VOLKSWAGEN OWNER'S TRANSPORTER HANDBOOK
Covers All VW Commercial Vehicles
In response to increasing demand from the owners and operators of Volkwagen commercial vehicles, the Pick-up, Kombi, Microbus, and Vans, we have published this fine and only TRANSPORTER HANDBOOK to cover these particular operation and service. The Handbook is not a shop manual but it thoroughly explains the Transporter's engine, drive train, chassis, body and accessories, and is so fully illustrated with photos, charts and drawings that the owner can gain a clear insight into the workings of his vehicle, perform routine maintenance chores in far more efficient fashion, and preclude trouble arising from misunderstanding. The TRANSPORTER HANDBOOK will be invaluable to the mechanic in charge of one or a number of transporters, particularly where they are part of a fleet, as well as to the individual owner and garage man.

It is also of extreme interest to those who may be contemplating the purchase of one or more of these fine units since it contains scores of photos showing the varied uses that industry, commercial and service organizations have made of the VW, as well as all technical data pertaining to the different models.

SOUPING THE VOLKSWAGEN
Here is a brand new fully illustrated how-to-do-it book by VW authority-engineer G. R. Morgan. It gives full information on high compression, speed, and acceleration in the Volkswagen engine. It covers all details about high compression, pistons and heads, camshaft, carburetor, ignition, exhaust systems, timing and general information for those who are souping the Volkswagen. Charts show the increase in efficiency and power obtained by each souping operation. Thus the owner may decide which steps best suit his requirements and his pocketbook. Included are operations on trouble shooting, tune-up, and faults in driving on the VW. There are dozens of charts and driving information on VW model and hundreds of things every VW owner should know.

POSCHE OWNER'S HANDBOOK
This large volume, the first of its kind to be published, is available only from this publisher. A complete reference book of repair technique. THE PORSCHE OWNER'S HANDBOOK explains the way of care, tuning, and repair of all 356 models. It is a better guide to the owner and can make him a better operator according to his ability.

In addition to the author, O.C. Ritchie, well known technical writer, this book includes the cooperation of many experts that make the book outstanding. The section on accessories shows for those interested in making use of the many Porsche enthusiast and tune-up experts. Valueable for professional owners and collectors. Fully illustrated with hundreds of illustrations, this is far more valuable than its nominal price permits. Price.

ENGINE SWAPPING
Here is a newly revised "How-to-do-it" book about engine swaping. Covers late model OHV engines with step-by-step method of installing into older cars and compacts information on installing Cadillac into Ford, Chevrolet into Ford, Chrysler into Ford and Chevrolet into Studebaker, etc. Also covers all Chevrolet and others. All electrical circuit changes, information on adapters, engine weights, suspension and chassis data, etc., make this book a must for the enthusiast who wants to change engines and other parts. Lots of photos.

MODEL A FORD SERVICE MANUAL AND HANDBOOK
This is the most fantastic book ever published on the Model A Ford. 480 pages and over 300 photographs, charts, and drawings. Written in 1929 and 1930 near the end of Model A production by S. A. E. mechanics. Model A was then considered the most outstanding authority on Model A Ford cars. Among the 300 illustrations there are many cutaway views of engine, transmission, differentials, carburetor, wheels, drop center rims, truck 2-speed auxiliary transmission, power take-off, and water cooling system. Data on re-filling bearings and all about the electric system, including wiring diagrams, disc and single plate clutches, steering gear.

A "must" for every owner, restorer, collector, mechanic, enthusiast and historian. Postpaid $3.00

BASIC AUTOMOTIVE HANDBOOK
How Your Car Operates From A to Z
Here is the ideal book for those who say "I don't know the first thing about a car," but who would like to have a working knowledge of its fundamentals. Written in easy-to-understand layman's language, the handbook covers every part and function so that the owner will know why he has a fuel tank to the exhaust pipe. And, it is carried out in a unique fashion which permits the reader to become as technically involved as he desires. Each factual explanation is followed by a discussion of theory and a deeper penetration of the subject, which can be skipped by those who are interested only in the "how" rather than the "why."

Profusely illustrated with hundreds of line drawings, cutaways and photographs, the BASIC AUTOMOTIVE HANDBOOK is an excellent manual for the teen-ager, students and the non-mechanically minded. The chapters on driver education and practice in aspects of owning a car alone are worth the price of the entire book to people in this category. Women will especially enjoy reading this book since they may not be more clearly understand what makes their car "tick."

It explains in everyday, simple and non-technical language the many things so many want to know. If there is someone in your family who is about to have a car for the first time, this handbook should be in his or her possession. Valuable also for libraries, driving schools and lecturers.

FORD MODEL "A" ALBUM
This big unique book is actually a pictorial history of the fabulous model "A," including trucks. 150 splendid 4 x 7 photos illustrate all of the "A" models from various angles. Each photo has captioned details and comments by the understanding model "A" authority, Leslie R. Henry. Included are interesting sales and promotion articles, technical articles and servicing data by experts, specifications, listing of motor numbers for each month, description and photos of prominent characteristics of each yearly model, and 24 pages illustrate and describe accessories of all kinds.

There is also an interesting article on the Ford-built Lincoln. This most comprehensive volume has 144 large pages which will delight any "A" owner, restorer, collector, or enthusiast.

RENAULT DAUPHINE OWNERS HANDBOOK
Here is this complete manual handbook needed by every owner of the Renault Dauphine. Tells the owner how to perform service operations on his car in top condition. Written in the language can understand it. In addition to the terminological section the book includes flow charts as well as many photos and comments on the car's behavior. Also consists of comments on manufacturing methods of Renault he must know on his visit to any factory.

This book also includes a fine section by the famous Belgian racing driver, Paul Frene. There are also beautiful photomicrographs of fine Renault parts, including manufacturing methods and assembly line procedure.

Floyd Clymer Publications, 1268 S. Alvarado St., Los Angeles 6, Calif.
A PICTORIAL ALBUM
of
WIRELESS AND RADIO
1905-1928
by
Harold S. Greenwood

This book is dedicated to the Scientists, Mathematicians, Engineers, Experimenters and Amateurs who made present day radio possible.

Copyrighted in 1961

Published by
FLOYD CLYMER
World's Largest Publisher of Books Relating to Automobiles, Motorcycles, Motor Racing, and Americana
1268 South Alvarado Street Los Angeles 6, California
ANNOUNCEMENT

One of the most fabulous eras in science was that period in which man took the giant step forward in communication by means independent of direct contact and the transmission of the human voice. Although we had developed a fair complex of land telegraph and telephone channels and had laid an undersea cable to Europe, the evolution of wireless permitted the long-dreamed-of communication with ships at sea and to any remote point of the globe. It was an era comparable to the present but even more exciting because nearly anyone could get into the act. The part played by the amateur experimenter cannot be overstated and the rapid growth of commercial broadcasting can only be traced to the avid manner in which mechanically-minded young people adopted the new hobby.

The equipment used by the pioneers, from the first crude detectors and transmitters to the rather complex super-heterodyne is, in itself, a fascinating study in evolution. To find a collection of that equipment, in restored and operating condition, as the property of an individual is almost beyond hope, but one man, the author of this book, Harold S. Greenwood (W6MEA) owns such a collection.

With radio as a hobby since his High School days (in the very early 'twenties) and with a quarter of a century as a radio parts supplier in his business career, Harold Greenwood can be ranked as an extremely knowledgeable and practical radio man. He was interested in the historical aspect of the art from his first experiences and made up his mind to keep certain milestone pieces of equipment. As a result, he possesses a unique assemblage of components, receivers, transmitters and experimental equipment unmatched (to our, or his, knowledge) anywhere in the world.

The brief, readable, history which accompanies the illustrations is not meant to be an exhaustive study. It gives the highlights and recalls many of the names familiar to amateur and layman alike. All of the photos are of items in his collection and each is in operable condition. Uncounted man hours have gone into the restoration and preservation of this equipment and I feel that the reader of this book will get the thrill I did when I was taken back in time in a review of these wire, metal, glass and wood links with the beginnings of wireless communication. The historical period ends with the superheterodyne circuit and the screen grid tube inasmuch as we are still developing that phase of electronic progress. And, we owe a debt of gratitude to Mr. Greenwood for preserving history for the present.

I hope you enjoy the book as much as I have in publishing it.

Floyd Clymer
Publisher.
# CONTENTS

- Radio Chronology .............................................. 4
- A Few of the Pioneers ........................................ 5
- Where You Could Buy It ...................................... 6
- The Electro Importing Co. .................................... 7
- Detectors .......................................................... 8
- The Fleming Valve ............................................ 14
- The Vacuum Tube ............................................. 15
- The De Forest System ........................................ 23
- Tuning Inductances ........................................... 35
- Spark Transmitters .......................................... 48
- Western Electric Tubes ....................................... 57
- Vacuum Tubes .................................................. 62
- C. W. Transmitters ........................................... 75
- Variable Tuning Condensers ................................ 79
- Crystal Radio Detectors ...................................... 91
- Apparatus of the Early 1920s ................................ 98
- Broadcast Receivers ......................................... 103
- Crosley ............................................................ 104
- Atwater Kent ..................................................... 104
- Radio Corporation of America ............................... 112
- Superheterodyne Sets ........................................ 151
- Headsets ........................................................ 154
- Amplifiers and Transformers ................................ 160
- Loudspeakers .................................................... 173
- Rheostats and Potentiometers ............................... 182
- Microphones .................................................... 186
- Sockets and Adaptors ......................................... 188
- Batteries, Eliminators, Chargers ......................... 194
- Dials ............................................................... 199
- Parts Kits and Servicing ..................................... 205
- Scanning Disc Television ..................................... 213
- Early Circuit Schematics .................................... 215
1832. SAMUEL MORSE, American, devised Morse Code, still in use.
1860. MICHAEL FARADAY, English, invented the spark induction coil, later improved by Ruhmkorff.
1865. JAMES MAXWELL, Scotch, found mathematically that light waves, electric waves and magnetic waves were similar in their behavior.
1883. THOMAS EDISON found that current would flow if a plate was put in a light bulb and connected in series with a battery, galvanometer and the bulb's filament; known as “Edison effect.” Discovered about same time in England by Fleming.
1875. ALEXANDER GRAHAM BELL invented magnetic microphone.
1883. PREECE and HEAVISIDE found that by running two wires parallel, signals could be sent from one to the other without direct connection. HEAVISIDE also devised theory of “Heaviside layer” above Earth.
1877. DAVID HUGHES, English, invented carbon microphone.
1887. HEINRICH HERTZ, German, discovered “Hertzian” electromagnetic waves; proved Maxwell’s theories. Found that electromagnetic waves traveled at speed of light and could be reflected. Hertz built an oscillator using a Ruhmkorff spark coil with spark gap for the transmitter; for a receiver he used a loom of wire with an adjustable resonating gap. When adjustments were made a fine spark appeared at the receiving gap.
1904. FLEMING patented his “Fleming valve,” a diode giving no amplification; used as a detector by Marconi Company.
1905. Several men claimed to be first with radio telephony. “Singing arc” had been discovered by Elihu Thompson in 1892. Poulsen was first to use a copper and carbon electrode arc for continuous-undamped waves. Fessenden used an alternator or “wave mill” giving up to 20,000 sparks per second, later improved to give 100,000/sec. Lee DeForest using an arc made commercial broadcasts in 1907. He played phonograph recordings and had “commercials.” Laughter and Ruhmer also used arcs for radio telephony. Frederick Collins also claimed to be “first” with the new media.
1908. Famous patent for Triode Audion tube granted to DeForest.
1914. Major Armstrong patented the regenerative circuit; later given to DeForest.
1917-19. Great strides in practical radio made due to war impetus.
JUST A FEW OF THE EARLY PIONEERS

DR. LEE DeFOREST
THREE ELEMENT AUDION
1906

GUGLIELMO MARCONI
SENT FIRST WIRELESS
MESSAGE 1896

HEINRICH HERTZ
ELECTROMAGNETIC WAVES
1887

SIR OLIVER LODGE
METHODS OF TUNING

MAJOR ARMSTRONG
REGENERATION 1914

DR. J. A. FLEMING
FLEMING VALVE 1905

NIKOLA TESLA
AC MOTOR & TESLA COIL

R. A. FESSENDEN
ELECTROLYTIC DET. 1903

EDOUARD BRANLY
COHERER DET. 1890
WHERE YOU COULD BUY IT

By 1906 wireless apparatus was on sale to the amateur and experimenter. The Electro Importing Co. of New York was formed by Hugo Gernsback and soon began making parts and sets for the amateur.

J. J. Duck, and later his brother Wm. Duck at Toledo, Ohio, put out a mail order radio parts catalog. Another mail order house was Manhattan Elect. Supply Co. F. D. Pitts of Boston put out a radio parts catalog containing testimonials. John First of New York sold the famous "Firso" line by mail.

In 1914 Merker-Flocker Electric Co. of Pittsburgh offered wireless gear for sale. Pacific Laboratories of San Francisco sold the Audiotron and Morehead tubes in 1916. National Radio Supply Co. of Washington, D.C. sold both amateur and commercial apparatus by mail order. An amusing advertisement of the period was that of the Electrical Supply Co., which read, "Be a detective and hear through the walls with our Skinderviken Button."

The DeForest Radio Tel. & Tel. Co. of New York issued catalogs after the war, selling their famous "unit parts" for the amateur.
One of the real pioneers in bringing radio as a hobby to the public was Hugo Gernsback who, in 1904, founded the Electro Importing Company, known to all early day amateurs simply as the E.I. Co. He and Louis A. Coggeshall rented a location at 32 Park Place, New York City, in 1906 and began to offer a wireless set labeled the "Telmico" a name made up from letters of the company's designation. Gernsback also began publishing his first magazine MODERN ELECTRICS about this time. The E. I. catalog was the 'bible'.

Gernsback designed much of his first wireless apparatus himself including the Radioson Electrolytic Detector and a Leyden Jar Variable Transmitting Condenser in 1906 and the famous Gernsback Rotary Variable Condenser in 1911.

In 1909 he formed the Wireless Association of America which jumped to 3,200 members in only a year. In 1915 Gernsback began the formation of the Radio League of America and started publishing ELECTRICAL EXPERIMENTER. In addition to his work as a publisher and prime mover in organized amateur radio, Gernsback was a tireless worker for legislation favorable to the amateur and experimenter and most of the statutes relating to amateurs are along his proposals. Most of the startling predictions he has made editorially have come to pass and he can certainly be counted as a great force in the growth of modern radio and electronics.
The first detector was a "coherer," simply a glass tube containing iron filings. A strong wireless signal passing through it caused the filings to cling together. But the top code speed was about 15 words per minute, too slow for commercial use; land telegraph lines were then doing 45 WPM.

In 1899 Lee DeForest read articles by Ashkinas and Neugswender, who had found that a piece of tin foil on a glass plate, when cut into with a razor blade, would detect electric waves if a drop of alcohol and a battery was attached across the cup gap. DeForest developed this detector by using tin for the gap and perovide of lead paste as the electrolyte. This detector was self-restoring and could be used at any code speed.

About 1902 Pickard used two needles and a carbon block as a detector; Fessendesn patented the electrolytic detector about the same time. This was a carbon cup of diluted acid with a platinum wire immersed in it; this like the carborundum detector required a battery. In 1907 Pickard invented the crystal detector, an inexpensive, self-restoring device needing no battery.

Other types followed: the Barr mercury cup, the Perikon using two minerals, the Ferron and the famous Crystalo using a hollow button filled with a sensitive mineral powder and many needle points; it only needed to be revolved to find a sensitive spot. When arc, alternator and tube transmitters came in, producing an undamped wave, the crystal detector would not receive them. So a buzzer circuit was inductively coupled through the antenna or a "tickker wheel" was used to break the signal into audio frequencies. A motor driven chopper wheel at the transmitter achieved the same purpose.

In the 1920s the crystal detector was made in many types: fixed for the reflex sets, and the common Galena with "cats whisker."

Three mineral detector.

R.C.A. chopper wheel.
BRANLEY COHERER AND DECOHERER
WITH KEY WIND TAPE PRINTER
ABOUT 1902 TO 1905

MARCONI TYPE D TUNER
AMERICAN MARCONI CO.
ALSO MADE BY UNITED WIRELESS.
1905

MARCONI CA 294
250 TO 3100 M.
1917

INSIDE VIEW
MARCONI 106D

MARCONI 106
MODIFIED TO 106D BY
GEN. ELEC. FOR RCA.
1915
WIRELESS DETECTORS

BRANLEY COHERER
ABOUT 1902

CRYSTALOI
WIRELESS DETECTOR
TYPE AA ABOUT 1914
$6.00

ELECTRO IMPORTING CO.
RADIOSON ELECTROLYTIC
DETECTOR, ABOUT 1914

MURDOCK
SILICON DETECTOR
WITH CONDENSOR
1913 $4.50

J. J. DUCK FERRON DETECTOR
HOLLAND BLUE MARBLE BASE
1913 $4.00
WIRELESS DETECTORS

CLAPP-EASTHAM
FERRON DET.
HOLLAND MARBLE BASE
ABOUT 1914    $3.25

THREE MINERAL DET.
JOHN A. FIRTH CO.

BABY DETECTOR
E.I. CO., 1915    $ .25

ELECTRO
GALENA DET.
F.I. CO., 1914

PEROXIDE OF LEAD
DRY ELECTROLYTIC
E.I. CO., 1913

BALL SLIDERS
FOR SLIDE TUNERS
E.I. CO., 1910

MINERAL
FIXED DETECTORS
WIRELESS DETECTORS

DEFOREST D-101 CRYSTAL DET. $2.60

DEFOREST CRYSTAL DET.

MURDOCK 324 DETECTOR 1919 $ .75

WIRELESS SPECIALTY APPARATUS CO. 1919

WIRELESS SPECIALTY CO. TRIPLE DETECTOR STAND 1917

DETECTOR MINERAL CATWHISKERS

PHONE CONDENSORS MURDOCK A. J. MORGAN PARKIN 1912 TO 1915
ELECTRO IMPORTING CO.
E. I. CO.
PRECISION COHERER
1910

WHIMSHURST
STATIC MACHINE
2 in. SPARK
CHICAGO APPRA. CO.
1910

"CROWFOOT"
GRAVITY BATTERY
USED FOR TELEGRAPH
AND WIRELESS
1905

COLUMBIA BATTERY
1907

SENSITIVE RELAY
USED
WITH COHERER DET.
1910

LEYDEN JAR
CHICAGO LABS. &
SCALE CO.
1910
THE FLEMING VALVE

Thomas A. Edison laid the groundwork for thermonic detection of high frequency oscillations in 1883. Edison found that a black deposit formed on the inside of an electric light with use. These particles, he discovered, were part of the filament. He sealed a plate in one of his lamps and found that with it connected to the positive end of the filament, current would flow from the filament to the plate. Edison patented this as an “Electrical Indicator” and called the phenomenon, “The Edison Effect.” Other pioneers became interested in the effect. Prof. Edwin J. Houston, Sir William Preece, Julius Elster and Hans Geitel of Germany all made experiments but it remained for Ambrose J. Fleming to perfect a new type of detecting device for receiving wireless oscillations.

Fleming, formerly with the Edison Co., had taken a new job with Marconi. He was hard of hearing and desired a visual indicator to use in place of audio detection. He thought of his work with Edison and decided to try one of the Edison Effect lamps. He set up the necessary circuits and found that a galvanometer gave a steady direct current reading. He then knew he had found a better rectifier for wireless oscillations.

Fleming, then, was not the inventor of, but actually the first to find an application for the Edison Effect phenomenon. On Nov. 7, 1905 he patented the “Fleming Oscillation Valve” or Glow Lamp, as he called it and it was the first thermonic wireless detector.

This valve was a diode and was made in many forms. It detected but did not have any intensifying qualities. By 1907 the Marconi Corporation was manufacturing Fleming valves for commercial use. They varied from approximately an inch to an inch and one quarter in diameter and from three and a half to four inches long. Both the Edison bayonet base and the Edison medium screw base were employed. No plate battery was used, merely a filament battery, and it was found that four volts was sufficient for wireless detection.
THE VACUUM TUBE

The vacuum tube was given its start in 1880 when Julius Elster and Hans Geitel of Germany found that adding a plate to an incandescent lamp gave a "valve" effect. Thomas Edison in 1883 found that a current would flow from a heated filament to a positively charged electrode within a lamp. John Fleming found that using the "Edison effect" rectification took place and could be used as a wireless detector.

In 1900 Dr. Lee DeForest while testing his new type detector (called a "Responder") noticed that his Welsback gas burner would dim when he operated his spark coil. In 1903 he used two platinum electrodes, one holding table salt, and detected signals by the change in the flame as current passed across the electrodes. This led DeForest to heating gas in a carbon filament lamp, and he had the H. W. McCandless Co. (makers of Xmas tree lights) make some two element tubes, which he patented. In 1906 DeForest applied for a three element tube patent, publicly announced a year later. In 1908, at the suggestion of the McCandless Co., the Audions were made spherical, and remained that way for some time. In 1909 they were made with a double grid and a double plate.

About 1910 DeForest made the RJ4 detector, sold as a unit with a DeForest Audion, the only way it could be bought. By 1915 the Audion tube was tubular and had a double filament. Next came Moreheads with Shaw bases, and Diodes with a control electrode on the outside, done to bypass the DeForest patent. During the war Western Electric made the famous VT-1 and VT-2. In 1919 General Electric made their advanced UV-200 and UV-201 for R.C.A. From this date many makes appeared on the market, including such "bootleg" names as Vaco-Bulbs.
DE FOREST TUBES

DE FOREST SPHERICAL AUDION
SINGLE GRID & PLATE
1909

DE FOREST SPHERICAL AUDION
DOUBLE GRID & PLATE
1909

DE FOREST AUDION
PATENTED 1908

DE FOREST OSCILLION
SINGLE TUBE, 1917

DE FOREST TUBULAR AUDION
1915
LEE DEFOREST

DEFOREST GAS FLAME DETECTOR
FORERUNNER OF THE VACUUM TUBE
REPLICA
1904

DEFOREST AUDION DETECTOR
TYPE RJ4
1909 $18.00 COMPLETE

DEFOREST LONG WAVE
CRYSTAL RECEIVER
1917

AUDION CONTROL BOX
FOR DEFOREST AUDION
1910
M AR C O N I
WORLD-WIDE WIRELESS
Is the slogan which has long served as a reminder of a great service rendered to mankind.
Two decades of experience have won for Marconi full recognition as the essential organization to marine commerce and an invaluable aid to trans-oceanic communication.
Marconi Men and Marconi Service Have Never Failed
Steamship owners receive under the Marconi Plan a service to meet any need; it provides for all requirements in home and foreign waters. The various types of Marconi equipment are standard apparatus for the merchant marine, naval vessels, pleasure craft, railroad trains and aircraft. Any type or power can be furnished, singly or in quantity, from a portable set to a high power installation for trans-oceanic communication.

Marconi V. T.
THREE-ELECTRODE OSCILLATION VALVE OR AUDION
Ruggenedness       Reliability       Long Life
Extreme Sensitiveness
Simplicity of Adjustment       Low Current Consumption
The Only Vacuum Tube Which Amateurs Can Use
This ultra-sensitive oscillation detector is an absolute necessity to bring wireless signals up to the point of audibility in communication between low power amateur stations over long distances. With 1/2 to 3/4 K. W. power and 200 meter wave length, amateur stations have established communication up to 2,000 miles by using the vacuum tube either as a detector or amplifier.

Marconi V. T. detector ........................ $7.00
Base  ........................................ $1.50
2-megohm resistance .......................... $1.00

COMMERCIAL DEPARTMENT
MARCONI WIRELESS TELEGRAPH CO.
OF AMERICA
Sole distributors for DeForest Radio Telephone & Telegraph Co.
WOOLWORTH BUILDING, NEW YORK
EARLY TUBES

ELECTRON RELAY
PACIFIC LABS., 1916

WEAGRANT VALVE
EXTERNAL GRID
1912

MARCONI TUBE
MADE BY
H. J. ROUND
1911

AUDIOTRON
DOUBLE FILAMENT
1915

AUDIOTRON
WITH ADAPTER
FOREIGN TUBES

BRITISH "R" TUBE
1917

PHILLIPS TUBE

MULLARD BRITISH
PM-22

TELEFUNKEN
TYPE EVE-193

TELEFUNKEN
TYPE ER 58

TELEFUNKEN
TYPE EVN-194

MARCONI
OSRAM VALVE

MARCONI
P-410
EARLY TUBES WITH SHAW BASES

A - P TRANS. TUBE 1920

MOORHEAD ELECTRON RELAY 1920

MOORHEAD AMPLIFIER

MARCONI VT 1920

MOORHEAD ELCTRON RELAY

DE FOREST TYPE H

MOORHEAD 1917

VT - 14
Dr. DeForest, early in 1903, tried out an electrolytic detector which Reginald Aubrey Fessenden had patented. He found it superior to the chemical detector he had been using in the Responder. Fessenden's detector used a Wollaston wire (invented by the man of the same name) which was a platinum wire sealed in a glass rod and dipped into a dilute acid solution. DeForest had Clifford Babcock make what he called a "Spade Electrode", a piece of platinum leaf sealed into glass. In 1905 the courts ruled that this was in infringement on Fessenden's patent and prevented DeForest from using it. However, by this time, DeForest had a carborundum detector and was developing the audion detector. With the spade electrode this pioneer was employing a three-slide and a five-slide tuner. He called these the two-coil and three-coil "Syntonizers" and they made up the receiving equipment for the DeForest system.
DEFOREST RADIO TEL. & TEL. CO.

DEFOREST F-5
RADIO PHONE
5 TUBE T.R.F.
1924  $75.00

RADIOPHONE TYPE D-10
PORTABLE REFLEX 4 TUBE
1923  $150.00

THE EVERYMAN CRYSTAL SET
1923  $31.50
The 200 meter wave to which the amateur is limited by government regulations, does not permit of high efficiency at the transmitting end. It is possible to more than offset this, however, by the use of super sensitive receiving apparatus—a fact that is well demonstrated by the way amateurs consistently communicate over greater distances than do commercial stations although obviously the latter work under more favorable conditions.

1919

25
COLIN B. KENNEDY RECEIVERS

KENNEDY 110 UNIVERSAL
175-25,000 METERS
1922 S.P. $250.00

KENNEDY 220 INTERMEDIATE
175 TO 3100 METERS
1921 S.P. $210.00

KENNEDY 281 & 521 AMP.
175 TO 620 METERS
1921 S.P. $135.00

KENNEDY MODEL V
1923 S.P. $86.50

KENNEDY PORTABLE
1923 S.P. $75.00

KENNEDY MODEL 22
5 TUBE
1924

BACK VIEW
MODEL 220
RADIO
TELEGRAPH and TELEPHONE
EQUIPMENT

DESIGNED FOR

COMMERCIAL SHIP AND SHORE STATIONS
MILITARY INSTALLATIONS
PLEASURE YACHTS AND CRUISER AUXILIARIES
SCHOOLS AND COLLEGES
PRIVATELY-OWNED RESEARCH AND
EXPERIMENTAL STATIONS

UNITED FRUIT COMPANY'S STEAMSHIP PASTORES

WIRELESS SPECIALTY APPARATUS COMPANY
ENGINEERS, DESIGNERS, AND MANUFACTURERS
BOSTON, MASS., U.S.A.

October, 1919
THE I-P TYPE RECEIVERS WERE DESIGNED BY W. H. PRIESS AND L. L. ISRAEL WHEN THEY WERE WITH THE U.S. NAVY.

I-P-500
CRYSTAL DET. RECEIVER
1918 $425.00
150 TO 6,800 M.

I-P-501
250 TO 8,000 M.
CRYSTAL DET. & AUDION
I-P-503 LONG WAVE
LOADING UNIT TYPE B AMP.
1910 $600.00

I-P-501A
250 TO 8,000 M.
CRYSTAL DET. & AUDION
TWO STEP AMPLIFIER
1920 $550.00

NATIONAL ELEC. SUPPLY CO.
CN 239
CRYSTAL DET. RECEIVER
1917 $425.00
The amateur will tell you that the Paragon three-circuit receiver, because of its greatly superior selectivity and sensitivity, can pick and choose between broadcasting stations of about the same signal strength with less than one per cent differential.

This means that with a Paragon receiver you get what you want when you want it—complete messages and clear music from the station you tune in on, without interruption and jamming. Until you have listened in with a Paragon three-circuit receiver, you cannot guess the real pleasure and fascination of radio.

Long before broadcasting popularized radio with the general public, Paragon equipment was the choice of the experienced amateur. He will tell you today that if you want quality and satisfaction, Paragon Radio Products are the best and safest buy on the market.

An illustrated Catalog of Paragon Radio Products is Yours For the Asking

DEALERS — The Adams - Morgan Company has an interesting proposition to make to reputable radio dealers who believe in quality merchandise. Details on request.

ADAMS-MORGAN COMPANY
6 Alvin Ave., Upper Montclair, N. J.

You would need them all to hear what you get nowadays with a single circuit receiver.

With several hundred powerful broadcasting stations, all operating on one narrow wave band, it takes real selectivity and sensitivity to get a satisfactory radio programme.
PARAGON RECEIVERS
ADAMS - MORGAN COMPANY

PARAGON RA TEN AMPLIFYING SHORT WAVE RECEIVER
1921 S.P. $75.00

PARAGON DA 2 DETECTOR 2 STAGE AMP.
1921 S.P. $65.00

INSIDE VIEW RA 10

III A
3 TUBE REGEN.
1923 $175.00

PARAGON RA 10 DA 2
Wireless Telephone and Telegraph Receiving Sets

Simple enough for any one to operate
and of almost unbelievable efficiency

Manufactured in the Clapp-Eastham Shops
in the Clapp-Eastham Way

A SATISFIED AUDIENCE

“A LITTLE BETTER THAN THE BEST”

CLAPP-EASTHAM COMPANY
139 Main Street, Cambridge, Mass.
LONG WAVE RECEIVERS

MURDOCK
LONG WAVE RECEIVER
LOADING INDUCTANCE
SILICON DETECTOR
1913 S.P. $50.00

CLAPP-EASTHAM
LONG WAVE RECEIVER
1914 FERRON DETECTOR

THREE SLIDE COIL
RADIOSON ELECTROLYTIC
DETECTOR, WITH
PLUNGER BATTERY.

LONG WAVE RECEIVER
NAVY COUPLER, CONNECTICUT TEL.
& TEL. VAR. COND. RADIOSON DET.
GRAPHITE POTENTIOMETER, PHONE
CONDENSOR. MURDOCK 55 PHONES.
REGENERATIVE ONE TUBE RECEIVERS
AND AMPLIFIERS

AMARAD
REGENERATIVE RECEIVER
DETECTOR & 2 STEP AMPLIFIER
1921  $57.50
AMERICAN RADIO & RESEARCH

CLAPP-EASTHAM ZRF
REGERATIVE TUNER
2 VARIOMETERS 1 VARIOCOUPLER
1919  $38.00

SLEEPER TYPE 3300
REGENERATIVE RECEIVER
1920  $35.00

AMARAD
REGENERATIVE RECEIVER
VARIOCOUPLER & DETECTOR
1921  $30.00

CLAPP-EASTHAM
REGENERATIVE RECEIVER
DET. 2 STEP AMP. 1921
$60.00 LESS TUBES

WIRELESS SHOP
REGENERATIVE RECEIVER
A. J. EDGCOMB LOS ANGELES

33
Syntony or tuning was used as early as 1900. Brass tubes, Leyden jars, coils and variable resistors were used to tune the transmitter and receiver. The coils were tapped every ten turns and switch points were used. Then the slide tuner appeared, using up to three sliders. But the slider would wear out the wire on the coil and deposit copper between the turns. The E. I. Co. corrected this in 1910 with a ball bearing slider. Litz wire came into use; this was many strands of small enameled wire wound into a cable.

The two-circuit or “loose coupler” next arrived, using a secondary winding sliding within the primary, and greatly increasing selectivity. By 1917 receivers were being made with a panel on which were found vario-couplers and variometers, making it possible to calibrate a dial.

The honeycomb coil was used by DeForest and others and produced the first all band receivers. By changing coils one could tune from 200 to 3100 meters without using the former loading coils. In the 1920s, with the coming of the tuned radio frequency receiver, many coils appeared on the market. Toroidal (doughnut) coils, spiderweb, figure-8, binocular and basket weave coils. The spider webs had a low loss as no coil form was used.
RECEIVING TYPE TRANSFORMERS
LOOSE COUPLERS

NAVY TYPE RECEIVING TRANSFORMER 5A
WM. DUCK 1915 $19.50

MURDOCK 337
1914 $12.00

MURDOCK 335
1913 $13.50

ARLINGTON RECEIVING TRANSFORMER
WM. DUCK 1915 $9.00

CLAPP-EASTHAM 1914

NAVY TYPE COUPLER

TRESKO LOADING COIL

AMCO SLIDE TUNER 1914
EARLY RECEIVING GEAR

WIRELESS SHOP
A. J. EDGCOMB
NAVY TYPE TUNER
1917 S.P. $24.00

CLAPP EASTHAM
SLIDE COIL TUNER
1912

VARIABLE SLIDING CONDENSOR
ABOUT 1912
EARLY RECEIVING GEAR

LOOSE COUPLER
1921 S.P. $10.00

SIGNAL LOOSE COUPLER
1919 S.P. $10.50

THREE CIRCUIT LOOSE COUPLER RECEIVER
FOR CRYSTAL DETECTOR OR AUDION
1919
DUO-LATERAL HONEYCOMB COILS & MOUNTINGS

DEFOREST COILS & MOUNTING
$16.50

SIGNAL MOUNTING FEDERAL COILS
$15.00

REMLER COILS & MOUNTING
$15.00

CROWN TWO COIL MOUNTING
COTO COILS $10.00

BRANSTON COILS & MOUNTING
$17.50
TUNING UNITS

EUGENE TURNEY
SPIDERWEB COILS
$8.00

HERROLD
SPIDERWEB COILS
$8.00

ATWATER KENT
COUPLED CIRCUIT
TUNER
$14.00

SIMPLEX
ADAMS MORGAN
VARIOCOUPLER 1920
$7.00

BROWNING DRAKE
COILS
$3.50

MADISON MOORE
M5 R.F. TRANS.
DECREMENT AND WAVE METERS

GENERAL RADIO
WAVE METER
TYPE 358 $15.00

MARCONI DECREMENT METER
1909

GENERAL RADIO
WAVE METER
TYPE 274 $10.00

GENERAL RADIO
WAVE METER
TYPE 174
1922 $68.00
THE Kellogg Switchboard and Supply Company have been manufacturing complete telephone exchange equipment, telephones, switchboards, apparatus and supplies for over twenty-five years. Our plant in Chicago is probably the largest factory of its kind in the world. Our floor space covers fourteen acres, and our manufacturing equipment is complete, up to date and of high efficiency.

The Kellogg Company is known throughout the telephone world, it may be said, but we include this brief explanatory statement in this bulletin which is addressed to the Radio trade.

The Kellogg Switchboard and Supply Company has been foremost in the production of standard, high efficiency telephone equipment. Its extensive laboratories and experienced engineering personnel guarantee Kellogg products to be of the utmost reliability.

In theory, design, and practice, Kellogg circuits and apparatus are conservative, yet known to be of the greatest dependability. Kellogg insulating products, such as receiver shells, transmitter mouthpieces, and the many forms of insulators necessary in the telephone field are in the front rank.

With such equipment and such experience it is reasonable that Kellogg radio apparatus should take first place in reliability and economy, as it has done. We are receiving the most satisfactory reports from the trade generally at the fine performance of the Kellogg head sets, and other Kellogg equipment. The engineer, the practical radio man, and the amateur, all acknowledge this superiority.

In extreme sensitiveness, accuracy, sound reproduction, and convenience in use, the Kellogg radio telephones are in a class by themselves.

For twenty-five years, our motto has been, "Use, is the Test."
VARIOMETERS & VARIOCOPLERS
1921 - 1922

KELLOGG VARIOMETER $7.50

GREBE VARIOMETER $7.50

PEARLCO VARIOMETER $6.50

GILFILLAN 5 INCH VARIOMETER $7.00
VARIOMETERS & VARIOCOUPLERS
1919 TO 1923

VARIOMETER
CHICAGO RADIO PROD. MFG.
CHICAGO $6.00

VARIOMETER
CHICAGO RADIO
APARATUS CO. 1919 $5.00

VARIOMETER
ATWATER KENT
1922 $8.00

VARIOMETER
ATWATER KENT
1922 $7.00

VARIOMETER
REMLER
$7.50

VARIOMETER
ATWATER KENT
1922 $8.00

ATWATER KENT
VARIOMETER
1922 $7.00
VARIOMETERS - VARIOCOUPLERS

SHAMROCK
180 COUPLER
$3.50

GENERAL RADIO
VARIOCOUPLER
$3.50

GENERAL RADIO
VARIOMETER
$3.50

ATEC
VARIOCOUPLER
$3.50 EACH

AMARAD VARIOMETER
AMERICAN RADIO & RESEARCH
MEDFORD, MASS. $3.75

SIMPLEX
SIMPLEX RADIO
PHIL., PENN. $3.50

HILCO VARIOMETER
A. E. HILL CO.
ATLANTA, GA. $6.00

GILFILLAN
SMALL VARIOMETER
MOULDED $4.50
FIVE TUBE RADIO FREQUENCY RECEIVER KIT $12.00

BRUNO R.F. AMPLIFIER REGEN. DETECTOR $8.50

THREE CIRCUIT TUNER $3.50

FIVE TUBE RADIO FREQUENCY RECEIVER KIT $12.00

SHORT WAVE TELEVISION KIT $12.00

OSCILLATOR COIL SUPERHET $4.50
Spark transmitters began with the Ruhmkorff spark induction coil. They were rated by the number of inches of spark they produced. The one inch coil would send eight miles and the four inch 32 miles. Spark transmitters up to 12 inch size were in use, the small ones ran on batteries and the large ones by generators. The spark transmitter consisted of a spark coil, or transformer, a spark gap, Leyden jar, a helix and a key-switch. Initially using a simple two-electrode spark gap, later models had a rotary motor-driven gap, and later still some used a quenched gap. The original Leyden jar condenser gave way to glass plates with tin foil between them, immersed in oil. Then came the mica condenser. Spark gap transmitting stations needed a hot wire ammeter to tune the antenna, a send-receive switch, a ground switch to earth the antenna.

Keys on small rigs were simple telegraph keys, but on KW transmitters ½ inch contacts were used as the key was in the primary circuit of the transformer. Some keys were enclosed to make them flame proof. Eventually the helix was made illegal and an oscillation transformer was used.

Antennas were usually a four-wire flat top or a five-wire cage for 200 meter; usually about 100 ft. long with a 35 foot rat tail and lead in. Commercial stations ran 100 KWs of power and operated as high as 3100 meters. The radio act of 1912 put the amateur on 200 meters with a maximum of one Kilowatt.
Low Power D. C. Transmitting Equipment

A Complete Transmitter Consisting of Amrad Induction Coil, Amrad Quenched Gap, Murdock Oscillation Transformer and Condensers and Bunnell Key. The Entire Assembly May Be Mounted in a Cabinet Measuring 20"x13"x10"

An Old Handicap Conquered

OWNERS of radio stations having no available supply of alternating current have heretofore been unable to obtain efficient and reliable transmitting equipment to operate with the power generated by batteries. With the advent of the Amrad Induction Coil and the special Amrad Quenched Gap the old handicap has been swept aside. These two instruments make the transmission of radio messages over distances of 25 miles and upwards an easily accomplished fact under ordinary conditions. Both instruments are of a design suitable for use with standard Oscillation Transformers and Condensers as illustrated above. The power supply may be obtained from either a 6 volt storage battery of the automobile type or from standard 32 volt farm lighting circuits.
MARCONI WIRELESS TELEGRAF CO.
OF AMERICA.
TYPE 10-A
10 INCH SPARK INDUCTION COIL 1910

MARCONI WIRELESS TELEGRAF CO.
OF AMERICA.
TYPE 107-A
MODIFIED FLEMING VALVE RECEIVER 1914

TRANSMITTER-RECEIVER USING CARBON DETECTOR 1917

MASSIE TUNER
USED IN MASSIE WIRELESS SYSTEM 1916
CLAPP-EASTHAM ROTARY QUENCHED
1920

MURDOCK ROTARY GAP
1913 $20.00

R. C. A.
1921 $7.50

BENWOOD ROTARY SEMI QUENCHED
1919

B. F. CHAMBERS ROTARY GAP
1915 $15.00

BEENWOOD SPARK WHEEL
1919
SPARK COILS AND TRANSFORMERS

E. I. CO.
1" SPARK COIL
1914  $4.00

RUHMKORFF SPARK INDUCTION COIL
ABOUT 1915

E. I. CO.
½ KW SPARK TRANS.
1912  $6.00

AMARAD TYPE C SPARK INDUCTION COIL
ABOUT 1920  $35.75
HELI X A ND OSCI LLATI ON T RANSFORMERS

HELI X
1 KW ABOUT
1914

AMCO OSC. TRANS.
1 KW MADE FROM KIT
ABOUT 1914

MURDOCK #424
OSC. TRANS.
1914

½ KW TRANSMITTING
TUNING COIL
ABOUT 1914
GENERAL RADIO AUDIBILITY METER 1920

EATON OSCILLATOR 1919 $15.00

MURDOCK KICK BACK PROTECTOR 1914

CLARK TONE TESTER 1919

MESCO AERIAL SWITCH 1916

TRUMBULL GROUND SWITCH 100 AMP. 1915
SPARK TRANSFORMERS

THORDARSON
¾ KW  1919
$15.00

THORDARSON FLEXIBLE
1.0 KW  1915
$25.00

THORDARSON TYPE R
1 KW  1919
$25.00

FISHER ½ KW WITH LINE REACTOR
E. I. CO.
VAR. TRANS. COND.
LEYDEN JARS
1908 $2.50

E. I. CO.
FIXED VAR. COND.
#10000
1912 $1.25

MARCONI
.003 VAR. CONDENSOR
1906

THORDARSON
OIL TRANS. COND.
1 KW. 1919 $32.50
WIRELESS APPARATUS

GENERAL RADIO FLAME PROOF KEY 1918

WIRELESS SPEC. APPARATUS 50 AMP KEY ABOUT 1917

OMNIGRAPH CODE MACHINE PAT. 1904 $20.00

ELEC. IMPORT. CO. GALVANOMETER 1916 30 CENTS

WESTON GALVANOMETER

SIDE WINDER KEY

STD. WIRELESS KEY 1916

WIRELESS SPEC. FLAME PROOF KEY
Western Electric was one of the earliest tube manufacturers. In 1915 they worked on the trans-Atlantic telephone tests at Arlington, Virginia, using a bank of 550 tubes in parallel — which would be an accomplishment even today. In 1917 they started work on the repeater bulbs for telephone use, using the ladder grid construction. In 1918 W.E. made the VT-1 and VT-2 tubes for the U.S. Signal Corps; the former was a general purpose detector-amplifier and the latter a five-watt oscillator-modulator.

In 1919 Western Electric made 50 watt type-211 tubes, the famous N tube, and the 215A peanut tube used in Western Electric receivers. By 1920 they were making tubes for commercial stations, but still continuing the telephone tubes.
EARLY TUBES

WESTERN ELECTRIC VT1 DET. AMP. 1923

WESTERN ELECTRIC 216A SPEECH AMP.

WESTERN ELECTRIC 205D 5 WATT MOUD.

WESTERN ELECTRIC VT2 DET. 1923 AMP.

WESTERN ELECTRIC 101 F 5 WATT TUBE

RADIOTRON UV 872 HALF WAVE RECT.

DE FOREST 552 100 WATT TRANS.

DE FOREST 503A 50 WATT TRANS.
WESTERN ELECTRIC

212D
250 WATT TRANS
EARLY TUBES

WESTERN ELECTRIC 271A
WESTERN ELECTRIC 277A
RADIOTRON CA 10 15 WATT TRANS.
RADIOTRON UX 210 15 WATT TRANS.

RADIOTRON UX 250
CLASS A AMP.
MODULATOR

RADIOTRON UX 281
RECTIFIER

RADIOTRON UX 874
RECTIFIER

RECTRON UX 216B
RECTIFIER
VACUUM TUBES

In 1919 radio was given a real boost when the Radio Corp. of America and Elmer Cunningham announced the 200 and 201 tube made by General Electric. The type 200 was a soft detector and the 201 was a hard detector-amplifier. Both were rated at five volts and one amp.

Radio stations with regular broadcasts were in full swing by 1921, and the receiver business was booming. A growing business was that of rebuilding tubes due to the tube shortage; charge was usually one to two dollars. Bootleg tubes were common and sold for about $5.00; some were very good. About this time G.E. brought out the Radiotron transmitting tubes UV-202 at five watts, UV-203 at 50 watts and the UV-204 at 250 watts. The same tubes were also sold under the Cunningham name.

1923 saw a need for tubes that would operate on dry batteries. Westinghouse made the WD-11 and WD-12 for RCA (both 1.1 volts, .25 amp.), and G.E. made the type 199, rated at three volts, .6 amp. The next two years brought many special tubes: the DeForest DV series, the Connecticut T&T Co. double sodium vapor detector, the Electrad diode to be used in place of a crystal detector, and the Welsh peanut tube with the control element outside the tube.

1926 brought better tubes such as the 120 and 112 series. They were hard amplifiers, and with proper bias circuits improved tone quality. The Raytheon BH cold cathode rectifier for "B" battery eliminators appeared. Also the first tubes to use A.C. on the filaments: McCullough, Ardon and Kellog. The following year extremely practical A.C. tubes appeared: the 226 with a filament slow to cycle action and the 227 with a cathode unit. These made possible the era of all-electric sets. Screen grids became common in 1928.

Geo. E. Brighton's True Blue Tubes.
EARLY TUBES

ARDON AC 373
MFG. CARDON CORP.

ARCTURUS 28
15 VOLTS AC

ATWATER KENT
AC RECTIFIER

MARATHON 608A
AC TUBE

KELLOGG 401
AC TUBE WITH
CAP

SOVEREIGN
AC TUBE WITH
CAP

McCULLOUGH 401
FIRST AC TUBE
PAT. BY McCULLOUGH
EARLY TUBES

STEWART WARNER
201A TYPE AMP.
5 VOLTS

QRS
201A TYPE
DET. AMP.
5 VOLTS

SUPER AIRLINE
GX 201 A
MONTGOMERY WARD

MAGNAVOX TYPE A
AMPLIFIER

OK X 200-A
SOFTWARE DETECTOR
5 VOLTS

5 VOLTS
PERRYMAN H 201A
DET. AMP.
5 VOLTS

CONCERT MASTER
DAVEN MU
FIRST TYPE TUBE
AMPLIFIER
SHIELDING
6 VOLTS

6 SONATRON 201A SUPERTRON SX 201
AMPLIFIER
5 VOLTS

5 VOLTS
MAGNATRON DC 201A
DET. AMP.
CONNEWERY ELEC. LAB.

A. P. TWO IN ONE
TWO SEPARATE TUBES
ATLANTIC-PACIFIC

MARATHON MX 201A PHILCO 112A
DET. AMP.
LAST
5 VOLTS
AUDIO STAGE

MUSSELMAN
The Golden Rule Tube

The Sodion does not oscillate. No declaration as to sensitivity, signal strength—or quality of tone—can mean half so much to every broad-minded radio enthusiast as this simple statement of fact.

For there—in five words—you have the key to the solution of the problem of eliminating the whistles, the squeals and the howls that interfere so seriously with your enjoyment of radio today.

Don't misunderstand—The Sodion does not protect YOUR reception against these noises from other sets.

But, because it does not oscillate—because it cannot reradiate—because it cannot whistle and howl—the Sodion DOES prevent your reception from interferring in any way with the reception of others.

This, we believe, is the practical way of eliminating one of the greatest faults in broadcast Radio reception.

In point of efficiency the Sodion Tube is far more sensitive and produces stronger signals than any detector now on the market. Its tone is fully equal to that of the finest crystal with the added advantage of great volume.

Descriptive Bulletin upon request.

CONNECTICUT TELEPHONE & ELECTRIC COMPANY
MERIDEN Radio Division
CONNECTICUT
EARLY TUBES

MAJESTIC COLD CATHODE RECT. 1928

EVERREADY RAYTHEON COLD CATHODE RECT.

RAYTHEON COLD CATHODE RECT. TYPE B 1927

BOSCH SPECIAL COLD CATHODE RECT.

COLD CATHODE RECT. TYPE BR 1927

NATIONAL RADIO TUBE CO. RECTOBULB.

AMARAD "S" TUBE 1923

SYLVANIA RECT. TYPE B66

RADIOTRON UV 876 VOLTAGE REGULATOR
EARLY TUBES

RADIOTRON
U. V. 201
LIST PRICE $6.50

RADIOTRON
U. V. 200
PRICE $5.00

DECEMBER 1920

Cunningham AudioTron Tubes
WITH STANDARD FOUR PRONG BASE

TYPE C-300
$5.00

TYPE C-301
$6.50
EARLY TUBES

CUNNINGHAM C 301A AMPLIFIER 1923
RADIOTRON UV 201A AMPLIFIER 1923
RADIOTRON WD 12 DETECTOR 1923
CUNNINGHAM C 12 DETECTOR 1923

RADIOTRON WD 11 DETECTOR 1923
WESTINGHOUSE WD 11 AERIOLA DETECTOR 1923
WESTINGHOUSE WR 21 AERIOLA DET. 1923
VACOBUB 201 DETECTOR

CUNNINGHAM C 199 DETECTOR 1923
RADIOTRON UV 199 DETECTOR 1923
KR Q201A DETECTOR AMPLIFIER
PANAMA 0201A DET. AMP. 5 VOLTS
KENOTRON RECTIFIER UV-216

RADIOTRON UV-203
50 WATT TRANSFORMER
$30.00

RADIOTRON UV-202
5-WATT TRANSMITTER
$8.00

KENOTRON RECTIFIER UV-217

250-WATT
EARLY TUBES

MERCURY ARC RECTIFIER
GENERAL ELECTRIC
3,000 VOLTS 1918
DE FOREST TUBES

VT 14 Audion
DE FOREST Audion DET.
TBI Experimental Diode

MOOREHEAD Electron Relay
1920

MOOREHEAD Round Type Amp.
1920

DE FOREST Audion
1920

ATLANTIC-PACIFIC
A-P 1920
Electron Relay
C.W. TRANSMITTERS

Immediately following W.W.I. amateur operators continued to use spark transmitters, but in 1921 G.E. made the Radiotron and Cunningham transmitting tubes, making Continuous Wave transmitters with tubes fairly common. RCA sold parts made by G.E. and also by Wireless Specialty Co. to build a complete C.W. or radiotelephone station. The Acme Apparatus Co. also made C.W. parts and transformers.

The early radiotelephone stations used Heising and grid modulation, and also modulated their antenna. Transmitters were self-excited oscillators of tubes in parallel. The tank coil used was a large tapped coil, tuning being accomplished by changing taps. It was soon found that using tubes the station could be tuned down to 175 meters with good output.

The M.O.P.A. transmitter followed, using a master oscillator with a power amplifier following; these were better than the parallel tube oscillator and the self-rectifying circuits.

Parts and tubes at this time were very expensive. The UV-204 250 watt tube cost $110.00. A 10 watt radiotelephone kit cost $150.00; a 100 watt kit cost $250.00. Thus many amateurs of the time wound their own transformers and coils. But the tube transmitters were clearly best, eliminating the interference of the spark transmitter, and giving about three times the range with the same antenna power while having much greater selectivity. By 1922 there were about 25,000 amateur radio transmitters in use, and about eight times that many receivers.
PIONEERS
What ACME has to offer besides apparatus

The Acme Apparatus Company are pioneer transformer and radio engineers and manufacturers and is composed of men who have associated themselves with radio and transformers for fifteen years, both as engineers and workmen skilled in art of construction.

Before the days of broadcasting Acme Apparatus was used by those amateurs who have now become the instructor of novice. They recommend it because of its tried efficiency, sturdy service and the way the company stands back of it.

As the rapid and continued growth of the Acme Apparatus Company has been due to the amateur and broadcast listener, we feel that our debt can partly be paid in service to prospective and actual purchasers of our product.

With this end in view, we maintain an Engineering Department continually at work to find out how to get the best results, how to improve the product and how to amplify more without distortion. This department welcomes your correspondence and questions, and freely and gladly gives advice obtained from actual experience.

OUR GUARANTEE

The only time a guarantee means anything is when an attempt is made to use it.

As always, Acme Apparatus is guaranteed against defects in material and workmanship and furthermore, we always try to make adjustments to the satisfaction of the customer.

ACME APPARATUS COMPANY
CAMBRIDGE, MASS.

Transformer and Radio Engineers and Manufacturers
ACME 100 WATT C. W. TRANSFORMERS, 1922

150 WATT FILM ENT
10 VOLTS
$16.00

ACME
C W INDUCTIONANCE
$8.00

500 WATT CW PLATE
1500 VOLTS
$25.00

75 WATT FILAMENT
5 VOLTS $12.00

500 MIL. R.F. CHOKE
$6.00

77
METERS, 1900 TO 1924

JEWEL PANEL MOUNT

WESTON PANEL MOUNT

FISHER PANEL MOUNT

JEWEL HIGH FREQUENCY METER
1919 $12.00

HUSTON BROS. CHICAGO.
TABLE MIL. METER
PAT. 1899

VOLT MIL. AND HIGH FREQUENCY METERS
VARIABLE TUNING CONDENSERS

About 1905 both receivers and transmitters were being tuned with some type of variable condensers. Some of the early types were just a series of fixed condensers with switch taps, some were brass plates that slid in and out like a drawer. Marconi built a condenser with rotor and stator plates much like those in use today. Crosley used a "book" condenser. Murdock was famous for its variable condensers and made some with Bakelite cases that could be filled with oil to increase the capacity.

When broadcast stations began to crowd the band a condenser spread the stations at the high end was needed. Some makers elongated the plates, others cut away part of the plate to make them elliptical. Then came the low-loss era; Bakelite end plates were left off or replaced with metal ones. C. J. Fitch used triangular plates which operated like a clamshell. Remler used square plates that operated the same way. Both these gave a straight line frequency condenser which spread the stations and gave a high maximum and low minimum capacity.

Soon simpler tuning was needed and one and two dial receivers appeared in which the condensers were ganged with metal belts, chains, universal joints and levers. Ten gang condenser units were known. There were also compression types, but losses were very high.
EARLY TUNING CONDENSERS

WIRELESS SHOP
A. J. EDGCOMB
LOS ANGELES $5.00

PITTSFIELD
VERNIER 43 PLATE
$4.50

RADIO TELE. SHOP
43 PLATE .001
SAN FRANCISCO $5.00

RCA
UC 1819 .005
MERCURY $8.75

RCA
UC 1820 .0006
$7.50
EARLY TUNING CONDENSERS

KARAS
ORTHOMETERIC
23 PLATE $7.00

MAR-CO
23 PLATE .0005
$6.50

G. I. LOW LOSS
43 PLATE .001
GENERAL INST. $7.00

H & H
LOW LOSS 23 PLATE
$5.00
EARLY TUNING CONDENSERS

CROSLEY

BREMER-TULLY
.00035 DUAL
$7.50

AMSCO
11 PLATE $3.00

NATIONAL
MIDGET
$2.00
EARLY TUNING CONDENSERS

NORCO
.0015 $4.00

KOELHR
23 PLATE .0005
$4.50

NATIONAL
TYPE DX $4.00

SIGNAL
.001 43 PLATE
$4.50

DEFOREST CV 1503
.0015 $14.25
EARLY TUNING CONDENSERS

CHÉLTON VERNIER COND.  
$1.95

PILOT VERNIER COND.  
$1.95

HAMMARLUND STAR VERNIER COND.  
$1.50

DEJUR TRIPLE .0005  
$8.50

DEJUR DUAL .0005  
$6.00
## EARLY TUNING CONDENSERS

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
<th>Plate</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>KING</td>
<td></td>
<td>17</td>
<td>$5.00</td>
</tr>
<tr>
<td>CROFOOT</td>
<td></td>
<td>.0005</td>
<td>$6.00</td>
</tr>
<tr>
<td>Premier Elec.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>COTO-COIL</td>
<td></td>
<td>23 P</td>
<td>$3.50</td>
</tr>
<tr>
<td></td>
<td></td>
<td>.0005</td>
<td></td>
</tr>
<tr>
<td>CARDWELL</td>
<td></td>
<td>43</td>
<td>$6.00</td>
</tr>
<tr>
<td></td>
<td></td>
<td>.001</td>
<td></td>
</tr>
<tr>
<td>DRIVER-TULLY</td>
<td></td>
<td>.00035</td>
<td>$5.00</td>
</tr>
<tr>
<td>HAMMARLUND DUAL</td>
<td></td>
<td>23 PLATE</td>
<td>.0005</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>$6.00</td>
</tr>
</tbody>
</table>
EARLY TUNING CONDENSERS

HAMMARLUND
23 PLATE .0005
$6.00

AMSCO
S.L.F. $6.50
ADAMS-MORGAN CO.

PILOT
.00035 $5.00
GENERAL RADIO
334 VERNIER
$5.00

GENERAL RADIO

GENERAL RADIO
248F TANDEM
$6.50
EARLY TUNING CONDENSERS

BLITZEN
CLAPP-EASTHAM .001
43 PLATE 1914 $5.00

MURDOCK 36B
23 PLATE .0005
1914 $4.50

TEWNO #53
21 PLATES .0005
1916 $4.75

CONNECTICUT
COMPRESSON TYPE
1910 .001 $6.50
EARLY TUNING CONDENSERS

MURDOCK 360
7 PLATE .0005
1913 $5.00

MURDOCK 361
TAPPED DISC. 0 TO .001
1913 $8.50

MURDOCK 367
43 PLATE .001
1914 $4.50

MURDOCK 366
43 PLATE .001
1914 $4.50
Before the radio tube came into use there were several detectors available. In 1907 Pickard invented the mineral or crystal detector. In 1921 with many broadcast stations coming on the air and the Quaker Oats box already in use everyone could then have a radio. Nearly every man and boy living near a broadcast station made a crystal set, or bought one ready made. Factory made crystal sets cost from $10.00 to $35.00 complete.

The two circuit sets with spiderweb coils, or other low loss coils, and a good galena detector received stations up to 1500 miles away. A Quaker Oats box set would do fine if you had a neighbor near by with a good regenerative receiver that radiated the station he was listening to. As more broadcast stations came on the air more selectivity was needed, and was often secured by separating the primary and secondary circuits by about five inches; this cut down the volume and good headphones were then needed.

The crystal set required a good outside aerial and a good ground connection. The two most common crystals used were galena and silicon. Galena was most sensitive but took longer to find a good sensitive spot with the "cats' whisker." The silicon was louder and it was easy to find a good spot. Crystal detectors were priced from 50c to $4.00 for a good one. They were sold in fancy boxes, marked with guarantees as to volume, distance and clarity. Fixed detectors were available, and while they required no adjustments they were not as sensitive as the cat's whisker type. Crystal detectors are still being made and sold today.
CRYSTAL RECEIVING SETS

PANDORA CRYSTAL SET
1922 $2.50

AMPLIFIER FOR CRYSTAL SET
CARBON MIKE DIRECT COUPLED
TO A RECEIVER. OPERATES A
LOUDSPEAKER WITHOUT TUBES.

BROWNIE CRYSTAL SET
BROWNIE CO. SAN FRANCISCO

ECLIPSE CRYSTAL SET
ECLIPSE MFG. LOS ANGELES

RAD-SCO CRYSTAL RECEIVING SET
RADIO SUPPLY CO.

C. D. T. CRYSTAL SET
TANNER CO. LOS ANGELES
CRYSTAL RECEIVING SETS

PHILMORE CRYSTAL SET

MIRACLE CRYSTAL SET
UNCLE AL'S RADIO SHOP
OAKLAND, CALIF.

WORLD CRYSTAL SET

BABY GRAND CRYSTAL SET
ONE OF SMALLEST MADE

A. C. GILBERT
CRYSTAL SET
1922  $10.00

GREG-SOR CRYSTAL RADIO
STERLING MFG.
BERKELEY, CALIF.
MEEPON CRYSTAL SET 1923

NATIONAL RADIOPHONE CRYSTAL DET. RECEIVER 1922

NATIONAL MONODYNE 1 TUBE RECEIVER & 1 STAGE OF AUDIO 1923 S.P. $18.00

AEREX CRYSTAL SET KING OF THE AIR 1922
CRYSTAL DETECTOR RECEIVER

UNCLE AL’S CRYSTAL SET
ONE STAGE OF AUDIO

STANDARDYNE THREE TUBE SET
USING MULTIVALVE TUBE
THREE TUBES IN ONE 1925

DUAL-WAVE CRYSTAL DETECTOR RECEIVER 1924

EISEMANN VARIO-COUPLER
SWITCH POINTS INSIDE

HOWE CRYSTAL RECEIVER 1925

CRYSTAL DETECTOR RECEIVER
BROADCAST RECEIVERS

KODEL PORTABLE
"THE CAMERA RADIO"
IN A CAMERA CASE
1924 S.P. $16.00

AERIOLA X
NOT MADE BY
WESTINGHOUSE
1924

FAMOUS J. L. REINARTZ
RECEIVER
ONE OF THE BEST FOR CW.
1921

MULTIPHONE CRYSTAL SET 1924

BETTA-PHONE
CRYSTAL SET
1924
A P P A R A T U S  O F  T H E  E A R L Y  1 9 2 0 s

After W.W.I many electric companies began manufacturing transmitting apparatus and receivers for amateur and home use. The old Marconi Co. was taken over by the Radio Corp. of America. General Electric made receivers and parts for RCA; also the Radiotron tubes. Westinghouse made receivers and the WD-11 and WD-12 tubes for RCA. The Wireless Specialty Apparatus Co. made a few receivers for RCA, the Faradon mica condensors, the Eaton oscillator and the Clark tone tester.

The Federal Tel. & Tel. Co. made receivers using the Federal radio frequency transformer and the 226W audio transformers. The Colin B. Kennedy Co. made receivers for both amateur and home use. A. H. Grebe Co. made a line of receivers for the amateur; also home receivers, and were one of the first to make a 10 meter receiver. The Adams-Morgan Co. continued to make the AMCO line and the Paragon receiver. They were one of the first to build a receiver using the Armstrong regenerative circuit.

C. D. Tuska, a radio pioneer and first Editor of QST Magazine, built regenerative amateur and home receivers. Chicago Radio Laboratories, owned by R. H. G. Matthews (9ZN) built wireless gear, later becoming the Zenith Radio Corp. American Radio Research made many parts, including the AMARAD "S" tube and the Mershon electrolytic condenser.

Remler — Elmer Cunningham was distributor for the Cunningham tubes and the Giblin-Remler duo-lateral honeycomb coils.

Giblin-Remler.
Chicago Radio Labs.
WEIRELESS APPARATUS

MERSHON
ELEC. CONDENSORS
1922 TO 1925

GENERAL RADIO
.003 VAR. COND.
1920

WIRELESS SPEC. CO.
.003 IP-301 VAR.
CONDENSOR
1919

R. C. A. CHOKE
MADE BY G. E.
1921

R. C. A. FARADONS
MADE BY WIRELESS
SPEC. APPAR. CO.
1921

WIRELESS SPEC. CO.
MICA TRANS. COND.
1917 $25.00

DUBILIER MICA
TRANS. COND.
1917 $25.00
WIRELESS APPARATUS

FISHER
1 KW. SPARK GAP,
AIR COOLED, 1919

MURDOCK #440
SPARK GAP
1919 90 CENTS

KNAPP
GENERATOR
1916

MESCO
SPARK GAP
1915

ELECTROSE INSULATORS
1912 TO 1920
U.S. Army
Spark Transmitter
First Type Used in Airplanes 1918

Sodium
Detector
1919

RCA
Magnetic Modulator
Used in Ant. Circuit 1922

Handmade Exp. Tube
1916

Enclosed Spark Gap
1919

Deforest Wave Meter
1923
CRYSTAL DETECTORS IN THE 1920's

KENNEDY

KOLSTER

CARBORUNDUM WITH BATTERY

FRESHMAN

PACENT

FIXED DETECTORS

FADA

102
BROADCAST RECEIVERS

Up to about 1921 only amateurs, experimenters and commercial firms were using receivers, with the exception of a few watchmakers who received the Navy time signals from Arlington, Va. The latter dated back to 1913. The earliest receivers available for home use by the layman were the one tube regenerative or "bloop" type. The "bloop" came when the detector was in oscillation and the station was being tuned. The radiation from such sets was naturally bad, and the one tube reflex became popular in kit form; it didn't radiate signals and would operate a loud speaker. Next came untuned R.F. transformers giving some gain without radiation. Then the tuned R.F. outfits, usually five tube sets that when properly designed didn't radiate. The Hazeltine Neutrodyne was the first really stable receiver.

Radio kits were common in 1923, with everyone building a home receiver. Popular magazines carried circuit diagrams of new types of receivers. Among reflex sets, Acme, Erla, Harkness and Grimes were good sets. Popular sets using other circuits were Reinhartz, Cockaday and Pilot Super Wasp. The Browning-Drake and the Hammerlund Roberts were also fine receivers. Many manufacturers sold their regular sets in kit form; Bremer-Tully, Freed-Eisemann, Fada, Workright and DeForest were available this way.

Superheterodyne kits were on the market by 1924. Lincoln, Branston and Remler Sampson were available in six to ten tube circuits. A complete "10" cost about $250.00 to build.

Falck Reflex.

Zenith Super VII.
CROSLEY

Crosley radio receivers were built by Powell Crosley Jr's. company. He had been radio amateur No. 8CR and later owned the WLW radio station at Cincinnati, most powerful in the world at that time. Millions of Crosley receivers (called the "Model T" of radios) were sold, giving good results at a low price. They used a "book" condenser. Crosley was one of the first with good regenerative receivers; it had low loss spider-web coils. Harko and Ace were other Crosley Corp. trade names.

Crosley VI one stage R.F. Regenerative Detector.

ATWATER KENT

Atwater Kent started building receiving sets in about 1922, beginning with the famous "breadboard" model. He was making and selling variometers and varicouplers before that. The A-K sets performed well, being made with the best of parts. Atwater Kent continued to build receiving sets into the 1930s, quitting as the low cost, low quality sets took over the market.

Atwater Kent Model 9.
March, 1922

For DISTANCE
HERE is a RECORD

The remarkable results achieved with Crosley Radio Instruments are equaled only by their exceptionally low cost. A man in Sebring, Fla, listening in with a Crosley Model X—price only $55 for this 4 tube set—wrote: "We are receiving from all standard stations north, east and west—from Winnipeg, Can., New York City, Seattle, Wash., and one night received three selections and two announcements from KDYX at Honolulu."

CROSLEY
Radio Apparatus
Better-
Costs-Less
Making distance
records everywhere

Crosley Receiver Model X

The most complete receiving set on the market. A 4 tube set consisting of one stage of tuned radio frequency, detector, and two stages of audio frequency amplification. It was on this instrument that Sebring, Fla, heard Honolulu. Price, without batteries, tubes and phones $55.00.

CROSLEY MANUFACTURING CO.
ALFRED STREET
CINCINNATI, OHIO
CROSLEY RECEIVERS

CROSLEY PUP
1923 $10.00

CROSLEY MODEL 50
1923 $14.50

CROSLEY MODEL 51
S1A 2 STAGE AMP.
1923 $47.50

INSIDE VIEW CROSLEY 52

CROSLEY MODEL 51 PORTABLE
1923 $28.50

Crosley 9-5, Radio
CROSLEY RECEIVERS

CROSLEY MODEL 52
THREE TUBE REGEN.
1923  $30.00

CROSLEY MODEL XJ
FOUR TUBE RECEIVER
1922  $55.00

CROSLEY MODEL X
FOUR TUBE REGEN,
1922  $60.00

CROSLEY TRIRDYN
SPECIAL
1923  $75.00

CROSLEY TRIRDYN
NEUPORT 1925
$100.00

CROSLEY MODEL 5-38
1925  $38.00

107
Connections shown above are for five $\frac{1}{4}$ ampere tubes with 45 volts on the plate circuit of the detector tube. When a one ampere 5 volt tube is used as a detector, decrease its plate voltage to 22$\frac{1}{2}$ volts by disconnecting wire A from point Y and connecting it to X.

If Battery Charger is used, a switch is recommended and should be connected, as shown in diagram.
ATWATER KENT RECEIVERS

ATWATER KENT
MODEL 9
1921 $65.00

ATWATER KENT
MODEL 10
1922 $80.00

ATWATER KENT
MODEL 12
1923 $100.00

ATWATER KENT
MODEL 10B
1923 $80.00

ATWATER KENT
TUNED R.F. REGEN. DET.
1922 $70.00
ATWATER KENT RECEIVERS

ATWATER KENT
MODEL 19
4 TUBE T.R.F.
1924 $60.00

ATWATER KENT
MODEL 20
5 TUBE T.R.F.
1924 $80.00

ATWATER KENT
MODEL 30
6 TUBE T.R.F.
1924 $85.00

ATWATER KENT
MODEL 32
6 TUBE T.R.F.
1925 $95.00

INSIDE VIEW
MODEL 20
ATWATER KENT RECEIVERS

ATWATER KENT
MODEL 33
6 TUBE T.R.F.
1924 $98.00

ATWATER KENT
MODEL 35
1926 $75.00

ATWATER KENT
MODEL 48
6 TUBE T.R.F.
1925 $80.00

ATWATER KENT
MODEL 50
7 TUBE T.R.F.
1927 $125.00

Tuned out. A.K.15, Ride

Tuned out. A.K.14, Ride

Tuned out. A.K.14, Ride

3 circuit and timer
2 medium Qr., det., 7 kb
The Radio Corporation of America was and is one of the largest and oldest manufacturers of radio sets. After the first World War the Alexander Co. offered for sale its patents on the Alternator. The British Marconi Co. were making arrangements to secure these, but the U.S. government intervened in the interests of maintaining our nation's lead in the radio field. So R.C.A. was formed on October 17, 1919 with Ed J. Nally as President and Owen D. Young as Chairman. A month later, on November 20th, the Marconi Co. was taken over by RCA.

They became the largest distributor of radio receiving sets in the world, selling the entire output of the General Electric Co. and Westinghouse. RCA took over the Marconi Institute, founded in 1913, and renamed it the Radio Institute of America; it offered technical radio courses and commercial radio operator's courses to thousands of students.

RCA World Wide Direless in 1920 sold transmitting and receiving commercial sets made by G.E. and Westinghouse, and also some made by Wireless Specialty Apparatus Co. RCA sold ship-to-ship and ship-to-shore stations complete. Portable mule pack sets, military tractor sets, spark transmitters from one to 20 KW, tube transmitters and interfleet radio telephones were all distributed by RCA at this time.

RCA Communications Inc. kept two 100 R.F. alternators in daily use to handle radiograms to 43 foreign nations. Radiograms were also handled by Western Union Telegraph Co. In 1926 RCA purchased radio station WEAF in New York for one million dollars and founded the National Broadcasting Co.; M. H. Aylesworth was president. There were more than five million home radio receivers in use at this date.
Completing Sets at the Westinghouse Electric and Manufacturing Company's Radio Works, Springfield, Massachusetts

Radio Corporation of America

Section of Radio Assembling Room at Immense Plant of General Electric Company, Schenectady, N. Y.
RADIO CORPORATION OF AMERICA

RADIOLA SIX TUBE RECEIVER WITH RE-ANT. TUNER, AR-THREE STAGE R.F. AMP. RA-REGEN. RECEIVER, DA-DET. TWO STEP AMP. MADE BY WESTINGHOUSE 1922 S.P. $225.00.

RADIOLA SENIOR TYPE RF REGEN. USES 199 TUBE MADE BY WESTINGHOUSE 1923 S.P. $65.00

AERIOLA JR. MODEL RE CRYSTAL SET 1922 SP $25.00 MADE BY WESTINGHOUSE
RADIOLA SPECIAL
ONE TUBE REGEN.
170 TO 500 M.
1923  $30.00
WIRELESS SPEC. CO.

RADIOLA CONCERT RECEIVER
CRYSTAL SET
170 TO 2650 M.
WIRELESS SPEC. CO.
1922  S.P.  $40.00

AERIOLA SR. RECEIVER
REGENERATIVE USES WD11
MADE BY WESTINGHOUSE
1922  S.P.  $65.00

AERIOLA AMPLIFIER
2,STEP WD 11 TUBES
MADE BY WESTINGHOUSE

RCA 1-5
RCA 1-6
RADIOLA I
TYPE ER-753-A
MADE BY GENERAL ELEC.
1922 S.P. $25.00

RADIOLA II AR-800
2 TUBE REGENERATIVE
PORTABLE RECEIVER
USED TWO 199 TUBES
1923 S.P. $60.00
MADE BY GEN. ELEC.

RADIOLA III AR-805
WITH BALANCED AMPLIFIER
REGEN. DET. ONE STEP
AUDIO. ONE STEP PUSH
PULL AUDIO. 1923
S.P. $65.00

RADIOLA TYPE RS
MADE BY
WESTINGHOUSE
1923
RADIO CORPORATION OF AMERICA

RADIOLA IIIA AR 806
REGEN. DET. ONE STEP
AUDIO. ONE STEP PUSH
PULL AUDIO. 1924
S.P. $65.00

RADIOLA IV AR-880
THREE TUBE RECEIVER
REGEN. DET. 2 STAGE
AUDIO. 1922
MADE BY GEN. ELEC.

RADIOLA V AR-885
AR-1300 CRYSTAL DET.
RECEIVER
AA-1400 TUBE DET.
TWO STEP AUDIO
1922 MADE BY GEN. ELEC.
$250.00 COMPLETE

RADIOLA VI AR-895
AA-1520 3 STAGE R.F.
AA-1400 3 STEP AUDIO
TUNES 200 TO 5000 M.
1922 MADE BY GEN. ELEC.
RADIO CORPORATION OF AMERICA

RADIOLA VII & IX
2 CIRCUIT TUNER
5 TUBE DET. AMP.
AR-907
1923 S.P. $245.00

RADIOLA IV
6 TUBE SUPER
PORTABLE
1925 S.P. $286.00

RADIOLA X
REGENOFLEX
4 WD 11 TUBES
1925 S.P. $245.00

$320.00
RADIOLA 16 AR-924
6 TUBE RECEIVER
UX 201As
1922 S.P. $150.00

RADIOLA GRAND
4 WD 11 TUBES
REGEN. RECEIVER
1922 S.P. $150.00

RADIOLA 17 AR-927
ONE OF THE FIRST
AC RECEIVERS
1928

RADIOLA 20 AR-918
5 TUBE T.R.F.
1925 S.P. $180.00
RADIO CORPORATION OF AMERICA

RADIOLA 24 AR-804
6 TUBE SUPER
USING 199 TUBES
PORTABLE
1925 S.P. $160.00

RADIOLA 25 AR-919
6 TUBE SUPER
USING 199 TUBES
LOOP RECEIVER
1925 SP $165.00

RADIOLA 26
6 TUBE SUPER
PORTABLE
HOME BATTERY BOX
WITH ANT. TUNER
1925 S.P. $225.00
### Radio Corporation of America

#### Westinghouse Regenerative-Vacuum Tube Receiver Combination No. 4

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>RC</td>
<td>Short Wave Regenerative Receiver, 170-700 meters, less tubes</td>
<td>$132.50</td>
</tr>
<tr>
<td>CB</td>
<td>Load Coil</td>
<td>$6.00</td>
</tr>
<tr>
<td>UV-200</td>
<td>One Radiotron Detector</td>
<td>$5.00</td>
</tr>
<tr>
<td>UV-201</td>
<td>Two Radiotron Amplifiers</td>
<td>$13.00</td>
</tr>
<tr>
<td>6HR-9</td>
<td>Storage Battery, 6 volts, 100 A. H.</td>
<td>$24.00</td>
</tr>
<tr>
<td>UD-790</td>
<td>Brandes Telephones</td>
<td>$8.00</td>
</tr>
<tr>
<td>UD-824</td>
<td>Telephone Plug</td>
<td>$1.75</td>
</tr>
<tr>
<td>Two “B” Batteries</td>
<td>Two “B” Batteries</td>
<td>$6.00</td>
</tr>
<tr>
<td>AD</td>
<td>Receiving Antenna Equipment</td>
<td>$7.50</td>
</tr>
<tr>
<td>LV</td>
<td>Vocarola (Loud Speaker)</td>
<td>$30.00</td>
</tr>
<tr>
<td>285168</td>
<td>Rectigon Battery Charger, 5 amperes</td>
<td>$28.00</td>
</tr>
</tbody>
</table>

**Total** $261.75
DECEMBER, 1919

Federal's
(There's Much in a Name)

Telephone & Telegraph Co.
MANUFACTURERS
TELEPHONE, TELEGRAPH AND RADIO APPARATUS AND ACCESSORIES
FACTORY AND HOME OFFICE
Buffalo, New York, U. S. A.

RADIO TELEGRAPH AND TELEPHONE APPARATUS

Home of Federal Radio Apparatus

BRANCH SALES OFFICES:

NEW YORK CITY
2198 Woolworth Bldg.

SAN FRANCISCO
603 Mission St.

CHICAGO
504 Plymouth Bldg.

BOSTON
90 Bedford St.

BRIDGEWELL
ONTARIO

PHILADELPHIA
1008 Drexel Bldg.

122
FEDERAL TELEPHONE & WIRELESS CO.

FEDERAL JR.
CRYSTAL RECEIVING SET
1921  S.P.  $25.00

INSIDE VIEW
FEDERAL 57 RECEIVER

FEDERAL 57 RECEIVER
SINGLE TUNED RECEIVER
1 STAGE R.F. DET. 2 STAGE
AUDIO 1922  S.P.  $98.00

FEDERAL 58 DX RECEIVER
DOUBLE TUNED RECEIVER
1 STAGE R.F. DET 2 STAGE
AUDIO. 1922  S.P.  $116.00

FEDERAL 60 RECEIVER
DOUBLE TUNED RECEIVER
2 STAGE R.F. DET. 2 STAGE
AUDIO 1923  S.P.  $135.00

FEDERAL 61 RECEIVER
3 STAGE R.F. DET. 2 STAGE
AUDIO 1923  $145.00
TRF-50
(as illustrated)
A 5-tube tuned radio frequency receiver with built-in Magnavox Reproducer unit which consumes no battery. Cabinet measures: height, 14¾ in.; length, 20½ in.; depth, 18¾ in.
Without tubes or batteries . . $150.00

TRF-5
This is identical with the above but encased in smaller cabinet without built-in Reproducer. Cabinet measures: height, 9½ in.; length, 20½ in.; depth, 14¾ in.
Without tubes, batteries or reproducer $125.00

MAGNAVOX
New Broadcast Receivers combining supreme efficiency, convenience and beauty

HERE at last is the perfected instrument permitting you to enjoy simultaneously the most desirable elements of broadcast reception.

Three decisive advantages go with the Magnavox: unequalled simplicity of control, reproduction of exceptional clearness—handsomely carved period cabinets.

Magnavox Radio Receivers, Vacuum Tubes, Reproducers, Power Amplifiers, and Combination Sets are sold by reliable dealers everywhere

THE MAGNAVOX CO., OAKLAND, CALIF.
New York: 350 W. 31st Street San Francisco: 274 Brannan Street
Canadian Distributors: Perkins Electric Limited, Toronto, Montreal, Winnipeg
RADIO BROADCAST RECEIVERS

DAY-FAN
5 TUBE T.R.F.
1924 S.P. $125.00

MAGNAVOX
TRF-5
TELOS VARIO-TRANSFORMERS
1924 S.P. $150.00

RADIODYNE
6 TUBE T.R.F.
USING 199 TUBES
1924 S.P. $150.00
WESTERN COIL CO.
BROADCAST RECEIVERS

THOROLA
5 TUBE T.R.F.
1924 $85.00

PREMIER RADIO MODEL 7A
5 TUBE REFLEX
3 STAGES OF R.F. CRYSTAL
DETECTOR 3 STAGES AUDIO
1924 $250.00

ELECTROLA
5 TUBE T.R.F.
1923 $90.00

PILOT SUPER WASP
SHORT WAVE RECEIVER
PLUG IN COILS 1928

126
EARLY RECEIVING SETS

PARAGON RA-6
ADAMS MORGAN
FIRST RECEIVER TO USE
ARMSTRONG REGENERATIVE
CIRCUIT. 1916 $35.00

GARROD TYPE RAF.
4 TUBE NEUTRODYNE
1923 S.P. $135.00

MURDOCK
5 TUBE NEUTRODYNE
1923 S.P. $100.00

MARCONIPHONE
MADE IN ENGLAND
1923
BROADCAST RECEIVERS

A-C DAYTON XL 5
5 TUBE T.R.F.
1924 $95.00

MAGNUTROL
5 TUBE T.R.F.
MAGNUS CO.
1924 $90.00

RADIO SERVICE LABS. R212
5 TUBE NEUTRODYNE
1924 $120.00

PACIFIC CLARATONE
5 TUBE T.R.F.
1925 $75.00
The STANDARD

View of FRONT PANEL

With Samson Radio Parts
THE PLEASURE IS ALL YOURS

SAMSON ELECTRIC COMPANY, CANTON,
Manufacturers of Quality Electrical Products Since 1882
Sales Representatives in Twenty Leading American Cities

129
KOLSTER
6 TUBE T.R.F.
GANGED TUNING
1926 S.P. $150.00
FEDERAL-BRANDES

KING
5 TUBE NEUTRODYNE
ONE DIAL TUNING
1926 $125.00

THREE CIRCUIT REGEN.
4 TUBES
1923 KIT 30.00

MOHAWK
5 TUBE T.R.F.
1924 S.P. $125.00
BROADCAST RECEIVERS

MELCO
4 TUBE ACMEDYNE
AMSCO PROD. INC.
1924 $125.00

STEWARD WARNER
MODEL 305
5 TUBE T.R.F.
1924 $120.00

STEWARD WARNER
MODEL 300
5 TUBE T.R.F.
1925 $75.00

SLEEPER SERENADER
5 TUBE T.R.F.
1925 $190.00
REGENERATIVE RECEIVERS 1924

ECHOPHONE MODEL 4
RADIO SHOP
LONG BEACH, CALIF.

ECHOPHONE MODEL A
RADIO SHOP
SUNNYVALE, CALIF.

ECHOPHONE MODEL J
SUNNYVALE, CALIF.
RADIO SHOP

ONE TUBE REGEN. RECEIVER

SIGNAL
SINGLE CIRCUIT REGEN.
ONE TUBE $25.00
BROADCAST RECEIVERS

KEMPER PORTABLE
K-52
1925 $90.00

TRAV-LER PORTABLE
5 TUBE
1925 $75.00

SOMERSET
5 TUBE T.R.F.
1924 $85.00

PARMAK 5 TUBE T.R.F.
1924 $85.00

HALES CALIFORNIAN
5 TUBE T.R.F.
1925 $80.00
KODEL—An astonishing new receiver that will make radio history

KODEL is the name of a circuit discovered by an independent experimenter. So wonderful is the KODEL circuit that it picks up stations 1,000 miles away, using only one tube, and no antenna, when conditions are right. Add tubes and you increase distance and volume until you succeed in covering 3,000 miles on the loud speaker. All this with only a single dial to turn!

If you travel—KODEL Portable. If you cannot erect an antenna—KODEL. If you want distance and quality—KODEL. If you want simplicity—KODEL. If your pocketbook is limited—KODEL. Even if you want results regardless of cost—KODEL.

See the KODEL line at your dealer's. If he cannot supply you, send us his name and address with check or money order and we will ship direct to you. Money returned if any KODEL set does not more than satisfy you.

ALL KODEL sets use the unique KODEL circuit and may be operated from either storage or dry batteries at will, and without an outdoor antenna if desired.

FREE. Write for instructive KODEL Catalogue, entitled "Radio for Every Purpose and Any Purse," FREE!

DEALERS: the KODEL is a sensation wherever introduced. Write for terms.

Kodel Manufacturing Company

Under same Management that made the Horn charger famous.

128 West Third Street  Cincinnati, Ohio
REMLER RECEIVER  
TYPE 400 COIL MOUNTING  
TYPE 300 DET. CONTROL PANEL.  1921  $22.00

KODEL C 11  
ONE OF THE LITTLEST  
ONE TUBE SETS MADE  
1924  S.P.  $10.00

C. D. TUSKA 225  
THREE TUBE REGEN.  
1922  $90.00

C. D. TUSKA 228  
SUPERDYNE  
1924  $120.00

C. D. TUSKA 224  
ONE TUBE REGEN.  
1922  $75.00

KELLOGG  
ONE TUBE REGEN.  
1922

135
Michigan hears Honolulu

"On Saturday night my Tuska and I picked up Station KGU, Honolulu Advertiser, and listened to them for an hour through my loud speaker. It was wonderful!"
BROADCAST RECEIVERS

BOSCH AMBOROLA
6 TUBE NEUTRODYNE
1924 $160.00
AMER. BOSCH CO.

SPLITDORF
5 TUBE T.R.F.
1924 $125.00

GAROD V
6 TUBE NEUTRODYNE
1923 $195.00
GAROD RADIO CORP.

HETRO-MAGNETIC
TYPE 5H
5 TUBE T.R.F.
1923 $140.00
SIDBENEL RADIO EQUIP.
BROADCAST RECEIVERS

GILFILLAN GN-3
NEUTRODYNE
1923 $75.00

GILFILLAN GN-2
5 TUBE NEUTRODYNE
1924 $135.00

GILFILLAN MODEL 10
5 TUBE NEUTRODYNE
1925 $125.00

SIX TUBE PORTABLE
1925 $65.00
BROADCAST RECEIVERS

WARE 3 TUBE NEUTRODYNE
1923  $72.00
TYPE T

FADA 175A
5 TUBE NEUTRODYNE
1923  $160.00
F. A. D. ANDRE CO.

MUSIC MASTER
TYPE 60
1924  $95.00

FRESHMAN MASTERPIECE
1923  $75.00
CHAS. FRESHMAN CO.
The Neutrodyne principle as applied to the FADA "One Sixty" has produced a radio receiver that is simplicity itself. Once the notations have been made of the dial settings of any stations, anyone can reset the dials in the given positions and listen to that station at will.

The pleasing design of the cabinet and its beautiful finish make it an ornament to any home. Its efficiency makes it a delight to all who listen. It is a receiver that you will be proud to own. See the FADA "One Sixty" at your dealer's. Price, exclusive of tubes, batteries and phones, $120.

F. A. D. ANDREA, INC., 1581 Jerome Ave., New York
ZN-ITH 3R
LONG DISTANCE RECEIVER
CHICAGO RADIO LABS.
1923  S.P.  $160.00

CONNETICUT TEL. & ELEC.
SODION NON-REGEN. DET.
2 STAGE AUDIO

FIVE TUBE RECEIVER
2 STAGE FIXED TUNED R.F.
REGEN. DET. 2 STAGE AUDIO
USING W. E. 215 AS
NORTHERN ELEC. CANADA

REZODON
PAUL G. NIEHOFF CO.
FIVE TUBE REGEN.
1921

MU-RAD MA 13
2 STAGE UNTUNED R.F.
DET. 2 STAGE AUDIO.
1922  S.P.  $125.00
"I am ready to obey thee as thy slave, and the slave of those who have that lamp in their hands."

MORE wonderful even than Aladdin’s Lamp is your perfect mastery of radio’s unlimited resources with the Mu-Rad MA-15 Receiver. Distance beyond imagination, sensitivity as quick as thought, itself, all with control that obeys your wishes easily and simply. Loud speaker reception, using only a two foot loop. The most highly developed circuit—two stages of audio and three stages of radio frequency amplification with detector.

RECEPTION CONSERVATIVELY GUARANTEED 1000 MILES

WRITE FOR ILLUSTRATED LITERATURE

Establishes a New Height in Radio

Mu-Rad Laboratories, Inc.
801 Fifth Ave. Asbury Park, New Jersey
FREED-EISMANN RADIO BROADCAST RECEIVERS

FREED-EISMANN
FE-15
5 TUBE T.R.F.
1924 $90.00

INSIDE VIEW
NR 5

FREED-EISMANN
NR-7
6 TUBE NEUTRODYNE
1924 $150.00

143
A. H. GREBE CO. RECEIVERS

GREBE CR-18
100 TO 200 METERS
ONE OF THE FIRST
10 METER RECEIVERS

GREBE RORK
2-STEP AMP.
$55.00

GREBE RORB
DETECTOR 2 STEP AMP.
$75.00

GREBE SYNCROPHASE M-1
5 TUBE T.R.F.
1925 $125.00
A. H. GREBE CO. RECEIVERS

GREBE CR-3
150 TO 680 M.
1920 $60.00

GREBE CR-6
THREE TUBE REGEN.
170 TO 680 M.
1919 $180.00

GREBE CR-5
ONE TUBE REGEN.
150 TO 3,000 M.
1921 $80.00

GREBE CR-9
THREE TUBE REGEN.
150 TO 3,000 M.
1921 $110.00

GREBE CR-8
ONE TUBE REGEN.
150 TO 1,000 M.
1921 $80.00

INSIDE VIEW CR-3
FOR the radio amateur and experimenter who is satisfied only when he knows that he possesses the very last word in radio receiving apparatus, there is but one answer: the short-wave regenerative receiver and two-stage amplifier, known as Type CR-6. This is one of the most popular receiving sets now in use, because of its remarkable completeness, efficiency, and ease of operation.

The electrical design of the CR-6 embodies the most suitable arrangement for high efficiency and smoothness of operating control, for the wave-lengths covered. The antenna circuit consists of an adjustable inductance in series with a variable capacity, giving a very wide range of settings. The secondary circuit comprises a coupling coil and a variometer, a combination...
BROADCAST RECEIVERS

DAVID GRIMES
INVERSE DULEV REFLEX
TYPE 4DL 4 TUBE
SAME AS 6 TUBE SET
1924 $160.00

CUTTING & WASHINGTON
11A 3 TUBE REGEN.
1922 $85.00

ARBORPHONE
5 TUBE T.R.F.
1923 $90.00
MACHINE SPEC. CO.

ERLA
5 TUBE T.R.F.
1924 $75.00

WURLITZER 5D
5 TUBE T.R.F.
1924 $85.00
EARLY RECEIVING SETS
REFLEX RECEIVERS

ERLA REFLEX

ACME REFLEX

NATIONAL BROWNING-DRAKE RECEIVER

HARKNESS REFLEX

149
RADIO BROADCAST RECEIVERS

STROMBERG-CARLSON
5 TUBE NEUTRODYNE
1924 SP $150.00

EAGLE NEUTRODYNE
BALANCED RECEIVER
1923 $135.00

HOWARD
6 TUBE NEUTRODYNE

FIVE TUBE NEUTRODYNE KIT
1924 $80.00
SUPERHETRODYNE SETS

In 1921 Major Armstrong invented the superheterodyne circuit; the heterodyne principal was not new, having been used in undamped wave wireless telegraphy. This was the ultimate in a receiver, for it gave better selectivity and had a low noise ratio. The front end of the superheterodyne used a loop antenna, an oscillator and a frequency changer or mixer. The intermediate frequencies were fixed at from 45 to 60 KC. A second detector and transformer-coupled audio stage followed. Initial problems with the “super” sets were bad radiation and two-spot tuning.

When RCA brought out their first superheterodyne sets in 1924 they used a revised circuit devised by Armstrong and Hauck which employed a second harmonic from the oscillator and cut down radiation. J. H. Pressley developed a circuit, the Autodyne, which combined the oscillator and mixer in one tube. This circuit used a tuned front end and increased the gain while at the same time prevented radiation.

The DeForest Utraden circuit and the super-regenerative circuit were actually transmitters, and a loop was used to prevent radiation.

LOOP ANTENNAS

The loop antenna was first used for direction finding, and is still thus employed. In the early broadcast era the loop was used where an elaborate antenna could not be erected, and to prevent radiation and cut out strong local stations. For home receivers loops were made from about 12 to 24 inches square; they were often made to fold for storage purposes. Eventually loops became smaller and were placed within the sets, as they are today.
LOOP ANTENNAS 1920s

AMPLIFEX WITH COMPASS
OPEN AND CLOSED
$12.00

LINCOLN LOOP
OPEN & CLOSED
$8.00

DUO-SPIRAL
$10.00
Low Ohm telephone receivers were the first used with radio receivers. The coherer was usually used with a tape printer. With the coming of self-restoring detectors it was found that receivers with higher Ohm-ratings were needed. Early 1,000 Ohm receivers usually appeared as a single unit, soon followed by double headsets. Some of the early makes were: Holtzer-Cabot, Brownies, Mesco, Brandies, Baldwin and Western Electric.

Murdock “55” receivers were sold by the thousands at $5.00; they were a good reliable unit. Brandies were popular at $10.00. Baldwin headsets were made with mica diaphragms and gave more volume than others; the makers claimed they were equal to an extra stage of audio amplification, and sold for $16.50.

During the 1920s other common makes were: Kellogg, Frost, Kennedy, Stromberg-Carlson, Federal and Red Head.
Equal to two stages of radio amplification

THE experience of leading radio operators—who have found Baldy Phones "equal to two stages of radio amplification"—clearly indicates the outstanding advantages of using good phones. From a standpoint of radio efficiency, you will get "more value per dollar" from your investment in Baldwin Amplifying Phones than from any other item of your equipment.

Here are the actual (un-asked-for) letters from experienced radio men, telling of their results with Baldys. They're worth careful reading!

"Have used a pair of Type 'C' Baldys for some time, in naval communication and commercial service. Consider them the most sensitive telephone on the market." (Name on request.)

"I faithfully believe the use of Baldwin Phones will improve any receiving set at least 50%." (Name on request.)

"I have found your Baldwin Telephones equal to one and two stages of radio amplification." (Name on request.)

"In our station it is a common occurrence to place the receivers (Baldys) on the table and copy in daylight the long undeciphered wave stations with but one V.T." (Name on request.)

"Equal to one and two stages of radio amplification": Of course Baldys cost more—but where can you get better value? Where else can you buy amplification equal to the super-sensitive Baldwin mechanism for so little?

And the more limited your investment in radio must be, that much more important becomes the use of a super-sensitive and selective Baldwin head set!

The best radio dealer in your town undoubtedly has a supply of booklets explaining the superior construction of Baldwin Phones, Eldredge Meters, and other Firth Specialties. If he does lack a supply, write, mentioning his name and address, direct to

JOHN FIRTH & CO., Inc., 18 Broadway, New York

Distributors for
Baldwin Phones U. S. Bureau of Standards
Eldredge Meters Wavemeter
Kolster Decremeter Brownie Adjustable Phones

Dealers: Write for advance information on new popular-priced loud speaker

BALDY PHONES

155
THE PRICES ARE REMARKABLY LOW
THE QUALITY IS UNUSUALLY HIGH

MURDOCK
No. 55

REAL RADIO RECEIVERS
capable of record reception of signals when used with sensitive detecting apparatus. From the time of their introduction seven years ago to the present, they have earned a deserved reputation for unusual sensitiveness and long-lived dependability. The thousands of sets now in everyday service all over the world are evidences of the esteem which they have won. The unprecedented present demand for "MURDOCK 55'S" is conclusive proof that their wonderful value cannot be duplicated anywhere.
RADIO & WIRELESS HEADSETS

KENNEDY
$6.00

FROST
$5.00

EISEMANN
$3.50

BRANDES SUPERIOR
ABOUT 1916
$7.00

WATCH CASE RECEIVER
75 OHMS
ABOUT 1914
$.60

SAMPSON WATCH CASE Receiver
HAND MADE PHONE TIPS
ABOUT 1912
HEAD PHONES

MESCO HEADSET
MANHATTAN ELEC. SUPPLY
SP $6.50  1916

KILBOURNE & CLARK
HEAD SET
1919

WESTERN ELECTRIC
HEAD SET
1500 OHM.  191B

KELLOGG HEADSET 2400 OHM
SP $12.00  1921

DEFOREST LOUD SPEAKER
1922
By 1921 one-tube and crystal sets were thought to be not loud enough for the whole family. Crystal sets could be amplified without tubes by use of an amplifier consisting of a receiver directly coupled to a carbon mike, the output of which would operate a loudspeaker.

The audio, or tube amplifier, developed by W. H. Priess and L. L. Israel of Wireless Specialties Co. in 1917 was in use after the war. In 1919 the Federal Tel. & Tel. Co. put on the market the famous 226W transformer, the first to be offered to the amateur and experimenter. Before this time two tube amplifiers were available in complete form at about $65.00 with tubes. By 1924 there were many transformers on the market with step-up ratios of 1:2 to 1:12, all claiming to be the best. By this date the technique of biasing the amplifier tube was in use, this not only saving the "B" battery but improving the quality.

The cheapest way to build an amplifier was to use the simple Loftin-White circuit, which with proper bias worked well. Two stages of transformer-coupled audio were all that could be used unless they were cascaded by using 45 V. on the first stage and 90 V. on the second and 135 V. on the third and biasing each stage correctly. The resistance-coupled amplifier next came on the market and was a decided improvement.

Radio frequency transformers came in use about 1922; both air and iron core were made, and tuned from 200 to 600 meters. Iron core I.F. transformers came in ranges from 45 KC to 75 KC and were used for long wave R.F. and I.F. in superheterodyne sets. The radio frequency transformer made possible the use of a loop antenna and stopped radiation from a regenerative receiver.
AMPLIFIERS USED IN THE 1920s

ALLEN BRADLEY
3 STAGE RES. COUP.
WITH TUBES $26.00

SONOTRON AUDIO AMP.
3 STAGE RES. COUP.
WITH TUBES $21.00

DAVEN AUDIO AMP.
RES. COUPLED
WITH TUBES $24.00

MUTER
RES. COUP. AUDIO
AMPLIFIER
WITH TUBES $21.00

SAMPSON

RADIO INST. CO.
R.F. AMPLIFIER
USING MEYERS TUBES
Recommended for Super-Autodyne!

The “Super-Autodyne” receiver described in this issue of the Citizens’ Radio Call Book has been tested and approved by leading authorities everywhere. It has been endorsed by such prominent publications as “Radio Broadcast,” “Radio Age,” “Radio Engineering,” “On the Air,” “Radio,” “Christian Science Monitor,” and others.

In every instance the remarkable results attained by fans who have built this unique six-tube receiver have been attributed to the use of Silver-Marshall parts, including the new silver-plated Straight-line-wavelength condensers, the bakelite cased intermediate transformers, and the S-M Coupling Unit. Such wholehearted approval can be merited only by actual performance.

SILVER—MARSHALL, Inc.
110C So. Wabash Ave. Chicago, Ill.
EARLY TRANSFORMERS

BRITISH INTERVALVE AMPLIFYING TRANSFORMER 1919

FEDERAL 226 W 3 TO 1 1918 $7.00

DEFOREST TYPE A200 1919 $7.50

DEFOREST 3 TO 1 $6.00

NA-ALD TRU-PHONIC $5.00

FEDERAL 65

HEDGE HOG 3 TO 1 $3.00

DAVEN RESISTOR COUPLED AMPLIFIER UNIT $3.00

PACENT TYPE 25 4 TO 1 $4.50
EARLY TRANSFORMERS

ACME
LONG WAVE 30 KC
INTERMEDIATE TRANS. $5.00

RCA UV 1714
LONG WAVE 200 TO 5000 METERS
MADE BY GENERAL ELEC. $6.00

ATWATER KENT LR.
RADIO FREQ.
150 TO 500 METERS $5.00

RECEPTRAD
INTERMEDIATE FREQ.
25,000 METERS $5.00

REMLER 600
INTERMEDIATE FREQ.
100 TO 15 KC $6.00

REMLER 610
INTERMEDIATE FREQ.
40 TO 50 KC $6.00

SILVER MARSHALL
TYPE 211
LONG WAVE 50 TO 70 KC
AIR CORE $6.00

ERLA
REFLEX 1
200 TO 700 METERS $5.00

ERLA
SELECTOFORMER
200 TO 700 METERS

ERLA
REFLEX 2
200 TO 700 METERS $5.00

ERLA
REFLEX 1 TUBE SOCKET MOUNTING
200 TO 700 M $5.00

165
EARLY TRANSFORMERS

RAULAND
ALL AMERICAN LONG WAVE
IRON CORE 30 TO 75 KC
$6.00

ARMY SALES
LONG WAVE IRON CORE

GENERAL RADIO
TYPE 271
LONG WAVE 30 KC
$5.00

DX 1 C3
RADIO FREQUENCY
170 TO 450 METERS
RADIO INST. CO. $6.00

FEDERAL NO. 30
RADIO FREQUENCY
275 TO 600 METERS
1921 $6.00

ACME R2
200 TO 700 METERS
RADIO FREQUENCY
$5.00

MURAD T11
RADIO FREQUENCY
150 TO 500 METERS
$5.00

DUBILIER DURATRAN
RADIO FREQUENCY
225 TO 550 METERS
EARLY TRANSFORMERS

FADA
3 TO 1
$6.00

SPLITDORF
3½ TO 1
$6.00

CHELSEA
3½ TO 1
$6.50

PEERLESS
4½ TO 1
$6.00

RAULAND 21
ALL AMERICAN
5 TO 1
$4.75

SAMPSON
3 TO 1
$5.00

JEFFERSON CONCERT
3 TO 1
$7.00

THORDARSON
6 TO 1
$4.50
Thordarsons are Absolutely Uniform!
They always "match up" perfectly

One reason that leading builders of fine sets use more Thordarsons than all competitive transformers combined is because Thordarsons run absolutely alike, absolutely uniform; always "match up" perfectly; always amplify evenly.

The following statement was made recently by a prominent set maker (name on request): "Any radio manufacturer who is sincerely desirous of producing an instrument of the volume necessary and of a tone superior to anything else on the market, must be absolutely forced to use Thordarson transformers sooner or later." Follow the lead of the leaders—build or replace with Thordarsons. They are unconditionally guaranteed. Any store can supply you. If dealer is sold out, order from us.

Thordarson Types and Prices
Thordarson Radio Transformers include: Audio Frequency (sub-panel or top mounting types) 2:1, $5; 3½:1, $4; 6:1, $4.50. Interstage Power Amplifying, $8 each. Power Amplifying, pair $13. Autoformers, $5 each. All Thordarson Products are unconditionally guaranteed. Dealers everywhere. We ship direct upon receipt of price if dealer cannot supply.

Standard on the finest
Thordarson Super Amplifying Transformers

Thordarson Electric Manufacturing Co., Chicago, U.S.A.

WORLD'S OLDEST AND LARGEST EXCLUSIVE TRANSFORMER MAKERS

Chicago, U.S.A.
# Early Transformers

<table>
<thead>
<tr>
<th>Brand</th>
<th>Model</th>
<th>Ratio</th>
<th>Description</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACME A2</td>
<td>4.25:1 Ratio</td>
<td></td>
<td>1922 S.P.</td>
<td>$5.00</td>
</tr>
<tr>
<td>ACME A 5</td>
<td>12 Ratios</td>
<td>2½:1 11.5:1</td>
<td>Made by G.E.</td>
<td>$7.00</td>
</tr>
<tr>
<td>GENERAL RADIO</td>
<td>Type 231 A</td>
<td></td>
<td></td>
<td>$6.00</td>
</tr>
<tr>
<td>GENERAL RADIO</td>
<td>Type 361</td>
<td></td>
<td></td>
<td>$7.00</td>
</tr>
<tr>
<td>RADIO CORPORATION</td>
<td>UV 712</td>
<td></td>
<td>Made by G.E.</td>
<td>$6.50</td>
</tr>
<tr>
<td>ATWATER KENT</td>
<td>3 To 1</td>
<td></td>
<td></td>
<td>$6.50</td>
</tr>
<tr>
<td>AMERTRAN 41</td>
<td>5 To 1</td>
<td></td>
<td></td>
<td>$4.75</td>
</tr>
<tr>
<td>PRECISE 450</td>
<td>3½ To 1</td>
<td></td>
<td></td>
<td>$6.50</td>
</tr>
</tbody>
</table>
STROMBERG CARLSON SPEAKER FILTER
#10A

STROMBERG CARLSON
3½ TO 1
$4.50

DONGAR
2 TO 1
$4.50

ERLA
3½ TO 1
$5.00
EARLY TRANSFORMERS

KELLOGG
3 TO 1
$5.00

CHASLYN 41
4 TO 1
$6.00

JEFFERSON STAR
6 TO 1
$3.75

REPUBLIC
2 TO 1
$5.00

KARAS
TYPE 26
$6.00

STERLING
3 TO 1
$5.00

KARAS HARMONIC
$7.00

KELFORD
3 TO 1
$5.00
EARLY TRANSFORMERS

JEFFERSON #150
LONG WAVE
$5.00

BRANSTON R 91
INTERMEDIATE FREQ.
$6.00

RAULAND R 10
ALL AMERICAN
150 TO 550 METERS
$4.50

SANGAMO TYPE 60
LONG WAVE IRON CORE
$5.00

SAMPSON HW-R1
INTERMEDIATE FREQ.
5000 METERS $6.00

FORD
RADIO FREQUENCY
180 TO 575 METERS
MOORE & MARMADUKE
LOUDSPEAKERS

By 1921 the broadcasting stations were increasing in number and the radio receiver was entering the home everywhere; kits and parts were easily available. One tube sets and crystal sets were most common, and to allow the whole family to hear the headset was often put in a wooden bowl or cardboard box to increase the volume. The first loudspeakers were horns with arms to accept the standard headset receiver.

Magnavox brought out a speaker with a six volt field which gave much better volume, and units appeared that enabled the homeowner to use his phonograph horn as a loudspeaker. Broadcast stations were then transmitting signals that were heard as 200 to 2500 cycles/sec audio, so speakers did not need to be elaborate; when broadcast quality became better so did the loudspeakers. They were commonly made of pulp, hard rubber and wood. By 1924 wooden box and cone speakers were in use.

Western Electric came out with their cone speakers in three sizes: 18", 24" and a 36" that hung on the wall. Prices ran from $35.00 up to $60.00. The Baldwin unit was used in many of the speakers; the same firm made a unit designed to attach to the sounding board of a piano. Baldwin also made their own horn speaker.

Magnetic speakers soon appeared, and were able to handle more audio and take higher plate voltages. 1926 brought the RCA 104 dynamic with voice coil; these were tops in their day.
LOUD SPEAKERS

ATWATER KENT TYPE-H
1924 $22.50

ARKAY
MADE FROM AUTO HORN
1921 $5.00

BRANDES TABLE TALKER
1924 $15.00

UTHA
1924 $18.00

THOROLA JR.
1924 $25.00

Vocarola Loud Speaker
1922 30.00

MANHATTAN
1924 $15.00
LOUD SPEAKERS

TRUTONE
1922 $15.00

MADERA CLEAR-TONE
1923 $17.50

SADLER
1922 $8.00

FEDERAL PLEIOPHONE
1921 $14.00

DICTOGRAPH
1921

WESTERN ELECTRIC SHAWPHONE
1922 $10.00

WESTERN ELECTRIC
1921 $30.00
What matters bad weather when Radio entertains?

Radio's "every-hour-every-where" broadcast schedule is the most stupendous organization of the means of entertainment the world has ever witnessed.

The Magnavox Co., Oakland, California
New York: 370 Seventh Avenue

MAGNAVOX
Radio
The Reproducer Supreme
MAGNAVOX LOUD SPEAKERS

MAGNAVOX R-3
1924 S.P. $35.00

MAGNAVOX TELEMEGAFONE
PUBLIC ADDRESS SET
1920 S.P. $150.00

MAGNAVOX TELEMEGAFONE
TS-2 1921 18" BELL
$93.00

MAGNAVOX 1923
14" BELL $45.00

MAGNAVOX M-4
1924 $25.00
BALDWIN 1924 $30.00

THOMPSON 1924 $35.00

ROLA 1923 $25.00

DICTOGRAPH 1922 $20.00

CHANSON REPRODUCER 1925 $25.00
LOUD SPEAKERS

ATWATER KENT
1926 $20.00

ATWATER KENT
1927 $25.00

CROSLEY DYNACONE
1927 $22.50

THOROLA
1927 $25.00

OVENSHIRE
1925 $32.50

THOROLA
1927 $30.00

STROMBERG-CARLSON
24" FLOOR MODEL
1927 $65.00

WESTERN ELECTRIC
24" 1927
RADIO CORPORATION OF AMERICA
LOUD SPEAKERS

RADIOLA 100
1925 $35.00

RADIOLA 100A
1926 $30.00

RADIOLA 103
1927 $35.00

RADIOLA UZ-1320
1923 $36.50

RADIOLA UZ-1325
1923 $25.00
LOUD SPEAKERS

ACME DOUBLE CONE
1926  $35.00

MAGNAVOX CM-4

LOUD SPEAKER UNITS' PHONOGRAPH ATTACHMENTS 1922 TO 1926
Potentiometers came into use in the earliest wireless days. They were used with electrolytic detectors and carborundum and other mineral detectors. They came back in use again during the 1920s as "loosers" or a means of preventing regeneration in R.F. amplifiers, also as bias controls in the reflex sets.

In 1908 rheostats were used to control filament voltage; they had naturally been in use for many years in other fields. Most common early radio rheostat was a coil of resistance wire mounted on a porcelain base, and they were sometimes mounted on the outside of the set's panel. By 1917 rheostats were made in a variety of ohm-ratings as required by the tubes used.

Regenerative detectors using soft tubes needed a fine adjustment on the filament; rheostats for the purpose were made with double shafts, the center control knob operating on just one turn of resistance wire. The smoothest, which would vary the emf by a fraction of a volt, were made of carbon discs or powder; resistance was secured by compressing the carbon. The Bradleystat was made for small transmitting tubes.

When it was found that the filament voltage on amplifier tubes was not too critical fixed resistors were used; some were just small wire-wound ones to be put on the tube socket, others were made to fit in a holder like a fuse. They came in different values for different tubes, some incorporating a fuse to protect the filament from burning out.
RHEOSTATS AND POTENTIOMETERS

STERLING 50 OHM RHEO.

BRADLEYSTAT GRAPHITE CONTROL

FEDERAL 18 RHEOSTAT

YAXLEY PONT. 40 OHM

DE JUR 20 OHM RHEO.

HOWARD RHEO WITH VERNIER

FILKOSTAT SMOOTH CONTROL

RHEOSTAT PARKEN 1914

POTENTIOMETER GRAPHITE ABOUT 1914
RHEOSTATS AND POTENTIOMETERS

Wireless Shop
Los Angeles
Power Rheo.

Electrad
Potentiometer

Vernier Control
No. 24

General Radio
#216 Rheo.

Clarostat
Uni. Control

Amsco
Potentiometer

Framingham
300 Ohm Potentiometer

Cantar
Jr. Rheo.

Potentiometer
Graphite
About 1916

Bunnell
Rheo. About
1916
RHEOSTATS AND POTENTIOMETERS

FROST GEM RHEO.
6 OHM

YAXLEY 6 OHM RHEOSTAT

DeFOREST 20 OH RHEO.

FADA 120A RHEO.

AMSCO POTEN. RHEOSTAT
ADAMS MORGAN

MURDOCE MODEL 560 RHEOSTAT

GENERAL RADIO 301 POTEN.
200 OHM

JENKINS VERNIER RHEO.

RCA 536 POTENTIOMETER

RCA 539 POWER RHEO.

185
MICROPHONES

Telephones were used as microphones in the early days, but the single button carbon unit was not good enough for music and singing. The simple carbon mike operated by variations of pressure on the carbon granules, varying the current. A double-button carbon mike was designed that still gave a carbon “hiss” and had to be mounted on springs to prevent vibration, but this did produce a somewhat better response.

The condenser microphone was then developed, operating on the principal that varying the space in a small condenser altered the voltage pressure. Condenser mikes used gold plated backs with Dural diaphragms; nitrogen gas was sealed in the unit. These had a low output and were subject to heat and cold; they required a preamplifier. There were many circuit problems, but frequency response was excellent, 40 to 10,000 CPS. They were made by Western Electric, Remler, American and others.

Velocity or ribbon microphones were developed, and proved to be unaffected by temperature changes and hum from R.F. fields. They required a preamplifier and an output transformer to match the amplifier input, but had good frequency response. They were bad for close-up talking. They operated on the principal that a moving conductor in a magnetic field induces a current in the conductor.

Crystal mikes appeared in two types: the grill and diaphragm. They functioned on the piezoelectric properties of Rochelle salts; i.e., when a dielectric material in a condenser changes its density the capacity change generates an A.C. voltage. Crystal mikes have excellent response, second only to the diaphragm type. They did not need a preamplifier, and up to 100 feet of mike cable could be used. Only drawback was high temperatures that destroyed the crystals.

Universal “Baby” microphone.
MICROPHONES USED IN THE 1920s

- American Condenser Mike with Pre-Amp.
  
  $100.00

- Western Electric Single Button with Stand

- Universal Single Button with Stand

- Magnavox Loud Speaking Transmitter

- Western Electric Double Button with Case

- American Double Button

- Universal Baby Mike

- Western Electric Hand Microphone
SOCKETS AND ADAPTORs

Tube sockets were used from about 1910; first types were the screw base and the Ediswan. Then came the candelabra for the early DeForest tubes. Western Electric made a cast brass socket for their first tubes. Then came molded and porcelain sockets with metal barrels. The hard detector tubes and the 190 tubes were very microphonic so a vibration proof socket was made for them.

The WD-11 tube required a special socket so that it could not be plugged into any other socket; it had a one volt filament. Transmitting sockets were much heavier and well insulated. The Radiotron 204 used a special socket as did the W.E.-212D; another special socket allowed the use of either the VT-2 or 216A tubes.

Adaptors became necessary as more tubes came on the market; the most common were used to change from storage battery to dry cell tubes. For a number of years an endless variety of adaptors appeared on the market.

Two gang Fada.

Silver contact, General Instrument Co.

Candelabra socket, DeForest audion tube.
SOCKETS AND ADAPTERS

PILOT
SHOCK ABSORBER
01A $1.00

BENJAMIN
SHOCK ABSORBER
01A $1.00

PAGENT 199
NO. 80
$0.75

FRONT
01A $0.50

BENJAMIN
SHOCK ABSORBER
199 $1.00

DEFARETE
RADIOTRON
ADAPTOR FOR ADAPTOR TO STD
DV3A TO 01A SOCKET 1917

DEFARETE
ADAPTOR FOR ROUND SOCKET FOR ROUND ADAPTOR TO 01A AUDION 1913

MEYERS TUBE
WD 11
ADAPTOR TO 01A SOCKET 1923

PILOT
01A SOCKET

NA-ALD
UX TYPE TO UV

RCA UR 556
UX TYPE TO UV
SOCKETS AND ADAPTERS

MIRRA
METAL SHELL
$1.25

CROSLEY
PANEL MOUNT
$.60

CROSLEY
CERAMIC PANEL MOUNT
$1.00

SE-AR-DE
PANEL MOUNT
$1.00

FADA
TWO GANG
$1.75

NA-ALD
199 TO 01A
$.75

NA-ALD
199 TO 120
POWER TUBE $1.25

KELLOGG
01A TYPE BELL
$1.00 199 $.75

PACENT
199 TO 01A
$.60

ADAPTER
WESTERN ELECTRIC 216A TO UX01A TYPE

LYNCH
MODEL RF TWO TUBE $1.50

190
SOCKETS AND ADAPTERS

BIRNBACH
TRANSMITTING

50 WATT
TRANS FOR 203

GENERAL ELECTRIC
50 WATT

FLEWELLING
5 WATT
$1.00

RADIO ELEC. LAB.
250 WATT 204
$2.00

GENERAL INSTR.
CORP.
SILVER CONTACTS

RCA UR 542
5 WATT TRANS.
$1.00

R. E. L.
50 WATT TRANS.
$2.00

E. T. L.
50 WATT TRANS.
MADE IN LOS ANGELES
SOCKETS AND ADAPTERS

NA-ALD SHOCK PROOF
199 TYPE $1.00

BREMER-TULLY SELF LOCKING
01A TYPE $1.00

ERLA METAL SHELL
199 $1.00

KELFORD
01A TYPE ABSORBER
$1.00

GILFILLAN
METAL SHELL
01A TYPE $1.25

BESTFORM
METAL SHELL
01A TYPE $1.25

NA-ALD
METAL SHELL
01A TYPE $1.25

GENERAL RADIO
PILOT SHOCK ABSORBER
TYPE 349 $0.75

ATWATER KENT
WD 11 SOCKET $1.25

SILVER MARSHALL
01A TYPE 511 $0.60

SILVER MARSHALL
01A TYPE
SOCKETS AND ADAPTERS

MAZDA RADIO
SPC. CONTACTS
$1.00

DEFOREST
STD. BASE AUDION
$1.00

BENZAMIN
TYPE B646
$1.00

COLIN B. KENNEDY
SPC. MOUNTING
1920  $1.00

FEDERAL
01A TYPE
$1.25

PARAGON 01A
ADAMS MORGAN
1919  $1.25

GENERAL RADIO
TYPE 156
$.75

KK
01A TYPE
$.75

PILOT
01A TYPE
$.75

WESTERN ELECTRIC
FOR 215 A "N"
1919  $1.00

EBY
01A TYPE
$.70

REMLER
TYPE 399
199  $1.00

REMLER
TYPE 50
01A  $.75
Among interesting early batteries used in wireless were liquid cells. The Lalande cell used caustic soda for the electrolyte with plates of cupric oxide and zinc. The michromate, or punger, battery used an acid solution and two carbon plates with a zinc plate that was plunged into the solution to put the cells into use.

When the storage battery entered the home the problem of its proper care was not understood. The batteries spilled acid, ate holes in the rug, the terminals corroded and reception became noisy, the fumes gave the home a bad odor. Storage batteries were expensive and needed frequent recharging; battery charging stations in many cities would pick up a battery and recharge it for a dollar or leave a rental battery for 25c a day.

The "B" dry batteries were also expensive, a 90 volt set costing $10.00 and lasting about three months; a five tube set usually cost about $5.00 a month for upkeek. When "C" batteries appeared the "B" battery's life was more than doubled and the "C" lasted a year. Wet "B" batteries became available at some cost, but cut the cost of receiver operation. The Edison wet cells were best as they used a potash solution and were easy to recharge.

Those who could spend up to $125.00 for an "A" and "B" eliminator had the problem solved; all that was needed was a little water and care. The "A" eliminator was a wet storage battery with a trickle charger that operated when the battery wasn't in use. The dry "B" eliminator used a Raytheon cold cathode rectifier and produced $22\frac{1}{2}, 45$ and 135 volts with no attention needed.
BATTERIES 1920s

EDISON B BATTERIES & CHARGER
1924 $42.00

BICHROMATE BATTERY
PLUNGER TYPE
ABOUT 1900

WET B AND A
BAT. CELLS
1920s

BATTERY CONDITION
TESTER

HYDROMETER
Tungar Battery Charger—keeps your battery at home. Also, with simple attachment, charges "B" storage batteries.

No Need of Doing This

Is yours a tube set?

Yes? Then you have a storage battery which frequently requires recharging.

Do you carry it to a charging station, wait three or four days, pay from 75 cents to a couple of dollars and then lug it home again? You don't need to.

A Tungar Battery Charger enables you to recharge your storage batteries for either radio or automobile use right at home—easily, quickly and at little expense. It operates from any a-c. lighting circuit.

Any one can operate a Tungar. Once started, it requires no attention; nor is there the slightest danger of injuring the battery.

The initial cost is low; the operating cost is little. Send for our new booklet on Tungar for radio, if your dealer cannot supply you. Address Merchandise Dept., General Electric Company, Bridgeport, Conn.

March, 1923

General Electric Company

General Office
Schenectady, N.Y.

Sales Offices in
all large cities
"A" AND "B" ELIMINATORS
BATTERY CHARGERS

ATWATER KENT
"A" AND "B" ELIMINATOR

MARATHON
"B" ELIMINATOR

YAXLEY AUTOMATIC
CHARGER CONTROL

SILVER MARSHALL
"B" ELIMINATOR

TODD "B" BATTERY
CHARGER

TWIN-BULB
BATTERY CHARGER
WATCH CASE BATTERY METERS
1915 TO 1920

METERS
1920 TO 1925
About 1915, with the Armstrong circuit in use, radio receiver manufacturers began to change from single pieces of equipment hooked together on a board to sets built in a cabinet. Good variable condensers were on the market, which brought a need for dials.

Early ones were made of hard rubber, Bakelite and metal and were usually graduated from 0 to 100. Dials made logging stations easy, and naturally facilitated tuning. As the number of stations increased finer tuning was necessary, so vernier dials were produced. Some used gears; others friction drive. Some variable condensers used a double knob, with the center knob tuning a single plate for fine tuning.

By 1925, with the three-dial set the most common, ganging the condensers was standard to make tuning easier. This brought about dials placed behind the panel, as they still are today.
 Preferred by Radio Experts

Commercial operators, men who know tuning efficiency, use Accuratune Micrometer Controls.

L. M. Cockaday, Arthur Lynch, R. E. Lacault, technical editors of the three leading radio publications, use and recommend Accuratunes for best tuning results to their thousands of readers.

Accuratunes are actual Micrometer Controls, geared 80 to 1 ratio for infinite tuning precision. More efficient than built-in verniers or any other tuning device. An absolute necessity on Super-Heterodynes and other Receivers requiring unusually close tuning.

Accuratune Micrometer Controls give you greater distance, greater selectivity, greater volume. Well worth their price of $3.50.

At your dealers, otherwise send purchase price and you will be supplied postpaid. 1923

Accuratune
Micrometer Controls

Pioneer
Manufacturers of quality vernier devices

Radio Ltd.,
Montreal,
Canadian
Representatives

MYDAR RADIO CO., 9-D CAMPBELL ST., NEWARK, N. J
DIALS

GISCHOW
$3.50

ACCURATUNE
$3.50

NATIONAL
$1.75

UNIVERNER
$3.00

MARCO
$0.75

APEX
$1.50

REL
$1.50

201
DIALS

BUTLER $1.50

VISCO. $.50

ATWATER KENT $1.00

KING $.90

GILFILLAN BROS. 2.50

GEN. RADIO $1.50

FADA $1.00

ALLEN DIAL VERNIER $1.50

ALLEN DIAL VERNIER
Eliminates All Body Capacity
PATENT PENDING

203
PARTS KITS AND SERVICING

In 1905 the E. I. Company put transmitter and receiver parts on the open market. When receivers became fairly common in homes across the country many parts were offered to improve the set. Antenna eliminators designed to plug into the A.C. outlet, howl eliminators (metal caps for the tubes), variable grid leaks and condensers, phone plugs, vernier dial tuners to eliminate hand capacity effect, wave traps and lightning arrestors were all offered the home set owner.

An item that sold by the thousands was the "hum eliminator" which made possible the use of A.C. on D.C. filaments; it was a center-tapped 20 ohm resistor to hook across the filaments, with the center tap grounded. Phone jacks incorporating a switch to shut off the radio's stage not in use were sold. Vibration proof sockets were offered as replacements for the original. Many varieties of outdoor antenna kits were offered at about $5.00.

When superheterodyne sets and "A" and "B" battery eliminators entered the home the occasional services of a trained repairman were needed. Storekeepers who sold the sets commonly did this up to about 1924. Among devices developed to serve the need were fast tube rejuvenators to bring back filament emission, tube testers and more accurate measuring meters. When A.C. sets came on the market in about 1928 the many receiver kits disappeared, and the role of the modern serviceman began.

Hum eliminators.
Watchcase voltmeter.
GRID LEAKS AND RESISTORS
FIXED CONDENSERS
1916 TO 1925

ADJUSTABLE GRID LEAKS

BRETTWOOD

CUTLER HAMMER

PENCIL MARK GRID LEAK

206
RADIO FREQUENCY CHOKES

NEUTRALIZING CONDENSORS

AERIAL ELIMINATORS

LINE REGULATORS

NOISE ELIMINATORS

LIGHTNING ARRESTERS
RADIO KITS

NATIONAL
BROWNING DRAKE KIT
1 STAGE R.F. REGEN.
DET. 2 STAGE AUDIO
1925 S.P. $22.00

BRANSTON
SUPER KIT
1924 S.P. $36.50

BREMER-TULLY
6 TUBE KIT
1925 S.P. $38.00

SAMSON
SUPER KIT
1925 S.P. $30.00
TEST EQUIPMENT USED IN THE 1920s

SYLVANIA TUBE TESTER

WESTON MODEL 802 TEST OSCILLATOR

VAN HORNE TUBE TESTER

HICKOCK TUBE TESTER

ELECTRON 5 INCH ELECTRON OSCILLOGRAPH GENERAL RADIO

BURTON TUBE TESTER
TUBE AND SET TESTERS USED IN THE 1920s

STERLING TUBE TESTER
$25.00

STERLING TUBE REACTIVATOR
$5.00

HEMCO TUBE VITALIZER
$5.00

JEFFERSON TUBE REJUVINATOR
$5.00

PEERLESS KONDENSOR TEST KIT
$10.00

STERLING TUBE AND SET TESTER $35.00
The principle of television was discovered in 1884 by Paul Nipkow who developed the Nipkow Scanning Disc. By 1928 scanning-disc TV was out of the laboratory. By 1932, Don Lee's W6XAO, at 7th and Bixel in Los Angeles and W2XF operated by RCA and broadcasting from Al Smith's Empire State Building were on the air with programming. By 1937 both Los Angeles and New York residents could receive transmissions on cathode ray tube reproducers. RCA, Gilfillan and others had console sets on the market. Meissner and Farnsworth were marketing kits. The DuMont Company, a pioneer in developing the VonArdenne C.R. tube had a 9" tube made by the Corning Glass Co. In 1940 RCA offered the 1" Iconoscope for amateur radio TV transmitters. Television started into full swing in 1946 with 3", 5", 7" and 10" receivers available to the public.

**COMPLETE SCANNING DISC TELEVISION KIT — 1928**

- 36-aperture scanning disc
- Daven television Lamp — 1½ sq. in picture
- 1700 rpm motor for disc
- Synchronizer control
- Daven resistance coupled television amplifier
- Television coil kit for receiver
LOOSE COUPLER CIRCUIT

TWO-SLIDE TUNER CIRCUIT

SPARK COIL TRANSMITTER

SPARK TRANSMITTER WITH ROTARY GAP

TUBE TRANSMITTER, GRID MODULATION
FLEMING VALVE CIRCUIT

UNDAMPED WAVE CIRCUIT USING TIKKER.

LONG WAVE CIRCUIT

HONEYCOMB COIL RECEIVER

CIRCUIT USING OSCILLATOR TUBE
FOR UNDAMPED WAVES
RADIO TELEPHONE BROADCASTING PROGRAM
New York City District
SUN., FEB. 18th, TO SUN., FEB. 19th, 1932

THURSDAY (continued)
Ex-President of the Newark Rotary Club. Also a rotary song by Andrew Krearch.
8:00 P. M.—Classical music.
9:20 P. M.—A program of songs by Janet Bush-Hecht, contralto soloist, First Congregational Church, Montclair, N. J., and a prize winner in a Newark Music Festival Contest. The program includes "In Flanders Fields", "Would You", "Bubbles", and "Joyous Youth", composition of Mabelanor Corby, who will be the accompanist for these and other selections. Courtesy, Aeolian Company.

Friday
7:00—"Man-in-the-Moon" stories for children.
8:15 P. M.—"Party Night," when several well-known artists of vaudeville and the musical comedy stage will entertain with songs and monologues.

Saturday
7:00 P. M.—Irv Pages Cornell Orchestra, Cornell University, composed of the following: Irv Page, banjo; Geo. Cox, banjo; Lyman Breese, banjo; Sam Bird, traps and drums; Jack Wallace, saxophone; and Paul Miller, cornet, banjo and violin.
7:45 P. M.—"Fashion Talks to Women", Marjorie Wells, N. Y. World.
8:00 P. M. — The "Daily Dozen" exercises address, by Walter Camp, foremost authority in American athletics.
8:30 P. M.—Dance Music by the Fernwood Dance Orchestra of Newark, N. J.
9:30 P. M.—Popular and character songs by Aileen Stanley, soprano, well-known in vaudeville circles.
9:45 P. M.—"Hello Prosperity", "Don't Leave Me Mammy", etc., by Max Hiltig, dramatic tenor, known from Coast to Coast.

DuO Art Piano Recital.

Sunday
8:30 P. M.—Radio-Chapel Services, Rev. Clarence H. Wilson, D.D., Glen Ridge Congregational Church.
4:30 P. M.—"Boys of the World", an address by C. R. Scott, State Secretary of Boys' Work, Y. M. C. A., Newark, N. J. Music by quartette including Miss May Kob, soprano soloist, South Park Presbyterian Church; Miss Marian Adams, contralto soloist, Church of the Redeemer; Bruce Campbell, tenor, and Louis Burke, baritone, Clinton Avenue Reform Church.
6:00 P. M.—Program of classical music by Mrs. Robt. Baldwin, violinist and Mrs. Ernest H. Harder, pianist.
7:45 P. M.—Sacred Music recital by the Aeolian Orchestrelle.
8:00 P. M.—Ed Wynn and the entire company of "The Perfect Fool", now playing at Geo. M. Cohan's Theatre, New York. For the first time in the history of radio an attempt will be made to broadcast an entire theatrical performance. Arranged by the N. Y. Globe.

OTHER FEATURES
Musical Program weekdays, every hour from 11 a.m. to 6 p.m., on the hour.

"FASHION TALKS TO WOMEN": Monday, Margaret Wood, N. Y. World.
Saturday 7:45 P. M.
WEATHER FORECAST (Official) — Daily, 11:00 A. M., 11:30 A. M., and 12:00 noon.

SCHERING'S Statistical Service, 8:30 p.m., Berkeley 4111.

OFFICIAL ARLINGTON: Stories by Miss Constance Lawrence (Newark Sunday Call).
Program will be announced daily by radio phone 7:45 P. M.

216
Radio March:
Another Prize Winner of RADIO NEWS Broadcast contest. Here, music lovers, is a wonderful number! Is there anything so appealing as the stirring strains of a military march?

Radio Jazz:
Irresistible fox trot. One of the prize winners of RADIO NEWS Broadcast contest! Young feet dance—old feet tap time, to the fascinating melody of this real smashing hit.

Listen In:
Featured in RADIO NEWS Broadcast contest, has caught the fancy of all America! Its rare swing hypnotizes—and its tuneful melody makes it simply irresistible.

Published and Distributed by
THE CONSRAD COMPANY, INC.
233 Fulton Street, New York City
The present form of radio-phone broadcasting dates back to the latter part of 1920, when the Westinghouse Electric and Manufacturing Company inaugurated the first radio-phone concert through its Pittsburgh station, KDKA.
Broadcasting the results of a boxing contest round by round. The radio-telephone is at its best in work of this kind, and special efforts are being made to report all athletic events of surpassing interest in this manner. This photograph was made at the time of the Dempsey-Carpentier fight.

A CORNER OF THE EXPERIMENTAL LABORATORY AT WGY

50 kw. was employed. The station was heard in England and on the Continent.
WELCOME
To the Convention

The Radio Corporation welcomes amateur wireless men to the First National Convention and Radio Show.

To do its share in making this event interesting, instructive and profitable, the Radio Corporation cordially invites amateurs, advanced experimenters, dealers and jobbers to visit

SPECIAL BOOTH “B”
IN CHARGE OF
MR. GEORGE W. HAYES

It will be a pleasure for Mr. Hayes to explain the features of R. C. Continuous Wave and other apparatus for amateur and experimental use.

Be sure to arrange to have your name placed on the first list to receive the Corporation’s new Catalog and Instruction Book on C. W. Operation, now ready.

A Few Leading C. W. Units:

Radiotrons for Transmission
Ketodinons for Rectification
Sockets for Vacuum Tubes
Filament-Plate Voltage Power Transformers
Filament Rheostats
Transmitting Grid Leaks

Special Mica Condensers
Filter Reactors
Antenna Ammeters
Rotary Grid Choppers
Magnetic Modulators
Microphone Transformers
Oscillation Transformers

These products of quality are manufactured expressly for the
Radio Corporation of America
by the
GENERAL ELECTRIC COMPANY
Set builders who strive for electrical and mechanical perfection inevitably come to AMSCO. Look behind the panel of the finest sets, and you will find the AMSCO trademark, the sign of engineered radio parts. Standardize on AMSCO Condensers, Vernier Dials, Rheostats, Potentiometers, Sockets and Binding Posts—each the best that can be made, and made to match each other.

Ask your dealer—or write Dept. R

AMSCO PRODUCTS, INC.
Broome and Lafayette Streets, New York City
MAKERS OF MELCO SUPREME RADIO RECEIVERS

NEW—The Amaco Vernier Dial—at a popular price. The right ratio for precision tuning.
What determines signal strength in Variable Condensers

Strength of signals, when you use a Variable Condenser, depends upon low “effective resistance.” In most ordinary commercial types this resistance lies between two and fifteen ohms.

Compare this with the CONNECTICUT Variable Condenser, about two-tenths of an ohm. This low comparative resistance not only permits, but insures, strength of signals.

There are other advantages—compactness, fine adjustments, stable in any position, sensitivity—any one of which should make the CONNECTICUT type your choice of variable condensers. Every well-informed amateur should know about this condenser. We will gladly send you a booklet describing it.
CATALOG OF 1909 CARS
This book of 144 pages has specifications and photos of all cars manufactured in 1909 by manufacturers who were members of the National Automobile Chamber of Commerce. The book is a reproduction of the original one published by the National Automobile Chamber of Commerce and referenced to as the NACC Handbook. Original copies are today considered collectors’ items and have considerable value, but the information in this reprint is identical.
Postpaid $3.00

CATALOG OF 1912 CARS
This book of 208 pages has specifications and photos of 194 vehicles, including passenger cars, commercial vehicles and fire apparatus. Prices are listed on 442 different models of passenger cars. Included are such names as Autocar, Brush Car, Terraza, Cymbin, Elmore, Franklin, Garford, Hazes, Jackson, Knex, Lorrain, Pullman, Reliance, Rex, Stevens-Duryea, Stoddard-Dayton, Thomas, Warren, and White. These 1912 models are beautifully illustrated with they include some real gems.
Postpaid $2.50

CATALOG OF 1914 CARS
This book of 208 pages has specifications and photos of all cars manufactured in 1914 by manufacturers who were members of the National Automobile Chamber of Commerce. The specifications are complete with beautiful photos illustrating the respective models. This book is a republication of the original one published by the National Automobile Chamber of Commerce and referenced to as the NACC Handbook. Original copies are today considered collectors’ items and have considerable value, but the information in this reprint is identical.
Postpaid $3.00

CATALOG OF 1918 CARS
This 224-page book has photos and specifications of 200 vehicles including fire apparatus and electric cars and trucks. There is an amazing total of 85 different makes of passenger cars alone. Of the 112 makes of cars and trucks combined, only a dozen were unusual. Included are icons ranging from Allen, Appleton, Brockway, Chalmers, Cole, Davis, Dort, Elgin, Elmore, Fiat, Grant, Hackett Inter-State, Jackson, Keating-Sangerfield, Lincoln, Lohrington, Liberty, Maxwell, Warren, Nash, Oakland, Paige, Regal, Scripps-Booth, Vim and Woom.
Postpaid $2.50

CLYMER’S CATALOG
OF 1956 U.S. CARS
Nearly of Floyd Clymer’s well-known series of U.S. automobile catalogs, this book includes many improvements over previous issues, with special articles, both descriptive and technical, on the various new cars, and a pleasing new format. B & 11 size.
Postpaid $1.50

CATALOG OF 1921 CARS
This book of 240 pages has specifications and photos of all cars manufactured in 1921 by manufacturers who were members of the National Automobile Chamber of Commerce. The specifications are complete with beautiful photos illustrating the respective makes. This book is a reproduction of the original one published by the National Automobile Chamber of Commerce and referenced to as the NACC Handbook. Original copies are today considered collectors’ items and have considerable value, but the information in this reprint is identical.
Postpaid $3.00

CATALOG OF 1924 CARS
This book has photos and specifications of all cars manufactured in 1924 by manufacturers who were members of the National Automobile Chamber of Commerce. The specifications are complete with beautiful photos illustrating the respective makes. This book is a reproduction of the original one published by the National Automobile Chamber of Commerce and referenced to as the NACC Handbook. Original copies are today considered collectors’ items and have considerable value, but the information in this reprint is identical.
Postpaid $3.00

CATALOG OF 1927 CARS
This book has photos and specifications of 80 passenger cars of 44 different makes. Included are such names as Auburn, Briscoe, Case, Diana, Essex, Elson, Gardner, Husmobile, Jordan, Kissel, Locomobile, Marmon, Oakland, Peerless, Rickenbacker, Star and Willys-Knight. Other features include the formula used to determine the N.A.C.C. Horsepower rating of motors of various sizes—a 28-page directory of automobile terms—a 24-page section of views from various automobile plants showing up-to-date mass production methods at that time.
Postpaid $2.50

CATALOG OF 1929 CARS
This book of 188 pages has photos and specifications of 148 vehicles, including passenger cars and buses, taxicabs and trucks. A few of the makes are Altenbury, Corbit, Cunningham, Durant, Elgar, Federal, Graham-Paige, Kelsber, Lamb, Moen, Pierce-Arrow, Rameer, Stutz, Staunton-Knight, Velie and Whippet. A six-page table lists alphabetically the prices of all models of passenger cars—an amazing total of 580 different models and billy styles. Another section gives some interesting facts and figures relating to the automotive industry.
Postpaid $2.50

U.S. CAR CATALOG BACK ISSUES
1955 U.S. Car Catalog $1.50
1954 U.S. Car Catalog $1.50
1953 U.S. Car Catalog $1.50
1952 U.S. Car Catalog $2.00
1950 U.S. Car Catalog $2.00
1949 U.S. Car Catalog $2.00

FLOYD CLYMER PUBLICATIONS
1286 S. Alvarado St. Los Angeles 6, California

223
De Forest Flame Audion

De Forest Responder

De Forest Synthizer

Western Electric VT-1

Illustrated with more than 1,000 photos of operating equipment.