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Photo: Dr. Harry F. Olson, world renowned acoustic authority of RCA Laboratories holds new 15 in. duo-cone loudspeaker which incorporates some of his many audio engineering achievements. Speaker will be on display at the Audio Fair in New York City October 27-29

October • 1949

CALDWELL-CLEMENTS, INC.

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NOW BRINGS YOU

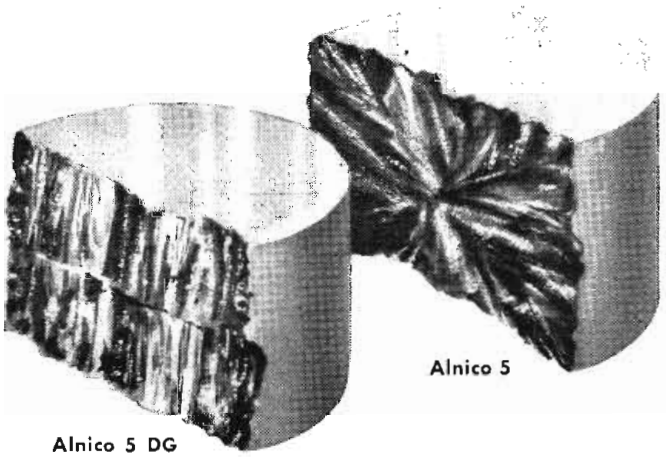
2 OUTSTANDING IMPROVEMENTS IN PERMANENT-MAGNET MATERIALS

ALNICO 5 DG

Now—the G-E Alnico 5 DG permanent magnet offers manufacturers greater available energy than ever before! Results of the continuing program of G-E research and development—a change in the manufacturing process which aligns the crystal structure of the magnet in the direction of magnetization—have been incorporated in the product of Alnico 5 DG.

Available in cast form, Alnico 5 DG now offers manufacturers additional advantages: Use of smaller magnets to do the same job; reduction in the size of magnetic frame, with a corresponding reduction in costs; reduction in equipment weight—opening new design possibilities and production savings.

Available from production, cast Alnico 5 DG is ready to provide manufacturers of radio speakers, magnetic separators, meters, instruments, and other industrial products with the greatest external energy and residual induction of any permanent magnetic material known today.



Alnico 5

Alnico 5 DG

Considerably smaller, this Alnico 5 DG permanent magnet has the same energy value as the Alnico 5. Note the directional grain growth which gives a higher energy value than can be obtained in the same size, random-crystal structure Alnico 5.

AND NEW ALNICO 7

Here is a new permanent magnet specifically developed by G. E. for applications where a high demagnetization force is present. In such applications as motors, generators, and variable air gap devices, new Alnico 7 shows a higher coercive force than any other grade of Alnico.

For more information on these magnets, and others in the G-E permanent magnet line, please write on your company letterhead to Section 50-10, Chemical Department, General Electric Co., Pittsfield, Mass.

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TELE-TECH

TELEVISION • TELECOMMUNICATIONS • RADIO

OCTOBER, 1949

Editorial Contents

CALDWELL-CLEMENTS, INC., Publication Office, Orange, Conn., Editorial and Executive Offices 480 Lexington Avenue, New York 17, N. Y., Tel Plaza 3-1340

Publishers also of RADIO & TELEVISION RETAILING

ELECTRONICS

Designers

A LINE-VOLTAGE STABILIZER

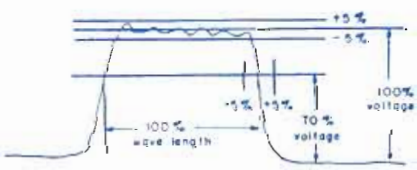
SO SMALL . . .

. . . it mounts on a radio chassis

These 15-, 25-, and 50-va G-E voltage-stabilizer units are only a little over 2 inches high and about 9 inches long. They'll mount easily on a medium-sized radio or electronic instrument chassis and will give you an even, non-fluctuating 115 volts for your equipment whether your line voltage is 95 or 130. A special transformer circuit provides a stabilized output voltage within 1% of 115 volts for fixed, unity-power-factor loads.

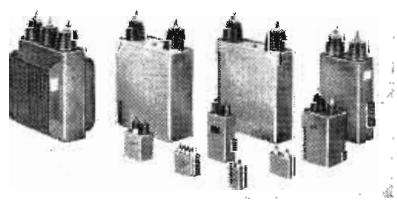
Continuous operation under conditions of short or open circuits will not damage the stabilizer in any way. Since there are no moving parts, there is little maintenance to worry about. For complete information on voltage-stabilizer units of all sizes from 15-va to 5000-va, write for Bulletin GEA-3634.

AN EASY WAY TO PRODUCE SQUARE WAVES



Specially designed G-E Type-E networks will produce impulses which have definite, known energy contents and durations, and thus are ideal for converting a-c or d-c charging voltages into approximately rectangular square waves. These networks consist of capacitor and coil sections adjusted to close tolerances and hermetically sealed in single metal containers.

G.E. helped meet wartime radar demands with thousands of these units and now offers them for commercial use. They are available in a wide range of designs, impedances, ratings, and sizes for pulse lengths of 0.1 to 40 microseconds. See Bulletin GEA-4996.

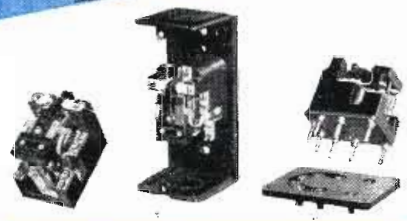


GENERAL ELECTRIC

667-3

Digest

TIMELY HIGHLIGHTS ON G-E COMPONENTS



HEAVY-DUTY RELAYS THAT MOUNT 3 WAYS

This versatile, general-purpose, heavy-duty, a-c relay unit is available in three mounting arrangements: front connected, back connected, or plug-in connected. All three mounting types ate available in open or enclosed models and are furnished in spst, dpst, or dpdt circuits. Heavy, long-lasting silver contacts carry 10 amps continuous. Normally-open forms make or break 45 amps; normally-closed forms make or break 20 amps. Relay coils come in 12-, 24-, 115-, or 230-volt, 60-cycle a-c sizes. D-c units are available in similar models. For full details see GEC-257.

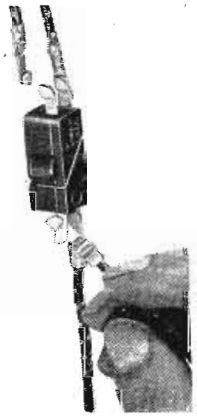
ACCURATE BUT RUGGED

The new, modern-looking, easy-to-read 2½ inch G-E instrument line is improved inside as well as outside. A single, self-contained mechanism supported on an extremely strong Alnico magnet assures permanent alignment even under the most adverse operating conditions. This high-gauss Alnico magnet permits the use of a large air gap with a consequent smoother, non-sticking action. The greater torque-to-weight ratio means better damping and allows the use of heavier vibration-resisting pivots. Accuracy is 5% of full scale on rectifier types, 2% on all others. For complete details, send for Bulletin GEC-368.

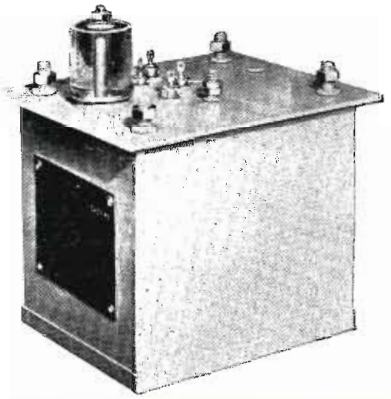
SNAP-SWITCH INSTALLATION TIME CUT TO SECONDS

You'll have a firm electrical connection without the use of solder a few seconds after you begin to install this small but rugged Switchette. Only 1½ inches long and weighing only 9 grams, this 230-vac, 10-amp unit has solderless knife-contact terminals made of pure, tinned copper.

G-E Switchettes are available in a variety of forms and circuits, all of which have double-break contact structures. They're particularly well suited for electronic applications because of their low RF noise output (short contact-bounce).



For your convenience there are screw-terminal and soldering-lug types as well as this special quick-connect unit. Send for Bulletin GEA-4888.



A SMALL PACKAGE OF WELL-REGULATED HIGH VOLTAGE

You get both high voltage and good regulation with small lightweight G-E precision rectifiers. This may interest you if you need compact, well-regulated, high d-c voltage sources for cathode-ray tubes, television camera tubes, radar indicator scopes, electron microscopes, Geiger-Mueller counters, or similar jobs.

These supplies are hermetically sealed and oil-filled. Typical units have outputs of 7 kv at 0.1 ma.—have only 3.5% deviation for every 0.1 ma load and output ripple of less than 1%. Size—only 6" x 6" x 7". Weight—8 lbs. For further data, write: General Electric Company, Section 667-3, Schenectady 5, N. Y., giving complete information on the proposed application with specifications required.

General Electric Company, Section A667-3
Apparatus Department, Schenectady, N. Y.

Please send me the following bulletins:

- ☐ GEA-3634 Voltage stabilizers
- ☐ GEA-4888 Switchettes
- ☐ GEA-4996 Capacitor networks
- ☐ GEC-257 Heavy-duty relays
- ☐ GEC-368 Instruments

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BUSINESS DEPARTMENT
M. H. NEWTON, *Business Manager*
480 Lexington Ave., New York 17, N. Y.
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Do you know

HOW THESE 9 FACTORS AFFECT THE QUALITY OF DISC REPRODUCTION?

1 INTERMODULATION DISTORTION?

Intermodulation distortion—present in many types of record reproducers to a far greater degree than suspected—causes "fuzziness" in reproduction, particularly at the higher frequencies. Low intermodulation distortion is essential for *clean* reproduction.

2 TRANSLATION LOSS?

When record groove velocity decreases (as the stylus moves closer to the center pin) a loss in high frequency reproduction occurs. To keep this "translation loss" to a minimum, stylus tip radius, stylus force and mechanical reactance must be in correct balance.

3 STYLUS FORCE?

While low stylus force is desirable to lengthen life of records, *too* low a force frequently results in inability of the reproducer to track properly at high frequencies. This, in turn, produces high intermodulation distortion. Stylus force should be kept to the lowest value consistent with proper tracking.

4 MECHANICAL IMPEDANCE?

For a given stylus force, low mechanical impedance in the reproducer stylus improves tracking at both low and high frequencies. Both ends of the recorded spectrum are therefore reproduced with less distortion.

5 UNWANTED OUTPUT?

On lateral recordings, the pick-up unit should not reproduce the unwanted vertical output which can result from surface irregularities, turntable vibrations and riding up of stylus on groove walls. Conversely, on vertical recordings, the pick-up unit should not reproduce the unwanted output caused by lateral stylus motion.

6 ARM RESONANCE?

The reproducer arm should not have resonant points within the spectrum of frequencies normally reproduced. If the resonant frequency of the arm is within the range of frequencies on the transcription or record, the resonant vibration of the arm will cause a spurious response.

7 FREQUENCY COMPENSATION?

The reproducing equipment must provide the correct frequency compensation for the recording characteristics most commonly used. Since different recording companies use widely varying characteristics, a correspondingly wide choice of equalization characteristics must be available.

8 SCRATCH EQUALIZATION?

A choice of scratch equalization is also necessary to meet the surface noise conditions of all records. "Rolloff" of reproducing curves must permit maximum scratch reduction while retaining as much as possible of the original material on the record.

9 NOISE PICK-UP?

The signal-to-noise ratio must not be impaired by induced noise pick-up in the reproducer or equalizing circuits. Design of the equalizer and repeating coil should minimize hum pick-up from motor fields or other sources.

How does the 109 Type Group stack up against these reproducer requirements?

Western Electric has just issued a 12-page bulletin explaining in greater detail the importance of these nine factors in high-quality reproduction—and showing just *why* the design of the 109 Type Reproducer Group results in outstanding performance. You'll want to have all these facts when you select reproducing equipment!

CALL YOUR LOCAL GRAYBAR REPRESENTATIVE FOR A COPY OF THIS NEW BULLETIN—OR MAIL COUPON BELOW

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T-45

Gentlemen: Please send me a copy of Bulletin T2531, "109 Reproducer Group."

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Title _____

Company _____

Street Address _____

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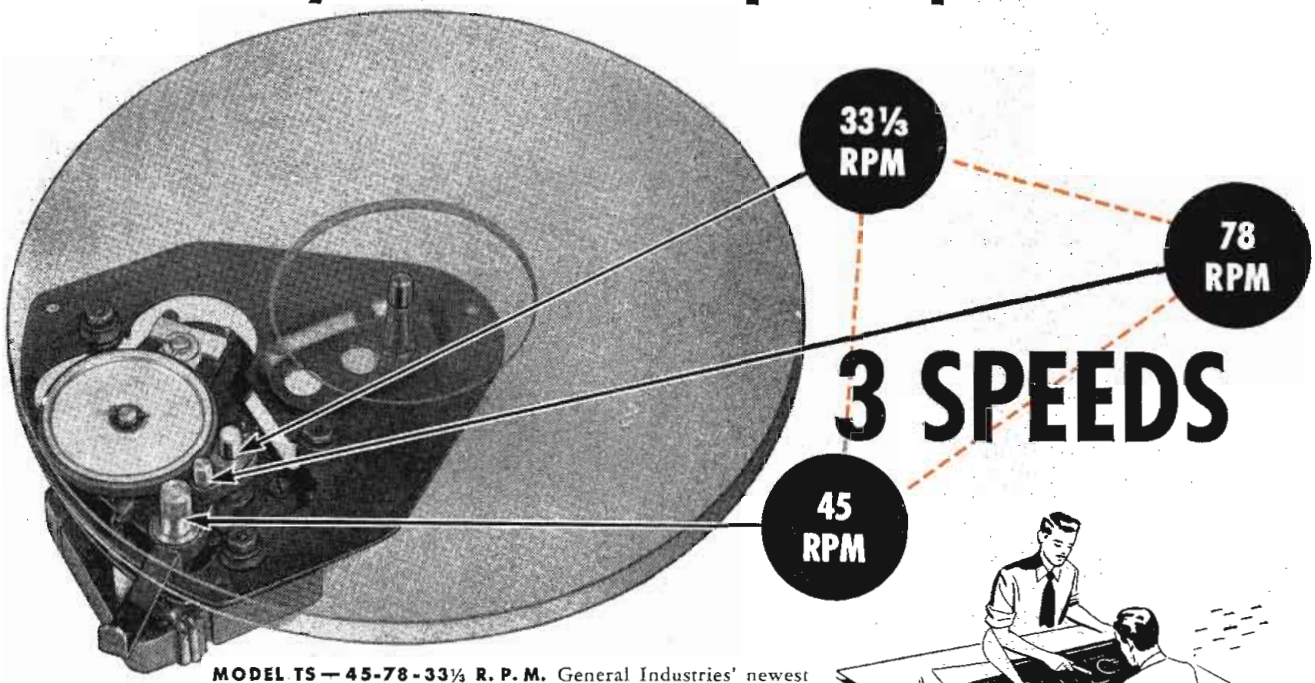
Let GI's *Smooth Power* Line-up solve your record speed problems



MODEL TS — 45-78-33⅓ R. P. M. General Industries' newest rim-drive phonomotor, designed to accommodate *all* types of records now on the market. Features include standard narrow flange turntable for compact installation, and ingenious speed-change mechanism which is both simple and positive in operation.

Single-speed phonograph motors for 78, 45 or 33⅓ R.P.M. operation . . . dual-speed motors for any two-speed combination of the above . . . and a low-cost rim-drive motor for *all* three speeds . . . that's the *complete* General Industries line-up which gives your designers and engineers the solution to their "which speed to use" problems.

And no matter what the choice, you get the same dependable *Smooth Power* motors which have made General Industries a leading name, as well as the oldest name in the phonomotor field. GI *Smooth Power* motors are engineered to meet exacting performance standards, and to provide trouble-free long life for the ultimate user. Every one of the GI motors is dynamically balanced to the degree necessary for excellent reproduction of records.

For full details, specifications and dimensions of General Industries' *complete* Smooth Power line of phonograph motors, recorders and record changer-recorders, write *today* for a copy of the latest GI catalog.

TWO-SPEED MOTORS

General Industries offers you a choice of six different dual-speed combinations to take any two of the standard three speeds shown above. Available in standard 2-pole rim-drive models, or a 4-pole rim-drive model for use in instruments in which the ultimate in performance standards is desired.

SINGLE-SPEED MOTORS

All five of the famous GI *Smooth Power* single-speed phonograph motors now are available in your choice of 78, 45 and 33⅓ R.P.M. speeds. Both 2-pole and 4-pole motors afford a complete range of selection to meet every operating requirement.

The GENERAL INDUSTRIES Co.

DEPARTMENT L • ELYRIA, OHIO

TELE-TIPS

UHF TV BOTTLENECK is still transmitter tubes. Present limit of practical manufacturing possibilities remains at about 1 kw. Tubes of 2½ to 5 kw are needed, and after these become available it will take another two years to get commercial 500-mc installations on the air! So, when?

500-MC STATION ANTENNAS will have to be highly elevated to avoid sharp shadows which are acute at these frequencies. This in turn means great attenuation of signal in the up-leads, suggesting that it may be necessary to install transmitter apparatus itself high on the tower, in order to get full radiation.

UHF RECEIVING ANTENNAS must be sharply oriented, in fact "aimed" at each station to get best reception. This will mean accurate positioning apparatus at the antenna. In addition, as Dr. DuMont recently suggested, the UHF TV receiver front-end itself may actually have to be mounted atop the antenna pole, with down-leads carrying only the picture-frequency to the indoor chassis and screen. So Mrs. Jones' UHF antenna may end up with as many motors as her kitchen!

ON AIR IN JUNE, 1950, seems best possible schedule for lucky winners among the 348 VHF TV applicants now snarled up in the FCC "freeze". It will take the rest of 1949 to adjudicate and assign channels to the winning applicants. And another six months will be needed to erect towers and buildings and get transmitters on the air,—this despite good backlogs of transmitter equipment now in manufacturers' stockrooms.

BRIDGEPORT UHF TV should be in test operation during the present month. This experimental job was originally planned for 1950 completion, but outlook for early activity in 500-megacycle field caused completion date to be advanced 90 days.

LONG-TERM EXPANSION is ahead for American business, say economic seers, despite slight slowing-up seen for next Spring. Based on 100% for 1949, they estimate 1950 at 97%, 1951 at 99%, 1952 at 106% and 1953 at 97%. In 1954, they think, the business curve will again turn upward, reaching 122% by 1957 and 128% by 1960!

SYNESTHESIA—In Webster recently we came across this word with its two fascinating definitions, which, we feel, are particularly apposite at this time. Physiologically, it is a sensation produced in one part of a body by a stimulus applied to another part. This seems to be an excellent description of the stimulus applied by Senator Johnson and a few of the more progressive TV interests, to the body of the FCC and the industry in general, which is producing sensations both in the general public and manufacturers. Probably red is the color seen by many of the latter, but for the former we prognosticate the possibility of a color receiver at the rainbow's end of the present hearings.

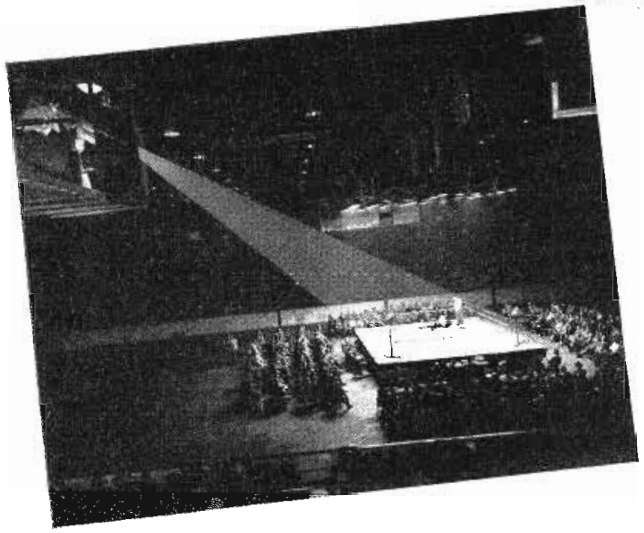
COLOR-HEARING — Psychologically synesthesia is also defined as "color hearing" or "color sensation." For example, some subjects associate specified colors with certain tones or sounds. We would not be surprised if many engineers and members of the general public, in common with ourselves, suffer from synesthesia in that mention of color TV arouses thoughts of CBS and other color proponents!

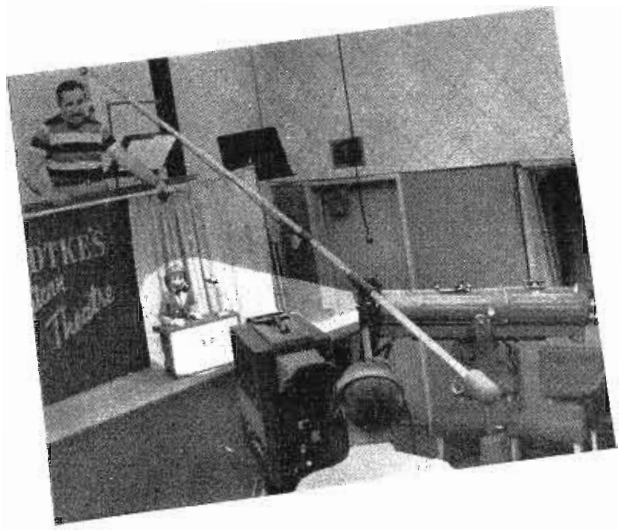
A NEW SPOTLAMP FOR TV STUDIOS

The STRONG TROUPER

Portable High Intensity A. C. CARBON ARC SPOTLIGHT

Permits better showmanship — and better lighting.





Produces snow white uniformly illuminated spot, with crisp edges, far surpassing in brilliancy any incandescent or vertical arc type spotlights. Delivers light of a quality ideal for TV.

Easily operated. Start it and forget it. You'll appreciate the unattended operation.

A silvered glass reflector and two-element variable focal length lens system.

Draws only 10 amperes from any 110-volt A.C. convenience outlet. Adjustable, self-regulating transformer which is an integral part of the base for the first time makes possible a high intensity arc spotlight without the use of heavy rotating equipment.

Automatic arc control maintains constant arc gap and a steady light, free from hiss or flicker. The airborne hum level does not interfere with sound. A trim of carbons burns one hour and twenty minutes at 21 volts and 45 amperes.

Horizontal masking control. Can be angled at 45 degrees in each direction.

Mounted on casters. Easily transported to remotes.

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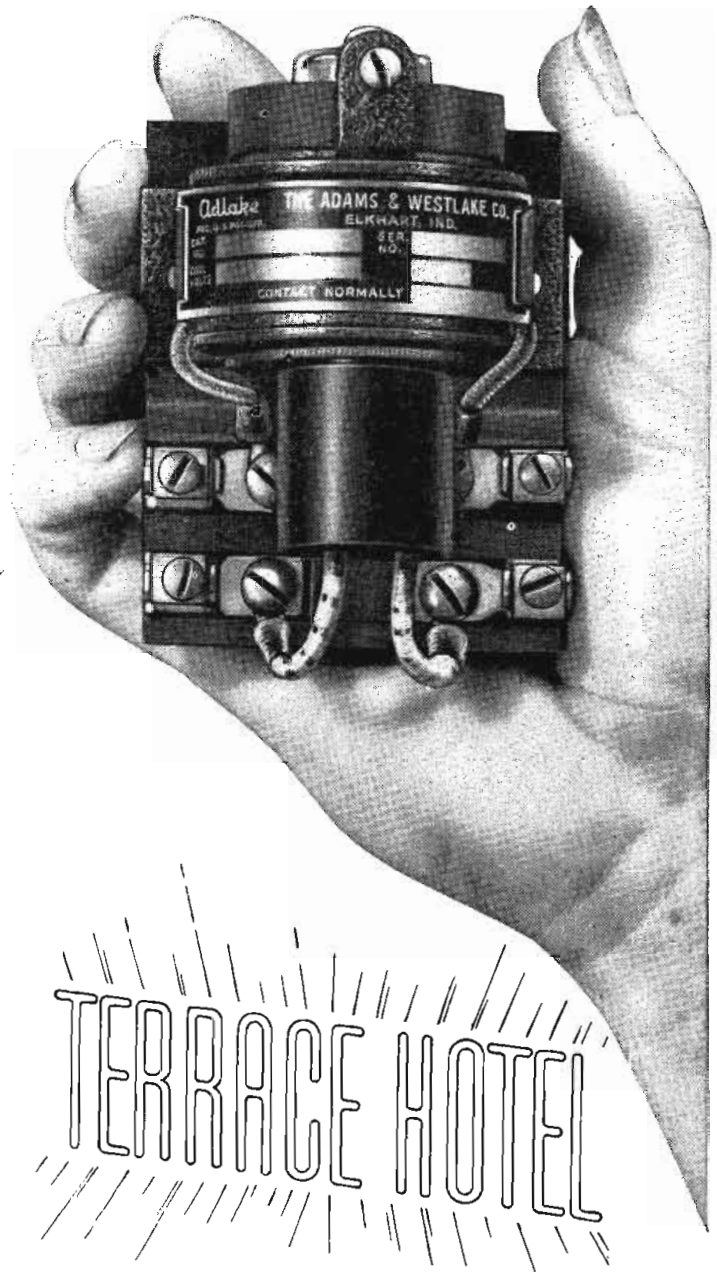
IS IDEAL FOR

Flasher Service



IT IS DEPENDABLE— REQUIRES NO MAINTENANCE

The Adlake No. 1110 Relay is small enough to fit in one hand, yet it makes and breaks 30 amps. easily, and with low operating current.

Like all Adlake Relays, No. 1110 is hermetically sealed against dust, dirt, moisture and oxidation; mercury-to-mercury contact prevents burning, pitting and sticking. It's absolutely safe, *requires no maintenance,* and is cushioned against impact and vibration.

These qualities make the Adlake "Mighty Midget" ideal for use with flasher installations—as well as in power circuits, motor and heater controls, traffic signals and a host of other uses.

WRITE TODAY for FREE illustrated catalog, with details on No. 1110 and other new Adlake Relays. The Adams & Westlake Company, 1117 N. Michigan, Elkhart, Indiana.

TERRACE HOTEL

The Adlake Mighty Midget Relay gives you long, trouble-free service on outdoor installations. It's weatherproof, shockproof and absolutely dependable! Silent and chatterless! Equipped with compression-type terminals to simplify installations.

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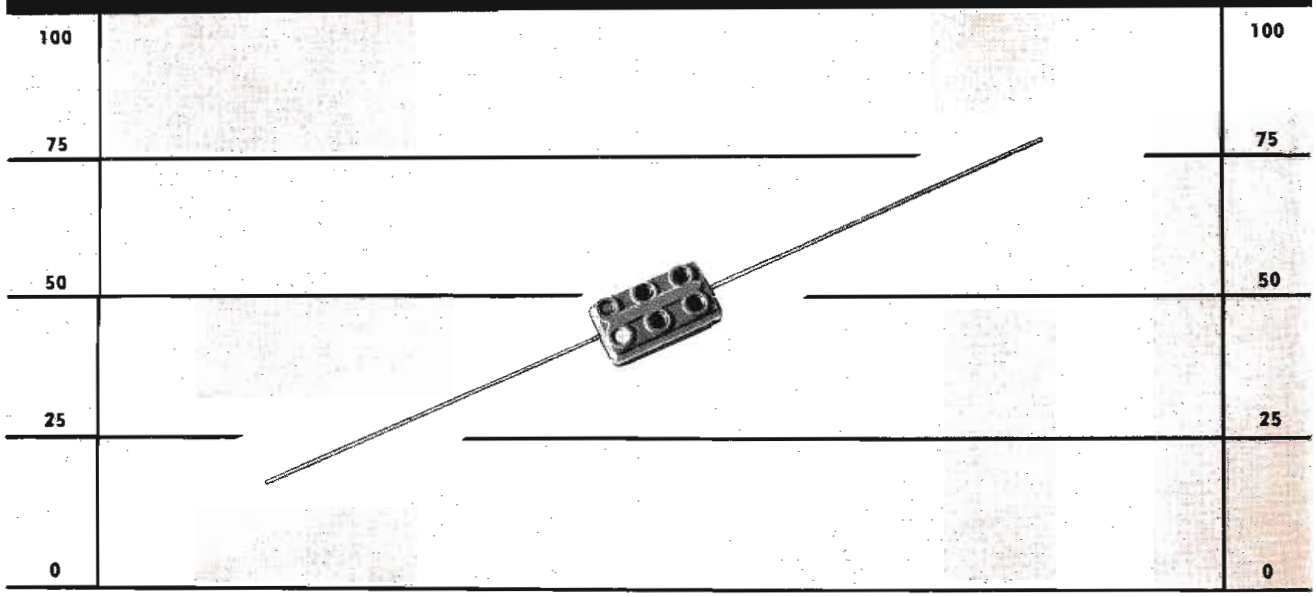
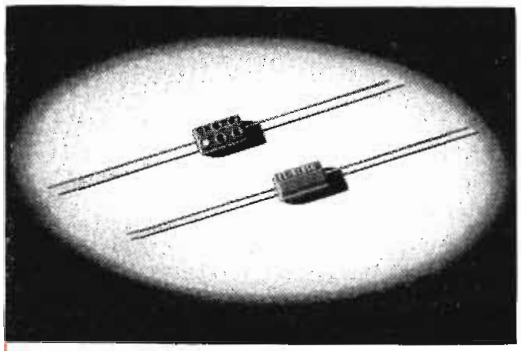


EL-MENCO CAPACITORS



CM 15

Actual Size 9/32" x 1/2" x 3/16".
For Television, Radio and other Electronic Applications.
2 — 420 mmf. cap. at 500v DCw.
2 — 525 mmf. cap. at 300v DCw.
Temp. Co-efficient ±50 parts per million per degree C for most capacity values.
6-dot color coded.

You can always depend on these tiny but tried and trusted El-Menco capacitors to give peak performance for long periods of time under the most exacting conditions. Rigid test during and after manufacture insures uniformity and assures quality.

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NO TUBE TROUBLE IN THIS 3 KW FM TRANSMITTER

If you are one of the many owners of FM transmitters where tube replacement cost has been heavily draining the reserve bank account, you will be particularly interested in the Gates BF-3D FM transmitter for 3000 watts power. The highly vulnerable power amplifier tubes which can be quickly damaged by changes in antenna characteristics, improper air circulation around the tubes and in some instances even low line voltage, have been engineered not only to good performance but to low maintenance cost.

On the attached brochure note the unique tank circuit design where the new 4-1000 power amplifier tubes are covered with a pyrox jacket which confines all of the air around the tube and finally concentrates it on the important end seal. Broadcasters are reporting from 2500 to 5000 hours of tube life and many purchasers of the BF-3D transmitter have the original set of tubes in the sockets after many months of use. To aid long tube life is a scientific air pressure control that immediately disconnects the plate voltage where the air for any cause reduces in pressure. Also a direct reading power and standing wave ratio indicator which tells the operator instantly if the antenna characteristics have changed because of icing or other reasons and is placing a heavy load on the power amplifier tubes.

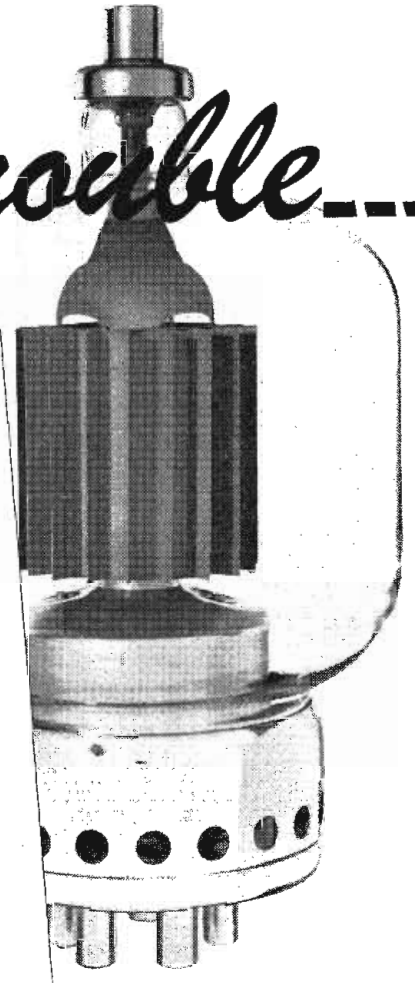
The BF-3D, like all Gates products, is engineered not only for fine performance, meeting rigid FM requirements, but having the practical touch added by such things as longer tube life that means dollars to the broadcaster.

Further information about this fine transmitter that cannot be found in the attached brochure will gladly be given upon request.

Yours very truly,

GATES RADIO COMPANY

Sales Department



EIMAC 4-1000A TETRODE

*This letter was distributed with a brochure on the popular Gates BF-3D, 3KW FM transmitter.

Commercially proven . . . the Eimac 4-1000A is an outstanding high-power tetrode. Its rugged construction and stability of performance enable the country's leading transmitter manufacturers to enthusiastically expound the tubes' advantages in their key socket positions.

Consider the Eimac 4-1000A tetrode for your high-power equipment . . . frequency limits are well into the vhf. Complete data is available, please write direct.

Follow the Leaders to Eimac TUBES

EITEL-McCULLOUGH INC.
San Bruno, California

Export Agents: Frazar & Hansen, 301 Clay St., San Francisco, California

TELE-TECH

TELEVISION • TELECOMMUNICATIONS • RADIO

O. H. CALDWELL, Editorial Director ★ M. CLEMENTS, Publisher ★ 480 Lexington Ave., New York (17) N. Y.

AID FOR UNCLE SAM—On the following pages, detailed information is given outlining the purchasing procedures of the Army, Navy and Air Force. Guided by the diagrams shown, the radio-electronic manufacturer can plan in advance his approach to the service or services he wishes to contact.

Government supply has been too exclusively in the hands of the large companies. These groups have the organizations to expedite special projects for the armed services. But if an Emergency should strike, even these huge plants would not provide half the manufacturing capacity needed for an all-out electronic war of 1949-50 dimensions. Hundreds of small shops and plants will be needed, also. Every manager and chief engineer of a radio-electronic factory should therefore study these charts on the next pages, as a patriotic and company obligation.

THEATRE TELEVISION—While the immediate projection problems of theatre television are well on the way to complete solution, as outlined in last month's issue, many engineers have still questioned how it is planned to utilize TV programs. Answer is found in the SMPE's application for 60 channels for theatre use.

Programs for theatre television, they explain, would be picked up from remote field locations, television studios or theatres, sent to a central studio or transmitter, being then distributed to theatres that wish to present the program on their screens. Channels of radio frequencies would be required to carry the picture and sound from point of origin to theatres either on a local basis, between nearby cities, or on a nation-wide basis, depending upon its commercial success.

NARBA PROSPECTS are not exactly rosy. The US delegation to the North American broadcasting conference at Montreal, now in session, seems destined to have a rough time. Not only did our party go unprepared as far as the FCC clear-channels decision is concerned, but they also face the certainty of encountering strong arguments from countries south of the border in favor of reducing broadcast channel widths to less then 10 KC. The suggestions appear to originate from Cuba and Mexico. These countries have long been anxious to obtain additional channels, particularly under 1,000 KC. A number of plans have been cited, some even going as far as to suggest 6-KC channels. As an alternative to having 150-kw Mexicans scattered over our broadcast band, narrowing the channels to 9, 8 or even 6 KC *might* be preferable. So many other factors have to be considered however, that it is not a question which can be settled by a snap reply at the convention. It seems quite possible that after months of wrangling a stalemate may result.

TELEVISION STANDARDS—We wonder whether television standards will be changed at the current FCC hearings? It seems that 80% of the engineers queried by the RMA television committee favors retention of present standards, while 15% want further study of frequency stability and modulation depth. More field tests and further experimentation were requested by the remaining 5%. On the basis of retaining the present 6 MC bandwidth it appears that no significant changes can be made in the frame and scanning frequencies; neither can one, apparently, find good reason to suggest changes in the type of modulation. We say let the standards remain as they are if we retain the same bandwidth. The public is familiar with present standards, the manufacturers are apparently happy, and it will be one less subject to confuse the issues before the FCC.

YEAR'S CHANGES—Comparing our analysis of the 526 TV models which appeared on last month's cover, with corresponding specifications of the 170 TV models we published just a year ago at this time: In 1948 42% of the models listed were 10-inch; in 1949 these had dropped to 22½%. In 1948 no 16-inch models were listed, of course; in 1949 29% of models were 16-inch. In 1948 55% of all models were table-sets; in 1949, 37½%. In 1948 54% of models received TV only; in 1949 this increased to 65%. In 1948, 69 manufacturers listed 170 models; in 1949 90 manufacturers offered 526 models. And in 1948 the average 10-inch model was priced at $406; in 1949 10-inch average was $255.

Don't Get Too Busy with the Slide rule!

The issues confronting this country are plain, the stakes are high, and the degree of danger is apparent. The situation demands intelligent expression and action. It is unsafe for you to delegate the duties of citizenship to others because of your preoccupation with the slide rule. To withdraw into the protective and respectable cocoon of your immediate task is to assume the spurious mantle of a protected class.

Charles E. Wilson, president General Electric Co., addressing American Institute of Electrical Engineers

How to Sell to Uncle Sam

Fourth of a Series

An analysis of the National Military Establishment's purchasing structure for potential government contractors and manufacturers

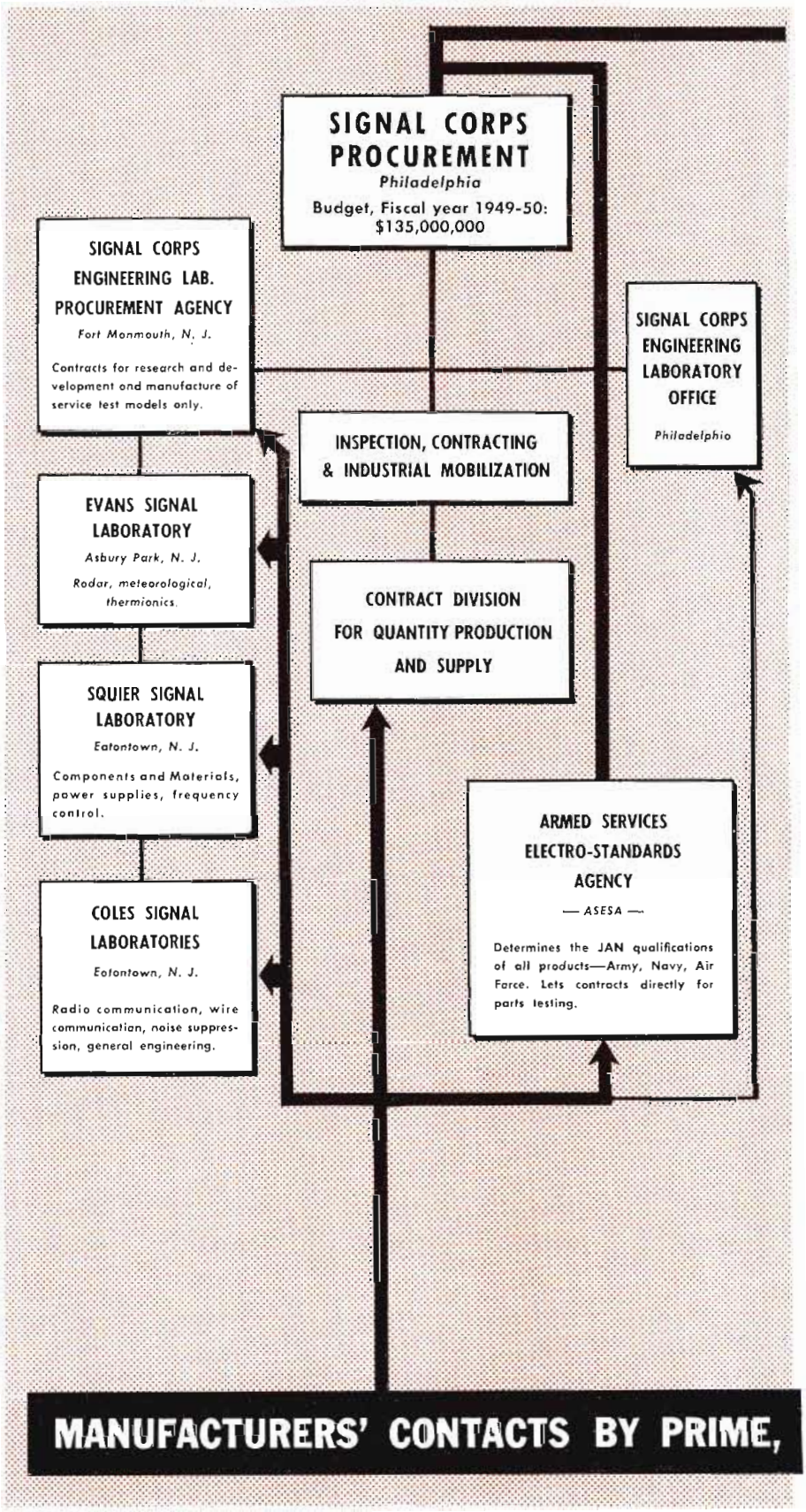
IN view of the tremendous interest in the editorial series in recent issues of Tele-Tech[1] on Armed Services procurement, and because of the extent of government expenditure for this purpose, the editors of this magazine feel that the accompanying chart fulfills a growing need for a simplified recapitulation of the procurement picture.

It is to be emphasized, of course, that an accurate presentation of all of the extremely complicated functions of the various bureaus and agencies involved would be impossible within the space limitations of the chart. Therefore, the high-level administrative bodies such as the Munitions Board and the industrial mobilization and planning divisions of the three services are not included. Our purpose rather is to show the points of contact which may be reached by prime and subcontractors doing business with the National Military Establishment.

At first glance, it may appear that the process of obtaining government contracts is an involved procedure. Actually this is not the case. The information in Tele-Tech's several preceding articles makes that point clear. This is particularly true when the contracts involve purchase of JAN-approved parts for the maintenance of supply inventory or in the case of assembled standardized components. In such cases, once the bidder is established as a qualified source of supply, his efforts consist primarily of the simple process of submitting bids.

Although other types of contracts such as those required for research and developmental projects become more complicated, and require the consideration of more than one segment of the agency at the level at which contracts are let, the process is still not as involved as one might expect. It is in this last case that contact may have to be made with

(*Continued on page* 16)



U. S. ARMED FORCES

AIR FORCE PROCUREMENT

Dayton and Field Offices

Budget, Fiscal year 1949-50: $125,000,000

ENGINEERING DIV.

Dayton

WATSON LAB.

Red Bank, N. J.

AERONAUTICAL EQUIPMENT SECTION

ELECTRONICS BRANCH

Dayton

Contracting Officers & Negotiators (Buyers) for: Airborne Radar, Ground Search Radar, Airborne and Ground Communications, Ground Navigation and Ground Controlled Approach.

GUIDED MISSILES BRANCH

Dayton

Buyers for: Controlled Aircraft Unit, Air Launched Missiles Unit.

ACCESSORIES BRANCH

Dayton

Buyers for: Flight and Navigation instrument systems, Electrical systems.

ARMAMENT BRANCH

Dayton

Buyers for: Aircraft Multi-turret Fire Control (VHB-Very Heavy Bombardment, Fire Control B-50 and B-54 (HB).

ORGANIZATIONAL EQUIPMENT BRANCH

Dayton

Buyers for: Electrical Unit.

PROCUREMENT FIELD OFFICES

Optional points of contact for all preliminary negotiation of Air Force contracts. Visits to AMC Procurement Hq. are unnecessary as all field offices render parallel services.

BOSTON

Commanding Officer, USAF, Procurement Field Office, Boston Army Base, Boston 10, Mass.

CHICAGO

Commanding Officer, USAF, Procurement Field Office, 209 W. Jackson Blvd., Chicago 6, Ill.

DETROIT

Commanding Officer, USAF, Procurement Field Office, West Warren & Lonyo Aves., Detroit 32, Mich.

FORT WORTH

Commanding Officer, USAF, Procurement Field Office, Govt. Aircraft Plant #4, Fort Worth 1, Texas.

LOS ANGELES

Commanding Officer, USAF, Procurement Field Office, 155 West Washington Blvd., Los Angeles 54, Calif.

NEW YORK

Commanding Officer, USAF, Procurement Field Office, 67 Broad St., New York 4, N. Y.

Substantial Volume ← → Limited Volume

NAVY PROCUREMENT

Washington and Field Offices

Budget, Fiscal year 1949-50: $72,000,000

NAVAL RESEARCH LABORATORY

Washington

OFFICE OF NAVAL MATERIEL

Washington

Bureau of **AERONAUTICS**

Airborne Equipment

Bureau of **SHIPS**

Shipboard Apparatus, Communication Equipment: Radio, Radar, Sonar.

Bureau of **ORDNANCE**

Fire Control

Bureau of **SUPPLIES AND ACCOUNTS**

Inventory Levels and Replacements.

Office of **NAVAL RESEARCH LABORATORY**

FIELD OFFICES

PHILADELPHIA

Aviation Supply Office.
Airborne Communications.

PHILADELPHIA

Submarine Supply Office.
Sonar and Batteries, etc.

CHICAGO

Great Lakes, Ill.

ELECTRONIC SUPPLY OFFICE

Navy Purchasing Office.
Stock and replacements for all Naval Services.

Limited local purchases for local use may be made by most of the Navy yards, bases, stations, and field offices.

SUB AND JAN CONTRACTORS. ALSO BY NEW APPLICANTS.

local purchases for local uses may be made also by any base, camp or station

the personnel of the engineering laboratories of the National Military Establishment.

Of the remaining types of contracts, the two main classifications are those designed to maintain inventory stock levels of parts and components for replacements and maintenance, and those let for quantity production of end-item assemblies or complete units. A subcategory of the latter type is the contract drawn up for the so-called service test models of equipments to be given field trials by the operating branches of the services prior to procurement of such equipments for general use.

As a rule, purchases for the purpose of augmenting inventory are handled separately and represent a relatively small portion of the total expenditure. Further, such purchases may on occasion be made on the scene at any base, station, or field procurement office of the three services. It should be stressed that these transactions are seldom large, and that when they are, contracts as such are let only by the procurement agencies themselves.

Mechanics of Contracting

In so far as the mechanics of contracting are concerned, the procedure throughout the National Military Establishment is well standardized. Any contractor will recognize a general pattern of procedure which is common to the three services. The routine steps equally applicable, whether doing business with the Army, Air Force or the Navy are outlined briefly in the column to the left of the chart. Minor variations will occur, depending upon the agency and the contract in question. This is particularly true in the procurement of tele-communications equipment, due to the complexity of the equipment itself, and the fact that in the case of the larger units a number of sub-contractors in addition to the prime contractor may be involved.

From the standpoint of organization and operation, there are dissimilarities, however, between the procurement agencies. This is necessitated by the difference in the nature of the procurement requirements of the services. For this reason, the activity at the contracting level may be more specifically defined with respect to equipment categories, as is the case in the "buying sections" at Wright Field. The end result, however, is to expedite and render the activities of the three agencies more efficient in the execution of their jobs, each within its own sphere.

In order to interpret the information contained in the chart properly, these basic differences in function should be explained. For example; in the case of the field offices of the Navy procurement organization substantial business may be transacted at the points designated. On the contrary, the procurement field offices of the Air Force serve only to expedite preliminary negotiations leading to the establishment of a manufacturer or supplier as a qualified bidder. The Signal Corps, owing to the nature of its more specialized procurement requirements, concentrates its functions in one office at Philadelphia. All of its activities, with a few exceptions, take place at this point.

One of the new agencies with tremendous indirect importance in the purchasing activities of the National Military Establishment is the Armed Services Electro-Standards Agency. Although this is shown on the chart in the section set aside for the Signal Corps, it is an inter-service organization. Its purpose is the establishment of JAN specifications for parts and materials used in telecommunications equipment for the National Military Establishment as a whole. An authoritative article on this organization appeared in the June issue of Tele-Tech (Page 22). It is included in the chart because one of its secondary activities is to award contracts to laboratories and institutions with facilities for the testing of materials, parts and components with a view of their suitability for standardized use, and to set specifications and tolerances to be adhered to by suppliers and contractors.

Selling Tele-Communications Equipment to the Government

Major Steps Common to all the Armed Services

1. Get information on bidding.
2. Fill out check list.
3. On invitation-to-bid list.
4. Fill out Industrial Facilities Survey.
5. Inspection Team visits plant.
6. Notification: qualified bidder*.
7. Submit bid.
8. Notification of award.
9. Progress reports.
10. Delivery, payment, etc.

*May bid on Signal Corps contracts prior to plant inspection.

Contracts Limited in Quantity

Also it should be made clear that such contracts as are awarded by ASESA are limited in quantity, and are seldom let to companies other than those with extensive laboratory facilities. Of greater interest to most manufacturers is the primary service of this agency. This is to assign JAN approval to specific part or material to be used by the armed services. Samples must be submitted to this group for extensive tests to enable them to qualify for general use in the equipments either as replacement or maintenance items, or as products to be employed in the manufacture of end-item assemblies.

In any attempt to present graphically the tremendously wide scope of organizations and functions such as are outlined on the chart, discrepancies are bound to occur when specific transactions are considered. The purpose of the comprehensive diagram is rather to serve as a general guide in correlating the information already more fully treated in the series of articles on this subject in Tele-Tech.

At this moment, in fact, changes are taking place in the unification of the services which will reflect themselves eventually in the buying procedures and plans of the bureaus shown. These changes should not materially affect the functioning of the sections as they exist at present for some time, however. The basic uniformity of procedures in negotiating business with any of the services within the National Military Establishment cannot be too strongly emphasized. In summation, the foregoing chart is presented as a reference guide to the entire procurement scene, designed to assist the potential government contractor in orienting himself with respect to the agencies involved.

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[1]Following is list of articles in the "How To Sell to National Defense Agencies" series which have appeared in previous issues of Tele-Tech:
"Signal Corps Procurement", by Robert Hertzberg, June, 1948, page 24.
"Selling To the Navy", by Robert Hertzberg, January, 1949, page 26.
"Selling to the Air Force", by Alfred Kuenzli, February, 1949, page 21.
Other articles pertaining to National Defense which have appeared in previous issues of Tele-Tech are:
"The 'Leadership' Plan in Electronic War Production", May, 1949, page 22.
"Standardization in the Armed Forces", by Col. Louis J. Tatom, USA and Capt. Henry E. Bernstein, USN, Co-Directors of the Armed Services Electro Standards Agency, June, 1949, page 22.
"Radio-Electronic Industry War Mobilization Plan", March, 1949, page 26.

McClelland Appointed Communications-Electronics Director

Choice by Defense Secretary considered an excellent step toward achieving fullest coordination among the unified services

IN his appointment of Maj. Gen. Harold M. McClelland, USAF, who has been Deputy Commander for Services of the Military Air Transport Service since early 1948 and during most of the war was Director of Air Force Communications, to take over the newly created post of Director of Communications-Electronics of the Department of Defense, Secretary of Defense Louis Johnson made a most excellent selection, observers feel. General McClelland, under the appointment announced August 29, also assumes the Chairmanship of the Joint Communications-Electronics Committee of the Joint Chiefs of Staff.

"The Office of the Director of Communications - Electronics has been established within the Department of Defense, under the direction and control of the Joint Chiefs of Staff, to insure maximum economy and efficiency of military communications," Secretary Johnson's statement brought out.

Actually, it is known that the communications services and operations of the Army Signal Corps, Air Force Communications and Naval Communications for a very long time during the war and especially since the war's end have achieved a most notable record of cooperation and coordination—one that impartial observers feel cannot be equalled by other branches of the armed services. In fact, unification in light of coordinated efforts had been a "fait accompli" in many phases of the military communications activities, long before the subject became a subject of discussion in the national capital.

General McClelland will hold the Directorship for probably two years under the plan, and the post will be rotated among the three services. The new Director is to be assisted by two officers from each service, preferably with the rank of colonel or Navy captain, together with such additional officers as the Joint Chiefs of Staff may determine to be necessary. It was understood that three of these six assistants who are assigned to the Secretariat of the JCEC will take over their new assignment in the next week or two, and the remaining three will be on duty around Oct. 1. So far the nominees for these assistants have not been finalized.

The aim of the new Directorship is to achieve the fullest coordination between the three services in accordance with the goals of unification of Secretary Johnson. The new post parallels in its principles to some degree the recent designation of General Bradley as Chairman of the Joint Chiefs of Staff. The wartime cooperation between the three services, in which General McClelland participated fully, was implemented in a most notable fashion by the Joint Communications Board (Joint Chiefs of Staff) now the JCEC, and the Combined Communications Board (Combined Chiefs of Staff). In the postwar period, Generals Akin and Ankenbrandt and Admiral Stone have carried forward the ideal of cooperation and coordination to notable accomplishments—e.g., the many consolidations of communications operational functioning and of procurement and research and development activities.

The announcement of the Department of Defense in outlining the responsibilities of General McClelland "under the authority and direction of the Joint Chiefs of Staff and with the advice of the Joint Communications-Electronics Committee", gave as the objectives:

"Establishment and control of general policies, standards, and programs for the joint communications-electronics activities of the armed services. General supervision over administration and utilization of personnel and facilities of the communications-electronics activities of the armed services. Implementation of approved plans, policies, and doctrines in this field. Coordination with the Director, Armed Forces Security Agency, of all matters pertaining to security of communications of the military services. Studies to integrate and coordinate the point-to-point wire, radio, and telephone facilities of the services."

It might be noted that General McClelland who has a high degree of intelligent comprehension and analyses of problems recognizes that coordination of communications cannot be carried to the extreme. Each military service has specific essential needs for combat communications that cannot be fused into a single unified communications system with the dangers of delays in transmission and reception. Such examples include the combat communications of ground troops; the shore-ship communications; and the aviation weather and operational communications.

30 SECOND TUBE TEST

An automatic tube testing machine developed by the Tube Division of General Electric Co., Schenectady, N. Y. is shown in operation. It can test a new tube every 30 seconds and is being used in the production of mercury and gas-filled thyratrons.

Color Television

A review of the various proposals for producing

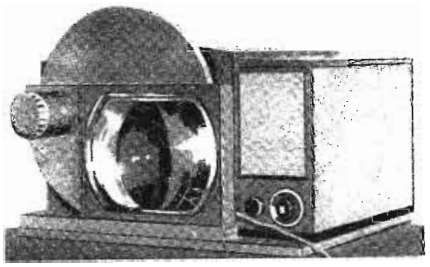
By JOHN H. BATTISON, Associate Editor, Tele-Tech

AT the time of going to press the color situation was somewhat obscured by a pre-hearing haze which produced garbled reports of the various systems, and rendered difficult, or impossible, the task of providing an accurate report of the many different systems. As the situation stands the following have been asked by the FCC for information concerning their investigations: CBS, GE, DuMont, Philco, Westinghouse, Color Television Inc., Thomascolor Corp., RCA and Dr. Charles Willard Geer of the University of California.

Details of the activities of GE, Westinghouse, Philco and DuMont, are not presently known. However the remainder *have* published information on their activities, and for the benefit of our readers, brief outlines of the respective systems are presented in alphabetical order.

CBS System

The mechanical system proposed by CBS and turned down by the FCC in 1947, used a filter disc consisting of segments of red, blue and green filters revolving in front of the camera tube at 1440 rpm. This resulted in the transmission of three separate incomplete images for each picture or frame since the filters passed only one color at a time. At the receiving end the colors were reinserted by the addition of a similar disc before the tube. This disc had to be in phase synchronization with the transmitter so that when the red filter was in front of the camera tube a red filter also in front of the receiving tube. 405 lines were transmitted with a field repetition rate of 144, or 72 frames per second. One of the criticisms levelled at this system at the hearings was the bandwidth required. This has now been reduced to six megacycles so that operation in the standard VHF television channels is possible. The system is sequential in that only one color at a time is presented. Persistence of vision and screen afterglow cause the colors to combine and produce the various shades.



Probable appearance of standard receiver fitted with disk converter for CBS color

Color Television Inc.

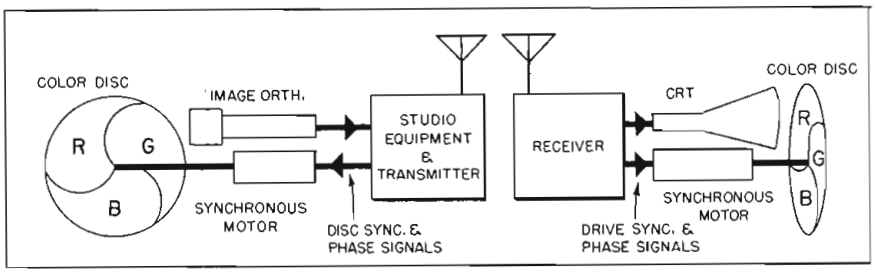
The system proposed by Color Television Inc., was described before the FCC in September 1948, by the chief engineer, G. E. Sleeper, Jr. The main features of the system are the use of stationary filters in conjunction with a three lens optical system at the camera and receiver. At the receiver superposing lenses are used to register three images, each through a different primary color on the screen of a single cathode ray projection tube onto a projection screen. Standard black and white equipment is modified in one major respect—the horizontal scanning frequency is only one third of the normal frequency, since each scanning line traverses three edge to edge fields in succession. Such a change is a simple one. Three equispaced synchronizing pulses are applied during the interval of one horizontal scan, arranged to lock into operation so that each color is flashed at the correct time, and the pictures will show up as black and white views on an ordinary receiver without difficulties. Horizontal linearity must be precisely attained.

The camera system consists of a standard black and white single image orthicon camera with a multiple image lens and filter system. Three optical images are focused side by side and scanned as though they were a single image. The video signals generated are transmitted in the normal manner to standard black and white amplifier and mixing equipment. Standard black and white, line, frame, and super-synchronizing pulses, are used to control the system. The colored pictures are reproduced from 525 line images in each filter color, with 10 color pictures per second and 60 color interlaced fields per second.

The horizontal linearity of the reproduced images on the receiver projection tube is adjusted with the use of a vertical bar signal generator pattern together with accurately spaced and aligned projection lenses. Coincidence of the bars from each image on the projection screen shows register. Perfect registration is shown when the bars are black and white without color fringing.

AC ripple is no more of a problem in this color television system than it is in black and white

Block diagram illustrating the operating principles involved in the CBS color disk system



Transmission Systems

color television pictures now being considered by the FCC

because it does not affect the registration.

The camera lens used experimentally consisted of three 16-mm. motion picture type lenses side by side, with centers spaced approximately ½" apart. Commercially a light splitting lens using dichroic mirrors to produce the three color separation images might be effective.

Vertical registration of images in this system is primarily an optical problem. Although the images may be non-linearly scanned in the camera and reproduced linearly or non-linearly in the receiver, the net result at worst can only be a distorted picture remaining in register vertically.

The system as a whole may consist of equipment similar to the present black and white equipment, except for the optical lens systems employed at camera and projection receiver and the widening of the video amplifier system throughout to pass the required bandwidth. There are no mechanically moving filters and the system is all electronic. Carry-over charges in the image orthicon from one filter to another filter color inherently is impossible. Only one image orthicon tube is required at the camera with a single electron beam. Register problems, electrical or optical, are taken care of accurately and simply. Only one projection tube is required at the receiver.

Dr. Charles Geer

Dr. Charles Geer, a professor of physics at the University of Southern California claims patents of a system utilizing a special receiving tube for direct viewing. The screen is serrated in such a manner that while all three facets are visible to the viewer, only one is exposed to each of the three guns. One gun is used for each color—red, blue and green. The appropriate color signal is fed to each gun and excites its associated screen at the proper time. The colors blend and form a picture in full color which can be viewed on a direct vision screen. The late John Logie Baird had worked on a similar tube in England before the war.

RCA System

The latest releases from RCA give news of what is said to be a completely compatable all-electronic color system. Time multiplex transmission is used with a bandwidth of 4 MC for full modulation.

The color camera at the transmitting end produces three signals, green, red and blue. These signals are sampled electronically in rapid sequence, combined and broadcast as a single signal.

At the receiver, separation is performed, so that the signal representing each color goes to an electron tube which produces a picture in that particular color. The green, red and blue signals are applied to their individual kinescopes. The three colors are then projected simultaneously and produce the complete picture.

One of the fundamental characteristics of the system is the application of time multiplex transmission, which has been adopted and applied to television from the art of radio telegraphy. Other innovations are the electronic sampler and picture dot interlacing.

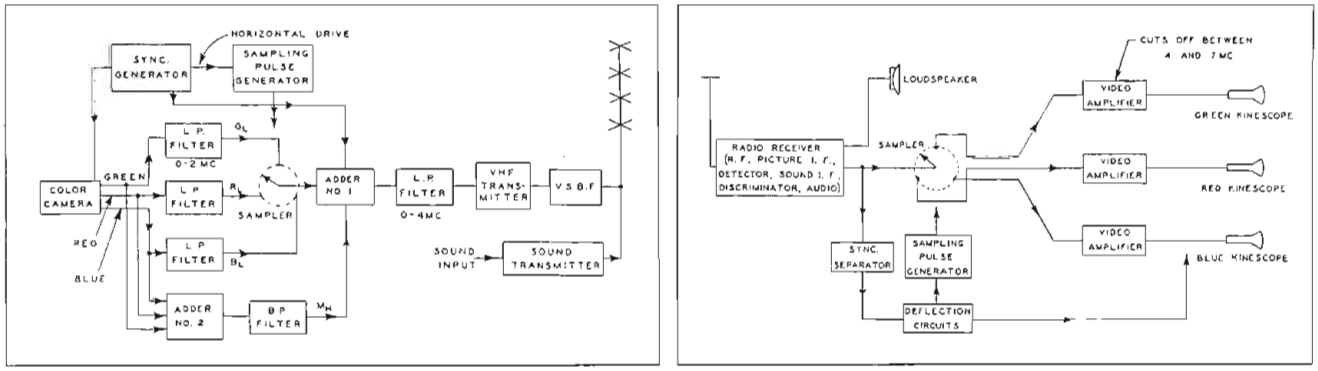
The electronic sampler has to function with microsecond precision in sampling the colors. From the sampler the signals, representing the three primary colors, are fed to an electronic combining device. Standard synchronizing signals from the synchronizing generator are also applied at this point, and the principle of mixed high frequencies is also utilized.

Each color is sampled, 3,800,000 times a second—for the three colors a total of 11,400,000 samples a second. The green signal is sampled and less than 9 hundred-millionths of a second later the red is sampled, and then the blue. This means that the signals of each color are transmitted at an approximate rate of one every four millionth of a second. When viewed on the screen of a receiver the recurrence of the signal is so rapid that the color appears to be constant.

The three color signals from the camera are combined in an electronic adder and then passed through a band-pass filter. The output of this filter contains frequencies between 2 and 4 MC, with contributions from each of the three color channels. Appearing at the output of the band-pass filter is "the mixed-highs signal." These

(*Please turn to next page*)

Block diagram showing the functions of the various transmitter (left) and receiver circuits used by the RCA color transmission system



mixed-high frequencies are fed to an integrator, which is already receiving signals from the sampler and from the synchronizing generator. The composite signal which comes out of a filter is applied to the modulator of the transmitter.

It is maintained that the mixed-highs procedure is successful and satisfactory in a wide-band simultaneous system. In this color system the sampling process by itself is sufficient to carry high frequency components of each color signal so that when combined the resulting bandwidth is below 4 MC (the sampling frequency determines the highest frequency which will be passed). However, it was decided to sample the lower half of the video band, (up to 2 megacycles) and use the mixed-highs principle for the upper half because this has technical advantages.

At the receiver the signal from the second detector also enters the sampler. It is a composite signal. An electronic commutator samples the composite signal every 0.0877 microsecond, producing short pulses. The amplitude of each of these pulses is determined by the amplitude of the composite wave at that particular instant.

The commutator feeds these pulses into three separate video amplifiers which in turn control three cathode-ray tubes or kinescopes having appropriate color-producing phosphors. This method for portraying the single color picture with three kinescopes in a projection system is similar to that which RCA has previously demonstrated.

The system has the following characteristics: (1) 6 MC channel; (2) fully compatible; (3) 525 lines; (4) 60 fields per second; (5) field interlaced; (6) picture dot interlaced; (7) 15 color pictures per second; (8) time multiplex transmissions; (9) all-electronic.

Standard VHF transmitters can be used for this system. Small changes are required in the studio equipment to produce color pictures plus the addition of a small amount of electronic equipment to perform the sampling and time multiplexing operations.

It is claimed that ordinary black-and-white receivers will produce normal pictures from this signal without any modifications, and color pictures can be seen on them with the aid of an adapter. This is a simultaneous system in which the three primary colors are produced at the same instant and combined at the viewing screen to produce pictures with full color values. However it might also be called sequential in that the color picture elements are transmitted in sequence.

Thomascolor

A system somewhat similar to that of Color Television Inc., is the one based on the well known Thomas method of making color films.

A special optical unit designed by Richard Thomas utilizes prisms to split the light from the scene into three rays. Each ray passes through its own lens and red, green or blue color filters. The three rays then fall upon one frame of standard motion picture negative film, recording upon it three discrete images. Two of these are placed side by side within the 35mm. frame and the third occupies a position below these. The density of each image, when developed, depends upon the intensity of the light passing through the color filter associated with that image. Positive prints from such a negative would be made on ordinary black-white stock. There is no color associated with the film.

Upon projection, three images per frame are available and each of these, after passing through its correct color filter, enters the Thomas projection lens which not only projects the images on the screen in the usual manner, but provides three mechanical adjustments which allow the three projected images to be superimposed accurately, giving motion pictures in natural colors.

For television the simplest arrangement would be to project into the standard black-white TV film scanner a Thomascolor film. On the black and white receiving tube appear three images. These might be projected, superimposed, on a screen after passing through three filters specially selected to work with the cathode ray tube used. It is believed this would produce pictures in color but such a simple system probably would suffer from low resolution and lack of flexibility.

Thomascolor, Inc., suggests using the special lens system placed in front of the camera tube in a simultaneous TV system and in front of a single (not a 3-unit) projection tube at the receiver. This means, of course, that the tubes just mentioned, instead of carrying a single large picture, will have impressed three smaller pictures, each of which will bear less than one-third of the picture "information" contained in a single normal picture.

Another application may be the Thomas type of lens, prism and filter unit with the camera of a simultaneous TV system that utilizes a three-unit projection tube at the receiver.

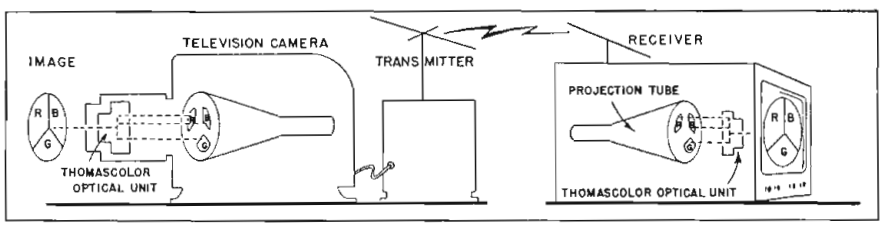
The "Chromoscope"

Although not specifically mentioned by the FCC at this stage, it seems possible some system incorporating the "Chromoscope" (described on page 49 of Tele-Tech, March 1948), may be discussed. Recapitulating briefly, it may be said that this is a type of cathode ray tube which has four screens and a single electron gun. These four screens which are coated with phosphors which fluoresce with red, blue and green colors are combined with a fourth, which maintains a constant potential. The screens are separated by a distance of one to three millimeters and are insulated from each other.

Any of the three color screens may be made to fluoresce by applying a high positive potential to the desired screen. As the three screens are made to fluoresce sequentially the three separate color pictures so produced are superimposed optically and the viewer sees a color image originating from an apparent single screen tube. It appears that

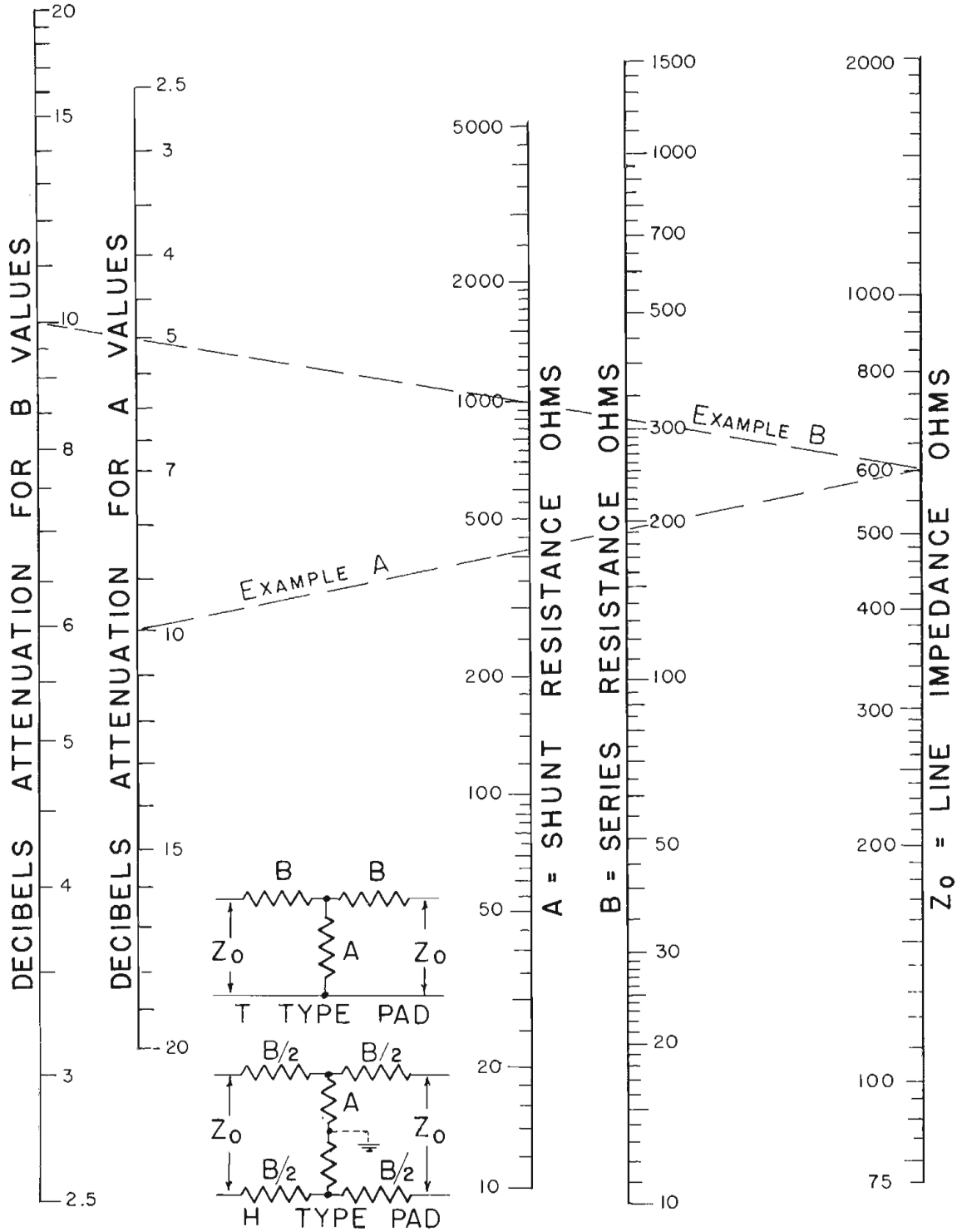
(*Continued on page 52*)

Thomascolor principle showing three colored pictures produced by the special unit



Page from an Engineer's Notebook

Chart 3. "T" and "H" Pads



"T" and "H" type attenuators are simple standby pad circuits where fixed units of various sizes are permanently installed in the line. In using these values the terminal impedances "in" and "out" must be the same. Two lines from the db point on each of the scales at left to the Z scale at right will cross the A and B scales in center at values that give the shunt and series resistance values resistively. In the "H" type pad, the series value (B) is split into two units and connected in each side of the line. Also in the "H" type pad shunt resistance A can be center-tapped if desired and connected to a common neutral to provide a balanced pad.

National Allocations Plan

NCUR shows how maximum employment

FOR the past four years the National Committee for Utilities Radio has been working to develop a sound plan for the allocation of radio frequencies to the public utilities providing electricity, water, gas, and steam services. With the announcement of the FCC's new frequency allocations for the mobile and other services it appears that such a plan will come to fruition. On July 1st, certain frequencies in the band 30 to 50 MC became available to the Power Radio Service, and made possible the operation of the plan envisaged by the committee. The frequencies allocated by the FCC and their suggested distribution are shown in the accompanying table. Also shown is the map prepared by the committee to indicate the areas where the various frequencies will be used.

A direct result of the new allocations is that the majority of the utility services will have to change frequency since many frequencies previously available to the utility services have been re-allocated to other services. In an effort to resolve the confusion which would inevitably occur if operators attempted to change to the new frequencies without coordinating their applications, the national committee has adopted certain principles of coordination in the allocations of the band 30-50 MC. While these principles have been agreed upon by the members of the NCUR, who are bound by their cooperative approach, they have no legal standing with the FCC. However, it has been requested that utility services cooperate with their local Regional Frequency Coordinating Committee which will recommend the most suitable frequency for the new or revised operation. If it is indicated that this has been done in the application form it will facilitate rapid action on the application.

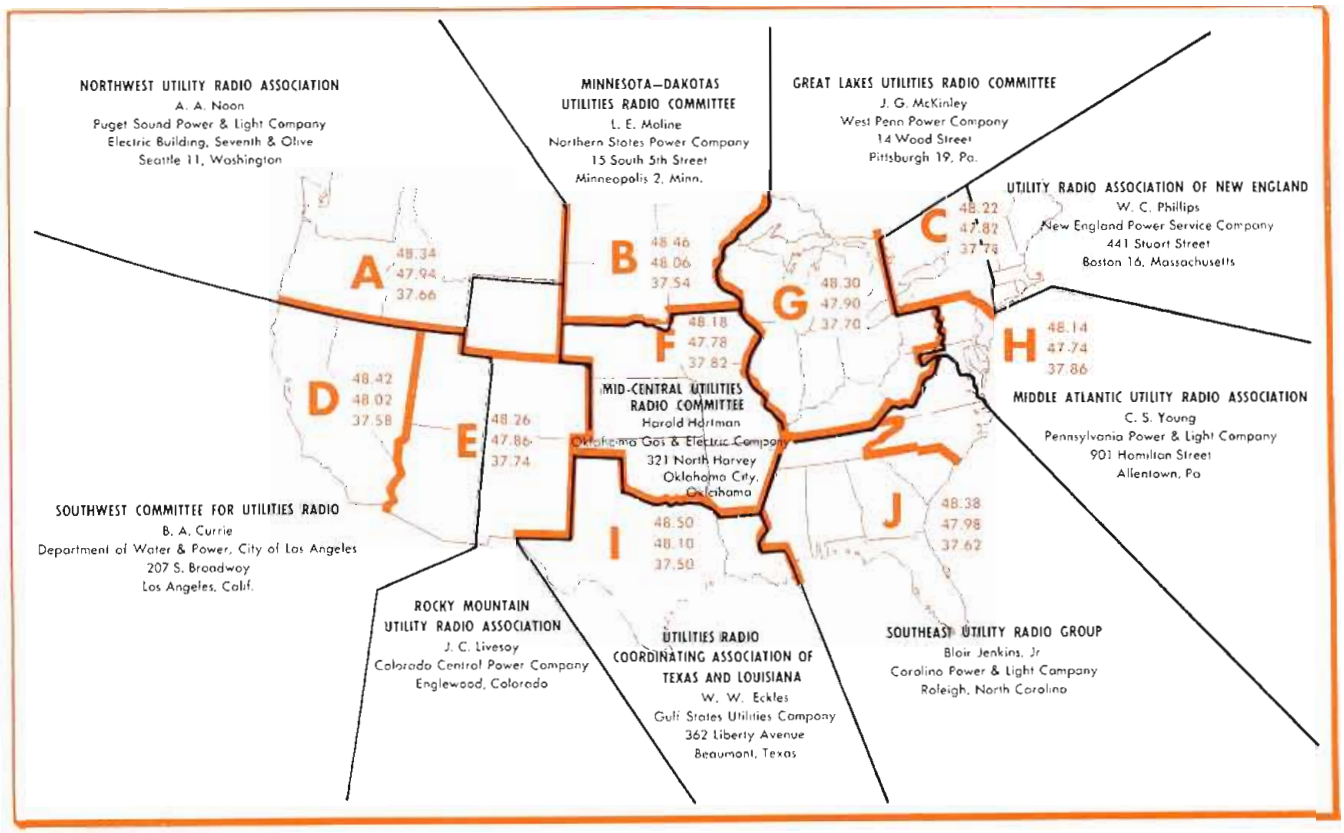
The whole plan is based on the controlled use of every available frequency according to a geographic distribution which covers the whole of the United States of America. In passing it may be noted that this principle of maximum frequency usage has been recognized by the FCC, and recommended to all other mobile services. The data which form the basis for these principles of coordination are included for the benefit of interested readers.

Principles of Coordination

1. The country is divided into ten geographic zones for primary frequency assignments within the Power Radio Service.

2. Three frequencies are designated as primary frequencies or

Chart indicating frequency allocations. Red boundaries show limits of assignment, black lines mark regional coordinating committees



for Utilities Radio

of each frequency allocated is assured

"zone channels" for each zone.

3. Primary frequencies for adjoining zones are so chosen as not to fall on adjacent channels.

4. Within the boundaries of a geographic zone the primary frequencies (zone channels) may be recommended by the regional committee without reference to adjoining zones for coordination.

5. Any frequency may be recommended without coordination if the system is located more than one hundred miles within any border of the home zone.

(a) if the frequency to be recommended is the primary frequency of the adjacent zone and the system is located within 100 miles of the common boundary, however, a committee should not normally recommend said frequency to a member who will be located as close as 100 miles to the border of the zone from which the frequency is "borrowed".

(b) if the frequency to be recommended is other than the two primary frequencies of the home and adjacent zones and the system is located within 50 miles of the common boundary, unless clearance has been given to the committee of the latter zone to use said frequency in a specific conflicting location which is less than 50 miles from the border.

7. All other recommendations, not covered above will be arrived at by consultation and agreement with the committee responsible for the affected adjoining zone.

The distances of 50 miles and 100 miles referred to above are derived from normal spacing data for flat terrain and 100 foot antenna height. These distances may be decreased or increased, as the case may be, depending on local conditions of antenna location and height.

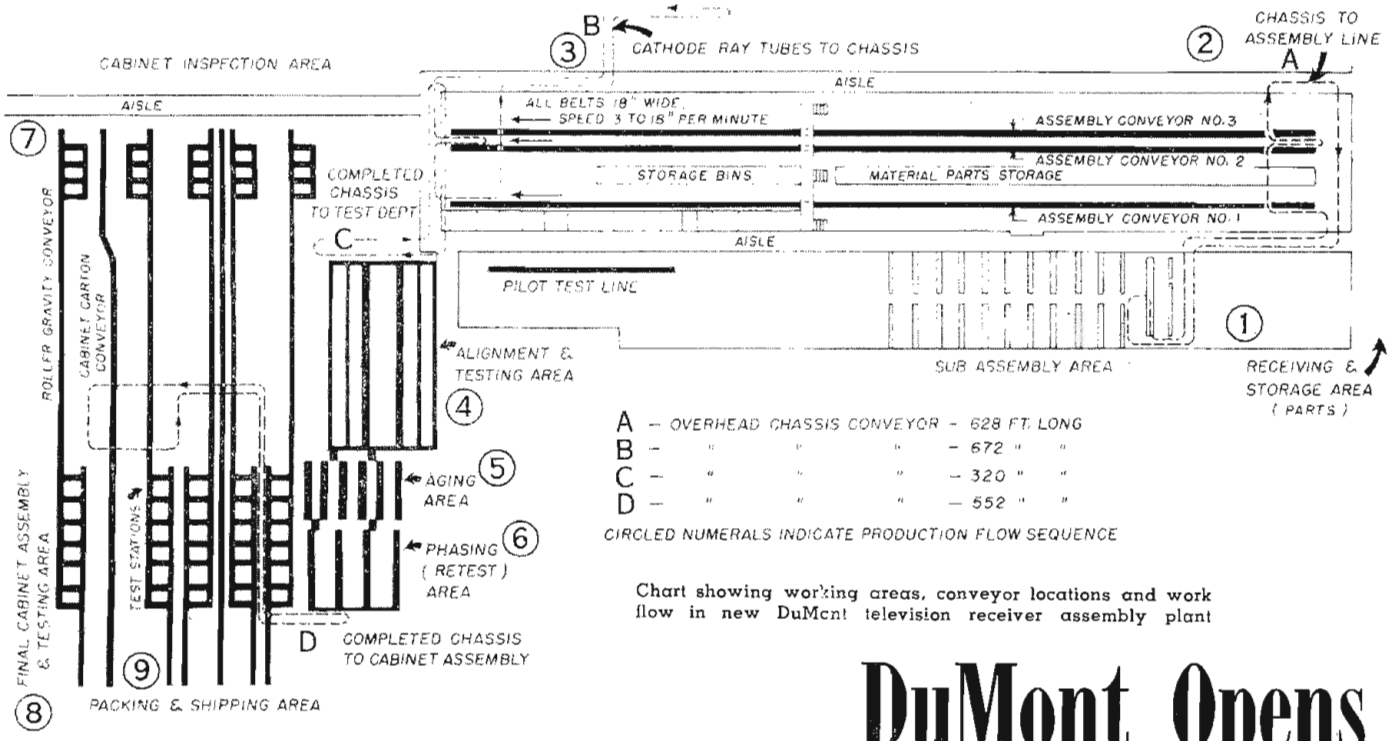
In most cases where a user is required to change frequency the cost will be nominal—about 10% of the total cost of the equipment. In a good many cases the insertion of a new crystal and retuning will be all that will be required to adjust operation to the new frequency. The areas covered by the ten coordinating committees are indicated on the regional map together with the name and address of the member concerned with frequency assignment matters for each region.

Table showing complete US distribution of zone frequencies and regional assignments

Zones — Zone Frequencies — and Sequence Order For Regional Assignments Applying to Thirty Channels 47.74 MC thru 48.50 MC and 37.50 MC thru 37.86 MC

Zone	A	B	C	D	E	F	G	H	I	J
Zone Channels										
1	48.34	48.46	48.22	48.42	48.26	48.18	48.30	48.14	48.50	48.38
2	47.94	48.06	47.82	48.02	47.86	47.78	47.90	47.74	48.10	47.98
3	37.66	37.54	37.78	37.58	37.74	37.82	37.70	37.86	37.50	37.62
Use sequence										
1st	A1	B1	C1	D1	E1	F1	G1	H1	I1	J1
	A2	B2	C2	D2	E2	F2	G2	H2	I2	J2
	A3	B3	C3	D3	E3	F3	G3	H3	I3	J3
2nd	E2	F2	H2	E2	D2	I2	H2	C2	F2	H2
	E1	F1	H1	E1	A2	B2	F2	C1	F1	H1
	E3	F3	H3	E3	A3	B3	H3	C3	F3	H3
3rd	B2	A2	G2	A2	D1	I1	H1	G2	E2	F2
	B1	A1	G1	A1	A1	B1	F1	G1	E1	F1
	B3	A3	G3	A3	D3	I3	F3	G3	E3	I3
4th	D2	E2	J2	B2	I2	G2	B2	J2	J2	I2
	D1	E1	J1	B1	I1	G1	B1	J1	J1	I1
	D3	E3	B3	B3	I3	G3	B3	J3	J3	F3
5th	F2	G2	B2	I2	B2	J2	C2	F2	B2	G2
	F1	G1	B1	I1	B1	J1	C1	F1	B1	G1
	F3	G3	E3	H3	B3	J3	C3	F3	B3	G3
6th	I2	I2	E2	F2	F2	E2	J2	B2	G2	B2
	I1	I1	E1	F1	F1	E1	J1	B1	G1	B1
	H3	D3	J3	F3	F3	E3	J3	B3	A3	B3
7th	H2	J2	F2	H2	H2	H2	I2	E2	H2	C2
	H1	J1	F1	H1	H1	H1	I1	E1	H1	C1
	C3	I3	A3	I3	H3	H3	I3	E3	D3	E3
8th	C2	D2	A2	C2	J2	A2	E2	I2	D2	E2
	C1	D1	A1	C1	J1	A1	E1	I1	D1	E1
	I3	H3	D3	C3	C3	A3	E3	A3	H3	C3
9th	J2	H2	D2	J2	C2	C2	A2	A2	A2	A2
	J1	H1	D1	J1	C1	C1	A1	A1	A1	A1
10th	G2	C2	I2	G2	G2	D2	D2	D2	C2	D2
	G1	C1	I1	G1	G1	D1	D1	D1	C1	D1

NOTE: Channels 37.46 M.C, 47.70 MC and 48.54 MC May Be Used In All Zones After Careful Local Inter-service Coordination In Each Zone

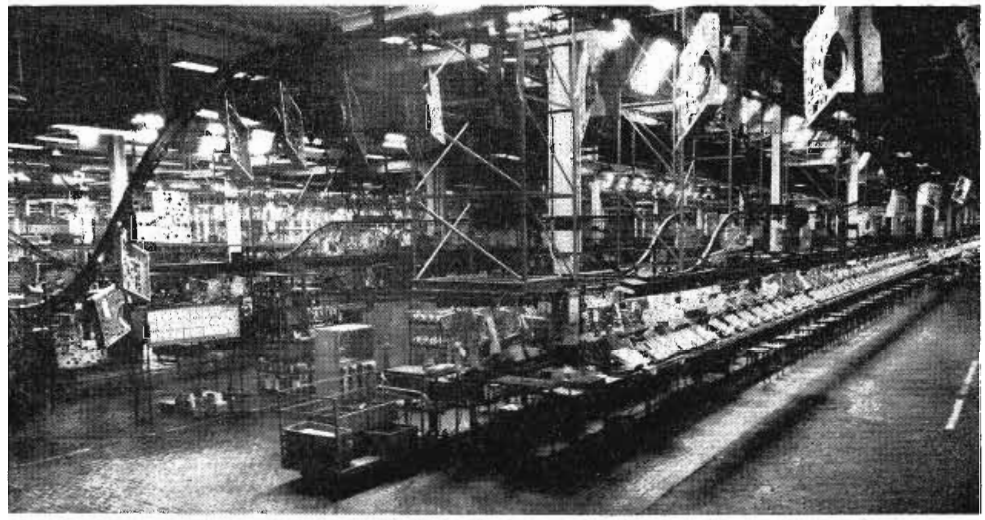


A – OVERHEAD CHASSIS CONVEYOR – 628 FT. LONG
B – " " " – 672 " "
C – " " " – 320 " "
D – " " " – 552 " "

CIRCLED NUMERALS INDICATE PRODUCTION FLOW SEQUENCE

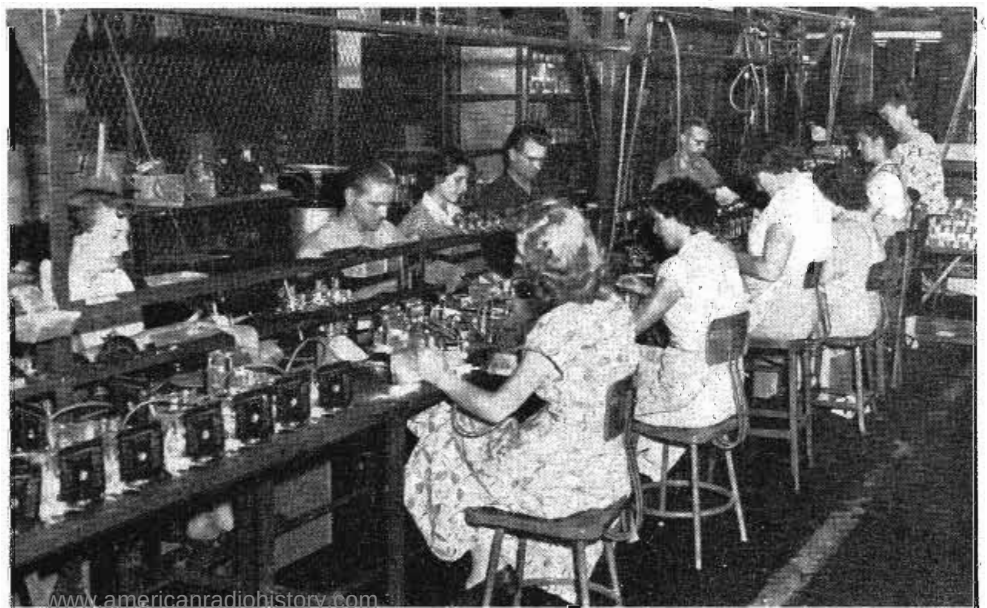
Chart showing working areas, conveyor locations and work flow in new DuMont television receiver assembly plant

DuMont Opens



↑ Starting point for the three main assembly lines. Overhead conveyor carries chassis from sub-assembly area where tube sockets and terminal strips are riveted into place

↓ Another view of the sub-assembly area. Operators are mounting dials on Inputuners



↓ Close-up showing final testing of Inputuners. Completed units are then trucked to main assembly lines for installation in receivers

Main assembly lines in operation (Line #3 at extreme left is not visible). Material parts storage is shown in center

Mounting cathode ray tubes on the completed chassis at end of assembly lines. Receivers are then aligned and tested

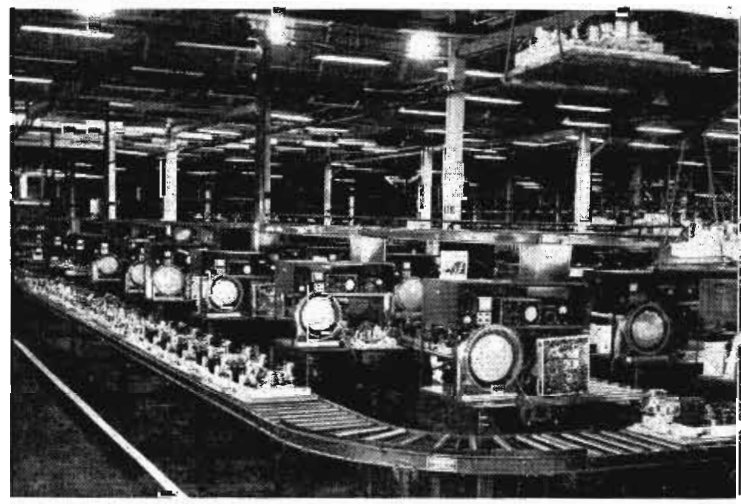
Largest TV Assembly Plant

58 acre installation in E. Paterson, N. J. to produce complete set every 10 seconds

THE tremendous impact that television has made on the nation has spurred DuMont to install a remarkable receiver assembly system, a few views of which appear here. This plant, dedicated September 26, was converted to streamlined receiver assembly from the aircraft production facilities of the Wright Aeronautical Plant in East Paterson, N. J. It provides some 391,000 sq. ft. of factory space and 87,600 sq. ft. of engineering laboratory and office space.

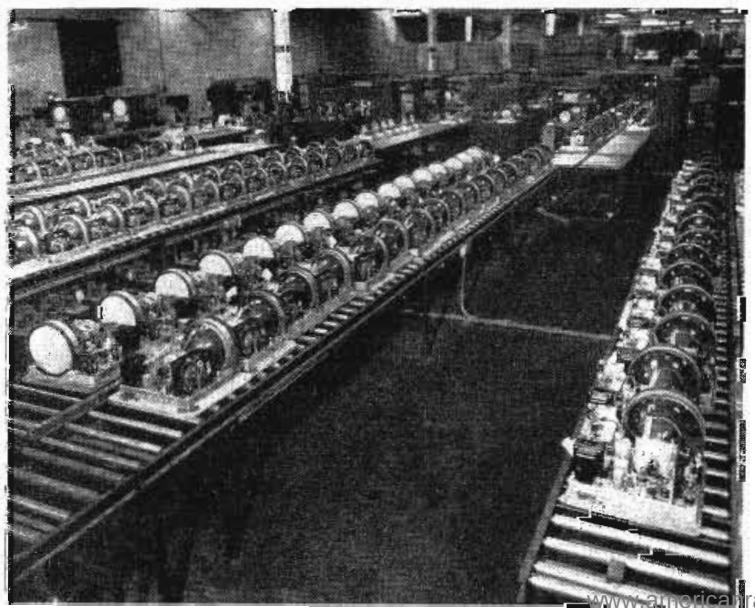
A staff of approximately 3500 will be employed when the plant reaches full production capacity. Eight departments in television receiver assembly production have been set up so that electrical and mechanical devices move the receivers from start to completion. Once on the assembly line the receivers are not lifted by hand. Three separate lines are each 464 feet in length and provide at present the largest straight-away production lines. The plant has cold-cathode light fixtures and the latest in industrial equipment and processes.

The building in general is a modern structure of steel and tile, with ceiling heights varying from 18 to 29 feet. Approximately 165 intake and exhaust ventilators have been installed on the roof.

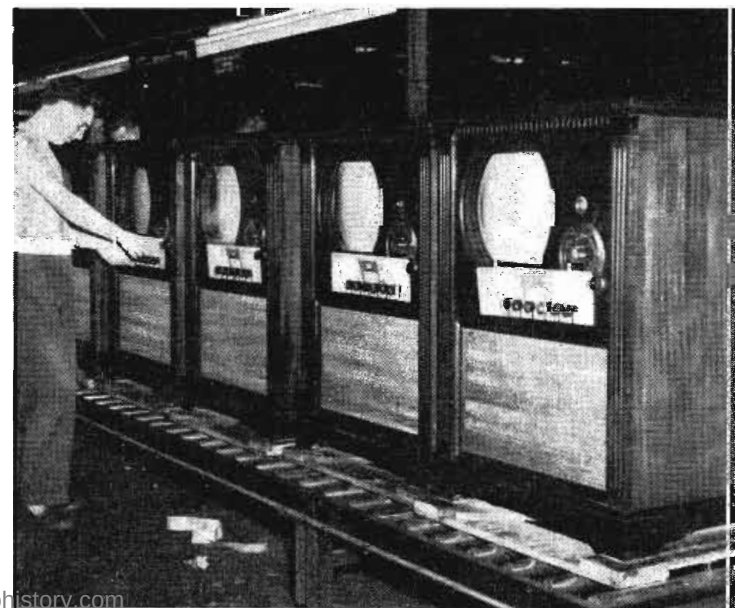


Alignment and Testing area. Generators providing test signals to stations are centrally located in air-conditioned room

New sets are aged two hours. Receptacles at sides of conveyors provide ac power; audio jacks are in center between conveyors



After aging alignment is re-checked. Chassis and cabinet are then assembled. Final operating checks include "off-the-air" signals



Surge Testing of

Experiments with artificially generated "Flash-arcs" reveals gas pressure, internal

By H. J. DAILEY, Westinghouse Electric Corp., Bloomfield, N. J.

THE "flash-arc" is the spontaneous breakdown of the high insulation normally afforded by a good vacuum between metallic electrodes and, in general, does not show up immediately upon application of voltage to the electrodes. This effect is not new. R. W. Wood[1] in 1897 described a discharge, which, from his description, resembles the flash-arc as it is known today. Hansford and Faulkner[2] in 1927 described this effect as "current discharges which are many times the maximum emission current of the filament . . .". This type of discharge was given the name "Rocky Point effect" from the experience at the RCA Communications transmitters at Rocky Point, Long Island. The term "flash-arc" was later applied as being more descriptive, and the term "flash" is applicable as it gives no warning.

Flash-arcs in high vacuum tubes have been studied by several authors[3,4] with particular emphasis on the causative factors. Some authors[3] and some tube manufacturers recommend that resistance be added in series with the plate supply to limit tube surge currents under certain conditions in order to minimize their effect in the tube.

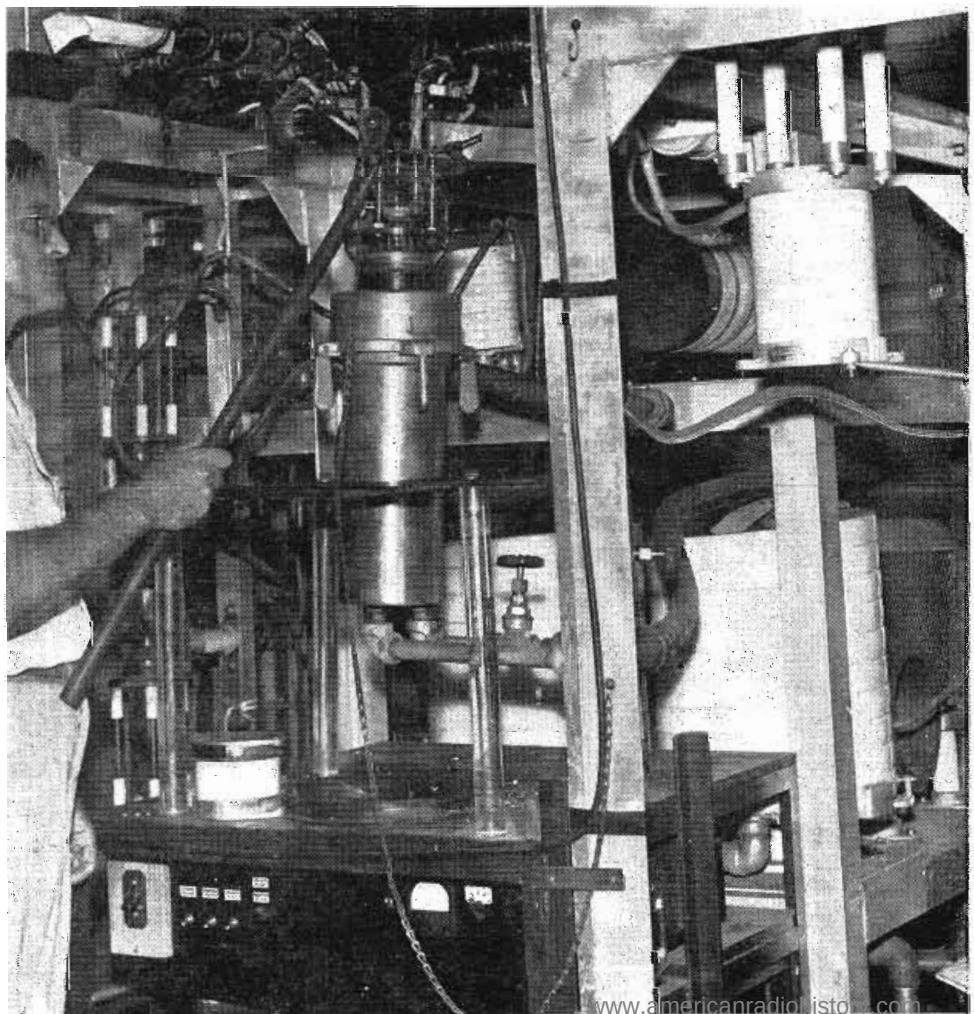
Surge currents and limiting thereof is of particular interest as tube sizes increase since satisfactory current limiting could easily become one of the most difficult application factors. The subject is a very controversial one and the data presented here are not presumed to conclude the investigations that should be made in this field.

This study was made in order to obtain answers to "Does the addition of a plate resistor minimize tube damage from flash-arcs under a given set of conditions?"

The conditions involved were:

1. The test tube must have commercially obtainable vacuum readings. (10^{-6} mm pressure). 2. The tests were to be made with the tube non-oscillating to eliminate results being obscured by gas bursts from sources other than the arc proper. 3. The maximum surge currents obtainable from the power supply were to be compared with the surge current limited to a maximum practical value, in tube damage and in surge tendency. 4. The limited surge currents were to be of the order obtainable from a power source using low impedance rectifier tubes and capable of driving only one tube.

Fig. 1: Westinghouse type WL-895, 100 kw power tube, in surge current test position



Arc Initiation & Equipment Used

A part of the set-up used for these tests is shown in Fig. 1. The high vacuum tube selected for this series of tests was the Westinghouse WL-895. The rectifier in the test set-up used was fed from a 1200 kva transformer and is composed of twelve type WL-857B rectifiers. The output voltage is variable from 0 to 20,000 volts at 60 amp. continuously by means of an induction regulator. This rectifier can supply up to 750 amp. during a flash-arc in the WL-895 as measured by an oscilloscope.

The circuit finally adopted for

High Vacuum Tubes

gas sources, filament-support construction as prime manufacturing control factors

starting the flash-arcs, after other means of initiating arcs had been tried out but found to be erratic in performance, is shown in Fig. 2. It will be noted by inspection that the triggering voltage from the spark gap is superimposed on the grid bias voltage. The condensers were charged in parallel and discharged in series by shorting the spark gap nearest ground. Pulsing the grid negative was found to be most effective in starting a flash-arc with the set-up as shown. The duration of the discharge from the plate supply was measured by a cycle counter energized by the discharge current itself. A current of approximately 10 amp. was necessary to start the counter.

The first series of tests were made in order to determine the plate voltage-plate current curve from the supply with no limiting resistance in the circuit. This curve is shown in Fig. 3.

Arc Current Damage to Tube

The first test tube was subjected to fifty-one surges at 200 amp. by selecting the proper voltage from Fig. 3. The filament structure of this tube is shown in Fig. 4. Arc marks are more pronounced on the filament strand to the front right of the center support. An enlargement of one filament support junction is shown in Fig. 5. The maximum erosion point may be seen near the support. For comparison purposes Fig. 6 shows a field failure with open filaments at approximately the same location as the maximum erosion point shown in Fig. 5. Fig. 7 shows the crazing resulting from arc travel along the glass surface far removed from the filament proper. The bottom edge of the corona shield located as shown in Fig. 8 was liberally marked with arc spots, with the filament supports showing arc marks also. The spacer positioning eyelets on the filament supports were fused from arc terminations. (Fig. 8 is used here only for purposes of giving the arc mark orientation.) The tube shown in Fig. 8 was made up "special" as described later.

The next tube was tested under similar conditions except that the plate supply was raised to 17 kv to obtain the maximum surge current corresponding to field usage. The arc currents averaged 495 amp. with 356 minimum and 745 maximum. After forty-seven arcs the tube punctured from an external arc-over. Although the tube filament was oxidized, examination showed slightly less damage to the filament proper and more evidence of arcing on the filament supports proper than on the previous tube.

In neither of the tests run thus far was any evidence of arcing to the grid wires proper. This evidence, plus the evidence of arc instability on the hot filament, suggested a special tube wherein the anode would be wholly shielded from the filament support structure. This tube is shown in cross-section in Fig. 8. The grid shield projects approximately ½" above the end of the filament supports. After four discharges at an average current of 530 amp. one filament strand was open, with one other melted about half way through. These openings

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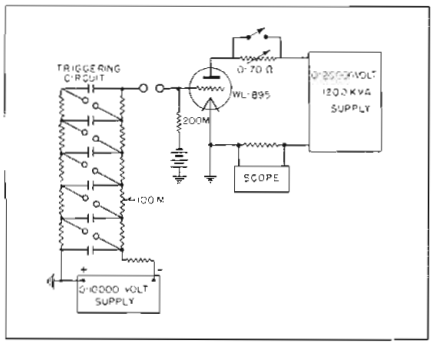


Fig. 2: Circuit used for surge current tests

Fig. 3: Variation of surge current magnitude vs. voltage settings of the plate supply

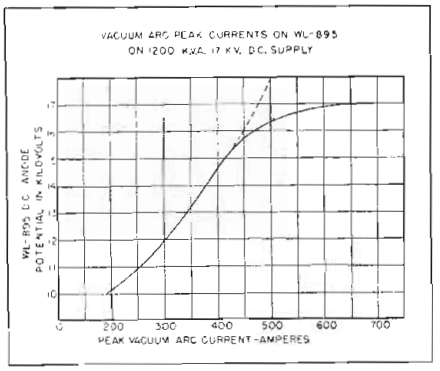
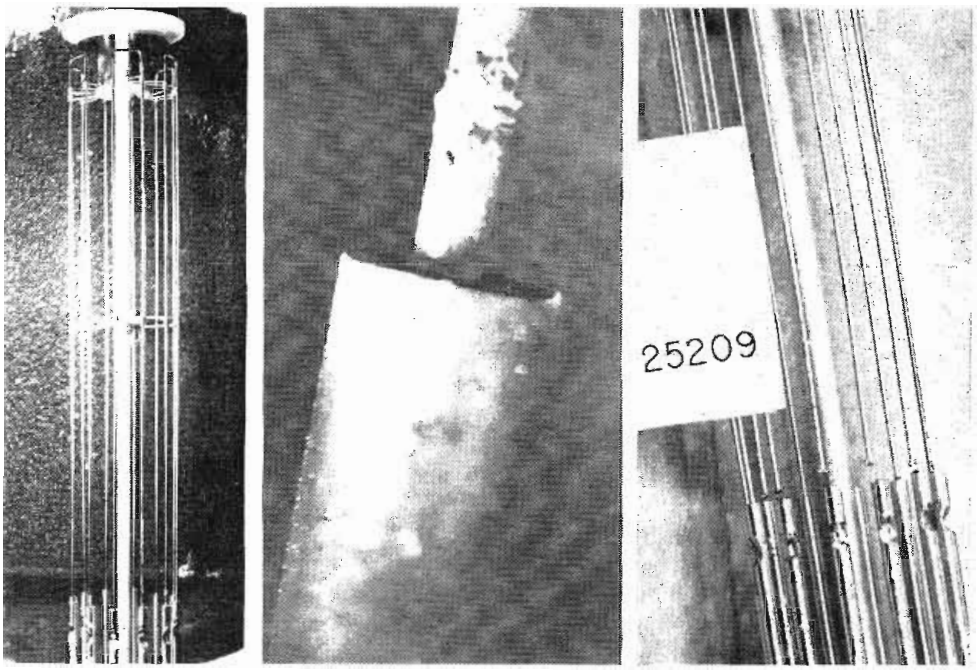


Fig. 4: (Left) Filament support structure subjected to 51 surges averaging 200 amps.
Fig. 5: (Center) Section of filament support-junction shows arc erosion near support
Fig. 6: (Right) Support structure of a field failure shows melted filaments near support



and melted spots were immediately above the filament support in approximately the position shown in the enlarged section of Fig. 5. Points 1 and 2 indicate the maximum travel of the high current arc between anode and cathode.

Conditions Affecting Arcing

As the foregoing tests had shown that damage to the filament was of the same order of severity with the flash-arc current limited to 200 amp. average and unlimited, that is, 500 to 600 amp. average, the next series of tests was made to determine: (1) Did a threshold voltage exist for generation of a vacuum arc using the set-up given, and if so, to what factors was it related? (2) Does arcing change the tube gas pressure? (3) Does gas pressure affect the arcing tendency?

A new tube was set up for these tests. This tube had reverse grid current readings comparable with an average new tube and approximately equal to previous tubes used in these tests. Data were taken on 1219 triggers of the arc-initiating circuit and analyzed. No rigid definitive voltage was found for initiating an arc although a plate voltage of 12,000 volts and a grid triggering voltage of −40,000 volts appeared to be on the threshold voltage. At 12 kv and with no resistance in series with the anode, a flash-arc could be started easier than with resistance, indicating a minimum current for a self-sustaining arc for a given gas pressure. The minimum current was indicated as being approximately 200 amp. to sustain an arc consistently, but with 125 amp. as a possible minimum for occasional arcs.

A check on tube reverse grid current was made after each flash-arc and for each group of trigger circuit discharges. While the gas current decreased slightly for each low current flash-arc and increased slightly for high current arcs, in no case was the deviation greater than 5% and the final reading was approximately 5% lower than the initial reading. All reverse grid (or gas) current readings were taken at a plate voltage of 15 kv and 2 amp. plate current.

Two separate tubes were used to determine the effect of gas current on flash-arc tendency. The first tube, with a reverse grid current reading of 70 μamp. was operated at a plate voltage of 17 kv and a triggering voltage of −60 kv. After 774 triggers, the average flash-arcing rate was one in forty-five tries and with 121 triggers between the last two arcs. The other tube was prepared with a gas reading of 750 μamp. After 244 triggers without a plate resistor and 1112 triggers with a plate resistor, the average flash-arc rate was one in eight with fifteen triggers between the last two arcs. This indicates the flashing rate is highly dependent upon the gas content of the tube.

The data from the last tube mentioned indicated that the tendency toward arcing was less with a resistor than without. The latter tube was operated alternately with a plate resistor until an arc occurred and then without the resistor until an arc occurred. The use of the same tube was to eliminate the variables of surface condition and tube gas content. The results are tabulated:

With Resistor	
Triggers:	**Flash-Arcs:**
1112	34
Rate = 1/32	
Without Resistor	
Triggers:	**Flash-Arcs:**
244	34
Rate = 1/7	

Examination of this tube showed considerably greater damage to the filament than in those tubes where the gas pressure was less. The damaged areas were spread along the entire length of the filament but predominated near the end farthest from the filament supports.

Analysis of Test Results

The data obtained indicate:

(1) The arc is initiated on the filament wire. (2) The arc is un-

Fig. 7: Enlarged photograph shows typical glass envelope crazing from internal arcing

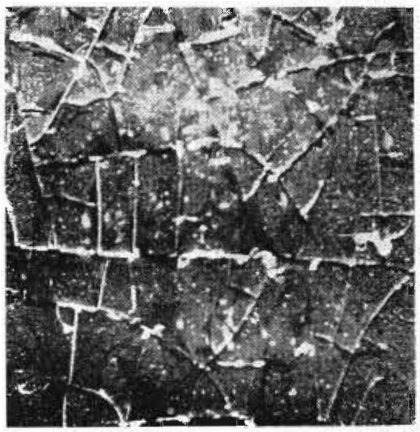
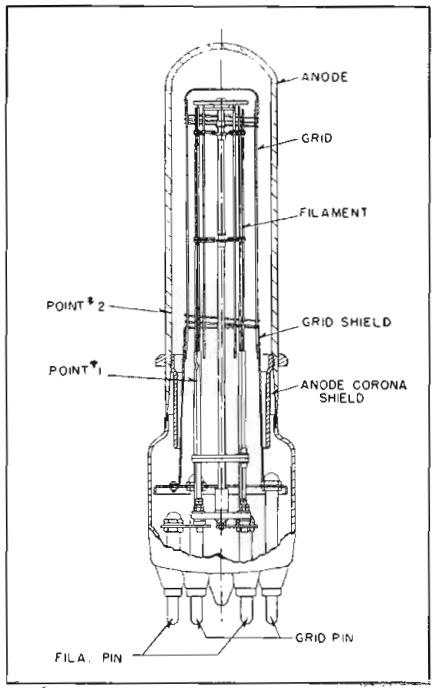


Fig. 8: Drawing shows details of special tube made for surge test; features solid grid shield projecting above filament ends



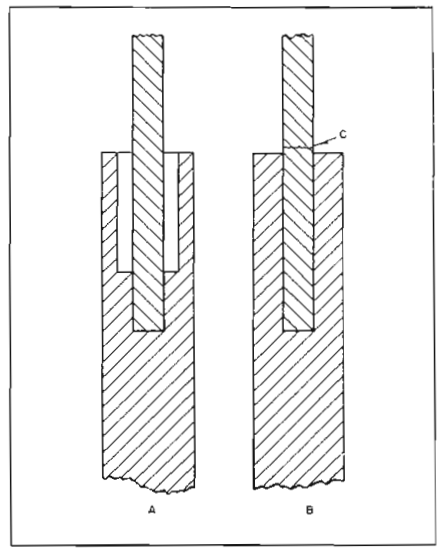
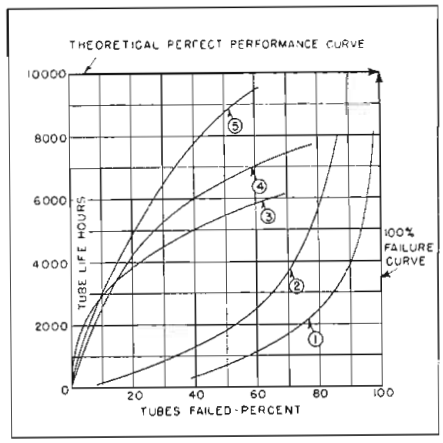


Fig. 9: Diagram showing filament-to-filament support junctions. (A) illustrates present and (B) illustrates previous constructions

Fig. 10: Field performance chart of WL-895



stable on a hot filament when the gas pressure is low. (10^{-6} mm mercury). (3) The arc is semi-stable on a hot filament if the gas pressure is high. (4) The arc travels to a cooler part of the tube structure when the gas pressure is low. (5) There is no damage done to the grid wires although cathode arc traces are visible on remote sections of the grid supports. (6) Restricting the arc to the filament proper by shielding results in prompt tube destruction. (7) When the arc can move freely, the damage done to the filament is of the same order of magnitude with or without the limiting resistor in the plate circuit if the tube gas content is low. (8) The rate at which the arc moves is a function of the gas pressure. (9) The tendency toward flashing is lower when the tube is well evacuated and a series resistor is used in the plate circuit. The voltage gradients between the elements were calculated by the relation:

(1) $g = EK/R_1 \log_e R_2/R_1$

where: g = potential gradient in volts per inch. E = total voltage difference between elements. R_1 = radius of smaller element in inches. R_2 = radius of larger element in inches. K = 1/pd. p = number of wires per inch (for grid). d = diameter of grid wire in inches. This relation is accurate within approximately ±10%. By the use of this relation and the test voltages, a grid-to-anode potential gradient of 290 kv/in. was necessary to initiate an arc with an anode voltage of 8-10 kv. With a plate resistor this gradient had to be increased to approximately 365 kv/in. for breakdown.

Voltage gradients calculated for other parts of the tube indicate maximum gradients exist during the triggering pulse on the grid wires nearest the filament supports. This is the region of the tube where ionization is less than in the region of the filaments at or near maximum operating temperature. The existence of ions near the hot filament, plus tungsten vapor, photo electrons, and some soft x-rays, may be contributing factors toward

(*Continued on page 58*)

Small Field Measurement by Electron-Optical Shadows

COMMUNICATION engineers desiring to study magnetic or electro-static fields of extremely small dimensions will be interested in the recently released method developed by Dr. L. L. Marton, Electron Physics Laboratory, National Bureau of Standards, Washington, D. C.

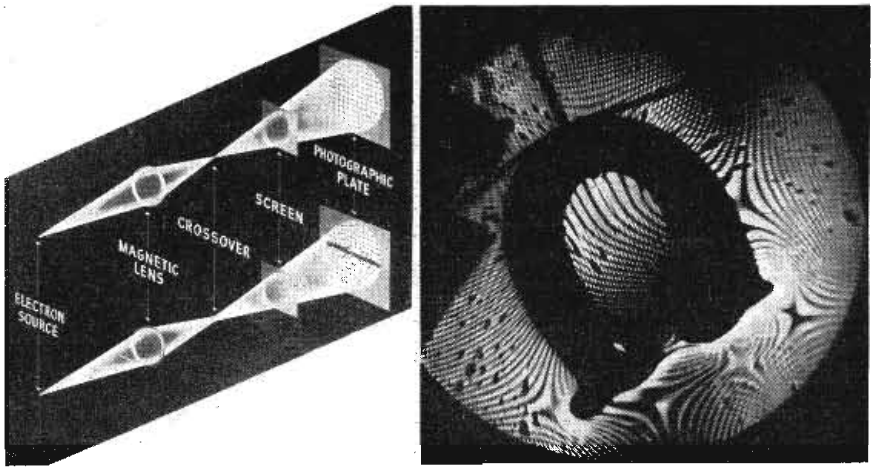
Electronic counters employing magnetic wire or tape often require that as much data as possible be crowded into a given length of wire. It is desirable that the recorded magnetic pulses be "pushed together" as much as possible and still retain their shape so as to be usable when removed from the wire by the reproducer. As far as the magnetic property of the wire is concerned, just how close can the pulses be spaced?* It was to answer this question that Dr. Marton evolved the method and apparatus briefly described below.

It seemed natural that this expert in the field of the electron microscope would devise an electron-shadow method. In a demountable cathode ray tube he set up an electron lens system which produces, on the usual fluorescent screen, the shadow of a fine wire mesh which is placed in the proper position in the tube. This is a convenient way to show coordinates, against which the later-to-be-discussed distortions are to be viewed. The upper half of Fig. 1 shows this system.

Now if the magnetized wire sample be placed in the electron beam just before the magnetic lens, at the point shown by a small, white line in the lower portion of Fig. 1, the crossover will be somewhat blurred and the effect of the almost infinitesimal magnetic fields existing along the wire sample will be readily seen in relatively large distortions in the pattern on the screen of the CR tube. This pattern is photographed in the usual way. The photo can also be enlarged if desired and from it the absolute field intensity can be computed. The positions of the distortions also indicate where along the wire the magnetized areas are located.

Scientists will recognize this method as somewhat similar to the Schieren method, worked out at the NBS, but the new method is better adapted for precise determination of field intensity.

Some of the applications of this method are: (1) Investigation of the fundamental nature of ferromagnetism; (2) Study of space-charge fields in many types of apparatus and (3) Study of spherical aberration in electron lenses. Other applications have been suggested but it must be realized that the unknown field to be investigated must be capable of being placed within the demountable, metal CR tube at the proper point.



Left: Drawing showing the principle of electron-optical shadow measurement technique. In the upper illustration a magnetic lens converges an electron beam, forming a reduced image of original source at crossover point. This reduced image acts as a virtual source and produces an enlarged shadow image of the wire screen on the photographic plate.

Right: Photo of magnetic field about horseshoe magnet ¼ in. wide. New method of measurement is expected to find extensive application in study of space-charge fields, fields produced by contact potentials, waveguide problems, and properties of dielectrics

*The recording and reproducing heads are the bottle-necks at present.

Two Second AM

Unique monitoring system permits a continuous check

By ARTHUR F. SCHOENFUSS, Construction Chief Engineer, Station WXKW, Albany, N. Y.

THE great increase in the number of standard broadcast stations, which took place during 1946 and 1947, was accompanied by a general trend on the part of existing stations to increase powers and coverage areas. (These two movements, taking place in the limited standard broadcast band, already well filled with operating stations, resulted in a squeeze to the limit. Each portion of the industry — the FCC, the existing stations, the applicants for new facilities, the consultants, and all the others, — had to assist in the general squeeze that finally made it possible to increase the number of stations to such an extent.) This resulted in the need for new measures to fit the expanding facilities into the limited spectrum.

Some of the measures taken were: to revise standards so that stations on the same and adjacent frequencies could be located with less geographic spacing; to design directional antennas with greater suppression of signals in the undesired directions; and greater supervision of the maintenance of directional antenna patterns.

WXKW, in Albany, New York, illustrates some of the problems involved. This station (then WRWR) was granted a Construction Permit for 10 kw, fulltime, on 850 KC, using an array of 6 towers in a line to produce the pattern of Fig. 1.

Upon completion of construction it developed that the degree of signal suppression specified in certain directions was extreme in view of certain irregularities in terrain, ground conductivities, re-radiation, and other phenomena.

Both during the period of adjusting the antenna and the first months of program tests, WXKW was confronted by a series of technical and legal problems revolving around the critical array and the question of maintaining adequate protection to other stations on the channel. It became apparent that the adjustment of the antenna was so critical that variations of a slight nature which could be expected to occur frequently, might result in exceeding the limits specified in the CP. This instability was eliminated by major redesign of the phasing and transmission system. However, it was obvious that WXKW's operation depended not only upon the station's ability to maintain its pattern but also upon its ability to prove that such was the case.

Monitoring System Installed

A monitoring system was installed which met the following requirements: Measure the exact radiation in each critical direction; permanent record of the signal strength in these directions; simplify routine pattern trimming and, possible major readjustments; replace elaborate and costly field measurements which were being made daily at the time, as required by a modified CP and program test authority.

A monitoring system meeting these requirements was designed by the station's engineering consultant, R. M. Silliman, of Washington, D. C., and was constructed during the first three months of 1949. This system is unique and is thought to be the first of its kind. In effect, WXKW now makes a simplified proof of performance several times a day—each time by merely pushing a button.

Fundamentally, the system consists of three monitoring installations, each with an antenna, a receiver, and a recording meter, and facilities at the transmitter for providing a non-directional reference signal of short duration. This appears simple, but by the time the completed installation was working, many problems had been overcome, all of which made the project more interesting, and more expensive.

During the period of adjusting the WXKW antenna, it was discovered that any one point in a null was not indicative of the signal strength radiated in that direction. This is because the effective signal at a point in a null was actually the resultant of the directly radiated signal plus re-radiated energy. The various signal components not being in phase, it was possible for the field at one point to go up with a certain change, while the field a hundred feet away, in the same direction, would go down. This phenomenon made necessary "Beverage," or long wire, antennas for the eventual adjustment of the antenna. One wavelength at 850 KC is about 1158 ft., therefore antennas about 2300 ft. long were used. This resulted in sampling and averaging the signal strength over a distance of about two wavelengths, which eliminated the effects of re-radiation and tended to cancel out inconsistencies in measuring points.

The following were the requirements for the monitoring point locations: They had to be in the proper directions from the WXKW antenna, to better than one degree; they had to be a minimum of fifteen miles away, airline distance, in order that the antenna appear as a point source of energy; they must be accessible by vehicle at all times of the year; they must be convenient to power and telephone lines; each must be at the far end of a half-mile stretch of terrain suitable for a long wire antenna placed radially with respect to the WXKW antenna, and not crossing property where the antenna might be subject to interference.

In each case the antenna wire itself was installed first and tried experimentally to insure that it was

Proof of Performance

on critical direction radiation of the antenna

in a satisfactory location before the remainder of the installation was put in. The wire runs in one case along a fence and then into woods for the remainder of its length. In the other two cases, the antennas are in overgrown clearings, scrubby areas, and lightly wooded areas, all of which are unused.

The antennas themselves are laid on the ground. They are already covered in part by high grass, weeds, and bushes, and in winter were covered by snow. As they serve only to indicate the ratios between a non-directional and a directional signal variations in pick-up caused by weather conditions are of no matter. Where they cross small streams or wet areas, they are supported above the water.

Surplus army field wire with three conductors is used. The conductors are connected in parallel at each end. Each strand has weatherproof insulation, designed for on-the-ground service in all weather, enough copper strands to keep the resistance low, and steel strands to maintain strength.

Antenna Terminations

In some cases the antennas were terminated in their characteristic impedances at the far ends. This was done to obtain the maximum ratio of signal from WXKW to other stations on the frequency. The terminations were determined experimentally, and communication between the ends of the antennas was provided by field phones using two of the strands. The terminating resistors, mounted in weather-proof boxes, connected between the antennas and ground systems. These consist of buried radials, each about 50 ft. long, of #10 bare copper wire brazed at the end to a grounded metal stake and all brazed together at the centers. Ground connections are made at these points. At the receiving ends, the antennas are used in association with similar grounds consisting of 25 buried radials.

The system was planned to be permanent, and it was anticipated that station engineers would spend considerable time at the field points, in all types of weather. This led to the decision to put up substantial buildings. Three wooden buildings were made. Each is six feet square, with a sloping roof.

Three similar receiving recording units were built by the consulting engineer. The receivers are war surplus BC-946-B aircraft receivers, which tune to the broadcast band. The long wire antenna is capacity coupled to the input. A.V.C. is not used, and the output of the receiver feeds an amplifier to drive the meter, and a relay control with several functions, see Fig. 2. The meter is an Esterline-Angus recording milliammeter, with a linear scale of 0-100 requiring 1 ma for full scale deflection. The receiver gain is adjusted to keep the readings near midscale.

The moving tape is continuously driven by clockwork, and moves at ¾ in./sec. This serves to expand readings for a few seconds for easy analysis and record. The relay control portion of the unit is actuated by any interruption of the carrier, so that a carrier break causes the slowly moving tape to speed up and record on the expanded scale for a preset period which is normally five or six seconds.

With the tape moving very slowly, the antenna is switched from directional to non-directional operation. During this switch, the

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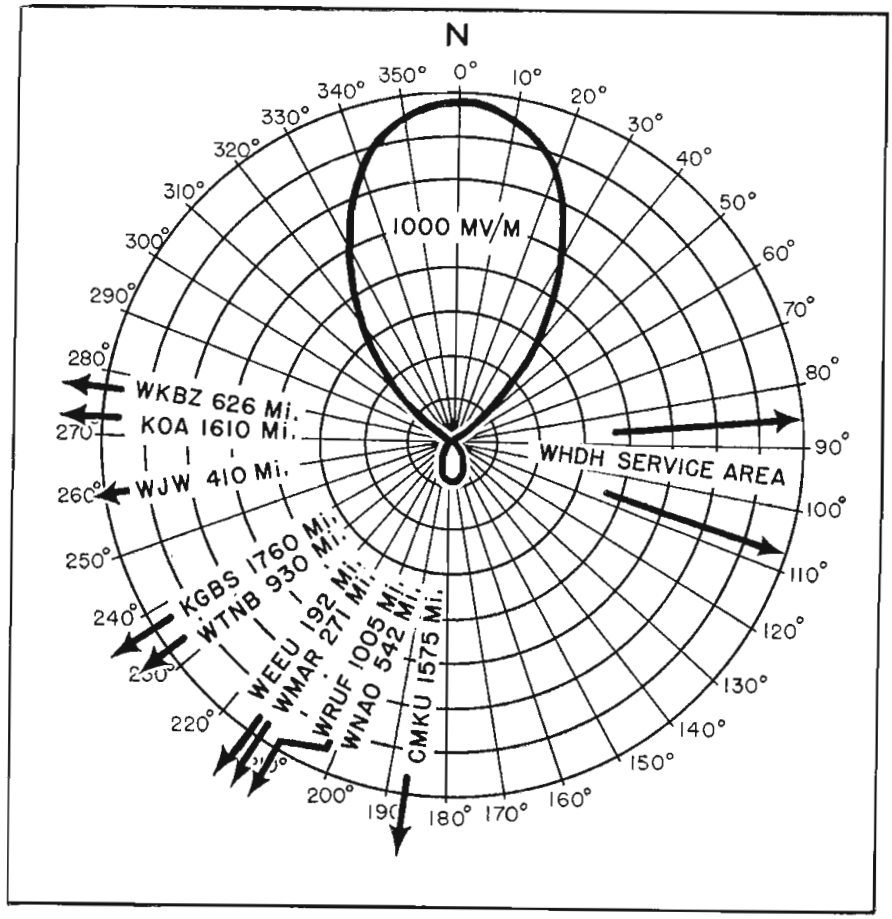
Fig. 1: WXKW 10 kw, 850 KC radiation pattern. Note high degree of suppression required



carrier is momentarily off the air, which triggers the recorder. The high speed scale then records the non-directional signal. The antenna returns to directional operation and this signal also is recorded on the expanded scale. After a few seconds the tape returns to idling speed to await the next test. The relay control unit contains adjustments for setting the level at which the tape motor is triggered, the duration of the break required the duration of the expanded scale operation, and the duration of the period during which the unit will be unaffected by another carrier break (such as the momentary break between non-directional and resumed directional operation). In addition to this, it has a protective feature that locks it out should there occur a lengthy carrier interruption, such as might be caused by transmitter trouble. Without this provision failure of a tube might result in running off a complete roll of tape in very little time.

Power to each unit is fed through a Montgomery industrial timer which turns it on ten minutes before a scheduled break for a period of approximately 20 minutes. If a lockout has taken place it is cancelled automatically upon reapplication of power by the timer.

All the drive motors operate on 12 volts dc. In the case of two units, the power supplies for the receivers and relay units are 12 volt dc vibrator supplies. These units are operated from two heavy-duty automobile storage batteries. (These units were built before it was known that ac power would be available; however, they maintain continuity of service despite power interruptions, common in the rural areas). Each house is equipped with a hydrometer, a supply of distilled water, and a battery charger, so the batteries are kept "floating" while in use. The third unit is all ac operated, with the motor and dc filaments supplied by selenium rectifiers. The recording meters and motors are identical, and are attached to the electronic units by cable and plug which makes them interchangeable.

The ink in the recording meters can freeze at low temperatures. To prevent this, each meter was placed in a specially made wooden cabinet, of double thickness, with insulation between the two walls. This "oven" is heated by a small incandescent bulb, controlled by a Minneapolis-Honeywell thermostat. The element was modified to reduce the operating range from room temperature to the freezing range. In the period before ac was available in all houses, two automobile headlamp bulbs, in series, were used instead of the 115 volt bulb. This arrangement can be seen in Fig. 4.

When these three installations are used simultaneously, e.g., during trimming operations, the party line telephone service is frequently not available. Therefore, each house is equipped with two way radio to the WXKW transmitter. Signal Corps BC-474-A transmitter-receiver units are used, converted to crystal controlled operation on 2830 KC, with the final stages replaced by 6L6GA's. They are operated from modified PE-103 dynamotors running off storage batteries, and are completely portable. Communications antennas are strung in the trees near the houses. These portable sets were in use during the initial WXKW adjustment, where they were used to provide communications between the main transmitter and the field measuring points.

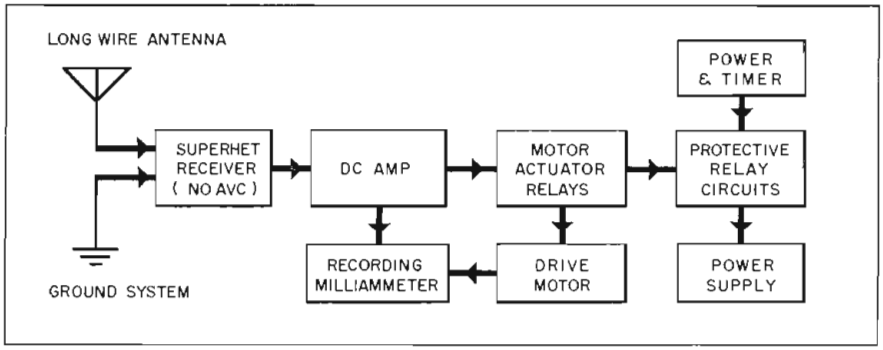
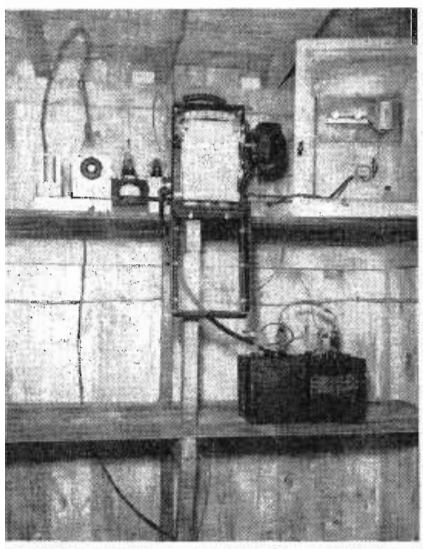


Fig. 2. Block diagram of apparatus at monitoring point shows functions of equipment



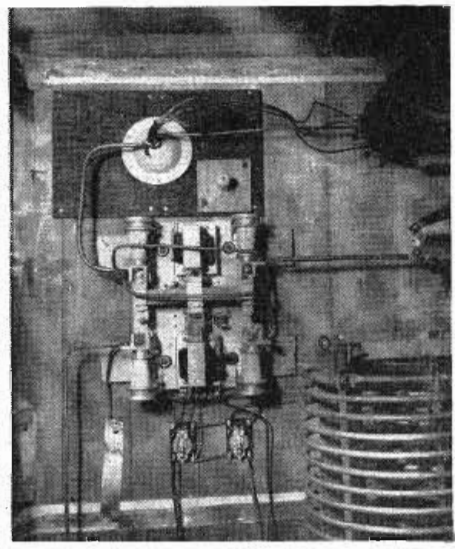


Fig. 3: (Left) View of first working installation shows (l to r) receiving unit vibrator pack, receiver, amplifier control chassis, recording receiver and heated cabinet
Fig. 4: (Right) Photo showing one of the r-f relays in its normal operating position

Separate Transmitter

A separate transmitter to produce the non-directional reference signal is necessary because of the very low power required. The limiting fields at one mile are of the order of 25 MV/M in the direction of three recorders. This is equivalent to only a few watts into a non-directional antenna. The non-directional signal is set to the maximum permissible directional value by using a low powered transmitter with an output of 10.5 watts.

This transmitter uses a third crystal unit identical with the two in the main RCA transmitter. The output of the final stage is regulated very closely by using a high degree of r-f feedback. This maintains a constant r-f output under all conditions. The transmitter is situated at the tuning house under #4 tower, which is the non-directional reference tower. The filaments are heat-

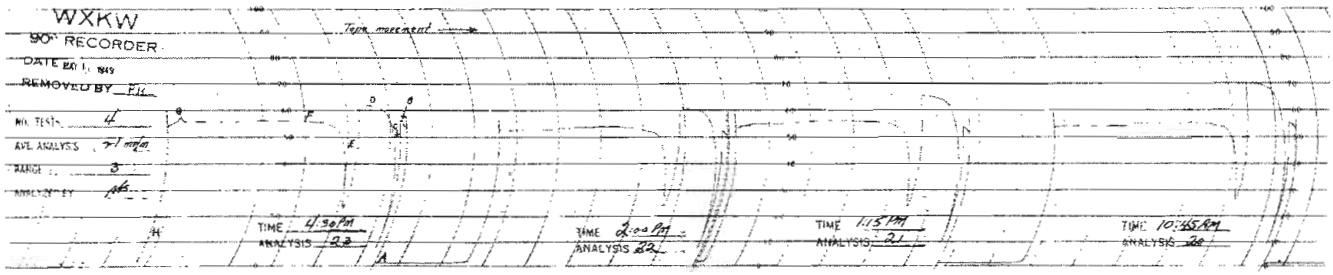


Fig. 5: A typical tape record of one day's operation shows four test periods. See text for explanation of the symbols appearing on tape

ed all the time, but plate power is supplied only when the reference signal is required.

WXKW operates with the same pattern day and night, but for monitoring a complete pattern change system had to be installed. Basically, the system consists of a Johnson r-f relay in each tower. In the normal position, the output of the antenna tuning unit is connected directly to the antenna. One of these r-f relays is illustrated in Fig. 4 and shows the temporary wiring installation (between 1 and 5 AM one morning, in time to readjust the pattern). The relay is shown in the normal position. In the "test", or non-directional position, the unused antenna is disconnected from the tuning unit, and connected instead to a network which tunes the tower for minimum induced current, as indicated by its sampling loop. This prevents the other towers from affecting the reference tower which then becomes truly non-directional. In the case of the reference tower, it was connected to the output of the 10.5 watt transmitter. The auxiliary contacts on the "test" side of this r-f relay were used to operate a relay to supply plate power to the transmitter.

To summarize, in normal operation the six towers are used in conjunction with their six tuning units, and the low power is on standby. When the six relays are operated, all six towers are removed from their normal connections. Five are connected to isolation circuits that effectively tune them out of electrical existence, and the sixth is connected to low power transmitter which is simultaneously turned on. The resetting of the six r-f relays turns off the transmitter and restores the pattern to normal.

The r-f relays are operated by 115 volts ac power in the coupling houses, on separate circuits, and with individual fuses. The power is controlled by a relay for each coil, and the relays instead of the coils are operated by remote control from the transmitter building over a thousand feet away. This was necessary because of the problem of voltage drop in the wiring since the coils draw a high surge when first energized. The relay control line to switch to non-directional is common to all towers, and the relay control line to return to directional is also common so that a pattern change requires only the momentary energization of one or other control line at the transmitter.

Elaborate Control Unit

Despite the apparent resolution of the control problem to two lines, an elaborate control unit was required. The unit was designed by station personnel and made to order by Gates. It combines operating and signalling features. Each r-f relay has a set of normally open auxiliary contacts for each position. Lines are brought back from these to the control unit. This has six green and six red pilot lights, a pair for each tower. Thus the status of all relays can be seen at a glance. The green lights indicate normal operation.

In addition to illuminating the green pilots, the circuits energize six holding relays. All these relays must be energized to hold the main transmitter on the air. Thus, after a test, power cannot be supplied until all towers have resumed normal conditions; this prevents damage in the event of trouble.

The non-directional control line is energized by pushing a "test" button. Although the button may be released immediately, a relay keeps the line energized until all the r-f relays have thrown. Simultaneously with this operation, pushing the same button breaks a transmitter control circuit and removes power from the antenna before the r-f relays can operate. The transmitter is held off the air until all of the six holding relays have eventually reclosed. This control unit can be operated in two modes, "manual" and "automatic." In manual, the non-directional signal continues until the operator presses a "reset" button, when the restoration sequence takes place. In automatic, however, after a preset interval, the unit automatically resets the pattern and restores transmitter operation. The control unit has two adjustments. One is to determine the length of time the reset control line is energized (normally about three seconds to insure positive action of all relays) and one to determine the duration of the automatic cycle. A control in the low power transmitter determines the delay between the time the r-f relay closes and the time it comes on. This is set to one-quarter second, to allow the recorders to come up to speed, and the duration of the signal is normally set to about one and a quarter seconds, so that the entire sequence takes place in two seconds.

Pressing the control button initiates the following sequence of operation: Main transmitter goes off the air; tape recorders speed up; relays switch antenna to non-directional; 10.5 watt transmitter comes on; signal strength recorded; 10.5 watt transmitter goes off; antenna switches back to directional. Main transmitter back on air — two seconds after it goes off the air. Directional signal recorded on tape which subsequently resumes idling speed.

After such an operation each recorder presents, permanently charted, the field strength averaged over two wavelengths in a given direction compared with a non-directional signal of known value recorded under identical conditions.

This test is currently being performed four times daily at scheduled times during station breaks, and is not noticed by the average listener. The duration of the pause required by the announcer is kept to a minimum. From the time the main transmitter goes off until it returns to the air, a 1000 cps tone is superimposed across the input to

(*Continued on page* 54)

Illumination for

A discussion of problems and experience gained in using most recent combination of illuminants and structural

Television Studio LIGHTING

Third of a Series

PART TWO OF TWO PARTS

IN addition to the photographic effect of the pickup tube and light source, the reaction of the performers and operating crew to the light source and its physiological and psychological effects within the studio proper cannot be overlooked. The amount of heat radiated, the natural color response to the eye under varied lighting conditions are of great importance. Mercury, for example, because of its discontinuous spectrum, particularly due to the absence of reds, has been found harsh and unreal. Similarly, such a source, rich in ultra-violet, may cause certain materials to fluoresce in most unexpected fashion. The erythemal effect to prolonged exposure of ultra-violet must also be guarded against to avoid serious injury to the eyes and skin.

One of the most serious objections in television apparatus to the use of mercury lamps is the length of time it takes the source to reach full output from starting up. Equally important is the length of time to restart after quenching since a cooling down period must intervene before the cycle can commence. Another operational hazard is the possibility of improper phasing leading to a stroboscopic effect between the frame frequency of the television camera and the cycle change in light output. Limited experimental use has thus far not revealed any serious disturbances in this regard but a noticeable shift in power frequency might introduce undesirable black bands in the picture. While this difficulty can be minimized by putting the lamps on different phases the installation becomes more complex and harder to justify. The use of auxiliary equipment in the form of reactors for high starting voltages and limiting current flow also makes such equipment less desirable. Space has to be provided. structural equipment supporting the lights must be heavier and the wiring if these transformers are located remotely, becomes more complex.

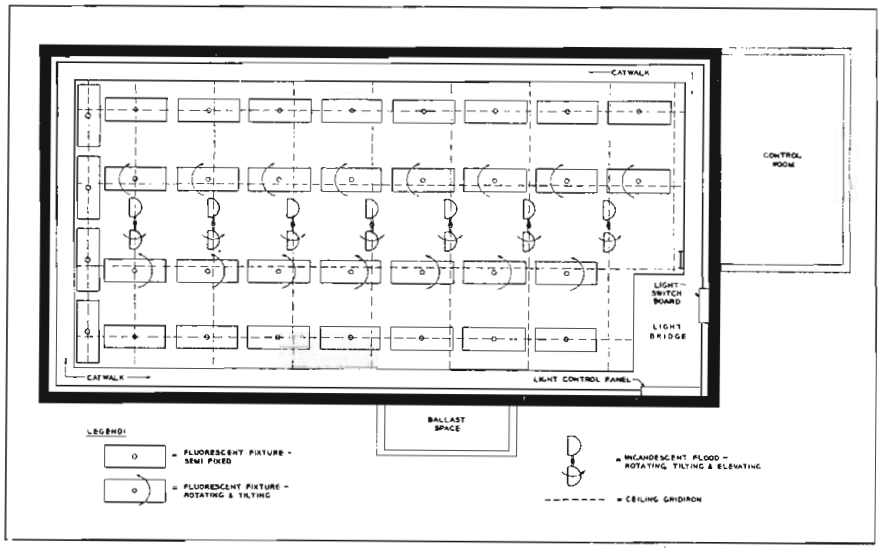


Fig. 9: Diagram of a typical lighting layout for a moderately sized television studio

A 1000 watt zirconium arc lamp was tried experimentally for flood illumination but found unsatisfactory for this purpose because of its spatial distribution which follows Lambert's law. Although equivalent to a tungsten source on a candlepower per watt input basis, the integrated volume of light, or total lumens from the incandescent source equals the product of 4π and total candlepower as compared to the product of π and the total candlepower of the zirconium arc. However the advantages of a high brightness in small source remains to be explored and more fully developed for television use.[7]

Incandescent sources, while they do not present any serious physical hazard, are notorious for the heat radiated and for the resultant discomfort over extended periods of operation. This reaction can be predicted by a study of the energy distribution from such a source and its existence makes such illumination less desirable. Certain advantages, however, make the use of incandescent light a definite requirement. Because of its high source brightness, maximum beam candlepower may be obtained and because of the source size accurate beam control in pattern and distribution can be readily achieved. Visual color adjustment under incandescent light is also more favorable because of the continuity of the source spectrum.

Fluorescent sources offer excellent efficiency in visible light, radiating only a very small part in heat and the ultra violet portion of the spectrum as shown in Table II. By mixing various phosphor coatings on the tubes, wide number of color

Television Studios

various light sources. Studio incorporating elements for easy manipulation described

By H. M. GURIN, Development Engineer, National Broadcasting Co., Inc. RCA Bldg., Radio City, New York 20, N. Y.

response characteristics may be obtained. Because of the length of the tubes, a uniform distribution of light over broad areas with a minimum of shadows may be produced making this type particularly suited for basic illumination. Unfortunately because of its size and low source

TABLE II

Radiant Energy in Percentage of Lamp Watts for Various Sources

Source	Ultra Violet (below 3800°A)	Visible (3800°-7600°A)	Infra Red (above 7600°)
Fluorescent	0.5%	20.0%	79.5%
Incandescent	0.1%	12.5%	87.4%
Mercury (Hi Pressure)	6.9%	29.0%	64.1%
Sun Radiation	5.0%	40.0%	55.0%

brightness, beam control becomes more difficult. Additional auxiliary equipment is necessary to limit lamp current and provide the initial high starting voltages. These ballasts sometimes lead to operating difficulties in producing audible hum, the dissipation of heat and the extra weight of the transformers.

First Consideration is Cost

In considering the requirements for basic illumination the matter of costs is usually the first to be reckoned with. The expenditures involved include not only the initial cost of the equipment under consideration but the cost of installation, the useful life, maintenance, lamp replacement and the manpower required to operate the equipment. For the three sources of illumination discussed above and in consideration of the factors previously mentioned, there is little doubt that fluorescent is the most expensive with incandescent the least costly. However, if the criteria for selection is based on the quality of technical performance, a combination of the best features of all should be applied.

With this in mind a lighting plan has been evolved for a typical, moderate sized, television studio. The advantages of filament and fluorescents have been combined to give a highly acceptable balance with adequate adaptability to meet a wide variety of operating conditions. Assuming the dimensions to be 30′-0″ wide x 60′-0″ long x 20′-0″ high, the ceiling layout of the fixtures may take the form shown in the diagram, Fig. 9. Also shown in Fig. 9 are the proposed catwalks and light bridge where the switching and adjustable controls are located. Scenery height is usually approximately 10′-0″ high. Sufficient fluorescent fixtures have been provided to permit their use in a semi-permanent position in order to minimize the amount of adjustment necessary together with a group of adjustable units for front and fill lighting. They have also been located in such a manner as to provide uniform illumination even when sets are arranged in irregular patterns. The ballasts have been shown remotely located to reduce the possibility of audible hum, radiant heat from the ballasts, and to keep the suspended weight to a minimum. For additional front fill lighting, adjustable incandescent flood lighting is indicated in limited quantity to obtain the maximum basic or general illumination. If the occasion warrants, fresnel spot lights with controllable beam patterns may be substituted. However, such units are generally reserved to form the modelling lights, cross lighting, and backlighting.

In order to avoid any obstruction to camera mobility on the studio floor almost all lighting is suspended. A convenient way is to have the lights supported from a pipe grid near the ceiling. The lights hung in the center of the studio should be lowered to the minimum mounting height so that the front fill light comes into a set not over 60° but preferably at 45° or even less to reduce shadows under the eyes, nose, and chins and to obtain some detail in this area. This factor is particularly important since lighting from the floor even in small amounts may frequently be impos-

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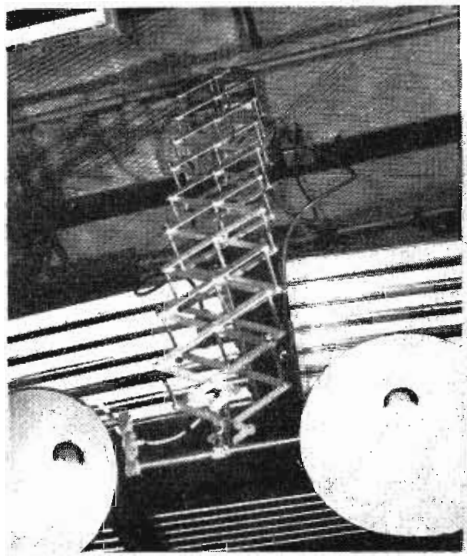


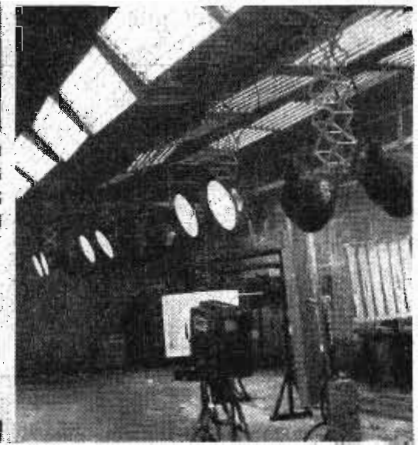


Fig. 10: (Left) Spaced ceiling pantograph units of the type shown provide a flexible method for handling problems of fill light. Fig. 11: (Below) View of lighting facilities installed in NBC's Studio "C", New York

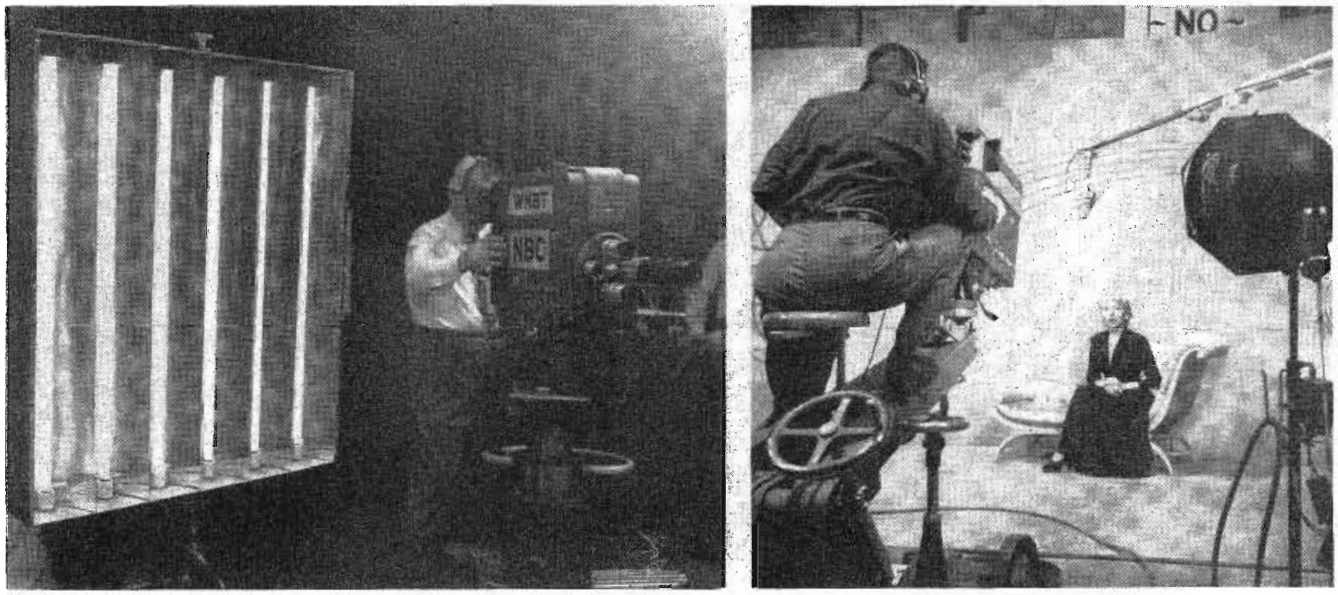


Fig. 12: Fluorescent and filament sources, mounted in stands with large roller casters, are used to complement lighting from ceiling fixtures

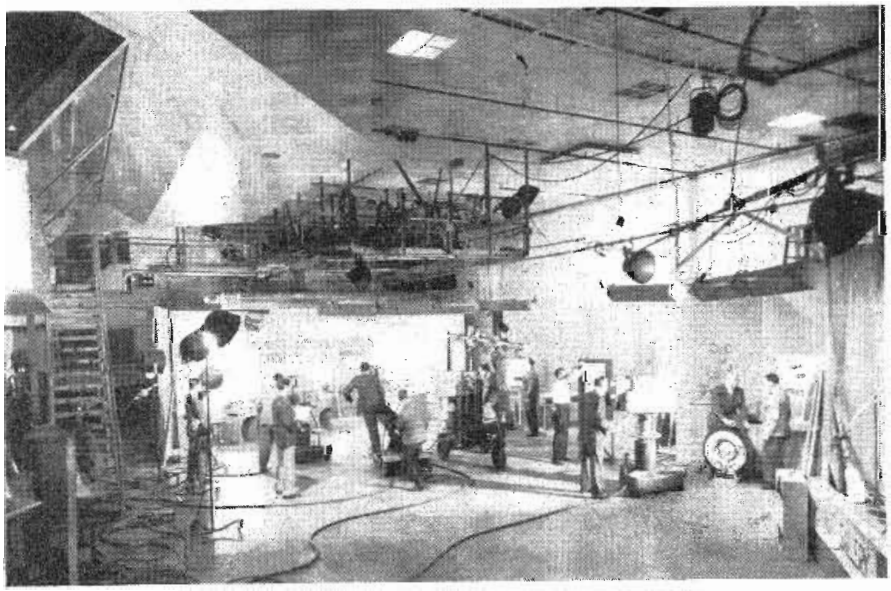
sible without seriously hampering the movement of the performers from set to set or of the camera equipment.

A flexible method in handling the problem of fill light from a suspended fixture has been devised by the use of an adjustable support mounted from the ceiling grid. Spaced at frequent intervals (approximately 4′-0″ on centers), these supports may be lowered manually to any desired height and any fixture being on the bottom. A receptacle, wired for the maximum current anticipated can be made part of the unit. In order to take up the cable for various lengths of the telescoping hangar, clips are attached to the sides thereby preventing any cables looping far enough below the lighting unit itself to interfere with regular operations. These units can accommodate various lamps by suitable counterweights, spring tension, or worm gear drives. Fig. 10 is an illustration of such a unit.[5]

A peripheral catwalk is also very useful in keeping spotlights off the floor when modelling light, back lighting and cross lighting are required. The catwalk should be below the pipe grid to avoid bad shadows from the equipment which is hung from the grid.

Unfortunately, all lighting cannot be restricted to ceiling suspension and some provision for floor broads with a large degree of mobility must be allowed for. Filament and fluorescent sources in open reflectors mounted on stands with large roller casters have been successfully used for this purpose and are shown in Fig. 12.

Fig. 13: Interior view of Studio 8G in Radio City (NBC), adapted for TV programming



Light Switching Control

To complete the description of the system outlined for a typical studio, the switching control of the lights should be included. It is desirable, of course, to be able to vary the incident illumination on a given scene. For incandescent sources, this may be accomplished through dimmers with a consequent change in color temperature which might unbalance the color rendition unfavorably if carried too far. Another method which has been successfully applied involved the use of multiple lamps of which some were completely extinguished. These lamps were so arranged that when under half-light conditions the distribution patterns were scarcely affected. At the same time the color temperature of the source remained constant. The problem is a little more difficult with fluorescents since they do not lend themselves to dimming as readily as incandescents. However, if multiple tubes are used in a reflector they could be wired so that a fraction of them could be extinguished with the same effect described above. Figs. 11 and 13 are

(*Continued on page 56*)

Philco's New Built-In TV Aerial

A description of the constructional and operational features of the system now used in all receiver models

THE Philco built-in aerial system consists essentially of two parts; an antenna that covers both the low band (54-88 MC) and the high band (174-216 MC) and a *tunable circuit for matching* the aerial to the standard 300-ohm input line to the tuner.

The physical characteristics of the system are illustrated in Fig. 1. The antenna itself is a half-wave dipole consisting of two tapered sections of aluminum foil 0.005-in. thick. The narrow ends of these aluminum arms of the dipole are attached to a tunable matching circuit consisting of a variable condenser connected across the terminals of a hairpin coil, which has two shorter loops attached to it at the antenna end. The 300-ohm line is taken off at the halfway point of the hairpin, as shown in the simplified coil sketch in Fig. 1. A long bakelite rod with a control knob at one end is attached to the tuning condenser.

When mounted in the cabinet of a television receiver, the aerial is attached to the under side of the top of the cabinet. The aluminum foil extends across the width of the cabinet, near the back and is folded at the wide ends not only to follow the contours of the inside of the cabinet but also to provide augmented capacity between the ends of the dipole. The rod carrying the tuning knob extends from the rear to the front, and the knob itself appears in a special slot at the top front of the cabinet so that it is easy for the user to tune the aerial.

A schematic diagram of this system's equivalent circuit is shown in Fig. 2A. At the extreme right is the circuit of the antenna, or of the two aluminum foil sections. Note that it consists of both a reactance, X_A, and the radiation resistance of the antenna, R_A. Connected to this antenna circuit is the tunable matching circuit, consisting of the variable condenser with reactance X_C, the two smaller side loops which are inductive with reactances labeled X_1 and X_2, and the long inductive loop with reactance X_L. Note at the left that the 300-ohm transmission line, which leads to the tuner and is labeled T_L, is tapped off the long coil at a point which corresponds to an impedance of about 300 ohms. This obviously results in a good match between the antenna (foil) and the lead-in (twin-X) to the tuner and input circuit, and hence a minimum standing wave wave ratio.

This point is graphically shown in Fig. 2B, which indicates that the matching circuit connected to the antenna is tuned for each channel to an impedance of about 1500 ohms. By choosing the right point on the long loop at which to tap off the 300-ohm line, the line's impedance can be effectively matched. The actual tap-off point is approximately halfway along the length of the long loop.

Considering the matching circuit and equivalent antenna circuit again, over the low band, 54-88 MC, the radiation resistance, R_A of the antenna is fairly uniform and low in value, while the antenna's reactance, X_A, is capacitive as shown in Fig. 2C. Hence to bring this antenna circuit to resonance for television channels 2 to 6, the matching circuit must be inductive. The rela-

(*Continued on page* 60)

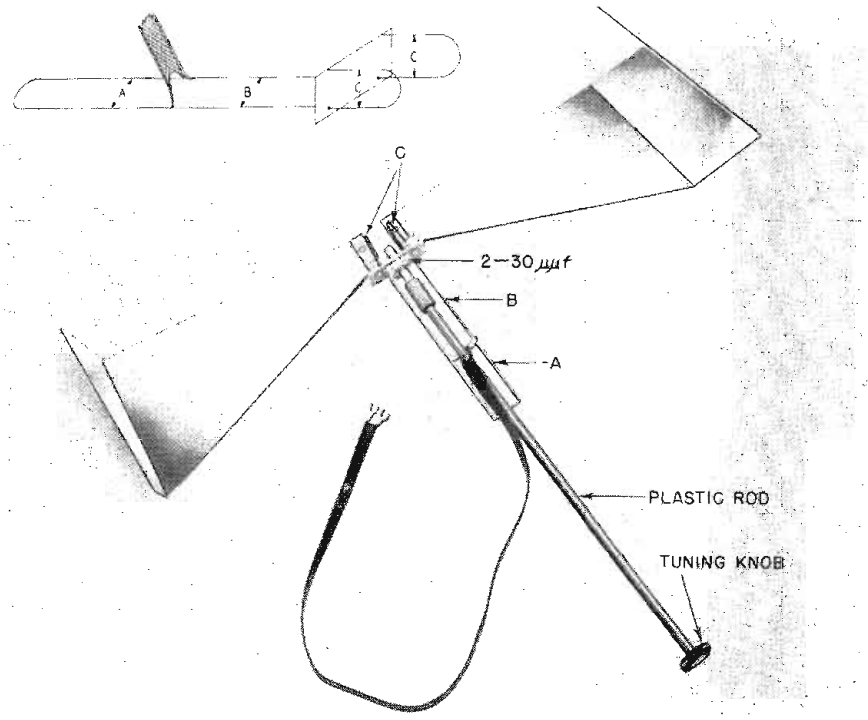
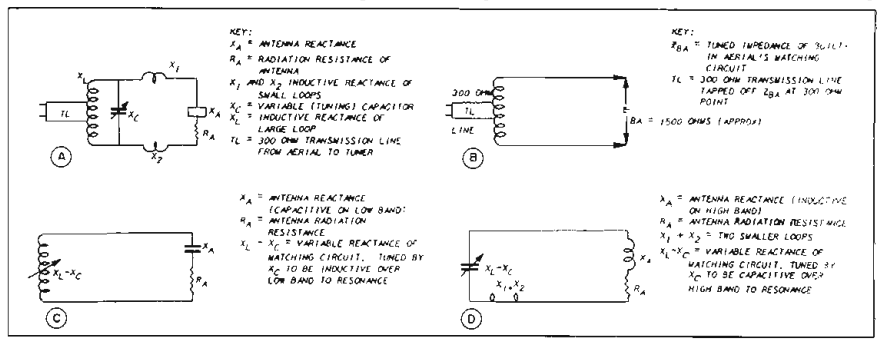


Fig. 1: Physical appearance of cabinet antenna. Details of coil structure at upper left

Fig. 2: Equivalent circuits of the system for high and low band impedance matching



Vestigial Sideband

New unit for television transmitters employs purely signals; is smaller in size and simpler electrically

By E. BRADBURD, R. S. ALTER, and J. RACKER, Federal Telecommunication Labs., Inc., Nutley, N. J.

TO conserve spectrum and reduce bandwidth requirements of the receiver, a television transmitter must conform to a vestigial, or quasi-single, sideband characteristic. The vestigial sideband (VSB) filter to be described in this article provides this output with a simple mechanical and electrical design. While engineered specifically to meet the requirements of television transmission, the principles embodied in this design also have application in other fields where high frequency equipment is employed.

At present there are two methods in use for obtaining the vestigial sideband characteristic in television transmitters. The r-f coupling networks following the modulated radio frequency stage can be designed to attenuate the undesired sideband —or a filter can be placed at the output of the transmitter to achieve the desired result. In the latter case, the complexities of filter design are eliminated from all circuits containing tubes or replaceable elements. This permits readjustment of all circuits after a tube is replaced primarily on the basis of maximum output, thereby simplifying the tuning procedure. In this article we

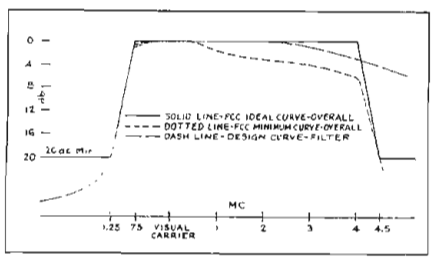


Fig. 1: Vestigial Sideband Characteristic

are concerned only with this second method.

Fig. 1 (solid lines) is the ideal sideband characteristic curve specified by the FCC for television transmission. Two important factors are indicated by this curve. One is that the signal must be attenuated at least 20 db at frequencies more than 1.25 MC below the visual carrier frequency. Secondly, the response between −0.75 MC and +4 MC (with respect to visual carrier) must be essentially flat. Some deviation from this ideal curve is permitted by the FCC, as indicated by the dotted line in Fig. 1, but this deviation represents the total tolerance for the entire transmitter. Hence, in determining the minimum response requirements of the VSB filter, the transmission characteristics of the transmitter coupling networks and antenna system must also be considered.

In addition to providing the proper frequency response, the

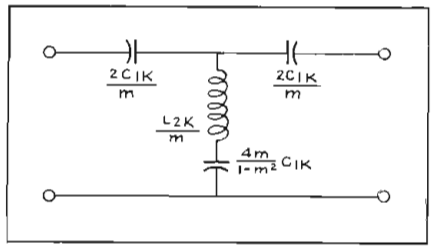


Fig. 2: m-Derived high pass T section

VSB filter phase response must be such that the overall system phase characteristic is essentially linear. This is not a very critical factor, however, since it is possible to introduce phase correction networks in other parts of the transmitter which compensate for phase distortion (within reasonable limits) in the VSB filter.

The vestigial sideband filter must also meet a number of mechanical and economic requirements. Simple design, both electrical and mechanical, small size, rigidity, and a single physical unit for an entire band (low or high frequency) are very desirable features. It must be efficient, and capable of handling large currents, voltages, and power. Furthermore, the filter should be of the type that can be tuned at the factory and require no further adjustment at the installation or during operation by the station staff.

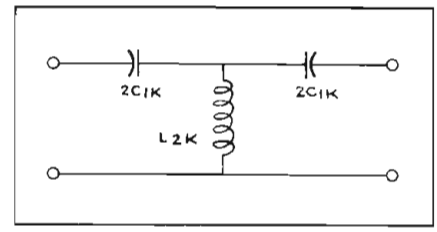


Fig. 3: Constant K high pass T section

Filter Design Considerations

In order to obtain the required sharp cut-off characteristic, a survey of many types of filters was made and it was concluded that either a ladder network or a lattice network could provide the desired result. The lattice network is a balanced type of circuit. It will be shown subsequently that it is necessary to use transmission lines as elements in these circuits — with the coaxial type of line being the most convenient to use. Since use of coaxial lines in a balanced circuit introduces many complexities, a lattice network was not considered suitable for this application. In addition, the values of reactances in the arms of lattice networks are very critical, making extremely accurate tuning necessary. This, of course, is not desirable.

These considerations lead to the choice of the ladder network as the desirable configuration for the filter. Among the ladder structures, the constant resistance or a conventional pure reactance type of circuit could be chosen for this application.

The constant resistance network absorbs the energy of the rejected band in a resistor—and the energy of the pass band is delivered to the load. Inasmuch as all the incident energy is absorbed in the filter structure, a properly designed network of this type presents a constant resistance to the generator over both the reject and pass bands.

Filter Design

PART ONE OF TWO PARTS

reactive network in attenuation of undesired and mechanically than many existing designs

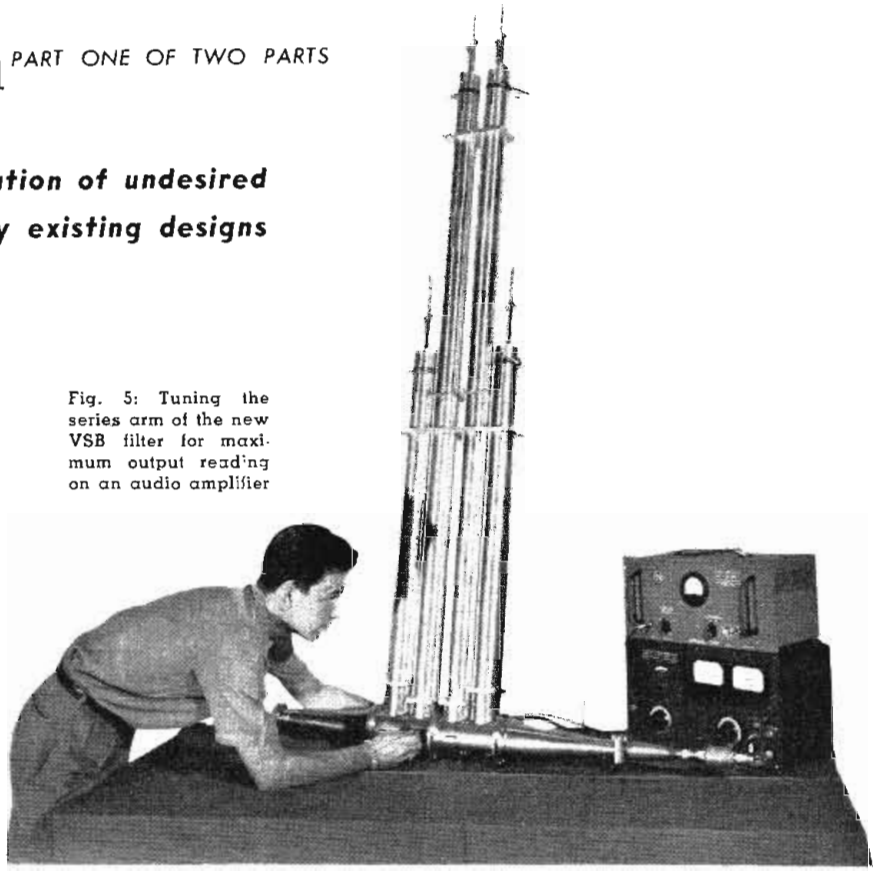


Fig. 5: Tuning the series arm of the new VSB filter for maximum output reading on an audio amplifier

The conventional pure reactance network reflects the energy in the reject band. This is true for all purely reactive four terminal networks. The relationship between the attenuation and the input SWR is given by: $\alpha = 10 \log_{10} (r_i+1)^2/4r_i$; where α = Attenuation in db and r_i = SWR in voltage.

This reflected energy in the stop band can be absorbed by the generator. If a short length of coaxial line (i.e. less than 0.01 μsec long which for air lines is approximately 10 ft.) is used to connect generator and the filter, the echoes produced by this reflected energy are not perceptible. The total amount of this rejected energy, for a television transmitter rated at 5 kw sync peak, is in the order of 100 watts. This power has to be absorbed in the output stage of the transmitter (which in this case is the generator) and since this power is so small, it places no undue strain on the transmitter.

The constant resistance filter is inherently more complicated than the purely reactive network because it actually consists of two filters in series or parallel (one for pass band energy and one for stop band energy). Hence it is more costly to construct.

For these reasons, it was felt that the purely reactive structure would

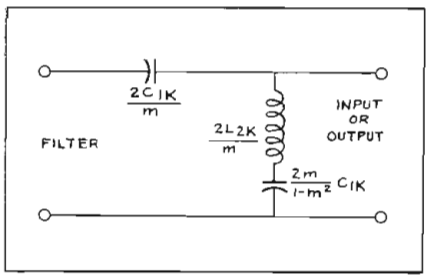


Fig. 4: m-Derived terminating half section

do the required filtering in the most economical and straight forward manner. Among the ladder types of purely reactive filter structures, the use of one or more "m" derived sections seemed the best way to obtain the sharp cut-off characteristic with the small pass band attenuation required in this application.

The ideal curve recommended by the FCC, having absolutely sharp corners, obviously cannot be realized in practical configurations. In addition, for purely reactive networks, such a filter would have a very distorted phase response. Some compromise with the ideal is therefore indicated. The dashed line in Fig. 1 shows the deviation from the theoretical on which the design of this filter is based. (The high frequency cut-off is obtained by the video and radio frequency amplifier coupling networks and diplexer.) This fixes the phase characteristic so that a uniform phase delay at video frequencies can be obtained through the use of phase compensation circuits.

A schematic diagram of the "m" derived high pass filter is shown in Fig. 2. The prototype of this filter (when m = 1) is shown in Fig. 3 and is the familiar constant "k" network. The values of the condensers and inductances in the "m" derived filter, as indicated in Fig. 2, are conventionally given in terms of the prototype values C_{1k} and L_{2k}. C_{1k} and L_{2k} are determined from the following relationships:

$$C_{1k} = 1/4\pi f_c Z_r$$

$$L_{2k} = Z_r/4\pi f_c$$

where Z_r is the nominal characteristic impedance of the filter; f_c is the cut-off frequency of the filter, and is equal to the visual carrier frequency minus 1.0 MC.

In designing the "m" derived fil-

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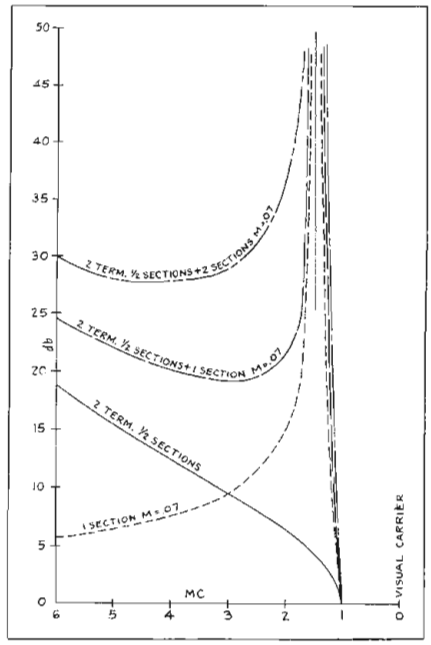
Fig. 6: Filter section attenuation curves



ter L_{2k} and C_{1k} are calculated first. In this case Z_c is 51.5 ohms while f_c varies depending upon the channel for which the filter is adjusted. To obtain a sharp cut off, a frequency of infinite attenuation is placed just below the cut-off frequency. The value of m for this section is then determined through the use of the equation:

$$m = \sqrt{1 - \left(\frac{f_\infty}{f_c}\right)^2}$$

where f_∞ is set equal to the carrier frequency minus 1.5 MC. For channels in the high band (174 to 216 MC) the value of m is approximately equal to 0.07 (for the low band approximately 0.15).

Knowing the value of m, L_{2k} and C_{1k}, the required series and shunt condensers, and the shunt inductance can be calculated. In the high band the order of the magnitude of the circuit elements is as follows: Series condensers — 100 $\mu\mu$f; shunt condensers — 2 $\mu\mu$f; and shunt inductance — 0.3 μh. The circuit parameters for the shunt elements can be obtained in practice with coaxial line elements (necessary to get low loss and high power ratings) and hence it is safe to proceed with the design.

The next factor to be considered is the selection of terminating networks so that losses due to mismatch are minimized. There are two points at which mismatch may occur assuming that the theoretical values of the "m" derived filter can be achieved in practice, i.e. there is no mismatch between sections or terminating networks. One such point is between the generator output and the filter input and the other is between the filter output and antenna system. The generator line and antenna both represent 51.5 ohm resistive impedances so that if the filter also represented a 51.5 ohm resistance at its termials, a perfect match would be achieved and no losses incurred. However, the "m" derived network with the value of m equal to 0.07 has a characteristic impedance which is far from uniform in its pass band and hence poor matching would be obtained to a constant resistance load over the pass band.

In order to reduce the mismatch between filter and generator or load, an appropriate terminating network must be utilized. This network serves the function of minimizing the variation of the characteristic impedance of the filter around the 51.5 ohm value in a particular frequency band. In effect these networks are matching circuits coupling the filter with the constant impedance generator line and load.

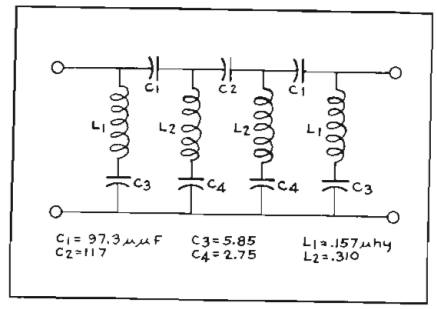


Fig. 7: Typical composite high band filter

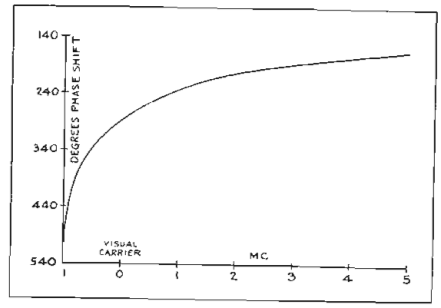


Fig. 8: Phase shift curve of composite filter

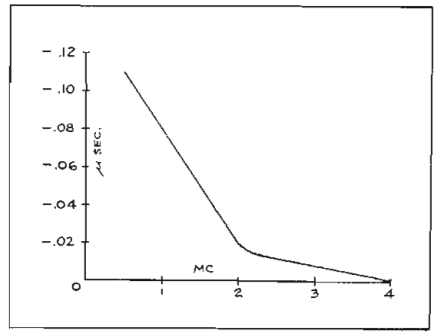


Fig. 9: Time delay vs. frequency for composite filter. (shown relative to delay at 4 MC)

Fig. 4 is the schematic diagram of the conventional "T" terminating half section for an "m" derived filter. It can be shown that for a perfect match the generator and load impedance (W) at any particular frequency should be equal to:

$$W = Z_c \frac{1 + X_k(1-m^2)}{\sqrt{1 - |X_k|}}$$

Table I tabulates values of W versus frequency over a typical TV channel and shows the resulting loss in db due to mismatch at both ends of filter when terminated in 51.5 ohms for m = 0.25, m = 0.30 and m = 0.35. It is readily seen from this table that m = 0.3 provides the best overall matching network. For m = 0.3 the mismatch loss at 4 MC above carrier is only 0.6 db. In addition there are mismatch losses between sections within the filter at those frequencies for which W is not equal to Z_c. However, these internal losses are very small and can be neglected.

TABLE I
CALCULATED MISMATCH LOSS (DB) FOR DIFFERENT VALUES OF "m"

Frequency	m=0.25	m=0.30	m=0.35
−.75 MC	0.08	0.64	1.48
−.5 MC	0.03	0.12	0.60
vis. carrier	0.31	0.01	0.10
+2 MC	0.93	0.38	0.08
+4 MC	1.05	0.59	0.23

Now that the optimum terminating networks have been determined, it is necessary to ascertain the number of filter sections required to give the desired cut-off characteristic. It is known that maximum attenuation of the lower sideband should occur at the adjacent channel sound carrier frequency which is 1.5 MC below the visual carrier frequency. It is also necessary to attenuate all energy in the frequency band beyond 1.25 MC below the visual carrier by at least 20 db.

The attenuation of the two terminating half sections and the "m" derived section can be calculated through the use of the following expression:

$\alpha = 20 \log_{10} (Y_k+m)/(Y_k-m)$

where $Y_k = 1-(1/|X_k|)$ and α = attenuation of a full "m" derived section.

Fig. 6 plots the attenuation versus frequency for the two terminating half sections and the one "m" derived section, and the total attenuation characteristic for all three. It is seen from this latter curve that additional filter sections are required since the cut-off is not sharp enough and curve dips down to less than 20 db. The insertion of another section with m = 0.07 (dot-dash lines) does provide the desired cut-off characteristics. Hence the circuit shown in Fig. 7, containing two terminating half sections with m = 0.3 and two filter sections with m = 0.07, gives a satisfactory vestigial sideband characteristic.

The phase response of this filter can be approximately determined through the use of the equation:

$$\beta = 2 \tan^{-1} \frac{m\sqrt{|X_k|}}{\sqrt{1-|X_k|}}$$

with the phase response of the terminating sections added to that of the filter sections in the same manner as the attenuation response curves were treated. The overall phase response of the VSB filter is shown in Fig. 8. The time delay is

(Continued on page 52)

DuMont's TV Allocation Plan

Proposal to FCC calls for 81 six-megacycle channels; UHF allocations are chosen to minimize interference

AS was to be expected Dr. Allen B. DuMont, long one of the most active figures in the TV allocations field has produced an allocation plan which has been submitted to the Commission for discussion at the current hearings. This is not the first he has produced, nor do we expect it to be the last. Besides having many common traits in the field of engineering eminence Dr. DuMont shares with Major Armstrong a faculty for outspokeness and action when it comes to FCC matters. Therefore it is not surprising to find that the DuMont TV allocation plan while being apparently somewhat reactionary is also very sound from an engineering point of view and goes much further than the FCC does in presenting a solution to the problem. Inevitably in a situation like this some operators will be inconvenienced and forced to spend more money but its effect is like that of a surgeon who operates so that the patient may live.

This plan advocates the allocation of the entire block of frequencies 476 MC through 890 MC in 6 MC channels to the public television service, and the denial of the Bell Telephone Laboratory's request for space in this band. Including both VHF and UHF 81 channels will be available. By maximum utilization of the present VHF spectrum four channels will be available for most of the 140 metropolitan districts and 48 UHF channels will be available for other communities. 12 UHF channels will be reserved for smaller communities for use when economically feasible and nine for non-commercial educational use with full metropolitan power. At the time the plan was presented to the Commission it had been developed only as far as the first 326 major markets, but the complete plan was promised for the hearings.

Particular attention is paid to the economic aspect of mixed UHF and VHF areas. Such operations work hardship on both station and receiver owners. The economics of the situation are obvious and do not require discussion in this article. A very important point, which concerns the station owners primarily is that of changes of frequency for existing stations. Fourteen operating stations and nineteen CP holders are affected in that some kind of frequency change is required. Twelve operating VHF stations, and fourteen CP holders are scheduled to move to UHF operation. Two operating stations and five CP's must transfer to new VHF frequencies. The reasons underlying these recommended moves are the foundation stones of the whole plan. Briefly, they are: A minimum spacing of 200 miles between co-channel stations; A minimum spacing of 70 miles between adjacent channel stations; Minimum of four VHF channels to each city to prevent intermixing of VHF and UHF stations; Retention of existing grants as far as possible in the cities in which they were granted. A "period of grace" of two years in which the plan would come into effect, to be followed by a year of dual frequency operation similar to the FM frequency shift, is supposed to tone down any hardship occurring to the operator.

The objects of the FCC allocations plan are five in number and in descending order of priority; they are: To provide at least one television service to all parts of the U. S. To provide each community with at least one television station. To provide a choice of at least two television services to all parts of the U. S. To provide each community with at least two television broadcast stations. Any remaining channels will be assigned according to the need, size and geographical location of each community. The DuMont plan goes much further in its attention to questions of interference caused by co-channel, adjacent channel, image and local oscillator interaction. The Canadian border cities have been considered as well as Mexico and Cuba, and the DuMont plan makes provision for services in these countries.

The plan takes into consideration the principles that the major portion of the allotted spectrum should be pre-assigned for metropolitan power commercial stations to make maximum use of the available channels. A few channels should be provided for community services on a first-come first-served basis and a few channels should be reserved for non-commercial educational services on a first-come first-served basis. The interference precautions were much more complicated. For instance, the co-channel separation is 200 miles and that for adjacent channels 70 miles. However, the restrictions imposed by radiation from local oscillators and image troubles were much more severe and necessitated considerably greater attention than was paid by the FCC allocation plan. In the DuMont plan, if channel "n" is assigned. then channels (n-7) and (n + 7) cannot be assigned closer than 58 miles; this protects the class "B" 29 miles service area. Picture image interference is reduced by not assigning (n − 15) nor (n + 15) closer than 75 miles. This eliminates the 1.5 MC beat caused by the picture carrier of an undesired station 15 channels above the desired station where the receiver rejection is assumed to be 24 db. Sound image interference is eliminated by similarly placing an embargo on channels (n − 14) and (n +14) for a distance of 58 miles. This protects class "B" service against the 3 MC beat from sound carriers.

Television Channels by Type of Service

List of television channel numbers and frequencies grouped by type of service recommended.

Group	Channel Numbers	Quantity	Channel Freq. (MC)
A	2-13	12	54-72 76-88 174-216
Recommended Service:—Commercial, full-power operation in the VHF bond according to a prescribed plan.			
B	14-61	48	476-764
Recommended Service:—Commercial, full-power operation in the UHF bond according to a prescribed plan.			
C	62-73	12	764-836
Recommended Service:—Commercial, community-powered operation on a first-come, first-served basis to suplement the prescribed VHF and UHF allocation plans.			
D	74-82	9	836-890
Recommended Service: — Non-commercial, full-powered operation on a first-come, first-served basis for educational institutions.			

1949 West Coast IRE Convention Report

TO an easterner, the Pacific Coast area has become known mainly as a center of advanced research where noteworthy developments have originated. It is the home of large radio and electronic laboratories at Stanford, at Cal. Tech. and the Universities of California, Oregon, Washington, etc., which have figured so prominently in recent electronic advances. In addition the Naval Electronics Laboratories at San Diego, Naval Ordnance at Inyokern, Calif., and several of the western aircraft manufacturers maintain large centers of research along electronic lines. The technical program of the 1949 West Coast Convention of the IRE was slanted therefore toward the coverage of some of these projects.

The fifth Pacific Electronics Exhibit, held in conjunction with this Convention August 30, thru September 2nd, was instrumental in calling attention to the surprising amount of manufacturing also being handled by the numerous companies now operating in that area. At the exhibit in the San Francisco Civic Center Auditorium more than 100 exhibitors were enabled to display or demonstrate their products, through the efforts of the West Coast Electronic Manufacturers' Association.

This organization is an active group of over fifty concerns manufacturing electronic parts and equipment in eleven Western states. The group, organized during World War II, provides a close coordination between western manufacturers, to improve their commercial and technological developments. A list of WCEMA members and products manufactured is available on request to the secretary, Fred W. Flack, 1260 W. 2nd St., Los Angeles (26), Cal.

A third part of this convention, the series of guided field inspection trips to the University of California, Naval Shipyards, Hewlett-Packard and Eitel-McCullough, Companies, and to the KGO and KRON TV transmitters was well attended.

(*Continued on page* 60)

New High Fidelity Dual Cone Loudspeaker

THE cover shot shows Dr. Harry F. Olson, the world renowned acoustic authority, standing beside the equipment he will use to demonstrate his latest version of the well known LC-1-A speaker. He will present a paper on the RCA 515 S1 Dual-Cone Speaker, as it is now known, at the Fall Meeting of the IRE in Syracuse, N. Y., November 2, 1949.

Rated at 25 watts, this speaker can be used in any system where high quality reproduction is a requirement, such as luxury model radio and TV receivers, station monitors and sound reproducing systems. Its size, 15 1/3 by 6 1/2 inches, makes it suitable for use as a replacement unit in many cabinets. For new applications a "baffle" consisting of a 5 to 10 cubic foot enclosure lined with a one inch thickness of sound absorbent material with a hole of between three and six inches in diameter immediately below the speaker is recommended.

An unusual feature in this type of speaker is the use of a dual air-gap for the twin voice coils. A two-pound Alnico magnet is designed so that the pole pieces and yokes form a bridge network to each air gap and thus effectively produce separate gaps for each coil. This is shown in the cutaway view in Fig. 1. The two cone construction is designed so that the cross-over frequency is about 2,000 cps with high sensitivity from 40 to 12,000 cps.

Fig. 2 shows the response curve of the speaker mounted on an infinite baffle; it is noteworthy that the response is substantially flat from 50 to 10,000 cps. The directivity pattern is practically uniform over the whole range through an angle of 60°. A fault commonly found in this type of dual speaker, that of mechanical linkage between the two cones due to improper isolation between the two diaphragms, with its resultant interference characteristic, has been overcome by designing the suspensions so that the two cones oscillate as one in the range of crossover frequencies. In fact the system is so designed that in lieu of the usual multi-element network usually required for a speaker of this type only a single condenser is required to divert the low and high frequencies to the proper voice coils.

To ensure that the correct coupling exists between the speaker and the driving amplifier two new output transformers have been introduced. In each case the secondary is designed to work into a voice coil impedance of 16 ohms at 400 cps. One model, the 213T1, is designed for line-to-voice coil operation with six primary taps covering 250 to 2,000 ohms: the other, the 214T1, is designed for a push-pull output stage with an impedance of 4500 to 14,000 ohms.

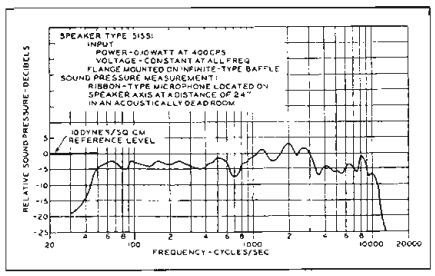


Fig. 2: Frequency response characteristic of 515S1 speaker mounted in infinite baffle

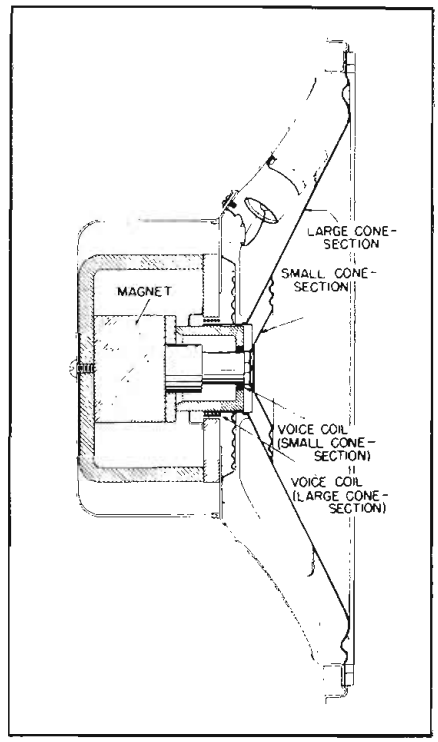


Fig. 1: Cross sectional view of the new loudspeaker showing magnet construction and mounting of large and small cone sections

WASHINGTON
News Letter

Latest Radio and Communications News Developments Summarized by Tele-Tech's Washington Bureau

FCC CAN BE CALLED FEDERAL TELEVISION COMMISSION—The FCC hearings on television standards and allocations with the future inauguration of color video as the uppermost subject, which commenced Sept. 26, were certain to be the longest and largest and most fraught with significance for the radio broadcasting-television industry in the history of the Commission. More than 175 requests for appearances at the proceedings had been received, but more in the public eye than the testimony and views of the leading executives, engineers and scientists of the radio industry will be the demonstrations of their color television systems by the Radio Corporation of America and Columbia Broadcasting System. In fact, the Federal Communications Commission during the latter part of September and throughout October in all probability might well be called the "Federal Television Commission" because the FCC will have little else on its mind and in its functioning than Television's blueprint.

CANNOT WAVE WAND FOR INSTANTANEOUS SERVICE—Granted that Color Television has received tremendous impetus in recent weeks through the statements of Chairman Johnson of the Senate Interstate Commerce Committee and the letters of FCC Commissioner Robert F. Jones to CBS President Frank Stanton, RCA Laboratories Executive Vice President C. B. Jolliffe and Color Television Inc. of San Francisco, the plain facts are—and the public should realize it—that NO magic wand can be waved to produce color television overnight. President Benjamin Abrams of Emerson Radio brought out emphatically the truth of the situation that color video has to go through a process of testing and production engineering so it could probably not become a widespread public service for two or three years and maybe not until 1953. RCA and CBS have definitely and successfully answered the far-fetched charges that the radio industry is holding back color video.

BROAD BAND UHF SYSTEM IMPORTANT TO MOBILE RADIO—Needs of mobile radio communications in the Ultra-High Frequency portion of the spectrum have precipitated a controversial storm that might be one feature of the FCC television hearings. It revolved around the petition of the Bell Telephone Laboratories for assignment of 30 MC—470-500 MC—for operation of its broadband multi-channel for general public mobile telephone communications to remedy the congestion in the mobile services in urban centers and to accomplish conservation and efficiency in the use of frequencies. The Television Broadcasters Association carried the main attack against the Bell Laboratories' request on the ground that the entire UHF band should be given over to television and the Society of Motion Picture Engineers inferentially were thought to side with TBA in their demand for 3000 MC for a nationwide competitive theater TV system. Dr. Oliver E. Buckley, President of the Bell Laboratories, signed the petition and statement on the broad band system which was submitted to the FCC. Because the mobile radio services are of such importance to the public and U. S. business and industry, it was generally conceded that the FCC would grant this space for broad band multi-channel operation.

COY TO REMAIN AS FCC CHAIRMAN—Readers of Tele-Tech and other radio industry publications can apparently put in the wastebasket the rumors about FCC Chairman Wayne Coy leaving the Commission to head the Television Broadcasters Association or another radiobroadcasting industry post. He has indicated he plans to remain at the FCC helm for the foreseeable future. Undoubtedly the bright chances of Congressional enactment of the increase in government salaries —the FCC Chairman to receive $18,000 and Commissioners to get $16,000 (instead of present meagre $10,000 per year)—motivated Mr. Coy's decision to a major degree. Incidentally, the woman FCC Commissioner, Miss Frieda Hennock, is understood to have told President Truman in a recent White House conference her sound views that the American public would benefit most by a well-established black-and-white television system on a nationwide basis rather than rushing into color TV before its developments and system are fully tested.

U. S. AND CANADA IRON OUT MOBILE RADIO PROBLEMS—In order to establish allocations assignments and power standards to avoid interference in the Mobile Radio services, top FCC engineers and technical officials of the Canadian Department of Transport's radio divisions have engaged in discussions on ways and means of eliminating interference. As a result of the conversations, the two countries are slated to draft an agreement on the mobile radio services. Similarly, in marine radio, the Great Lakes with U. S., British and Canadian government and industry observers participating, are to be the scene in early October of the testing and operation of the new proposed world standards for auto alarms on marine radiotelephony, using 2182 KC. British and American official models are being tested for submission of the most successful system to the next CCIR (Consultative Committee on International Radio to the International Telecommunications Union.)

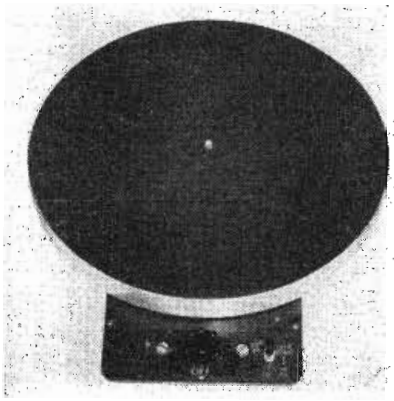
National Press Building
Washington, D. C.

ROLAND C. DAVIES
Washington Editor

New Transducers, Amplifiers and

3-Speed Turntable

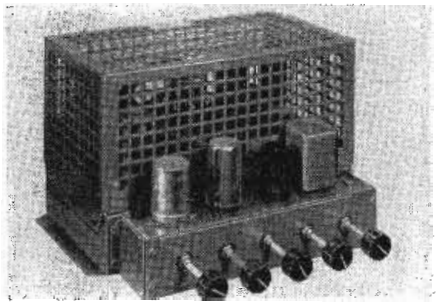
The LP743 is a 3-speed phono turntable (33 1/3, 45, and 78 rpm) with an instantaneous speed selector and is designed and di-



mensioned for easy replacement of old motors in the average console. It is 12-in. long, 15-in. wide and overall height is 6⅜ in. Noise level is 30 db below maximum recording level. The turntable itself is lathe turned and balanced. List, $49.95.—**Rek-O-Kut Co., Inc., 38-01 Queens Blvd., Long Island City 1, N. Y.**

Phono Amplifier

Unlimited flexibility is provided by the ingenious design of the compact preamplifier unit in the model 1825 high-fidelity phono-



graph amplifier. The preamplifier is detachable from the main unit and can be mounted in any position to meet the mechanical requirements of any custom installation. A power output of 25 watts is delivered with not more than 5% total harmonic distortion. Frequency response is plus or minus 1 DB, 40 to 20,000 cps. Output impedances are 4, 8, 16, 250 and 500 ohms.—**Rauland-Borg Corp., 3523 Addison St., Chicago, Ill.**

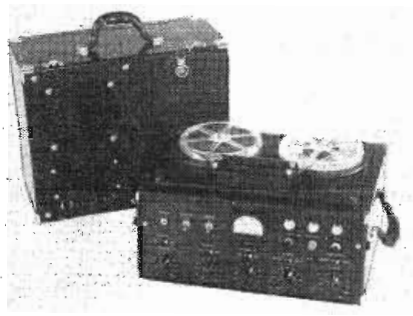
Audio Oscillator

The model M oscillator features a unique circuit which has no lower limit to its possible frequency of oscillation. Harmonic dis-

tortion is less than 0.2% at all frequencies from 20 cps to 15 KC. The third harmonic increases below 20 cps and reaches a value of approximately 1% at 1 cps. Where it is desired to have extremely pure sine waves at the very low frequencies, an amplitude control element having a longer time constant can be provided upon request.—**Southwestern Industrial Electronic Co., 2831 Post Oak Road, Houston 19, Texas.**

Portable Tape Recorder

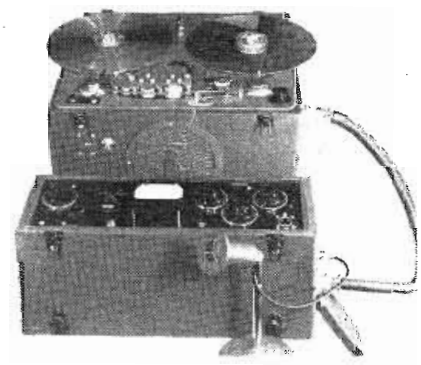
A portable tape recorder has been developed which is completely housed in 2 carrying cases with a combined weight of



80 lbs. A tape transport mechanism, 5 separate amplifiers, and electrical interlocking controls are in one unit; power supplies, monitor speaker, and storage space for accesesories and tapes are in the other. There are 2 input-line or microphone amplifiers with impedance-change switches; a recording amplifier; a line amplifier, a monitoring amplifier; and a playback amplifier. The recording amplifier is arranged with a plug-in tape equalizer for easy accommodation to future developments. An equalizer and synchronous motor are provided for dual-speed operation; 7½-in per sec. tape speed provides ±2 db response from 50 cps to 10 KC and the range is extended to 15 KC at 15-in. per sec. speed.—**Audiograph Co., 1422 El Camino Real, San Carlos, Calif.**

Magnetic Tape Recorder

A sprocketless system which synchronizes by electrical striation of standard ¼-in. magnetic tape is an exclusive feature of a new



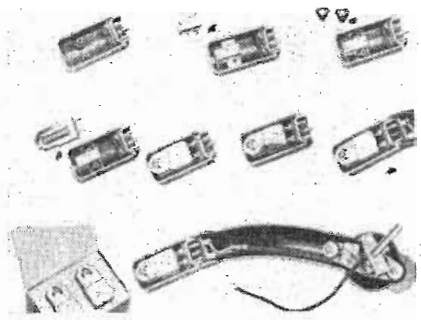
line of Rangertone magnetic tape recorders. Basically, a synchronizing signal is put on the tape during a normal recording in addition to and perpendicular to the normal sound track. In playback this synchronizing signal is reproduced by a similarly mounted playback head and then applied to a variable frequency generator (Gyratron) which speeds up or slows down the drive motor as required. This synchronous recording equipment maintains playback timing to such an accurate degree that the error on a ½ hour recording amounts to less than 1/20th of a sec.—**Rangertone, Inc., 73 Winthrop St., Newark 4, N. J.**

Input Transformer

An easily installed input transformer has been developed for matching low impedance microphones, and pickups to high impedance circuits, such as are common on any audio amplifier. The unit matches any source from 50 to 500 ohms impedance to grid. The transformer is housed in a rugged, die-cast case with a standard jack receptacle for low impedance plug-in. Output connections are brought to a standard plug for the high impedance input side of the amplifier.—**United Transformer Corp., 150 Varick St., New York 13, N. Y.**

Cartridge Clip

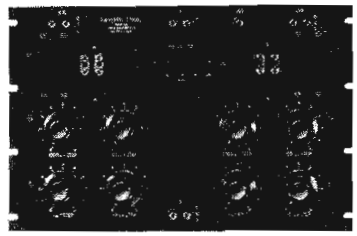
The installation of the Pickering magnetic cartridge in plug-in cartridge holders of Webster Arms for playing microgroove or standard records is shown in the accom-



panying illustration. The Pickering clip fits over the screw lugs in the cartridge holder and is held in place by speed-nuts; the cartridge slides onto the clip and its contacts are soldered to the terminals of the cartridge holder; cartridge and holder become one unit and when plugged into the arm, the uuit is ready for use. Because different cartridges are required, 2 cartridge holders with their individual cartridges are required for the playing of microgroove (33 1/3 and 45 rpm) or standard records. Model 140 cartridges are for microgroove records; models 120 and R-150, gold finished cartridges are for playing standard records.—**Pickering & Company, Inc., Oceanside, L. I., N. Y.**

Universal Bridge

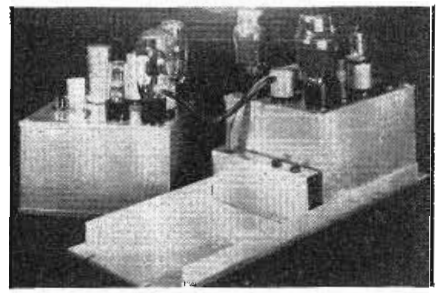
Model 1150 universal bridge is a new lab instrument for measuring inductors and capacitors and determining the resistive and re-



active components of impedances. It may be used as a Maxwell Bridge, Hay Bridge, Resonance Bridge, Series Resistance Condenser Bridge, and Parallel Resistance Condenser Bridge. Frequency range is from 20 cps to 20 KC. Accuracy is 1%.—**Freed Transformer Co., 1718-36 Weirfield St., Brooklyn 27, N. Y.**

Audio Amplifier

Amplifier and power supply of model 50 W-1 high efficiency audio amplifier feature filter condensers, phase inverter, volume con-

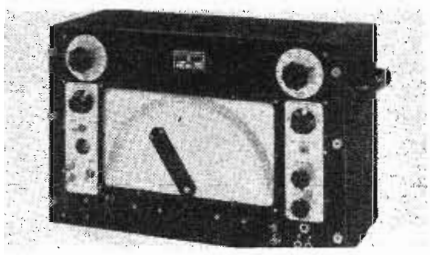


trol, bias supply voltage divider and hum centering unit as separate plug-in units to facilitate instant removal for check or replacement. Power requirement is 175 watts for 50 watt output from two 6L6 tubes. Gain is rated +45 DB minimum to 100 DB maximum.—**McIntosh Engineering Laboratory, 910 King St., Silver Spring, Md.**

Test Equipment for Audio Applications

Audio Sweep Generator

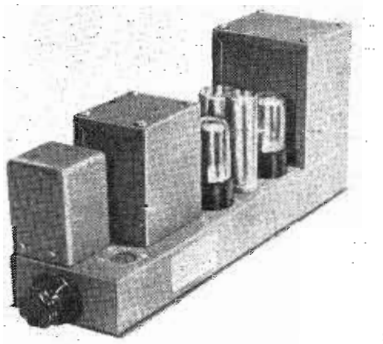
Wave form distortion in the CB automatic audio sweep generator is stated to be less than ½ of 1%, and the sweep calibration



is linear, sweep frequency being adjustable from 2 to 10 sweeps per sec. Continuous frequency range is from 25 cps to 32 KC. Within this range, the automatic sweep may be adjusted to any spread from 500 cps to 10 KC, or the instrument may be operated manually. Panel calibration is direct with a Verni-Vider dial approximately 17-in. long. Complete construction and operation data is given in bulletin 8A which will be sent upon request.—**Clough Brengle Co., 6014 Broadway, Chicago 40, Ill.**

Amplifiers

A new series of 4 high-fidelity 8-watt amplifiers have been developed for use by radio television broadcasting studios, wired music



applications, recording studios and similar installations where bridging or line inputs are required. Output impedances are provided for either line or voice coil connections. The amplifiers can be mounted in either a console or a rack. All have a power output of 8 watts with nominal distortion of not more than 2% at any frequency between 30 and 12 KV. Response is flat within ½ db over the same range. A built-in power supply with low external magnetic fields minimizes hum problems. Noise levels are held to more than 78 db below full output. Gain control range is 38 db for bridging or 50 db for line applications.—**Audio Development Co., 2833 13th Avenue South, Minneapolis, Minn.**

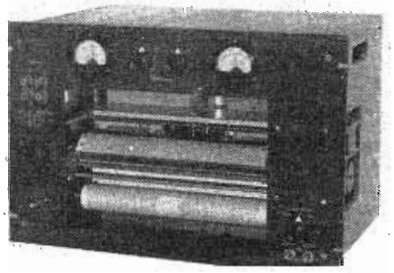
Sound Pressure Measurement Equipment

Improved sound pressure measurement equipment (Model GA-1064) for the audible

and ultrasonic range has been developed, including several major improvements over the earlier wide range GA-1605 system. In this instrument a tiny microphone is permanently attached to the tip of a flexible probe which is, in turn, mounted to a stainless steel base plug that may be assembled to the preamplifier as indicated in the illustration. Sound pressures from a few dynes/cm² to several million dynes/cm² may be measured directly over the frequency range of 50 cps to 250 KC. The output signal is delivered by a 25-ft. cable at an impedance level of 500 ohms. Longer extension cables may be used without appreciable effect on the frequency characteristic of the system.—**Massa Laboratories, Inc., Inc., 3868 Carnegie Ave., Cleveland, Ohio.**

Graphic Twin Recorder

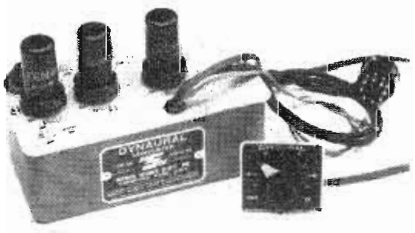
Model RZ graphic twin recorder has been extensively redesigned, resulting in an instrument with an extended frequency range, im-



proved mechanical construction, and a complete metallic housing. This unit is a dual frequency response recorder which can record simultaneously 2 signals on a 10-in. double-track chart. Recordings of frequency response characteristics, the simultaneous recording of noise and vibration, or beam pattern recording and directional properties of transducers can be conveniently made. It is powered by 2 synchronous motors; one to drive the writing pens, and one for chart advancement. Gears of chart drive are interchangeable and can be synchronized with any available oscillator, or wave and sound analyzer.—**Sound Apparatus Co., Stirling, N. J.**

Dynaural Converter

Based on the Scott noise suppressor, a new line of equipment has been developed for dynaural reproduction of music, particularly



from phonograph records. In a dynaural system the bandwidth is automatically and continuously adjusted to conform with the requirements of the music, thus combining maximum fidelity with minimum noise level. The type 111-A is designed for use with standard amplifiers, phonographs and combinations and has a 11-KC range.—**Hermon Hosmer Scott, Inc., 385 Putnam Ave., Cambridge 39, Mass.**

Plug-In Amplifier

Known as the "Sound-Screen", a new plug-in amplifier has been developed which its manufacturers claim is the smallest unit of its kind in the miniature electronic field. Eliminating wires, soldered connections and a maze of parts, it is sealed in solid plastic, making it moisture-proof, shock-proof and tamper-proof.—**The Microton Co., St. Paul, Minn.**

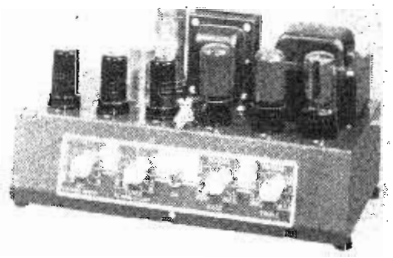
Recorder

Recordall is a new type recorder which employs a permanent jewel to record or playback continuously up to 3½ hours (up to

24 hours on custom built models) on each face of an endless plastic band of safety film known as Sonaband. The Sonaband is automatically self-aligning and can be removed or replaced at the end of 3½ hours within 2 seconds. Each Sonaband holds over a mile of soundtrack which is indexed and permanent, requiring no erasing or shaving. It is estimated that long time continuous recordings will cost less than 2½ cents per hour.—**Miles Reproducer Co., Inc., 812-814 Broadway, New York 3, N. Y.**

Amplifier

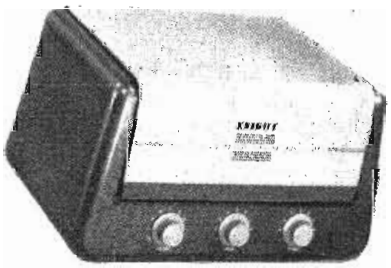
Model PE-100PG 10-watt amplifier has been designed for use with low voltage pickups and fine quality radio tuners. Frequency re-



sponse with tone controls normal is ± 1 DB, 20 cps to 20 KC. Peak power output is 18 watts and power consumption is 75 watts. 110/120 v. AC, 60 cycle, fused. Separate bass and treble controls, each having boost and attenuation ranges, provide flexible compensation of frequency response for individual preference.—**Precision Electronics, Inc., 641 Milwaukee Ave., Chicago 22, Ill.**

High-Fidelity Amplifier

Reproducing from records, tuner or microphone (with interstage takeoff after preamplifier that permits switching at tuner), the

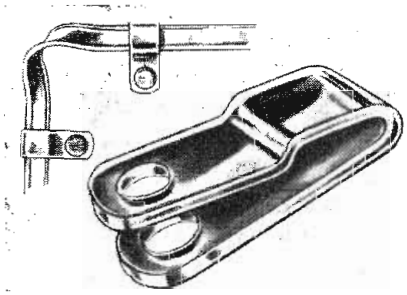


Knight 20-watt high-fidelity amplifier features wide range response (± 1 DB, 20 cps to 20 KC) with less than 2% distortion at full output. An equalized preamplifier is incorporated in the unit for playing records from any variable reluctance or new-type magnetic cartridge. It has separate bass and treble tone controls, 5 speaker output impedances (4, 8, 16, 250, 500 ohms) and a tapped power transformer for optimum operation from 117-volt or 130-volt AC lines.—**Allied Radio Corp., 833 West Jackson Blvd., Chicago 7, Ill.**

New Parts, Components & Test Equipment

TV Lead-In Clamp

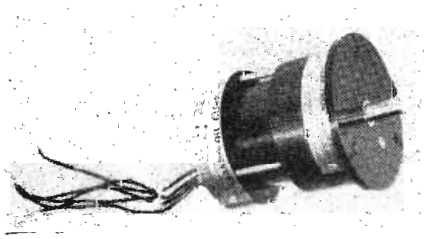
Formed to hold standard double wire television lead-in tape securely, the new CPC-TV plastic clamp is weatherproof and a good



insulator. The clamp is easily opened for tape insertion and is made fast with only one nail or screw. Write to manufacturer for samples and circular P-1.—**Commercial Plastics, Merchandise Mart, Chicago 54, Ill.**

Servo Motor

Plate-to-plate operation, a proved feature of Transicoil servo motors, now makes possible an important saving of weight and



space in industrial and military control systems. This is achieved by eliminating the use of an output transformer in the servo-amplifier through direct winding. Motor stall torque ranges from .25 in., oz. up to 4.25 in., oz.—**Transicoil Corp., 114 West Worth St., New York 13, N. Y.**

TV Signal Generator

The composite output signal produced by type 213 monoscope television signal generator is suitable for modulating a TV broad-

cast transmitter, an RF TV signal generator or for direct test of video portions of TV equipment. This model includes the following circuit units: monoscope sweeps; video pre-amplifier and mixer amplifier; monoscope and CR blanking; CR monitor sweeps, video and switching; regulated power supply; high voltage power supply. Operation is from standard 115/120 v., 60 cycle line.—**Television Projects, Inc., 3660 Coral Way, Miami 35, Florida.**

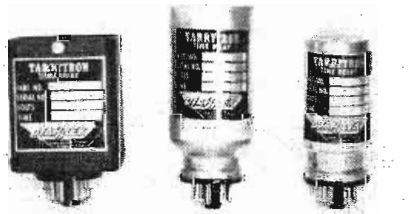
TV Camera Tube

Although designed for outdoor use at remote locations, the 5820 television camera tube may also be used with satisfactory re-

sults in studio cameras. It features exceptionally high sensitivity, a spectral response approaching that of the eye, stability of performance at all incident light levels on the subject ranging from bright sunlight to a deep shadow, and a resolution capability of better than 500 lines at the center of the picture. The photocathode in the 5820 has a response characterized by high blue sensitivity, high green sensitivity, good red sensitivity, and practically no infrared sensitivity. This latter characteristic of the response prevents any color-masking by infrared and thus permits portrayal of colors in nearly their true tonal gradation.—**Radio Corporation of America, Tube Dept., Harrison, N. J.**

Time Delays

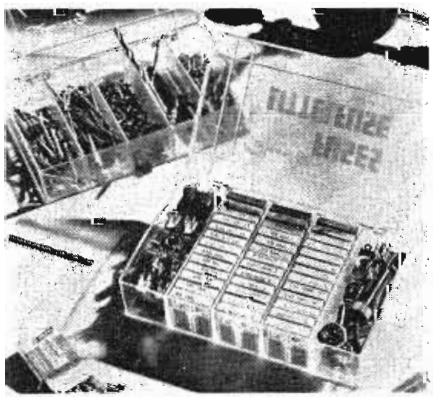
An exclusive feature of the Tarryiron time delays is the use of a relay in conjunction with the time delay. This relay supplies



multiple contact arrangements, fast switching and also automatically relieves the time delay heating element of the necessity of continual excitation after performing the prescribed delay. Tarryirons are hermetically sealed or stratopaxed with inert gases which completely protects them from altitude, moisture, dust or other atmospheric conditions. Units are supplied with timing ranges from 2 to 150 seconds.—**Cook Electric Co., 2700 North Southport Ave., Chicago 14, Ill.**

Plastic Fuse Case

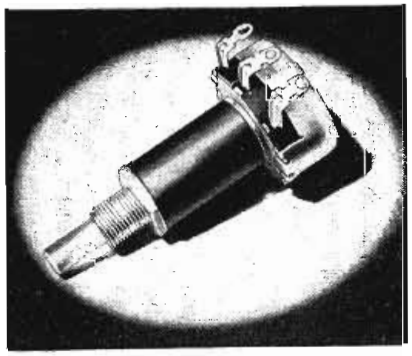
The fuses and holders which have been packed in a new plastic case have been selected to cover the most frequent needs of



the design and research engineer and the equipment maintenance engineer in the radio, communications, instrument and television fields. Several handy compartments are provided for the storage of screws, nuts and bolts.—**Littelfuse, Inc., 4757 North Ravenswood Ave., Chicago 40, Ill.**

High-Voltage Coupler

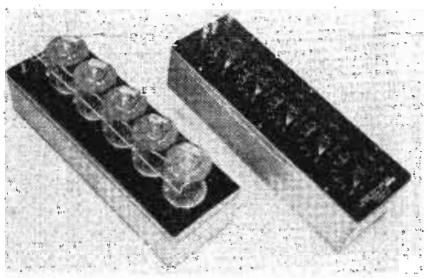
To provide the safe insulation factor required of controls used in TV, oscillograph, and other high-voltage circuits, an improved



high-voltage-coupler feature has been developed for most types of Clarostat controls on special order. Known as the type 56-125, the unit makes use of a plastic straight-through shaft in place of the previous insulating strip joining separate sections of the metal shaft. The new type construction eliminates troublesome backlash, thereby providing more critical settings. An insulating tube isolates the control proper from its mounting bushing and protects the elongated plastic shaft. The control-to-ground breakdown rating is better than 10,000 v.—**Clarostat Mfg. Co., Inc., Dover, N. H.**

Decade Resistance Box

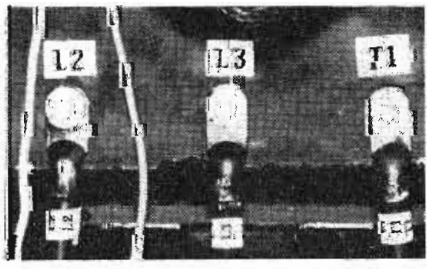
Several new features have been incorporated in Daven decade resistance boxes as a result of their redesign and new mechanical



construction. Contact resistance is .002 ohm and it will remain within .0003 ohm throughout the life of the unit. All resistors in the box have a temperature coefficient of less than ± .002% per degree C., at room temperature. Vibration-proof construction will withstand Signal Corps vibration tests. Frequency characteristics are 0.1, 1, 10, and 100 ohm steps, flat to 1 MC; 1000 ohm steps, flat to 50 KC; 10,000 and 100,000 ohm steps, flat over the audio range.—**Daven Co., 191 Central Ave., Newark 4, N. J.**

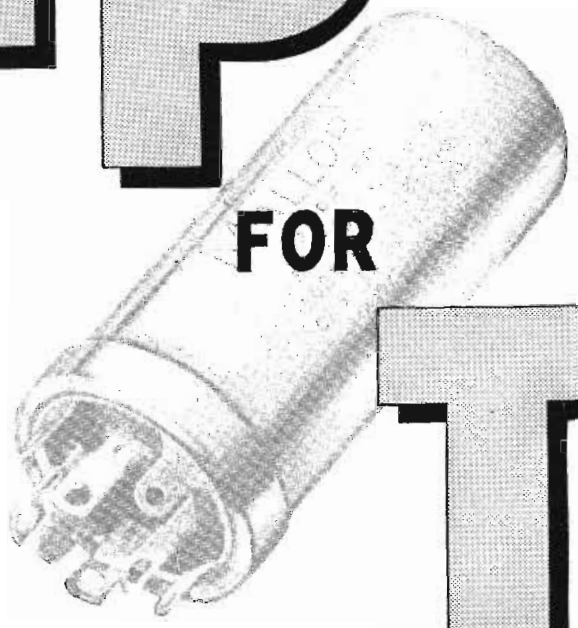
Terminal Markers

Rapid identification of terminals, harness boards, switches and panels is effected with "Spot-It", self-adhesive markers which are



applied without moistening by finger tip pressure to any wire end or terminal. Mounted on handy, pocket-size cards, 40 to the card, the markers are numbered in series 1 to 10, 1 to 20, or 1 to 40, and are also available in letter series from A to Z.—**Western Lithograph Co., 220 Rose St., Los Angeles 54, Calif.**

FP FOR TV



Television Demands Extra Margins of Safety

Everyone knows that higher temperatures hasten the destructive forces of corrosion. It's equally obvious that a capacitor which will take this extra punishment will stay on the job even longer at lower temperatures.

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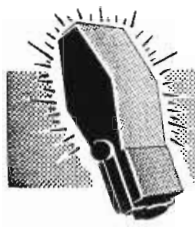


TELE-TECH's NEWSCAST

Audio Engineering Society to Conduct Fair, Oct. 27-29

A session on magnetic recording including operating problems, experience, standards, technical problems of standardization, speed regulation, duplication, and new developments in basic theory will highlight the Audio Engineering Society's "Audio Fair" at the Hotel New Yorker in New York City, Oct. 27-29. At another session a symposium on audio testing methods will be held. Intermodulation, transient methods, and operational problems will be discussed. Some of the technical papers which will be presented are:

"Longitudinal Interference", H. W. Augustadt, Bell Telephone Laboratories, 463 West St., New York City.
"Microphone Placement in AM & TV", H. M. Gurin, National Broadcasting Co., RCA Bldg., New York City 20.
"Audio Consoles for TV", R. W. Byleff, National Broadcasting Co., RCA Bldg., New York City 20.
"Sound Reinforcing Systems", A. W. Schneider, Commercial Radio Sound, Inc., 570 Lexington Ave., New York City.
"Logic in Relay Circuits", Design technique for relay circuits with an introduction to Boolean Algebra, W. E. Keister, Bell Telephone Laboratories, 463 West St., New York City.
"A New Coupling Circuit for Audio Amplifiers", F. H. McIntosh, Consulting Engineer, 710 14th St., N. W., Washington, D. C.
"Audio Techniques in TV Broadcasting", S. Patrenio, Allen B. DuMont Laboratories, Inc., Clifton, N. J.
"Standards — A General Discussion", Cyril Ainsworth, American Standards Association, 70 East 45th St., New York City.

Companies which will exhibit audio equipment and audio components are:

Altec Lansing, Inc., 250 West 57th St., New York City 19; Audio and Video Products (Ampex), 1650 Broadway, New York City; Audio Instrument Co., 1947 Broadway, Nem York City 20; Audio Devices, Inc., 444 Madison Ave., New York City; Audio Development Co., 11 Park Place, New York City; Audak Co., 500 Fifth Ave., New York City; Audio Facilities Corp.; Ballantine Laboratories, 1060 Broad St., Newark, N. J.; Broadcast and Components Parts; Frank Capps Co., 244 West 49th St., New York City; Emery Cook, 139 Gordon Blvd., Foloral Park, N. Y.; Daven Co., 191 Central Ave., Newark, N. J.; Allen B. DuMont Laboratories, Inc., Clifton, N. J.; Electronic Workshop, Inc., 351 Bleecker St., New York City; Fairchild Recordering & Equipment Corp., 154th St. & 7th Ave., Whitestone, N. Y.; General Electric Co., Gawler-Knoop, Inc., 1060 Broad St., Newark, N. J.; Magnecord, Inc., 360 North Michigan Ave., Chicago 1, Ill.; John Maurer; Frank MacIntosh Amplifiers; Proctor Soundex Corp.; Permaflux Corp., 4900 West Grand Ave., Chicago; Presto Recording Corp., 242 West 55th St., New York City; Pickering, Inc., 29 West 57th St., New York City; Panoramic Radio Products, Inc., 10 South Second Ave., Mount Vernon, N. Y.; Racon Electric, Inc., 52 East 19th St., New York City; Ranger Tone, Inc., 73 Winthrop St., Newark 4, N. J.; Rek-O-Kut Co., 146 Grand St., New York City 13; Stancil Hoffman Corp.; Somerset Laboratories, Inc., 1701 Palisade Ave., Union City, N. J.; Sun Radio & Electronics, 124 Duane St., New York City; Tech Laboratories, 7 Lincoln St., Jersey City 7, N. J.; University Loudspeakers, Inc., 225 Varick St., New York City 14.

Municipal Signal Assn. Meets

The International Municipal Signal Association, Inc., will hold its annual meeting at the William Penn Hotel, Pittsburgh, Pa., Oct. 10-13. The four-day technical conference will devote one day, divided into two meetings, to discussion of police and fire radio problems, as well as those applicable to highway maintenance, forestry and utility radio services.

SMPE to Talk TV at Hollywood, Oct. 14

Talks on television will highlight the 66th semi-annual convention of the Society of Motion Picture Engineers, to take place at the Hollywood Roosevelt Hotel, Hollywood, Calif., from October 10 to 14. Earl I. Sponable, president of the Society, reported that the October 14 meetings will be devoted to television, including a visit to the television transmitters situated atop Mt. Wilson.

Titles of some of the papers which will be presented are:

Cathode Ray Tube Applications in Photography and Optics.
Noise Considerations in Sound Recording Transmission Systems.
Supplementary Magnetic Facilities for Photographic Sound Systems.
Cinecolor Three Color Process.
Recording through the Use of Relay Networks.

FCC Proposes New License

The FCC has proposed the establishment of a new commercial radio operator license, to be known as "Radiotelephone Third Class Operator Permit", which will be a non-technical classification fitting between the present restricted radiotelephone operator permit and the radiotelephone second-class operator license.

Under the proposal the FCC would permit that noncommercial educational FM broadcast stations, using transmitters with power ratings of 10 watts or less, be operated by holders of the new license as well as other classes of stations under certain restrictions.

IRE-AIEE Nucleonics Conference Oct. 31-Nov. 2

A round-table discussion on "Evaluation of Radiation Hazards" and an address by Dr. Karl T. Compton, chairman of the Research and Development Board of the National Military Establishment, will highlight the three-day Second Annual Joint IRE-AIEE Conference on Electronic Instrumentation in Nucleonics and Medicine, to be held Oct. 31, Nov. 1-2 at the Hotel Commodore in New York City.

The round-table discussion, by a four-man panel of scientific experts, and Dr. Compton's talk on "Cooperation Between the National Military Establishment and the Atomic Energy Commission" will be held the evening of November 1. Following are a few of the papers which will be presented:

Stable DC Amplifier for Biological Recording, by Dr. Harry Grundfest, College of Physicians and Surgeons, Columbia University, New York City.
Design of Cathode-Ray Oscillographs for Biological

TRUCK-TRAILER FOR MOBILE TELECASTING

WPTZ, Philadelphia, recently placed in service what is believed to be the first truck-trailer used for mobile telecasting. The tractor-trailer combination eliminates the possibility of serious delays in reaching the scene of the telecast. Should the tractor fail for any reason, another tractor can be immediately coupled to the trailer. The manufacturer (Trailmobile Co., Cincinnati 9, Ohio) claims more space is provided in the trailer than in mobile truck units

Applications, by Dr. W. A. Geohegan, Cornell University Medical College, New York City.
Solids for Radiation Detection, by Dr. R. M. Lichenstein, General Electric Laboratory, Schenectady, N. Y.
Desirable Improvements in Nuclear Instruments, by Dr. J. B. H. Kuper, Brookhaven National Laboratory, Brookhaven, L. I., N. Y.

Dr. V. Bush's New Type-Setting Machine

A new electronic type-setting machine which photographs type faces directly on positive or negative film was unveiled last month by the newly-formed Graphic Arts Research Foundation, Cambridge, Mass. Within a few minutes these films can be developed and engraved on a printing plate, ready for the presses. Designed in the research laboratories of the Lithomat Corp., Cambridge, Mass. with the help of Dr. Vannevar Bush, president of the Carnegie Institution of Washington and Dr. Samuel H. Caldwell of the Massachusetts Institute of Technology, the new device by-passes the use of metal type and composes lines three times faster than present day linotype machines.

Cornish Wire Opens "Harness" Division

Cornish Wire Co., Inc., 15 Park Row, New York City, manufacturers of industrial and electronic wire products, has appointed Alexander Norden Jr. to organize and develop a new division. It will be known as the Wired Assemblies Division and will concentrate on the designing, engineering, and manufacturing of staple and specialized electrical wire assemblies for manufacturers of radio and allied equipment.

Coming Events

October 10-14—Society of Motion Picture Engineers, 66th Semi-Annual Convention, Hollywood Roosevelt Hotel, Hollywood, Calif.

October 10-13—International Municipal Signal Association, Inc., Annual Meeting, William Penn Hotel, Pittsburgh, Pa.

October 11-14—American Standards Association, Thirty - First Annual Meeting, Waldorf - Astoria Hotel, New York City.

October 17-21—American Institute of Electrical Engineers, Midwest General Meeting, Netherland Plaza Hotel, Cincinnati, Ohio.

October 27-29—"Audio Fair", Audio Engineering Society, Hotel New Yorker, New York City.

October 31-November 2—Second Annual Nucleonics Symposium, Sponsored by the IRE and AIEE, Hotel Commodore, New York City.

October 31-November 2—URSI and IRE Fall Meeting, National Academy of Sciences, 2101 Constitution Ave., N. W. and Auditorium of new State Dept. Bldg., 21st and Virginia Ave., Washington, D. C.

October 31-November 2 — 1949 Radio Fall Meeting (formerly Rochester Fall Meeting). Sponsored by Engineering Dept., RMA; Hotel Syracuse, N. Y.

BOOKS

TV Picture Projection and Enlargement

By Allan Lytel, Published by John F. Rider Publisher Inc., 480 Canal St., New York 13, N. Y., 1949. 192 Pages. Price $3.30.

This is a comparatively small book—192 pages. But it should be extremely useful both to video beginners and experienced engineers. The first two sections of the six constituting the book deal with elementary optics. However, quite often, information of this type is forgotten as one progresses and uses more complicated equipment. This reviewer, for one, admits that his memory was considerably refreshed after reading the book. The latter part of the volume deals with the commercial applications of optical systems described in the first part, and details the methods used by manufacturers of projection receivers. In addition it provides comprehensive notes on the adjustment of these systems. Color television is not mentioned, although its omission must have been quite a struggle. The book is well indexed and contains a useful bibliography. It makes very useful and informative reading.

Extrapolation, Interpolation and Smoothing of Stationary Time Series

By Norbert Wiener, Published by John H. Wiley & Sons, Inc., 440 Fourth Avenue, New York 16, N. Y., 1949. 163 Pages. Price $4.00.

This is another book by the author of the widely read and discussed *Cybernetics* which compared human control systems and electro-mechanical systems. The current book deals with the problems involved in combining the methods of the statistician and the engineer and concludes by presenting discussion on suggested evolution of common techniques. As far as the average broadcast engineer is concerned the book will not have much appeal, for although it includes a section on the effect of random noise and long term phenomena its application is for the laboratory and theoretical worker rather than the practical man. On the other hand, the lover of mathematics will revel in the complexity of the chapters on prediction and filtering. Recommended as a book for the physicist and high level statistician or communication engineer.

Terrestial Magnetism and Electricity

Edited by J. A. Fleming, Published by Dover Publications Inc., 1780 Broadway, New York 19, N. Y., 1949. 794 Pages. Price $4.95.

This is a fascinating book. The thirteen contributors under the editorship of J. A. Fleming have combined to present a very comprehensive survey of the phenomena of the earth's magnetism. The text is not unnecessarily complicated by the inclusion of complex formulae and should make extremely interesting reading for the average radio engineer. In fact it stim-

(Please turn to next page)

He finds trouble by ear

As this cableman runs his pickup coil along the cable, his ear tells him when he has hit the *exact spot* where unseen trouble is interfering with somebody's telephone service.

Trouble develops when water enters a cable sheath cracked perhaps by a bullet or a flying stone. With insulation damaged, currents stray from one wire to another or to the sheath. At the telephone office, electrical tests on the faulty wires tell a repairman approximately where to look for the damage.

A special "tracer" current, sent over the faulty wires, generates a magnetic field. Held against the sheath, an exploring coil picks up the distinctive tracer signal and sends it through an amplifier on the man's belt to headphones. A change in signal strength along the cable tells the exact location of the "fault."

Compact, light, simple to use, this test set makes it easier for repairmen to keep your line in order. It is another example of how Bell Laboratories research helps make Bell Telephone service the most dependable in the world.

BELL TELEPHONE LABORATORIES

Exploring and inventing, devising and perfecting, for continued improvements and economies in telephone service.

(Continued from preceding page)

ulates the imagination and provides food for thought along many avenues which have not heretofore received much consideration from the radio fraternity. The discussions of such topics as earth currents, which are of radio interest owing to their influence on receiving-point conditions, and radio exploration of the earth's outer atmosphere with its tremendous control over radio communication, to cite only two chapters, are worth the cost of the book.

Vestigial Sideband

(Continued from page 40)

determined by the slope of the phase characteristic. Fig. 9 shows the time delay of the video frequencies relative to the 4 MC time delay. The distortion introduced by this filter is included in an overall calculation of the phase distortion existing in the transmitter. One phase correcting network is then inserted in the video amplifier to provide the linear phase response required.

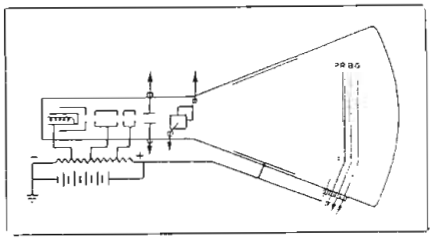
(Part Two of this article will appear in the November issue.)

Color Television

(Continued from page 20)

this type of tube may be used for either direct or projection viewing.

By the time that this review appears in print some new and startling revelations may have been made before the FCC; however, it seems extremely probable that any workable color TV system will in-



Chromoscope color tube showing placement of four color and constant potential screens

corporate features from one or more of the following systems which were included in the JTAC Report.

12 MC Simultaneous Compatable
12 " Field Sequential
6 " Field Sequential
6 " Field Sequential Dot Interlaced
6 " Line Sequential with Simple Interlacing
6 " Line Sequential Non-Interlaced
6 " Line Sequential Color Line Commutation
6 " Dot Sequential

PERSONNEL

John T. Wilner has been named engineering director of station WBAL, Baltimore, Md. His duties will be devoted exclusively to broadcasting and black-and-white television.

Edward J. Meehan, Jr., has been named RCA broadcast equipment field sales representative in the Dallas, Tex. region. He has been a sales engineer with RCA since 1946 and is the former director of the company's television clinic training program.

Lloyd M. Hershey has assumed the post of director of research of the General Instrument Co., Elizabeth, N. J. He will concentrate on the development of new radio and television components and will coordinate activities with other television and radio manufacturers

William W. Follin has joined Radio Frequency Laboratories, Inc., Boonton, N. J., as field engineer for the Washington, D. C. area. Formerly, he was an electronic engineer in the design branch, test equipment section of the Bureau of Ships, Navy Dept.

Thomas D. Fuller, formerly industrial engineer, has been transferred to the sales merchandising department of the Radio Division, Sylvania Electric Products, Inc., Emporium, Pa.

Alfred H. Massalek has been named executive designing engineer of Shure Brothers, Inc., 225 West Huron St., Chicago, manufacturers of microphones, phonograph pickups and acoustic devices.

Sava Jacobson has been appointed chief television engineer of Air King Products Co., Inc., 170 53rd St., Brooklyn, N. Y.

William Warren Davis has been appointed to the electronic division of the National Bureau of Standards, Washington, D. C. He will do research on the high speed electrostatic memory of the electronic digital computing machines.

Dave Schaible has been appointed chief purchasing agent and director of production planning for Littlefuse Inc., Chicago 40.

Sam Bialck and **Leon Adelman** have been named manufacturers representatives in the metropolitan New York area for the Permoflux Corp., Chicago, manufacturers quality speakers.

Rudy Poucher has been named to the field engineering staff of Neely Enterprises, Hollywood, Cailf. He will headquarter in Sacramento, Calif.

Performance Proof

(*Continued from page 33*)

the transmitter (which is off the air and therefore unaffected). However, the tone backs up the line feeding the transmitter and is heard in the monitor speaker of whichever studio or control room is feeding the transmitter at the time. Cessation of the tone is the signal for the studios to resume programming. This not only keeps dead time to a minimum, but also is a safety measure in case of a delayed return. It also makes possible tests without advance schedule, as was done successfully at almost every station break when pattern trimming operations were in progress.

Four tests are made each day. The last is currently being made at 4:30 PM. After the last test, the recording units are visited. The man making the inspection verifies that the pattern is in proper adjustment. In the event it is not, he telephones the transmitter so that corrective action can be taken immediately, and stays at the recorder until an acceptable ratio has been obtained and recorded. He then tears off the tape, stamps it with location and date, initials it, sets up the next day's

(*Continued from preceding page*)

selves may eventually be brought back to the transmitter building and operated via lines, but such lines, besides being unavailable at present would be very costly to lease.

Illumination for Studios

(*Continued from page 36*)

photographs of existing studios adapted for television programs.

With adequate facilities and suitable light sources a general procedure can be outlined whereby a typical set is illuminated. The first consideration is the basic lighting. This is established according to the requirements of the script, i.e., daylight, evening, indoors or an exterior scene. In any case a foundation level is set which will insure an acceptable signal to noise ratio. In the studio previously described, the basic light is obtained by the use of fluorescent lamps producing a well diffused even illumination of the proper intensity which may vary from 50 to 200 ft.-candles. The backgrounds should be separately lighted to establish the locale and identify the scene. This must be done cautiously, however, to avoid detracting from the main focus of attention.

The subject or area which is the

antenna current of the low power transmitter while making tape recordings, and these tests have shown that the response, in terms of scale indication versus field strength in voltage, is linear.

The pertinent information is extracted from the tapes and kept in a book which is more convenient to handle than tape. The tapes themselves, after inspection, are filed away to be kept as permanent records along with the transmitter operating logs.

The maintenance required by the system has been less than was once expected. The man making the daily rounds checks batteries, adds water, connects or disconnects battery chargers as required, and makes a general inspection. Once a month the antenna wires are patrolled for visual inspection, and loop resistance measurements are made between strands and between strands and ground.

There is a bypass switch between the panel of the control unit so that the transmitter holding feature can be shorted to permit removal of the unit from the circuit during broadcast poeration.

The r-f relays are kept tight and the contacts lubricated using G.C. Lubriplate The 10.5 watt transmitter has a Weston 640 ammeter, and its antenna current is read, logged, and adjusted if necessary, when the other six antenna currents are read and logged. A dummy load is built in so that it can be operated for maintenance even while the main transmitter is on.

This monitoring system has been in operation now for several months, and does its job reliably. It establishes beyond doubt the operation of the directional array in the critical directions. As a monitoring system, it is thorough and conclusive. As an aid to pattern adjustments whenever they may again be necessary, it saves a great deal of time and replaces difficult field measurements. It is in effect a system for making a large part of a proof of performance at the touch of a button.

The system was exceptionally costly to install. The equipment was expensive, details were many, and a great deal of time went into its installation and adjustment. Even after completion, the operation of the system ties up a man each day, seven days per week, and necessitates a minimum of seventy miles of driving a day, in all kinds of weather. The recorders them-

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selves may eventually be brought back to the transmitter building and operated via lines, but such lines, besides being unavailable at present would be very costly to lease.

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(Continued from page 36)

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The subject or area which is the chief center of interest is then illuminated to highlight the action in the script with carefully controlled spotlights. In the case of individuals, excellent results have been obtained by using back lighting with spots mounted on top of the vertical sets but angled sharply and screened with "barn doors" to prevent any spill into unwanted areas or into the cameras which they may face. Cross lighting and modelling lights with carefully controlled spotlights set the subject away from surrounding walls of the set and are very helpful in obtaining three dimensional effects. Where a person moves from one part of a scene to another part of the same scene, no attempt should be made to keep the person illuminated equally at all times. Rather the subtle use of shadows help maintain an illusion of realism particularly if the areas of interest are highlighted to catch any important action.

Another element, too frequently neglected, is the foreground. This is particularly important in closeups. High contrast illumination tends to exaggerate wrinkles and blemishes and should therefore be avoided. Instead, broad fill light to soften the overall picture and eliminate harsh shadows should be the general rule.

If extreme care is exercised, a small spotlight mounted at the camera may be used to highlight the eyes and teeth. The use of adequate diffuse front light normally does not interfere with "long-shots" even when an individual is spotlighted, as in an "on stage" sequence, and permits rapid switching without upsetting the tonal scale as viewed by an observer. In general, high brightness in border areas of the picture should be guarded against to avoid distracting the attention away from the portions of interest upon which the eye should be focused.

A frequent source of annoyance in television pictures is the occurrence of microphone shadows. These can be minimized by setting all spotlights with "goboes," "barndoors," or other similar devices so that most of the light from these sources is cut off just above the working level of the set permitting the full swing of the microphone boom in a relatively dark area above the set. Attempts to cover up the microphone shadows on the backgrounds by adding more light to the backdrops frequently result in overemphasizing unimportant areas and in a general increase in the overall illumination required for the entire set. This method should therefore be avoided as much as possible.

No mention has been made of the various "effects" lighting frequently observed in other photographic mediums such as silhouettes, "firelight," "bottom lighting," etc. because it is felt that such a subject is complete in itself and should be treated separately.

The final result, which is the picture the viewer sees, depends in a large part on the skill with which the foregoing principles are applied and is related to the overall operation of the television studio equipment, the program transmission and its final reception.

The assistance and information obtained from the several lamp manufacturers particularly General Electric Co., Westinghouse, and Western Union are gratefully acknowledged. Thanks for the cooperation of the RCA staff and my NBC colleagues are also extended. All of the work has been conducted and is continuing in the engineering department under the direction of Mr. O. B. Hanson, vice president and chief engineer.

(7) "Characteristics and Applications of Concentrated Arc Lamps", Buckingham and Deibert. **Journal of PSA**, Vol. 12, No. 10, Nov. 1946.

(8) Courtesy of Display Lighting Inc.

SURGE TESTING

(*Continued from page 29*)

starting the arc on the filament proper.

If it is assumed that the energy in the arc is evenly distributed at both terminal points and that an isolated segment of the filament wire is being dealt with, this expression for the minimum arc velocity along a filament wire to just melt it, may be written:

$$(2) \qquad V = \frac{2280\ EI}{(Q_2 - Q_1)d^2}$$

where: V = velocity in meters per second. E = arc drop in volts. I = arc current in amperes. Q_2 = heat content in calories per gram atom at melting point. Q_1 = heat content in calories per gram atom at maximum operating temperatures of the filament. d = diameter of wire in mils. From the test data, E is approximately 10,000 volts when I is 500 amp. At the melting point of pure tungsten Q_2 is 27,311; Q_1 is 17,000. and d is 51.5 in the WL-895.

Substituting in (2) V = 400 meters/sec. along the filament at maximum operating temperature. At the junction of the filament and filament support the temperature is approximately 1400°K. Substituting the values applicable in (2) V = 215 meters/sec. for the boundary velocity. In order to melt 10% of the wire cross-section, the minimum velocity from (2) becomes 4000 meters/sec. on the hottest portions of the filament.

The fact that melting of filaments usually occurs nearest the support, as shown in Fig. 5, indicates slowing down of the arc as it moves to a cooler section of the filament.

In an Ignitron, where the pres-

sure may be several millimeters, the velocity of the arc spot on a mercury pool is approximately 9 meters/sec. at 500 amp., indicating that the velocity of the arc movement is related inversely to gas pressure within the tube.

Path of Arc

There is some evidence that the arc travels from a region of high vapor pressure to a region of lower vapor pressure; however, this is not an established fact from this investigation. Fig. 6 shows the average type of failure caused by flash-arcs in the WL-895. Fig. 9A shows a design of a cross-section of a filament wire and its support. With this construction an arc tends to transfer from the filament to its support where it cannot do so much damage. If Fig. 9B is used, the arc will usually stop and burn out the filament at point marked "C" *unless* the tube has an unusually good vacuum. It is thus indicated that with an arc on a hot filament, the additional tungsten vapor pressure resulting from the heat added to the wire by the arc increases the pressure in that region so the arc moves toward a region of lower vapor pressure. As the arc nears the support as shown in Fig. 9B, the arc energy is not sufficient to increase the vapor pressure to the point where the arc drop goes up so it anchors near the support. If the construction as shown in Fig. 9A is used, the filament is up to practically full operating temperature as soon as it is exposed to the arc. Thus when an arc travels toward this support, the vapor pressure created by the arc is essentially constant so the arc transfers to the support to supply the necessary conditions for a lower voltage drop.

When a resistance is added to the circuit, the energy in the arc will be in inverse proportion to the resistance added, thus there will be a proportionate reduction in the vapor pressure resulting from the arc. This effect in turn reduces the pressure differences existing from the arc. This effect in turn reduces the pressure differences existing in the tube and consequently reduces the tendency of the arc to move from the filament. This hypothesis is partially borne out by the second tube tested. After forty-seven surges at 500 amp., the damage is slightly less than in the one with fifty-one surges at 200 amp. even though the total energy in all discharges was approximately 11.7 x 10^6 watt-sec. as compared with 1.5 x 10^4 watt-sec. It is believed that the difference in damage would have been much greater if the gas pressure in these tubes had been greater, that is, of the order of 10^{-5} mm.

Fig. 10 shows the field performance of the WL-895 since the installation of several equipments requiring parallel operation from the same power source. Curve #1 is the initial performance. Each step, with one exception, has been aimed at improving the vacuum during manufacture and removing the possible sources from which gas could be evolved during normal service. The results of these changes are shown progressively in Fig. 10. One step in this improvement program was the modification of the filament support to that shown in Fig. 9A.

From the data presented, the following conclusions are indicated: 1. The addition of series resistors in the plate circuit should not materially change tube damage per flash-arc when the tubes are well outgassed but the addition of the resistor minimizes the tendency toward arcing. 2. Restricting the path of a flash-arc by shielding the filament supports from the anode will

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cause prompt failure. 3. Internal sources of gas must be minimized in order to give the largest pressure differential in case of a flash-arc. 4. The initial gas pressure reading should be of the order of 10^{-6} mm of mercury to minimize flash-arc damage. 5. The filament exposed to the flash-arc should be at maximum operating temperatures. 6. The addition of a series resistor may increase flash-arc damage if the tubes are soft and remain so.

1"A New Form of Cathode Discharge", R. W. Wood, Physical Review, 1897, Vol. 5, page 1.
2"Design of High-Power Radio-Telegraphic Transmitter Using Thermionic Valves", R. V. Hansford and H. Faulkner, Journal I.E.E., 1927, Vol. 65, page 308.
3"The Flash-Arc in High-Power Valves", B. S. Gossling, Journal I.E.E., 1932, Vol. 71, No. 429.
4"High-Power Valves: Construction, Testing and Operation", J. Bell, J. W. Davies and B. S. Gossling, Journal I.E.E., August, 1938, Vol. 83, No. 500.
5"The Characteristics of Tungsten Filaments as Functions of Temperature", Howard A. Jones and I. Langmuir, General Electric Review, September, 1927, Reprint No. 419.

Philco TV Aerial

(*Continued from page 37*)

tively large inductance of the loop or hairpin is the principal factor in achieving this, whereas the effect of the smaller loops on this band is of lesser importance. The tuning capacitor serves to vary the inductive reactance of the long loop over the low band for the purpose of matching the X_A (capacitive) of the antenna.

A similar analysis of the aerial system's operation on high-band channels is illustrated in Fig. 2D. Note that now the antenna's reactance, X_A, is inductive. Also it may be mentioned that the radiation resistance of the antenna is higher on channels 7 through 13. Here the circuit is tuned to resonance by means of the variable condenser, and the inductance of the two smaller loops, X_1 and X_2, is a substantial factor.

West Coast IRE

(*Continued from page 42*)

The technical program covered a wide range of projects with television, tube developments and microwave techniques (especially those relating to antennas and radiation) predominating. Two symposia sessions were featured—one on television needs and trends, another on Airborne Antenna developments. These sessions were national in scope and attracted experts on these subjects from all parts of the country.

Among the papers a great many presented much detailed circuit information, and technical operating processes, and were well received by the engineers in attendance. The presentations were usually not generalized and ultra concise as sometimes occurs at such conferences.

One paper that received unusual attention (because of the interest in TV along the Coast) described the microwave radio relay communications system now under construction between Los Angeles and San Francisco and scheduled to be completed next Spring. D. I. Cone, transmission and protection engineer of The Pacific Telephone and Telegraph Company made the presentation. Construction has begun on the eight intermediate repeater stations along the eastern side of the Coast Range and over the Tehachapi Mountains. The system will utilize newly developed equipment in the 3700-4200 MC band of frequencies.

A review of electronic research for military usage was given by Rear Admiral T. A. Solberg, U.S.N. Chief of Naval Research. "The Place of Electronics in Naval Planning" anticipated an even larger trend toward tube methods in the future.

Electronic Engineering Handbook

By Ralph R. Batcher, E.E. and William Moulic

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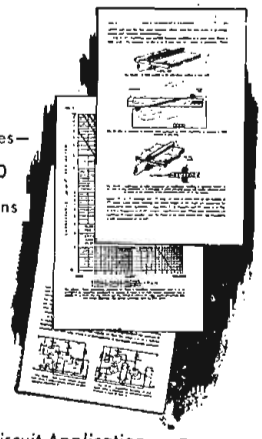

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BULLETINS

Die-Less Duplicating

O'Neil-Irwin Manufacturing Co., 348 Eighth Ave., Lake City, Minn. has published a new catalog (49-15) on its die-less duplicating machines. The company offers free engineering service on the application of die-less duplicators to any cutting, forming or bending operation. (Mention T-T)

Coil Winding

No. 10 in a series of leaflets on "Getting the Most from Coil Winding" has been issued by the Universal Winding Co., P. O. Box 1605, Providence, R. I. This issue deals with arbors for spool-wound coils. (Mention T-T)

Vacuum Pumps

"Stokes Microvac Pumps for High Vacuum", a 36-page catalog and data book, is now available for the engineer and research man. Published by the F. J. Stokes Machine Co., Philadelphia 20, Pa., it describes the complete line of Stokes Microvac pumps, including specifications, and their applications in research and industry. (Mention T-T)

Adhesives

The complete story of adhesive products and the Paisley facilities are presented in a 6-page brochure currently being offered by Paisley Products, Inc., 1770 Canalport Ave., Chicago 16, Ill. Ten main divisions of basic adhesives are described and a product list shows end uses and industries served. (Mention T-T)

Microphones

A 4-page bulletin (No. 104) has recently been issued by Electro-Voice, Inc., Buchanan, Mich., which gives concise information and list prices on the E-V line of microphones and microphone stands. It includes the latest high fidelity broadcast dynamics, cardioid dynamic and crystal microphones, general purpose dynamic and crystal, velocity microphones, dynamic and carbon Mobil-Mikes, desk stands and floor stands. (Mention T-T)

FM Radio Center

A new brochure, describing the establishment of FM radio centers in high schools and colleges, is available from the General Electric Co., Electronics Park, Syracuse, N. Y. In addition to specifications for radio center layouts, the brochure suggests types of programs which may be presented. (Mention T-T)

Commercial Glass

Bulletins B-83 and B-84 entitled "Properties of Selected Commercial Glasses" and "Manufacture and Design of Commercial Glassware" have been released by the Corning Glass Works, Corning, N. Y. These bulletins contain important properties of glass and glass manufacturing methods. (Mention T-T)

Solderless Terminals

"The AMP Pocket Catalog of Solderless Wiring", published by Aircraft-Marine Products, Inc., 1523 North Fourth St., Harrisburg, Pa., facilitates the quick analysis of various types of solderless terminals and the applications for which they are best suited. (Mention T-T)

Photoelectric Cells

International Rectifier Corp., 6809 South Victoria Ave., Los Angeles 43, Calif., has recently published a bulletin identified as PC-649, describing its new line of selenium self-generating photoelectric cells. It contains diagrams, curves, etc. describing the construction, performance characteristics and application of the photocells. (Mention T-T)

Fuses and Fuse Holders

Littelfuse, Inc., 4757 North Ravenswood Ave., Chicago 40, Ill., has published a bulletin (Catalog No. 10) illustrating and describing its line of fuses and fuse holders. Neon pilot lights and low voltage automatic reset circuit breakers are also covered. (Mention T-T)

TELE-TECH

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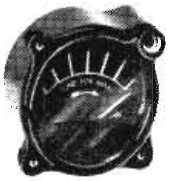

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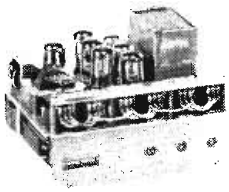

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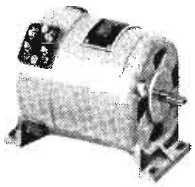

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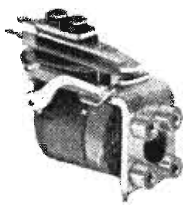

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