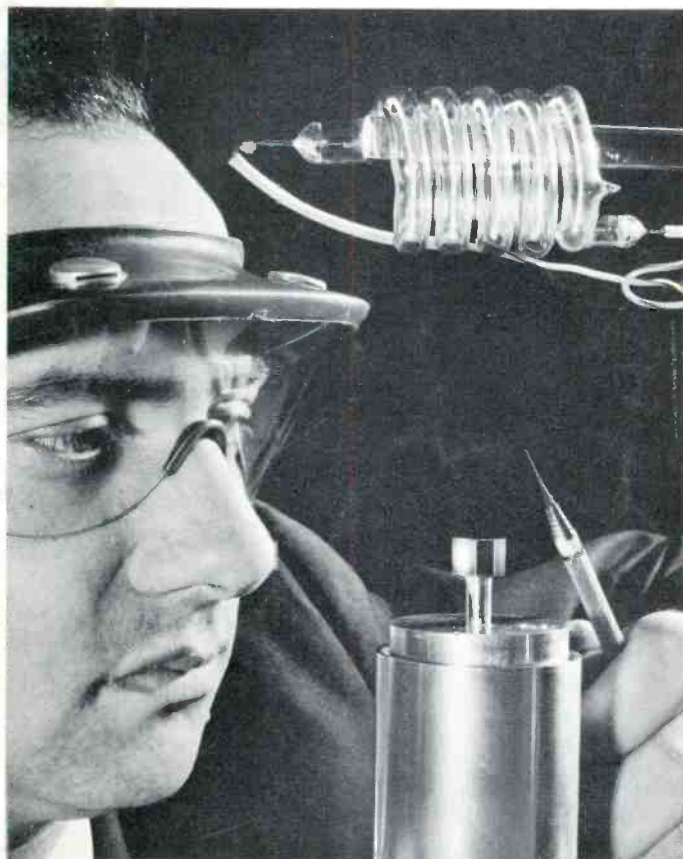




journal

JAN./FEB. 1965



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- **LASER
THE LIGHT
FANTASTIC**
- **ROVING SPEAKER
FOR A
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1B3	.79	6AW8	.90	6SA7GT	.39	12CX6	.54				
1DN5	.55	6AX4	.66	6SH7	1.02	12DA	.69				
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1J3	.79	6BA6	.50	6SK7GT	.95	12DL8	.88				
1K3	.79	6BC5	.61	6SL7GT	.84	12DQ6	1.04				
1R5	.77	6BC8	1.04	6SN7	.65	12DS7	.84				
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3AU6	.54	6BJ7	.79	6W6	.71	12EG6	.62				
3AV6	.42	6BK7	.85	6X4	.41	12EK6	.62				
3BC5	.63	6BL7	1.09	6X8	.80	12EL6	.50				
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3BU8	.78	6BQ6	1.12	7AU7	.65	12F8	.66				
3BY6	.58	6BQ7	1.00	7EY6	.75	12FA6	.79				
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3DT6	.80	6C4	.45	8C7	.63	12J8	.84				
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3GK5	.54	6CDB	1.51	8C7M	.97	12L6	.73				
3Q4	.63	6CDB	1.51	8C7M	.97	12L6	.73				
3S4	.75	6CDB	.80	8E8B	.74	12SF7	.69				
3V4	.63	6CL8	.79	8F07	.56	12S7GT	.95				
4BQ7	1.01	6CM7	.69	9CL8	.79	12SN7	.67				
4C56	.61	6CN7	.70	11CY7	.75	12SQ7GT	.91				
4DT6	.55	6CQ8	.92	12A4	.60	12U7	.62				
4GM6	.60	6CR6	.60	12AB5	.60	12V6	.63				
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5CL8	.76	6DE6	.62	12AL8	.95	19BG6	1.39
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5EAB	.80	6DK6	.59	12AT7	.76	19F8	.85
5EU8	.80	6DN6	1.55	12AT7	.76	19K6	1.49
5J6	.72	6DQ6	1.10	12AU6	.51	25AX4	.70
5T8	.86	6DTS	.81	12AU7	.61	25C5	.53
5U4	.60	6DT6	.53	12AV6	.41	25CA5	.59
5U8	.84	6DT8	.94	12AV7	.82	25CD6	1.52
5V6	.56	6EAB	.79	12AX4	.67	25CU6	1.11
5X8	.82	6EB5	.73	12AX7	.63	25DN6	1.42
5Y3	.46	6EB8	.94	12AY7	1.44	25EH5	.55
6AB4	.46	6EM5	.77	12AZ7	.86	25L6	.57
6AC7	.96	6EM7	.82	12B4	.68	25W4	.68
6AF4	1.01	6EUB	.79	12BD6	.50	32ET5	.55
6AG5	.70	6EV5	.75	12BE6	.53	35C5	.51
6AH4	.81	6EW6	.57	12BF6	.60	35L6	.60
6AH6	1.10	6EY6	.75	12BH7	.77	35W4	.42
6AK5	.95	6F07	.69	12BK5	1.00	35Z5	.60
6AL5	.47	6FV8	.78	12BL6	.56	36AM3	.36
6AM8	.78	6GH8	.80	12BK6	1.16	50B5	.69
6AQ5	.53	6CK5	.61	12BT7	.74	50C5	.53
6AS5	.60	6CK6	.79	12BV7	.76	50EH5	.55
6AT6	.49	6GN8	.94	12BY7	.77	50L6	.61
6AT8	.86	6H6	.58	12BZ7	.86	70L7	.97
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6AU6	.52	6J6	.71	12CR6	.67	807	.75

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SPECIFICATIONS

CASE: Black, leather-fabric; removable, hinged lid with safety catch

PANEL: Satin-finish, aluminum

PANEL LETTERING: Red, etched—won't rub off

METER: Double-jeweled D'Arsonval type; accurately balanced and factory calibrated to within 2% accuracy

ROLL CHART MECHANISM: Triple-window, high speed, gear-operated; illuminated

SAFETY FEATURE: Test circuits transformer isolated from power line affords utmost safety to operator and instrument

POWER REQUIREMENTS: 50-60 cycle, 110-120 Volt, AC only

WARRANTY: Standard EIA warranty on all parts

DIMENSIONS: Width 15¼"; length 10½"; depth 4¾"

ACTUAL WEIGHT: 12 lbs.

SHIPPING WEIGHT: 15 lbs., parcel post insured

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ACCOMMODATE ALL SERIES STRING AND OTHER UP-TO-DATE TUBE TYPES: 17 individual filament voltages from .75 to 110 volts. Tests all standard base types: 4, 5, 6 and 7-pin large, octal, loctal, 7, 9 and 10-pin miniatures, 5 and 7-pin nuvistors, novars, and Compactrons, etc. **OPEN ELEMENT TESTS:** This special test supplements the primary Emission Test. **12-LEVER ELEMENT SELECTOR-DISTRIBUTING SYSTEM:** Important feature provides complete flexibility and anti-obsolescence due to changing and new tube basing terminations. **INDEPENDENT FILAMENT TERMINAL**

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USE HANDY ORDER FORM ON PAGE 26—CASH OR TERMS

ON OUR COVER



The "stubborn young man" depicted is Dr. Theodore H. Maiman, physicist then working in Hughes Aircraft Research labs, who made an actuality in 1960 of Nobel prize-winner Dr. Charles H. Townes' concept of the laser (Light Amplification by Stimulated Emission of Radiation).

The laser in turn has been put to practical usage in medicine, weapons, communications, and industry, (especially for drilling, welding, and cutting of tiny electronic parts), with every indication that it still has a long, long way to go in economically feasible application. Man's first achievement for a "coherent light source", which produces the purest colors ever known, among other things, has electronics-age implications never dreamed of in Gray's Elegy, "Full many a gem of purest ray serene...." Here Dr. Maiman, now president of his own company for laser research, Korad Corp., shows a cube of synthetic ruby that forms the heart of a laser, which generates the light. The light source (at top) is used to excite the tightly-packed atoms in the ruby, which then amplify the laser's light into an intense parallel beam.

o o o

JOB OFFER

John Thomas, 5924 Muir Drive, Washington, 22, D. C., is looking for a radio-TV and/or appliance man to work on a bus that goes into various subdivisions repairing all types of household equipment, etc. (including sharpening tools, upholstery cleaning). The bus has its own power generator and a welding unit. Mr. Thomas prefers a handicapped person. Other job opportunities begin on Page 20.

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THIS is a different kind
of New Year's greeting.

Instead of urging you to try
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For a better job
for increased earnings
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I simply want to wish you
personal happiness during the New Year.

For if a man isn't inwardly happy, if he isn't
at peace with himself,
any other kind of success can be
meaningless and empty.

There is no guarantee that material things—money, success,
friends, and possessions—will make you happy.

But there IS reasonable certainty that any one who
lives a well-rounded life, keeps his mind attuned to learning,
and who strives for self-improvement,
will not only find a good measure of personal happiness,
but will, in all probability,
enjoy some of the material benefits as well.

They go together
. . . . like your enthusiasm,
the close friendships I have had with many of you,
and—your loyalty.

Please continue to visit with us,
to give us your suggestions and ideas
to work with us to make your NRI training the very best
For you.

Then
we'll both be happy.

Sincerely,

J. M. Smith

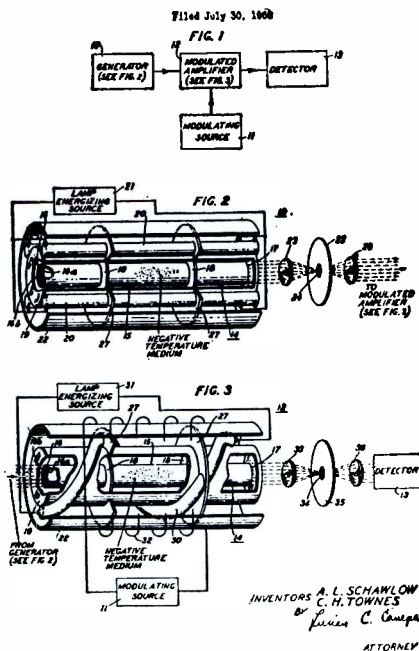
President
National Radio Institute

Electronic-Age Marvel

LASER. . . THE LIGHT FANTASTIC

It can penetrate all kinds of metal, track missiles, weld electronic parts, blind enemy troops or aid in healing

In the short span of four years, the laser—intense light energy—has become the most significant advance in electronics since the discovery of the transistor and the subsequent development of solid-state technology. It may, says at least one eminent laser-company head, rank in the foreseeable future with the development of the atom . . . a view not unlikely, considering what it has already done. It is, in a way, a simple, uncomplicated process, to the extent that some companies lend one of its prime ingredients—the ruby "heart"—to promising high-school students who want to build their own lasers; conversely it is so complex in its effects that the Armed Forces won't even talk about what they're doing with it. It has done some incredibly wonderful things in medicine, in industry, in photography, and communications, and it is becoming more practical all the time. In short, it is a subject of which every student of electronics ought to become aware, because it is very likely to become a part of his future.



Schematic of the laser in patent awarded to Dr. C.H. Townes and Dr. A.L. Schawlow in June, 1960.

WHAT IS IT?

Light Amplification Stimulated by Emission of Radiation. In more simplified terms, it uses a fluorescent substance that is capable of "shooting" light when its chromium atoms are struck by a form of energy, such as a flash of light. Some of the atoms in the substance then get "pumped" (excited) into higher energy; when they drop back to normal they radiate energy on their own wavelength, shooting billions of photons (smallest possible segments of light). These photons hit the still-excited atoms, which in turn release their photons to join the first batch. The laser device is engineered to catch and control all of this resulting light energy and emit it in a parallel beam.

WHO DISCOVERED IT?

Dr. Charles H. Townes, 49-year-old physi-

cist, for one, in mid-1960. It was an extension of his earlier discovery of the maser in 1951 (Microwave Amplification, etc.). He and his brother-in-law, Dr. A. L. Schawlow, just carried the idea a little further into the optic and infrared regions.

A couple of Russian scientists, Prof. Alexander Prokhorov and Nikolai Basov, made the discovery very shortly thereafter, and share with Dr. Townes this year's Nobel prize in science, a split of \$52,000. Dr. Theodore H. Maiman, physicist then working at Hughes Aircraft Research Laboratories, made Dr. Townes' idea an actuality a month or so later in tests he and assistants made with synthetic ruby crystals. Now Dr. Maiman heads his own company, Korad Corp., one of some 500 laboratories throughout the United States engaged in laser research and pro-

duction. Dr. Townes, somewhat of a child prodigy (He graduated with a bachelor's in physics, summa cum laude, at 19), is now provost at Massachusetts Institute of Technology.

WHAT CAN IT DO?

It can measure heights of clouds, track missiles, repair eyes, kill induced human cancers in hamsters, burn a period off a typewritten page without scorching the paper; drill, weld --- you name it. If it hasn't yet, it will soon.

Major, and most promising application in the near future seems to be the field of long-range and space communications, and in electronics. It's already been successfully used for missile-tracking, illuminating the moon; transmitting TV pictures, etc. The photons that emerge in a laser beam are those that strike the laser mirrors full force, and they travel in the same direction, so that the beam is so parallel that it spreads less than an inch per mile. Thus, if the Army uses it for message-carrying, as purportedly it intends to do, in open battle, it cannot be intercepted by the enemy. It is also very tightly "coherent", with light waves all of even length and lined up. This light can then be focused to a point many, many times sharper than a surgical or mechanical cutting tool, which further expands possibilities.

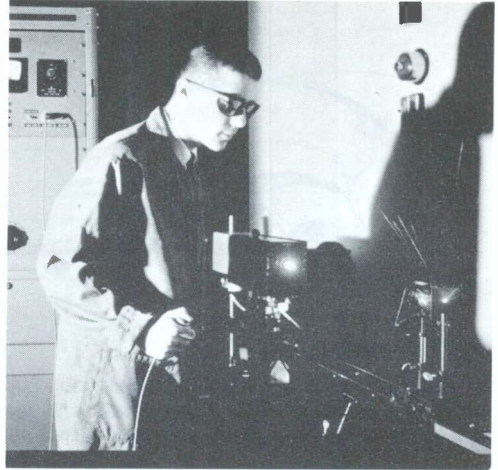
Now it has been used for precise and delicate eye operations; cutting, welding, and drilling of tiny electronic parts.

One single side-band modulator in the laser cavity, tried by Sylvania, for instance, gave almost a hundred-fold increase in the degree of frequency-shifted power obtained. Some early claims have been discounted, or just didn't happen, and its leaders are the first to admit that a bit of caution is indicated.

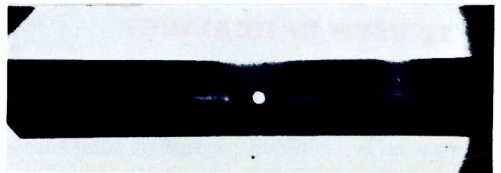
Among other new developments, the Air Force is modifying a telescope operated by Lincoln Labs at Wallops Station, Va., to test a "ladar" --- a laser radar system. Accurate positioning of satellites using a Q-switched laser beam to illuminate the vehicle is expected to result.

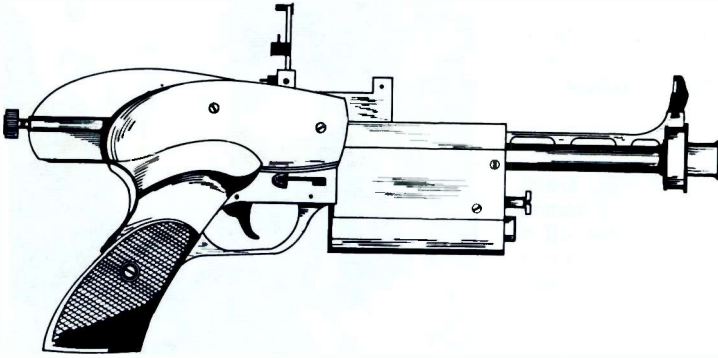
HOW POWERFUL IS IT?

Depending on the number of atoms available for "pumping", the laser light can be as much as 500 million watts per square centimeter, or five billion times as much as the sun at midday ... and even higher rates recently predicted by its discoverer ... 500 trillion watts, "sort of a blind man's radar". It produces the purest, most intense colors ever known to man.



The photo shows a hole being "drilled" through a .010-inch thick piece of 430 stainless steel by an output beam from an 18-inch long neodymium-doped glass laser rod developed and built by American Optical. The laser output was a 3-joule/800 microsecond pulse of 1.06 micro wavelength (in the near infrared region of the electromagnetic spectrum). The white plume and sparks in the photo are traces of the molten plasma and microscopic particles blown off by the laser beam action; radiation of the beam is invisible to the human eye and in ordinary photographic processes. The drilled hole was .012 inch in diameter, and the active neodymium-doped area of the laser rod was .080 inch in diameter. The outer surface of the rod consisted of a .020-inch thick cladding of lower index glass. The rod was water cooled to remove the heat by-products of the pumping and laser cycle. The special dark glasses worn by the operator are a protection against laser radiation, transmitting only about 5 one-millionths of the infrared energy incident on them in the 1 micron wavelength region. The optics used to focus the laser beam are housed in the unit to the left of the steel specimen; a 10,000 joule electrical power supply for operating the flashtubes used for laser pumping is behind the operator. Approximately 700 joules of electrical energy input was needed to drill hole.





Staff artist Rick Whilden is also a gun enthusiast, so it was duck soup for him to imagine a possible laser hand weapon of the Buck Rogers type.

In weapons research, little information has been made public. It's known that a laser beam, without protection, can blind in less than a second; also, that a laser rifle has been developed ... the rest is hush-hush.

ARE THERE PROBLEMS?

As with any new development, costs were prohibitive for some time for general usage. (Military spending in 1963 in laser research was \$16 million; reports for 1964 aren't complete, but estimates are twice that much.) The primary development period has passed on to efficiency and higher output stability. The emphasis now is on its development as a practical device that doesn't cost more than its standard-in-practice competitors. Key figures in the field met in Washington recently and expounded that theme, but cautioned that conventional techniques should always be compared with laser devices before switching: It's really not just a gadget for some hip company president to latch on to because it's cute, and new. However, they modestly admitted that laser devices have been tested and produced "enormously better and less expensive" work.

The biggest problem in the communications angle has been the modulation, and numerous devices have been tried. Now apparently the answer has been found with the use of gallium arsenide as a semi-conductor. The material is doped with the proper degree of impurities, and is so effective that it's said it can "lase" with simple electric current. Bell Laboratories, among others, have been doing some very effective work on modulation with gallium arsenide by polarizing the laser beam into two components which travel at different speeds.

IS IT USED IN HEALING?

Some eye surgeons are now using the laser beam to "weld" in cases of retinal detachment, where the inner lining of the eye is peeled away, causing partial or total blindness, and for burning out small eye tumors

and blood clots. In the welding, the laser beam is shined into the eye from the front, and coagulates in less than a thousandth of a second. (The danger is that the laser beam is so powerful.)

At Tufts-New England Medical Center in Boston, human cancers planted in hamsters have been treated with laser beams. Results were that two of the cancer types disappeared completely, without injury to healthy tissues, and the third type showed a 60 to 80 per cent reduction. The center is now studying the same thing with regard to human patients, but says firmly that while "it looks promising, we cannot claim laser treatment to constitute a cure for cancer in human patients at this time."

Indications are that also in the works are research in its application to brain and heart surgery, usage for transatlantic phone calls at the rate of several million calls at once on a single light beam (when a way to sort messages is evolved), and on and on.

ARE THERE HAZARDS?

Probably more than many realize. The Atomic Energy Commission has issued a general safety guide for laser users, cautioning that improper use can cause eye or skin burns, temporary blinding, electric shock, and pointing out other dangers connected with working around glass equipment subject to extreme temperature changes.

The release was based on studies at Argonne National Laboratory, and includes these precautions: the laser work should be controlled, not public; an audible signal should announce the firing of a laser; each laser should have a key-lock switch available only to authorized users; removal of all shiny surfaces in the general direction of the beam; no looking directly into a beam even wearing optical absorbing lenses; proper maintenance of switches, cables, connectors, etc.; the area should be free of combustible materials; when gases are used, users should wear impervious gloves, face shields, and safety glasses.

POINTS TO REMEMBER:

BY RALPH E. ELLISON

Are You Getting the Business?



IF NOT, MAYBE YOU NEED TO PUT MORE SERVICE IN THE 'SERVICEMAN'

If, like thousands of other radio and television technicians, you have your own place of business, your goal is to hold your old customers and gain new ones.

There's no better way to accomplish this than to have a list of well-satisfied customers. If your old customers are well pleased with your service, it's natural for them to tell others and that kind of advertising is worth more than a full-page ad in your local paper.

How you bring all this about is no deep dark secret. It's just plain every-day thinking. You can accomplish more with a few simple, thoughtful acts than with a high-priced advertising campaign prepared by an advertising agency. It's a simple rule of believing what you see.

To illustrate the difference between good business and bad business take the following examples:

You walk into a service shop to buy tubes or parts, the salesman hands you your merchandise, collects his money, and that's it. In other words, you have no guarantee that the stuff you paid your cold cash for will even work, and nine chances out of ten if you have to return the goods the excuse will be that you should have had it tested before leaving the store. That's bad business, both for the shop and customer interest. You can kill customer interest and profit by such underhanded sales techniques.

The point I'm trying to make is simple. When a customer enters your shop to purchase tubes or parts that can be tested, they should be tested while the patron watches. You can simply say that you wish him to be satisfied with his purchase and that you want to be sure that the parts you sell will actually work. This way of doing business will pay off handsomely in added profit and customer satisfaction.

You do not have to be a high-pressure salesman in order to make sales. If a customer

walks in to get a tube tested, and he seems to be satisfied with the old tube, you can show him how much better a new tube tests right before his eyes. Thus you make a sale without having to tell the customer that he should buy a new tube.

It all adds up to just one thing. If you have test equipment, use it. Use it while the patron watches. It gives him more faith in you and your business.

Don't forget the thousand and one other little things you can do to build up customer good will, such as giving small useful gifts from time to time, discussing radio and television problems with them, and just being friendly. Above all, keep your shop neat and clean.

There's one other thing you can do to help your business. Occasionally you should mail reminder cards to each customer, asking how his set is performing, and telling him that if he needs service or repairs you stand ready to serve him.



"Raise your sights and your charges a bit, put more time in on each job, use only the best parts, and I think you'll pull out of your depression!"

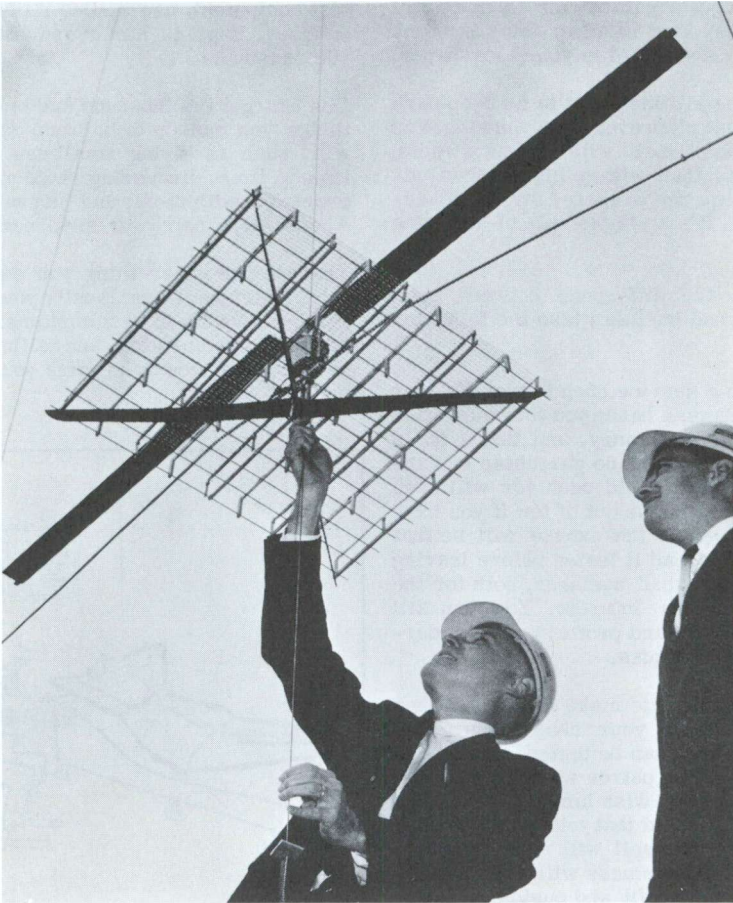
MICROWAVES POWER HELICOPTER FLIGHT

Burlington, Mass.----A six-foot helicopter powered only by invisible energy beamed from the ground climbed 50 feet into the air here in the first public demonstration of the remote transmission of microwave power.

The accomplishment at Raytheon Company's Spencer Laboratory was in the nature of a

progress report for visiting officials from the U.S. Air Force's Rome Air Development Center (RADC) at Rome, N.Y., which had commissioned the firm to develop the device.

Microwave energy, similar to that used in radar, was beamed from a saucer-like transmitting antenna on the ground upward to

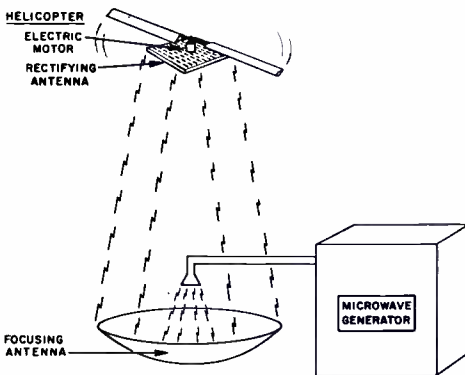


READY TO LAUNCH. William C. Brown, left, head of the development team, and Robert Bowen, an engineer, prepare a small helicopter for demonstration flight at Raytheon's Spencer Laboratory, Burlington, Mass.

TV Transmission, Missile Detection, Weather Aids From 'Flying Platforms' Seen As Possible Outcome Of Miniature's Successful Demonstration Flight

a small helicopter. Mounted under the helicopter was a special rectifying antenna, a device that looks at first glance like a glass-beaded blanket. It is actually an array of thousands of tiny diodes, each less than a half-inch long.

When the diodes were hit by the beam of microwave energy an immediate flow of direct



current electricity resulted. This electricity ran the motor which turned the rotor blades of the helicopter.

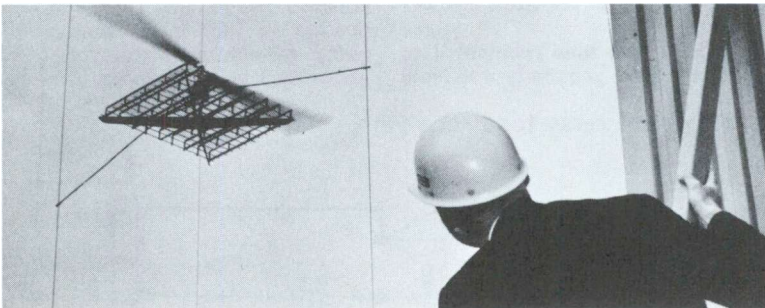
Dr. John S. Burgess, chief scientist at RADC, said, "The transmission of large amounts of power without the use of wires is of revolu-

tionary importance to our technological culture. The ability to supply power continuously from the ground to hovering aerospace vehicles adds an important new capability to our aerospace competence."

According to William C. Brown, manager of Raytheon's Super Power Laboratory here and head of the company's development team, the achievement might well set the stage for "flying platforms" that could be used for television transmission, missile detection, aviation beacons, navigational and weather aids, and surveillance.

In the demonstration, the helicopter flew up and down vertical guy ropes which kept it positioned over the microwave beam. Beam-riding techniques are applicable to such a vehicle, Brown said. Continued development can make it possible to create a more sophisticated flight vehicle that could be fully automated and keep itself continuously in the path of the microwave power at a prescribed altitude thousands of feet in the air.

The visual progress report employed 5 kilowatts of generated power. Contemplated is the use of a new Amplitron tube, also developed under an Air Force RADC contract, that can generate nearly 100 times as much power at 70 per cent efficiency. With this amount of power helicopters could be maintained for long periods of time at altitudes up to 50,000 feet.



AND AWAY SHE GOES! The helicopter takes off on a 50-foot flight in the first public demonstration of the remote transmission of microwave power.

DEVICE OF THE MONTH

TONE SIGNAL CONTROL

BY LEO G. SANDS

Audio tone signals have revolutionized the control systems business. In the past, a separate wire circuit was required for each control function. Now, using audio tones, up to 30 functions can be controlled over a single pair of wires.

Audio tone signaling systems are very much like radiotelegraph systems except that wires are employed in lieu of a radio path and the signal frequencies are much lower.

A one-way radiotelegraph system consists of a CW radio transmitter and a radio receiver tuned to the transmitter frequency. Intelligence is transmitted by keying the transmitter on and off to form dots and dashes. A tone channel is similar in that it consists of an audio oscillator (CW tone transmitter) and an audio amplifier (tone receiver) which is tuned so that it will reject all audio frequencies except at the frequency of the audio oscillator. Intelligence is transmitted by keying the audio tone on and off.

The tone receiver utilizes the incoming tone signal to control a relay. When no tone signal is being received, the relay is not energized. When a tone signal is received, the relay is energized. Hence, a device at a remote location can be turned on by transmitting a tone, and turned off by ceasing to transmit a tone.

The tone transmitter and tone receiver are linked by a pair of wires, generally a leased

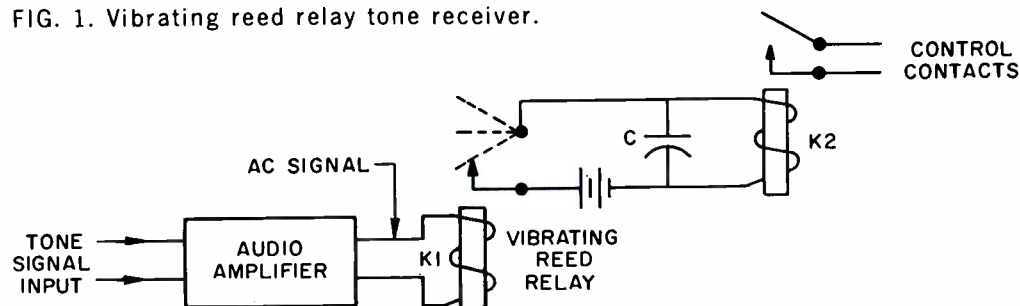
telephone circuit. Since a telephone circuit will pass audio signals up to 3000 cps, or slightly higher, a number of tone signals at different frequencies can be transmitted simultaneously over the same pair of wires.

The tone transmitter employs an audio oscillator whose frequency is determined by an RC circuit, an LC circuit, or a resonant reed. The tone signal can be turned on and off by starting and stopping the oscillator or by keying the output circuit of a continuously-running oscillator.

The tone receiver generally contains an amplifier to raise the level of the incoming tone signal. The amplifier may be tuned to accept a signal of a certain audio frequency only, employing an LC or RC filter. The tone signal is then rectified and the resulting DC signal is amplified and used to control a relay.

Some tone receivers employ an untuned amplifier which drives a vibrating reed only. This relay ignores all audio signals except one at the frequency at which its reed is resonant. When a tone signal at the appropriate frequency is received and passes through the relay coil, the reed vibrates and makes intermittent contact with a stationary contact. Since the reed and the stationary contact do not mate continuously, another relay of conventional type is required as shown in Fig. 1. Each time the reed contacts

FIG. 1. Vibrating reed relay tone receiver.



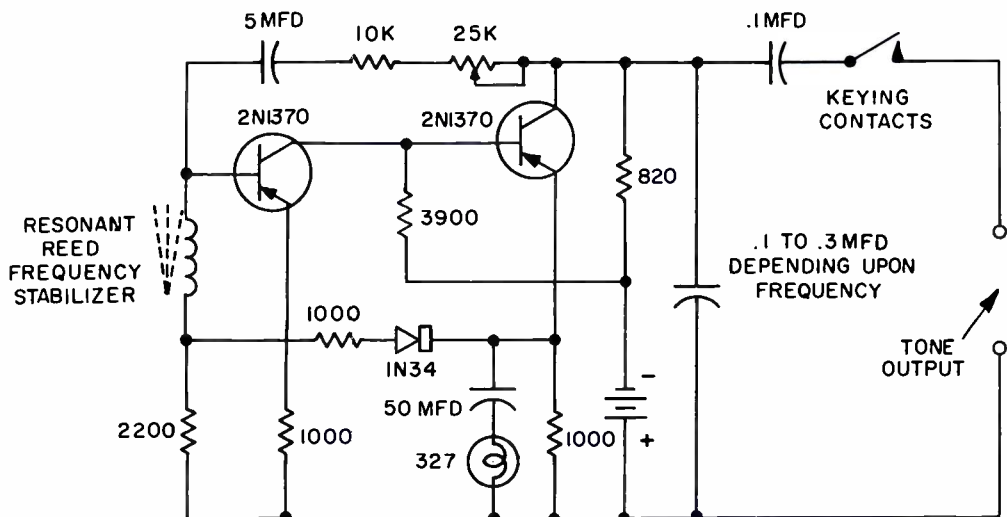


FIG. 2. Bramco reed-type tone transmitter.

mate, capacitor C is charged. This charge holds relay K2 energized. When the tone signal ceases, the reed stops vibrating and making contact. As soon as C discharges, relay K2 drops out.

Some vibrating reed relays have as many as five reeds and five contact sets, each responsive to a different frequency. Hence, one tone receiver of this type can be used to control up to four functions. When only one function is to be controlled, only one of the reeds is used and the contacts of the other reeds are not wired into the circuit.

Mallory has recently introduced a vibrating reed relay which does not require an auxiliary relay. Instead, it locks up mechanically and holds its contacts closed continuously as long as a tone of appropriate frequency is being received.

The number of tones that can be transmitted simultaneously over a single pair of wires depends upon the bandpass of the circuit, the selectivity of the tone receivers, the frequency stability of the tone transmitters, and the speed at which the tones are keyed on and off. When LC or RC transmitters and receivers are used, the tones are generally spaced 100 or 120 cps apart. They can be placed closer together when resonant reed transmitters and vibrating reed relay receivers are used. However, the reed type devices do not operate at as high frequencies as LC and RC types can.

When a tone signal is keyed on and off, amplitude modulation is produced and sidebands

are generated. Thus the transmitted bandwidth increases as the keying speed increases. LC and RC type oscillators can be keyed at high speeds. A resonant reed oscillator (Fig. 2), on the other hand, does not react immediately, since it requires from 100 to 2500 milliseconds for the reed to reach maximum vibrating amplitude. Higher keying speeds can be achieved by running the reed oscillator continuously and keying its output.

LC and RC tone receivers react almost instantaneously. There is some delay, however, which is introduced by the filter and the rectifier circuit time constant. Vibrating reed relay receivers react slowly since they require at least 100 milliseconds to build up vibrations big enough to obtain contact closure.

In addition to AM (on-off) tone transmitters and receivers, FSK (frequency shift keyed) tone transmitters and receivers are widely used. In these a tone is transmitted continuously. When the keying contacts are closed, the tone frequency is shifted. There are two-stage and three-stage FSK tone transmitters. In a two-stage type, a tone at frequency f_1 is normally transmitted, representing the off or space state. When the frequency is shifted by closure of the keying contacts, the on or mark signal is transmitted.

In a three-stage FSK tone transmitter a neutral tone is normally transmitted. When the frequency is shifted upward, a mark signal is transmitted. When shifted downward, a space signal is transmitted. Hence, a three-

stage FSK tone channel can be used to perform three functions such as off, on-forward, and on-reverse.

An FSK tone receiver is similar to an AM tone receiver except that it employs a discriminator. Its relay may be a three-position polar type or two or three relays may be employed, of which only one is energized at a time. Thus a relay contact closure is obtained for mark and space signals in a two-stage system, and mark, neutral, and space signals in a three-stage system.

There are also tone transmitters whose frequency can be varied without steps by varying the level of the input signal, which is usually a DC voltage. The receiver is similar at an FM radio receiver, except it operates at a much lower frequency. It delivers a DC output voltage whose level is determined by the frequency of the input signal.

There are many things that can be done with tone signals. All tones in a system can be transmitted in one direction, or some in each direction, since a wire line is a bi-directional circuit. In Fig. 3, for example, tone channel f1 is used to turn a motor on and off, and tone channel f2 is used to reverse the direction of the motor. Relay K5 reverses the polarity of the motor field coil voltage.

Tone channel f3 is used to transmit a signal back to the control point which, when present, indicates that the motor is running in the forward direction. Tone channel f4 transmits a signal to indicate that the motor is running in the reverse direction.

The speed of the motor is monitored at the control point with a microammeter, calibrated in rpm, which is connected to a pulse rate integrator (circuit similar to the ones used in electrical tachometers). The motor

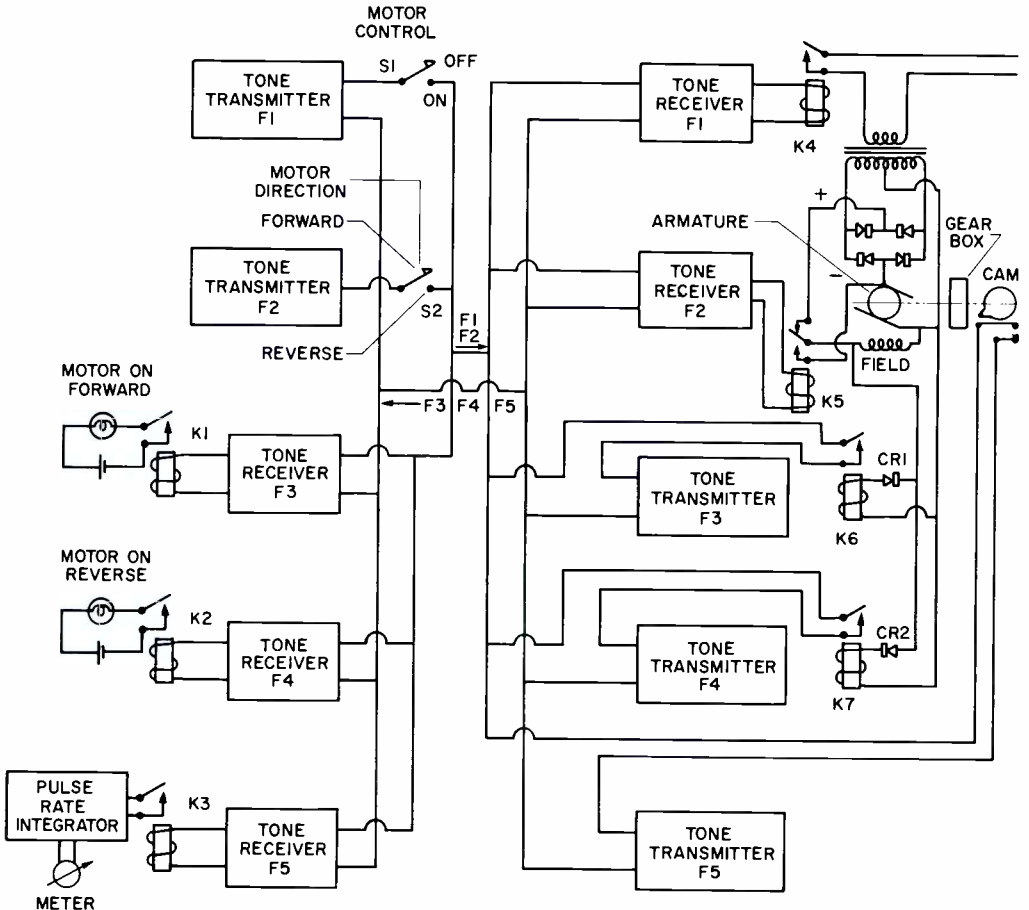


FIG. 3. Five-channel tone-signaling system.

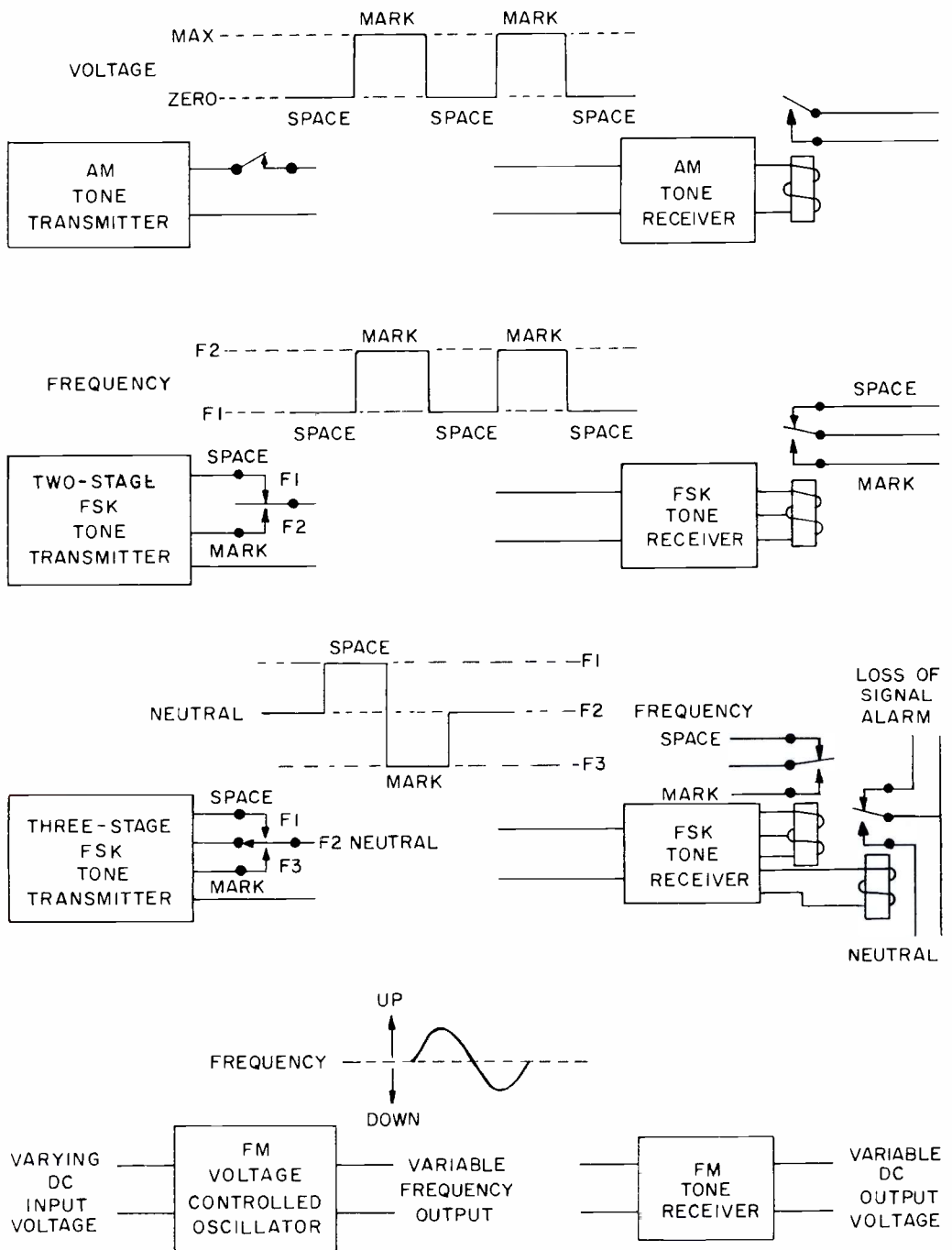
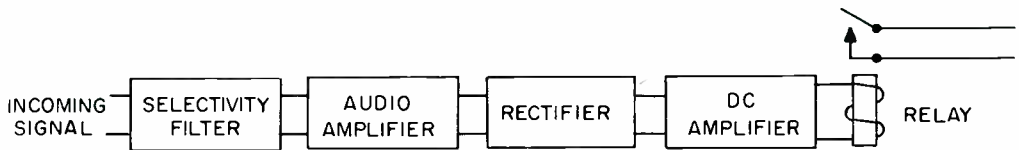
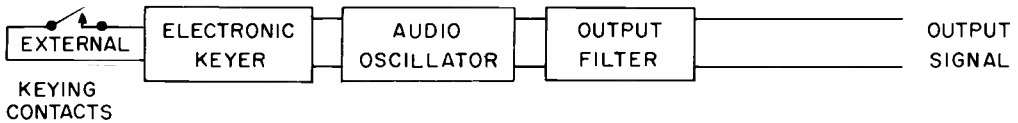


FIG. 4. Pulse repetition rate can be converted to a voltage or current by connecting output relay contacts through a DC voltage source to a pulse rate integrator.



AM tone receiver.



AM tone transformer.

drives a cam through a gear mechanism. The cam opens and closes the contacts of S3 at a rate determined by the speed of the motor. Whenever S3 is closed, a tone at f_5 is transmitted. The tone pulses energize relay K3 whose contacts provide the pulse input signal to the pulse rate integrator.

This circuit shows the tone keying contacts at the output of each tone transmitter for the sake of simple explanation. In actual systems, keying circuits are usually inside the tone transmitters.

Quantitative information can also be transmitted by varying the number of tone pulses or the duration of tone pulses. A pulse duration encoder, for example, keys the mark tone so as to make it longer when the measured quantity is higher, and vice versa. At the tone receiver output, a pulse duration decoder measures the time duration of each pulse and converts it into a meter reading or takes other appropriate action.

A specific quantity can also be communicated as a train of short tone pulses which are

counted. Or the pulse repetition rate can be converted into a voltage or current by connecting the tone receiver's output relay contacts through a DC voltage source (battery or power supply) to a pulse rate integrator, as in Fig. 4. The more often the pulses recur, the higher the average current indicated by the meter of the pulse rate integrator.

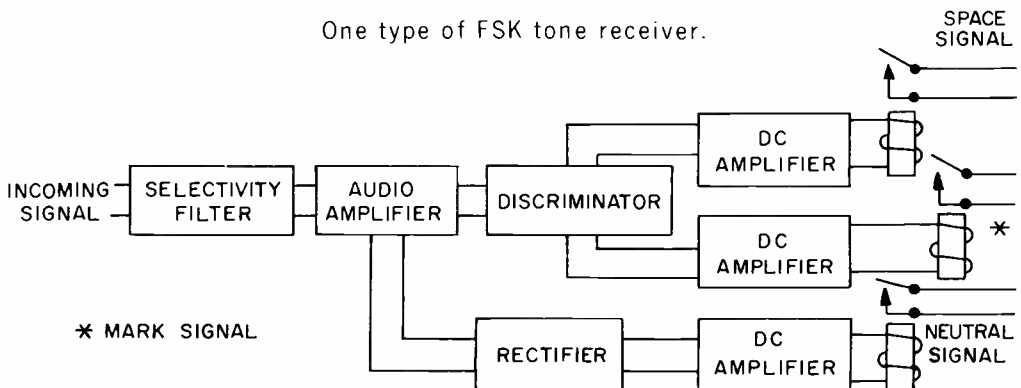
Intelligence may also be transmitted by sending binary coded tones, in series or in parallel. Only one tone channel is required to transmit serial data. Several tone channels are used simultaneously to transmit parallel data.

The binary coded data are then fed from the tone receivers into a computer or storage device or decoded and used for control or indicating purposes.

In addition to wire lines, tone signals can be transmitted over radio links. By using appropriate filters, it is possible to transmit tone signals simultaneously with voice or program material without the tones being audible.

Most tone signaling systems are sold by manufacturers to the end users through reps.

One type of FSK tone receiver.





Vibrating reed relay with four reed contacts.

However, there is a growing trend toward the sale of tone-signaling equipment through local dealers in the same manner as engineered sound systems and closed circuit television systems.

Tone signaling equipment is made by several manufacturers, and detailed information about their products is available. Among them are the following:

- Quindar Electronics, Inc., 5 Lawrence St., Bloomfield, N. J.
- Hammarlund Systems and Instruments Co., 185 Dixon Ave., Amityville, N. Y.
- Femco, Inc., Irwin, Pa.
- General Electric Co., Lynchburg, Va.
- Radio Corporation of America, Bldg. 15-1, Camden 2, N. J.

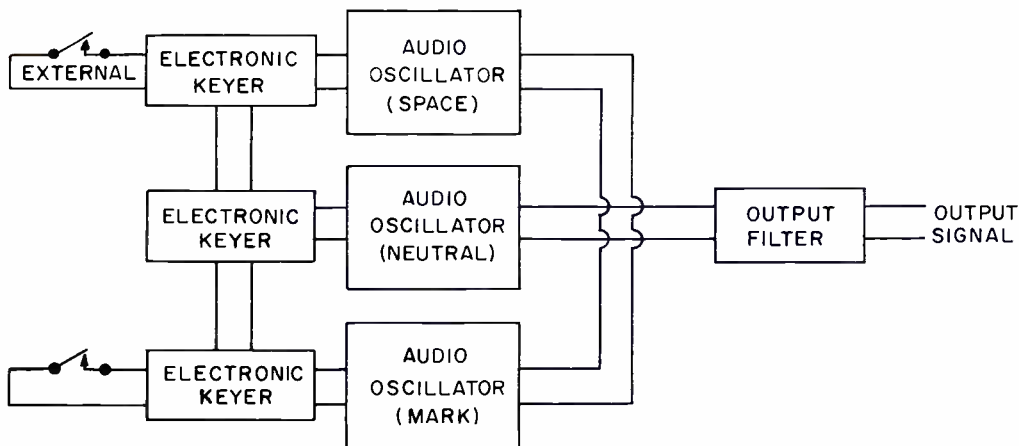
- Radio Frequency Laboratories, Boonton, N. J.
- Stromberg-Carlson, Rochester 3, N. Y.
- Lenkurt Electric Co., San Carlos, Calif.
- Lynch Communication Systems, 795 Bryant St., San Francisco, Calif.
- Automatic Signal, Regent Street, East Norwalk, Conn.

Tone signaling equipment is generally packaged in plug-in modules. Mounting frames are available for accommodating from one to eleven transmitter, receiver, or power supply units. Generally, only one power supply unit is required for ten or so transmitters and receivers.

Most employ transistors. However, there is still a big demand for tube-type equipment designed several years ago for expanding existing systems.

Users of tone-signaling equipment include water works, sewage plants, gas companies, pipelines, electric utilities, railroads, and process industries, and other manufacturers for remote control and telemetering equipment. Tone signals are also used for controlling and monitoring remote-controlled radio stations, weather information-gathering stations, and in central station burglar/fire alarm systems.

It is important for the electronics technician to become familiar with tone signaling because of its growing use in industrial electronics.



One type of FSK tone transmitter.

Technical Consultant Steve Bailey's column, "Communications", begins with this issue on Page 23.

● AMUSES SMALL FRY

A ROVING SPEAKER FOR THE BACK SEAT

● INSTALLS EASILY

● STAYS PUT

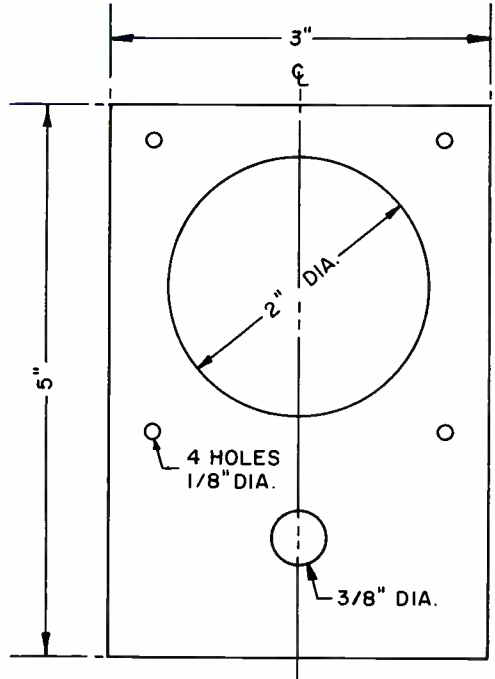
BY HOMER L. DAVIDSON

The roving back seat speaker for a station wagon is not intended to replace, or take the place of, a regular installation, but just to entertain the young fry in the far back seat. Or it can provide radio listening to grandfather, who is hard of hearing.

In most station wagons it is rather difficult to install a back-seat speaker. This small roving speaker can be placed right where you need it, and it will stay put.

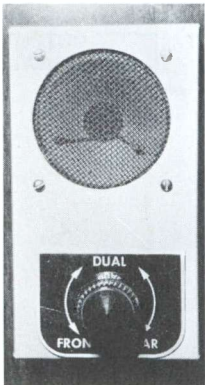
A 15-pound pull magnet is bolted to the inside of the speaker minibox and clings to the metal car surface. (Photo 2 shows the speaker unit on the metal back seat of the station wagon.) Any magnet, with 8 to 15 pounds of pulling power, will do the job nicely. If the unit is placed on the metal floor to the far rear platform, where the children always play on long trips, there is no sliding or rolling around.

A fader control turns the music to either front or back seat, or both can be blended together. The circuit shown in Fig. 1 is very simple. First, mount the speaker in a minibox with a 1000-ohm, wire-wound control. Drill four 1/8-inch holes for the speaker mountings. Use grille cloth and metal screen to protect the small 2-1/2-inch speaker. Drill

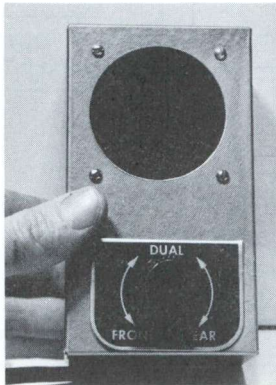


MINIBOX SIZE — 3" x 5" x 2-1/4"

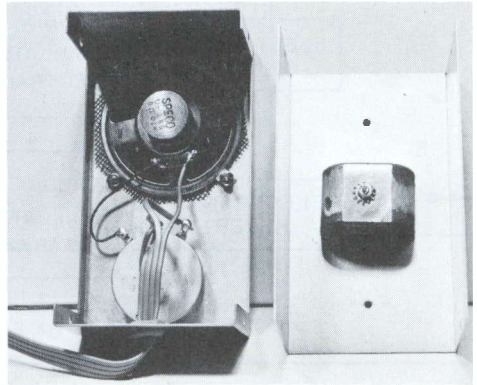
a 3/8-inch hole for the volume control and a 3/16-inch hole for the rubber grommet to hold the interconnecting cable.



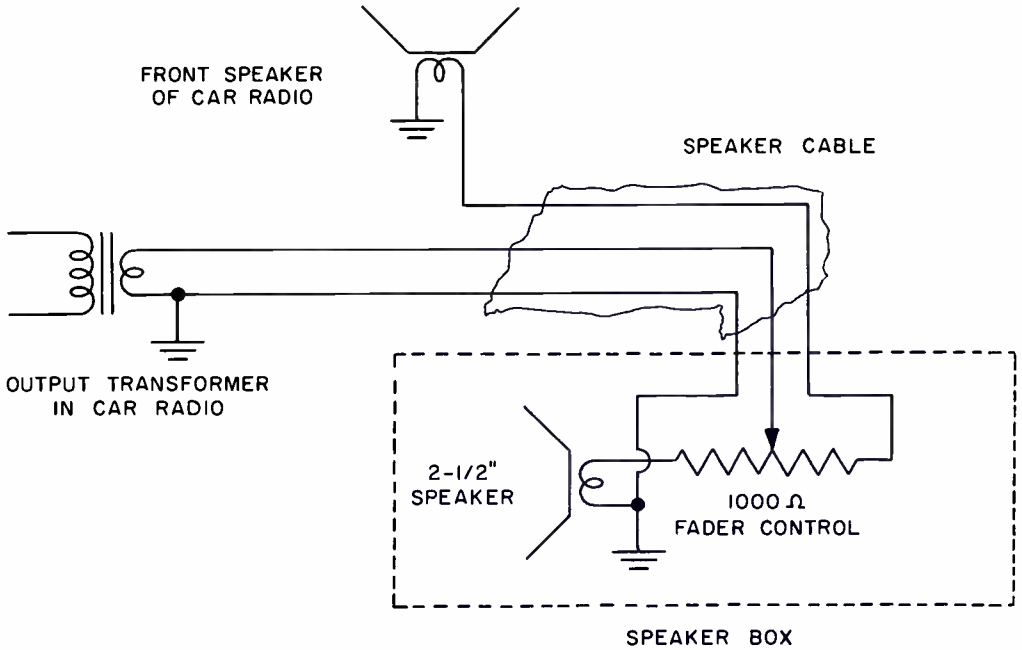
Speaker in place.



Front view.



Inside case.



Wiring diagram for the back-seat speaker.

Insert a flat flexible rotator cable through the rubber grommet and wire up the speaker box. One of the wires will not be used. Run the four-wire cable down under the seat and floor mat. Cut off one of the ungrounded wires going from car radio to speaker and wire to the center of the fader control. Use one of the wires as a common ground.

The other cable wire goes to the wire that was cut off from the front speaker. Always remember to turn the control toward the front speaker when no one is using the roving speaker in the rear of the station wagon.

PARTS LIST

- 1 - Magnet, 15 lb., can be secured from Miami Magnet Co., 3240 N. W. 27th Ave., Miami, Fla.
- 1 - 2-1/2 inch PM speaker
- 1 - 1000-ohm wire-wound control
Linear taper
20 ft. 4-wire flat rotator wire
- Misc. - Bolts and nuts, grille cloth, knob, and rubber grommet.

Sing Along With Stereo

Enjoy singing along with the records on your stereo hi-fi equipment, as many do? You may not realize that you can go a big step further in this direction....that is, the sound of your voice or instrumental accompaniment can easily come from the same loudspeaker. All you need to accomplish this satisfying effect is a simple crystal microphone. Plug in the mike to one of the stereo amplifier's inputs, replacing one of the leads going to the stereo phono cartridge. Then your own personal music will come from one speaker while the music from the record will come from the other. Both sound sources are controlled individually by the separate volume dials.



EMPLOYMENT OPPORTUNITIES

CLOSED-CIRCUIT TECHNICIAN, FCC SERVICEMEN WANTED

Stephens College for Women needs a trained technician to work with present engineering staff in operation and maintenance of television equipment. Prefers a man who'd enjoy academic atmosphere, and is willing to take on larger responsibilities with possible future expansion into closed-circuit color or open circuit UHF.

The college, at Columbia, Mo., now operates a closed-circuit educational television system on its campus. Equipment includes two complete TV studios (40 x 50 and 30 x 40) with five studio vidicon camera chains, two vidicon film chains, videotape, kinescope recorder, and other equipment, more than half of it purchased new this year. Shortly educational FM transmission will begin at 90.5 mc.

NRI graduates from Missouri or the surrounding area are invited to apply. Applications should be addressed to Eldon E. Blust, director of engineering (television, radio, and film) at Stephens College, Columbia, Mo. 65203.

The Suburban Electronics Service, Inc., 37 Fulton St., White Plains, New York 10606, is looking for qualified Communications servicemen with a second class FCC Radio-telephone license or better. White Plains is in the greater New York metropolitan area, a few miles north of New York City. The company needs men with bench or field capabilities. Salaries will be commensurate with ability, and are in keeping with local wage standards. For further information, contact Mr. Valden of Suburban Electronics.

The following firms have contacted NRI recently about the possibility of hiring NRI graduates. Those interested should call or write directly to the firms.

Pan American Union, 17th Street between Constitution Avenue and C Sts., N. W., has had opening for a radio and television engineer. Write or telephone Mr. John Schiele.

C and P Telephone Co., Culpepper, Va., is looking for men 18 to 28 years old with communications training and/or experience for vacancies in northeastern Virginia. Address inquiries to Mr. Donald Schaeffer, Employment Supervisor.

Western Electric, Installation Div., 1201 S.

Hayes St., Arlington, Va., is accepting applications for jobs as installers. Write or telephone Mr. Bressler.

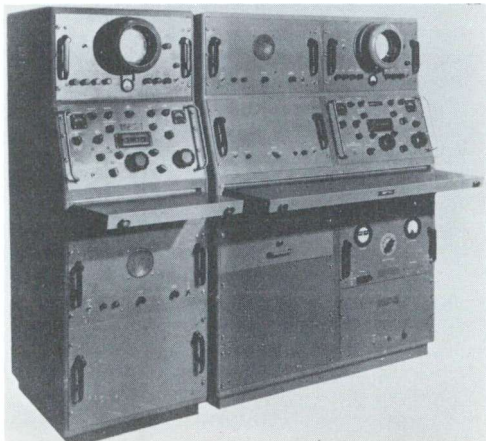
E. J. Korvette Department Store, Bailey's Cross Roads, Va., has position available in stereo, hi-fi and audio department. Telephone 481-2000, Extension 324, for interview.

Damascus Electric Co., Damascus, Md., has been looking for a Radio-TV serviceman. Telephone Mr. Woodfield, CL 3-2111.

SERVO GETS CONTRACT

A \$1,322,322 contract for transportable radio direction finder equipment has been awarded to Servo Corporation of America by the Army Electronics Command. The order increases Servo's backlog of unfilled orders to \$4,150,000.

Calling for 30 units, the contract is for a military version of the company's SERVOFLIGHT Model 3000, an improved high-frequency direction finder employing the Doppler technique, which has wide application in long-range air navigation and air-sea rescue operations. First shipments are expected to begin about April, 1965.



Major contracts (\$1 million or more) were recently awarded by government agencies or major contractors to the Electronics firms listed here. Such large orders frequently require the hiring of additional personnel. Those interested in possible employment should contact the companies.

Hughes Aircraft Co., Culver City, Calif.
Western Electric Co., New York, N. Y.
Radio Corporation of America, Moorestown, N. J.
Radiation, Inc., Melbourne, Fla.
Westinghouse Electric Corp., Baltimore, Md.
Simmonds Precision Products, Inc., Tarrytown, N. Y.
Bendix Corp., Mishawaka, Ind.
Ampex Corp., Redwood City, Calif.
Motorola, Inc., Scottsdale, Ariz.
Magnavox Co., Torrance, Calif.
Stanford Research Institute, Menlo Park, Calif.
General Electric Co., Pittsfield, Mass.
Melabs, Inc., Palo Alto, Calif.
Space Technology Labs., Inc., Redondo Beach, Calif.
Litton Systems Inc., Woodland Hills, Calif.
Carnegie Institute of Technology, Pittsburgh, Pa.
Automatic Electric Co., Northlake, Ill.
Remanco, Inc., Santa Monica, Calif.
Polytechnic Institute of Brooklyn, Brooklyn, N. Y.
North American Aviation Inc., Downey, Calif.
Sperry-Rand Corp., Long Island City, N. Y.
Sanders Associates, Inc., Nashua, N. H.
Beckman Instruments, Inc., Santa Monica, Calif.
System Development Corp., Santa Monica, Calif.
Belock Instruments Corp., Long Island, N. Y.
Goodyear Aerospace Corp., Akron, Ohio.
United States Underseas Cable Corp., Washington.
General Electric Co., Johnson City, N. Y.
Hughes Aircraft Co., Fullerton, Calif.
General Precision, Inc., Little Falls, N. J.
Sperry-Rand Corp. Minneapolis, Minn.
Hallcrafters Co. Chicago, Ill.
Lear Siegler Inc., Santa Monica, Calif.
Melpar, Inc., Falls Church, Va.
Computer Sciences Corp., El Segundo, Calif.
Martin Co., Orlando, Fla.
Raytheon Co., Lexington, Mass.
Communications Systems Corp., Morton Grove, Ill.
Zenith Radio Corp., Chicago, Ill.
IBM Corp., Poughkeepsie, N. Y.
Technical Material Corp. Mamaroneck, N.J.
Lear Seigler, Grand Rapids, Mich.
Arthur D. Little Co., Cambridge, Mass.
Litton Systems Inc., New Rochelle, N. Y.
Johns Hopkins University, Silver Spring, Md.
Westinghouse Electric Corp. Dayton, Ohio
Cook Electric Co., Morton Grove, Ill.

Dynamics Corp. of America, Garden City, N. Y.
North Electric Co., Gallon, Ohio.
Northrup Corp., Anaheim, Calif.
IBM, Oswega, N. Y.
C-E-I-R, Inc., Arlington, Va.

o o o

George Melnyk, NRI graduate in radio and TV, has been promoted to associate engineer in communications systems at IBM General Products Division Development Laboratory, Endicott, N. Y.

Local Chapters of NRI Alumni Association Seek New Members

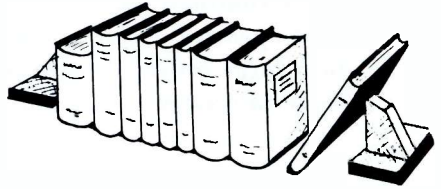
There are local chapters of the NRIAA in fifteen cities in the U. S. These chapters were founded and are maintained by NRI graduates. Their purpose is to provide facilities for NRI men to hold meetings for the benefit of the members. The meetings are devoted primarily to talks, demonstrations, and discussions on the practical side of Radio-TV servicing. These programs are generally conducted by the senior members of the Chapter, who lead, guide, and otherwise help the more inexperienced members.

The members also enjoy the opportunity to associate with other fellows who have the same interests as they in Radio-TV-Electronics. They like to get together, swap experiences, hold "bull" sessions. Many Chapters serve refreshments such as cold drinks, coffee and doughnuts or snacks. This helps the members to relax and enjoy the good fellowship.

Membership in a local Chapter is NOT limited to graduates. Students are just as eligible as graduates. All local Chapters constantly strive to get as many new members as they can and extend a warm welcome to any NRI student or graduate who wants to join or visit the Chapter.

If there is a local Chapter in your area (see "Directory of Local Chapters" on Page 31) we strongly suggest you drop in on some meeting night and get acquainted.

NEW BOOKS



Two new books published by Techpress Publications, compiled by its editorial staff, make it easy for the TV engineer, technician, hobbyist, student, or experimenter to pick the most accurate transistor for his specifications. One, the second edition of TRANSISTOR SPECIFICATIONS and SUBSTITUTION HANDBOOK, lists products of 60 manufacturers whose specs fall within 30% higher than those of the original. Transistors were programmed by computers in order of accuracy, including maximum voltage ratings, maximum collector power dissipation at 25° Centigrade ambient temperature, and also with the transistor connected to a heat sink. Manufacturers are coded and transistor symbols explained. (88 pp, \$1.95)

The second book, TRANSISTOR SELECT-A-SPEC, contains in index form all of the maximum operating DC values of more than 5,000 transistors, plus the typical gain figure of each at certain parameters, as well as the use to which each transistor is best suited. Listings are in order of power rating at ambient and case temperatures. Other sections list maximum collector current from the lowest-current-rated transistor to the highest maximum collector-emitter, collector-base, and emitter-base voltages. The format facilitates selection of, say, a transistor that has a power rating of 3 watts that will also work satisfactorily in a 12-volt circuit. (136 pp, \$3.95)

Anyone who likes to repair, adjust, or simply tinker with his automobile should enjoy a new Sams Book, ELECTRONIC GADGETS FOR YOUR CAR, by Len Buckwalter, with instructions on how to construct 10 devices. Little knowledge of electronics or auto mechanics is assumed in the text ... unfamiliar terms are explained and illustrated. For example, the reader is told how to locate a "hot" terminal, where to hook up to distributor points, etc. For readers interested in theory, there is a section in each chapter devoted to how the project operates in terms of its schematic diagram. Each project is laid out in a simple pattern, with an exact description of each gadget: an audible "beep" tone addition to the turn indicator, a dwell meter for

proper setting of points, an ammeter, spare-tire alarm, trunk alarm, tachometer, troubleshooting meter, emergency flashlight, transistorized battery charger, and a car-radio PA system.

Another Sams book, just out, is a newly revised and updated edition of Jack Helmi's 2-WAY MOBILE RADIO HANDBOOK, excellent for use in an expanding field. The operational theory of the basic systems, receiver, transmitter, control systems, antennas, and power supplies is explained in down-to-earth language. There is also an extensive discussion of servicing, plus pointers on setting up and operating a shop for sales and servicing of mobile-radio equipment. An explanation of the common-carrier services completes the coverage. (224 pp, \$3.95)

Closed-circuit television is rapidly becoming one of the most useful tools in our modern way of life, but little has been written about it except adaptations of broadcast TV. CLOSED-CIRCUIT TELEVISION HANDBOOK, by Leon A. Wortman, meets the need with comprehensive coverage of the subject. (Sams, 288 pp, \$6.95 hardbound)

Allan Lytel's new book, HOW TO SERVICE UHF TV, is a timely guide for the serviceman unacquainted with its facets ... now that all sets built for interstate commerce must be equipped to receive all of the ultra-high frequency channels, it should be a very useful book.

Its indited purpose is to explain some of the peculiarities and special characteristics of UHF so that the TV serviceman will have no trouble working with it. It first considers the general characteristics of UHF signals, and then treats, in detail, the essential UHF equipment features, UHF tuner and converter circuitry, special UHF channel strips, and servicing procedures.

The book should pay dividends to the serviceman who takes it seriously. (Hayden Publishing Co., Inc., 136 pp, \$3.50).



BY
STEVE
BAILEY

DEAR STEVE,

I don't understand how to use the formula given in lesson 6BB for finding the total inductance of coils connected in series. Also, what does the term "2M" mean?

E.M.G., Ariz.

When coils are connected in series, their inductances will add. However, if they are placed near each other, the inductance of one will affect the inductance of another. We call this mutual inductance. This will affect the total inductance of the circuit.

The main thing to consider now is whether the mutual inductances will be aiding or opposing each other. If the magnetic lines are flowing in the same direction, they will be aiding each other. However, if they are not flowing in the same direction, they will oppose each other. Therefore, we have a formula for determining the total inductance when the mutual inductances are aiding and one for when they are opposing.

If you have two coils connected in series and their fields are aiding, you use the formula $L_T = L_1 + L_2 + 2M$. The term "2M" means that you are to multiply the mutual inductance by 2. Then, you add that number to the sum of L_1 plus L_2 . This gives you the total inductance.

If the fields are opposing, use the formula $L_T = L_1 + L_2 - 2M$. Again, you multiply the mutual inductance by 2. This time, however, you subtract the answer you get from the sum of L_1 plus L_2 .

In summary, the letter "M" stands for mutual inductance and the term "2M" means that you

are to multiply the mutual inductance by 2. Then, you are to add or subtract (aiding, add; opposing, subtract) the answer you get from the sum of the values of the coils in the circuit.

DEAR STEVE,

Currently I am studying Ohm's Law and the power formulas. I believe I could understand it much better if you would tell me when a volt becomes a watt, an ohm, and so on.

E. C., Calif.

First of all, it would help you if you understood that a volt never becomes a watt or an ohm or any other part of Ohm's Law. A volt is simply a unit of measurement. Also, an ampere, a watt, and an ohm are each a unit of measurement.

Using Ohm's Law, you can determine the amount of resistance, voltage, or current by knowing two of the other factors. You must know, for example, the current and resistance in a circuit in order to determine the voltage. The same is true for the power formulas. You have to know two of the factors in the circuit, either voltage, current, or resistance, before you can determine the power.

DEAR STEVE,

I am having trouble understanding exactly what is meant by step-up and step-down transformers. Could you help me with this problem?

O. C. S., Idaho

A step-up transformer is simply a transformer that has more voltage in the secondary

than in the primary. A step-down transformer is one that has less voltage in the secondary than is in the primary.

The amount of voltage in a transformer secondary depends upon the number of windings in the primary and in the secondary. If a step-up transformer has twice as many windings in the secondary than is in the primary, the voltage will be doubled. The turns-ratio is expressed 1:2. On the other hand, if a step-down transformer has twice as many windings in the primary as is in the secondary, the voltage will be only one-half the primary voltage. Its turns-ratio is expressed 1:2.

DEAR STEVE,

At this time, I am studying lesson text 13BB. There is a discussion on page 28 about alpha cut-off frequency. After studying this several times, I still don't have a clear idea of what it means. Could you help me?

S. T., S. C.

I will be glad to help you.

A transistor is similar to all other electronic components in that it is useful only up to a certain point. In a transistor, this point is the alpha cut-off frequency.

If a transistor is used in a circuit where the operating frequency reaches the alpha cut-off frequency, the current gain will drop substantially. The value of alpha at this point will be equal to .707 times the value of alpha at a lower frequency when the transistor was operating properly.

The alpha cut-off frequency of a transistor is determined by characteristics of the transistor. Thus, as you can see, you should always select a replacement with this factor in mind. You cannot use a transistor in a circuit where the operating frequency is equal to or greater than the alpha cut-off frequency.

DEAR STEVE,

In Lesson 9, we learned that to obtain maximum power transfer, we must match the impedance of the generator circuit to the impedance of the load. This can be accomplished by using a matching transformer. The formula for finding the turns-ratio of the transformer is given on page 17. Would you explain this formula to me, using an example?

C. B. S., N. Y.

To determine the turns-ratio of a matching transformer, you use the formula:

$$\frac{N_1}{N_2} = \frac{Z_1}{Z_2}$$

Here, you have to substitute values just as you do in Ohm's Law. Z_1 is the generator (output) impedance and Z_2 is the load impedance.

Let's assume we want to match an output impedance of 20,000 ohms to a load impedance of 200 ohms. We would begin by taking the load impedance and dividing it into both parts of the problem. 200 will go into 200 one time and will go into 20,000 one hundred times.

Now, our formula is:

$$\frac{N_1}{N_2} = \frac{200}{1}$$

The square root of 100 is ten and the square root of 1 is one. Thus, our turns-ratio is equal to

$$\frac{N_1}{N_2} = \frac{10}{1} \text{ or } 10:1.$$

A transformer with this turns-ratio would match an output impedance of 20,000 ohms to a load impedance of 200 ohms.



NOW IT'S A 'CLEAN ROOM'

Precision assembly of electronic equipment to be used in a National Aeronautics and Space Administration observatory, which will circle the earth in a 500-mile high orbit, is under way in a newly constructed "clean" room of Sylvania Electric Products, Inc., in Needham, Mass. Sylvania is a subsidiary of General Telephone and Electronics Corp.

Sylvania employees, dressed in special hats, smocks, and boots, piece together electronic components in the ultra-pure work area. The room is designed to provide maximum freedom from contamination, which interferes with the close tolerance assembly work.

Prior to entering the "clean" room, employees vacuum their clothes in one of two entry "locks" which contains a walk-through vacuum shoe cleaner. A second "lock" provides further protection against the entry of dirt. The components being assembled here will be used in the Princeton University portion of NASA's Orbiting Astronomical Observatory program, directed by Goddard Space Flight Center.



Pre-vacuumed Sylvania assemblers work in an ultra-pure "clean room".

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(Name) (Address)

THEY MEET AGAIN

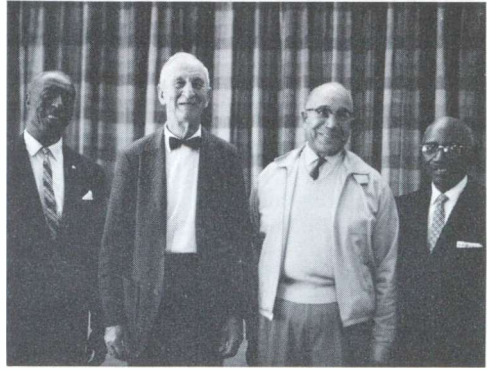
Sylvester R. Woodfork could hardly believe his eyes when he looked at the Sunday newspaper. James E. Smith still alive? Impossible....still, there was the living evidence, a smiling picture of the man along with a story of the golden anniversary celebration of National Radio Institute.

Why it was so hard to believe was that Mr. Smith had been Mr. Woodfork's instructor in the early days of the first World War, when the latter had been one of 800 draftees at Howard University in training for radio operators.

All that afternoon the phone rang, with others of that 1918 class asking the same question, "Did you see the picture...?"

Mr. Woodfork thought about it for a couple of days. On Wednesday he decided to do something about it, and came over to NRI unannounced. Smith was out, but his long-time secretary, Mrs. Ida Malloy, set up an appointment for the next day.

Woodfork came to the meeting reinforced by two other members of the class, Winfred Sparks and Thomas Bowen, also anxious to renew old acquaintanceship. "He was such a good teacher, so kind and understanding."



From left are Sylvester R. Woodfork, J. E. Smith, Winfred Sparks, and Thomas W. Bowen.

The meeting, as you might expect, was an emotional one. Then the very-much-alive Mr. Smith took his former students on a tour of the NRI building.

Mr. Woodfork, president of the newly reactivated Hutradena Club (Howard University Training Detachment National Army, those inducted from Howard U.), wound up the meeting by inviting Mr. Smith to speak at its next meeting. Which he did. **JAMES SHURBET**

CONAR ORDER BLANK

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WE HAD A BALL AT THE

NRI 50TH ANNIVERSARY LUNCHEON

Some 200 employees and guests gathered at the International Inn to mark the 50th anniversary of National Radio Institute. Good talk and an epicurean luncheon helped the holiday atmosphere, and to complete it employees got the afternoon off! The star of the show was undeniably the witty honoree, James E. Smith, founder of NRI. M. C. was R. E. Daiger, and speaker R. F. Hurleigh, head of Mutual Broadcasting. Tech editor Ted Beach and other members of his barbershop quartet entertained at the luncheon. Among gifts to Mr. Smith were a plaque from employees and a gold golf tee. Ted Rose chaired the event.



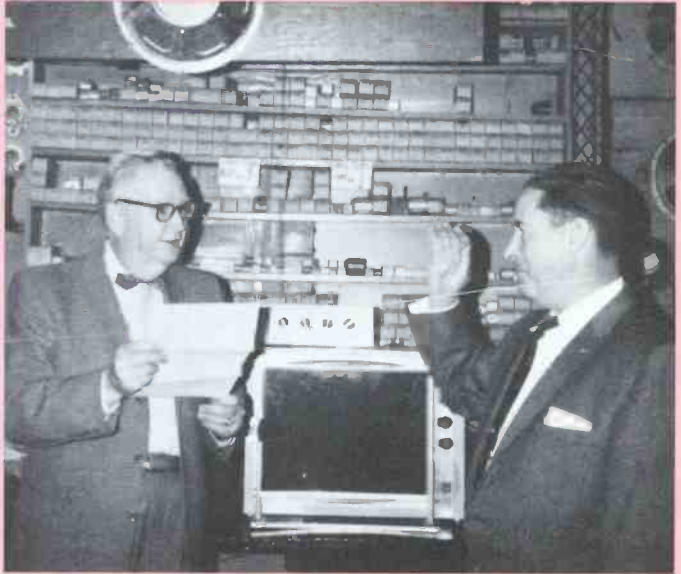


ALUMNI NEWS

David Spitzer.....President
 Jules Cohen.....Vice President
 F. Earl Oliver.....Vice President
 Joseph Stocker.....Vice President
 James L. Wheeler..Vice President
 Theodore E. Rose...Executive Sec.

CHAPTER CHATTER

DETROIT CHAPTER held one of the largest meetings in recent years at the Radio-TV Shop of George Povlich, who served as host for the evening. This meeting was attended by J. B. Straughn of the NRI Consultation Service and Ted Rose, Executive Secretary of the NRI Alumni Association, on their annual visit to the Chapter. One of the highlights of the meeting was the swearing-in of F. Earl Oliver as a National Vice President of the Association for 1965 by Ted Rose.



NRIAA Executive Secretary Ted Rose, left, administers oath of office to F. Earl Oliver of Detroit Chapter, new national Vice President of NRI Alumni Association.

At a subsequent meeting John Korpalski discussed the many different types of antennas. The Chapter has been planning on showing films from Howard Sams in January and February. Also a demonstration in January by John Nagy on Radio Speakers, a subject on which he is well qualified to speak.

Gilbert Sager is the newest member to be admitted to membership. Congratulations!

FLINT (SAGINAW VALLEY) CHAPTER has undertaken a long winter program for a concentrated study of color TV. The Chapter buys certain makes of color TV sets to work on, which are later sold to the members. At present the chapter owns an RCA and a Westinghouse. By getting different sets, the members get experience on several different types of receivers.

The members are divided up into groups to work on different days. First each group learns how to set up a color TV set, employing

a bar generator. Then the group proceeds into troubleshooting. This is an ambitious program and one which should have very worthwhile results.

HACKENSACK CHAPTER broke some kind of a record. At its October 30 meeting at which J. B. Straughn of the NRI Consultation Service and Executive Secretary Ted Rose were guests, the Chapter signed up thirteen (that's right, thirteen) new members. They are: William Frankel, Leroy Feienschner, Lester Heltsche, Edward Hostak, Michael Enatusko, Vincent W. Kuch, Louis J. Koei, Walter J. Kwiczola, Clefford F. Lewaine, Henry Minero, Bruno R. Ottino, Theodore Steinberger, St., Ignatius N. Trzeciak.

This was a very large meeting. There were

79 members and guests present. A soldering gun donated by Chairman George Schalk was given as a door prize and was won by Leroy Felenschner, one of the new members.

The evening terminated with the serving of cakes, doughnuts, various kinds of pastry and coffee and soft drinks. Our thanks to the members' wives who prepared such delicious cakes and pastry.

HAGERSTOWN (CUMBERLAND VALLEY) CHAPTER was pleased to welcome five visitors from Martinsburg, W. Va., as guests at one of its meetings. It was the first time any of the five had attended a meeting of the Chapter. The occasion this time was the annual visit of Executive Secretary Ted Rose and J. B. Straughn, Chief of the NRI Consultation Service. Come back again, any time, fellows. You will always find a warm welcome waiting for you.

LOS ANGELES CHAPTER Secretary Jim Law brought his Conar Custom 70 Television receiver to a meeting to be aligned with Gene DeCaussin's B and K TV Analyst, resulted in considerable improvement in the performance of the set.

Graham Boyd told the members about converting a Packard Bell from a 24BP4 tube to a 24EAP4 tube, a job which he did for a customer with excellent results.

Two new members have recently joined the chapter. They are Richard Hall and Nathan Bolen. Welcome, gentlemen!

After several delays a meeting was finally held at Jim Law's home. The feature of the evening was a demonstration of the CONAR Stereo 300. Everyone present was pleased with it.

MINNEAPOLIS-ST. PAUL (TWIN CITY) CHAPTER reports its officers to serve for the current year (until next fall) as follows: Edwin Rolf, Chairman; Kenneth O. B. Worden, Vice-Chairman; John Babcock, Secretary; George Dixon, Treasurer; and Mike Lundgren, Sergeant-At-Arms. Our congratulations to these gentlemen.

NEW YORK CITY CHAPTER members feel that from the beginning last fall the Chapter has been enjoying a good season. It started with a lively interchange of Radio and TV problems that had accumulated over the summer. A number of faces have been seen at the meetings that had been absent for some time.

A good workout with the CONAR tuned signal

tracer and the transistor demonstration board awakened considerable interest. The members were also much impressed with Ontie Crowe's oscilloscope to which he has added an audio circuit, so that he can hear as well as see what is going on in the circuit. Ontie has a number of interesting gadgets which are helpful to his service work and the members look forward to his sharing more of these with them.

The newest member to be admitted to membership is Ewart Fegin, an NRI student. Welcome to the Chapter, Ewart!

PHILADELPHIA-CAMDEN CHAPTER carried through on its plans for a tour of the Philco Corporation factory in Philadelphia, as mentioned in the November-December issue of the NRI Journal. Through the courtesy of Mr. Howard Tomlin, Philco General Service Manager, twenty Chapter members met at the Philco Corporation. Mr. Herman Scheler, Industrial Relations Department, and Mr. Lou Abrams, Assistant National Electronics Supervisor, conducted the group through the plant where the members saw first-hand how Radios and TV's are made from start to finish. It was a fascinating tour and the members were intensely interested in everything they saw. After the tour, they were treated to a sumptuous luncheon.

The next meeting of the Chapter featured Channel Master Antenna, arranged by "Resco" (Radio Electric Service Co., distributors of Channel Master in Philadelphia). Mr. Sid Love, General Manager of Resco, made the arrangements. With movies, a blackboard, and the know-how of Mr. Dick Deutsch who did the narrating, the members enjoyed the meeting, which was all about UHF



Guest speakers at a meeting of Philadelphia-Camden Chapter were, from left, Sid Rosenberg, Sy Gerscher, Dick Deutsch, Sid Love, and Mel Pressman of Channel Master.



The group also made a tour of the Philco plant. At right-center are the host-guides, Herman Scheier, left, and Lou Abrams.

antennas. Literature was given out and ten door prizes were donated. This was all made possible by Sid Rosenberg, Resco Salesman, Sy Gerschwer, Channel Master Sales Representative, Dick Deutsch, Channel Master Regional Sales Manager, Sid Love, Resco General Manager, and Mel Pressman, Resco Salesman.

The last meeting in October was attended by J. B. Straughn, Chief of the NRI Consultation Service, and Executive Secretary Ted Rose of the NRIAA. The latter took advantage of the opportunity to administer the oath of office to Jules Cohen as a National Vice President of the Association for 1965.

Strange as it may seem, the Chapter has reported only one new member recently. He is Joseph Kuklinski. Our congratulations to you, Joe!

PITTSBURGH CHAPTER was pleased to welcome Mr. George Mann, Vice President and National Promotional Manager of All Channel Products Corp., as a guest speaker. Mr. Mann told the members all about Rembrandt antennas, their use and how they are made.

But the next meeting, held November 5, was one of the most outstanding meetings in the history of the Chapter. It was held at Station WIIC in Pittsburgh. Acting as host for the station, Mr. Henry Kaiser, Chief Engineer, conducted the Chapter members and their wives through the station and explained in detail the broadcasting of TV pictures and sound. This was an absorbing tour and lecture.

The second half of the meeting was taken over by J. B. Straughn, NRI Chief of Consultation Service, and Ted Rose, Executive Secretary

of the NRI Alumni Association. It is believed that this meeting broke all records for attendance at a meeting of any local Chapter. It was estimated that about 250 members and guests were present -- a meeting long to be remembered.

SAN ANTONIO ALAMO CHAPTER'S Harold Wolff had the undivided attention of Chapter members when he gave a talk in which he explained various auto radio circuits and how to repair them. He had several schematic drawings on large sheets of cardboard that made his explanations much more understandable.

Equally as interesting was a talk given at the next meeting by Johnnie Noll, who is a repairman of telephone cable and other telephone equipment. He demonstrated line repair, using actual telephone cable samples and telephone test equipment. He then showed two films, "Transistors" and "Solar Batteries," which added still more interest to his program. It was an excellent talk and demonstration.

The social part of some of the meetings are made particularly enjoyable by the donations of really delicious apple pies by Jesse DeLao, who bakes them himself. These pies are served with coffee. The members look forward to the meetings when they plan to have such a snack.

SAN FRANCISCO CHAPTER members are continuing to benefit from lectures and demonstrations by Guest Speaker Peter Wivel. At one meeting he talked on and demonstrated the uses of the VTVM; at another meeting his demonstration was devoted to a Television receiver that had sound and snow but no picture.

Mr. Wivel has repeatedly pointed out and emphasized that practical experience and a thorough knowledge of theory pay off handsomely when the serviceman is working with tough dogs.

SOUTHEASTERN MASSACHUSETTS CHAPTER'S newest members are John Russell, Providence, and John Widelski, Fairhaven, Mass. We are pleased to have these new members.

At the Chapter's October meeting the members were given an outline of future programs. Following this, Manuel Figueiredo showed the members present, step by step, how to take the chassis and tuner out of a new set and how easy it is to get to the various stages so they can be tested, etc.

The Chapter is continuing to hold its regular



Southeastern Massachusetts Chapter's Manuel Sousa, left, and John Alves explore Manuel's color dot-bar-grid generator during meeting.

meeting on the last Wednesday of each month. But beginning in September an additional meeting is held in the middle of the month. These meetings are devoted to learning more about Color Television.

SPRINGFIELD (MASS.) CHAPTER did not hold a meeting in December because of the holidays. What used to be called its Annual Christmas Party will be held this year on January 16.

The officers serving the Chapter for the current year ending next September are: Steve Chomyn, Chairman; Gus Lorrantzetti, Treasurer; and Albert Dorman, Secretary. Our congratulations to these officers!

The Chapter's newest member is Donald Fournier, Huntington, Mass. A warm welcome to the Chapter membership, Donald!

Directory of Local Chapters

Local chapters of the NRI Alumni Association cordially welcome visits from all NRI students and graduates as guests or prospective members. For more information contact the Chairman of the chapter you would like to visit or consider joining.

CHICAGO CHAPTER meets 8:00 P. M., 2nd and 4th Wednesday of each month, 666 Lake Shore Dr., West Entrance, 33rd Floor, Chicago. Chairman: Frank Dominski, 2646 W. Potomac, Chicago, Ill.

DETROIT CHAPTER meets 8:00 P. M., 2nd and 4th Friday of each month. St. Andrews Hall, 431 E. Congress St., Detroit. Chairman: James Kelley, 1140 Livernois, Detroit, Mich., VI-14972.

FLINT (SAGINAW VALLEY) CHAPTER meets 8:00 P. M., 2nd Wednesday of each month at Andrew Jobbagy's Shop, G-5507 S. Saginaw Rd., Flint. Chairman: Henry

Hubbard, 5497 E. Hill Rd., Grand Blanc, Mich., 694-4535.

HACKENSACK CHAPTER meets 8:00 P. M., last Friday of each month, St. Francis Hall, Cor. Lodi and Holt St., Hackensack, N. J. Chairman: George Schalk, 471 Saddle River Rd., Ridgewood, N. J.

HAGERSTOWN (CUMBERLAND VALLEY) CHAPTER meets 7:30 P. M., 2nd Thursday of each month at the YMCA in Hagerstown, Md. Chairman: Francis Lyons, 2239 Beverly Dr., Hagerstown, Md. Reg 9-8280.

LOS ANGELES CHAPTER meets 8:00 P. M., 2nd and last Saturday of each month, 4912 Fountain Ave., L. A. Chairman: Eugene DeCaussin, 4816 Fountain Ave., Apt. 401, L.A.

MINNEAPOLIS-ST PAUL (TWIN CITIES) CHAPTER meets 8:00 P. M., 2nd Thursday of each month, at the homes of its members. Chairman: Edwin Rolf, Grasston, Minn.

NEW ORLEANS CHAPTER meets 8:00 P.M., 2nd Tuesday of each month at Galjour's TV, 809 N. Broad St., New Orleans, La. Chairman: Herman Blackford, 5301 Tchoupitoulas St., New Orleans, La.

NEW YORK CITY CHAPTER meets 8:30 P. M., 1st and 3rd Thursday of each month, St. Marks Community Center, 12 St. Marks Pl., New York City. Chairman: David Spitzer, 2052 81st St., Brooklyn, N. Y., CL 6-6564.

PHILADELPHIA-CAMDEN CHAPTER meets 8:00 P. M., 2nd and 4th Monday of each month, K of C Hall, Tulip and Tyson Sts., Philadelphia. Chairman: John Pirrung, 2923 Longshore Ave., Philadelphia, Pa.

PITTSBURGH CHAPTER meets 8:00 P. M., 1st Thursday of each month, 436 Forbes Ave., Pittsburgh. Chairman: James L. Wheeler, 1436 Riverview Dr., Verona, Pa. 793-1298.

SAN ANTONIO ALAMO CHAPTER meets 7:30 P. M., 3rd Wednesday of each month, Beethoven Home, 422 Pereida, San Antonio. Chairman: Sam O. Dentler, 329 Southcross, San Antonio, Texas. WA 2-8682.

SAN FRANCISCO CHAPTER meets 8:00 P.M., 1st Wednesday of each month, 147 Albion St., San Francisco. Chairman: Peter Salvotti, 2543 Great Hwy., San Francisco. Calif.

SOUTHEASTERN MASSACHUSETTS CHAPTER meets 8:00 P. M., last Wednesday of each month, home of Chairman John Alves, 57 Allen Blvd., Swansea, Mass.

SPRINGFIELD (MASS.) CHAPTER meets 7:00 P. M., last Saturday of each month as shop of Norman Charest, 74 Redfern St., Springfield, Mass. Chairman: Steven Chomyn, Powder Mill Rd., Southwich, Mass.

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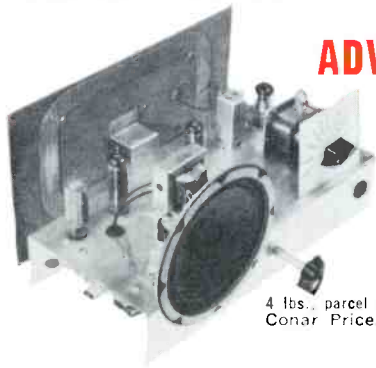
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