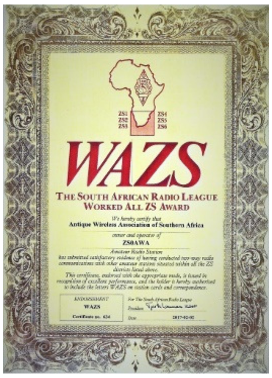
Antique Wireless Association of Southern Africa

205 September 2023



Inside this issue:

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Visit our website: www.awasa.org.za

Reflections:

What are you doing this Saturday morning ? If your reply to this is, "Not much", then why not join us on the Saturday morning AWA net from 08:30 SAST (06:30 UTC) and get involved in our discussion group.

We have had some really awesome discussions on varying topics and we know the listenership is always there too. Besides having made it so easy for you to join us, there are several ways to do this:

HF on 7.125 LSB

HF on 10.125 USB

HF on 14.135 USB

Echolink via the

ZS0AWA-L server.

VHF 145.700 Sandton

VHF 145.6625 Kempton

So really, there is no excuse anymore for you not to try and join us.

Then if you really can't make it but would like to hear what happened on the net, you can always go to our website, check on the top of the page "Latest News", and you can open the audio blog from the Saturday or subject of your choice. It really is that easy, and we would love to hear many more of you joining.

Renato, (our honourable President) is always open to subjects for discussion, so if you have something that you would like to share or want to hear more about from a few of our "Guru's", then let him know. He's available on WhatsApp Telegram or email.

The open days at SAIEE are becoming more popular by the month. This last month, August, we had a good turnout of people coming to either browse the museum, discuss radio, or just meet with other like minded Amateurs. Of course while they are munching on a steak roll.

There has even been the exchange of some jewels that are brought along for those interested.

With the weather improving all the time now, it's a great outing after the net on one Saturday a month. Bring some of your buddies along and let them see what we talk about when we mention our "Amateur Heritage".

You never know, it may just inspire them to either become hams, or dig out some of their relics in the garage to revive them.

There are still a few more surprises in the wings to make your connection with the AWA of Southern Africa even more pleasant. Listen out for what is in store. We will be first to make the announcement and keep you up to date. (I bet that's got you all wondering now).

This insert has been brought to you with the express interest of raising your level of cognisance and placing a desire within you to be more radio active, specifically on a Saturday morning. You will find it extremely enlightening and raise your level of interest, much to the ire of non-believers.

Best 73

DE Andy ZS6ADY

Coronal Mass Ejection (CME)

Wikipedia

Initiation

CME initiation occurs when a pre-eruption structure in an equilibrium state enters a nonequilibrium or metastable state where energy can be released to drive an eruption. The specific processes involved in CME initiation are debated, and various models have been proposed to explain this phenomenon based on physical speculation. Furthermore, different CMEs may be initiated by different processes.

It is unknown whether a magnetic flux rope exists prior to initiation, in which case either ideal or non-ideal magnetohydrodynamic (MHD) processes drive the expulsion of this flux rope, or whether a flux rope is created during the eruption by non-ideal process. Under ideal MHD, initiation may involve ideal instabilities or catastrophic loss of equilibrium along an existing flux rope:[3]

- The **kink instability** occurs when a magnetic flux rope is twisted to a critical point, whereupon the flux rope is unstable to further twisting.
  The **torus instability** occurs when the magnetic field strength of an arcade overlying a flux rope decreases rapidly with height. When this decrease is sufficiently rapid, the flux rope is unstable to further expansion.
- The **catastrophe model** involves a catastrophic loss of equilibrium.

Under non-ideal MHD, initiations mechanisms may involve resistive instabilities or magnetic reconnection:

- **Tether-cutting**, or **flux cancellation**, occurs in strongly sheared arcades when nearly antiparallel field lines on opposite sides of the arcade form a current sheet and reconnect with each other. This can form a helical flux rope or cause a flux rope already present to grow and its axis to rise.

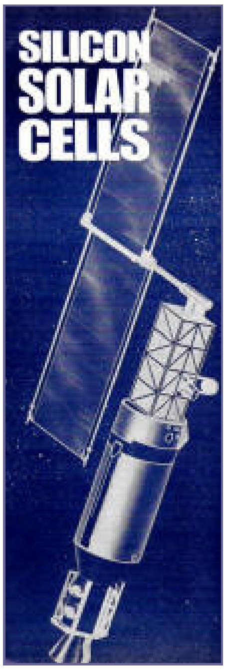
The **magnetic breakout model** consists of an initial quadrupolar magnetic topology with a null point above a central flux system. As shearing motions cause this central flux system to rise, the null point forms a current sheet and the core flux system reconnects with overlying magnetic field.

Silicon Solar Cells
November 1973 Popular Electronics

As with most technologies, solar cells have come a long way in the last half century. Fabrication processes and efficiencies have improved significantly, motivated highly in the last twenty years or so by the global push to replace fossil fuels with other forms of power*. This article from a 1973 issue of *Popular Electronics* magazine is a snapshot of state of the art solar cells at the time. In the 1970s, there were no large scale solar cell arrays that were a critical part of an electric power grid. Ditto for wind turbines. One of the most significant uses of solar cells then was for powering satellites that operated near enough to the sun to generate useable energy (out to about Mars' orbit). Due to the relatively low output capacity, nuclear power supplies provided electricity for higher demand nearby loads and for deep space probes. A radioisotope thermoelectric generator; i.e., nuclear, powered the lunar rovers for Apollo astronauts. Yep, we left plutonium 238 on the moon.

* I reject the term "renewable" power since regardless of the source, no power source is renewable. The wind passing over a turbine blade has yielded that portion of its energy that resulted in motivating the blade, hence, not renewable. Solar rays impinging on a photovoltaic cell yields that portion of its energy that effected the conversion of light to electrical current, hence it is not renewable. Water falling over a dam yields that portion of its potential and kinetic energy that drives the generator, hence it is not renewable. "Renewable" is purely a feel-good marketing word.
See also "Power from the Sun with Silicon" in the February 1973 issue of *Popular Electronics*.

Silicon Solar Cells - What makes them work; where they are used



By Joseph H. Wujek

The photoelectric effect that takes place in certain materials has long been known. However, it was not exploited in semiconductors until the mid-1950's when Bell Laboratories produced a solar cell, a device that converts the sun's energy into electrical energy. Then, as semiconductor technology expanded, improvements in solar-cell performance followed.

Although solar cells employ diverse materials, in this article we will discuss only the silicon device. Because of its high efficiency, stability, and reliability, silicon has become the most important and widely used material in solar cell technology.

Physical Principles. Before expanding in detail the characteristics of the silicon solar cell, let us review the physics involved in its operation to get a better understanding of the device's characteristics. Figure 1 shows a pn junction that is similar in principle to a simple semiconductor diode. While the events occurring in the junction are like those of an ordinary diode, several important differences in construction should be noted.

If useful application of the device as a solar cell is to be made, the surface area must be as large as possible to permit it to "see" the maximum amount of sunlight.

However, recognizing that silicon is an easily damaged brittle material, a surface area of roughly 2 cm on each side (0.8"x 0.8") was chosen. A means for drawing off the electrical energy generated by the cell was required; so, leads were attached to each side of the junction, with care taken to minimize the area used for connections on the "sun side" to avoid obscuring the sunlight from the active portion of the device. Then, to reduce the cell's resistivity, thin metallic "fingers" or grids are often used on the active surface, while the other side

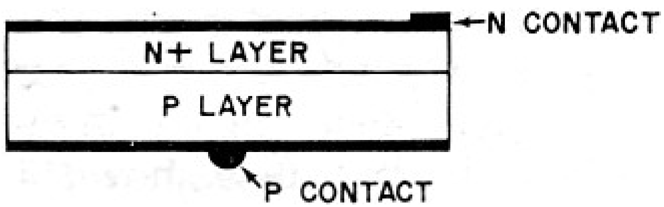
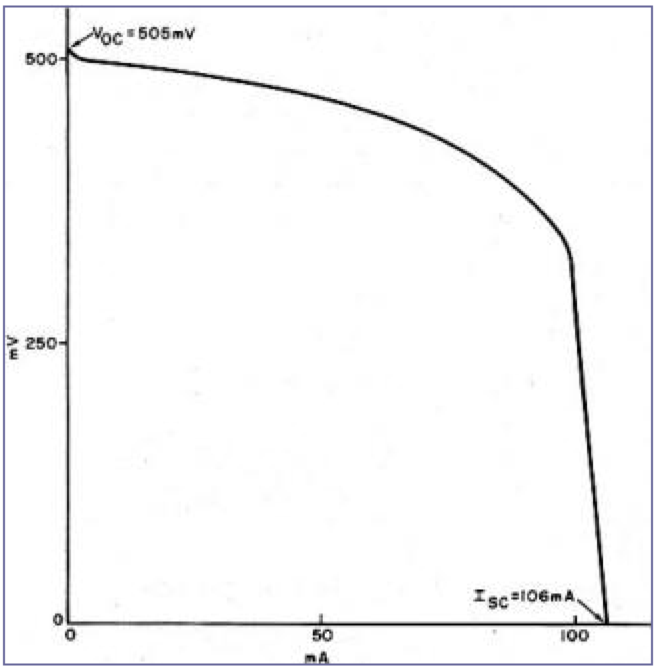


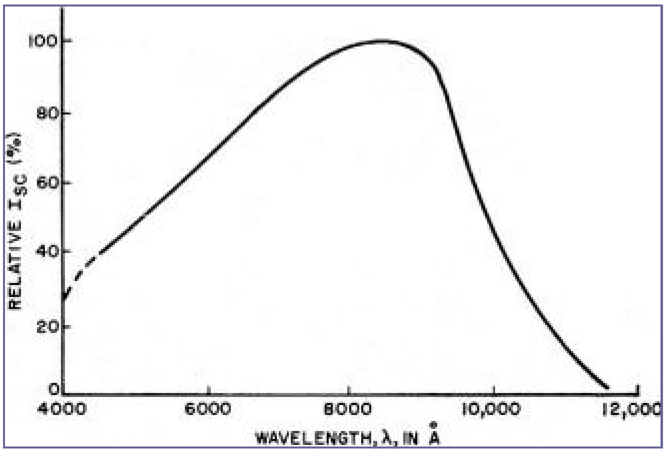
Fig. 1 - Cross section of silicon solar cell shows its similarity to simple pn junction.



may be entirely metallized.

Depending upon the spectrum (wavelength characteristic) of the excitation light and the physical properties of the cell, electron-hole pairs are generated and a voltage appears across the terminals. If a resistance is placed across the terminals and the voltage and current for various loads are measured, the voltage-current (V-I) characteristic for the cell can be determined. A typical V-I plot for a commercial 2-x-2-cm silicon cell is shown in Fig. 2. (Note: the silicon solar cell has a negative temperature coefficient of 2 mV/°C; its output decreases by approximately 2 mV for each 1°C rise in temperature.)

Fig. 2 - Voltage-current characteristic for a silicon solar cell at 20°C with noon sun at right angles

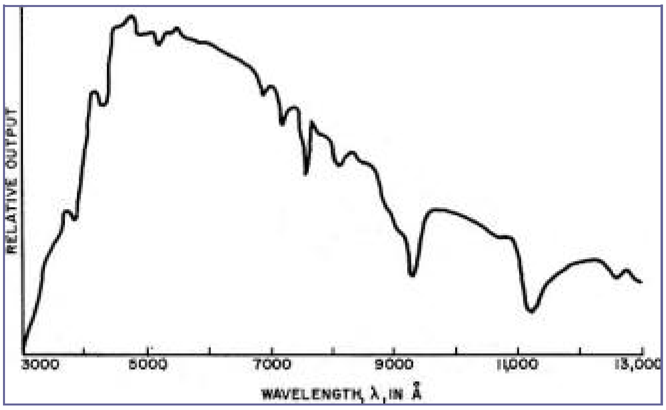


Performance Characteristics

To predict the performance of a solar cell, we must rely on spectral response measurements which state the cell's output as a function of the wavelength of the incident light for a given brightness. Energy is inversely related to wavelength (the higher the energy, the shorter the wavelength). The spectral response of the cell, as well as the spectral output information of the sun, enable us to predict the cell's performance.

In Fig. 3 is given the spectral response of a silicon solar cell. The wavelength is stated in angstroms (Å), equal to 10^{-10} meter, or 10^{-4} micron. The visible portion of the spectrum extends from 4000 Å (ultraviolet) to 7000 Å (infrared). The curve plot is given in terms of percent of peak (normalized) short-circuit current for a constant light intensity (flux). The curve's shape remains the same over a broad range of flux levels, although the short-circuit current increases with increasing flux. To find the total output of the cell, the function must be integrated, yielding the area under the curve.

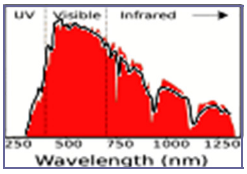
Fig. 3 - The spectral response of a silicon solar cell in terms of peak short-circuit current for a constant light intensity (flux).



The curve is statistical in nature. It is a measure of the number of electrons that are excited into the conduction band of the p-n junction. At the right, no output is obtained until the energy is increased to about 11,000 Å - which corresponds to the 1.1 eV of energy required to "trigger" the mechanism in silicon. The presence of excess electrons lowers this threshold somewhat so that some output appears at energies slightly below 11,000 Å.

As the energy is increased, more electrons are dislodged because an electron given additional energy can also collide with other electrons and transfer some of its energy, yielding additional electrons. If the energy is increased beyond a certain limit, the output decreases. This is due to the bluish-purple color of the silicon-dioxide passivation layer on the top of the cell; this layer filters the light in this energy region so that the junction does not "see" as much light. A further increase in energy would ultimately destroy or at least degrade the cell with X-rays.

Fig. 4 - Relative spectral output of the sun viewed at surface of the earth.



The plot to the left is a 2015 measurement of solar flux as a function of wavelength at the Earth's surface (Wikipedia). I re-scaled and superimposed the original to fit over the 1973 version above. The new plot is more detailed, but the general curve is a very close match.

The information given in Fig. 3 is useless unless something of the nature of the spectrum associated with the sun is known if the cell is to be excited. The relative spectral output of the sun, as viewed at the earth's surface, is shown in Fig. 4. The dips are due to atmospheric absorption of certain wavelengths.

The flux from the sun observed at the earth's surface depends upon the geographic location, time of year, and time of day, as well as local atmospheric and elevation conditions. For most of the U.S., the peak flux is 80-90 mW/sq cm, measured for clear-sky conditions at solar noon. For standardization, most workers in the field use the so-called air-mass zero (A.M.-0) flux, 140 mW/sq cm, based on measurements performed in high-altitude balloons and solar simulators. The peak earth-surface flux at noon for the above conditions corresponds to an air mass of 1 (A.M.-1). For times other than noon, the air mass is greater than 1, with an attendant decrease in flux. This effective increase in air mass, as well as the change in the incident angle of the sun throughout the day, cause variations in the output of a stationary terrestrial solar array.

The output current of a solar cell decreases as the angle of incidence of the sun changes from perpendicular to the cell. This roll-off is shown in Fig. 5. The "best" angle for mounting an array of solar cells will depend on geographic location, time of year, and time of day. A sun-tracking mechanism can be used to rotate the cells and at the same time vary the array's tilt to keep the sunlight perpendicular to the plane of the cells. Earth satellites use this scheme, although it is more common for them to have cells that "look" in all directions simultaneously. In Fig. 6 is shown a satellite of the latter category; so long as it is not oriented in an end-on attitude or is eclipsed behind the earth, power will be generated by the array.

For the most part, cells supplied by U.S. manufacturers are either rectangu1ar (1 X 2 cm) or square (2 X 2 cm), although other sizes and shapes are also manufactured. For example, Fig. 7 shows cells made by IRC. They have more than 95 percent of their surface area active. (Electrical contacts occupy a small fraction of the area.)

Most silicon solar cells have an efficiency of 8 to 11 percent. (At 90 mW /sq cm of sunlight, a 2- X -2-cm cell will have a 26-36-m W output.) The peak output also depends on the load.

Since the individual solar cell has an output of about 0.5 V, cells must be interconnected in series and parallel configurations to raise the voltage and current, respectively, to the load's demands. To prevent one series string from driving current into another string, isolation diodes are used. These diodes are particularly important when sunlight is reduced or cut off from a string. If the diodes were not present, the shadowed string would appear as an ordinary diode across the unshadowed cells, reducing the voltage and perhaps destroying the cells by drawing excessive current. Diodes can also be used to protect individual cells in an array.

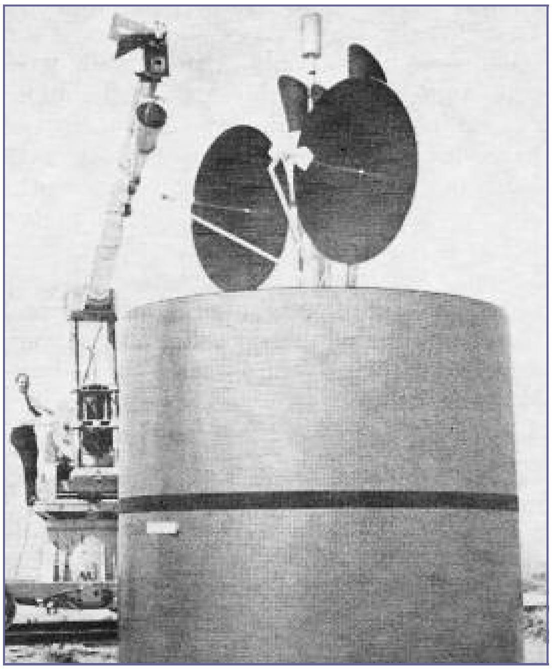


Fig. 6 - Intelsat 4 communication satellite showing the solar cells that are mounted around circumference. By contrast, the Sky Lab satellite which is in orbit uses flat panels.

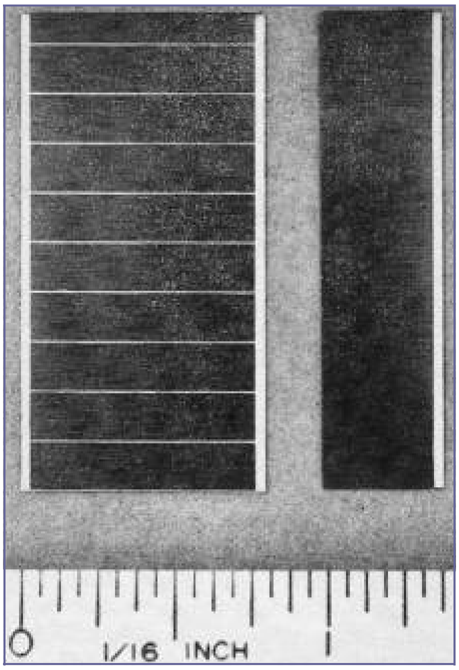


Fig. 7 - IRC silicon cells occupy 95 percent of the surface; contacts make up the rest

Types & Applications

Centralab Semiconductor manufactures a standard array that provides up to 6 watt-hours a day. The panels can be had at nominal outputs of 4.7, 7, 14, 16.5, or 28 volts at a nominal 1-watt output. The array's area is 5 1/4 X 6 3/4 in., and weight is about 2 lb. Panels such as these are used to power weather recorders, snow-depth recorders, and pipeline monitors.

Centralab, along with Heliotek and International Rectifier Corp., furnish most of the silicon solar cells manufactured in the U.S. Although some panels are available as standard items, most of the arrays made by these companies are to customer specifications. Individual cells are also supplied for user-designed arrays.

An example of what can be done in designing an array is the FRUSA (Flexible Roled-Up Solar Array) developed by Hughes Aircraft Co. The system (Fig. 8) consists of two 16- X -55 1/2-ft. solar panels on which are mounted a total of 34,500 2- X -2- cm cells. The mounting medium is du Pont's Kapton® film, and a 0.006-in. glass cover protects the cells. Fabricated in this manner, the arrays are flexible and can be rolled up in window-shade fashion on a 10-in. diameter cylinder. The 1500-watt, 28-volt system was designed for satellite applications.

The FRUSA system represents an improvement of 300 percent/lb ratio over space power systems developed in the past. Hughes engineers are hopeful that the FR USA concept will find application in powering electrically propelled spacecraft in interplanetary exploration.

A proposal for building solar-powered stations has been advanced by E.L. Ralph of Heliotek. He points out the need for developing new sources of power to alleviate the fossil fuel shortages that are bound to occur. These stations would consist of great quantities of solar concentrators to reflect the sunlight to the solar cell over a broad range of solar angles. Ralph believes that such a system could be built at a cost of between $2000 and $10,000 per kilowatt for small power stations and as little as $1000 for large stations. The prospects of such installations is appealing since solar energy costs nothing and maintenance would be only a small effort when compared to present-day fossil-fuel stations.

Less exotic, but no less important perhaps, are other applications of solar cells. With the growing emphasis on preservation of our natural resources, the migratory habits of wildlife are of considerable interest. Schemes for implanting tiny transmitters in birds and sea otters have been discussed; they would be powered by small solar arrays attached to the subject. Information gathered in these studies is of fundamental importance in preserving the well-being of the species.

With travel by automobile gaining in popularity in the U.S., the need to provide emergency roadside call boxes


THE NEW SHIELDED HAMMARLUND-ROBERTS Hi-Q★
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Complete instructions for assembling, wiring, and operating the Hammarlund-Roberts Hi-Q Receiver. Prepared under the direction of the Engineer-designers.
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Automatic Variable Coupling—same control operates tuning condenser and primary coil coupling simultaneously, gives maximum and equal amplification and selectivity over entire tuning range.
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Different And Finer Results
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THE new Hammarlund-Roberts Hi-Q is an entirely modern radio receiver, incorporating the latest approved features. The most important of these include dual tuning, stage shielding, automatic coupling variation, high detection efficiency, a high power output and that it is non-oscillating.
Tried and proven fundamentals have been adhered to; but they are applied in new and different ways that produce greater selectivity, clearer tone, simpler tuning.
This new Hammarlund-Roberts is the united achievement of ten of the leading radio engineers in the country; all concentrating on producing the most advanced and efficient receiver—regardless of cost.
YOU CAN BUILD THE HAMMARLUND-ROBERTS YOURSELF
Anyone can build the Hammarlund-Roberts HI-Q. All the research, the selection of parts, the exact placing of units, has been worked out in advance for you. And you have a receiver that will equal an eight tube set—simplicity of design and operation hitherto unthought of—all at less than half the price you would pay for a factory made set of anywhere near equal efficiency.
HAMMARLUND-ROBERTS, 1182-G Broadway, New York
Hammarlund ROBERTS Hi-Q★
Parts complete (less cabinet) $63.05
★High ratio of reactance to resistance. High ratio—Great selectivity—Loud siganal.
HI-Q FOUNDATION UNIT
Includes drilled and engraved Bakelite panel, drilled Bakelite sub panel, two complete shields, hardware, wire, nuts and screws. $10.50
ASSOCIATE MANUFACTURERS
Carter Radio Co.
Martin-Copeland Co.
Radiall Company
Samson Electric Co.
Sangamo Electric Co.
Benjamin Electric Mfg. Co.
Eby Manufacturing Co.
Hammarlund Mfg. Company
International Resistance Co.
Westinghouse Micarta

Fig. 8 - Panel of solar cells for a Hughes FRUSA (Flexible Rolled-up Solar Array).

also grows. In those areas that are remote from power lines, solar cell powered call boxes could provide the means for furnishing this needed service. Even in those areas where power lines are accessible, solar power might prove economical. The development over the past several years of low-powered complementary symmetry MOS circuits enables designers to produce circuits that perform complex functions at power levels in the microwatt region. With high-density packaging made possible by large-scale integration (LSI) technology, these circuits, when combined with small batteries and solar-cell chargers, could provide new products that up to now were not feasible. Portable instruments, consumer products, and marine navigational aids are among the major product areas where this new technology is likely to appear.

To the interested amateur, solar cells are available from most of the major mail-order electronics supply houses. A variety of interesting circuits and gadgets can be built from these components, using the information contained in this article and manufacturer data sheets for the cells.

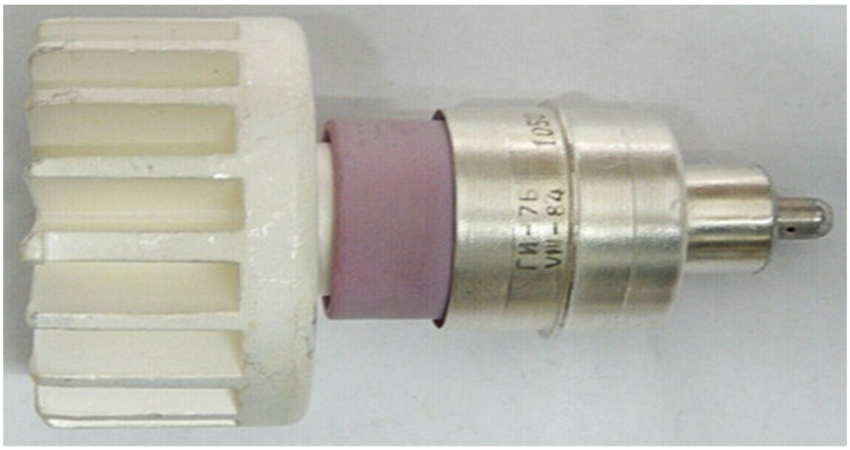
Beyond furnishing power to recharge batteries, the cells can be used as sunlight sensors to power relays or drive transistors. Used with small batteries, recharge capability is provided for activities in remote locations for backpacking campers, on small boats, and the like.

The solar energy, radiated to the earth's surface, is of the order of 10^{16} kW-hr/yr. This enormous source of energy is too plentiful to be overlooked. Solar cells will undoubtedly continue to provide a means for tapping this vital source.

The Exotic GI7b

by Daniel Romila VE7LCG

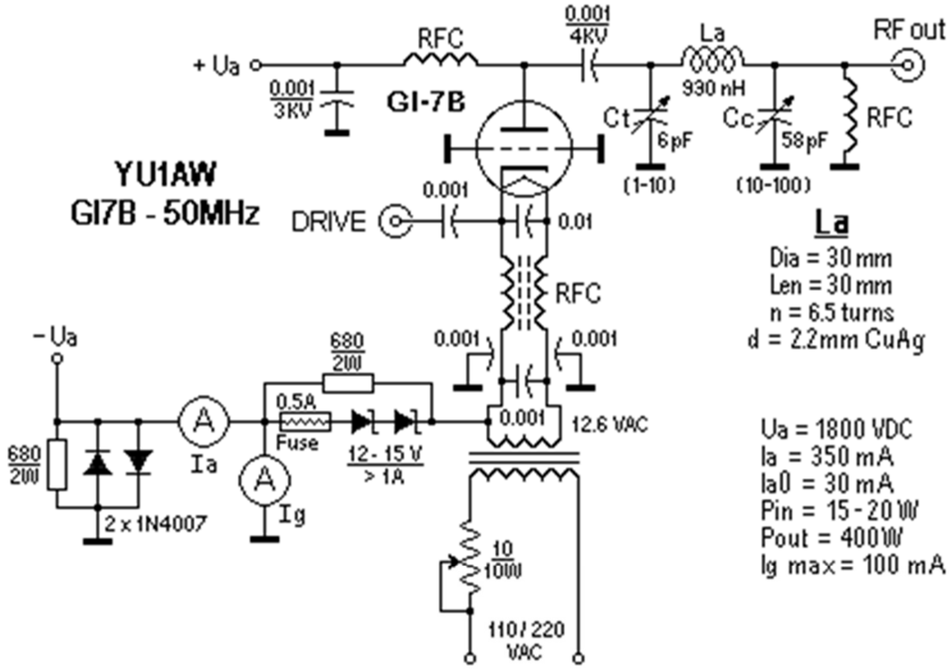
Some tubes are so elegant that one feels like keeping them on the shelf as decoration more than he/she feels like using them in a practical radio amateur project. This is what I always felt about GI7B, which is not even in glass, so people would be able to take it from the shelf, admire it and put it back in its place, without me worrying I will have to pick up the pieces.

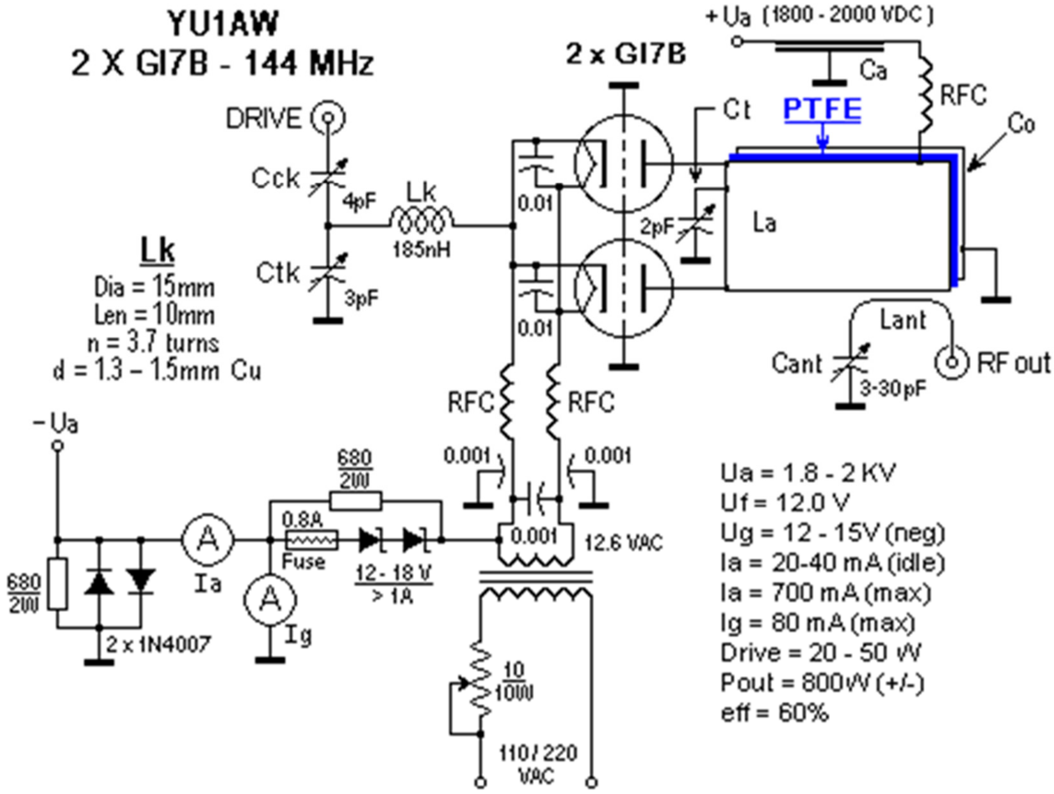


GI7b data	min	nominal	max
Heater	12V	12.6V	13.2V
Heater	1.8A	1.92A	2A
Plate voltage	-	1500V	2500V
Plate Current	-	400mA	600mA
Plate dissipation	-	-	350W
Working freq			2.7GHz
	20 mA/V	23mA/V	26mA/V
Pout	-	250W	
P in	-	10W	20W
C g-k	10pF	11.1pF	12.2pF
C a-k	0.055pF	0.075pF	0.08pF
C g-a	4pF	4.6pF	5.2pF
Grid bias		-15 to -17V	

This tube was manufactured long time ago in the past and used in military equipment of all Eastern Europe. It is still available as New Old Stock in huge quantities.

One of the early adopters of GI7B for radio amateur power amplifiers seams to be YU1AW, because many of his schematics are posted all over the Internet and everybody else building with this tube refers back to YU1AW.



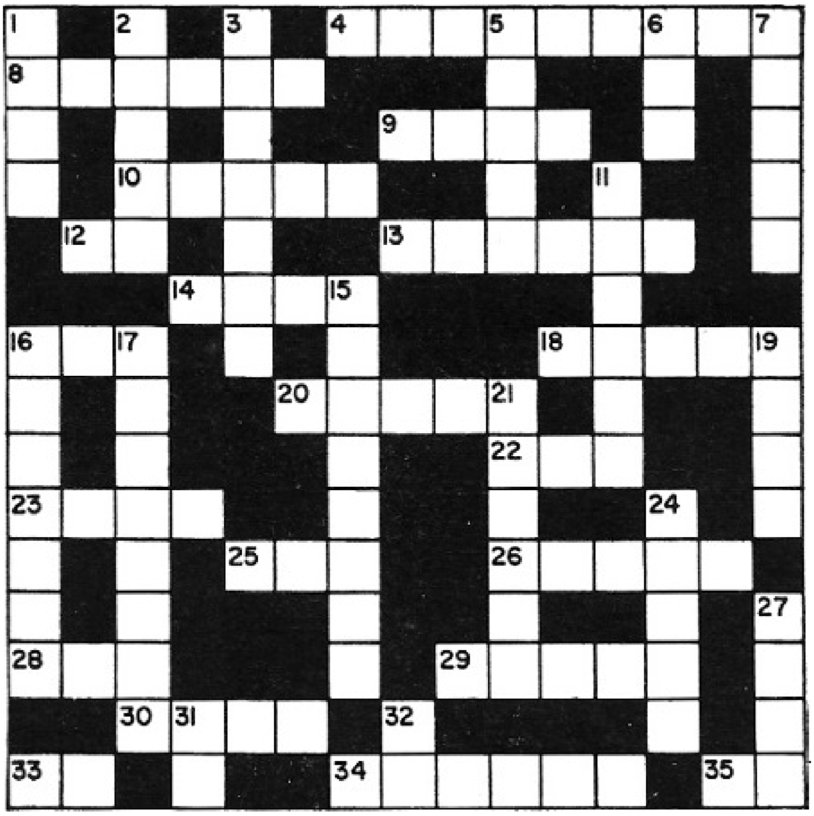


I found on the Internet a website belonging to W4ZT, "All About the GI-7B":
https://gi7b.com/

Like many sources about tubes and vintage equipment, the update of the above website stopped some 10 years ago, in 2014. I think this stop in updates relates more to the age of the people using the tube, and not to the age of the tube itself (LOL).

John A. Comstock

Your association with the electronics field should include familiarity with the many famous scientists without whom radio, TV, hi-fi, and electronics would be impossible. Try your hand at working this puzzle. If you can fill in the correct names and words, you have paid small tribute to these outstanding men who have helped make life easier for all of us through electronics.



Across

4. Inventor of superhet circuit and FM system of broadcasting.
8. Inventor of the cylinder phonograph.
9. "Gauss" is unit of ______ density.
10. First man to demonstrate electromagnetic radiation phenomenon.
12. An electronic device invented by Fleming (abbr.).
13. De Forest's early triode.
14. The relationship between current flow and magnetic flux was investigated by ______.
16. William Gilbert is closely linked with ______ (abbr.).
18. Unit of inductance bears this U.S. physicist's name.
20. Discoverer of e.m.f.
22. Well-known New England technical school. (colloq.).
23. British engineer after whom unit of power consumption was named.
25. German physicist, Kirchhoff's initials.
26. Armstrong's first name.
28. First name of the "Father of the Vacuum Tube."
29. In 1946 it was proved possible for radar to ______ the moon and be reflected back to earth.
30. X-______ were discovered by the German physicist, Wilhelm K. Roentgen.
33. ______ Forest invented the triode by adding a grid to Fleming's diode.
34. Man famous for his contributions to sound measurement.
35. "Alva's" first and last initials.

Down

1. Inventor of telephone.
2. Angstrom is noted for his contributions in measuring the wavelength of ______.
3. The French mathematician, Jean B. J. ______ whose name is associated with wave analysis.
5. W. C. Sabine developed a well-known formula for measurement.
6. German physicist after whom the unit of resistance was named.
7. The unit of flux density was named after this German mathematician.
11. He added a third element to the diode.
15. Inventor of the "Iconoscope."
16. The CGS unit of magnetic flux was named after this British physicist.
17. Scientist whose name is associated with sound range because of his investigations into this phenomenon.
19. Japanese inventor of an antenna.
21. French physicist after whom the unit of current flow was named.
22. The hand that is employed for motors.
27. ______ analysis was investigated by Fourier.
31. First and last initials of the man who gave us the practical unit of current intensity.
32. Unit for designating length of light waves was named for this physicist (first and last initials).

AWA Open Day at SAIEE

The AWA in conjunction with the South African Institute of Electrical Engineers is holding another open day at the grounds of the SAIEE.

The museum will be open for viewing, the SAIEE shack will be operational. Should you wish to bring along some of your valuable jewels that you no longer have space for and want to either sell or barter them, bring them along. A boot sale will be available. There are no tables, so if you need one, you can bring your own along.

There will be refreshments available, and maybe even some rolls with meat inside.

If you want to come and view what the AWA is all about, (Our amateur Heritage) it is there to be seen in all it's glory.

Times will be from 10:30 to 14:00

The address is 18a Gill Street, Observatory or look for directions on the AWA website, under "Museum".

Dates are 16 September; 14 October….further dates will be announced.

Any members wishing to help out at the SAIEE can let Andy ZS6ADY or Renato ZS6REN know when you will be available. We need more hands to help out.

CONTACT US:

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Benoryn
1504

Mobile: 082 448 4368
Email: andyzs6ady@vodamail.co.za

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

Visit our Website:
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.

Notices:

Net Times and Frequencies (SAST):

Saturday 07:00 (05:00 UTC) —Western Cape SSB Net— 3.640; Every afternoon from 17:00—7.125
Saturday 08:30 (06:30 UTC)— National SSB Net— 7.125; Sandton repeater 145.700
Echolink—ZS0AWA-L
Relay on 10.125 and 14.135 (Try all and see what suits you)
Saturday 14:00 (12:00 UTC)— CW Net—7025

AWASA Telegram group:

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