

Seasons Greetings

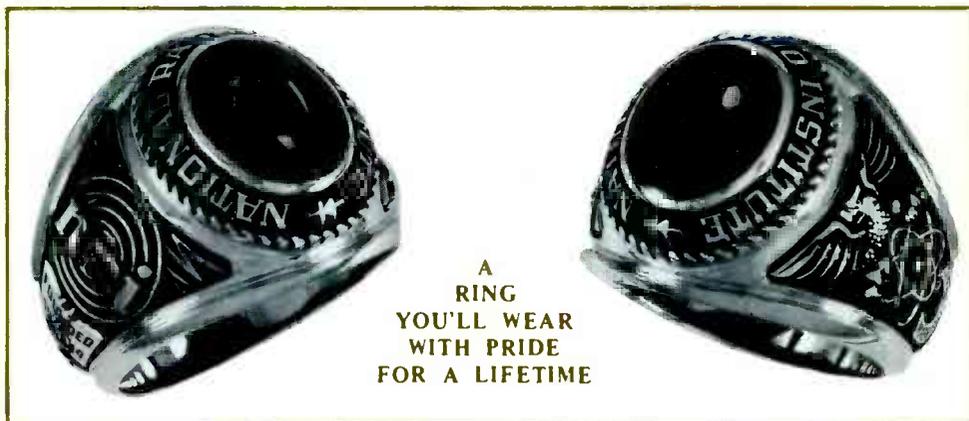


- The Great Venture: Your Own TV Servicing Business
- More Adventures in TV Servicing



journal
November/December 1974

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EDITOR AND PUBLISHER

William F. Dunn

TECHNICAL EDITOR

Ted Beach

MANAGING EDITOR

Tom Beadling

EDITORIAL ASSISTANT

Mildred Duncan

STAFF ARTISTS

Bill Massey

Arthur Susser

Ernie Blaine

In this issue, NRI's Jim Crudup explores the perils and triumphs of starting a TV servicing business and long-time TV service man J. B. Straughn explores additional practical case histories from his TV servicing business.

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The Great Venture: Your Own TV Servicing Business

by Jim Crudup

The time to go into business comes when you have a sincere desire to start and build a successful business. By planning, promoting, and working, your dream of becoming your own boss can become a reality. The right amounts of technical training, business expertise, and capital are the main ingredients of a successful TV service business.

New businesses are being started every day, with an average of 500,000 new businesses started each year in the United States. In addition, nearly another half million businesses change ownership each year.

There are also quite a few businesses going out of business; that is, they sell out or close their doors. Approximately 300,000 businesses are liquidated each year. This does not necessarily mean that they are bankrupt, although many are. Some are closed because the owners are retiring, or for other similar personal reasons.

These numbers fluctuate greatly from year to year. In prosperous times, many more businesses are started. When times are difficult and money is tight, many more businesses fail and fewer are started. These averages point out one fact: Running a business is not a guaranteed way to make money, but it can be very profitable for those who can do it properly.

Is there, then, a formula for business success? No one has found such a formula, though many have tried. Business success, for example, is partly a matter of drive and energy, but many people who are not business successes have plenty of drive and energy. Likewise, it is partially a question of ingenuity, but many inventors were business failures. It is a question of salesmanship, to some extent, but many overly sales-minded managements have foundered on the rocks of financial mismanagement. It is skill in advertising, to a degree, but no advertising man ever claimed that his medium was exclusively the key to success.

BUYING OR STARTING A NEW BUSINESS

There are two ways to become a businessman. One is to buy an established business; the other is to start a new business.

We will assume that you have the background and ambition necessary to get started in the TV service business. We will also assume that you have a reserve of capital that you can invest in this business.

Let's compare the advantages of buying an established business with those of starting a new business. (For the present, we will disregard the specific details of any particular service business.) Starting a new business is more complicated in many ways. Since you are starting from scratch, you must do everything yourself. For example, you have to find a suitable building and location for your business. You will need to purchase the necessary tools and equipment as well as your initial inventory. You will need to hire and train employees, then you will have to set up your work procedures. Finally, you will need to advertise to interest customers. This requires a great deal of time and patience, but it can be very satisfying to watch your plans produce tangible profits.

Buying an established business would eliminate the work and initial expense of starting from scratch. An existing business is already located and has equipment, inventory, employees, and customers. Although buying a profitable existing business is somewhat simpler, it also has its own set of problems. Here are some of the points to consider:

ADVANTAGES:

You might be able to buy at a bargain price because, for personal reasons, the owner may be anxious to sell.

You save the time required to set up your establishment with equipment and merchandise.

You may acquire customers who usually trade at that place of business.

The owner may give you the benefit of his experience in the business and the community.

DISADVANTAGES:

You may pay too much because the owner may have misrepresented it, or because of your inaccurate appraisal of what the business is worth and what it can produce for you.

The owner may have a bad reputation and you could have trouble establishing a good one.

The location may be poor or perhaps construction planned for the area, like an expressway, may make the proposition a very poor one.

The old equipment and fixtures may be in bad shape and require replacement.

Much of the merchandise may be obsolete and difficult to sell to customers.

ORGANIZATION:

The financial future of a retail or service business will be affected by the initial decision of the owner as to the form to be used in its organization. There are certain incidents attached to any form selected which make it imperative that an attorney discuss fully the consequences with the owner.

TABLE I

INDIVIDUAL PROPRIETORSHIP

ADVANTAGES

Easy to set up.
Freedom of decision.
Few restrictive laws.

DISADVANTAGES

Limited by your own personal resources and abilities.
Affected by your personal life.
Your personal assets can be claimed for business debt.

PARTNERSHIP

ADVANTAGES

Money and ability can be pooled for expanded venture.
In your absence other partners will look after the interests of the business.
Generally makes the business a better credit risk, than an individual proprietorship.

DISADVANTAGES

Differences of opinion and conflicting personalities can hurt the business.
You are liable for business actions of partners.
Death of one partner dissolves the partnership.

CORPORATION

ADVANTAGES

Your personal assets are not liable for corporate debts.
Stock can be given or sold to employees to stimulate interest in business.
You can share ownership and still maintain control of the business.

DISADVANTAGES

It takes time and money to incorporate.
The corporation must abide by certain state regulations.
Net profits paid as dividends are taxed twice.

Three forms of ownership are generally available: sole ownership, partnership, or incorporation. Each form has distinct rules applicable to it regarding taxation, management, liabilities of the owner, and division of profits. Only after being advised as to all of these can an intelligent decision be made as to which form is most suitable (see Table 1).

Legal services are a necessity when the choice of organization requires contracts, partnership agreements, or the filing of certificates. There are many municipal and state law requirements attached to the beginning of any new business. Full compliance can be best ensured with legal advice.

GAINING EXPERIENCE:

Although it is possible for a non-technical person to open and operate a successful television repair business, the individual with the technical knowhow and the desire to learn proper business techniques should be more successful. The technical training that you receive through your NRI Complete TV Servicing Course will enable you to handle the technical aspect of your business. For business knowhow you will find several books listed at the end of this article that should be read prior to opening your business. This information will be very helpful to anyone with or without prior business experience.

The safest and probably the smartest way to find out about the TV repair business is through part-time servicing or by working for someone else until you have learned the ins and outs of a television business. Since this can generally be done while you maintain a full-time job, there is very little risk involved. You will have the opportunity to get paid and “get the feel” of the business without actually signing leases, investing money in equipment and quitting your job. Part-time servicing gives you the necessary experience to handle the repair end of the business. Plunging head-first into business without prior experience can be a hectic encounter. A part-time job in a shop is even better—you have an opportunity to further your ideas and rid yourself of any misconceptions that you might have.

FINANCIAL CONSIDERATIONS:

Assuming you are starting a new business, the first concrete step toward planning your business should be in the direction of money required to start the business. Potential sources of capital include banks, relatives, friends, the Small Business Administration in your locality, and if you are a veteran, contact the Veterans Administration. This of course will depend upon your expected overhead. Overhead is the total dollar amount required to finance a business for a particular length of time. It is safe to assume that you will not make enough to meet your monthly overhead until you have been in business for at least a year. Therefore, the initial cash required to open your business should be centered around this particular figure. Find out what the average rent is in your expected locality. Add up the cost of the necessary equipment you will need and add this to your initial overhead. Don't forget signs, benches and stock. Compute the salary for the necessary employees that you will need for one year. Don't fool yourself. You will need at least one assistant even though your business is just starting out. It might be

possible to get by with a part-time helper during the first month of operation, but that's pushing it. You'll need operating cash—it should include funds for insurance, remodeling, advertising and possible emergencies. Don't forget to include your salary in the initial overhead figure. Once you have this figure, multiply it by twelve for the number of months that it may take you to break even. If you have this amount of money on hand, plus 20% as an error factor, then you are prepared to consider the next step.

Allow for possible emergencies. If the twelve-month period is not long enough to meet your overhead expenses, be prepared to either obtain additional capital from a lending institution or from some reliable individual. Have firm commitments for this liquid capital. After six months in operation, your books and your personal experience should be complete enough to enable you to determine whether the business actually has potential.

Obtaining a good location is very beneficial if you want to operate a successful business. By all means consider a shop that is located in a section zoned for commercial occupancy. Also ask yourself if the site is good for a television servicing business. Be honest with yourself. Check the traffic in the area. Also check the potential customers (passers-by). It is important that the business be exposed for it to be successful. Do not expect to survive on neighbors, relatives and friends. Parking is important. Do not overlook adequate parking. Sufficient space is also important when you plan your shop. Your plans for the shop layout should be flexible. The store should have display windows and it should be reasonably attractive. The construction should be sound and the store should comply with safety, health, and fire codes. Do not consider a place that requires major remodeling or alterations. Check to see that you have sufficient electrical power and outlets available. Check the heating, the plumbing, and the fixtures.

Once you have selected a location and a store, the next step is in obtaining a lease. Before signing the lease, always read it carefully and have your lawyer (or at least some lawyer that represents your interest) explain the terms of your lease to you. The lease should be in your favor. You should have a fairly short first-term commitment with a fairly long-term optional agreement in the contract. The idea behind this is to ensure that if you are not satisfied with your business, it will be easy to get out of your leasing arrangement. A possible sub-lease clause should be in the contract. This would allow you to sub-lease the store should you desire to close the business. A possible one, two or three-year lease with a five, ten or twenty-year option should be considered. The amount of rent should not be abnormal. Commercial space is generally computed by the square foot. Investigate to determine whether you are getting the store at a fair price. As always, the amount will be proportional to the desirability of the location and the size of the store.

Before you can open your business, you must have the required license and insurance. In most cases, this information can be obtained from your city, town, or county services buildings. Aside from local licenses and taxes, state and federal taxes may also be required. This information can generally be obtained at the local level or from the Internal Revenue Service.

Insurance should be obtained in order to protect your stock, equipment, employees and customers. As a proprietor of a business you are responsible for personal injury in and around your property. You are also responsible for the contents of the building and the general safety of your employees. Consideration should also be given to insurance policies for burglary, glass damage, fire, flood, and any service vehicles that you use. Consult with your insurance agent on what is considered adequate coverage. Check with several companies and compare the coverages and premiums.

Obtaining and planning your stock is also important. It is best that you obtain stock on a recurring basis. Try stocking only the most popular parts until you have the necessary experience and knowledge to purchase stock effectively. You should make purchasing arrangements with the local electronic wholesaler. You might also find that they will deliver the items you will need on a day-to-day or week-to-week basis.

Since most wholesalers give their largest discounts to their best customers, it is generally best to trade with one particular wholesaler as much as possible. This is generally done with the best-equipped and most helpful wholesaler in your area, not necessarily the largest. In some cases special parts can only be obtained through a franchised dealer of a particular brand of TV or stereo.

ACCOUNTING AND RECORDS:

A good bookkeeping system is a must for a successful business. You should obtain the services of a bookkeeper or accounting service. Some bookkeepers and accounting services service their accounts on a weekly or monthly basis for a reasonable charge—much less than it would cost you to do the work. Although this seems an unnecessary expense, I can assure you that it will pay off in the long run. Adequate records can let you know exactly where your business stands. They also protect you from possible legal action by county, state, or Federal authorities. Adequate books are required by the Federal government for tax purposes. You might also find that you need a cash register and calculator to maintain adequate records that you can turn over to your bookkeeper or accountant. Your business expectations and financial arrangements should be discussed with your bookkeeper or accountant and the necessary arrangements should be made accordingly. You will find that your accountant or bookkeeper can be very helpful. You might also need special forms for records. Most forms and receipts can be purchased pre-printed. There are a few that you will need to have printed. It is important that you have business cards prepared for distribution. You will be able to obtain most of your repair receipt books and necessary paper work for the business through your local wholesaler.

ADVERTISING:

Although advertising expenses are tax deductible, advertising is undoubtedly one of the most neglected areas of a small business. I suggest you invest as much as possible in advertising. You will not regret it. By all means try to open your business at a time when you can be listed in the local yellow pages. Ads are taken

for the yellow pages once a year. Also, try to have circulars printed to announce your opening or obtain space in the local paper. Of course, this should be given careful consideration as to the cost involved. Consideration should also be given to advertising on the local radio or TV networks. You will be surprised at how reasonable it is to buy a "one-minute" spot on a local radio program. Records should be kept of your advertising expenses and the return on the type of advertising that you are using. You will find that this is very worthwhile. For example, you may find that an initial \$100 investment for a radio spot will net you five repair jobs. This may at first glance appear a poor return but once considered you can assume this to be a success. A chain reaction of five satisfied customers can be very profitable to you. Consider the possibilities: satisfied customers can start a chain reaction.

The store should be well-lighted, clean and professional-looking. Your shop advertises the type of business that you run. If your shop is professional-looking it creates customer confidence. A dark, crowded shop with a TV chassis on every bench, chair, and table does not present a good image. It is advertising that will build your business. Sufficient time should always be given to improving your advertising techniques. Make sure your display window is properly dressed and by all means try to obtain the best possible store sign that you can afford.

STORE POLICIES:

Consideration should be given to the type of guarantee that you will give. Ninety days on parts and labor seems to be the standard. Decide on your price policies. Make sure that your prices are competitive but do not undersell yourself because you are new. Decide on your hours. Check to see what hours your competitors remain open. Always be open during those hours you indicate. Decide if you would attract trade by opening earlier, remaining open later, or being open on Sundays or holidays. Will you have the personnel to be open on these hours or days?

If you expect to have employees, decide on a method of paying them and be sure to check the prevailing wage scales. A good employee is hard to find and sometimes hard to keep. Make sure your employees are properly trained and well aware of your store policy.

Now that some states are requiring that television repairmen be licensed, check with the county and state governments about license requirements for your employees. Your employees should know how to make out and handle sales tickets. Write out a formal set of guidelines.

Prepare for charge customers if at all possible. Check with the credit card companies. An important point that many businessmen overlook is the fact that a satisfied customer is a customer who will certainly return when your services are needed. Always treat your customers with courtesy and respect. It is better to lose a few dollars on one customer and retain that customer's good faith than it is to make a few dollars and lose the customer forever. Word of mouth advertising is the best advertising available.



EXAMPLE OF AN ATTRACTIVE, WELL-APPOINTED TV SALES/SERVICE STORE.

ESTIMATE OF SALES AND PROFITS:

It is very difficult to be both a businessman and a service technician. Set a schedule and stick to it. If at all possible, devote most of your time to running your business. The employee should do the actual repair. Devote most of your time to running the business; this will be beneficial to you in the long run. Do not neglect the business end for the service end or you will certainly fail. Keep adequate records for your own personal use. Know how the business is doing at all times. With adequate records you can determine your best days, your best hours and your best workers. This will be very important when you plan for expansion. Set realistic goals and try to achieve them. Prepare sales charts and try to achieve your goal for the first week or six months. Determine what the gross profit or loss is from month to month. Find out what your expenses are and try to shave them where possible. Use your records to improve and increase your business.

PREPARING FOR THE OPENING OF YOUR BUSINESS:

Before opening day, you will probably be very nervous. By planning adequately, your opening day should be very successful. Here are a few tips you should find helpful.

Double-check to be sure that you have complied with all the necessary regulations. Check with the local, county and state authorities that govern businesses. Make sure you have the licenses and permits displayed properly. Make sure you check the police and health regulations pertaining to your business in your area. Make sure you obtain a Federal employment number if you have employees. Make sure that you have worked out a system for paying the withholding tax for your employees. Check to see what type of system can be used for handling sales taxes and excise taxes in your particular locality. Make sure you have adequate accounting and sales forms on hand. Check your insurance policies and make sure that they are in force.

If you are employing people, you will need workmens' compensation. Make sure that your shop is in proper order before opening day. A clean, fresh-smelling shop is very impressive.

Make sure that you have advertised properly. Check to see that the electricity, gas and meter deposits have been made. Make sure that your telephone has been installed and that your number has been placed on your business cards, records and receipts. Your store signs should be in place on opening day if possible. Entice customers to come in on opening day. Perhaps free food, flowers, miscellaneous items or special discounts on repair work could be helpful. Some prominent spokesman or figure may be able to help start your business off with a boom. These ideas should be considered.

THE SWEET SMELL OF SUCCESS:

I hope you have found the information in this article helpful. I am sure that if you follow the information as outlined, you will have no trouble in starting your business. Running a successful business requires more than fixing a few TV receivers as you will undoubtedly find out. Expect to work hard, expect to worry a lot and expect to be the boss of your own business. Through dedication, patience and sound business techniques, you are the only obstacle between success and failure.

The Small Business Administration in Washington, D.C. has published several booklets that will be helpful. I recommend "Starting and Managing a Small Business of Your Own" (forty cents), which may be obtained from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

They have other books that are also helpful. Write to the GPO and request a list of publications helpful in starting a business.

You might also consider a copy of "TV and Radio Tech's Guide to Pricing." This book explains how to charge for labor and parts. It is available by writing to Sperry Tech, Inc., PO Box 5234, Lincoln, Nebraska 68505, at a cost of eighteen dollars.

MORE adventures in tv servicing

J.B. Straughn

SILVERTONE CHASSIS 528.71270

This set belongs to a man now confined to a nursing home. His friends brought me two receivers in the hopes I could fix one of them. In addition to the Silvertone (Sears) there was a Philco which looked worse off than the Sears and which did not have uhf, so I asked and got permission to scrap the Philco, after first removing anything usable for my junk box.

When I fired up the Sears, I found no B supply voltage and the tubes did not light. "Oh boy," I thought, "You have an easy one this time." I dragged out a schematic just in case and also noted that the 150- μ f capacitor feeding the voltage doubler was swollen and had leaked at one end. I replaced it, but still no dc voltage. There was no ac voltage from the negative lead of C112 (see Figure 1) to the chassis. Checking back from this point to the line plug with an ohmmeter showed an open. The circuit breaker was open so I put in a new one. The circuit still tested open but the surge resistor, R124, was okay. This left only the on-off switch on the volume control. Sure enough, it was defective. I shorted the B+ section of the switch out and the set played, but poorly. All stations were picked up but both the horizontal and vertical sync were terrible--I could not make either stand still with the hold controls.

I installed a new volume control and on-off switch but the set seemed to me to be worse than before. When the set was turned on there was a big black hole in the middle of the raster which closed up after a while. I noticed that at one time the yoke had been replaced, which caused me to wonder if the right size had been used. This could cause the hole in the raster and just maybe the poor horizontal and vertical sync (the sync tube being supplied from the boost voltage, which would be affected by a wrong yoke).

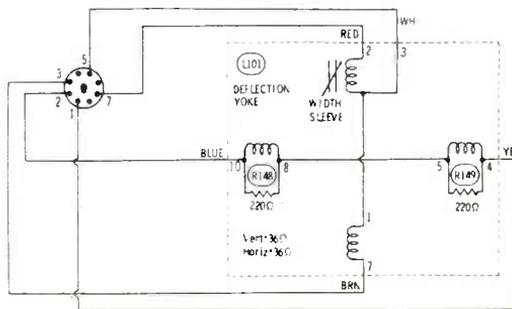
enjoy a program with good sync and to congratulate myself on being such a good serviceman but the darned thing was just as bad as before!

Next, I measured all dc voltages on the 11KV8 and found plate and screen voltages about 200 volts instead of 75 and 94 volts respectively. The cathode voltage was low but the control grid voltage was about right. I at once checked plate and screen circuits to see if the resistance values were okay, which they were. It was obvious the tube was not drawing correct plate and screen currents, and this accounted for the low cathode voltage. I suspected the 11KV8 although it tested okay. This is one thing about a tube tester which you should always remember. If a tube tester says a tube is bad—believe it. If the tube tests good, maybe it is and maybe it isn't—it depends on how the circuit works and the symptoms. Anyway, I decided to buy a new tube the next time I went to town just to satisfy myself.

In the meantime I remembered that low filament voltages could reduce emission. The only tube I could easily get at was a 17BF11, which should have about 18 volts on its filament instead of the 8 volts ac I measured. I rechecked the schematic to see if an 8BF11 was called for. No, the 17BF11 was correct. This upset me as I had visions of a tube with a much higher than normal filament resistance, but just then I noted that none of the tube filaments seemed very bright. This caused the light to dawn in my head—I had a defective (new) on-off switch or I had made a poor solder joint at the filament section of the switch contacts in the crowded space available. This would account for the low filament voltage since filament current would only be supplied through the instant-on diode across this switch section. A check showed both sections of the original on-off switch to be open.

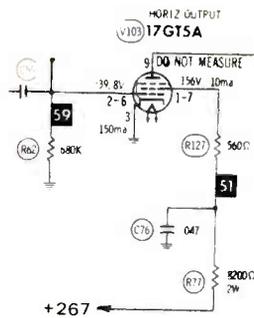
I removed the new control and switch, which checked okay with the ohmmeter, and very carefully resoldered the connection. The tubes now lit to normal brilliance, the video voltage became normal and the sync locked in solid.

Now I noticed the pictures on all channels were filled with snow and the tuner contacts were dirty. I could not satisfactorily clean the contacts, so off the tuners



Courtesy Howard W. Sams

FIGURE 3. SCHEMATIC DIAGRAM OF A YOKE WHICH SHOWS A SLEEVE MADE OF COPPER IS USED TO CONTROL PICTURE WIDTH.



Courtesy Howard W. Sams

FIGURE 4. HORIZONTAL OUTPUT STAGE.

went to United Tuner Repair in Atlanta. When they got back, in less than the usual week, I reinstalled them and got snow-free pictures; but now I noticed that everybody had a fat face--the screen was being overscanned horizontally.

Figure 3 shows a "width sleeve" alongside the horizontal yoke. This is a copper sleeve fitted between the neck of the picture tube and the yoke. Moving more of the sleeve into the yoke reduces the sweep width. Of course, it was my luck that whoever replaced the yoke had discarded the sleeve. This is something you can't buy, as today's sets use other methods of controlling width.

Look at the schematic in Figure 4. There are a number of methods of reducing the width. You could insert a small resistor between the cathode, pin 3 of the 17GT5 and the chassis. I don't like this method very much. Another method is to reduce the screen current by increasing the value of the 8200-ohm series screen resistor. You could also remove the 0.047 screen bypass capacitor which would also reduce the width.

I had just about decided to try a 12,000-ohm resistor in place of the 8200-ohm unit when I happened to remember the big junk box of discarded yokes a big-city friend of mine has. I had one of my sons drop by and he returned with three sleeves. One of them did the job and the set was about perfect. Everybody was real happy but me, as I could not in good conscience charge what the job was worth. The repair of the two tuners and the other parts cost me \$25 and I charged \$60, which, everything considered, put me in the minimum wage bracket for this job. However, I did a good deed and kept myself out of trouble, so it evened out.

ADMIRAL CHASSIS G310-1

This portable I did not want to fix because I saw signs that someone had been working on it. They had tried to remove the uhf tuner and had left it hanging loose on its mounting bracket. I knew why they had had trouble. They couldn't figure how to remove the separate metal chassis hanging under the cabinet top. The tuners

plus the volume control and on-off switch are mounted on this flat metal strip. There are a number of screws to remove but what fouls some servicemen up is that the heads of four of the screws are concealed under the flat metal brackets on top of the cabinet, which hold the carrying handle. By trial and error I had learned that these brackets are to be pried up, exposing the screw heads. Sometime in the past the on-off switch had been replaced by burning a hole in the side of the cabinet with a soldering iron and mounting a toggle switch. The customer did not like the arrangement and asked me to put in a proper part.

I agreed, without enthusiasm, to fix the set. When I plugged the set in, no tubes lit. A check showed the wiring to the toggle switch had been messed up. I corrected this but still no tube lit. The circuit tested good from the ac input to pin 1 of the first tube in the series string (similar to Figure 1 or Figure 5). It was therefore apparent there was an open in the filament string. I was about to start pulling tubes so I could check for filament continuity when I noticed a depressed and broken place in the circuit board. It looked as if someone had hit it with the end of a ballpeen hammer. I called the customer and told her to come get the set and junk it. She talked me out of this by flattery and by promises of "Rich Rewards in Radio," or in this case TV. Oh, well.

I had to remove the shield on the bottom of the circuit board to get at the break, which was easy enough to fix, but I didn't know what I'd find next. I found out soon enough. The set had a raster but no sound or picture. A check with my substitute tuner showed there was trouble past the tuners, although the tuners could still be at fault. I strongly suspected this because of the "work" that had been done on the uhf.

With my eyes now wide open for visual damage, I found a peaking coil near the edge of the circuit board which had some of the cement, in which the coil had been sealed, cracked off. I checked the coil and it was open. I was really on the track of skullduggery now as I found two other peaking coils had received the same treatment. Someone had squeezed them with pliers to break the wires! The coil in the video output tube control grid return was smashed, the one feeding sync signals to the sync separator tube was open as was the one in series with the cathode of the picture tube. I bought suitable replacements, but had to go to two wholesale houses, as neither had all three coils.

Next I removed the tuners and volume control on-off switch. I packed up the tuners carefully and sent them off for a complete overhaul. The uhf tuner was defective and the vhf in need of repair. When they came back they were reinstalled, along with a new control and switch. I tried the set out and got a beautiful picture on all channels. The set worked like new. I made out a bill for \$67.25. The customer only had \$42.25, but a neighbor, who buys hay from me agreed to guarantee payment on the first of the month if the customer did not make good. About the second of the month the customer showed up with the balance and was still tickled with the set's performance. Makes you wonder just how many peaking coils have naturally opened in sets. In some cases the sets will work but the picture is usually degraded. I have started checking all readily available peaking coils as this is a simple thing to do.

GENERAL ELECTRIC CHASSIS S3

This set came in with the remark that a kid had knocked it off a table and that something rattled inside. When I opened the set I found out that the 33GY7 had been jarred out of its socket and was the cause of the rattling noise. Much to my surprise the 33GY7 tested okay, but the 23Z9 used in the vertical sweep was weak as was the mixer tube in the vhf tuner.

I replaced the defective tubes, adjusted in the vertical size, linearity and hold and got good sound and picture. I buttoned up the set and then discovered the bar part of both the vhf and uhf selector knobs broken off to the "quick." It would be possible to live with the uhf knob as it can be easily turned by grasping the rim with your finger tips. The vhf knob is another matter since some force is required to turn it against the locking action of the detent in the tuner.

Now there is something you should know about ordering knobs. The chassis number is, in practically all cases, worthless for identification purposes. The manufacturer may have produced 50 models using the same chassis. There may be a wide variation in the size of the picture tube, in the cabinet and most certainly in the knobs.

At one time I had this problem with an Admiral model and purchased \$15 worth of knobs which, while okay for the "chassis," did not fit this particular model. The parts man at Admiral had me send in the broken knob and was able to match it up with a dozen new ones, which I will eventually use.

With the GE S3 chassis I found that matching up was not possible. I expect this is due to the stock inventory arrangement and the number of models for a given chassis (circuit-wise they are identical). In any event, the knobs I sent to GE, after a phone conversation, with a letter stating that the model number was missing, came back with a reply neatly written on the bottom of my letter—"Please advise correct model number." I muttered some choice remarks to myself, which are herewith deleted. The next day, after I got back my cool, I called GE, re-explained my problem, and got hold of an understanding soul in the parts department, one R.S. Averitt, who advised me that if I would give him the numbers on the two tuners he would try and pull the right knobs from stock.

With the aid of a magnifying glass I found on the vhf tuner: GE P1261964 (turned out to be worthless for identification) and Cat# ET86X245. The numbers on the uhf tuner had been stamped over, but looked like ET 135-1. A call to Mr. Averitt identified the catalog number ET86X245 on the vhf and armed with the fact the set used a 12-inch picture tube, he promised to have the new knobs on their way via United Parcel Service that afternoon.

A point to bear in mind for your sake and for others who may follow, is never to remove a tag showing the model number from a set—too many servicemen have been guilty of doing just that. Sometimes the number is on a sticker which has come unglued and is lying inside of the cabinet. Either mark the model number on the chassis with a grease pencil or leave the sticker loose in the cabinet when you

reinstall the chassis. You may do yourself a favor on a future job on the same set or help some other serviceman. One thoughtful guy in the area marks the Sam's Manual Number on the chassis--a great time-saver.

Reader Exchange

FOR SALE: Approximately 792 copies of Sams Photofact sets of Electronic Servicing Guide. Approximately 80 copies of 1-200. All copies of 200-912. \$1.50 per set. Contact James Lindvig, J and J Electric, Rte.1, Box 185A, Viola, Wisconsin 54664. Telephone (608) 627-1687.

Job Ops

TECHNICIANS WANTED: Digital Communications Corporation in Gaithersburg, Maryland, has recently asked assistance in locating electronic technicians for possible employment. Mr. Bill Kaht, Digital's Director of Personnel, is looking for technicians with experience in digital and analog circuits, including phase-lock loops, filters, and phase detectors. Mr. Kaht is reviewing resumes of NRI advanced students or graduates for employment at Digital's Gaithersburg location as well as other locations throughout the United States and overseas. Resumes should be sent to Bruce Dickinson, NRI Career Advancement Service, for processing and forwarding to Mr. Kaht.

HAM NEWS



By Ted Beach K4MKX

Well gang, it looks like this is going to be a short column this time. As usual, we have been kept busy both at the office and at home, and there just hasn't been an awful lot of time for me to devote to my various Ham projects. In addition, as you will see, we have not had many letters with goings-on of you guys, so not much to report in that area either.

The one thing that I have been spending a bit of time on recently is my home brew two-meter frequency synthesizer, mentioned briefly in the last column. Indeed, writing about this in the Journal was what prompted me to drag the thing off of the shelf and get back to work on the project.

If you have done any reading at all about these monsters, you know that they are quite complex and not very easy to tame. Well, mine is no different than the rest in these two respects, and trying to track down the little gremlins that creep in is quite a job.

To give you an idea of the complexity, my unit has 21 integrated circuits and one transistor in its present configuration. It gulps 800 ma at 12 volts (that's right, almost 10 watts!). This is fine for a base station, but doesn't look too good for use with a portable rig-mobile, perhaps. I have a second version on the drawing board that uses only about half as much current as the present model, and hopefully it will work out all right.

What all of this mess does is generate as many frequencies as needed in the 146 MHz to 147.99 MHz FM band. It can actually cover the entire two-meter band very simply; however there are not many rigs that can cover the 4-MHz band without retuning of the receiver and transceiver. So at any rate what I get from one crystal is any frequency in the two-meter FM band that is on a multiple of 5 kHz or 10 kHz. There is selection circuitry which will allow automatic repeater operation in which the received frequency is

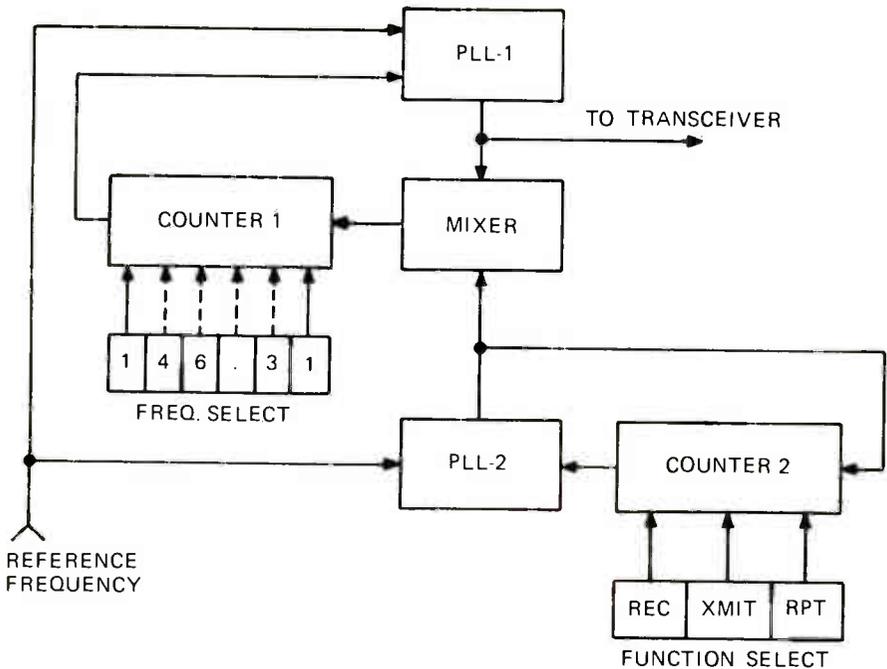


FIGURE 1. BASIC OPERATION OF PROGRAMMABLE FREQUENCY SYNTHESIZER.

set to be 600 kHz above the transmit frequency. At present there is no provision for automatic high-in, low-out repeater splits, but all it would take to install this feature is a handful of diodes to program a counter.

Without going into a lot of theory and details about phase locked loops, counters, voltage controlled oscillators and the like, I will attempt to give you a rough idea of how the synthesizer works. Figure 1 shows most of it.

Look first in the lower right at PLL-2 and COUNTER 2. The output of PLL-2 is a frequency in the 11-12 MHz range. This output goes to a digital mixer and to COUNTER 2, which is a programmable frequency divider. It will divide any input frequency by a fixed number that is determined by the FUNCTION that is selected. That

is, we divide by one number on RECEIVE, by another number on TRANSMIT and another number on REPEAT. The output of COUNTER 2 is a low frequency (about 1.666 kHz) which is fed back to PLL-2.

A 1.666-kHz REFERENCE FREQUENCY is also applied to PLL-2 and this frequency is compared with the 1.666-kHz signal from COUNTER 2 in a part of the PLL. When the two frequencies are exactly the same, the PLL is said to be LOCKED and producing the desired frequency output. If another FUNCTION is selected or if the oscillator of the PLL attempts to drift, the two inputs will no longer be the same (1.666 kHz) and the comparator part of the PLL will generate a voltage which is applied to the oscillator to shift its frequency so as to once again equalize the two low-frequency

inputs. This is the basic operation of all closed-loop systems (PLL's) and allows the output frequency to have the basic stability of the REFERENCE frequency, which is crystal-controlled.

The synthesizer of Figure 1 has TWO PLLs, you will notice. PLL-1 is the one that generates the output frequencies (actually 1/12 the true output frequency), also in the 11-12 MHz range, like PLL-2. The outputs of the two PLLs are applied to a DIGITAL MIXER whose output contains only the difference frequency of the PLLs. The resultant rather low frequency is sent to COUNTER 1 which divides the signal in accordance with the frequency dialed in on the FREQUENCY SELECT switches. The output of this counter is again 1.666 kHz which is compared with the 1.666-kHz reference frequency in PLL-1 to keep its output constant.

With this scheme, *both* PLLs must be locked to have a valid output frequency to the transceiver frequency multipliers. For this reason, there is additional circuitry that disables

PLL-1 when going from TRANSMIT to RECEIVE or REPEAT (or vice versa) until PLL-2 is locked. Then PLL-1 is enabled and steered to the correct frequency. Small frequency excursions, such as changing channels, affects only PLL-1 so it is quite simple to QSY without losing the loop lock.

And that's basically (very basic!) how the thing works. I won't go into numbers or exact frequencies as there are some patent problems, and besides there is just not enough room in one column to give a detailed analysis of the synthesizer. At any rate, it can be programmed for virtually any receiver i-f and can have all sorts of weird splits programmed into it. If anyone would like more information I would suggest reading the Motorola Application Notes on PLLs and the Signetics application information on PLLs as well as the many fine articles that have appeared in various magazines in the past three or four years.

Now let's see who we've heard from since last time.

Jim	WN1TBM	N	Lowell, MA
-	WN2UQI	N	Brooklyn, NY
Charles	WN2WCP	N	Tupper Lake, NY
Carlos	WN4IGJ	N	Key West, FL
Jim	WN4JES	N	Corbin, KY
Charles	WN5EFL	N	Abilene, TX
Jim	W-5ITZ	A*	Giddings, TX
Thornton	WN5MHT	N	Oak Ridge, LA
Fred	WN6VMX	N	Huntington Park, CA
Bob	WA7UTW	G*	Longview, WA
Clarence	WBØ IZS	G*	Anamosa, IA
Gary	WNØ LUW	N	Minneapolis, MN
Aristides	WP4EAN	N	Loiza, PR
Michael	CP8BB	-	Riberalta, Beni, Bolivia
David	WN3WZX	N	Ellicott City, MD
Don	WA9YOL	A	Bourbonnais, IL

* Just upgraded - congratulations!

As usual, the first names (14) are those students and graduates of NRI Amateur Courses. The last two are students of other NRI courses.

WN1TBM wrote us that he had just passed his Novice and was itching to get his code up to 14 or 15 WPM so he could take the General test. Jim says that he feels he will sail through the theory part because of his NRI lessons. Fine, Jim, and be sure to let us know when the day arrives.

WN2UQI is Sister Mary Benita Carey whom we mentioned in the July/August column without her call. She says she did not send it in as she was not yet on the air and thought it might be confusing for anyone who might want to contact her. Also, Sister Mary Benita's picture appeared on page 8 of the September/October Journal as the winner of the 1974 Gernsback Award! Fine business, and a first for an Amateur Course student.

W-5ITZ is listed as such since Jim doesn't know whether he has changed his 'N' to an "A" or a "B," having passed the General test in July at the Dallas office. Jim is using a Heath SB102 on 40, 15 and 10 using an inverted vee antenna. He has worked 36 states with 35 confirmed and also has the much coveted RCC certificate. In September Jim entered Texas A and M as an EE student and still expects to find time to use the club station, W5AC. Good luck! Jim is also looking for a Heath external LMO (SB640) which has not been made for some years. Anyone who knows where Jim can pick one up, please write him at: James Arndt Jr. WN5ITZ, 1122 East Austin, Giddings TX 78942.

WN5MHT has problems. Thornton passed the conditional Technician test

on August 8 and then went down to Dallas with his 18 WPM code speed to take the General on August 20. Unfortunately he blew the theory badly! Thornton says he was just "testing the water" and will try again later.

Bob, WA7UTW, wrote us a nice note telling us of his recent upgrade. He uses a Heath HW16 with VFO on 40 meters and is usually on 0815 to 0915 local time and 2330 to 0100, also local time. In the mornings he works up and down the coast, but at night gets a haul to Hawaii and Alaska. Bob closed his letter with these very welcome words: "TNX for the fine course in Amateur Radio. It is worth every dollar invested." Thanks, Bob.

CP8BB didn't tell us much about his ham station, but he did tell us that he is "Director, Technician and Handyman of CP114, Radio San Miguel, putting out 250W, 9 hours a day on 4.700 MHz into a dipole." Michael also says the transmitter is an elderly, much-modified Gates with a converted BC610 as a back-up.

WA9YOL uses dipoles on 20 and 40 meters and has a quarter-wave vertical on two. All these antennas and Don lives in an apartment! Don't say it can't be done! Don uses a Heath HW202 on two meters and a Hallicrafters SR160 on the dc bands. He started out in ham radio as a Novice in 1967, got his Advanced in 1968 and hopes to try for Extra real soon.

And there we are for this time. Have a happy holiday season and we will look forward to hearing from you real soon. Happy New Year and very 73!

Ted — K4MKX

NRI HONORS PROGRAM AWARDS

For outstanding grades throughout their NRI courses of study, the following July/August graduates were given Certificates of Distinction along with their NRI Electronics Diplomas.

WITH HIGHEST HONORS

Connie A. Allen, Huntsville, AL
Bradley B. Barnes, Greeneville, TN
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Virgil D. Carr, Laramie, WY
Joe T. Dickey, Huntsville, AL
Robert Fischer, Longmont, CO
Nicholas Fortunato, Ormond Beach, FL
William K. Griemsmann, Hagerstown, MD
Charles R. Houghtby, Livonia, MI
Richard K. Hughes, Paw Paw, MI
Le Lai, McLean, VA
Alfred Petrunti, Mineola, NY
Thomas B. Riedmiller, Scranton, PA
John J. Ryan, Philadelphia, PA
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Richard F. Dombrowski, Belleville, NJ
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Roger D. Dwelle, Douglasville, GA
Christopher P. Escarcega, Hanford, CA
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Patrick C. Foell, Anoka, MN
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Page Goldbeck, Los Altos Hills, CA
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Neal Goodman, Englewood, CO
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CHAMBERSBURG (CUMBERLAND VALLEY) CHAPTER meets at 8 p.m., 2nd Tuesday of each month at Gerald Strite's TV-Radio Service Shop, RR2, Chambersburg, Pa. Chairman: Gerald Strite.

DETROIT CHAPTER meets 8 p.m., 2nd Friday of each month at St. Andrews Hall, 431 E. Congress St., Detroit. Chairman: James Kelley, 1140 Livernois, Detroit, Mich. 841-4972.

FLINT (SAGINAW VALLEY) CHAPTER meets 7:30 p.m. second Wednesday of each month at Andy's Radio and TV Shop, G-5507 S. Saginaw Rd., Flint, Michigan. Chairman: Larry McMaster, (517) 463-5059.

NEW YORK CITY CHAPTER meets 8:30 p.m., 1st and 3rd Thursday of each month at 199 Lefferts Ave., Brooklyn, N.Y. Chairman: Samuel Antman, 1669 45th St., Brooklyn, N.Y.

NORTH JERSEY CHAPTER meets 8 p.m., 2nd Friday of each month at The Players Club, Washington Square. Chairman: George Stoll, 10 Jefferson Ave., Kearney, N.J.

PHILADELPHIA-CAMDEN CHAPTER meets 8 p.m., 4th Monday of each month in RCA Building, 204-I, Route 38 in Haddonfield Rd., Cherry Hill, New Jersey 08034. Chairman: Joe Szumowski.

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SAN ANTONIO (ALAMO) CHAPTER meets 7 p.m., 4th Thursday of each month at Alamo Heights Christian Church Scout House, 350 Primrose St., 6500 block of N. New Braunfels St. (3 blocks N. of Austin Hwy.), San Antonio. Chairman: Robert Bonge, 222 Amador Lane, San Antonio. All San Antonio area NRI students are always welcome. A free annual chapter membership will be given to all NRI graduates attending within three months of their graduation.

SOUTHEASTERN MASSACHUSETTS CHAPTER meets 8 p.m., last Wednesday of each month at the home of Chairman Daniel DeJesus, 12 Brookview St., Fairhaven, Mass. 02719.

SPRINGFIELD (MASSACHUSETTS) CHAPTER meets at 7 p.m. on the second Saturday of each month at the home of Chairman Art Byron.

TORONTO CHAPTER meets at McGraw-Hill CEC, 330 Progress Ave., Scarborough, Ontario, Canada. Chairman Branko Lebar. For information contact Stewart J. Kenmuir (416) 293-1911.



NEW YORK CHAPTER FINDS NEW HOME

New York's chapter chairman Steven Kross has had problems with his health. He is now moving to Las Vegas, Nevada and we wish him the best of luck but will miss him as he is the most informed electronics man in the chapter.

Sam Antman our past chairman is taking over the responsibilities not only as chairman but is allowing his home to be used as the new meeting place for the chapter. The address is 1669 45th St., Brooklyn, NY. The April 3rd meeting at Sam's home was well attended and Sam hopes this will give the chapter a shot in the arm for the coming year. There will not be any dues collected for the year 1974. All dues already paid will be credited toward those due in the future. Sam has offered his basement for the meetings gratis and this will cut expenses of high rent that can bankrupt the chapter in a short time.

Now that the chapter has a place to meet with low expenses it is up to the chapter to keep going on the

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James Kelley.....President
William W. David..... Vice President
Albert H. Sharp..... Vice President
W. L. Simmons..... Vice President
Arnold E. Verdow... Vice President
Tom Nolan.....Exec. Secretary

Alumni News

technical knowledge that all of the members have and are glad to share. The Executive Secretary, Tom Nolan will make his annual visit on December 5, 1974.

FALL RIVER CHAPTER HEARS NATIONAL SECRETARY

The September 19 meeting was held at the home of Daniel De Jesus in Fairhaven, Massachusetts. The meeting was attended by Tom Nolan the Executive Secretary of the National Radio Institute Alumni Association who was making his annual visitation.

Tom brought along the latest Model 255 triggered solid-state oscilloscope and used the instrument to demonstrate the use of probes and oscilloscope in troubleshooting.

There was a good turn-out and the membership as well as Tom enjoyed a very nice evening.

After the meeting refreshments were served by Dan and the members and the meeting broke up around 10:30.

Charles Kelly

Mr. Charles Kelly was a member of the Pittsburgh Chapter for fifteen years. He joined the Chapter in July of 1959. The following year he was elected director. He was elected Vice President in 1961. And 1966, 67, 68 and 69 he served again as director. In 1972 and 73 he was elected Chairman and in 1974 he served as Treasurer, which office he held until his death on July 14, 1974.

Charley very seldom missed a meeting and was a good and faithful member. The Chapter will miss him.

PITTSBURGH CHAPTER HEARS TALK ON LATEST TV RECEIVERS

At the August meeting Mr. Tom Schnader, one of the Pittsburgh Chapter's members and a TV technician, spoke at length on the new GE television receivers. Tom showed a series

of slides which were supplied by General Electric. He used a viewer which he had built himself. At the September meeting Tom gave a lecture on Motorola TV receivers and showed a series of Motorola 35-millimeter slides dealing with the convergence section of their receiver.

The membership is looking forward to their annual party and elections later in the year.

SPRINGFIELD MASSACHUSETTS CHAPTER HEARS LECTURE BY CHAIRMAN

At the September 14 meeting Mr. Arthur Byron, Chairman of the chapter had a talk on troubleshooting the high voltage section of TV receivers.

With a diagram of a black and white Zenith TV that he was repairing, Art gave a very interesting talk on high voltage troubleshooting. In this set with no sound, no raster, no high voltage and no boost voltage, he traced the various troubles that could be found from the horizontal oscillator on thru the high voltage section.

NORTH JERSEY CHAPTER VIEWS SAMS AUDIO-VISUAL MATERIAL

At the September meeting the North Jersey Chapter was entertained by visual and audio material from the Howard Sam's Company. The slides and sound dealt with the fundamentals of the color TV system and receiver circuitry. This was the first fall meeting since summer vacations and was well-attended.

DETROIT CHAPTER HEARS LECTURE ON TRANSISTORS

At the September meeting Mr. Jim Kelly gave a talk on the operations and characteristics of various transistors. He discussed how transistors are manufactured and the many inspections that are performed on the units before they are shipped out.

At the next meeting, technical films from the Detroit Public Library and General Motors Library will be shown on Mr. Nagy's new 16-millimeter sound projector. This unit adds considerably to the entertainment of the meetings.

Below you will find the ballot for the 1975 Alumni officers. You are asked to elect one man for President and four men for Vice President. The polls close on November 30, so please send your ballots in promptly.

BALLOT

FOR PRESIDENT:

- Tom Schnader
Irwin, Pa.
- Eldred M. Breese
Prineville, Ohio

Send your ballot to:
Tom Nolan, Exec. Scy.
NRI Alumni Association
3939 Wisconsin Avenue
Washington, D.C. 20016

Your name _____

Address _____

FOR VICE PRESIDENT

- Richard G. Moore
North Grafton, Mass.
- Angelo J. Colombo
Philadelphia, Pa.
- Homer Chaney
Branson, Missouri
- Victor E. Bartling
Grand Mound, Iowa
- Dan J. Kiernan, Jr.
Dallas, Texas
- Alford Hays
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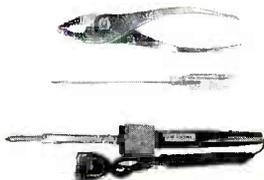
- Then you become a Radio Announcer. You set up a broadcast station, and with the speaker as your "mike," transmit your voice through your radio or a neighbor's set.

- Now you assemble a "Secret Listener." The speaker becomes a concealed microphone. Put it in one room and hear any conversations through a receiver without being present. Use it as an electronic "baby sitter." Mother can place the "Listener" near baby's crib and hear cries while she's in another room.

- You'll experiment with sound. In one project you build an Audio Oscillator and produce a wide range of sounds. Another experiment teaches how sound is magnified. After putting together an Audio Amplifier, you amplify sounds from a phonograph pick-up.

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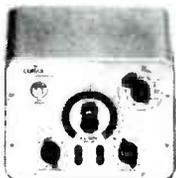
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MODEL 311

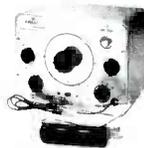


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25.01-30.00	1.50	4.00			
30.01-35.00	2.05	4.50			
35.01-40.00	2.65	4.75			
40.01-50.00	3.00	5.00			
50.01-60.00	4.15	5.50			
60.01-70.00	5.50	6.00	6.40	4.50	
70.01-80.00	7.00	6.50	8.00	5.00	
80.01-90.00	8.00	7.75	10.10	5.00	
90.01-100.00	9.00	8.75	12.60	5.25	
100.01-110.00	10.00	9.75	14.80	5.50	
110.01-120.00	11.00	10.75	16.20	6.00	
120.01-130.00	12.00	11.75	17.60	6.50	
130.01-140.00	13.00	12.75	19.40	7.00	
140.01-150.00	14.00	13.75	21.60	7.50	
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160.01-170.00	16.00	15.75	24.80	8.50	
170.01-180.00	17.00	16.75	26.20	9.00	
180.01-200.00	18.00	17.00	27.90	10.00	
200.01-220.00	20.00	18.50	29.80	11.00	
220.01-240.00	22.00	20.00	32.40	12.00	
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280.01-300.00	30.00	24.50	41.20	15.50	
300.01-320.00	32.00	25.50	44.20	17.00	
320.01-340.00	35.00	27.00	47.80	18.00	
340.01-370.00	38.00	28.00	52.40	18.50	
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