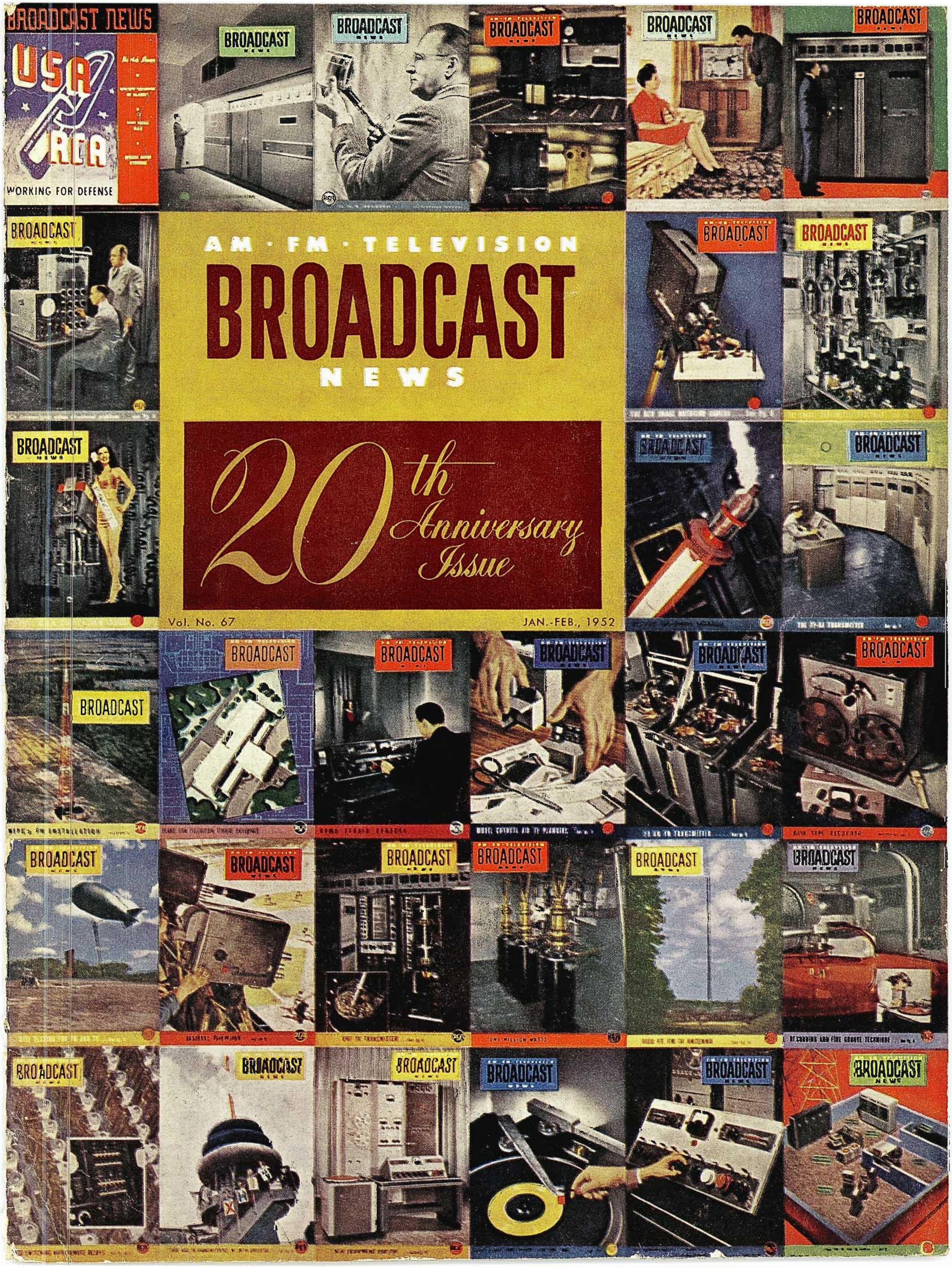
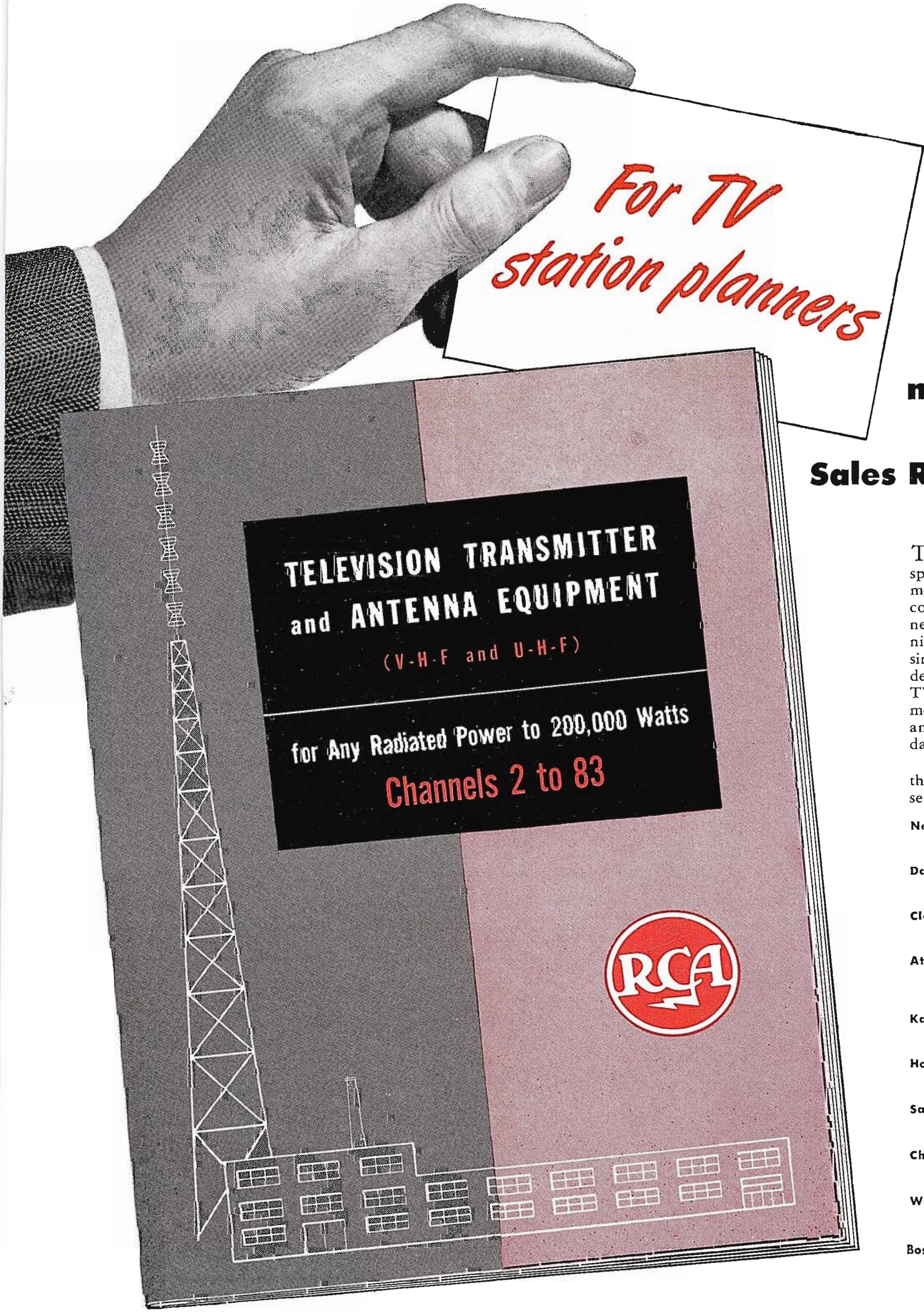
AM · FM · TELEVISION

BROADCAST NEWS

20th Anniversary Issue

Vol. No. 67 JAN.-FEB., 1952





. . . from your nearest RCA Sales Representative

This 64-page book is prepared specifically for TV station management, chief engineers, architects, consultants, and attorneys connected with station designing, planning, building, and operating. In a single reference it contains concise descriptions of RCA's entire line of TV transmitter and antenna equipment—including transmitter plans and layouts, general application data, and cost charts.

For your copy, get in touch with the RCA Broadcast Sales Representative nearest you:

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RADIO CORPORATION of AMERICA
ENGINEERING PRODUCTS DEPARTMENT — *CAMDEN, N.J.*

Broadcast News

AM • FM • TELEVISION

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JOHN P. TAYLOR, Editor W. O. HADLOCK, Managing Editor

M. L. GASKILL, E. B. MAY, E. C. MASON, W. R. COULTER, Associate Editors

Contents

OUR COVER, as you hardly need be told, is a reproduction of the covers of all issues of BROADCAST NEWS from Vol. No. 1 (October 1931) to the last previous issue (Vol. No. 66). On the back cover (did you notice it?) are the covers from 1931 through May 1941. These are arranged chronologically, in rows, from top to bottom. On the front cover are all issues from September 1941 to date, similarly arranged.

HISTORY OF BROADCAST NEWS is portrayed in picture and story, starting on Pg. 2. If the story seems to get a little sticky now and then, please forgive us. When we think of how the industry has grown, and our business (and BROADCAST NEWS) with it, we get a little carried away by it all.

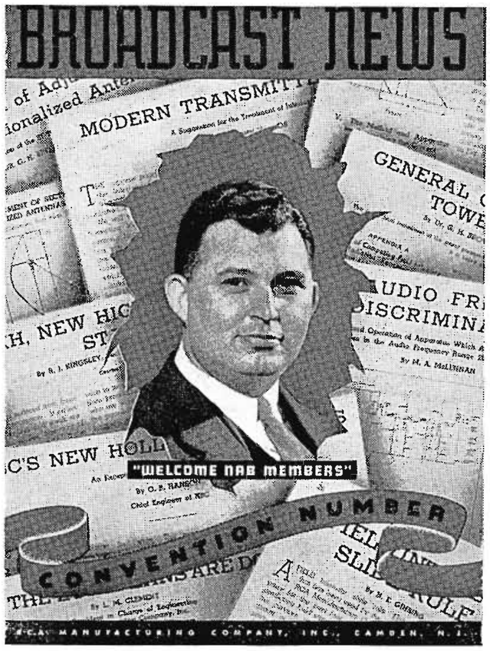
THE INDEX, which we have been promising you for too long has finally been put in shape and appears on Pg. 14-27 of this issue. Main credit for getting this done goes to Dick Newman of our broadcast transmitter sales group. Dick, who has been in Camden as Product Manager for Transmitters for the past two years, has now returned to his old stamping grounds in the San Francisco area. However, before he left he managed to get the index almost done and Norm Rivkees, who recently joined our group, has completed it. We hope you like it, and find it useful. But if you find any errors, please write Dick, not the editor.

ACKNOWLEDGMENT is also due here to all of the RCA engineers who have given of their time (usually their own, not the company's) to make BROADCAST NEWS as interesting and technically accurate as it has been. In many, if not most, cases, they could have "sold" their material to outside magazines. However, because of their interest in the broadcasting business they preferred to see it in BROADCAST NEWS where it reaches several times more broadcast operating personnel than it would in any other place. To these men we owe a real debt—and we hereby acknowledge it.

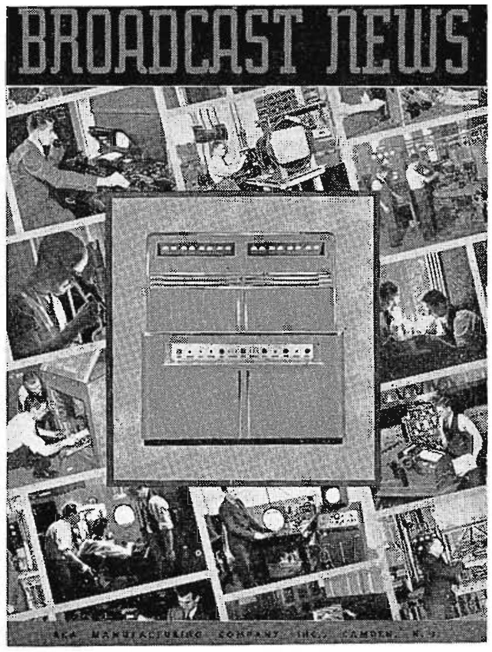
THANKS also to all of you station and network engineers—and not a few managers—who have taken time to furnish material for all the many issues of BROADCAST NEWS that have rolled off the presses. It is your stories that have kept BROADCAST NEWS from becoming as one-sided as many house organs are. We hope you will continue to supply us with your material—and we'd even like to have a little more of it . . . not so much the beaming face of your station manager and the pretty front of your new transmitter (although we have nothing against them), but rather more of the details of how you did it. Especially those little ideas that are your very own. Maybe you would be surprised how interested others would be in them.

ANTENAPLEX, the community kind, comes in for a few kind words in the article starting on Pg. 54. RCA has developed and is marketing high-quality equipment suitable for serving communities in fringe areas of TV stations. As Ed Jones points out, such installations actually increase the audience of the station since, in most cases, they bring signals to homes which otherwise would have no service. Just how widely such systems will be used is still a matter of conjecture. However, the number of installations being made is such that coverage will definitely be a factor in some parts of the country.

VOLUME NO. 1, October 1931, was a thin 12 pages, with a single color cover, which by today's standards looks a bit old-fashioned. Contents, however, were not too different from our most recent issues. The feature story was a description of KFI's then brand new RCA 50B installation—"the first 50 KW west of Texas" (which, incidentally, is still going strong). In addition, there were two engineering "know-how" stories: one of them on Microphone Placement by T. A. Smith, now Assistant General Manager of the Engineering Products Department; another on Field Intensity Measurements by the present editor.



VOLUME NO. 21, July 1936, was much flossier. By this time BROADCAST NEWS had grown to a nice big 36 pages. The cover of this volume, a special Convention Number, was unusual in that it featured a picture of I. R. Baker, who managed RCA's broadcast transmitter business from 1930 to 1943. It was Bake who formulated RCA's policy of building the best in broadcast equipment and of merchandising it with directness and honesty. BROADCAST NEWS, too, was Bake's idea—and certainly no one deserved more to grace the cover. However, such was his modesty that he was considerably irked when, without his foreknowledge, this cover appeared.



VOLUME NO. 30, May 1939 marked a milestone in BROADCAST NEWS, when, for the first time, a piece of "commercial" television gear appeared on the cover. The TT-1A Television Transmitter shown on this cover, and described in following issues, was announced coincidentally with the start of "commercial telecasting" in New York. Although the "start" was somewhat premature it was an unmistakable portent of things to come, and of postwar issues of BROADCAST NEWS which have been more and more marked by the gradual ascendance of television as a main topic of conversation among non-TV broadcasters as well as present telecasters.

TWENTY YEARS OF BROADCAST NEWS

by JOHN P. TAYLOR
Engineering Products Department

Broadcast News is now in its twenty-first year! The cover of this issue, which so proudly proclaims our 20th Anniversary, is actually a little late, for the first issue of Broadcast News was dated October 1931. Whether or not that impresses you, and how it impresses you if it does, will depend on how old you are and how long you've been in the broadcast business.

If you were in the business in 1931 we don't need to tell you how different it was then. But if you were not, then we will have a difficult time convincing you. If you are statistically minded maybe we can do it by pointing out that in 1931 the total gross revenue of all the stations in the United States was only 56 million, about 8% of 1951's total gross revenue. That sounds as if broadcasting in 1931 was a small thing—and by today's standards it was. But this comparison tells only half the story. To complete the picture you must also note that only four years before, in 1927, the total gross of all the stations was less than five million dollars. In other words, in 1931 the industry was still an infant, dollar-wise, but it was a husky brat that had grown ten times over in only four years.

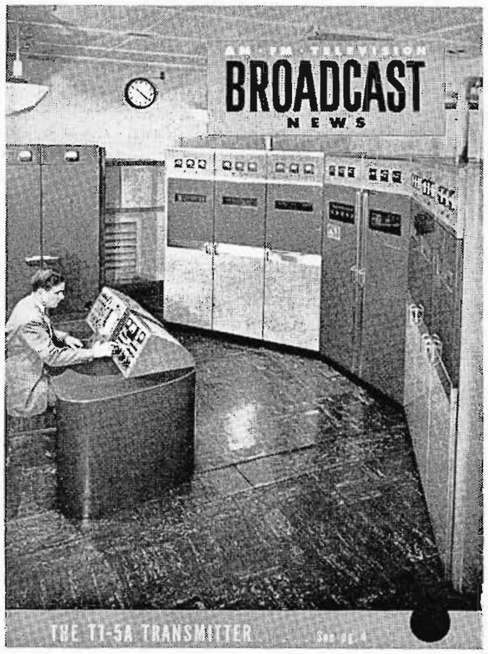
So much for the statistics. If you are technically minded, and you weren't around then, maybe we can place it for you by telling you that all audio equipment was operated from storage batteries, a one kilowatt transmitter required a water-cooled tube, most plate power (as well as filament power) was supplied by motor-generators, the condenser microphone was the high favorite in the studios, radiating towers were only just coming into use, and directional antennas were only a subject of conversation.

Of some 700 stations on the air in 1931 the great majority were of "composite" manufacture. Many of them were really "home-made" in the homiest sense of the word. This was not surprising, for many, if not most, of the broadcast stations taking the air during the twenties did so by the grace, if not the inspiration, of some aspiring amateur. However, by 1931, quite a few stations were making money (a development which originally came as something of a surprise). As the cash registers started ringing broadcasters stopped looking on their stations as hobbies, or prestige operations, and began running them like businesses. That's where we came in.

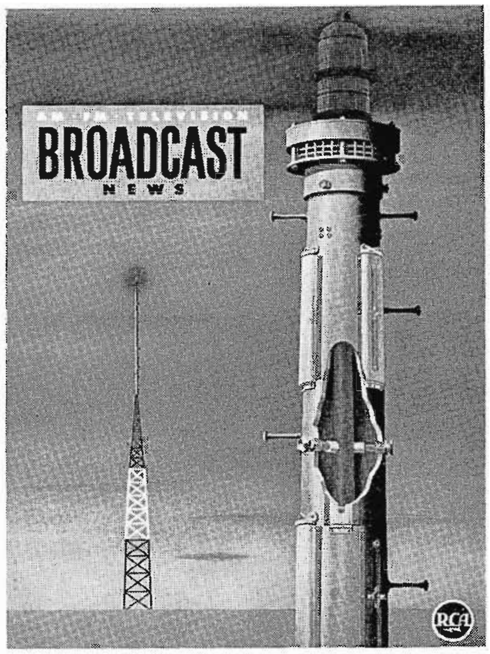
RCA had started selling broadcast equipment in 1927, but did not aggressively go after the market until its manufacturing operation was established in Camden, N. J., in 1930. In the early part of 1931 there were just 30 RCA transmitters on the air. Six RCA transmitter salesmen were running themselves ragged trying to sell all the other 670 stations the advantages of RCA equipment.

It soon became evident that in order to get information about our new equipment out to 700 stations in a hurry we would need some other means to augment personal calls. But how?

VOLUME NO. 37, September 1941 marked another important milestone. By this time BROADCAST NEWS covers had gone through several metamorphoses. (See outside front and back covers of this issue.) Only the masthead stayed reasonably constant. But it remained for this issue to strike a really different note. Although Pearl Harbor was yet to come, its shadow was on the land. BROADCAST NEWS, on cover and in editorial, recognized the state of national emergency. And, within months thereafter, it, like everyone else, went to war. From this time until V-J Day, issues were few and far between.



VOLUME NO. 48, March 1948 symbolized the post-war boom of the broadcasting industry—and of BROADCAST NEWS. Now a big grown-up boy of 72 pages, with a four-color varnished cover, this issue of BROADCAST NEWS featured a detailed technical description of RCA's 5KW TV Transmitter, Type TT-5A. This is the transmitter which made today's television a reality. On the market, and available in quantity, long before any competitive make, it powered—and still powers—most of this country's first one hundred television stations. It set the standard of today's television.



VOLUME 68, March 1952, is, so to speak, a glimpse in the future. This "preview" of our next issue's cover shows BROADCAST NEWS still leaing the way in picturing new developments. This time it's UHF. Featured on the cover, and in the feature story, is RCA's new UHF antenna, now in production to meet the demand of post-freeze stations in the new UHF band. Also featured in this issue will be a description of RCA's completely new TV camera and camera control units. In addition, there will be the usual station and engineering articles which have featured every BROADCAST NEWS from the very first.

The answer we arrived at was Broadcast News—our own magazine, for our own customers (and fair prospects). A magazine devoted to the interests of broadcasters—particularly those of a technical bent— and carrying only information of interest and usefulness to them.

The selfish purpose of Broadcast News, of course, was to present information on our equipment, its uses, its advantages, and its operation. We soon found, however, that this need not be a one-way street. From the very beginning we had sugar-coated our message by using at least half the page space for presentation of engineering "know-how" articles. To our delight station engineers all over the country received Broadcast News with obvious pleasure. Best of all, they sent in not only their kind comments, but also pictures of their installations, and articles on various ideas they had used successfully. Most of this material found its way into Broadcast News pages . . . and thus the magazine became a sort of meeting place for station engineers.

Naturally we were very happy with this development and have done our best to encourage it. Proof of this is found in the fact that in recent years nearly half of the content material has been supplied by sources outside of RCA. We have not stopped there, however. In order to further supplement these engineering type articles we have enlisted the assistance of our own large corps of engineers. Nowadays almost every issue carries at least one article by one of these engineers. Ranking at the top of the profession, and working day-to-day on the newest and most advanced developments, they speak with authority, whether they write about theory, equipment design, or operation.

To these article by station engineers and our own engineers, we add station stories and equipment news stories written by our own technical staff. Then we throw in a few of our best and prettiest ads, and that's it. No cheesecake, no cartoons (well, not many), no company puffs; in fact, no extraneous material at all. Just broadcast engineering and operation—straight. That has been the continuing policy for twenty years, and, if we're here, it will be for another twenty.

On the outside cover of this Anniversary Issue we have reproduced the covers of all issues from the very first—in chronological order. These covers, in themselves, tell most of our twenty-year history in the briefest, and probably most interesting, manner. Then, just above, we have reproduced some of our "milestone" covers—with a few comments about their significance. Finally, in the pages immediately following we have collected a representative sampling of Broadcast News articles over the twenty-year period. This is just to refresh the memories of the old-timers—and perhaps to slightly awe the new-comers (and Johnny-come-latelies).

Starting on Pg. 14 will be found an overall index to all issues of Broadcast News to date. To those of you who have carefully hoarded your back copies this should be of some usefulness. To those who haven't it may still be a useful reference to material available elsewhere.

However, please note that we have a supply of only a few back issues. Those available are Nos. 42, 43, 44, 45, 46, 47, 48, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 63, 64. First come, first served as long as they last. Twenty cents each for handling and mailing.

Twenty Years of

A Simple Method of Adjusting Top Loaded and Sectionalized Antennas

A Description of the BF-90 Meter

By DR. G. H. BROWN

LOGARITHMIC RECORDING OF FIELD INTENSITIES

SIMPLIFIED SOLUTION FOR ANTENNA IMPEDANCE MATCHING NETWORKS

By A. VOLLENWEIDER

DIRECTIONAL ANTENNAS

MECHANICAL DESIGN OF OPEN WIRE TRANSMISSION LINES

By H. M. KEARNEY

CALCULATION OF T.I.F. FOR TRANSMITTER LOADS

By J. C. WALTER

SIX WIRE TRANSMISSION LINE

SELECTING A SITE FOR AN FM STATION

GROUNDED-GRID POWER AMPLIFIERS

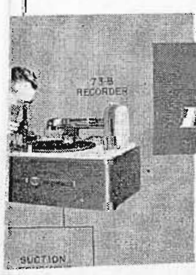
Radio-Frequency Power Amplifiers Using Grounded-Grid Circuits Operate At Higher Frequencies And Can Handle Wider Bandwidths Than Capacitance-Neutralized Grounded-Cathode Circuits

By E. E. SPITZER

A NON-DIRECTIONAL ANTENNA FOR MOBILE FIELD STRENGTH MEASUREMENT IN THE FM BAND

W. ROBINS

AUDIO FREQUENCY RESPONSE AND DISTORTION MEASURING TECHNIQUES FOR FM TRANSMITTING SYSTEMS



RECORDING AND Fine GROOVE TECHNIQUE

By H. E. ROYS
Audio Engineering Section

Introduction

MEASURED CHARACTERISTICS of the PYLON ANTENNA

DESCRIPTION OF TEST SETUP

A FIELD INTENSITY SLIDE RULE

By H. E. GIHRING

LIGHTNING IS A MENACE

Some Suggestions to Broadcasters for the Prevention of Serious Damage

By I. E. YOUNG

A Brief Survey of the Characteristics of Broadcast Antennas

By H. E. GIHRING and DR. G. H. BROWN, RCA Victor Eng. Dept.

SIMPLIFIED NETWORK SYNTHESIS

Building Circuits to Specified Performance Requirements

By EDMUND A. LAPORT

PARALLEL MIXER CIRCUIT CALCULATIONS

A Few Suggestions on this Important Subject for Station Engineers

By C. W. SLAYBAUGH

SUGGESTIONS FOR COUPLING OF R-F TO MEASURING EQUIPMENT

CHARACTERISTICS OF UNBALANCED OVERHEAD TRANSMISSION LINES

By DR. G. H. BROWN

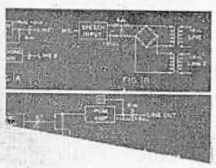
FM AUDIO MEASUREMENTS with an AM RECEIVER

THE GROUNDED-GRID AMPLIFIER

by C. J. STARNER

OSCILLOSCOPES AND VACUUM TUBE VOLTMETERS HOW THEY READ AND WHAT THEY DO

by GEORGE E. REILING



SPEECH INPUT SYSTEMS

A Thorough Discussion of the Practical and Theoretical Aspects of Various Systems

FREQUENCY RANGE PREFERENCE FOR SPEECH AND MUSIC

by HARRY F. OLSON
RCA Laboratories

A METHOD OF DETERMINING THE TRACKING CAPABILITIES OF A PICKUP

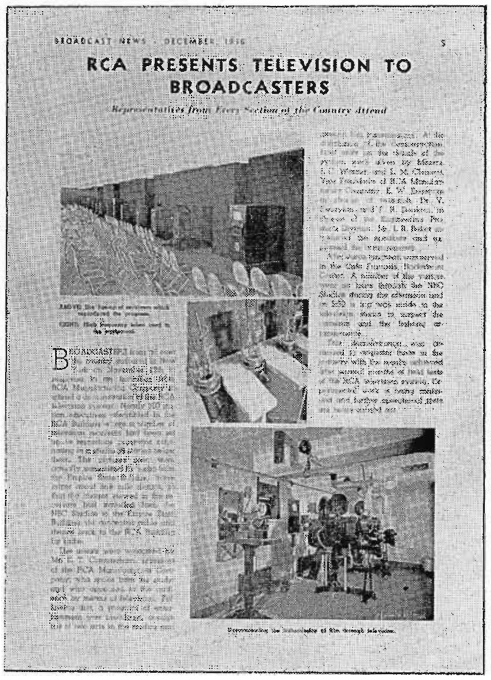
by H. E. ROYS
Engineering Products Department
RCA Victor Division, Camden, N. J.

Introduction

TECHNICAL ARTICLES on station operation have always been the most important part of BROADCAST NEWS. Many of these articles have emphasized the how-to-do-it angle. All have been chosen because of their direct usefulness to station engineers. In twenty years of publishing, BROADCAST NEWS has printed literally hundreds of such articles, most of them by the top men in the profession. The wide range of subjects covered by these articles is indicated by the headings in the columns at the left.

Broadcast News

STATION DESCRIPTIONS have been a close second to technical articles in popularity as a BROADCAST NEWS feature. More than 200 station installations have been described in detail. Many of these station stories have included detailed floor plans, schematic diagrams, and photographs showing details of construction, arrangement of equipment, etc. From these, station engineers have been able to learn "how the other fellow did it", pick up ideas they could use in planning their stations.


BROADCAST NEWS • DECEMBER 1936

RCA PRESENTS TELEVISION TO BROADCASTERS

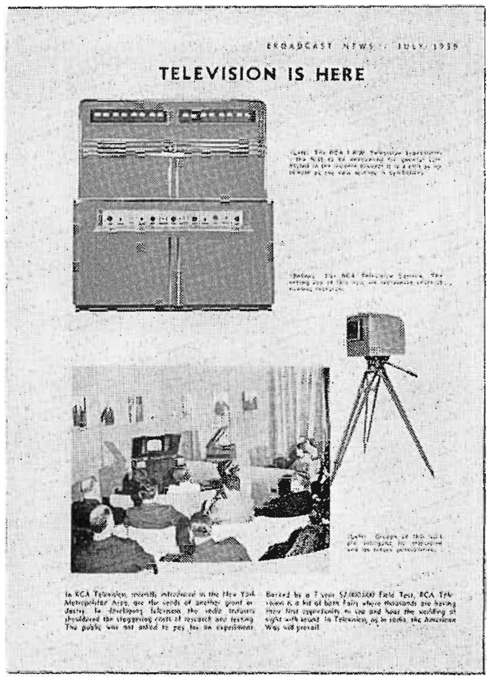
Representatives from Every Section of the Country Attend

DECEMBER 1936 issue described demonstration of RCA Television on November 12, 1936. Nearly 300 station executives attended. A part of first large scale field test of TV, this demonstration was the first of RCA's "progress reports on television" to the broadcast industry.


BROADCAST NEWS • JULY, 1939

TELEVISION RECEIVERS ARE HERE

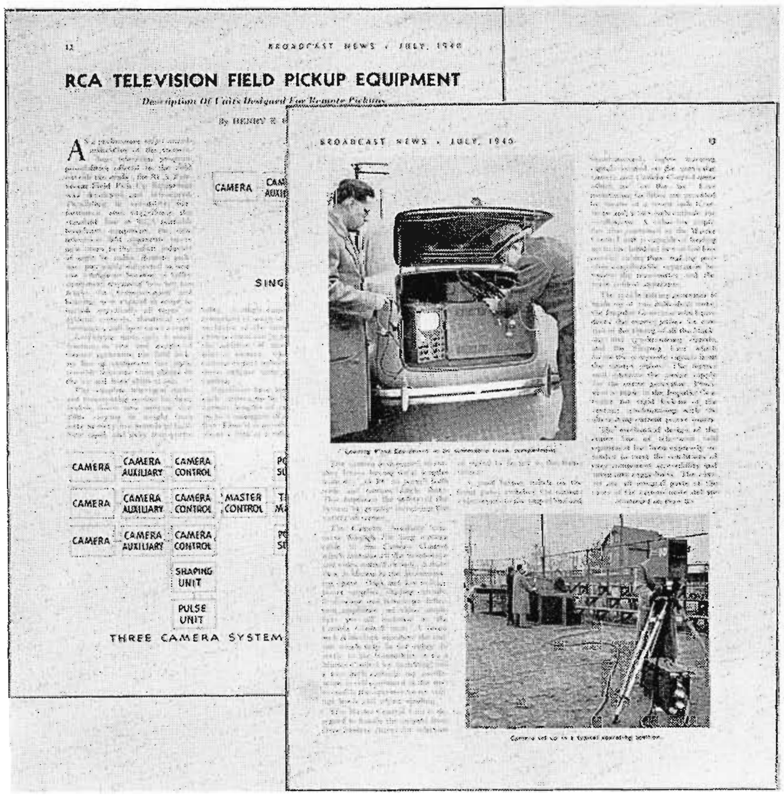
JULY 1939 issue reported the introduction of "commercial" television receivers in the New York market, noted the wild-eyed enthusiasm of crowds viewing television for the first time at the World's Fair. Some of the receivers shown (modified for 525 line operation) are still in use.


BROADCAST NEWS • JULY, 1939

TELEVISION IS HERE

JULY 1939 issue, proclaiming that "Television Is Here", also announced the first TV Transmitter to be offered for general sale—the RCA Type TT-1A, predecessor of the RCA TT-5A Transmitter now used by nearly 100 TV stations. Also announced the first "commercial model" TV camera.

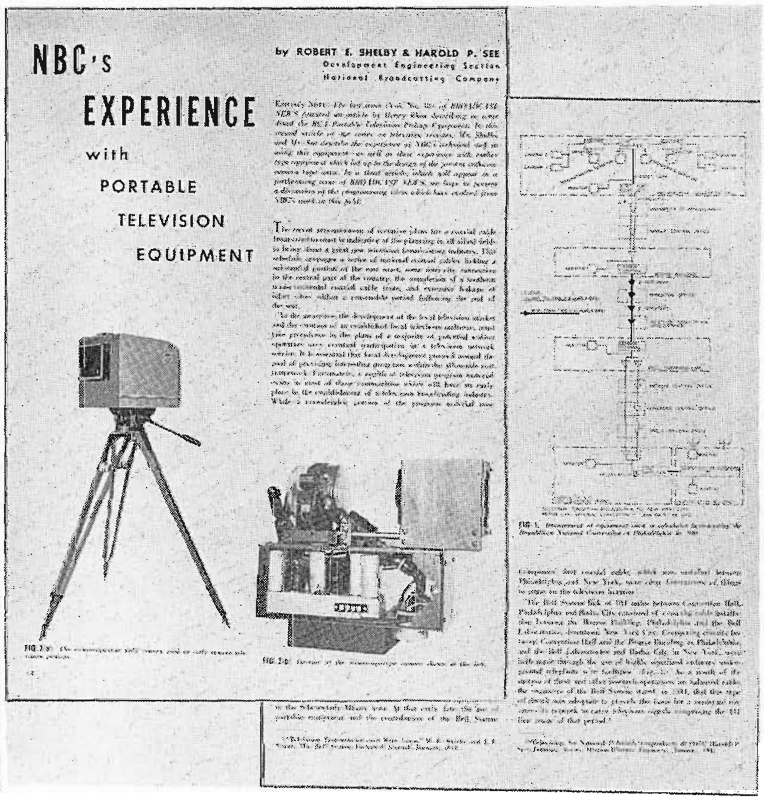
TELEVISION PIONEERING MILESTONES AS REPORTED IN TWENTY YEARS OF BROADCAST NEWS


BROADCAST NEWS • JULY, 1940

RCA TELEVISION FIELD PICKUP EQUIPMENT

Description Of Units Designed For Remote Pickups

JULY 1940 issue described RCA's new "Field Pickup Equipment". This was the first commercial-type field equipment to be produced. It set a pattern for field units which is still being followed. Today's units, although using image orthicons instead of iconoscopes, are arranged in very similar manner.


NBC's EXPERIENCE with PORTABLE TELEVISION EQUIPMENT

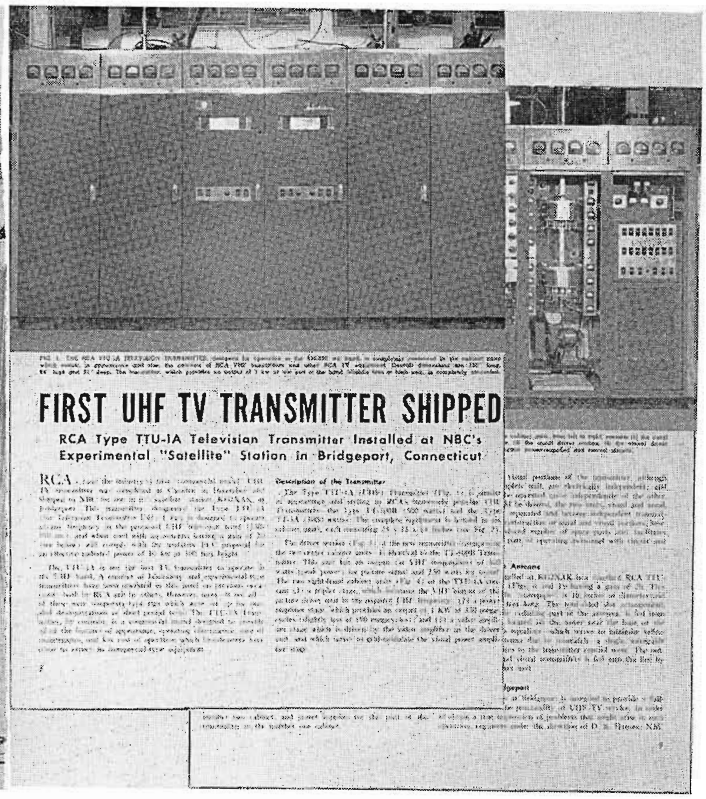
by ROBERT E. SHELBY & HAROLD P. SEE
Development Engineering Section
National Broadcasting Company

AUGUST 1944 issue carried this article on NBC's experience with the pre-war RCA Field Equipment (described in the July 1940 issue). The experience of NBC engineers with this, and other early equipment, formed the background of nearly all early post-war TV planning.

JANUARY 1946 saw the first article describing the new RCA Image Orthicon, the camera pickup tube which obviated the need for extremely high light levels and thereby made possible today's TV techniques. BROADCAST NEWS was among the first to recognize the tremendous portent of this development. In a six-page article, complete with illustrations depicting televising by candle-light, the new tube was described in terms of near rapture.

OCTOBER 1946 issue carried an eight-page picture story describing the new RCA TK-30A TV Camera—the first TV camera to use the image orthicon, and the first TV camera to be produced in quantity. An unusual engineering success, and an immediate hit, this camera has been the standard of the industry ever since. Today, some five years later, nearly 800 TK-30A Cameras are in use all over the world.

JUNE 1947 issue heralded the advent of the first new TV station to go on the air following the war. Winner of a close race for this honor was KSD-TV in St. Louis. BROADCAST NEWS paid tribute with a ten-page article describing the station's equipment facilities in detail. This was the first of a series of TV Station stories which in the five years since then has included descriptions of 17 of America's top TV stations.



JANUARY 1950 issue carried first story on a new aspect of television—the burgeoning interest in the UHF spectrum. As a result of early tests in Washington, D. C., RCA decided to field test UHF television at a site near Bridgeport, Conn. A "commercial-type" transmitter, built by RCA for this test, was the subject of this BROADCAST NEWS article.

Twenty Years of

(T)HE PHILOSOPHY OF OUR TV SYSTEM

(A) Brief Review of the Functions of the Most Important Parts of the TV (Sy)stem, With An Explanation of the Reasoning Behind the Choice of (St)andards, Type of Transmission, Shape of Synchronizing Pulse, Etc

by JOHN H. ROE
Supervisor
TV Systems Engineering Group
Engineering Products Department

HOW TO GET THE BEST PICTURE OUT OF YOUR IMAGE ORTHICON CAMERA

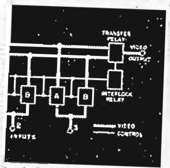
by H. N. KOZANOWSKI
Advance Development Group
Television Terminal Equipment Section
Engineering Products Department

(TE)ST AND ALIGNMENT PROCEDURES FOR VIDEO AMPLIFIERS

By
F. E. CONE and N. P. KELLAWAY
TV Terminal Equipment Engineering

HIGH GAIN AND DIRECTIONAL ANTENNAS FOR TELEVISION BROADCASTING

by LESTER J. WOLF
Engineering Products Department



TV REMOTE CONTROL SWITCHING

By
W. E. TUCKER & C. R. MONRO
Television Terminal Equipment Group

New Video Relay Switching Systems Handle Many and Complex Variations of TV Programs Economically

HOW TO ADJUST FREQUENCY RESPONSE IN VIDEO AMPLIFIERS FOR TV

JOHN H. ROE
TV Terminal Equipment Engineering
RCA Engineering Products Dept.

VERSATILE VIDEO SPECIAL EFFECTS SYSTEM

By E. M. GORE
Television Terminal Equipment Engineering

TELEVISION STUDIO ACOUSTICS

by
M. RETTINGER
RCA Victor Division
Radio Corporation of America
Hollywood, California

On Means of Measurement of Output Plate A. C. Voltage (in) Television Deflection Circuit During Scanning Interval

by J. M. BRUMBAUGH
Television Terminal Equipment Section
Engineering Products Department

HOW TO USE THE TELEVISION STABILIZING AMPLIFIER

by JOHN H. ROE
Television Terminal Equipment Section
Engineering Products Department

DIRECTIONAL ANTENNA SYSTEMS

At Microwave Frequencies

By C. A. ROSENCRANS
Terminal Equipment Section
Engineering Products Department

COMPOSITION OF THE VIDEO WAVEFORM AS SEEN ON THE SCOPE

By ROBERT M. CROTINGER
Remote Engineering Supervisor
Station WHIO-TV

The most common oscilloscope pattern seen in television is that of the standard RMA video signal in its entirety when viewed at sweep frequencies of 7,875 and 30 cycles. An analysis of why these patterns look different from the standard textbook representation brings many things to light.

STANDARDIZING AND MEASURIN(G) VIDEO LEVELS IN A TV STATIO(N)

by J. H. ROE
TV Terminal Equipment Engineering

TV STUDIO ILLUMINATION

By
H. M. GURIN* & R. L. ZAHOUR**

TV TECHNICAL ARTICLES have, in recent years, gradually replaced similar articles on AM and FM. While most station engineers were not yet in television, nevertheless, nearly all were looking forward to it, and preparing for it insofar as possible. Articles of this kind, containing material of a type found almost nowhere else, have been received with great enthusiasm by TV station engineers.

Broadcast News

TV PLANNING ARTICLES have also been very popular. All of these articles were written especially for BROADCAST NEWS and have been slanted to the special interests of station engineers with the idea that they should be of direct usefulness to these engineers in planning their own installations. They cover every aspect, from first "idea" planning down to the actual choice of equipment.

Twenty Years of


WMAR-TV
BALTIMORE, MD.

by CARLTON G. NOPPER
Chief Engineer WMAR-TV, WMAR-FM

WHIO-TV DAYTON

Miami Valley Broadcasting Corporation's Unusually Well-Planned Studio Transmitter Plant Was Designed and Erected By The Austin Co...

WOR'S TV STUDIOS

By NEWLAND F. SMITH
Engineer-in-Charge of Television
WOR-TV, New York

Building and General Facilities

WCAU-TV

by JOHN G. LEITCH
Technical Director
WCAU, WCAU-FM, WCAU-TV

KGO-TV, SAN FRANCISCO

by the
KGO-TV Engineering Staff

WENR-TV

by
E. C. HORSTMAN
Engineering Director, ABC Central Division
and
J. M. VALENTINE
Supervisor of TV Operations, WENR-TV

KANSAS CITY'S
WDAF-TV
KANSAS CITY · MISSOURI

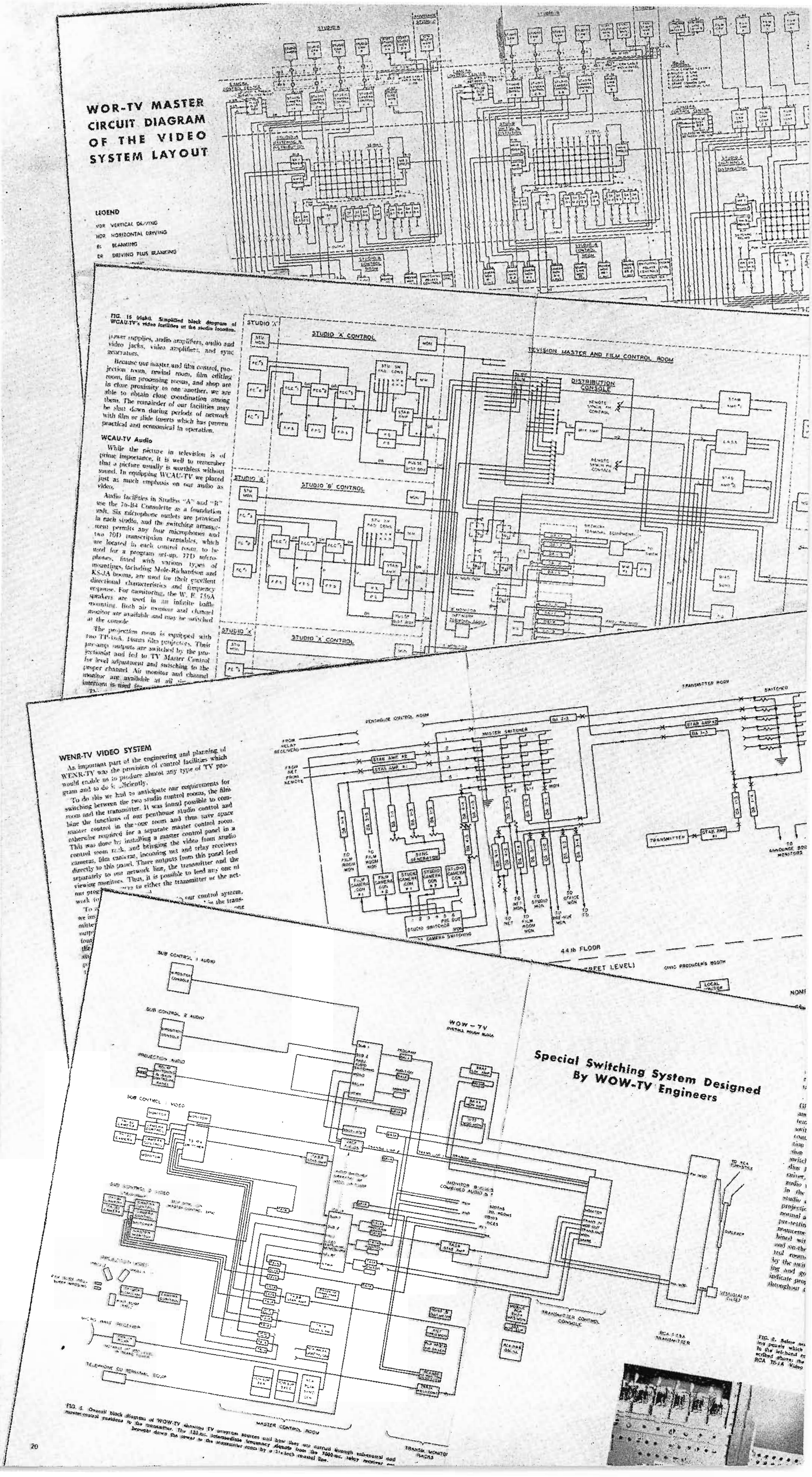
WDAF-TV raised the video curtain for Kansas City back in September 1949. Excellent reception of regularly-scheduled programs of film, studio shows and field pickups has been confirmed as far distant as Witchita, 178 miles away. WDAF-TV is Kansas City's only TV outlet.

• Mr. Dean Fitzer, Manager of WDAF and WDAF-TV.

THE KANSAS CITY STAR.
Television Comes to Kansas City Today Through Station WDAF-TV

TV STATION STORIES have become an outstanding feature of almost every issue. Some 17 of these stories running from eight to twenty or more pages in length, have appeared since the first KSD-TV story (see Pg. 7). All have been accompanied by large numbers of photographs showing, not only equipment, but also the design of studio and transmitter buildings, construction of studios, etc.

Broadcast News



SCHEMATIC DIAGRAMS showing extent and arrangement of audio and video circuits used in the TV stations described have been a part of most TV station stories. When related to the physical operation of these stations, the description of these circuits serves to indicate to other station engineers the extent of equipment facilities required for various types and sizes of operations.


WPIX Baseball

HOW NEW YORK'S NO. 1 SPORTS STATION SETS UP ITS EQUIPMENT AND CONDUCTS OPERATIONS AT THE POLO GROUNDS — WITH PHOTOS FROM THE MONITOR SCREEN SHOWING FIELD OF VIEW WITH VARIOUS CAMERAS, EFFECT OF ZOOMAR LENS, AND TYPICAL

HE SELECTS ONE OF THREE CAMERA PICTURES FOR TRANSMISSION

WHAT THE VIEWER SEES AS THE CAMERAMAN "ZOOMS IN" ON VARIOUS PARTS OF THE FIELD

IN TYPICAL SWITCHING SEQUENCE WPIX MIXES ZOOMAR SHOTS WITH CLOSEUPS FROM CAMERAS No. 2 & 3

IF HE WISHES HE CAN DO A WHOLE SWITCHING SEQUENCE WITH THE ZOOMAR CAMERA ALONE

ON AN OUTFIELD HIT WPIX USUALLY FOLLOWS THE BALL OUT AND BACK WITH THE ZOOMAR

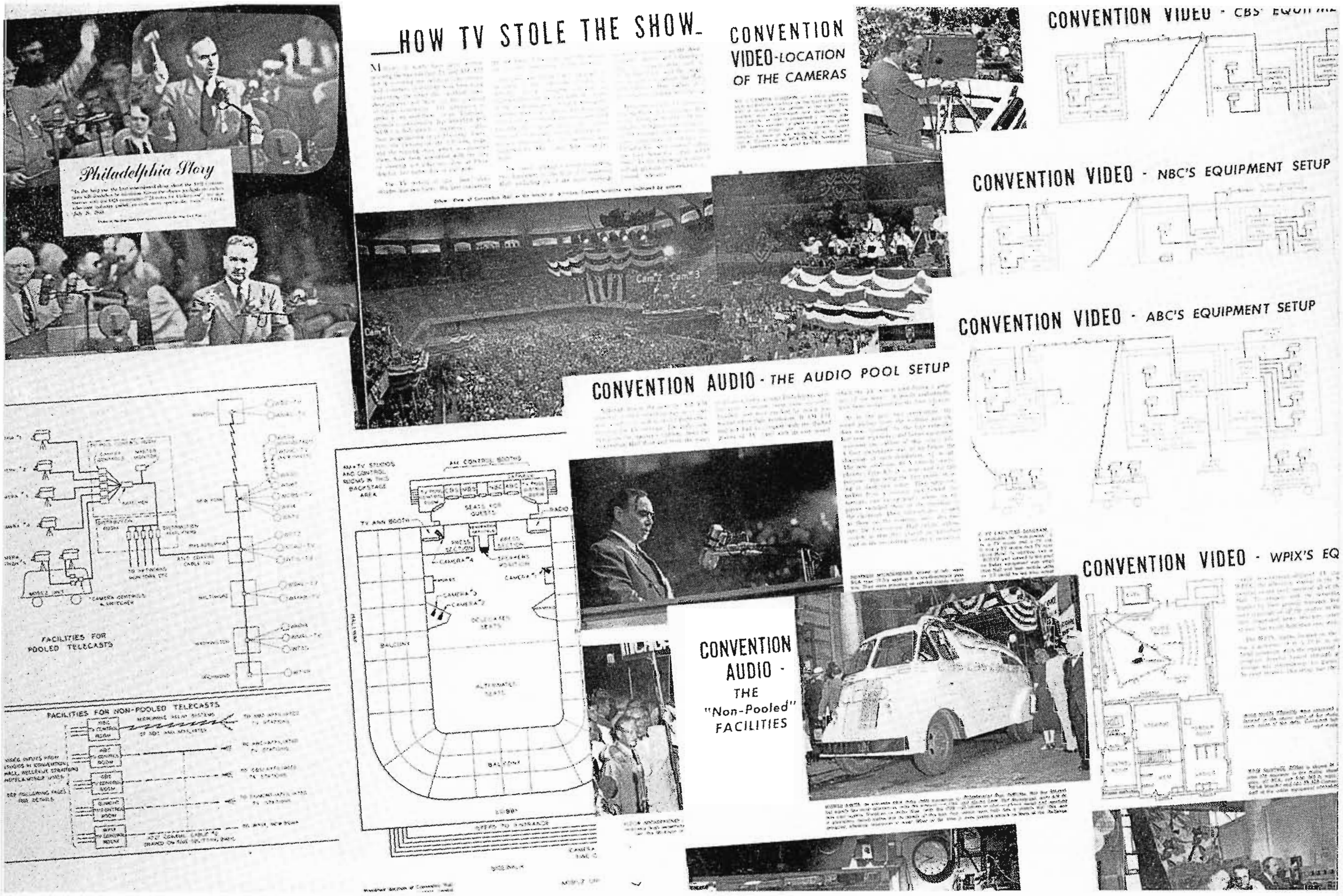
COMMERCIALS COME NATURALLY ON WPIX BASEBALL TELECASTS

BASEBALL TELEVISING TECHNIQUES have been described in exhaustive detail in several issues of BROADCAST NEWS. Because of a large number of baseball telecasts the early experience in this field was considerable and could be used as a guide to other types of field operation.

FOOTBALL TELEVISING TECHNIQUES, less standardized than baseball telecasts, were the subject of this article which, like many BROADCAST NEWS articles, was written especialy for this publication by an outstanding network engineer with direct personal experience in this field.

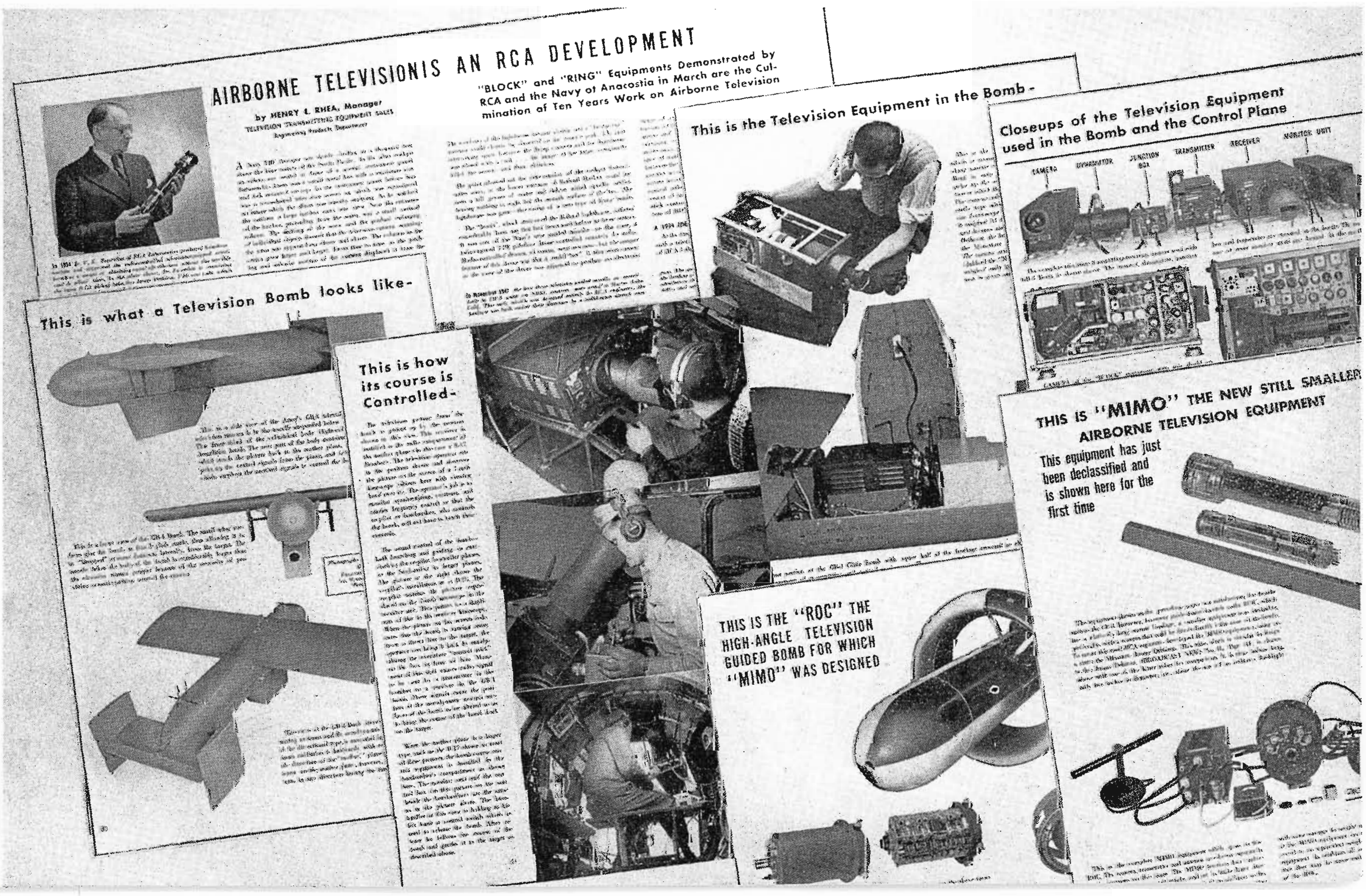

Televising FOOTBALL FROM LOS ANGELES COLISEUM

By PHILIP G. CALDWELL



CONVENTION TELEVISING TECHNIQUES were exhaustively described in this article which portrayed in photographs, sketches and copy, the equipment setups used by each of the networks in covering the 1948 political conventions for television.

OTHER TV DEVELOPMENTS, in fields outside that of broadcasting, have occasionally been reported in BROADCAST NEWS. This has been done only when such developments seem to portend future developments in broadcast TV equipment, as, for instance, this story on evolution of lightweight "airborne" TV.



INTRODUCTION TO BROADCAST NEWS INDEXES

WHAT IS INCLUDED

The BROADCAST NEWS Master Cross-Reference Index is a handy guide for reference to the numerous articles which have appeared in the 66 volumes of BROADCAST NEWS since 1931. Representing a 20 year accumulation of technical information, the index has been composed in three main parts to facilitate its use. The first section is a "Chronological Listing of BROADCAST NEWS" issues, showing issue or volume number, printing date, and an "index key number" (this is simply the volume number followed by two zeros). The second section is a "Master Table of Contents" which lists by title and author—according to volume and page number—every article printed in volumes 1 through 66. The third section is the "Cross-Reference Index" which includes every article, in volumes 1 through 66, listed categorically, under main and subheadings according to subject matter, uses, or other helpful classifications.

WHAT THE "INDEX" HEADINGS MEAN

The *main headings* are used to designate particular subject matter, in alphabetical order, within a particular alphabet letter group. In cases where one heading satisfactorily includes all pertinent articles, only one appears. Where it is necessary to break down further the main headings, two or more *subheadings* are used. These subheadings have been indented to show further breakdowns as needed.

WHAT THE NUMBERS MEAN

The numbering system indicates the "BROADCAST NEWS" issue or volume number as well as the page number in the specific issue or volume. For the issues 1 through 9 all references are 3 digit numbers—the first digit designates the volume number and the second and third digits designate the page or pages in the particular issue. For the issues 10 through 66 the the same system is used, but references are made to 4 digit numbers. The first two digits designate the volume number and the third and fourth signify the page or pages in the particular volume. *For example,* 904 refers the user to page 4 of volume 9; similarly, 3521 refers the user to volume 35, page 21.

HOW TO USE IT

The BROADCAST NEWS Cross-Reference Index is easy to use, since practically every listing appears several times, under a different heading. For example, the user seeking information about "transmitting equipment" will find it listed "all-inclusively" under "E"—Equipment, and "T"—Transmitting Equipment. If it is desired to obtain data which applies only to a specific class of Transmitting Equipment such as AM, FM or TV, the user will find these listed "selectively" under "A" AM—Transmitting Equipment, "F" FM—Transmitting Equipment and "T" Television—Transmitting Equipment. Thus, it is not necessary to sort through information which is not pertinent to the user's immediate needs.

BROADCAST NEWS—CHRONOLOGICAL LISTING

Volume	Date	Index Key No.	Volume	Date	Index Key No.	Volume	Date	Index Key No.
1	October 1931	100	23	December 1936	2300	45	June 1947	4500
2	January 1932	200	24	May 1937	2400	46	September 1947	4600
3	April 1932	300	25	June 1937	2500	47	December 1947	4700
4	July 1932	400	26	November 1937	2600	48	March 1948	4800
5	October 1932	500	27	December 1937	2700	49	May 1948	4900
6	January 1933	600	28	July 1938	2800	50	August 1948	5000
7	April 1933	700	29	January 1939	2900	51	October 1948	5100
8	August 1933	800	30	May 1939	3000	52	December 1948	5200
9	November 1933	900	31	July 1939	3100	53	February 1949	5300
10	February 1934	1000	32	May 1940	3200	54	April 1949	5400
11	May 1934	1100	33	July 1940	3300	55	June 1949	5500
12	August 1934	1200	34	August 1940	3400	56	September 1949	5600
13	December 1934	1300	35	February 1941	3500	57	Jan.-February, 1950	5700
14	February 1935	1400	36	May 1941	3600	58	March-April 1950	5800
15	April 1935	1500	37	September 1941	3700	59	May-June 1950	5900
16	June 1935	1600	38	January 1944	3800	60	July-August 1950	6000
17	September 1935	1700	39	August 1944	3900	61	Sept.-October, 1950	6100
18	December 1935	1800	40	January 1945	4000	62	Jan.-February, 1951	6200
19	April 1936	1900	41	June 1945	4100	63	March-April, 1951	6300
20	June 1936	2000	42	January 1946	4200	61	May-June 1951	6400
21	July 1936	2100	43	June 1946	4300	65	July-August 1951	6500
22	October 1936	2200	44	October 1946	4400	66	Sept.-October 1951	6600

BROADCAST NEWS MASTER TABLE OF CONTENTS
(Volumes 1 Through 66)

KEY TO INDEX NUMBERING (ISSUES 1 THROUGH 9)

(A) First digit indicates "Broadcast News" volume or issue number. (B) Next two digits indicate the pages on which articles begin.

BROADCAST NEWS MASTER TABLE OF CONTENTS—(Cont'd)

KEY TO INDEX NUMBERING (ISSUES 1 THROUGH 9)
(A) First digit indicates "Broadcast News" volume or issue number.
(B) Next two digits indicate the pages on which articles begin.

KEY TO INDEX NUMBERING (ISSUES 10 THROUGH 66)
(A) First two digits indicate "Broadcast News" volume or issue number.
(B) Next two digits indicate the pages on which articles begin.

BROADCAST NEWS MASTER TABLE OF CONTENTS—(Cont'd)

KEY TO INDEX NUMBERING (ISSUES 10 THROUGH 66)

(A) First two digits indicate "Broadcast News" volume or issue number. (B) Next two digits indicate the pages on which articles begin.

BROADCAST NEWS MASTER TABLE OF CONTENTS—(Cont'd)

KEY TO INDEX NUMBERING (ISSUES 10 THROUGH 66)

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(A) First two digits indicate "Broadcast News" volume or issue number. (B) Next two digits indicate the pages on which articles begin.

BROADCAST NEWS CROSS-REFERENCE INDEX

(Volumes 1 Through 66)

Trends in BROADCAST AUDIO

W. E. STEWART, Mgr.
Audio Engineering Section

1952 The latest RCA Microphone to be announced is the BK-1A Pressure type, successor to the 88-A.

1950 The BK-4A Starmaker Microphone, a Ribbon-Pressure type suited for Television use.

The audio equipment required to set up a satisfactory studio installation comprises an important part of the Broadcast Station's investment. Thus, its purchase and installation is generally treated with serious study; and once installed, it must serve for a long time. To discern trends we must go back over 20 to 25 years of Broadcast history, since most of the installations of 10 to 15 years ago are still in use.

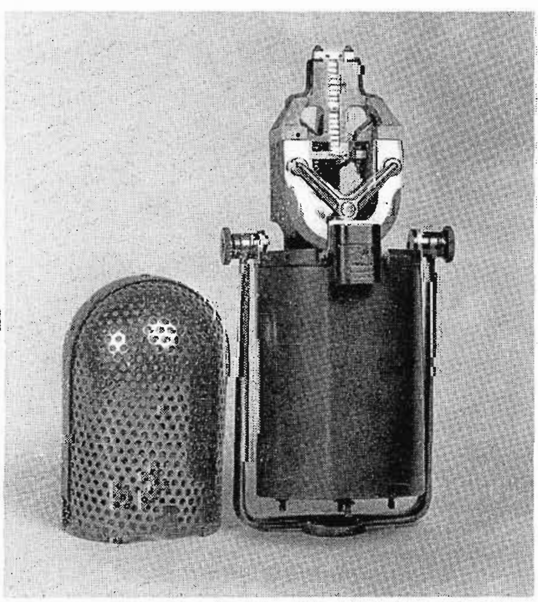
The accompanying group of pictures have been chosen to illustrate typical construction as nearly as possible, with some indicating the period at which an item first appeared. There are several phases to trends that can be considered.

Suppose we start with styling. Most of the early control room equipment was black as was the power plant equipment and the automobile of 25 years ago.

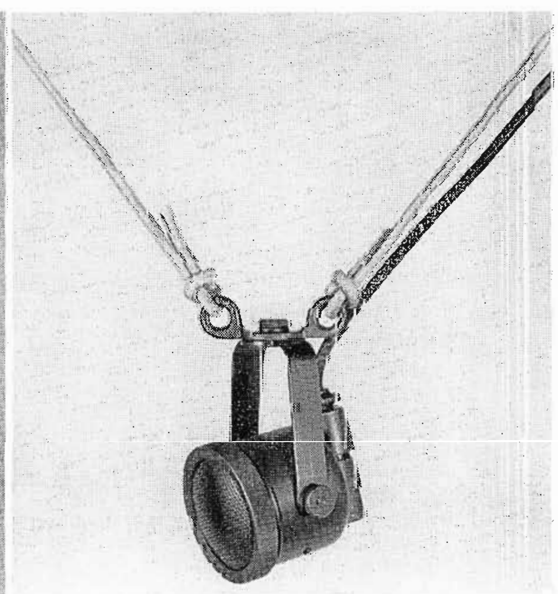
The first attempts to liven the appearance of this equipment consisted of adding chrome plate. Whole chassis and various louvres were plated to give them a flashier appearance.

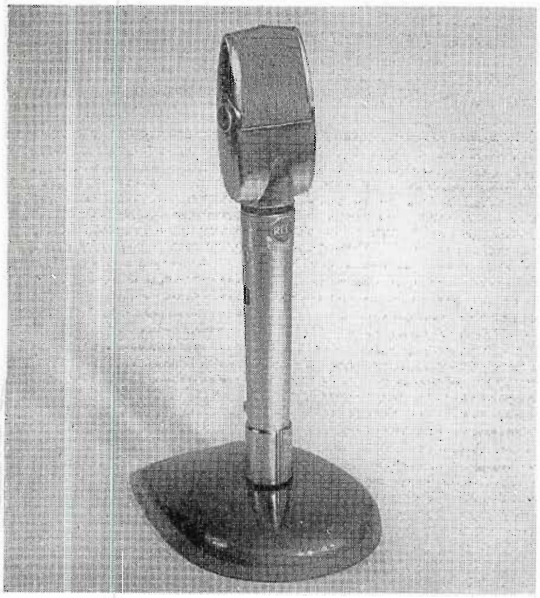
1938 The 88-A Pressure Microphone (successor to the 50-A) has been widely used for announce and newscasting.

1936 The Type 77-A Universal (Ribbon) Microphone, forerunner of the present-day "77-D".



1933 The Model 50-A Pressure type, first in the line of induction microphones.





1948 The KB-2C "Bantam" Velocity Microphone, designed for studio or remote use.

1944 The popular 77-D Ribbon type which may be used as a "bi-directional", "non-directional", or "uni-directional" microphone.

1938 The 77-C, Universal (Ribbon type) Microphone, a predecessor of the famous 77-D.

About this time the use of color became common and various manufacturers standardized on certain colors to make their equipment distinctive. This made the stations more color conscious (or perhaps the stations led the manufacturer, I don't know who was first), and they occasionally demanded color schemes of their own.

As color came in chrome went out so far as the control room is concerned, and outside surfaces were made plainer. This makes it easier for the station to change the color to its choosing.

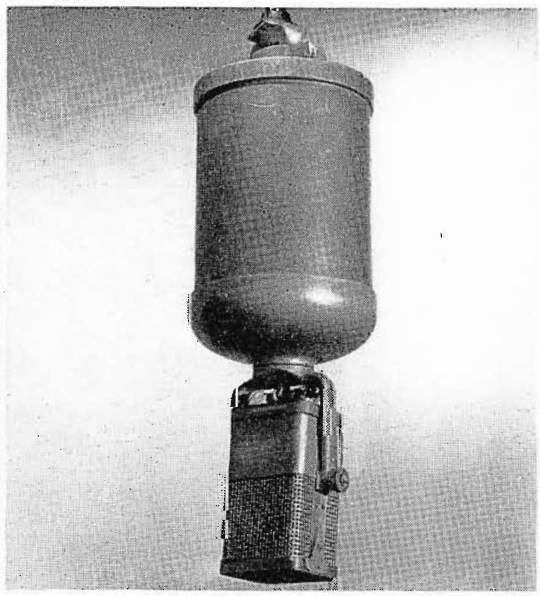
Now that TV is with us, the control room must be darkened. Dull surfaces, lighted meters and dials, and better vision over the control desk are some of the most recent changes in this line.

Color has been put to work in several recent cases to indicate related switching and mixing functions. The CBS Audio Console for TV; the NBC Audio Console for TV; and the new RCA consolette are examples of this trend.

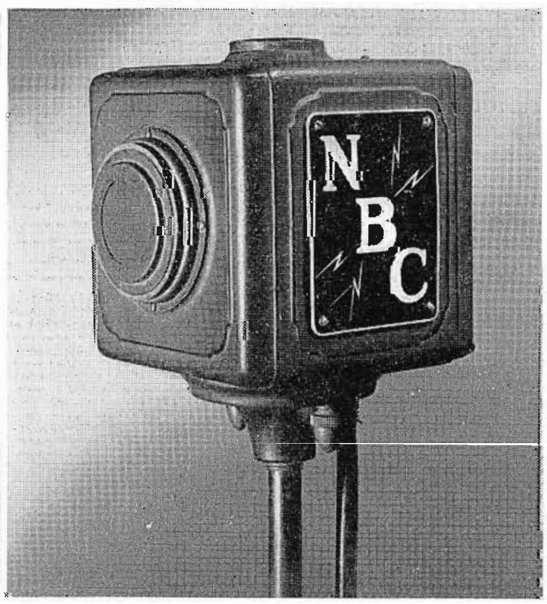
A well planned control room can be a real show place for visitors, and the smooth lines of today can give an impression of efficiency even better than the gadgety racks of 15 years ago.

In the studio, microphones have had quite a different history. This item is before the producer and subject to his demands. It remained large and gaudy until

1932 The 44-BX Velocity Microphone has become the standard of broadcasting where the highest quality of reproduction is desired.



1930 An early model Ribbon Microphone (Velocity type). Note attached pre-amplifier and use of electromagnetic field.



1928 An early Condenser type Microphone with pre-amplifier attached.

TV came along. Now, it must suddenly become unobtrusive. It must have its glitter removed, lest it become a beam in the TV camera's eye. Smaller microphones, and microphones with dull finishes are now available for this application. For AM, the smaller microphones are finding use in interview work, but the old standards are not changing rapidly in the studio.

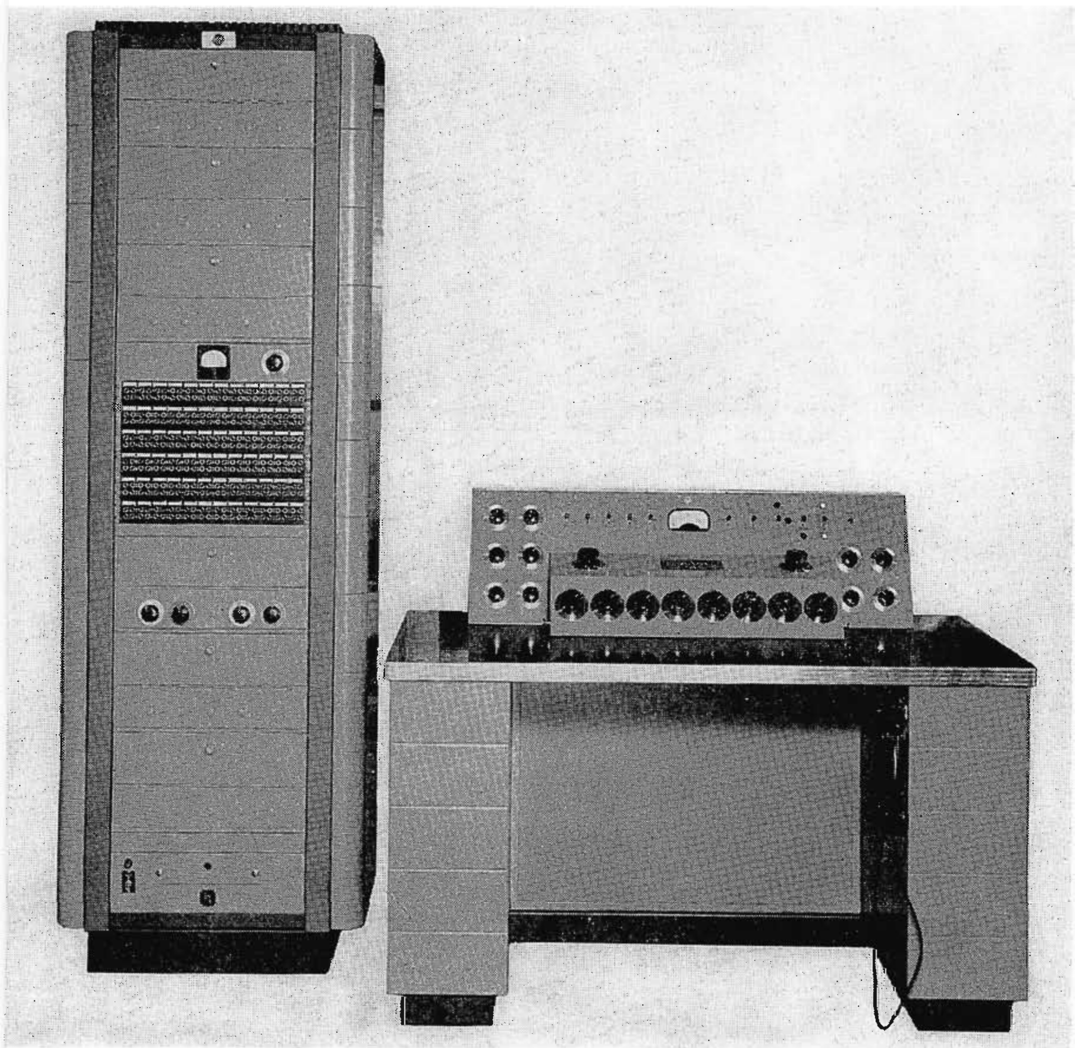
Again in the control room, the reduction in size of units, compactness of control consoles, and technical improvement in switching has kept up with the growth of systems. Amplifiers are getting smaller. Where a preamplifier formerly required 3½ to 5 inches of rack space, you can now put 6 in 8¾ inches. The new CBC Master Control System in Montreal has a still smaller amplifier and so does the new RCA consolette.

Master control systems are becoming larger. More and more stations have come to the realization that a well planned Master Control system can reduce the cost and improve the performance of their operation at the same time. As the opportunity ripens, various stations are rebuilding their systems.

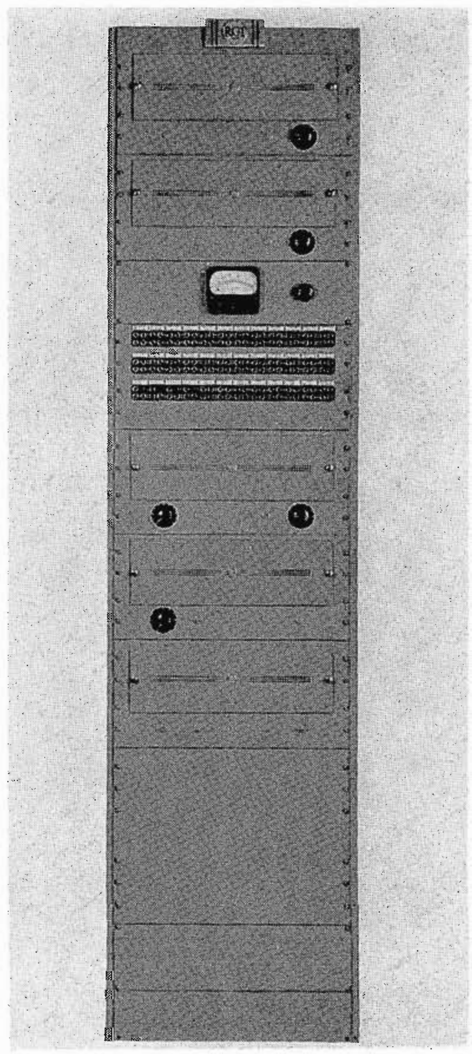
The Voice of America installation in New York City, built during the last war, and the new CBC switching system at Montreal are outstanding examples of large installations. 25 to 50 circuit switching is required in some cases. A control system was installed in Vatican City, Italy, last summer that accommodates ten men at the central control desk, each man handling the program in a different language.

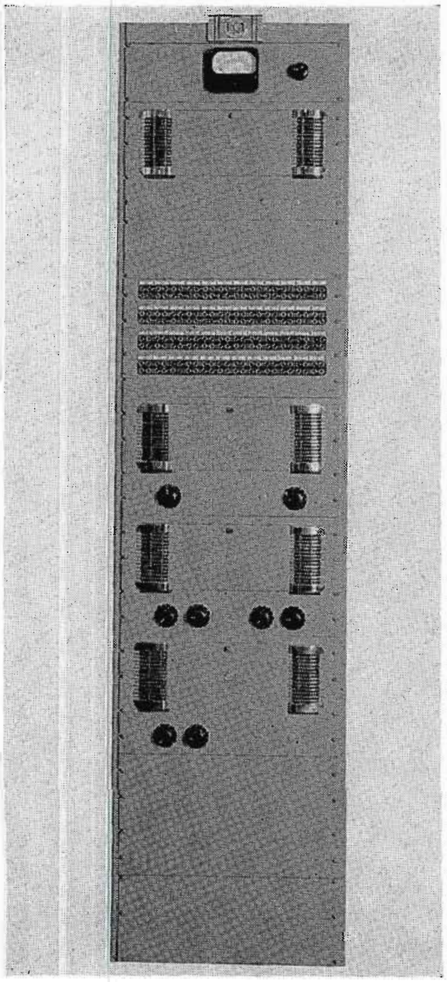
While the systems are becoming large, and more input and output channels are required, stress on planning with skillful application of these trends which have improved efficiency and flexibility has kept the size of the control room and central operating desks to a minimum of expansion. Note the increased amount of equipment within reach of the operator in recent control desks.

1948 Modern Broadcast Studio Control Console and companion audio equipment rack of the BR-84 series. Note matched appearance and styling of rack and console.

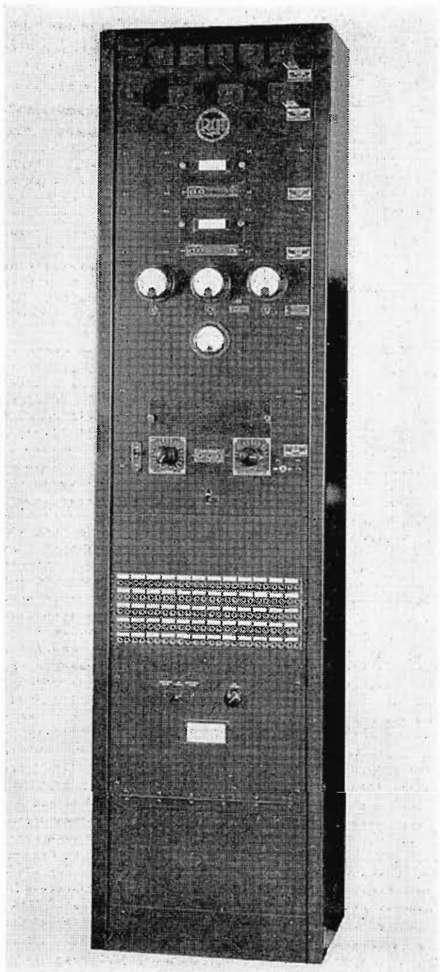


1940 Audio equipment rack of the RCA Type "9 AX" series. Note trend toward streamlining.

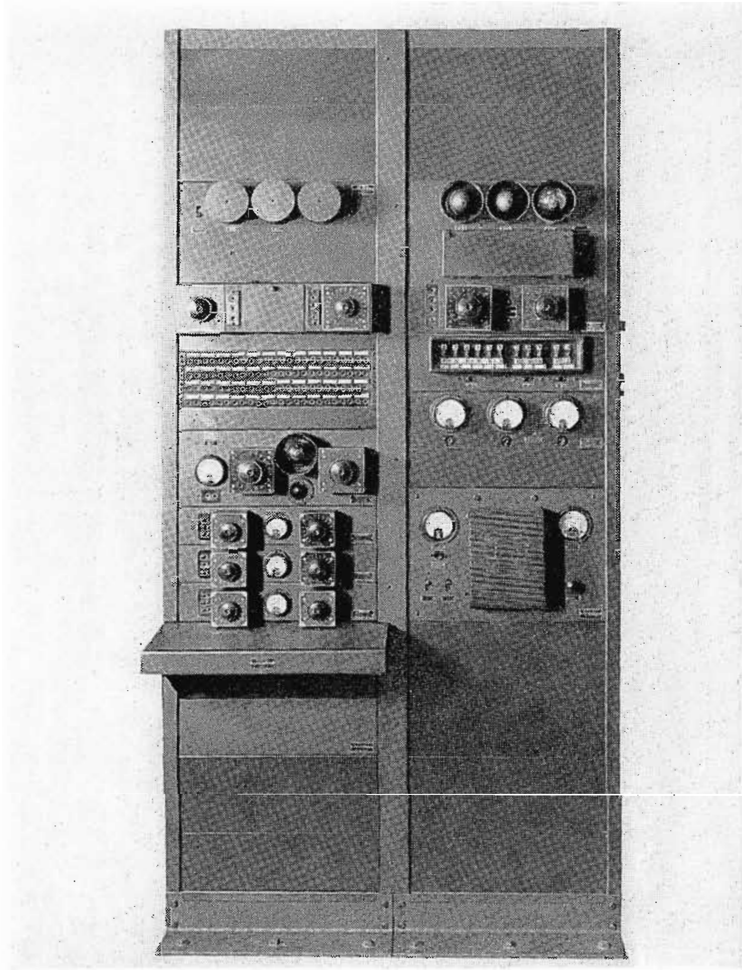




1936 Audio equipment rack showing use of chrome plate, different amplifiers, and "square-type" meter.

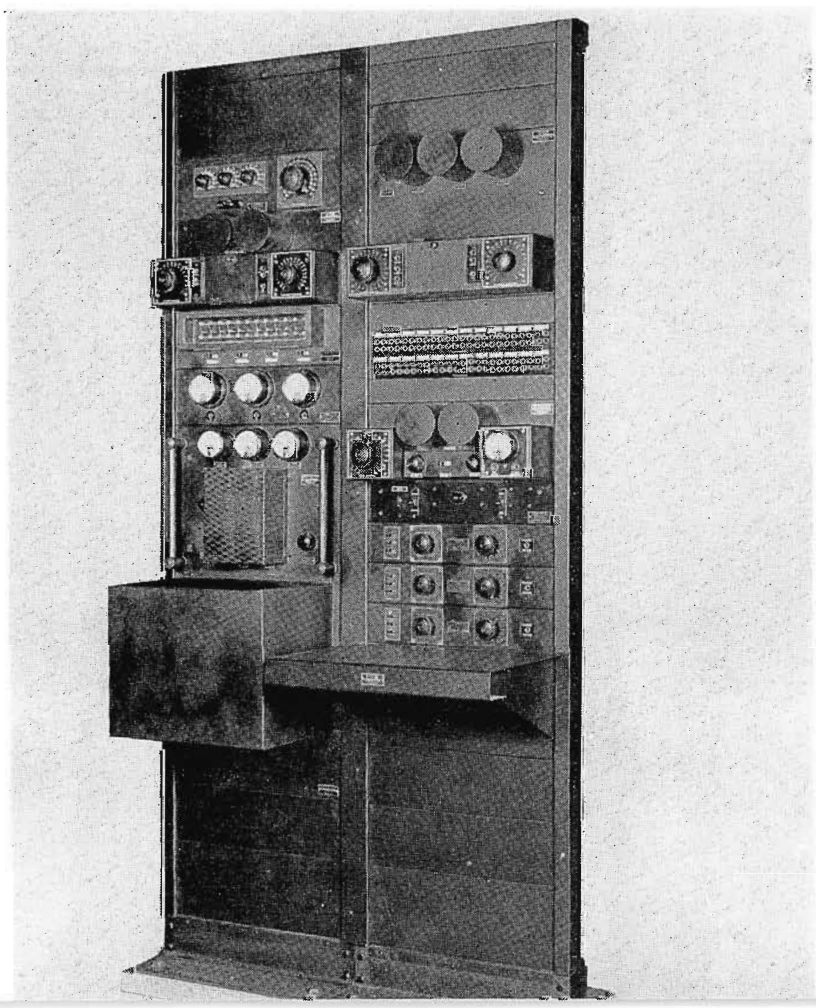


1934 Early audio rack which employs round meters and some components still mounted on the front panels.

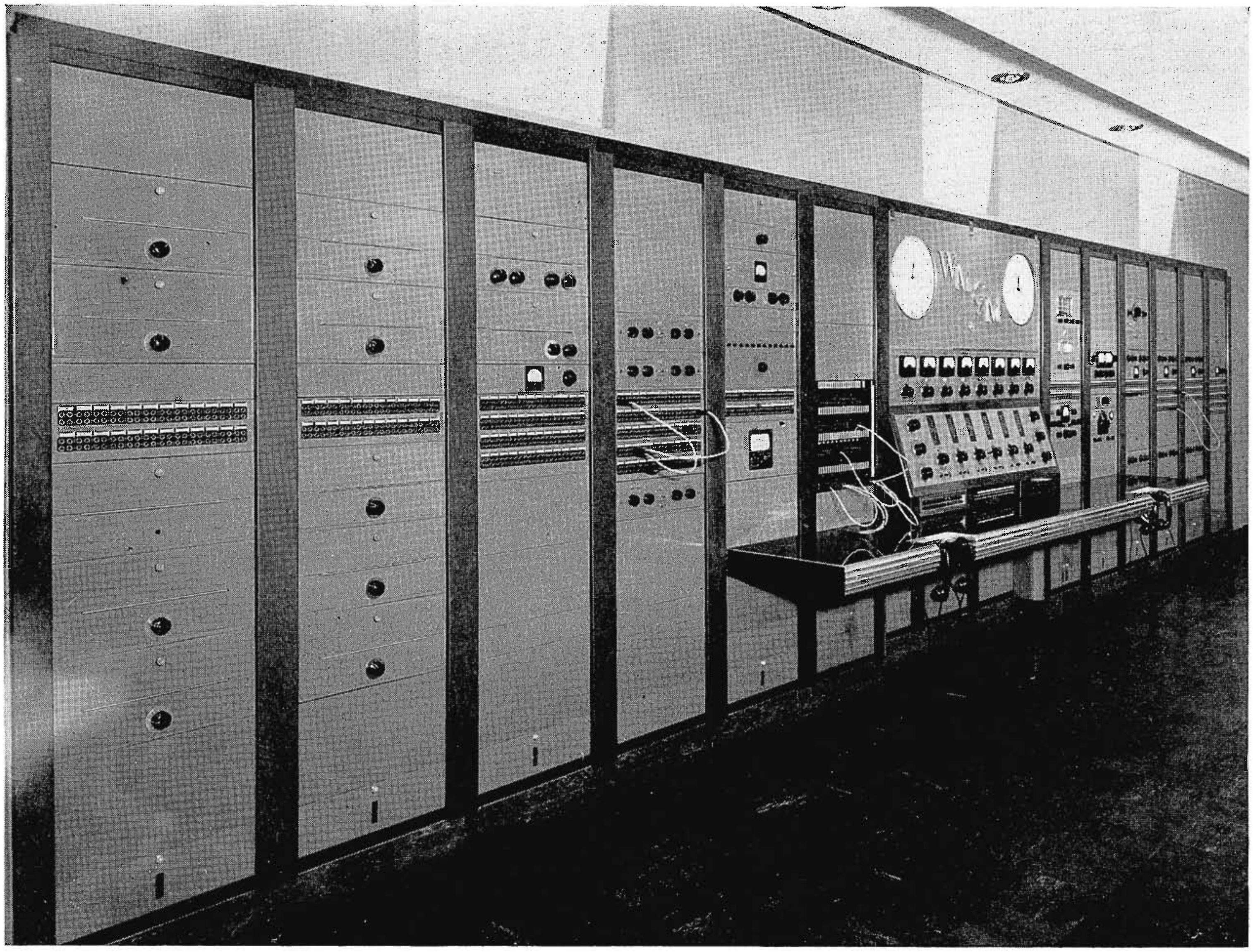


1932 Early version which shows the use of tubes and components mounted on the front panels.

Some form of preset system is usually necessary. This is usually planned to conform to the division of labor as found in the particular union contracts, to use men's time more efficiently, to make the switching as mistake proof as possible, and to assign definite responsibility. If an operator knows that he is responsible for a certain operation and that errors in its execution can be traced to him, he is less likely to make an error. Error prone operators can be quickly pinned down and moved to other jobs. Recent Master Control plans show definite improvement along these lines.



1932 Another early audio equipment rack in which tubes, components are mounted directly on panels. Note the greater number of controls and adjustments required.



1948 A deluxe, custom-built Master Control Console installed at Radio Station WMGM. It handles ten studio inputs and feeds six channels simultaneously, or individually by preset relay system. Note how the twelve audio equipment racks are installed "in-line" at either side of the operator's position for convenience and accessibility.

TV has made new problems in MC switching and interesting results are beginning to emerge from the struggle with this operation. In nearly every case, ways are being sought to make a single control perform both the audio and video switching. To do this and still keep flexibility as to source, previewing and other functions under control presents many new engineering problems. Several approaches to this problem are in use or being planned and will no doubt be the subject of future Audio Engineering articles.

Trends in Audio would not be complete without some mention of recording.

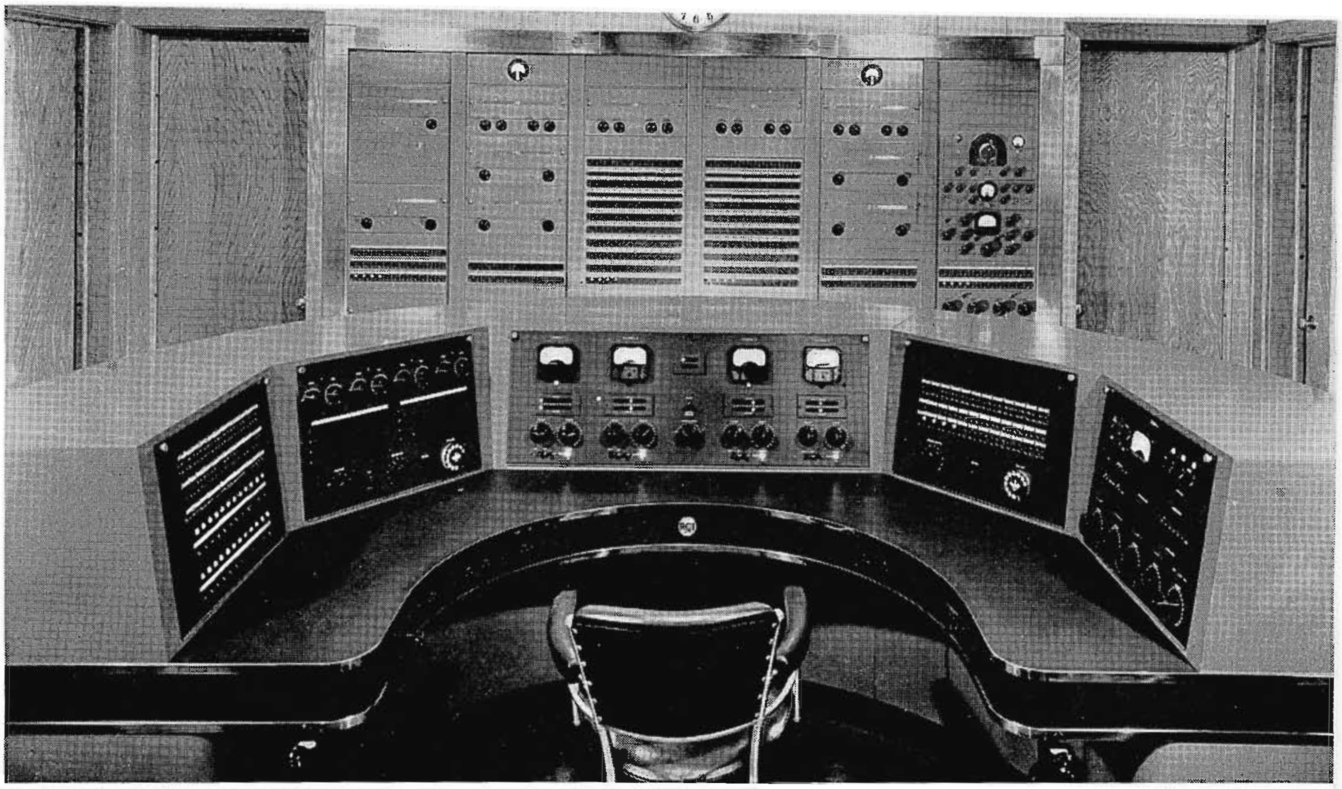
The most important item has been the sudden addition of magnetic tape recording. Its use is still on the increase. New applications are still being found for this excellent programming tool.

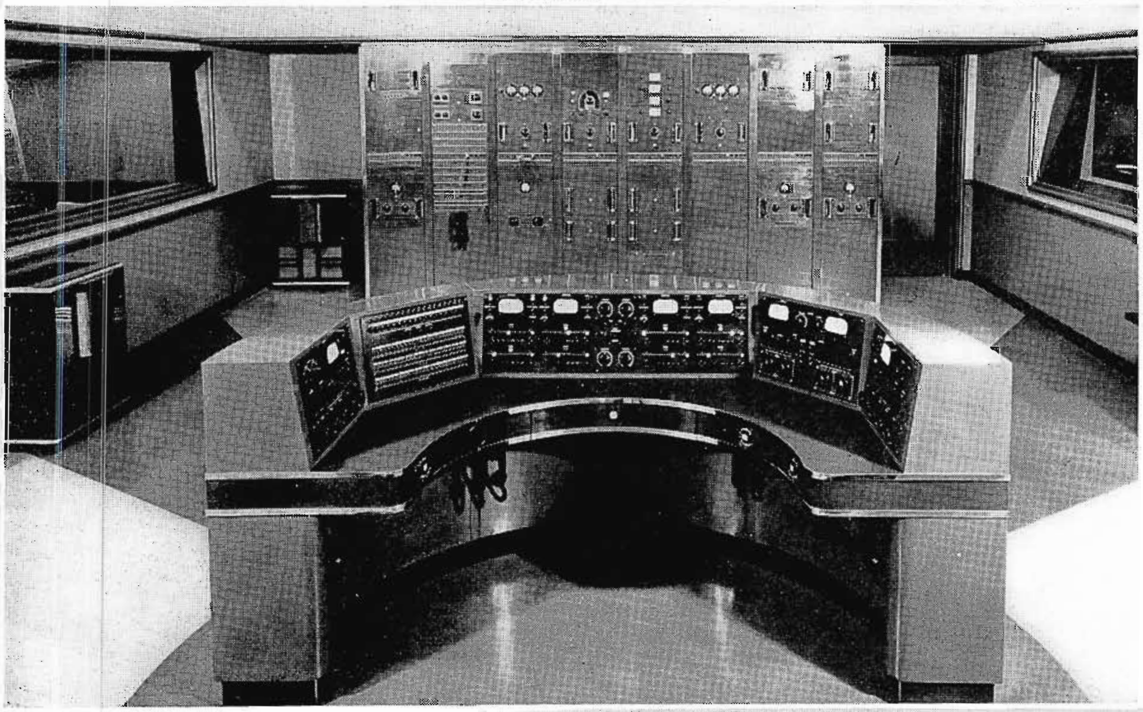
The advent of tape seems to have slowed disc recording somewhat, but it is still a big business. Discs still have many advantages. The disc jockey programs use as many records as ever and fine groove recording is gaining slowly.

Hot stylus recording has offered some improvement in acetate recording but is still somewhat experimental.

In summary: Overall trends indicate larger installations, circuit-wise; smaller components to give more compact installations; and centralization of control. With respect to style we have the additional use of color, and simpler appearance.

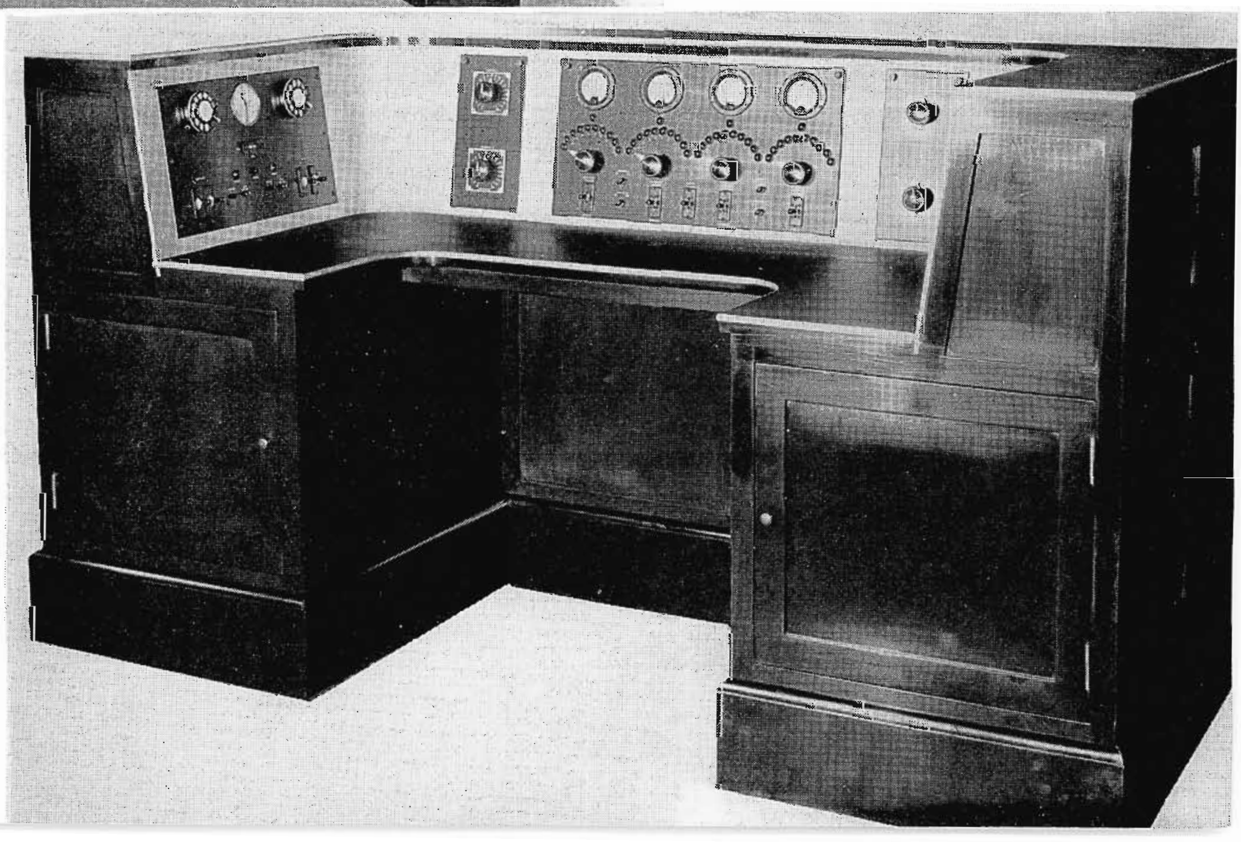
1940 Master Control Console installed at Radio Station WLS. In this arrangement controls, meters and switches are convenient to operator by a "U" type turret arrangement. Audio racks are installed nearby at the rear of console.





1938 Master Control Console and associated audio equipment racks installed at Radio Station WFBR. This shows the trend toward bringing controls, meters and switches into convenient operating range.

1935 Early WGN Master Control Console. Note that fewer controls and switches are convenient to the operator's position.



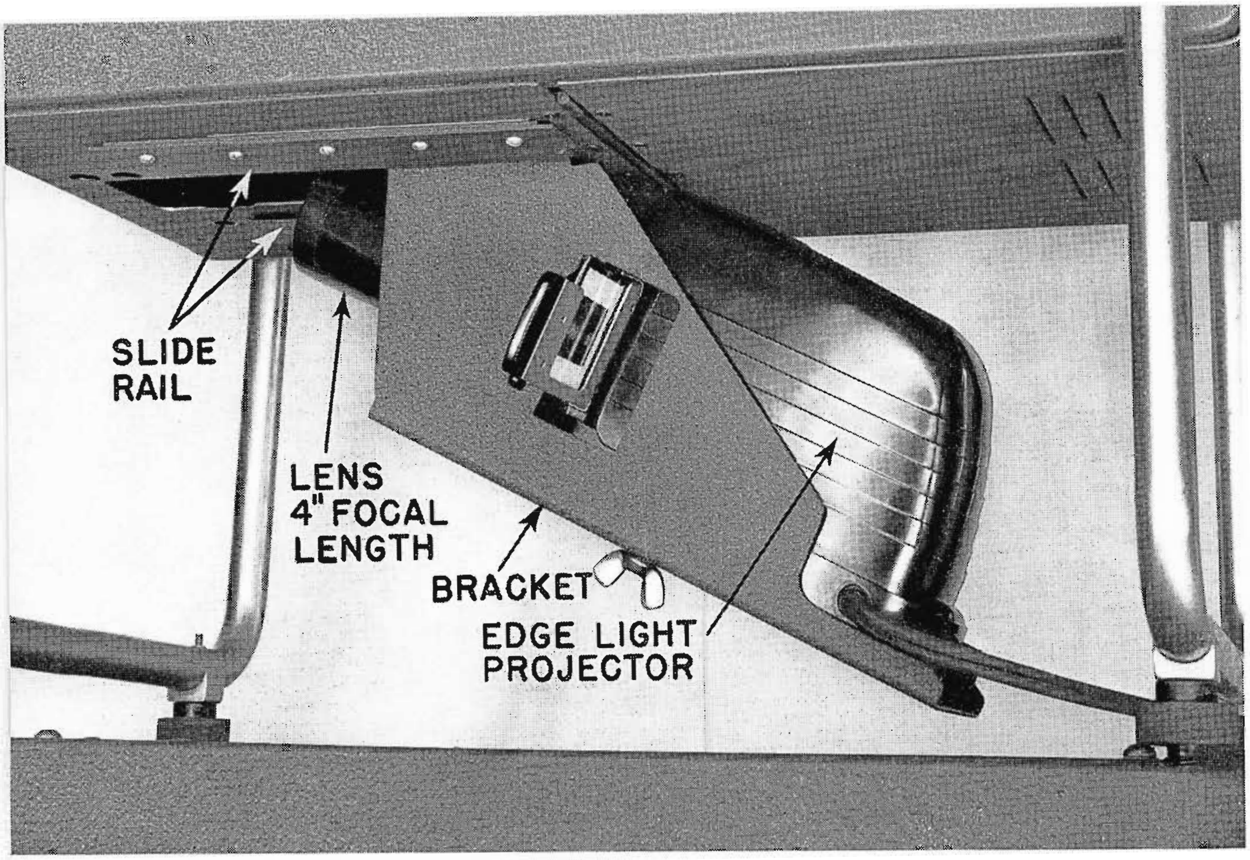


FIG. 1. External Edge-Light Projector Assembly shown in operating position on the under side of the TK-20A Film Camera.

IMPROVED TELEVISION PICTURE PERFORMANCE

Step-by-Step Description on How to Modify RCA Film Camera Equipment

by H. N. KOZANOWSKI
TV TERMINAL EQUIPMENT ENGINEERING

Developments in the art of television broadcasting during the past few years have shown very forcibly that programming is depending more and more heavily on film material either as a basic source of programs or for continuity in live broadcasts as well as for the usual advertising sources. It has also been recognized that the quality of film transmission as compared to live-talent material leaves, in many cases, much to be desired. An ideal situation would be one in which the home viewer would not be aware whether the source of broadcast material were live talent or film recording. With the now wide-spread and continuing increase of kine-photography this criterion of performance becomes more and more vital to the success of any long-range operation. For this reason, we have studied possible methods of improving motion picture reproduction in television broadcasting and have arrived at a very encouraging conclusion. The iconoscope film chain, when suitably operated and improved according to our recent findings, can produce pictures which closely approach studio quality.

We shall discuss the basic philosophy of operation of the iconoscope film chain, paying specific attention to the factors which at present limit performance, pointing out their relative importance, and then outlining in greater detail the changes which can be made in existing equipment to bring the standard of performance up to the quality which has been produced in the laboratory. Work during the last year on developmental iconoscope film chains has resulted in the crystallization of specific improvements which contribute to better overall film reproduction. Demonstrations to critical viewers over a long period have indicated that these improvements are significant.

We have prepared this discussion and information in order that stations which wish to introduce these improvements will have sufficient detailed data to do this themselves without waiting approximately six months, the estimated time in which RCA can furnish the required modification items. For purposes of logical presentation, we can list the areas of improvement and then discuss each item in detail.

1. Video Amplifier
2. Mosaic Illumination
3. High Peaking and Microphonics
4. Amplifier Over-load
5. Black Level Control

1. Video Amplifier

The predominant source of noise in an iconoscope chain is not the iconoscope itself but the first-stage amplifier. Extensive study of this problem has resulted in the development of a cascode preamplifier using the Western Electric 417A triode for the input, feeding an RCA 6J6 as the output tube. This preamplifier unit, shown in Fig. 2, physically replaces the conventional triode-connected RCA 6AK5 stage used in existing equipment. Since the transconductance of the 417A tube is approximately 25,000, the improvement in equivalent noise resistance over the RCA 6AK5 is 5 to 1 giving an equivalent reduction in noise voltage which is the square-root of this number of 2.24 to 1. This means that for the same voltage amplification the signal-to-noise ratio of the chain increases by at least a factor 2. This is certainly of primary importance. In addition, the use of the cascode amplifier makes the Miller effect relatively small as compared to that which exists in the conventional triode preamplifier. The overall voltage gain of the WE417A, RCA 6J6 cascode amplifier with a 1000 ohm load resistance is 24 as compared to approximately 8 for the original RCA 6AK5 stage. The 417A-6J6 cascode amplifier is particularly subject to parasitic self-oscillation in the region of 80 to 240 Mcs. These have been suppressed by the use of small resistors in the first and second grid circuits and in the output-plate coupling condenser lead. By-pass condensers of very low inductance have also been provided in the filament circuits to provide stability against parasitic oscillations and pickup from filament supply. We have found it essential to operate the heaters of the cascode amplifier from D.C. in order to eliminate completely the familiar sharp 60-cycle "glitches" which exist on practically all 60-cycle power lines. The matter of heater power supply will be discussed in detail later. It has been found that the use of the RCA 6J6 in the second stage of the cascode amplifier entails practically no sacrifice in performance and at the same time allows the tube to be operated within heater-to-cathode voltage rating. Since the tube is already used in the output stage of the camera, its application in the cascode amplifier represents a definite advantage from the standpoint of reduction in the tube cost and stock maintenance.

2. Mosaic Illumination

A. Edge Lighting

This problem is one of the most subtle problems connected with the correct operation of an iconoscope chain. It is perhaps interesting to outline the function of an edge light in this manner: Any iconoscope which has "normal" sensitivity resolution and storage will have a rather restricted range of beam current (0.1 to 0.2 micro-amps.) within which satisfactory operation can be obtained. This is determined fundamentally by the effectiveness of edge lighting in providing sufficient photo-emission from the mosaic frame to suppress edge and bottom flare associated with a given beam current. Restating the situation: It is important to operate with a maximum beam current within the above limits which can be used with the available edge lighting to produce a substantially flat and "flare-free field *when the active portion of the mosaic is in complete darkness*. This edge-lighting requirement may vary between iconoscopes. The reason for choosing an unilluminated mosaic as a reference lies in the fact that flare is particularly prominent and annoying in fades to black and in low-key scenes. If the field can be made flat and black by the control of edge-light intensity and by introduction of electrical shading signals, all other modes of operation at higher light levels on the mosaic are non-critical of adjustment. It is important to point out that when correct and adequate edge-lighting is used, the flare is no longer dependent on the picture content of the active portion of the mosaic and therefore edge-lighting is introduced as a fixed adjustment during the initial setup of the iconoscope and need not be changed during actual use.

B. Effects of Stray Light on Storage

A factor which cannot be ignored is the effectiveness of edge-lighting in the illumination of the edges of the mosaic, also called the frame or mask, without at the same time throwing an appreciable amount of useless stray light on the active mosaic area. This useless light produces two effects which are inter-related. We are here concerned primarily with motion picture operation with light-pulse exposure occurring during vertical blanking time. In this case, all available picture information is on the mosaic as a stored charge image and should ideally persist at full amplitude from top to bottom of the vertical scan. Stray light from any source, either edge lighting, back lighting, or accidental ambient room light, falling on the mosaic will tend to wipe out the charge image, giving a poor storage characteristic, and will produce a signal of progressively decreasing amplitude from top to bottom of the picture. This can, of course, be electrically shaded to have a flat axis but will show progressive slumping of detail contrast from top to bottom of the picture. Evidence from pulsed-light single-frame operation of stationary film indicates that, in the absence of edge, back, and stray light, the average iconoscope storage characteristic is excellent, but deteriorates rapidly with an increase in the intensity of stray light falling on the working surface of the mosaic.

The mechanism of the effect of stray light on the mosaic can be outlined by the following argument. Assume that the light application pulse is rectangular and lasts for 5% of the total field scanning time and that the light input-mosaic potential relationship is substantially linear. Then the average value of lighting is 1/20th of the rectangular light pulse peak. Now let us further assume that the stray light is uniformly distributed over the mosaic. What must be its maximum permissible value in order to have a tolerable small effect on storage? If the light range of film material is 40 to 1, a typical value for motion picture film, the black gamma step would be represented by 0.5 foot-candles on the mosaic and the white level step by 20-foot candles. Now if there is an area at the bottom of the mosaic which is black 0.5 foot-candles, as a result of the light application pulse, an increment of a 0.5 foot-candles due to stray light will raise the effective potential of this area to that corresponding to one-foot candle; whereas the highlight potential has at the time been raised to 20.5 foot-candles equivalent, decreasing the effective charge image contrast ratio from 40 to 1 to 20.5 to 2. Thus a stray-light level of 2.5% of the average projector light intensity is sufficient to knock down the contrast ratio in the image by 2 to 1 at the bottom of the raster. Tests have been made of this reasoning by the use of a calibrated grey-scale wedge at the top and bottom of the picture under pulse-light or motion picture operating conditions.

Using an external projector to produce uniform stray light and adjusting the stray light to equal the average projector illumination, it is very easy to bracket the limits for permissible stray light. Using neutral density filters having 1, 2, and 5% transmission, one can demonstrate that 5% produces intolerable wash-out of storage, 2% is quite noticeable, while 1% represents an adequately low and readily attainable value. It should be pointed out that the effect of stray light is cumulative, having very little influence immediately after the

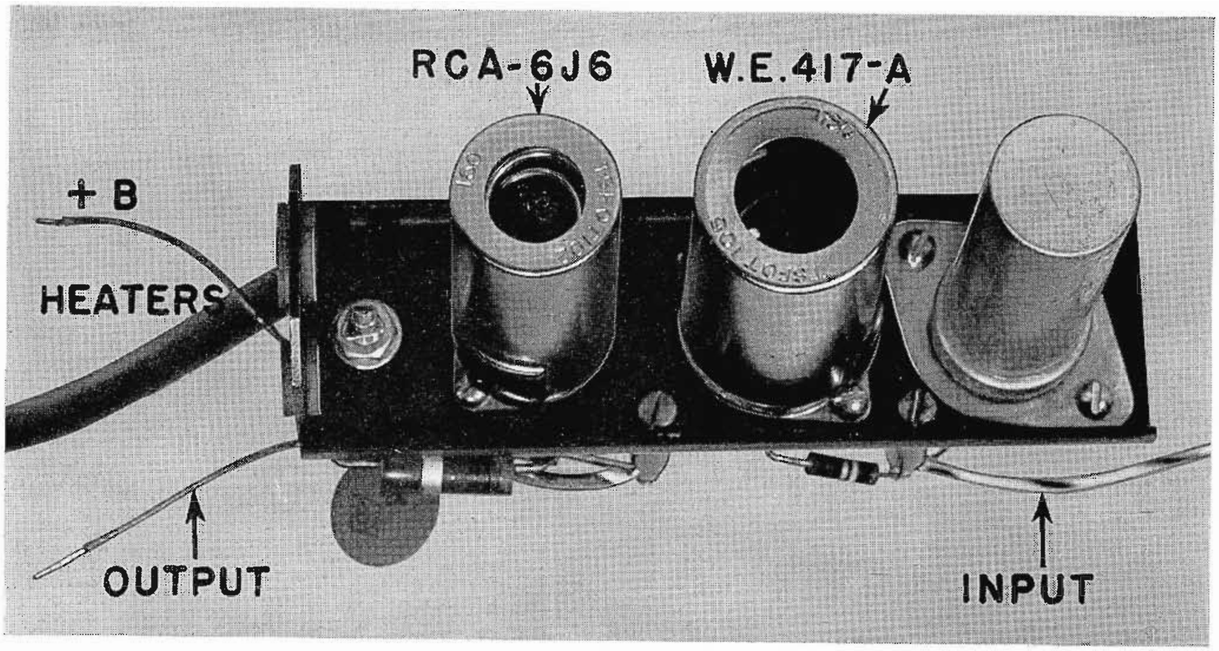


FIG. 2. Low-Noise Cascode Preamplifier shown as it appears from the front.

light pulse and having greater and greater effect towards the bottom of the scan. The present edge-lighting produced by the line source filament and the opaque slotted mask results in rather poorly defined edge-lighting and a rather large amount of scattered light on the active mosaic area when compared with the same "effective" edge-lighting intensity from an external edge-light projector. This is due to a great extent to the necessity for firing the edge-lighting image through the lower glass seal region of the iconoscope front face plate. This region may be inhomogeneous, striated, and quite variable from tube to tube. "Effective" edge lighting intensity is that which will suppress the edge and bottom flare in the iconoscope output signal *with no light on the mosaic* at the maximum operable beam current without causing the storage characteristic to deteriorate markedly. Various possibilities for edge lighting were investigated. An external projector edge-light mounted below the camera has been developed which has excellent performance and which does not hamper the chain operationally. This is shown in Fig. 1 and will be described in detail later. As a result of our tests, it is our opinion that many iconoscopes criticized for poor storage actually have adequate storage but may work under severe handicaps as a result of limitations in the edge-lighting or back-lighting sources.

C. Infra-Red Filters

The use of infra-red and heat absorbing filters in the projector light path and in edge lighting sources has been investigated by several independent groups. It has been found that a polished plate of Corning #9788 filter glass* approximately 5mm in thickness or equivalent does an excellent job in attenuating the high-energy infra-red and red components of the incandescent source to which the iconoscope is normally quite sensitive and thereby gives improved detail contrast and apparent gain in resolution.

The improved contrast with the use of a red cut-off filter for technicolor movies is truly startling, the contrast range going from very small values with no filter to completely acceptable values with the filter. A probable explanation of the observed effect is that when the lens is focused for a visible light image, the infra-red image is out of focus or diffuse, but still responsible for a large proportion of the mosaic photo emission. Removal of this component by the filter leaves only the sharp image information which results in gain of both resolution and contrast ratios. In the case of color film, the transmission of infra-red components between various color dyes in the various sections of the picture is substantially the same, producing practically no differential contrast. With removal of the infra-red, the dye absorption of visible light previously masked by the over-riding infra-red transmission is again normal and gives the observed increase in contrast.

D. Bias or Back-Lighting and Automatic Black Level Control

The main function of variable intensity bias lighting is the illumination of the photosensitive walls of the iconoscope in order to furnish an easily adjustable source of low velocity electrons which act to stabilize the D.C. photoemission of the mosaic, the "floating" mosaic frame, and to actually increase the signal output of the iconoscope itself. It was pointed out by Schade in an unpublished memorandum in 1942 that with correct adjustment of edge and back-lighting intensity, taking precautions to keep stray light from the useful picture area of the mosaic, the iconoscope is capable of true D.C. operation. The iconoscope under these conditions generates a constant "peak white" signal in its output load resistor which is determined by wall and edge illumination and is generated during the horizontal and vertical blanking intervals when pulses are applied to the control grid of the iconoscope to cut off the beam current. This peak white signal is substantially independent of the illumination of the mosaic itself and once adjusted remains fixed for a given value of beam current. By adding to this peak white signal a constant "black pulse" or blanking wave, the resultant output wave behaves normally and, using circuits essentially identical to those in the image orthicon field and studio chains, gives a close approximation to true d-c presentation. Thus, an unilluminated mosaic will give zero pedestal height and a "fully" illuminated mosaic will give maximum pedestal height. With a slide, the action is fully automatic and produces a video signal in which elemental signal amplitude is directly related to the elemental mosaic illumination. Under pulsed-light motion-picture operation conditions, the black level setting addition is a fairly good approximation to the ideal, even when the iconoscope is used as a full storage device,

* Corning Catalogue #9788 ground to Transmission Curve 4-97, approximately 5mm. thick. Can be obtained from: Esposito and Stuhler Optical Co., 911 Willow Avenue, Hoboken, N. J.

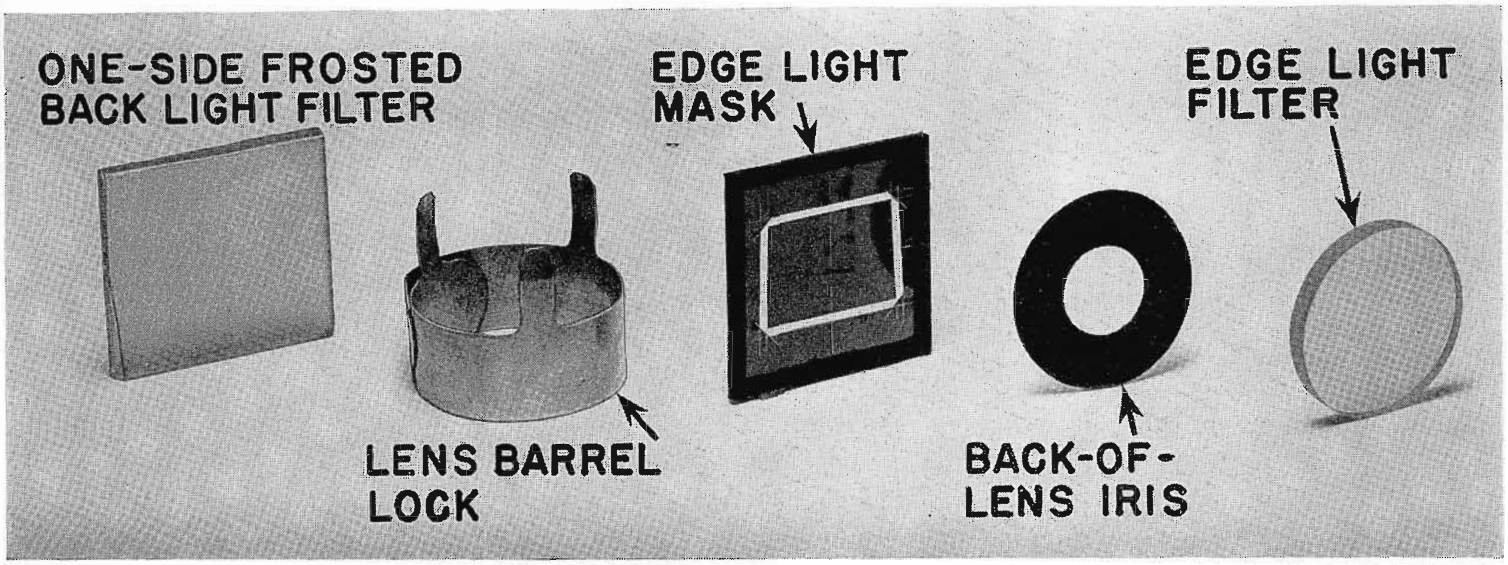


FIG. 3. Details of Edge and Back-Light Elements.

where the picture is pulsed on the mosaic during the vertical retrace interval. We believe that this "d-c" mode of iconoscope camera operation is one which has great operational importance since, with the other improvements, it makes it unnecessary for the operator to manipulate any pedestal height controls for artificial black-level setting. In addition, with controllable but fixed edge-and-back-lighting, any motion picture having tolerable transmission characteristics can be shown over the chain without touching *any* controls. This appears to us a major step forward from the present mode of operation where shading and pedestal control variation during a program has become a fine art requiring a well-developed sense of anticipation or reflex action, or has been ignored altogether.

The primary function of the back lighting in our mode of operation is that of effectively cancelling the application pulse signal in the video amplifier which is developed during vertical retrace time which has no direct functional part in operation but is the cause of serious amplifier overload. It is quite normal for this video pulse signal during retrace time to be 5 to 15 times as large as the useful video signal during the scan cycle. It is essential in setting up a chain to use the minimum amount of edge-and-back lighting to achieve flare suppression and application-pulse cancellation for smallest signal deterioration due to stray-light effects over the active mosaic surface.

Tests have shown that the present back-light source operated from D.C. and using an infra-red filter with additional diffusion is adequate for our purpose. Fig. 3 shows the back-light diffusing filter, projector lens barrel lock to provide additional rigidity in the assembly, special edge-lighting mask slide, iris, and edge-light lens filter.

3. High Peaking and Microphonics

Detailed study of the high peaking problem as it applies to iconoscope input circuit compensation has shown that our present high impedance R-C plate compensating circuit can be replaced by a two-stage R-C low impedance cathode peaking arrangment with substantial improvements both from the standpoint of compensation and freedom from microphonics. Calculations have shown that the frequency characteristic of the iconoscope output resistor shunted by the stray capacity can be compensated completely by a two-stage cathode high peaker arrangement having two time-constants which are substantially independent of each other in adjustment. The short time-constant peaking circuit affects only the high-end of the passband and the long time-constant peaking circuit affects only the low-end (45 kc). These two circuits can be adjusted exactly for no high frequency overshoot or low frequency trailing by a technique which is almost intuitive and very easy to acquire. The physical arrangements are shown in Fig. 4. It is important to point out that some very low frequency trailing may probably be present in the picture which is not affected by either of the cathode peaker controls. This is due to inadequate phase and frequency fidelity in the video amplifier low-frequency coupling circuits and can be practically eliminated by the use of a suitable low-boost circuit in the camera preamplifier as will be described later in detail. In order to suppress residual streaking in the film with a wide range of picture content the low frequency amplitude and phase characteristics of all video pre-amplifiers should be good to 300 cycles or even lower instead of to half-line frequency as had previously been assumed.

A very important improvement which results directly from the change in high-peaking arrangement is that of eliminating of microphonics. The present high-peaker is driven from two video amplifiers in series, having a total gain of 50, through the R-C-R divider having a low frequency attenuation of the order of 200 to 1. This means that with a 10 millivolt signal at low frequencies from the iconoscope 2.5 millivolts appear at the high peaker grid. Laboratory tests indicate that with tubes of the 6AK5 variety the equivalent sine wave voltage for an "average" microphonic tube is at least of this order of magnitude. Thus with a "microphonic" excitation of this reference amplitude the signal-to-microphone ratio is unity. With the cathode high peaker which has been developed the previous sampling network is no longer necessary and the low frequency input signal rises to 0.5 volts giving signal-to-microphonic ratio for the same microphonic excitation, of 200 to 1. The new arrangement allows us to use 6AK5's throughout and has shown that the microphonics problem due to the high-peaker has been eliminated.

On occasions we have definitely traced an appreciable portion of amplifier shot noise to the presently used high peaker. Since low frequency video input voltage to the high peaker grid is 1/4th of that existing at the iconoscope, sufficient amplification must be provided to bring this up to standard level, the tube behaving as another first stage and contributing shot noise.

4. Amplifier Over-Load

With the 417A-6J6 cascode input stage and two-stage cathode high peaking compensation we get considerable increase in system gain. This excess gain has been ab-

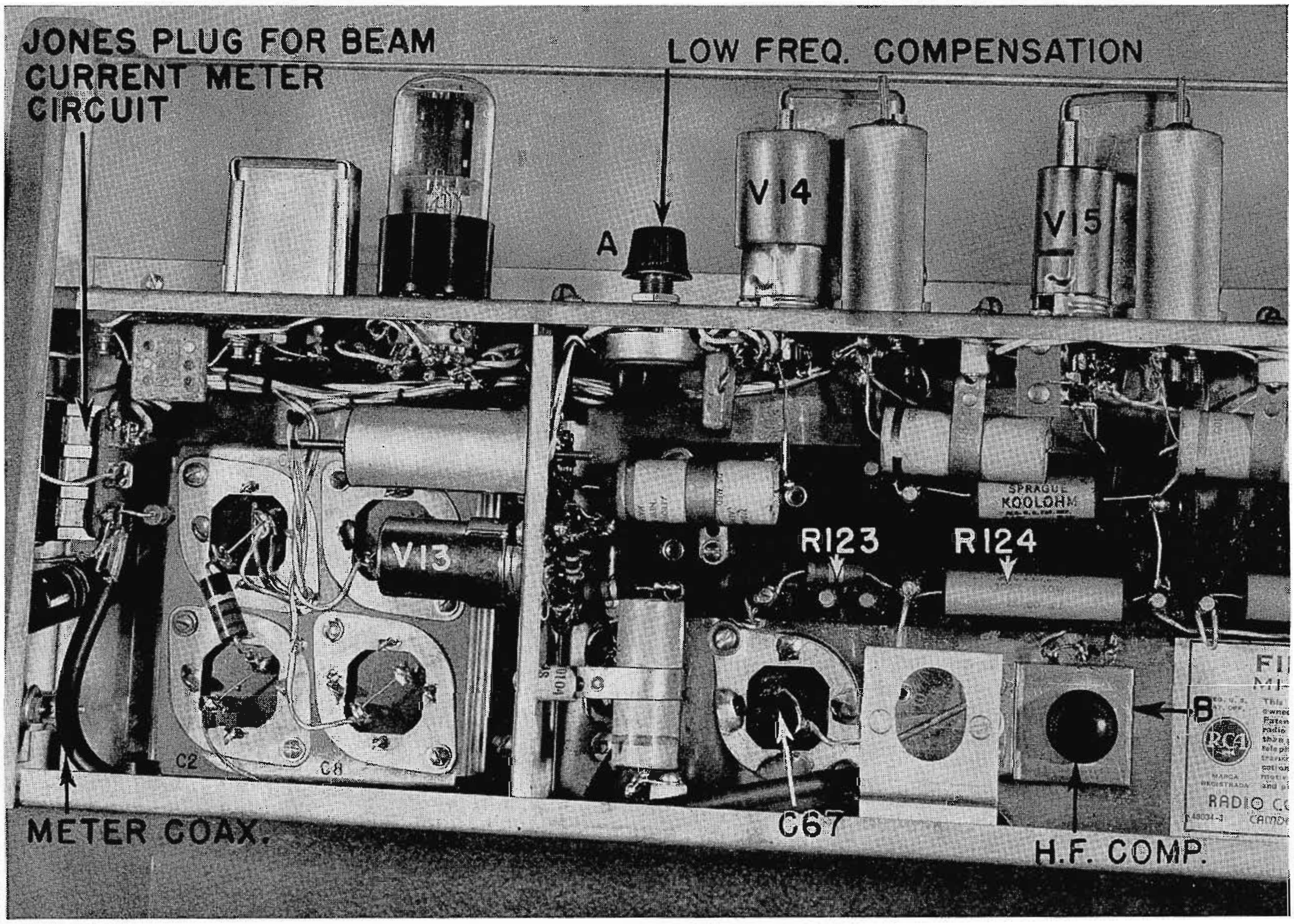


FIG. 4. Location of Compensation Controls.

sorbed in additional cathode degeneration, in order to obtain greater signal latitude for the video and application pulse signals and to minimize the problem of amplifier overload. It is important to point out that adjustments of bias lighting and edge-lighting will decrease, cancel, or reverse the polarity of the useless high amplitude video signal generated during the vertical blanking interval. Therefore, in actual operation, it is desirable to adjust back-lighting so as to just cancel the application-pulse signal, providing a condition of greatest freedom from amplifier setup and overload.

Effects of Deflection Non-Linearity and Yoke Distortion

The effectiveness of appropriate edge lighting on suppression or cancellation of flare is based on uniform or constant scanning velocity at the mosaic during horizontal and vertical sweep time. This requires careful adjustment of horizontal and vertical mosaic sweep linearity. Any serious non-linearities may produce false flare signals which cannot be controlled by the action of edge light but which will disappear when the sweep is adjusted to be linear. Excessive geometric distortion or bowing in the deflection yoke particularly at the bottom will make it difficult to suppress bottom flares completely over the whole mosaic width at the same time. In this case, it may be necessary to replace the yoke.

Gamma Characteristics

During the past year, there has been a great deal of discussion resulting in conflicting recommendations for modifying the transfer characteristic of the iconoscope film chain. Tests made on a wide variety of motion picture film subjects and accurately calibrated grey-scale step film, have shown that at least a range of 50 to 1 can be transmitted by the iconoscope and a conventional kinescope so that the gradation between adjacent steps can be definitely recognized. This indicates that, with a kinescope gradient of 2.5, the iconoscope transfer gradient is substantially less than unity, approaching square root, in its upper light range. Attempts at white expansion with fixed peak kinescope brightness result in a final display with compressed blacks.

Our demonstrations have indicated that by using a linear amplifier transfer characteristic, with the iconoscope as the gradient-determining element in the system, a grey-scale range of at least 50 to 1 can be used. It is possible that with some films and kine-recordings which crush whites, white-expansion may be useful. However, we believe that this does not hold true in general for normal, typical motion picture film.

Concepts Involved in the Overall Operation of an Iconoscope Film Chain

In order to clarify the procedures involved in operating an iconoscope chain so as to obtain the best possible picture we can tabulate the variables involved as:

1. Film characteristics
2. Projector lamp intensity
3. Beam current
4. Video gain
5. Edge and back lighting
6. Shading signal

Average photographic film has a typical density range D = 0.2 to D = 1.8, or a range of 40 to 1, in release prints where density D is defined as log 1/T and T is the transmission in per cent. With D = 0.2 or a transmission of 62% the minimum open-gate illumination from the projector should be 32-foot-candles to obtain a 20-foot-candle highlight illumination on the mosaic. For these conditions the low-light mosaic illumination will be 1.6% of 32-foot-candles or 0.5 foot-candles. Increased illumination in the projector above this level does not produce radical changes in the appearance of the picture because of the wide latitude of the iconoscope characteristic. However, decrease of illumination may cause the picture to deteriorate, primarily because of lower output signal and hence poorer signal-to-noise ratio, and accentuation of residual flare and local defects which would ordinarily be unnoticed with normal illumination. For this reason we have found that stopping down the projector lens to obtain greater sharpness or depth of focus of the projected image produces poorer overall performance.

Since the standard f:2.6 Kollmorgen Projector Lens has a television resolution of at least 1200 television lines at the magnification used, it alone does not represent a limitation in 16mm film reproduction. All cases investigated, in which significant improvement in resolution was noted on stopping down the lens, were traced to clamping strain distortion of the front surface multiplexer mirrors, or were due to insufficient care in aligning the iconoscope itself to coincide with the focal plane of the projection system. When these difficulties were eliminated there was no noticeable difference in resolution between wide-open and stopped-down lens operation. Providing depth of focus by stopping down the lens to take care of system errors is a rather uneconomical method of operating the iconoscope chain. The adjustable iris in the present lens furnishes a convenient means of checking these factors and of decreasing light output for special films in which this may be advantageous. In order to obtain maximum light output, it is important to make sure that the condenser lens system and the reflector in the projection lamp path are clean and that the projector lamp is operated close to rated voltage since a 5% decrease in lamp terminal voltage produces a 16% decrease in the light output.

It is apparent that the success of a motion picture film chain depends directly on the quality of the film itself. In general, the resolution and gray scale of commercial 35mm film releases are excellent, whereas 16mm film has appreciably poorer resolution and more variable range characteristics. It is beyond the scope of this discussion to analyze the factors involved in poorer film quality, but it is only fair to point out that poor film does not make good television pictures. Side-by-side comparisons of 16mm and 35mm motion picture film material using a well-adjusted iconoscope film chain are very striking; the 35mm film giving quality very close to that obtained in a studio shot, while 16mm film is decidedly softer and lacks snap. In such a comparison the only variables in an in stantaneous mechanical switching or dousing operation are the two film sources and projectors, the iconoscope chain adjustment remaining untouched.

One must be quite sure that in the process of evaluating film chain performance the quality of the film used is adequate. Otherwise, this evaluation becomes a comparison of relative film performance, which in 16mm film is a bottleneck limiting performance at much lower levels than the capabilities of the iconoscope chain itself allow. Even the currently available 16mm television test film prints used for checking television performance leave a great deal to be desired particularly in the resolution and detail contrast in the various resolution frames of the film. One can verify this easily by examining such frame sections under a microscope, using a magnification of 30 to 50 times. The same criticism holds true for available 2 x 2 television test slides, except that, in addition, the performance of the still projector lens often limits resolution seriously. We have found that a simple circular front-of-lens stop ¾ to ⅝ inch in diameter produces a decided improvement in picture appearance and still provides sufficient light for good operation. This test is very easy to try and provides a method for producing an optical image on the mosaic which approaches the quality required to obtain meaningful information on system performance.

Beam Current Edge and Back Lighting

As previously mentioned, with adequate provisions for edge lighting and back lighting, the iconoscope should be operated with the maximum permissible beam current which can be accommodated to produce a flare-free field. This beam current will be between 0.1 and 0.2 microamperes. The video gain is then adjusted with normal illumination on the mosaic to provide an output signal of 1 volt peak-to-peak across the 70 ohm output line. It has been found that with a continuous indication of beam current, one can duplicate accurately the results with a given chain from day to day. In the absence of beam current metering facilities the operator is governed entirely by intuition and he is likely to set up for smaller than normal beam current, making up for decreased iconoscope signal output by increasing video amplifier gain at the expense of poor signal-to-noise ratio or will select a beam current which is higher than normal and will sacrifice overall performance from the standpoint of excess flare. The addition of a beam current metering circuit makes it possible to provide straightforward means of setting up and maintaining a high standard of operating quality.

Edge lighting and back lighting should be used to provide satisfactory cancellation of flare, cancellation of light application video pulse and to improve signal output. It is again important to point out that these factors should be handled with some discretion in order to minimize stray light and to preserve good storage characteristics with acceptable gray-scale rendition.

In principle, it is possible to manipulate edge-lighting intensity and distribution and back lighting amplitude so as to produce an output signal from the chain which requires no addition of electrical shading signals. However, the problem is made much simpler if edge-lighting is used primarily to control the abrupt flare components at the sides and bottom of the picture and electrical shading is introduced horizontally and vertically in the familiar available sawtooth and parabolic waveforms to produce flat output and flat shading. Our experience has shown that with preliminary setup of edge lighting, back lighting and electrical shading using an unilluminated mosaic as the most difficult condition, it is thereafter unnecessary to touch either the edge lighting, back lighting or the electrical shading signal controls during the reproduction of film.

DETAILS OF IMPROVEMENTS IN THE TK-20A FILM CAMERA EQUIPMENT

Video Amplifier

The cascode video amplifier consisting of a Western Electric 417A and an RCA 6J6 tube has been designed to replace the present 6AK5 single stage triode preamplifier located in the iconoscope compartment. The chassis-mounting features are identical with the previous design. The photograph of Fig. 5 shows a side view of the cascode preamplifier chassis and Fig. 6 shows a rear view including the important features of parasitic suppression resistors, heater by-pass condensers, and general wiring arrangement, including d-c filament supply leads. The schematic of Fig. 7 gives

(Continued on page 42)

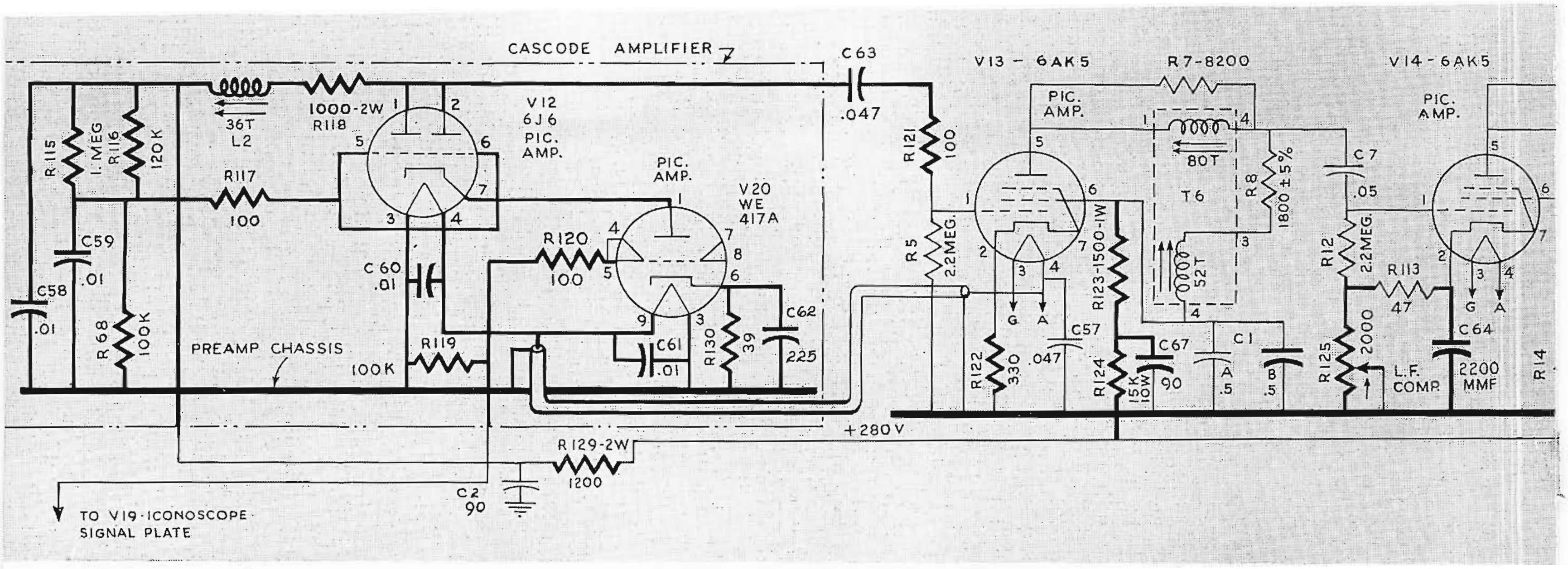


FIG. 9. General Schematic of Compensation Control Changes in the Film Camera Circuit. New parts or changes are indicated in heavy lines.

COMPLETE INFORMATION FOR MODIF
FILM CAMERA EQUIPME

TABLE OF MODIFICATIONS

MODIFICATIONS:

For those who have no spare cameras, the modifications have been divided up and listed below in steps. The camera may be used after each change has been accomplished:

1. Cathode Type High Peaking:

Remove the following components from the camera:

R9, C4, R10, R11, C6, R6, and R23. Disconnect C5A.

At V14, install R125, 2000 ohm pot. and C64, 2200 mmfd cap.

At V15, install R126, 2000 ohm pot. and C65, 220 mmfd. cap.

Change V14 to Type 6AK5.

At V16, install R127, 330 ohm resistor.

At V13, install temporary pot., 500 ohms, in place of R122.

At V13, connect C7 to T6, pin 4.

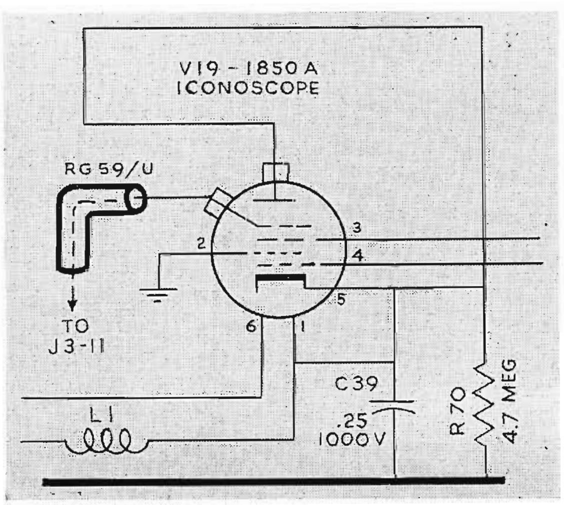


FIG. 9B. Schematic of V19 1850A Iconoscope and new installation of RG 59/U Ground Coax.

The potentiometer in place of R122 is adjusted so that with a normal picture input to iconoscope .5 volts peak-to-peak is obtained at the 51 ohm camera output. Later, when the preamplifier is installed R122, 330 ohms, is installed in this position.

2. Jones Plugs:

Cut holes in rear of camera and mount 6 pin Jones plugs as shown in Fig. 10. These plugs are the H. B. Jones type, 400 series.

3. D.C. Power Supply and Iconoscope Metering Provision:

Remove the heater circuits from Plug J1 and ground and connect to the Jones plug J2, as shown in Fig. 9.

Connect D.C. supply to camera through plug J2.

Remove the collector wire from the iconoscope, V19, to ground and connect iconoscope through a suitable length of RG-59/U to J3 as shown in Fig. 9.

At J3, connect R133, 1 megohm, and C66, .47 mfd., as well as heater and plate voltages as shown in the same figure.

The iconoscope camera will operate satisfactorily with or without a connection to the metering circuit.

3A. Metering Panel:

Assemble the metering circuit according to schematic, Fig. 13. A cable containing one coax as well as three individual conductors must be provided between the camera and camera control, where the metering panel may be mounted.

4. Edge Light:

Remove original edge light assembly and control.

Cut clearance holes in bottom of camera. Mount previously made projector support and mirror assembly on camera.

It will be necessary to provide a Variac or a high wattage variable resistor to control the intensity of the edge light.

5. Preamplifier Stage:

Assembly preamplifier as shown in Fig. 7.

Remove temporary potentiometer in V13 cathode.

Remove R2, R17 at V17, and original preamplifier.

Disconnect C2A, C2B, and C1A.

Connect R124, 15,000, R123, 1500 ohms; C67, 90 mfd. mounted in place of C6; C1A and B, .5-.5mfd.; R121, 100 ohms; C2, 90 mfd.; R129, 1200 ohms; and R134, 100,000 at V17.

Install preamplifier.

Connect output to C63.

Connect B+ to preamplifier at C2.

Connect heater coax center to V13, pin 4 and shield to ground lug at V13. Connect input to iconoscope.

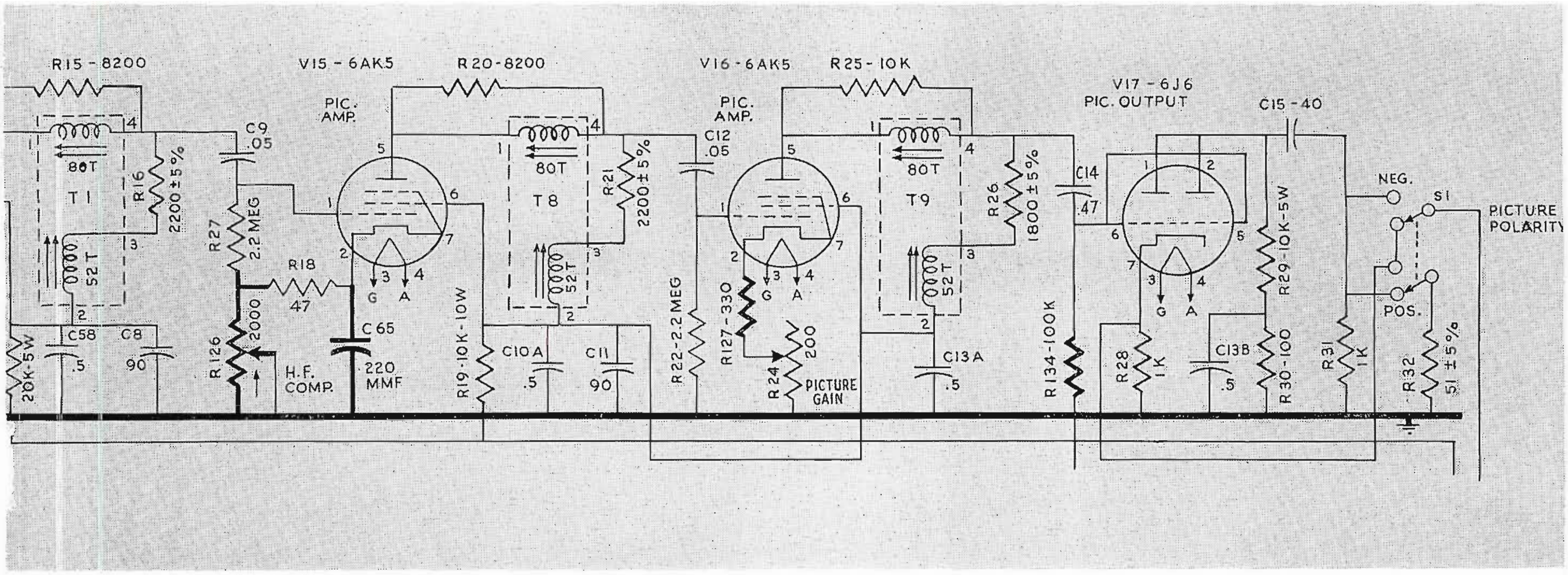


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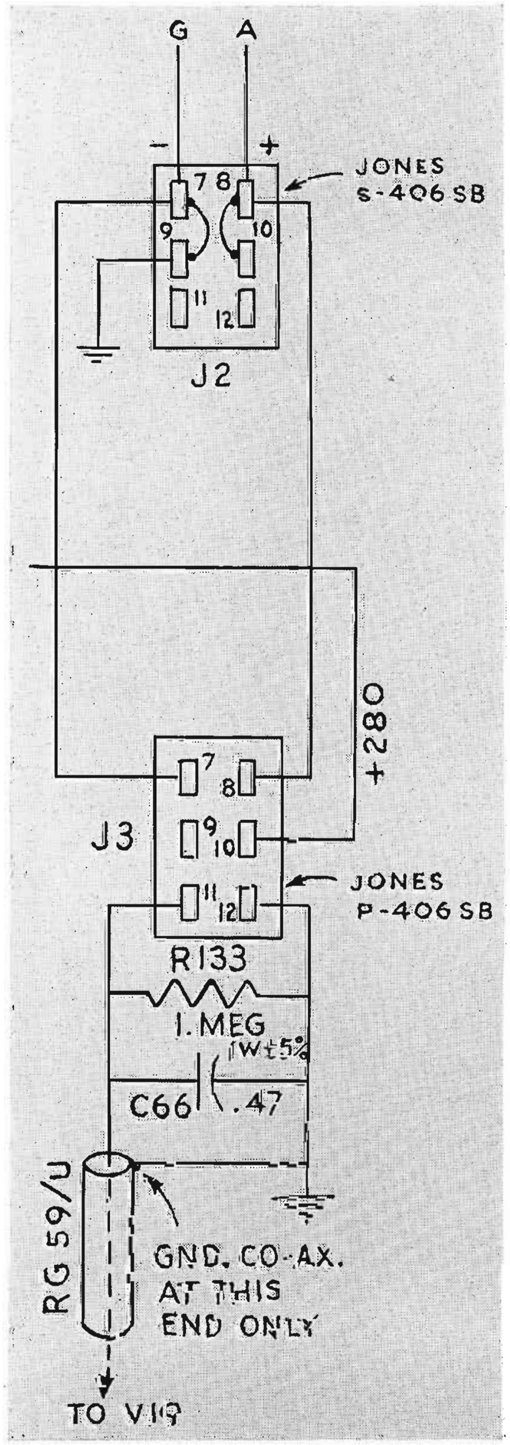
FIG. 9A. Schematic of new Jones Power Plugs circuit. This entire section would be heavy if shown in a general schematic.



PARTS FOR FILM CAMERA MODIFICATION

Qty.	*Symbol No.*	*Description*
2	R201, R202	50,000 Ohm Potentiometers, 2 W. Linear
2	R125, R126	2000 Ohm Potentiometers, 2 W. Linear
2	R207, R209	Resistors, 1 Meg., 1 W., ±10%
1	R208	Resistor, 300 Ohm, 1 W., ±5%
1	R210	Resistor, 1000 Ohm, 1 W., ±5%
1	R206	Resistor, 2.7 Meg., 1 W., ±5%
2	R203, R205	Resistors, 100,000 Ohm, 1 W., ±10%
1	R204	Resistor, 47,000 Ohm, 1 W., ±10%
3	R117, R120, R121	Resistors, 100 Ohm, ½ W., ±10%
1	R130	Resistor, 39 Ohm, ½ W., ±10%
3	R68, R119, R134	Resistors, 100,000 Ohm, ½ W., ±10%
1	R116	Resistor, 120,000 Ohm, ½ W., ±10%
1	R118	Resistor, 1000 Ohm, 2 W., ±10%
1	R129	Resistor, 1200 Ohm, 2 W., ±10%
1	R124	Resistor, 15,000 Ohm, 10 W.
1	R115	Resistor, 1.0 Meg., ½ W., ±10%
1	R123	Resistor, 1500 Ohm, 1 W., ±10%
2	R122, R127	Resistors, 330 Ohm, ½ W., ±10%
1	R133	Resistor, 1.0 Meg., 1 W., ±5%
4	C60, C61, C58. C59	Capacitors, .01 MFD, 600 W. V. D.C. (Ceramic)
1	C62	Capacitor, 225 MF, 15 V. (Electrolytic)
1	C64	Capacitor, 2200 MMF, 500 V. (Mica)
1	C65	Capacitor, 220 MMF, 500 V. (Mica)
1	C67	Capacitor, 80-10 MFD, 400 V. (Electrolytic)
1	C66	Capacitor, .47 MFD, 200 V.
1	L2	Peaking Coil; approximately 10 Micro H., wound on ¼" slug tuned coil form. 2 pies, 18 turns each, 1/16" wide, spaced 1/16", #30 S.C.E. wire
1	S201	Switch, 3 Position, 4 Pole—Oak Type #49530K1
1	X20	Tube Socket, 9 Pin with Lug Strap and Shield Base
2	X12, X201	Tube Sockets, 7 Pin
1	J2	Connector (Jones Catalog #P-406SB)
1	J3	Connector (Jones Catalog #S-406SB)
1	P2	Plug (Jones Catalog #P-406CCE)
1	P3	Plug (Jones Catalog #S-406CCE)
2	V201, V12	Tubes, 6J6
1	V20	Tube, WE-417A
1	V14	Tube, 6AK5
1	M1	Meter—0-100 Microamps
1		Power Supply (Stancor Model #752)
1		Kodaslide Type 1A Projector
2		Filter Glass (See Fig. 3)

circuit values and wiring details of the cascode amplifier. The photograph of Fig. 8 shows the installation of the cascode amplifier in the iconoscope compartment. It is important to adhere to a single path grounding system in order to minimize the possibility of spurious feedback from later stages.

The plate current of this cascode amplifier in normal operation is approximately 24 m.a. and can be checked by measuring the voltage drop across the plate filter resistor R-129 in the above schematic. It should be noted that the plate and screen supply filters which formerly provided voltages for the normal first and second video stages now supply only the second stage alone and must be revised accordingly.

High Peaker Circuits

The photograph of Fig. 4 shows the location of the two compensation potentiometers in the cathode circuits of the two video stages, V14 and V15. The appropriate R-C time constant values are given in the schematic of Fig. 9, which outlines all of the changes required in the video amplifier to obtain the new improved form of operation. The potentiometer marked "A" and located on the video amplifier shelf is used to control low-frequency compensation for the iconoscope input circuit characteristic. The control marked "B" governs the response at the upper end of the frequency characteristic. These are mutually independent and can be set using a standard test pattern as the basis for alignment. It is easily possible to set the high frequency control for good resolution with no white overshoot and the low frequency control for no low-frequency trailing or black or white smear. It may be found that after adjustment of these two controls there will still be present some residual very low frequency streaking which is not affected by the controls previously mentioned. This is due to inadequate phase and frequency fidelity at extremely low frequencies and can be corrected almost completely by the use of a plate-booster filter C_1A, and C_1B, and R123 (1500 ohms) shown in Fig. 9.

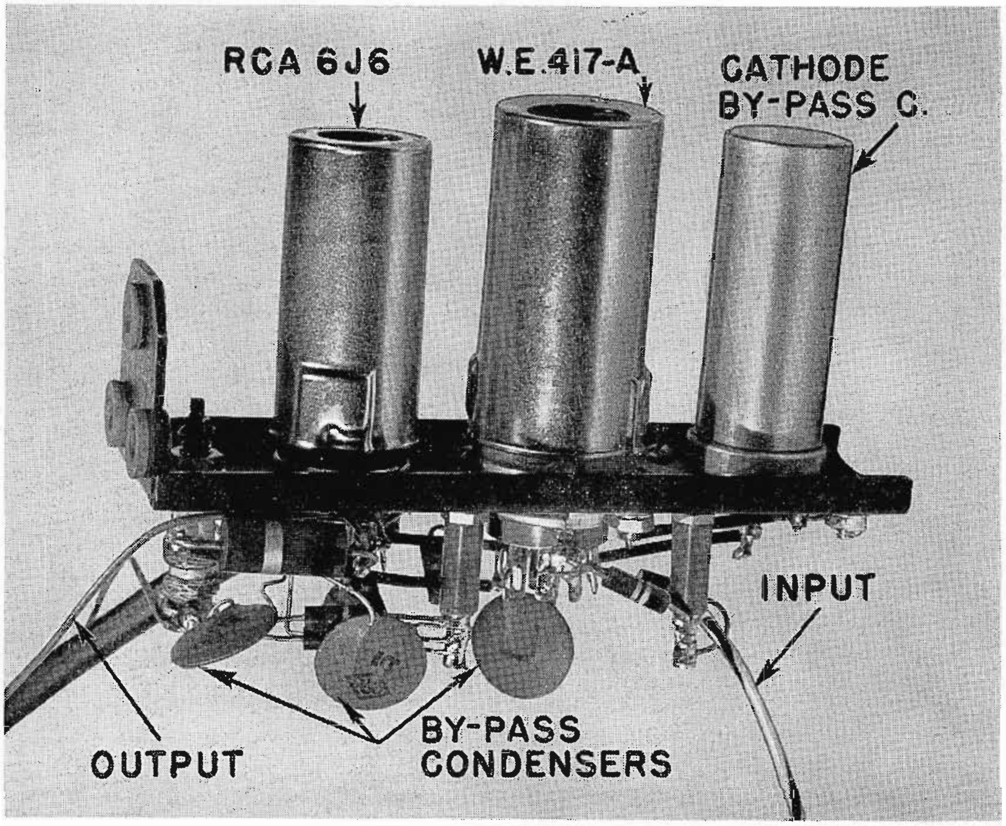


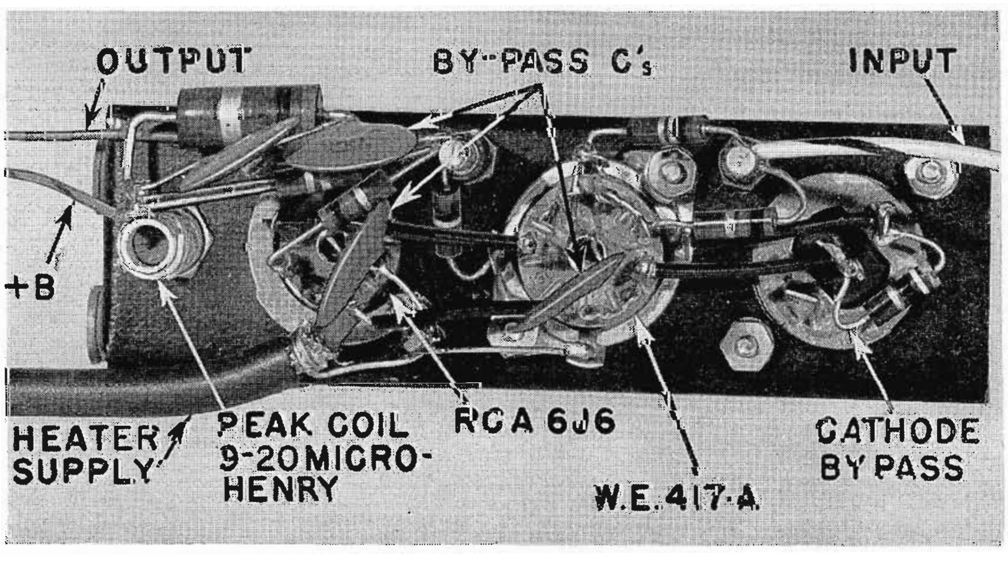
FIG. 5. Side View of Cascode Preamplifier showing details of by-pass condensers and connections.

D-C Heater Supply

Fig. 10 shows a dimensioned photograph of the rear of the camera giving details of the Jones Plug at the left which has been added to provide an easy means for connecting to an external d-c, 6.3 volt dry-rectifier filtered power supply which we have located in the base of the camera. It is necessary to reconnect all camera heater circuit leads to provide for 6.3 volt d-c operation instead of the balanced 12.6 volt circuits previously used. These changes are indicated in the schematic of Fig. 9.

It has been found that the use of D.C. in the first two tubes of the cascode amplifier is essential in order to eliminate the effect of "glitch" disturbances introduced by the usual A-C heater supplies. It is just as convenient to provide for complete d-c heater operation in the camera unit using the Stancor Model 752 power supply shown in the photograph of Fig. 11 to furnish the 9 ampere, 6.3 volt D-C heater power. Suitable Jones connectors are provided for easy interconnection of the d-c filament supply and camera unit.

FIG. 6. Wiring View of Cascode Preamplifier, showing wiring structure necessary for making the unit.



Beam Current Metering

The plug at the right of the camera (Fig. 10) provides connections for the iconoscope beam current metering circuit located on the camera control console. The iconoscope beam current normally operates within the range of 0.1 to 0.2 microamperes. The center conductor of the coaxial metering line is attached to the collector terminal of the iconoscope, and terminates at the camera Jones plug in a 1 megohm resistor and suitable bypass as shown in Fig. 4. The voltage drop across this resistor, which is directly proportional to iconoscope beam current, is applied through an interconnecting cable to a D-C

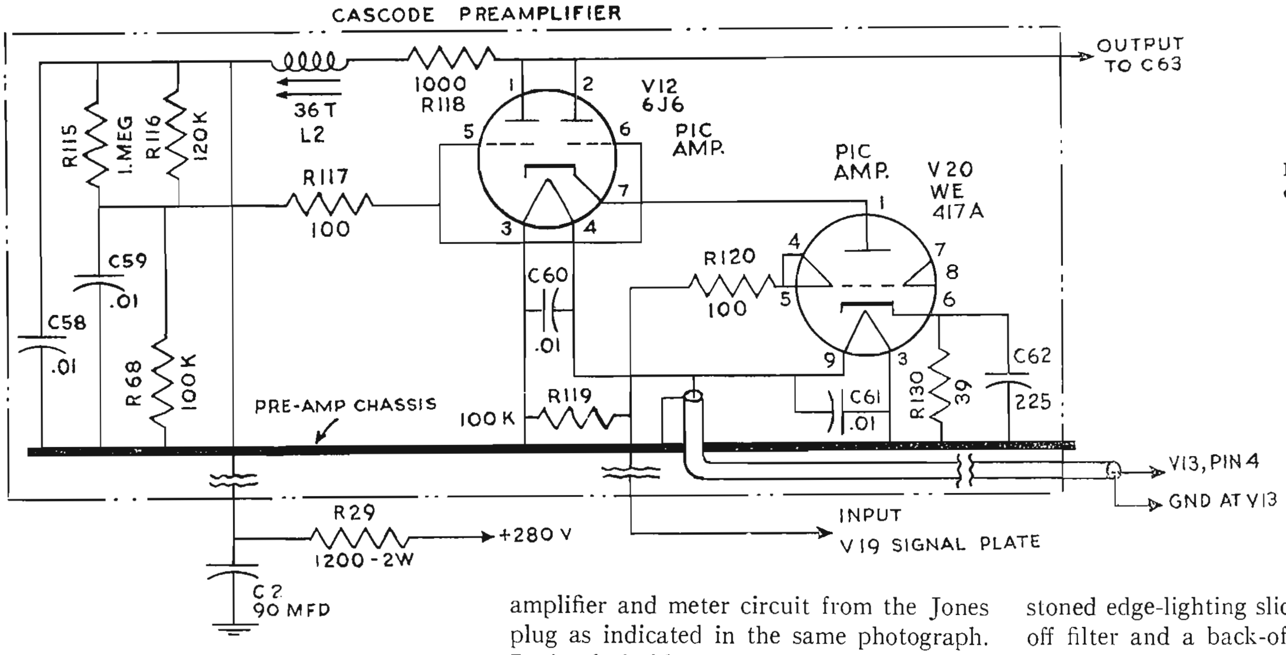


FIG. 7. Circuit diagram of the new Cascode Preamplifier.

bridge-type amplifier, meter, and controls located in a separate panel, as shown in Fig. 13. Since the metering circuit is completely self-contained, it can be located where operational control is most convenient. This D-C bridge amplifier is shown schematically in the drawing of Fig. 13.

The 100 microampere D-C meter for beam current indication is calibrated for sensitivity by variation of the series meter resistor, and the bridge is balanced by the zero-adjusting potentiometer to give zero meter reading. The three-way switch allows the operator to select zero, calibrate, and operate positions with a minimum of effort. The calibration voltage is obtained from regulated B-supply using a resistor-divider to provide one-tenth volt D-C, corresponding to 0.1 microampere beam current, and applied for bridge calibration to the opposite grid of the 6J6 dual-triode bridge amplifier. It is easy to adjust for a full scale sensitivity of 100 or 200 millimicroamperes merely by changing the sensitivity control. This metering circuit has been in daily use for several months and shows very little tendency towards drift after the initial warm-up period. The approximations introduced in calibration and design were made on the basis that it is more important to provide a stable simple indicator of beam current rather than a precise measuring means since the original selection of an appropriate beam current is made on the basis of freedom from picture flare. It is then only necessary to maintain this current during operation without any direct regard for its absolute value. The photograph of Fig. 4 indicates the arrangement of coaxial conductor, Jones plug and the location of pilot voltage resistor and filter condenser. Plate and heater supply voltages are furnished to the remote amplifier and meter circuit from the Jones plug as indicated in the same photograph. It is desirable to preserve a one-point ground at the camera Jones plug, leaving the circuit at the camera control floating in order to avoid disturbing effects of interchassis differences of potential.

New Edge-Light Arrangement

The photograph of Fig. 2 shows the edge-light arrangement which has finally been developed for use with the iconoscope chain. This is basically an Eastman 1A projector using a special metal-insert keystoned edge-lighting slide, an infra-red cutoff filter and a back-of-lens iris. The projector is installed below the camera in the normal operating position. In order to change iconoscopes or to service the equipment, it is merely necessary to push the projector forward on the guide-rails by means of the supporting bracket, giving ample clearance for opening the swinging door to the rear compartment, as shown in the photograph of Fig. 14. The diagram of Fig. 17 gives the layout of projector, bracket, guide rails, reflecting mirror and the dimensions of the special preamplifier

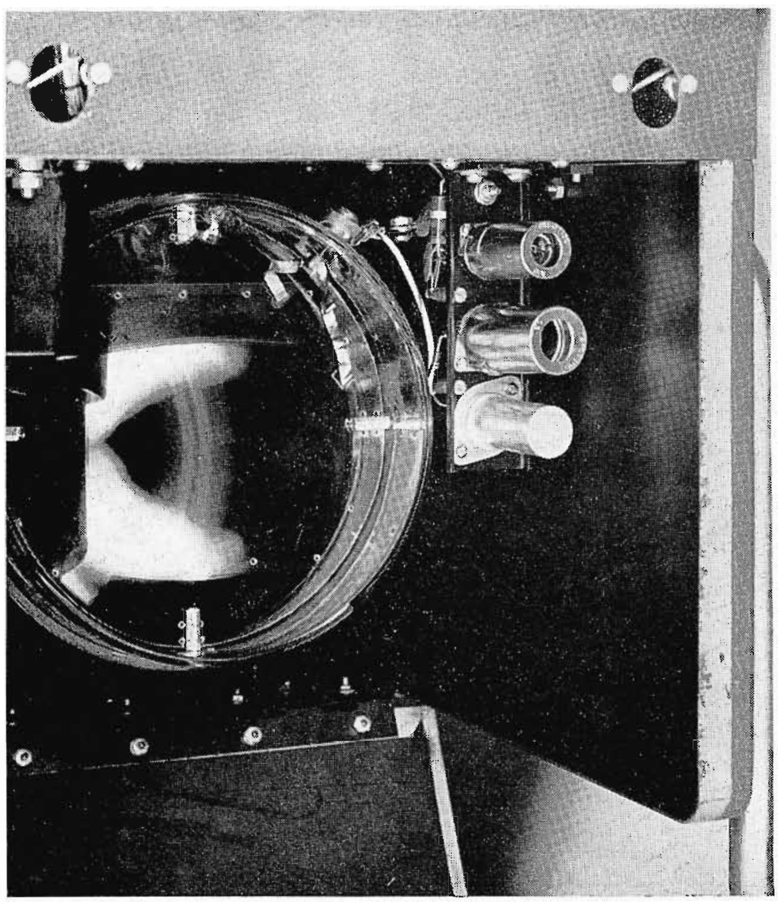


FIG. 8. The Cascode Preamplifier is shown installed in position inside the TK-20A Film Camera.

chassis and edge-lighting slide. It is preferable to use D-C on the edge-light to eliminate the possibility of introducing a light-hum component in the video output. In the edge-light layout drawing are given the exact dimensions of the clearances required in the various chassis locations for mirror and adjustable edge light bracket and the dimensions of the slide mask.

Back Light

Tests have shown that the present back-lighting system operated from D-C is adequate for the purpose. It is desirable to add an infra-red cut-off filter and a diffusing screen.

Black-Level Control

While automatic black-level set in a developmental camera control amplifier has been in satisfactory operation for some time, it should be pointed out that this feature is not absolutely essential at the present time to improve camera performance in all other details. We believe it advisable to postpone the actual conversion of the camera control to a later date, at which time we expect to have complete simplified information which will require the minimum number of changes. These are not extensive and consist basically in providing a convenient adjustable source of pre-blanking, d-c clipper-level control, and a physical rearrangement of the clamper so that it is d-c coupled to the grid of the clipper stage.

Suggestions on Conversion

In our investigation of the problems of conversion, particularly with stations which have one, or a limited number of cameras which cannot be taken out of service for an extended period, it is safer to plan on this conversion in several stages which will allow for interim operation of the camera chain and which will finally result in complete introduction of all of the new features without taking the camera out of service except during the usual maintenance and overhauling intervals. For this possibility, we suggest that the work be divided as follows:

1. The high peaker circuit can easily be revised by addition of the two potentiometers and the appropriate condensers to give immediate improvement in microphonics and high peaking characteristics. It will at the same time be necessary to introduce variable degeneration (approximately 80 ohms) in the cathode circuit of video amplifier V13 Fig. 4, so that when these changes are introduced the excess gain can be absorbed in this degeneration to provide normal signal output levels.
2. Holes can be cut and Jones plugs installed for the D-C heater supply and for the iconoscope beam current metering circuit.
3. The metering circuit can be installed and calibrated.
4. The edge lighting hole in the bottom of the iconoscope camera can be cut, the mirror and support installed, and the Eastman 1A Projector with special bracket and slide can be adjusted for improved edge lighting.
5. The cascode preamplifier previously described in detail can be installed and appropriate peaking and degeneration gain settings can be frozen to provide for normal systems operation. By proceeding in the manner outlined, it will be possible to modify the chain a section at a time without at any point being caught in the position of having the iconoscope equipment unavailable for film use.

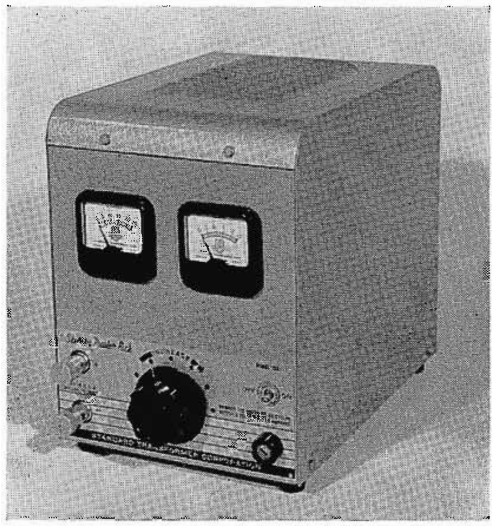


FIG. 11. D.C. Power Supply Unit suitable for use in the modification procedure.

For convenience in carrying out the camera changes, the following table of component additions, removals or change of values has been prepared. In all cases, the part numbers are those used in the schematics of Instruction Books for the TK-20A Film Camera Chain. New part numbers are assigned to added components.

When the changes have been completed, we feel that the improved performance in picture quality, signal-to-noise ratio, and simplicity of operation, with the assurance of continuously controlled high standards of picture excellence, will more than repay the required modification efforts.

We take this opportunity to express our appreciation to Mr. Vernon J. Duke of the NBC Television Engineering Staff, working under the direction of Mr. George M. Nixon, in charge of NBC Development Engineering. He first recognized many of

FIG. 10. Location of the new Jones Power Plugs.

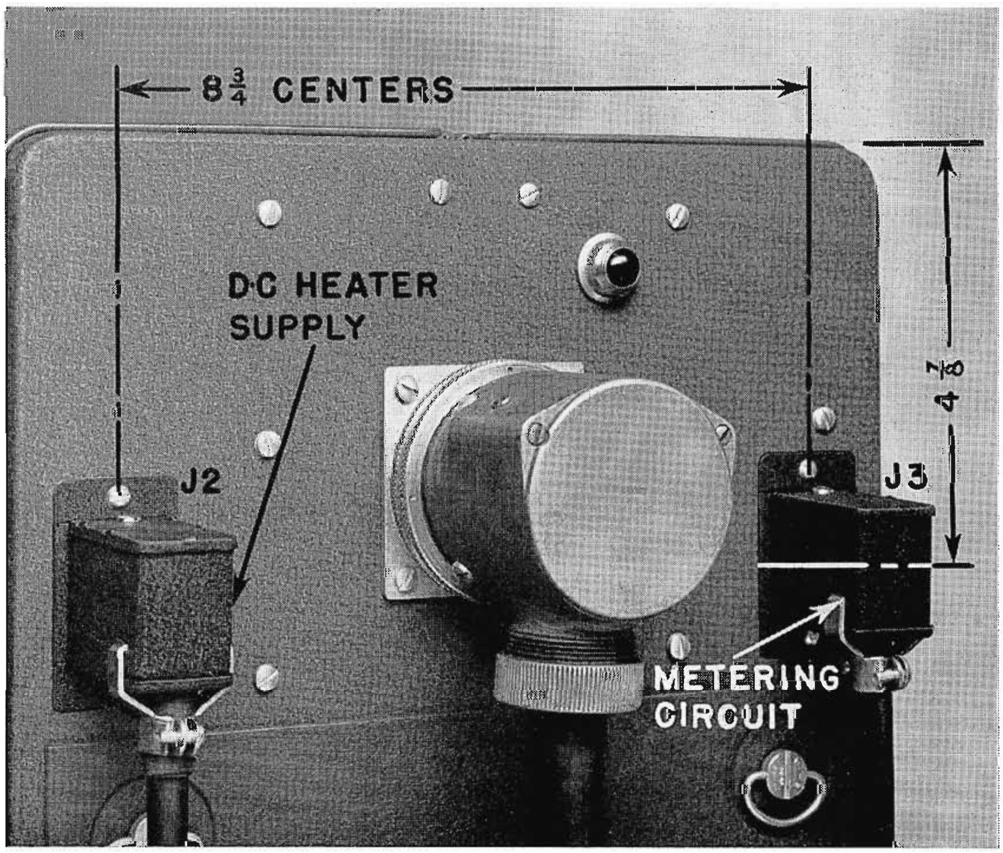
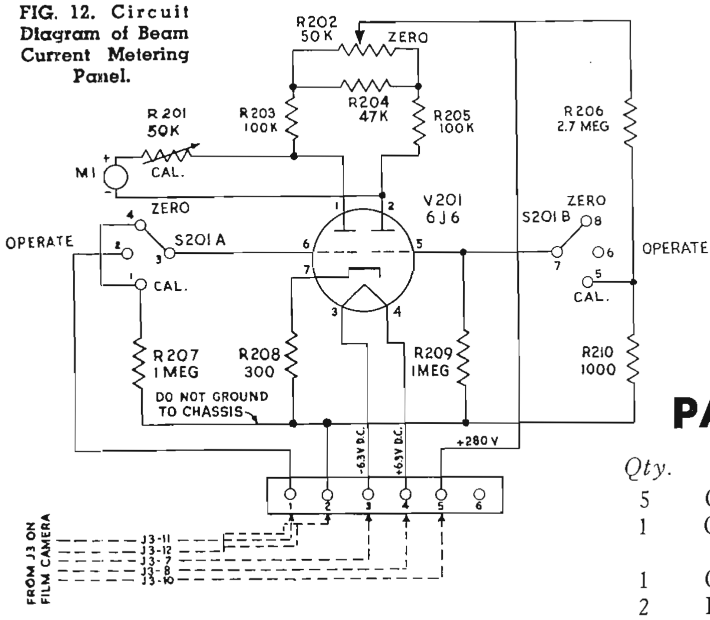


FIG. 12. Circuit Diagram of Beam Current Metering Panel.



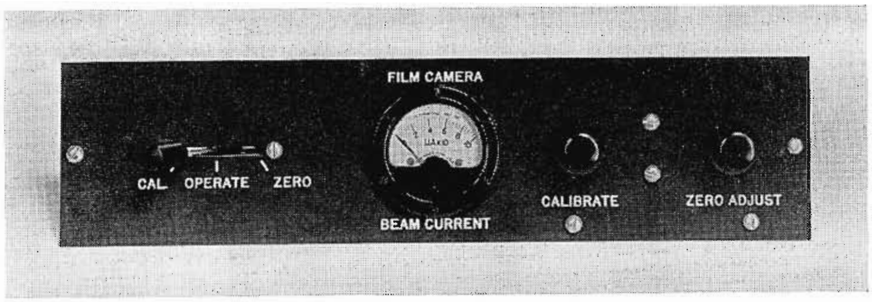


FIG. 13. Beam Current Metering Control Panel.

the limitations in iconoscope camera performance, and first demonstrated the improvements possible in commercial equipment by careful attention to many details which had hitherto been neglected. We wish also to thank Mr. Otto Schade for his fundamental studies on the iconoscope, which evaluated many of the factors which we have introduced in commercial equipment. Dr. Janes and Mr. Marschka of RCA, Lancaster have cooperated completely in discussion and analysis of iconoscope problems and in furnishing special and standard tubes for test. Mr. E. M. Gore of our Advance Development Group, and Mr. R. J. Marian of Product Design, deserve special commendation for their many contributions during the initial and final phases of this study.

ALTERNATE MODIFICATION

During the preparation of this article, development and study of Film Camera Modifications have continued. As a result, we have found that substantially the same improvement in video amplifier signal-to-noise ratio can be realized by the use of two RCA-6BQ7 double triodes driving an RCA 6AG7, triode connected, in exactly the same cascode arrangement as was described for the Western Electric 417-A, RCA 6J6 tube complement. As these tubes are much more readily available and lower in cost than the W.E.-417A, we feel that they can be used to advantage in the camera modifications we have outlined. A detailed schematic, parts list, general remarks, and chassis details for the 6BQ7-6AG7 cascode amplifier are shown in Figs. 15 and 16.

PARTS LIST for ALTERNATE PREAMPLIFIER

Qty.	*Symbol No.*	*Description*
5	C1, C4, C5, C6, C12	Capacitors, .01 mfd. 600 V.D.C. (Ceramic)
1	C3	Capacitor, 2000 mfd. 6 WVDC, non-inductive, Electrolytic, (Aerovox Type E3A208)
1	C7	Capacitor, .1 mfd., 400 V.
2	R1, R8	Resistor 100,000 Ohm, ½ W., ±10%
4	R2, R3, R4, R5	Resistors 100 Ohm, ½ W., ±10%
1	R6	Resistor, 15 Ohm, ½ W., ±10%
1	R7	Resistor, 12 Ohm, ½ W.
1	R9	Resistor, 1 Meg., ½ W., ± 10%
2	R10, R11	Resistors, 1800 Ohm, 2 W., ±10%
1	R12	Resistor, 470 Ohm, 2 W., ±10%
1	L1	Peaking Coil: approx. 10 micro. H.; wound on ¼" slug-tuned coil form, 2 pies, 18 turns each, 1/16" wide, spaced 1/16", #30 S.C.E. wire
2	V1, V2	Tubes, 6BQ7
1	V3	Tube, 6AG7
2	X1, X2	Tube Socket, 9 pin (no shield)
1	X3	Tube Socket, Octal (Amphenol type S)

(The above symbols refer to Figure 15 only.)

Refer to Figure 9. Change value of C64 to:

1	C64	Capacitor, 3900 mmfd. (mica)

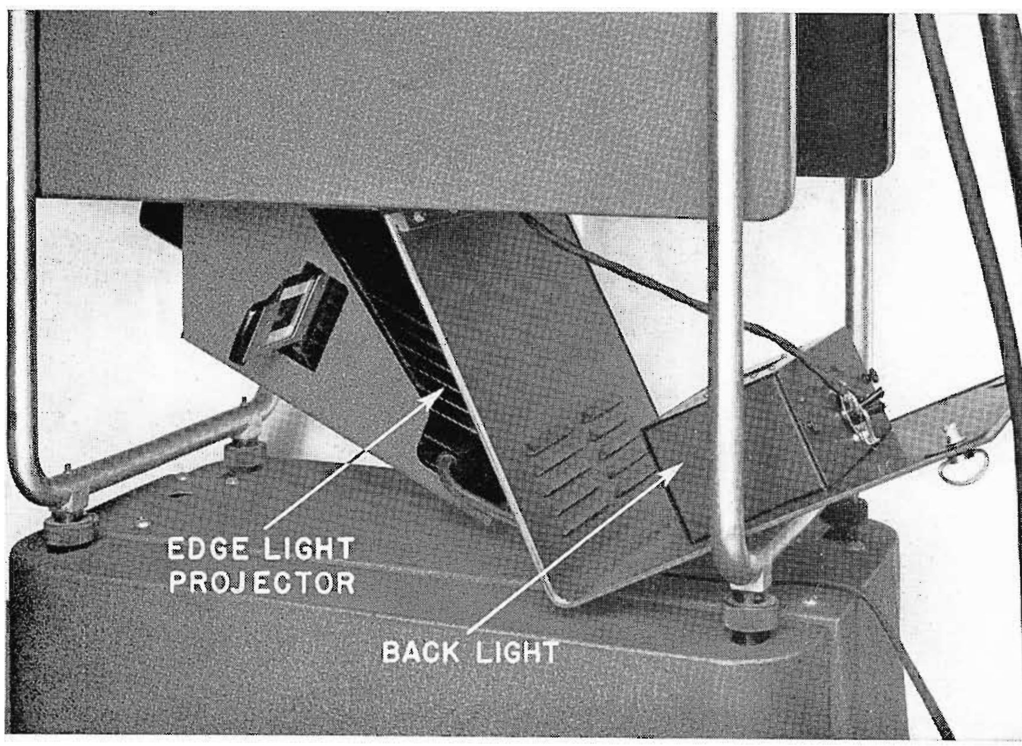


FIG. 14. External Edge-Light Projector Assembly is shown pushed forward to the farthest point in the track so that easy access makes possible work inside the film camera.

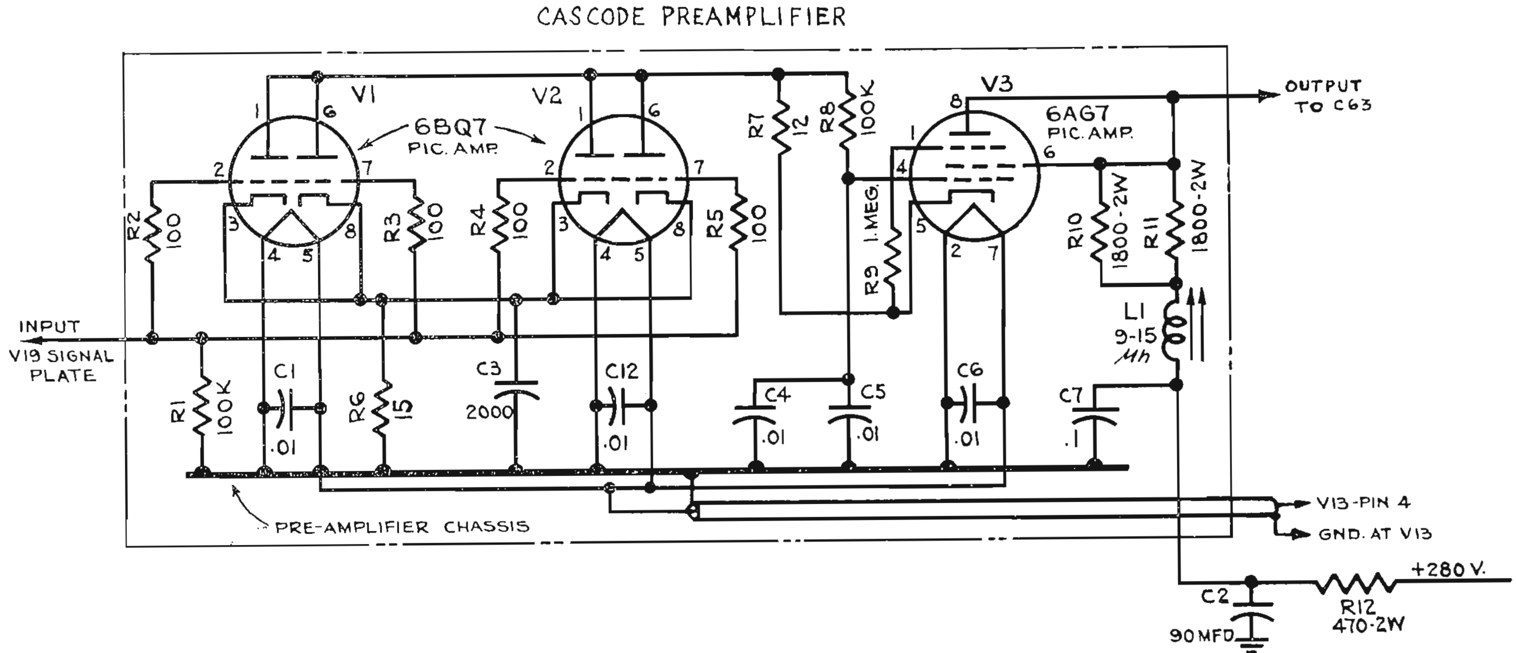
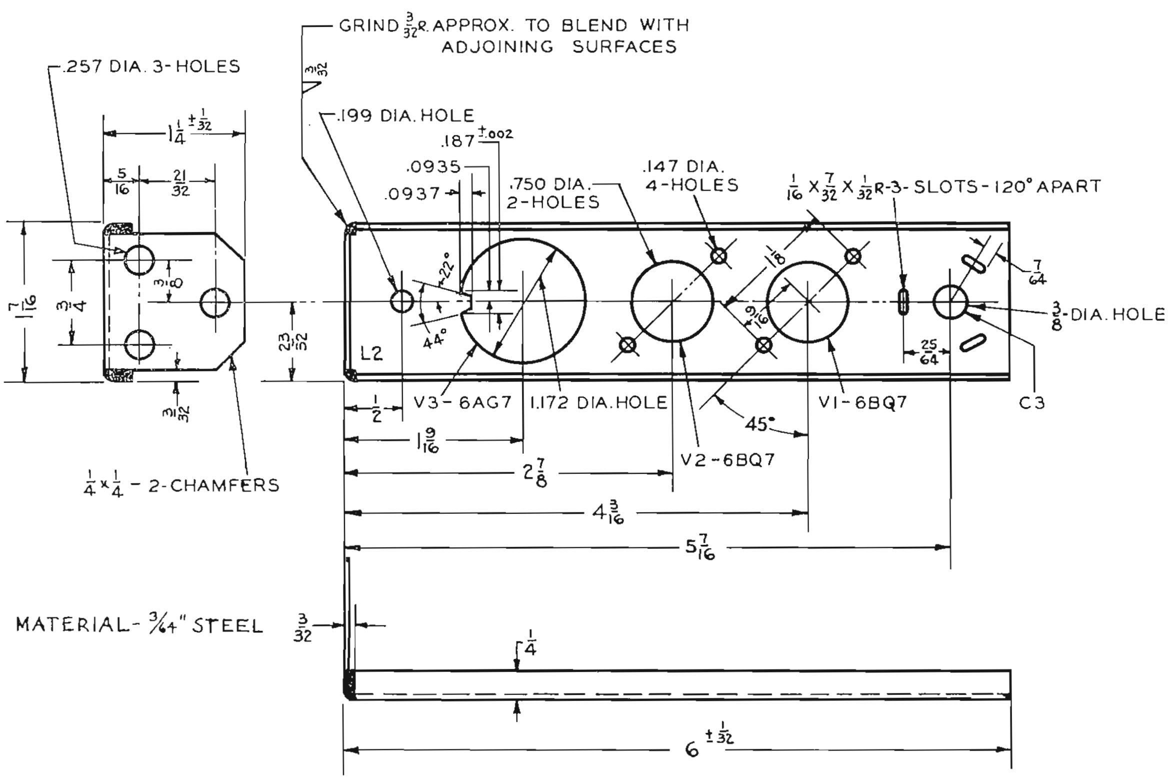


FIG. 15. Circuit diagram of alternate Cascode Preamplifier.

NOTE: The case of the Stancor pack should be connected to the negative output terminal. However, with the alternate modification the heater drain is increased and a heavier supply is recommended. This d-c supply which has a continuous current rating of 20 amperes at 6 volts is the Electro Model "B" manufactured by Electro Products Labs., Inc., 4501 Ravenswood Ave., Chicago 40, Ill.

V3, 6AG7 should be mounted so that pins 2 and 7 are in a vertical plane. (See RCA Tube Manual.)

FIG. 16. Preamplifier Chassis.



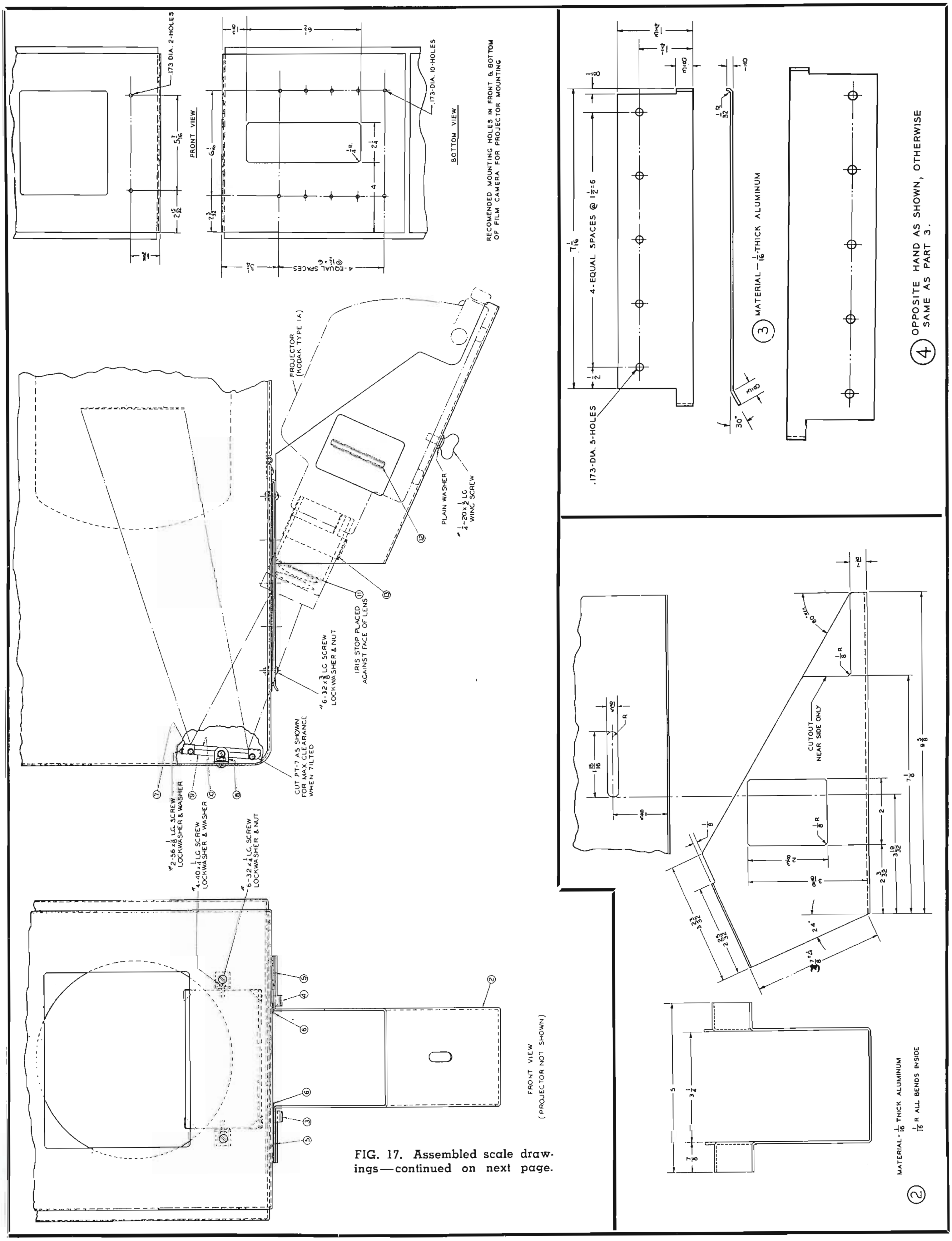
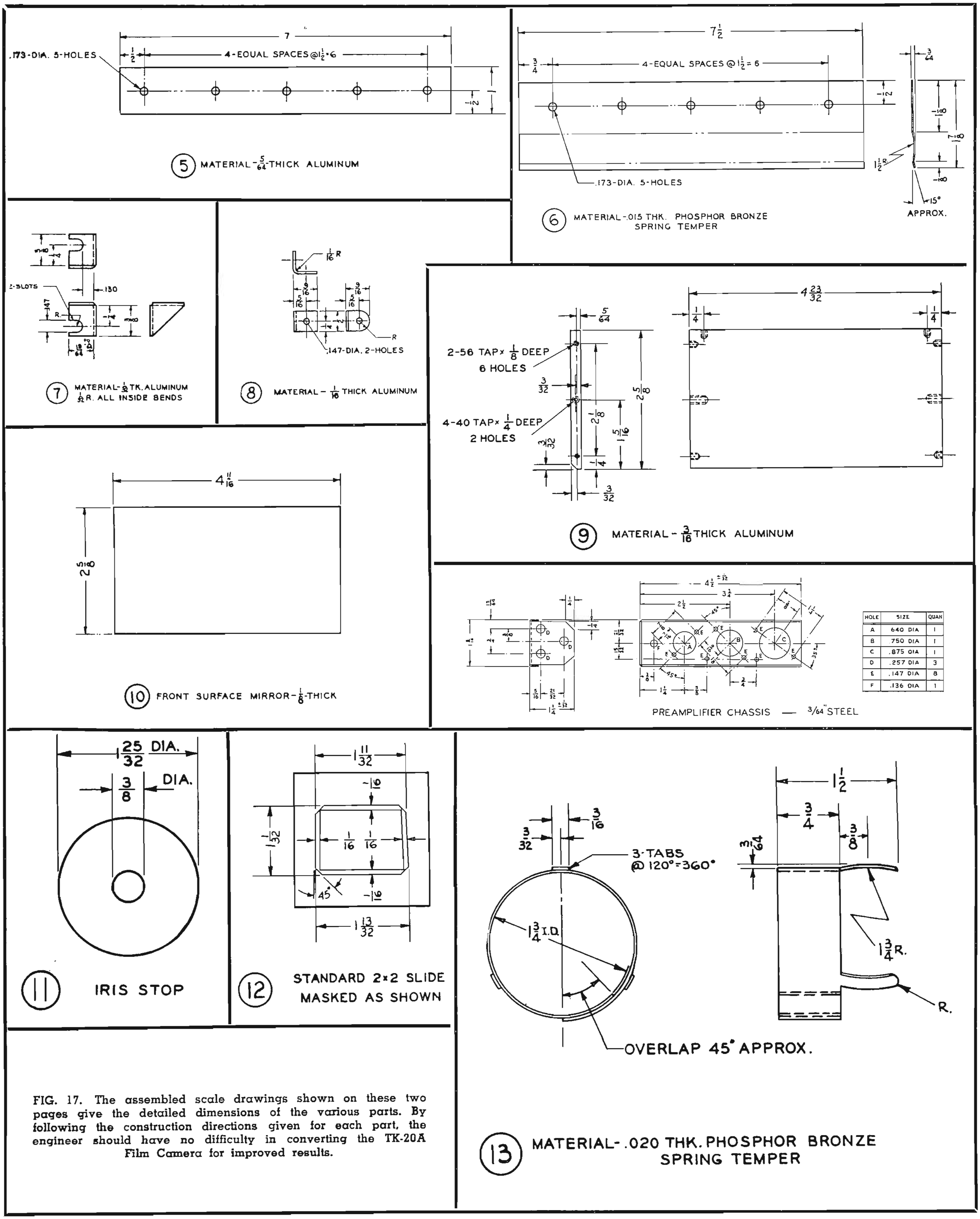


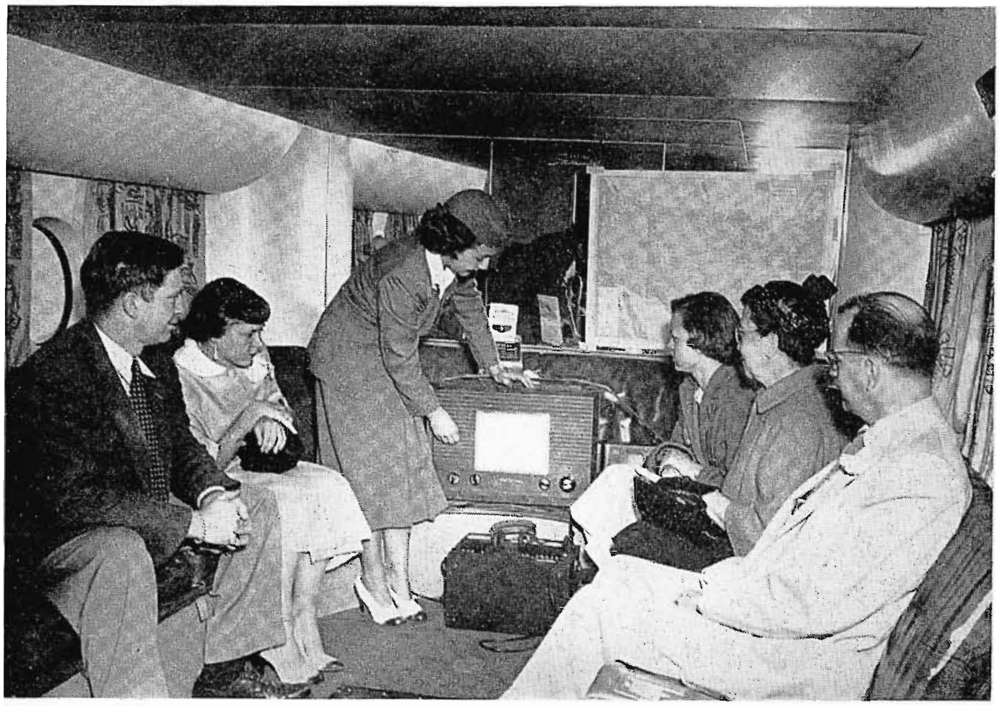
FIG. 17. Assembled scale drawings—continued on next page.



HOLE	SIZE	QUAN
A	640 DIA	1
B	.750 DIA	1
C	.875 DIA	1
D	.257 DIA	3
E	.147 DIA	8
F	.136 DIA	1

FIG. 17. The assembled scale drawings shown on these two pages give the detailed dimensions of the various parts. By following the construction directions given for each part, the engineer should have no difficulty in converting the TK-20A Film Camera for improved results.

TELEVISION ON THE WING...



The first attempt to receive television aboard a transpacific Hawaii-bound airline met with great success on United Air Lines' Flight 49, outbound from San Francisco.

The joint experiment, conducted by technicians of United and KRON-TV of San Francisco, was the first of its kind on the West Coast.

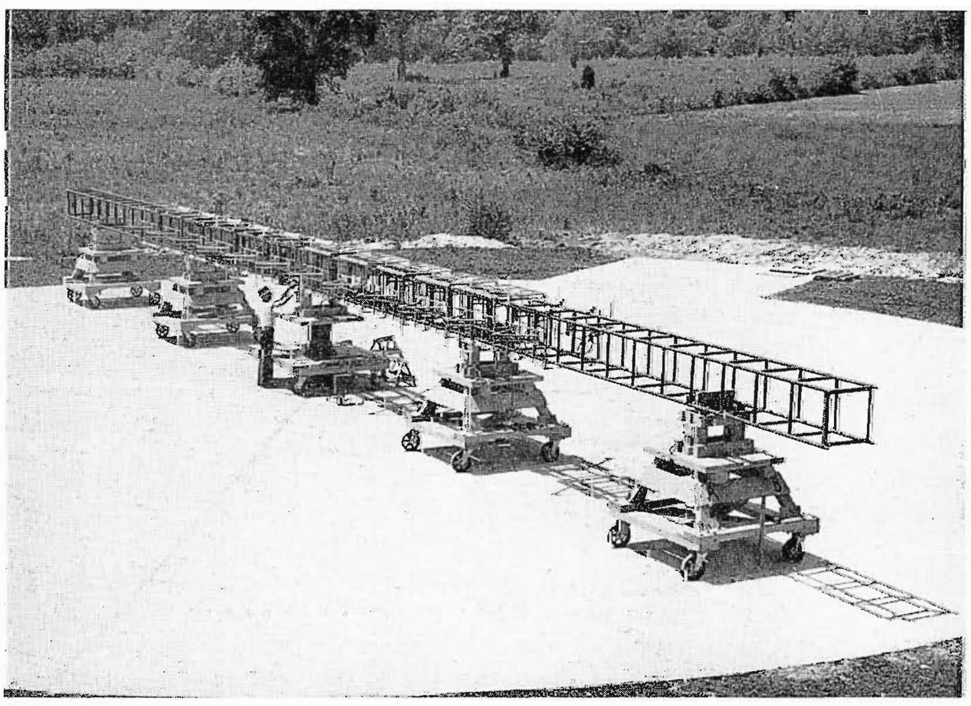
The photo (at right) shows intent passenger interest as Phyllis Chase, United Air Lines stewardess adjusts the three-year-old RCA Victor television receiver (10-inch screen), which was used in the test.

Richard Grace, United radio engineer who monitored reception of a KRON-TV newscast, reported that the program came in clear while the Mainliner Stratocruiser prepared for take-off. During take-off the image grew fuzzy, but sharpened as the plane gained altitude.

Reception at 20,000 feet was perfect for 250 miles west of San Francisco. Beyond that point the signal grew progressively weaker and finally faded out 306 miles from the West Coast.

VERSATILE ANTENNA TEST APPARATUS

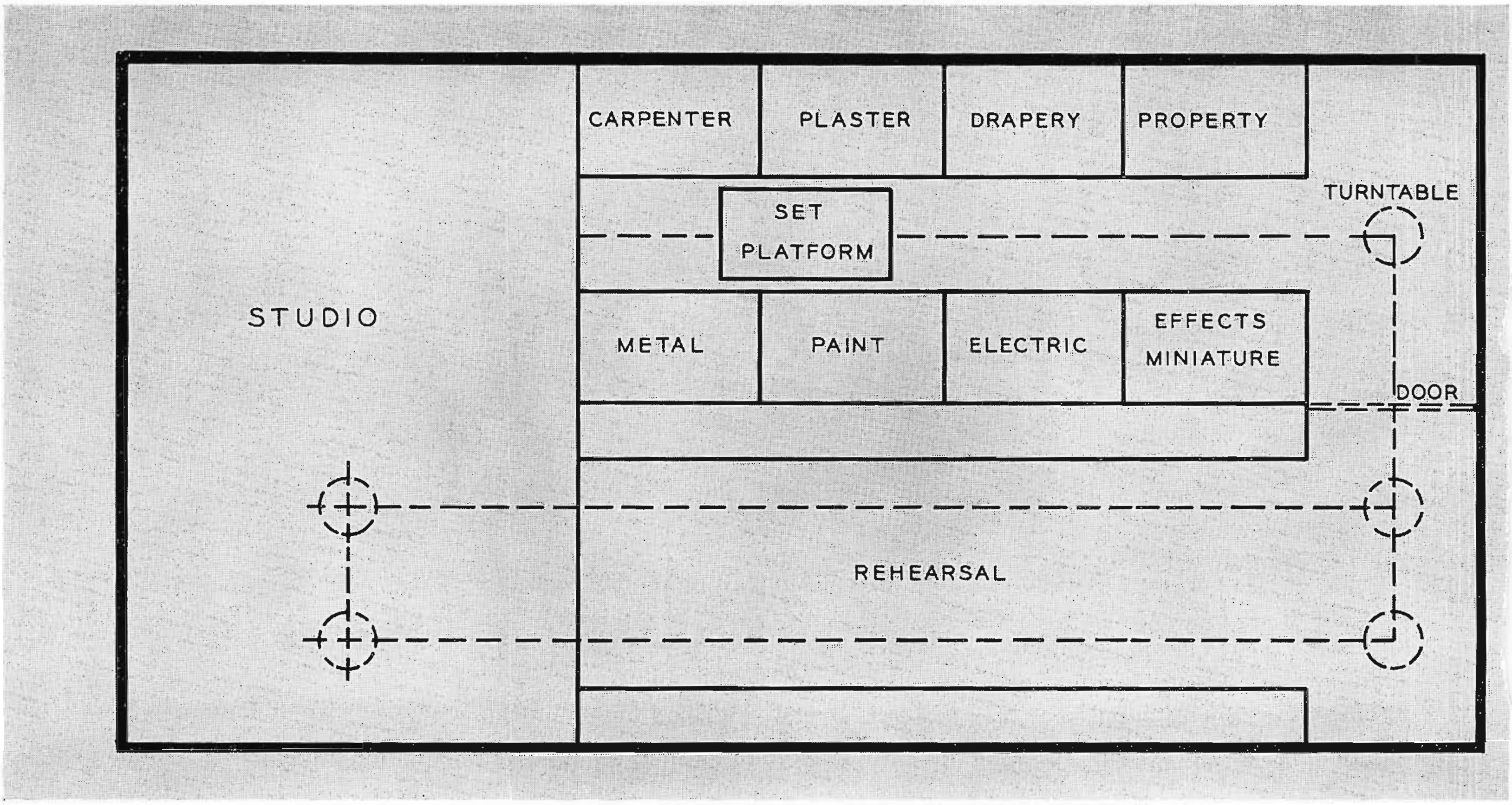
The Broadcast Design Group of the RCA Engineering Products Department is the proud possessor of a new and easy method for testing broadcast antennas. It consists of a 100-foot circular concrete apron which resembles a huge sundial, upon which are mounted five wooden dollies that support the steel frame. The center dolly revolves through a 360-degree arc around a vertical shaft in the center of the apron, while the steel frame holding the antennas being tested is built in sections that can be used to extend it up to 140 feet in length.



This $25,000 test installation, located at Medford, New Jersey, eliminates the need for erecting antennas in the normal vertical position. This system permits movement of antenna elements in a horizontal position, the only reliable means of establishing the gain characteristics of broadcast antennas.

The antennas are connected by cables to electrical test equipment in a nearby building. A signal generator is located at a distant point, and the antenna is rotated on its horizontal axis while data is recorded by means of a selsyn drive.

Such facilities enable the engineers to continue their measurements with the highest degree of accuracy with a minimum of lost time for construction changes in the units under test. It's the answer to a test engineer's dream.



"ASSEMBLY-LINE TV STUDIOS"

By
M. RETTINGER
RCA Victor Division
Radio Corporation of America
Hollywood, California

In the field of motion picture production it has at various times been suggested to construct all necessary sets outside of the sound stages, and to convey them to a certain stage when needed there. After the use of the set, it was to be removed and another set was to take its place. By this method of production fewer sound stages would be required, while the sets could be constructed near the machines frequently required for this purpose, such as joiners, band-saws, plaster mixers, etc. One such system is known in the motion picture field as the "Pelton System" after F. E. Pelton;[1] another is referred to as the "Kasold System";[2] a third as the "Berkely System".[3]

At least a half dozen patents have been issued decsribing various means and methods of prefabricating sets and then conveying them in some manner to the locale of production, as may be noted in the references given at the end of this paper.[4] Indeed, the problems involved are often well stated in the patents, as in British Patent No. 439,969, to quote:

"At the present time, the cost of production of motion pictures (silent or with sound) is materially increased by the time and labour involved (apart from that occupied by the actual scene-shooting) in erecting and dismantling the sets in the studios and in assembling and dismounting the lighting installation required for each scene, and also by the players' fees which have to be paid during this time and from which no immediate benefit is derived.

"It has already been proposed to overcome part of the above disadvantages by employing movable stages having sets already prepared thereon and inserting such stages into stationary theatre spaces of different sizes for filming the different scenes.

"According to the invention, a filmtaking installation is proposed, wherein the filming apparatus together with at least a part of the lighting equipment constitute an independent unit, and a number of successive rooms, cubicles or the like accommodating the built-up sets or scenery for sets constitute another unit, the said units being movable relatively to one another, for example on rails, in such manner that any desired combination of the filming and lighting unit with a set may be selected therefrom."

While such "systems" generally lay claims to motion picture production, they can with equal benefits be applied to television work. Indeed, the construction of pre-fabricated sets which can be wheeled on and off a sound stage when needed appears even more desirable in the case of television work than for motion picture production. First, most motion picture stu-

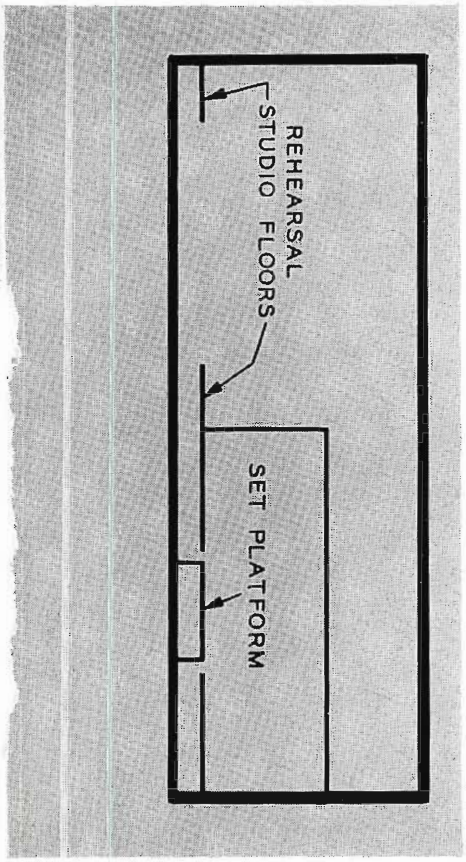


FIG. 1. Floor plan layout of a "streamlined" TV studio constructed on 20' x 40' platforms. Platforms are supported by wheels which move on rails. Platform floors and shop floors are at same elevation.

dios are located in suburbs where ground is not very expensive, while television studios, like radio stations, tend to occupy metropolitan areas where ground can be had only at a premium. Secondly, television production is more nearly a round-the-clock activity which employs various programs and directors, while a motion picture is most always made by one director, cameraman, and cast, who require rest periods. Thirdly, motion picture scenes are of relatively short duration, and hence may be rehearsed in the sound stage after the set has been built. Television scenes are frequently rather lengthy, however, and are preferably rehearsed at some place outside the sound proof and voluminous sound stage. Indeed, under the present method of television production the set may be photographed, that is, used in actual production, for some 20 minutes, while it may be employed for several hours during rehearsing. These difficulties are not unknown to the television industry, and have recently been noted by various authors, as for instance Morton H. Read and Eugene N. Bunting, who write:[5]

"Set design in a small studio can be something of a problem, especially if it is necessary to have several sets ready at the same time. When budgets are low and space is limited, casts cannot be kept on subsistence while sets are changed and the studio is rearranged. This is especially true when a series of television commercials involves (as they often do) a kitchen, dining room, living room, hallway with front door, etc. If the studio can be completely set up in advance with all top lighting in place, it is possible to do a vast amount of work in a minimum of time."

The problem becomes even more complicated when it is realized how many different material-processing and fabricating shops and subdepartments go into a large television set. A cursory summary includes the following factors: carpentering, drapery, property, paint, scenic, lumbermill, foundry, cabinet, hardware, mechanical, greenery, miniature and special effects. For this reason, as well as those mentioned above, it appears desirable to construct a set off-stage, to use it for rehearsing at a convenient location, and then to wheel it onto the sound stage where a low noise level is assured, where high platforms provide adequate lighting facilities, and where room is available for the operation of microphone booms.

In the design of television studios employing an assembly-line type of production method, a U-shaped set construction area has to be provided containing various shops—painting, plastering, metal work, etc. When the set has been constructed it is conveyed in some manner—either by wheels, or elevator—to the rehearsal room or stage. Several rehearsals can well take place simultaneously in that enclosure, with the lighting adjusted and noted in a book. At the program hour, the set is conveyed to the sound stage where the actual recording and televising takes place. At the end of the program the set is removed and another set is wheeled in. It should be noted that this method of production is possible also when the sound stage is of the type which accommodates an audience. Indeed, if such is used for the presentation of a theatrical feature with several acts, hardly any other method appears practical if the sets are to be "real".

Fig. 1 shows the layout of a "streamlined" television studio. The set is constructed on 20-foot by 40-foot platforms in a locale containing the various shops required to fabricate sets. Thus, in the carpenter shop the essential "flats" are constructed, which may be made of presswood, compositionboard, plywood, fiberboard, etc. In the plastering shop are built all necessary "casts", and plaster forms made by sprayingthe material on with special spray guns. The platforms are supported by wheels which roll on rails set at such a height that the platform floors have the same elevation as the floors of the shops.

After the set has been constructed it is rolled into the rehearsal studio, the "apron" floor of which is again at the same elevation as the platform on which the set is built. It should be realized that, at present, in a rehearsal studio intended for rehearsing as well as set construction, rehearsing is constantly interrupted by men hauling set props, carrying ladders, hammering, sawing, and perhaps even operating machinery. To facilitate lighting operations, the rehearsal studio, like the sound stage, may be equipped with grids which can be raised and lowered. These may be suspended from the roof trusses, with all cables located overhead, instead of lying across the studio floor as at present.

Sound proof doors obviously are required between the shops and the rehearsal studio as well as between the rehearsal studio and the sound stage. They must be large enough to allow the sets to pass as a whole.

At program time, the set is wheeled onto the auditorium stage, if the studio has an audience, or into the sound stage if no such audience is present. The stage may be equipped with a number of "catwalks" for lights which can be raised and lowered to accommodate sets of various heights.

Two turntables in the sound stage assure a practically continuous flow of sets into and out of the enclosure. They are made of steel and electrically operated. The stage contains, of course, the usual video monitoring rooms, and may incorporate an orchestra pit.

References

[1] Pelton, F. E., "The Pelton System," a privately published and mimeographed folder dated May 1, 1947.

[2] Kasold, E. B., U. S. Patent No. 2,290,242.

[3] Berkely, B., U. S. Patent No. 1,979,363.

[4] U. S. Patent No. 479,001 Issued to J. H. Gutierrez.
U. S. Patent No. 748,116 Issued to O. Stoll.
U. S. Patent No. 1,045,398 Issued to C. L. Hagen.
British Patent No. 439,969 Issued to Normaton Filmgesellschaft.

[5] Read, Morton H., and Bunting, Eugene N., "Practical Operation of a Small Motion Picture Studio," SMPTE Journal, July, 1951, Vol. 57, No. 1, Page 24.

WRZE

White Rose Broadcasting Company

FM EXCLUSIVELY

By **QUINTEN G. CUMERALTO**
Chief Engineer, WRZE-FM

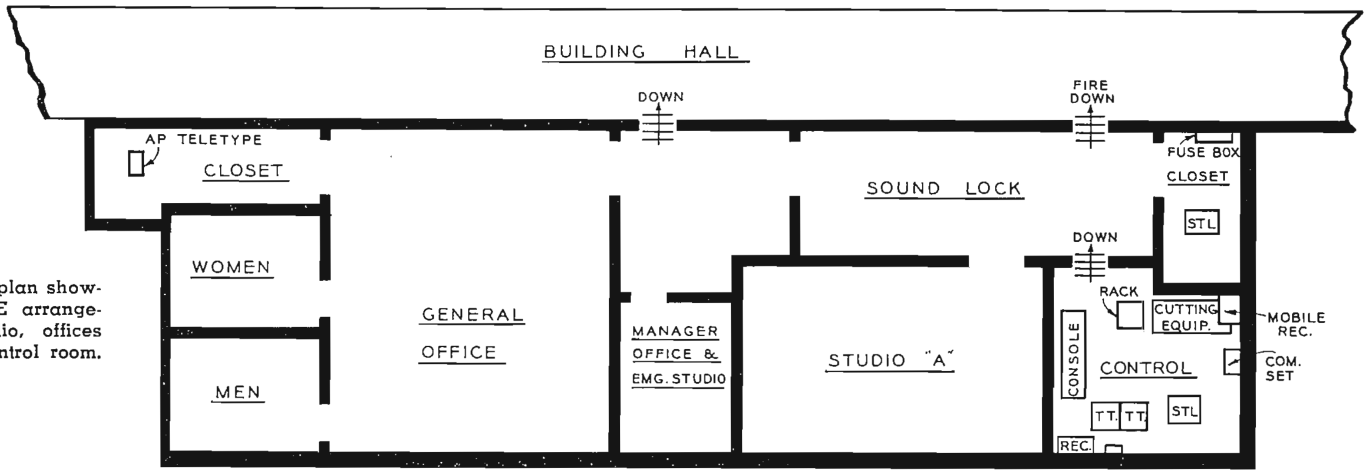


FIG. 1. Floor plan showing the WRZE arrangement of studio, offices and studio control room.

WRZE, located in York, Pennsylvania, is an "FM only" station with coverage that takes in a large portion of southeastern Pennsylvania, and northeastern Maryland.

The construction permit for WRZE was granted on August 17, 1947, for eventual operation on channel 253 with an ERP of 8 KW. Clearing of the land for the transmitter location was begun shortly thereafter. This proved to be somewhat of a job, as it was necessary to construct a road for some distance through the woods and to move solid rock in order to make room for the building and tower. This task being completed, the remaining construction both at the transmitter and at the studio went along smoothly.

Since the remodeling of the building for our studio location had to be completed first, installation of the audio equipment began during May of 1948. Soon after, the transmitter building and tower was completed, and a crew proceeded with the installation of the transmitting equipment. Even though we had no communication equipment between studio and transmitter during this phase of the work, very little trouble was encountered. The only real difficulty occurred while attempting to orientate our STL antennas without communications. However, we managed to get enough signal to the transmitter, to operate the receiver, and when our communications equipment arrived shortly thereafter, we were able to touch up the rough spots.

WRZE went on the air with program on September 6, 1948, and we have encountered very little trouble since that time. The only exception has been power failure several times. However, this will be taken care of when the 31.25 KVA stand-by unit, now located at the main transmitter, is installed.

Studios

As our main studios are quite small, it is necessary to take advantage of all possible space, and this is done in the following manner: The Main studio is equipped with two mikes with facilities for a third mike if necessary. Our control room is ideally suited for combination work and has facilities for two mikes and three turntables. In addition, as the floor plans show,

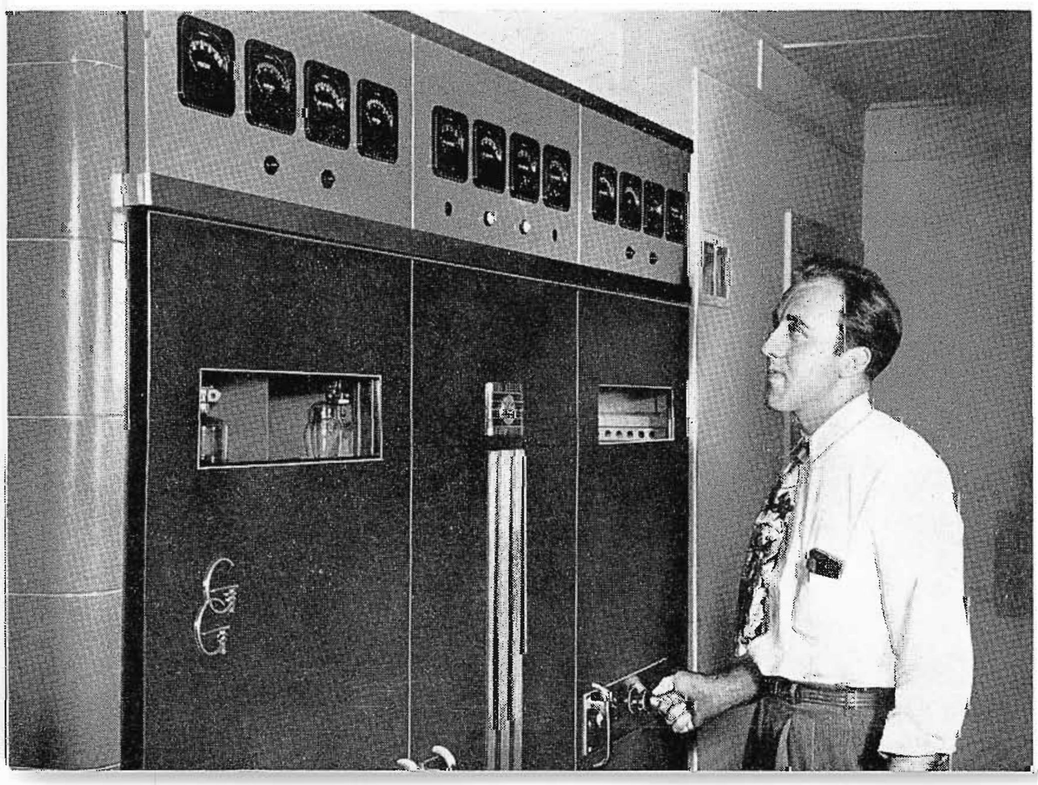


FIG. 2. Quinten G. Cumeralto, Chief Engineer, shown at the controls of the 3-KW FM Transmitter, RCA Type BTF-3B.

it is possible to use the manager's office for an announce booth, should the occasion arise.

The studio has the ordinary run of equipment which includes the RCA 76B Consolette, Two Turntables, Two Portable Cutting Tables with associated amplifier and an audio rack with VU meters, amplifiers, etc. In addition, the communication equipment consisting of the RCA CT1A transmitter and the CR1A receiver is mounted on shelves in the control room as is the remote receiver which is part of the RCA Model BTM-1B remote equipment. Of course, our STL transmitter is also located at the studios with the low power section in the control room and the IPA tripler and the PA doubler section in a small closet adjacent to the control room. The STL antenna and the remote receiving antenna, of the ground plane variety manufactured by RCA, are located on a thirty foot tower on top of the studio building, with the Communications antenna mounted at roof level.

The transmitting portion of the BTM 1B remote equipment is mounted in a Willys Jeep at the present time. However, we hope to improve these facilities in the near future since the frequency allocations for this type of service have been completed. Our audio equipment for remote use consists of the OP-6 and -7 as well as a three-channel amplifier and a tape recorder.

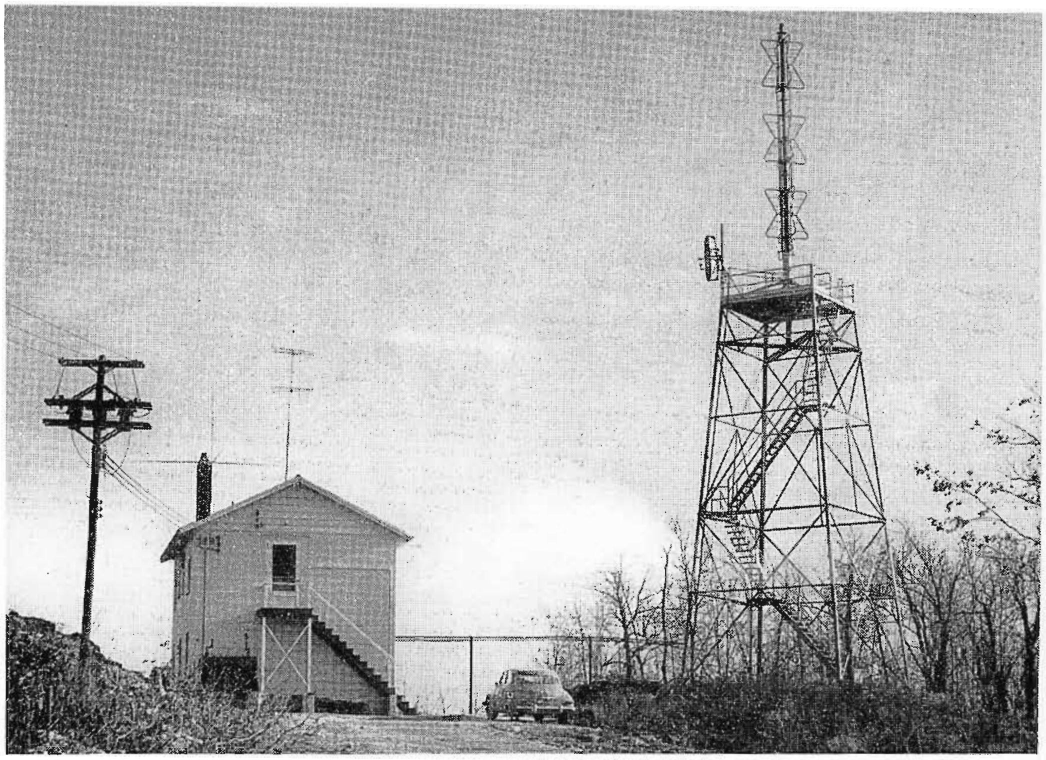


FIG. 3. Transmitter house, FM antenna and relay facilities are located about fifteen miles southeast of York.

Transmitter

The transmitter location is some fifteen miles southeast of York. As this is one of the highest points in York County, 705 feet above average, this location was chosen even though it is somewhat inconvenient with respect to mileage. Our transmitter building is a two story structure with all radio equipment on the second floor and the heating plant and storage space on the first. The original plans called for a one story structure with basement, however, it was found to be impractical to excavate for the basement, and this accounts for the two story building. The second floor of the building is quite elaborate as it contains a complete studio-control room, office, shop and bath room with shower. The studio-control room is of the "room within a room" type of construction and is quite effective in eliminating the blower noise from the transmitter.

We are presently using the RCA BTF-3B operating with a power output of 2.1 KW feeding the RCA 3 Bay Super Turnstile Antenna with a gain of four, giving WRZE an ERP of 8 KW. The audio equipment, all located in the studio-control room, consists of a standard console, two turntables and the audio rack with the RCA 86-A limiter, VU meter Panel, and Monitor amplifier which feeds the hall speaker from any portion of the audio line chosen with the selector switch on the VU meter Panel.

In addition, the modulation monitor and an FM receiver for re-broadcast purposes are also located in the rack. Adjacent to the audio rack is the STL receiver on the right and the Monitor speaker on the left with the control box for the communications equipment, which is also the CT 1A transmitter and the CR 1A receiver; with the antenna located atop the transmitter building as is the FM receiving antenna.

All wiring in the building is run in conduit with each joint welded and the conduit bonded every foot of the way to a system of ground wires which are terminated to a buried ground system located behind the building. As it was felt that this would not be adequate, due to the poor conductivity of the soil, the ground system is also connected to the copper water pipe which runs some 800 feet under ground to a 200-foot well. Each of the tower legs is also connected to this ground system.

The Super Turnstile is mounted on a 40-foot supporting structure complete with stairs to the top, which enable the engineering staff to do all maintenance on the antenna and associated lighting. Also included is a 110 volt AC receptacle at the base of the Turnstile, and it has proven a very handy accessory. As seen by the accompanying photo, our STL receiving antenna is mounted on one corner of the supporting tower.

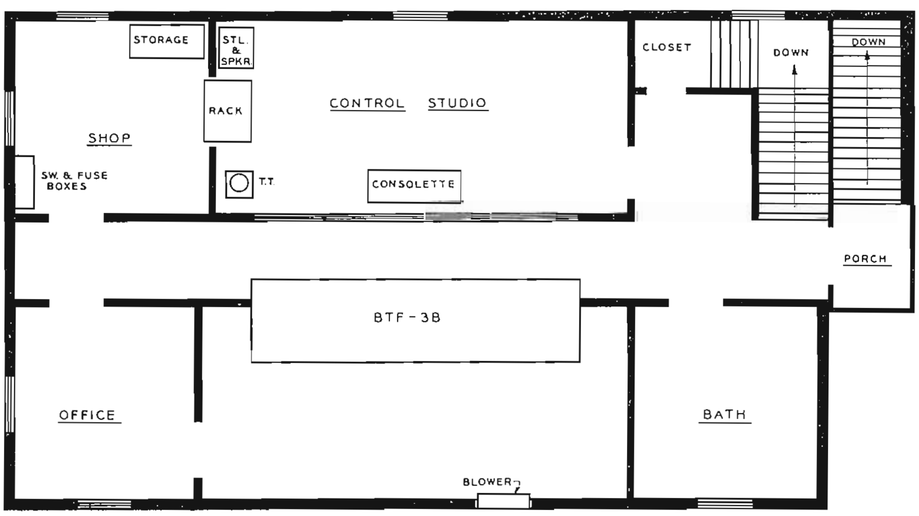
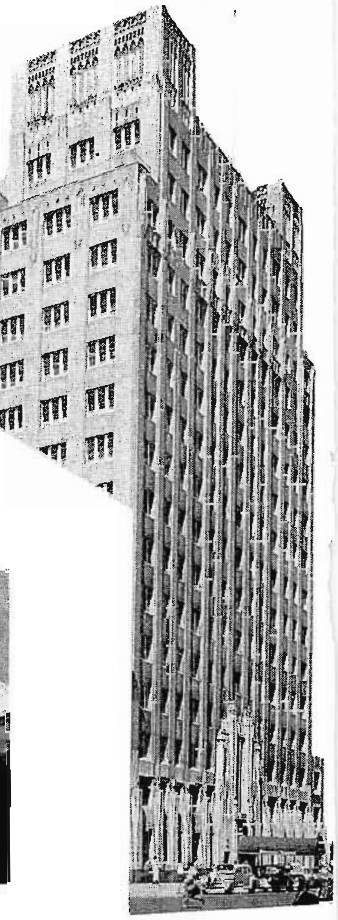
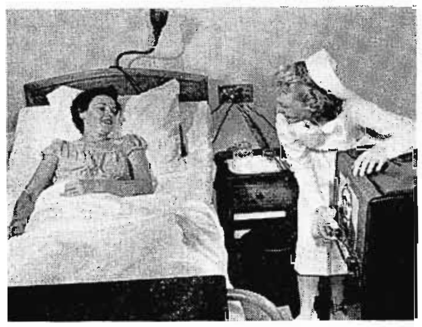


FIG. 4. Floor plan of the WRZE transmitter building showing location of the FM transmitter and control equipment.

ENLARGING THE TELEVIEWING AUDIENCE





Bedside television receivers to brighten the road to convalescence is just one of the many conveniences made available by the management of Hahnemann Hospital.

By E. T. JONES
Engineering Products Advertising

RCA's interest in its customers and products extends far beyond the actual design and sale of the equipment. No constructive phase of the business is overlooked. As a concrete example, take the case of the Television Broadcaster. In certain locations a good portion of his potential audience has been unable to view the programs because:

(a) apartment house management refused to permit tenants to erect a multitude of television antennas on the roofs of their buildings.

(b) in some communities individual rooftop antennas were shielded from TV signals by mountains which surrounded the city or town.

To overcome the above mentioned difficulties, RCA engineers developed and perfected special Television Receiving Antenna and Distribution equipment . . . *RCA Antenaplex® System.*

APARTMENT-HOTEL-HOSPITAL SYSTEM

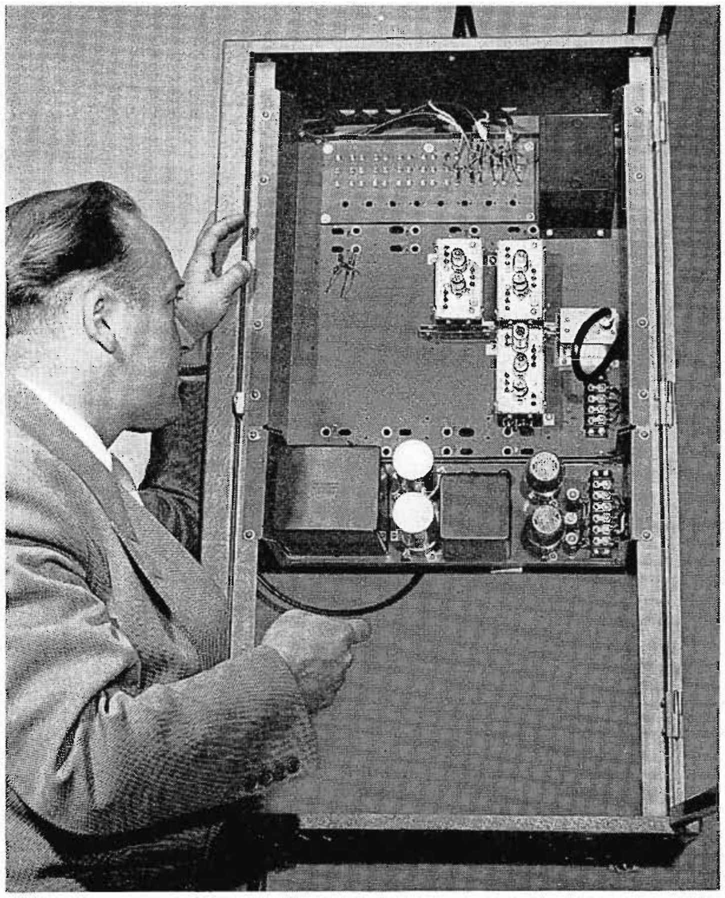
With a single array of antennas on the roof, this system is capable of distributing signals equivalent in quality and quantity to those provided by individual antennas to as many as 350 TV receivers located in as many apartments or rooms.

Rooftops no longer need be disfigured by an unsightly and hazardous clutter of antennas. A modern installation of this kind, employing only one array of antennas, prevents damage to the roof and lessens the hazard of personal injury—with resultant law suits—through the collapse of individual rooftop antennas.

◄ New York City's famous Waldorf-Astoria Hotel serves its guests with clear, sharp television pictures. Seven television channels are fed to 2,500 receivers by means of RCA Antenaplex system.

The Twin Oaks Apartment House of Kansas City, Missouri—designed for gracious living—provides television reception to more than 600 apartments through the expedient of RCA Television Antenaplex System. ▼

The RCA Television Antenaplex array looms above the 20-story hospital. The hospital is the first in the world to provide patients and staff with this multiple-outlet RCA master television Antenaplex system.



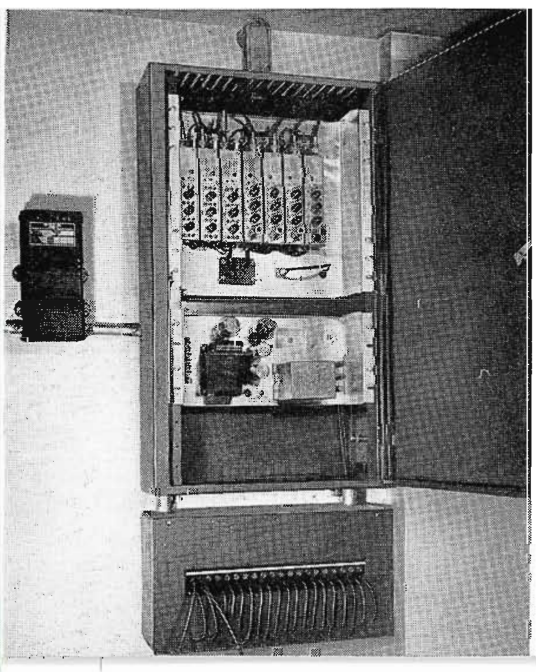
Frank E. Douglas, Jr., Business Manager of Hahnemann Medical College and Hospital, is shown with RCA Antenaplex amplifier and distribution equipment. Excellent reception throughout the entire hospital area is assured.

Hahnemann Hospital of Philadelphia, the first hospital in the world to install an RCA Television Antenaplex system, provides clear and uniform television reception for patients and staff members in virtually any part of the 20-story building. The system is especially free from interference presented by diathermy, X-ray, and other hospital equipment.

Television at the patient's bedside affords many hours of fine entertainment by bringing to him the world's greatest entertainers. He can derive a variety of entertainment from Drama, Comedy, Sports and Religious programs which are broadcast from nationwide networks. The hospitalized patient is truly a receptive audience.

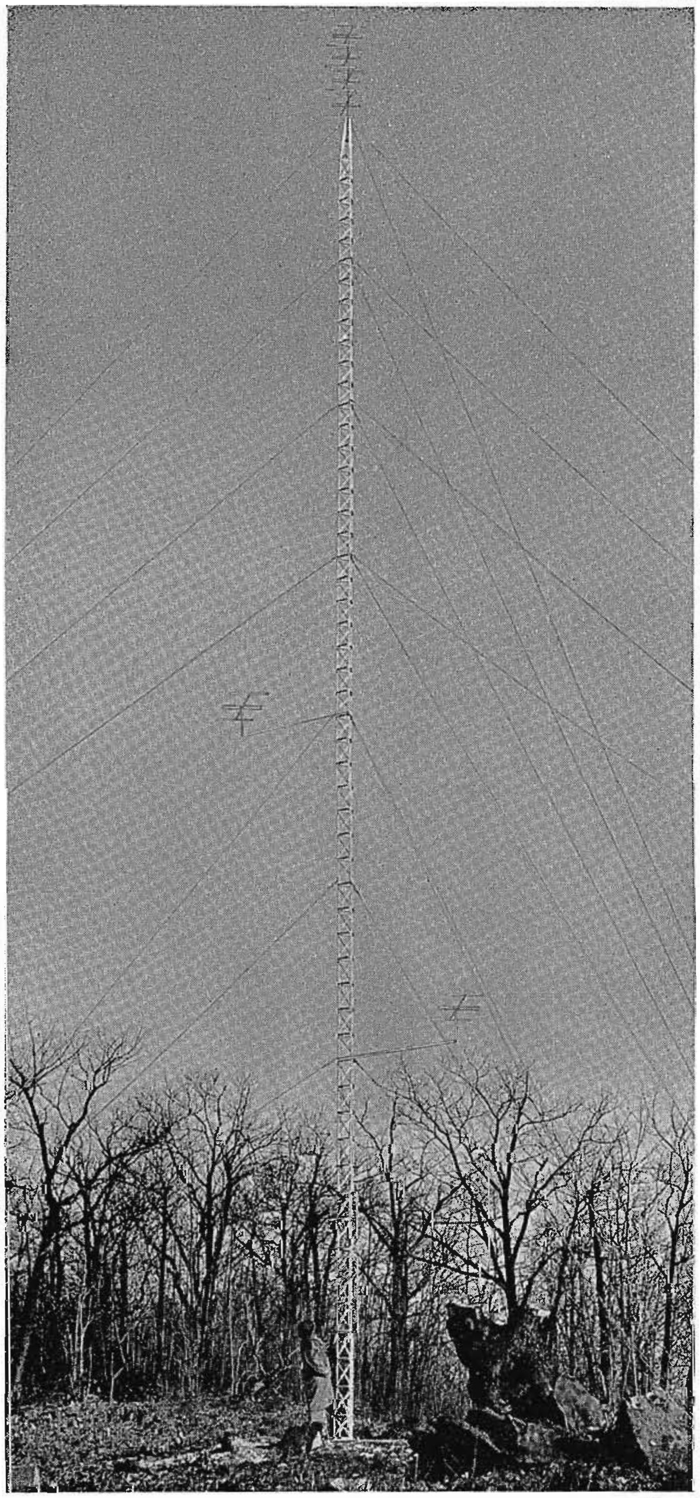
HOW THE WALDORF INSTALLATION OPERATES

It is capable of receiving, through the seven antennas mounted on five masts on the roof, every channel presently locally receivable or programmed for the future, whether in color or in black and white. A special pre-amplifier located in the Tower feeds ten individual risers, one for each channel with three spares running from the 45th to the 6th floor. These risers assure full strength signals at every floor level of the house. To cover the needs of the East and West Towers, the Lower Tower and the various guest and public rooms in the main body, individual amplifiers serving upwards to 250 outlets each, are tapped off the system at the 45th, 18th and the 6th floor. Each amplifier represents a typical antenaplex master antenna system, distributing signals through a single coaxial cable approximating the size of a

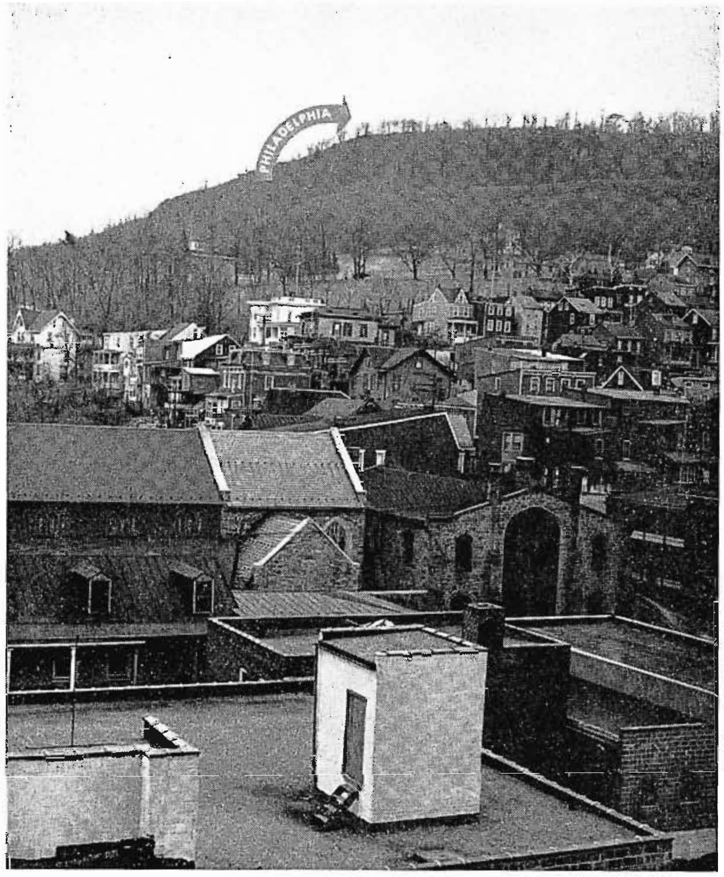


◄ Typical of the units installed at the Waldorf-Astoria Hotel, this 7-Channel Antenaplex Amplifier intensifies the received signals and assures excellent reception in every apartment.

Wall outlets provide the final link of the distribution system. The television receiver is ready for operation as soon as the cord is plugged in. ►



This 80-foot tower reaches out over the top of Sharps Mountain, itself 1,390 feet above sea level, to pick up the three Philadelphia television stations and distribute their programs to the residents of Pottsville.



The shielding effect of Sharps Mountain on the homes in the city of Pottsville is clearly illustrated.

This special RCA Community Television Antenaplex Amplifier greatly intensifies the signals picked up on top of Sharps Mountain—assuring excellent reception in Pottsville homes.

pencil to the individual set outlet in each room. This unique system gives the Waldorf a capacity for operating over 2500 television receivers simultaneously. Moreover, all television receivers throughout the house give clear sharp pictures on every channel. As far as television is concerned the Waldorf can truly be said to be "ghost-free". All equipment is RCA throughout, built to the highest standards of quality.

These features, outstanding as they are, are only a partial measure of the system's value, for in tackling the problem of the Waldorf's public rooms, Master Video and RCA Service engineers developed the special "Master Video control panel" for the public room system which is installed in the Radio Room. This panel enables the Waldorf to completely control the signals to all public rooms from the small parlors and meeting rooms on the fourth floor, to the Grand Ballroom. By means of this control panel, the hotel can give its clientele any desired capacity, from one to 200 receivers operating simultaneously in any public room. Thus the hotel is able to offer to manufacturers, distributors and dealers a proven means of demonstrating their sets or their products through television.

At the same time, by utilizing the spare risers from the roof level to the control panel, the hotel can take off the air direct radio relay signals beamed exclusively to the Waldorf and transmit that signal to any given public room; or the hotel can transmit a closed circuit sales meeting or similar telecast to one or more of the public rooms. All this can be done without disturbance to the Waldorf's guests or normal television reception in other parts of the hotel. Any number of public rooms can be linked for such closed circuit meetings. Or, if the hotel desires, it can transmit its own telecasts to its patrons and guests without resort to outside facilities.

RCA Victor set equipment was carefully tailorded to the hotel's needs. Seventeen-inch consolette-type receivers have been expressly modified, both to incorporate the hotel's radio system and to permit the hotel to cover the needs of those portions of the house still not equipped with the master system and alternating current; for the Waldorf, like many buildings in the area is still faced with the DC problem in portions of the house. Master Video's modifications incorporating the hotel's radio system in TV receivers, provide the hotel's guests with the finest combination system yet evolved.

A special 6′ x 9′ projection unit, for example, was installed by Master Video in the Peacock Lounge for the World Series, naturally contributing towards an increase in restaurant and beverage business. The results were substantial both in revenue and in guest satisfaction.

RCA COMMUNITY ANTENAPLEX SYSTEM

Even entire communities, previously shielded by mountains, have been added to the televiewing audience through the application of the RCA Community Antenaplex System. Clear programs may be obtained from stations up to 100 miles or more depending on the strength of the signals.

Providing television signal reception and distribution service for an entire community, the system consists of a master antenna assembly, mounted on a tall mast on the highest nearby elevation; a network of coaxial cable, strung over utility poles from the antenna site through the areas to be served; amplifiers mounted on poles at fixed intervals to boost the strength of the signals; and lead-off lines terminating in wall or baseboard outlets in the homes of set-owners subscribing for the service. On the antenna mast are three separate elements, each tuned for a channel on which programs are available.

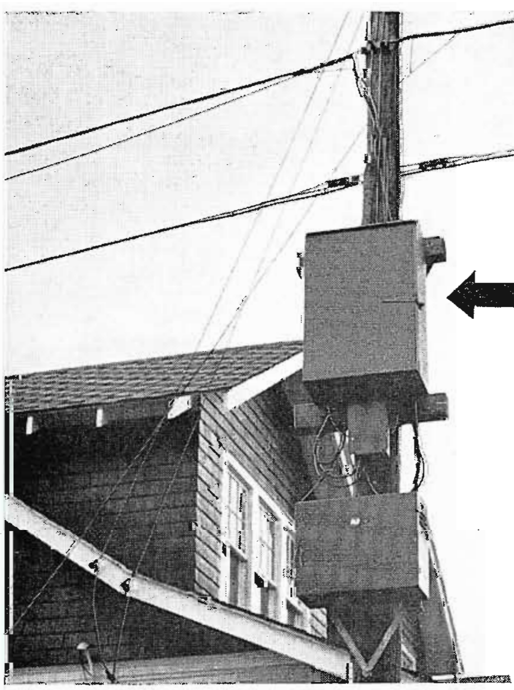
The system eliminates the television "blind spots" represented by mountain-ringed communities, as well as those on flat terrain where the nearest broadcast stations are too remote to permit reception with individual roof-top antennas.

At Pottsville, Pennsylvania, a mountain-ringed community, an RCA installation of this kind is bringing high-quality television reception to more than 400 families whose receivers are connected to the community antenna system. Programs are received from three stations in Philadelphia, *more than 75 miles away.*

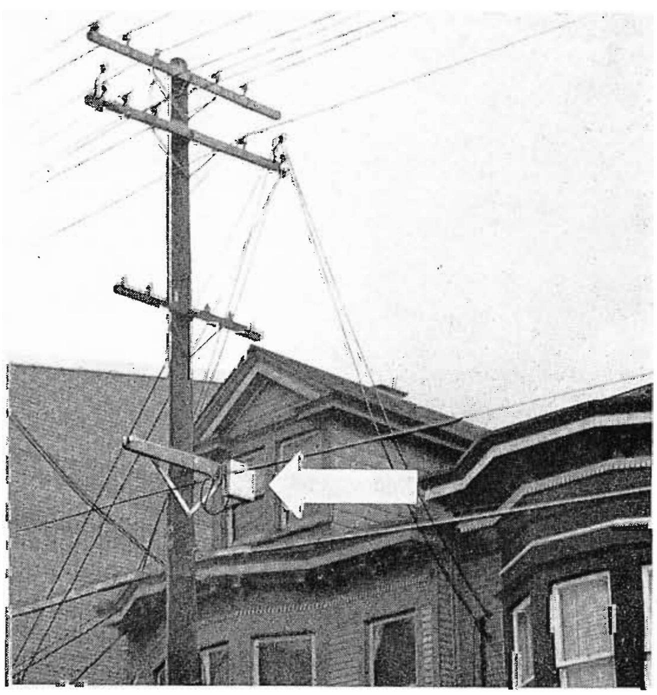
Before the community antenna system was installed, television reception in Pottsville homes was extremely poor, even with elaborate roof-top installations costing in excess of $500 and very often more than the cost of the television receivers.

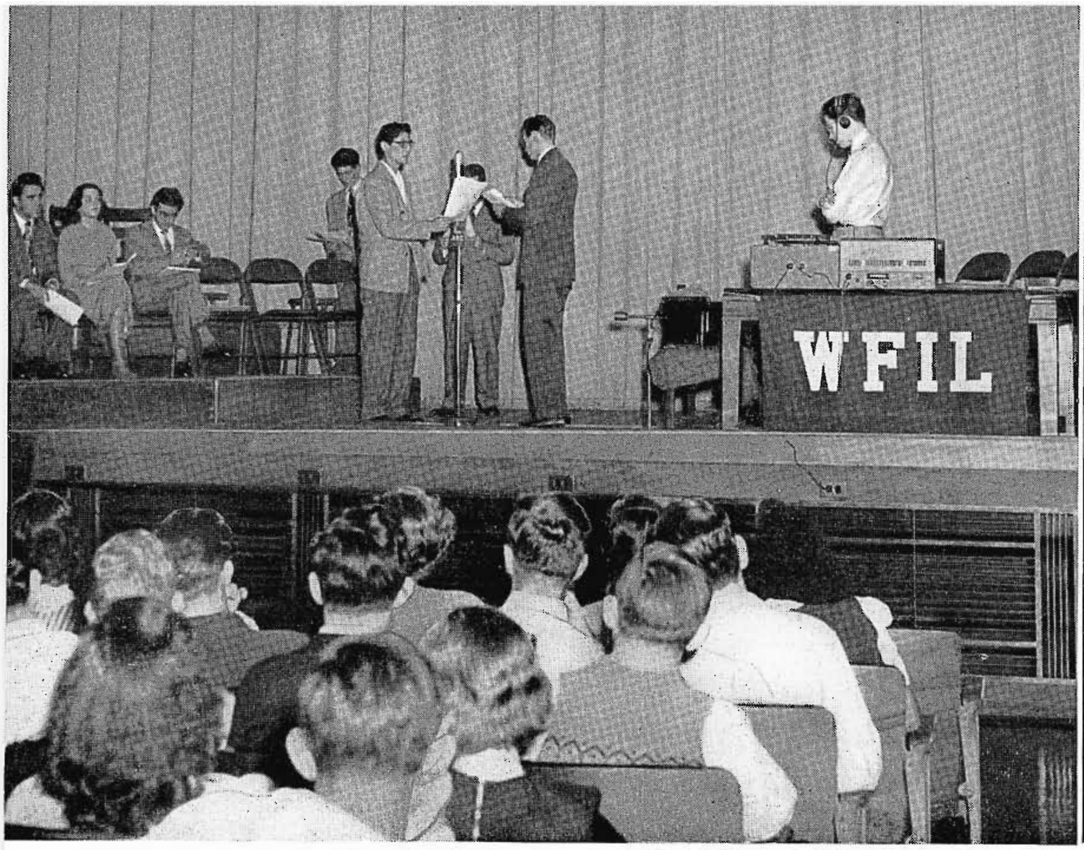
The new system makes use of roof-top antennas unnecessary. Local operating companies, such as the Trans-Video Corporation at Pottsville, Pa., offer the service for a fixed installation fee, plus a monthly service charge.

In addition to the main amplifier, line amplifiers like those below are inserted wherever needed to maintain a definite value of signal strength.

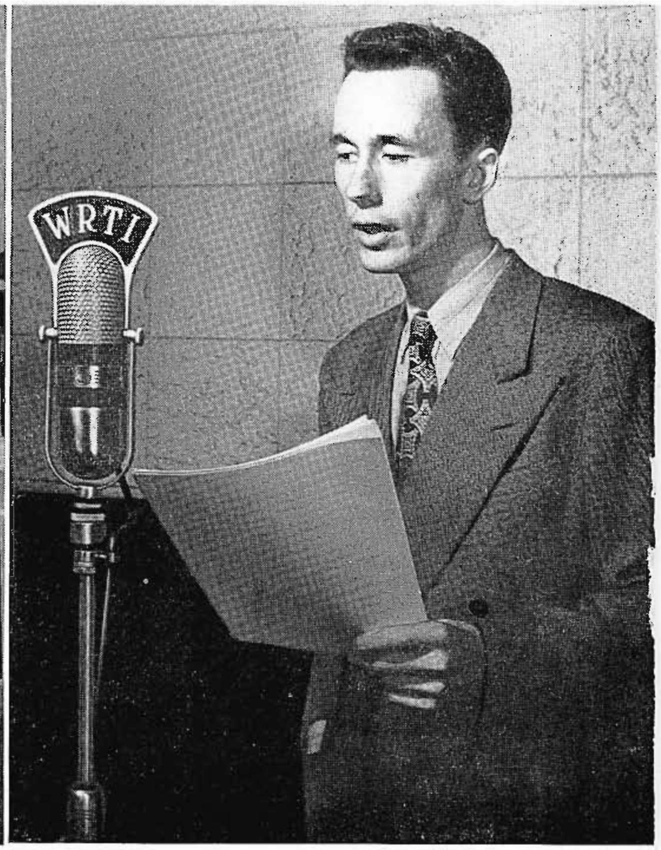


From these distribution boxes, individual homes are fed strong signals which provide high-quality pictures and sound.





The "Studio Schoolhouse," jointly sponsored by RCA Victor and Station WFIL is a busy student activity.



Student announcer gets acquainted with the RCA 77-D Microphone.

Future Talent FOR BROADCASTING

By GEORGE KOEHLER
Promotion Director
Philadelphia Inquirer Stations, WFIL—WFIL-TV

and E. C. MASON
Associate Editor—BROADCAST NEWS

Radio Station WFIL has helped Temple University establish a radio department to provide a practical laboratory for teaching the finest techniques of broadcasting.

Temple's Department of Radio Speech and Theatre operates a campus Radio Station—WRTI. Advice and assistance in the functioning of WRTI is provided by members of the WFIL Stations' Staffs.

The University's Philadelphia Collegiate Network consists of four stations linked together by telephone lines to provide afternoon and evening listening. Temple's WRTI is the Network's key switching center with programs provided by WXPN—the University of Pennsylvania, WPWT—the Philadelphia Wireless Technical Institute and WRTI. The Intercollegiate Network is an agency of good will and a community service.

WRTI frequently contributes recordings of important campus speeches and other events for broadcast over Philadelphia's WFIL. Students trained on WRTI appear five times each week in WFIL's Studio Schoolhouse programs, designed for in-school listening. Other students assist in television productions over WFIL-TV.

WRTI, a small but efficient radio station, operates on a frequency of 640 kilocycles. Costing more than $40,000, it was constructed in 1947 with the aid of a grant from Philadelphia's radio station WFIL.

Transmission eminates from two 10-watt transmitters operating simultaneously through the University's electrical system, covering a 4-square-block area. Radiation is never beyond 200 feet from the power lines.

Although registered with the FCC, WRTI is not licensed because signal radiation is confined to such a small area. However, there is strict adherence to FCC regulations at all times.

Located in the basement of Thomas Hall, Park Avenue and Norris Street and directed by Professor John B. Roberts, WRTI is a completely independent operating unit . . . four studios, four control rooms, reception rooms and lavatories.

Completely RCA-equipped (as WFIL), WRTI uses everything in microphones from the RCA 44-BX down to the Bantam KB-2C's. Also RCA 70-D Turntables and RCA type 76-C consolletes. The OP6 and the OP7 RCA Remote Amplifier and Mixer is used for remote broadcasts.

In the hands of the ingenious and alert student broadcasters, this remote equipment has been a versatile instrument, bringing to the listening audience the voices of such distinguished personalities as President Harry S. Truman, Senator Francis J. Myers, Carl Sandburg, Arthur Garfield Hays, Adolph Berle, Thurman Arnold and Dr. Ralph Bunche. In the field of entertainment, Virginia Mayo, Joe Walcott, Duke Ellington and others. WRTI broadcasts more remotes (other than sports) than any other Philadelphia or surrounding area stations.

Thirty-five percent of WRTI's programs are "live" programs—more than any other Philadelphia professional station. Over 200 students take part in some phase of its activity.

WRTI MEANS BUSINESS!

WRTI sells time and is a complete replica of the most efficient commercial station with regard to programming. Audience analysis, scheduling and logging of programs and maximum utilization of available talent follows the pattern of the most highly organized broadcast service.

In radio, the signing of an advertising contract is an important event. WRTI offers the advertiser a highly select radio audience.

A positive friendly relationship has been constantly maintained with the local stations.

HANDLED WITH CARE!

Discussion type programs that most stations would not tackle are handled at WRTI . . . Minority Group Problems . . . Republican to Democrat . . . Progressive to Socialist . . . all receive full and fair treatment!

WELL-BALANCED DIET

WRTI listeners have enjoyed programs ranging from newscasts received in a teletype-equipped news room, to classical music and dramatic shows. The music library is large and constantly growing.

In the dramatic line, "stay-at-home theatre goers" hear weekly presentations by the Temple Theatre Guild. Many of these half-hour shows are written by WRTI staffers. All this means hours of rehearsal time for actors, announcers, musicians, and sound-effects men. WRTI has grown from a sparsely-staffed, "trial and error" operation to a well-organized, smoothly functioning team.

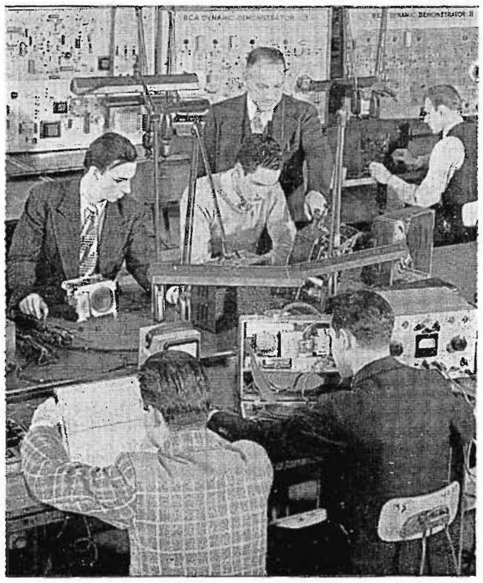
During the football season, WRTI's flag waves from the press box in the stadium, where WRTI sports men cover the game. Basketball, baseball, track, and all physical training meets are handled by the roving special-events staff.

TEMPLE'S TECHNICAL INSTITUTE

To provide the Radio and Television Industry with technical men, the Temple University Technical Institute offers courses designed to meet the needs of a highly-specialized field. The work is intensive in nature and the lectures are supplemented by thorough and practical laboratory experiments. Competent instructors are from radio and television industries in the area —field, test, and telecasting engineers. Thus, Temple gives a completely rounded group of courses in *all* phases of radio, electronics and television.

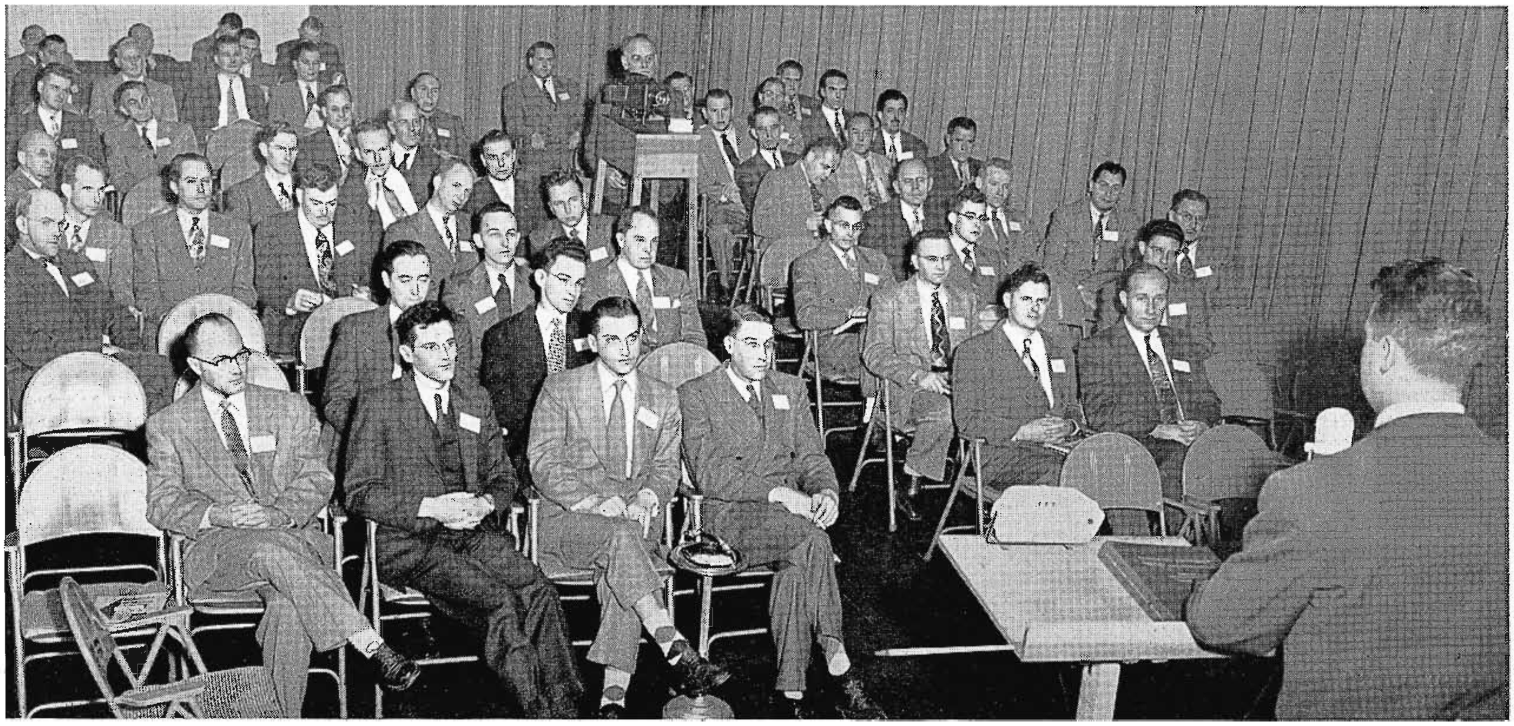
WRTI'S PURPOSE

WRTI has been dedicated as a means of improving present radio standards. Since WFIL helped launch WRTI as a means of providing a reservoir of trained personnel, it is natural that many graduates have become a part of WFIL's organization. But others have become affiliated with WCAU, WDEL, WORK, WCOJ, as well as TV stations. Many other stations have been availing themselves of students graduating with a B.A. degree in radio.



Technical Men of the Future.

RCA Professional Broadcast Audio Equipment creates the "authentic atmosphere" at WRTI—prepares the student Broadcaster adequately for his future.



The "Ninth" Television Training Program—Tuesday Morning Class.

THE "*Ninth*" BROADCASTERS' TV TRAINING PROGRAM

On November 26, 1951 the "Ninth" Broadcasters' Television Training Session was presented by RCA Engineering Products Department in the Exhibition Room in Camden, New Jersey. More than 60 Broadcasters attended the week-long session bringing the number of Broadcasters attending all sessions since their inauguration to the grand total of 500.

A hearty welcome was extended by W. W. Watts and T. A. Smith with general announcements and introductions made by E. T. Griffith. The topics discussed at the Monday session were: "What It Takes to Make a TV Station"—by E. C. Tracy; "Introduction to TV Studio Equipment" — H. Duszak; "Television Theory"—J. H. Roe and A. H. Lind; "TV Camera Equipment" — A. Reisz; "Flying Spot Equipment"—W. E. Tucker; "Synchronizing Generator"—R. J. Smith; "TV Switching"—L. E. Anderson.

A group of Broadcasters inspect a four-section version of RCA's new TFU-24B UHF Antenna—one of the many items of interest displayed.

The Exhibition Room was divided into three sections: a lecture room, a display area and a luncheon section. An intermission at each morning and afternoon session—with refreshments—provided relaxation and an opportunity to "get acquainted". During the recess much interest was shown in a four-section version of RCA's new TFU-24B UHF Antenna. A showcase displayed a model studio layout of RCA's "Basic Buy" TV Studio Package—fully described in BROADCAST NEWS No. 66, and soon to be released as a 12-page brochure. Many familiar pieces of equipment and many items entirely new to the Broadcasters were shown.

Luncheon was served each day at 12:30 and high-fidelity music was provided by the RCA RT-11A Professional Tape Recorder and LC-1A Loudspeaker.

TUESDAY'S PROGRAM

The Tuesday program included talks on "Film Projectors"—by A. E. Jackson; "Video Amplifiers"—R. J. Hucaby; "Video Monitors"—N. P. Kellaway; "Genlock and Special Effects"—E. M. Gore; "Microwave Relay"—C. A. Rosencrans; "TV Mobile and Supplementary Equipment"—L. E. Anderson; "TV Pick-Up Tubes"—R. Johnson (RCA Tube Dept.); "TV

REGISTRANTS AT THE 9TH TELEVISION TRAINING PROGRAM

Walter H. Allen	KALB	Alexandria, La.
Theodore Andras	WDET-FM	Detroit, Mich.
George Andrewsky	WBRE	Wilkes-Barre, Pa.
James Ascher	WJDA	Quincy, Mass.
Major John Bauriedel		Joliet, Ill.
Allen Bell	WELM-WCLI	Elmira, N. Y.
Edgar T. Bell	KTOK	Oklahoma City, Okla.
Robert M. Booth		Washington, D. C.
George Borden	WPTZ	Philadelphia, Pa.
Ray Boyd	WNOE	New Orleans, La.
Harold Brinkman	WXEL	Cleveland, Ohio
Elliot A. Browning	WTAG	Worcester, Mass.
Nestor Cuesta	KWBU	Corpus Christi, Tex.
W. Darling	WMAR	Baltimore, Md.
Maynard Davis	WWNY	Watertown, N. Y.
Lewis Dickensheets	WIBW	Topeka, Kansas
William Ellis	WFAA	Dallas, Tex.
J. Gilmour	CBC	Montreal, Quebec
A. J. Ginkel	WJLS	Beckley, W. Va.
A. Goodman	WMAR	Baltimore, Md.
A. Hill	KTOK	Oklahoma City, Okla.
Frank Hales	WBRY	Waterbury, Conn.
J. Harold Haughawout	KTAR	Phoenix, Ariz.
George Hixenbaugh	WMT	Cedar Rapids, Iowa
Karl B. Hoffman	WGR	Buffalo, N. Y.
Arthur Holbrook	WIBW	Topeka, Kans.
Harold Holland	WFBM	Indianapolis, Ind.
W. Hooper	WMAR	Baltimore, Md.
Arthur Hopwood	WPTZ	Philadelphia, Pa.
Paul Huhndorff	KPRC	Houston, Tex.
William Hunt	WHIZ	Zanesville, Ohio
J. H. Jones	CBC	Montreal, Quebec
Noran E. Kersta		New York City
C. Lau	WMAR	Baltimore, Md.
D. Leibensperger	WHP	Harrisburg, Pa.
William G. Matta	WLOA	Braddock, Pa.
Ward Miller	WHLD	Niagara Falls, N. Y.
J. H. Mitchell	WFLA	Tampa, Fla.
Carlton Nopper	WMAR	Baltimore, Md.
N. J. Pappas	CBC	Montreal, Quebec
Ben Parrish	KHMD	Hannibal, Mo.
Chester Rector	WIOU	Kokomo, Ind.
F. Remley		Ann Arbor, Mich.
Joseph H. Rohrer	KRDO	Colorado Springs, Colo.
John Roth	WPTZ	Philadelphia, Pa.
Charles Sakoski	WBRE	Wilkes-Barre, Pa.
R. E. Santo	CBC	Montreal, Quebec
Joseph H. Saxon	WTOK	Meridian, Miss.
Erwin Schoney	WGBP	Evansville, Ind.
Al Smith	KCOM	Sioux City, Iowa
H. Snyder	WMAR	Baltimore, Md.
Blair Thron	WFPG	Atlantic City, N. J.
George Townsend	WSPR	Springfield, Mass.
W. Weaver	WNOW	York, Pa.
L. A. Wilkinson	WTOP	Washington, D. C.
W. A. Wilson	KBOR	Brownville, Tex.
Robert J. Wilson	WHLD	Niagara Falls, N. Y.
Charles Wirtenan	WIBM	Jackson, Mich.
G. Wooden	WMAR	Baltimore, Md.

Studio Lighting"—H. M. Gurin (NBC); "TV Systems"—J. H. Roe; "Installation, Tune-Up and Maintenance"—T. Griffin (RCA Service Co.).

WEDNESDAY'S SESSION

On Wednesday morning a laboratory visit was conducted under the direction of W. J. Poch to acquaint the Broadcaster with new developments in video equipment.

After having lunch and returning to the lecture room, discussions covering "Introduction to Audio Equipment"—by D. Bain; "Audio Systems for TV"—W. E. Stewart; "Custom Audio for TV"—M. Gunn; and "Microphones and Microphone Techniques"—by G. Graham (NBC) were presented.

THURSDAY'S PROGRAM

Thursday's schedule included "Introduction to Transmitters"—by R. J. Newman; "Principles of TV Transmitter Design"—T. Gluyas; "TT-2AL/2AH, 2 KW TV Transmitter"—W. T. Douglas; "TT-10AL/10AH, 10 KW TV Transmitter"—R. Meisenheimer; "TT-25AL/20AH, 25 and 20 KW TV Amplifiers"—F. Talmage; "TTU-1B, TTU-10A, 1 KW and 10 KW UHF Transmitters"—T. P. Tissot; "General Principles and Theory of TV Antenna"—W. Darling; "TV Antenna Components"—L. J. Wolf; "TV Super-Turnstile Antennas"—H. Wescott.

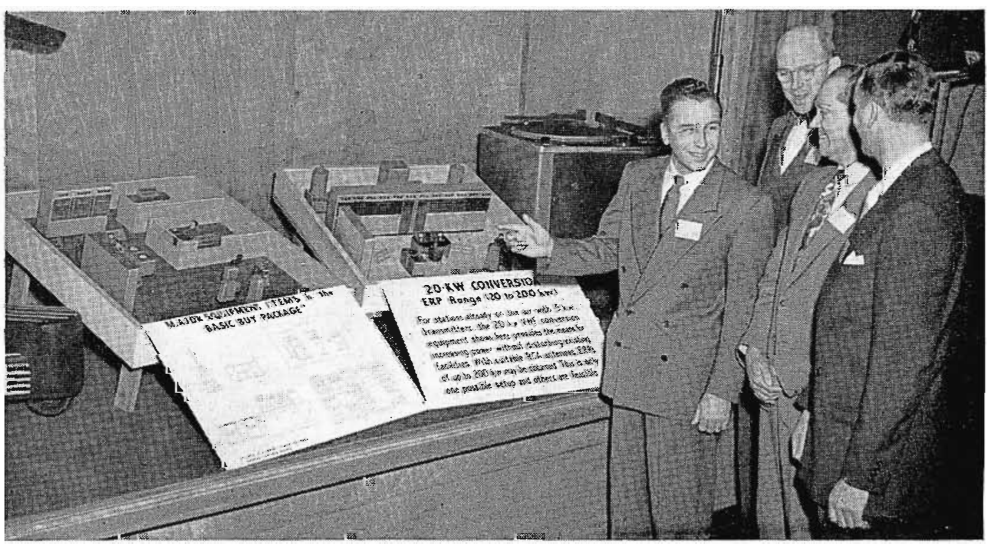
Thursday evening provided a little diversion—with Cocktails and a Banquet. Truly a cordial evening!

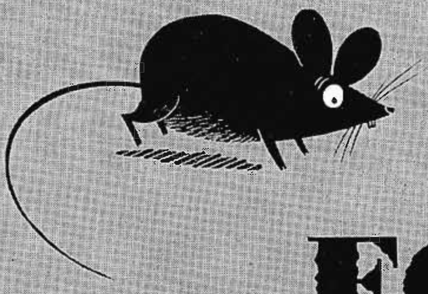
FRIDAY'S SESSION

Friday's session included such topics as: "VHF Custom Antennas"—by L. J. Wolf; "UHF Antenna Systems Equipment"—O. O. Fiet; "TV Towers"—D. Balmer; "TV Markets"—D. Halpin; "Monitor and Test Equipment"—W. T. Douglas.

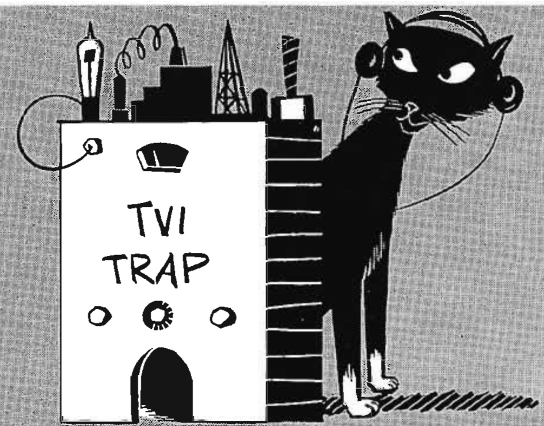
Since 1947, RCA has played host to over 500 enthusiastic Broadcasters at nine Television Training sessions. The "Tenth" Training Program will be held February 25, 1952.

Discussing the RCA "Basic Buy" and 20 KW Conversion Equipment display are (l. to r.): Paul Huhndorff, KPRC, Houston, Texas; Harold Brinkman, WXEL, Cleveland, Ohio; Nestor Cuesta, KWBU, Corpus Christi, Texas; James Barclay, RCA.

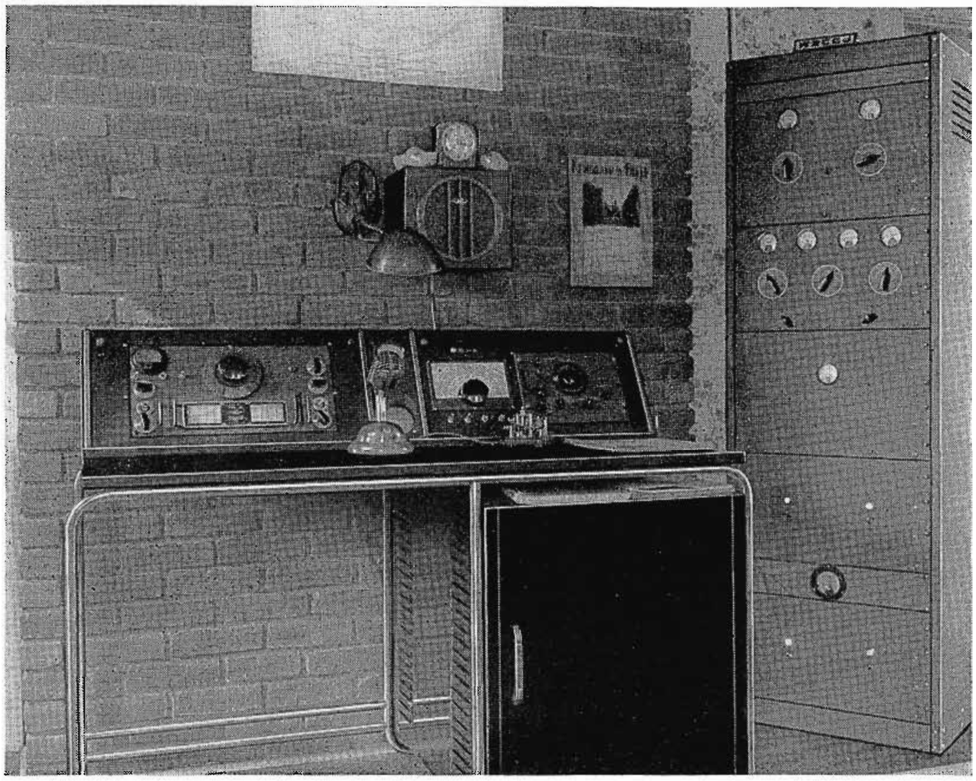




HAM FORUM



A DEPARTMENT FOR THE BROADCAST RADIO AMATEUR



W2CGJ made this attractive ham desk (above) from an RCA Broadcast Type 80-B Console Desk. Below, Allen Jones, W1NW of WHDH is shown operating W1TOP, Tri Tower Radio Club Headquarters Station.

HAM SHACK — LIVING ROOM STYLE!

Those who have been in the Broadcast Business for at least 10 years won't have to guess what was used to make this attractive ham console.* Construction of this neat, convenient desk for receiver, VFO, freq. meter, speech amplifier and monitor scope, with all power supplies, was the ingenious work of Fred de Jaager, W2CGJ, Chief Engineer of Empire Broadcasting Corporation, N. Y. . . . *This should give somebody i-d-e-a-s . . . !*

Fred's transmitter, shown beside the console, is a 750-watt job, 100% TVI-proofed, with push-pull 100TH's in the final. This transmitter made DXCC in 1949, operates on 3.5, 7, 14 and 28 mc. Beams for 10 and 20, mounted atop a 50-foot pole several feet behind the house, are fed with one piece of co-ax. A relay at the top of the pole selects either beam. Co-ax and all control wires between the house and pole are underground.

W1TOP GOES AFTER W-A-C 75 FONE

Philip K. Baldwin, W1ZW, Chief Engineer of WHDH and WHDH-FM, Boston, reports excellent results with W1TOP, 200-watt headquarters station of the Tri Tower Radio Club. In only a few months operation, they have worked all districts several times and dx including two ZL contacts—all on 75-meter phone! Club membership is limited to employees of WHDH and WHDH-FM, Boston.

W1TOP is installed in the WHDH transmitter building at Needham, Mass., twelve miles southwest of Boston. One corner of the workshop bench (see photo at left) is utilized for the club's installation. The transmitter uses a pair of 812's in the final modulated by Class B 811's, and a surplus

* RCA Type 80-B Console Desk.

Address correspondence to:
HAM FORUM
Marvin L. Gaskill (W2BCV)
Associate Editor, Broadcast News
RCA, Camden, New Jersey

aircraft transmitter ECO. Two receivers, an SX-28 and NC100 are used with a switching arrangement for selection of either to feed the speaker.

Groundplane Vertical Antenna

The W1TOP antenna is a groundplane vertical radiator 61 feet long. The radiator, constructed of aluminum tubing, is supported by a 30-foot pole and wire guys. Four horizontal radials spaced at 90-degree intervals terminate in a copper ring at the base of the radiator about 16 feet above ground. The antenna is fed at this point with RG8U cable. Operation is presently confined to 75-meter phone.

Let's hear from some W6's and K6's. All districts have been heard from but the sixth. . . . Shame! 73, W2BCV

NAA 1914 — How Many Do You Know?

John Stengér, Jr., W3ZS of WBAX, Wilkes Barre, Pa., submits this picture of the 1914 crew at famous NAA. Are any of the sigs familiar to you? Inset shows John at his ham station, 8NR, in 1912. He was 5G in 1908, 8ZS in 1915 . . . interrupted his ham career during World War I when he joined the Navy.

Effective ¼ wave vertical of W1TOP is shown in above photo behind WHDH station wagon.

Below, 1914 NAA personnel of U. S. Naval Station, Arlington, Va. Top row, left to right: J. E. O'Neil, Chief Machinist; Simonton, Civil Clerk; W. A. Eaton, Chief Elect.; Penland, Chief Elect.; George Clark, Radio Inspector; Wood, Chief Yeoman; J. W. Scanlon, Chief Elect., Radio, In Charge; Lt. Cmdr. S. W. Bryant, Asst. Supt. Naval Radio Service; J. H. Knapp, Asst. Paymaster. Middle row, left to right: Pritchett; Palmer; (the mascot, "Static"); Bain; Burge; Carbin; Hunter; Pitts, all Operators; and Hildum, Yeoman. Bottom row, left to right: Burke, Operator; Kweeder, Yeoman; Ferree and Wilken, Operators; M. E. Eason, Chief Elect.

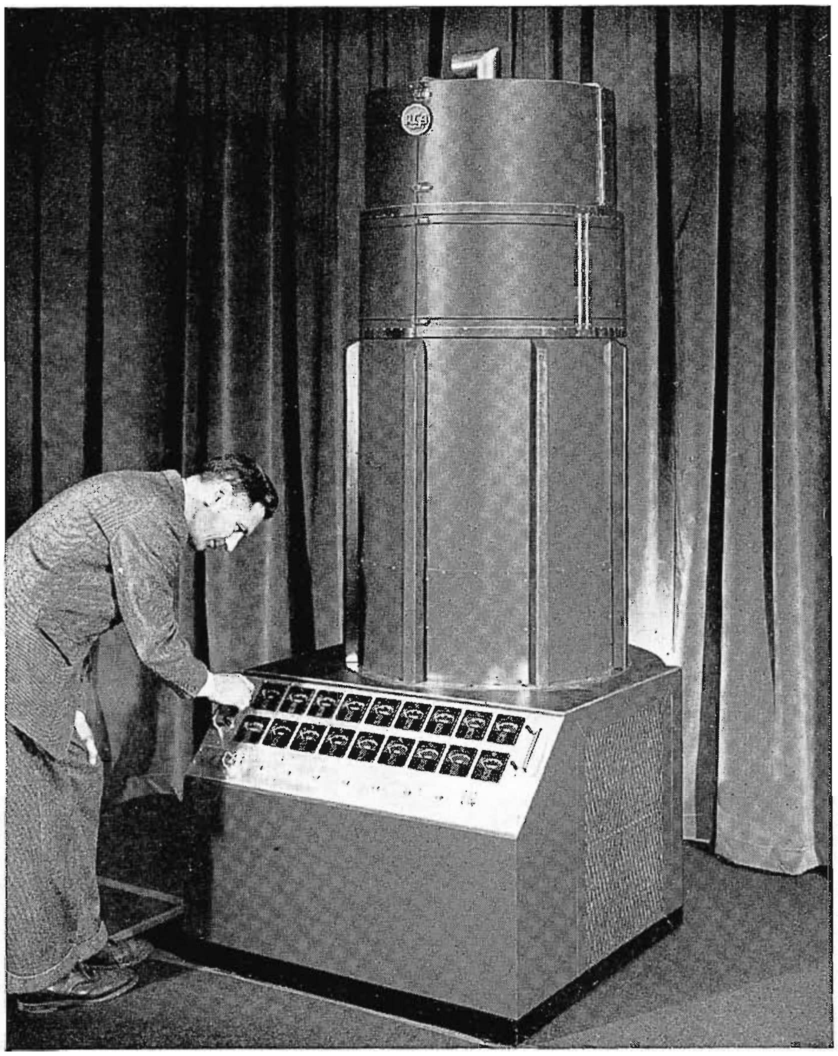


FIG. 2. External view of the low band amplifier for channels 2 to 6.

TT-25AL/20AH CONVERSION EQUIPMENTS

HOW TO CONVERT AN OPERATING 5-KW TV STATION ON VHF TO 200 KW (ERP)

by F. E. TALMAGE
BROADCAST TRANSMITTER ENGINEERING

The TT-25AL and the TT-20AH conversion equipments are high power amplifiers for use with 5 kilowatt television transmitters. The TT-25AL operates on channels 2 through 6 and will provide up to 25 KW peak visual power and 12.5 KW aural power. The TT-20AH operates on channels 7 through 13 and will supply up to 20 KW peak visual power and 10 KW aural power. These equipments are designed primarily to operate with the RCA TT-5A television transmitter but can also be furnished for use with any other 5 KW television transmitter meeting the FCC and RTMA specifications.

In the light of the effective radiated power increases which the FCC has granted recently to operating TV stations in the VHF band, the RCA Transmitter Power-Conversion Equipment has assumed new importance to the industry. For the TV station on-the-air which began life on a small scale, the opportunity to raise its effective radiated power is afforded through a conversion job, rather than a complete, new installation.

Using the TT-25AL/20AH Conversion Units with a 5-KW Transmitter as a driver, it is possible for a station to multiply its transmitter power 4 or 5 times, depending upon whether the channel in use is low band or high band. Thus, a transmitter with a 20-KW output, used in conjunction with a 6-bay antenna and an average length of line would give an effective radiated power of at least 100 KW. With a 12-bay antenna, the ERP would become at least 200 KW.

The advantages of higher power are obvious. The station gets increased coverage with its signal, plus better signal to noise ratio in the picture. More effective use of indoor antennas is possible in the reception area, and there is less receiver oscillation interference.

Fig. 1 is a block diagram of the TT-25AL/TT-20AH equipment. The internal circuits of the 5 KW driver are not changed. The video and audio signals are fed to the driver and the modulation occurs in this unit. The RF output from the visual driver is fed to a class "B" linear amplifier. The aural amplifier is similar to the visual amplifier except that it may be operated class "C" since the sound carrier is frequency modulated.

Construction

The power and control equipment for the amplifiers are housed in four cabinets which match the cabinet of the RCA TT-5A. These cabinets may be placed either in line with the TT-5A or at right angles. Several suggested floor plans are shown on the preceding pages. Since the two power supply cabinets do not contain any operating controls or meters, they can be mounted either with the other cabinets or in the rear as shown in the second floor plan.

The RF circuits are housed in two cylindrical cabinets illustrated in Fig. 2. The units for the visual and for the aural amplifier are mechanically almost identical.

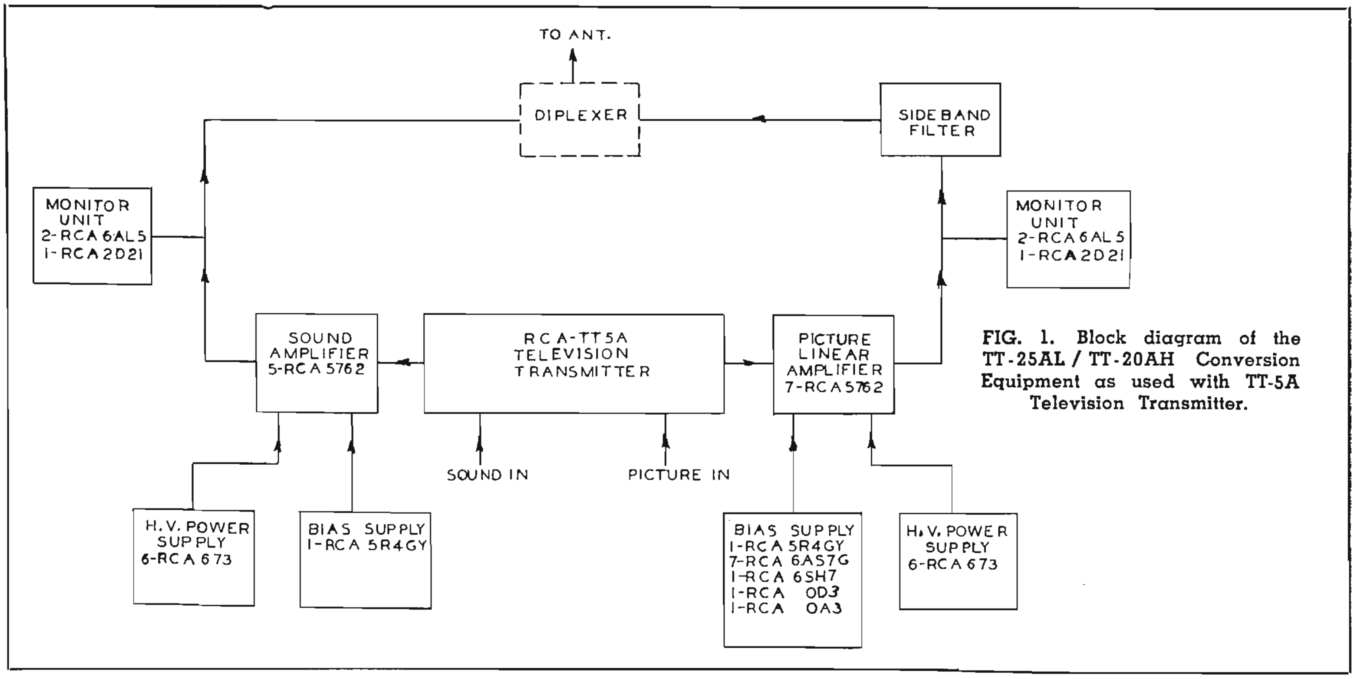


FIG. 1. Block diagram of the TT-25AL / TT-20AH Conversion Equipment as used with TT-5A Television Transmitter.

The lower rectangular section of the amplifier unit houses the blower, filament transformers, meters and tuning controls while the upper cylindrical section contains the tubes and RF circuits. Air for cooling the tubes is drawn in through two filters on the sides of the bottom section and is expelled out the top of the unit. Access to the tubes is obtained through four hinged doors near the top of the unit. All other parts are easily accessible for servicing by removing the top dust cover, the side plates or the filters. The reflectometer and monitor circuits are contained in a separate unit which may be inserted in any convenient place in the output line.

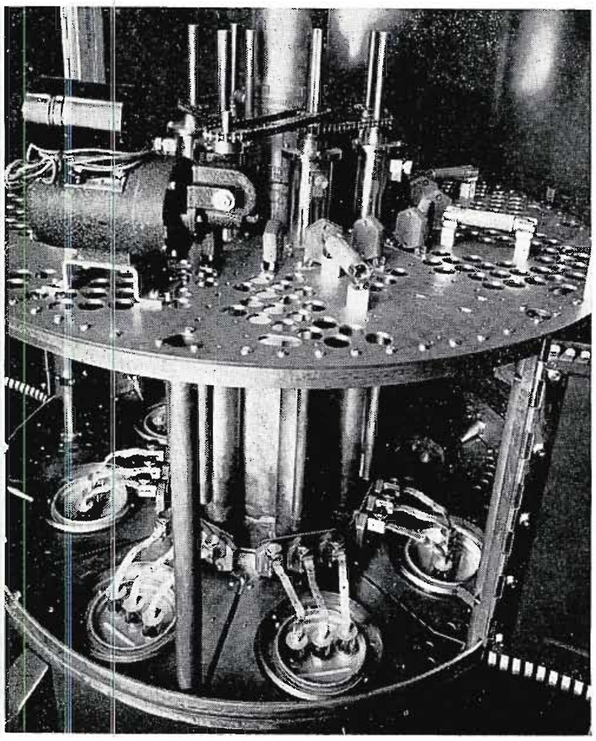


FIG. 3. Closeup showing the cluster of seven air-cooled 5762 triodes used in the 20 kw amplifier equipment.

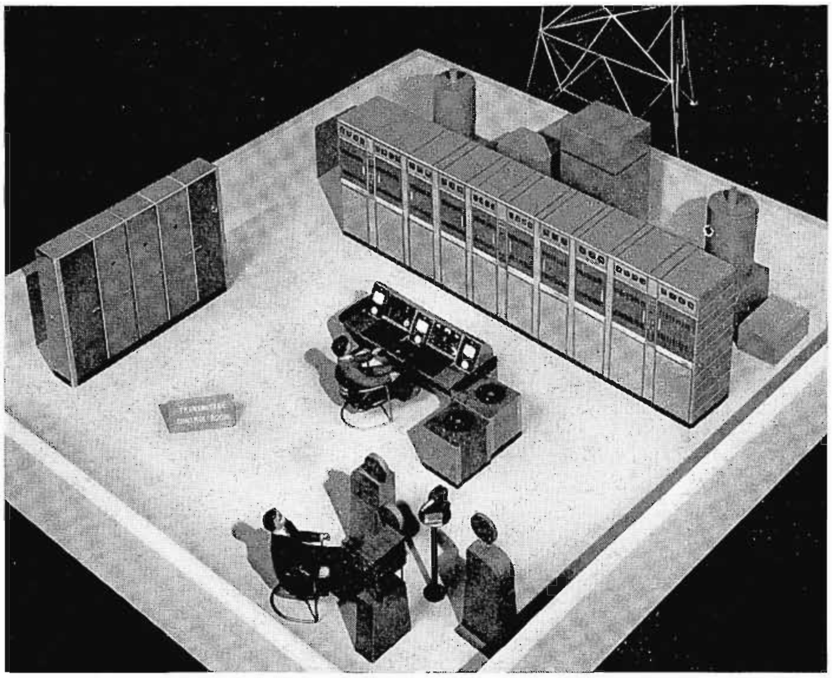
Circuit Description

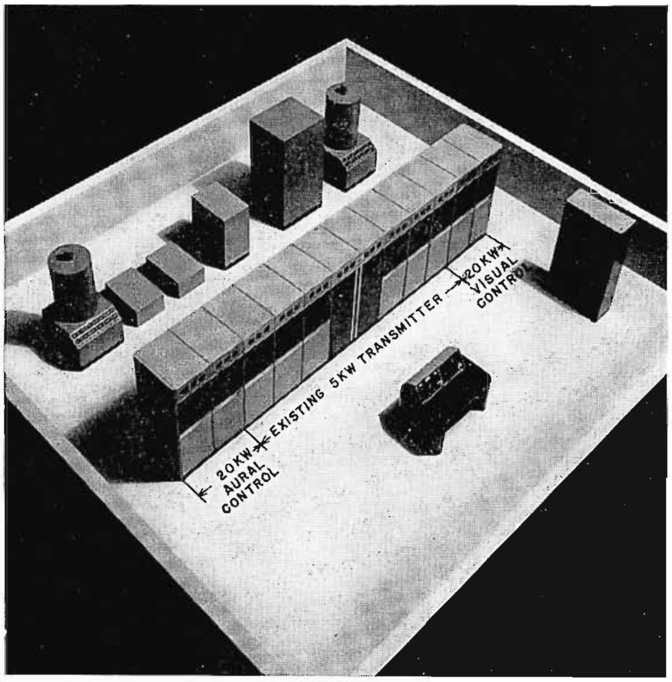
The visual RF amplifiers for both the low-band and the high-band equipments each employ seven RCA-5762 air cooled tubes operating in parallel in a grounded grid circuit. The tubes are placed in a circle as shown in Fig. 3. The aural amplifier also contains seven RCA-5762 tubes in an almost identical circuit, however, the filaments of two of the seven tubes may be turned off if desired, leaving only five operating tubes. The general appearance of the low and high band units are similar but the internal circuits necessarily differ in several important respects. Both the low and the high band units will be described separately below in more detail.

Low-band Amplifier: The operation of the low-band unit can best be understood by referring both to the simplified equivalent circuit Fig. 5 and the cut-away view of the amplifier shown in Fig. 4. The plate tank circuit is tuned by (L-10). As can be seen in the cut-away view, this inductance is a co-axial tank formed by the outer shell, and an inner cylinder, and varied by a shorting bar located below the tubes. The shorting bar is motor driven and controlled from the front panel. The output transmission line is brought up through the center of the tank and coupled to the plate circuit through a variable capacitor (C-40). This capacitor is also motor driven and controlled from the front panel. What is equivalent to a second tuned circuit is formed by inserting a shunt capacitor (C-10) in the output transmission line approximately one quarter wave from C-40. This secondary circuit is tuned by sliding capacitor (C-10) along the line. The inductance L-30 shown in the equivalent circuit is actually the first quarter wave of the output transmission line. By a suitable selection of the value of capacitor (C-10) and proper adjustment of the coupling capacitor (C-40) a broadband flat-topped circuit can be obtained as illustrated in Fig. 6. The optimum circuit has been found to be 8½ to 10 megacycles wide between half power points and almost flat over the six megacycle channel.

The input or cathode circuit is also essentially a co-axial tank circuit tuned by a shorting bar shown near the center of Fig. 4 just above the tube level. In the equivalent circuit this is shown as a variable inductance (L-40). Because of the high input capacity of seven tubes in parallel this tank is actually much less than a quarter of a wavelength long. A large part of the inductance is formed in the tube and by the tube leads. The input line is fed through the center of the cathode tank and is connected in series with the input circuit at a low impedance point. In order to match this impedance to the 72 ohm line from the driver two quarter-wave transformer sections T9 and T10 are employed. In the cut-away view these are shown built into the 3⅛" input line by using the proper size center conductors for the quarter-wave sections.

To allow for variation in tube input capacity and for variation in feed-through power, a means for making some adjustment to the input coupling must be provided. In the low band amplifier this is ac-



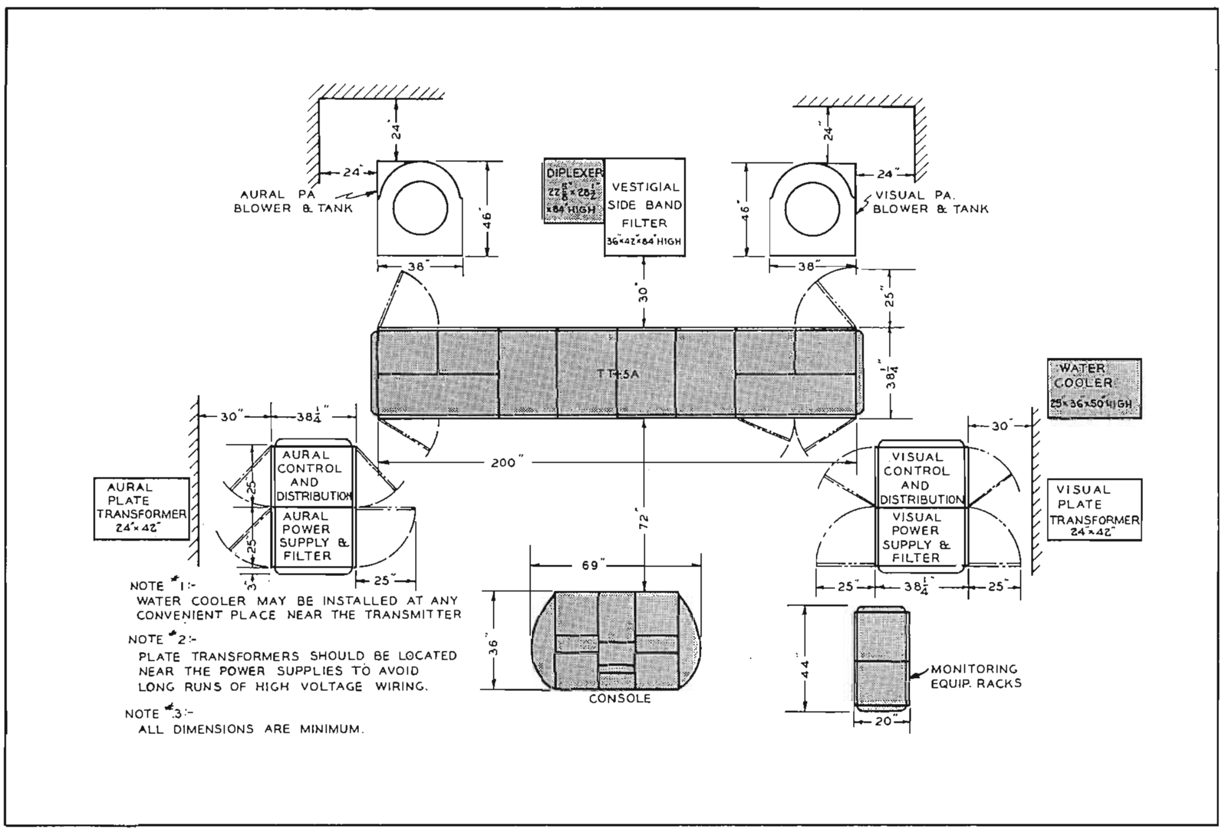


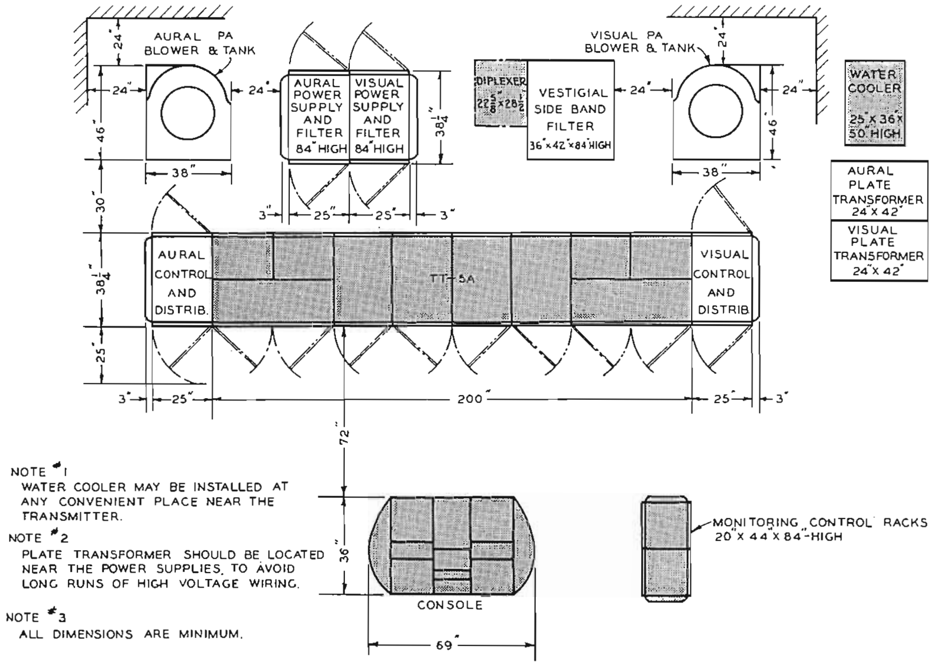
20-KW, VHF ERP Range (20 to 200 kw). For a new station desiring to start with the maximum power, the 20-kw Type TT-20B Transmitter will provide the full 200 kw when used in connection with an RCA 12-section Super Turnstile Antenna. In this layout the TT-20B Transmitter is located "In-line" with associated power equipment at the rear. Some Broadcasters may prefer a block "U" arrangement.

20-KW CONVERSION ERP Range (20 to 200 kw). For stations already on the air with 5-kw transmitters, the 20-kw VHF conversion equipment shown here provides the means for increasing power without disturbing existing facilities. With suitable RCA antennas, ERP's of up to 200 kw may be obtained.

FLOOR PLANS AND STATION LAYOUTS FOR

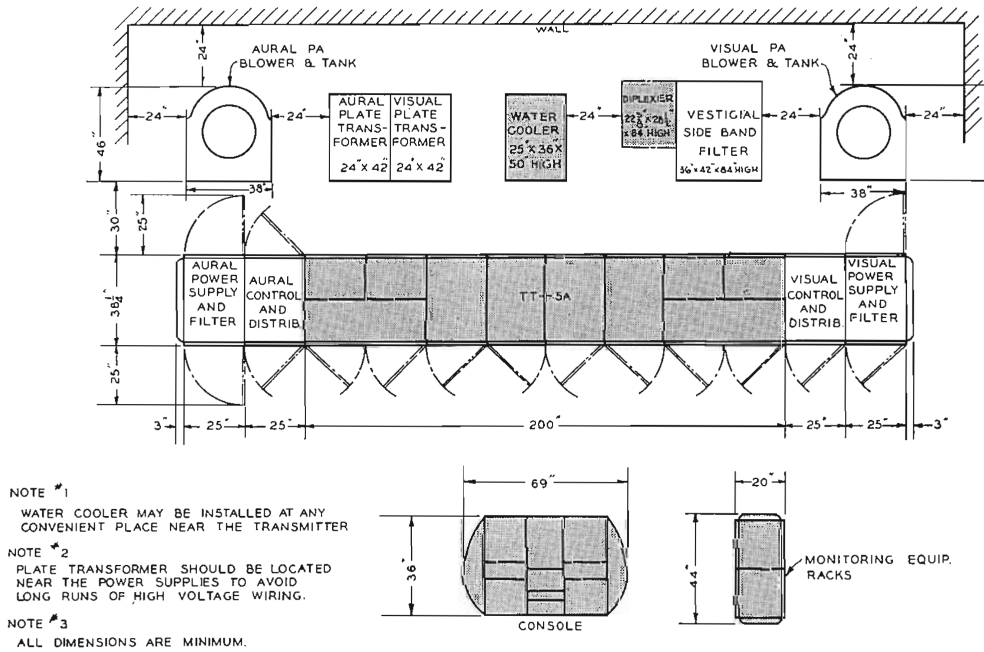
Floor plan of TT-25AL/TT-20AH with power supply and power control racks located at the ends of the transmitter. Shaded portions of the diagram are TT-5A units.





Floor plan of TT-25AL/TT-20AH, with power supply and power control racks located behind the transmitter. Shaded portions of the diagram are TT-5A units.

25/20 KW TRANSMITTER CONVERSIONS



Floor plan showing the straight line arrangement of TT-25AL/TT-20AH. The shaded portions of the diagram are TT-5A units.

complished by adding in shunt capacitors C-101—C-107. As can be seen in Fig. 4 these capacitors take the form of seven co-axial capacitors. To vary the capacity a mycalex cylinder which has a dielectric constant of approximately 6 is inserted between the center and outer tubes. These seven mycalex cylinders are mechanically ganged together and driven by a tuning motor. Since the tube leads form a portion of the tank inductance these capacitors are not actually in parallel with the tube input but are part way down the tank circuit where it has been found that they serve as a coupling adjustment and have little effect on the resonant frequency of the circuit.

High Band Amplifier: A cut-away view of the high band amplifier is shown in Fig. 8 and the simplified equivalent circuit is shown in Fig. 9. The general appearance of this unit is similar to the low band unit, but the circuit actually differs in several important details. Because the operating frequency is much higher, it would be impractical to use a simple quarter wave concentric line tank similar to that used in the low band amplifier since there would be little or no tank circuit left outside of the tubes themselves. To overcome this, two

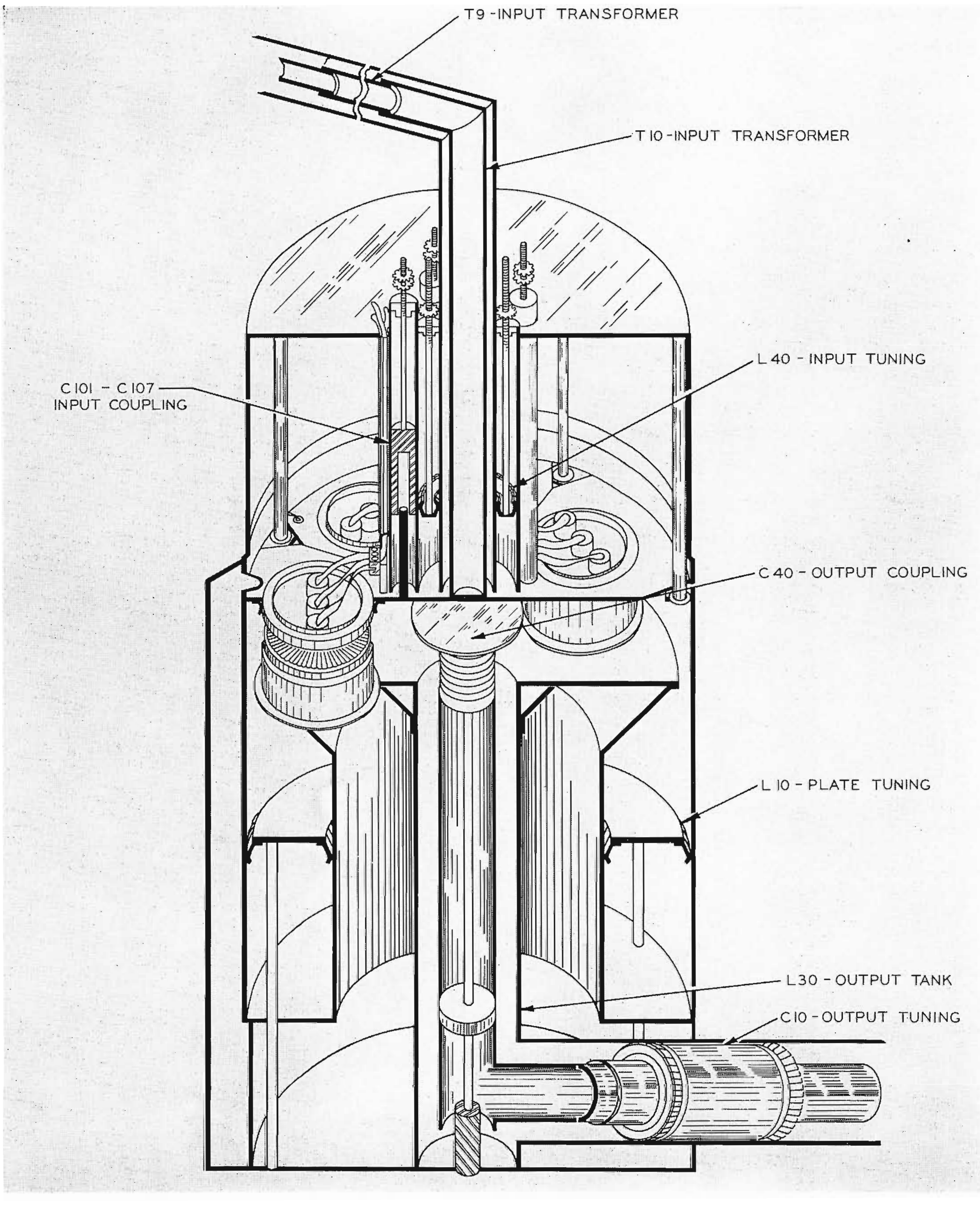


FIG. 4. Cut-away view showing R-F circuits of the TT-25AL Amplifier.

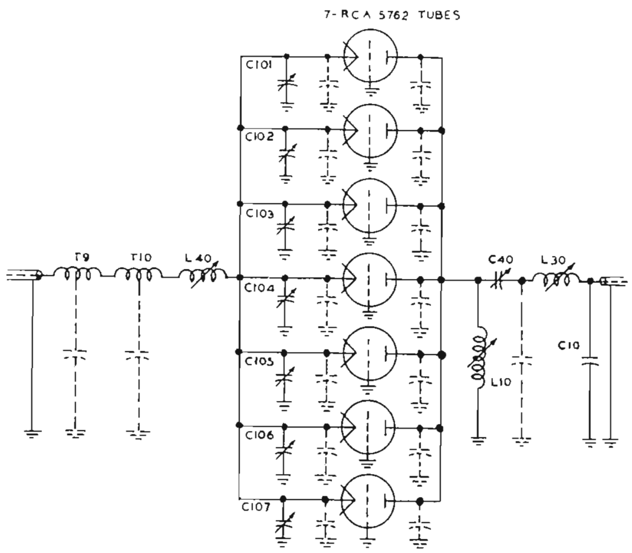


FIG. 5. Simplified equivalent circuit of the TT-25AL (low band amplifier).

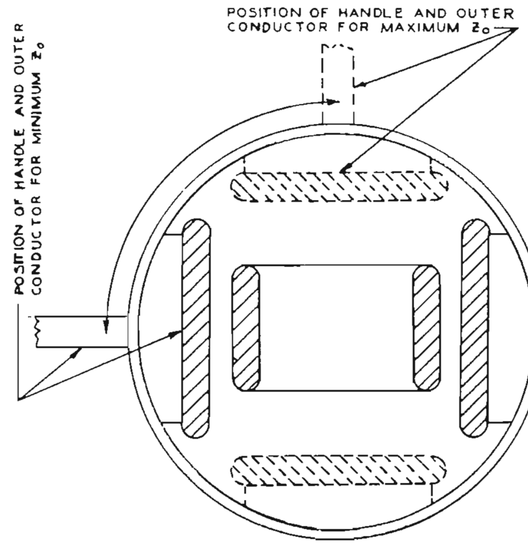


FIG. 7. Cross-section view of variable Z_0 transformer used in TT-20AH.

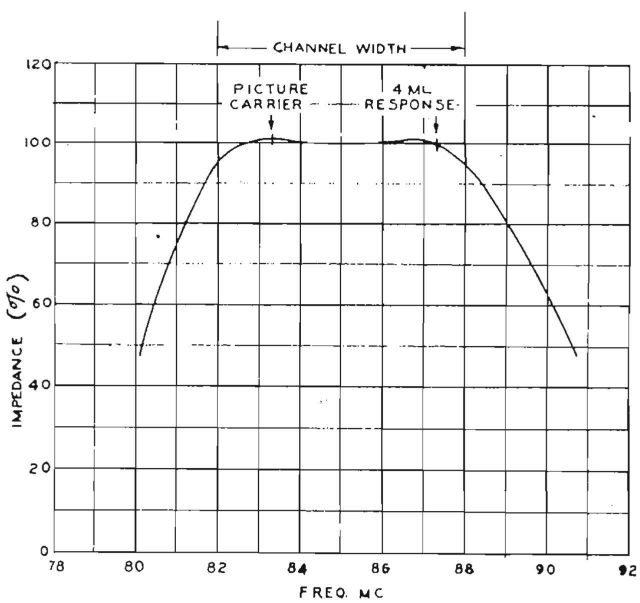
co-axial tank circuits are employed. One of these tanks is inside the other as shown in Fig. 8. These function as inductances in parallel and thus raise the effective resonant frequency. In the equivalent circuit these inductances are (L-10) and (L-20). The output is coupled to the inner of these plate tank circuits across a shunt inductance L-60. To preserve the circuit symmetry this inductance is actually made up of seven small adjustable shorted transmission lines connected in parallel and located on a circle just inside the inner plate tank. Like the low band unit, the secondary or output circuit is formed by inserting a shunt capacitor C-10 in the output transmission line and is tuned by sliding this capacitor along the line. Because the two circuits are coupled at a low impedance point this capacitor is located approximately ½ wave length along the line. This secondary circuit, coupled to the plate circuit by means of a mutual reactance L-60, forms the necessary elements of an overcoupled broadband circuit whose response is equivalent to that shown in Fig. 6 for channel 6.

The cathode circuit, like the plate circuit, cannot be made a conventional quarter-wave tank because the first low impedance point will occur on the tube straps. To compensate for this extra inductance of the straps, the seven co-axial capacitors C-101—C-107 are connected in series with the tube leads instead of in shunt as was the case in the low band amplifier. These capacitors are variable and when mechanically ganged together serve as the input tuning control. This cathode circuit is matched to the 72 ohm input by two quarter-wave transformer sections in series. To provide for an input coupling adjustment one of the transformers (T-9) is constructed so as to have a variable characteristic impedance as the outer shell is rotated through 90°. A cross sectional view of this transformer is shown in Fig. 7 (above).

Power and Control Equipment: The control equipment is of conventional design. An instantaneous trip relay is connected in the cathode return circuit of each of the seven power amplifier tubes. In addition, a total d-c current relay is provided and a-c relays are inserted in the primary leads of the high voltage plate transformer. The overload system has an automatic reset feature. After an overload occurs the plate voltage will be removed momentarily then automatically returned twice. If the overload persists for the third time the plate voltage will remain off. All circuits such as the filament bus, the blower and the bias supply are protected by breakers with built-in overload trip coils. The control equipment for the aural transmitter is identical to that for the visual transmitter and the two are arranged so that the two carriers may be turned on and off independently.

Except for the bias supply and slight differences in the high voltage filter, the power equipment for the aural and visual equipments are identical. The high voltage rectifiers for each employs six RCA-673

FIG. 6. Curve showing typical response of TT-25AL output circuit, channel 6.



mercury vapor rectifier tubes in a three-phase full wave circuit with a balance coil. The bias supply for the visual amplifier is well regulated, its output voltage remaining constant for large changes in grid current. The bias for the aural amplifier is essentially obtained from grid leaks with just enough fixed bias to protect the tubes when there is no drive.

Installation

The layouts shown in the floor plans on the pages preceding this article are only three of many possible arrangements. In all three views the amplifiers are shown in the rear of the driver. Actually they can be located at the ends or at right angles to the TT-5A. This feature should be of particular interest to those stations which already have their 5 KW driver and are limited in available space to add an amplifier. The important thing to keep in mind is that the length of transmission line between the driver and the amplifier should be kept as short as possible. Distances between the output of the driver and the center line of the amplifier of 15 feet or less should be satisfactory. If the distance is much greater than this it will be difficult to obtain the required bandwidth. To understand why the line cannot be too long it should be remembered that the amplifier input circuit is essentially a single tuned circuit and can terminate the line exactly at only one frequency. To provide for a line of indefinite length, it would have to have a standing wave ratio of better than 1.1 to 1 over the six megacycle channel. This would mean that the bandwidth of the terminating cir-

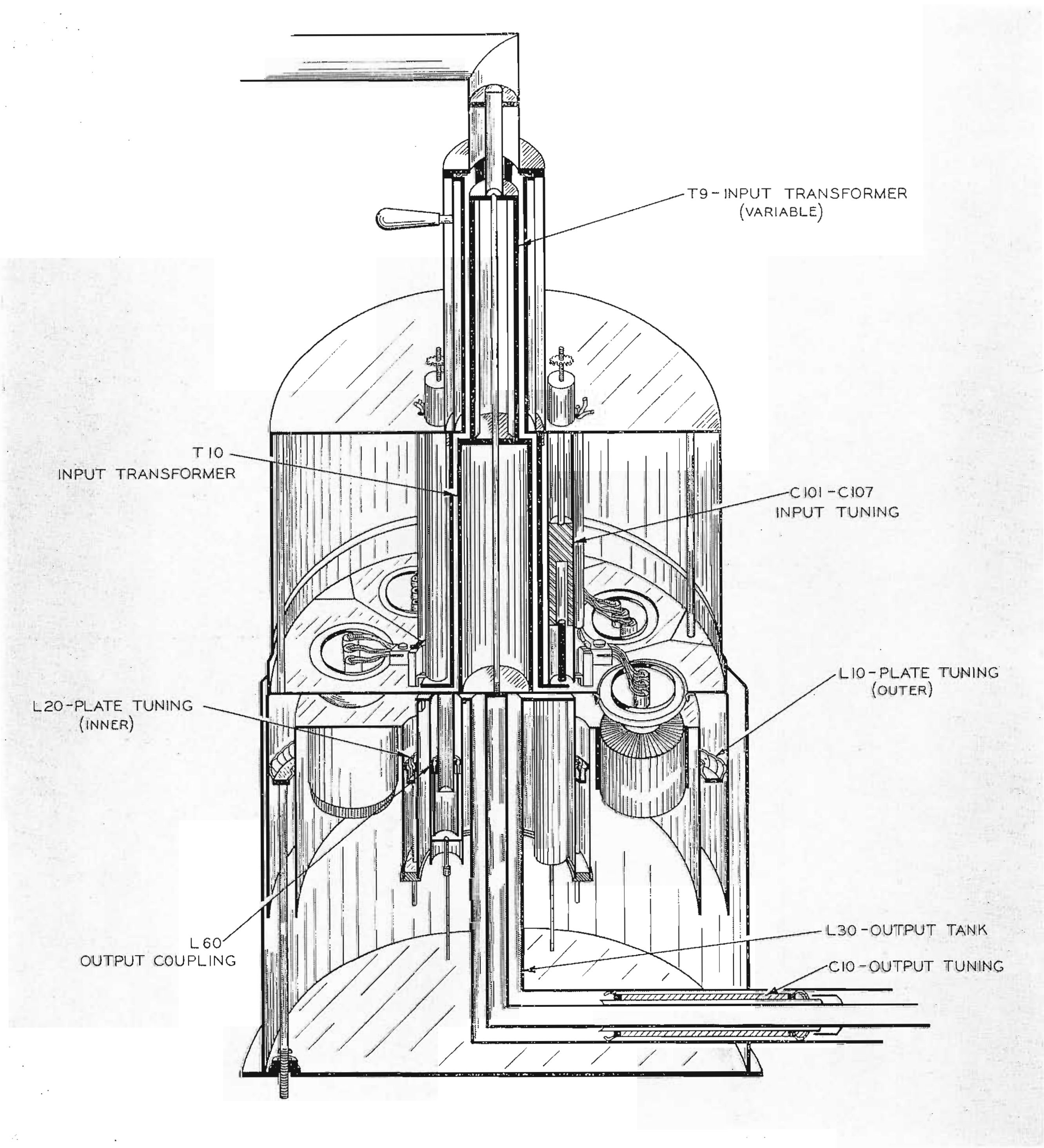


FIG. 8. Cutaway view showing R-F circuits of the TT-20AH high-band amplifier.

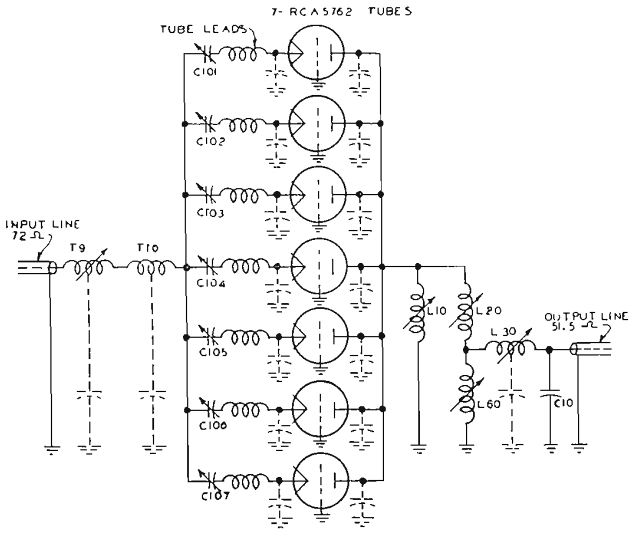
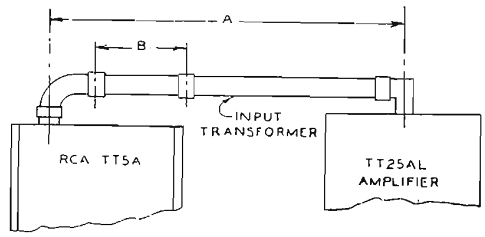


FIG. 9. Equivalent circuit of the TT-20AH Amplifier for channels 7 to 13.



CHANNEL NO.	A (INCHES)	B (INCHES)	$\frac{1}{2}$ WAVELENGTH
2	121	25	$103\frac{5}{8}$
3	101	5	$93\frac{3}{4}$
4	175	77	$85\frac{5}{8}$
5	141	45	$74\frac{3}{4}$
6	125	29	$69\frac{3}{8}$

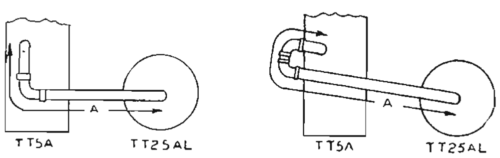


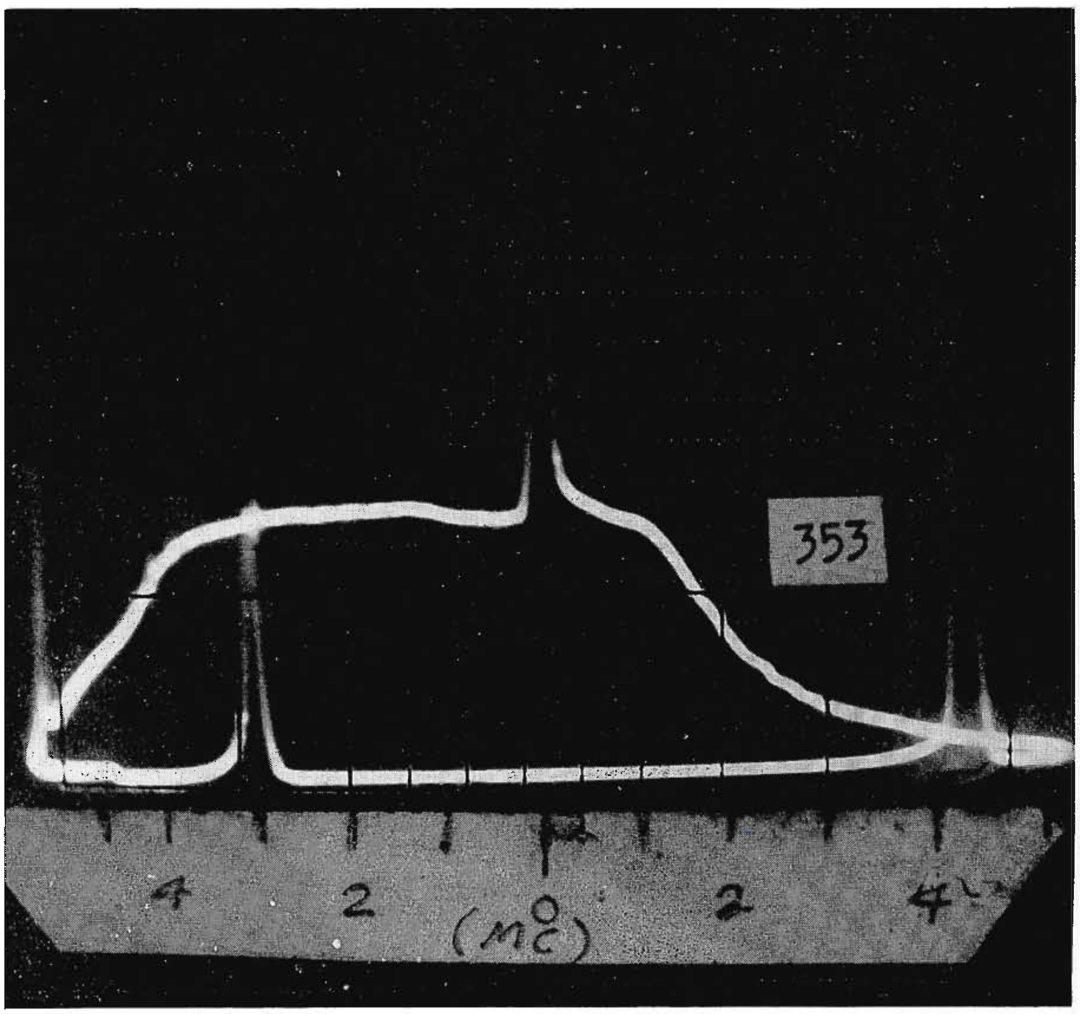
FIG. 10. Table and sketches showing length of line between driver and 25 kw amplifier and several ways of running the line to obtain the correct length.

cuit be 60 megacycles between half power points. On channel 2 this is equivalent to having a Q of 1 which is obviously an impractical condition. It is necessary, therefore, that the input circuit of the amplifier must be a part of the driver output circuit. On the low channels it is not only important that the length of line be kept short but the effective length of line should be in approximate multiples of ½ wavelength. Fig. 10 gives a table of the recommended length of line for the low band channels. This line does not necessarily have to be straight but can have a right angle bend or a 180° fold as shown in the two bottom views in Fig. 10.

Performance

A summary of the performance specifications is shown on the next page. When the TT-25AL or the TT-20AH amplifier is used with the TT-5A the overall performance will meet all the RTMA and FCC requirements. The overall linearity curve is shown in Fig. 12 and the linearity curve for the input signal is shown in Fig. 13. From these two curves we have plotted the linearity of the amplifier alone. This is shown in Fig. 14. It will be noted that the amplifier introduces almost negligible amplitude distortion except in the sync region where it can be easily compensated for by the sync stretcher in the TT-5A.

FIG. 11. Overall frequency response of the TT-25AL Transmitter including the TT-5A Driver. Measurements were made on channel 2 with the side band response analyzer.



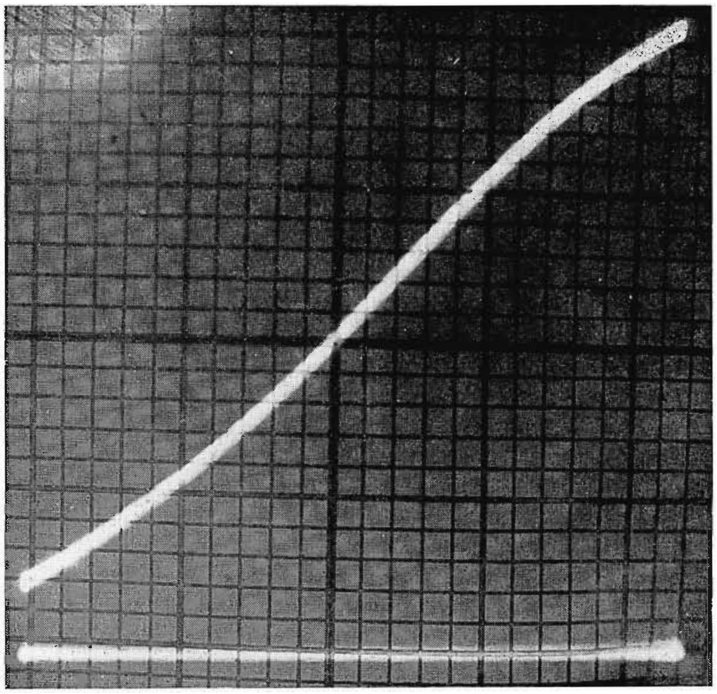


FIG. 12. Overall linearity curve of the TT-20AH including the TT-5A driver.

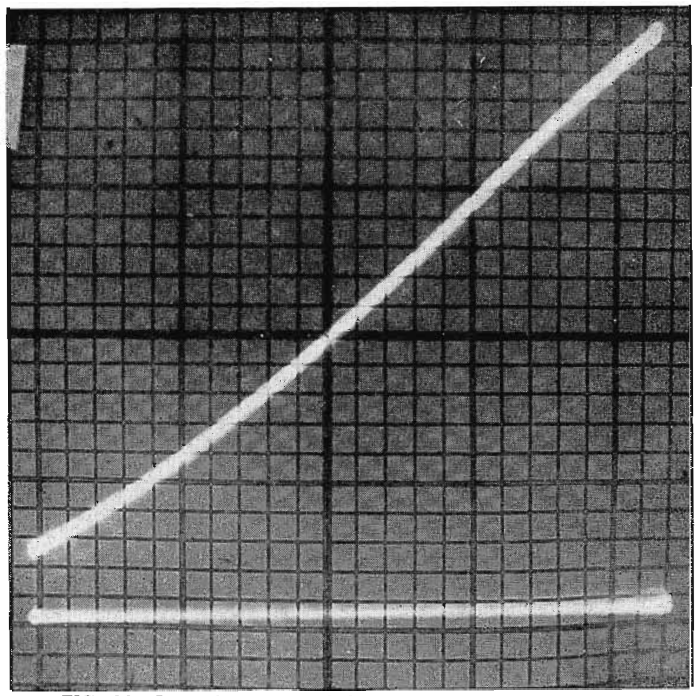


FIG. 13. Linearity curve of the TT-5A driver made under the same conditions as those of Fig. 12.

A typical overall frequency response curve without a sideband filter as viewed on the sideband response analyzer is shown in Fig. 11. Note that the response at 4 mc. is considerably better than the 4 db limit proposed by the RTMA standard.

Performance Specifications*

Type of Emission:

Aural A3

Visual A5

Frequency Range:

TT-25AL .... Channels 2-6

TT-20AH .... Channels 7-13

Power Output:

TT-25AL

Aural .... 12.5 kw

Visual.... 25 kw from sideband filter

TT-20AH

Aural .... 10 kw

Visual..... 20 kw from sideband filter

R-f Output Impedance........ 51.5 ohms

Frequency Response:

Aural.............. **Uniform ±1 db 30 to 15000 cy.

Visual........... ***2 db at 0.5 mc
2 db at 1.25 mc
2 db at 2.0 mc
2 db at 3.0 mc
3 db at 4.0 mc

Power Line Requirements:

Voltage 208/230

Phase 3

Frequency .... 60 cycles

Instantaneous Regulation .... ±3%

Slow Time Drift.............. ±5%

Power Consumption (approx.) 60 kw (with black picture) (Conversion Equipment only)

Power Factor (approx.).......... 0.90

Exhaust air recommended for cooling, aural and visual amplifiers only, each 2000 cfm.†

Ambient Temperature:

Minimum .... +10° C

Maximum .... +45° C

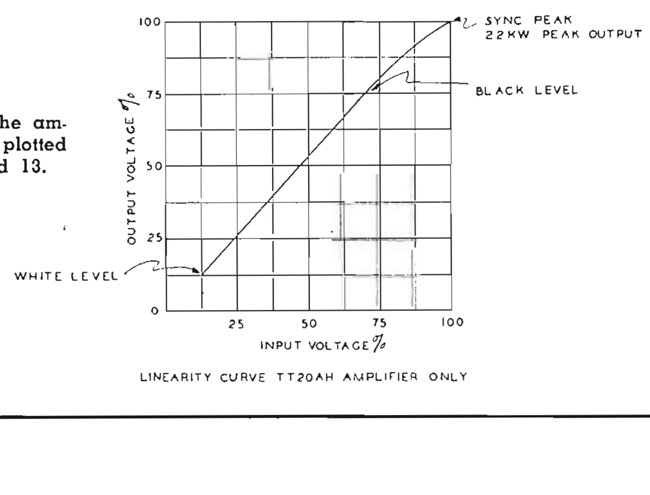
* The overall performance of a TV Transmitter using a TT-25AL or TT-20AH Amplifier is necessarily dependent upon and governed by the performance of those portions of the transmitter preceding the amplifier.

** For pre-emphasized response, the pre-emphasis filter (MI-4926-A) may be inserted in the 600 ohm audio input at the most effective point.

*** Maximum variation with respect to the idealized rectified vestigial sideband response. These are overall limits when the amplifier is used with the TT-5A Television Transmitter.

† Air ducts from the top of each amplifier are recommended. The above figure is based on a duct with approximately four square feet cross section. Operation without ducts requires considerably more air movement.

FIG. 14. Linearity curve of the amplifier only. The curve was plotted by comparing Figs. 12 and 13.



RECTIFIER TUBE *Protection*

from high-voltage overloads resulting from grounding stick shorts

By
MAL MOBLEY, JR.
Field Supervisor
Radio Station KMPC
Los Angeles, California

Summary

A simple means of protecting rectifier tubes against excessive overloads resulting from grounding stick shorts has been devised, insuring against premature arc back and subsequent program interruptions.

* *

The KMPC transmitter plant utilizes both RCA 10E and 50F transmitters. These transmitters are equipped with the usual safety devices such as door interlocks, high-voltage grounding relay, and grounding sticks in the power amplifier, modulator and high-voltage rectifier bays. As an added safety precaution, grounding sticks have been added to all other units where high voltage is present, such as in the 50F exciter bay and in the transformer vault.

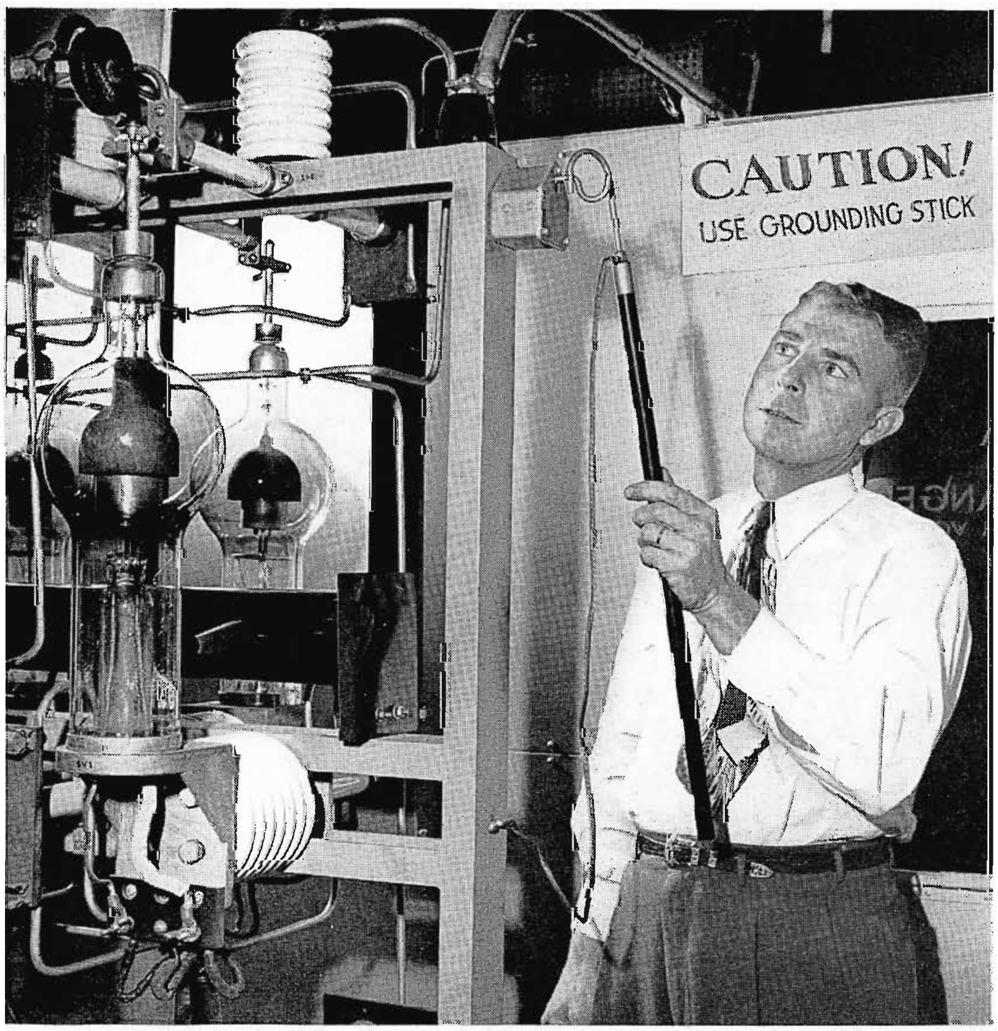
The use of grounding sticks upon entering high-voltage bays are important to the safety of the operating personnel, but on occasion have proved detrimental both to the operation and to the longevity of the high-voltage rectifier tubes. For example, during testing or work on the transmitter following a carrier failure, occasionally a grounding stick is left shorted across the high voltage. Consequently, on application of plate voltage, a direct short to ground places an excessive overload on the mercury vapor rectifier tubes, thereby reducing their expected tube life and possibly resulting in an additional delay in restoring the program. Mercury-vapor rectifier tubes, such as 857B's, will withstand a considerable overload under normal operating conditions, however, as the tube ages, its ability to withstand overloads lessens, and arc backs become more prevalent.

Experience with 857B rectifier tubes used in KMPC's 50F transmitter over five years of operation has indicated that premature arc backs and tube failures can be indirectly attributed to excessive overloads caused by grounding stick shorts.

In an effort to increase rectifier tube life, but maintaining rigid safety precautions set forth in KMPC's operation, thought was given toward a means of providing rectifier tube protection and maintaining the usefulness and protection of the grounding sticks.

This problem was resolved by devising a series of grounding stick switches in such a manner that, if any grounding stick is left off its hook, a micro switch in series with the door interlock circuit will be actuated, preventing application of plate voltage, thereby offering protection to the rectifier tubes.

KMPC Engineer, Tom Crosnoe is shown at BTA-50F High-Voltage rectifier bay demonstrating a lever actuated micro switch which provides protection against accidental grounding switch shorts.



The grounding-stick switches were assembled from surplus aircraft parts consisting of normally open micro switches, lever-type actuators, aluminum junction boxes, lead hookup wire and some ingenuity. The lever-type actuators were modified, installing hooks for hanging the grounding sticks which have sufficient weight to actuate the switches. The switches were wired into the transmitter door interlock circuit, as this was both convenient and effective, since the door interlock switches in the 50F transmitter are in series with interlock relay 6E7, which is in the control circuit, preventing application of plate voltage unless all door and grounding stick switches are closed. Transmitter and console interlock-indicator lights are also actuated, giving a visual indication of whether the interlock circuit is completed.

The photo shows a grounding-stick interlock-switch installation as installed in the high-voltage rectifier bay of KMPC's 50F transmitter. This is a typical installation of those made in other units of 50F and 10E transmitters.

In conclusion, it is felt that the addition of this protective circuit will increase rectifier tube life, with added assurance against arc backs and resulting program interruptions.

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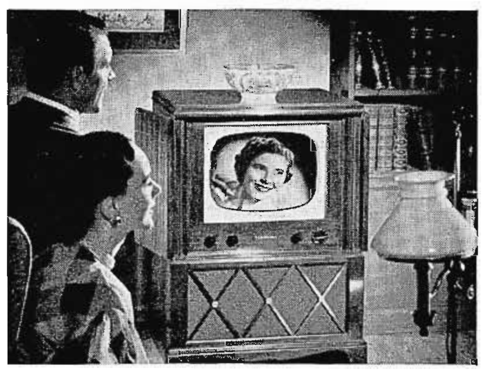

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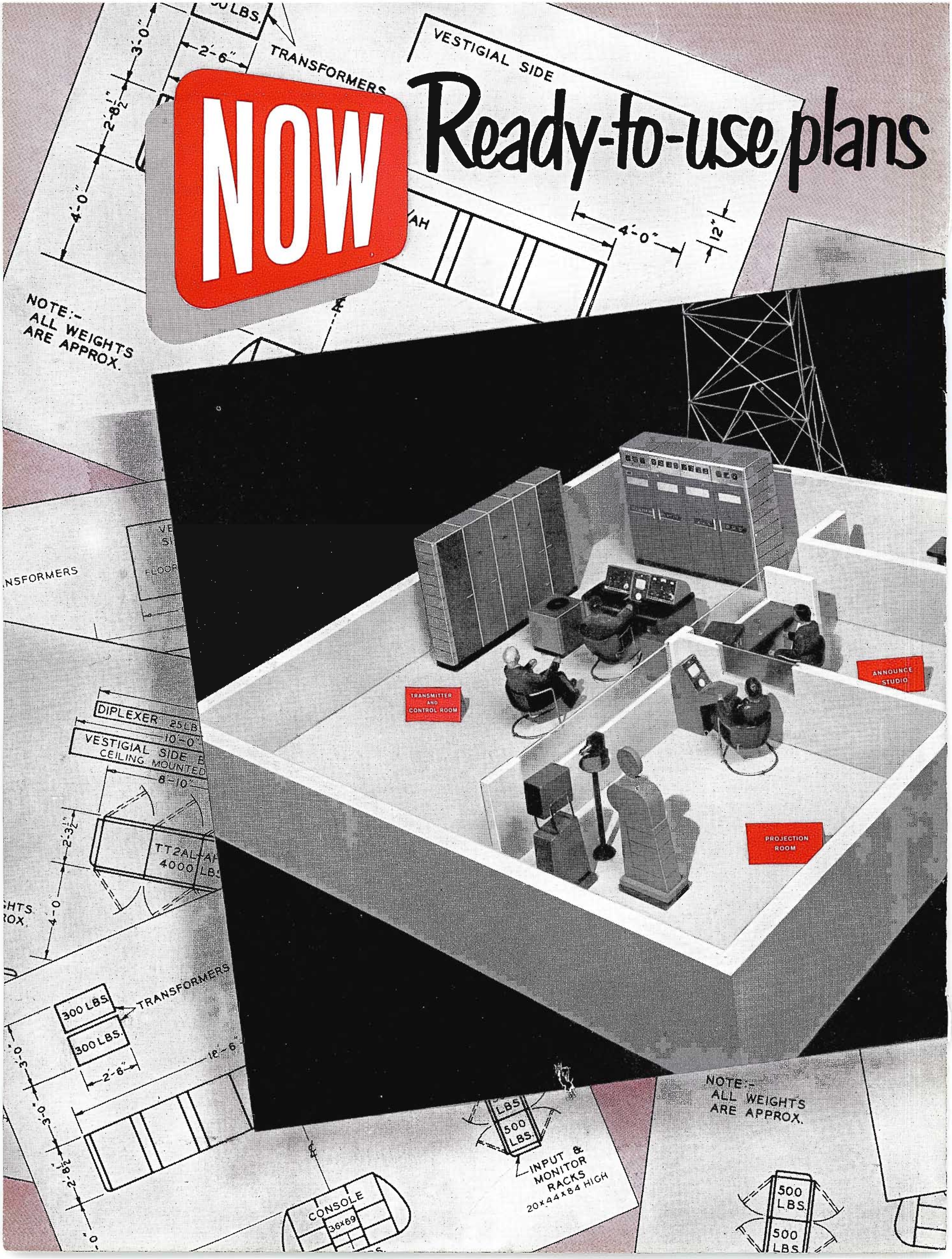
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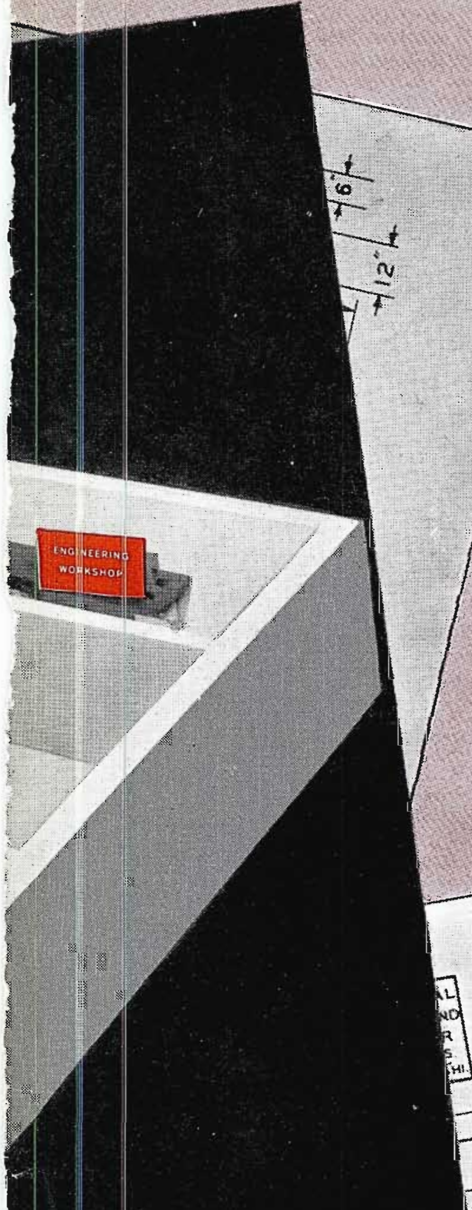

Typical 2-kw TV station layout for VHF (ERP range, 2 to 20 kw)

A low-cost arrangement for getting up to 20 kw ERP with an RCA high-gain antenna. The installation includes: an RCA 2-kw transmitter, control console, transmitter monitoring equipment, audio equipment, sync generator, video equipment, and power supplies.

The drawings spread across these pages are layouts of typical TV transmitter rooms using RCA equipment. They are prepared expressly for TV station planners in accordance with the best engineering practice known today. Each plan represents the basic or minimum TV transmitter room equipment needed to get "on the air" for a specific power. Each indicates the approximate space needed for the equipment—including approximate weights of individual units. Each provides wide flexibility for equipment rearrangements to meet the special or future requirements of individual stations.

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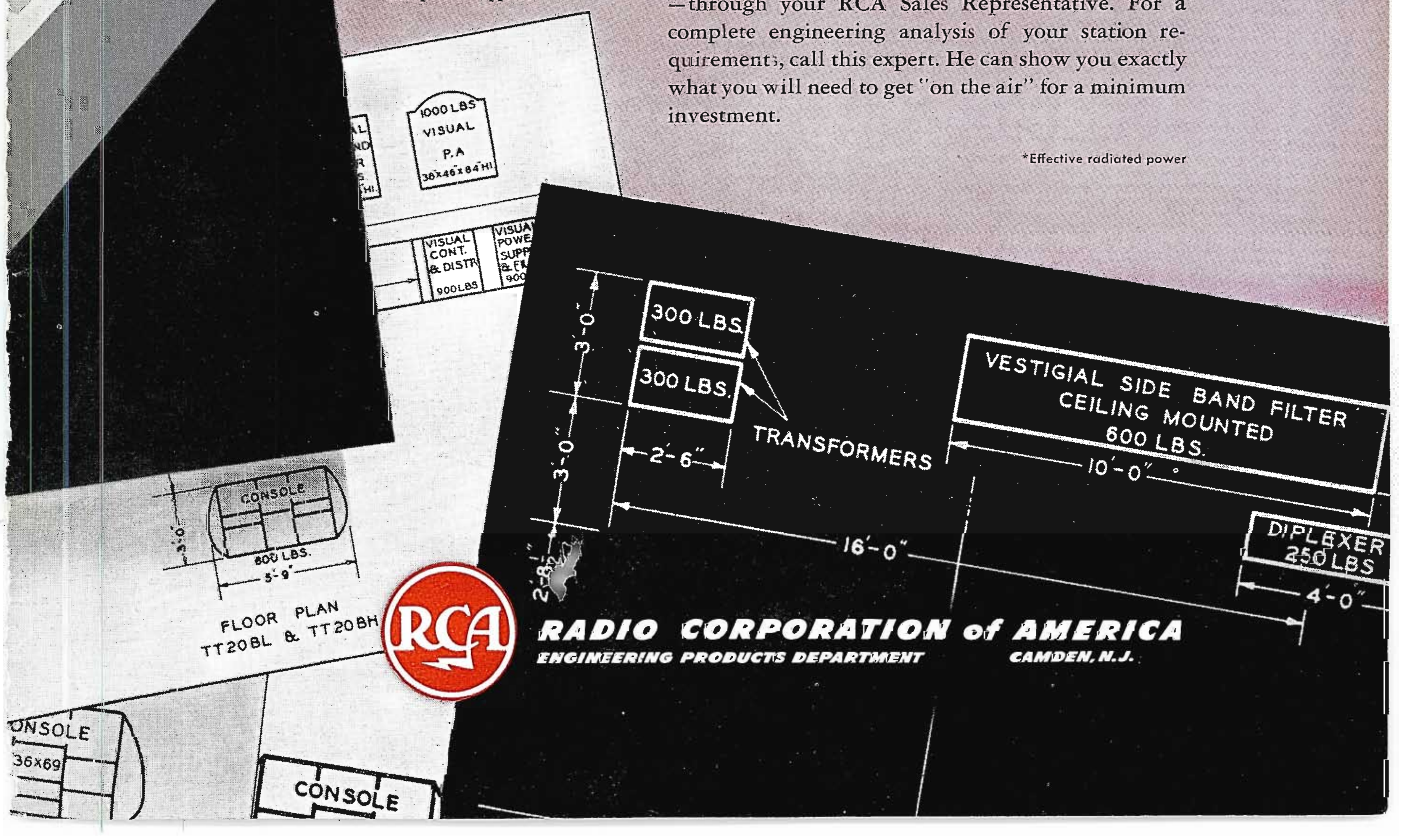
*Effective radiated power



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Arm assembly MI-11885 is complete with tone arm, mounting plate, hardware, and the filter modification kit MI-11874 (for 70-series turntables).

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