 volts at 100 microamperes.



Dr. Rohrback, originator of Magna Inc.'s bio-power concepts, points to power-producing bacteria culture. The firm go into the "bug" battery business while investigating underwater corrosion of metal.

is some resistance in the cell. Practically, 75 per cent is a good figure of merit.

With this kind of performance it might be wondered who needs batteries made from bugs. But the conventional fuel cell still has drawbacks. Hydrogen and oxygen. are expensive, and power densities of fuel cells are rather low even though they are more attractive than regular batteries. A fuel cell that operates on cheap fuel oil is needed, and work is going on in this direction. Catalysts to speed up the reaction and cut down the internal loss of power are important. Such things as platinum, and more recently, nickel boride, are being used. Unfortunately, fuel cells using inexpensive hydrocarbon fuels such as natural gas, octane, etc., seem to require expensive catalytic electrodes such as spongy platinum.

The stage was now set for the entry of the bacteria battery, the biochemical fuel cell. As Dr. Welsh and others had noted, bacteria and their derivatives provide catalysts par excellence. And they are not nearly so fussy as more conventional catalysts. Experiments suggest that bacteria may make hydrocarbon fuel cells practical. More important, biocells have already shown they can turn even waste material into power.

The Electron Molecule Research bio-battery in action on the cover represents the simplest type of bio-power. With its aluminum and copper electrodes it might appear to be a galvanic battery, using the rice husk "carrier" as an electrolyte. However, if a weak acid solution is added instead of the bacteria nutrient, current flow lasts only a short time. Thus the bacteria seem able to prevent polarization, or coating of the electrodes, that halts the reaction. EMR demonstration cells have been operated for more than a year with no decrease in output.

In more sophisticated biocells the anode and cathode sections are separated by an ion-exchange "bridge" through which ions diffuse to sustain current flow. Bacteria are placed at one or both electrodes and promote the process of stripping electrons from the "fuel" provided them.

In addition to more effective catalytic action and the use of cheaper fuels, the biocell operates at room temperature rather than the high temperatures required in some fuel cells. It is also characterized by the mild, "natural" conditions at which life processes take place, with a pH factor in the neutral range and a dilute water solution as an electrolyte.

Fuel for the biocell varies from sugar to organic sea material, yeast, mushrooms, or urea. The U. S. Bureau of Mines has demonstrated a biocell operating on the inorganic material, pyrite, or fool's gold. Suggested are such things as grass, dry leaves, sewage, and other waste materials. One of the most interesting biocells was made by Magna researchers, using bacteria at one electrode and algae at the other, with sunshine as fuel! In effect this represented a biological solar battery and offers the intriguing possibility of converting sunlight to electricity more efficiently than the photovoltaic cell.

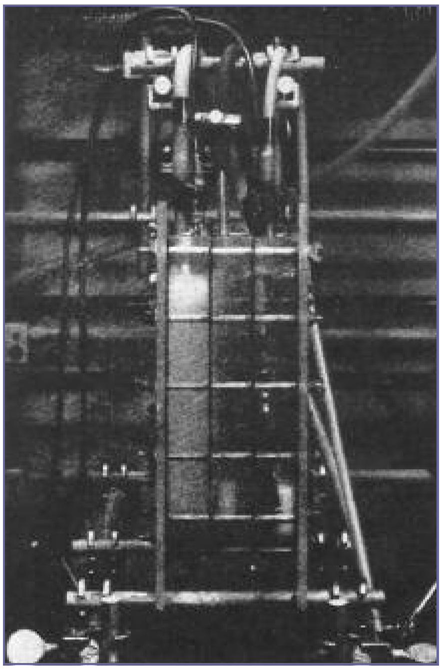
The biocell, like the conventional fuel cell, is not without its drawbacks, of course. Compactness is not among its merits, as witness the bulk of the EMR do-it-yourself battery. Densities of only several amperes per square foot of electrode surface have been reported and this is not sufficient for many applications.

The potential difference exhibited by living materials leads to mild reactions, and the voltage of typical cells is only about half a volt. Cell resistance is a problem, as is the proper shape and size of the cell itself. And obviously the bacterial "workers" must be fed and thus gobble up half the available energy!

Success already achieved with biocells, despite little real knowledge of the phenomenon of bioelectrochemistry, seems to indicate that the biocell's problems are not insurmountable. Compared with those of harnessing the power of nuclear fusion they seem small by contrast, though, of course, nobody suggests that the payoff will be as great. Right now researchers know that the biocell works; they want to know how to make it work better and the chances are good that they will succeed.

Biocells - Today and Tomorrow

Space planning is helping to boom biocell development. When NASA asked for bids on a project there were 33 responding firms. Contracts have gone to four of them, and working systems may be part of manned space vehicles within several years. This is the "Space Oasis" concept, referred to before, with biocells working in conjunction with an algae solar converter in the spaceship's closed cycle. Magna Corporation, Marquardt Inc., General Electric, and Ford's Aero-nutronic Division are doing such research work for NASA.



The elaborate apparatus at left is an experimental hydrocarbon biocell being tested at Socony Mobil Oil Company Field Research Laboratory.

In operation, such a closed-cycle plant will process waste material to provide water, food, and electricity to operate radio and other auxiliary equipment. As an example of the potential power supply, tentative specifications describe a 20-watt urea-fueled battery with 100 ampere-hour daily output from the waste of one crew member.

Much farther along are: U. S. Navy projects. Magna has produced multi-watt units of a marine bio-battery. These are presently being used only to power transmitters in buoys, but there are heady suggestions of bio-powered boats for the future. General Scientific Corporation has also produced prototype units for the Navy.

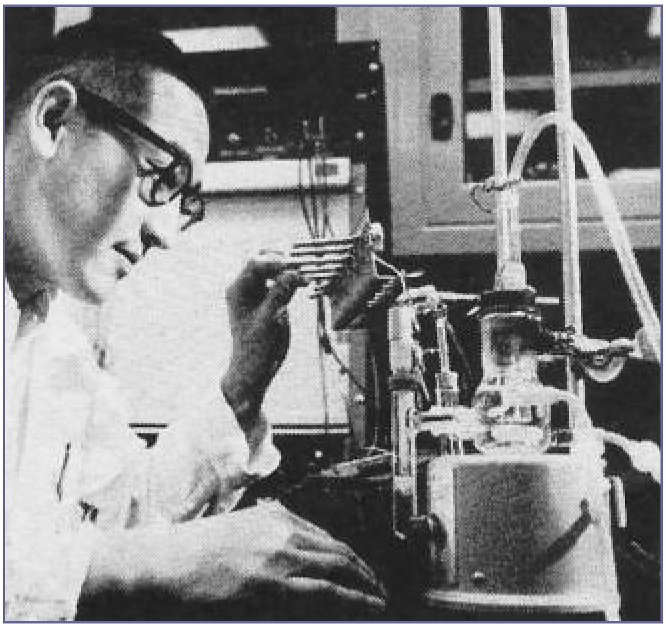
A submarine to be powered by conventional fuel cells is being studied, and there is a possibility that the biocell may be advantageous in such applications. If the model boat already demonstrated, and the hints of using the Black Sea as a power source can be taken seriously, the term "ocean current" takes on an entirely new meaning!

In addition to these programs and other government-funded work, there are privately sponsored projects in the bio-cell field, with some aimed at commercial use of the new power source. On land the biocell may be put to work first in powering remote electrical and electronic installations, aircraft landing lights, fence chargers for ranches and farms, and similar tasks. Army portable radars have already operated successfully on conventional fuel cells and such military gear using bio-power seems possible.

Later on may come projects like harnessing the energy in sewage, paper mill effluent, and so on. While conventional generating plants are obviously safe for many years to come, developments in biochemistry may eventually lead to low-cost industrial electricity competing in some areas with that produced by fossil fuels.

More easily foreseeable are processes in which the biocell does a dual job. It has been pointed out that a brewery is a potential power plant if the heat of fermentation can be converted to electricity. The same might apply to a bakery and to other industries dependent on biochemical action.

The biocell may also prove of great value as a chemical process rather than a power producer. Since the fuel cell can work both ways, electricity might be supplied to the cell and the bacteria furnish useful by-products rather than electricity. Another interesting suggestion is use of the biocell as a detector of germs during possible germ warfare, since a foreign strain of bacteria would adversely affect the electrical output.

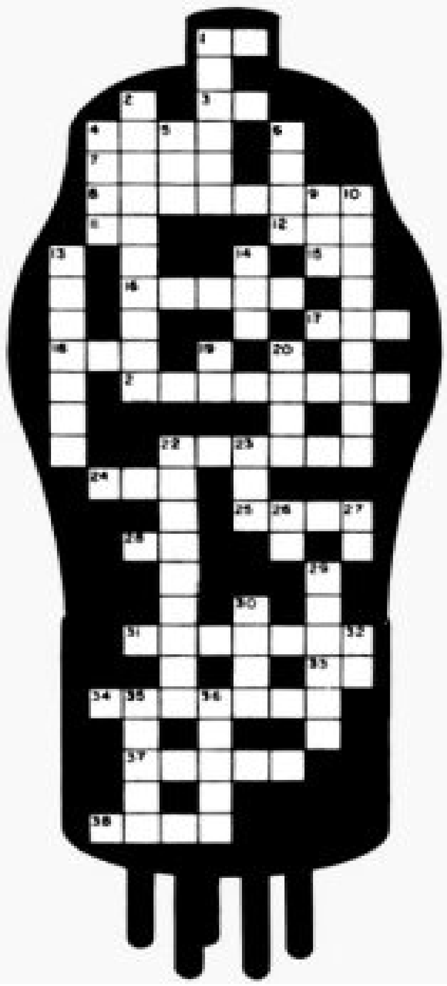


Reversing the usual procedure, power can be fed to a biocell to produce chemical reactions. Above. Dr. Y. H. Inami does so in a NASA study to simulate reactions that occur in biocells.

The conventional fuel cell has a history of more than 20 years of accelerated development. Even though it is still a long way from perfected, it is considered worthy of spending additional millions toward improvement. Application of the biocell, on the other hand, came just three years ago and it has made amazing progress in that short time.

Many scientists feel that attempts to exploit bio-power this early are putting the cart before the horse and that many more years of basic study are indicated first. However, Ernest Cohn, head of NASA's Electrochemical Technology Projects, points out an interesting parallel in the chemical industry. While papers and theses are still being written describing original research on production of ammonia, we nevertheless have an excess of manufacturing capacity for the compound.

Not sure just how the biocell really works, scientists and engineers are nevertheless putting it to use. Given 20 years, it too may do some marvelous things. Meanwhile, you can put together a simple bio-battery of your own and watch, or listen to, bug-power go into action!



Down

1. Unit of current flow.
2. Divide 300 by frequency in mc. to get _______.
4. International Morse ______.
5. Knobs are held by ______ screws.
6. Practical unit of electrical power.
9. Unit of resistance to current flow.
10. Device to produce pulsating d.c. from a.c.
13. Electron-emitting electrode.
14. Signal evaluation code.
19. End of message: abbrev.
20. Unit of electromotive force.
22. Number of cycles per second.
23. Record of station activities.
26. Radio frequency: abbrev.
27. Distant.
29. First name: slang.
30. To get a license, you must pass a ______.
32. Alternating current: abbrev.
35. Receiving set.
36. Cathode-ray test instrument.

Across

1 Audio frequency: abbrev.
3 Public address system: abbrev.
4 Enclosure.
7 Your turn to talk.
8 R.f. rectifier.
11 Elevated railroad.
12 Article.
15 Megacycle: abbrev.
16 Undesired sound.
17 Unwired equipment (sold as).
18 Ungrounded connection.

21 Multiple of the fundamental.
22 Selective a.f. or r.f. network.
24 Heater: abbrev.
25 Electrode in vacuum tube.
28 General call to any ham station.
31 Device to radiate radio waves.
33 Direct current: abbrev.
34 Frequency-controlling element.
37 Two-element vacuum tube.
38 Dot-dash signals.

CONTACT US:

WA/Telegram +27824484368
email: andyzs6ady@vodmail.co.za
www.awasa.org.za

Antique Wireless Association of Southern Africa

Mission Statement

Our aim is to facilitate, generate and maintain an interest in the location, acquisition, repair and use of yester-days radio's and associated equip-ment. To encourage all like minded amateurs to do the same thus ensur-ing the maintenance and preservation of our amateur heritage.

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

Get your backdated issues at
http://www.awasa.org.za/index.php/newsletters

Visit our website:
www.awasa.org.za

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—7.140
Saturday 08:30 (06:30 UTC)— National SSB Net— 7.125;
Echolink—ZS0AWA-L; ZS6STN-R
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

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 ZS3ADY 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
