- Introducing the CONAR Model 682 TV Pattern Generator
- John F. Thompson Assumes the Presidency

nri journal

January/February 1974

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In this issue, NRI welcomes Jack Thompson as its new President. Also, Phil Deem gives us a practical and detailed discussion of CONAR's brand new TV pattern generator.

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President
National Radio Institute

John F. Thompson Assumes the Presidency

John F. Thompson has been named President of NRI succeeding J. Morrison Smith who is now semi-retired. It seems appropriate that "Jack" Thompson should succeed Morrison Smith, for it was Morrison who hired Mr. Thompson as Student Service Consultant in 1956, the same year that Morrison became president of NRI. Even today Jack Thompson remembers his first early months with NRI and his astonishment at the close, personal relationship maintained by NRI with each individual student.

Then and there Jack determined that NRI was an organization that offered him unique challenges and personal satisfaction beyond job and salary. He remembers students telling him things like this: "It's this small personal interest in your students that has made my studies with NRI such a pleasure" or "I'm very well pleased with my course and the way NRI gives you the feeling of being with you." Reflecting on his own classroom experiences and that of friends and acquaintances, he realized all too clearly the shortcomings of the usual classroom and all too often its remoteness from the real world of work.

From the very beginning of his career he demonstrated an exceptional ability to "get in step with a student," to truly appreciate the student's effort at learning from the student's point of view. Jack grasped the NRI idea – he was motivated.

Consequently, it wasn't many months before Jack was promoted to Assistant Director of Graduate Service. In this position, he came face to face with NRI graduates. He saw at first hand how the NRI Discovery learning method put NRI graduates into well-paid careers. Jack decided NRI had a great story to tell and he was soon given responsibility for the NRI Journal in addition to his Graduate Service responsibilities. For six years as its editor he was highly successful in creating issues of the Journal that were a warm, lively mix of graduate and student news, career information and timely technical articles. In fact, his knack for getting directly to the point with just the right words turned out to be an unusual talent. Jack had, and has today, the unusual ability to make the listener say to himself almost involuntarily, "He's so right, I wish I had said it that way."

It was perfectly natural, therefore, that Jack became the first Marketing Manager of the Student Supply Division which was beginning to outgrow its original purpose and, as CONAR, was rapidly evolving into a major supplier of test equipment and associated electronic supplies. Under Jack's direction – his flair for marketing had

an outlet – and Jack followed through with a remarkable series of highly successful sales efforts. He had a sixth sense as to just the right equipment for students and graduates, and for seeking out the best technical know-how to give him what he wanted in CONAR equipment. Best of all, he knew how to communicate this to NRI men to let them know exactly what they were buying and why. Before any new kit was made available to students, Jack insisted on personally assembling it at home and carried out the required experiments to ensure technical accuracy and proper realibility. When NRI's Director of Advertising and Public Relations retired in 1964, Jack was appointed to this position.

A few years later Mr. Thompson's concern for the traditions of NRI and, in particular his enthusiastic support of NRI leadership in innovative technical training, led to his appointment in 1966 to Vice President and member of the Board of Directors. His membership on the board with its more immediate exposure to the founder of NRI, James E. Smith, Chairman of the Board at the time, made Jack determined to follow this man's standards for himself, and to back J. Morrison Smith, President, and "J.E's" son, in continuing NRI's traditions.

Jack was always tremendously impressed by NRI's founder. Jack says, "J.E. Smith's love of people and his personal concern for their welfare made NRI a natural outlet for his immense energy. From the day NRI enrolled its first student in March, 1914, J.E. was intensely motivated by his belief that one man could make a difference. He inspired this same conviction in each and every NRI employee. That no matter what their job, they can make an important difference in the lives of many persons through the NRI Idea: individual technical training with specially designed training kits for priceless on the job experience."

In 1968 Morrison Smith made a momentous decision. NRI became part of the McGraw-Hill Company. It was not an easy decision to reach. But in the end the reasons were simple: To maintain NRI's leadership in technical training during the seventies would require extraordinary increases in people with special skills in many new technical fields, buildings would have to be acquired with highly expensive facilities for creating new and different ways of learning. This could not be accomplished by depending on NRI's resources alone and still keep NRI's traditional reasonable tuition schedules.

McGraw-Hill, however, had the resources and the know-how. Although through its book company, McGraw-Hill is the largest and most prestigious publisher of technical books, even more important to Morrison Smith, he saw McGraw-Hill as a total communications company on the forefront of multi-research projects in technical training.

It was clear that McGraw-Hill understood and respected the NRI no-compromise position on providing absolutely first-rate training at home second to none at a fair tuition.

"In retrospect," Jack believes, "it was just one man, Edward H. Booher, President, McGraw-Hill Books and Education, whose character said it all: There was just one way to go and that was with McGraw-Hill."

"When Time magazine once characterized Ed Booher as 'the brilliant educational publisher', Time made it clear," adds Mr. Thompson, "that brilliance was not a matter of flashy footwork in some corporate hierachy, but of solid accomplishments achieved with rare insight and creativity."

With a deep life-long involvement in education both as a private citizen serving as university trustee and on public commissions, and as a McGraw-Hill executive, Mr. Booher had held a knowledgeable respect for NRI over a number of years. He was convinced that NRI's reputation for educational integrity and demonstrated capability for highly effective training techniques could only result in real benefits for McGraw-Hill, NRI, and most of all, for NRI's present and future students.

To get these benefits underway without delay, Jack Thompson, as a member of a small task force, helped make a number of decisions. Perhaps the most important of these was to establish the McGraw-Hill Continuing Education Center in Washington, D.C. Under the leadership of Bartley A. Costello as President, the Center provides directions and physical plant for member schools much in the same way a university provides for the colleges on its campus. The Center has also acquired a new complex of buildings as a production and mailing services center. Important as these "CEC" services are, however, the influence of the officers of the Center on the schools is primary.

Now, as well as being President of NRI, Mr. Thompson is also a Senior Vice President of the McGraw-Hill Continuing Education Center. Jack finds this a stimulating experience with exciting possibilities for NRI. A recent planning session covered the possibility of setting up CEC Learning Centers within many of McGraw-Hill worldwide locations. This would mean, for example, that in almost every principal city in the United States, students and graduates could attend a "Meet Your NRI Instructor" session at the Center, join an Alumni Meeting, or perhaps talk to one of the great authorities in the field of your training. (Most of them are McGraw-Hill authors.)

Be assured, though, no matter how extensive are Mr. Thompson's CEC responsibilities, he will always ask, "How well will it work for students?" In the recent past Jack Thompson has been known to take home over the weekend a briefcase full of student exams and grade them himself. Jack's intent? To meet each student "face-to-face." Are the questions clear to this student? Is the lesson an effective learning experience? This precedent of individual concern for the student as a person goes right back to your school's beginnings.

In the President's message welcoming new students, Jack concludes his letter with this final paragraph:

"You are a Very Important Person to us! *You* are the reason this School exists. Today, we know you as a new student. In the weeks and months ahead, we hope to earn the right to call you our friend."

INTRODUCING THE CONAR MODEL 682 TV PATTERN GENERATOR

Phillip D. Deem

Right now, you're probably asking yourself, "What in the world is a TV pattern generator? Is it some kind of new gadget for entertaining the kids on a rainy Saturday afternoon?" Well, that isn't what it was intended for; however, I guess it could be used for that purpose.

A TV pattern generator is a miniature television broadcast station in a box. It has a rather limited "program," and is totally incapable of displaying even one commercial! If you grow weary of watching a particular pattern, just operate its controls to display a new one. You have a choice of: blank raster, crosshatch, vertical lines, horizontal lines, dots, gated color bars, and, by throwing the pattern switch from full to single, a single cross, a single vertical line, a single horizontal line or a single dot, for ten selections in all.

You may have guessed by now that I have been putting you on--just a little. A photo of the CONAR Model 682 is shown in Figure 1. It is a versatile servicing instrument. You can use it to check and adjust the performance of a TV set, either black and white or color, as you will see later.

Let's think for a moment about the manner in which a picture is displayed at the screen of a television receiver. For the purpose of this discussion, let's consider the operation of a black-and-white TV. We will disregard the signal processing circuits and concentrate on the action inside the picture tube only.

A simplified drawing of a picture tube is shown in Figure 2. Basically it consists of a face plate whose rear or inside surface has a phosphor coating. The coating lights up

FIGURE 1. PHOTOGRAPH OF THE CONAR MODEL 682 TV PATTERN GENERATOR.

whenever an electron strikes it. As more electrons strike the coating, the light becomes brighter. The electrons come from a gun at the rear of the tube. The gun produces a beam of electrons. The number of electrons in the beam is controlled by circuits in the TV set.

Now, if all we wanted to see at the face of the picture tube was a single dot at the center of the screen, we would be in business! Of course, we want to see more than that. The beam must move all over the screen. A deflection yoke and sweep circuits are added to move or sweep the beam across and up and down the screen. The sweep circuits move the beam to the top of the picture tube and send it scooting over to the right side of the screen, causing it to drop toward the bottom ever so slightly as it goes. As soon as it reaches the right side, the circuits shut the beam off and send it flying back to the left side of the screen. There the beam is turned back on and sent on its way to the right side again. This process continues over and over, tracing out or scanning 262½ lines, one just below the other, from the top of the

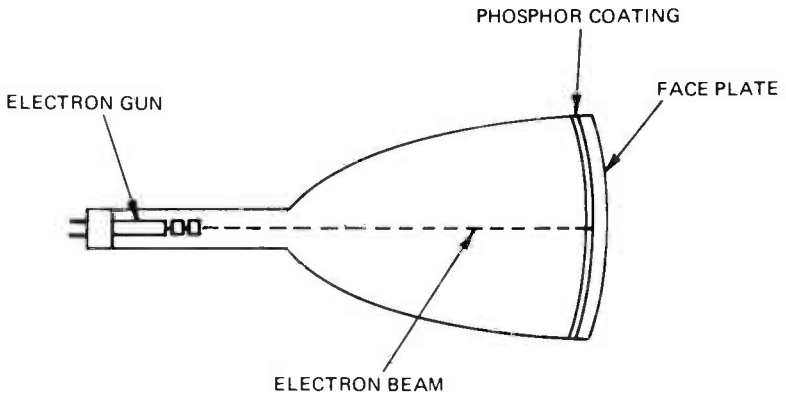

FIGURE 2. SIMPLIFIED DRAWING OF A TELEVISION PICTURE TUBE.

screen to the bottom. When the beam finishes scanning the last line, the sweep circuits turn it off and send it back to the top of the screen, at a position slightly different from the original starting position, to generate 262½ more lines between the first set. This generation of 525 lines produces what is called a raster. It causes the screen to become white all over when the set is not receiving a signal.

The TV set accomplishes this all on its own and needs no external signals to do so. When a TV station signal is received, pulses contained in the signal command the TV set to start the generation of its raster at an exact time. These pulses are called sync pulses. There is a pulse on the TV station signal to tell the TV set when to begin each raster–the vertical sync pulse, and when to begin each line–the horizontal sync pulse. This allows the TV set to reproduce the picture viewed by the camera at the TV station by locking both scanning systems together.

Now, if we want to generate patterns on the TV screen, our generator must be able to control the TV set just the same as a TV station does. Let's think about how a specific pattern might be produced.

The secret of producing a pattern on the screen is all in the timing. First, we must be able to command the set to start its raster and each line at a specific time. Therefore, we must generate horizontal and vertical sync pulses. Then, after a certain interval, we must tell the electron beam in the TV set when to turn on and off.

For example, suppose we wanted to display a single vertical line at the exact center of the TV screen. In order to accomplish this, the electron beam in the TV set must

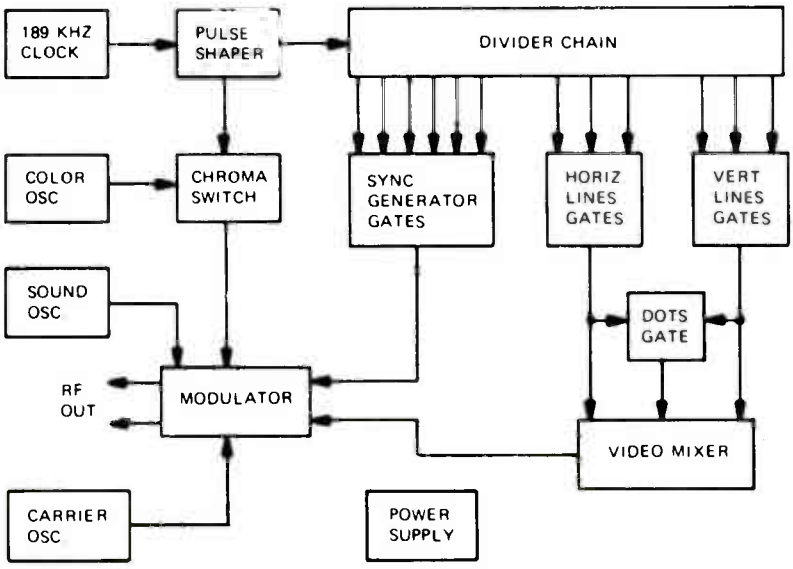

FIGURE 3. SIMPLIFIED BLOCK DIAGRAM OF THE TV PATTERN GENERATOR.

be turned on for just an instant, then off, when the beam is in the position corresponding to the center of a horizontal line. This must be done as each horizontal line is scanned. The result is a series of dots from the top center of the screen to the bottom. Since these dots occur at the center of each horizontal line, they are very close together. They look like a single vertical line when viewed at the face of the picture tube. Sounds fairly easy, doesn't it?

Let's see how the Model 682 does it. We'll begin our discussion of the generator's operation with an overview of the circuitry.

A block diagram of the Model 682 is shown in Figure 3. Four oscillators are included in the generator, the 189-kHz clock, a color oscillator, a sound oscillator and a carrier oscillator. Each is crystal-controlled to ensure operation on the exact frequency required. A special integrated circuit is used as a pulse shaper to "square up" the sine wave from the 189-kHz clock before feeding it to the divider chain and the chroma switch.

Digital integrated circuits are used in the divider chain, gates and video mixer. This section of the circuitry produces the composite sync signal and all of the patterns except the gated color bar pattern. The composite sync signal is fed to the modulator where it is combined with the signal from the carrier oscillator. Depending upon the setting of the generator's controls, signals from the video mixer, chroma switch or sound oscillator may also be combined in the modulator and impressed upon the rf carrier along with the composite sync signal.

The power supply contains a bare minimum of components as shown in Figure 4. Only these few parts are required due to the use of a special linear integrated circuit, IC1. IC1 is a three- terminal voltage regulator. It electronically removes the ripple on the dc voltage at its input, terminal 1, and supplies a regulated 5 volts at its output, terminal 3. A portion of the voltage from the bridge rectifier is filtered by R_{22} and C_{22} to provide a 9-volt source to power the carrier oscillator. The rest of the generator circuitry operates from the regulated 5 volt source.

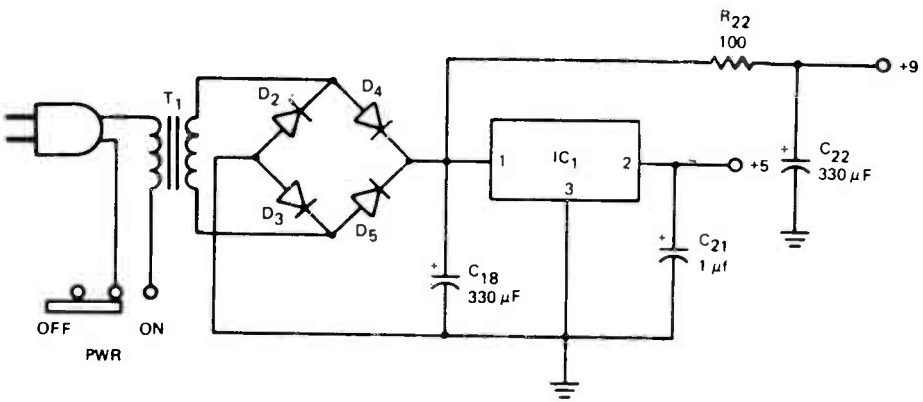

FIGURE 4. SCHEMATIC DIAGRAM OF THE POWER SUPPLY.

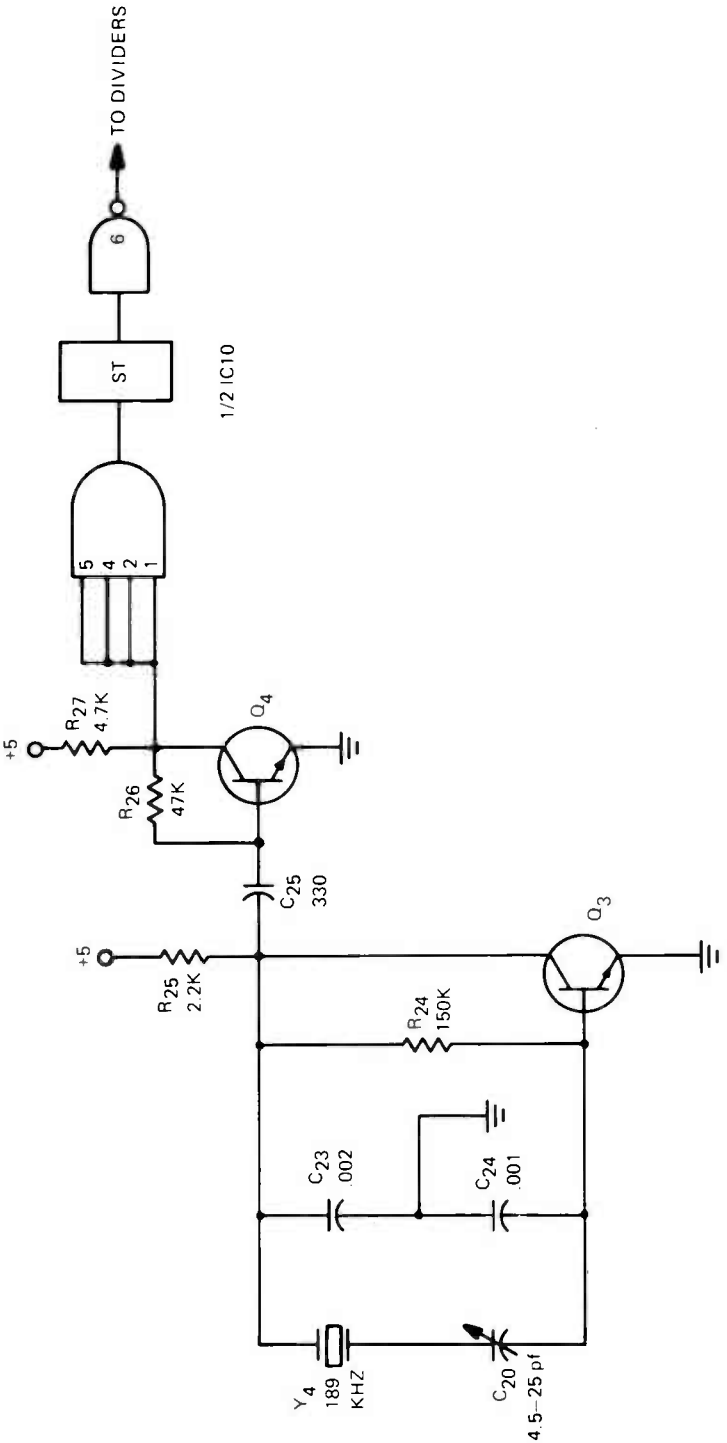

FIGURE 5. SCHEMATIC DIAGRAM OF CLOCK AND SHAPER.

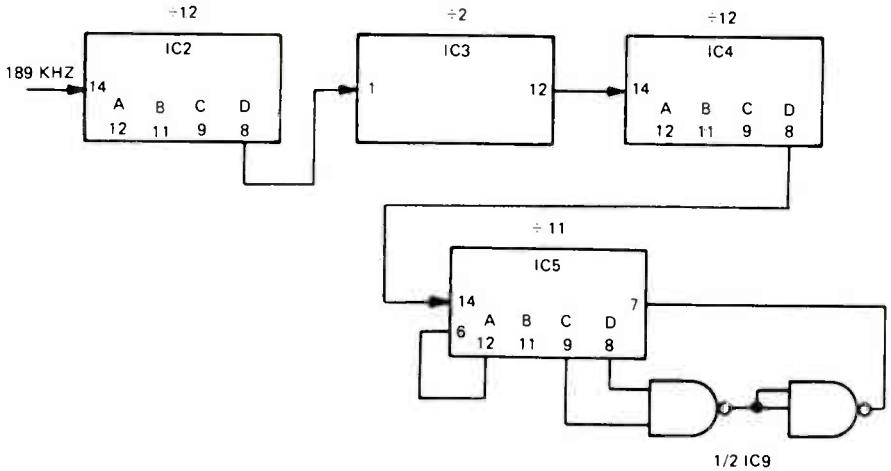

FIGURE 6. BLOCK DIAGRAM OF THE DIVIDER CHAIN.

A schematic of the clock and pulse shaper is shown in Figure 5. The clock is a common emitter Colpitts oscillator whose frequency is determined by Y_4, a 189-kHz crystal. When power is applied to the circuit, a signal develops at the collector of Q_3 which is coupled through C_{25} to the base of Q_4.

Q_4 serves as a buffer amplifier. It builds up the amplitude of the signal and feeds it to IC10. IC10 is a special integrated circuit called a Schmitt trigger. It is used to shape the 189-kHz signal from the crystal oscillator into a square wave for driving the divider chain.

A block diagram of the divider chain is shown in Figure 6. Four of the IC's shown in the figure contain a very large number of logic gates interconnected in such a manner that the output signal frequency is a fixed fraction of the input frequency.

IC2, for example, will divide the input frequency by a factor of 12. With a 189-kHz input frequency, the output at pin 8 will be 189 kHz/12 = 15.75 kHz (15,750 Hz), which is the correct frequency for the horizontal sync signal.

The next stage, IC3, divides the 15,750-Hz signal by 2, producing a signal of 7,875 Hz at its output. IC4 divides this signal by 12, producing an output of 656.25 Hz.

IC5 is actually a divide-by-12 circuit which we "trick" into dividing by 11 by using the two gates (½ IC9). The output of this divider is then 656.25/11 = 59.65909 Hz, the frequency of the vertical sync signal.

In addition to the four output signals just mentioned, there are other signals available at the pins labeled A, B, C and D of IC2, IC4 and IC5. These signals are used for generating the various pattern signals (dots, crosshatch, lines, etc.). They are combined in and switched through additional logic gates to produce the signal required for a specific pattern. The space available here does not permit an

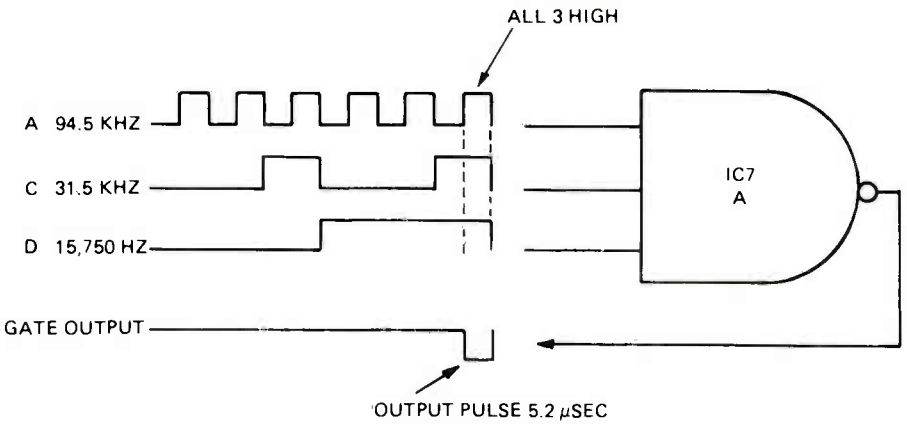

FIGURE 7. GENERATION OF THE HORIZONTAL SYNC SIGNAL.

extensive discussion of how the digital logic works, but let's see how the horizontal sync signal is formed, as an example.

The A, C, and D outputs from IC2 in the divider chain are combined as shown in Figure 7. Waveform D has a frequency of 15,750 Hz, the correct frequency for the horizontal sync pulses. The other waveforms are used to allow us to reduce the width of the pulse at the output of IC7A. The resulting pulse occurs at a rate of 15,750 Hz and is 5.2 microseconds in duration, very closely approximating the horizontal sync pulse broadcast by a TV station. The vertical sync pulse is generated in a similar manner.

By differentiating the 189-kHz clock signal and gating it with a couple of other signals from the divider chain, we can add the video signal to the composite sync waveform and produce a single vertical line at the picture tube. The waveform which would accomplish this is shown in Figure 8. Three lines of video are shown. The sharp positive pulse at the center of each line will turn the electron beam on and off for a short time, each time it sweeps across the TV screen.

The other patterns are produced in a similar manner. We can cause the TV set to display a full horizontal line merely by turning on the electron beam for the complete time interval between two consecutive horizontal sync pulses. The brief on/off cycle, as in the waveform in Figure 8, will produce a vertical line if it occurs

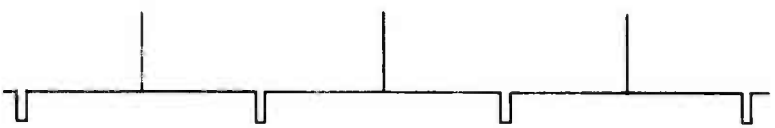

FIGURE 8. VIDEO WAVEFORM WHICH WOULD PRODUCE A SINGLE VERTICAL LINE ON THE TV SCREEN.

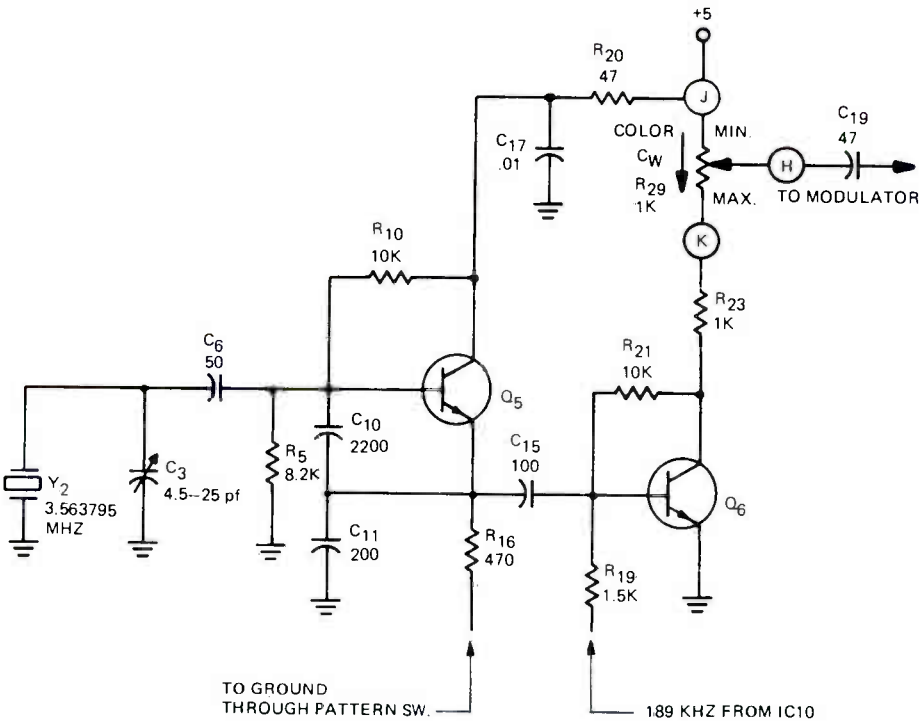

FIGURE 9. SCHEMATIC DIAGRAM OF THE COLOR OSCILLATOR AND SWITCH.

after each horizontal sync pulse or it will produce a dot if certain lines are skipped. The crosshatch pattern is simply a combination of both horizontal and vertical lines.

The only pattern that is not produced solely by the digital logic circuits is the color bar pattern. Let's see how this pattern is developed.

The color oscillator, in conjunction with the 189-kHz switch in the generator, modulates the carrier oscillator to produce a color bar pattern at the picture tube. In order to learn how this can be done, we must think about the operation of the color oscillator in the set as well as the one in the generator.

The color oscillator in the TV set operates at a frequency of 3.579545 MHz. Since we wish to produce the full range of colors across the face of the picture tube, we must choose an oscillator frequency whose phase relationship with the oscillator in the set will change from 0 degrees through 360 degrees as each line in the raster is scanned from left to right. Therefore, the frequency of our offset oscillator must be: 3.579545 MHz - 15,750 Hz = 3.563795 MHz. The oscillator in the generator will bring the color oscillator in the TV set into sync immediately after the horizontal sync pulse. As each line is scanned, the phase relationship will change, producing yellow-orange, through red, through blue, to green across the face of the picture tube.

Since we wish to produce color bars, we will gate the color oscillator signal in the generator on and off with the 189-kHz clock signal. This will produce 11 bars, the first of which will serve as the color burst. The schematic of the color oscillator and switch is shown in Figure 9.

The color oscillator operates at a frequency of 3.563795 MHz under the control of crystal Y_2. The oscillator signal is coupled from the emitter of the stage to the base of Q_6, the chroma switch. The emitter of Q_5 is switched to ground by the pattern selector switch when the color bar pattern is desired.

A 189-kHz signal from the clock also appears at the base of Q_6, along with the signal from the color oscillator. When the 189-kHz signal goes high, the chroma switch will saturate and prevent the color oscillator signal from reaching the collector. When the 189-kHz signal goes low, the switch allows the color signal to get through. The signal is developed across the color control, whose setting determines the amplitude of the gated color signal passed on to the modulator.

A diagram of the carrier oscillator is shown in Figure 10. It is responsible for generating a signal which can be received by a TV set. The oscillator operates at a frequency of 61.25 MHz under the control of crystal Y_3. The oscillator provides an rf output on TV Channel 3. The signal is developed across L_1 and C_4 and coupled to the modulator through C_9. L_1 is adjustable to compensate for component tolerances.

A schematic of the modulator is shown in Figure 11. The rf carrier signal is applied to the anode of D_1. The modulating signals are applied to the cathode. The result is

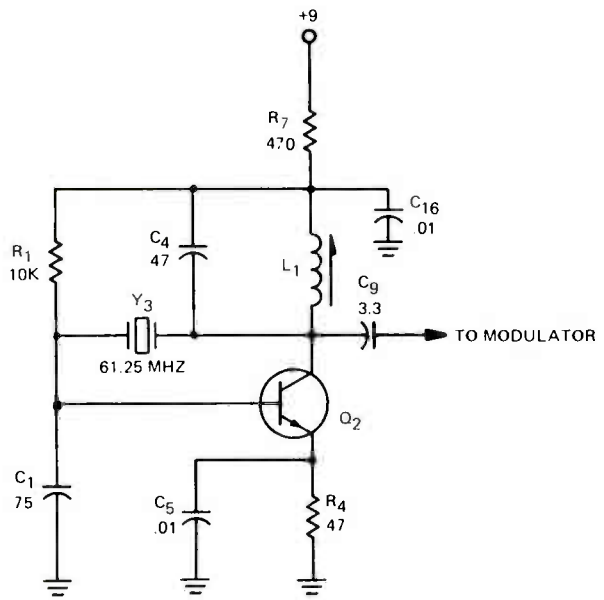

FIGURE 10. SCHEMATIC DIAGRAM OF THE CARRIER OSCILLATOR.

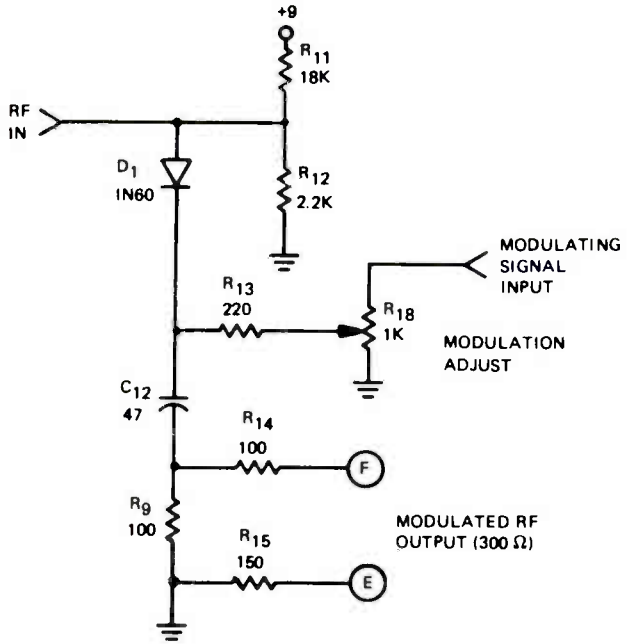

FIGURE 11. SCHEMATIC DIAGRAM OF THE DIODE MODULATOR.

a series of pulses through the diode at the rf carrier frequency which vary in amplitude in accordance with the modulating signal. The level of modulation is determined by the setting of R_{18}.

A 4.5-MHz sound oscillator is also included in the generator. It can be applied to the carrier whenever it is desired by operating a switch at the front panel of the generator. It serves as a fine tuning aid when adjusting a set to receive the color bar pattern and allows you to adjust the sound trap in a TV set.

So, there it is. It is a pretty busy little box! Now, let's see how you can use it in servicing television receivers. The generator is most useful in performing those sweep circuit adjustments which affect the display at the face of the picture tube – height, width, vertical and horizontal linearity, centering and focus. These adjustments must be performed on both color and black and white television receivers. Don't get the idea that the generator is useful for only color television work. While it is an absolute necessity for setting up color sets, it is very useful in black and white TV servicing, too!

Regardless of what test or adjustment you are going to perform using your Model 682, the generator must be connected to the set. Plug the ac cord into a convenient outlet and attach the rf antenna clip to the vhf antenna terminals on the set you are testing. Be sure to remove any external antenna connected at this point. Turn the TV set and the generator on and tune the set to Channel 3. Set the TV pattern generator controls so that it will produce the full crosshatch pattern. This is the

best pattern to use in accurately tuning in the generator signal. Watch the TV screen as you adjust the set's fine tuning. Pay particular attention to the vertical lines in the crosshatch pattern. Be sure the brightness and contrast controls are adjusted so that the pattern becomes sharp and clear as you adjust the fine tuning. If you have these controls up too high, the lines will become much wider than they should be. This effect is called "blooming" and is due to the excessive current drain under this condition. It causes the high voltage to become somewhat lower and allows the electron beam to spread out, resulting in a wider trace at the TV screen.

When you have the generator signal correctly tuned in, the vertical lines will be sharp and clear. As you tune each side of this point, they will become fuzzy. Leave the fine tuning set to the point at which the lines are sharpest.

Begin the sweep circuit adjustments by checking the centering of the raster. Use the single cross pattern for this. On black and white sets, this is usually accomplished by adjusting a set of centering rings around the neck of the picture tube, at the back of the yoke. On color sets, there is usually a separate control for both horizontal and vertical centering located somewhere on the chassis. Adjust the rings or controls as necessary to place the center of the cross at the center of the TV screen.

Next, the height, width, vertical and horizontal linearity should be adjusted. The idea is to be sure that the display completely fills the screen without excessive overscan. These controls may not always have the same name on each set. Sometimes you will see a size control instead of a height control, a horizontal efficiency adjustment instead of width, etc. In some color sets, both height and width may be controlled by a B+ adjustment in the power supply section. When making adjustments on any set you are not familiar with, consult the manufacturer's service literature for the recommended procedures.

The full crosshatch pattern is the best one to use for these adjustments. Some technicians prefer the color bar pattern for the width and horizontal linearity adjustments. The equally spaced lines of the crosshatch pattern are ideal for adjusting horizontal and vertical linearity. If they are not equally spaced across and up and down the TV screen, the TV set is at fault. Those digital integrated circuits just don't make mistakes!

The vertical linearity on all sets can be adjusted to be very nearly perfect. This is not always true in the case of horizontal linearity. Horizontal linearity is a bit more difficult to control in the design and production of TV receivers. Fortunately, errors in horizontal linearity are not as noticeable as errors in vertical linearity. So, perform the adjustment for the best horizontal linearity you can obtain on the set you are working on, but don't get upset if you cannot obtain a perfect adjustment. You won't be able to tell the difference when watching a regular picture, anyway.

Be sure the set you are working on is properly focused. The best pattern to use for this adjustment is the blank raster position. Adjust the brightness and contrast controls for a nice white screen, taking care not to turn the controls up so high that you see blooming or defocusing as you adjust them. On some sets, the focus is

adjusted by a continuous control. On others, it is adjusted by moving a tap on a voltage divider network. Adjust the control or try different positions of the tap for the sharpest scanning lines possible.

Now, the width, height, centering, focus, horizontal linearity and vertical linearity have been adjusted. If you are working on a black-and-white set, you would be finished. If you're working on a color set, you've just begun! Color sets must be converged so that the set will be capable of producing a black-and-white picture without color fringing. Each manufacturer has a procedure which he recommends for setting up the receiver. You should follow the procedure recommended for the set you are working on, but the following method will give you an idea of what is involved.

Once the previous adjustments have been performed, the purity is usually adjusted next. Use the blank raster pattern for this adjustment. The blue and green guns must be turned off. If the color signal is mixed in the picture tube, you will be able to use the gun killers in the Model 682 for this purpose. Each of the gun killer leads should be attached to the red, blue and green control grid leads coming from the picture tube socket. The black lead should be clipped to the TV chassis (ground). Now, the gun killer switches will control the guns in the picture tube.

If the color signal is not mixed in the picture tube, as is the case in many modern color sets, you will have to extinguish the guns by turning down the screen controls. In any case, switch or turn off the blue and green guns so that only the red gun is working. Use a degaussing coil to thoroughly demagnetize the face of the picture tube and any nearby metal areas, while checking for a pure red screen. If you are not able to obtain a pure red screen in this manner, you will have to perform the purity adjustment.

Loosen the hardware holding the deflection yoke in position and slide it back against the convergence yoke. Adjust the purity rings around the neck of the tube on the blue lateral/purity magnet assembly, until you have an intense red area exactly centered on the picture tube screen. Once you have it centered, slide the yoke forward until the red area just fills the screen. This is likely to occur before the yoke is fully up against the bell of the tube, so don't move it too far forward. When you are satisfied with the position of the yoke, fasten it in place. Turn the red gun off and check the purity of the blue and green screens by turning each of these guns on, one at a time. Turn all the guns on when you have finished.

Set the screen controls according to the procedure recommended by the manufacturer of the set you are working on. Usually, this consists of collapsing the vertical sweep by placing the service switch in the service position. This will produce a horizontal line or lines across the face of the tube, at the center of the screen. Adjust each of the screen controls so that its associated line is just barely visible at the face of the picture tube. Place the service switch back in the normal position and check to see whether the raster is tinted by any other color. It should be white. If it is not, the drive controls should be adjusted to balance out the colors to produce a pure white screen.

Next, the static convergence adjustments must be performed. Adjust the pattern generator to display a single dot at the center of the TV screen. The dot should be completely white. However, you may be able to see a red, a green and a blue dot if the set is badly out of convergence. The position of each dot is controlled by a magnet in the convergence yoke. The position of the blue dot can be adjusted only in a vertical direction by the magnet in the convergence yoke. A second magnet is located in the blue lateral/purity magnet assembly. This will move the blue dot from side to side. By adjusting all four of these, you will be able to cause each of the dots to fall exactly over each other to produce a pure white dot. When you have done so, the static convergence is complete.

Finally, the dynamic convergence adjustments are performed. These affect the position of the beams toward the edges of the TV screen. There are a sizable number of adjustments and these will not be covered here. The single vertical line, single horizontal line, full vertical lines, full horizontal lines and full crosshatch patterns are used for certain of these adjustments. By consulting the manufacturer's service information, you will see which pattern is best for each adjustment.

The color bar signal is used in testing and adjusting the chroma circuits in a color TV receiver. The operation of these circuits can be investigated thoroughly with the Model 682 and an oscilloscope. The service literature usually shows the appearance of the color bar signal at various points in the circuits. By comparing the waveforms you obtain with those shown, you will be able to locate defects in the color circuits.

The color APC adjustment is performed while feeding a color bar signal into the set. Remove the normal color phase correction signal from the reactance circuit and adjust the reactance coil or APC adjustment until a nearly stationary bar pattern is obtained. The pattern will drift slowly to the right or left when the adjustment is correct. Reapplying the phase correction signal will cause the pattern to lock into place.

The range of lock-in can be checked by reducing the amplitude of the color signal from the generator. Color sync should be maintained until the signal nearly disappears.

The setting of the color killer can also be checked with the Model 682. By switching between the color bar pattern and one of the other patterns produced by the generator, the killer control can be set to turn the color circuits off so that no trace of color is visible when viewing any pattern other than the color bar display. The threshold of the color killer can be checked by turning the color control on the generator toward the minimum position.

The sound signal can be added to any of the patterns produced by the generator and used to set the 4.5-MHz sound trap in a TV set. In some sets, this adjustment can be performed by viewing the pattern at the TV screen and tuning the trap for minimum sound beat in the display. In other cases, an oscilloscope can be connected to a point in the video signal path beyond the sound trap to observe the effect of the adjustment. Using either method, the trap is adjusted to remove as much 4.5-MHz signal from the video signal as possible.

The generator is also invaluable as a source of steady-state TV signal. It has all the same characteristics a regular broadcast television signal has, complete with sync pulses and video information that doesn't jump around like the video coming from a TV station does. The signal can be followed through the various stages of the set under test to check almost any aspect of its operation.

The Conar Model 682 TV pattern generator is a modern, state-of-the-art servicing instrument and will be a valuable asset on any servicing bench. If you don't already have one, it is available through our Conar Instruments division.

Job Ops

WANTED: Television broadcast engineer. Contact California Oregon Broadcasting, Inc., Box 5M, Medford, Oregon 97501.

Reader Exchange

WANTED: Meter for the NRI Model W VTVM. New or used. Contact C. V. Todd, 1320 N.W. 116th Street, Miami, Florida 33167.

HAM NEWS

By Ted Beach K4MKX

Golly, it hardly seems possible that another year is upon us already. Happy 1974. And guess what? right off the bat we are going to have to clean up some 1973 problems.

Just as soon as I had the first press copy of the last Journal in my hot little hands I detected a gross error in one of the figures in the Ham News. In Figure 3, the labels for the two integrated circuits are reversed—U2 should be on the left and U1 on the right. If any of you built up the QRPP key and put the ICs in wrong (as per Figure 3), naturally the unit would not work. However, if you used sockets all you have to do is swap the two ICs and everything should be okay—no damage will result to the ICs. If you soldered the ICs to the board, my apologies. You will have fun unsoldering the fourteen leads of the two packages (we **did** suggest using sockets, you know).

We only heard from one reader on the article and he was sharp-eyed enough to detect the IC reversal. It was Jack, WN8MGX, who caught it but he did not say whether or not he had attempted the construction. More about Jack later.

Well, there may still be hope of my getting on the dc bands one of these days. As some of you know, my main hangup in the past has been the lack of a suitable antenna. Well, I've had the wire-out-the-window bit matched to the antenna tuner described here earlier, but that works only with the QRP rig and I'd sure like to crank up the Ranger one of these days (some people would consider its 75-watt input as QRP!). Anyway, I have finally ordered a multiband vertical that I plan to install on the roof of the house with a whole bunch of radial/guy wires to make it go. After searching through the available ads and literature on the commercially available multiband units I settled on the Newtronics 4-BTV with a top-mounted 75-meter resonator.

If the weather holds up and the dealer gets the thing in soon, I should have it up and in operation in the near future. Then perhaps I can talk to some of you guys in person. (CW only, please—I'm trying to get my code speed up to try for Extra later this year when my license is up for renewal. Besides, I've removed all the audio tubes from the Ranger to increase the cw input as much as possible.)

Anyway, by the time you read this I should have everything going and if you should hear a real shaky fist calling CQ somewhere on 80 or 40, it may be me so give me a shout. Don't be surprised if I give you a QRS as it has been a long time since I've had a key (or keyer) in hand. I'll probably be using the QRPP key and all errors will be attributable solely to operator problems.

Now, let's see who we've heard from since last time. As before, the people listed first are those enrolled in our Amateur Radio courses and those listed later (beginning with K2IVG) are students and graduates of other NRI courses.

WN4GFG may be one of the first people I work on cw as Manassas is just a few miles down the road from where I live in Arlington. Frank got his ticket in October and had a rubber stamp made up with his call, name and QTH which he uses on Post Office "penny" postcards (now 6¢) for QSLs.

WN5ITZ doesn't have his QTH listed because I am writing this at home and forgot to get the information from our filing section at the office. His name and call came to me via our senior consultant, Joe Schek, who noted that James is using the CONAR 400 transmitter. Welcome aboard, Jim, wherever you are!

Speaking of the CONAR transmitter, WN5KMN also uses one and was wondering if there is any easy way to make a vfo to use with it. I'm afraid we had to answer "no" to that one, and I'm afraid I wouldn't recommend it to anyone. When we first came out with the Novice transmitter, we wanted something which would be inexpensive and allow the beginner to get his feet wet without spending an arm and a leg for gear. The regulations at the time specified crystal control for Novices, so we took one of the tried and proven ARRL power oscillator circuits and packaged it in a CONAR box.

Gary	WN2SEY	N	Cazenovia, NY
Ed	WN4FRF	N	Lauderhill, FL
Frank	WN4GFG	N	Manassas, VA
James	WN5ITZ	N	—
E.T.	WN5KMN	N	Waco, TX
Maurice	K6EPT	T	Lakewood, CA
Patricia	WA7QLS	G	Nampa, ID
Burton	WN7UOC	N	Salem, OR
Alvin	WN8QPZ	N	Fairborn, OH
Peter	WN9BCF	N	Rockford, IL
Henry	KL7HIF	T	Ketchikow, AK
George	K2IVG	A	Haledon, NJ
Bob	WA3UKZ	A	Harrisburg, PA(?)
Horace	WB4CRZ	E	Salem, KY
Jim	WA8HPD	G	Parkersburg, WV
Jack	WN8MGX	N	Washington, WV
William	WB8PLS	T	Maumee, OH
Wayne	VE3CIM	—	Burwash Ont. Can.

Adding a vfo to a power oscillator is *not* a good practice as the loading on the oscillator by the amplifier would probably pull the frequency, causing a very poor signal. You'd have to use a vfo and one or more buffer stages for isolation, and I'm afraid that the cost would not make it worthwhile.

If anyone has made this conversion successfully, let us know about it and we'll pass the information along in the column.

K6EPT had his shot at a General license, but like so many of us, Maurice blew the code test and had to settle for Tech. Don't feel bad, OM, back when I first tried for General they didn't have the Tech to fall back on—no Novice either and I blew it twice when I was 12!

WN9BCF is 15 and wrote a very nice three-page letter and included a diagram for a two-transistor code practice rig that has loudspeaker output. We can't reproduce the circuit here since it is from a copyrighted publication. However, the circuit is available in a Calectro catalog (I think!) which lists all the parts, etc. The reason Peter had to build a new oscillator is that the man who gave him his Novice test bought his code records, oscillator and key to teach his son the code. How's that for wheeling and dealing? Also, now that he has his ticket, Peter is looking for a Novice rig (see Ham Ads).

K2IVG just recently got his Advanced license after passing the test back in July. George works mostly cw and usually on 40 meters. He says that now that he has expanded phone privileges he just may go mobile on 40.

Late in October I got a phone call at the office from a Gordon Edwards, W4ADF, in Springfield VA. He had Bob, WA3UKZ, on a 40-meter phone patch from Pennsylvania. I must say, this was the first and only time that I had been on the receiving end of a phone patch and I rather enjoyed it! Bob is another one whose QTH I failed to get from our filing section, but on the phone he related that he was a minister and had had a Tech license last year when we had that bad flood (storm Agnes if my memory is correct). He could see first-hand the value of amateur radio in emergencies and made up his mind to study and get on the dc bands for just such occasions. As a result, he now has his Advanced license and I'm sure is going ahead with study for the Extra.

Speaking of Extras, I'm always real pleased to list these calls in these pages. WB4CRZ is our latest. Horace runs Heath gear (SB303 and SB401) from his Kentucky QTH into various dipole and quad antennas. We'll be looking for you on the bands, Horace.

While I'm thinking about the phone patch, I'm reminded that one evening when I was away from home my nine-year-old daughter took a phone call from another local Ham who was passing traffic from an NRI student in Lakeland Florida. And that's about all of the message that was legible! One other part of the message that was decipherable was that the man would write later so we may hear the end of this yet!

WA8HPD writes us that he works for a cable TV company in Parkersburg and that his chief engineer is also a Ham. As part of his job, one day Jim had to track down a TVI complaint which he did, and then proceeded to help the guilty party erect a better antenna so that his cw signals would not interfere with the cable TV signal. All of this was to the surprise and amazement of the cable customers, says Jim. Nice going, OM, and I'm sure that your help was invaluable.

When Jim is not working or studying he cranks up his SB102 which he is using with an indoor antenna. Can you believe that? Don't know what bands he is on, but I would be interested to know how that combination works out!

Next on the list is Eagle-eye Jack, WN8MGX. He says that he had built an op-amp keyer that was featured in the November 1971 QST and wanted to build the one I described as it would last a lot longer on batteries than the QST model. (It was several recent references to the W7ZOI keyer that prompted me to make the truly digital QRPP key design.) Jack has had his Novice a little more than a year and is just about ready to try for General. I'm sure you'll have no trouble with the test, Jack—best of luck.

VE3CIM is a new student and wrote to ask if NRI had any Hams aboard or if we had a Ham Club. Well, yes, Wayne, there are at present four active amateurs on the staff, and no, we don't have a club. A year or so ago I tried to drum up some enthusiasm for a W3NRI station for use by visiting students, but like so many ambitious projects, this one never got off the ground. We're still working at it, but not too actively!

I had a nice letter from Wilmer Giese (no call) the other day telling me of his "wireless" activities in the early days. He was one of the very early NRI students and became an "Authorized Radio-Trician" in 1933. At present, Wilmer enjoys listening to commercial cw and would very much like to be able to identify the various stations he is copying. He says that there was at one time a list or booklet published by the government that had this information but he has been unable to come up with the name or number of the most recent publication. If any of you can help with this, please write Wilmer at:

Route 1 Box 65
Stevensville MD, 21666

And that wraps it up for this time. Let us hear from you now and then, fellows and gals and tell us what you'd like to see in these pages. Remember, this is *your* column.

Very 73, Ted — K4MKX

Ham Ads

WANTED: Complete Novice station for under $200. Contact Peter White, WN9BCF, 1521 Weldon Avenue, Rockford, Illinois 61102. Telephone (815) 965-6950 days or (815) 963-5373 after 9 p.m.

FOR SALE: School forces sale—come and get 'em. Clegg Venus 6-meter SSB transceiver, almost perfect condition, $230. Heath Twoer in A-one shape, $30. Heath DX60 still in kit form with a few parts missing, $30. Contact Stephen Couch, WBØGAR, 1815 Princeton Road, Ottawa KS, 66067.

WANTED: A copy of "CQ" for October, 1959. This issue contained information by W2HDM on modification of a BC 733-F receiver for 2 meters. A photocopy of the article will be acceptable if the entire magazine is not available. Please advise cost for copy. Contact E. G. Worrell, 2358 Wineleas Road, Decatur, Georgia 30033.

NRI HONORS PROGRAM AWARDS

During the months of September and October, 1973, the following NRI graduates received, in addition to their NRI electronics diplomas, CERTIFICATES OF DISTINCTION under the NRI Honors Program for outstanding grades throughout their NRI training. This distinction is made part of their permanent NRI records and appears on all transcripts of records requested. NRI's worldwide leadership in electronics training is represented by these outstanding graduates from almost every area of the United States, from Mexico and Canada, and from other foreign countries.

WITH HIGHEST HONORS

Ronnie L. Bass, Wilson, NC
Ronald L. Bastardi, Halifax, PA
Warren V. Carrigan, Jr., Newport, RI
Patrick Collins, Winnipeg MB, Canada
Alex A. Ewanick, Blakely, PA
LeRoy C. German, Des Moines, IA
Ronald Otis Gray, North East, MD
Linn E. Holmes, Fremont, CA
Jack Herman Horner, Carlos, IN
Gail A. Schooley, National City, CA
Brian M. Stephens, Weymouth, MA
Robert F. Stickle, APO San Francisco
Frank E. White, Orleans, MA
Roger C. Verdesi, Beacon, NY
Joseph P. Zarcone, Holbrook, NY

WITH HIGH HONORS

Gage N. Aborn, Hamilton, MA
Raymond R. Barca, Staten Island, NY
James Beaumont, Warner Robins, GA
Curtis D. Birkeland, Minnetonka, MN
Burnell Bosshart, Highland, IL
Michael L. Branning, Richmond, CA
D. W. Brodie, Menlo Park, CA
Daniel J. Buckley, Burnaby, BC, Canada
James C. Byrd, Suffolk, VA
Alexander Cabot, Fairport, NY
Gordon M. Cameron, Prince George, BC, Canada
Donald G. Carpenter, Mediapolis, IA
William R. Chandler, Copperas Cove, TX
Ronald Chin, San Francisco, CA
Donald K. Close, Wappingers Falls, NY
Walter S. Copeland, Topeka, KS
Everett O. Couch, Hanahan, SC
Wade E. Crumpton, Patrick AFB, FL
Jerome M. Culp, Benton, KY
Dennis A. Deffenbaugh, Milford, OH
Dennis D. Dillon, Scituate, MA
Joseph Dobash, Wilkes-Barre, PA
Wayne E. Dollyhigh, Mount Airy, NC
Harold E. Dorsey, Angelica, NY
David Fogel, Washington, DC
Jack Fortner, Carson City, NV
James A. Freeman, Jr., Dawson Springs, KY
Claude G. Fuller, Marion, OH
Kenneth Geisinger, Carson City, NV
Thomas L. Goff, APO New York
Edward J. Graham, APO Seattle
Jessie J. Granier, Jr., Thibodaux, LA
Jeryl B. Grantham, Minot AFB, ND
Lawrence R. Graver, Tulsa, OK
John S. Grech, Pittsburgh, PA
Raymond Grego, Monroeville, PA
Donald Hetfield, Goleta, CA
Robert A. Hirsch, Villa Park, IL
Robert L. Horton, Washington, DC
Thomas S. Hudson, Las Vegas, NV
Delbert R. Huggins, FPO, Seattle
Gene M. Johnson, Crystal Lake, IL
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Maurice E. Jones, Jr., Barstow, CA
Bobby Lex Kirby, Lake Butler, FL
David M. Lake, Greenstone, PA
Robert G. Langland, Corvallis, OR
Julian LeBlanc, Toronto, ON, Canada
David A. Lloyd, Arlington, VA
Louis J. Long, Alexandria, VA
Melvyn D. Long, Rogersville, TN
Charles W. Mackay, Webster, NY
Ronald L. Mamere, Chagrin Falls, OH
Louis R. Mateo, Far Rockaway, NY
Karl R. Mayo, Jr., Violet, LA
Michael T. McClellan, Tacoma, WA
Richard P. McCoy, East Gadsden, AL
Rene D. Mock, Beaverdam, VA
Mervyn J. Navarro, San Jose, CA
Robert Grant Nelson, Austin, TX
Mark Newpher, Bethesda, MD
Loren E. Page, Phoenix, AZ
Maurice Pasck, Lapeer, MI
George N. Pavlakis, Bowie, MD
Richard E. Pigg, Washington, DC
George Joseph Rebecca, Scooba, MS
Thomas Reeves, Reevesville, SC
Santos C. Rivera, Jr., Waipahu, HI
Steven C. Rivera, Monterey Park, CA
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Richard S. Rogers, Cape Coral, FL
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Charles Whitchurch, San Diego, CA
David J. White, Silver Spring, MD
Kenneth Wiechman, Highland Heights, KY
Charles E. Williams, Lawrenceburg, KY
Scott Zehms, Green Bay, WI

WITH HONORS

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Mike McCarthy, Stroughton, WI
Richard Wayne McGee, Grand Prairie, TX
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John L. Norton, Phenix City, AL
John Oberch, Northlake, IL
Orval D. Ogden, Brunswick, GA
Robert Samuel Parent, Enosburg Falls, VT
James P. Parrish, Metairie, LA
Michael A. Parylak, Jackson, MI
Robert H. Pearce, Cassville, MO
Joseph E. Pedro, Hughesville, PA
Ronald W. Perry, Fishkill, NY
Vernon E. Phipps, Onalaska, WI
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Nolan R. Whaley, Richlands, NC
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John W. Williams, Lake Jackson, TX
Robert J. Williamson, Jr., Cleveland, OH
Louis H. Willis, Willcox, AZ
Charles W. Young, Dorval, PQ, Canada

DIRECTORY OF ALUMNI CHAPTERS

CHAMBERSBURG (CUMBERLAND VALLEY) CHAPTER meets at 8 p.m., 2nd Tuesday of each month at Bob Erford's Radio-TV Service Shop, Chambersburg, Pa. Chairman: Gerald Strite, RR1, Chambersburg, Pa.

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., 2nd Wednesday of each month at Andy Jobaggy's shop, G-5507 S. Saginaw Rd., Flint, Mich. Chairman: Stephen Avetta, 239-0461.

NEW YORK CITY CHAPTER meets 8:30 p.m., 1st and 3rd Thursday of each month at 199 Lefferts Ave., Brooklyn, N.Y. Chairman: Steve Kross, 381 Prospect Ave., 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 at K of C Hall, Tulip and Tyson Sts., Philadelphia. Chairman: John Pirrung, 2923 Longshore, Philadelphia, Pa.

PITTSBURGH CHAPTER meets 8 p.m., 1st Thursday of each month in the basement of the U.P. Church of Verona, Pa., corner of South Ave. and 2nd St. Chairman: Charles Kelly.

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 north of Austin Hwy.), San Antonio. Chairman: Robert E. Bonge, 222 Amador Lane, Antonio, Tex. 78218, 65-3299. San Antonio area NRI students always welcome. Free annual membership to all NRI graduates attending within 3 months of 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 (MASS.) CHAPTER meets 7 p.m., 2nd Saturday of each month at the shop of Chairman Norman Charest, 74 Redfern Dr., Springfield, Mass. 734-2609.

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

At the September meeting of the Chapter, the membership elected new officers for the year 1974. They are: Daniel DeJesus, Chairman; William Cooper, Secretary; and Frank Sarro, Treasurer.

Also at that meeting, the Chapter played host to the National Secretary, Tom Nolan. Tom gave his annual lecture on "Troubleshooting the Color Section of Color TV Receivers." The talk was well received and a great number of questions were directed to and answered by Tom.

The Chapter is looking forward to a great year of programs to help the membership with their electronic problems.

At the September meeting Mr. Matty Rechner was back to the chapter after a long absence. Matty was a charter member of the chapter in 1963, elected as the First Vice Chairman and in 1965 as Chairman.

The chapter also welcomed three NRI students as guests to this meeting. They

Alumni News

were Nunzio Podimani, Robert McFeeley and Thomas Miller. The program included the troubleshooting of the remote control TV chassis.

At the November and December Chapter meetings it was decided to keep the present chapter officers and they were re-elected unanimously.

SAN ANTONIO CHAPTER HOST TO GE FIELD REPRESENTATIVE

Mr. Will Marrs the General Electric Company field technical representative of the GE Houston, Texas distributor gave a talk to the October meeting. His subject was the new GE solid-state "JA" chassis.

Mr. Marrs made an excellent presentation and the chapter was very much impressed with the repairability of this particular set. Our hats are off to General Electric for designing a TV receiver that can be easily serviced by the average television technician. Some other manufacturers are still using non plug-in yokes, tuners, front controls, etc. They could learn a little bit from GE and their JA chassis.

FLINT-SAGINAW VALLEY CHAPTER HAS ACTIVE SEASON

Due to the election results being printed in this issue, it will be impossible to tell you all the things that the Flint-Saginaw Chapter has been doing. However, as Executive Secretary I must express my appreciation to the chapter and to Mr. & Mrs. Andrew Jobaggy for their wonderful hospitality when I made my annual visit on October 10.

I was treated to a royal feast by Mrs. Jobbagy who must be one of the world's best cooks. Andy is a very lucky man.

Perhaps next time we can go back and publish some of the work that the chapter has been doing the past year.

DETROIT CHAPTER ENTERTAINS NATIONAL SECRETARY

On October 11, 1973 Tom Nolan, the Executive Secretary of NRI AA, attended the chapter and gave his yearly talk which was titled "Troubleshooting the Color Section of a Color Television." His talk was well received by the chapter and also was well attended.

Refreshments were served and meeting adjourned around 10:30 PM.

PITTSBURGH CHAPTER HAS TALK BY TOM SCHNADER

Tom Schnader, local serviceman and member of the Pittsburgh chapter, gave a very informative talk on transformers, how to recognize and check them. At the October meeting Mr. Thomas P. Brutscher the field supervisor for the Zenith service company presented a program tilted "Consumerism—Why Now." Motorola is planning to present a program at the November meeting of the Chapter.

IN MEMORIAM FOR A NEW YORK MEMBER

Mr. Theodore Freije, secretary of the New York Chapter, passed away August 31, 1973 from a heart attack. He was survived by his wife Mae and six daughters, three sons and 29 grandchildren.

He was an active member of the American Legion Post #1073 of Brooklyn, New York. He donated many days to help run bingo games to gain funds for the Veteran's hospital and help the Vets obtain those things that the hospital didn't normally supply. He was also retired from the U. S. Postal Service.

He was an active nember with NRI AA New York Chapter for many years, and accepted the job as Secretary when no one else wanted it. He held this position for over three years and did a commendable job. We all miss him.

KELLEY NEW NRI AA PRESIDENT

In a very close contest, Jim Kelley emerged as our new President of NRI AA for the year 1974.

Jim was born in Pittsburgh, Pa. in 1908. He was raised in a coal mining town near Greensburg, Pa.

In his younger days he wanted to be a mine electrician. He even took a course from the Chicago Engineer Works in Chicago but before entering the mines he took a job with the Hamot Hospital in Erie, Pa. It was while working at the hospital that he saw an ad in one of the magazines about NRI and that's when he took his first NRI course. He graduated from that course in 1928, a good many years ago.

Jim Kelley

He later came to Detroit and lost contact with the school. He didn't know there were local chapters in Detroit until one of his friends at the shop where he was working told him about it. That's when he got acquainted with the Detroit Chapter and the year was 1954 when he joined up.

Also, it was then that he got into TV servicing, and as the city was instituting a new city licensing ordinance, naturally Jim got his license and has been servicing radio and TV in the city of Detroit ever since.

Jim has just finished his second course with NRI, the Color Course. While taking this course as chairman of the Detroit Chapter, he used the course as a lecture series to enlighten the other members about the latest information on color television.

Congratulations on your election, Jim. We know you will make a fine President of the NRI AA.

We also extend our congratulations to the men who have been elected to serve as Vice Presidents for the 1974 term. They are William W. David of Pembroke, Virginia; Arnold E. Verdow of Marion, Iowa; Albert H. Sharp of Wycoff, New Jersey; and W. L. Simmons of Whitman, Massachusetts.

SAVE $25 OFF NATIONALLY ADVERTISED PRICE!

ON THE LEADER LCG-388

COLOR BAR PATTERN GENERATOR

Nationally Advertised
at $199.95

CONAR PRICE
$174.95

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ABSOLUTE DIGITAL ACCURACY GIVES THE ULTIMATE IN PATTERN STABILITY

Originally developed for critical production testing, the LCG-388 is now available for TV service shops. This extremely versatile laboratory grade instrument produces 15 patterns including the all-important single dot and single cross. The composite video signal used for circuit tracing has stability approaching standards set for transmitters. Trigger pulses are available to sync an oscilloscope to either the vertical or horizontal pulses of the video signal. The remarkable accuracy of the digital clock and binary countdown system accounts for the pattern stability. Easy-to-remove computer-style plus-in PC boards are used for rapid servicing.

CHECK THESE FEATURES!

- Flip-flop and logic circuitry throughout for maximum stability.
- One input connection to TV receiver at antenna.
- Two selectable channel frequencies.
- Horizontal line flickering prevented by progressive scanning.
- Composite video signals available for video circuit testing.
- Horizontal and vertical signals return trace blanking.
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- Triggering output: vertical and horizontal.
- Square crosshatch to check and adjust for dynamic convergence, linearity, and pincushion effects.
- Scope sync pulse
- Regulated dc power supply.
- Pattern selection by on-line switching.

Two-Year Guarantee by Leader

SPECIFICATIONS

RF Output: Channel 5 and 6, selectable; 10 mv open circuit from 300-ohm balanced source. **Patterns: Color bars:** Gated rainbow, R—Y, B—Y, and —(R—Y) rainbow. **Dots:** Fine—15 vertical x 21 horizontal. Coarse—7 vertical x 11 horizontal. Single dot at center of raster. **Crosshatch:** Fine—21 vertical x 15 horizontal. Coarse—11 vertical x 7 horizontal. Single cross centered on raster. **Vertical:** Fine—21 lines. Wide—11 lines. One line at middle of raster. **Horizontal:** Fine—15 lines. Wide—7 lines. One line at middle of raster. **Composite Video Output:** —3 to +3 volts p-p, continuously adjustable; impedance 500 ohms approximate. **Trigger Signal Output:** —10 volts p-p, horizontal and vertical for oscilloscope triggering. **Power Supply:** 105 to 125 volts, 50/60 Hz; 2 va approximate. **Size and Weight and Accessories:** 3-1/8" high by 7-3/4" wide by 7-3/4" deep. 4.6 pounds. 300-ohm video, trigger and ground leads.

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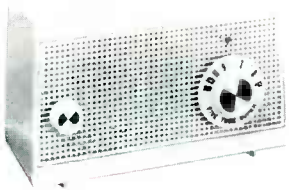

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TWO-TRANSISTOR RADIO KIT

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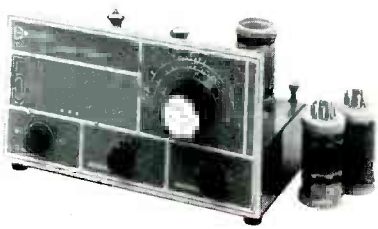
$24.95

Stock No.UK511



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1. Complete other side of this sheet.
2. Use Select-A-Plan Schedule on the right to find your Finance Charge and your Monthly Payment.
3. Insert amount of down payment (at least 10% of total order) and other information in Payment Agreement below.
4. Sign Payment Agreement and fill in Credit Application.

IMPORTANT: When you have made three monthly payments, you can "add-on" purchases with no down payment. If you are under 21, please have the Payment Agreement and credit application filled out and signed by a person over 21. He can make the purchase for you and will be responsible for payment. If you have a CONAR account open or recently paid-in-full, just sign the Payment Agreement.

NOTICE TO THE BUYER: (1.) Do not sign this agreement before you read it or if it contains any blank space. (2.) You are entitled to a copy of this signed agreement. (3.) The Finance Charge will be waived if the unpaid balance is paid within 30 days. If paid within 60 days, the Finance Charge will be reduced by ⅖; if paid within 90 days, the Finance Charge will be reduced by ⅓. Accounts extending beyond 30 days will pay up to $3 in Credit Service Charges before the above reductions are made.

SELECT-A-PLAN SCHEDULE

PLEASE CHECK ONE ☐ STANDARD PLAN ☐ EXTENDED PLAN

IF UNPAID BALANCE IS	STANDARD PLAN		EXTENDED PLAN	
	Finance Charge	Monthly Payments	Finance Charge	Monthly Payments
20.01- 25.00	1.05	3.50		
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
150.01-160.00	15.00	14.75	23.20	8.00
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
240.01-260.00	24.00	22.00	35.20	13.00
260.01-280.00	26.00	24.00	38.20	14.50
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
370.01-400.00	42.00	29.50	57.20	20.00
400.01-430.00	46.00	31.50	62.20	21.00
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Use the Select-A-Plan Schedule to find out what your monthly payment is. Then divide your monthly payment into your "Total of Payments" to find out how many monthly payments you must make. The amount which is left over is your final payment. FOR EXAMPLE, if your unpaid balance is $95, then your monthly payment is $8.75 (using the Standard Plan). If your "Total of Payments" is $104, then your monthly payment of $8.75 divides into that number 11 times with $7.75 left over. This means you make 11 payments of $8.75 each, plus a final payment of $7.75.

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PRINT FULL NAME ..... Age .....

HOME ADDRESS ..... CITY ..... STATE ..... ZIP CODE .....

HOME PHONE ..... HOW LONG AT THIS ADDRESS .....

( ) OWN HOME ( ) RENT ..... RENT OR MORTGAGE PAYMENTS $ ..... PER. MO.

WIFE'S NAME ..... MARITAL STATUS ( ) MARRIED ( ) SINGLE

NUMBER OF DEPENDENT CHILDREN .....

PREVIOUS ADDRESS ..... HOW LONG? .....

B → WHERE DO YOU WORK?

YOUR EMPLOYER ..... POSITION ..... MONTHLY INCOME $ .....

EMPLOYER'S ADDRESS ..... HOW MANY YEARS ON PRESENT JOB? .....

Street ..... City ..... State .....

PREVIOUS EMPLOYER ..... HOW LONG? .....

Name ..... Address .....

WIFE'S EMPLOYER ..... MONTHLY INCOME $ .....

Name ..... Address .....

C → WHERE DO YOU TRADE?

BANK ACCOUNT WITH ..... ( ) CHECKING

Street ..... City ..... State ..... ( ) SAVINGS

CREDIT ACCOUNT WITH ..... ( ) LOAN

Street ..... City ..... State .....

CREDIT ACCOUNT WITH ..... TOTAL OF ALL MONTHLY PAYMENTS INCLUDING CAR $ .....

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JANUARY/FEBRUARY ISSUE

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