National RADIO-TV NEWS

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Professional Charges for Radio-TV Service

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New Horizons In Television

A CHALLENGE is down! The FCC's action in lifting the Television freeze creates new and greater opportunities for you in your chosen career.

For three and one-half years the Television industry has patiently waited for the freeze to be lifted. This move is expected to expand the already multi-million dollar industry to tremendously greater proportions. Today your Television opportunities are as bright as those in the days of Radio's infancy.

The power of Television to do good, to help the shut-ins, the sick, the old, to educate the young will now be given to additional millions of people in this wonderful country of ours. As a medium of entertainment, as a means of hearing debate on important issues of the day, to see and hear our political leaders, and to have brought to us important news events the very day, if not the moment they happen, makes Television the modern miracle. You, as a student or graduate of the National Radio Institute, are privileged to become a part of this new Television age.

Over 2000 stations in nearly thirteen hundred cities are permitted by the FCC's plans—many more are envisioned in places where the FCC's plan has not taken care of the demand. Job potential, and the opportunity to implement the growth of Television are all yours for the taking. Your NRI training will make you ready to take part in the March of Television to its new horizons.

J. E. SMITH, *President.*

YOU—
THE END OF THE TV FREEZE —AND UHF-TV

By JOHN H. BATTISON

NRI Director of Education

BY the time that you receive this copy of NATIONAL RADIO-TV NEWS the FCC's lifting of the freeze will have been widely publicized. The public has been waiting three years and eight months for this day and now that it has come some readers may be confused about what to expect of the new television situation. We at NRI are presenting this article to show you how lifting the freeze will fit in with your own future plans for the development of your Radio and Television business.

As of today there are 108 VHF commercial television stations in operation in the United States.

The FCC's plan is to make available 2053 assignments in 1291 communities throughout the United States, its territories and possessions. Many of these new assignments consist of combination UHF-TV and VHF-TV assignments to communities. In some cases a city will have VHF only, in others it will have UHF only.

Although the freeze has been lifted, the FCC will not start issuing any construction permits until after July 1 of this year. This is to allow potential telecasters time to prepare their applications and get them on file with the FCC. The first applications to be granted by the FCC for new stations will be for cities which have no service at all at present. Following this, cities which are to have UHF-TV only, will be processed. In this latter group are included cities where all the VHF channels have been assigned, and UHF-TV channels only are now available.

Thirty existing television stations operating in the VHF band will have their frequencies changed under the new FCC regulations. Announcements of the change of channel in those communities or cities so affected will be made by the FCC and the local stations at the time that the change is authorized. These changes will be authorized by the commission first thing of all—before any new stations are authorized.

In some cases where a low band (channels 2 through 6) station is changed to a high band channel (channels 7 through 13) additional service work may be required. Antenna installations may need revising together with the possible addition of a high band VHF receiving antenna; especially if prior to the change in channel and frequency of the local station there was no other high band station operating in the area. These things all add up to more work, and more income for the serviceman who is on his toes, and knows how, and is prepared to handle the rush of work which may be expected.

In the case of UHF installations the serviceman will not, generally speaking, be faced with any problems in this field until after the end of 1952. Many applications for TV stations were filed before the freeze was lifted and are still pending. However, because the FCC has revised its application forms and some of the requirements, every application previously filed has to be resubmitted and amended to conform with the new rules of the FCC. This means that the FCC will have a tremendous amount of work facing it when it commences considering new applications in July of this year.

There are a few stations, perhaps twenty, which have already built or almost completed full TV studio facilities. These may even be already in possession of an installed transmitter and antenna, which have only to be connected and tested before they go on the air. These telecasters are in most cases old-time AM operators who are confident of their ability to obtain television station licenses. These will probably be the first new telecasters to go on the air after the freeze is lifted.

At the end of this article appears a complete tabulation by state and U.S. territories, of the final television allocations for both VHF and UHF bands. Reference to your city's listing in this table will show you whether to expect VHF-

TV or UHF-TV, or a combination of the two. It will also show you whether there will be any changes from your existing television service—if any.

UHF Characteristics

As a matter of fact operation in the ultra-high-frequency band does not pose as many problems for the serviceman as we anticipated two or three years ago. Not only have components been improved and redesigned, but also a great deal more is known about ultra-high-frequency operation today.

In the last two years the National Broadcasting Company in conjunction with RCA has been operating an ultra-high-frequency transmitter at Bridgeport, Connecticut. This television transmitter has been rebroadcasting the full daily program of WNBT, picked up on Channel 4 from New York, fifty-five miles away. As a result of the availability of this regular daily transmission all the major television receiver manufacturers have been conducting tests in the area using converters—sometimes called translators, and a special type of tuner which will accommodate both VHF and UHF transmissions.

As far as the serviceman is concerned there will be few changes in his method of operation with UHF. However, the changes which *are required* may be quite large and should provide an additional source of work and therefore income.

Antennas will need to be re-installed and re-oriented for the UHF transmissions. In most cases a special UHF antenna will be required.

In individual cases it may be possible to use the existing VHF antenna provided that trouble with multipath transmissions or ghosts is not encountered. The popular folded-dipole, or straight dipole with reflector, will sometimes operate reasonably well at UHF. Due to the fact that the antenna then becomes many wave lengths longer than the signal its pickup pattern changes considerably—and its direction of maximum pickup will probably be different from that for VHF operation.

Bow-tie antennas are quite popular and effective for UHF operation. These antennas are cheap, easily made, and resemble a bow-tie in appearance. They consist of two triangular pieces of metal connected at their apexes to the transmission line. Detailed information concerning antennas and their installation will be issued in the NEWS in due course.

Transmission lines present something of a problem. However, by the time that UHF is really beginning to boom this will be overcome. At the present time the best line appears to be coax such as RG 59-U, or RG 11-U. The popular 300 ohm flat twin line suffers from excessive attenuation in the presence of moisture on the line, and even the new round twin 300 ohm line suffers to a lesser degree when it rains or snows, etc. Unfortunately, the coaxial type of line has rather high initial attenuation of the order of 6 or 7 decibels. However, this is constant and the picture does not fade when it rains!

Front End

The receivers in use today use either continuous tuning, turret tuning, or switched coil selection tuning. The first type of tuning necessitates use of a converter or translator to receive UHF transmission; no modifications can be made to this type of tuner. The turret type in most cases should be comparatively simple to modify by removing one or more of the VHF tuning strips, and substituting the correct UHF strip for the channels required.

Similarly, if you have a front end which uses tapped, or switched inductances for channel selection you will have, in most cases, to use a converter to modify the set for UHF.

As most readers are probably aware, the trend today is toward a 40 mc i-f rather than the current 25 mc i-f. I-f operation at 40 megacycles is, generally speaking, necessary for satisfactory UHF operation since problems of beat interference, intermodulation interference, oscillator harmonic radiation, and very low image rejection are encountered in the operation of front ends at frequencies between 470 and 890 mc. In other words, the degree of pre-selection obtainable before the i-f amplifier is just about zero if a low i-f value is employed. Many of today's receivers using turret type tuners have 25 mc i-f's. However in many cases it will be found that adding the correct UHF tuning strip will make operation of these receivers in the UHF band fairly satisfactory.

The remainder of the receiver circuit will normally not differ to any great extent from current VHF customs. That is, the i-f, power supply, sweep circuits, and picture tube circuits will all be similar to those you know. One of the biggest problems you have to cope with is convincing the lady of the house that it is in her best interest to allow you to attach an external converter to her receiver if it is the type which cannot use interchangeable UHF strips!

Lifting the television freeze will make a big difference to your business. You will receive more inquiries from prospective customers and purchasers, and you will be called upon by people whose television sets you service to answer questions concerning the effect of UHF television in your city. Here are a few questions and answers which will help your customers understand what UHF will do for them.

Question: Will UHF Television make my present set out of date?
Answer: No. Assuming you live in a city with current VHF television service the addition of UHF television to the city will not affect your present set in any way. However, if you want to receive the UHF station you will have to have your set modified at a cost of from $20 to $50 to get the *new* station.

Question: I live in a town where there is no television but UHF television is allocated. Suppose I buy a UHF only receiver and then move to another city where there is no UHF reception, what shall I do?
Answer: All the new television receivers which are being built are designed to receive both VHF and UHF so you will have no trouble.

Question: We have two VHF stations in our town and there is an allocation for three UHF stations. Do I have to buy a converter to get these stations?
Answer: If your set has a turret type of tuner you can replace three of the unused coil strips with UHF strips. If it has a continuous tuner or a tapped inductance switch for tuning then you can buy an external converter which is attached to the back of the set out of sight. This will give you reception of UHF stations.

Question: Do I have to get a big UHF converter for my set which doesn't have a turret tuner?
Answer: No, if you live in a city where there are only one or two UHF-TV stations you can buy a one or two channel UHF converter which will cost you from ten to twenty dollars.

Question: Must I have a special antenna installation for UHF?
Answer: In some cases you do not need a special antenna installation for UHF-TV. Whether you do or not depends upon how far you are away from the UHF station and its direction with reference to you and existing VHF stations. Sometimes existing VHF antennas work perfectly satisfactorily on UHF. At other times a small additional UHF antenna is required.

Question: If I have a UHF antenna installed for my set will I have to have two transmission lines going into my living room?
Answer: No. There is a small matching network which can be connected between the VHF antenna, the UHF antenna, and the single transmission line. The latter will convey both UHF and VHF signals to your receiver without any switching.

Question: Will reception be better on UHF than VHF?
Answer: In many cases reception will be better on UHF because UHF television reception is less affected by auto ignition and other forms of interference than VHF.

Question: Is the service area from UHF-TV stations as large as from VHF?
Answer: No, in general the maximum service area for a UHF station is 40 miles. For a VHF station it's between 60 and 70 miles.

Question: Will UHF-TV stations show the same programs as VHF? Will I be able to get my favorite network program on UHF?
Answer: In many cases the network programs to which you are accustomed will be available on UHF. Of course if there is already an existing VHF station affiliated with your favorite network then the new UHF stations will not carry that network's program in that city.

Question: How long will it be before I have to buy a UHF converter or receiver?
Answer: That is hard to say. If you live in a city where there is no television reception at all, applications for stations in that city will be granted before those from cities where there is a service. However, even so, it will be at least a year before there are many UHF Television stations on the air.

Question: How much will combination UHF-VHF receivers cost?
Answer: The cost should not be more than $20 to $50 greater than a standard VHF receiver. The cost will depend upon the number of UHF channels you want to receive. If you have a receiver with one UHF strip in it it will naturally cost you less than a receiver with four or five UHF strips.

Question: How high should my antenna be for UHF reception?
Answer: It is always best to place your antenna as high as possible, and with UHF this is even more important since UHF waves operate very much like light and therefore the shielding effect of high buildings and trees is very much more pronounced.

Question: Will pictures that I get on UHF be as good as those on VHF?
Answer: They should be just as good. However, in many cases more care will be required in making the antenna installation because of the fact that more ghosts are produced by UHF transmissions.

Final Television Allocations

Following is a complete listing by state and U. S. territories of the final television allocations by the FCC for both VHF and UHF bands. Note that some of the channel allocations are marked with an asterisk (*) which indicates that the channel is to be used exclusively for educational purposes. Those who now have TV in their area will also note that some of the VHF channels listed are already in service.

ALABAMA

	Channel No.
Andalusia	29
Anniston	37
Auburn	*56
Bessemer	54
Birmingham	6, *10, 13, 42, 48
Brewton	23
Clanton	14
Cullman	60
Decatur	23
Demopolis	18
Dothan	9, 19
Enterprise	40
Eufaula	44
Florence	41
Fort Payne	19
Gadsden	15, 21
Greenville	49
Guntersville	40
Huntsville	31
Jasper	17
Mobile	5, 8, *42, 48
Montgomery	12, 20, *26, 32
Opelika	22
Selma	58
Sheffield	47
Sylacauga	24
Talladega	64
Thomasville	27
Troy	38
Tuscaloosa	45, 51
Tuskegee	16
University	*7

ARIZONA

Ajo	14
Bisbee	15
Casa Grande	18
Clifton	25
Coolidge	30
Douglas	3
Eloy	24
Flagstaff	9, 13
Globe	34
Holbrook	14
Kingman	6
Mesa	12
Miami	28
Morenci	31
Nogales	17
Phoenix	3, 5, *8, 10
Prescott	15
Safford	21
Tucson	4, *6, 9, 13
Williams	25
Winslow	16
Yuma	11, 13

ARKANSAS

Arkadelphia	34
Batesville	30
Benton	40
Blytheville	64, 74
Camden	50
Conway	49
El Dorado	10, 26
Fayetteville	*13, 41
Forrest City	22
Fort Smith	5, *16, 22
Harrison	24
Helena	54
Hope	15
Hot Springs	9, 52
Jonesboro	8, 39
Little Rock	*2, 4, 11, 17, 23
Magnolia	28
Malvern	46
Morrilton	43
Newport	28
Paragould	44
Pine Bluff	7, 36
Russellville	19

ARKANSAS—(Continued)

	Channel No.
Searcy	33
Springdale	35
Stuttgart	14

CALIFORNIA

Alturas	9
Bakersfield	10, 29
Brawley	25
Chico	12
Corona	52
Delano	33
El Centro	16
Eureka	3, 13
Fresno	12, *18, 24, 47, 53
Hanford	21
Los Angeles	2, 4, 5, 7, 9, 11, 13, 22, *28, 34
Madera	30
Merced	34
Modesto	14
Monterey (see Salinas)	
Napa	62
Oakland (see San Francisco)	
Oxnard	32
Petaluma	56
Port Chicago	15
Red Bluff	16
Redding	7
Riverside	40, 46
Sacramento	3, *6, 10, 40, 46
Salinas-Monterey	8, 28
San Bernardino	18, *24, 30
San Buenaventura	38
San Diego	8, 10, *15, 21, 27, 33, 39
San Francisco-Oakland	2, 4, 5, 7, *9, 20, 26, 32, 38, 44
San Jose	11, 48, *54, 60
San Luis Obispo	6
Santa Barbara	3, 20, 26
Santa Cruz	16
Santa Maria	44
Santa Paula	16
Santa Rosa	50
Stockton	13, 36, *42
Tulare	27
Ukiah	18
Visalia	43, 49
Watsonville	22
Yreka City	11
Yuba City	52

COLORADO

Alamosa	19
Boulder	*12, 22
Canon City	36
Colorado Springs	11, 13, *17, 23
Craig	19
Delta	24
Denver	2, 4, *6, 7, 9, 20, 26
Durango	6, 15
Fort Collins	44
Fort Morgan	15
Grand Junction	5, 21
Greeley	50
La Junta	24
Lamar	18
Leadville	14
Longmont	32
Loveland	38
Montrose	10, 18
Pueblo	3, 5, *8, 28, 34
Salida	25
Sterling	25
Trinidad	21
Walsenburg	30

CONNECTICUT

Bridgeport	43, 49, *71
Hartford	3, 18, *24

CONNECTICUT—(Continued)

	Channel No.
Meriden	65
New Britain	30
New Haven	8, 59
New London	26, 81
Norwalk (see Stamford)	
Norwich	57, *63
Stamford-Norwalk	27
Waterbury	53

DELAWARE

Dover	40
Wilmington	12, 53, *59

DISTRICT OF COLUMBIA

Washington	4, 5, 7, 9, 20, *26

FLORIDA

Belle Glade	25
Bradenton	28
Clearwater	32
Daytona Beach	2
De Land	44
Fort Lauderdale	17, 23
Fort Myers	11
Fort Pierce	19
Gainesville	*5, 20
Jacksonville	4, *7, 12, 30, 36
Key West	14, 20
Lake City	33
Lakeland	16, 22
Lake Wales	14
Leesburg	26
Marianna	17
Miami	*2, 4, 7, 10, 27, 33
Ocala	15
Orlando	6, 9, 18, *24
Palatka	17
Panama City	7, *30, 36
Pensacola	3, 15, *21, 46
Quincy	54
St. Augustine	25
St. Petersburg (see Tampa)	
Sanford	35
Sarasota	34
Tallahassee	*11, 24, 51
Tampa-St. Petersburg	*3, 8, 13, 38
West Palm Beach	5, 12, *15, 21

GEORGIA

Albany	10, 25
Americus	31
Athens	*8, 60
Atlanta	2, 5, 11, *30, 36
Augusta	6, 12
Bainbridge	35
Brunswick	28, 34
Cairo	45
Carrollton	33
Cartersville	63
Cedartown	53
Columbus	4, 28, *34
Cordele	43
Dalton	25
Douglas	32
Dublin	15
Elberton	16
Fitzgerald	23
Fort Valley	18
Gainesville	52
Griffin	39
La Grange	50
Macon	13, *41, 47
Marietta	57
Milledgeville	51
Moultrie	48
Newnan	61
Rome	9, 59
Savannah	3, *9, 11
Statesboro	22

GEORGIA—(Continued)

	Channel No.
Swainsboro	20
Thomasville	6, 27
Tifton	14
Toccoa	35
Valdosta	37
Vidalia	26
Waycross	16

IDAHO

	Channel No.
Blackfoot	33
Boise	*4, 7, 9
Burley	15
Caldwell	2
Couer d'Alene	12
Emmett	26
Gooding	23
Idaho Falls	3, 8
Jerome	17
Kellogg	33
Lewiston	3
Moscow	*15
Nampa	6, 12
Payette	14
Pocatello	6, 10
Preston	41
Rexburg	27
Rupert	21
Sandpoint	9
Twin Falls	11, 13
Wallace	27
Weiser	20

ILLINOIS

	Channel No.
Alton	48
Aurora	16
Belleville	54
Bloomington	15
Cairo	24
Carbondale	34, *61
Centralia	32, 59
Champaign-Urbana	3, *12, 21, 27, 33
Chicago	2, 5, 7, 9, *11, 20, 26, 32, 38, 44
Danville	24
Decatur	17, 23
De Kalb	*67
Dixon	47
Elgin	28
Freeport	23
Galesburg	40
Harrisburg	22
Jacksonville	29
Joliet	48
Kankakee	14
Kewanee	60
La Salle	35
Lincoln	53
Macomb	61
Marion	40
Mattoon	46
Moline (see Davenport, Iowa)	
Mt. Vernon	38
Olney	16
Pekin	49
Peoria	8, 19, *37, 43
Quincy	10, 21
Rockford	13, 39, *45
Rock Island (see Davenport, Iowa)	
Springfield	2, 20, *26
Streator	65
Urbana (see Champaign)	
Vandalia	28
Waukegan	22

INDIANA

	Channel No.
Anderson	61
Angola	15
Bedford	39

INDIANA—(Continued)

	Channel No.
Bloomington	4, *30, 36
Columbus	42
Connersville	38
Elkhart	52
Evansville	7, 50, *56, 62
Fort Wayne	21, *27, 33
Gary	50, *66
Hammond	56
Indianapolis	6, 8, 13, *20, 26, 67
Jasper	19
Kokomo	31
Lafayette	*47, 59
Lebanon	18
Logansport	51
Madison	25
Marion	29
Michigan City	62
Muncie	49, 55, *71
Richmond	32
Shelbyville	58
South Bend	34, *40, 46
Tell City	31
Terre Haute	10, *57, 63
Vincennes	44
Washington	60

IOWA

	Channel No.
Algona	37
Ames	5, 25
Atlantic	45
Boone	19
Burlington	32, 38
Carroll	39
Cedar Rapids	2, 9, 20, *26
Centerville	31
Charles City	18
Cherokee	14
Clinton	64
Creston	43
Davenport-Rock Island & Moline, Illinois	4, 6, *30, 36, 42
Decorah	44
Des Moines	8, *11, 13, 17, 23
Dubuque	56, 62
Estherville	24
Fairfield	54
Fort Dodge	21
Fort Madison	50
Grinnell	46
Iowa City	*12, 24
Keokuk	44
Knoxville	33
Marshalltown	49
Mason City	3, 35
Muscatine	58
Newton	29
Oelwein	28
Oskaloosa	52
Ottumwa	15
Red Oak	32
Shenandoah	20
Sioux City	4, 9, *30, 36
Spencer	42
Storm Lake	34
Waterloo	7, 16, *22
Webster City	27

KANSAS

	Channel No.
Abilene	31
Arkansas City	49
Atchison	60
Chanute	50
Coffeyville	33
Colby	22
Concordia	47
Dodge City	6, 23
El Dorado	55
Emporia	39
Fort Scott	27
Garden City	9, 11

KANSAS—(Continued)

	Channel No.
Goodland	31
Great Bend	2, 28
Hays	7, 20
Hutchinson	12, 18
Independence	20
Iola	44
Junction City	29
Larned	15
Lawrence	*11, 17
Leavenworth	54
Liberal	14
McPherson	26
Manhattan	*8, 23
Newton	14
Olathe	52
Ottawa	21
Parsons	46
Pittsburg	7, 38
Pratt	36
Salina	34
Topeka	13, 42, *48
Wellington	24
Wichita	3, 10, 16, *22
Winfield	43

KENTUCKY

	Channel No.
Ashland	59
Bowling Green	13, 17
Campbellsville	40
Corbin	16
Danville	35
Elizabethtown	23
Frankfort	43
Glasgow	28
Harlan	36
Hazard	19
Hopkinsville	20
Lexington	27, 33
Louisville	3, 11, *15, 21, 41, 51
Madisonville	26
Mayfield	49
Maysville	24
Middlesborough	57, 63
Murray	33
Owensboro	14
Paducah	6, 43
Pikeville	14
Princeton	45
Richmond	60
Somerset	22
Winchester	37

LOUISIANA

	Channel No.
Abbeville	42
Alexandria	5, 62
Bastrop	53
Baton Rouge	10, 28, *34, 40
Bogalusa	39
Crowley	21
De Ridder	14
Eunice	64
Franklin	46
Hammond	51
Houma	30
Jackson	18
Jennings	48
Lafayette	38, 67
Lake Charles	7, *19, 25
Minden	30
Monroe	8, 43
Morgan City	36
Natchitoches	17
New Iberia	15
New Orleans	*2, 4, 6, 20, 26, 32, 61
Oakdale	54
Opelousas	58
Ruston	20
Shreveport	3, 12
Thibodaux	24
Winnfield	22

MAINE

	Channel No.
Auburn	23
Augusta	10, 29
Bangor	2, 5, *16
Bar Harbor	22
Bath	65
Belfast	41
Biddeford	59
Calais	7, 20
Dover-Foxcroft	18
Fort Kent	17
Houlton	24
Lewiston	8, 17
Millinocket	14
Orono	*12
Portland	6, 13, *47, 53
Presque Isle	8, 19
Rockland	25
Rumford	55
Van Buren	15
Waterville	35

MARYLAND

Annapolis	14
Baltimore	2, 11, 13, 18, *24, 30
Cambridge	22
Cumberland	17
Frederick	62
Hagerstown	52
Salisbury	16

MASSACHUSETTS

Barnstable	52
Boston	*2, 4, 5, 7, 44, 50, 56
Brockton	62
Fall River	40, 46
Greenfield	42
Holyoke (see Springfield)	
Lawrence	38
Lowell	32
New Bedford	28, 34
North Adams	15
Northampton	36
Pittsfield	64
Springfield-Holyoke	55, 61
Worcester	14, 20

MICHIGAN

Alma	41
Alpena	9, 30
Ann Arbor	20, *26
Bad Axe	46
Battle Creek	58, 64
Bay City	5, 63, *73
Benton Harbor	42
Big Rapids	39
Cadillac	13, 45
Calumet	13
Cheboygan	4, 36
Coldwater	24
Detroit	2, 4, 7, 50, *56, 62
East Lansing	60
East Tawas	25
Escanaba	3
Flint	12, 16, *22, 28
Gladstone	40
Grand Rapids	8, *17, 23
Hancock	10
Houghton	19
Iron Mountain	9, 27
Iron River	12
Ironwood	31
Jackson	48
Kalamazoo	3, 36
Lansing	6, 54
Ludington	18
Manistee	15
Manistique	14
Marquette	5, 17
Midland	19

MICHIGAN—(Continued)

	Channel No.
Mount Pleasant	47
Muskegon	29, 35
Petoskey	31
Pontiac	44
Port Huron	34
Rogers City	24
Saginaw	51, 57
Sault Ste. Marie	8, 10, 28, *34
Traverse City	7, 20, *26
West Branch	21

MINNESOTA

Albert Lea	57
Alexandria	36
Austin	6, 51
Bemidji	24
Brainerd	12
Cloquet	44
Crookston	21
Detroit Lakes	18
Duluth-Superior, Wisc.	3, 6, *8, 32, 38
Ely	16
Fairmont	40
Faribault	20
Fergus Falls	16
Grand Rapids	20
Hastings	29
Hibbing	10
International Falls	11
Little Falls	14
Mankato	15
Marshall	22
Minneapolis-St. Paul	*2, 4, 5, 9, 11, 17, 23
Montevideo	19
New Ulm	43
Northfield	26
Owatonna	45
Red Wing	63
Rochester	10, 55
St. Cloud	7, 33
St. Paul (see Minneapolis)	
Stillwater	39
Thief River Falls	15
Virginia	26
Wadena	27
Willmar	31
Winona	61
Worthington	32

MISSISSIPPI

Biloxi	13, *44, 50
Brookhaven	37
Canton	16
Clarksdale	6, 32
Columbia	35
Columbus	28
Corinth	29
Greenville	21, 27
Greenwood	24
Grenada	15
Gulfport	56
Hattiesburg	9, 17
Jackson	12, *19, 25, 47
Kosciusko	52
Laurel	33
Louisville	46
McComb	31
Meridian	11, 30, *36
Natchez	29
Pascagoula	22
Picayune	14
Starkville	34
State College	*2
Tupelo	38
University	*20
Vicksburg	41
West Point	8, 56
Yazoo City	49

MISSOURI

	Channel No.
Cape Girardeau	12, 18
Carthage	56
Caruthersville	27
Chillicothe	14
Clinton	49
Columbia	8, 16, 22
Farmington	52
Festus	14
Fulton	24
Hannibal	7, 27
Jefferson City	13, 33
Joplin	12, 30
Kansas City	4, 5, 9, *19, 25, 65
Kennett	21
Kirksville	3, 18
Lebanon	23
Marshall	40
Maryville	26
Mexico	45
Moberly	35
Monett	14
Nevada	18
Poplar Bluff	15
Rolla	31
St. Joseph	2, 30, *36
St. Louis	4, 5, *9, 11, 30, 36, 42
Sedalia	6, 28
Sikeston	37
Springfield	3, 10, *26, 32
West Plains	20

MONTANA

Anaconda	2
Billings	2, 8, *11
Bozeman	*9, 22
Butte	4, 6, *7, 15
Cut Bank	20
Deer Lodge	25
Dillon	20
Glasgow	16
Glendive	18
Great Falls	3, 5, *23
Hamilton	17
Hardin	4
Havre	9, 11
Helena	10, 12
Kalispell	8
Laurel	14
Lewistown	13
Livingston	16
Miles City	3, *6, 10
Missoula	*11, 13, 21
Polson	18
Red Lodge	18
Shelby	14
Sidney	14
Whitefish	16
Wolf Point	20

NEBRASKA

Alliance	13, 21
Beatrice	40
Broken Bow	14
Columbus	49
Fairbury	35
Falls City	38
Fremont	52
Grand Island	11, 21
Hastings	5, 27
Kearney	13, 19
Lexington	23
Lincoln	10, 12, *18, 24
McCook	8, 17
Nebraska City	50
Norfolk	33
North Platte	2, 4
Omaha	3, 6, 7, *16, 22, 28
Scottsbluff	10, 16
York	15

NEVADA

	Channel No.
Boulder City	4
Carlin	14
Carson City	37
Elko	10
Ely	3, 6
Fallon	29
Goldfield	5
Hawthorne	31
Henderson	2
Las Vegas	8, *10, 13
Lovelock	18
McGill	8
Reno	4, 8, *21, 27
Tonopah	9
Winnemucca	7
Yerington	33

NEW HAMPSHIRE

Berlin	26
Claremont	37
Concord	27
Durham	*11
Hanover	*21
Keene	45
Laconia	43
Littleton	24
Manchester	9, 48
Nashua	54
Portsmouth	19
Rochester	51

NEW JERSEY

Andover	*69
Asbury Park	58
Atlantic City	46, 52
Bridgeton	64
Camden	*80
Freehold	*74
Hammonton	*70
Montclair	*77
Newark	13
New Brunswick	*19, 47
Paterson	37
Trenton	41
Wildwood	48

NEW MEXICO

Alamogordo	17
Albuquerque	4, *5, 7, 13
Artesia	21
Atrisko-Five Points	18
Belen	24
Carlsbad	6, 23
Clayton	27
Clovis	12, 35
Deming	14
Farmington	17
Gallup	3, *8, 10
Hobbs	46
Hot Springs	19
Las Cruces	22
Las Vegas	14
Lordsburg	23
Los Alamos	20
Lovington	27
Portales	22
Raton	46, *52
Roswell	*3, 8, 10
Santa Fe	2, *9, 11
Silver City	*10, 12
Socorro	15
Tucumcari	25

NEW YORK

Albany-Schenectady-Troy	6, *17, 23, 41
Amsterdam	52
Auburn	37
Batavia	33

NEW YORK—(Continued)

	Channel No.
Binghamton	12, 40, *46
Buffalo (also see Buffalo-Niagara Falls)	17, *23
Buffalo-Niagara Falls	2, 4, 7, 59
Cortland	56
Dunkirk	46
Elmira	18, 24
Glens Falls	39
Gloversville	29
Hornell	50
Ithaca	*14, 20
Jamestown	58
Kingston	66
Malone	20, *66
Massena	14
Middletown	60
New York 2, 4, 5, 7, 9, 11, *25, 31	
Niagara Falls (see Buffalo-Niagara Falls)	
Ogdensburg	24
Olean	54
Oneonta	62
Oswego	31
Plattsburg	28
Poughkeepsie	21, *83
Rochester	5, 10, 15, *21, 27
Rome (see Utica)	
Saranac Lake	18
Schenectady (also see Albany)	35
Syracuse	3, 8, *43
Troy (see Albany)	
Utica-Rome	13, 19, *25
Watertown	48

NORTH CAROLINA

Ahoskie	53
Albemarle	20
Asheville	13, *56, 62
Burlington	63
Chapel Hill	*4
Charlotte	3, 9, 36, *42
Durham	11, *40, 46
Elizabeth City	31
Fayetteville	18
Gastonia	48
Goldsboro	34
Greensboro	2, *51, 57
Greenville	9
Henderson	52
Hendersonville	27
Hickory	30
High Point	15
Jacksonville	16
Kannapolis	59
Kinston	45
Laurinburg	41
Lumberton	21
Mount Airy	55
New Bern	13
Raleigh	5, *22, 28
Roanoke Rapids	30
Rocky Mount	50
Salisbury	53
Sanford	38
Shelby	39
Southern Pines	49
Statesville	64
Washington	7
Wilmington	6, 29, *35
Wilson	56
Winston-Salem	12, 26, *32

NORTH DAKOTA

Bismarck	5, 12, 18, *24
Bottineau	16
Carrington	26
Devils Lake	8, 14
Dickinson	2, 4, *17
Fargo	6, 13, *34, 40
Grafton	17

NORTH DAKOTA—(Continued)

	Channel No.
Grand Forks	*2, 10
Harvey	22
Jamestown	7, 42
Lisbon	23
Minot	*6, 10, 13
New Rockford	20
Rugby	38
Valley City	4, 32
Wahpeton	45
Williston	8, 11, *34

OHIO

Akron	49, *55, 61
Ashtabula	15
Athens	62
Bellefontaine	63
Cambridge	26
Canton	29
Chillicothe	56
Cincinnati	5, 9, 12, *48, 54, 74
Cleveland	3, 5, 8, 19, *25, 65
Columbus	4, 6, 10, *34, 40
Coshocton	20
Dayton	2, 7, *16, 22
Defiance	43
Findlay	53
Gallipolis	18
Hamilton-Middletown	65
Lancaster	28
Lima	35, 41
Lorain	31
Mansfield	36
Marion	17
Massillon	23
Middletown (see Hamilton)	
Mount Vernon	58
Newark	60
Oxford	*14
Piqua	44
Portsmouth	30
Sandusky	42
Springfield	46, 52
Steubenville (see Wheeling, W. Va.)	
Tiffin	47
Toledo	11, 13, *30
Warren	21
Youngstown	27, 33, 73
Zanesville	50

OKLAHOMA

Ada	50
Altus	36
Alva	30
Anadarko	58
Ardmore	55
Bartlesville	62
Blackwell	51
Chickasha	64
Claremore	15
Clinton	32
Duncan	39
Durant	27
Elk City	12, 15
El Reno	56
Enid	5, 21, *27
Frederick	44
Guthrie	48
Guymon	20
Hobart	23
Holdenville	14
Hugo	21
Lawton	7, *28, 34
McAlester	47
Miami	58
Muskogee	8, *45, 66
Norman	31, *37
Oklahoma City	4, 9, *13, 19, 25
Okmulgee	26
Pauls Valley	61
Ponca City	40

OKLAHOMA—(Continued)

	Channel No.
Pryor Creek	54
Sapulpa	42
Seminole	59
Shawnee	53
Stillwater	29, *69
Tulsa	2, 6, *11, 17, 23
Vinita	28
Woodward	8

OREGON

Albany	55
Ashland	14
Astoria	30
Baker	37
Bend	15
Burns	16
Corvallis	*7, 49
Eugene	*9, 13, 20, 26
Grants Pass	30
Klamath Falls	2
La Grande	13
Lebanon	43
McMinnville	46
Medford	4, 5
North Bend	16
Pendleton	28
Portland	6, 8, *10, 12, 21, 27
Roseburg	28
Salem	3, *18, 24
Springfield	37
The Dalles	32

PENNSYLVANIA

Allentown	39, 45
Altoona	10, 19, 25
Bethlehem	51
Bradford	48
Butler	43
Chambersburg	46
Du Bois	31
Easton	57
Emporium	42
Erie	12, 35, *41, 66
Harrisburg	27, 33, 71
Hazleton	63
Johnstown	6, 56
Lancaster	8, 21
Lebanon	15
Lewistown	38
Lock Haven	32
Meadville	37
New Castle	45
Oil City	64
Philadelphia	3, 6, 10, 17, 23, 29, *35
Pittsburgh	2, 11, *13, 16, 47, 53
Reading	55, 61
Scranton	16, 22, 73
Sharon	39
State College	*44
Sunbury	65
Uniontown	14
Washington	63
Wilkes-Barre	28, 34
Williamsport	36
York	43, 49

RHODE ISLAND

Providence	10, 12, 16, *22

SOUTH CAROLINA

Aiken	54
Anderson	58
Camden	14
Charleston	2, 5, *13
Clemson	*68
Columbia	10, *19, 25, 67
Conway	23
Florence	8

SO. CAROLINA—(Continued)

	Channel No.
Georgetown	27
Greenville	4, 23, *29
Greenwood	21
Lake City	55
Lancaster	31
Laurens	45
Marion	43
Newberry	37
Orangeburg	44
Rock Hill	61
Spartanburg	7, 17
Sumter	47
Union	65

SOUTH DAKOTA

Aberdeen	9, 17
Belle Fourche	23
Brookings	*8, 25
Hot Springs	17
Huron	12, 15
Lead	5, 26
Madison	46
Mitchell	5, 20
Mobridge	27
Pierre	6, 10, *22
Rapid City	7, 15
Sioux Falls	11, 13, 38, *44
Sturgis	20
Vermillion	*2, 41
Watertown	3, 35
Winner	18
Yankton	17

TENNESSEE

Athens	14
Bristol, Tenn-Bristol, Va.	5, 46
Chattanooga	3, 12, 43, 49, *55
Clarksville	53
Cleveland	38
Columbia	39
Cookeville	24
Covington	19
Dyersburg	46
Elizabethton	40
Fayetteville	27
Gallatin	48
Harriman	67
Humboldt	25
Jackson	9, 16
Johnson City	11, 34
Kingsport	28
Knoxville	6, 10, *20, 26
Lawrenceburg	50
Lebanon	58
McMinnville	46
Maryville	51
Memphis	3, 5, *10, 13, 42, 48
Morristown	54
Murfreesboro	18
Nashville	*2, 4, 5, 8, 30, 36
Oak Ridge	32
Paris	51
Pulaski	44
Shelbyville	62
Springfield	42
Tullahoma	65
Union City	55

TEXAS

Abilene	9, 33
Alice	34
Alpine	12
Amarillo	*2, 4, 7, 10
Athens	25
Austin	7, 18, 24, *30
Ballinger	25
Bay City	33
Beaumont-Port Arthur	4, 6, 31, *37

TEXAS—(Continued)

	Channel No.
Beeville	38
Big Spring	4
Bonham	43
Borger	33
Brady	15
Breckenridge	14
Brenham	52
Brownfield	15
Brownsville (also see Brownsville-Harlingen-Weslaco)	36
Brownsville-Harlingen-Weslaco (1)	4, 5
Brownwood	19
Bryan	54
Childress	40
Cleburne	57
Coleman	21
College Station	*3, 48
Conroe	20
Corpus Christi	6, 10, *16, 22
Corsicana	47
Crockett	56
Crystal City	28
Cuero	25
Dalhart	16
Dallas	4, 8, *13, 23, 29, 73
Del Rio	16
Denison	52
Denton	*2, 17
Eagle Pass	26
Edinburg	26
El Campo	27
El Paso	4, *7, 9, 13, 20, 26
Falfurrias	52
Floydada	45
Fort Stockton	22
Fort Worth	5, 10, 20, *26
Gainesville	49
Galveston	11, 35, 41, *47
Gonzales	64
Greenville	62
Harlingen (also see Brownsville-Harlingen-Weslaco)	23
Hebbronville	58
Henderson	42
Hereford	19
Hillsboro	63
Houston	2, *8, 13, 23, 29, 39
Huntsville	15
Jacksonville	36
Jasper	49
Kermit	14
Kilgore	59
Kingsville	40
Lamesa	28
Lampasas	40
Laredo	8, 13, *15
Levelland	38
Littlefield	32
Longview	32, 38
Lubbock	5, 11, 13, *20, 26
Lufkin	9, 46
McAllen	20
McKinney	65
Marfa	19
Marshall	16
Mercedes	32
Mexia	50
Midland	2, 18
Mineral Wells	38
Mission	14
Monahans	9
Mount Pleasant	35
Nacogdoches	40
New Braunfels	62
Odessa	7, 24
Orange	43

(1) These assignments may be utilized in any community lying within the area of the triangle formed by Brownsville, Harlingen and Weslaco.

TEXAS—(Continued)

	Channel No.
Pampa	17
Paris	33
Pearsall	31
Pecos	16
Perryton	22
Plainview	29
Port Arthur (see Beaumont)	
Quanah	42
Raymondville	42
Rosenberg	17
San Angelo	6, 8, 17, *23
San Antonio	4, 5, *9, 12, 35, 41
San Benito	48
San Marcos	53
Seguin	14
Seymour	24
Sherman	46
Snyder	30
Stephenville	32
Sulphur Springs	41
Sweetwater	12
Taylor	58
Temple	16, 22
Terrell	53
Texarkana	6, *18, 24
Tyler	7, 19
Ulvalde	20
Vernon	18
Victoria	19
Waco	11, *28, 34
Waxahachie	45
Weatherford	51
Weslaco (see Brownsville-Harlingen-Weslaco)	
Wichita Falls	3, 6, *16, 22

UTAH

	Channel No.
Brigham	36
Cedar City	5
Logan	12, 30, *46
Ogden	9, *18, 24
Price	6
Provo	11, 22, *28
Richfield	13
St. George	18
Salt Lake City	2, 4, 5, *7, 20, 26
Tooele	44
Vernal	3

VERMONT

	Channel No.
Bennington	33
Brattleboro	58
Burlington	*16, 22
Montpelier	3, 40
Newport	46
Rutland	49
St. Albans	34
St. Johnsbury	30

VIRGINIA

	Channel No.
Blacksburg	*60
Bristol (see Bristol, Tenn.)	
Charlottesville	*45, 64
Covington	44
Danville	24
Emporia	25
Farmville	19
Fredericksburg	47
Front Royal	39
Harrisonburg	3, 34
Lexington	54
Lynchburg	13, 16
Marion	50
Martinsville	35
Newport News (see Norfolk-Portsmouth-Newport News)	
Norfolk-Portsmouth (also see Norfolk-Portsmouth-Newport News)	27

VIRGINIA—(Continued)

	Channel No.
Norfolk-Portsmouth- Newport News (also see Norfolk-Portsmouth)	3, 10, 15, *21, 33
Norton	52
Petersburg	8, 41
Portsmouth (see Norfolk-Portsmouth and also see Norfolk-Portsmouth-Newport News)	
Pulaski	37
Richmond	6, 12, *23, 29
Roanoke	7, 10, 27, *33
South Boston	14
Staunton	36
Waynesboro	42
Williamsburg	17
Winchester	28

WASHINGTON

	Channel No.
Aberdeen	58
Anacortes	34
Bellingham	12, 18, 24
Bremerton	44, 50
Centralia	17
Ellensburg	49, *65
Ephrata	43
Everett	22, 28
Grand Coulee	37
Hoquiam	52
Kelso	39
Kennewick (also see Kennewick-Richland-Pasco)	25
Kennewick-Richland-Pasco	*41
Longview	33
Olympia	60
Omak-Okanogan	*35
Okanogan (see Omak)	
Pasco (also see Kennewick-Richland-Pasco)	19
Port Angeles	16
Pullman	*10, 24
Richland (also see Kennewick-Richland-Pasco)	31
Seattle	4, 5, 7, *9, 20, 26
Spokane	2, 4, 6, *7
Tacoma	11, 13, *56, 62
Walla Walla	5, 8, *22
Wenatchee	*45, 55
Yakima	23, 29, *47

WEST VIRGINIA

	Channel No.
Beckley	6, 21
Bluefield	41
Charleston	8, *43, 49
Clarksburg	12, 22
Elkins	40
Fairmont	35
Hinton	31
Huntington	3, 13, *53
Logan	23
Martinsburg	58
Morgantown	*24
Parkersburg	15
Welch	25
Weston	32
Wheeling (also see Wheeling-Steubenville, Ohio)	*57
Wheeling-Steubenville, Ohio	7, 9, 51
Williamson	17

WISCONSIN

	Channel No.
Adams	*58
Appleton	42
Ashland	15
Beaver Dam	37
Beloit	57
Chilton	*24
Eau Claire	13, *19, 25

WISCONSIN—(Continued)

	Channel No.
Fond du Lac	54
Green Bay	2, 6
Janesville	63
Kenosha	61
La Crosse	8, *32, 38
Madison	3, *21, 27, 33
Manitowoc	65
Marinette	11, 32, *38
Milwaukee	4, *10, 12, 19, 25, 31
Oshkosh	48
Park Falls	*18
Portage	17
Prairie du Chien	34
Racine	49, 55
Rhinelander	22
Rice Lake	21
Richland Center	15, *66
Sheboygan	59
Shell Lake	*30
Sparta	50
Steven Point	20, 26
Sturgeons Bay	44
Superior (see Duluth, Minn.)	
Wausau	7, 16, *46
Wisconsin Rapids	14

WYOMING

	Channel No.
Buffalo	29
Casper	2, 6
Cheyenne	3, 5
Cody	24
Douglas	14
Evanston	14
Gillette	31
Green River	16
Greybull	40
Lander	17
Laramie	*8, 18
Lovell	36
Lusk	19
Newcastle	28
Powell	30
Rawlins	11
Riverton	10
Rock Springs	13
Sheridan	9, 12
Thermopolis	15
Torrington	27
Wheatland	24
Worland	34

U. S. TERRITORIES AND POSSESSIONS

ALASKA

	Channel No.
Anchorage	2, *7, 11, 13
Fairbanks	2, 4, 7, *9, 11, 13
Juneau	*3, 8, 10
Ketchikan	2, 4, *9
Seward	4, 9
Sitka	13

HAWAIIAN ISLANDS

	Channel No.
Lihue, Kauai	3, *8, 10, 12
Honolulu, Oahu	2, 4, *7, 9, 11, 13
Wailuku, Maui	3, 8, *10, 12
Hilo, Hawaii	2, *4, 7, 9, 11, 13

PUERTO RICO

	Channel No.
Arecibo	13
Caguas	11
Mayaguez	3, 5
Ponce	7, 9
San Juan	2, 4, *6

VIRGIN ISLANDS

	Channel No.
Christiansted	8
Charlotte Amalie	10, 12

Letters from NRI Graduates Tell of Their Progress in Radio and TV

Found Course Helpful in High School and College

"In my estimation the NRI Course has helped me in many ways. I have done some repair work, and worked in repair shops. This broadened my general knowledge. The course definitely helped me in high school physics which I needed to enter college.

"I am now studying Electrical Engineering and majoring in Electronics. It is a pleasure to have an opportunity to recommend NRI, as I am completely satisfied with your course."

WILLIAM S. WEST,
46 Park Blvd.
Winston-Salem, N. C.

Earned Over $800 Last Year Servicing TV Part Time

"The NRI Course made it possible for me to earn $827.23 last year servicing Television, spare time, for a local store. I don't want to give up my regular job because of retirement advantages, etc., but I could easily make a living from Radio and TV servicing. Have had several good offers which I turned down. My best friend is now taking a course upon my recommendation. I heartily recommend your course."

FORREST B. TUCKER,
Box #154,
Lakeside, Ohio.

———n r i———

Doubled Size of Store To Handle Television

"As TV became more and more recognized in this part of the country, and more people acquired sets, I entered into the sales end of Television also. It was necessary to double my premises for Television display and salesroom.

"I am a franchised dealer of four of the leading makes of Television Sets. Have at least a dozen new sets on display. Repairs have also been tremendously good. It gives me a great deal of pleasure to know that most of my customers are well pleased."

LEO BALFUR,
1727 Jefferson St.,
Oakland, California.

Services All Makes of Radios And Television at Home

"I began servicing after my fifteenth lesson and by the time I finished the NRI Course I had earned enough to pay for my basic equipment. Am now doing part-time Radio work at home and service all makes of Radios and TV sets. Have a nice spare time business and well equipped shop.

"All of this I owe to NRI. I don't think there is a better course. I shall always praise NRI."

LEO DUNCAN,
34-64 110th Street,
Corona, New York.

n r i

Past Sixty When He Took Up Radio As a Hobby

"I was past the sixty mark when I took up Radio as a hobby. I set up my shop at home on the farm. Neighbors soon began bringing in servicing jobs, and without any advertising, outside of word of mouth, work began to roll in. NRI training has helped me to do work to the entire satisfaction of all.

"For the time I put in at Radio work my profit is about doubled that which I could earn working for someone else. A man past sixty with an active mind and limber fingers can still learn to make an independent living from the NRI Course in Radio."

A. F. MELIN,
RFD #1—Box 35,
Summerfield, Florida.

n r i

Has Own Business— A New Way of Life

"Thanks to the NRI Course I have a business of my own. Everything is changed, exactly as you said when I started the course. It seems like a new world for me. You changed my way of living, gave me inspiration and the initiative to go ahead, which I did with your fine help.

"The young lady in the photograph is my wife who takes care of the Records Department, handles appointments, checks Radio tubes, etc. Today I am living a reasonable life on account of your course which I took at night, after work."

JOHNNY D'ERRICO,
7089 De St Vallier,
Montreal, P.Q., Canada.

n r i

As space permits, from time to time, we plan to devote a page or two in NR-TV News to short success stories such as above. They are taken from testimonial letters we have on file. Photographs and letters of this kind are always greatly appreciated by us. We feel we should pass them on to our readers for the inspiration to be gained from a reading of them.

Photoelectric Cell Applications

Reprinted through courtesy of the Aerovox Research Worker

THE photoelectric cell, or "electric eye" as it is often referred to, has many applications—from use in burglar alarms and smoke detectors to facsimile, television, and even the measurement of microscopic tissue cells. It is based on a discovery by Hertz in 1887 that emission of electrons can be caused by light striking the surface of certain materials such as sodium and potassium.

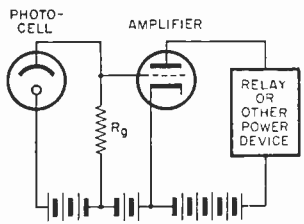
Photosensitive devices fall into three general classes: (1) photoelectric or "phototubes," (2) photoconductive cells, and (3) photovoltaic cells. Phototubes are those in which impinging light causes emission of electrons from the photosensitive surface. Most practical photo-sensitive devices, such as the burglar alarm, automatic counter, door opener, and smoke detector, fall in this category. Photoconductive cells are those in which the internal resistance varies with the amount of light striking the sensitive surface. These cells are used to operate very sensitive relays and in the measurement of infrared radiation. Photovoltaic cells are those which generate an internal emf upon exposure to light. The ordinary light intensity meter used in photography employs a photovoltaic cell connected directly across a low resistance meter.

This article from *Aerovox Reserch Worker* is devoted to some typical applications of the various types of photosensitive devices mentioned above.

Phototubes

Commercial phototubes are essentially diodes contained in glass envelopes very similar to those used for thermionic vacuum tubes. The cathode is usually a large semi-cylindrical surface coated with a photoemissive material. The anode is a wire lying parallel to the cathode axis. These elements may be inclosed in an evacuated bulb, or one which is gas-filled. The gas tubes ionize when the plate voltage exceeds a certain value and thus pass a larger current than do the high vacuum types. Gas-filled tubes are employed largely in motion picture work where their higher sensitivity reduces the amplification needed. High vacuum phototubes are used in light measurement work and in certain relay operating applications. They are less subject to damage due to application of excessive voltage or current, and their sensitivity remains more constant over a period of time.

The most common applications of phototubes involve the use of associated vacuum tube amplifiers, as in Fig. 1. The tube is coupled to the input of an amplifier by means of a large resistance, Rg. Since the current flow through the cell is of the order of a few microamperes, this

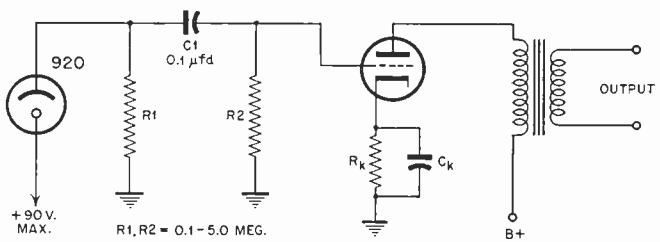


TYPICAL PHOTOTUBE AMPLIFIER CIRCUIT

Fig. 1

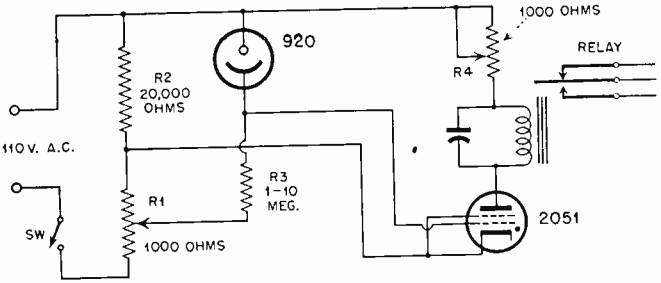
resistance should be very high. By proper amplifying circuits, the current in the final output stage of the amplifier may be sufficient to operate a relay or a loudspeaker as in the sound picture industry. See Fig. 2.

Another valuable application of the photoelectric cell is the control of lighting. The tube is used with an amplifier and relay to turn the lighting system on when daylight decreases and off when natural light is again adequate. Fig. 3 illustrates a circuit in which the relay is energized by an increase in light. As long as the illumination on the phototube is below a certain value, the 2051 grid potential is below cutoff, and



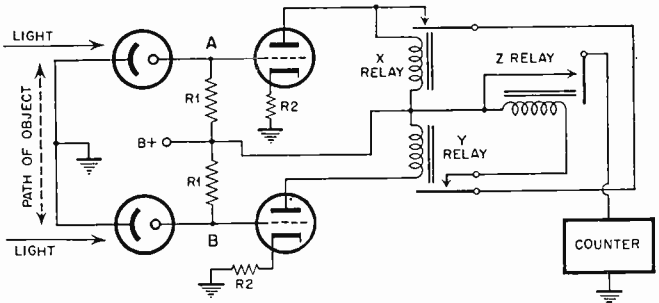
PHOTOTUBE CIRCUIT FOR SOUND REPRODUCTION

Fig. 2



P.E. CELL LIGHTING CONTROL CIRCUIT

Fig. 3



DIRECTIONAL PHOTOELECTRIC COUNTER

Fig. 4

prevents conduction. When illumination rises, grid voltage is made less negative and the tube conducts, closing the relay. The function of R4 is to keep the current through the 2051 within the tube's maximum rating. Note that this circuit works directly on a.c. line voltage, requiring no d.c. supply.

Photoelectric Counting System

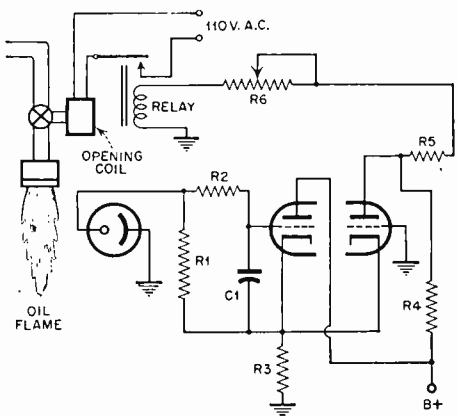
The simplest use of the phototube and relay is that of counting. A beam of light is directed across a conveyor belt into a photoelectric tube which operates a counter. When the beam of light is interrupted by one of the objects to be counted, the change in tube current operates the counter. An interesting circuit of this type is the one-way counter illustrated in Fig. 4. This arrangement records objects passing in one direction, but not in the other.

Suppose an object is passing downward in Fig. 4 so that it obscures phototube A and then B. When the light to tube A is interrupted, plate current flows in tube X, opening the contacts of relay X. As the object continues downward, both tubes are obscured and relay Y closes. But since the contacts of X relay are open, no current flows through the Z relay and the counter is inoperable. Now suppose that the object passes from B to A. Relay Y is operated when amplifier tube B starts to conduct. Then, when the object obscures both phototubes, the current through the amplifier tube associated with phototube A passes mainly through the contacts of relays X and Y to operate the Z relay and the counter. Relay X does not operate and its contacts remain closed. Thus, the counter is actuated only by objects passing in the direction from B to A.

Industrial Safety Controls

The applications of photoelectric cells to safety devices are very numerous. Some of the more familiar safety controls are the smoke detectors, traffic control, and protective door openers which prevent automatic doors from closing until personnel are clear.

Another important protective circuit of this type is the flame-failure detector shown in Fig. 5. This device, intended to safeguard oil furnaces, uses a dual triode as its principal element. When light from the flame is present, photocurrent flows and the first triode section is blocked. The second section normally conducts current enough to close the re-

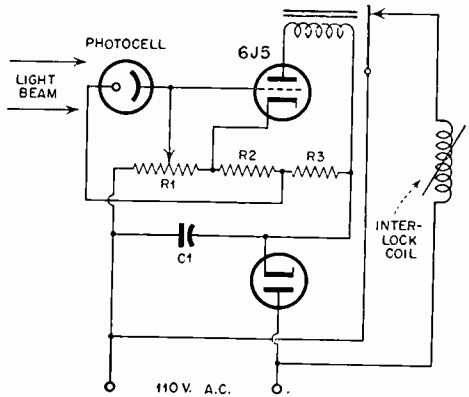


FLAME FAILURE PROTECTIVE CIRCUIT

Fig. 5

lay which opens the solenoid oil valve and allows the flame to burn. Should a flame failure occur, the photo-cell no longer provides blocking voltage to the first section, which then conducts and applies a blocking voltage to the grid of the second triode section.

The blocking of current in the second triode



"LIGHT CURTAIN" PROTECTIVE CIRCUIT

Fig. 6

opens the relay and closes the oil valve with the simultaneous ringing of an alarm bell.

An even more common kind of industrial safety control is the "light curtain" type of protective device used to safeguard the operators of heavy machines. In this application of photoelectric devices, a light curtain is formed about the area of danger by a series of beam projectors and mirrors, the beam falling ultimately on a set of phototubes. If the operator inadvertently reaches into the protected area, one of the beams of light is interrupted and the machinery is stopped by an interlock operated by the photocell relay.

Fig. 6 is a typical circuit of this kind. Here the bias potentiometer (R1) is adjusted to cut-off so that the 6J5 does not conduct in the absence of light on the photocell cathode. With incident light the photocurrent through this bias resistor causes the tube to conduct and operate its load relay which, in turn, operates an interlock which permits the machine to operate. Interruption of the incident light beam causes the 6J5 to cut off and stops or delays the operation of the machine. A safety control of this type is most frequently used with punch presses.

Photoelectric Gages

Phototubes also find many applications in the measurement of time, distance, thickness of materials, etc. A photoelectric device can be made to operate as a micrometer for razor blades, wire, tube stock, and many other materials. A good example is its use in making precision measurements on piston rings. One light beam, directed at a phototube, scans the separation of the sample ring and a master. If the sample exceeds the permitted tolerance, a rejection signal is operated. A mechanical shutter cuts off this beam as the piston ring gap is scanned. A second beam, scanning the gap, causes other rejection signals if the gap dimension is under or over tolerances. The entire inspection cycle requires less than 5 seconds.

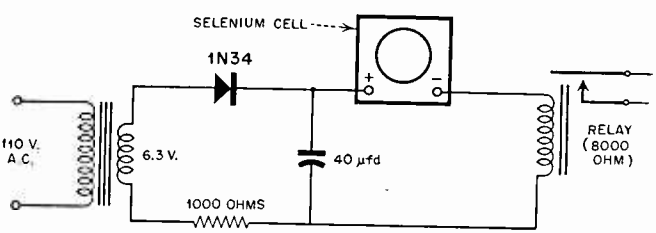
Photoconductive Cells

The selenium cell is the most common photoconductive cell in modern usage. It is usually mounted in a glass container filled with an inert gas. Although used in conjunction with an amplifier in some cases, the photoconductive cell will pass sufficient current to operate a very sensitive relay directly. A relay having a winding resistance of 5,000 to 10,000 ohms is frequently used in connection with these cells. When an amplifier is used with photoconductive cells, the choice of the grid resistance should depend upon the light resistance of the particular cell used rather than being as high as possible, as with phototubes.

Fig. 7 illustrates the novel use of a self-generating selenium cell with a 1N34 germanium crystal rectifier to operate a rugged, less expensive relay. A small d.c. operating bias is provided by the crystal rectifier operated from the 6.3 volt winding of the filament transformer. This circuit is applicable to a wide variety of devices such as intrusion alarms, light-operated switches, garage door openers; etc. It is also used frequently in crowd-attracting window displays because of its simplicity and the fact that the absence of a high gain amplifier makes it immune to false operation by extraneous signals.

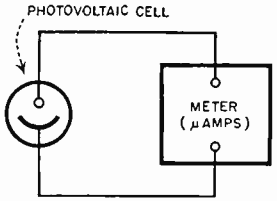
Photovoltaic Cells

Photovoltaic cells are most frequently used directly in series with a relay, meter, or other load. See Fig. 8. A simple photovoltaic cell consists of a lead electrode and an oxidized copper electrode immersed in an electrolyte. Exposure to light causes the cell to become a generator. Other "dry" photovoltaic cells consist of a sandwich of iron and selenium fitted with copper electrodes. Since such cells generate an emf., they require no external source of power. The copper oxide type of cell (Phototox) has a color



SIMPLE PHOTOELECTRIC CELL CIRCUIT

Fig. 7



PHOTOVOLTAIC CELL CIRCUIT
(EXPOSURE METER)

Fig. 8

response almost identical with that of the human eye and hence is used in illumination control and in regulating industrial processes in which color or change of color of the product are important.

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INFORMATION WANTED

It seems that every opportunity is taken to regulate something or somebody. Usually a job to be created and fees to be collected are the real reasons for such regulations. The tendency is to tax almost anything that can be taxed.

Would you send us any newspaper items that you see pertaining to proposed or enacted bills affecting the activities of Radio and Television Technicians, including the licensing of technicians? We will appreciate this information as we want to be able to keep you and other students and graduates posted on matters of this kind.

There is no reporting service to which we can subscribe that covers all states and municipalities, so we are asking for your support in keeping up-to-date on news items of this nature from your state, city or town. Address all material to L. L. Menne, Editor, National Radio-TV News, 16th and U Streets, N.W., Washington 9, D. C. It is not necessary to write a letter unless you wish to do so. The newspaper clipping will be sufficient.

Transitors

I. J. Kaar, manager of engineering for the G-E Electronics Division at Electronics Park, Syracuse, N. Y., said that the development of tiny electronic components known as transistors has brought tiny radios like those used by the comic strip character Dick Tracy within the realm of possibility.

Transistors and another product, the diode, are made from a silver-like metal, germanium, and promise to have an effect on the electronics industry comparable to that of the vacuum tube. Mr. Kaar said, "A really personal radio of hearing aid size running indefinitely on one set of batteries is within sight. The Dick Tracy wrist-

A General Electric engineer holding a flea-sized potted transistor.

watch two-way radio is no longer possible only in the comic books."

Mr. Kaar predicted that transistors, tiny pellets of germanium which can be made smaller than the head of a match, will be used extensively as substitutes for many vacuum tubes. He said both transistors and diodes are smaller, more efficient, cheaper to operate, longer-lasting, and potentially less expensive than vacuum tubes.

He described germanium as metallic in appearance, silvery grey, and extremely hard and brittle. It is recovered as a by-product in the smelting and refining of zinc ores. "Twenty freight car loads of zinc ore must be handled to recover one pound of germanium," he said. Astounding purity is required—less than one part per hundred billion of some impurities have an observable effect. "Germanium purified to this extent is comparable in cost with gold. However, in each diode or transistor, so small an amount is used that material cost is small compared to fabrication costs."

"Meet John H. Battison, Our New Director of Education"—J. E. Smith

JOHN H. BATTISON, whose article on the lifting of the TV freeze is in this issue, joined our organization on February 1, 1952 as Director of Education, succeeding Joseph Kaufman, who resigned. Mr. Battison is a graduate engineer who has been active in the Radio and Television field since 1934. Prior to joining the National Radio Institute he was a Radio and Television Consultant and before this was Editor of the leading technical journal, *Tele-Tech*. In 1947 he became Assistant Chief Allocations Engineer for the American Broadcasting Company and was actively engaged in designing and constructing the five television and FM stations of the ABC network.

John H. Battison

Before joining ABC, he was research engineer and Technical Director for the Midland Broadcasting Company, operators of KMBC - KFRM - Kansas City. While with the Midland Broadcasting Company he participated actively in the development of CBS color television.

He took time out for six years in the RAF as a fighter and bomber pilot and before that was a member of the British Air Ministry Technical Staff designing and producing airborne Radio equipment. He received his grounding in Radio with E. K. Cole Company of England where he spent three years in the receiver and loudspeaker research and development department. Before the war he was active as a ham, being a member of the A.R.R.L. and the Radio Society of Great Britain.

In New York he was a member of the Faculty of New York University from 1950 until 1952 teaching television. He is presently also a member of the Faculty of the American University of Washington, D. C. in the Communications Department.

In addition to his engineering activities in the television broadcast field John Battison takes a keen interest in the studio and motion picture side of Television and Broadcasting. In addition to being a consultant in the technical fields he has done considerable work in adapting motion picture techniques to television.

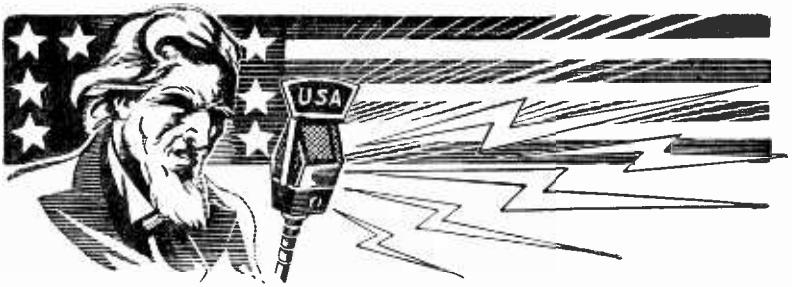
He is the author of four books on television, three of which are being published by the MacMillan Company. He contributes regularly to the leading Radio and Television publications. As a senior member of the Institute of Radio Engineers he participates actively in the Institute of Radio Engineers proceedings and is a member of the Transmitter Committee and the Board of Editors, *Journal of the Institute of Radio Engineers*. He has presented papers at Institute of Radio Engineers' national conventions as well as regional Institute of Radio Engineers meetings.

In the broadcasting field he has presented papers at the annual engineering conventions of the National Association of Radio and Television Broadcasters.

He is member of Panel 3 of the National Television Systems Committee. This panel was the one which was charged with the job of producing the new VHF and UHF Television Allocations for the new TV stations.

He is a senior member of the Institute of Radio Engineers, a member of the British Institute of Radio Engineers, the Society of Motion Picture and Television Engineers, and Associate of the Institute of Electrical Engineers.

Mr. Battison brings to us unusual talents and experience to add to those of such stalwarts as Frank Cook, J. B. Straughn, Wm. F. Dunn, Raymond H. Schaaf, Leo M. Conner, George Rohrich, and other members of our Educational Staff, who are well known to you and who will continue to serve you as in the past.



THE VETERAN'S PAGE

Devoted to news items and information of special interest to veterans taking NRI courses under the GI Bill of Rights.

PROTECT YOUR BENEFITS!

If you had a $100 bill or two $100 bills in your hand right now, you'd do something to protect them from possible loss. You would be careful not to simply lose them. Certainly you would not let them lie around the house three or four months without doing **something** to protect them.

The same applies to your GI Benefits. They are valuable. What your benefits are worth in dollars and cents depends on how much of your course remains to be finished. But you can lose them—simply by doing nothing to protect them. You lose them by *doing nothing!*

There's a tendency to look upon your GI benefits in terms of how much the VA pays for your training. A more accurate way to measure their value might be to measure *how much earning power* you get as a result of the VA payments.

It's no exaggeration to say that a graduate *gets* many times the cost of the course in earning power. The VA pays approximately $135 for the Servicing course, but the graduate may earn more than that as a result of his training *each* month of the year. Studying a course is somewhat like planting a fruit tree; you invest labor today from which you get a larger and still larger return each year thereafter.

There is no accurate measure of what you *lose* if you don't keep studying. The difference between success and failure is slight. The fellow who succeeds just keeps going; the fellow who fails may be as smart but stopped. The successful man was tempted to stop somewhere along the line, too, but went on. The man who stopped, meant to go on, but never did. The difference between the two is so slight, but the results of their decisions makes a great difference in their earnings and prestige.

Those GI students who are still enrolled should keep going *somehow.* If you haven't much time, study a little; take just one night a week if you must, but schedule *some* study.

If by chance you are forced to interrupt training, by all means ask VA permission to resume just as soon as you're able. They might turn you down, but they may approve instead. It's worth the effort of trying.

• • • •

If you have a friend discharged from service less than four (4) years ago, who would like to take training under the GI Bill, suggest that he write NRI. The Institute has a contract for the Servicing or Communications courses for any veteran who can still get a Certificate to *start* training. Time may be short for him to enroll; but if he's interested in Radio or Television, have him write today for information about getting a certificate of eligibility.

Professional Charges For Radio-Television Service

ALL charges in this rate schedule are *for professional services only.* Parts should be billed at list prices, as explained at the end of the schedule.

Each bill should include one of the five following charges, to cover testing of tubes, check-up of set, and tests needed to determine the nature and extent of the trouble:

I Check-up and test at customer's home.. $4.00
This covers 1 hour of time including trip to and from home, if located within 2 miles of shop. Charge for extra time or mileage at the rate specified in schedule. Minor repairs that can be made within time limit are included in this charge.

II Check-up and test at shop including pick-up and delivery of set 5.00
This includes time and transportation expense for two round trips to a customer located up to 2 miles away from shop; charge for greater distance at mileage rate specified in schedule. Minor repairs or adjustments to be included in this charge.

III Check-up and test radio-phono combination at shop, including pick-up and delivery of set where it is necessary to remove both the radio chassis and the phono 7.50
This includes time and transportation charges for 2 round trips to a customer located within 2 miles from shop; charge for greater distance at mileage rate.

IV Check-up and test console receiver or radio-phono combination at shop, when customer brings set in and takes it away 2.50
Minor repairs that can be made within time limit (½ hour) should be included in this charge.

V Check-up and test table model at shop when customer brings set in and takes it away 1.50
This includes time for minor repairs.

ALPHABETICAL SCHEDULE OF CHARGES

Note: These charges cover the actual installation of the replacement part. Cost of parts is not included in these charges.

Antenna, built-in loop—install $2.00
—repair broken wire 1.00

Antenna, auto—install complete unit..... 4.00
—install new lead-in wire 2.00

Antenna, home—simple outdoor installation not requiring ladder or poles ... 5.00
—difficult installation .....Hourly Rate

Antenna, FM 10.00
(For the average installation, antenna, lead-in wire, and hardware can be purchased for about $10.00, list price $15.00, bringing total cost of job to about $25.00.)

Alignment, trf set 1.50

Alignment, superheterodyne set:
1-band, AC/DC table model 1.50
1-band, 2-section console 2.00
(two tuning-condenser sections)
1-band, 3-section 2.50
2-band, 2-section 3.00
2-band, 3-section 3.50
3-band, 2-section 4.00
3-band, 3-section 4.50
4 or more bands 5.00
FM receiver 3.00
AM-FM combination—broadcast bands only 4.00
—broadcast and FM bands 5.00
FM tuner 3.00

Auto radio—original installation of set and antenna, with reasonable amount of interference elimination for a custom-made set designed to fit into the car conveniently 7.50
—original installation of single-unit set and antenna with reasonable amount of interference elimination; not a custom-made receiver 10.00
—original installation of new two-unit set 12.50
—remove set from car and re-install after bench work is done 3.00
—interference elimination .....Hourly Rate

AUTOMATIC RECORD CHANGER:
—clean and oil 2.00
—adjust or replace part .....Hourly Rate
Minimum of $5.00
Battery replacement—rewiring required.. 2.00

COIL installation:
Oscillator or rf coil in AC/DC table model receiver 3.00
Oscillator or rf coil in console receiver
—1-band 4.00
—2-band 5.00
—multi-band 6.00
(These charges include touching up alignment after replacement has been installed.)
RF choke 2.00
AF choke 2.50
Filter choke 2.50

CONDENSER installation:
Single paper, mica, or ceramic 2.00
Each additional ..... .50
Trimmer or padder (includes adjustment) 3.00
Gang tuning unit 4.00
Single electrolytic
—tubular type 2.00
—can type 3.00
Dual electrolytic
—tubular type 2.50
—can type 3.50
Multi-section electrolytic
—tubular type 3.00
—can type 3.50

Connection—locate and repair loose connection causing intermittent trouble
Hourly Rate
Dial-drive cable or belt, install
—easy job 1.50
—normal job 2.50
—special jobs requiring over 1 hour.. 4.50
Dial-drive—repair friction type 2.25
Dial pointer or scale—repair or replace .. 1.50

HOURLY RATE 3.00
(This may vary considerably between large cities and rural communities. We have given an average charge.)
Interference—install simple power-line filter 1.00
—install and adjust wave trap 2.50
—eliminate interference at source
Hourly Rate—Minimum of $3.00
Intermittent trouble—Base your estimate on past experience and observed symptoms. If you guarantee the job, be sure to make the estimate high enough to cover the possibility of a call-back.
Line cord, plain 2-wire—install 1.00
Line-cord resistor—install 2.00
Loudspeaker—install 3.00
—substitute PM for electrodynamic... 4.50
Mileage rate, per extra mile traveled ... .25

Phono motor—clean and lubricate 1.50
—replace motor, non-automatic player 3.00
—replace motor, automatic player ... 4.00
Phono pick-up—adjust, repair, or replace 2.50
Push-buttons, automatic tuning—reset:
Simple mechanical type, per station .. .25
Telephone-dial type, per station ..... .50
Electrical (trimmer type), per station .25
Motor-operated type, per station ..... .50

RESISTOR installation:
Single resistor 2.00
Each additional ..... .50
Voltage divider or bleeder 3.00
Ballast—substitute universal replacement for ballast type no longer available 2.00
Shadow tuning meter—replace or repair .. 3.00
Switch—install simple on-off type 1.50
—band-changing, 2-band set 4.00
—band-changing, 3-band set 6.00
—complex jobs on multi-band
Minimum of 4.00
Plus .25 per terminal
—radio-phono 3.00
Tone control—install 3.00

TRANSFORMER installation:
AF transformer 3.00
I-F transformer 3.50
FM detector transformer 4.00
Power transformer
—for time not exceeding 1 hour.... 4.00
—additional time .....Hourly Rate
RF transformer
—1-band 3.50
—2-band 4.50
—multi-band 6.00
Tube socket—install 3.00
Tube tests—Included in shop or home check-up and test.
Tone control—install 3.00
Volume control—install 3.00

PROFESSIONAL CHARGES FOR TELEVISION SERVICE

All charges are for professional services only, except where otherwise indicated. Parts should be billed at list prices as explained at the end of the schedule.

Each bill should include one of the following charges, to cover the cost of testing tubes or parts or any other tests that may be necessary to determine the nature and extent of the trouble.

I Check-up and test at customer's home.. $5.00
This covers up to 1 hour of time including trip to and from home, if located within 2 miles of shop. Charge for extra time or mileage at rate specified in schedule. Minor repairs that can be made within time limit are included in this charge.

II Check-up and test at shop, including pick-up and delivery of set 7.50
This includes time and transportation expense for two round trips to a customer located up to 2 miles away from shop; for greater distance charge at mileage rate specified in the schedule of charges, and for time exceeding 1 hour, charge according to the hourly rate.

III Check-up and test at shop, when customer brings set in and takes it away.. 2.50
This charge is for ½ hour time. Minor repairs or adjustments that can be made within time limit should be included.

ALPHABETICAL SCHEDULE OF CHARGES

Antenna—install simple outside or attic type 30.00
(This charge includes the antenna, lightning arrestor, lead-in, supports, and hardware necessary to complete installation.)
—install complex antenna for fringe area. Charge list price for equipment used. Labor charge $5.00 per hour for man in charge of installation, plus $3.50 an hour for each helper.
—repair, resolder lead-in 5.00
—install new transmission line 10.00
(includes up to 100 feet of line)
—orient antenna 5.00

Alignment—adjust oscillator in sets where the oscillator can be adjusted from the front of the set without removing the receiver from the cabinet
Covered in Service Charge
—adjust oscillator where set must be removed from cabinet 2.50
—sound i-f alignment 2.50
—video i-f alignment, stagger tuning.. 4.00
—video i-f alignment, band-pass tuning 6.00
—complete alignment 10.00

AUTOMATIC RECORD CHANGER (TV combination)
—clean and oil 1.50
—adjust or replace parts.....Hourly Rate
Minimum of 5.00

COIL installation:
Peaking coil 3.00
Filter choke 3.00
Focus coil 5.00
Coil in tuner 5.00

CONDENSER installation:
Single by-pass (paper, mica, ceramic) 3.00
Each additional ..... .50
By-pass, coupling, etc., in tuner where component is difficult to get at and it may be necessary to remove other parts to make replacement..... 5.00
Single electrolytic (filter or by-pass)
—tubular 3.00
—can 4.00
Dual electrolytic—tubular 3.50
—can 4.50
Multi-section
—tubular 4.50
—can 5.50
Connections—locating and soldering loose or intermittent connection.....Hourly Rate

Control:
Single (brightness, contrast, volume, etc.) 3.00
Dual, concentric (Horizontal and vertical hold, etc.) 4.00
Deflection yoke—install 5.00
—repair broken lead 2.00
Focus coil—install 5.00
—repair broken lead 2.00

HOURLY RATE 5.00
(This rate may vary considerably between large cities and rural communities. An average charge is given here.)
Interference—install simple power-line filter 1.50
—install and adjust stub for FM interference 3.00
—install high-pass or low-pass filter.. 2.50
—install and adjust wave trap 3.00
—eliminate interference at source
Hourly Rate
Minimum of $5.00
Line cord, plain 2-wire—install where soldering is necessary 1.00
—install plug type .....No Charge
Loudspeaker—install 2.50
—substitute PM for electrodynamic.. 4.00
Mileage rate, per extra mile traveled ... .25
Phono motor—clean and lubricate 1.50
—replace motor (automatic player).. 4.00
Phono pick-up—adjust, repair, or replace. 2.50

RESISTOR installation:
Single resistor 3.00
Each additional ..... .50

TRANSFORMER installation:
AF output 3.00
Sound detector 4.00
Sound i-f 3.00
Horizontal output (includes adjusting width, drive, and linearity controls) 5.00
Vertical output (includes adjusting height and linearity controls) 4.00
Video i-f, stagger tuning 3.00
Video i-f, band-pass tuning 4.00
Trap (sound, adjacent-channel sound, adjacent-channel picture) 3.00
Power transformer (usual installation, not exceeding 1 hour) 5.00

Tube socket, install—easy to get at	3.00
—difficult to get at	4.00
Tube tests—No additional charge if this can be carried out within the period allotted to general check-up. If additional time is required, or where customer simply brings tubes in, per tube	.10
Tuner—install new coil strip in turret tuner when coil snaps in and out of position	2.00
—install contact strip in turret tuner; strip riveted in position	5.00
—install new detent and shaft	4.00
—dismantle and clean turret tuner ...	5.00
—clean contacts of turret tuner when not necessary to dismantle	3.00
—install new tuner	5.00
—miscellaneous repairs .....Hourly Rate	

HOW TO FIGURE BILLS

Fixed Rates. The fixed rates in this schedule are based upon the following factors.

1. The amount of skill and knowledge required to locate the trouble and figure out the remedy. Thus, automatic-record-changer repairs are higher than other equivalent mechanical repairs.

2. The average time a competent, fully equipped Radiotrician or Teletrician would need to complete the job. The check-up and test charges cover only the time required to determine enough about the trouble to give an estimate. On jobs usually requiring additional time to isolate the exact trouble, the price takes this into account.

On jobs that require exact duplicate replacement parts, extra time that may be required to get the correct replacement part is likewise considered. You are *not* taking a pleasure trip when you drive from one radio jobber to another in search of a part.

3. The possibility of complications that might be encountered on the particular job. Some troubles, particularly squealing, distortion, or too-frequent burn-out of tubes or some part, require an actual change in circuit design. Hum is another example; many a customer who complains of hum becomes so hum-conscious that he expects the Radiotrician to eliminate hum that he did not notice when the set was new.

In addition, the possibility of call-backs is definitely a complication, and has been considered in practically every charge. Rare indeed are the jobs where you can collect extra when the set fails within your guarantee period, and still keep the good-will of your customer. The charges in this schedule allow you to handle most call-backs cheerfully without asking for more money, regardless of the reason for the call-back.

Any system of professional charges is based on average conditions. It is intended that you adapt the rates and billing method to special cases whenever necessary, as illustrated by the examples at the end of this booklet.

Material Prices. All radio parts and materials are to be billed at regular list prices as established by the manufacturer.

When no list price is known, the easiest way to figure it for billing purposes is to multiply your cost price by 2. If the result is an odd value, reduce it to the nearest 5¢.

When the list price of a part is 50¢ or less and you are making a separate installation charge for that part, it is usually better business just to list the part without a charge. Thus, there would usually be no charge for small resistors or condensers. This emphasizes the value of your knowledge and skill. On small parts like pilot lamps or replacement control knobs, which have no installation charge, use your own judgment in each case.

Beginners. Because all rates in this schedule are fair charges for completion of the work, these rates can and should be used by beginners as well as experienced Radiotricians. A beginner may take longer for the job and hence earn a lower hourly rate, but if in the end he does as good a job as an expert, he should get professional rates.

There is no such thing as beginner's rates in radio and television—if a beginner isn't able to make a perfect repair job, he has no right to charge for a make-shift job. Either return the set without charge, or sub-let the job to an expert.

Relatives and close friends are admittedly a beginner's biggest problem; it is far better to do work for them free and charge it off to charity on your books, than to cut the rates. Hundreds and hundreds of servicemen have been forced out of business because they could not live down the rumor that they'd fix radios at cut-rate prices because they were beginners and wanted experience.

Hourly Rate. All prices in this book are based on an hourly rate of $3.00 an hour for radio service work and $5.00 an hour for TV work. This may seem high at first thought, but never forget that it takes into consideration all those little things that come under the heading of *overhead expense* and spell the difference between profit and loss at the end of the year. When you consider *all* of the time you spend on your servicing business, you may find that your *average hourly salary* for work may be considerably less than $2.00 an hour at the $3.00 hourly rate and less than $4.00 an hour at the $5.00 rate.

Overhead. Under overhead expenses come such items as the following:

1. Rent, heat, light, water, gas, and telephone bills (or a proportionate share of them if you are working in your home).

2. Depreciation and amortization of equipment. If your tube tester has a useful life of three years, your overhead expense each month includes 1/36th of its cost. Five years is about the longest time over which you can spread equipment expenses.

3. Non-income-producing labor. Such things as bookkeeping work, sweeping the shop, building shelves and benches, going out for parts and doing other business errands, talking to salesmen or people who "just drop in to see how you're getting along," and other shop mantenance jobs together add up to quite a bit of valuable time—either your own or that of someone you have hired—and the hourly rate for income-producing work must recompense you for this time also.

4. Car expense and depreciation. Gasoline, oil, repairs, insurance, license plates, tires, batteries, washing, waxing, and parking fees are examples of car expenses. The Mileage Rate of 25¢ per mile for extra-long trips may seem high to you, but it just barely covers these factors, and doesn't take into account the fact that you use extra time of your own in driving extra miles (at least 2 minutes per mile in cities).

As to depreciation, $300 a year is not at all out of the ordinary for a commercial vehicle.

5. Advertising. In addition to ordinary telephone-book, newspaper, radio-program, and direct-mail advertising, you must consider good-will advertising through purchase of tickets to community raffles, etc., membership in the local Chamber of Commerce and other businessmen's groups, contributions to churches, and to charities such as Red Cross and Community Chest.

6. Taxes. All federal, state, and local taxes applying to your business are overhead expense.

7. Miscellaneous. In the course of a year, there'll be a hundred and one little miscellaneous things taking money out of your pocket. Here are a few: Losses or cost of collection when credit was unwisely given; postage; stationery; fire and theft insurance; radio and television magazines; membership in associations and clubs; small tools; etc.

All special jobs that do not come up often enough to justify listing in this schedule should be charged for at hourly rates, or use the rate given for similar jobs as a guide for estimating the charge.

Tubes. Servicemen should always remember that they are primarily selling professional services involving skill and knowledge. Replacing tubes is a necessary evil, but should never be allowed to influence your charges for repair work.

Many a man has lost all his profit on a repair job through including tube prices in the repair estimate and cutting what he should have charged for repair when the total seemed too high. Therefore, always let your main bills be only for the repair work. Quote tube prices separately, telling the customer which tubes are definitely bad and which are just weak.

If the customer can't afford a complete job, stick to your repair charges and put used tubes in the set *without charge* so that it can be used until the customer can afford new tubes. *Never sell used tubes,* because they destroy confidence. Never cut your repair charges one single penny for anyone.

Credit. Here's another factor that has ruined many a serviceman. You should do all radio and television service work on a cash basis, collecting at the time you deliver the set, unless you know definitely that the person has a reputation for paying his bills promptly. It is a sad but true fact that whenever debtors are hard-pressed, bills for radio servicing are apt to be neglected.

You'll be a lot better off to turn down a job politely and let your competitor risk the loss, than to do the job on credit and then perhaps make an enemy through attempts to collect for the work.

If you are of a charitable nature, spend your spare time fixing up old radio sets, and donating them to deserving social agencies, hospitals, or aged-people's homes.

BUSINESS ETHICS

A good business and a good reputation can be built only upon a policy of honesty and fairness. Your charges must be honest ones for services rendered, and your charges must be fair both to yourself and to your customers. When people bring their radio and TV sets to you and say "Fix it up; I'll be back day after tomorrow," without even asking how much the charge will be, then you'll know you have a reputation based on honesty and fairness.

Guarantees. A suggested guarantee to be printed on your statement of charges is:

Unless otherwise indicated, all repairs and materials listed above are guaranteed for 90 days, just as for a new radio or television set. Work and materials covered by the guarantee will be replaced without charge within this time limit if defective.

Guarantee starts on: (insert date of delivery)

By .....

YOUR FIRM NAME PRINTED HERE

Storage Charges. When a set is left at your shop beyond a reasonable length of time, you can collect storage charges or dispose of the set, provided you notify the customer in a suitable manner as provided by the laws in your particular state. One form of notification used by a large firm is a postcard that takes the following form when revised for radio or television servicing purposes:

Uncalled for radio or television sets are subject to a storage charge of 25¢ each per week, starting one month (30 days) after receipt of the set. Storage charges for your set will begin on .....

Radio or television sets left here over two months after the date storage charges start will be disposed of. Failure to call for your set on or before.....will constitute a permission to sell or junk this set without recourse to its owner.
Type of Receiver .....
We are not responsible for sets left over 30 days.

Signature here

.....

FIRM NAME AND ADDRESS HERE

EXAMPLES OF BILLS

Case No. 1. Five-tube AC/DC set brought to shop by customer. Put in new dual electrolytic filter condenser, type 35W4 tube, and pilot lamp. Realign set. Brush out set and polish cabinet.

BILL: Check up and test at shop	$1.50
Install dual electrolytic condenser ...	2.50
20-20 mfd electrolytic condenser	1.40
Type 35W4 tube	1.25
Pilot lamp	.15
Total	$6.80

Comment. A 20-20 mfd, 150-volt condenser costs 71¢; multiplying by 2 gives $1.42, so make its list price $1.40. Cleaning chassis, polishing cabinet, and alignment are all done within the ½ hour allowed for check-up and test.

Case No. 2. Go to nearby home, remove chassis, speaker, and automatic record-changer; bring to shop and replace oscillator coil and phono pick-up; adjust record changer; realign receiver.

BILL: Check-up and test at shop, including pick-up and delivery	$7.50
Install oscillator coil	3.00
Install phono pick-up and adjust changer	5.00
Universal oscillator coil	1.30
Phono pick-up	4.45
Total	$21.25

Comment: The total charge of $21.25 is justified since this is a big job that will take several hours time when the pick-up and delivery trips are included.

Case No. 3. Customer brings in table model TV set for repair. Put in new horizontal sweep output transformer. Discover 2 tubes in video i-f are weak.

BILL: Check-up and test at shop	$2.50
Install Hor. Output Transformer	5.00
Horizontal Output Transformer	12.95
Total	$20.45

Comment: The horizontal output transformer costs $6.47, and therefore the list price is $12.95. The customer should be informed of the two weak tubes and replacements may be installed when he picks up the set. The only additional charge would be the list price of the tubes.

Case No. 4. Go to the customer's house and install a new high-voltage rectifier tube.

BILL: Check-up and test in customer's home	$5.00
1B3 tube	2.65
Total	$7.65

Case No. 5. Customer brings TV set to shop. Install a new high-voltage rectifier.

BILL: Check-up and test in shop	$2.50
1B3 tube	2.65
Total	$5.15

When making service calls in the customer's home, it is advisable to carry a supply of the tubes most often needed in radio and TV servicing. It's less expensive for the customer when you can make the repair on the spot and also it's more profitable for the serviceman. There is nothing that reduces the profit on a service job as rapidly as several trips between the customer's home and the shop. Of course it is not wise to attempt difficult and time-consuming jobs in the customer's home. You can work far more efficiently in your shop because you have all the data, materials, and test equipment at hand and a bench to work on. Tube replacements, of course, can be made as easily in the customer's home as in the shop.

Mr. Stephen J. Petruff, an NRI graduate, is the newly elected President of the Florida Radio and Television Technicians Guild. Standing left to right, Thomas M. Middleton, Secretary, Mrs. Frances Milne, Corresponding Secretary, and Shan Des Jardins, Vice President. Seated, A. Edward Stevens, Treasurer, and at right, Stephen J. Petruff, President.

Reconditioning Water-Damaged Electronic Equipment

By RAYMOND H. SCHAAF
NRI Consultant

OF course, a receiver which has been through a flood or has been drenched by a fire hose will be well water-soaked. Let us see what to do with such a receiver as certain steps are necessary to restore it to the point where ordinary procedures will be effective.

When a receiver obviously shows signs of disaster damage, the first thing to do is to remove the chassis and speaker from the cabinet. Remove the tubes and clean off the accumulation of mud or other debris. Some servicemen figure that since the receiver has already been water saturated, a little more water won't hurt, so they use a stream of warm water from a hose to clean the chassis. However, if possible, clean the chassis by using a dry cloth. If there is oil or grease on the chassis, Varsol may be used for cleaning. A rag or brush dipped in the solvent can be used to remove grease and other chassis dirt. (This work is best done outside, or in a well ventilated room, since the fumes from the cleaning solvent make some people ill and Varsol is highly inflammable.)

When the chassis has been cleaned, you must find a way of removing the accumulated moisture. A damp chassis put in a warm, dry place will not become completely dry. Excess water will evaporate, but the moisture-laden air will be trapped in parts and under shield cans.

To remove moisture from the chassis completely, a stream of dry, heated air should flow over the chassis and around and through moisture-laden parts. The moisture will be carried away by this stream of air.

For occasional jobs, a small electric fan and an electric heater can be directed against the chassis. The heater vaporizes the moisture and the fan drives the moisture-laden air away from the chassis. It is necessary to change the chassis position several times so that all parts will be dried equally.

Once the chassis is perfectly dry, blow out all dirt and dust with a small hand bellows, a bicycle pump, or a vacuum cleaner blower attachment. Clean all surfaces with a dry cloth. Use pipe cleaners (available at any tobacco store) to remove all dirt and dust from between the plates of the variable condensers.

Operating Precautions

Before trying the receiver out, first check for leakage within the power supply, by measuring across the B supply terminals with an ohmmeter.

Place the ohmmeter test probes across either the input or output filter condenser leads—whichever are more accessible. The diagram will show if a bleeder resistor is used. If there is no bleeder, the leakage resistance should be that of the filter condensers, provided you observe proper

ohmmeter polarity. If the resistance is abnormally low, disconnect the condensers and check them individually. Make replacements if you find the condensers are at fault; otherwise, run the trouble down to the defective part.

If the B supply resistance is normal, replace all the tubes *except the rectifier,* and turn the set on. The tube filaments will place a partial load on the power transformer. (You cannot make this check on ac-dc receivers, since removing the rectifier tube breaks the filament circuit. However, there is no power transformer to worry about in such sets, so you can plug in the receiver directly.)

If the transformer shows no signs of overheating after half an hour, put the rectifier tube in its socket. This will supply tube electrode voltages throughout the chassis. You can now treat the receiver as if it were in for an ordinary repair job. Of course, the speaker cone will have been ruined, and will have to be replaced, and you will probably find other parts similarly damaged.

After the receiver is restored to operating condition, very likely you will find it desirable to improve its performance with regular revitalization procedures.

Radio test equipment that has been damaged by a flood, or some other disaster, also need not be written off as a total loss. After a thorough cleaning and drying, it may be almost as good as new.

The cleaning and drying procedures described above for radio chassis also apply to test instruments. Care must be taken in drying the equipment, however, to avoid excessive heating which might change the value of a multiplying or shunt resistor. Special attention must also be given to removing accumulations of dirt from the test lead jacks, and the various tube socket holes on tube tester panels. You may be able to use pipe cleaners and a thin, sharp-pointed instrument such as a scribe to good advantage. An old toothbrush will also be handy in helping to clean range and function selector switch contacts.

Don't attempt to clean or repair the indicating meter yourself. Write to the factory which made the test instrument for their suggestions. If they are not equipped to handle the repair they will probably refer you to some company they have authorized to handle their repair work for them.

After the equipment has been thoroughly cleaned, it should be tested. Volt-ohmmeters can be checked by measuring ac and dc voltages, and resistances, the values of which are known. Inaccuracies may be due to damaged multipliers and shunts. Signal generators can be checked by beating the signals they produce against those of broadcast stations as picked up by a radio set. By checking a number of different type tubes which you know are good you can check a tube tester.

It is generally inadvisable to attempt to correct any serious errors you discover in the operation of your test equipment. Let the factory do that. It will take longer but you'll be repaid many times in the knowledge that the instrument has the manufacturer's OK once more. You, too, will have more confidence in its operation.

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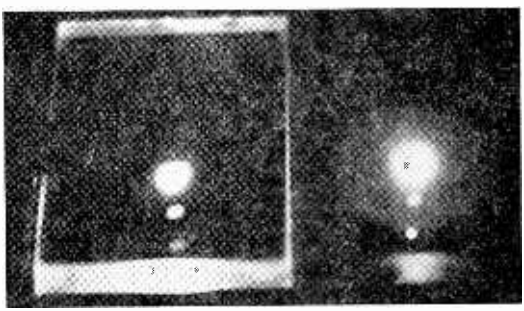
Our Cover Photograph



The cover photo for this issue was taken from the annual report of General Electric Developments in Research. This photograph illustrates some of the research which is going on in developing a transparent phosphorus coating for television picture tubes in an effort to improve contrast and sharpness. According to the report, two disadvantages of the present powdered phosphorus screens now used in Television tubes are an overall haze limiting obtainable contrast, and a loss of sharpness caused by light scattering within the phosphor screen.

To counteract these effects, developmental screens are made by a process involving the chemical reactions of vapors at the surface of the glass backing plate. Developmental screens produced thus far lack some of the brightness of conventional screens, but are said to yield superior contrast and sharpness. In the photograph above, on the left, the contrast and sharpness of the new type screen is shown. On the right, above, appears the contrast and sharpness of a conventional television picture tube.

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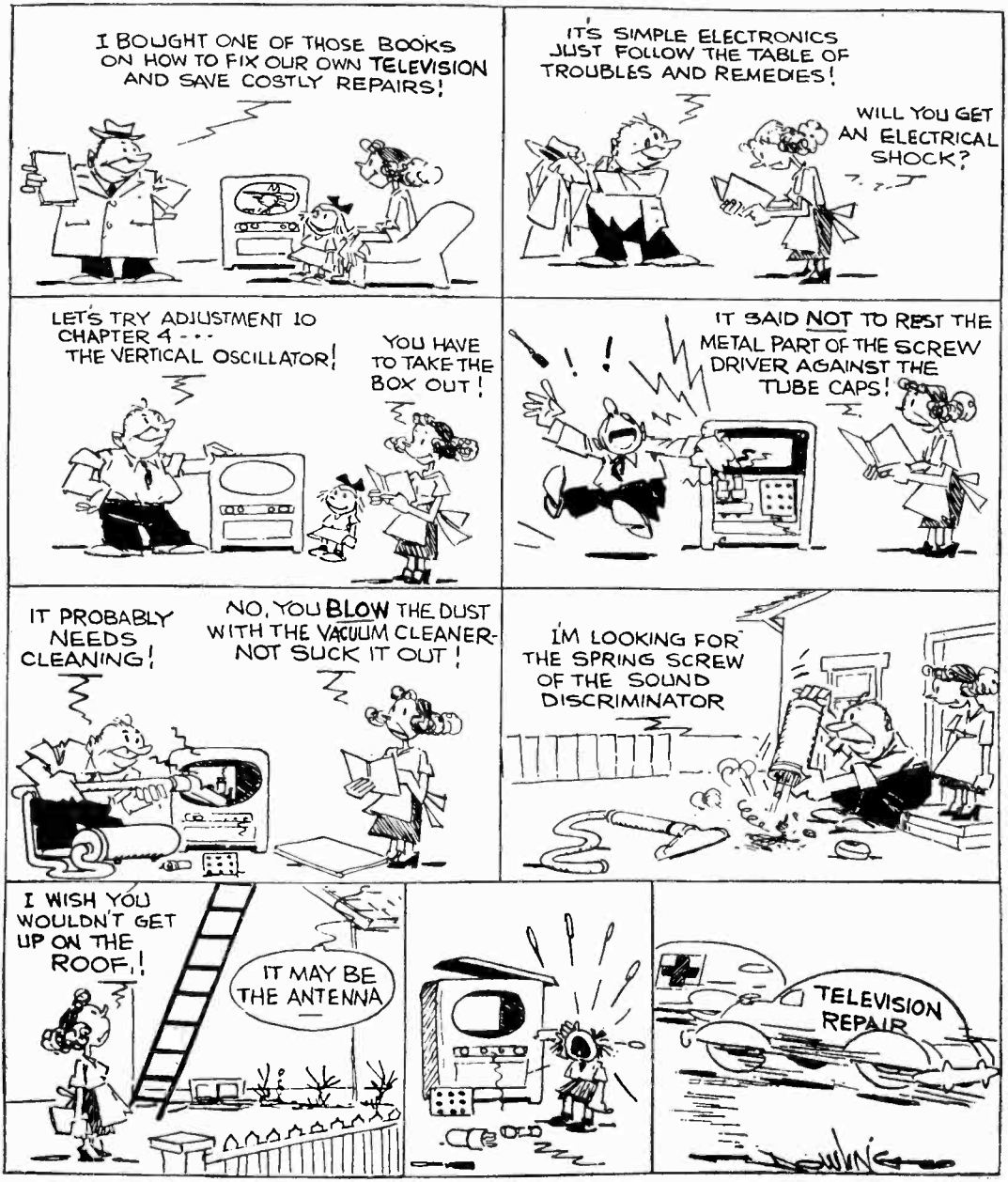
Customer: "Have you a book called 'Man, The Master of Women'?"
Salesgirl: "The fiction department is on the next aisle."

Mr. Customer Fixes His Own TV Set

Reprinted through the courtesy of the New York Herald Tribune.



N.R.I. ALUMNI NEWS

Chapter Chatter

New York Chapter has had some of the greatest meetings of all time during the past few weeks. Attendance and spirit have been high under the stalwart leadership of our officers, including Bert Wappler, Chairman, all the way down the line.

Our own members make some of the finest talks which anyone could desire. Thomas Hull, Jr., is gaining a reputation as "the doctor" through his work in conducting the radio service clinic. Jimmy Newbeck is our TV specialist and continues his very educational lectures as a feature of most meetings. Months ago when he started this series of lectures, we thought it was quite an undertaking but James has come through with flying colors.

Theo. Durante, who is a television service manager, has also spoken to us on his television experiences. We get excellent information from him—first hand.

One of our newest speakers was Andrew Antosh, who demonstrated his television bar generator. Along the lines of Radio service, Ralph Georg spoke to us recently on line resistors, their polarity and measurement. Frank Manz and David Spitzer have also spoken to us recently on their radio servicing experiences, and Morris Friedman has related some of his television servicing experiences.

We make it a point at each meeting to make visitors and new members feel at home. If you live in this area, plan to set aside our next meeting night and meet with us. We gather on the first and third Thursday of each month, at St. Marks Community Center, 12 St. Marks Place, between second and third ave., New York City.

Chicago Chapter. Several of our members have favored us with informative lectures and demonstrations. Our Chairman, Charles Mead, has drawn an enlarged schematic diagram of the Model 630 RCA Television receiver which will be used in our group discussions. Member Dan Scholz explained the block diagram of this TV receiver. He also put on a little skit showing the correct and incorrect behavior for a radio or television service man in the customer's home. Mrs. H. Webber, our Secretary, gave a brief but splendid resume of Chicago Chapter's activities.

Member Clark Adamson demonstrated his Signal Tracer, explaining details of the tracer to our members.

We cordially invite students and graduates of the Chicago area to meet with us on the second and fourth Wednesday of each month, thirty-third floor, Tower space, American Furniture Mart Building, 666 Lake Shore Drive, Chicago. Use West Entrance.

Detroit Chapter. Everything is going along fine. Through the Michigan office of Civil Defense, we have been showing some very good films on Radio Communications. Titles include such films as "A Voice Shall Be Heard," "Pattern for Survival," "Disaster Control," and "Introduction to Radiation Detection Instruments." Our "Service Forum" follows the movie.

We were extremely fortunate to have with us a special representative of RCA who spoke to us on Color Television.

Our meetings are held on the second and fourth Friday of each month at Electronics Institute, 21 Henry Street, Detroit. All in our area are invited.

Philadelphia-Camden Chapter is proud to announce a continued growth in membership. Recent men admitted to the Chapter include Lyle J. Quinn, James J. Hannan, Joseph Guida, Edward P. Carroll, James C. Beatly, and Joseph A. Donnelly. Our Chapter is in the midst of a campaign to expand our membership and NRI students and graduates interested in information about the Chapter are invited to contact our Secretary, Jules Cohen, 7124 Souder Street,

Phila. 24, Penna. Mr. Cohen's telephone number is Fidelity 2-8094.

Philadelphia-Camden Chapter is purchasing a television set for their own use at meetings. This will help students and graduates in becoming familiar with TV. We are making plans for future guest speakers. Some of these speakers will be top-notch electronic engineers and should be a real treat for our Chapter members. We hope to have a good showing of photographs ready for the next issue of the NEWS.

We had a particularly interesting demonstration recently, given by Norman Kraft and John Drumhellie. This feature consisted first of an interesting talk on trouble shooting using our RCA Dynamic Demonstration Board, and then students were given an opportunity to come up to the board and try their hand at alignment using a signal generator and output meter. This was a treat for beginning students.

Philadelphia-Camden Chapter is open for membership to all. We meet regularly on the second and fourth Mondays of each month at the K of C Hall, Tulip and Tyson Streets, Philadelphia, Penna.

Baltimore Chapter has been enjoying a very interesting series of lectures on the "Western Union Tele-Car System" which is an interesting application of Radio Communications. The lectures are given by Mr. Albert S. Flood, who maintains this type of equipment.

At another meeting, H. J. Rathbun gave a talk on FM Alignment and balancing discriminators. Elmer Shue gave a very informative description of the procedure he used in converting a 10 inch television set to a 14 inch screen.

We hold a general servicing forum for all chapter members which includes service work and discussion on Television, auto radios, and other subjects of common interest.

We welcome all NRI students and graduates in our area to visit our Chapter on regular meeting nights. More information can be had by writing to our Secretary, Mr. Thomas P. Kelly, 1414 Mount Royal Ave., Baltimore 17, Maryland. Meeting nights are the second and fourth Tuesday of each month at Redman's Hall, 745 West Baltimore Street, Baltimore, Maryland.

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A lady with two sons in the army and a daughter in the WAC was visiting a farm and saw a youth of draft age milking a cow.
"Young man," she said sternly, "why aren't you at the front?"
"Cause there ain't no milk at that end, missus," was the calm reply.

"Teddy" Durante, of New York Chapter

"I had never worked on Radio or Television before taking the NRI Course. Believe me I studied it hard and always read the fine philosophy on the back cover of each lesson. While still a student, I wrote a letter to Bert Wappler of New York Chapter and inquired about the NRIAA. He sent me a very fine answer and a personal invitation to visit one of the local chapter meetings. After meeting Bert, Lou Kunert, Frank Zimmer, Alex Remer and others with their friendly attitude I could not help joining this fine organization. Believe me it helped give that additional lift I needed from time to time.

"I graduated in January, 1947, and took a part-time job in a local radio shop, also conducting a spare time shop at home. When I got a tough one, I would talk it over with a fellow member at the next Alumni meeting. Then, when TV came into the picture, I applied for a technician's job with the Admiral Distributor in Newark. With the knowledge I had gained from the NRI course, and the contact with fellow members of our Alumni Association I had what it took to hold down my job. The self-confidence that I received from my studies permitted me to help my fellow workers and gain the respect of my employers. It finally paid off with my present position as Supervisor of all of our service technicians. I am proud of my NRI training and my association with its Alumni Association."

TED DURANTE,
77 Bleeker Street,
Newark 2, N. J.

———*n r i*———

According to the Statistical Department of the RTMA, the 275,026 TV sets with 15 inch or smaller screens produced in April 1950 represented 50.68 per cent of total Television production. By the end of 1950, 15 inch and smaller screens were only 5.62 per cent of the total production, and by the end of 1951 only 0.44 per cent of total TV production had 15 inch or smaller screens.

Here And There Among Alumni Members

Members of Philadelphia-Camden Alumni Chapter wish to extend their congratulations to their fellow member, Joe Lynch. Joe has just become a father for the third time. He and Mrs. Lynch have a fine new baby girl.

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Graduate C. Lantz is now in charge of the Radio department of Moore's Electric Company, Ltd., North Sidney, N.S., Canada. His work is REALLY diversified, as it involves ship-to-shore installations, depth indicators, Loran, weather station equipment and fishing craft radar, as well as ordinary home receivers. Lantz also has patents pending for a new type ohmmeter and a new type voltage indicator.

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Alumnus Robert H. Holler, of Paterson Creek, West Virginia, visited NRI and discussed some of the technical problems which he is meeting in connection with a community television antenna installation.

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Stephen J. Petruff of Miami, Florida has been elected President of the Florida Radio and Television Technician's Guild according to an announcement in "Service Magazine." They could not have picked a better man than our Alumni brother Petruff.

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Another great crusader for Radio and Television technicians is Harold Chase, former Chairman of our Detroit Chapter, who is president of the Television Service Association in Detroit, with a membership of more than 700 technicians.

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Alumnus M. M. Koerin, of Norfolk, Virginia paid a personal visit to NRI and discussed some of his problems with us. Koerin is now Sales Manager for the Radio and Television Distributing Company, of Norfolk. He especially mentioned the large number of NRI graduates he calls on in his territory.

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Nice story in *Sylvania News* about Walter Lundblad of Odeboldt, Iowa, who is doing very well in his Radio and Television sales and service business. Mr. Lundblad graduated from NRI in 1942 and has made great progress since then. The name of his business is Walt's Radio and Television Service.

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E. M. Quimby of Columbia, S. C., writes to tell us how much he enjoys Radio as a hobby. He holds a class A amateur ticket and handles his own radio work. Quimby's professional work is concrete bridge and structure building.

Graduate Johnnie B. Clanton, TE1, says hello from French Morocco. He is on duty there with the U. S. Navy, in Communications. Clanton hails from Waynesboro, Penna.

———n r i———

Graduate H. L. Smithey of Weslaco, Texas, has rented business quarters, and plans on establishing his own Radio and TV shop soon.

———n r i———

Graduate Jesse W. Parker, of Meridian, Miss., has just received his 2nd class radiotelephone license, and is getting ready for the 1st class examination.

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Sergeant R. E. Probst, of Fort Bliss, Texas, is now attending a Radar repair course. He says that this opportunity for further electronic work was made possible through NRI training.

———n r i———

Another successful NRI graduate, Oscar T. Pugh of Roanoke, Virginia visited NRI and told us about his business progress. Pugh has an outstanding Radio and Television business. He employs two full time technicians in addition to himself, and says that business is definitely increasing from year to year.

———n r i———

A nice letter from John R. Dennison, of Tonawanda, New York. Graduate Dennison reports a good part-time Radio and Television trade.

———n r i———

In addition to his spare-time Radio & TV work, Graduate Elmer A. Johnson, of Webster, Mass., reports that he is taking in work on movie projectors, electric shavers, and appliances. Says this gives him new Radio customers, too.

———n r i———

Peter Cameron, of Alliston, Ont., Canada, has gone into Radio Servicing full time. He's doing service work for two Radio stores and Auto Radio installations and warranty work for the local garages in addition to his own business.

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J. M. Hall, of South Norfolk, Virginia has been called back into Government work as a 1st class mechanic. Says could not have mastered his new job without NRI training. Hall has also completed NRI's Advanced Television Practice.

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Earl Merryman, charter member and first secretary of the NRI Alumni Association, is in Naval Hospital, Philadelphia, undergoing treatment. Earl has never fully recovered from an illness he contracted in line of duty during World War II. He has been in and out of hospitals periodically. We hope this time when he gets out he won't have to go back. Earl was Chief Engineer in a Maryland Broadcasting station and things looked bright for the future. Our best wishes to Earl, a great guy, a strong Alumni member, and a true American.

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16th & U Sts., N.W. Washington 9, D. C.

For:

Mr. Francis H. Fingado 25236
611 17th St.
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