

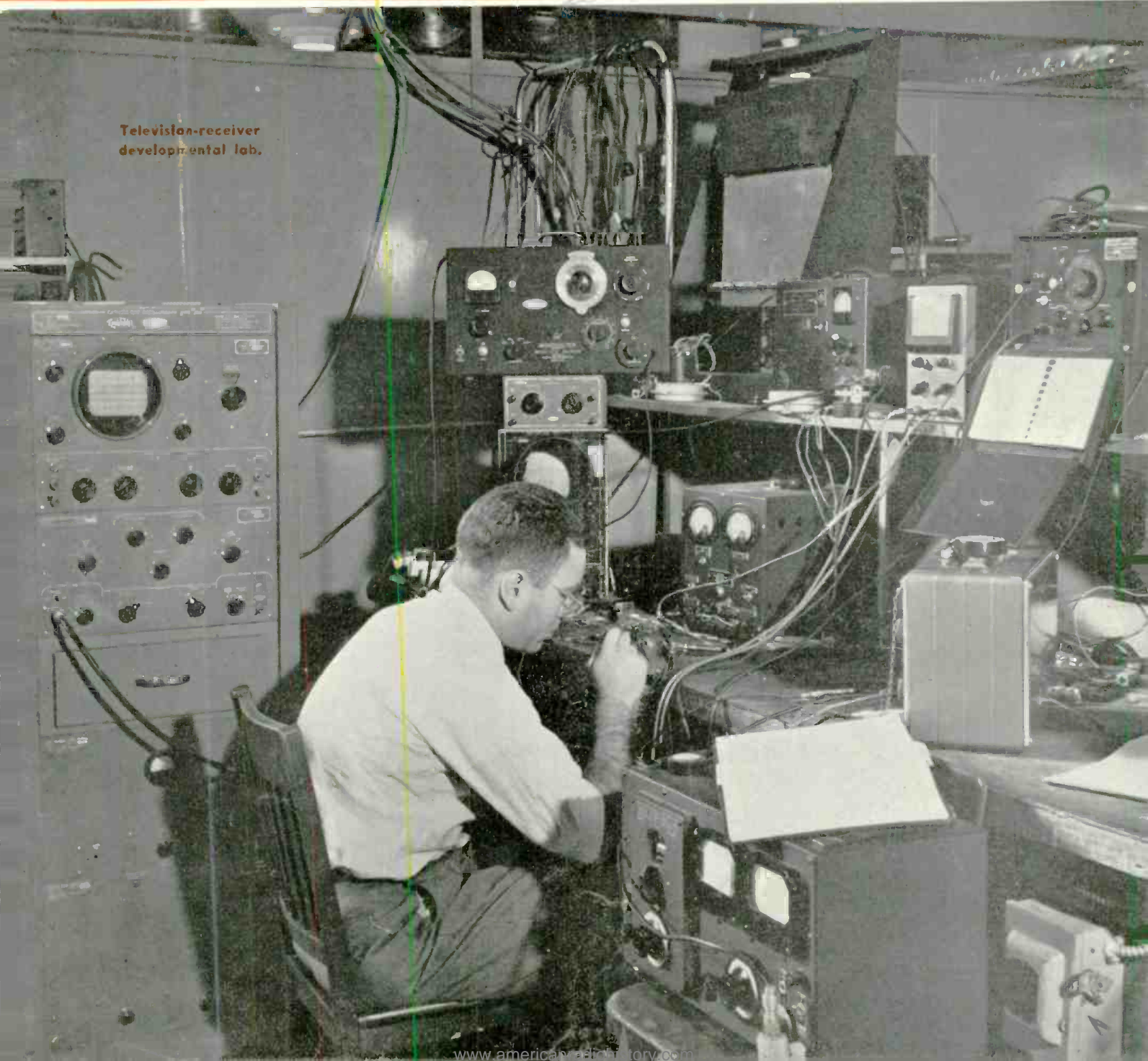
TELEVISION ENGINEERING

SEPTEMBER, 1951



The News-Engineering Journal of The TV Industry

Television-receiver developmental lab.



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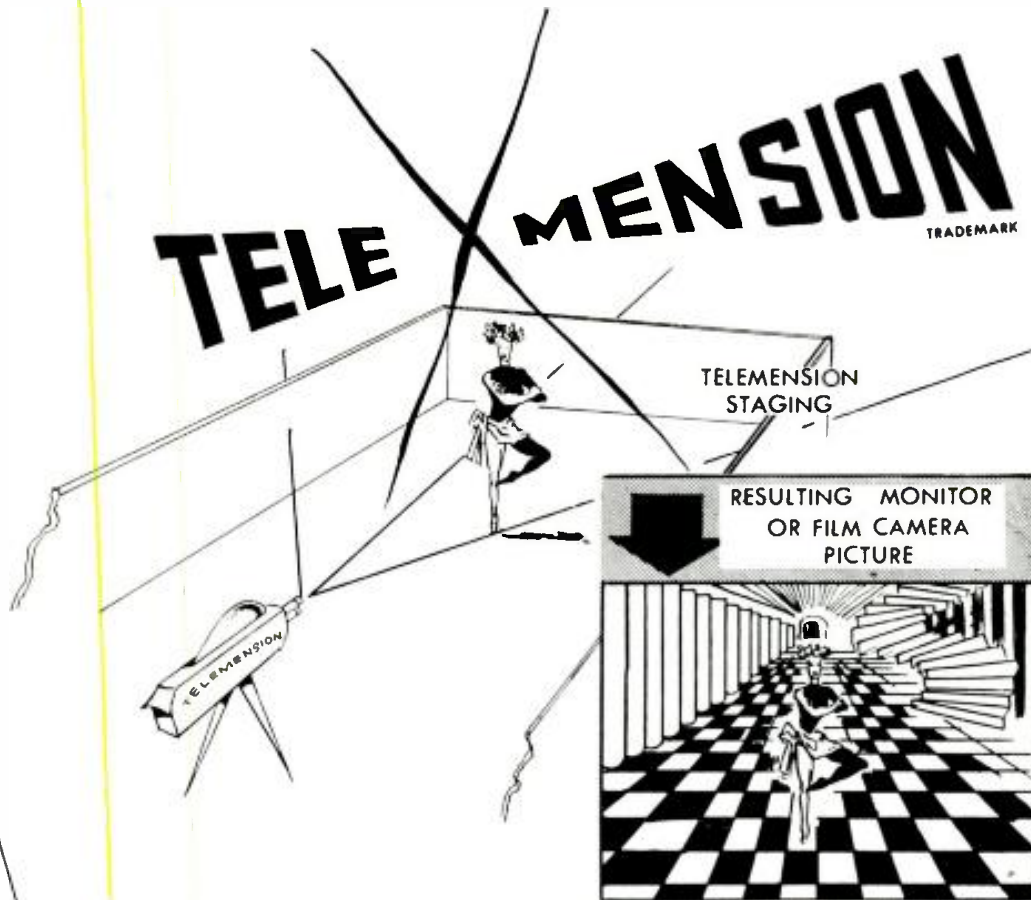
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VOLUME 2

SEPTEMBER, 1951

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Cover Illustration

Setup for running tests on development model of a television receiver sub-assembly. (Courtesy DuMont)

Editor: LEWIS WINNER



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FURTHER DETAILS and QUOTATIONS ON REQUEST

Television Engineering, September, 1951

TELEVISION ENGINEERING

LEWIS WINNER, Editor

September, 1951

Ultrahigh Potentialities Winning Rave Notices—

With the bold declaration that it might be best if all stations eventually went on the ultrahighs, fired at an audience of specialists by FCC spokesman Wayne Coy during a recent seminar meeting conducted by RCA, there appeared a prophetic view that many believe will introduce a new era in sight and sound. Scoring critics on their opposition to *uhf*, Coy said that a visit to downtown New Haven would prove quite conclusively not only how good an ultrahigh signal can be, but how much better it is in many instances. No only are the *uhf* signals clear and devoid of interference so common to *vhf*, but they have as much gain as low-band occupants who are much closer to receiving areas, cited Coy. The higher bands must be considered as the only solution to coast-to-coast and border-to-border coverage, a condition that the veryhighs cannot possibly meet, the FCC chairman emphasized.

Declaring that the FCC felt, in reviewing the allocation pattern, that competition is all-important, the commission's chieftain said that we must have more competition and . . . "we propose to use every megacycle in the ultrahigh spectrum to encourage such thinking."

"If I can convince management, and in particular the station's lawyers, that there is a real value in the ultrahighs, I could shorten the time when we could have a nationwide competitive TV system in this country," Coy told his audience.

Continuing the enthusiastic appraisal of the new bands, RCA's prexy Frank Folsom declared that the eventual opening of the new channels, and the proposed expansion on the present bands, will mean the establishment of a chain of stations far exceeding the number contained in the present broadcasting network.

It was also pointed out that while the actual construction costs for an ultrahigh station would be about the same as for a low-band unit, the capital outlay could be kept to a bare minimum by perhaps operating the ultrahigh station as an auxiliary to the low-band unit. In other words, the high-frequency station could be used to pickup lowband telecasts with coax or radio relay, for rebroadcasting. To provide for such a service, there has been developed a compact *uhf* transmitting chain.

During a meeting of distributors in Chicago, featuring a talk by Doc Baker, G. E.'s vice prexy and general manager, the ultrahighs were also praised as a solution to many problems. In Doc Baker's opinion, there should be on the air within the next two years about 200 more stations, of which over 100 would be of the *vhf* type, and

the remainder of the *uhf* category. Within five years, he felt, we can look forward to a minimum of over 500 stations, of which about 166 would be of the *uhf* variety. Noting that this production forecast does not agree with many other predictions which indicate a network of over 1500 transmitters, he stated that if materials, including construction materials, should be in free supply, his estimates could be held as quite low.

UHF Selected for Relays in Great Britain—

Between London and Birmingham, the ultrahighs have been found to be an ideal medium for an all-important video-sound link, featuring the use of channels in the 610 to 950-mc band, in which it was felt the fading effects would be less severe than at higher frequencies.

In a report on the system, now in operation, it was noted that a dipole and passive reflector located in the aperture plane of a paraboloidal mirror served as a part of the antenna system for the transmitter and receiver, the paraboloid having an aperture plane of 14 feet in diameter. The theoretical gain of the system over a simple half-wave dipole was noted as 27.5 db. It was pointed out that no deterioration of performance due to the use of a non continuous reflecting surface had been detected.

Describing the receiver used, the report said that a heterodyne frequency filter is employed to reduce the effective local oscillator noise by introducing a narrow frequency gate, and providing for the rejection of any unwanted frequency components in the output of the frequency-shifter stage in a repeater station transmitter. The filter was also described as providing a stable resistive load for the local oscillator source. Consisting of two resonant cavities, coupled together by a section of coax line, in which shunt and series-resistive elements are included, the filter was said to have an 800-ke wide response at 3 db points, with rejection better than 50 db at ± 20 mc from the midpoint of the band.

Thus far, it has been reported, the system has been found to be very reliable, providing an effective means of transmission as a radio link, and also serving as a feed for a coax-line trunk system, in a hook-up very similar to the procedure used in the recently inaugurated coast-to-coast system here. The *uhf* link and cable tie, in a mixed-cascade arrangement, was cited as an important step toward the optimum planning of national and international networks, in which both air and wire systems can play their appropriate parts.—L.W.

Small Business Activity

Washington and Associations Strike Up Band: To overcome the special problems inherent in smallness, particularly in manufacturing, there is an urgent need for a variety of assistance.

As long as a business is small, it may suffer within its own organization from lack of specialists in the various phases of management. Without sufficient capital to retain the personnel versed in the techniques of sales and product promotion, production, inventory supply and control, finance, credit and collection, traffic control, accounting and auditing, product and market research, a small concern has to rely on its own abilities in these fields. In most small concerns, management functions of all these specialized fields of business are undertaken by one individual, the owner. Very often he has the assistance of a few partners. But even then there is a paucity of experienced talent for all the diverse fields of management.

In the public interest, the smaller enterprise must be protected, within practical limits, from unfair trade practices, from unfair competition and from unequal impact of Federal controls and regulations.

To protect the right of the individual to start his own business and to give freedom of expression to his initiative and creative ability; to protect public interest in the maintenance of minimum disappearance rates among business enterprises; to disperse and control extreme concentrations of economic power and employment; to protect the full plant capacity of the nation for use in periods of national emergency, it becomes necessary to lend a hand.

Properly, that special assistance needs to be rendered, in general terms, in the fields of government control of material supply, federal procurement, credit control, price and wage regulation and finance. Specifically, that assistance is required by the individual unit at the site of its establishment and in the fields of management in which it finds itself individually in need of advice, encouragement, leadership and technical service.

Washington has developed programs to help the small businessman in his own community through the field offices of the Department of Commerce and the Governor's Commissions on Small Business Problems, both of which offer information gathered from private and public sources, including studies of local markets.

RTMA has also been alert to the small-business problem and has established a *small business committee* and is setting up a liaison between large prime contractors and small manufacturers to facilitate more subcontracting. Information leading to subcontracting opportunities is being released. There's also a program afoot involving the study of future shortages so that new opportunities may be uncovered.

According to association prexy Glen McDaniel, the larger prime contractors are already subcontracting on an average of 50 per cent or more of their defense business to those in the *small business* category.

Noting that, short of an all-out war, manufacturers equipped only to do assembly operations will probably not be able to get sufficient military business to keep their plants busy, RTMA's headman said: "We must do everything possible to keep our civilian business strong and healthy, thus keeping our industry intact for a greater emergency."

In his opinion, from a long range point of view, there is every reason to be optimistic. Many new TV areas will be opened up within the next few years.

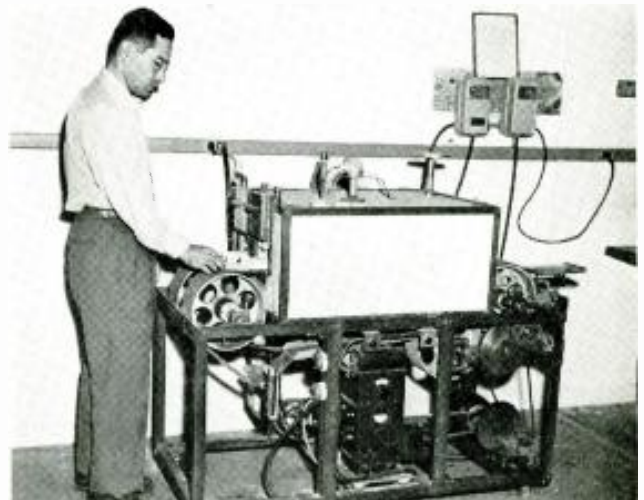
He noted that new export markets are opening up as other countries, especially in Latin America, are turning to television as they did formerly to American movies. American manufacturers, with a head start on most foreign radio-television producers, he felt, should be able to supply these new world markets.

Thus, he pointed out, it appears that while the pattern of military production is changing, there should be enough civilian business to keep the industry, particularly the small operator, busy once television is permitted to extend its boundaries.

NBS magnetic attenuator, an inexpensive type of microwave attenuator that requires no movable components, mechanical controls, or slotted sections in the waveguide or coax transmission line. An attenuator (center foreground) is placed between the poles of an electromagnet, an interaction occurs between the electromagnetic field, produced by the energy from the uhf generator (left) and the magnetic field of the electromagnet supplied by voltage generator (center background). The uhf energy is attenuated by the magnetic attenuator before passing on to the standing wave machine (right foreground).



Small continuous furnace recently constructed at the National Bureau of Standards for the firing of printed electronic circuits. A batch of small ceramic chassis, on which circuit patterns have been printed with silver paint, is being loaded on the continuous belt. The belt, adjustable in speed, is ordinarily set to deliver the fired chassis at the output end of the furnace in about 65 minutes. Temperature at the center of the furnace, also adjustable, is usually set at 1350° F.



Mineral Supplies

The Mica Situation: With the recent reports presented in Washington indicating that grades of mica being received from India are deteriorating in quality and industry requirements for better films are increasing daily, industry has found it necessary to review carefully the various natural and substitute sources which might have to be expanded and explored for future supply.

While deposits in Brazil, and in North Carolina, South Dakota, Virginia and New England are substantial, the quality has not been too impressive, although Brazilian mica has been found quite useful in many instances. Efforts to provide substitutes have been quite rewarding and eventually the man-made products may provide the answer to the problem. The striking progress achieved in this direction was revealed a short time ago during an industry-military roundtable discussion in Washington.

It was disclosed, for instance, that there has been developed a solid state mica, which, from present appearances, may take an important place in the field of inorganic insulating material. The material was identified as hot pressed synthetic fluorine phlogopite, which is a potassium magnesium aluminum fluorosilicate. It can be hot pressed and reacted in a solid state at the same time, or the batch can be reacted separately, the mica being made first and then ground up and hot pressed separately. The mica batch can also be pre-melted and poured into water, and ground up.

The solid state reaction was noted as being preferred, the mica powdering very readily then, practically one hundred percent mica.

This type was said to have several advantages: It has good weathering resistance, and is soft and easy to machine. Threads can be cut on it and it can be placed on a lathe. And from that point of view, it was said, it can be considered as a substitute for block talc, although it is a little bit difficult to cut the material quite as rapidly as block talc.

Noting that mica is a layer and sort of a sandy structure, the experts said that there are two of major silicon oxygen layers, and in between there is a layer of magnesium which

binds it together. On the other faces there are potassium ions, which is the plane of good cleavage. It has been found that it's possible to take out the potassium and replace it completely with sodium, molybdenum, and barium. The magnesium layer can be taken out and replaced completely with iron, nickel, and cobalt.

It was also said that aluminum can be replaced with boron. Replacing one aluminum with one boron has been found to permit lowering the melting temperature by 200°, affording hot pressing at 900° to 950° instead of 1200°.

Thus, it was shown, with a combination of all these various substitutions, it is possible to make many different kinds of micas and solid solutions between them, opening up a very vast field for controlling the electrical and physical properties of the material.

Reviewing the electrical properties of synthetic micas, the specialists said that the minimum dielectric constant was 7.0 at 50 kc; at 1 mc, 7.6 to 5.9; at 5 mc, 6.2 to 5.7; at 10 mc, 6.4 to 5.6.

Also probed at this meeting were the eventual possibilities of integrated mica, which consists of a large number of flakes held together by their own cohesive force. Noting that this is not a mica substitute, but pure mica, the experts declared that it possesses to a very large degree most of the characteristics that natural mica possess; it will not burn, nor is it affected by any temperature at which ordinary mica would not be affected.

The principal advantage of integrated mica was said to be in the fact that it can be made in sheets of indefinite size, and can be made in different thicknesses.

Biotite, a material that the electrical industry has shied away from, has been found to have, in an integrated form properties that might make it a pretty fair capacitor.

Integrated mica, it was found, could be made extremely thin. Power factors as low as .06 per cent have been obtained. The mica can withstand heat, better than the parent mica itself.

The cost of producing integrated mica was said to be approximately fifteen cents a pound.

Beating the heat on the production line at the Bardwell and McAlister plant in Burbank, Calif., where TV studio lights and accessories are made.



Dr. W. R. G. Baker, G. E. electronics division vice proxy and general manager, examining big borer while on tour of the division's million-dollar building and equipment expansion of its equipment development works in Schenectady.



Television Recording

The Tone-Reproduction Problem: Correct tone reproduction in TV with adequate contrast range, which has been cited as the greatest single factor in determining the subjective quality of any television image, has been described by many as quite a neglected factor in the recording process. Pictures with low definition, measured in terms of lines, it has been found, can often be very acceptable, providing that the tones in the subject are reproduced with the correct tone separation and contrast range. Surveying the possibilities of this control procedure recently during the SMPTE meeting in New York City, W. D. Kemp of Great Britain*, revealed that with the object of improving the tonal characteristics of BBC television recordings, a series of tests were carried out during '50 and '51 to investigate the transfer characteristics of all processes from the television camera to the final print of the finished telefilm.

To obtain reproduction of a television program by means of TV recording, ten transfer characteristics were said to be involved.

It was pointed out that any particular tone in the picture will be represented by a particular voltage, and this may be expressed as a percentage of the peak white signal, or in the case of a transmitter, percentage carrier, as the modulation is positive.

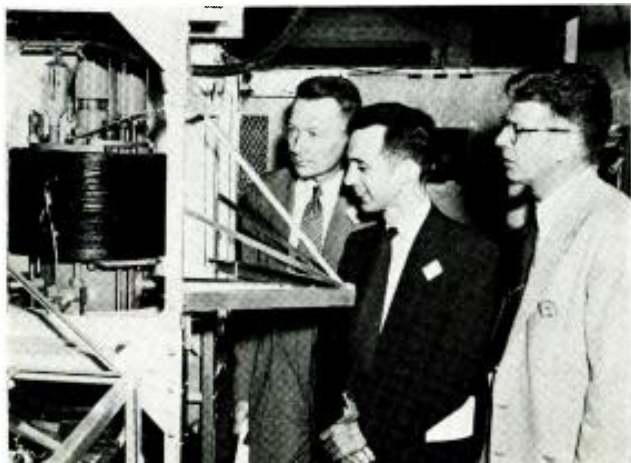
Due to the close tolerance of linearity for individual items of equipment, Kemp said that the effect on the overall response is small when compared with other factors, unless actual overload is occurring.

Unfortunately this effect tends to crush highlights, which are often already compressed in the cameral tube.

Reviewing the transfer characteristic of the picture tube used for recording, the British specialist said a family of static characteristics of picture tubes which until recently has been used for recording was taken, the curves being obtained with various brightness or grid bias setting. Due to the difficulty of obtaining adequate exposures on the film, it was necessary to record with a grid bias such that the beam current

*This talk was first presented before the Royal Photographic Society and the British Kinematographic Society.

George F. Metcalf (right), manager of the G.E. commercial and government equipment department, explaining operation of hi-power uhf transmitter operating experimentally at Electronics Park to Edward W. Allen (left), FCC chief engineer, and Curtis B. Plummer, chief of the FCC broadcast bureau, during a recent visit.



was not zero at black level. Thus, it was indicated, there appeared loss of contrast gradient in the lower parts of the picture. Over the voltage range from 10% to 100% of the picture signal, however, it was noted, the departure from the true power law was not very serious, although enough to increase the black compression in the overall recording characteristic.

Detailing the problem of the overall characteristics of the negative stock and its development, Kemp declared that it is important to obtain the negative characteristic for two reasons: The spectrum of the light from the television screen may differ considerably from that of the sensitometer used by processing laboratories, and the law of reciprocity breaks down due to the extremely short exposure time. The total exposure time of any one element of film, it was pointed out, corresponds to the time of scanning one picture element of the television image, plus a longer period of afterglow during which the brightness decays exponentially. Even with long afterglow picture tubes, this was described as being short by photographic standards.

Analyzing various brightness settings of the picture tube, Kemp said in the four characteristics plotted compression appeared in both the higher and lower tones of the picture. The compression in highlights was said to be due mainly to the television camera characteristic and the positive characteristic, while the compression of the darker tones was due mainly to the tone of the negative characteristic, combined with the loss of contrast gradient in the darker tones of the picture tube, at high brightness settings.

Of all the transfer characteristics discussed, the most flexible was said to be electrical linearity, since this can be easily changed by the use of non-linear elements such as crystals, tubes, etc.

Kemp disclosed that experiments are now proceeding with various contrast correction techniques, to provide telefilms which ultimately will be comparable with normal motion pictures. He pointed out that there is the interesting theoretical possibility of producing an overall television recording characteristic which would provide a linear density/log subject brightness law, at present unattainable by photographic processes alone.

Dr. Roy K. Marshall (right), conductor of the TV program, The Nature of Things, receiving a briefing on the vidicon pickup-tube camera from M. S. Klinedinst, manager of RCA industrial equipment sales, prior to a highlight talk of the equipment on an NBC network program.



Fluorescent-Lamp Interference

Gaseous-Discharge Tube Noise Probed: Interference caused by sustained discharges produced in neon signs and fluorescent lamps, has been a provoking and challenging problem ever since their inception, prompting continuing investigations into the means which might be used to curb the nuisance. A few weeks ago there was offered a progress report, before the Illuminating Engineering Society, which indicated that many major cause and effect conditions have been discovered and that remedies for the disturbances appear to be imminent.

The analysis, prepared by J. Warren Culp of the Physics Lab of Sylvania Electric, revealed that there are four general types of noise radiated by the fluorescent tube: reignition noise, hollow cathode noise, anode noise and starting noise, the latter due to operation of the lamp starting circuit.

Describing the noise types, Culp said that the *grassy* pulse at the beginning of the lamp cycle, called *reignition noise*, occurs when the arc begins to rebuild after current reversal. Low-frequency pulses, in the middle of the half-cycle which bear a relation to the anode glow, were identified as *anode noise*. The term *starting noise* was applied to the noise which is generated during operation of the lamp starting circuit.

In a review of the reignition type of noise, which comes in a pulse at the beginning of each half cycle, it was pointed out that this noise in hot-cathode lamps is usually louder than other types when heard in a speaker and is thus more conspicuous.

A crude frequency spectrum analysis of this condition can be made, it was said, by tuning a receiver over a 540-ke to 31-mc range and judging the relative loudness. Such a check will show that the reignition noise is chiefly concentrated in the range below 2 mc and possibly is loudest around 1 mc, directly in the middle of the broadcast band. When account is taken of the seeming randomness of *rf* noise within each pulse in an oscillogram, it will be noted that the noise consists of either a random series of rapid pulses or a frequency-modulated oscillation. In the latter case, Culp said, the frequency of the oscillatory wave must sweep across the entire broadcast band of a receiver, so that no matter to what frequency the receiver is tuned,

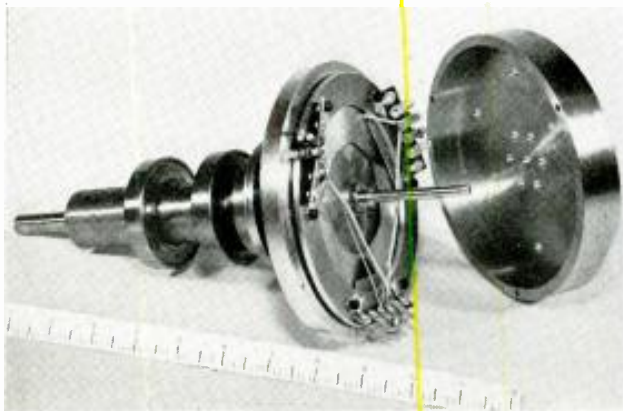
its circuit will respond to the noise. Furthermore, this broad sweep must be accomplished during the life of each single reignition pulse of noise to give the observed overall effect of a 120-cycle buzz.

Surveying methods which might be used to locate the source of noise in the lamp, the physicist said that an exploring antenna or coil was not too fruitful, because noise generated at one place in the lamp was radiated by the whole discharge acting as a transmitting antenna. However, this experiment will tend to localize the source of any given noise pulse at the filament which acts as cathode at the time the pulse is emitted. A magnet held near one filament will cause some change in the noise pulse radiated when that filament is cathode, while the noise on the other half-cycle is unaffected. An auxiliary heating current through one filament was said to give a similar effect. In fact, it was shown, on occasion, the noise was almost completely quenched by these methods. However, it was said, unfortunately the experiment is seldom reproducible at will. A more conclusive demonstration of the source of noise can be made by constructing a short lamp with only an inch between the two filaments, in which case, it was pointed out, the discharge consists of the usual cathode and anode structures but has no positive column.

One type of noise which was said to appear in many cases, was the hollow-cathode noise, more likely to occur in aged lamps, although new lamps sometimes will show it. This noise was described as resulting from the formation of the cathode spot at a point on the coiled-coil filament where some of the oxide coating has burned away and left a tiny hollowed-out cavity in the minor helix. When that happens, a noise oscillogram will show one or more pulses of *rf* noise located almost anywhere in the cycle. However, these pulses, are unlike those of reignition noise; they are smooth in appearance and there is nothing random in their nature excepting possibly their location in the cycle.

Culp noted that the cathode spot of the discharge can be studied by means of a microscope in conjunction with a rotating disc stroboscope. When hollow-cathode noise is present, at a certain time in the cycle, a tiny glow will appear suddenly inside the hollow of the minor helix, and a milli-second or so later it will disappear just as suddenly. Other than this, it was said, there is no observed peculiarity of the discharge associated with this type of noise.

National Bureau of Standards experimental crystal clutch, unmounted, with cover plate removed, which features three Bimorph crystal elements which bend when a dc voltage is applied. This bending pinches the output disk between the rotating mounting plate and the rotating crystal pressure plate. Suitable for certain specialized instrumentation applications, the new clutch is characterized by high speed of response and negligible current drain.



Harry R. Ashley (right), president of Electronic Instrument Co., Inc., inspecting use of Eico 'scope and vtvm at an alignment position along a television production line of Tele-King, as James Adler, Tele-King production test foreman, demonstrates alignment procedures employed.



Low-Hum Amplifiers

Heater-Hum Reduction Techniques Evolved: Heater-induced 60-cycle hum in *ac* operated low-level amplifiers, which in some instances has been found to yield a 500-microvolt level, can be substantially minimized by adopting better tube-and-circuit combinations, according to the National Bureau of Standards electronic instrumentation lab. In a recent survey of the problem, it was found the hum can be reduced to less than 1 microvolt through a suitable solution of tubes and circuits.

Eleven tube types, in various circuit arrangements, were studied. Included were single triodes 6F5 and 6SF5; dual triodes 6SL7, 7F7, and 5691; and pentodes 6J7, 6J7G, 6J7GT, 6SJ7, 5693, and 6SH7.

Circuits were varied with respect to cathode bypass capacitance, heater return tie point, heater return potential, and grid circuit resistance. The cathode resistor was either bypassed with a 50-mmfd capacitor or left unbypassed. Input grid resistance was either zero or 0.5 megohm. The heater return was either to one side of the heater, or through the adjustable arm of a 100-ohm potentiometer placed across the heater supply and adjusted for minimum 60-cycle output. Heater return potential was either to ground, to 45 volts positive, or to 45 volts negative. Hum measurements were made with various combinations of these circuit variations.

In the test setup, the 60-, 120-, and 180-cycle hum components of the output of the amplifier under study were measured on a *rtm* using appropriate amplification and filtering. At the same time, wave form was observed on a scope. Gain was measured by applying a known signal to the grid of the test amplifier; hum level could then be expressed in terms of equivalent microvolts at the grid. Provision was made for switching from *ac* to *dc* heater supply for calibration and comparison.

To obtain the desired measurements of heater-induced hum, external *ac* hum was reduced to a negligible value, using recognized shielding precautions; heater leads were twisted and shielded and kept away from the grid circuit, which was also shielded.

Circuit components were based on median values given in manufacturer's manuals. Preliminary checks indicated that hum is not significantly affected by the usual variations in components — plate, screen, and cathode resistors, and cathode and screen bypass capacitors—required to match different load impedances.

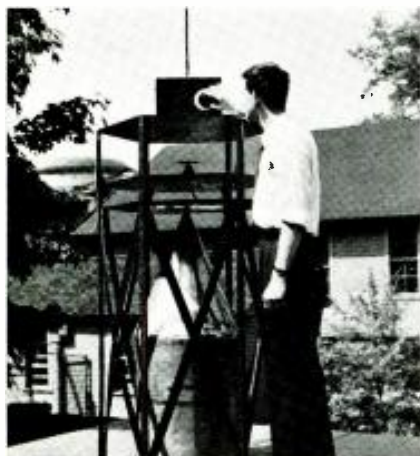
The most hum-free amplifiers investigated so far used either of several triodes (6F5, 6SF5, 7F7, or 5691) or a pentode (5693), in a circuit including bypassed cathode, heater grounded through an adjustable potentiometer, and low grid impedance. Wide hum differences were found for different tube types, as well as for different circuit arrangements. It was found that the 60-cycle equivalent input hum of almost any tube type tested, whether triode or pentode, can be reduced to 10 microvolts by suitable circuitry; and all of the triodes tested could be brought below 2 microvolts.

Return of the heater circuit through an adjustable potentiometer connected across the heater supply, when adjustment was optimum, was found to reduce hum to as little as 1/20 or even 1/50 of the initial value. Returning the heater circuit through 45 volts, either positive or negative but preferably positive, reduced hum somewhat in most cases. Increased grid circuit resistance tended to give greater hum in triodes, while in pentodes hum in general either showed no change or else decreased with increased resistance.

Picture-Tube Development

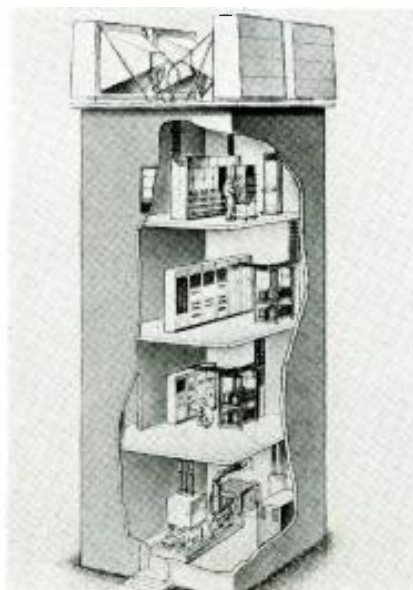
Low-Lead Picture-Tube Glass: A glass, featuring a lead-oxide content of approximately 11.4 per cent, in contrast to the standard percentage of 29.5 per cent, recently developed by Harold R. Black and Lawrence V. Gagin, has become the basis of a patent grant. The glass, which will probably be made by Owens-Illinois Glass Co., to whom the patent rights have been assigned, features a combination of the lead oxide with a small amount of barium oxide. A larger amount of silica than is ordinarily included in lead glass, is employed, too.

It is reported that the glass is lighter and less costly than the types now being processed.



Lester Saporta, research assistant of the N.Y.U. research division, tuning a whip antenna in connection with a research project subcontracted by Camburn, which seeks to develop an antenna assembly that covers the frequency range 100 kc to 4000 mc. Cone shaped devices are broad-band omnidirectional antennas, the lower one having a range of 12 to 600 mc, the upper one from 600 to 4000 mc. The whip, using receiver design, covers a band from 100 kc to 12 mc.

Schematic cutaway view of typical station used in the recently opened A. T. and T. transcontinental microwave relay network.



Lightning-arrester installation on the roof of the White House recently completed by the George E. Thompson Co., Minneapolis, which features use of 1/2" lightning conductor cable from all television and radio antenna fed to 1/2" copper ground rod 10' long.

New Posts: *Lincoln N. Kinnicut*, formerly an account executive for the F. W. Prella Co., has been appointed advertising manager of the LaPointe-Plascomold Corp. . . . *Nonie Hunter* is now handling public relations for Magnecord. . . . *William C. George* has been named chief engineer for the tape recorder division of Eicor, Inc. *Don Morse* has been promoted to assistant sales manager of the company. . . . *Robert E. Giannini* has been appointed district rep for the G. E. tube divisions with headquarters in Los Angeles, covering southern California and Arizona. . . . *Dr. Malcolm H. Hebb* has been named assistant manager of the General Physics division of G. E. Research Lab. . . . *Dr. Ivan A. Getting*, formerly professor of electrical engineering at M.I.T., has been elected vice president, engineering and research, of Raytheon. . . . *Otto C. Bixler*, formerly with Airesearch Manufacturing Co., has been appointed director of engineering for the newly created development lab of Magnecord, Inc. *John W. Hines* and *Patrick J. McCauley* have been appointed sales engineer and special products department head, respectively. . . . *Gerard Kelly* has been named field rep for the Teleflex sales division of Audio and Video Products Corp. . . . *Richard Mahler* has been appointed director of the CBS license and contracts department. . . . *Dr. Harry G. Mitchell*, formerly director of product development and advertising for the Speer Carbon Co., has been recalled as chief, carbon products section, National Production Authority. *Ives Harvey* has taken over Dr. Mitchell's advertising duties. . . . *Julius Dorfman* has been appointed to handle equipment sales of receiving tubes and television picture tubes in the New York area for the receiving tube division of Raytheon, headquartering at 19 Rector St. . . . *J. B. Farr* has been named manager of sales training for the G. E. receiver department. *R. M. Lutz* has been appointed supervisor of cooperative advertising. . . . *Bruce M. Williams* is now a sales engineer with the John A. Green Co., Dallas, Texas. . . . *Arthur L. Rathburn* has been made superintendent of buildings and maintenance of Hoffman Radio. . . . *George Urey* and *Leonard Larson*, have been named general manager and sales manager, respectively, of Deltronic Corp., 9610 Ballanca St., Los Angeles 45, Calif. . . . *R. C. Freytag*, vice president, has been elected to the board of directors of Scott Radio Labs. Others reelected to the board were *Hubert S. Conover*, *H. S. Darr*, *Russel G. Eggo* and *John S. Meck*. *Meck* was reelected president of Scott; *R. C. Freytag*, v-p; *L. M. Sandwick*, vice president and general sales manager; and *R. G. Eggo*, secretary. *P. E. Schuecking*, controller of the corporation, was elected treasurer, replacing *G. F. Meck*. . . . *C. W. Bryant* has been appointed manager of the purchasing section of the G. E. materials and purchasing department. . . . *Norman F. Barnes*, formerly section engineer in charge of radiation and photometric instruments, has been named assistant to the engineering manager of the G. E. engineering laboratory at Schenectady. . . . *George C. Mercer* has been appointed director of purchasing of P. R. Mallory & Co., Inc. *W. J. Topmiller, Jr.*, formerly assistant purchasing agent has been

promoted to the post of purchasing agent. . . . *Dr. Raymond C. Machler* has been appointed director of research and a member of the executive committee of Leeds and Northrup Co. *Dr. Machler* succeeds *I. Melville Stein*, who has been elected executive vice president. . . . *Bernard Hecht*, formerly with RCA-Victor, has been named general manager of Starrett Television. . . . *Arthur R. Hines*, formerly Michigan sales district manager, has been appointed assistant manager of marketing for G. E., headquartering in New York City. . . . *Edwin H. Howell* has been appointed assistant manager of the east central district of the G. E. apparatus marketing division. . . . *Dr. Albert Charles Walker*, research chemist at the Bell Telephone Labs, has been awarded the Louis Edward Levy Medal by The Franklin Institute, in recognition of his paper, *Growing Piezoelectric Crystals*. . . . *Joseph Racker* has formed a radar consulting and editing service, with offices at 67 West 44th St., New York 18, N. Y. *Racker*, co-author of *Pulse Techniques*, was formerly a Signal Corps radar officer and assistant to division head at I. T. and T. . . . *Herman Weissberger*, president of Electronic Devices, Inc., has announced the purchase of Precision Rectifier Corp., which will be operated as a division of the company to produce selenium rectifiers for civilian and military applications. *Earl Steiker*, formerly of FTR, has been named director of production and engineering. . . . *Samuel J. Spector* recently celebrated his thirtieth year with Insuline as prexy. . . . *Barton K. Wickstrum* has been elected vice president and director of sales of Sylvania. He succeeds *Robert H. Bishop*, who has resigned to become a vice president of E. F. Drew & Co., Inc. . . . *Harold R. Terhune*, formerly vice president of the Mycalex Tube Socket Corp. is now administrative engineer at Federal Telecommunication Laboratories, Inc. . . . *Monte Cohen*, president and treasurer of the F. W. Sickles Co., has been elected executive vice president in charge of operations of the General Instrument Corp. of Elizabeth, N. J. *Richard E. Laux* has resigned as president and treasurer of General Instrument. He will continue to serve as a director. . . . *W. P. Maginnis* has become assistant to F. B. Powers, vice president in charge of manufacturing operations for FTR. *Maginnis* will assist in the coordination of engineering and production activities at Federal. . . . *James M. Valentine*, formerly television engineering manager of the American Broadcasting Company's central division, has been named an assistant division head in charge of television field engineering at FTR. He will establish headquarters in Buenos Aires, Argentina, where he will supervise the installation and initial operation of Radio Belgrano, Argentina's first television station. Equipment for this station is being supplied by Federal Telecommunication Labs. . . . *John M. Brush*, project engineer of the TV transmitter division of Allen B. Du Mont Labs, will deliver a talk on *Video Switching Problems* at the forthcoming Fall AIEE general meeting, to be held at the Hotel Cleveland, October 22nd to the 26th. *Brush's* paper on *TV Video Switching* appeared in the July issue of TELEVISION ENGINEERING.



Dr. Ivan A. Getting



Joseph Racker



Julius Dorfman



Bruce Williams



J. M. Valentine

Figure 1
Pulse-cross pattern with interpretation.

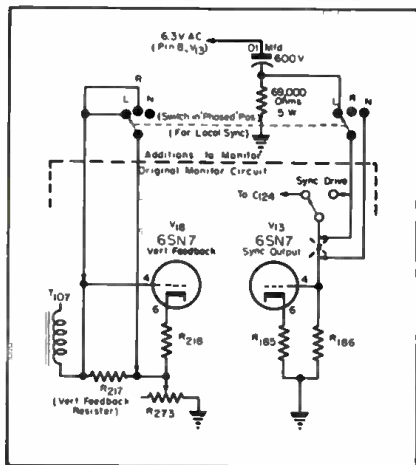
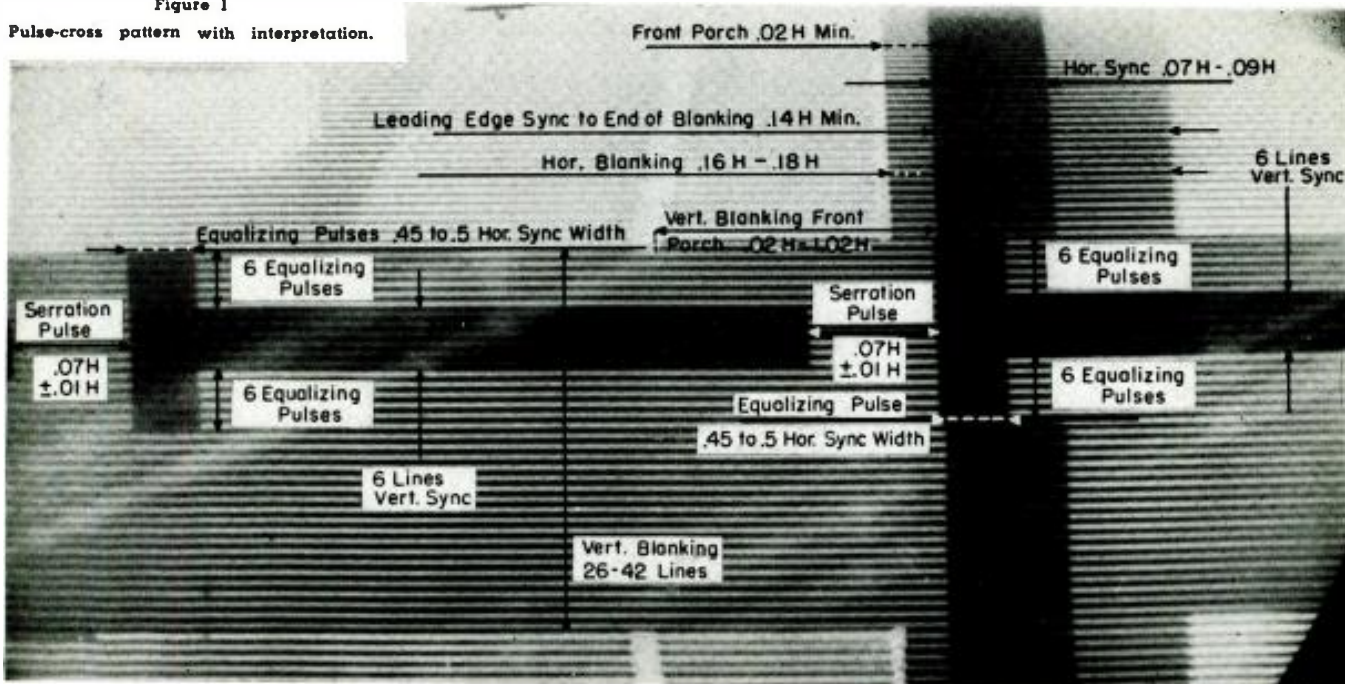


Figure 2
Master-monitor¹ circuit modification required for vertical phasing and expansion.

THE RELATIVE PHASING and duration of synchronizing information, transmitted with the video signal, must be known with a high degree of accuracy by the TV broadcaster. To provide these important guide data, there should be available a method which is relatively simple to manipulate and interpret. The *pulse-cross* technique* has been found to be such a method.

The method of measurement is basically oscillographic. Intensity modulation of the scanning beam produces a pattern from which the time relationships of the synchronizing detail may be obtained.

In obtaining a *pulse-cross* pattern (Figure 1), it is necessary to phase both the horizontal and vertical sync and blanking to the near-center of the raster. At the same time the vertical

Producing and

A Report on the Practical Application of the Loughren and Bailey 'Scope Measurement Technique, Which Reveals With a High Degree of Accuracy the Relative Phasing and Duration of Synchronizing Information Transmitted With the Video Signal. Results Obtained by Intensity Modulation of Scanning Beam Which Produces Pattern from Which Time Relationships of Sync Detail Can be Obtained.

interval must be expanded so that the individual lines are more easily observed and counted. Although the vertical interval is both phased and expanded, it is desirable to phase the horizontal interval, while maintaining the same horizontal sweep speed and linearity, in order that the scanning time will remain unaffected. By doing this it becomes possible to measure the pulse-widths directly, and determine what part of the total line period they occupy.

The *pulse-cross* thus obtained will show most of the defects present in the standard sync signal, such as incorrect pulse-widths, wrong number or position of pulses, phase distortion of pulses, etc.

The horizontal phasing, and vertical phasing and expansion are accom-

plished by two separate methods and circuits.

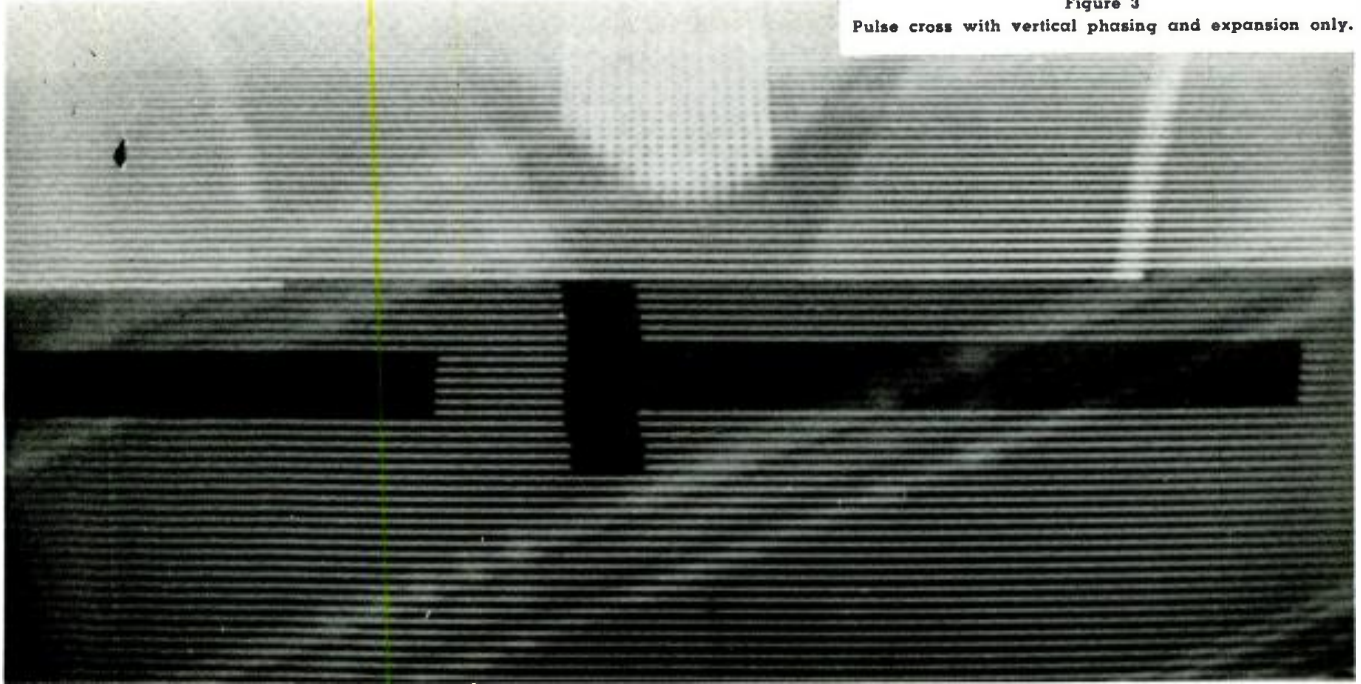
Vertical Phasing and Expansion

Vertical phasing can be accomplished in the easiest way by syncing the vertical oscillator with a 60-cycle sine wave of variable phase which may be obtained from the *ac* line.

In monitors using a blocking oscillator for vertical sweep, the control required to phase the 60-cycle sine wave can be eliminated. With this type of oscillator a 60-cycle voltage can be obtained from a filament winding and controlled in amplitude, so that the oscillator triggers at a specific point on the curved portion of the sine wave, near the top of the cycle. With the oscillator triggering in this region, the exact point of discharge can be controlled by the vertical hold control, al-

*Loughren, A. V., and Bailey, W. F., *Special Oscilloscope Tests for Television Wave-Forms*, Rochester Fall Meeting; November, 1940.

Figure 3
Pulse cross with vertical phasing and expansion only.



Interpreting the PULSE-CROSS

by DONALD M. LAUNER, *Master Control Engineer, American Broadcasting Company*

lowing the vertical interval to be brought to a convenient point within the raster. This method may be used on a master monitor,¹ the application of which is illustrated in Figure 2. The original monitor circuit is shown within the dotted line, and the additions to the circuit are shown outside the line. The three positions of the phasing switch indicate: (V)—normal operating position; (L)—position for observing local syncs; and (R)—position for observing remote syncs from a different power system.

Since it is impossible to use the local 60 cycles to phase the vertical interval on remote syncs, the vertical oscillator is allowed to run free on this position, and the phasing can be done manually. Although this method causes the vertical interval to drift slightly, it is still sufficiently stable to observe easily, and since the *pulse-cross* is most often used for observing the local sync-generator operation, it is a rarely used position.

Expansion of the vertical interval is accomplished by gross distortion of the

vertical linearity which can be done by various approaches depending upon the particular circuits involved. In any monitor employing a vertical feedback circuit for vertical linearization, this can be easily accomplished by shorting out the vertical feedback resistor, as indicated in the left portion of Figure 2.

Vertical phasing and expansion only (without the simultaneous horizontal phasing) produces a pattern of the type shown in Figure 3. It is, of course, necessary to increase the monitor brightness, above normal viewing position, to observe these various pulses. This can be done manually, or by incorporating it into the three position phasing switch.

Horizontal Phasing

In monitors using a horizontal blocking oscillator, the horizontal phasing is somewhat more complicated since it involves a three-tube reactance control sync circuit, which is constructed on a separate chassis and connected to the

monitor through a cabling system.

To obtain horizontal phasing, it is necessary to insert electrically, by means of the three-position switch, in the horizontal blocking oscillator timing pulses. Thus, in the *phased* positions of the switch the sync pulses, normally applied to the horizontal blocking oscillator, are instead fed to the input of the horizontal phasing unit, and the phased output pulses are fed to the blocking oscillator. The circuit diagram of the phasing unit is shown in Figure 5, while the few necessary additions or changes that must be made in the master monitor¹ are shown in Figure 4; original monitor circuit is shown within the dotted line, whereas the circuit additions are shown outside.

The power requirements for the horizontal phasing unit, which in most cases can be obtained directly from the master monitor without overloading the power supply, are: 6.3 volts at 1.7 amperes, 280 volts *dc* at 25 milliamperes, and -7 volts *dc* at 5 milliamperes.

The phasing unit may be connected

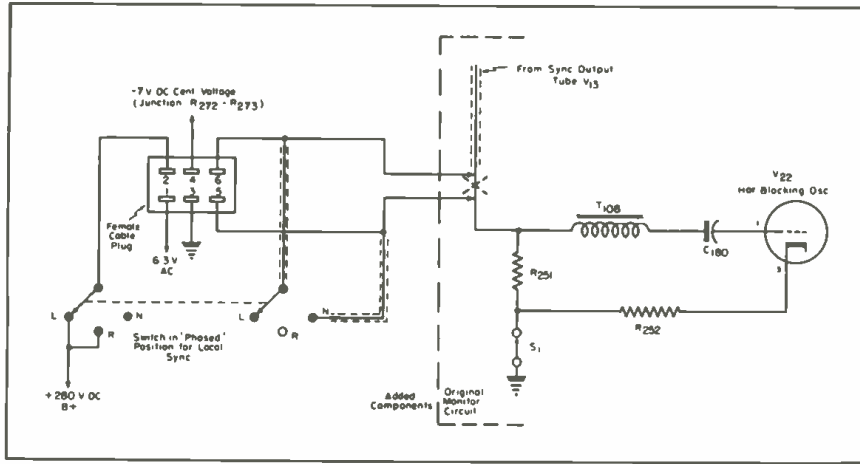


Figure 4
Master monitor modification required for horizontal phasing.

to the master monitor through a small plug connection on the monitor. The unit may be disconnected from the monitor by withdrawing the plug, with-

adjusted. The horizontal hold control can be used for a fine adjustment.

The phasing control on the sync-discriminator transformer can be adjusted

there will be some interaction between the phasing and frequency controls, it may be necessary to make readjustments, back and forth between the controls, when adjusting the unit.)

In monitors using the discriminator type of horizontal oscillator control, such as the *synchrolock* circuit, the phasing can be accomplished more easily, since it is only necessary to reverse the leads going to the plates of the duo-diode from the secondary of the sync-discriminator transformer to accomplish horizontal phasing. This switching may be accomplished easily using two poles of the three-position phasing switch.

It is necessary to place both horizontal- and vertical-phasing circuits into operation simultaneously by using a 4-pole 3-position rotary switch, with two poles for horizontal and two poles for vertical switching. If desired, a 5-pole 3-position switch can be used and the brightness switched at the same time. It may be found more desirable to use two switches, so that the horizontal and vertical intervals may be observed independently of one another.

Interpretation of the Pulse-Cross Pattern

Examination of the Horizontal Interval: All the pulse-widths shown on the FCC standard synchronizing waveform chart are represented by a fraction of a total period H , where H denotes the interval between successive scanning lines from the leading edge of one horizontal sync pulse to the leading edge of the next pulse.

Since H may be expressed as a linear measurement of scanning distance, the various pulse-widths may be expressed in terms of a percentage of this distance. By use of the pulse-cross, the

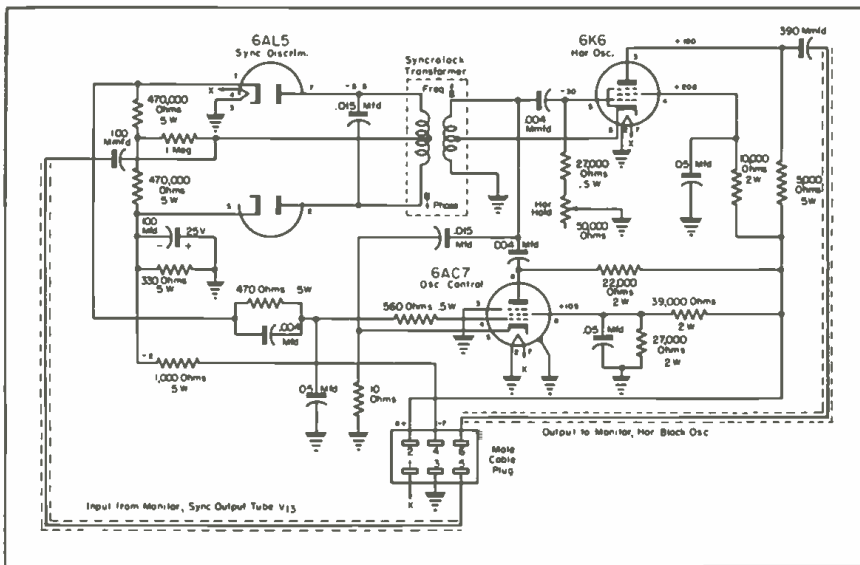


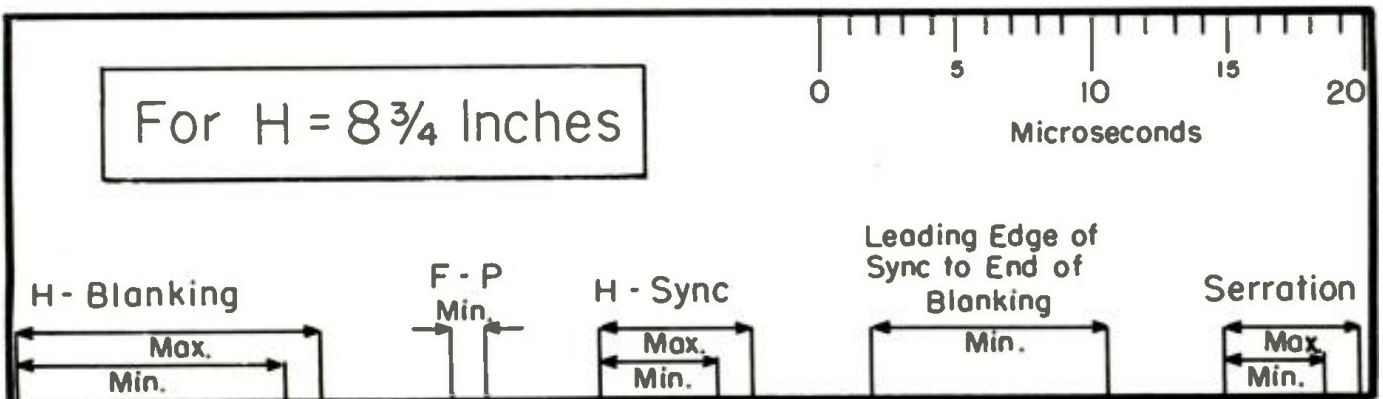
Figure 5
Horizontal-phasing unit.

out affecting the normal operation of the monitor.

The raster will remain horizontally synchronized, in either the phased or normal positions of the phasing switch, when the frequency control on the sync-discriminator transformer is properly

to shift the position of the horizontal sync and blanking within the raster. The horizontal interval should be phased to a point within the raster (not the center) so that both sets of equalizing and serration pulses may be observed, as shown in Figure 1. (Since

Figure 6
Typical pulse-cross rule.



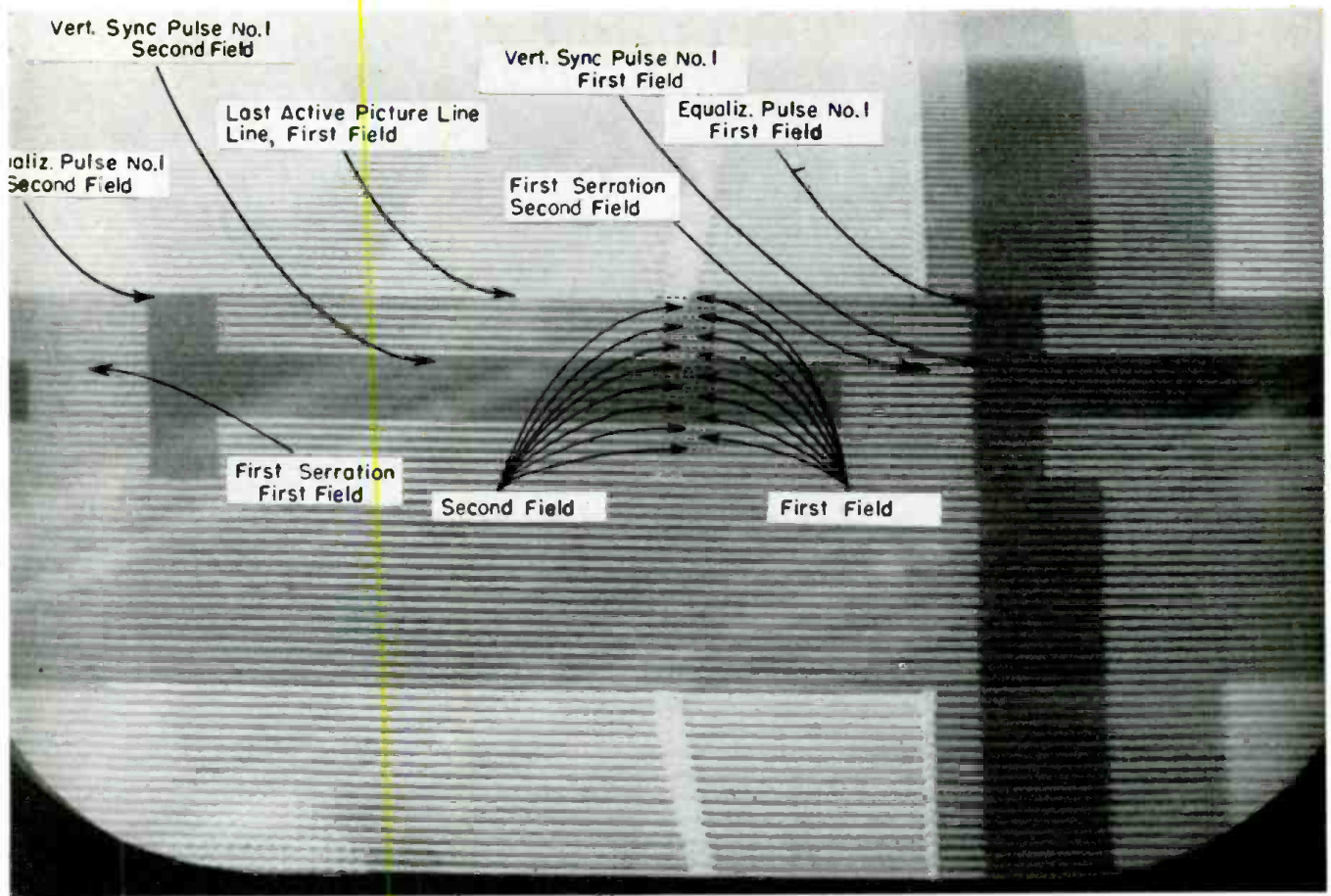


Figure 7
Sequential interpretation with respect to time.

distance H can be readily determined in the following manner:

Let us assume that the horizontal linearity of the monitor has been checked and is accurate. Then, it will be necessary to measure the normal picture width of an active scanning line (not including blanking), shift horizontal phasing, and measure the total horizontal blanking width. The addition of these two values will provide the period H . Before these two measurements are taken the monitor brightness must be raised to a point where the pulses can be easily viewed, since width may be a function of monitor brightness.

Since H is thus a known distance, and the pulse-widths given by the FCC are expressed as fractions of this distance, it is a simple matter to determine pulse-widths.

The correct pulse widths for the horizontal interval have been found to be: total horizontal blanking width . . . $0.16 H$ to $0.18 H$ (10.16 to 11.43 microseconds); front porch . . . $0.02 H$ min (1.27 microseconds min); sync . . . $0.08 H$ to $0.01 H$ (4.445 to 5.715 microseconds); leading edge of sync to end of blanking . . . $0.14 H$ min (8.89 microseconds min); back porch . . . no back porch tolerances are specified since the exact length of the back porch will be determined by the individual values of the preceding four pulse widths which

will automatically establish the back porch at the correct width.

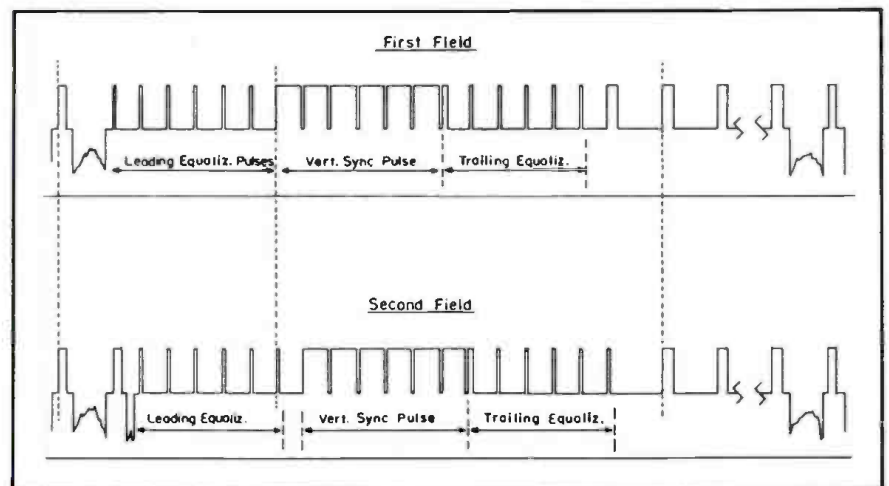
All of these pulse widths and locations are shown directly on the pulse-cross pattern in Figure 1.

If it is desired, a rule may be constructed for any particular monitor, with pulse-width limits measured off directly. This rule may be placed on the pulse-cross pattern, and pulse-widths checked instantly. Such a rule is illustrated in Figure 6, and is ap-

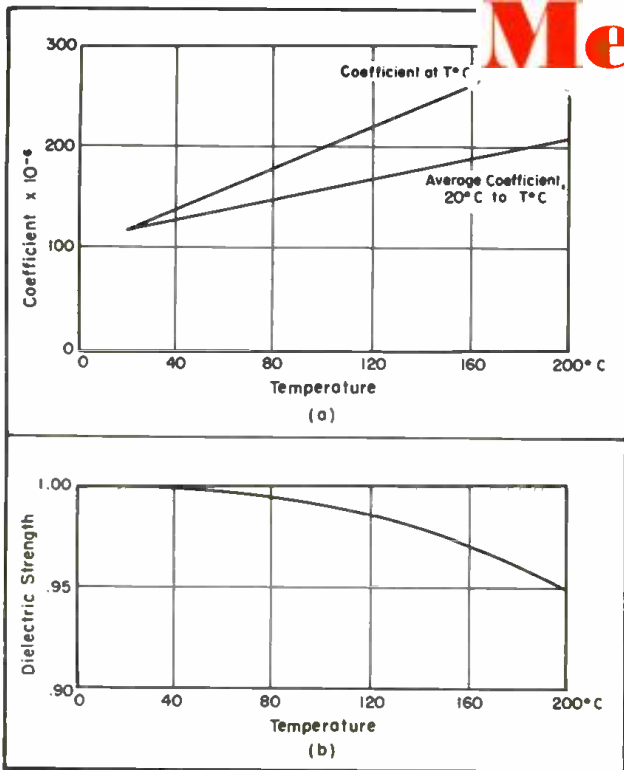
plicable to a 10-inch monitor adjusted so that all corners are visible, with an approximate raster size of $7\frac{1}{4}$ " by $5\frac{1}{16}$ ", and with $H = 8\frac{3}{4}$ ".

In making up this rule the following calculations were used: Blanking (min) = $0.16 H = (.16) (8.75) = 1.40$ "; blanking (max) = $0.18 H = (.18) (8.75) = 1.57$ "; front porch (min) = $0.02 H = (.02) (8.75) = .175$ "; sync (min) = $0.07 H = (.07) (8.75) = .612$ "; sync (max) = $0.09 H = (.09) (8.75) = .787$ ". and leading
(Continued on page 29)

Figure 8
Standard sync presentation showing horizontal pulse alignment and half-time shift of alternate vertical pulses.



Metallized Glass



Metal-to-Glass Sealing Techniques, Affording Improved Dielectric Strength, Lower Losses, Etc., Found to Be Effective in the Design and Production of Such TV Products as Attenuator Plates for Microwaves, and Ribbon Capacitors and Spiral Inductances.

Figure 1 (l-ft)

Operating characteristics of ribbon-glass capacitor.

Figure 2 (right)

Tuning curves of two permeability-tuned inductances; one being a linear-pitch type and the other a variable-pitch design. Core in this instance was a Stackpole G5. Shunt capacity was 12 mmfd.

THE COMBINATION of electrical conductors bonded to excellent insulators, such as glass, has been found to permit a wide diversity of component designs.

It has been found possible to apply various types of metallic conductors to glass. A thin film, vacuum evaporated to the glass, is one interesting example of conductor-to-glass processing. A common application is for attenuator plates, as used in the microwave frequencies. In this type of application the conducting-film thickness must be uniform and small, so that its resistance is relatively independent of frequency. A typical resistance for this application is 140 ohms per square. However, val-

ues from 10 to 1,000 ohms per square are available. The glass base, in this instance, is in the form of a plate held to close dimensional tolerances. Its high dimensional and electrical stability combined with a film of special geometrical design, have been found to afford attenuator designs that can be held to precise limits and with very low standing-wave ratios.

It has also been found possible to apply glass in the form of a continuous thin ribbon. Because glass can be made uniformly thin, from about .020" to .001", it has been found to be very effective as a dielectric. Capacitors, made with ribbon glass, have been one

of the prominent components in this category. In production, the conducting electrodes and ribbon glass are stacked and the whole sealed together in a single monolithic unit. This type of capacitor has been found to lend itself to flexible design, resulting in increased stability, both electrically and mechanically; miniaturization and high-temperature operation. The sealing feature, permitting bonding of the dielectric layers together, and to the electrodes, has been found to be an important asset, allowing designs for high voltages. Single units 1½" x 1¼" x 1¼" having a 200-mmfd capacitance have been found to operate successfully

Figure 3
Glass-to-metal direct-traverse trimmer which features positive rf contact within 1 to 8-mmfd tuning range and stability under vibration of better than ±15 kc at 140 mc.

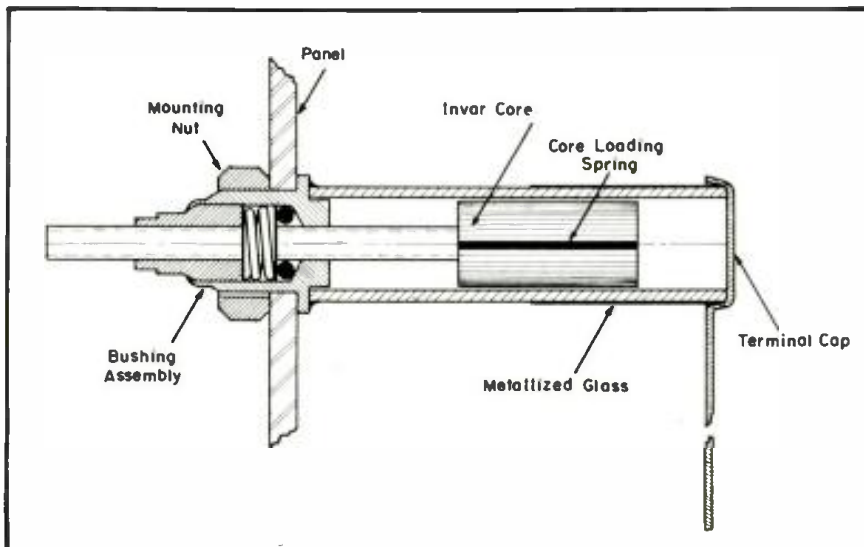
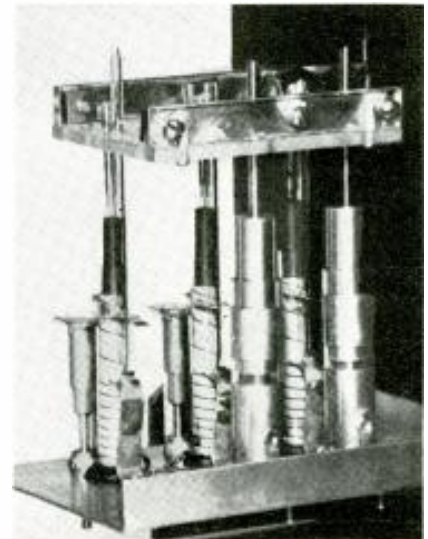


Figure 4
Experimental glass-to-metal lc tuner which tunes through the TV band and skips the 88 to 174-mc band.



Components for TV

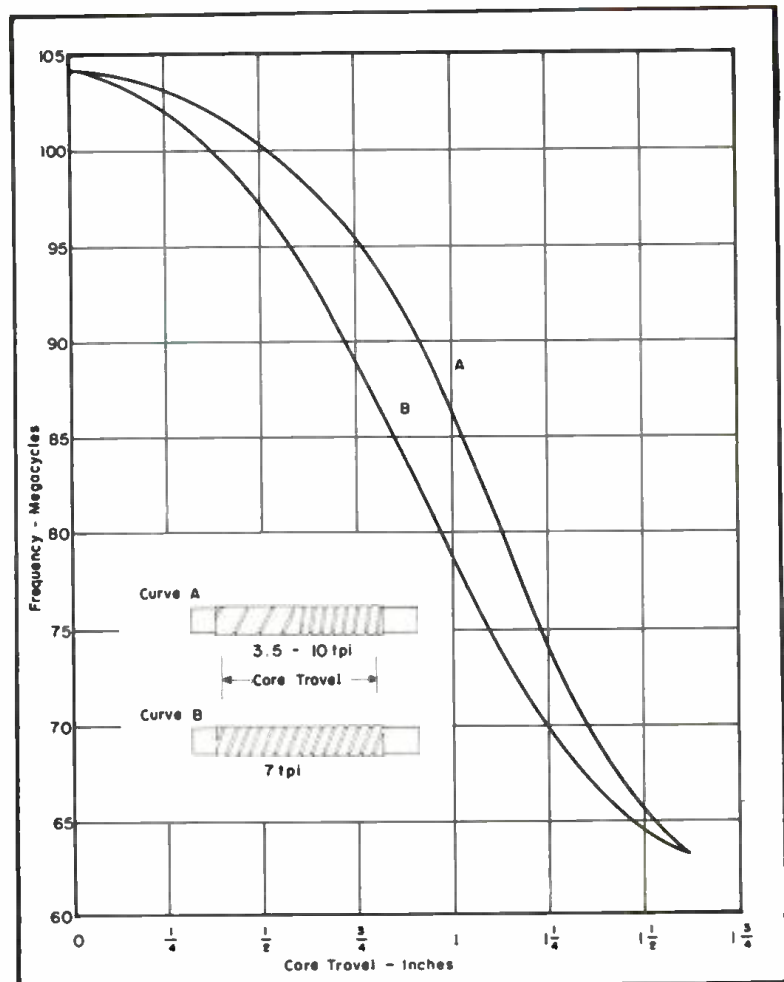
by H. S. CRAUMER, Product Engineer, Corning Glass Works

at 20 kv. Some of the operating characteristics of these capacitors are shown in Figure 1.

Glass tubes have also been found to offer many possibilities for metallized components. The glass tube, with metallized bands on each end, has been found to be a particularly promising item. Metallizing, in this case, involves a fired-on base of silver. Because the silver is fired on at high temperatures, there is formed a strong bond of the order of 2,000 psi. To this may be electroplated copper, followed by tin, as required. Thus, it becomes simple to solder metal caps on the ends of the glass tube, forming a hermetically sealed enclosure with convenient electrical termination. Since glass is readily available in tubular form, in a wide range of dimensions, the enclosures have been widely used for capacitors and resistors. It has been found that the enclosures insure against weathering effects, afford a high mechanical strength, and provide sure and safe electrical insulation.

There are many other attractive design possibilities in strongly-bonded metallized glass, since metal parts can be easily added and electrical connections made as desired. An example of this end-result prospect appears in trimmers, where mounting bushings can be soldered on one end and a terminal on the other. One such type commonly used in TV and FM sets has been previously described,* and Figure 2 demonstrates a more advanced design. In this instance, the electrical specifications, while severe, still permit practical and economical production methods due to careful and unique component design. A few of the outstanding characteristics of this trimmer are: Absolute *rf* contact at all

*Peters, R. Iph, *New Trends in Component Design*, TELEVISION ENGINEERING; May, 1951.



points within the rated 1 to 8-mmfd tuning range; departure from linearity in the tuning curve, of less than 25 kc in 140 mc; stability, under mechanical vibration, of better than ± 15 kc in 140 mc; operation in the temperature range of -65° to $+105^\circ$ C; temperature coefficient of $+50 \times 10^{-6}$. These char-

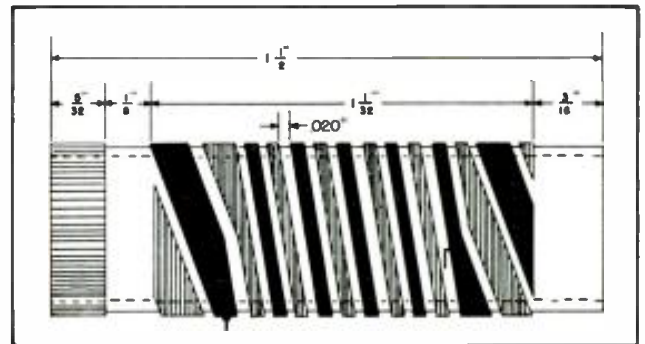
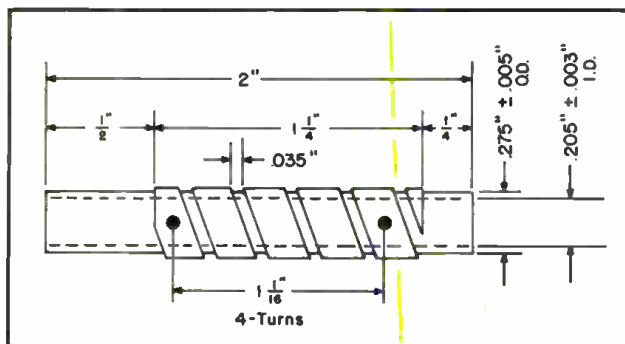
acteristics demonstrate the practicality of combining metallized glass with conventional metal parts into a rugged, sturdy, and reliable component design.

Figures 5 and 6
Common glass-to-metal inductance designs, coil at left being an FM type and one at right a bifilar coil with double pitch.

acteristics demonstrate the practicality of combining metallized glass with conventional metal parts into a rugged, sturdy, and reliable component design.

Carrying the manufacturing process a bit further, from tubular glass pieces with simple bands to those with metallized spirals, we have an inductance. These inductances have been found to display a maximum usefulness in the

(Continued on page 23)



Oscillating Color Sequence in Color TV

by RALPH G. PETERS

Highlights of Report on New Technique Which Has Been Found to Permit Greater Tolerance on the Phase of Reinserted Subcarrier at Receiver, Permit Use of Higher Color Subcarrier Frequency and Wider Chromaticity Bandwidth, Simplify Design of IF Channel in Receiver and Increase the Probability of Obtaining Good Color Under Conditions of Multipath Transmission.

THE PAST FEW MONTHS have witnessed several striking contributions to the all-electronic compatible color TV art. In the development of practical solutions to many disturbing problems. One such improvement, described by B. D. Loughlin of Hazeltine in a recent report, involving a flip-flop or color-phase alternation technique, applied to the dot-sequential system, has been found to reduce the visibility of phase (timing) errors in the subcarrier (sampling) channel of the system, by reversing the phase sequence (timing order) of the color subcarrier information after each scanning field, so that opposite types of color errors result on adjacent lines in space. In the study leading to the evolution of this new approach, it was found that the eye averages the color of adjacent elemental areas, thus giving a first order correction for chromaticity errors due to phase errors in the color subcarrier channel, permitting a greater tolerance on the phase of the reinserted subcarrier at the receiver. The major advantage of the plan was said to lie in the fact that vestigial sideband transmission of the color subcarrier information can be made practical, thus improving both compatibility and the reproduced color pictures.

OCS Characteristics

By using the new method, which has been described as oscillating color sequence (*ocs*) a first order correction can be obtained for chromaticity errors that would normally result due to phase errors in the color subcarrier

channel, and vestigial sideband transmission of the color subcarrier information is then made practical.

OCS and Constant Luminance

While it was noted the *ocs* principle can be applied to an unmodified *dot-sequential system*, it provides best results when applied to a simplified constant luminance system using quadrature sampling or demodulation.

Crosstalk Problems

Analyzing the vexing problem color crosstalk due to phase errors, and its relation to *ocs*, the report declared that if the phase of the reinserted subcarrier reference at the receiver relative to the transmitted subcarrier signal is not correct color crosstalk is produced. If the average value of the relative phase is in error due to misphasing of the reinserted subcarrier, a *large area* color contamination was said to result. However, it was noted even if the average value of the relative phase is correct, the instantaneous relative value may be incorrect due to unintentional phase modulation of the received subcarrier. Such phase modulation can result, it has been found, when the color subcarrier signal passes through a channel having non-uniform amplitude and phase characteristics. These non-uniform characteristics may result from purposeful vestigial sideband transmission, or from phase distortion in the color receiver, or from multipath

transmission (echoes). Thus, the spurious phase modulation produced by these non-uniform characteristics results in color crosstalk *near edges* of colored areas.

Color-Sequence Reversal

The foregoing factors, when mathematically and electronically surveyed, revealed that errors in a particular output signal produced by phase errors in the color subcarrier channel were due mainly to crosstalk from the subcarrier component which is in quadrature to the component desired for the particular channel under consideration. If this quadrature component were reversed in polarity, it was found, the crosstalk error produced is also reversed. Reversing one component of the color subcarrier is equivalent to reversing the color sequence; that is, instead of the color sequence being green, red, blue with increasing phase angle, the color sequence is changed to green, blue, red. Thus, it was noted, that by periodically reversing the color sequence, the color crosstalk errors due to misphasing can be made to be of opposite sign during successive periods of time.

Eye Resolution Tests

Describing the tests made on the resolution of the eye for chromaticity changes at constant brightness, the report said that only about 40% of the resolution for brightness changes. Thus, at normal viewing distance, the chromaticity of adjacent lines in space will

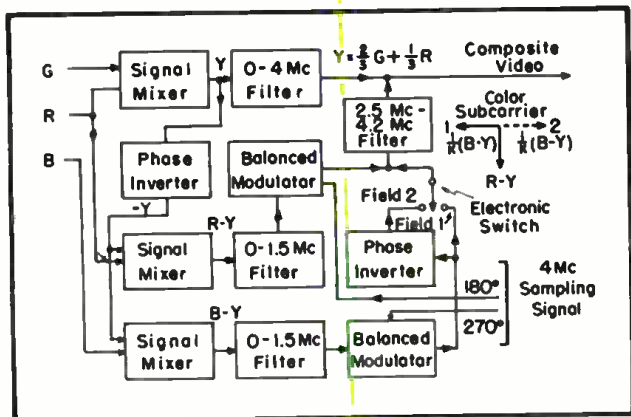


Figure 1

Block diagram of transmitter employing constant luminance system with oscillating color sequence.

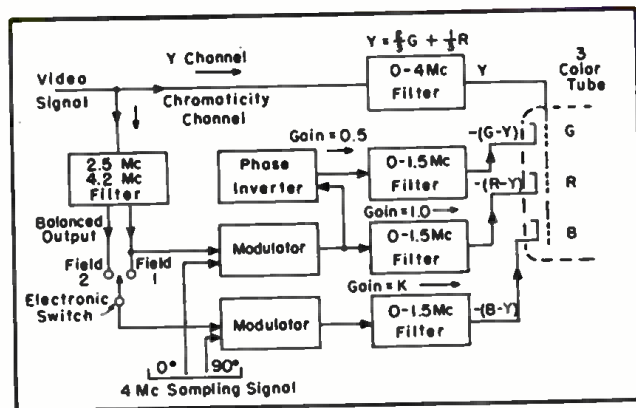


Figure 2

Layout for receiver using constant luminance system with ocs using subcarrier channel switching.

automatically be averaged by the eye. It was noted, therefore, that if the color errors due to misphasing are opposite on adjacent lines in space, such as would be produced by reversing the color sequence after each field (when using interlaced scanning), the eye will automatically average the errors so that they visually cancel out. This was found to be equivalent to using the mixed-highs principle in the vertical direction. It was noted that if the eye is to do a good job of averaging the color of adjacent lines, only the *chromaticity* can be in error, and *not* the brightness. It was learned that phase errors in the *dot-sequential* system can produce brightness as well as chromaticity errors, but as a first order approximation only chromaticity errors are produced in the constant luminance system. Accordingly, the *ocs* idea seemed to offer more advantages when applied to the constant luminance system, and particularly so when applied to the simplified constant luminance system using quadrature sampling or demodulation.

Cancellation of Color Errors Near Edges

The elimination of color distortion due to vestigial sideband transmission of the color subcarrier was described as permitting a substantial improvement of the color system. A higher subcarrier frequency can be used, thus improving compatibility. By changing the color subcarrier frequency from approximately 3.5 to approximately 4 mc, it was noted, a substantial improvement in compatibility may be obtained due to the relatively sharp cutoff characteristic of the *if* amplifiers of most TV receivers. It was also found that by using a higher subcarrier frequency, the spurious patterns

produced in the color receiver can be minimized by a very slight reduction in bandwidth of the transmitted brightness signal. In addition, the study showed that a higher sub-carrier frequency permits a wider chromaticity bandwidth to be used.

ocs Features

In a discussion of the *ocs* technique during a NTSC panel meeting, it was brought out that allowing single side band operation of the color subcarrier, reduces the need for uniformity of the amplitude and delay characteristics of the receiver in the vicinity of the color subcarrier frequency. This, it was said, simplifies the conversion of existing monochrome receivers to color receivers and likewise simplifies the design of *if* amplifiers for color receivers. In addition, it was pointed out, the effect permits a higher color subcarrier frequency which in turn permits the transmission of the wider color bandwidth and for the same subcarrier visibility permits the subcarrier to be transmitted at a higher amplitude because of increased attenuation on existing monochrome receivers. This higher amplitude improves the signal-to-noise ratio and decreases the probability of cw interference. Furthermore, it was noted, *ocs* permits greater tolerance in the phase of the reinserted subcarrier at the receiver and improves the probability of obtaining good color under conditions of multipath transmission.

Color Subcarrier Frequency

There has been considerable discussion whether the color subcarrier frequency should be 3.99+ mc or 3.89+ mc.

Those in favor of 3.99+ mc, have noted that a high-color subcarrier fre-

quency decreases the visibility of the subcarrier in a greater number of monochrome receivers because the high frequency lies in a region of high attenuation. A study by RCA was reported as indicating that a weighted average of commercial receivers disclosed an attenuation of 30 db at 3.99+ mc. The same weighted average was said to show an attenuation of 24 db at 3.89 mc. The 3.99+ mc frequency was also said to allow about .1 mc more color bandwidth than 3.89+ mc.

Those believing that 3.89+ mc would be the better selection have declared that it may be much easier to pass a frequency of 3.89 mc through network terminal facilities and coax cable repeaters than 3.99 mc. In addition, it has been felt that 6-db attenuation for the color subcarrier which is usually required for vestigial sideband operation may be less difficult to obtain, and the quadrature component distortion will be somewhat lower, resulting in a better transient response characteristic. Another advantage offered has been easier receiver design. It has also been said that the separation of the color subcarrier and sound carrier signals would be facilitated.

Use of 3.89+ Mc Recommended

Panel 13 of the NTSC have indicated that the latter features merit the use of the 3.89+ mc frequency and thus recommended its adoption. Specifically the subcarrier frequency suggested is 3.898.125 (equal to $3 \times 3 \times 5 \times 11 \times 15.750/2$); the color information would be carried predominantly on the lower side band, although vestigial upper side band information would also be used to a very limited extent. A 6-db attenuation for the color subcarrier would be provided at the receiver.

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SPECIFICATIONS

Automatic TV Sync Generator

by CALVIN ELLIS, *Broadcast Engineering Section
Commercial Equipment Division, General Electric Company*

Part II . . . Features of Multivibrator . . . Gate Operation . . . Characteristics of Master-Oscillator System.

IN THE FIRST part* of our sync-generator discussion, it was noted that all of the pulses in the sync signal are generated by one multivibrator. However, the synchronizing signal must contain pulses of different widths, namely the equalizing pulses, vertical sync pulses, and horizontal sync pulses. Hence, the multivibrator must be controlled in its start and stop operation in the precise timing sequence corresponding to the RTMA synchronizing signal. It was found possible to accomplish this through the use of a time delay line, driven by triggers from the master oscillator.

This multivibrator consists of a pair of 6AS6s directly coupled to each other, so that there are two stable conditions of equilibrium wherein one tube is conducting and the other is cutoff. Each of these tubes contain two control elements, so that the triggering of each tube is entirely independent. One tube is fed starting triggers and the other tube is fed stopping triggers, both of which are obtained

from the delay line. Positive sync signals are taken from the plate of the tube fed by the negative starting triggers. When this tube is conducting, a negative trigger causes its plate to rise, thereby reversing the conditions of equilibrium and forming the start of a sync pulse. This pulse continues in time duration until a stopping trigger cuts off the other tube, which was conducting, to reverse the action and terminate the pulse.

The starting triggers for all pulses are taken from the same point, (G), on the delay line and fed continuously to the sync signal multivibrator. This was found to insure timing accuracy for the leading edges of all pulses.

The stopping triggers for the pulses in the synchronizing signal are taken from three separate points, (C), (H), and (J), on the line. The proper trigger to be fed to the sync multivibrator is selected by gating pulses. Therefore, these gates determine the number and

position of each type of pulse in the signal.

The gates used in this control are shown in Fig. 1. The 3H-3H gate (a) is taken from binary scaler. The 9H gate (b) is taken from the 2:1 counter. The 3H gate (c) is obtained by gating the 3H-3H gate with the 9H gate and inverting the result.

Since the sync signal control gates are taken directly from a binary counter chain, the composition of the synchronizing signal is a result of a counting process and is independent of circuit adjustment and variations. This chain is so constituted as to complete its cycle after the first eighteen twice-line-frequency triggers, occurring immediately after the start of the vertical blanking interval, and then to remain quiescent during the remainder of the field.

Binary scalars Z_{261} through Z_{265} (Fig. 5*) form a 6-to-1 counter section by the use of appropriate feedback connection. The output of Z_{265} is fed to Z_{261} and Z_{265} in parallel. Z_{265} , Z_{266} and Z_{267} form another 6-to-1 section, Z_{261} through Z_{264} yield a count of 12-to-1 and Z_{261} through Z_{267} yield a count of 36-to-1.

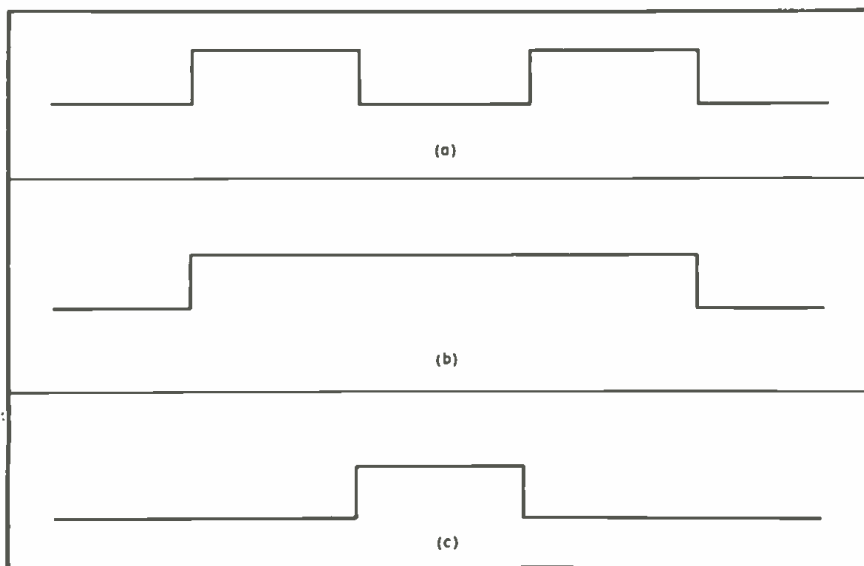
Input triggers to the chain will reach Z_{261} through Z_{262} only during the positive portion of output of Z_{267} . The output of Z_{267} is amplified by V_{211b} and used as a gate for V_{211c} .

Triggers derived from the leading edge of the vertical blanking pulse are fed directly to Z_{261} and Z_{267} in such a manner as to result in a positive output appearing at Z_{261} and Z_{267} . This positive output of Z_{267} gates on the incoming triggers to the binary chain. Since the additional triggering of Z_{261} and Z_{267} , by the vertical period trigger, is the equivalent of one half-cycle operation of these scalars, only 18 input triggers are required to cause Z_{267} to complete its cycle, and only 6 input triggers are required to cause Z_{261} to complete its cycle. When Z_{267} completes its cycle after the eighteenth trigger, the output goes negative and

*TELEVISION ENGINEERING; AUGUST, 1951.

Figure 1

Gates used for synchronizing signal formation: (a) represents the 3H-3H gate; (b) the 9H gate and (c) the 3H gate.



no more triggers will reach the chain from the gating tube, V_{212} , until after the start of the next vertical blanking interval.

The positive output of Z_{207} during its period of operation is the $9H$ gate shown as c in Fig. 1, and the positive output of Z_{204} is the $3H-3H$ gate shown as a in Fig. 1.

The master oscillator used in this equipment is a stabilized multivibrator which has a measured long-time frequency stability superior to that of the conventional lc oscillator-reactance tube combination. This oscillator was selected because of its positive and rapid response to synchronization and control in addition to its frequency stability.

Even though the RMTA recommendations state that the field repetition rate shall not vary more than one per cent from 60 per second when locked to a power system, it has been found desirable to provide a pull-in range which will accept much wider variations in power line frequency to prevent the possibility of searching or beating when the afc is near the limit of its range. Synchronization can be accomplished with no observable tendency for hunting.

This master oscillator and afc combination have been found to provide this increased frequency pull-in range.

A selector switch allows the control of the master oscillator to be obtained from the power system by means of the afc , or from a built-in crystal oscillator, or from an external sync-locking unit which will allow synchronization to a remote incoming sync signal.

When the sync generator is locked to the power system, its phase can be shifted in respect to the power system by approximately 360° . Controls are provided on the panel for this and provision is made for remoting this control.

Every effort has been made to eliminate all of the controls and adjustments concerned with the fixed operation of the sync generator, in providing the basic timing relationships and the RMTA synchronizing signal. However, it was not considered desirable to eliminate any control which might limit the application or versatility of the unit. For this reason all blanking and driving pulse widths were made adjustable over the usual range.

The multivibrators which generate the blanking and driving pulses are of the type having one stable condition; that is, the so-called one-shot type. Thus, these multivibrators cannot operate at any frequency other than that of the timing triggers.

The sync generator design permits the use of suitable adapters for either line-sequential or dot-sequential color television.

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Metallized Glass Parts

(Continued from page 17)

high-frequency field, from about 30 mc up.

Basically, metallized glass inductances have four advantages: (1) Approximately zero temperature coefficient; (2) convenient termination at any point on the winding; (3) mechanically stable and rugged, vibration having no effect on the value; (4) automatic manufacture, insuring piece-to-piece identity over any period of time.

Because of the foregoing properties metallized-glass inductances are commonly incorporated in TV chassis.

Frequently, special tuning characteristics are required in the design of a permeability tuned system. These characteristics can be conveniently attained by varying the winding function of the inductances to create the particular tuning curve required. Figure 2 shows the comparison of the tuning curves of two permeability tuned inductances, one being a linear pitch while the other a variable pitch. Figures 5 and 6 illustrate some common inductance designs. An inductance with two windings on one form appears in Figure 4. In this example the end turns have been broadened to provide sufficient termination area.

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VWOA News

THUMBING THROUGH notes on VWOA old timers, ye secretary has discovered many intriguing items on their activities in the early days. For instance, W. H. Mehd helped install the first long-distance de Forest station. At Pensacola he made many wireless records, including one of transmission to Point Loma, Calif. The records also reveal that he was the first to send time wireless signals from Washington. The books show that he has been recommended as being one of the youngest chiefs in the Navy. Another historic first to his credit was his conversation over the de Forest radiotelephone as an enlisted member of the Navy. He was also the first to talk around the world via radiotelephone while on board USS Maine, '07-'08. With F. E. Butler he opened what is believed to be the first commercial school and taught radiotelephone and radiotelegraph engineering at Detroit, Mich. Owns a *Certificate of Skill* as a wireless operator, (No. 236), issued May 19, '11. Exam was held at Navy Yard, Brooklyn, N. Y. . . . According to the records, there are long lists of first credits belonging to VWOA old-timer Louis G. Pacent. As a consulting engineer on talking picture sound equipment for Warner Brothers he designed the first all-power-operated talking motion-picture sound equipment and founded the Pacent Reproducer Corporation to engineer, service, and install this equipment in '28. He was also consultant to the Telefunken Company of Germany in '34, and to the Fullograph Company in '35. On October 9, '46, Pacent received from the War Department the Certificate of Appreciation awarded in official recognition and gratitude of his service: "For valuable assistance to the Signal Corps by developing and adopting manufacturing techniques which involved mass production of communication equipment and the widespread appreciation felt by the Signal Corps Laboratories for outstanding service directed toward the successful conduct of the recent war." . . . According to the books, there are also many firsts to the credit of VWOA veteran Jack Poppele. In the early days of radio he was instrumental in staging many broadcasting events. He superintended the first transatlantic communication test to London and later the first play-by-play description of a remote football game. He was also responsible for broadcasting the first golf tournament. In addition to his duties at WOR, Poppele has served as radio consultant to the New Jersey State Police.



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Microwave Beam Bender

A SELF-POWERED MICROWAVE RELAY, used for redirecting signals on non-line-of-sight courses, that is said to require neither tubes nor power and operates in conjunction with standard 7000-mc equipment, has been announced.—*Beam Bender; Technicraft Labs., Thomaston, Conn.*



Technicraft beam bender.

2-KW VHF TV Transmitters

TWO-KW VHF TRANSMITTERS that are said to provide radiated powers up to 20-kw, have been developed.

Four matching cabinets, bolted together, form a single unit; have an overall dimension of 106" wide, 84" high, and 31" deep. Visual section of each model consists of a 500-watt transmitter in one cubicle followed by a single stage class *b* linear amplifier in another cabinet. Aural transmitter, which uses a direct FM exciter, is housed in a third cabinet, while the fourth houses the amplifiers for the aural circuit.

Provided are a reflectometer between the 500-watt visual stage and its final amplifier, dual reflectometers in the output line to indicate peak power and standing wave ratio continuously, and diode monitors after the 500-watt driver and on the output line. Hum level of -45 db is said to insure operation on non-synchronous network origination.—*Model TT-2AH, TT-2AL; RCA Engineering Products Dept., Camden, N. J.*

Parabolic Antennas

PARABOLIC ANTENNAS available in 2', 4', 6' and 10' diameters have been introduced. At 2000 mc, 10' model is said to have a gain of 29 db over half-wave dipole. Reflector for antenna is wire mesh on formed steel framework.

Radiator assemblies for antennas are protected by weatherproof plastic radome, and can be coupled directly to air dielectric feed lines without an intervening gas barrier. Antenna feeds for all frequencies terminate in a 3/8" flange.—*1002-10, 2002-10; Andrew Corp., 363 East 75th St., Chicago 19, Ill.*

Correction

THE REPETITION FREQUENCY of the Teletronics pulse generator and calibrator, detailed in the August issue, should have read 50-5000 pulses per second.

Multiple Input and Output Networks

MULTIPLE INPUT AND OUTPUT NETWORKS, used to equalize incoming signal levels in multi-channel mixers and similar broadcast equipment, and to combine two or more incoming lines into a single outgoing line, or to divide one incoming line into two or more outgoing lines, have been introduced. Available in either balanced *H* or unbalanced *T* circuits.

Resistors are said to have an accuracy of $\pm 2\%$. Maximum level of pads is +24 *ru*. Maximum number of 10 inputs or outputs are available.

Multiple networks frequency range is from zero to 50 kc for most values; may be extended if necessary.—*Series 1130; The Daven Co., 191 Central Ave., Newark, N. J.*



Daven multiple input and output networks.

Rack-Mounting Closed Circuit TV Transmitter

TV CLOSED-CIRCUIT TRANSMITTERS that it is said can feed a group of standard TV receivers without modification of any sort, over a coax line, are now available for rack-mounted installations.

Operating as a non-radiating transmitter by taking both audio and composite video signals and sending them at carrier frequency of either TV channel 2 or 3, over a single coax line, the equipment can be used to feed standard TV receivers as monitors in studios, holding closed-circuit TV sales conferences.

By connecting suitable distribution pads to output terminals, up to 25 receivers can be fed from one pair of terminals or up to 125 receivers by using the five terminals provided.—*Du-mitter; Television Transmitter Division of Allen B. Du Mont Laboratories, Inc., Clifton, N. J.*

Tower Ladder Safety Device

A TOWER LADDER SAFETY DEVICE that is said to lock and hold within six inches of the spot where it is, when user slips or falls, has been developed. Device may be installed on ordinary ladders, peg ladders, corner pegs, open framework, without welding, cutting, drilling or altering the tower or ladder.

Unit is claimed to be unaffected by rain, ice, mud, oil or slime, and staggered ladders do not prevent or handicap its use.—*Produced by Lewis and Lamberth, Dallas, Texas; Distributed by W. S. Sherertz Co., 5705 Lake St., Chicago 44, Ill.*

UHF Radio Noise and Field Strength Meter

A UHF RADIO NOISE AND FIELD STRENGTH METER, which features the *slide-back* technique in a *vum* circuit, has been developed.

Meter, covering the frequency range of 15 to 150 mc, can be used for the measurement of steady carrier voltages or fields; line loss; front-to-back ratios of directional antennas; signal-to-noise ratios of antennas; effectiveness of noise filters and for the investigation of ignition and other types of radio noise.—*Model 58; Measurements Corp., Boonton, N. J.*



Measurements uhf noise-field strength meter.

Direct-Coupled DC Amplifier

A DIRECT-COUPLED DC AMPLIFIER designed for use in standard 19" racks, and having a 7" high front panel, has been introduced.

Voltage gain of the instrument, approximately 1000 times, is said to be sufficient to give one millimeter of deflection on oscillograph chart per millivolt input. Zero signal drift is claimed not to amount to more than one chart millimeter per hour. When the amplifier is used with a penmotor, the frequency response is essentially linear from *dc* to 100 cps.

Control panel on the face of the unit contains an attenuator with five factor-of-ten positions, gain control, calibrating meter, and controls for determining input voltages. Balancing potentiometer is provided for electrically biasing the oscillograph pen to any position on the chart. Input jack and output sockets are located on both the front panel and the rear of the chassis.—*Model BL-962; The Brush Development Co., Instrument Division 15, 3405 Perkins Ave., Cleveland 14, Ohio.*

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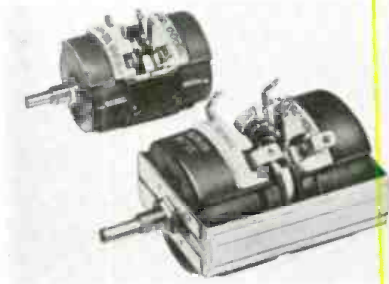
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TV Parts

Dual Power Rheostats

DUAL POWER RHEOSTATS, with single hole mounting for 25- and 50-watt sections, have been announced.

Featured is metal construction for maximum heat dissipation, with black anodized aluminum die-cast frame, metal winding core, stainless steel insulated shaft, and copper graphite brushes. Available in resistance ranges within $\pm 5\%$ up to 50,000 ohms in the 25-watt size, and 75,000 ohms in the 50-watt size. Linear and non-linear windings over this range can be maintained within $\pm 1\%$.—Model 245, 241; Industrial Division, Sec. TE, DeJur-Amsco Corp., Long Island City, N. Y.



DeJur-Amsco dual power rheostat.

Miniature Feed-Thru Ceramic Capacitors

TWO MINIATURE FEED-THRU CERAMIC CAPACITORS have been announced. Both units are .135" maximum diameter; one .400" maximum length and the other .690" maximum length. Equipped with a $\frac{1}{4}$ " diameter eyelet which can be soldered to the chassis.

Capacitors are rated at 500 volts, *dc* working, 1000 volts, *dc* flash test. Available in any standard capacitance tolerance from 25 to 250 mmfd; up to 650 mmfd with $\pm 20\%$ tolerance and up to 1000 mmfd with a *gm*v tolerance. Also available in ranges from 50 to 700 mmfd in standard capacitance tolerances; up to 1500 mmfd in $\pm 20\%$ tolerance; *gm*v tolerances apply to values up to 3000 mmfd.—FT-20, FT-25; Centralab, 900 E. Keeffe Ave., Milwaukee 1, Wis.

Miniature Lug Resistors

MINIATURE HERMETICALLY-SEALED RESISTORS with solder lug terminals, designed to meet the requirements of JAN-R-93, characteristic A, style RB11, have been announced.

Resistors are $\frac{19}{32}$ " long x $\frac{1}{2}$ " diameter and are rated 0.25 watt at 250 volts. Resistance values up to .1, .3 or .4 megohm are said to be obtained depending on the alloy wire used for the non-inductive winding.—Data available in bulletin R-3b; Shallcross Manufacturing Co., Collingdale, Pa.

Aircore Horizontal Output Transformer

AT AIR CORE HORIZONTAL-OUTPUT TRANSFORMER designed for use in direct drive systems has been developed. Can be used with cosine yokes.—HVO-8; Merit Transformer Corp., 4427 N. Clark St., Chicago 40, Ill.

NEW DELAY LINE

TYPE 1477-A



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Available now. This new, versatile Type 1477-A Delay Line permits delay intervals ranging from 0.05 microseconds to 0.9 microseconds. Compact yet flexible design facilitates circuit installation.

Other designs with variations of impedance, bandwidth and delay are available. Inquiries solicited.

SPECIFICATIONS

Sections: 18
Characteristic Impedance: 680 ohms
Delay per section: 0.05 microsecond
Total Delay: 0.9 microsecond
Bandwidth: 4.3 megacycles
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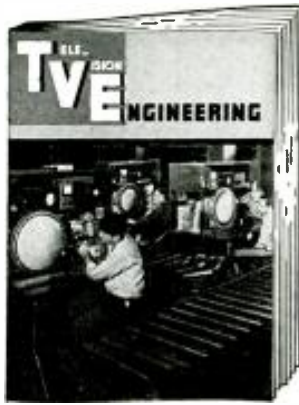
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Plastics in TV

(Continued from page 20)

less heating, combined with longer life, were found to permit the required economical operation. Since cooler operating conditions require less ventilation, overheating of nearby parts can be reduced to a minimum.

With the appearance of larger screen receivers, operating at higher voltages, it has been found necessary to consider materials that will eliminate the corona effects noted in present type deflection yokes. The ethoxylines were found to afford an effective solution. Yokes potted with *Araldite* casting resin *B* have been found very satisfactory. These potted coils do not demand separators, straps, tape, supports, etc., required with the current type yoke assemblies. This is due to the nature of the cured resin: rigid, yet not brittle, and displaying high tensile, compression and flexural strengths. It has been found possible to eliminate corona through the use of this resin due to the absence of any voids in the cured, potted coils. The high heat resistance of the resin has been found to permit operation under high-voltage conditions, where temperatures well above 200° F can be tolerated for indefinite periods. The comparatively high heat conductivity was another factor that led to the choice of this material.

Tube Base Cements

Television manufacturers are becoming more and more aware of the limitations of present tube base cements. This awareness has prompted tube manufacturers to seek a tube base cement (for bonding phenolic, ceramic, etc., bases to glass or metal envelopes) that will have excellent adhesion and withstand boiling water.

An ethoxyline resin, in paste form, has been developed and found quite satisfactory as a tube base cement that will withstand boiling water conditions.

The excellent adhesion, exhibited by this class of resins, has been found to be useful in speaker manufacture. The bonding of alnico magnets to speaker pots has long been a problem. Through the use of ethoxylines, an effective adhesive has been provided, requiring a minimum of handling and equipment. No pressure appears to be required, other than contact; the resin has also been found to display good fatigue strength, little danger of failure, due to vibration, prevailing.

Further demands have indicated the use of this type of resin as a transformer structure. Its light weight, high-heat distortion point (230° F), dielectric strength, and simplicity in cast-

ing procedures, were found to be very satisfactory for the assembly. Chassis temperatures often reach 140° F requiring the use of thermosetting materials, such as ethoxyline, that will remain rigid and hard at this temperature and still retain low dielectric loss and power factor.

The resin's properties of high-heat dissipation, strength, and low moisture absorption have been found to provide another application; impregnation of paper tubes for coil forms.**

An ethoxyline resin is also available for the coating of small diameter wire, of the magnetic type. Wire coated with these resins is scheduled to appear soon. It has been found that the wire will operate under temperature conditions as high as 300° F.

The resins are available commercially in both solid (powder, paste, or rod) and liquid (any viscosity) forms for bonding, casting, surface coating, and impregnating. Included are both heat-setting and cold-setting types.

Castings free from voids and displaying low shrinkage during cure can be obtained. The resins have also been found to be resistant to heat and solvents and display low vapor pressures.

**Araldite surface coating resin 985E.

Pulse-Cross

(Continued from page 15)

edge of sync to end of blanking (min) = $0.14 H = (.14) (8.75) = 1.225''$.

If the four pulse widths are found to be within the limits shown, the back porch has been arithmetically established as being within tolerance.

Sequential Examination of a Typical Pulse-Cross Pattern: Although a check of sync generator operation may be made very easily by counting pulse-groups and measuring pulse-widths, a more complete understanding of what is being seen and what is happening is necessary to determine the *cause* of any troubles, as found by use of the pulse-cross.

Since the pulses as viewed on the pulse-cross are different from the usual RTMA waveform presentation, a pulse-cross pattern as illustrated in Figure 7 will be used as a typical example, with the various pulses being examined in the *sequence* of their occurrence, rather than grouping them together for a quantitative measurement. Two fields of the synchronizing waveform, shown in Figure 8, have been arranged with horizontal sync in vertical alignment, so that all the horizontal pulses of both fields appear in the same relative position as they do on the pulse-cross pattern.

[To Be Concluded in October issue]

Wide Band UNIVERTER

for complete
frequency coverage
when used with the
FM-AM SIGNAL GENERATOR



The UNIVERTER Type 207-A provides a continuous extension of the frequency range of the 202-B FM-AM Signal Generator down to 0.1 mc. The two instruments may be used over a continuous frequency range of 0.1 mc. to 216 mc. The Univerter Type 207-A subtracts 150 mc. from a signal obtained from the 202-B and provides outputs between 0.1 mc. and 55 mc. without change of signal level. Negligible spurious signals are introduced and modulation of the signal is unaffected. Small incremental changes can be made in frequency to allow the study of band pass characteristics of very narrow band receivers. A regulated power supply prevents change of gain or frequency with line voltage.

SPECIFICATIONS (When used with 202-B)

FREQUENCY RANGE: 0.1 mc. to 55 mc. (0.3 mc. to 55 mc. with 200 kc. carrier deviation).

FREQUENCY INCREMENT DIAL: Plus or minus 300 kc. calibrated in 5 kc. increments.

FREQUENCY RESPONSE: Flat within ± 1 db over frequency range.

FREQUENCY ADJUST: Front panel control allows calibration with 202-B output.

OUTPUT: Continuously variable, at XI jack from 0.1 microvolt to 0.1 volt across 53 ohms by use of 202-B attenuator.

HIGH OUTPUT: Uncalibrated approximately 1.5 volts from 330 ohms into open circuit.

DISTORTION: No appreciable FM distortion at any level. No appreciable AM distortion at carrier levels below 0.05 volt and modulation of 50%.

SPURIOUS RF OUTPUT: At least 30 db down at input levels less than 0.05 volts.

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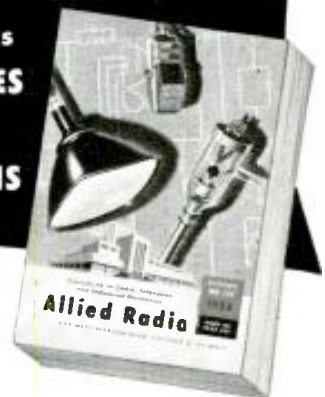
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Production Aids

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A WIRE HARNESS CLAMP, which can be opened and closed without the use of tools, and featuring an interlocking slot and tongue so it cannot be opened accidentally, has been developed. T-shaped tongue inserted by pressure of the hand on the clamp, slips into a narrow portion of the slot and is held by lateral and outward spring action.

Clamp may be used singly or in tandem and to hold bundles 5/16" to 1 1/4" in diameter. It is said that the clamp can be opened without removal from the structure to which it is attached, is pre-assembled to the wire bundle, and is suitable for wire bundles of varying dimensions caused by variations in wire insulation thickness. Also suitable for mounting to the structure by hand operation with a screw driver.—Tinnerman Products, Inc., Box 6688, Dept. 14, Cleveland 1, Ohio.



Tinnerman wire-harness clamp.

Nonstrip Wire

AN INSULATED WIRE, that can be soldered directly without stripping the insulation, has been announced. Insulation is said not to affect the electrical resistance of the soldered joint.

Wire may include solid or combination color coding markers, and is claimed to be capable of withstanding 125° C.—Non-strip; Rex Corp., 51 Lansdowne St., Cambridge 39, Mass.

Flexible Thermal and Electrical Insulation

FLEXIBLE THERMAL AND ELECTRICAL INSULATION for use as high temperature thermal insulation, electric space separators, filtration of corrosive or high temperature materials, catalyst or catalyst support, ion exchanger and plastic laminates, has been produced.

Sleeving of this insulation, which is said to have chemical properties of vitreous silica, is flexible and claimed to be effective up to temperatures of 1800° F.

In batt form, it is claimed to have low thermal conductivity, a fiber diameter of .00020"-.00040", specific heat of .19, nominal thickness of 3/16", and surface density of .05 pound per square foot.—Refrasil; The H. I. Thompson Co., 1733 Cordova St., Los Angeles 7, Calif.

Magnetic Driving Assembly

A MAGNETIC DRIVING ASSEMBLY with replaceable sockets for use on power wrenches for self-tapping and sheet metal screws has been announced. Socket is driven by the square end on the shank and is held on the shank with a left-hand thread which provides the connection.

Tool is said to deliver maximum pulling power to the screw head through a spring-loaded Ahico magnet, transmitting its magnetism through a hardened steel tip. Magnetic tip retracts under pressure so that driving pressure is applied against a shoulder in the socket instead of the tip.

Available in a 1/4" hex shank with a 1/4" square drive accommodating 1/4" square drive sockets. Sockets are available in three sizes of hex openings, fitting 6, 7, 8, 10, 12 and 14 1/4 hex head screw sizes. Driving member also is available in the form of a 1/4" square female adapter with a 1/4" square drive, also fitting the sockets.—Magna Tool Corporation, 779 Washington St., Buffalo 3, N. Y.

Tweezers

TWO TWEEZERS for use on bearings having bores from 3/32" to 1/2", one for gripping the bearing by the inside race and the other for the outer race, have been produced. Tool is said to avoid the corrosive effects of finger handling of bearings.—The Baker Co., Maplewood, Maine.

Flux

A FLUX which is said to be neutralized by the heat of the soldering operation, leaving a residue that is normally non-corrosive, non-hygroscopic, non-conductive to electricity and non-fuming, has been produced. It is said to contain no zinc or ammonium chloride, rosin or other gums.—No. 30; Superior Flux and Manufacturing Co., Dept. BB, 1302 Ontario St., Cleveland 13, Ohio.

Rubber Circuit Stamps

RUBBER CIRCUIT STAMPS to save time in drawing and drafting have been announced. Impressions available include resistors, capacitors, coils, diode to multi-grid tubes, selenium rectifiers, etc., individually or in sets, in two different sizes.—Precise Measurements Co., 942 Kings Highway, Brooklyn 23, N. Y.

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- Micrometer type size control
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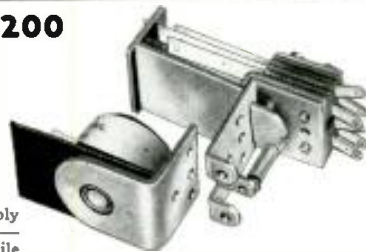
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200-M3	Midget Contact Switch Parts Kit		

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Cat. No.	Volts	Cat. No.	Volts
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200-12A	12 A.C.	200-12D	12 D.C.
200-24A	24 A.C.	200-24D	24 D.C.
200-115A	115 A.C.	200-32D	32 D.C.
		200-110D	110 D.C.
		200-5000D	

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Cornell-Dubilier Electric Corp., South Plainfield, N. J., has released a 60-page catalog, 420-421, on mica and faradon capacitors. Detailed are manufacturer's type number and the corresponding JAN unit designation, and characteristics, de-rating, dimensions, tolerances, extras or exceptions, on the same page with a particular type in question. A faradon capacitor section is also included. Capacitors covered include cylindrical, ceramic-cased and potted mica, plastic-cased potted mica, molded mica both for transmitting and receiving, metal-clad sulfinate, cast-aluminum cased mica and rectangular brass-cased mica.

The Brush Development Co., Instrument Division 15, 3405 Perkins Ave., Cleveland 14, Ohio, has issued an 8-page folder, *Surface Evaluation by Faxfilm*, which describes applications for inspection and for test and process engineering of the process, which employs a plastic replica to show roughness, wear, grain and other surface conditions of materials.

Sorenson and Co., Inc., 375 Fairfield Ave., Stamford, Conn., have prepared a 4-page catalog, *Condensed Standard Specifications*, covering voltage regulators.

Chicago Telephone Supply Corp., Elkhart, Ind., have released a data sheet, 150, describing the performance character of military-type, high-temperature composition variable resistors. Technical data on types 65 and 95 are included.

Industry Literature

Allegheny Ludlum Steel Corp., 2020 Oliver Building, Pittsburgh 22, Pa., have published a 120-page handbook on stainless steels. Forty types of stainless steel are discussed, covering analyses, fabrication, heat treatment and special conditions of service.

Eutectic Welding Alloys Corp., Department 512P, 172 St. and Northern Blvd., Flushing, N. Y., have issued a six-page folder, *Eutectic Instant Hardner*, covering emergency surface hardening with an ordinary welding torch. Described is a how-to-do-it section to harden steel tools, parts, edges, threads, dies, drills, etc.

Centralab, 900 E. Keefe Ave., Milwaukee 1, Wis., has prepared a technical bulletin, 42-123, entitled *High Accuracy Capacitors, Type 950 Series*, on capacitors that are shielded and sealed hermetically and designed for close tolerance oscillator circuits, primary and secondary frequency standards, frequency meters and precision resonant applications.

The International Nickel Co., Inc., Development and Research Division, 67 Wall St., New York 5, N. Y., have issued a 32-page booklet, T-33, on the resistance welding of nickel and high nickel alloys. Detailed are tables on mechanical properties, chemical compositions and recommended conditions for welding.

The Calnevar Co., Microwave Division, 1732-42 West Washington Blvd., Los Angeles 7, Calif., has released a 4-page brochure covering microwave system components and laboratory instruments.

Insulating Manufacturing Corp., 565 West Washington Blvd., Chicago 6, Ill., have released eight bulletins covering varnished cotton base cloth and tape insulation, 750A; straight cut varnished silk, 750C; varnished asbestos cloth, 750D; varnished glass cloth and tape insulation, 750B; silicone resin coated glass cloth and tape insulation, 750; varnished paper, 750E; resinous sheeting and tape, 750F; and extruded tubings, 310.

Stackpole Carbon Company, St. Marys, Pa., has published a 12-page engineering bulletin detailing the behavior characteristics of each of its three grades of metallic oxide Ceramag cores under varying conditions of permeability, flux density and temperature. These non-metallic cores are being used in TV flyback transformers, deflection yokes, image width controls and other applications where high permeability for relatively low flux densities and medium frequencies is required.

Anchor Plastics Co., Inc., 535 Canal Street, New York 13, N.Y., has released an 8-page brochure, *Extruded Plastics*, describing applications of custom made thermoplastic extrusions. Has sections describing the facilities and range of extrusions available, applications of extrusions to particular products, and a digest of properties of thermoplastics with a table.

BENDIX RADIO DIVISION



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Briefly Speaking..

CLOSED-CIRCUIT TV, believed by many to be a gadget-like idea, has proved itself to be quite the contrary, serving as a key tool in many major industries and in government agencies for lab and plant control service. Thus far, there are only a few producing equipment for the industry-TV field, but there are many others who have indicated that they are intrigued by the possibilities, and are mapping elaborate plans for the future. . . . *Electro-Seal Corp.*, Des Plaines, Ill., is now located in a new plant at 946 North Ave. . . . *Sylvania Electric* has announced that it has organized a subsidiary, *Sylvania Electric of Puerto Rico, Inc.*, to fabricate mica for use in radio tubes. Production in a 10,000-square foot plant in Rio Piedras, a suburb of San Juan, will start soon. . . . *Acro Products Co.* has moved to 369 Shurs Lane, Roxborough, Philadelphia 28, Penna. . . . *International Telephone and Telegraph Corp.* has granted non-exclusive patent licenses to the *Diamond Power Specialty Corp.*, Lancaster, Ohio, for the manufacture and sale of industrial television, telemetering, and facsimile equipment, including the Farnsworth dissector tube. . . . The capital stock of the A. W. Haydon Co., Waterbury, Conn., has been purchased by the *North American Philips Co., Inc.* . . . *F. A. Daugherty*, 100 Woodrow Ave., Bedford, Ohio, has been named sales rep for the cathode-ray tube division of Allen B. DuMont Labs, Inc., covering West Virginia, western Pennsylvania, and Ohio. . . . *Ellinger Sales Co.*, 6663 Northwest Highway, Chicago, will cover Illinois, Wisconsin, and half of Iowa, including Des Moines for the division. . . . *Henry S. Bamford*, president of the Electronic Tube Corp., Philadelphia, is touring Europe reviewing electronic-tube manufacture. . . . The Astatic Corp., Conneaut, Ohio, has appointed *Joseph Plasencia, Inc.*, New York City, to handle foreign sales of their products. . . . *Polarad Electronics Corp.*, 100 Metropolitan Ave., Brooklyn 11, N. Y., has released a manufacturing facilities brochure. The company has added another floor to increase its manufacturing space to 27,000 square feet. . . . *Sierra Electric and Manufacturing Co.* has purchased McDonald Manufacturing Co. *Lee T. Bordner* is president. . . . *Sarkies-Tarzian, Inc.*, has announced that the facilities of their plant in Hawthorne, N. J., will be devoted to the development and research on tubes of all types. Production of picture tubes will be concentrated in the Batavia, Ill., plant.

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Ceroc 200

**CERAMIC-COATED
MAGNET WIRE**



...FOR HIGHER RATINGS IN SMALLER WINDINGS



Same v-a rating! At the left is a filament transformer for a radio transmitter wound with double vinyl-acetyl insulated wire and impregnated with synthetic varnish. It is rated at 1,000 hours life under 85°C. ambient temperature operation. At the right is the same transformer, redesigned, and wound with CEROC 200 and impregnated with silicone resin. It has a rated life of 10,000 hours at 160°C. ambient temperature operation!

Shrink the size of small transformers, chokes, relay coils, and other wire-wound electrical components by winding them with Sprague's CEROC 200 Magnet Wire.

This wire has an exclusive ceramic-silicone insulation which permits continuous operation at 200°C. Size for size, it safely carries far larger currents than ordinary magnet wires using conventional insulating materials. Consequently, CEROC 200 can save both copper and magnetic materials for you.

Write for Engineering Bulletins 401 and 403B

Ceroc T
Wherever higher temperatures and severe mechanical stresses are present, investigate CEROC T, the most heat-resistant of all magnet wires! For specifications on this 250°C. ceramic-Teflon insulated wire, write for Engineering Bulletin 402F.

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ELECTRIC AND ELECTRONIC DEVELOPMENT

SPRAGUE ELECTRIC COMPANY

NORTH ADAMS, MASSACHUSETTS

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An improved miniature complement for TV tuners...



RCA-6BQ7 Medium-Mu Twin Triode

Heater Voltage (AC or DC)
Heater Current
Plate Voltage
Cathode-Bias Resistor
Amplification Factor
Plate Resistance
Transconductance
Plate Current
Grid Volts (Approx.) for plate current of 10 μ amp

6.3 volts
0.4 amp
150 volts
220 ohms
35
5800 ohms
6000 μ mhos
9 ma
-10 volts

RCA-6X8 Triode-Pentode Converter

Heater Voltage (AC or DC)
Heater Current

Plate Voltage
Grid—No. 3 voltage
Grid—No. 2 voltage
Cathode-Bias Resistor
Amplification Factor
Plate Resistance (Approx.)
Transconductance
Grid—No. 1 Bias (Approx.) for
Plate Current of 10 μ amp
Plate Current
Grid—No. 2 Current

Triode Unit
100
100
40
6900
5800

6.3 volts
0.45 ampere
Pentode Unit
250 volts
0 volts
150 volts
200 ohms

750000 ohms
4600 μ mhos

-10 volts
7.7 ma
1.6 ma



THE FOUNTAINHEAD OF MODERN TUBE DEVELOPMENT IS RCA

New RCA 6BQ7 and 6X8 provide higher gain, reduced noise factor, and simplified tuner design

Two important new miniature tubes . . . specifically designed to improve the performance of VHF television tuners . . . have been developed by RCA in its continuing program of television research.

The RCA-6BQ7 medium-mu twin triode is intended primarily for use as the first RF amplifier in VHF tuners, or as a low-noise IF pre-amplifier in UHF television receivers employing a crystal mixer. Because of its high transconductance, low input capacitance, low input loading, and low plate-to-cathode capacitance, the RCA-6BQ7 gives especial advantages in driven grounded-grid or cascode-type circuits.

In such circuits, this new tube provides a reduction in noise with resultant improved receiver sensitivity. It also reduces oscillator radiation.

The RCA-6X8 triode-pentode converter is approximately equivalent to a 6J6 triode unit and a 6AG5 pentode in one envelope, and therefore contributes to the simplification of front-end designs. It is designed primarily for use as the oscillator-mixer in VHF tuners having 40 Mc IF systems. Its low value of output capacitance enables the pentode section to work into a high-impedance plate circuit with resultant increase in mixer gain.

The RCA-6X8 is also especially suitable as an oscillator-mixer in AM/FM receivers.

RCA Application Engineers are at your call in adapting the RCA 6BQ7 and 6X8 to your specific designs. For prompt service, phone the nearest RCA office* . . . or write RCA, Commercial Engineering, Section 581R, Harrison, N. J.

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