"How" of the Flivver Super—by E. T. Flewelling

Radio Digest

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FOIL TRAIN CRASH PERIL

WAVES BRING ENDANGERED CARS TO HALT

New German Invention Ends Travelers' Fear of Death at Throttle

U. S. May Adopt Device

William Dubilier Brings Remarkable "Look Out" Control System to America

(By Evelyn Lanzius, Special Correspondent)

NEW YORK.—Death at the throttle will no longer be a worry or fear for the railroad traveling public if the German Radio train control invention just brought into this country by William Dubilier is applied to the steam and electric railways. When the device is in use it is claimed train wrecks will be at a minimum. Even though the engineer should fall dead or helpless at the throttle, the speeding steed of steel will be stopped automatically by ether waves.

Mr. Dubilier is president of the Dubilier Condenser and Radio Corporation and has just returned from a trip abroad.

The device, one of the most remarkable of its kind, is of German design and origination. The United States Railroad Commission required the use of some form of automatic control only a short time ago, and this instrument promises to fill the requirements and even surpass the fondest dreams of present day inventors.

Stands Tests in Europe

The system of train control by Radio has been in successful operation in some of the European countries and has met every claim of the inventors. The new invention requires no apparatus placed along the tracks, the entire apparatus being placed within the cab of the locomotive and is directly connected with the usual air brake mechanism now in use.

(Continued on page 2)

BOSTON BROADCASTS SECOND GRAND OPERA

BOSTON, MASS.—In recognition of the enthusiastic response of the Radio audience to the broadcast of "Aida," as sung by the Chicago Civic Opera Company, WNAC (the Shepard Stores) gave a broadcast of "The Jewels of Madonna," by the same company, February 3, at 7:50 P. M. This was to stimulate invisible listeners to the cultural benefit of grand opera.

Columbus Radio Forces Band for Good of Fans

Set Hours for Silence, Broadcasting, Sparks, and Testing

COLUMBUS, O. — Columbus' Radio forces are now banded together for the good of all fans in the city. Station WEAO, Ohio State university, represented by Prof. Roy A. Brown, of the department of electrical engineering, is now a party to the agreement which was signed by the Columbus Radio club, two members of the rank and file of listeners and members of the mayor's committee and the three other broadcasting stations in the city.

This agreement definitely fixes the quiet hours from 7 to 10 P. M., on all nights except Saturday. Columbus broadcasting stations agree to transmit their evening programs between 7 and 9 P. M., all spark, continuous wave and amateur Radiophone sets will refrain from transmitting during the period of the quiet hours, and all testing of apparatus must be done between 6 A. M. and 5 P. M.

The new regulations go into the Radio rules of Columbus along with the break-in rules formulated last spring. Both will be combined in pamphlet form by the Columbus Dispatch for distribution by the Radio club to all persons interested. The complete code, which has been recognized more or less by all parties for a year and now is given full sanction, is to be known as "The Columbus Plan," according to President Fred W. Redding, of the Columbus Radio club. It is believed that Columbus, at the time the decision was made, was the only city of its size in the country where all forces were combined to such an extent.

Exactly 942 letters commented favorably on the singing of seven-year-old Clarabelle McDonald of Bellefountaine, Ohio, after she had appeared recently at the studio of Station WLW, the Crosley Manufacturing Company, Cincinnati

"Fiddlin' John" Carson, Blue Ridge Mountaineer and Dixie champion fiddler, whose fame was spread far beyond Dixie recently by WSB, the Atlanta Journal

Miss Edna Geertsen makes many "hits" every time she hammers the xylophone at the studio of KDYL, The Salt Lake (Utah) Telegram, if one is to judge from the number of letters received after each one of her appearances there. She is a member of the KDYL Marconi Opera orchestra

Radio Positions Open

NEW ORLEANS, LA. — Examinations will be held here, May 1, at the New Orleans customhouse, to fill the positions of Radio Engineer, Assistant Radio Engineer and Associate Radio Engineer. The positions are with the government and pay from $2,000 to $5,000 a year.

THREE FROM FAMILY BROADCAST AT WBAV

COLUMBUS, O.—A unique program was broadcast from Station WBAV, of the Earl and Hopkins Company here, when three members of one family were on the same bill. Thomas J. Enright, baritone, and his two sisters, Mary, violinist, and Mildred, pianist, made up the trio. Walter R. Jones, who is well known in the vocal music world, was also on the program.

NEW PICK-UP GIVES TRUE TONE QUALITY

MICROPHONE OF RADICAL DESIGN USED AT WGY

Pallophotophone Inventor, C. A. Hoxie, Adapts Device to Broadcasting Direct—Sound Quality Excellent

(Special to RADIO DIGEST)

SCHENECTADY, N. Y.—Surprising results have been obtained by the General Electric Company's broadcasting station, WGY, following the recent installation of new microphone embracing the Pallophotophone principle. This station has acquired a remarkable true tone quality through use of this instrument as those Radiophans who have listened in will testify.

A new use has been found for the remarkable device which photographs sound on motion picture film and then reproduces the sound from the film. C. A. Hoxie, the Pallophotophone inventor, devised the pick-up or microphone using the principle of the reproducer.

How Pick-Up Operates

In the Pallophotophone pick-up a very sensitive diaphragm is set vibrating by sound. The movement of the diaphragm is communicated to a mirror three sixty-fourths of an inch square. A strong light strikes the dancing mirror which reflects the light beam at a sensitive light cell. The variation in the beam of light, caused by the vibration of the mirror varies the effect on the light cell and thus produces a corresponding variation in the electric circuit. Amplification is then obtained in the ordinary way.

Moving Part Weight Half Pinhead

The new pick-up eliminates the hiss which accompanies the use of the ordinary microphone, and it is said to be more sensitive and responds more readily and accurately to sound waves, capturing harmonics which would ordinarily be lost.

A feature of the new pick-up is the weight of the moving or vibrating part. The diaphragm and mirror combined weigh one-tenth of a grain, or half as much as the head of a common pin.

The Pallophotophone pick-up is now a permanent part of the studio equipment of station WGY. Many letters complimenting WGY on the improvement of its tone quality were received after the program of January 30, when the play "Bought and Paid For," which was broadcast through the new pick-up was presented.

Plan for Silent Night Will Allow Fishing for Outsiders

CHICAGO. — Representatives of broadcasting stations and the Federal government, appeared before the Radio subcommittee of the Chicago city council committee on gas, oil and electric light recently and discussed the proposed "silent night" plan by which only one station would broadcast each night and one night each week would be allowed Radiophans to "fish" for outside stations.

The representatives of the various stations agreed to confer on the plan and were to report at a meeting to be held at a future date.

One interesting point brought into the discussion was that the proposed local ordinance could in no way conflict with the existing federal regulations and the rights granted by these. It is doubtful on this account whether or not an ordinance will be passed.

FOIL TRAIN CRASH PERIL

(Continued from page 1)

It can be installed in any existing locomotive in a very short time and at a cost of about $20 or $30.

The main features of the control system are now a secret on account of patent reasons, but the following information was given the Radio Digest's representative by Mr. Dubilier, who brought plans for the control device to this country.

Better than Block Signals

The system will do the work more efficiently than is now performed by the present block signal system and is entirely free from the human element, that is to say with the use of Radio it will be absolutely impossible for two trains to enter into the same block. Another advantage of the system is that it is free from any interference caused by either static or Radio currents not inteded for its operation.

In case the engineer becomes disabled upon approaching a signal a loud speaker will repeat the words, "Look Out," and if no action is taken the train will be caused to come to a standstill. The indicator will then have to be readjusted before the train can be moved. The apparatus will fullfil the recent requirements laid down by the Railway Asseciation Engineers for such devices.

Radio telephone messages have been sent successfully from balloons to the ground for distances up to 25 miles.

Listeners 9,000 Miles Apart Pick Up WGY Broadcast of Christmas Greetings

Transmission from Schenectady Station Is Heard in Every State of Union, Also Panama Canal Zone, Santo Domingo, Canada and Mexico—Record Claimed

SCHENECTADY, N. Y.—Electrical pulsations from the antenna of WGY, the Schenectady broadcasting station of the General Electric Company were radiated so widely that they were received on two different days in places 9,000 miles apart.

Postmaster Costa of Wailuku, Hawaii, and a radio engineer in London, England, at practically the same instant were greeted with "Merry Christmas and a Happy New Year" from Secretary of Navy Edwin Denby. The postmaster, A. L. Costa, heard the message of good-will at 5:45 p. m., December 24, and Captain H. J. Round picked up the words at 4:15 a. m., December 25. The message was broadcast at 11:15 p. m., December 24, but the actual words of the greeting were spoken December 13 at 1 p. m. in Washington, D. C., where a photograph of a speech by the secretary of navy was made by the Pallophotophone. This photograph, made on motion picture film, was reproduced at WGY, Christmas eve.

Possible New Record

In writing WGY Postmaster Costa stated that "I heard your station very clearly and picked you up just as a man with a solid voice was finishing his talk which ended by saying: 'I wish you all a Merry Christmas and a very Happy New Year.' The time he finished was exactly 5:45 p. m. our time which must have been 11:15 over there. After that talk you announced very clearly the name and call letters of your station thus: "This is WGY, the General Electric Co., Schenectady, New York. The next number on our program will be —."

The time given by Mr. Costa and the words heard checked up with the log WGY. The "solid voice" referred to was that of Secretary of Navy Denby.

Christmas eve transmission of WGY established a new record for the station and, it is believed, a record which is not exceeded by any other broadcasting station. WGY was heard that night in every state in the Union, in the Panama Canal Zone, in London 3500 miles from Schenectady, in in London 3500 miles from Schnectady, in Cuba, Santo Domingo, Mexico and Canada.

French Trawlers Have Radio

WASHINGTON.—The use of Radio on French fishing vessels has become so general that there is now hardly a trawler in operation without complete Radio equipment according to Vice Consul W. W. Corcoran, Boulogne. This development is the result of years of experience and is due largely to the active aid given by the French government. In actual operation Radio installation has proved more valuable for the receipt of broadcast newe, storms warnings, notices to mariners, time signals, etc., than for communication with the shore.

Radio Taught at College

COLUMBUS, MISS. — The Mississippi State College for Women here has installed a Radio set in the Physics classroom where the students will be taught the principles of Radio reception. A new set was also recently installed by the University of Mississippi, located at University, Mississippi.

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Looking Ahead

Jackie Coogan Broadcasts at WOR—and then gives an exclusive interview to Radio Digest. Read what "Jackie" has to say when you buy the March 10 issue. It's Good.

Charles V. Logwood vs. Edwin H. Armstrong for the Title to the Super-Regenerative Circuit Patent will be an interesting case and full of potentialities. The U. S. Patent Office agrees that it was a little hasty in issuing this patent to Mr. Armstrong and has reopened the case inasmuch as Mr. Logwood really had a patent application on file previous to the "Major." Read the exclusive scoop and the only statement or interview Mr. Logwood has made as yet for the press in the March 3 issue of Radio Digest. Compare the two circuits and judge for yourself.

Flewelling Tells How to Mount the Parts of the Flewelling Flivver Super in the next issue of this paper. This will be the sixth article of his exclusive series for Radio Digest. Read the fifth article, page 7, this issue.

H. J. Marx Will Continue His Series on the Reinartz Set. Next week he will tell further details regarding the making of the two-step amplifier for the compact Reinartz panel set.

Arthur G. Mohaupt's Article for Radio Beginners next issue will give a number of popular vacuum tube circuits and discuss them. He will give pointers on operating tube sets.

TORONTO RESIDENT CLAIMS BIG PATENT

LONGWOOD VS. ARMSTRONG FOR SUPER CIRCUIT

Patent Office Admits Error in Not Fully Considering Logwood's Claim Before Award

TORONTO, CAN.—Who was the first man to conceive the principle of what is known as the "super-regenerative" circuit for Radio receiving sets? Without going into any technical details, it may be explained that this circuit is claimed to be more sensitive than any other—in other words that it enables reception over a longer distance than is possible with any other circuit.

The bringing out of the "super" circuit was hailed by engineers all over the world as the greatest contribution to the improvement of Radio during the past year. It follows that the man who is officially credited with priority in inventing the circuit must be assigned a permanent niche in the Radio hall of fame.

Rival Claims

At the present time representations are being made to the United States patent office by rival aspirants to this honor. Last year a patent for the circuit was awarded to Major Edwin H. Armstrong, a young American Radio engineer now connected with Columbia University. It is contended that at least one other person had made application for a patent on the same principle as discovered by Armstrong.

That other person is Chas. V. Logwood. His claim of priority over Armstrong is of especial interest to Canadians, owing to the fact that Mr. Logwood has been living in Toronto for more than a year, and that a circuit on which he holds a patent has been used in the design of nearly every big Radio broadcasting set in Canada.

Long Experience

His experience with Radio dates back to 1903, when he started working on Radio telephone developments. At that time it was possible to talk, without wires, a distance of one mile, under best conditions, and when apparatus was not inclined to be "mulish."

Mr. Logwood is best known, so far for his work with Dr. Lee De Forest, who revolutionized Radio science by his development of the vacuum tube. The young Toronto resident is registered as joint inventor with Dr. De Forest, of the famous "ultra-audion" circuit, which is patented all over the world.

There seems to be good ground for believing that Mr. Logwood may be awarded the much prized "super" circuit patent. The United States patent office has tacitly admitted that there was an error in not more fully considering his application before granting that of Major Armstrong. This means much, and the outcome of the deliberations which are now going on in this connection will be awaited here with deep interest.

HIGH SCHOOL DEBATE TO BE HEARD ON AIR

Arrangements to Be Completed to Broadcast from Platform

BUFFALO, N. Y.—A nation-wide high school debate to be held in the spring will be broadcast from several middle western and far western states. Arrangements are now being completed to have the debates broadcast from some of the platforms. Where this is not possible the broadcasting will be done in exhibition debates.

The debate will be between Canisius High School of Buffalo and high schools in Cleveland, Toledo, Chicago, Omaha, Denver, San Francisco, Los Angeles, Kansas City, St. Louis, Indianapolis and Pittsburgh. The Buffalo team will take the affirmative side of the question:

"Resolved: That Buffalo has greater industrial advantages than any other city in the United States."

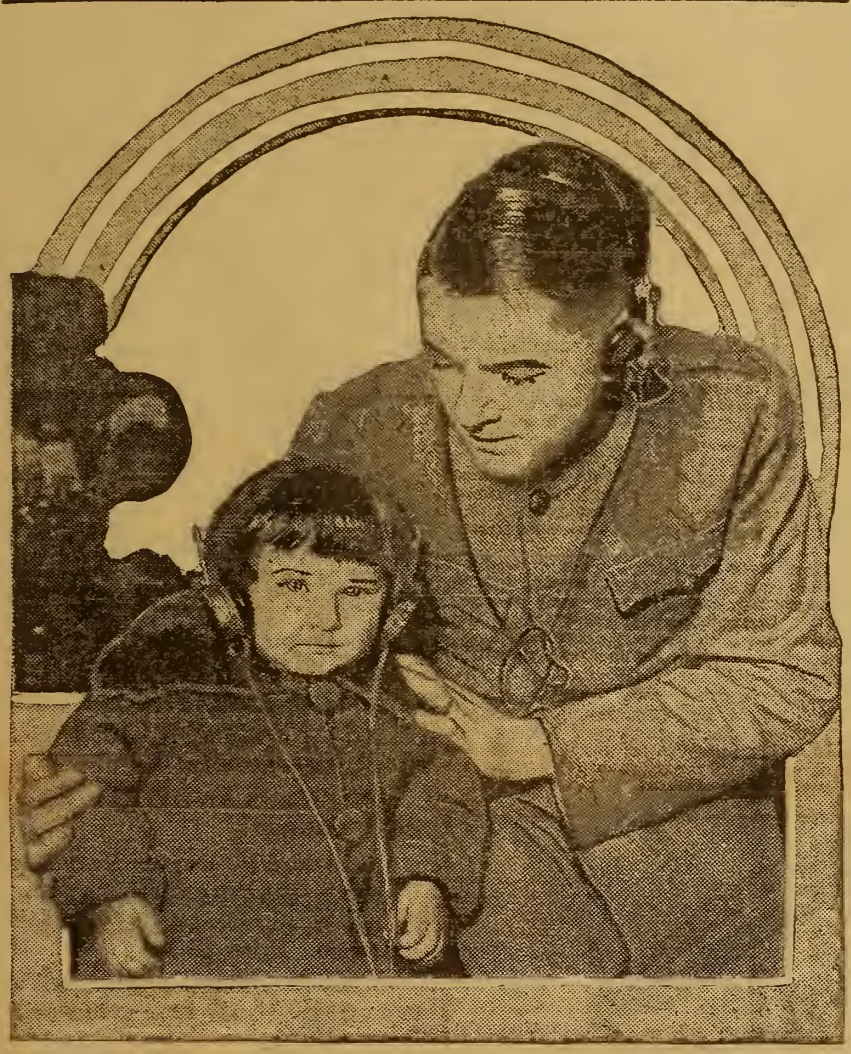
SPRINGFIELD TO GET PUBLICITY VIA ETHER

SPRINGFIELD, O.—The Erner & Hopkins company, Columbus, has asked Mayor Furry to appoint a man to come to the broadcasting station in Columbus and give an address pointing out the advantages of Springfield. Mayor Furry has advised Manager Hansell of the Springfield Chamber of Commerce of the letter and has asked him to cooperate in arranging the program.

HEAR WMAK IN CAPE BRETON AND SIDNEY

LOCKPORT, N. Y.—Official tests of a new microphone attachment which has been added to the equipment of the station of the Norton Laboratories here, WMAK, show that programs broadcast have been picked up as far as Porto Rico, Sydney, Cape Breton and points in Florida. Further experimental work is underway with the new device.

"SPARKS" TUNES IN FOR KIDDIES



Radio Operator C. P. Morgan of the S. S. St. Mihiel is one of the busiest men on the ship, entertaining all the children of the Army of Occupation. Many crying babies were hushed by the tune of the Radio. The picture shows "Sparks" Morgan entertaining little Anna Cauthorn, born in Coblenz. A few minutes before this picture was taken she was screaming at the top of her voice but was soon consoled by listening in © K. & H.

Alma, Stopped by Victor Uses Records for Kiddies

Famous Singer Makes Talk to Children Over Ether

COLUMBUS, O.—Radiophans in this city and throughout the state and country were disappointed when the announcement that Madame Alma Gluck-Zimbalist, famous singer, would not be permitted to sing over the microphone as had been announced.

Victor Talking Machine company contracts were the cause of the failure of the noted artist to carry out the program. Accompanying the Victor objection to the plan of the singer to give a half-hour concert, was an explanation of why the company had compelled the restriction. Spurious records have been made through Radio transmission, it was stated, two being known to have been produced in this manner. For this reason and to protect themselves and the artists, the Victor company requested that the personal appearance of the singer be dispensed with.

Madame Gluck, keeping her promise as best she could to her children in New York who had been acquainted with the plan of hearing their mother over the radio, had several Victor records of her best numbers played for the radio. She prefaced each record with a little talk to her children after informing other listeners that she regretted the original program could not be carried out.

The average transmitting range of all broadcasting stations in the United States is given by one authority as 368 miles.

WEIRD STORIES TOLD BY DISTRESS CALLS

CUTTER SNOHOMISH GIVES AID TO SOS CALL

Pacific Coast Listens to Air Messages of Tragedy in "Graveyard of Ships"

(Special to RADIO DIGEST)

SEATTLE, WASH.—"We are on fire. Help." "Aro breaking fast. We are going down." "In dangerous position off Umatilla reef. Lost rudder." Such were the messages listened in on by Pacific coast Radiophans working on 600 meters during the recent coast storm.

Filled with stories of despair, heroism, of disregard to danger, men facing almost sure death in the teeth of one of the worst storms that has swept the Pacific in years to rescue other men trapped aboard doomed ships, the Radiograms came one upon another with hardly an hour passing without the SOS call.

Word by word, the messages halted and broken, some trailing off into dead silence, the Radio brought the story of the storm's toll into Seattle during the day and night. The fitful flashes from stricken vessels formed a weird tale of the tragedy of the "graveyard of ships."

Cutter First on Air

First came the Radio from the coast guard cutter Snohomish: "We are going to aid of Steamer Nika." The Snohomish was then at Port Angeles, only eight hours run from the disabled Nika.

Later came the message that the Coolca had been abandoned by her crew who were picked up by the steamer Algerene. The operator of the naval Radio station at Bremerton, Wash., heard something about "Nika on fire" but the message was indistinct and was without signature. Numerous Radiograms were heard like this without the completing signature or position of the ship, probably due to the fast sinking of the vessel.

In no other tragedy of such scope has Radio played such a large part in the saving of human lives and valuable property as it has in the recent coast storm. It is this development of modern science that was the large factor in giving aid to those in peril.

Herbert Hoover Loses License Fight in Court

District Court of Appeals Sustains Action of Supreme Court

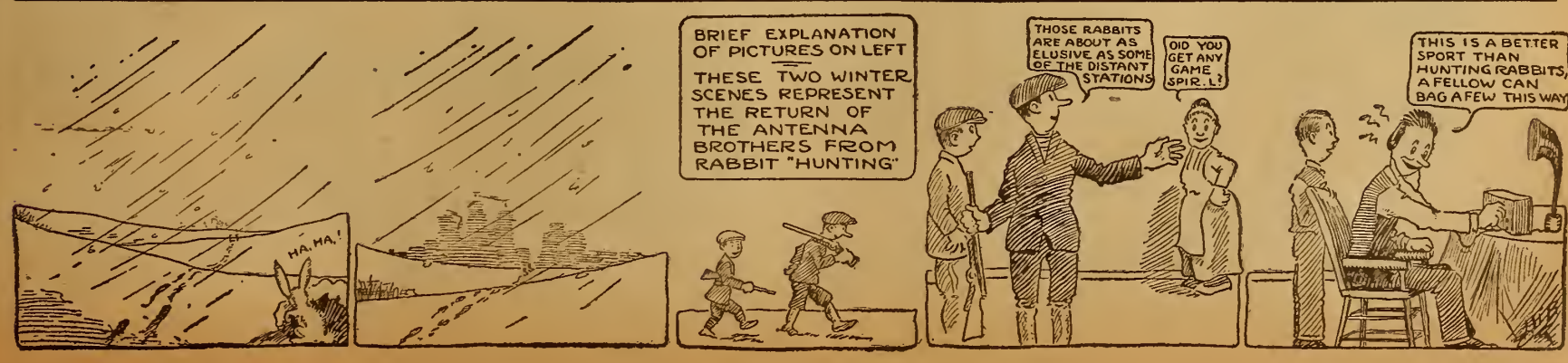
WASHINGTON, D. C.—Herbert Hoover, Secretary of Commerce, lost his appeal from a mandamus requiring him to issue a license to the Intercity Radio Company to operate a Radio station in the city of New York. The District Court of Appeals in a decision by Justice Van Orsdel sustained the action of the District Supreme Court for the writ of mandamus.

The act under inquiry reposes no discretion whatever in the Secretary of Commerce, the court finds, in issuing licenses to persons and corporations coming within the classification designated by the law. His duty is mandatory and the courts will not hesitate to require its performance.

Secretary Hoover refused the license because the Radio station was claimed to be interfering with the sending of government messages from naval and military stations. The court finds that Congress recognized there would be interferences, and the act undertakes to prescribe regulations by which the interference may be minimized rather than prevented.

"The only discretionary act," says the court, "is in selecting a wave length within the limitations prescribed in the statute, which, in his judgment, will result in the least possible interference. The issuance of a license is not dependent upon the fixing of the wave length. It is a restriction entering into the license. The wave length named by the Secretary merely measures the extent of the privilege granted to the licensee."

THE ANTENNA BROTHERS — Spir L. and Lew P. — Spir Becomes a DX Hunter



THEORY IS THE BUNK SAYS NOTED EXPERT

RECEIVING STATIONS CAN NOT STRENGTHEN WAVES

"Regeneration of Receiving Stations Serve to Weaken Signals" —Dr. Pickard

BOSTON, MASS.—In a recent letter to Lloyd C. Greene Dr. Greenleaf W. Pickard, the famous Radio inventor and expert of the Wireless Speciality Apparatus Company, gives some notable information on Radio and explodes a popular theory that the remarkable receptions by crystal detectors, of broadcasts from distant stations, reported from time to time, are caused by re-radiation from neighboring vacuum tube receiving sets tuned in to the distant transmitting stations.

Dr. Pickard says that this theory is entirely fallacious, and that one of the things a receiving station of any kind cannot do is to strengthen the electric wave field in its neighborhood. Inevitably it acts to weaken this field, he says. The greater amplification or regeneration employed by one station the weaker is the electric field around its antenna and the weaker becomes the reception of a neighboring station.

"From the distant broadcasting station wave trains pass the receiving antenna, and as a result a varying electric field exists in its vicinity," says Dr. Pickard. "This wave field induces a current in the antenna and in turn the current produces a field around the conductor which is out-of-phase with the signal wave. The resultant field around the antenna, which is the sum of the fields in the wave and in the current around the antenna is always less than that of the signal wave. If the impedance of the receiving antenna is lowered by regeneration increase the current in the antenna and consequently the electric field aroud it, will increase, but the resultant field will still further decrease.

"Finally, if regeneration is increased until the effective resistance of the antenna is zero, the field due to the current in the antenna will exactly equal the wave field and will be 180 degrees from it in phase, and thus the field resulting in the immediate neighborhood of the conductor will fall to zero and reception will be weakened materially.

"If regeneration is increased to such an extent that effective resistance is less than zero, having a negative value, oscillations will be produced and the field around the antenna may have greater values than the wave field of the signal. But, representing, as they do, an unmodulated field they only produce the all too well known squeal.

"In a large measure a good crystal reception is due to a good antenna, a good location for the receiver and efficient tuning, but primarily, however, to the abnormally high transmission which occurs now and then, particularly on winter nights."

For the greatest economy in broadcasting, many Radio engineers believe the range will have to be extended to the greatest possible extent and intermediate stations eliminated.

JUDGE SCRATCHES HEAD OVER REFLEX

Developments in Priess Case Causes Confusion in Massachusetts' Court

BOSTON, MASS.—Radio and its developments have caused so much confusion in the Massachusetts courts that Judge McLaughlin of the superior court has sought the advice of the supreme bench before he adjudicates a Radio inventor in contempt or not.

William H. Priess of Belmont, inventor of the Radio reflex circuit, amplifiers and other Radio devices, is the central figure in the court tangle. Some weeks ago the Wireless Specialty Apparatus Company brought a bill in equity asking that the inventor be restrained from disposing of his patents or applications for patents to anyone else. They claimed that he worked for them under an employment contract.

After this company had received an order of notice Priess executed an assignment of his patents to the De Forest Radio Telephone & Telegraph Company. The Wireless Specialty Company then asked that Judge McLaughlin adjudge Mr. Priess in contempt of court, arguing that the order of notice was to all intents and purposes the same as a temporary injunction. It is this point that Judge McLaughlin will present to the supreme court to have the whole matter threshed out.

KING OF MARDI GRAS HEIGHT OF MODERNITY

Communicates By Ether from "City Care Forgot"

NEW ORLEANS, LA.—Messages from Rex, leader of the annual Mardi Gras pageantry climaxing the pre-Lenten festivals, were sent by Radio during his 1923 "trip across the Atlantic." Until unmasking at sundown, the king of the carnival always conceals his identity, but traditions of the festival have it that he, with his court, sails for the "city care forgot" in a royal barge, and during the trip "messages" are received faithfully recording his progress. On Mardi Gras day he is met at the wharf, tendered a giant key to the city, and frivolity rules the day.

Rex has one virtue discernible above all others and about which he is consistent year after year, that quality is the ability to keep up with the times. He will hold his centenary in just three more years, so he can easily recall when sending his messages by telephone was the height of modernity. So, in 1923, the up-to-date all Radiophone and receive important messages that way, and the press heralded the approach of the incognito monarch in keeping with the march of progress.

Mexican President Is Fan

MEXICO CITY.—President Obregon of Mexico is an enthusiastic Radiophan, a set now being installed in Chapultepec Castle. Secretary de la Huerta has ordered a set installed in his home near the lake in Chapultepec Park.

COPS OF 100 CITIES PLAN BROADCASTS

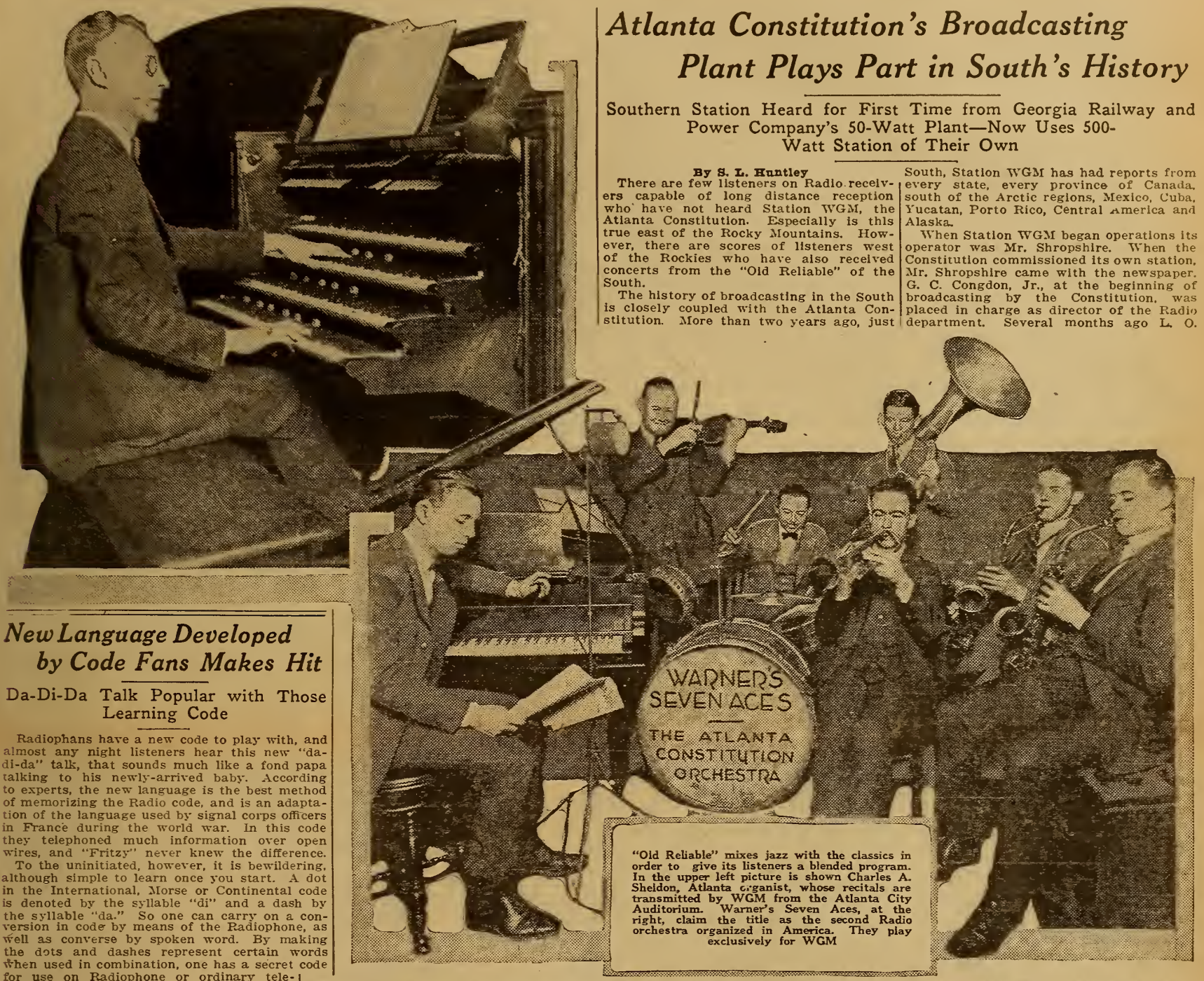
Others to Follow in Footsteps of Detroit Police Plant, KOP

DETROIT.—The police of 100 cities in the United States, Canada and the West Indies have agreed to cooperate with Supt. W. P. Rutledge of the Detroit police department in developing a system of broadcasting police information.

The plan was first broached by Supt. Rutledge at a convention of police chiefs as long ago as 1920, but at that time the scheme was looked upon as visionary. The rapid development of Radio since then has proven the plan is of practical value. The Detroit police department at present is broadcasting police information twice each day, giving particular attention to stolen cars. Departments in other cities with receiving sets have formed the habit of listening for these messages. Those without sets have made arrangements with amateurs.

It is the hope of Mr. Rutledge that notice of each major crime in America soon will be broadcast to all police departments within a few minutes of its commission, together with a description of the suspects, thus eliminating the old method circularizing departments.

WGM "OLD RELIABLE" OF SOUTH



"Old Reliable" mixes jazz with the classics in order to give its listeners a blended program. In the upper left picture is shown Charles A. Sheldon, Atlanta organist, whose recitals are transmitted by WGM from the Atlanta City Auditorium. Warner's Seven Aces, at the right, claim the title as the second Radio orchestra organized in America. They play exclusively for WGM

Atlanta Constitution's Broadcasting Plant Plays Part in South's History

Southern Station Heard for First Time from Georgia Railway and Power Company's 50-Watt Plant—Now Uses 500-Watt Station of Their Own

By S. L. Huntley

There are few listeners on Radio receivers capable of long distance reception who have not heard Station WGM, the Atlanta Constitution. Especially is this true east of the Rocky Mountains. However, there are scores of listeners west of the Rockies who have also received concerts from the "Old Reliable" of the South.

The history of broadcasting in the South is closely coupled with the Atlanta Constitution. More than two years ago, just before the San Francisco Democratic convention, one of the first really comprehensive aerials in Atlanta was erected on the roof of the Constitution building in the hope that the Constitution's staff correspondent might be able to transmit some of his articles by Radio. But this experiment ended in failure.

Broadcasts for First Time

In the latter part of February, 1922, the Constitution's executives put their heads together for a Radio conference. Radio broadcasting then in the South was something to be considered perhaps only by semi-scientific minds. It was the middle of March when the Constitution started broadcasting. Installation of an efficient broadcasting transmitter in the Constitution's building could not be accomplished for some little time.

The Georgia Railway and Power company had a 50-watt transmitter it used sometime before this for straight messages. An agreement was reached between the Constitution and this company for the Constitution to broadcast, using the power company's station. It was, then, the middle of March, when the Atlanta Constitution first went on the air with a program.

Dubbed WGM

As soon as the Constitution began broadcasting, it was assigned the call letters, WGM, and these were used with the Georgia Railway and Power company's station. P. C. Herault and A. W. Shropshire, of the power company, were given the contract immediately to erect a 500-watt broadcasting station for the Atlanta Constitution.

The Constitution's own broadcasting station was heard on the air for the first time the night of September 1, 1922. Since then Station WGM has operated every night. Its week-day programs are given between 6 and 7 o'clock and between 9:30 and 10:30 o'clock in the evening, Central time. The Sunday schedule calls for a broadcasting between 3:30 and 4:30 o'clock in the afternoon and between 9:30 and 10:30 o'clock in the evening.

Since it started broadcasting in the South, Station WGM has had reports from every state, every province of Canada, south of the Arctic regions, Mexico, Cuba, Yucatan, Porto Rico, Central America and Alaska.

When Station WGM began operations its operator was Mr. Shropshire. When the Constitution commissioned its own station, Mr. Shropshire came with the newspaper. G. C. Congdon, Jr., at the beginning of broadcasting by the Constitution, was placed in charge as director of the Radio department. Several months ago L. O. Moseley was added to the staff as program director. He announced each program.

Heard Only Twice Daily

Station WGM was one of the first broadcasting stations to receive a Class B, 400-meter license, and operates under such a license now. It is a notable fact that WGM comes on the air only twice daily. The schedule of two programs daily was decided on for one reason alone. It was in consideration for the type of programs to be given.

The number of listeners who comment especially in their reports on the excellent quality of Station WGM's programs is notable. The Constitution's executives believed that it would be possible to give only two programs daily from Station WGM as long as quality was to be the prime consideration.

Variety in Programs

As soon as Station WGM's big transmitter was commissioned, the second Radio orchestra organized in America was presented by the Constitution. This orchestra, Warner's Seven Aces, said to be the premier dance orchestra of the South, gives the program from Station WGM every night of the week at 6:00 o'clock. The orchestra plays dance music principally, but frequently gives semi-classical and classical numbers.

The 9:30 o'clock program is devoted largely to instrumental and vocal presentations of classical numbers. In this connection it is well to mention Signor E. Volpi, noted director of opera, who furnishes from his studio the 9:30 o'clock program for Sunday, Tuesday and Friday nights.

"Old Reliable" Silent First Time

During its six months of age the Constitution's new station has enjoyed a remarkable record of service. WGM has not failed its listeners in with programs a single day with the exception of January 23 and January 24, when one of the heaviest sleet storms that has struck Atlanta in years put "Old Reliable" off the air for the two days.

Station WGM's aerial is an 85-foot cage of six wires supported by two 75-foot

(Continued on page 6)

New Language Developed by Code Fans Makes Hit

Da-Di-Da Talk Popular with Those Learning Code

Radiophans have a new code to play with, and almost any night listeners hear this new "da-di-da" talk, that sounds much like a fond papa talking to his newly-arrived baby. According to experts, the new language is the best method of memorizing the Radio code, and is an adaptation of the language used by signal corps officers in France during the world war. In this code they telephoned much information over open wires, and "Fritzy" never knew the difference.

To the uninitiated, however, it is bewildering, although simple to learn once you start. A dot in the International, Morse or Continental code is denoted by the syllable "di" and a dash by the syllable "da." So one can carry on a conversion in code by means of the Radiophone, as well as converse by spoken word. By making the dots and dashes represent certain words when used in combination, one has a secret code for use on Radiophone or ordinary telephone lines. The full Radio alphabet in the "da-dit" code is as follows:

Letter	Code
A	Di-da
B	Da-di-di-dit
C	Da-di-da-dit
D	Da-di-dlt
E	Dit
F	Di-di-da-dit
G	Da-da-dit
H	Di-di-di-dit
I	Di-dit
J	Di-da-da-da
K	Da-di-da
L	Di-da-di-dit
M	Da-da
N	Da-dit
O	Da-da-da
P	Di-da-da-dit
Q	Da-da-di-da
R	Di-da-dit
S	Di-di-dit
T	Da
U	Di-dl-da
V	Di-di-di-da
W	Di-da-da
X	Da-di-di-da
Y	Da-di-da-da
Z	Da-da-di-dit

WEAN Gives First Opera

PROVIDENCE, R. I.—For the first time since its installation, WEAN, station of the Shepard Stores here, gave an entire opera program. This was heard not only by Rhode Island and Connecticut fans, but by many in Massachusetts. WEAN is heard quite frequently by Boston listeners. The production was given by the F. B. C. entertainers of East Providence, and the cast included some of the best talent in the state.

Data covering 340 of the American broadcasting stations shows that 40 stations have a range of 55 miles, 69 stations a range of 100 miles, 73 of 200 miles, 43 of 300 miles, eight of 400 miles, 61 of 500 miles, eight of 700 miles, 17 of 1,000 miles, 19 of 1,500 miles, and two of 2,000 miles.

RECEIVING RECORDS? SEND 'EM IN—

By the Contest Editor

SOME of these days we are going to let all the readers of Radio Digest "in" on the kind of sets the 2,300-mile and over record holders possess. That ought to be something most Radiophans would be interested in. At least the readers of this column are eager for this information.

Last week 24 new records were set. These are given below. Next week the complete list of record holders to date will be given. Watch for it.

Station—Miles Away—Record Holder

CHXC—1500, M. B. Gilbert, Douglas, Wyo.
KFAY—2200, L. A. Graf, Dunkirk, N. Y.
KFEL—1050, H. R. Wunder, Cheriot, O.
KFI—2425, J. H. Mitchell, Elmhurst, L. I., N. Y.
KJJ—2175, M. P. Jacot, Copley, O.
KNT—2150, John Kiener, Cleveland, O.
KQV—1325, M. B. Gilbert, Douglas, Wyo.
NAA—1150, H. S. Johnson, Chandler, Okla.
WAAJ—1725, M. B. Gilbert, Douglas, Wyo.
WAAM—1575, M. B. Gilbert, Douglas, Wyo.
WDAH—1625, W. M. Brown, Pittsburgh, Pa.
WGAD—2575, L. Jang, Hanley Falls, Minn.
WGAM—1275, H. B. Porter, Lynn, Mass.
WGF—1175, B. S. Watkins, Bridgeport, Conn.
WEAD—1000, John Kiener, Cleveland, O.
WFAZ—1000, Doyle Getter, Arkansas City, Kans.
WKAQ—2600, Edwin Perkins, Jr., Sioux Falls, S. D.
WLAY—4200, M. P. Jacot, Copley, O.
WMC—1125, C. T. Mower, Malden, Mass.
WNAF—1525, W. Rankin Woodfords, Me.
WNAS—1200, B. S. Maynard, Detroit, Mich.
WOO—1575, M. B. Gilbert, Douglas, Wyo.
WQAM—1150, R. Clark, Bridgeport, Conn.
WRR—1425, B. S. Watkins, Bridgeport, Conn.

Unique Concert by WSY

BIRMINGHAM, ALA.—WSY, the Alabama Power Company broadcasting station here, recently gave a unique concert program especially for Alabamians. A number of musical selections composed by Alabamians and played or sung by the composers made up the program. The selections were heard at many places all over the state. Among the composers who rendered selections on this occasion were people from Birmingham, Selma, Montgomery and other points in the state.

NEW STATION BOWS TO WESTERN FANS

OLD TIMERS GIVE AWAY TO NEWCOMER

Dedication Program Presented in Three Parts—Lasting from Eight Until Midnight

(Special to RADIO DIGEST)

LOS ANGELES, CALIF.—Saturday evening, January 27, will remain a red letter date in the Radio world for sometime, for at the hour of 8 o'clock, the great Examiner-Anthony Central Radio station was formally dedicated to the ether world. It was presented to an unseen audience of millions, located over an area of thousands of miles.

The new station is to be known as the Central Radio Station, and from it, programs which will be arranged by the Los Angeles Examiner, Earl C. Anthony, Inc., the Evening Herald, Leo J. Meyberg Company and the Western Radio Electric Company, will be broadcasted at different hours of the day and evening.

Replaces Old Stations

The new station will replace in the ether KWH; the old KFI; KOG; and KYJ; all of whom have been familiar for so long to the public and who have completed their work; have passed on as individual broadcasting units, with the exception of KWH, the Los Angeles Examiner, which will continue to operate as an individual station for the purpose of broadcasting weather reports and other Government bulletins on the 485 meter wave-length.

The dedication program was presented in three parts. Part One, opening at 8 p. m., was presented by the Anthony Studio. The Second Part was from the Examiner Broadcast station, between 9 and 10:30 p. m., while Part Three from 10:30 to mid-night was from the Anthony Studio. Among those who were presented on the dedication program were: George E. Cryer, Mayor of Los Angeles; William M. Garland, distinguished for city advancement work; Len E. Behymer, internationally famous music impresario; and Sid Grauman, managing director of the Grauman Theatre interests of Southern California.

Radio Products Corp. Fraud Says Canadian Government

LONDON, ONT., CAN.—In a list of mail order concerns which have been denied the use of the Canadian mails under a fraud order issued by the Dominion postal department is a New York firm styling itself the "Radio Products Corporation of America," with offices at 55 Broadway, New York City.

It is alleged that this firm has been offering stock in its various undertakings for sale by mail, and that its character has not been found satisfactory upon investigation by the Canadian postal department. Many Radiophans in London and Western Ontario are said to have purchased stock in the New York concern and as a result of the postal ban on the concern, are now wondering whether they will ever receive any dividends on their investment.

Book Reviews

The Radio Amateur's Handbook. By A Frederick Collins. A new revised edition of this book is just out. It is complete, authentic and informative work on Radio. Fully illustrated. Price, $1.50.

Vacuum Tube Receivers. By O. F. Heslar. A book that telis how to make a simple set. How to make a cabinet. It includes a 27 by 36-inch layout blue print. Price, 75 cents.

The Armstrong Super-Regenerative Circuit. By George J. Eltz, Jr., E. E. This is a De Luxe edition of this famous circuit. Profusely illustrated and fully explained. Fifty-two pages. Price, $1.00.

Letters of a Radio Engineer to His Son. By John Mills. A series of interesting letters written to a boy. Each letter is full and complete and the most advanced student can skip over some of the letters and get just the information he desires. Price, $2.00.

How to Retail Radio. A new book telling of tested plans and methods and policies for the dealer in Radio. Financing, location, store equipment and arrangement. Price, $2.00.

Radio First Aid. Illustrated with working drawings and complete data as to the necessary equipment and cost of constructing from the simplest to the most modern Radio outfits at home. Price, $1.

Home Radio—How to Make It. By A. Hyatt Verrill. This book is particularly adapted for the amateur who desires to know how to make Radiophones. Twelve full page illustrations and diagrams. Price, 75c.

Radio for the Amateur. By A. H. Packer and R. R. Haugh. The underlying principles of Radio thoroughly explained in simple language and understandable illustrations. This book will teach you how to construct and operate a receiving set successfully. Price, $1.50.

Radio Communication. By John Mills. The fundamental principles and methods upon which recent developments are based are emphasized. The vacuum tube is treated in a simple, fundamental and up-to-date manner. Present methods and tendencies of the art are explained in a chapter which is non-mathematical. Price $2.00.

The book department of the Radio Digest is prepared to send you any of the books on Radio published, whether listed in our Book Review or not. Let us know what book you want, send us your check and we will see that the book is mailed to you. Postage stamps in payments for books not accepted. Send money order or check. Radio Book Department, Radio Digest Illustrated, 123 W. Madison St., Chicago, Ill.

KHJ and KFI Both Work 400 Meters

Broadcasting of Two Class B Stations First Time in History of Los Angeles

LOS ANGELES, CALIF.—For the first time in Radio history, two Class B, 400-meter broadcasting stations went on the air in the same city, at the same time and presented their programs simultaneously, when on Saturday evening, January 27, in this city, KHJ, the Los Angeles Times, presented its regular concert and the new KFI, the Examiner-Anthony, Central Radio Station, held its dedication program. The event was made possible through a conference between those in charge of the stations and Maj. J. F. Dillon, federal Radio inspector for the sixth district.

Major Dillon believes that this may be common practice soon if Congress will pass the contemplated legislation providing a wider band of wave lengths for stations. He expects that the legislation will give wave lengths sufficient meters apart so that listeners in will have no difficulty in tuning in the station they desire to hear.

Forty Meters Necessary

KHJ will continue to broadcast on its wave length of approximately 400 meters, and the KFI will broadcast with a wave length near 400 meters. The two stations have tested this plan recently, both being on the air at the same time on wave lengths varying from 15 to 25 meters.

With a selective tuning device it was found that ten meters difference did not permit of separation, while 15 meters made it possible to tune the station desired moderately well, although there was found some interference. At a difference of 25 meters, perfect elimination of interference was found. It is therefore expected that a difference of 40 meters will make possible the relatively easy reception of concerts which will be presented by both KHJ and KFI at the same time.

"WGM" OLD RELIABLE

(Continued from page 5)

wooden and steel masts located more than 100 feet above the ground on the roof of the Constitution's building. The wires are No. 6 stranded cables and after six hours of sleet Tuesday afternoon, January 23, these wires were coated with three inches of ice. The tremendous weight of this was too much for one of the wires and it snapped at the center hoop.

Operator Makes Repair

Operator A. W. Shropshire lowered the antenna with a view to cutting the dead end of this broken strand and replacing the antenna. The storm was too intense to contemplate immediate repair. Mr. Shropshire had raised the antenna to the top of the masts and had just entered the operating room of Station WGM to retune the transmitter to the changed aerial when the entire antenna crashed down on the roof of the Constitution building.

Now Station WGM has an entirely new antenna system since the antenna in falling crashed through the wire counterpoise.

According to heads of the Radio Chamber of Commerce, immediate limitation in the number of stations will have beneficial results in every way.

The "How" of the Simplified Super Circuit

Part V—The Importance of, and How to Make Variable Leaks

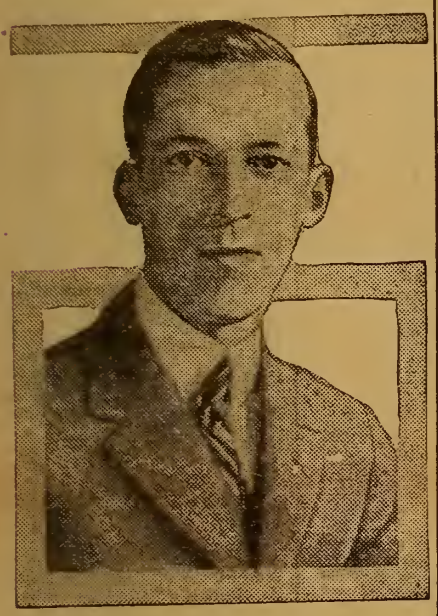
By E. T. Flewelling

THE Flewelling Super Circuit and the functions performed by its various parts have been pretty well covered by now, so far as its general requirements are concerned. We haven't bothered much about the theory of its action, because it is believed that no more than a rough outline of this is desired by the fans, most of whom haven't the time for it.

It will be noticed however, that a question might be raised as to how the circuit operates, because of the article last week. If we know what is happening in the set, we are much more liable to get the most pleasure and results from it. Let us settle the operation, if we can, and then discuss in detail a few points that have to do with getting the maximum results from the Flivver.

Operation of Flivver

The explanation of how the Flivver circuit operates really was covered in Part IV, last week's article. The action is due primarily to the starting and stopping of the tube action, and this action working on the super circuit is responsible for the results. It is pointed out that there is no



E. T. Flewelling, Inventor of the Flivver Super Circuit

low frequency oscillation in the circuit. By that statement we mean that there is not the usual train of oscillations imposed upon the circuit that are produced by a tuned auxiliary circuit, as is general in former types of super circuits.

Of course, the starting and stopping, which results in more or less charging and discharging of the condenser bank, will result in oscillations of a type. However, that the predominating action is the starting and stopping of the tube, is what we wish to emphasize. It will then be seen that the operator should learn to handle the starting and stopping rather than a separate oscillation. This is really the keynote to success with the Flivver Circuit.

Action of Leaks

Because the most important action of the circuit is controlled mostly by the leak resistances, let us take these up first in our consideration of the best parts and proper handling of the circuit.

An important point to remember is, that if the blocking action is allowed to take place at too slow a rate, about all that one will hear will be the sound caused by this action. The blocking action must be controlled and timed properly to get the results, and the leaks give us the ability to handle this timing.

Time your set then with the two leaks and you find that when you change the coupling of the coils, or tune with the condenser, that you change the timing. Quite often the speed will be too slow at the point where the set is tuned to the sending station, and, although the broadcasting is heard, it is not at all satisfactory because one hears too plainly the blocking and freeing noises occurring. Then the thing to do is to speed up the blocking by changing the grid leak resistance values.

Bring the speed up to the point where the reception of the signal is satisfactory and oftentimes you will find that by careful tuning and setting of the leaks that perfect reception is accomplished but that the squealing sound caused by the blocking is entirely gone. It really is there still, but it is occurring so fast that the resultant note is too high in pitch to be audible to the average person.

Importance in Flivver Circuit

It is probably very clear now, just how important it is to have a grid leak that can be changed in value to suit the station desired. Pencil or ink marks on the condensers have been given as the simplest and cheapest way of doing this. It is conceded, however, that it is difficult to make a permanent setting for these leaks which is satisfactory at all points in tuning, and it is believed that better work can be done if both leaks are readily adjustable.

If you buy your grid leaks purchase the best obtainable because your success depends much upon their being of good quality.

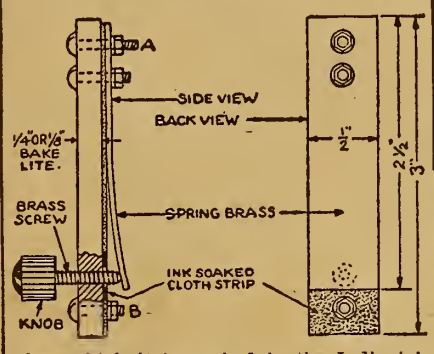
The Durham variable resistance is good, but for the Radiophans who prefer panel mounting one may use a leak that is controlled by turning a knob. Good leaks of this type are the CRL and the Freshman. A number of manufacturers have sent in for test purposes several of their variable grid leaks. Once in a while we have found a defective one that we could not operate. Be careful that you are not trying to make your set work with a leak that looks all right but is defective in reality.

Making Your Own Leaks

If you prefer to make your own leaks it may be done very easily in the following way:

The materials required to make the leak are some India ink, a strip of closely woven, smooth linen cloth, a strip of phosphor bronze or spring brass ½-inch wide, 2½ inches long and about 1/32-inch thick, a piece of bakelite or hard rubber ⅛ or ¼-inch thick, ½-inch wide and 3 inches long, four brass screws, 4/36 or 6/32, three washers and three nuts to fit, and an insulating knob with an internal thread.

First cut the bakelite strip and drill the necessary holes. The control knob screw hole is drilled small and then tapped to fit the thread of the screw used. The cloth is then cut to the size of the bakelite strip,



after which it is soaked in the India ink ad lald on one surface of the bakelite. The spring brass is bolted down over the cloth at one end with two of the screws and nuts, using a washer under each nut. Cut a ¼-inch hole in the cloth where the control screw comes through, so that no electrical contact is made between the screw and the cloth. Otherwise the leak would be short-circuited at this point. See that the spring lays flat against the cloth all along. Another screw and nut with washer holds the other end of the cloth and makes a connection for the circuit.

The body part of the remaining screw with its nut is used for making the adjustment. The head is removed from the screw and the insulating knob is substituted. The manner of making the adjustment can be readily understood by the illustration. In purchasing screws be sure to select the proper thread to fit the insulating knob. The end screws, A and B, are used for the connections in the circuit.

Tho fabric is of high resistance and the spring resistance negligible. The more spring we lay on the fabric the less fabric the current has to go through and the lower the resistance of the leak. The sketch and description for making are for a type that the writer has been using successfully. Several points however should be noted in the construction of this leak. Be sure that when the spring is screwed down that it works from one end of the fabric to the other uniformly. This may be done by laying a stiff piece of metal on top of the spring and working the screw on this more substantial piece. Change the width of the fabric until the correct value is reached, but be sure that this is not done until the ink has had a day or two in which to dry thoroughly. This type of leak can be adapted to panel mounting. With both leaks mounted in this way, the set may be coaxed into doing its utmost.

No Trouble in Condenser Bank

The bank of condensers, C3, C4 and C5, when once assembled properly, needs no changes and can be forgotten. In fact, this point should be emphasized. Be sure to use condensers having a mica dielectric, and then don't be afraid that you have the wrong values. If you buy reliable apparatus, you will find that these condensers will be of such values that the set will at least function.

The set will operate even when the values of these condensers have large variations from the value .006 mfd. The value .006 is given as the best, all around value. Values from .002 to .012, in fact, have been used successfully, but results, of course, were not so good. If your set doesn't "fire" don't blame the condensers if you have good ones, but check up on your leaks, coil coupling, tuning condenser, and whatever you may be using as an antenna.

An ordinary amount of patience is needed, no more. The time to find out whether you can improve on the condenser capacity values you are using, is after the set is in operating condition. It is then suggested that you do this experimenting while receiving signals, in order that you may know when the right point has been reached.

Weight for Aerial on Tree

An aerial that is attached to a tree should have a balance weight attached at one end to prevent the wire from snapping during severe wind storms. The weight should be suspended so that it will take up a maximum of 15 feet of the rope's length.

Radiophone Broadcasting Stations

Corrected Every Week—Part III

State, City, Call

Alabama:
Auburn, WMAV
Birmingham, WOAY, WSY
Mobile, WEAP
Montgomery, WKAN

Arizona:
Phoenix, KDYW, KFAD, KFCB
Tucson, KDZA, KFDH

Arkansas:
Fort Smith, WCAC, WGAR
Little Rock, WCAV, WEAX
Pine Bluff, WOK

California:
Altadena, KGO
Bakersfield, KDZB, KYI
Berkeley, KQI, KRE
Del Monte, KLN
El Monte, KUY
Eureka, KNI
Fresno, KDZH, KMJ
Hanford, KFBD
Hollywood, KFAR
Long Beach, KSS
Los Angeles, KDZF, KFCL, KFI, KHJ, KJS, KNN, KNV, KOG, KUS, KWH, KXS
Modesto, KXD
Oakland, KLX, KZM
Pasadena, KLB
Reedley, KFAZ
Richmond, KFCM
Sacramento, KFBK
San Diego, KDPT, KDYM, KFBC, KFFA, KON
San Francisco, AG1, KDN, KDZG, KDZX, KFDB, KLS, KPO, KSL, KUO
San Jose, KFAQ, KQW,
San Luis Obispo, KFBE
Santa Ana, KFAW
Santa Barbara, KFHJ
Stanford Univ., KFGH
Stockton, KJQ, KWG
Sunnyvale, KJJ
Taft, KFEB
Venice, KFAV

Colorado:
Boulder, KFAJ
Colorado Springs, KFFQ, KFBV, KFCK, KHD
Denver, DD5, DN4, KDZQ, KEEP, KFAF, KFDL, KLZ
Pueblo, KFGB
Trinidad, KFBS

Connecticut:
Bridgeport, WKAX
Greenwich, WAAQ
Hartford, WDAK
Middleton, WOAS
New Haven, WGAH, WPAJ
Waterbury, WQAD

Delaware:
Wilmington, WHAV, WOAT, WPAW

District of Columbia:
Washington, WDM, WEAS, WHAQ, WIL, WIAY, WJH, WMU, WPM, WWX

Florida:
Jacksonville, WDAL
Miami, WIAZ, WQAM
Pensacola, WGAN, WLAV
Tampa, WDAE, WEAT, WHAW
West Palm Beach, WKAH

Georgia:
Atlanta, WGM, WSB
College Park, WDAJ
Decatur, WAAS

State, City, Call

Gainesville, WKAY
Macon, WGAK, WMAZ
Savannah, WHAO

Idaho:
Boise, KFAU, KFDD
Moscow, KFAN
Thomasville, WPAX
Wallace, KFCC

Illinois:
Belvidere, WOAG
Carthage, WCAZ
Chicago, KYW, WAAF, WBU, WDAP, WJAZ, WMAQ, WPAD, WSAH
Decatur, WBAO, WCAP, WHAP
Galesburg, WRAM
Mattoon, WQAL
Peoria, WJAN
Quincy, WCAW
Rockford, WIAB
Springfield, WDAC
Tuscola, WDZ
Urbana, WRM

Indiana:
Anderson, WEAW
Brookville, WSAL
Evansville, WNAM, WOAU
Fort Wayne, WFAS
Greencastle, WLAX
Huntington, WHAY
Indianapolis, WLK, WOH
Marion, WIAQ
Mishawaka, WOAO
Muncie, WJAF
Richmond, WOZ
South Bend, WGAZ
Terre Haute, WEAC
West Lafayette, WBAA

Iowa:
Ames, WOI
Burlington, WIAS, WLAT
Cedar Rapids, WJAM, WKAA
Centerville, WDAX
Council Bluffs, WPAF
Davenport, WHAI, WOC
Des Moines, WGF, WHX
Dubuque, WQAK
Fort Dodge, WEAB
Iowa City, WHAA
Le Mars, KFCY, WIAU
Marshalltown, WLAR
Newton, WIAH
Shenandoah, WGAJ
Sigourney, WOAD
Sioux City, WEAU, WHAE
Vinton, WIAE
Waterloo, WHAC, WMAR, WRAN

Kansas:
Anthony, WBL
Atwood, WEAD
Beloit, WPAR
Eldorado, WAH
Emporia, WAAZ
Hutchinson, WLAS
Independence, WFAY
Liberal, WMAG
Manhattan, WNAK, WTG
Marion, WRAD
Parsons, WOAJ
Salina, WFAD
Topeka, WJAQ, WPAM
Wichita, WAAP, WEAH, WEY

Kentucky:
Bowling Green, WNAB
Frankfort, WOAK
Lexington, WQAH
Louisville, WHAS, WKAG, WLAP
Paducah, WIAR

State, City, Call

Louisiana:
New Orleans, WAAB, WAAC, WCAG, WGV, WIAF, WWL
Shreveport, WGAQ

Maine:
Auburn, WMB
Bangor, WPAY
Houlton, WLAN

Maryland:
Baltimore, WCAO, WEAR, WKC, WNAV
Frostburg, WPAQ

Massachusetts:
Boston, WAAJ, WFAU, WNAC
Dartmouth, WMAF
Lowell, WQAS
Medford Hillside, WGI
New Bedford, WDAU
Springfield, WBZ
Worcester, WCN, WDAS

Michigan:
Ann Arbor, WMAX, WQAJ
Bay City, WTP
Dearborn, WWI
Detroit, KOP, WCX, WWJ
East Lansing, WKAR
Flint, WEAA
Kalamazoo, WOAP, WLAQ
Lansing, WHAL
Laurium, WPAV
Rodgers, WCAF
Saginaw, WIAW

Minnesota:
Duluth, WJAP, WMAT
Hutchinson, WFAN
Minneapolis, WBAD, WBAH, WCAS, WLAG, WLB
Moorhead, WPAU
Northfield, WCAL
St. Cloud, WFAM
St. Paul, AV7, WAAH

Missouri:
Butler, WNAR
Cameron, WFAQ
Cape Girardeau, WSAB
Columbia, WAAN
Independence, WPAG
Jefferson City, WOS
Joplin, WHAH
Kansas City, WDAF, WHB, WMAJ, WOQ
Marshall, WJAT
Rockport, WMAD
St. Joseph, WEAK
St. Louis, KSD, WCK, WEB, WEW, WMAY, WRAO
Springfield, WIAI, WKAS, WQAB
Tarkio, WIAT
Webster Grove, WOAL

Montana:
Billings, KFCH
Butte, KFAP
Great Falls, KDYS
Havre, KFBB
Polytechnic, KFED

Nebraska:
David City, WRAR
Fremont, WOAE
Hastings, WQAY
Lincoln, WFAV, WGAT, WJAB, WKAC, WLAF, WMAH, WQAP, WSAS
Norfolk, WJAG

State, City, Call

Omaha, WAAW, WDV, WIAK, WNAL, WOAW, WOU, WOV
Rushville, WEAV
Tecumseh, WTAU
University Place, WCAJ
York, KFDR

Nevada:
Reno, KDZK, KFAS,

New Hampshire:
Laconia, WKAV

New Jersey:
Atlantic City, WHAR
Camden, WRP
Jersey City, WAAT, WNO
Moorestown, WBAF
Newark, WAAM, WBS, WJZ, WOR
N. Plainfield, WEAM
Ocean City, WIAD
Paterson, WBAN
Roselle Park, WDY
Trenton, WMAL, WOAX

New Mexico:
Roswell, KNJ
State College, KOB

New York:
Albany, WNJ
Amsterdam, WPAS
Binghamton, WIAV
Buffalo, WGR, WWT
Canton, WCAD
Cazenovia, WMAC
Ithaca, WEAI
Lockport, WMAK
Newburgh, WCAB
New York, KDOW, WBAY, WDT, WEAF, WJX, WLAW, WWZ
Poughkeepsie, WFAF
Rochester, WHAM
Ridgewood, WHN
Schenectady, WGY, WRL
Syracuse, WDAI, WFAB, WLAH, WNAN
Tarrytown, WRW
Troy, WHAZ
Utica, WSL
Waterford, WFAG

North Carolina:
Asheville, WFAJ
Charlotte, WBT
Raleigh, WLAC

North Dakota:
Fargo, WDAY, WPAK
Grand Forks, WOAB
Mayville, WRAC
Wahpeton, WMAW

Ohio:
Canton, WWB
Cincinnati, WAAD, WHAG, WIZ, WLW, WMH
Cleveland, KDPM, WHK, WJAX
Columbus, WBAV, WCAH, WEAO, WMAN, WPAL
Dayton, WAI, WJAJ
Fairfield, WL2
Granville, WJD
Hamilton, WBAU, WRK
Lebanon, WPG
Lima, WOAC
Marietta, WBAW
Sandusky, WQAF
Springfield, WLAM, WNAP
Stockdale, WJAK
Toledo, WJK
Warren, WLAZ
Washington C. O., WGAX
Wooster, WGAU
Youngstown, WAAY

Oklahoma:
Ardmore, WOAA

State, City, Call

Enid, WNAF
Norman, WNAD
Okemah, WKAK
Oklahoma City, WKY, WMAB
Okmulgee, WPAC
Tulsa, WEH, WGAF, WLAL

Oregon:
Astoria, KFGG
Baker, KFDA
Corvallis, KFDJ
Eugene, KFAT
Hood River, KQP
Marshfield, KFBH
Medford, KFAY
Pendleton, KFFE
Portland, KDYQ, KFEC, KGG, KGN, KGW, KQY
Salem, KFCD

Pennsylvania:
Altoona, WGAW
Clearfield, WPI
Easton, WMAP
Erie, WOAV
Grove City, WSAJ
Johnstown, WTAC
Lancaster, WGAL
McKeesport, WIK
Parkesburg, WQAA
Philadelphia, WCAU, WDAR, WFI, WGL, WIP, WNAT, WOO, WWAD
Pittsburgh, KDKA, KQV, WCAE, WHAF, WJAS
Scranton, WQAN, WRAY
State College, WPAB
Villanova, WCAM
Wilkes-Barre, WBAX, WNAH

Rhode Island:
Cranston, WKAP
Edgewood, WEAG
Providence, WEAN, WJAR

South Carolina:
Charleston, WFAZ, WNAQ, WOAH
Orangeburg, WGAM

South Dakota:
Rapid City, WCAT
Sioux Falls, WFAT
Vermillion, WEAJ

Tennessee:
Knoxville, WNAV
Lawrenceburg, WOAN
Memphis, WKN, WMC, WPO

Texas:
Abelene, WQAQ
Amarillo, WDAG, WRAU
WRAU
Austin, WCM, WNAS
Beaumont, WMAM
College Station, WTAW
Dallas, WDAO, WFAA, WRR
El Paso, WDAH, WPAT
Fort Worth, WBAP, WPA
Galveston, WHAB, WIAC
Houston, WCAK, WEAY, WEV, WGAB, WRAA, WSAV
Laredo, WWAX
Orange, WKAL
Plainview, WSAT
Port Arthur, WFAH
San Antonio, AS6, DM7, WCAR, WOAI
Stanford, WOAZ
Tyler, WOAF

State, City, Call

Waco, WJAD, WLAJ, WWAC
Wichita Falls, WKAF

Utah:
Ogden, KDZL, KFCP
Salt Lake City, KDYL, KDYV, KZN

Vermont:
Bellows Falls, WLAK
Burlington, WCAX
Springfield, WQAE

Virginia:
Blacksburg, WEAE
Fortress Monroe, WNAW
Portsmouth, WOAQ

Washington:
Aberdeen, KNT
Bellingham, KDZR
Centralia, KDZM
Everett, KDZZ, KFBL
Lacey, KGY
Mt. Vernon, KFGF
Pullman, KFAE
Seattle, KDZE, KDZT, KHQ, KJR, KTW
Spokane, KFDC, KFZ
Tacoma, BE1, KFBG, KFEJ, KGB, KMO
Walla Walla, KFCF
Wenatchee, KDZI, KZV
Yakima, KFV

West Virginia:
Arlington, NAA
Clarksburg, WHAK
Morgantown, WHD

Wisconsin:
Beloit, WKAW
Kenosha, WOAR
Madison, WGAY, WHA
Milwaukee, WAAK, WCAY, WHAD, WIAO
Neenah, WIAJ
Superior, WFAC
Waupaca, WPAH

Wyoming:
Casper, KFCQ, KFDF
Laramie, KFBU

Alaska:
Fairbanks, WLAY

Hawaii:
Honolulu, KDYX, KGU, KYQ

Porto Rico:
Ensenada, WGAD
San Juan, WKAQ

Canada:
Calgary, CHBC, CHCQ, CFAC, CFCN, CJGY
Edmonton, CJCA
Fort Frances, CFPC
Halifax, CFCE, CJCS
Hamilton, CKOC
Iroquois Falls, CFCH
Kitchener, CJCF
London, CFCX, CHCS, CJGC, CKQC
Montreal, CFCF, CHCX, CHYC, CJBC, CKAC
Nelson, CJCB
Ottawa, CHXC
Regina, CKCK
St. John, CJCI, CKCR
Toronto, CFCA, CFTC, CHCB, CHVC, CJCD, CJCH, CJCN, CJSC, CKCE, CKCZ, CKKC
Vancouver, CFCB, CFYC, CHCA, CJCE
Winnipeg, CHCF, CJCG, CKCB, CKZC, CJNC

Cuba:
Havana, PWX

(NOTE.—The third and last part of the schedule list appears below. Next week the first part will appear.)

WLK, Indianapolis, Ind. 485 also. 500 mi. Hamilton Mfg. Co. Daily ex Sun, 11-11:30 am, 12-12:30 pm, 2-2:30, 3-3:30, 5-5:30, reports. Tues, Thur, 8:30-10 pm, concert. Sun, 2-4 pm, 8:30-10. Central.

WLW, Cincinnati, O. 485 also. 2,000 mi. Crosley Mfg. Co. Daily ex Sun, 10 am-3 pm, music, reports. Tues, Fri, 8-10:30 pm, Thurs, 10-12 pm, music, news. Sun. 11 am, church service. Central.

WMAB, Oklahoma City, Okla. 500 mi. Radio Supply Co. Daily ex Sun, 9:30-10:30 pm, music. Fri, 11:30-12:30 pm. Central.

WMAC, Cazenovia, N. Y. 330, 250, 275 only. 500 mi. C. R. Meredith. No definite schedule.

WMAD, Rock Port, Mo. Atchinson County Mail.

WMAF, Dartmouth, Mass. Round Hills Radio Corp.

WMAG, Liberal, Kan. 75 mi. Tucker Elec. Co. Daily ex Fri, Sun, 7:30-8:30 pm, music, news. Fri, 8-9 pm, concert. Central.

WMAH, Lincoln, Neb. 100 mi. General Supply Co. Daily ex Sun, 2:15 pm, music, news. Mon, Thur, 7:30 pm, music. Central.

WMAJ, Kansas City, Mo. 485 also. 600 mi. Daily Drovers Telegram. Daily ex Sun, 8:15 am, 9:15, 10:15, 11:15, 12:15 pm, 2:15, weather, markets. Central.

WMAK, Lockport, N. Y. 485 also. 1,500 mi. Norton Labs. Tues, 8-9:30 pm, music. Eastern.

WMAL, Trenton, N. J. 100 mi. Trenton Hdwe. Co. Mon, Thur, 7:30-9 pm, music, lecture. Eastern.

WMAM, Beaumont, Tex. Beaumont Radio Equipment Co

WMAN, Columbus, O. 50 mi. First Baptist Church. Sun., 10:30-12 m., 7:30-9 pm, church services. Central.

WMAP, Easton, Pa. 400 mi. Utility Battery Service Co. Daily ex Sun, 4-5 pm, 6-6:45. Wed, 8-9:55 pm, entertainment. Eastern.

WMAQ, Chicago, Ill. 1500 mi. The Chicago Daily News (Fair Department Store). Daily, 4:35-5 pm, 9:15-10. Mon, Wed, Fri, Sat, 7-7:30 pm. Tues, Thurs, 7-8 pm. Central.

WMAR, Waterloo, Iowa. Waterloo Electrical Supply Co. Schedule not established.

WMAT, Duluth, Minn. 485 also. 500 mi. Paramount Radio Corp. Daily ex Sun, 11:20 am, 4:20 pm, weather; 6:15-7:30 pm, markets. Tues, Fri, 8-9:30 pm, concert. Central.

WMAV, Auburn, Ala. Ala. Polytechnic Inst.

WMAW, Wahpeton, N. D. 50 mi. Wahpeton Elec. Co. Daily, 7-7:30 pm, music, sports, news. Central.

WMAX, Ann Arbor, Mich. K. & K. Radio Supply Co.

WMAY, St. Louis, Mo. 1,000 mi. Kingshighway Presbyterian Church. Sun, 11 am, 8 pm. Tues, 7-8 pm, church services. Central.

WMAZ, Macon, Ga. 250 mi. Mercer University. Daily ex Sun, 5:30-6 pm, 7-7:30, 8:30-9:30, music. Tues, Wed, Thur, 10:30-11 am, chapel. Eastern.

WMB, Auburn, Me. Auburn Elec. Co.

WMC, Memphis, Tenn. 400 and 485 only. 2,000 mi. The Commercial Appeal. Daily, 12 m, 3 pm, weather, markets; 8 pm, entertainment. Central.

WMH, Cincinnati, O. 485 only. 500 mi. Precision Equipment Co. Daily ex Sun, 11 am, 4 pm, reports. Mon, Wed, Sat, 8:15 pm, entertainment. Central.

WMU, Washington, D. C. 100 mi. Doubleday-Hill Elec. Co. Daily, 4:30 pm, concert, sports. Thurs, 8.9, concert. Eastern.

WNAB, Bowling Green, Ky. 500 mi. R. D. Nichols. Daily ex Tues, 4-5 pm, 7:30-9, music. Central.

WNAC, Boston, Mass. 200 mi. Shepard Stores. Daily ex Sun, 4-5 pm, dance music. Tues, Thur, 7-8:30 pm. Wed, Sat, 9:30-11 pm, Fri, 8-9:30 pm. Sun, 11-12 am, 6:30-8:30 pm, church services. Eastern.

WNAD, Norman, Okla. 200 mi. Okla. Radio Engineering Co. Daily ex Sun, 7:45-8:15 pm, news. Central.

WNAF, Enid, Okla. Enid Radio Dist. Co.

WNAK, Manhattan, Kans. Manhattan Radio Supply Co.

WNAL, Omaha, Neb. R. J. Rockwell.

WNAM, Evansville, Ind. 200 mi. 485 also. Ideal Apparatus Co., Inc. Mon, Wed, Fri, Sat, 10-11 am, music, reports; 3-4 pm, 7-8, entertainment. Sun, 3-4 pm, music. Central.

WNAN, Syracuse, N. Y. 1,000 mi. Syracuse Radio Tel. Co. Mon, Wed, Sat, 7:30-9:30 pm, concert, agriograms, etc. Eastern.

WNAQ, Charleston, S. C. Charleston Radio Elec. Co.

WNAP, Springfield, O. 200 mi. Wittenberg College.

WNAR, Butler, Mo. C. C. Rhodes.

WNAS, Austin, Tex. Tex. Radio Corp. (Austin Statesman).

WNAT, Philadelphia, Pa. 500 mi. Lennig Bros. Co. Daily ex Sun, 12:15-1 pm, Wed, Sat, 7:30-9:30 pm. Sun, 2:30 pm, 4:30, church services. Eastern.

WNAV, Knoxville, Tenn. People's Tel. & Telg. Co.

WNAW, Fortress Monroe, Va. Henry Kunzmann.

WNAX, Yankton, S. D. Dakota Radio Apparatus Co.

WNAY, Baltimore, Md. Shipowners Radio Service.

WNJ, Albany, N. Y. 60 mi. Shotton Radio Mfg. Co., Inc. Daily ex Sun, 10-10:15 am, market reports. Wed, 8:15 pm, concert. Eastern.

WNO, Jersey City, N. J. Wireless Telephone Co of Hudson Co., N. J.

WOAA, Ardmore, Okla. Dr. Walter Hardy.

WOAB, Grand Forks, No. Dak. 50 mi. 485 also. Valley Radio. Daily ex Sun, 10-11 am, 2-2:30 pm, entertainment, reports. Sun, 3-4 pm, music, church service. Central.

WOAC, Lima, O. Maus Radio Co.

WOAO, Sigourney, Ia. Friday Battery & Elec. Co.

WOAE, Fremont, Nebr. Medland College.

WOAF, Tyler, Tex. 485 also. 50 mi. The Tyler Commercial College. Daily ex Sat & Sun, 12 m, weather, markets; 7 pm, weather, codes; 10:15, U. S. Navy press. Sun, 11 am, 7:30 pm, church service. Central.

WOAG, Belvidere, Ill. Apollo Theatre.

WOAH, Charleston, S. C. 200 mi. Palmetto Radio Corp. Mon, Thur, Sat, Sun, 10 pm-1 am, music. Eastern.

WOAI, San Antonio, Tex. 485 also. 1,800 mi. Southern Equip. Co. Daily ex Sun, 10:30 am, 12:15 pm, 3, 6, news, markets. Tues, Suu, 9:30-10:30 pm, concert. Thurs, 7:30-8:30 pm, concert. Central.

WOAJ, Parsons, Kans. 50 mi. C. E. Ervin. Thurs, 7-8 pm, music, lectures, news. Sun, 3-4:30 pm, Sermon, music, news. Central.

WOAK, Frankfort, Ky. Collins Hardware Co.

WOAL, Webster Groves, Mo. 300 mi. W. E. Woods. Sun, 3-5 pm. Central.

WOAN, Lawrenceburg, Tenn. 1,000 mi. James D. Vaughan. Daily, 8-9 pm, concert. Central.

WOAO, Mishawaka, Ind. 200 mi. Lyradion Mfg. Co.

WOAP, Kalamazoo, Mich. Kalamazoo College.

WOAQ, Portsmouth, Va. Portsmouth Radio Assn.

WOAR, Kenosha, Wis. H. P. Lundskow.

WOAS, Middletown, Conn. 100 mi. Bailey's Radio Shop. Daily ex Sun, 4:15-6 pm, music. Sat, 9-12 pm, dance music. Eastern.

WOAT, Wilmington, Del. Boyd Martell Hamp.

WOAU, Evansville, Ind. Sowder Bowling Piano Co.

WOAV, Erie, Pa. 600 mi. Penna. Nat'l Guard. Tues, Thurs, 8:30-10 pm, music. Fri, 10 pm, sports. Sun, 7:45 pm, church services. Eastern.

WOAW, Omaha, Nebr. Woodmen of the World.

WOAX, Treuton, N. J. 342 only. 300 mi. F. J. Wolff. Intermittent schedule.

WOAY, Birmingham, Ala. John M. Wilder.

WOAZ, Stanford, Tex. Penick Hughes Co.

WOC, Davenport, Ia. 400 and 485 only. 1,000 mi. Palmer School of Chiropractic. Daily ex Sun, 10:55 am, time; 11, weather; 12 m, chimes; 2 pm, markets; 3:30, talk; 5:45 chimes, ex Wed; 6:30, sports; 7, concert; 10 pm, concert, Wed only. Sun, 9 am, chimes; 1:45 pm, 6, concert; 7, church services; 7, concert. Central.

WOH, Indianaoplis, Ind. 1,000 mi. Hatfield Elec. Co. (Indianapolis Star.) Daily ex Sun, 10-11 am, music; 10:15, financial, marketa; 1-2 pm, music; 1:20, markets; 4-5 pm, music; 4:15, police notes; 4:50, sports. Mon, Wed, Sat, 8:30-10 pm, Concert. Central.

WOI, Ames, Ia. 485 also. 200 mi. Iowa State College. Daily ex Sun, 9:30 am, 12:45 pm, 9:30, music, weather. Central.

WOK, Pine Bluff, Ark. 485 also. 500 mi. Ark. Light & Power Co. Tues, Fri, 9-10 pm, concert. Sun, 11-12 m, 7:30 pm, church services. Central.

WOO, Philadelphia, Pa. 400 and 485 only. 500 mi. John Wanamaker.

WOQ, Kansas City, Mo. 485 also. 1,000 mi. Western Radio Co. Mon, Tue, Wed, Thur, 9:45 am, 10:55, 11:30, 12:30 pm, 2, 7:30, time signals, reports, etc. Fri, 1:15 pm, sacred service. Sat, 8 pm, concert. Sun, 7 pm, concert.

WOR, Newark, N. J. 400 only. 2,000 mi. L. Bamberger & Co. Daily ex Sun, 2:30-4 pm, 6:15-7:30, music, talks. Tues, Fri, 8-11 pm, music, entertainment. Eastern.

WOS, Jefferson City, Mo. 485 also. 1,500 mi. Missouri State Marketing Bureau. Daily ex Sun, first 15 min. of every hour from 8 am-2 pm, markets. Daily, 5 pm, music, markets. Mon, Wed, Fri, 8-9:30 pm, concert. Central.

WOV, Omaha, Neb. R. B. Howell.

WOU, Omaha, Neb. Metropolitan Utilities Dist.

WOZ, Richmond, Ind. 485 also. 300 mi. Palladium Printing Co. Daily ex Sun, 12-12:25 pm, 4-5, 6:30-7, music, markets. Central.

WPA, Ft. Worth, Tex. 485 also. 1,000 mi. Fort Worth Record. Daily ex Sun, 10:58-11 am, time, 2:30-3 pm, 6-6:30, 9-9:30. Sun, 3-3:30 pm, 9-9:30. Mon, 11-12 mid. Central.

WPAA, Waco, Neb. Anderson & Webster Elec. Co.

WPAB. State College, Pa. Pa. State College.

WPAC, Okmulgee, Okla. Donaldson Radio Co.

WPAD, Chicago, Ill. 1,000 mi. W. A. Wieboldt & Co. Daily ex Sun, 12:30-1:30 pm, 6:30-7, music. Central.

WPAF, Council Bluffs, Ia. Peterson's Radio Co.

WPAG, Independence, Mo. Central Radio Co., Inc.

WPAH, Waupaca, Wis. 485 only. 3,000 mi. Wisconsin Dept. of Markets. Daily ex Sun, 8:30 am, 9:30, 10:30, 11:30, 3 pm, 5, markets, weather, news, etc. Central.

WPAJ, New Haven, Conn. Doolittle Radio Corp.

WPAK, Fargo, N. D. North Dakota Agricultural College.

WPAL, Columbus, O. Superior Badio & Tel. Equip. Co.

WPAM, Topeka, Kans. Awerbach & Guettel.

WPAP, Winchester, Ky. Theodore D. Phillips.

WPAQ, Frostburg, Md. General Sales & Engineering Co.

WPAR, Beloit, Kan. 50 mi. R. A. Ward. No definite schedule.

WPAS, Amsterdam, N. Y. J. & M. Electric Co.

WPAT, El Paso, Tex. Saint Patrick's Cathedral.

WPAU, Moorhead, Minn. Concordia College.

WPAV, Laurium, Micb. Tinetti & Sons.

WPAW, Wilmington, Del. 50 mi. The Radio Installation Co. Daily ex Sun, 4-6:30 pm, music, code instruction. Wed, 8-10:30 pm, music. Eastern.

WPAX, Thomasville, Ga. 25 mi. S-W Radio Co. Daily ex Sun, 5-6 pm, roads, weather, stocks, music. Mon, Wed, Fri, 8:30-9:30 pm, music. Sat, 10-11 am, codes. Sun, 11:30 am-12:30, 8:30 pm-9:30, church service. Eastern.

WPAY, Bangor, Me. Bangor Radio Lab.

WPAZ, Charleston, W. Va. Dr. John R. Koch.

WPG, New Lebanon, O. 485 also. 1,500 mi. Nushawg Poultry Farm. Daily ex Sun, 12-12:15 pm, news, 6-6:30 pm, markets. Mon, Fri, 8-9:45 pm, music, farm program. Central.

WPI, Clearfield, Pa. Elec. Supply Co.

WPM, Washington, D. C. 200 mi. Thos. J. Williams, Inc. (Washington Daily News.) Daily ex Sun, 12:30 pm, news. Mon, 8 pm, concert. Eastern.

WPO, Memphis, Tenn. 100 mi. United Equip. Co. Daily, 7:15-8:15 pm, music. Central.

WQAA, Parkesburg, Pa. 1,500 mi. Horace A. Beale, Jr. Daily, 10:30 pm. Eastern.

WQAB, Springfield, Mo. Southwest Missouri State Teachers College.

WQAC, Amarillo, Tex. 200 mi. E. B. Gish.

WQAD, Waterbury, Conn. Whitall Elect. Co.

WQAF, Sandusky, O. Sandusky Register.

WQAH, Lexington, Ky. Brock-Anderson Elect. Eng. Co.

(Continued on page 9)

STATION SCHEDULES

(Continued from page 8)

WQAJ, Ann Arbor, Mich. Ann Arbor Times News.
WQAK, Dubuque, Ia. Appel-Higley Elec. Co.
WQAL, Mattoon, Ill. Cole County Tel. & Telg. Co.
WQAM, Miami, Fla. 500 mi. Electrical Equip. Co. Daily ex Sun, 5:15-5:45 pm, news, stocks, weather; 7:30-9 pm, music. Sun, 9-11 pm, music. Eastern.
WQAO, New York, N. Y. Calvary Baptist Church.
WQAP, Lincoln, Nebr. Am. Radio Co.
WQAQ, Abilene, Tex. West Tex. Radio Co.
WQAR, Muncie, Ind. Press Pub. Co.
WQAS, Lowell, Mass. 50 mi. Prince-Walter Co. Daily ex Sun, 10:45-11 am, 2:30-3 pm, music. Mon, Wed, Fri, 6-7 pm, news, concert. Thurs, silent. Eastern.
WRAA, Houston, Tex. Rice Institute.
WRAC, Maryville, N. D. State Normal School.
WRAD, Marion, Kans. Taylor Radio Shop.
WRAJ, Pittsburgh, Pa. M. H. Pickering Co.
WRAM, Galesburg, Ill. 200 mi. Lombard College. Wed. 7:30-9 pm, college activities, announcements. Schedule irregular. Central.
WRAN, Waterloo, Ia. 100 mi. Black Hawk Electrical Co. Daily ex Sun, 5 pm, 5:30, concert, news. Mon, Wed, Fri, 8:30-9:15 pm, concert. Sun, 11:15, church services. Central.
WRAR, David City, Nebr. 100 mi. Jacob C. Thomas. Tues, Fri, 7-9 pm. Central.
WRAU, Amarillo, Tex. 50 mi. Amarillo Daily News. Tues, Thurs, 7:30-8:30 pm, music. Central.
WRAV, Yellow Spring, O. Antioch College.
WRAY, Scranton, Pa. 485 also. 100 mi. Radio Sales Corp. Daily ex Sun, 11 am, music; 12 m, reports; 3:30-5:30 pm, reports, music; 7:8:30, bedtime stories, music. Sun, 3 pm, chapel. Eastern.
WRK, Hamilton, O. 1,000 mi. Doron Bros. Elec. Co. Tues, Thur, 9-10:30 pm, music, lecture. Sun, 10:30 am, church service. Central.
WRL, Schenectady, N. Y. Union College Radio Club.
WRM, Urbana, Ill. 300 mi. Univ. of Ill. Mon, Thur, 8:30-8:50 pm, 9-9:30 news, talks, music. Central.
WRP, Camden, N. J. 250 mi. Federal Inst. of Radio Telg. Daily ex Sat, Sun, 10-10:45 pm, music, news, agriograms. Eastern.
WRR, Dallas, Tex. 485 also. 200 mi. City of Dallas. Daily ex Sun, 12-12:30 pm, weather; 3-3:30, sports, markets, naws; 7-7:15, police news; 8-8:30, music. Sun, 11 am, church service; 7-8 pm, police news, church service. Central.
WRW, Tarrytown, N. Y. 1,000 mi. Tarrytown Radio & Research Laboratory. Daily ex Sun, 10:30-12 m. Mon, Thur, Sat, 6:15-7 pm, 7:30-8:30, 10:30-12 pm. Sun, 1-3 pm. Eastern.
WSAA, Marietta, O. 50 mi, B. S. Spragua Elec. Co. Wed, 7:30 pm. Eastern.
WSAB, Cape Girardeau, Mo. Southeast Mo. State Teachers College.
WSAH, Chicago, Ill. A. G. Leonard, Jr.
WSAJ, Grove City, Pa. 700 mi. Grove City College. College activities. No definite schedule.
WSAL, Brookville, Ind. Franklin Elec. Co.
WSAS, Lincoln, Nebr. 485 also. 700 mi. Nebr. Dept. of Agri. Daily ex Sat pm and Sun, 9:30 am, 9:45, 10, 10:30, 10:45, 11, 11:30, 11:40, 11:50, 12 m, 1:15 pm, 1:30, 1:45, reports.
WSAV, Houston, Tex. 300 mi. Clifford W. Vick, Radio Const'n Co. Mon, 8-10 pm, concerts. Daily, 7:15-8 pm. Central.
WSB, Atlanta, Ga. 400 and 485 only. 1,500 mi. Atlanta Journal. Daily ex Sun, 12-1 pm, music; 2:30, reports; 4-4:45 pm, music, reports; 5-6 pm, 7-8, 10:45-12 music. Sun, 10:45 am, 5-6 pm, 7:30-9, church services. Central.
WSL, Utica, N. Y. 500 mi. J. & M. Elec. Co. Daily ex Sat, Sun, 11-11:30 am, 2-2:30 pm, 3-3:30, 4-4:30, 5-5:30, music, news. Mon, Wed, 8-9 pm. Sat, 11-11:30 am, 5-6 pm, 8-9. Sun, 10:30-12 m, 7:30-9 pm. Eastern.
WSN, Norfolk, Va. 100 mi. Shipowners Radio Service Inc. Mon, Wed, Sat, 8:15-9:30 pm, concert. Eastern.
WSX, Erie, Pa. 75 mi. Erla Radio Co. Tuas, Thurs, Sat, 10-10:55 pm, news, concert, lecture. Sun, 12:15-1:30 pm, sermon. Eastern.
WSY, Birmingham, Ala. 2,000 mi. Alabama Power Co. Mon, Wed, Fri, 3-3:30 pm, 8-8:45, reports, concert. Sun, 11 am, 7:30 pm, church services. Central.
WTAH, Collega Station, Tex. 200 mi. Agri. & Mech. College of Texas. Wed, Fri, 7:30-8:30 pm, addresses. Sun, 11 am, 4 pm, 7 pm, church services. Central.
WTAC, Johnstun, Pa. Penn Traffic Co.
WTAU, Tecumseh, Neb. Ruegy Battery & Elec. Co.
WTAW, College Station, Tex. 200 mi. Agricultural and Mechanical College of Tex. Wed, Fri, 7:30-8:30 pm, addresses. Sun, 11 am, 4 pm, 7, church services. Central.
WTG, Manhattan, Kan. 485 only. 75 mi. Kan. State Agri. College. Daily ex Sun, 9:55 am, weather (code). Central.
WTP, Bay City, Mich. 75 mi. Ra-Do Corp. Mon, Wed, Fri, 1:30-2 pm, reports, news; 6:30-7:30 pm, concert. Central.
WWAC, Waco, Tex. 485 also. 200 mi. Sanger Bros. Daily ex Sun, 10 am, weather, 1:30 pm, music. Mon, Wed, Fri, 8:45 pm, music. Central.
WWAD, Philadelphia, Pa. Wright & Wright, Inc.
WWAX, Laredo, Tex. 150 mi. Wormser Bros. Daily ex Sun, 4:30-5:30 pm, music. Mon, Sat, 8-9 pm, music. Central.
WWB, Canton, O. 300 mi. Daily News Printing Co. Tues, Thurs, 8-9 pm. Eastern.
WWI, Dearborn, Mich. 200 mi. Ford Motor Co. Wed, 10-11 pm, music, lectures. Eastern.
WWJ, Detroit, Mich. 400 and 485 only. 1,500 mi. Evening News. Daily ex Sun, 9:30-9:40 am, household hints; 9:40-10:25, health talks; 10:25-10:30 am, weather; 11:55-12 m, time; 12:05-12:45 pm, music; 3-3:30 music; 3:30-3:35, weather; 3:35-4:15, markets; 5-6, sports; 7:30-10, entertainment. Sun, November 11, and every other week, 11 am, 4 pm, church services. Sun, fill in weeks, 2 pm, 7:30, church services, special. Eastern.
WWL, New Orleans, La. Loyola Univ.
WWT, Buffalo, N. Y. 200 mi. McCarthy Bros. & Ford. Daily 3-4:30 pm, 7:30-9:30. Eastern.
WWX, Washington, D. C. 1,160 only. 600 mi. Post Office Dept. Daily ex Sun, 10 am, weather; 10:30, markets, 12:30, 2:15, 3:30, markets, 5 pm, 7:30, markets; 9:45, waather. Eastern.
WWZ, New York City. 200 mi. John Wanamakar. Daily ex Sun, 1:15-2:15 pm. Tues, 7:30-9 pm. Fri, 7:30-8:30 pm. Eastern.

(Note.—This completes the station schedule list. The first part will appear again next week.)

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Small Receiving Sets in Favor

Simple Set Is Desired by Most Radiophans

ENTHUSIASM for the large and complicated set has abated and most of the amateurs are now using or experimenting with the simplest form of a receiver. A large portion of those who listen in are beginning to demand a small set that will receive broadcasts at a reasonble distance. The call for a set having a large number of tubes with Radio and audio frequency is abating, and in its place there has come a steady demand for a very simple form of apparatus that will do the work required of it. "Super" sets cease to be objects of experiment. The added effect produced by the extra parts and accompanying complication does not compensate for the expenditure.

There are many Radio bugs who like to fuss with super sets, but the large portion of Radiophans want to sit down and enjoy a concert and do not care to be bothered with complicated apparatus. Then, too, these sets cost more to build.

One of the main reasons the Flewelling set has been such a success is found in its simplicity. It is not necessary to use several steps of amplification with this circuit, and in many instances only one tube will be sufficient to pick up stations that usually require a five-tube set.

The crystal set has its advantages, not only in cost but in upkeep. It is not necessary to use an A or B battery or to have a large number of parts, and there is no oscillation to cause squealing and noises.

The entire receiving set is undergoing many changes and engineers are working on processes to simplify it. When a very simple and easily controlled set is produced there is a large market waiting and the business will flourish. The receiver has ended being a plaything and now is in the realm of useful entertainment.

Directing Motion Picture Plays

Large Armies of Players Directed by Radiophone

THE Radiophone has not had much time in which to acquire a history, but it has found a new application of itself in directing large numbers of actors in scenes for making motion picture film. Recently Rex Ingram, producer of "The Prisoner of Zenda," used the Radiophone in giving commands to a young army of extras in the great coronation scenes.

Practical tryouts of the Radio idea brought approval from Mr. Ingram. The working out of the scheme was not so complicated as he had anticipated. By placing sub-directors to issue orders to every group in the crowds and so arranging the positions of these subordinates as to hide them from the camera and equipping them with receiving apparatus tuned in to his master phone, Mr. Ingram was able to direct the mass of people with instantaneous response.

Expensive Apparatus Not Required

Farmers Benefited by Simple Equipment

TO RECEIVE Radiophone messages requires only a limited equipment, simple and inexpensive. Thousands of farmers have installed receiving sets recently, with the result that isolated rural homes have been brought instantly in touch with the many kinds of information and instruction which are being broadcast continually.

Weather information thus reaches the farmer as promptly and effectively as any urban business man. Farm operations are absolutely dependent for success upon the knowledge of weather conditions, and the protection of crops from disaster due to frost, drought, storms and other weather phenomena is only possible if adequate warnings are received in time. Heretofore a large number of farmers of the country were so located that they could not be supplied by newspapers or telegraph with the daily forecasts and warnings of the weather bureau of the United States department of agriculture in time to be of service to them. Radiophony has changed all of this. Also the number of broadcasting stations has increased to meet the needs of those equipped to receive the messages.

Condensed

By DIELECTRIC

Much has been said in support of the plan to have only a few of the better equipped broadcasting stations transmit programs for the entertainment of all Radiophans. Whatever the ultimate outcome of propaganda so directed may be, it seems certain that the American Telephone and Telegraph Company is satisfied that it can provide a single program simultaneously from a nnmber of toll stations situated in various parts of the country. This was made evident through its recent experiment with Station WNAC in Boston. There seems to be little difference of opinion among those who listen to WEAF as to the quality of their programs and the excellence in transmission. If, when this chain of stations is completed, they can persuade the Metropolitan Opera Company to broadcast their performances from the New York station, everybody will have a chance to listen to grand opera.

It is a natural source of pride for a broadcasting station to be able to point to instances of reception of its entertainment by fans in distant parts of the world. While not so long ago it was a rare thing for Radiophony to be heard over distances of several thousand miles, today such records are becoming quite general. So fine are the spinal adjustments of Station WOC at Davenport, Iowa, that an amateur in France, 4700 miles away, heard part of an address by Major Atkinson at this station. Pearl Harbor, Hawaiian Islands, is about 5100 miles removed from the City of Brotherly Love, yet WIP was heard by a government Radio operator at the former place. Philadelphia may be accused of being slow, but here she is setting up a great record for the "speedy" towns to equal or surpass. Of course, WJZ has been getting across fairly often, they have to live up to their announcement—"the international broadcasting station." It is really WGY to whom must be awarded the medal for distant reception. It is said that a member of the British Marconi Company picked up the Schenectady station one night and the volume of sound which came from his loud speaker when a piano solo was broadcast, awakened a sleeping child in an adjoining room. From the U. S. to England, and then an indefinite distance into slumberland!

To that perturbed Doctor, whose letter of protest against broadcasting "No. 2 yellow corn" appeared in the columns of this paper, little of joy may be found in the announcement of the purchase by the Chicago Board of Trade of Station WDAP. However, this city is to be congratulated on having (since we shall continue to hear futures, etc., by Radio) so modernly appointed a transmitting system as the glass booth, from which quotations are directly sent from the floor to the world. I am quite sure that stock quotations are limited to certain hours in the day, and that periods in the evening are not so utilized. Be that as it may, the fact remains that to a great many this particular feature is of prime importance and greatly appreciated. Health talks are mostly elementary, yet they are essential to many comprising Radio audiences. No, we must not cut out the corn, rye, or Bourborn quotations, though, of course, they should fall to at least one-half of one per cent; nor should the instructions in the care of infant feeding be prescribed, but broadcast all the information available.

I have heard a number of well-meaning individuals declare their objections to broadcasting church services, on the ground that church attendance was thereby reduced. It is not possible to quote figures to substantiate my contention that few regular attendees remain at home because they can hear the service through a receiving set, but I feel confident that such is the fact. Those who attended irregularly may be influenced by home comforts. Others because of dislike for the minister may avail themselves of the opportunity to remain at the dials and tune in whom they please. It is the countless number of afflicted, who in no other way could feel themselves a part of a worshipping congregation, to whom broadcasting church services are of inestimable worth. What will they say of the services in Tremont Temple, Boston, being broadcast every noonday as well as Sunday mornings, which has resulted in the conversion of one man and the contributions by many to the furtherance of this work? Not being a licensed preacher perhaps I had better leave you to think it over.

What is a Radiowl? Well, it depends upon the authority you select for answering this question as to the exact definition you will get. "The Voice of the South" would give you a roseate view of this particular species of "bug," while from other quarters would come beseeching pleas for the quick extermination of every specimen of Radiowl. To the ordinary listener in of local broadcasts (not situated in the sunny southland) one of these birds of ether flight might arouse no antagonism, because that one would have turned out his lights and retired before the Buzzard, Hoot, Ananias and Screech Owls had begun their nightly play. It is when you sit up to hear what follows the Bedtime Stories that you form an opinion of Radiophone fraternities. Listening to the reading of a long list of Owls who have communicated with the Big WHOO-Whoo-whoo may equal as a thriller hearing the letters of a distant station, and if it does, then don't write Station WOAI for a definition of Radiowl. As a matter of fact, there are comparatively few fans ignorant of the purpose and personnel of this club, whether intentionally or otherwise.

This is Station DIELECTRIC, located between the humorous and serious columns of Radio Digest, signing off till next week. Good day!

RADIO INDI-GEST

(This column is open to all aspiring Radioknuts who tender suitable contributions. Try to "make" the column if you can. All unsuitable manuscripts are turned over to the Office Squirrel who does not guarantee their return or anything else for that matter.—Indi.)

Give Her a Radio Set

Lily's vacuum tubes were burning,
While my heart was wildly yearning
  For a kiss!
Lil forgot me quite completely
As she tuned her set so neatly—
  Frigid miss!

Lily's hair, intoxicating,
Tantalizing, aggravating,
  Brushed my cheek.
How I longed to kiss these tresses—
With my own lips' fond caresses
  Hers to seek!

"No!" her answer was emphatic
As the crashing of the static—
  What a din!
As I murmured: "Dear, take pity,"
Lily shouted: "Kansas City—
  Tuned 'em in!"

As the signals came in clearer,
Lily's head kept coming nearer—
  Glossy head of black—
Then she said: "Such oscillation
Justifies some osculation"—
  Smack! Smack! Smack!

—Arthur L. Lipmann.

Sh! I. Spy, Only a Ham Can "Get This"

Sing to tune of "Wabash Blues"

One dreary night, Bill Sparks sat down to pound the key awhile,
He slowly turned the rheostat and fiddled with a dial,
He thought he'd try to raise some bug that lived around the state
So he confidently pressed the key, but alas! it was too late!

A bluish flame! A little ping!
The bulb was heard to sputter and sing.
Poor Bill arose and began to totter.
Alas, the wreck of a fifty-watter.

—I. Spy.

No, They Drink That Stuff

Bathing by Radio is one of the last broadcasts from the Public Health Service, but whether ether waves were recommended was not made known.

It Books Along with the Short Circuit

Dear Indi—

I have heard so much about the Flewelling Circuit I would like to know where they play. Is it similar to the Orpheum Circuit? —Polly W.

A. B. C. Lessons for Radio Beginners

Chapter IX—The Three Electrode Vacuum Tube

By Arthur G. Mohaupt

THE three-electrode vacuum tube has played a greater part than any other piece of apparatus in furthering the progress of the Radio art. In fact, Radio telegraphy and telephony would not be at its present high stage of development if it were not for the introduction and perfection of the three-electrode vacuum tube. The vacuum tube has now been developed to such an extent that many results are accomplished with it which were formerly considered impossible.

Prior to the advent of the vacuum tube Radio made slow progress. Numerous detectors and other devices were tried out,

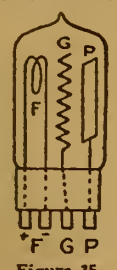


Figure 35

but none proved exactly satisfactory. However, in the few years that the vacuum tube has been available, progress has been made in so many ways and in so many directions that it was almost impossible for the average man to keep pace with it.

Electrons from Heated Objects

In order to fully understand the details of operation of the three-electrode vacuum tube, it will first be necessary to spend a little time on the so-called electron theory. According to this now generally accepted theory, the atom as known by the chemist is no longer the smallest particle of matter; but the atom itself is said to be composed of a large number of still smaller quantities known as electrons. At the center of the atom is a nucleus bearing a positive charge of electricity, while surrounding the central charge are a large number of small negative charges of electricity called electrons. These electrons are in a constant state of motion or vibration, the degree of activity depending upon the temperature of the object.

The higher the temperature, the more active are the electrons; and when the temperature reaches a certain degree, the activity becomes so great that some of the electrons actually leave the metal (are flipped off, we might say) and travel outward into space with great velocity. Some metals are capable of emitting (sending off) more electrons than others. Also, the electronic emission can be greatly increased by coating the metals with various metallic oxides, such as thorium oxide for example.

Charges Space Negatively

It is interesting to note at this point that according to the electron theory matter is really a form of energy, electrical energy, and that it manifests its presence only by the effects it produces on our physical senses.

Since the emitted electrons are tiny negative charges of electricity, if the emission is permitted to continue for a short time, the surrounding space will soon become negatively charged. The result is that it is rendered a conductor for electric current. It is this fact which forms the basis of operation of the vacuum tube as used in Radio receiving and transmitting apparatus.

Emission Controlled by Filament Heat

Another important factor to be considered is that the rate at which the electrons are given off can be readily con-

Figure 36

trolled by regulating the temperature of the hot metal. The presence of a nearby electrically charged object also influences the rate of emission, for a positive charge will attract the electrons and thus accelerate their flow, while a negative charge will repel them and thus retard their flow.

Let us now see how these principles are employed in the vacuum tube construction and operation.

Construction of the Three-Electrode Tube

The three-electrode vacuum tube consists of a glass tube out of which the three elements or electrodes are mounted and hermetically sealed (air tight). One of these elements is known as the filament, another as the plate, and the third as the grid. Each of these plays its individual and important function, as we shall presently see. The general appearance of the three-electrode vacuum tube is illustrated in Figure 35.

The filament forms the unit which is heated to incandescence and from which the negatively charged electrons are emitted. The filament is heated by means of an electric current generally supplied by a 6-volt storage battery, although there is also a tube on the market which is so designed that the filament can be heated by means of a 1½-volt dry cell. It is evident that a tube of the latter kind is very desirable in that the expensive and troublesome storage battery is not needed. The filament is generally in the form of an inverted V.

Filament Circuit Connections

The storage battery for supplying the current to the filament is commonly known as the A battery. The temperature of the filament is controlled by the current strength supplied to it, and the current in turn is regulated by means of a rheostat connected as is illustrated in Figure 36.

As is shown, the negative terminal of the A battery is connected directly to one terminal of the filament, while the positive terminal of the battery is connected to the rheostat. The other terminal of the rheostat is connected to the free terminal of the filament. As the position of the rheostat R is changed, the current, and hence also the filament temperature is regulated accordingly. The entire circuit including the filament, A battery and rheostat is known as the filament circuit.

The Plate and B Battery

The filament, when heated to incandescence, sends out the negatively charged electrons, and soon the space in the tube becomes so densely charged negatively that no more electrons can possibly escape from the filament. In order to avoid this condition and to make possible a continuous stream of electrons, the plate is inserted and sealed into the tube. The plate is generally in the form of a rectangular or circular cylinder surrounding the filament.

In order to bring the plate into action,

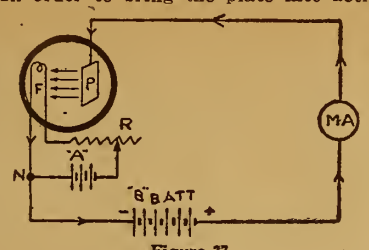


Figure 37

another battery is employed known as the B battery, Figure 37. This battery is hooked into the circuit so that its positive terminal is connected to the plate and its negative terminal to the point N in the filament circuit. The point N is commonly known as the neutral or zero potential point.

What Lets Current Flow in Tube

The result of the B battery in the circuit is that the plate will always be at a positive potential with respect to the filament. Consequently, since opposite electrical charges attract each other, the electrons (negative) emitted from the filament (negative) will be attracted by the plate (positive), and thus form a continuous stream between these two elements. The intervening space is by this action rendered a fairly good conductor of electricity, and current can flow through the plate circuit as is indicated by the arrows.

Leaving the B battery at the positive terminal, the current flows through the milliammeter MA to the plate P, within the tube it flows from the plate to the filament, and then returns to the negative terminal of the B battery. The milliammeter is inserted to measure the strength of the current flow in the plate circuit. It is a peculiar condition, and is a little difficult to comprehend at first, that the current in the plate circuit travels in a direction opposite to that in which the electrons within the tube travel. We must satisfy ourselves by assuming that the stream of electrons provides a conducting path over which the current can flow.

Cold Filament Stops Flow

The circuit between the plate and filament, including the B battery, is generally called the output circuit of the tube, for it is into this circuit, we will learn later on, that the telephone receivers are connected when the tube acts as a detector. As long as the filament is cold, no electrons are being emitted, and hence the space between the filament and plate is an insulator and no current can flow in the plate circuit.

Under these conditions the B battery can be left in the circuit indefinitely without being discharged. As soon as the filament is heated, the electrons close the circuit and current can flow.

Control of B Voltage

The strength of the current flowing in the plate circuit depends upon the temperature of the filament and the E. M. F. (voltage) of the B battery. If the B battery is provided with taps for varying the potential of the plate, the plate circuit current can be varied accordingly. However, when the potential has reached a certain value, any further increase will not affect the strength of the current, for under this condition all of the electrons coming from the filament are taken up by the plate as fast as they can be furnished. The saturation point is thus said to be reached. However, if the temperature of the filament is raised slightly by increasing the current flow through it, a high plate potential will again cause a further increase in the plate circuit current, for more electrons are being emitted at the higher temperature.

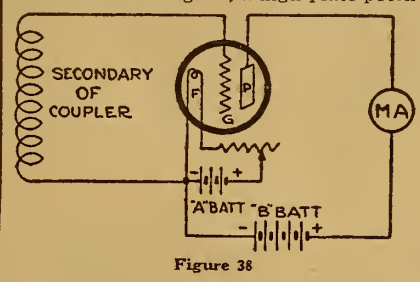


Figure 38

Every vacuum tube has a particular plate potential and filament temperature at which it functions best, and these values can be found only by experiment.

The Grid and Its Functions

The grid, or third element of the tube, is in the form of a wire network or perforated plate, and is placed between the filament and plate of the tube, as is illustrated in Figure 38.

The grid acts as a sort of control valve or regulator for the current flowing in the plate circuit. If the grid is charged positively, it will assist the plate and cause an increase in the electron emission, and hence also in the plate current flow. However, if the grid is charged negatively, it will repel some of the electrons, thereby opposing the plate action and decreasing the plate current flow.

Tuning Apparatus in Circuit

To bring the grid into play, it is connected to the secondary of the coupler or tuning coil, and is thus affected by the electrical waves as they are received by the antenna and enter the receiving set. Under normal conditions the grid is thus at a negative potential with respect to the filament. As the incoming electrical oscillations pass through the primary of the coupler, they induce in the secondary an alternating potential which passes from zero to a positive maximum and then to a corresponding negative maximum value.

Signals Control Flow Via Grid

Since the coupler secondary is connected across the filament and grid, the alternating voltage pulsations from the received signals will be impressed on the grid. As the grid becomes less negative, the electron flow will be greater and the plate circuit current will be increased; but as the grid becomes more negative, the electron flow will be retarded and the plate current flow decreased. Pulsations will thus be set up in the plate current which correspond in every detail to the potential pulsations induced in the coupler second-

(Continued on page 12)

Bank Winding Gives Selective Tuning

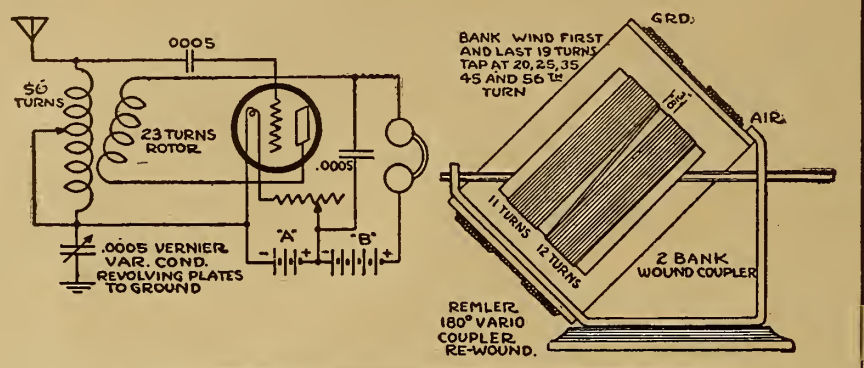
Coupler Design Allows Choice of Plant Desired

The acoompanying circuit is very sensitive and selective providing the variocoupler is used as outlined. I use a variable B battery and have a variable condenser with a vernier and two fixed condensers. Best results will be obtained with condensers using mica as a dielectric.

The volume of tone will be surprising the first time it is used and with one step of amplification, 10 to 1 ratio, it is all that can be desired.

I am using this pet hookup in preference to one with a variometer and variocoupler. I use an indoor aerial, two wires 32 feet long, and a soldered ground. Just a detector tube is used in the set. I have heard out of town stations clear and distinct while local stations are in the air. There is practically no body capacity in this set. —C. W. Miller, Chicago, Ill.

SENSITIVE AND SELECTIVE HOOK-UP



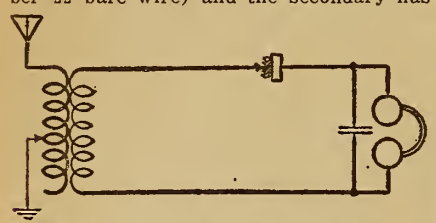
WORKSHOP KINKS? EARN A DOLLAR—

THERE are many little kinks worked out at home that would aid your fellow Radio worker if he only knew about them. There are new hook-ups, new ways of making parts and various unique ways of operating sets that are discovered every day. Radio Digest is very much interested in securing such material. Send them in with full details, including stamped envelope so rejected copy may be returned. The work must be entirely original, not copied.

RADIO KINKS DEPARTMENT,
Radio Digest Illustrated,
123 West Madison St., Chicago, Ill.

Special Coil Winding

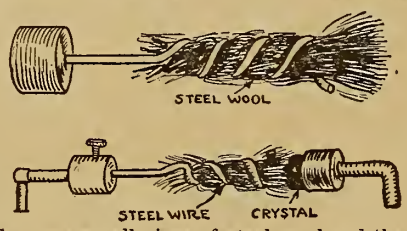
I have been getting good results with my crystal set which, outside of the coil, is extremely simple. The hook-up contains one coil only. On this coil are wound alternately the primary (60 turns of number 22 bare wire) and the secondary has



60 turns of number 30 cotton or silk covered wire. The coil is about 6 inches long and 3 inches in diameter—oval shaped. As the bare wire is larger the slider touches it and not the small insulated wire. The slider is controlled by the dial and it turns in a semicircle.—Bill Keating, Minneapolis, Minn.

Multiple Catwhisker

If you have trouble in finding a sensitive place on the crystal try the method which I have used with much success.



Secure a small piece of steel wool and then wind a piece of wire around it, allowing some of the steel to stick out at the end. Cut the end off with a pair of tinner's snips to make a "broom" end and spread the ends out evenly. Attach this steel wool whisker to the set. Apply the broom end lightly to the crystal. You will have many steel points out of which one or more will find a sensitive spot.—Eli Nemensky, New York, N. Y.

Don't Throw Set Together

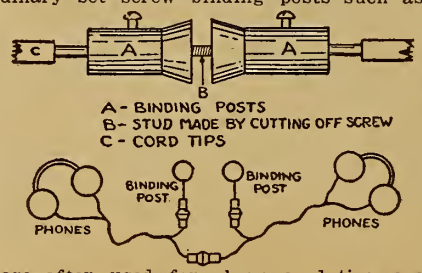
It is only necessary to glance at many homemade Radio receiving sets to find out they have been literally "thrown" together. Carelessness is a fault, and explains why so many sets will not function efficiently.

For instance, wiring is allowed to loop and stray around in every direction, connections are left unsoldered, wires are merely twisted around one another, poor connections are made to the binding posts, and coils and other apparatus are loosely mounted. The reason for all of this is "it is only temporary." As a matter of fact, all this poor work interferes seriously with efficient operation and tuning of the set.

It is evident that many leads and bad connections on low tension circuits lead to a waste of current and are still more disastrous on high tension circuits. Loose by means of solder. Small soldering lugs provide a ready and neat means of doing this.

Extra Phone Connectors

An excellent and inexpensive multiple phone connector is shown in the illustration. This device can be used where it is desired to use an extra head set. Two ordinary set screw binding posts such as

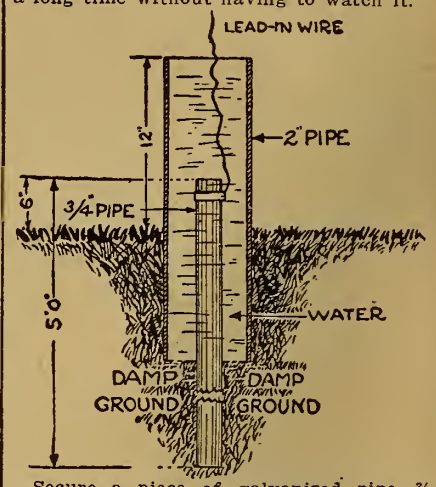


are often used for phone cord tips, are fastened end to end with a stud made by cutting off one of the screws of the post. The phone tips are then connected in series as shown.—H. L. Peterson, Charles City, Iowa.

Small pieces of rubber hose or tubing make fair insulators for the lead-in wire where it passes around the cornice of a building. The wire is run through.

Ground Line Kept Damp with Water Pipe Well

Most fans in hooking up a Radio outfit either have a poor aerial and a good ground or a good aerial and a poor ground. Almost always it's a poor ground. Here is a very simple way to make a good ground, one that will keep itself wet for a long time without having to watch it.



Secure a piece of galvanized pipe ¾ inch in diameter and 5½ feet long, also a piece of 2 inch pipe 3 feet long. Drive the ¾ inch pipe into the ground about 1 foot. Fill the pipe with water and let it settle, then fill it up again. The water in the 2-inch pipe serves to keep the smaller pipe full all the time and also keeps the ground wet around the smaller pipe.—Dick H. Roberts.

Don't Boil in Paraffin

Spider-web coils should not be boiled in paraffin, as this causes a considerable increase in the distributed capacity of the coils. In order to protect the insulation of the coils, from absorbing moisture, they may be painted with or immersed in collodion.

Like everything else you buy, do not expect too much from a cheap ready made set.

A. B. C. LESSONS

(Continued from page 11)

ary by the osillations received from the antenna.

The operation of a vacuum tube will vary somewhat with different relative adjustment of filament current and plate voltage. It is these changes in operating characteristics with different adjustments that makes it possible to use the vacuum tube for the various purposes in Radio practice.

The A Battery

The A battery is the one used for supplying current to the filaments of the vacuum tubes, and ordinarily must have a terminal voltage of 6 volts. The battery may be either of the lead-sulphuric acid type or the Edison-alkaline type. A greater pressure than 6 volts must never be used, or otherwise the filament is likely to be burned out. After the battery has been in service for some time, it will be exhausted, and consequently must be recharged.

The B Battery

The B battery is the one used for supplying the required potential to the plate, and for the average detector tube has a terminal voltage of 22½ volts. Ordinary door bell dry cells could be used for this purpose, providing enough of them were connected in series to produce the necessary 22½ volts.

This amount of pressure is needed because most detector tubes are made to work best under these conditions. In other words, at this pressure maximum electron flow occurs and hence maximum current flows in the plate circuit.

Tubes used as amplifiers, however, require a higher plate voltage. The B battery need not be of the storage battery type because the current they are required to furnish is only a few thousandths of an ampere, and this does not warrant the higher cost.

Life of B Battery

A question that is often asked is how long will the B battery last? This is quite difficult to answer, for there are a number of different factors that enter in and determine the life of a battery. Among these are the care exercised in the making of the battery, and the use and abuse the battery receives in the hands of the owner. A good grade of B battery will give reliable service for a long period; from 500 to 1,500 hours of use.

In the course of time, however, every battery will gradually wear out and become weak. The usual indication of a B battery becoming weak is given by the telephone receivers, for at the start the signals come in strong and firm and then gradually decrease in intensity or "fade." It is true that at times this condition may also be due to some other cause.

Testing Cells

A battery can be tested fairly satisfactorily with the aid of a battery voltmeter connected across the terminals of the battery. This test, however, should be made only after the battery has been in use for an hour or so, and not after the battery has been resting for a time. Try the test on the various battery terminals, and if the readings are much below the markings for these terminals, the battery is practically run down and should be replaced by a new one.

Of course, any of the common wet cells can be used with good results, but their bulky size makes their use a little awkward and inconvenient. Since the voltage required for a B battery is 22½ volts, and since a single wet cell has a voltage of only 1.1 volts, about twenty such cells would have to be used connected in series.

Chapter Ten

Having completed our study of the principles of construction and operation of the three-electrode vacuum tube, we are now ready to see how it is employed in Radio receiving circuits. Chapter Ten which will appear next week, will consequently be devoted to a number of efficient vacuum tube circuits. It will be a most interesting chapter and contain many practical operating hints for the owner of a vacuum tube set.

Reinartz Panel Set Designed for Compactness

Part IV—Two-Step Amplifier Panel Layout

By H. J. Marx

AS WAS anticipated, the publication of the first of this series on the Reinartz Panel Type Receiving Set brought in a voluminous mail requesting details of a two-step audio frequency amplifier panel. Numerous letters also asked for jacks in the circuit so that receivers could be plugged in any stage of the set, including the detector alone.

After due consideration, it was decided to use double circuit jacks instead of filament control. All three jacks are of this double circuit type since the last jack cuts out the loud speaker binding posts when the phone is disconnected. The lighting of the filaments is controlled entirely by the individual rheostats.

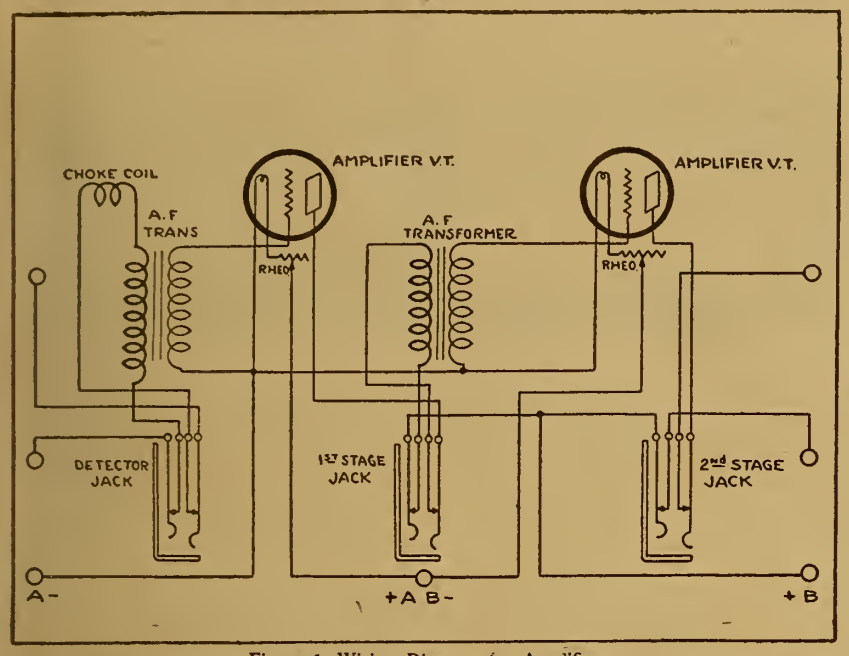


Figure 1—Wiring Diagram for Amplifier

Panel Layout

The panel layout is shown in Figure 2. The two sets of three holes at the top of the panel are for the filament rheostats. Vernier type rheostats are not necessary. The three large holes below these are for the stage control jacks. The diameters are not given since these will vary with different makes of jacks.

The three countersunk holes at the base of the panel are for the three flathead wood screws fastening it to the baseboard. The remaining seven ⅛-inch holes are for the binding posts. The two upper ones on the left side are the input posts for connection to the detector unit. The two upper posts on the right side are for loud speaker connections. The one in the lower left corner is connected to the negative side of the A or filament battery; the lower right post is for the positive B battery connection. The lower center binding post connects to the positive side of the filament battery and the negative side of the plate battery.

Parts Required

The list of parts required is given in the box elsewhere on this page. The panel is the same type and size as that used for the detector unit. The cabinets for both the detector and amplifier stages, as stated in the previous articles, are alike.

Two audio frequency transformers of any efficient commercial type are necessary. Two tube sockets, two amplifier or hard tubes and two rheostats are required. The sockets and rheostats should, for appearance sake, be the same type as used in the detector set. The three jacks are of the four spring double circuit type. The wire used for connections should preferably be of the tinned copper bus bar type. This wire not only makes a very neat job but in addition takes solder quickly and easily, thus insuring more efficient electrical connections.

Choke Coil Employed

The choke coil called for in the list of parts and shown in the diagram will no doubt puzzle many fans. In some localities special chokes of this type have been placed on the market. If not they can be wound very easily.

On a tube 1¾ inches in diameter and 1¼ inches long, about thirty turns of No. 26 double silk covered wire are wound. The actual number of turns necessary will vary, but after the circuit has been completed, tests can be made by unwinding or adding turns until the point is found where reception is loudest and clearest.

The writer personally made this coil with six taps and used a spring wire clip to connect to the taps. After the set was completed and the best adjustment was found, the unused turns were unwound in order to avoid any dead end losses. Another method of varying the value of this choke coil was to wind about ten turns and then lay a number of light 1-inch brads inside of the tube, thus building up an iron core. Brads were added until the best results were obtained. The nails were then tied in a bundle and sealed in the tube using sealing wax. Paraffin can be used also for this purpose.

It will be found that with some vacuum tubes this choke coil is not necessary. However, it will usually be the case that the plate battery potential can be built up higher when the choke coil is used.

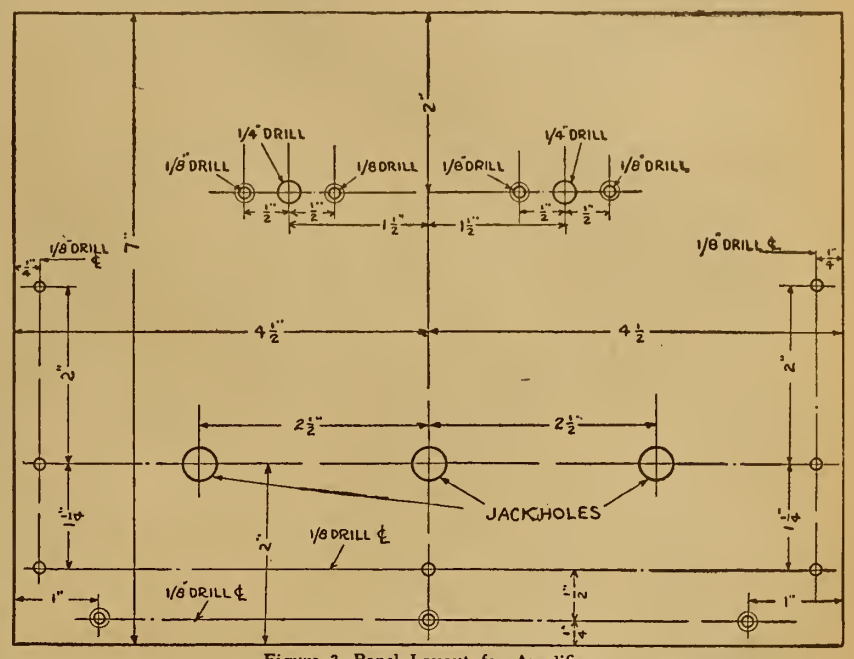
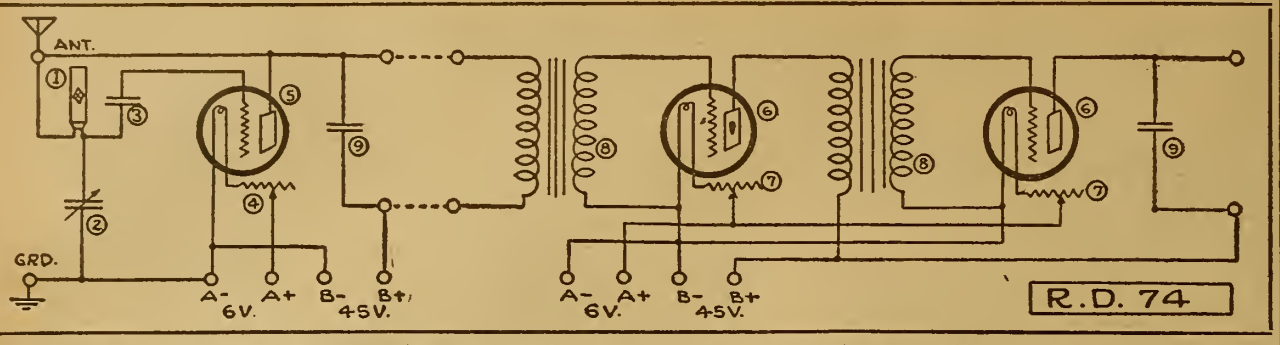


Figure 2—Panel Layout for Amplifier

LIST OF PARTS

1 Panel 7x9x⅛ inches
2 A. F. Transformers
2 Tube Sockets
2 Rheostats
2 Amplifier Vacuum Tubes
3 Double Circuit Jacks
1 Choke Coil
7 Binding Posts
3 Flathead Wood Screws
1 Cabinet and Panel Baseboard
50 Feet Tinned Copper Bus Bar Wire

R.D. 74 SHOWS AMPLIFIER FOR POPULAR HOOK-UP



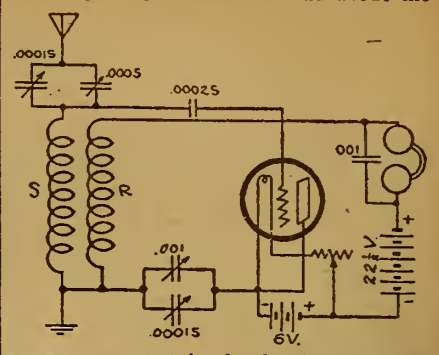
WAY back in the November 4, 1922, issue of Radio Digest, a simple regenerative receiving circuit was published. This hook-up was sent in by L. W. Martin, of San Antonio, Texas. Since then it has been republished numerous times in various publications, each time with a different name attached as the so-called inventor of the circuit. Its simplicity and efficiency of operation has appealed to the fans to such an extent that innumerable letters have been received not only in praise of the circuit but also requesting details of how to add two stages of audio frequency amplification.

The initial detector circuit has been kept the same as the original. No. 1 is a 50-turn honeycomb coil, No. 2 is an ordinary .001 mfd. variable condenser, but it is suggested that a vernier be used. No. 3 is a .00025 mfd. grid condenser. In some cases a grid leak was found necessary, and when used, a megohm resistance or more gave best results. No. 4 is a vernier filament rheostat. The tube 5, is a soft detector tube, but a potential of 45 volts was used in the plate-filament circuit.

In the amplifying stages, 6 represents hard or amplifier tubes, each using a filament rheostat, 7, which need not be vernier. No. 8 in both cases is a standard audio frequency transformer. No. 9 is a typical .001 mfd. phone condenser. The plate voltage for the amplifying stages is also 45, so the same batteries can be used for both detector and amplifier stages.

Different Style of Hook-Up

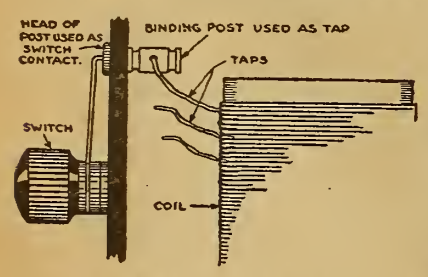
The hook-up shown in the illustration seems to work as good as a detector and one stage amplifier for DX and about the



same as a one tube for local. The coils represented are the rotor and stator of a variometer.—Fritz Franke, Chicago, Ill.

Binding Posts Make Contacts

Experimenters who desire to make changes do not like to unsolder wires from switch taps. The illustration shows a method of making switch points out of binding posts and if a change is desired it can be done without much trouble. The



knurled set screw head is used for the switch points. The base, which is back of the panel, is used for the connection and it may also be held with the screw for attaching the binding post to its base.—Chester Wilson, Chicago, Ill.

Questions and Answers

Tuning Unit

(2082) BS. Ludlow, Ky.

I would like to know if the choke coil shown in the December 30th, 1922, issue is an R. F. or an A. F. and will a Myers choke coil do?

Will a high resistance grid leak of a range of from 1,000 to 100,000 ohms. Answer for that 50,000 ohms resistance?

I am thinking of using a variocoupler for tuning one with 72 turns of 22 D. C. C. on primary and 28 turns of 22 D. C. C. on secondary.

A.—Answering your inquiry referring the three tube Reflex receiver appearing in December 30th issue of Radio Digest, would advise that the audio frequency choke coil is indicated. A Myers coil should answer. Resistance as suggested will be alright, and variocoupler may be used.

32-Volt Tubes

(1966) GEC, St. Francis, Kansas.

Kindly inform us if there are as yet any vacuum tubes on the market having filament that can be used on 32-volt current. We have in mind the many farmer prospects for Radio equipment, who already have lighting plants with standard 32-volt battery. If such tubes are not now on market, will it not be likely that manufacturers will soon awaken to the demand for such a tube?

We are often asked by the prospective purchaser if it is not likely that the broadcasting stations will cease their operations in course of a year or so and thus render the receiving outfits valueless to them. What is your opinion on this matter, and if the broadcasting is to continue, what will support it?

A.—There is no tube such as you describe on the market at the present time. The party with a 32-volt battery should consider himself in luck from a radiofan's viewpoint. He can use six-volt tap for the filament and the entire 32 volts for B battery.

Relative to the art of broadcasting, in our opinion it is but now in its infancy. We believe that it has come to stay and there is not the slightest possibility of having to scrap our receivers for the lack of it. There are many considerations to make it a worth while venture for the broadcaster, not least its value from the advertising standpoint.

RD 68 and 69

(1963) RCS, Muncie, Ind.

I am a constant reader of your magazine and as such take the liberty of asking a few questions about your drawings RD-68 and RD-69. This is the circuit I have been looking for and want to know the resistance of the potentiometer. Also, is the tickler as used in this circuit very effective, or would the circuit work nearly as well without it? The reason I ask this is because in most regenerative sets to which you add Radio frequency, most of the effect of regeneration is lost. However, I note the tickler in your circuit is used on the Radio frequency amplifier tube instead of the detector tube. Possibly this makes quite a difference.

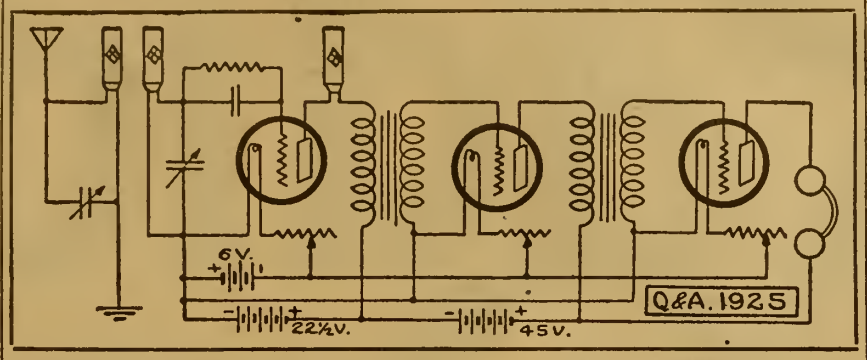
A.—The tickler as shown is essential for best results. Any standard potentiometer will serve, resistances vary from two to four hundred ohms.

Triple HC Coil Hookup

(1925) RB. Amsterdam N. Y.

Will you kindly forward to me the best hookup for triple honeycomb coils and two step amplifier.

A. We show on this page a diagram of



circuit employing triple honeycomb coils and two stages of amplification.

Reflex Circuits

(1985) LJS, New York City, N. Y.

With reference to the article on Reflex Circuits, part 2 in the January 6 issue, will you please answer the following questions?

Can a WD 11 tube be used in place of the Myers tube?

If so, will it be necessary to change the capacity of the condensers?

What is the capacity of the condenser across the phones? Of the condenser across the A. F. transformer?

A.—W. D. 11 tube can be used in place of Myers tube. However, results are not quite as good.

It will not be necessary in so doing to change capacity of condensers.

.001 condenser across the fones, also across amplifying transformer.

The above relating to Reflex Circuits is treated on in that series of four articles.

Condenser Spacing

(2080) GMF, Los Angeles, Calif.

I wish to use three variable condensers, Primary, Secondary and Grid, mounted on a panel with one inch space between them. Please advise me if they will affect one another in such close proximity.

A.—Answering your inquiry would advise that the use of variable condensers in close proximity, as suggested, will have no detrimental effect.

Flewelling Again.

(2105) EMP, Niagara Falls, N. Y.

Would a 43 plate and a 23 plate condenser work in the Flewelling? I am using these condensers at present in a three coil honeycomb outfit.

Would the actual distance covered by the Flewelling be greater than the distance I cover now, on a reguair 100 ft. single strand aerial?

Would it be possible to use "peanut" tubes?

Using a two foot loop, what range could I reasonably expect to cover under ideal conditions? What range using a regular 100 foot single wire aerial? Just a general idea is all I require, as I realize it is impossible to rate a receiver for range.

A.—Answering your several inquiries with reference to Flewelling circuit the only variable condenser needed is a twenty-three plate, although a forty-three plate may be used in the series with antenna.

The circuit has a possible range of one thousand miles and greater under favorable conditions. You can determine if the range is greater than obtained with present receivers only through experimentation as there are so many factors entering into consideration in this relation.

Peanut tubes may be used with any standard circuit.

It is probable that a range of five hundred miles, perhaps greater, could be obtained with aerial described. It is difficult to more than approximate.

Radio Illustrated

A "gobboon," as will he recognized hy Rumphans as popular B. R. (Before Radio), a hunch of keys, hed springs and the human body serve as antennae for the set operated by O. C. Smith of Jacksonville, Ill. Everett Mann is the part of the aerial standing in the center of the picture. When this photo was taken KSD, St. Louis, was coming in like "a ton of bricks"

One of the heaviest sleet storms to hit Atlanta in years proved too much for WGM's antenna and counterpoise. The havoc done by the ice is shown in the above picture. Attempts were made hy the operator, A. W. Shropshire, to effect temporary repairs but despite his work "Old Reliahle" was forced to suspend operations for two days. The normal radiation of this station is 10½ amperes, hut this was cut to 7½ amperes for several days following the storm

"Wheat down six points," comes over the Radio. "F'evven's sake!" exclaims John Marvin Jr. and takes another hitch in his —— (belt). "Mr." Marvin Jr., a prominent citizen of St. Paul, Minn., is an ardent Radiophan and spends his leisure hours wearing a headset. In an interview granted a Digest reporter, Marvin said he was in favor of abolishing bedtime stories in order to give more time for hroadcasting market reports and scientific lectures