Experimental Broadcaster's

Newsletter

Volume 5, Number 10
October 1988

Hob-Goblins, Witches, Pumpkins and Pranks - Halloween is upon us!

Non-commercial broadcasters - the "Educational" type stations often present Halloween shows - something that commercial stations usually don't want to do. A little "Monster Mash", some Edgar Allen Poe's "Raven" and "Tell-Tale Heart" to run chills down your spine. Good alternative broadcasting fare.

Pirate operators also take delight in Halloween. Some do elaborate radio shows. Others, usually the Short Waver's, may broadcast only once a year..on Halloween. This year we may be in for a REAL SURPRISE. The voice of the "Great Pumpkin" and the "Purple Pumpkin" and whoever may be eclipsed by the voice of NEEWOLLAH from the NILBOG people!

Talk shows should be easier and sound more professional with this month's circuit submission from WBNO. The unit should be easily constructed from just a few dollars worth of parts from Radio Shack.

WTPS apparently was alive and well in March of this year. Todd sent us a copy of one of this year's early play list. Remember, we'll run your play list also if you submit it!

Roger submitted some ideas on boosting power supply performance. Good ideas but which prompted a mini-lesson concerning some not-so-obvious design parameters. And we keep getting calls wondering why output power readings differ from those that are expected. An RF power meter inserted in the transmission line for example measures 15 Watts while the transmitter only puts out 10! Yes, Silvia - there is a meaningful answer for this contradiction...another mini-lesson!

Enjoy! May Charlie Brown's "Great Pumpkin" be with you.......

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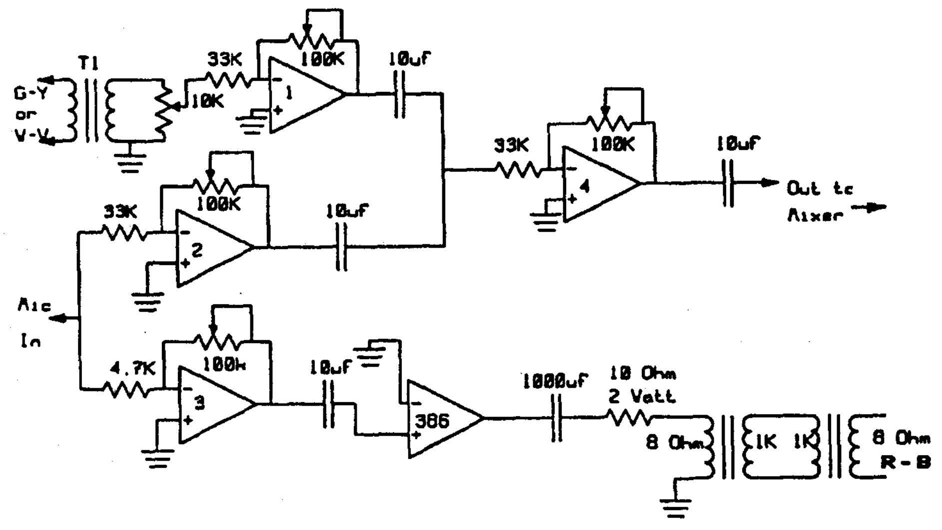
Tele-Patch from WBNO



Talk Show Phone Interface

The purpose of this circuit is to interconnect a telephone with an audio mixing board. It will allow the user to speak into a microphone and be heard by the caller, and also allow the user to hear the caller through the mixing board. The result is a professional sounding talk show.

CIRCUIT EXPLANATION - First of all, the circuit gets its input and provides its output through the handset jack of the telephone being used. You will need to buy a handset cord and sacrifice one connector and strip back the outer insulation to expose the four wires. The input comes from the Green and Yellow or the two white wires of the handset cord. The output of the circuit feeds into the Red and black wire of the handset cord.

The input feeds transformer T1, which is a Radio Shack 1:1 audio isolation transformer (273-1374), which isolates the circuit from the phone and feeds op- amp #1 through a 10K pot. Op-amp #1 then feeds into the output op-amp (#4) which provides an output to the mixer. The microphone input is split and set two ways, one path for the mixing board and the other path for the telephone output. The path through op-amp #2 is for the mixing board as op-amp #2 also feeds the output op-amp #4. The path through op-amp #3 goes out to the telephone line by way of an LM386 audio amplifier. The two transformers are necessary because both the output of the 386 and the phone line require low impedance, and they MUST be isolated. Op-amp #4 acts as a buffer and also allows control of the overall volume. The output of op-amp #4 is microphone level, and therefore, the output of the circuit should connect to a microphone input on the mixing board.

The 100 K pots for each op-amp controls the gain of that op-amp. These are necessary to provide the proper balancing of audio levels. The 10K pot adjusts the incoming level of the phone audio. This circuit requires a +12 VDC and a - 12 VDC power supply. Power supply connections are not shown. The +12 VDC for the 386 must be bypassed by a .1 uF capacitor at the chip. Also a .1 uF capacitor may be needed from the swinger of the 10K pot to ground to reduce noise in the circuit. For the op-amps a TL084 quad op-amp was used. Two TL082 dual op-amps may be used, however a LM324 quad op-amp provided very distorted audio and should not be used.

A microphone mixer may be used to provide the mic input to this circuit, this allows several people to talk at the same time to the caller. Of course, anyone talking into a microphone needs a set of headphone plugged into the mixing board to hear the caller.

A prototype built exactly as shown has been used on the air and worked very well. Good Luck.

Bob O. of WBNO

Incoming Mail

Dear EBN,

A few changes have been made to my station here and all are for the good. First, the problem I had with 5 Watt PA transistor was apparently just a bad transistor. My friend Bill found a source of them, checked over my work, and just replaced the transistor as he could find nothing wrong. That did it! It has been working fine since last May with no problems at all.

I made a much heavier duty supply using the Panaxis PS1200 circuit but substituted most of the parts. First I used a 30 volt - 4 Amp center tapped transformer. This runs very cool and gives plenty of headroom necessary to properly run the regulator IC's. In addition to bypassing the rectifier diodes with .01 caps I put ferrite beads on each of the leads of the rectifier bridge. I also used 11,000 uF computer grade caps for filtering and type "K" case style (TO-3 power transistor style) regulator IC's mounted on large finned heat sinks. The heat rise on these is only about 10 or 15 degrees above room temp. -- very cool and conservatively rated low.

I built the supply so as to be rack mountable, and I have it and my transmitter both mounted neatly together in a small rack enclosure.

I've also added an audio compressor/limiter. It is made by Alesis and is called the MicroLimiter. It sounds great, is very low noise, and has variable input, compression, and output level. Best of all it sells for a modest $125.00! Bill heard it and it compares favorably against his dbX unit which sells for over $600! In case anyone would be interested in one of these goodies the address to contact is : Alesis Corp. 3630 Holdrege, Los Angeles, CA 90016

I've also added a studio quality Audio Technica electret mic., a shock mount and gooseneck stand for the mic., a swivel chair to make operating more convenient and comfortable, and lots more CD's.

I have enough material to do several Halloween shows without repeats. I'm planning to do two for my own station, and a third on tape for another station.

That's it for now. Keep up the good stuff, and let's have more mini-lesson and maybe more quizzes in future issues of EBN.

73's & Happy Halloween!!

Roger

Dear EBN,

I would like to take this opportunity to describe my station to you, and to thank you for producing the EBNewsletter. It's unreal!

I am called the "The Dude" over my station. In April of 1983 I gave my station (as) WSSO. Back then I was using a local oscillator out of a portable FM receiver. Modulation was fair and my range just reached the corners of my property. This was fine back then since the station's purpose was to transmit tunes to a walkman while I was doing yard work. Except for doing a little announcing I didn't do too much on improving it for about a year and a half

In January 1985 the biggest and most popular album rock station in the area of western New York, WGRG went mellow. Other rock stations soon followed. Many of my friends as well as myself, were very disappointed. This motivated me to set up something better. I bought myself better transmitting equipment, more tapes, and home brewed my self a better studio. Also I renamed the station and stopped frequency hopping.

The station is now set at 91.5 MHz and is called 91WGBR "Rock 'n Roll for Ellis Heights". The station has about a quarter mile range. Digital audio has definitely made an improvement in the station's audio quality. I've made a special for friends of mine which I call "CD Rocks Vol. I", which has made an impact on my friends buying CD players. I plan to release "CD Rocks Vol. II" later this year. I do not make any money from this.

This year was a big surprise to me since I did not expect to run into another pirate in town. He needed to improve his range and audio quality badly. So, with my trial and error experience that I've picked up over the years, I got him up to par in a few months where it has taken me a couple of years. We share each other's programming although we are not able to receive each other yet.

One thing that I believe is different about WGBR from all the rest of the pirate stations around he the fact that I have failed to pick up any listeners. Five and a half years and not a one. I believe the odds are against me in doing it still. I do not live in a crowded residential area. My nearest neighbors range from 50 to 80 years of age. Also I have too much absorption from trees that are about 80 feet in height.

So, why do I do it? Well, it's great studio practice as well as electronic experience. Also, when I'm on the air it gives me a change to keep in touch with my expanding rock collection. And yeah...it's fun..that's reason enough to keep me going.

Sincerely, The Dude, WGBR

Mini-Lesson / Peak Power Supply Currents

Roger has been providing EBN subscribers with worthwhile circuit revisions and ideas for some time now. His letter concerning a power supply suggests a mini- lesson on the sizing of filter caps in power supplies. To touch that subject briefly at this time consider this:

In a full-wave rectifier system the charging time for the filter caps is the period of the first half of each one-half cycle of the AC input. At 60 Hz this is about 4/1000th of a second (4 milliseconds). The value of charging current is found by the formula Ic = de/dt x C where Ic is the charging current, de (delta e) is an incremental change of voltage, dt (delta t) is an incremental change in time, and C is the capacitance in Farads. Roger is using a center tapped 30 volt transformer. With the center tap grounded it provides 15 volts AC to each of the diodes in his full-wave rectifier. The peak voltage is 1.414 times the rms value (15 volts) - in this case 21 volts. He is using 11,000 uF capacitors.

By applying these known values to a formula we can find the initial charging current at the moment the supply is switched on. For example:

The capacitor (11,000 uF) must charge to 21 volts (de) in 4 milliseconds (dt).

(21/.004)(.011) = 57.75 where 21 is volts, .004 is seconds, and .011 is Farads and the 57.75 is in AMPS!

Of course the resistance of the transformer windings limits the current somewhat but sometimes not enough. It's common practice therefore to place a current limiting resistance in series between the transformer and the diodes. The value may be only an Ohm or two. The actual value is calculated by dividing the peak voltage (in this case 21 volts) by the diode's maximum allowed surge current. If the surge current specification is unknown you should assume it is 10 times the diodes rated continuous current. A "2 Amp" diode then should not see surges greater than 20 Amps. Assuming Roger is using 2 Amp diodes the current limiting resistors should be 21 volts divided by 20 Amps or 1 Ohm.

There is a problem on the other side also. The load draws current from the capacitor during the 2nd half of each half cycle of AC. The time it takes to discharge the capacitor fully is 5 times the "time constant" of the circuit. The time constant is simply the load resistance times the capacitive value. Assuming a 1-Ampere load we have 21 divided by 1 = 21 Ohms. 21 Ohms times .011 Farad results in .231 seconds (231 milliseconds). 5 times that is 1.16 seconds. Obviously we won't fully discharge the capacitor since it receives a re-charge pulse every 8 milliseconds (every half cycle of AC). But...it does lose some charge however and at an exponential rate thus.. In one time constant (231 mS) the cap will lose 63.7% of its charge, in 1/10th of a time constant (23.1 mS) it will lose 10% of its charge. In 10 milliseconds it would lose about 5% of its charge. Or in other words drop in voltage 5% from 21 volts to 20 volts.

The next charging pulse will recharge the capacitor from 20 up to 21 volts. It must do this however in a much shorter time. No charging current is used until the charging pulse is greater than the 20 volts still remaining. The whole charging pulse is only 4 mS in duration - the time from the 20 volt level to the peak of 21 volts is about 1 mS. Going back to the capacitor current formula we find:

de = 1 volts, dt = .001 seconds, C = .011 Farads

(1/.001) (.011) = 11 Amps!

The peak charging current could be too much for a diode rated for 1 Ampere continuous duty. In addition the transformer core could saturate momentarily on 11 Amp peaks.

Conclusion: Often the first thought to reduce ripple in a power supply is to simply use large capacitors. As we can see here it's not quite that easy. Excessive peak charging currents can damage diodes. Another point to consider is the size of the transformer iron core. The transformer works only while it's able to change the magnetic field within its core. During high peak currents the core may become "saturated". This results in a loss of counter emf which in turn results in high winding currents and heat during that period of time.

Sometimes a higher ripple voltage is tolerated at the filters in exchange for using smaller capacitors, diodes and transformer cores. The resultant ripple however must remain above the lowest voltage required for proper regulating action when regulators are used. The 7800 series of regulators for example require a minimum of 2 volts D.C. above their rated output. A 7812 (12 volts) therefore should have at least 14 volts without ripple. This is the absolute minimum supply voltage. 18 volts with no more than 1 volt of ripple is recommended. The 21 volt peak used in our example allows some additional "head-room". It should also be emembered that too much is head-room is not good either. At 21 volts supply and a 12 volt output, the 7812 regulator has 9 volts across it. At a maximum rated current of 1 Ampere the poor 7812 must disipate (as heat) 9 Watts! With a supply of only 18 volts it would only have to disipate 6 Watts..

WTPS Is Still at It

WTPS MODERN ROCK 107
the Nation's Music Source

airPLay

As reported to Rockpool for the period ending:

March 14, 1988

WOC	LC	TC	
6	4	1.	FIREHOSE- If'n (SST)
4	14	2.	MISSION OF BURMA- (Taang!)
2	-	3.	BIG DIPPER- All Going Out Together (Homestead)
6	11	4.	KILLDOZER- LA'l Baby Bunting (Touch & Go)
2	-	5.	ROBYN HITCHCOCK & THE EGYPTIANS- Globe Of Frogs (A&M)
4	25	6.	THE SQUARES- Enjoy Yourself And Others (Boat)
2	-	7.	PONTIAC BROTHERS- Johnson (Frontier)
4	BU	8.	KISIO- Love Thang (Frontier)
2	-	9.	INCREDIBLE CASUALS- That's That (Rounder)
2	-	10.	BIG PIG- Bonk (A&M)
2	-	11.	JAZZ BUTCHER- Fishcotheque (Relativity)
2	-	12.	X-CLEAVERS- Cult Static (Permanent)
2	-	13.	FOURWAYCROSS- Shimmer (Motiv)
2	-	14.	POP WILL EAT ITSELF- Box Frenzy (Rough Trade)
8	6	15.	THE SHAMEN- Drop (Fundamental)
2	-	16.	NRBQ- God Bless Us All (Rounder)
2	-	17.	RED LORRY YELLOW LORRY- Smashed Hits (Fundamental)
2	-	18.	WHITE GLOVE TEST- Look (Fundamental)
2	-	19.	MEN & VOLTS- The Mule (Shimmy Disc)
2	-	20.	THE EMBARASSMENT- LP (Time To Develop)
4	7	21.	EURYTHMICS- Savage (RCA)
2	-	22.	BAMBI SLAM- It's....(Rough Trade)
2	-	23.	THE SPACE NEGROS- Do Ethnic Generic Muzak...(Arf Arf)
2	-	24.	FELT- Gold Mine Trash (PVC)
2	-	25.	BOB MARSH- The Forest (Chameleon)
2	-	26.	TACKHEAD SOUND SYSTEM- Tackhead Tape Time (Nettwerk)
4	BU	27.	FIELDS OF THE NEPHILIM- Dawnrazor LP (RCA)
2	-	28.	CARNIVAL SEASON- Waiting For No One (What Goes On)
2	-	29.	ARMS AKIMBO- This Is Not The Late Show (688)
2	-	30.	SECRET SERVICE- It's All Happening Here (Secret Service)

THE NEXT 30: FINI TRIBE, DROWNING POOL, BIRDHOUSE, BLISSED OUT FATALISTS, B.C.R., FOOLKILLERS, RAINDOGS, JONATHAN RICHMAN, IT'S RAINING, BATFISH BOYS, ERIK LINDGREN, SPOONER, SON OF SAM, I LOVE ETHYL...

SYM.

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TRADE: Air check tapes. Mine for yours. Jim Klauck, 118 Bay St. Glens Falls, NY 12801 (518) 792-9290

Nice To Know

FREE * AIR, the official newsletter of "The Association of Clandestine Radio Enthusiasts" gave us favorable comment in their October issue. We appreciate it! FREE * AIR is now being published by Thibodeaux Publishing. It looks good, reads well and is available on a subscription basis from The Association of Clandestine Radio Enthusiasts, PO Box 46199, Baton Rouge, LA 70895-6199

The Association of North American Radio Clubs (ANARC) now has a computer bulletin board. Crank up the ol' modem and access 309-688-0604.

Some answers to our September issues's "Techy Quiz" are coming in. Some thought there might have been one or two "trick" questions....not so, all answers can be proven correct and will be in the October issue of the EBN.

John T. came closest so far with 12 out of 14 questions answered correctly. Roger S. was next with 10 correct answers ("Wobulator" answer was correct). Paul B., Charles S., Tom D., and Marion P. came in at 9 correct. Susan C. and John H. both had 8 correct.

Hint: Many of the answers have appeared in past issues of the EBN.

Good try gang! How about the rest of our subscribers? Give it a try!

It's a Bird?, It's a Plane?, No, It's NEEWOLAH!

Gentlemen,

Your publication was recently brought to our attention. A friend thought we might be interested in a story you ran in your September issue - a parallel to what our group will be doing at the end of October.

The three of us are attending a college in California. Each of us are majoring in different fields, I in electronics, "JC" in broadcasting, and "Sam" in the Physical sciences.

A couple of months ago we were discussing what we might do for Halloween as Halloween pranks are somewhat of a tradition here on campus. Our discussion began with setting-up a low-power "voice from space" broadcast. The signal would be heard only on campus and surrounding environs. As we got more into it however the plan grew to a much more complicated and larger endeavor - why limit the broadcast to our immediate area?

Sam's classes furnished us with the information about weather balloons. Although he didn't know he was contributing to our "project" the professor was quite helpful in showing Sam how to calculate gas expansion, and altitude vs gas volume and payload. My job was to design a light-weight transmitter which could broadcast on several frequencies at one time. JC handled the "message" content and dubbing it onto a miniature reversible cassette.

It took us two weeks to find a suitable balloon. We finally found a 15 foot diameter weather balloon at a "Army/Navy" surplus store about 150 miles from here. The store also had metal boxes, hand-warmers, aircraft instruments, etc. We dug down deep, this project was not going to be inexpensive but we were determined. These items were just too good to pass up.

Sam arranged an aircraft altimeter and solenoid valves so it would either fill or relieve the balloon of gas. If the altimeter reads above 25,000 feet some gas will be exhausted, if below 20,000 feet gas will be replaced from a Helium bottle. Hopefully this will keep the balloon from rising too high and bursting yet keep it high enough so it will be essentially out-of-sight of ground observers. The scheme seems to work, at least with our tests at ground level. We may never know if it works in flight since this is a one-shot deal.

The transmitter is a simple 4-transistor circuit which outputs about 2 and a half watts. The oscillator frequency is controlled by varactor diodes modulated by two separate sources. One of course is the audio message, the other is a saw- tooth waveform at 100 kHz. The rise of the sawtooth sweeps the oscillator frequency from about 90 Mhz to 105 MHz. The fall of the sawtooth returns the frequency to 90 MHz very rapidly so it can start the next sweep. The 100 Khz sweep frequency is of course removed by the time it gets through an FM receiver. The audio itself is only slightly distorted - but so much the better for our purpose. The end result is what counts, it broadcasts to almost the entire FM band on all channels at the same time. Because the transmitter is designed to sweep the FM band no attempt was made to crystal control the oscillator. A broad-band amplifier was used for the output.

We were just a bit afraid the chilly temperatures at 25,000 feet could cause our oscillator to drift off the FM band altogether. So, just in case we'll include a "surplus" hand-warmer in the transmitter box. The transmitter box is made of aluminum (also purchased at the surplus store). It has just enough room for the transmitter, hand-warmer, and a 12 volt "Gel-Cell". The battery is rated at 20 hours at almost .4 amperes which should give about 24 hours of continuous operation, but more about that later. Aside from the Helium gas bottle the battery is the heaviest part of the whole system, almost 6 pounds!

The antenna will be a half-wave horizontal dipole made from aluminum tubing and attached to the bottom of the transmitter box. The box and antenna hang below the balloon by about a quarter wavelength. For convenience we based our calculations on a mean frequency of 100 MHz. The bottom of the balloon has been sprayed several times with an aluminum paint so it will act as a "reflector" for the antenna. This way most of the transmission is directed downward, and at 25,000 feet fans-out considerably. We figure up to 200 miles coverage during each transmission.

The audio comes from the outgoing message tape section of a phone answering machine which we cannibalized. Only the mechanical and head portions were retained. The case, incoming record and playback, etc. weren't needed so they were simply thrown away. The tape itself is a sub-miniature continuous loop cartridge. A simple 2-transistor preamp was put between the tape head and the transmitter input.

The audio received some extensive processing before it was dubbed onto the continuous loop tape. Just a bit of reverberation was used. Frequencies below 500 Hz were attenuated 20 db. Overdriving the recording amp produced a nice raspiness. Almost all of the dynamic range was removed with heavy audio compression. Even JC's mother wouldn't recognize his voice!

GREETINGS PEOPLE OF THE THIRD PLANET OF THIS STAR SYSTEM. OUR SHIP WILL ARRIVE IN TEN OF YOUR PLANET'S REVOLUTIONS. PREPARE TO MEET OTHER INTELLIGENT LIFE FORMS. THIS IS NEEWOLLAH, AMBASSADOR OF THE NILBOG PEOPLE.

NEEWOLLAH (pronounced NEE-WOL-LA) is HALLOWEEN spelled backward and NILBOG (pronounced NEEEL-BOG) is GOBLIN spelled backwards

To extend the life of the project we inserted a miniature reed relay between the battery and the tape/transmitter combination. An IC timer chip energizes the relay approximately every 2 minutes. The timer is reset when the tape reaches its end-of-message tab. This results in a 20-25 second message while the transmitter is on and 1 and a half minutes of dead space while it's off. The battery therefore will only be working one-fourth of the time and should last 4 to 5 days. With any luck our balloon can reach the east coast and still be transmitting!

Launch time will be an hour or two before dawn October 31st. After two months of preparation we can hardly wait! Respond to this publication if you hear us, but don't tell anyone else this isn't the real thing! Hopefully the EBN will print responses from those that hear us. We can't give out a mailing address of course as we wish to remain anonymous.

Jack-O-Lantern

Mini-Lesson / Standing Waves on Transmission Lines

The first figure shows what happens when a transmission line is shorted at its end. The darkest line represents the "incident" or "forward" wave traveling along a transmission line from a source (transmitter) to a load (antenna).

The shorted end reflects 100% of the wave back toward the source. Its amplitude reduced only by whatever resistive losses are in the line. Because the load is a short (zero Ohms) all voltages at that point are zero. So it may be seen more easily the reflected wave here is shown at a slightly reduced amplitude.

The forward and reflected waves are "in phase" and therefore their amplitudes are additive. "Standing waves" are formed along the line which coincide with the sum of the forward and reflected waves. If the peak voltage of the forward wave is 100 volts and the reflected is 95 volts the peak standing wave voltage is 195 volts! The first peak occurs 1/4 of a wave back from the load and at each 1/2 wave point thereafter.

Figure 2 shows a transmission line which has no load connected (open circuit or very high resistance). The voltages at the load end are at maximum due to the open circuit. Again, 100% (less line losses) of the wave is reflected back toward the source. The first standing wave peak (also called a "node") is at the load itself. The other nodes appear at each 1/2 wave point back toward the source. The peak voltage at each node is the sum of the forward and reflected waves.

Where the load is "reactive", that is either inductive or capacitive then a phase displacement occurs between the forward and reflected waves. An antenna which is much too long appears somewhat inductive to the line. An antenna which is much shorter than it should be appears somewhat capacitive.

Figure 3 shows the voltage distribution along the transmission line when the load is a pure inductance. The reflected wave is shifted in phase by 90 degrees by the inductive load. The standing wave nodes reach their peak voltage in this case when the forward and reflected waves cross. The first peak occurs 1/8th of a wave back from the load end. The other nodes then appear at each 1/2 point back toward the source.

Figure 4 shows what happens when the load is close to the same impedance as the transmission line. Most of the forward energy is used by the load. If the load is resistive the power is dissipated as heat. If the load is an antenna the power is radiated. Very little of the energy is reflected back toward the source. Still, standing wave nodes will be the sum of the forward and reflected waves, even though the reflected wave may be very small in amplitude. The standing wave voltage appears much more constant with only a slight ripple where the nodes appear.

The "Standing Wave Ratio" (SWR) more properly called VSWR where is "V" is for voltage is determined by the ratio of the node's maximum and minimum voltages. Looking at Figure 4, assume that SW e maximum is 100 volts and its minimum is 80 volts. We find 100/80 = VSWR. 100 divided by 80 equals a VSWR of 1.25 or more properly expressed as 1:1.25. This ratio is also the same for the transmission line impedance versus the load impedance (resistance). If the line impedance is rated at 50 Ohms then our load impedance for this example is either 50 x 1.25 = 62.5 Ohms or 50/1.25 = 40 Ohms.

Where a person places a "power meter" along the line becomes very important.. Let's use Figure 4 with its relatively low "SWR" of 1.25. If the power meter is between the end of the line and the load we measure very close to the actual power going to the load. On the other hand if the meter is placed 1/4 wave back from the load it would be on a node and measure a higher voltage. This would translate to a meter reading showing more power at that point than actually exists. Assuming 10 watts source power and the characteristics of Figure 1, a meter at the load would show zero power while 1/4 wave back it would show 20 Watts - more than you started with!

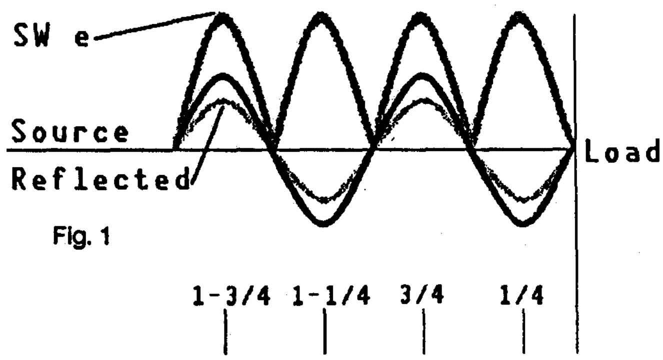

Fig. 1

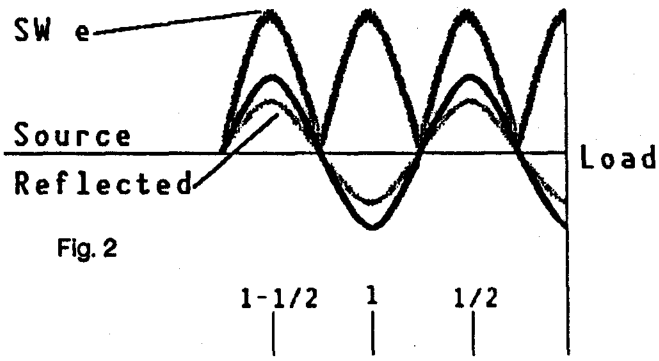

Fig. 2

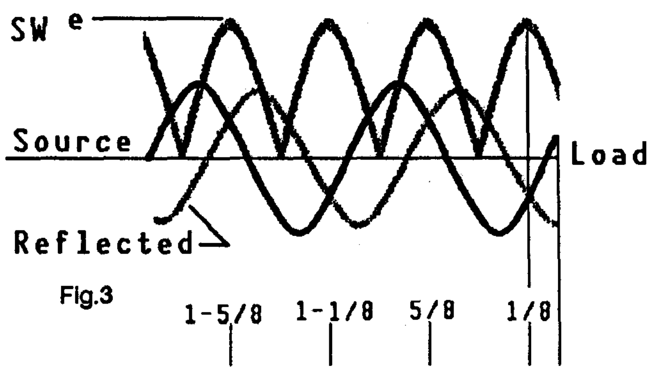

Fig.3

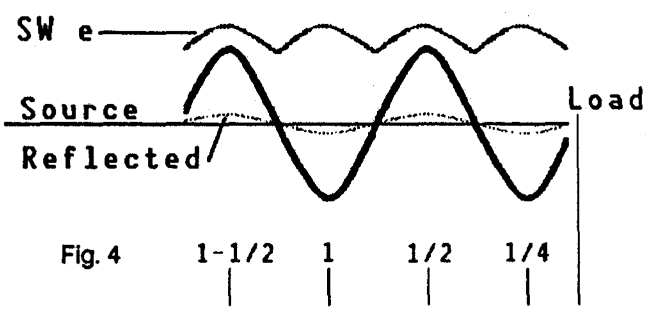

Fig. 4