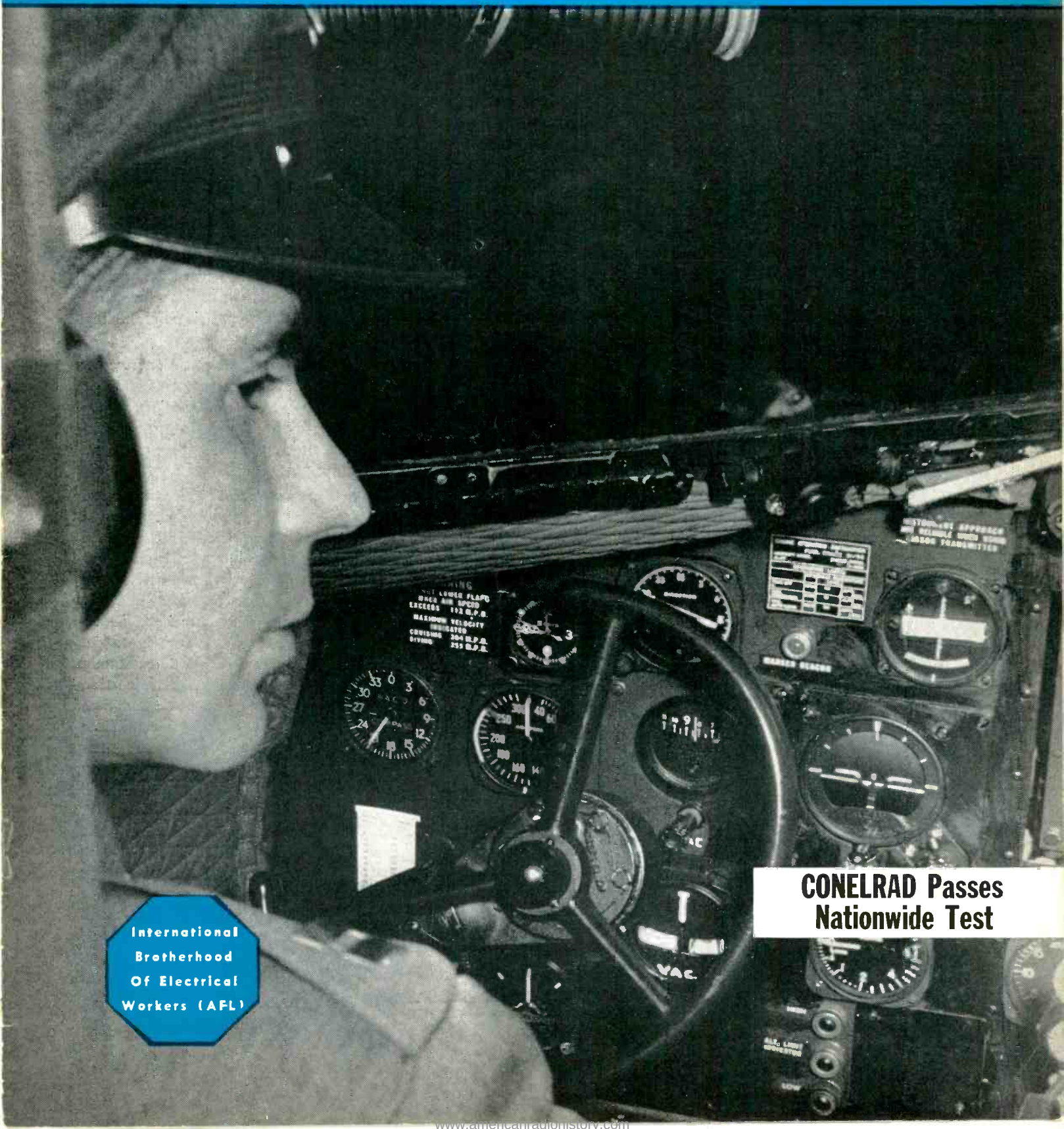
RADIO, TV and RECORDING

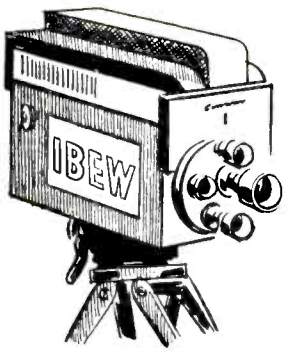
TECHNICIAN-ENGINEER

OCTOBER, 1953



CONELRAD Passes Nationwide Test

International Brotherhood Of Electrical Workers (AFL)



'Any workingman would be fired . . . for the kind of job done.'

Congress Falls Down

An editorial by AFL President George Meany, first published in the "American Federationist" August, 1953.

ANY workingman would be fired summarily for the kind of job done by the first session of the Eighty-third Congress. It quit with its work scarcely half completed. To make matters worse, the little that was accomplished must be classified, even by an impartial judge, as more destructive than constructive.

As an institution, Congress is the backbone of our democratic form of government in America and deserves the highest respect. But in recent years Congress itself has done more to undermine its good standing with the American people than any of its detractors. Thus after, the Eighty-third Congress has followed the sorry pattern set by the Eightieth Congress, which was probably the worst in history.

Only in the field of foreign affairs did Congress come close to fulfilling its responsibilities. Even here, however, it practiced what may turn out to be false economy by making drastic cuts in the appropriations recommended by President Eisenhower for the Mutual Defense Program and by the Joint Chiefs of Staff for the National Defense Program.

In the field of domestic affairs, Congress really fell down on the job. Consider the facts:

(1) Congress voted to give away the tremendously valuable submerged oil lands to the coastal states for exploitation by private petroleum and natural gas interests. At the same time, it voted to liquidate the public housing program, thus ending hopes for wiping out slum areas where the lowest-income families are forced to live. It also voted to end rent controls, thereby exposing to millions of low- and middle-income families to the danger of unjustified rent increases.

(2) Congress failed to act on revision of the Taft-Hartley Law. It failed to act on improvement of the social security system. It failed to make a perceptible move on the grave problem of health legislation. It did nothing on the protection of civil rights for minority groups. It postponed consideration of the pressing farm price problem, which affects not only the farmers but the living costs of every workingman's family. Obviously, the disinterest of Congress toward the welfare of the great masses of the American people was matched only by its apparent concern for the relief of big business.

(3) By its control of the purse-strings, Congress attempted to wreck enforcement of laws protecting labor which it did not dare openly to repeal. The heavy cuts in the appropriations voted for the Department of Labor, already the smallest in the federal government, were wholly unjustified.

In the final analysis the responsibility for the record of Congress rests upon the voters rather than upon the members of Congress themselves. Unless and until the people of this country pay more attention to the work of their Congressmen and Senators, we will continue to get misrepresentation instead of good government.

I cannot urge the members of the American Federation of Labor and their friends too strongly to get ready now for the 1954 Congressional elections. Study the reports of Labor's League for Political Education on the voting records of your Congressmen and Senators and make certain to vote next year for candidates who put the interests of the people ahead of the interests of entrenched wealth.

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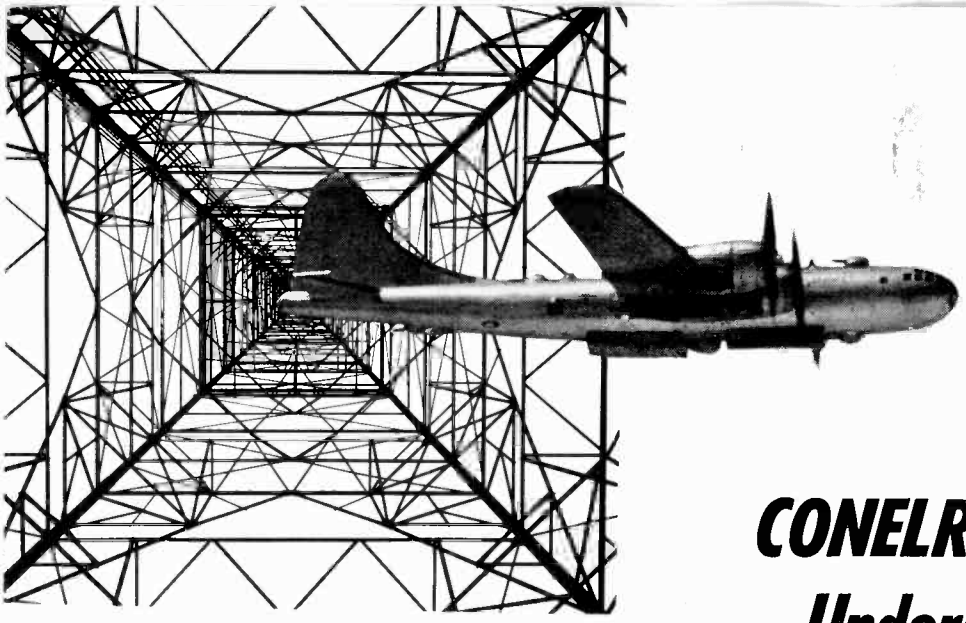


Staff writer joins press junket at Mitchel Field, Long Island, to observe nationwide test of Civil Defense Plan of broadcasting during an air raid alert.

CONELRAD Defense Plan Undergoes 'Shakedown'

A FEW days ago New Yorkers took cover for their third "public participation" air raid test in as many years. The city stood still for 15 minutes. Policemen waved traffic to a halt. Millions took shelter as the 604 sirens of Manhattan, the Bronx, and other boroughs sounded the grim warble of a red alert. It was a practice drill for more than 8-million concentrated Americans, and it was termed a success.

But what would happen if these and other sirens suddenly went on unheralded, the lights went out and the city was suddenly blackened, and the major cities of America faced a terror much worst than the blitz of Britain?

The thought keeps many a Civil Defense leader worried and puts a question mark in the Air Force's major strategy for air defense of the nation.

A public panic can be as dangerous as an enemy attack.

How best to prepare for such a possibility? What measures can be taken to meet an emergency?

Civil Defense authorities turned to radio broadcasting as a major weapon for public morale. They asked the Federal Communications Commission for a plan whereby radio stations could stay on the air with CD information and continuous programs, without acting as a radio beam for homing bombers or missiles.

The FCC produced CONELRAD.

When the plan was announced and details released by the White House, last December, THE TECHNICIAN-ENGINEER presented a detailed run-down of the plan in its next edition. We shall not repeat all of this background now. Our purpose in this story is to show you how CONELRAD stands today, now that a nationwide test of the system is accomplished, and now that IBEW engineers all over the nation are familiar with the bugaboos of CONELRAD cluster broadcasting.

CONELRAD received its initial test, by a small number of stations, as far back as June, 1951, before it was approved and announced in Washington. The theory of switching all broadcasts to either 640 or 1240 kilocycles and then broadcasting a single program from several transmitters via connected lines was proven practical and the FCC, the Air Forces, and Civil Defense proceeded with their planning.

First of all, let us say that CONELRAD is an American development. During the last war all stations of Europe just went off the air when an alert sounded. The only words out of the air for the population came from public address systems.

Because CONELRAD is simple in principle for broadcasters and a basic solution to a defense problem, it has quickly filtered behind the Iron Curtain, and every major power, allied or otherwise, can now put CONELRAD into operation in some manner.

The key to CONELRAD's success here, however, is America's genius for developing gismos to simplify the cluster broadcasting and Civil Defense's ability to make the public understand what the plan is all about.

To accomplish the latter, Civil Defense invited the

Col. John E. Fondahl, Director of Civil Defense for the District of Columbia, at a microphone in the radio room of the Washington CD Headquarters. Barnett Addis, radio dispatcher, works short wave equipment in the rear. In just such a set-up as this, CONELRAD broadcasts will go out to battery-powered receivers all over the city.

The radio operator of the press-observer plane, S/Sgt. Charles Scalion, Jr., of Baltimore, checks the flight course and the Conelrad "garble," as cluster patterns overlapped.

News writers covering the test were unimpressed by the technical details and had trouble finding "an angle" for their stories. AAF liaison officer is at center.

Alida Carey of Newsweek's National Affairs Department takes notes for a story via the radio operator's earphones.

press to observe the first big nationwide test of the system, September 16. THE TECHNICIAN-ENGINEER was invited to join writers from the AP, UP, *Time-Life, Newsweek,* and the New York City papers in a flight out of Mitchel Air Force Base to observe CONELRAD in the New York City area.

The night selected was an unlucky one, in some respects. It was raining and the sky was laced with lightning periodically as we assembled for a 12:30 a. m. briefing. Radio reception on a portable receiver, or flying at several thousand feet, was poor.

Secondly, it was the night after the big New York City mayor's election, and stations were going beyond their regular scheduled hours with the returns. Listeners were concerned with Wagner versus Impellitteri instead of 640 and 1240 switching. The newswriters suspected that stations were breaking CONELRAD rules, until the FCC representative present explained that only stations enlisted in the CONELRAD plan were involved in the present test. Other stations could stay on the air during the "shakedown." (Which would not be the case in an actual alert.) All of which added to the confusion.

Much emphasis has been placed on the fact that CONELRAD fouls up the direction-finding apparatus on approaching enemy planes, making the radio compass useless. This is true, but this is of secondary importance in the present situation. If aerial navigation jamming was the only problem, the FCC could just take all stations off the air at the yellow alert. Actually, today air science has progressed to radar scanners, and other methods of approaching a target, so that homing on a radio frequency isn't of so much strategic importance. (It would be of tremendous value, however, against rocket missiles preset to a certain frequency.)

The enemy navigator can take his star fix, or compute with wind deflection, etc., and when he reaches the coast or known geographic lines he can switch to his radar scanner or what-have-you.

But, let's suppose an enemy pilot wants to use a known radio frequency. He looks in his top secret book and sees that Station WWWW operates on 1140 kilocycles. He is in range. He turns a dial on his ADF control box in the ceiling of the cockpit to 1140, then he turns to the radio compass on his instrument panel. The loop antenna outside the fuselage begins to function. Then, 1140 automatically becomes zero on his 360-degree indicator. He flies on zero, compensating if he goes right or left.

If the pilot tries this when CONELRAD is in operation, his radio compass needle goes crazy, swinging back and forth as much as 20 to 90 degrees, as the cluster radio stations switch from antenna to antenna.

One could easily see, on board the Air Force C-47 covering the test, that the ADF (automatic direction finder) system of navigation was useless during CONELRAD.

But was CONELRAD functioning properly as a broad-

THE COVER

Capt. John Wilkins, AAF pilot of the press observation plane, keeps a skeptical ear tuned to the intermittent switching of the CONELRAD broadcasts of the New York metropolitan area. The instrument at the far left on the panel is the radio compass, which acts as a direction finder when not thrown completely off by CONELRAD clusters.

casting plan? Government officials admitted after the September 16 test that there are flaws. There were times when the switching was noticably erratic, with momentary pauses in the signal. There are gaps, too, in CONELRAD coverage in the far stretches of the West and Mid-West.

Considering the complete picture of the September 16 test, however, reports were favorable. FCC Commissioner George Sterling cited good coverage of the country on 640 kc, although he acknowledged the existence of "holes" in the 1240 kc coverage because of low power signals. He emphasized that more stations are needed to take part in the system, particularly in the 1240 group. (Newswriters from the New York papers thought for a while that they had a "lead" out of the fact that "some stations were shirking their civic duty," until the Air Force liaison officer explained that authorities do not want *all* stations in CONELRAD, but only a selected group.)

The public who tuned into the broadcasts all over the nation during the wee hours of the September morn were a little disappointed, perhaps. There was no drama a la Orsen Welles. Some listeners expected programming to be up to commercial standards, not realizing that reduced power and navigation deception were involved in this strictly "technical" test.

The FCC had about 2,000 technical ground observers throughout the country to determine the effect of ground coverage. The Air Force assigned 20 bombers, flying individual missions, to determine the navigational deception of the cluster-casts. Loud speakers were installed in the cabin of the press plane to demonstrate the garbled reception which resulted from receiving two or more clusters of CD programming at flying heights.

CONELRAD Problems Still Unsolved

● "A man has to be on hand at all times to handle any emergency at the transmitter." We have that on the good authority of an FCC official witnessing the September 16 test. With enemy bombers or missiles approaching, it wouldn't be snuff for something to go wrong at the transmitter, with the station remaining on regular power and frequency. The IBEW has constantly reminded the FCC of this fact, in an effort to combat managements' determination to operate remote-controlled transmitters and eliminate first-class operators from station staffs. But to date, the FCC has turned its back on this significant fact.

● The September 16 test was one of a series to check the effectiveness of CONELRAD by uncovering the weak points in the nationwide "net." Previous tests, on a more confined scale, had failed to reveal technical flaws, but it did show that in some parts of the nation, particularly in rural areas not enough stations are taking part in CONELRAD to make it fully effective as a defense plan. More stations for the 1240 band are particularly needed.

● The three agencies concerned still have not had an all-out dress rehearsal of CONELRAD. Perhaps the troubles resulting from the "Men from Mars" broadcast so many years ago deters them. Public consciousness of CONELRAD cannot be accomplished while non-participating stations are allowed to remain on the air during a test.

● The public must get a calm awareness of the whole Civil Defense picture. Displays such as the one shown at right are helpful, but they are sketchy and cannot tell the full defense story.

Two views of a window display recently installed in a street window by the Pennsylvania Electric Company of Altoona, Pennsylvania.

WOR Strike Ends!

By RAYMOND A. WOOD
President, Local Union 1212

Agreement runs for a year and nine months and shows improvement in some 33 items. Dual operation prohibited; Local votes unanimously to accept no wage increase for first nine months and $2.50 across the board for the remaining year of the contract. Reduction in escalator and upgrading brings immediate increases to some groups at the station.

ALMOST six weeks to the hour from the start of the strike action by Local 1212 against WOR and WOR-TV, a new agreement was signed by Charles A. Calame, business manager of Local 1212, and General Teleradio, Inc., which owns the struck properties.

The new agreement runs for a period of a year and nine months, with its next anniversary date being July 1, 1955. The agreement shows improvement in some thirty-three items, with dual operation eliminated, interchangeability of sound effects engineers penalized whenever sound effects men are assigned to do sound effects and to any other technical duties the same day. Penalty invoked is that they must be paid at double time rate for each such entire day.

Faced with a choice of three possible arrangements with respect to dual operations in relation to other features of the proposal, the WOR shop in order to abolish dual operation, voted unanimously to accept a wage structure which gives no wage increase for the first nine months of the agreement, and $2.50 across the board for the remaining year of the contract. After this had been voted by the shop, negotiators for the Local Union were able to include in the final package a reduction of the escalator from five years to four and one-half years for the first nine months, and four years for the balance of the contract term. This results in immediate increases to some groups, such as the men now in the four to four and a half year bracket, who will now not have to wait another six months for their next anniversary increase. Technical directors and master control engineers are now rated as Assistant Supervisors, which means a pay increase of $7 per week for about a dozen men.

The contract may now be reopened for changes under new language, and features language adequately covering work done for Mutual Broadcasting System, Inc. Acceptance of overtime assignment is recognized as being voluntary with the exception of those situations where it is obviously necessary for engineers to finish assignments already in process of completion. Scheduled overtime cannot be cancelled on less than 24 hours notice and cannot be cancelled at all if on a day off.

Any engineer working away from home now will get paid for eight hours on each of his days off away from home. If he works on his day off while away from home (traveling) he will be paid at time and one-half for a minimum of four hours and at straight time

Continued on page 14

September 24th, 1953.

IBEW, Local 1212
11 West 42nd St.
New York, N. Y.

Brothers:

We, of Local No. 794, IATSE, realize that at this time the burden to the strike bound WOR members of 1212 IBEW must seem insurmountable. Therefore, at a recent meeting, our local voted unanimously to offer a token of five hundred dollars ($500) in order that the situation be slightly alleviated.

A further individual collection will be forthcoming very shortly.

In the meantime, we sincerely hope that your woes will soon be terminated and that all brother unions will in the future work vigorously to solidify the position of labor in the broadcasting field.

Fraternally yours,
/s/ Philip Tantillo,
President.

Local 1212 engineers of WOR received financial support from Local 794 of the International Alliance of Theatrical Stage Employes, and Moving Picture Operators of the United States and Canada. This Manhattan local is composed of television broadcasting engineers.

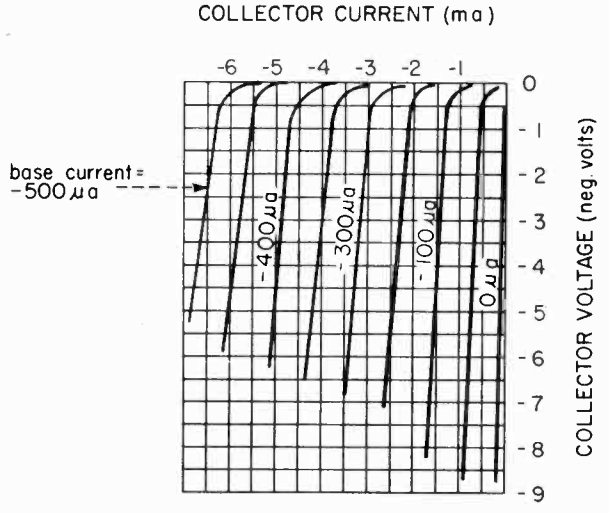
Junction Triode Circuits, Cascaded Amplifiers, Transistor Oscillator Circuits, and Much More Are Herein Discussed

Junction Transistor Circuits

By the Engineering Department, Aerovox Corporation

EDITOR'S NOTE: *The increasing availability, coupled with decreasing prices, has contributed to a spurt in interest of experimenters and amateurs in the field of the application of transistors. Various publications have incorporated articles in previous issues, but most such writings have been on a plane just a little above that which interest the average radioman.*

In the hope that our readers will appreciate a simple and straightforward explanation of the operation and application of transistors, we have received permission of the Aerovox Corporation to reprint parts of an article which appeared in a recent issue of the "Research Worker." We acknowledge, with thanks, the permission so kindly granted. With research work in progress, attempting to MINIATURIZE television equipment, we feel that a basic understanding of transistor operation will be of special interest to readers of the TECHNICIAN-ENGINEER.



TYPICAL COLLECTOR CHARACTERISTICS OF CK722 TRANSISTOR

FIGURE 1

CK722 OPERATING DATA

Absolute Maximum Ratings

Collector Voltage (V^c)	—20 volts
Collector Current (I^c)	—5 ma.
Collector Dissipation	30 mw. at 30° C.
Emitter Current (I^e)	5 ma.
Ambient Temperature	50° C.

Typical Grounded-Emitter Amplifier Characteristics

Collector Voltage (V^c)	—1.5 volt
Collector Current (I^c)	—0.5 ma.
Base Current	—20 ua.
Current Amplification Factor (beta*)	12
Power Gain	1000 (30 db.) Source 1000 ohms; Load 20,000 ohms.
Noise Factor	22 db. at 1000 cycles

* This rating applies only to the grounded-emitter circuit. The current amplification factor *alpha* for the grounded-base connection is, of course, less than 1 for the junction transistor.

Figure 2

THE circuits included here have been made to work satisfactorily and can be duplicated. It should be borne in mind, however, that these circuits satisfied one set of typical conditions and do not necessarily represent the best or only way of applying the transistor for the purpose intended. Considerable flexibility in individual design is possible. In addition, some readjustment of constants may be required when transistors of various manufacturers are used. The circuits described are intended especially for junction-type transistors and some of them often will not operate equally well with point-contact triodes. In presenting this material, we feel that it will be invaluable in guiding the newcomer to transistor circuitry and will be of provocative importance as well.

Several characteristics of the junction transistor distinguish it from the point-contact type. One of the most important of these is the increased ruggedness of the junction type. In the junction transistor, the three con-

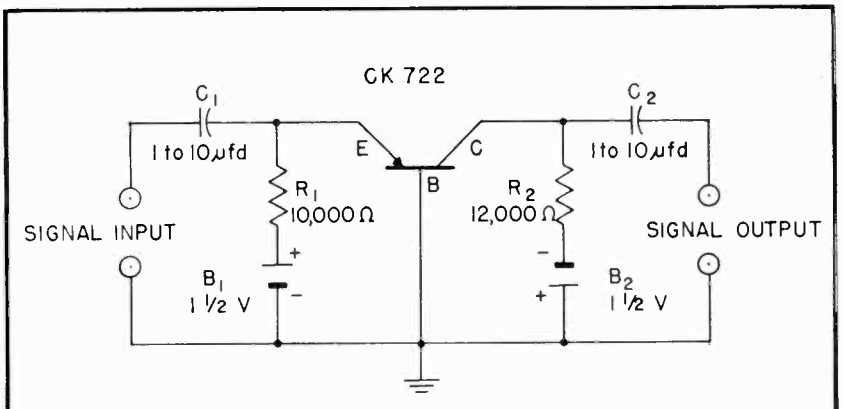
duction layers (P, N, and P in the case of the CK722) are parts of the same germanium wafer. There accordingly are no whiskers or sandwich sections which might be displaced accidentally.

A dramatic property of the junction transistor is its high efficiency and its ability to operate at very low values of applied d.c. voltage. A class "A" amplifier using a junction type, for example, will operate close to the theoretical 50% efficiency point, as compared with a vacuum-tube amplifier giving 25 to 30 per cent. Practical amplifiers and oscillators can be operated from a single 1½-volt cell with current drains so low that in some arrangements the cell will give shelf life. Audio oscillators can be made to operate at such low d.c. levels that, in demonstrations, the "power supply" current has been furnished by a self-generating photocell, thermocouple, or makeshift wet cell made from two coins separated by a piece of paper moistened with saliva.

The temperature sensitivity of the junction transistor makes the latter somewhat poorer than the point-contact type, but the junction type is not as noisy. The maximum ambient temperature allowed for the CK722 is 50°C. The 1000-cycle noise factor is 22 db. (Compare the noise factor of 65 db. which is given for the CK-716 point-contact transistor).

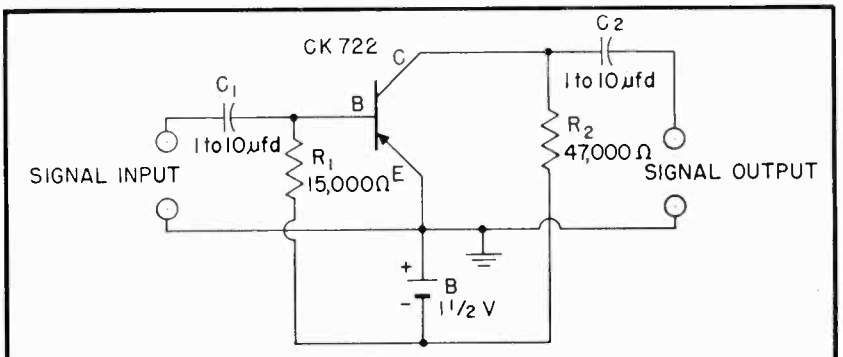
Frequency response of the junction transistor appears to be lower than that of the point-contact type and is limited by such factors as the increased capacitance of the junction layers and the differences in mobility of the carriers. Our tests indicate that the CK722 is suited particularly to audio and *low-frequency* r. f. applications, of which there are many in each category. As a radio-frequency oscillator, this unit has given good performance in our circuits as high as the upper limit of the standard broadcast band, but beyond that point its operation has not been encouraging.

Figure 1 shows a family of collector current-vs-collector voltage curves for the CK722. These curves are plotted for eight values of constant base current (0, 50, 100, 200, 300, 350, 400, 450, and 500 microamperes). Note that these curves have the general appearance of pentode vacuum-tube curves. The collector voltage (V^c) values are negative. The corresponding collector currents (I^c) also are designated as negative.



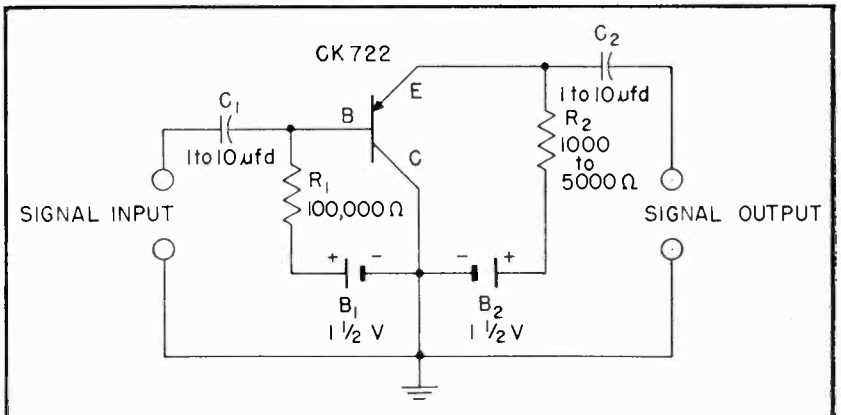
SINGLE-STAGE GROUNDED-BASE AMPLIFIER

FIGURE 3



SINGLE-STAGE GROUNDED-EMITTER AMPLIFIER

FIGURE 4



SINGLE-STAGE GROUNDED-COLLECTOR AMPLIFIER

FIGURE 5

The Table in Figure 2 lists important operating data for the CK722. One listing is apt to confuse the reader who has had some prior contact with transistor literature. This is the current amplification factor, always mentioned as less than unity for junction transistors, which is given here as 12. The reason for this higher figure is that the factor given in Figure 2 is not *alpha* (which is less than 1) but *beta* which applies only to the grounded-emitter (base-input) operation shown. Beta (b) is related to alpha (a) approximately as follows: $b = 1/(1-a)$.

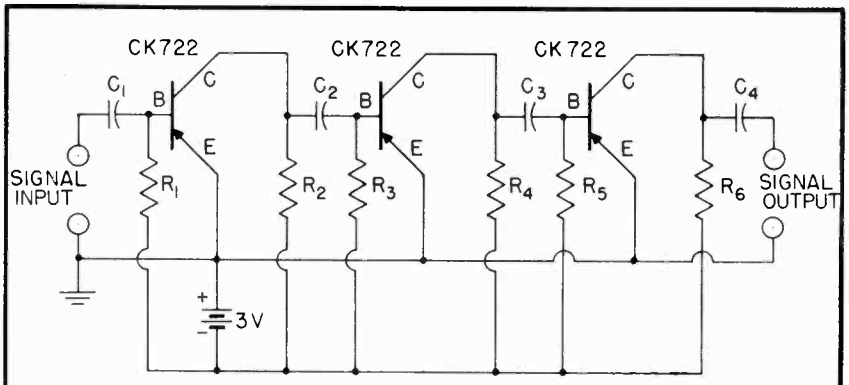
Junction Triode Circuits

Figures 3 to 9 show several selected amplifier and oscillator circuits. Additional circuits will be described in a forthcoming issue of the *Research Worker*. These preliminary circuits can serve as building blocks for more complex equipment. Note that each of these arrangements uses the low d. c. voltages at which the junction transistor is capable of operating.

Single Amplifier Stages. Figure 3 is a resistance-coupled, grounded-base audio amplifier circuit. The grounded-base arrangement is the progenitor of all transistor circuits.

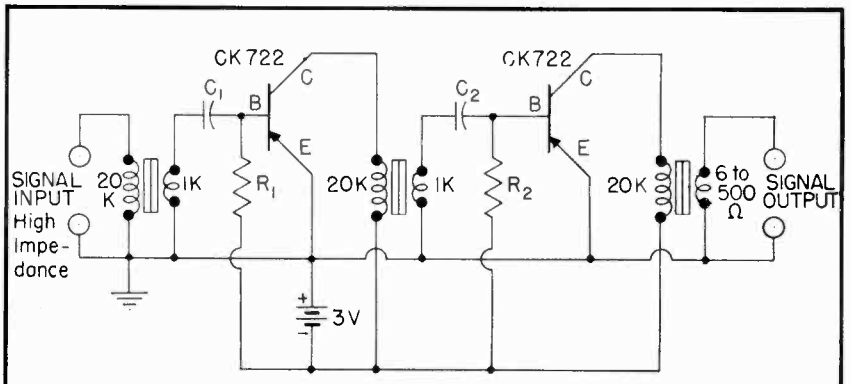
The grounded-base circuit has an input impedance of approximately 1000 ohms and an output impedance of 5000 to 10,000 ohms, depending upon individual transistor collector characteristics. Higher operating impedances are possible in the output with higher R_2 values, but with somewhat reduced gain. Operating into a high-impedance load (100,000 ohms or higher), this stage, as shown, has a voltage gain of 40, although the gain may vary between 36 and 44 with individual transistors. At lower load resistance values, the gain drops proportionately.

With 1-microfarad input and output capacitors (C_1 and C_2), the frequency response is such that the gain at 100 cycles is 25% of the 1000-cycle value, and at 20,000 cycles is 92% of the 1000-cycle value. With 10-microfarad capacitors, the 20-cycle gain is 67% of the 1000-cycle value, and the 20,000-cycle gain 98% of the 1000-cycle value. Miniature, low-voltage electrolytic coupling capacitors may be used for the high values.



3-STAGE RESISTANCE-COUPLED, GROUNDED-EMITTER AMPLIFIER

FIGURE 6



2-STAGE TRANSFORMER-COUPLED, GROUNDED-EMITTER AMPLIFIER

FIGURE 7

Because the grounded-base amplifier requires two batteries, there is some objection to its use. Current drain of the emitter battery is 150 microamperes, and of the collector battery 100 ua. The grounded-base amplifier offers the maximum power gain possible with a given transistor.

Figure 4 shows a grounded-emitter amplifier. An important advantage of this circuit is its ability to operate with a single battery at a drain of 10 to 80 microamperes, depending upon the individual transistor employed. Input impedance is of the order of 1000 ohms; output impedance 20,000 to 40,000 ohms. Higher output impedance values are possible with higher values of R_2 but with reduced gain.

With the constants given in Figure 4, voltage gain of this stage is 40 to 50 when B is 1½ volt, and 80 to 100 when B is 3 volts. These gains are obtained only when the stage is worked into a high load impedance (100,000 ohms or higher).

Frequency response is the same as that quoted for the grounded-base amplifier in the foregoing paragraphs.

Figure 5 shows a grounded-collector amplifier. This circuit has high input impedance (of the order of 50,000 ohms) and low output impedance, 1000 ohms. It thus is equivalent to the cathode-follower vacuum-tube amplifier. Like the cathode follower, the grounded-collector circuit provides no voltage gain ("gain" of the stage shown in Figure 5 is 0.2 to 0.3). It does afford power gain, however, of the order of 15. The frequency response of this stage is the same as that stated earlier for the grounded-base circuit.

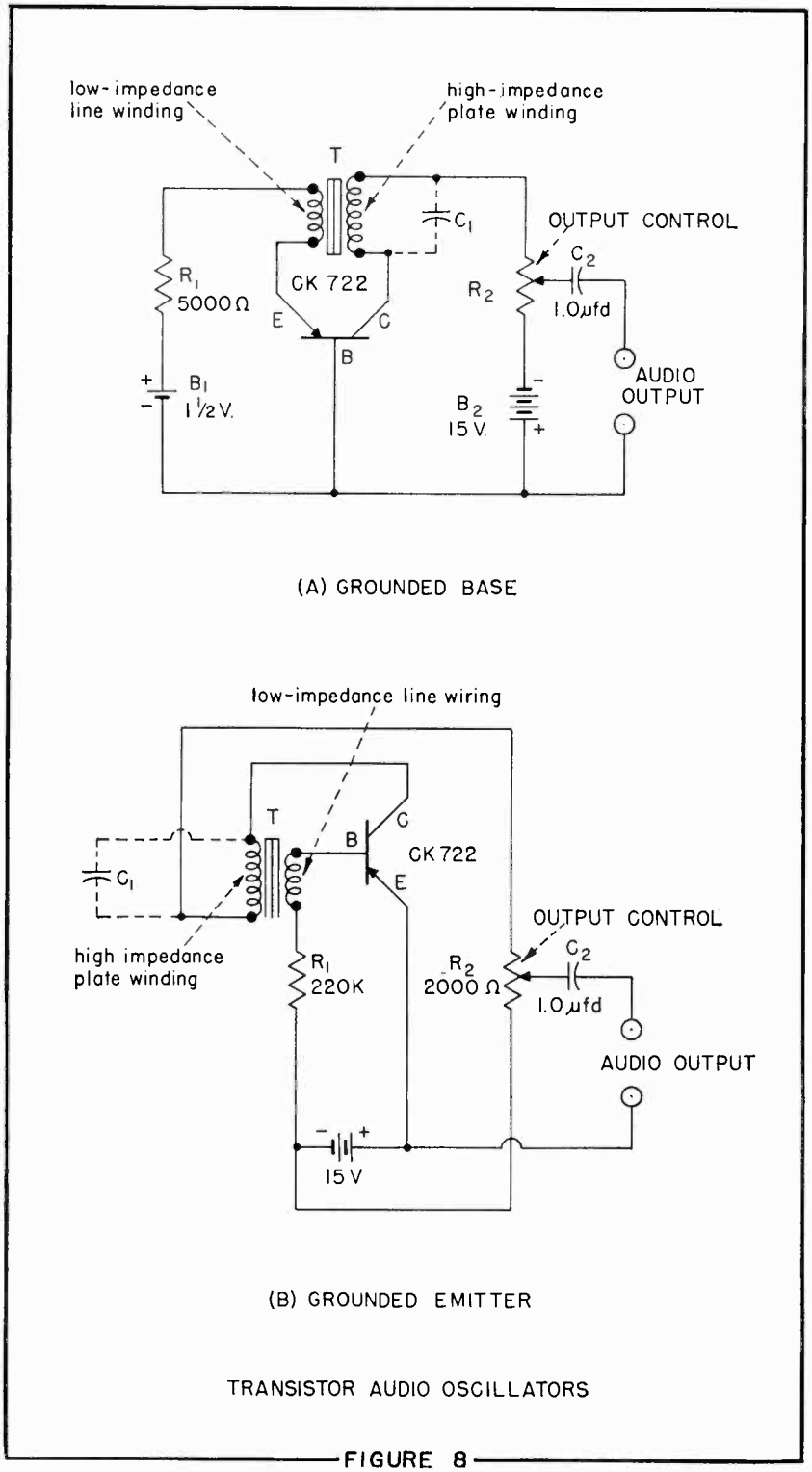


FIGURE 8

A slight disadvantage of the grounded-collector type of circuit is its requirement of two batteries (B_1 and B_2). But its relatively high input impedance suits it very well to use as the input stage of a transistor amplifier whenever the loss in voltage gain is of no consequence.

We did not discover that bypassing either of the power supplies in any of the circuits shown offered improvement in performance at any frequency between 20 cycles and 20 kc.

Cascaded Amplifiers

The circuits given in Figures 3 to 5 are fundamental building blocks. Like tube circuits, transistor amplifier stages may be cascaded for increased voltage gain and power gain. The difference with transistors, however, rests in the fact that in grounded-base and grounded-emitter stages, the output impedance is higher than the input impedance. This requires an impedance stepdown between stages. While resistance coupling may be employed as well as transformer coupling between stages, the greater power gain will be obtained with interstage transformer coupling, since the latter has the lower stepdown ratio and offers best power transfer. In resistance coupling, at least one additional transistor stage usually is necessary to provide the same overall power gain afforded by transformer coupling.

Figure 6 shows one method of resistance-coupling three junction transistor stages. Overall power gain is approximately 60 db. Collector resistors R_2, R_4, and R_6 each is 20,000 ohms. Base resistors R_1, R_3, and R_5 each is 150,000 ohms. For best results, each of these resistors should be adjusted carefully for the best gain and lowest noise output with the individual transistors used. Capacitors C_1, C_2, C_3, and C_4 each is 10 microfarads. This amplifier will deliver approximately 2½ milliwatts output to a high-impedance load. A 1000- or 2000-ohm headphone may be connected in place of R_6 and C_4 to obtain approximately the same output in such applications as hearing aids, pocket radio receivers, etc.

Figure 7 shows a transformer-coupled 2-stage transistor amplifier. This unit has an overall power gain of approximately 50 db. The interstage transformers have primary impedances of 20,000 ohms each, and secondary impedances of 1000 ohms each. For experimental setups, good results can be obtained with carbon-microphone transformers connected backward. The output transformer has a 20,000-ohm primary. Its secondary may have the proper value required to match a small loudspeaker, headphones, line, or other device. If desired, a 1000- or 2000-ohm headphone may be connected in place of the primary of the output transformer, T_3. Suitable subminiature trans-

formers for use in the transistor amplifier intended for hearing aids, pocket receivers, are available at most parts distributors. A high-impedance crystal microphone may be coupled into the first transistor by using a 200,000- to 1000-ohm input transformer at T_1.

In Figure 7, capacitors C_1 and C_2 each is 10 microfarads. Resistors R_1 and R_2 each is 150,000 ohms.

Using the fundamental building blocks, a number of combinations of cascaded amplifier stages is possible to suit individual requirements. For example; grounded-base, grounded-emitter, grounded-collector, resistance-coupled, and transformer-coupled stages may be combined, as needed.

Transistor Oscillator Circuits

The CK722 junction transistor appears to oscillate most readily in an inductive-feedback type of circuit. Figure 8 shows two audio-frequency oscillators employing this principle. Figure 9 is a radio frequency oscillator employing inductive ("tickler") feedback.

Audio transformers are used in Figure 8 (A) and 8 (B). In each instance, the high-impedance winding is connected to the collector. A satisfactory transformer is the type used to couple a single triode plate to 500- or 600-ohm line. Satisfactory results may be obtained also with a carbon-microphone transformer. The transformer must be phased properly for oscillation. If oscillation is not obtained immediately upon application of battery voltage, reverse the connections of *either* the primary or secondary. With a microphone transformer at T in each circuit, a 700-cycle signal was generated. The "natural" frequency will depend upon the inductance of the windings and their distributed capacitance, and may be lowered by means of capacitors connected at C_1.

Figure 8 (A) shows a grounded-base oscillator; Figure 8 (B) a grounded-emitter oscillator circuit. The first circuit requires two batteries but is somewhat less temperature-sensitive than the second.

An experimental radio frequency oscillator was built, using a CK722; the highest operating frequency was found to be 1500 kc. No frequency data has been available for this transistor. Tight coupling was employed, with the coil on the base side being wound on the top of the coil on the collector side. The output coupling coil was wound on the same form, close to the collector side coil. It was found that by making coil sets plug-in, frequency bands between 50 and 1500 kc could be covered.

A good broadcast band oscillator may be made with the collector coil being a 540-1750 kc antenna coil. The output coil is used as is normal; the slip-on primary normally supplied. The base coil would consist of approximately 75 turns of No. 30 enameled wire close wound on top of the coil connected to the collector and insulated with scotch tape. The tuning capacitor is the usual 365-uufd condenser.

3-D to TV, or Flying Tomahawks in the Living Room

THE Twentieth Century version of Alice's trip through the looking glass—better known as 3-D—is now in full speculation through the nation's movie theaters, comic books, and display advertisements.

In time, it seems that even the picture tube in the family video receiver will be affected. Infants will be trying to break the viewing screen with their blocks to get at the ice cream commercial. Thirsty fight fans will be frothing at the mouth as announcers thrust tantalizing mirages of beer toward their easy chairs after each round. Mothers will be climbing behind TV sets to see how Lucy's gown is fitted in the back.

These various results of technical progress are still in two dimensional planning, however, and it will probably be many months before U. S. television viewers need arm themselves against flying tomahawks, charging herds of cattle, and sinister characters with long knives, in their living rooms.

Here is some evidence of how 3-D for TV stands:

• A compatible 3-D system of color television is in the process of development by Allen B. DuMont Labs and may be demonstrated by the end of this year, President Allen DuMont told his stockholders at their recent annual meeting. Although he was optimistic about early development of the DuMont 3-D system, he said that the company is not preparing to put this system forward now.

He said that video pictures could be received in four ways in the company's 3-D system: in black and white, in color, in 3-D color; and in 3-D black and white. He estimated the retail cost of a 17-inch color receiver at $600 to $700, and predicted that a 3-D black-and-white set would be less expensive.

• Meanwhile, British technicians are reported to have developed a three-dimensional system for television which obviates the need for viewers to wear special spectacles, as they now have to do in the movie theaters. British Broadcasting Company officials are said to agree that the invention will work on all existing TV systems, with little of any alteration to existing TV cameras and wave systems, and only a few dollars additional expense to viewers for a small set attachment.

To accomplish the British 3-D, a small scrambling box 18 inches square, carrying a line of six camera lenses across the front, is fixed to the camera. Spaced

2½ inches apart, the average width between human eyes, the lenses converge and focus themselves automatically as human eyes do when the camera is moved nearer the object. A high-speed shutter opens and closes the lenses in rotation, producing more than a hundred complete frames per second. The camera picks up a scrambled picture thrown to a translucent screen at the back of the box and sends the image over the air.

A special screen on the receiver rearranges the picture and sends out to a wide angle for viewers thousands of pairs of parallel pictures, each 2½ inches apart, and the viewer's right and left eyes each receive different images, making polarized or other spectacles unnecessary.

Most known color processes can be used with the system, it has been reported. When a permanent record is needed, a cine-camera is used instead of an electron camera.

• RCA has come out with new portable 16 mm arc projection equipment designed to use three-dimensional motion pictures for business and industry. This RCA development brings to non-theatrical users, for the first time, the advantage of 3-D.

The RCA system consists of two 16 mm portable arc projectors with selsyn interlocking motors for perfect timing of the two images. Polarized glasses are used by the audience.

RCA has not, as yet, announced plans for bringing the third dimension into commercial television.

Broadcast Engineers Still Ask, 'What Are We Waiting For?'

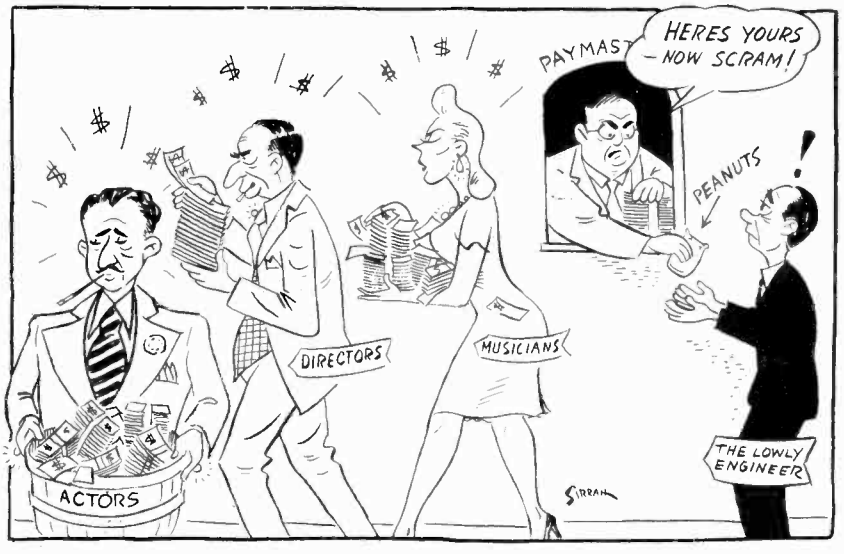
LET'S suppose you're making out pay checks for the personnel involved in a typical half-hour commercial air show.

"Boy, would I like to be in radio!" you mutter enviously as you fill in figures for the director, actors, musicians. Right up there in the surtax brackets, those boys and girls, you tell yourself.

And then you come to the last checks on the list—the engineers'.

You consult your records twice before filling in *that* one. It just doesn't seem possible that you read the amount right. You did, though. So after the name of Joe Doakes, engineer, you write some numbers and decide you're not so bad off, pounding a typewriter in the studio accounting department. For, comparatively speaking, the engineer is the least well-paid participant in radio.

The engineer puts in more time on the show than anyone else. Before anyone else reports in, he has to set up mikes, patch cords, arrange for special effects facilities, and much more. Through the individual script readings he's at his post, through the preliminary rehearsal and the dress rehearsal. After final rehearsal the musical director is almost certain to need him while the music score gets a last-minute going-over. When the show goes on, there's the engineer in the control room, observing, listening, gauging, just as does the director, and, in addition, manipulating his equipment with split-second accuracy. Suppose this show calls for six mikes and a couple of special effects. With the master pot, that gives the engineer around seven to 10 pots and accompanying switches to handle, along with everything else, not to mention the VU meter. And what does he get for this work that has lasted longer than anyone else's, required technical training and experience no one else need possess, combined this technical skill with the director's "feel" which has enabled him to control every note, every inflection that has gone out over the air? For about seven highly-specialized hours, he's earned less than the bit-part actress who has nothing to say but, "number, pleeuz!" For these reasons, the broadcast engineers still ask, "What are we waiting for? Let's realize our rightful share of the payroll."



Condensed from an article in The Local 1212 News, written by A. W. Landry. The cartoon, right, is from the same publication and is the work of Carl Harris of Local Union 1212.

Reading Time

Home Music Systems, *First Edition, 300 pages. Edward Tatnall Canby. Harper Brothers, New York. $3.95.*

While this book is not necessarily recommended reading for the expert or by the expert who has customers for custom-built installations, it can very well be a Godsend if you've tried to explain high-fidelity to your wife, a neighbor or a friend who looks to you for advice and promptly gets lost in your explanation. On the other hand, if you approach it with an open mind, you may find a few nuggets of information in it and you will probably agree that it fits the need for which it is intended.

Of Mr. Canby's prowess, little need be said. His reputation as a regular contributor to "Audio Engineering" magazine, his candid comments on audiology and his reviews of record releases are well known; he spares no efforts (or words) to be utterly frank and objective. His reference, in this book, to acknowledgment of the layman's lack of experience is well-founded. One gathers that the non-technical reader regards soldering as being in a realm comparable to nuclear research—which is not far from true. Thus he strikes a responsive chord in the minds of such readers. His explanation and praise of Klipsch horns, coaxial speakers; his defense of the costs of good amplifiers, etc., is well-founded and will make good sense to the audiophile of discriminating taste.

It can certainly be said that the A-B-C style of this book, on this subject, has been sorely needed in the rapidly-expanding field of high-fidelity audio. From the technicana of music, through the problems encountered in room acoustics, tuners, turntables, pickups—many will be enlightened by the simple, concise explanations and descriptions.

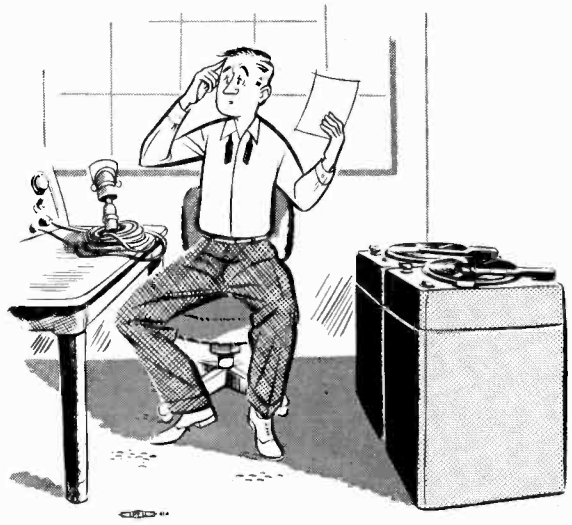
The Director, *a quarterly published by the Radio and Television Directors' Guild, AFL, 114 East 52nd Street, New York 22. $3 a yearly subscription.*

Volume 1 of *The Director* came out in June. It is the first entry of the Radio and Television Directors' Guild in the publication field. A quarterly, of 36 pages, it hopes to print "many and constructive viewpoints concerning the radio and television industry."

It is not an internal union publication, in the sense that we usually consider one. It doesn't contain, for instance, announcements of meetings, conventions, or official union business. Instead, its first issue is made up wholly of five articles by leading directors, floor managers, etc., in the field. For example, there is an article entitled, "Breaking the Cost Barrier," by Worthington Miner, producer of such shows as "Toast of the Town," "Studio One," "The Goldbergs." Gordon Auchincloss has a feature entitled "The Tape Worm's Primer," telling of the problems of the tape recording engineer.

The Editorial Board of *The Director* is composed of Walter Gorman, Joseph Dackow, Joe Papp, Franklin Schaffner, and Frances Buss.

One Moment Please



Engineers at WAPX, Montgomery, Ala., are having to stretch their lone kilowatt more than a hundred miles to please an earnest listener in Lumber City, Ga.

Owen A. Lehr of IBEW Local 1299, Montgomery, sends in the following message from this listener received by APX's "Gospel Song Parade":

Dear Sir:

As I failed to hear the songs I wrote you to play on your Monday program, will you please play "Talk About Jesus" by the Oak Ridge Quartet or "Rock of Ages" and "One of These Mornings" by the Statesmen. Please get the record player as close to the mike as possible. Play these songs for my daughter. ———, who has the flu.

EDITOR'S NOTE: Mail your tale of woe to The TECHNICIAN-ENGINEER, International Brotherhood of Electrical Workers, 1200 Fifteenth Street, N. W., Washington, D. C.

Television Terminology, Bibliography, *compiled by Benjamin Draper, California Academy of Science, San Francisco 18. 57 pp. $1.*

More than 400 words used in the television industry are listed and explained in this paper-bound mimeographed booklet. More than 300 books concerning television are also listed—all major books on TV since 1928, says Benjamin Draper, executive producer of the Academy of Science's program "Science in Action."

WOR Strike Ends

Continued from page 6

for the balance of the eight hours, whether worked or not.

Further improvements have been achieved in both language and benefits in such areas as: vacations, no timing of programs or other production work, auto mileage increased to 12 cents per mile, engineers to be under authority of Engineering Department only, and elimination of two job groupings—"Boom and Dolly Men" and "Construction." Boom and Dolly men formerly had separate seniority.

Retroactivity was sacrificed in favor of other features. The men, with the exception of those summer replacement men who would have been laid off in any event, and those men who had been assigned to the 67th Street TV Center, will be back on their jobs as of Tuesday, September twenty-ninth at the start of the broadcast day. Those TV men displaced as the result of closing down WOR-TV will be given a rehiring date within thirty days of the date of the agreement or will be paid severance pay under the agreement.

This delay in rehiring some members of the shop will be resolved as soon as the work in progress at Empire State nears completion. Work there had been halted by Local 3 and the Ironworkers, Plasterers, Painters and Carpenters had also walked off the job when the strike began.

The terms of the settlement also protect those members of other Unions who honored our picket lines and contributed so much to the men of Local 1212 who manned the picket lines. This has been another reminder of the strength inherent in the practice of true Union principles. IBEW picket lines were augmented from time to time by volunteers from other unions, such as the Radio Officers Union and many interested individuals. Financial contributions were offered by many announcers and artists, and a check for $500 was received from Local 794, IATSE, which has contracts with the DuMont Network.

IN MEMORIAM

W. L. INGRAM, (1893-1953)
Vice President, 7th District

The members and staff of the Brotherhood extend their sympathy to the family and associates of Brother Ingram, who passed away on September 21, 1953, as the result of a heart attack.

September 21, 1953

Dear Sir:

I have just finished reading the September issue of Technician-Engineer paying particular attention to the article on the Strike at WOR. In an otherwise excellent article you have made an error in reporting, which I wish you would correct in your next issue.

DuMont management did attempt to secure an injunction against Local 1212 to prevent picketing at Ebbets Field. I defeated their first attempt on technical grounds. On the second try I was all set to argue the motion when, for reasons best known to themselves, electricians belonging to Local 3, supplied power to WABD's technicians enabling them to telecast the game. Accordingly, DuMont withdrew its motion and the right to enjoin us was never tested in court.

Yours truly,
ROBERT SILAGI,
Counsel to Local
1212, IBEW

Page 1
Form 3526
Rev. 8-48

Read the instructions on page 2 of this form.

STATEMENT REQUIRED BY THE ACT OF AUGUST 24, 1912, AS AMENDED BY THE ACTS OF MARCH 3, 1933, AND JULY 2, 1946 (Title 39, United States Code, Section 233) SHOWING THE OWNERSHIP, MANAGEMENT, AND CIRCULATION OF

Radio, TV and Recording Technician-Engineer (Insert exact title of publication) published Monthly (State exact frequency of issue)

at Washington, D. C. (Name of post office and State where publication has second-class entry) for October 19 53

1. The names and addresses of the publisher, editor, managing editor, and business managers are:

	Name	Address
Publisher	Int'l. Bro. of Electrical Workers	1200 15th Street, N. W.
Editor	Albert O. Hardy	1200 15th Street, N. W.
Managing editor	None	
Business manager	None	

2. The owner is: (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding 1 percent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a partnership or other unincorporated firm, its name and address, as well as that of each individual member, must be given.)

Name	Address
International Brotherhood of Electrical Workers (an unincorporated labor organization).	1200 15th Street, N. W. Washington 5, D. C.

3. The known bondholders, mortgagees, and other security holders owning or holding 1 percent or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state.)

Name	Address
None	

4. Paragraphs 2 and 3 include, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting; also the statements in the two paragraphs show the affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner.

5. The average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the 12 months preceding the date shown above was: (This information is required from daily, weekly, semiweekly, and triweekly newspapers only.)

Albert O. Hardy
(Signature of editor, publisher, business manager, or owner)

Sworn to and subscribed before me this 17th day of September 19 53

[SEAL]

Lawrence Timberly

(My commission expires 19)

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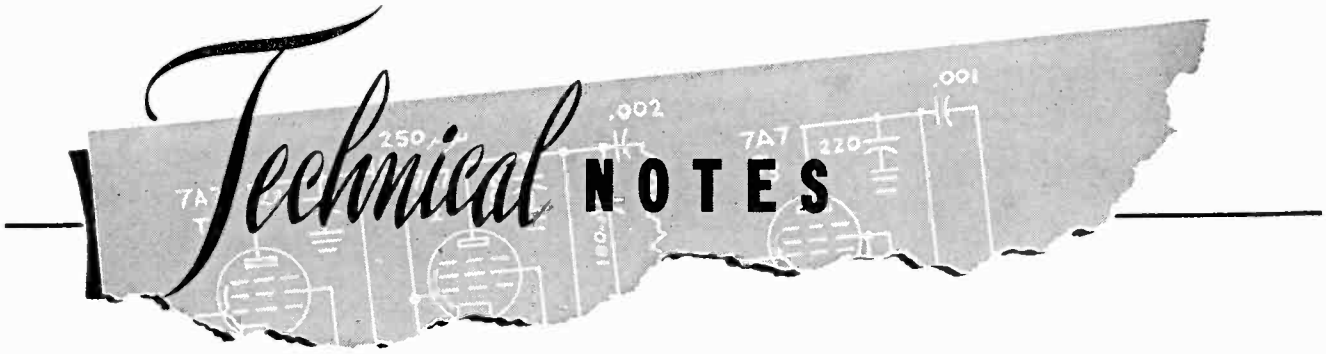

Ingot Process for Transistors

Mass production of transistors may be just in the offing, with a resulting nose dive in costs of this revolutionary item.

Up to the present transistors have cost more than vacuum tubes, the electronic devices they threaten to supersede. Reason for this has been the difficulties which germanium, the basic ingredient, must undergo in production.

But now Dr. Robert N. Hall of GE Laboratories, Schenectady, N. Y., has developed a method whereby as many as 100 wafer-thin layers of specially treated germanium can be produced in a single six-inch ingot. Only one or two layers can be produced by other methods.

Still in the laboratories stages, the process turns out germanium layers mixed with a trace of gallium. These layers are separated by thicker regions of germanium containing antimony.

One section of the gallium-doped layer in each transistor does the work of the grid in a vacuum tube, Dr. Hall explains. The antimony-doped layers take the place of the cathode and plate in a tube.

Dual-Disc Slide Projector

Another item of studio equipment has been announced by RCA—a dual-disc slide projector. The new projector (RCA Type TP-3A) allows the uninterrupted presentation of either glass or cardboard mounted two-inch square slides. Push-button controls permit remote operation from the audio-video console. The projector has a 150-watt lamp, two five-inch lenses, and two slide turrets which are operated by individual motors. It can be mounted on the conventional RCA multiplexer stand if desired.

Phonograph 'Speedometer'

Zenith Radio Corporation has introduced a new high-fidelity Cobra-Matic record player with a built-in stroboscope or "speedometer" that permits visual adjustment of the turntable to play all makes of phonograph records at the precise speed at which they were recorded.

The new Cobra-Matic will be available on various Zenith high-fidelity radio-phonograph combinations, and on a number of TV models. These are the first phonographs for the home equipped with a positive, visual "speed check" and regulator comparable with equipment used in master recording studios.

"For perfect reproduction, phonograph records must be played at the exact speed they were recorded," says Zenith. "A variation of only one revolution per minute from recorded speed will make an LP record sharp or flat by a full quarter tone, and cause unwelcome changes in tempo and timbre."

A row of dots on the stroboscope indicator appears to stand still when synchronization is perfect. Any variation starts the dots moving—to the left, if the turntable is revolving too slowly; to the right, if too fast. Error can be spotted at once and corrected with a touch of the speed control. Played right on the dot, each record is reproduced exactly as recorded, with the range of highs, lows, and overtones.

The Cobra-Matic can be regulated to any speed from 10 to 85 r.p.m. including the new talking book speed of 16⅔ r.p.m.

New Receiving Tube

A new metal-and-ceramic receiving tube, with a noise figure of 8.5 decibels or better and a power gain of 16 decibels at 1200 megacycles, was displayed at the National Electronics Conference by the General Electric Tube Department.

Grady L. Roark, marketing manager for the Tube Department, said the tube, type GL-6299, was developed to offer a solution to some of the military U-H-F designer's high noise-level problems in lower frequency radar equipment.

The new tube is a co-planar triode designed specifically for use as a low-level Class A R-F amplifier operating at frequencies as high as 3000 megacycles. It is one inch long, weighs one-sixth ounce, and is gold-plated to improve conductivity and resist corrosion.

The new tube was conceived at the G-E Research Laboratory and put into production by Tube Department engineers.

Station Breaks

AFL Convention Covered

Members of Local 1217 employed at St. Louis, Mo., station KWK ran lines into the Hotel Jefferson, last month, for any on-the-spot coverage of the AFL Convention. Newsreel coverage of the big annual get-together of American labor was good throughout the convention, as the Federation expelled the Longshoremen and extended plans for unity talks with the CIO.

Address Corrections

Last month, the TECHNICIAN-ENGINEER published its annual directory of IBEW locals with broadcasting members. Please make the following corrections in that listing:

C. J. Kiedinger, Business Manager, Local Union 676, is at 114 East Gregory Street, Pensacola, Fla. Telephone 6978.

Charles Byers, Business Manager of Local 768, is at 761 Sixth Avenue, Kalispell, Mont. Telephone 6255.

Glenn Barrett, Business Manager of Local 575, is at 1215 Fourth Street, Portsmouth, Ohio. Telephone 34381.

Wm. A. Cooper, Business Manager of Local 624, P. O. Box 678, Panama City, Fla. Telephone 4761.

Scratch Local 1216 of Minneapolis, Minn., and substitute Joseph F. Krech, Business Manager of Local 292, 243 Foshay Tower, Minneapolis 2, Minn. Telephone Main-0552.

Cost of Car Operation

The October issue of the *Reader's Digest* contains a condensed version of an article which appeared in *Changing Times,* The Kiplinger Magazine, and which should be of primary interest to engineers using their cars at work. IBEW locals are concerned with transportation costs from time to time in contract discussions. We suggest you read the article, which appears on page 10 of the *Reader's Digest.* The article is entitled "How Much Does It Cost to Run Your Car?". You'll find that your car is sometimes a costly vehicle.

Color Demonstration

The FCC announced the first official demonstration of a new color television system will be held in the New York City area October 15.

The FCC approved arrangements proposed by the National Television System Committee which developed the new system. The FCC now is considering whether to approve the NTSC Standards, which would permit present TV sets to receive color telecasts in black and white.

The exact site for the demonstration will be announced. The NTSC suggested some place on Long Island, possibly the Homestead Hotel at Kew Gardens. The demonstration will last from noon to 1:45 p. m.

New Long Wave 'Voice'

The U. S. Information Agency announced that a new long wave Voice of America transmitter is beaming radio programs behind the Iron Curtain.

The new transmitter, located in Munich, uses one of the frequencies employed by Radio Moscow. Theodore C. Streibert, director of the Information Agency, said the new transmitter "has materially reduced the effective coverage of Western Europe and satellite countries by Soviet broadcasts."

Besides reaching Soviet satellites, the new Voice transmitter also beams broadcasts to parts of Germany, Austria and Yugoslavia. It carries seven hours and 15 minutes of broadcasts daily in 11 languages.

The new station will be operated by 13 American engineers and technicians and 30 local employes. The estimated annual cost of operation is about $400,000.

The Free Rider's Creed

The Dues-Paying Member is My Shepherd; I shall not want.
He provideth me with paid holidays and vacations so I may continue to lie down, idle, in green pastures beside the still waters.
He restoreth my back pay.
He guideth my welfare without cost to me.
Yes, though I alibi and pay no dues from year to year, I fear no evil, for he pays my way and protecteth me.
The working conditions he provideth, they comfort me.
He annointeth my head with the oil of seniority.
He fighteth my battles for pay raises.
Yes, my cup runneth over with benefits.
Surely, his goodness and Union Spirit will follow me all the days of my life, free of cost.
And I shall dwell in the Union House that he hath built forever, and allow him to pay the bill.