THE A-P TRANSMITTING TUBE

TO BE USED ONLY IN TRANSMITTING APPARATUS MANUFACTURED BY DE FOREST RADIO TEL. & TEL. CO.

Retail Price
$7.50

This tube has been developed as an undamped wave transmitter for the amateur. It is exhausted to the highest possible vacuum in order to operate at the high B battery potential necessary for transmitting purposes. From 150 to 600 volts may be used on the plate of the tube, and can be obtained from flashlight batteries or by vacuum tube rectified alternating current from a 110 volt, 60 cycle supply. The grid in this tube is made of molybdenum in accordance with British Government specifications. The A-P Transmitting Tube fills a long felt want in bringing the radio telephone and undamped wave transmitter to the amateur at a low price.

LICENSED UNDER THE DE FOREST AUDION AND FLEMING PATENTS

THE

ATLANTIC AND PACIFIC

VACUUM TUBE

COMBINATION

As advertised in all radio periodicals

THE A-P ELECTRON RELAY
THE A-P VT AMPLIFIER-OSCILLATOR

ATLANTIC RADIO SUPPLIES CO.
8 Kirk Place, Newark, N. J. Phone Market 1575

PACIFIC RADIO SUPPLIES CO.
638 Mission Street - San Francisco, California

Distributors for
MOORHEAD LABORATORIES, Inc.

IT IS WELL KNOWN to the Radio Art that no one tube can be both an amplifier and an efficient detector of spark signals. This is because the detector tube must be operated at a higher stage of ionization and consequently must not be exhausted to as great a vacuum. Only a *combination* of tubes can give complete efficiency and provide all necessary operating characteristics without the sacrifice or subordination of desirable features. In the new *A-P Electron Relay* and *A-P VT Amplifier-Oscillator* there is offered amateurs and experimenters the one such perfect combination on the market to-day. Both types of tubes are rugged in construction and unqualifiedly guaranteed.

THE A-P ELECTRON RELAY

Retail Price Six Dollars

Originated by our laboratories in 1915, the A-P Electron Relay was the first tubular vacuum valve ever manufactured. For the sake of convenience in operating, it is now supplied with the SHAW standard four-prong base, but retains the copper grid and aluminum plate of the old type relay. The Electron Relay has the familiar hissing point and low B battery potential requirement characteristic of the efficient detector tube.

LICENSED UNDER THE DE FOREST AUDION AND FLEMING PATENTS

THE A-P VT AMPLIFIER-OSCILLATOR

Retail Price Seven Dollars

This is the Navy SE 1444 tube, designed for amplification and undamped wave reception by the regenerative method. It is highly exhausted to insure efficient performance as a generator and amplifier. It may be used singly for receiving continuous waves or in cascade as a two or more step amplifier. Recent Navy tests show that this tube has a higher amplification constant than any other tube known to the radio art.

A combination of two or more VT Tubes as Amplifiers with an Electron Relay as the Initial Detector or Oscillator is the Ideal receiving combination for long distance amateur or long wave reception

Marconi Wireless Apparatus

For Experimenters and Amateurs

COMMERCIAL DEPARTMENT

Marconi Wireless Telegraph Company of America

Woolworth Building

233 Broadway, New York City

The Marconi V. T.

THREE-ELECTRODE OSCILLATION VALVE OR AUDION

THE remarkable distances over which wireless signals are now transmitted may be attributed in a large measure to the amplifying properties of the *vacuum tube*. Although continent-to-continent wireless communication has been established with oscillation detectors of lesser degrees of sensitiveness, the Marconi V. T. (three-electrode valve) permits the same distances to be covered with smaller amounts of power.

High power stations often employ several hundred kilowatts of electrical energy, whereas the experimental station is required to operate on a restricted wave length and with the relatively small antenna current of amateur transmitters. A sensitive oscillation detector such as the Marconi V. T. is therefore an essential to communication between low power amateur wireless stations; in fact, this *ultra-sensitive oscillation detector is absolutely necessary to bring the signals up to the point of audibility* when receiving over great distances.

Amateur wireless stations using power inputs of ½ to ¾ kw. and operating at the wave length of 200 meters, *have established wireless communication with similar stations*

up to 2,000 miles. These records were directly due to the use of the vacuum tube either as a *detector* or as an *amplifier*. Such work cannot be duplicated by any other type of oscillation detector known today.

STANDARDIZATION OF VACUUM TUBES

In the earlier days of vacuum tube manufacture, the experimenter always faced uncertainty as to the quality of the tube he purchased. Some vacuum tubes were very sensitive, but had short life; others possessed varying degrees of sensitiveness and could not be relied upon for steady working. The majority of the so-called "good" bulbs had to be operated at such critical filament temperatures to bring in strong signals, that their life was only a matter of a few hours.

All these objections have been overcome in modern manufacturing methods, for engineers now know the materials best suited for the filament, grid and plate, and have developed improved methods of exhausting the tubes to a uniform vacuum.

It is now possible to design vacuum tubes, structurally, to meet any desired requirements, so that all possess identical operating characteristics. The era of standardization has arrived, and the Marconi V. T. enters the market as a highly standardized product. This insures to all purchasers a uniform degree of sensitiveness and eliminates one of the chief objections to former types of vacuum tubes.

THE EXPERIMENTER'S REQUIREMENTS

The amateur experimenter requires a three-electrode tube of universal operating char-

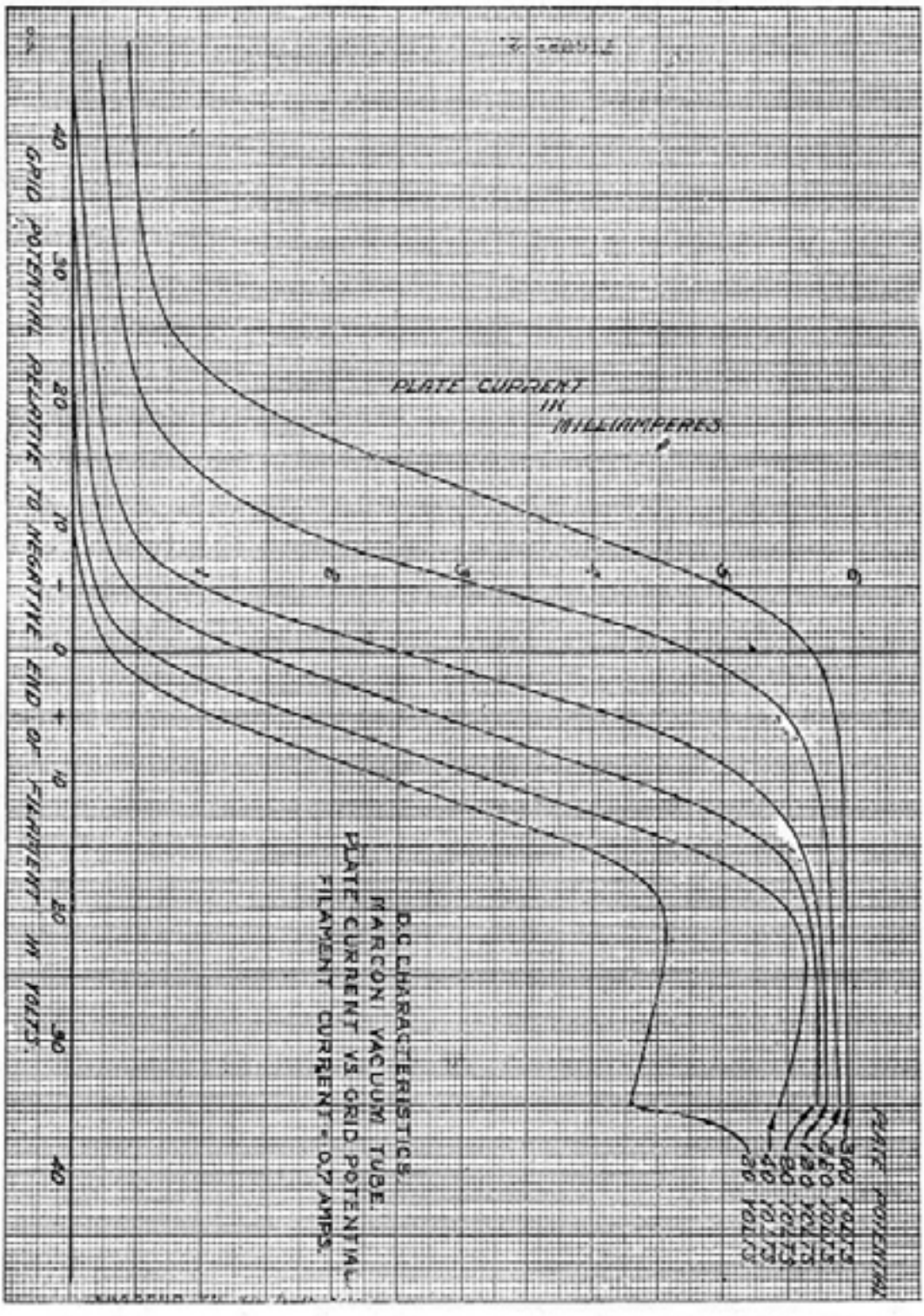

Figure 1.—Characteristic curves of the Marconi V. T.

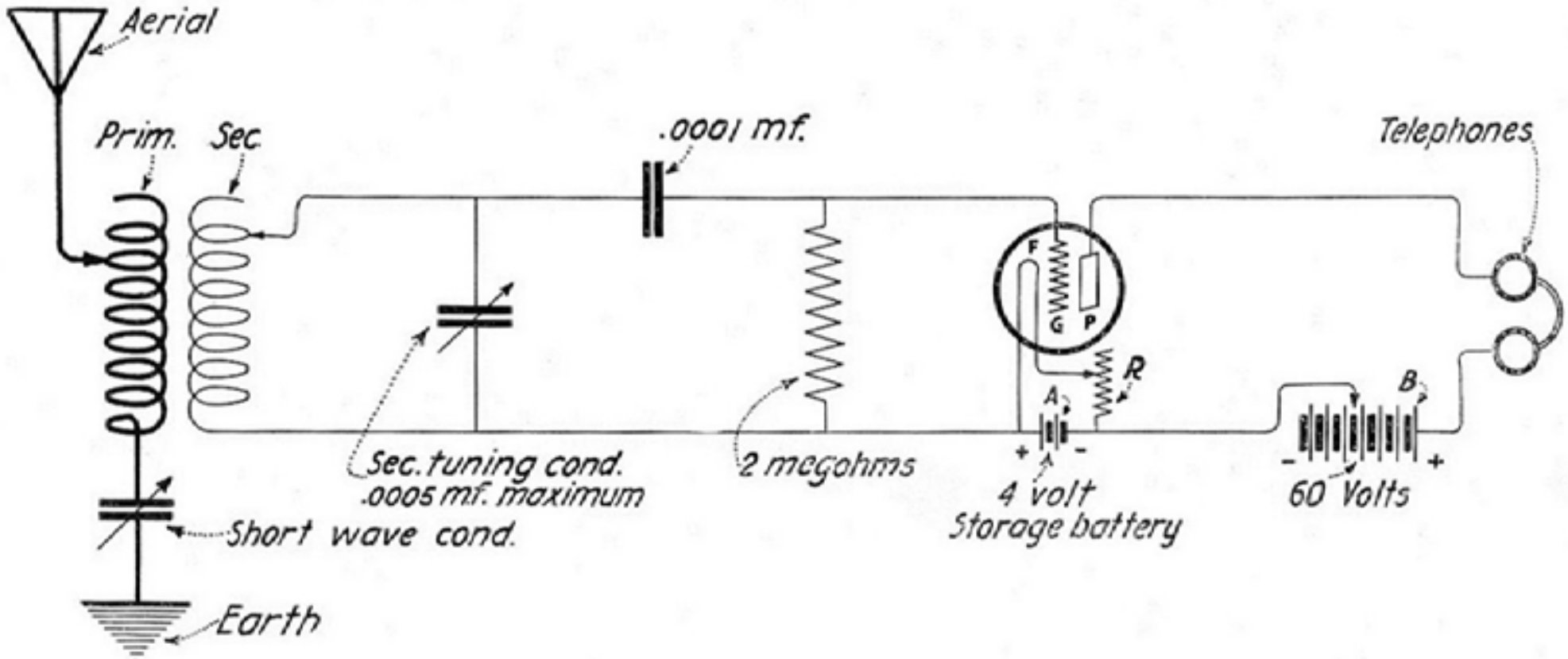

Figure 2.—The preferred detection circuit for the Marconi V. T.

acteristics—tubes designed for specific services are not suitable. The Marconi V. T. is an all-around detector, one which can be used in any sort of a detection or amplification circuit.

It operates efficiently over a wide range of plate voltages and at sufficiently low filament temperatures to insure long life.

An inspection of the accompanying characteristic curves in figure 1 will reveal desirable operating characteristics.

THE MARCONI V. T. OSCILLATION DETECTOR

No better detector for the amateur's station has ever been devised. With proper care it will function for at least *1,500 hours* with marked uniformity. It gives excellent results in amplification circuits.

The filament, grid and plate are made from materials from which *all occluded gases can be readily removed* during the process of manufacture. This prevents ionization and insures stable operation.

The Marconi V. T. is built to take the standard 4-contact base which makes all connections to the grid, plate and filament when the bulb is inserted.

PREFERRED CIRCUITS FOR THE AMATEUR STATION

The amateur experimenter is satisfied with only the best. Attention is therefore called to the *preferred detection circuit* for the *Marconi V. T.* shown in figure 2, where an inductively coupled tuning transformer is indicated. The secondary coil of the tuner is shunted by a variable condenser of 0.0005 mfd. maximum capacity. The *grid condenser* is of 0.0001 mfd. capacity. It may be fixed or variable. A *grid*

leak of *two million ohms* is connected between the grid and filament. These leaks can be made by drawing several lead pencil lines between two binding posts on cardboard, or can be purchased mounted ready for use.

The filament is rendered incandescent either by a *4-volt storage battery* or by ordinary dry batteries. The storage battery is preferred, but the filament may be operated from dry cells for brief periods with good results. If dry cells are used a series parallel connection of the cells will prolong their life. If a battery in excess of 4 volts is used a *10-ohm rheostat* should be used in the filament circuit.

The plate voltage may be furnished by a bank of *flashlight cells* giving an E. M. F. of approximately 60 volts. The telephones should be of approximately 2,000 ohms.

OBSERVE THESE PRECAUTIONS IN OPERATING

If you use a battery in excess of 4 volts, be careful not to exceed the stated filament current of 0.7 ampere.

If a low reading ammeter is not available an approximate adjustment of the filament current can be made by cutting in all the resistance at the filament rheostat and putting 60 volts on the plate circuit. The resistance is then gradually cut out (with resulting increase of the filament temperature) until the telephones indicate the strongest signals.

Then try other values of plate potential and different filament currents, keeping the filament current within the stated limits.

Do not burn the filament at higher temperatures than are necessary for strong signals, as lower temperatures tend to prolong its life.

If the filament battery exceeds 4 volts it may recuperate sufficiently while standing still so that it will burn out the filament the next time it is used. Cut in all of the filament rheostat before closing the filament circuit.

STORAGE BATTERY

A 4-volt, 20 ampere hour, storage battery is sufficient for the filament circuit of a single bulb, but a 40 ampere hour cell is preferred when several bulbs are employed in cascade amplification. But even here dry cells may be used for temporary operation.

CASCADE AMPLIFICATION CIRCUIT FOR THE MARCONI V. T. DETECTOR

The amplifying circuit in figure 3 has been found especially suitable for the Marconi V. T. It gives *60 times the strength of signals* that can be secured with a single detector tube; and because of the uniform properties of these tubes, all may be operated from the same filament and plate batteries. This saves experimenters the purchase of additional filament and plate batteries.

The "A" BATTERY—the source of filament current—should have an E. M. F. of 4 volts. The current consumption of the three tubes in parallel is approximately 2.2 amperes. Dry cells may be used for temporary operation.

The "B" BATTERY—the source of plate current—for the most successful operation should have with this circuit an E. M. F. of 80 volts.

The primary and secondary coils of the receiving transformer are indicated by the usual notations. Inductance L-2 and the shunt con-

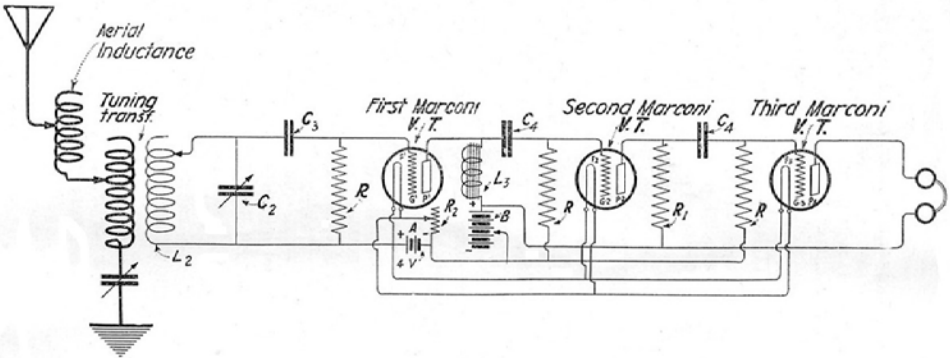

Figure 3.—Cascade amplification circuit for the Marcon V. T

denser C-2 constitute the secondary oscillation circuit. C-3 is the grid condenser of 0.0001 mfd. capacity.

The leak resistances, R, have resistance of 2 megohms each. R-1 is a coupling resistance of 2 megohms. The choke L-3 has inductance of approximately 20 henries. It can be made by winding 10,000 turns of No. 36 enamelled wire on a core of silicon steel or iron wire $\frac{5}{8}$ of an inch in diameter and 3 inches long.

Condenser C-4, should have .005 mfd. capacity. The leak resistances may be made from graphite rods or lead pencil marks on cardboard.

The circuit of Figure 3 gives remarkable results on short wave lengths and will in time become the amateur standard.

Sold only for experimental use

Fleming Pat. No. 803684
De Forest Pats. Nos. 841387-879532 3

Price of the detector, singly or in quantities, each - - -	$7.00
Price of the base - - - - -	1.50
Price of the 2-megohm resistance, mounted ready for use	1.00

Postpaid and insured to all points in the United States

Mail all remittances to

COMMERCIAL DEPARTMENT

Marconi Wireless Telegraph Company of America

Woolworth Building

233 Broadway, New York City

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Published for men who do things. Complete texts by experts. Up to the minute. Most modern apparatus and practice. Prepared for amateurs, experimenters, operators, engineers, as well as for men with a hobby. In use in libraries, universities, colleges, schools, manufacturing plants, and the Army and Navy.

Vacuum Tubes in Wireless Communication—*Bucher* $1.75

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Practical Aviation Including Construction and Operation—*White* $1.75

Military Signal Corps Manual—*White* $1.75

How to Pass U. S. Gov. Wireless License Exams—*Bucher* .50

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Ruggedness Reliability Long Life

Extreme Sensitiveness

Simplicity of Adjustment

Low Current Consumption

The Marconi V. T. Oscillation Detector

NOTICE

These Audion Vacuum Tubes are manufactured by de Forest Radio Telephone and Telegraph Company and Marconi Wireless Telegraph Company of America are the sole distributors. They should be used in connection with apparatus manufactured or sold by Marconi Wireless Telegraph Company of America or de Forest Radio Telephone and Telegraph Company, or their licensees or agents, to obtain the most efficient operation and the best results.

THE MOORHEAD TRANSMITTING TUBE

Retail Price $7.50

A Moorhead Product

LICENSED TO BE USED ONLY ON TRANSMITTING APPARATUS MANUFACTURED BY DE FOREST RADIO TEL. & TEL. CO.

This tube has been developed as an undamped wave transmitter for the amateur. It is exhausted to the highest possible vacuum in order to operate at the high B battery potential necessary for transmitting purposes. From 150 to 600 volts may be used on the plate of the tube, and can be obtained from flashlight batteries or by vacuum tube rectified alternating current from a 110 volt, 60 cycle supply. The grid in this tube is made of molybdenum in accordance with British Government specifications. The Moorhead Transmitting Tube fills a long felt want in bringing the radio telephone and undamped wave transmitter to the amateur at a low price.

LICENSED UNDER THE DE FOREST AUDION AND FLEMING PATENTS

THE

MOORHEAD

PERFECT VACUUM TUBE

COMBINATION

As advertised in all radio periodicals

THE MOORHEAD ELECTRON RELAY

THE MOORHEAD VT AMPLIFIER-OSCILLATOR

PACIFIC RADIO SUPPLIES CO.

Sole Distributors for

MOORHEAD LABORATORIES INC.

638 MISSION ST. SAN FRANCISCO

Reference—The American National Bank, S. F.

Eastern Agents ATLANTIC RADIO SUPPLIES CO.

8 Kirk Place, Newark, New Jersey *Telephone Market 1575*

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Retail Price Six Dollars

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A combination of two or more VT Tubes as Amplifiers with an Electron Relay as the Initial Detector or Oscillator is the Ideal receiving combination for long distance amateur or long wave reception

RELAY
(½ Size)

MOORHEAD
VACUUM VALVES
FOR
WIRELESS TELEGRAPHY and TELEPHONY

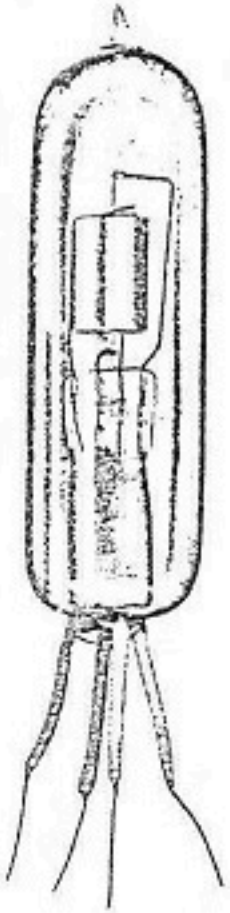
RELAY, Price $5.50

This valve needs no introduction, as it has been used by amateurs and experimenters for over five years. It is a familiar aluminum plate, copper grid, and double filament device operating on 20 to 45 volts plate battery and 4 volts filament battery. It can be used in combination as an amplifier, detector, and oscillator for receiving damped and undamped signals. It carries a guaranteed life of 700 hours. This bulb has been greatly improved during the war and is especially designed for the beginner and experimenter, requiring little adjustment or attention. The recent long-distance records made by the Federal Telegraph Company from Sydney, Australia, to South San Francisco in daylight, a distance of 6000 miles, were accomplished by the use of this valve.

TYPE R, Price $5.00

This valve is built entirely of pure nickel and is the same construction as the valve designed by the British Government for the reception of damped and undamped signals. It requires a plate voltage between 15 and 40 volts operating on a 4 to 6 volt filament battery. It contains a single filament of pure crimped tungsten and is guaranteed for 800 hours life. It has been especially designed for the more advanced experimenter and requires careful adjustment on A and B battery. However, phenomenal results can be obtained with its use. Thousands of these have been built for the British Government and used during the war in all branches of radio communication.

TYPE R
(Full Size)



TYPE RH, Price $5.50

This valve is similar to Type R, except that it is evacuated so that any voltage from 50 to 400 on the plate may be used, thus making it especially desirable as an oscillator and amplifier. It can be used as a generator for undamped oscillations for radio telephony and telegraphy. Using the telephone circuit which we will furnish with each valve, a radiation of five-tenths to one ampere may be obtained, and official government tests both by the British and American Governments have proven this amount of power to be sufficient to communicate 120 miles in day time. There are no critical adjustments on this valve, and it may be operated by anyone without trouble. This type has been used in all aeroplane radio sets, and is extremely rigid and long lived.

TYPE B, Price $6.50

Type B is primarily designed for transmitting and is made in accordance with the latest discoveries relating to vacuum valve transmitting sets, although very good results are obtained by using it as a receiver. Using the circuits furnished with this bulb, sufficient radiation is obtained when 500 volts are applied to the plate to cover a distance of 200 miles, daylight, either telephone or telegraph. This bulb is exactly the same as those being furnished the United States Navy at the present time.

YOUR MONEY ENTITLES YOU TO A GENUINE MOORHEAD VACUUM VALVE.
BE SURE THE VALVE YOU BUY BEARS THE WORDING:

PATENTED

This Moorhead Valve is licensed under the Fleming Patent—
Number 803684—for amateur and experimental purposes only.

TERMS: Cash with order, or C. O. D.
The prices of all our goods are F. O. B. San Francisco.

FOREIGN ORDERS: A draft or money order covering the cost of the goods purchased must be enclosed with all orders from outside the United States, or from the U. S. Territories, and all expenses such as freight, insurance, etc., connected with the shipping of the same must be remitted to us on receipt of the merchandise, which is forwarded at purchaser's risk.

All previous prices, terms and discounts are hereby cancelled.

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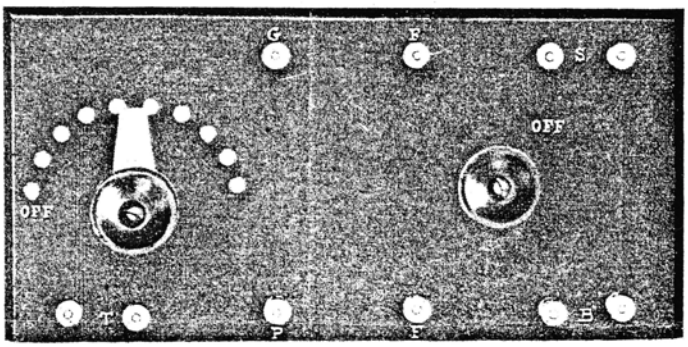


NO. 1A PANEL SET

SPECIFICATIONS

Maple Panel with Hard Rubber Finish
Back Connected Rheostat
7 point Multiple Point Switch
Large Moulded Control Handles
30 Cell Sealed-in B Batttery
Tested Combination Electron Relay
All binding posts, screws and metal parts are nickel plated

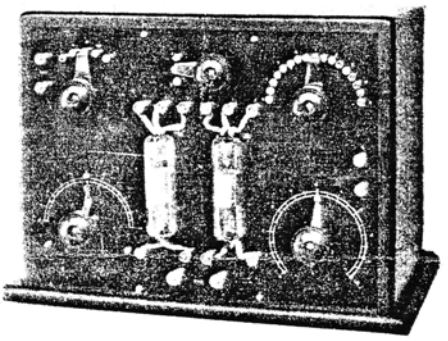
We can supply the above with potentiometer control at the same price, but we do not advise the use of a potentiometer.

This set presents a pleasing appearance and is within the reach of every Radio experimenter. It is guaranteed to work equally as good as any $50.00 panel.

Full instructions for operation are sent with each instrument.

Panel Set Complete - - - - - -	$10.00
Panel without Tube and Battery - - - - -	5.00

MOORHEAD LABORATORIES
165 JESSIE STREET
SAN FRANCISCO, CAL.



Type A6 Detector for Damped and Un-damped Wave Reception

SPECIFICATIONS

Bakelite panel highly finished
Genuine Mahogany Cabinet, (back removable)
Circular Rheostat, mounted on back of panel
Multiple Point B Battery Switch, (17 points)
Variable Condenser mounted on back of panel
Two Tested Electron Relays
Filament Switch, (5 points)
Oscillating and Spark Switch, (3 points)
All metal parts highly nickeled

This is the highest grade detector we manufacture and it is used for commercial and government work as well as in amateur stations.

The set is wired so that it may be used as an oscillator or detector by throwing the three point switch at the top of the cabinet to point A or S.

The filament switch is arranged so that either filament of either bulb may be used.

All controls are adjusted so that they operate noiselessly and smoothly.

Full instructions accompany each set and you are fully protected by our guarantee.

TYPE A6 DETECTOR - - - $75.00

MOORHEAD LABORATORIES
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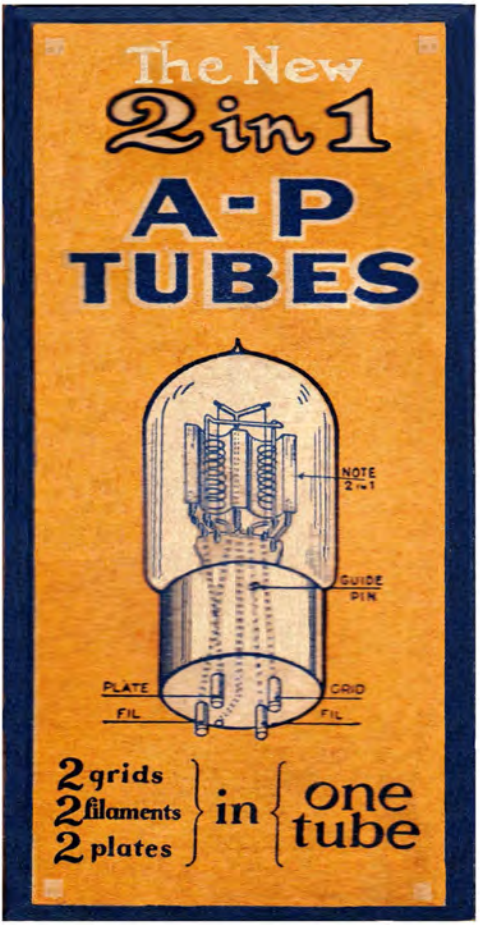
The New Two In One A-P Radio Tubes



A-P Radio Laboratories

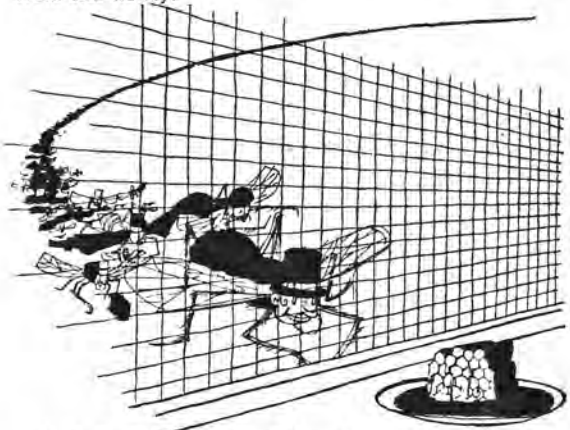
650 Mission Street San Francisco, California, USA.

THE new A-P "Two-In-One" Radio Tube is the only fundamental improvement in Radio Vacuum tubes since they were first made. It differs radically from other tubes by overcoming the inherent weaknesses of other tubes and at the same time emphasizing their strong points.

HOW RADIO TUBES ARE MADE:

The most important factor in any vacuum is the filament. When heated to a certain degree this filament gives off negative centers of energy called electrons. These electrons are attracted by a metal surface within the tube called the plate, just as flies are attracted to a plate of honey. This attraction is caused by a positive electrical potential eminating from the "B" battery.

The third element and the one which has made present day radio possible is the Grid. This consists of a number of wires closely spaced around the filament and placed between the filament and plate. When so placed this grid becomes the controlling factor of the electrons, passing from filament to plate. When your radio is working this grid controls the filament electrons and at certain instances keeps them from reaching the plate, just as a screen at the window keeps the flies from the honey.



In A-P "Two-in-One" Tubes the Grid controls the electrons, just as the screen controls the flies after the honey.

By its amount of grid surface or control can be determined the probable efficiency of your tubes. In the new A-P "Two-In-One Tubes you have **two** grids—**two** filaments—**two** plates, all in one tube, operating to give you greater clarity, greater efficiency, greater distance, yet consuming only ¼ ampere of filament current.

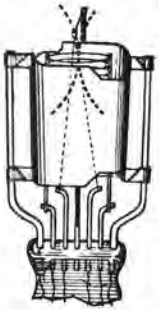


Fig. 1

In so-called standard tubes the plate and grid construction is oval and there is a pronounced loss of energy between the legs or lengths of the filament, due to difference in potential. (See Fig. 1).

In A-P "Two-In-One" Tubes the grids and plates form two complete and separate circles, giving them greater mutual conductance and greater amplification. The plates, which completely surround the two filament lengths conserve the energy that ordinarily is lost in other make tubes. (See Fig. 2).

The new A-P "Two-In-One" Tube is fully protected by the United States patent office, both as to construction and principles. Each tube is carefully tested, with instruments and actually on the air. All tubes are matched and balanced before packing. Certain factory marks on the carton indicate the particular characteristics of each tube.

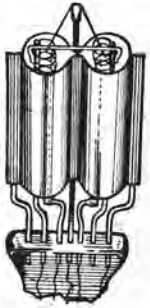


Fig. 2

When using several tubes in a set it is always best to use those of like character for best results. After many, many months of exhaustive tests our laboratory has determined definitely what A-P Tubes work best together in each of the better known radio sets.

Would you try to move a load of hay to market with a horse, a goat and your pet dog, or would you hitch up animals of like power and characteristics? (See Fig. 3).

Do not expect to get full efficiency by using different kinds of tubes of varying size and capacity. Use new A-P "Two-In-One" Tubes of like characteristics to best amplify what is in the air. Follow this plan and we can guarantee you'll get greater distance—greater clarity—more general efficiency and use less plate current on higher voltage. Complete operating data as to

which A-P tubes work best in certain standard sets is given elsewhere.

To make it easier to understand. You want to hear clearly and distinctly what's in the air. You want volume. You want tone. You want minimum distortion.

For your radio set substitute (mentally) a fisherman, trying to catch the tiny fish (far distant stations) with a net intended only for whales. How many fish get away? How many get by and through the net grid?

But, suppose the fisherman used a net of finer mesh —a tube with double the grid surface of so-called standard tubes! (See Fig. 4).

The new A-P "Two-In-One" Tubes are the "fine mesh net" of radio. Having double the grid and double the plate surface they naturally control more electrons than tubes with only half the grid and plate surface.

There also is a big advantage in the construction of the "Y" shape filament support wire which is connected to the shell of the base of the A-P tube. This may be operated as a center tap from the two filaments. By means of this center tap you can connect the filament of your new A-P tubes in series or in parallel and operate them on either three or six volts. Should one filament burn out or break, do not throw away the tube. You can easily restore it to useful life by operating the remaining filament over this center tap as a return lead. It also may be used in place of a potentiometer. Or, in a circuit where an alternating current supplants the storage battery you may connect a lead from the center tap of a suitable transformer to the center tap of the tube, which is connected to the center tap of the base. This will give equal voltage to both filaments at all times and materially reduce the A-C hum.

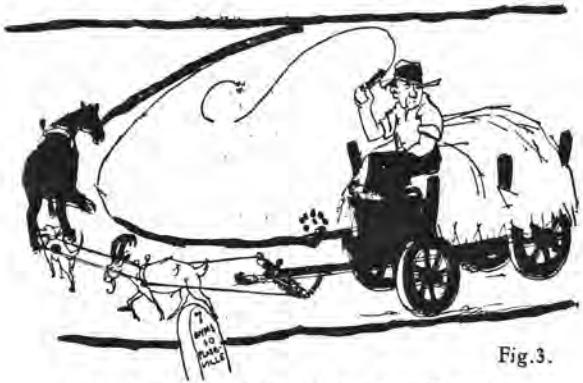


Fig.3.

Hitch-up Radio Tubes that will pull together.

Because it takes advantage of all the energy without waste, the new A-P "Two-In-One" tube can and does handle more power without distortion. It's amplifying power, as compared with the power of other tubes is that of the elephant compared to the power of a horse. The elephant can perform many times the work of a horse with no greater expenditure of energy. Again—the so-called standard tube will give good service with a 90 or 100 volt "B" Battery. The A-P "Two-In-One" tube will handle up to 400 volts "B" Battery without distortion. This means less effort to bring in distant stations—greater clarity—easier tuning—greater efficiency of your set.

TEST THEM IN YOUR RADIO SET.

The only fair way to test the efficiency of A-P "Two-In-One" tubes is in your own radio set. Do not try to determine their efficiency with antiquated instruments made especially to test some other make of tubes.

When using the new A-P "Two-In-One" tubes in any sensitive set, reduce the rheostat setting to the lowest possible point: **otherwise there is danger of oversensitizing the set,** which will cause undesirable noises and distortion. This merely emphasizes the fact that the new A-P tubes are super-sensitive and that balanced tubes of like characteristics should be used. People have asked what we mean by "sensitivity" in a radio tube?

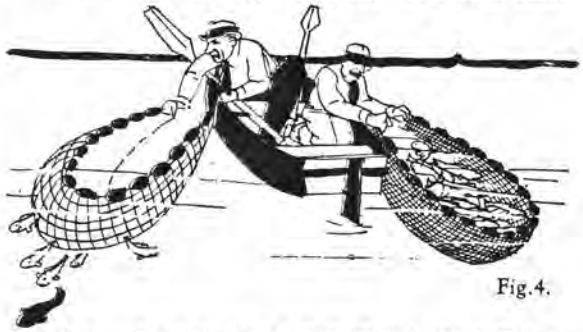
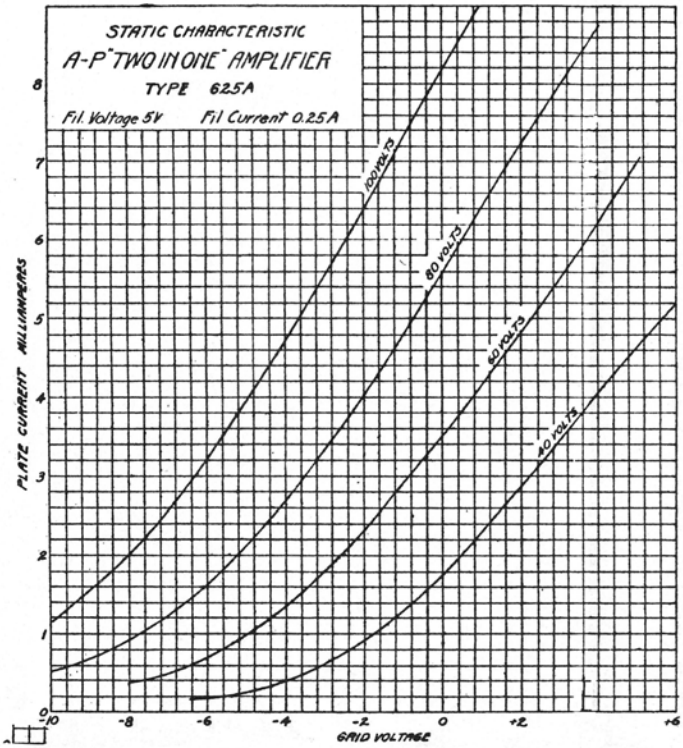


Fig.4.

The fine mesh net (grid) of A-P "Two-in-One" Tubes catches all the fish.

Fig. 5.



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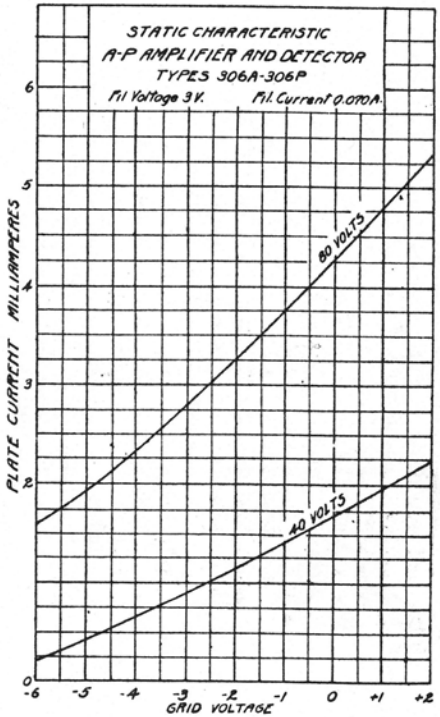
Characteristic curves of the new A-P "Two-in-One" 625-amplifying tube, showing performance on various "B" Battery voltages and how much "B" Battery current is consumed.



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The difference in sensitivity between the new A-P "Two-In-One" tube and other tubes may be compared to the natural ability of wild animals to "pick-up" a scent many times more quickly than a domesticated dog. (See Fig.8).

For best amplification a negative grid bias of "C" battery should be used when the plate voltage exceeds 45 volts. The grid return should be connected to the negative end of the filament or if the rheostat is connected in the negative "A" battery lead, the grid return should be connected direct to the negative side of the "A" battery.

The following grid bias voltages should be used:

Plate Voltage	Negative Grid Bias (C Battery)
45 volts	0
60 volts	1 to 2
75 volts	2 to 3
90 volts	3 to 4½
105 volts	4 to 6
120 volts	6 to 8

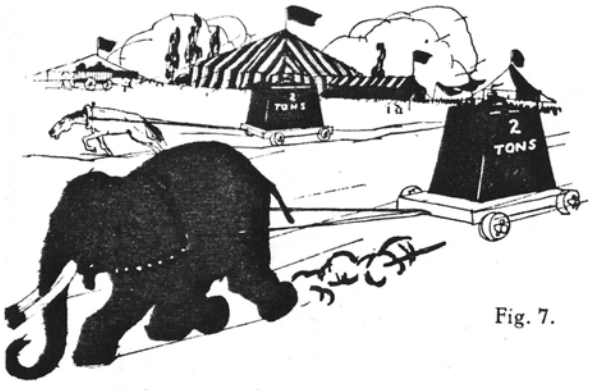
Unless the signal intensity is very high the adjustment of the negative grid bias is not so important, but if the signal intensity is very high an improper grid bias will be shown by distortion, causing an unnatural sound in music and speech.

Most important—**these tubes are amplifiers** and should not be used as detector tubes in any set. When so used this tube will **over-sensitize the set and make it microphonic.**

We recommend the new A-P 625-D tube for this purpose. No. 625-D is a gas contained tube and is very critical on A & B battery adjustments; and great care should be used in the selection of your Detector tube. If your set is not adaptable for fine adjustment on your detector tube use any other good, less sensitive detector tube in this position, in conjunction with the new A-P "Two-In-One" amplifiers. In hooking your detector tube to your "B" battery, be sure to adjust your detector voltage to get best reception and to prevent distortion.

Type 306-P tube (Peanut type) has a small base and is recommended where compactness is desired. Type 306-A has a standard base and a little larger bulb which eliminates the troublesome adapter and has the same operating characteristics as Type 306-P. Both can be operated on three ordinary dry cells, connected in series, i. e., the outside terminal of one battery connected to the center terminal of the next.

A rheostat of 30 ohms should be used when only one tube is used in circuit and a 10 ohm rheostat,



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To the elephant of radio—A-P "Two-in-One Tubes" a load is moved with ease that would strain the horse.

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The negative grid bias required for the best operation of Type 306-A and 306-P tube is:

Plate Voltage	Negative Grid Bias
45 volts	1 to 2
60 volts	3 to 4
75 volts	4½
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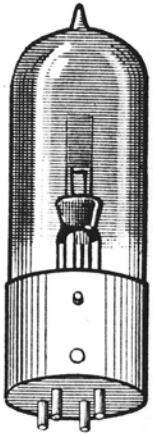
As a detector, Type 306 tube should have a grid return to the positive end of the filament. A grid leak of from 2 to 10 meghoms should be used for the higher voltages and weaker signals.



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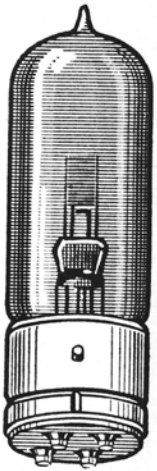

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192[illegible] RADIO NEWS LABORATORIES Number 692

Certificate of Merit

We hereby Certify that this Certificate of Merit has been awarded to A-P RADIO LABORATORIES in connection with their 2 in 1 A-P TUBE. This TUBE has been subjected to the various rigid tests of our laboratories and has been found to possess all the high standards adopted for this type of DETECTOR AMPLIFIER AND OSCILLATOR. The article complies fully with all modern radio engineering principles of this class.

Awarded the Certificate of Merit.

RADIO NEWS LABORATORIES

DIRECTOR LABORATORY DIRECTOR LABORATORY DIRECTOR

APPROVED RADIO NEWS LABORATORIES

RADIO NEWS LABORATORIES

PHONE BARCLAY 7222

53 PARK PLACE NEW YORK, N. Y.

DIRECTORS
H. GERNSBACK, Chairman
L. M. CLEMENT, Technical Director
R. D. ACAUL, Laboratory Director

February 18, 1925

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650 Mission Street
San Francisco, California

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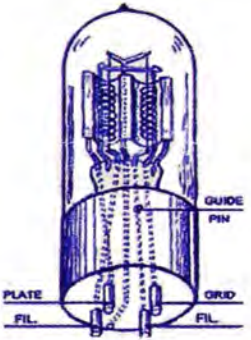
If you have any other radio instruments that you care to have tested, we shall be pleased to extend the further services of the LABORATORIES to you.

Very truly yours,

RADIO NEWS LABORATORIES

Patents Pending
A California Product

The New 2 in 1 A-P TUBES



2 grids
2filaments — in — one tube
2 plates

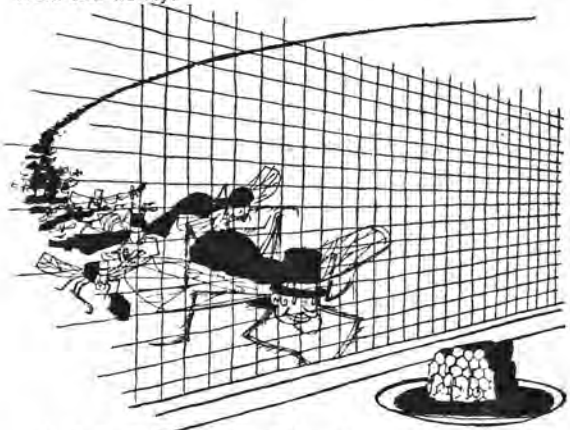
A-P Radio Laboratories
650 Mission Street San Francisco, California, USA.

THE new A-P "Two-In-One" Radio Tube is the only fundamental improvement in Radio Vacuum tubes since they were first made. It differs radically from other tubes by overcoming the inherent weaknesses of other tubes and at the same time emphasizing their strong points.

HOW RADIO TUBES ARE MADE:

The most important factor in any vacuum is the filament. When heated to a certain degree this filament gives off negative centers of energy called electrons. These electrons are attracted by a metal surface within the tube called the plate, just as flies are attracted to a plate of honey. This attraction is caused by a positive electrical potential eminating from the "B" battery.

The third element and the one which has made present day radio possible is the Grid. This consists of a number of wires closely spaced around the filament and placed between the filament and plate. When so placed this grid becomes the controlling factor of the electrons, passing from filament to plate. When your radio is working this grid controls the filament electrons and at certain instances keeps them from reaching the plate, just as a screen at the window keeps the flies from the honey.



In A-P "Two-in-One" Tubes the Grid controls the electrons, just as the screen controls the flies after the honey.

By its amount of grid surface or control can be determined the probable efficiency of your tubes. In the new A-P "Two-In-One Tubes you have **two** grids—**two** filaments—**two** plates, all in one tube, operating to give you greater clarity, greater efficiency, greater distance, yet consuming only ¼ ampere of filament current.

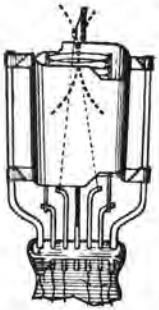


Fig. 1

In so-called standard tubes the plate and grid construction is oval and there is a pronounced loss of energy between the legs or lengths of the filament, due to difference in potential. (See Fig. 1).

In A-P "Two-In-One" Tubes the grids and plates form two complete and separate circles, giving them greater mutual conductance and greater amplification. The plates, which completely surround the two filament lengths conserve the energy that ordinarily is lost in other make tubes. (See Fig. 2).

The new A-P "Two-In-One" Tube is fully protected by the United States patent office, both as to construction and principles. Each tube is carefully tested, with instruments and actually on the air. All tubes are matched and balanced before packing. Certain factory marks on the carton indicate the particular characteristics of each tube.

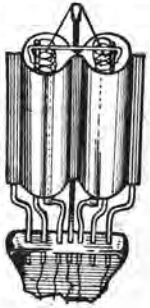


Fig. 2

When using several tubes in a set it is always best to use those of like character for best results. After many, many months of exhaustive tests our laboratory has determined definitely what A-P Tubes work best together in each of the better known radio sets.

Would you try to move a load of hay to market with a horse, a goat and your pet dog, or would you hitch up animals of like power and characteristics? (See Fig. 3).

Do not expect to get full efficiency by using different kinds of tubes of varying size and capacity. Use new A-P "Two-In-One" Tubes of like characteristics to best amplify what is in the air. Follow this plan and we can guarantee you'll get greater distance—greater clarity—more general efficiency and use less plate current on higher voltage. Complete operating data as to

which A-P tubes work best in certain standard sets is given elsewhere.

To make it easier to understand. You want to hear clearly and distinctly what's in the air. You want volume. You want tone. You want minimum distortion.

For your radio set substitute (mentally) a fisherman, trying to catch the tiny fish (far distant stations) with a net intended only for whales. How many fish get away? How many get by and through the net grid?

But, suppose the fisherman used a net of finer mesh —a tube with double the grid surface of so-called standard tubes! (See Fig. 4).

The new A-P "Two-In-One" Tubes are the "fine mesh net" of radio. Having double the grid and double the plate surface they naturally control more electrons than tubes with only half the grid and plate surface.

There also is a big advantage in the construction of the "Y" shape filament support wire which is connected to the shell of the base of the A-P tube. This may be operated as a center tap from the two filaments. By means of this center tap you can connect the filament of your new A-P tubes in series or in parallel and operate them on either three or six volts. Should one filament burn out or break, do not throw away the tube. You can easily restore it to useful life by operating the remaining filament over this center tap as a return lead. It also may be used in place of a potentiometer. Or, in a circuit where an alternating current supplants the storage battery you may connect a lead from the center tap of a suitable transformer to the center tap of the tube, which is connected to the center tap of the base. This will give equal voltage to both filaments at all times and materially reduce the A-C hum.

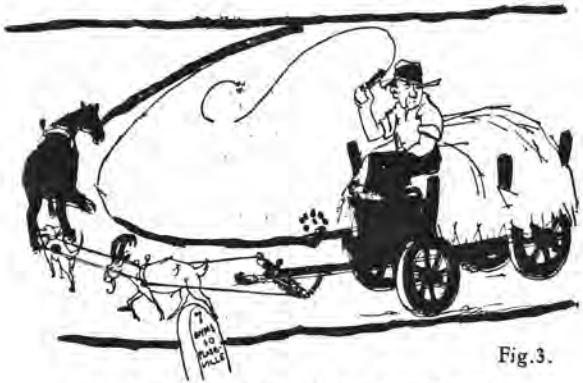


Fig.3.

Hitch-up Radio Tubes that will pull together.

Because it takes advantage of all the energy without waste, the new A-P "Two-In-One" tube can and does handle more power without distortion. It's amplifying power, as compared with the power of other tubes is that of the elephant compared to the power of a horse. The elephant can perform many times the work of a horse with no greater expenditure of energy. Again—the so-called standard tube will give good service with a 90 or 100 volt "B" Battery. The A-P "Two-In-One" tube will handle up to 400 volts "B" Battery without distortion. This means less effort to bring in distant stations—greater clarity—easier tuning—greater efficiency of your set.

TEST THEM IN YOUR RADIO SET.

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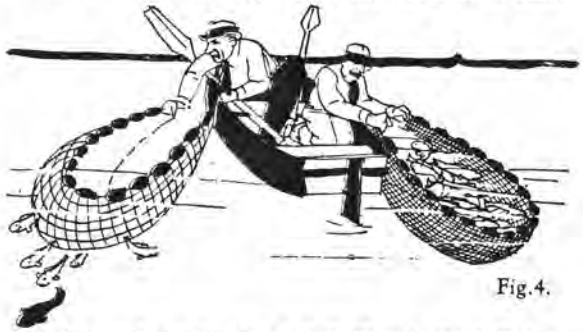

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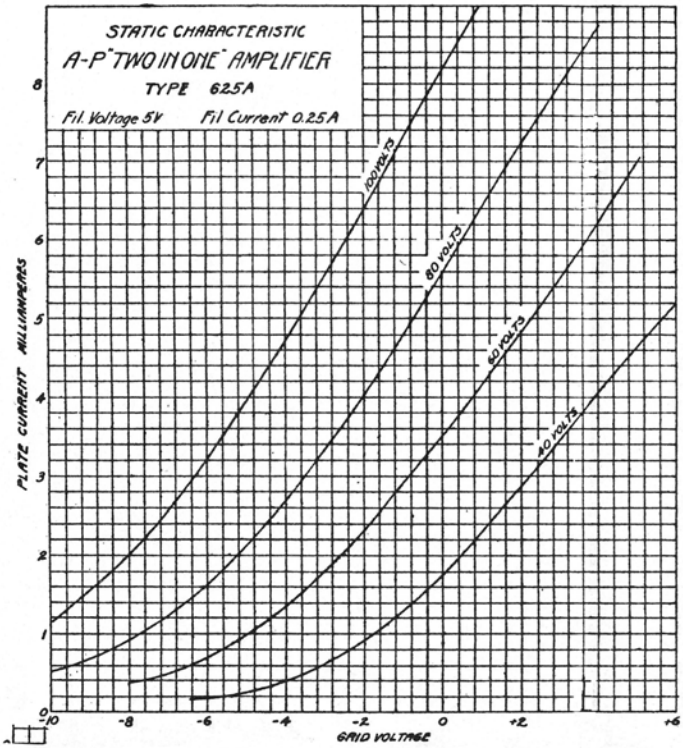

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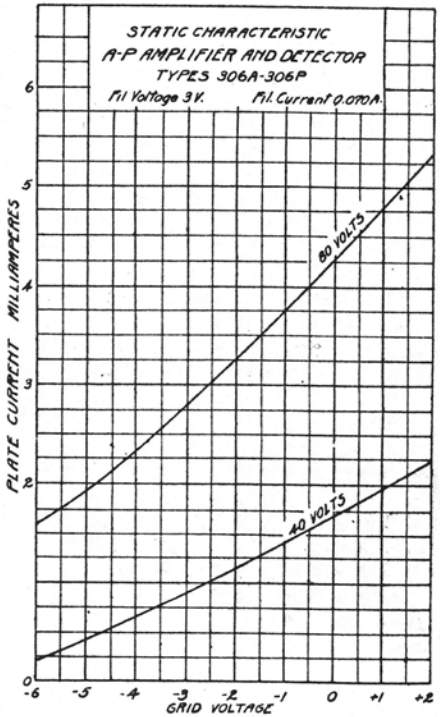

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For best amplification a negative grid bias of "C" battery should be used when the plate voltage exceeds 45 volts. The grid return should be connected to the negative end of the filament or if the rheostat is connected in the negative "A" battery lead, the grid return should be connected direct to the negative side of the "A" battery.

The following grid bias voltages should be used:

Plate Voltage	Negative Grid Bias (C Battery)
45 volts	0
60 volts	1 to 2
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Unless the signal intensity is very high the adjustment of the negative grid bias is not so important, but if the signal intensity is very high an improper grid bias will be shown by distortion, causing an unnatural sound in music and speech.

Most important—**these tubes are amplifiers** and should not be used as detector tubes in any set. When so used this tube will **over-sensitize the set and make it microphonic.**

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A rheostat of 30 ohms should be used when only one tube is used in circuit and a 10 ohm rheostat,

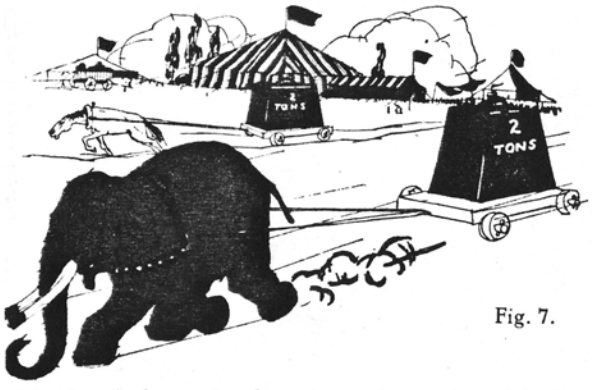

Fig. 7.

To the elephant of radio—A-P "Two-in-One Tubes" a load is moved with ease that would strain the horse.

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The negative grid bias required for the best operation of Type 306-A and 306-P tube is:

Plate Voltage	Negative Grid Bias
45 volts	1 to 2
60 volts	3 to 4
75 volts	4½
90 volts	6 or more
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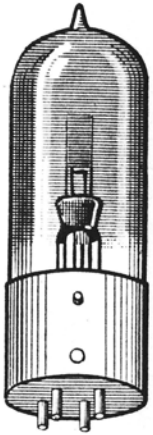
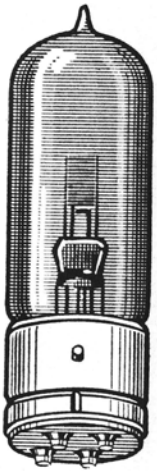
As a detector, Type 306 tube should have a grid return to the positive end of the filament. A grid leak of from 2 to 10 meghoms should be used for the higher voltages and weaker signals.



No. 306-A



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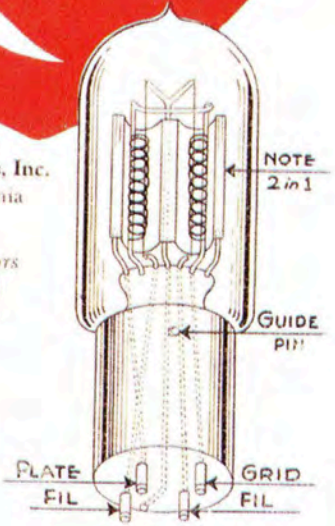

Manufactured by
A-P Radio Laboratories, Inc.
San Francisco, California

Exclusive Distributors
BAKER - SMITH COMPANY, Inc.
New Call Bldg.,
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Offices in all principal cities

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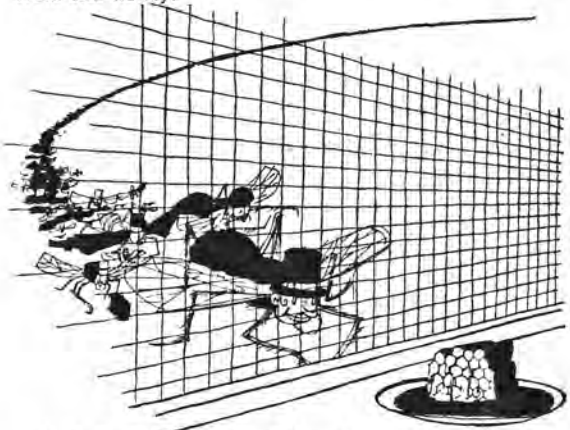

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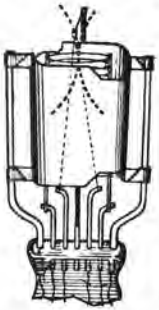

Fig. 1

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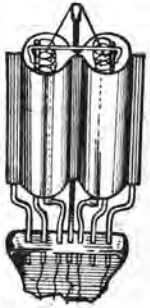


Fig. 2

When using several tubes in a set it is always best to use those of like character for best results. After many, many months of exhaustive tests our laboratory has determined definitely what A-P Tubes work best together in each of the better known radio sets.

Would you try to move a load of hay to market with a horse, a goat and your pet dog, or would you hitch up animals of like power and characteristics? (See Fig. 3).

Do not expect to get full efficiency by using different kinds of tubes of varying size and capacity. Use new A-P "Two-In-One" Tubes of like characteristics to best amplify what is in the air. Follow this plan and we can guarantee you'll get greater distance—greater clarity—more general efficiency and use less plate current on higher voltage. Complete operating data as to

which A-P tubes work best in certain standard sets is given elsewhere.

To make it easier to understand. You want to hear clearly and distinctly what's in the air. You want volume. You want tone. You want minimum distortion.

For your radio set substitute (mentally) a fisherman, trying to catch the tiny fish (far distant stations) with a net intended only for whales. How many fish get away? How many get by and through the net grid?

But, suppose the fisherman used a net of finer mesh —a tube with double the grid surface of so-called standard tubes! (See Fig. 4).

The new A-P "Two-In-One" Tubes are the "fine mesh net" of radio. Having double the grid and double the plate surface they naturally control more electrons than tubes with only half the grid and plate surface.

There also is a big advantage in the construction of the "Y" shape filament support wire which is connected to the shell of the base of the A-P tube. This may be operated as a center tap from the two filaments. By means of this center tap you can connect the filament of your new A-P tubes in series or in parallel and operate them on either three or six volts. Should one filament burn out or break, do not throw away the tube. You can easily restore it to useful life by operating the remaining filament over this center tap as a return lead. It also may be used in place of a potentiometer. Or, in a circuit where an alternating current supplants the storage battery you may connect a lead from the center tap of a suitable transformer to the center tap of the tube, which is connected to the center tap of the base. This will give equal voltage to both filaments at all times and materially reduce the A-C hum.

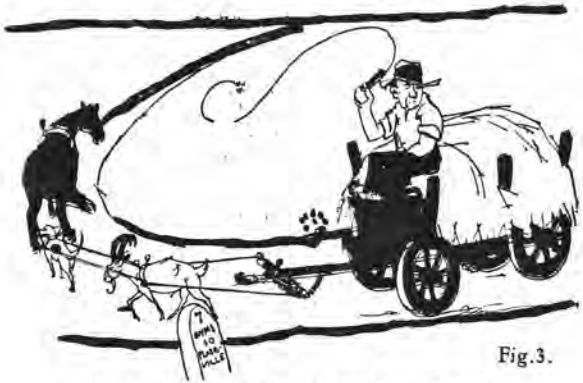


Fig.3.

Hitch-up Radio Tubes that will pull together.

Because it takes advantage of all the energy without waste, the new A-P "Two-In-One" tube can and does handle more power without distortion. It's amplifying power, as compared with the power of other tubes is that of the elephant compared to the power of a horse. The elephant can perform many times the work of a horse with no greater expenditure of energy. Again—the so-called standard tube will give good service with a 90 or 100 volt "B" Battery. The A-P "Two-In-One" tube will handle up to 400 volts "B" Battery without distortion. This means less effort to bring in distant stations—greater clarity—easier tuning—greater efficiency of your set.

TEST THEM IN YOUR RADIO SET.

The only fair way to test the efficiency of A-P "Two-In-One" tubes is in your own radio set. Do not try to determine their efficiency with antiquated instruments made especially to test some other make of tubes.

When using the new A-P "Two-In-One" tubes in any sensitive set, reduce the rheostat setting to the lowest possible point: **otherwise there is danger of oversensitizing the set,** which will cause undesirable noises and distortion. This merely emphasizes the fact that the new A-P tubes are super-sensitive and that balanced tubes of like characteristics should be used. People have asked what we mean by "sensitivity" in a radio tube?

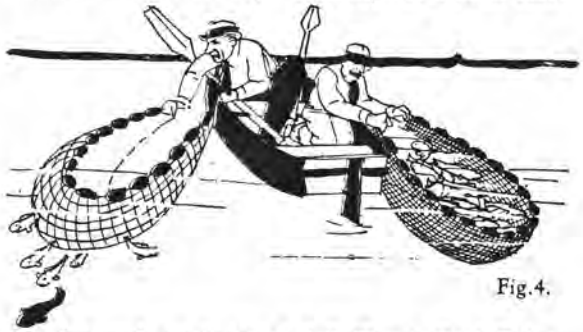
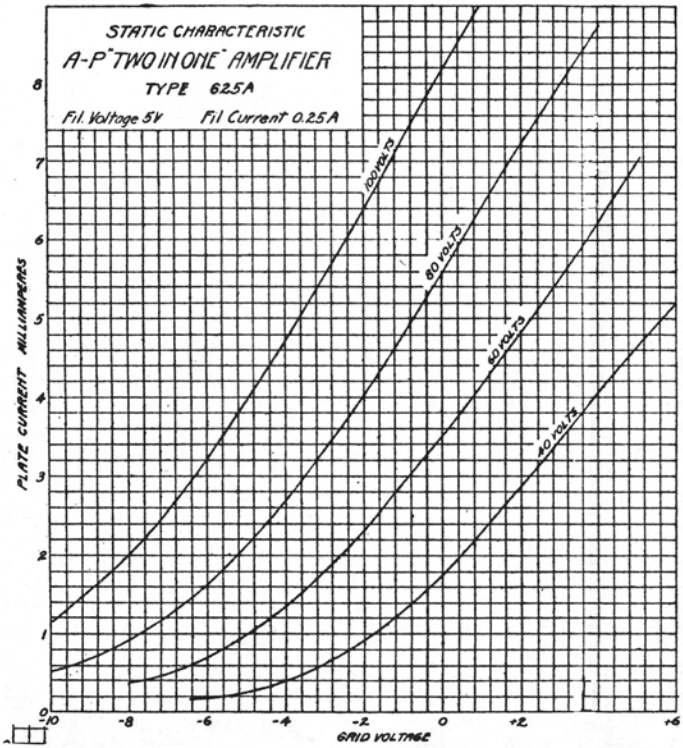


Fig.4.

The fine mesh net (grid) of A-P "Two-in-One" Tubes catches all the fish.

Fig. 5.



Charts shown on this page indicate graphically just how the new A-P "Two-in-One" Tubes perform. Test the new A-P "Two-in-One" Tubes in YOUR set. Watch your detector tube voltage and your tuning.

Characteristic curves of the new A-P "Two-in-One" 625-amplifying tube, showing performance on various "B" Battery voltages and how much "B" Battery current is consumed.

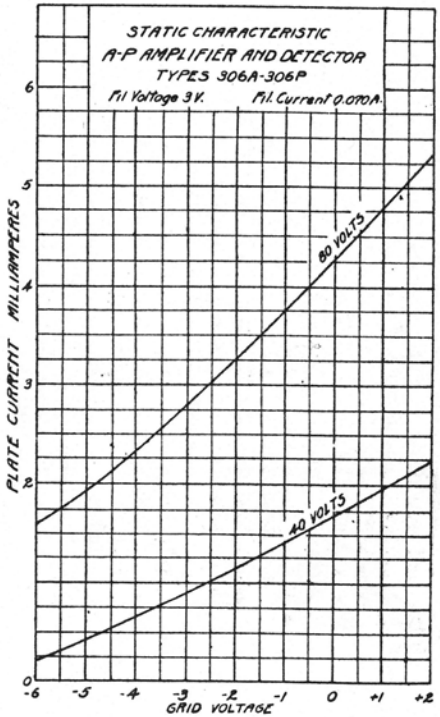


Fig. 6

The difference in sensitivity between the new A-P "Two-In-One" tube and other tubes may be compared to the natural ability of wild animals to "pick-up" a scent many times more quickly than a domesticated dog. (See Fig.8).

For best amplification a negative grid bias of "C" battery should be used when the plate voltage exceeds 45 volts. The grid return should be connected to the negative end of the filament or if the rheostat is connected in the negative "A" battery lead, the grid return should be connected direct to the negative side of the "A" battery.

The following grid bias voltages should be used:

Plate Voltage	Negative Grid Bias (C Battery)
45 volts	0
60 volts	1 to 2
75 volts	2 to 3
90 volts	3 to 4½
105 volts	4 to 6
120 volts	6 to 8

Unless the signal intensity is very high the adjustment of the negative grid bias is not so important, but if the signal intensity is very high an improper grid bias will be shown by distortion, causing an unnatural sound in music and speech.

Most important—**these tubes are amplifiers** and should not be used as detector tubes in any set. When so used this tube will **over-sensitize the set and make it microphonic.**

We recommend the new A-P 625-D tube for this purpose. No. 625-D is a gas contained tube and is very critical on A & B battery adjustments; and great care should be used in the selection of your Detector tube. If your set is not adaptable for fine adjustment on your detector tube use any other good, less sensitive detector tube in this position, in conjunction with the new A-P "Two-In-One" amplifiers. In hooking your detector tube to your "B" battery, be sure to adjust your detector voltage to get best reception and to prevent distortion.

Type 306-P tube (Peanut type) has a small base and is recommended where compactness is desired. Type 306-A has a standard base and a little larger bulb which eliminates the troublesome adapter and has the same operating characteristics as Type 306-P. Both can be operated on three ordinary dry cells, connected in series, i. e., the outside terminal of one battery connected to the center terminal of the next.

A rheostat of 30 ohms should be used when only one tube is used in circuit and a 10 ohm rheostat,

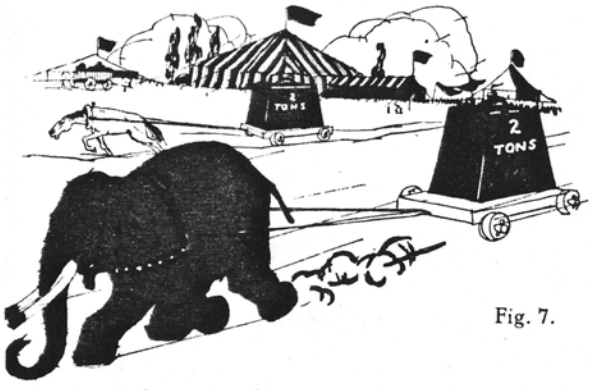


Fig. 7.

To the elephant of radio—A-P "Two-in-One Tubes" a load is moved with ease that would strain the horse.

Fig. 8.

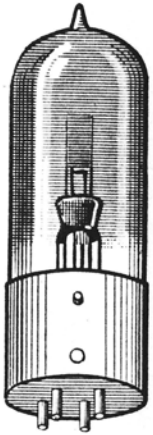
The old 'houn' dog is like a turtle, on the scent compared to an honest-to-goodness lion. So are A-P "Two-in-One" Tubes.

when three or more tubes are connected to the same rheostat. When used with three new dry cells the rheostat should be operated with the maximum resistance in the circuit. When operating with all the resistance cut out, the life of the tube will be materially shortened. Move the rheostat up accordingly as the dry cells become weak from constant use. Normal operation of the tube should be at three volts at the terminals of the tube. The normal operation of plate voltage should be from 45 to 90 volts. Greater voltages may be used, but they will materially shorten the life of the tube.

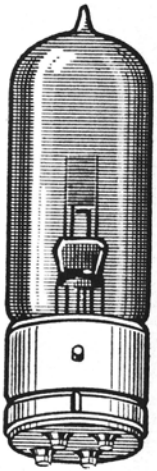
The negative grid bias required for the best operation of Type 306-A and 306-P tube is:

Plate Voltage	Negative Grid Bias
45 volts	1 to 2
60 volts	3 to 4
75 volts	4½
90 volts	6 or more
100 volts or more	

As a detector, Type 306 tube should have a grid return to the positive end of the filament. A grid leak of from 2 to 10 meghoms should be used for the higher voltages and weaker signals.



No. 306-A



No. 306-P

Could anything be fairer than this?

After you have put them in set, if you believe that your A-P "Two-In-One" Tubes are defective, return them to your dealer. He will replace them without quibble or cost.

192[illegible] RADIO NEWS LABORATORIES Number 692

Certificate of Merit

We hereby Certify that this Certificate of Merit has been awarded to A-P RADIO LABORATORIES in connection with their 2 in 1 A-P TUBE. This TUBE has been subjected to the various rigid tests of our laboratories and has been found to possess all the high standards adopted for this type of DETECTOR AMPLIFIER AND OSCILLATOR. The article complies fully with all modern radio engineering principles of this class.

Awarded the Certificate of Merit.

RADIO NEWS LABORATORIES

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H. GERNSBACK, Chairman
L. M. CLEMENT, Technical Director
R. D. ACAUL, Laboratory Director

February 18, 1925

A-P Radio Laboratories
650 Mission Street
San Francisco, California

Gentlemen

We are pleased to inform you that the 2 in 1 A-P Tubes that you recently submitted for tests have met with our approval and a Certificate of Merit will be issued within a few days

The nine tubes submitted were very uniform as to their electrical characteristics and were accurate in rating The 2 in 1 feature is very good and should meet with favor among radio experimenters Although we have made no detailed electrical tests or life tests of these tubes, we find them fully up to standard as to efficiency and operation. We note that when used in a tuned radio frequency set, the circuit does not have as great a tendency to oscillate as when other tubes are used, indicating that the electrostatic capacity between grid and plate is less, which of course is a very good feature. In other words, we believe this tube ideal for tuned radio frequency amplifiers A short write-up describing it will appear in a coming issue of RADIO NEWS.

If you have any other radio instruments that you care to have tested, we shall be pleased to extend the further services of the LABORATORIES to you.

Very truly yours,

RADIO NEWS LABORATORIES

The A-P Radio Laboratories

Patents Pending

A California Product

The New 2 in 1 A-P TUBES

OPERATING DATA

Filament Volts - - -	5.0
Filament Amperes - - -	0.25
Plate Volts - - -	40 to 200

This tube is of the New A-P "Two-in-One" construction. It has two filaments, two grids and two plates. The grids and plates are connected within the tube and function as one unit A special lead is brought out from the center of the two filaments and is connected to the shell of the base.

CAUTION—Do not use the tube in any circuit where the tube socket is grounded or otherwise connected.

Should one filament burn out, the life of the tube may be restored by connecting the shell with the peg to which the burned out filament is connected and operate the rheostat with a little more of the resistance in the circuit.

By short circuiting the two pegs on the base or the binding posts on the tube socket, and using the shell as the return lead terminal, the two filaments are in parallel and the tube will function on two volts "A Battery."

To use this tube on an alternating current supply, a transformer of the proper design is necessary to give the right voltage and amperage for the number of tubes used. There should be a neutral or no voltage tap brough out from the transformer and connected to the shell of the base. This will materially reduce the residual hum of the alternating current. This can be improved a great deal by inserting such coils and condensers as might be desirable in the receiving circuit.

This type of tube is especially adapted for Radio frequency amplification and reflex circuits. It has a high amplification constant. To get best results use a high "B" battery. This tube is not easily overloaded and will stand well over 150 volts on the plate.

A=P Radio Laboratories

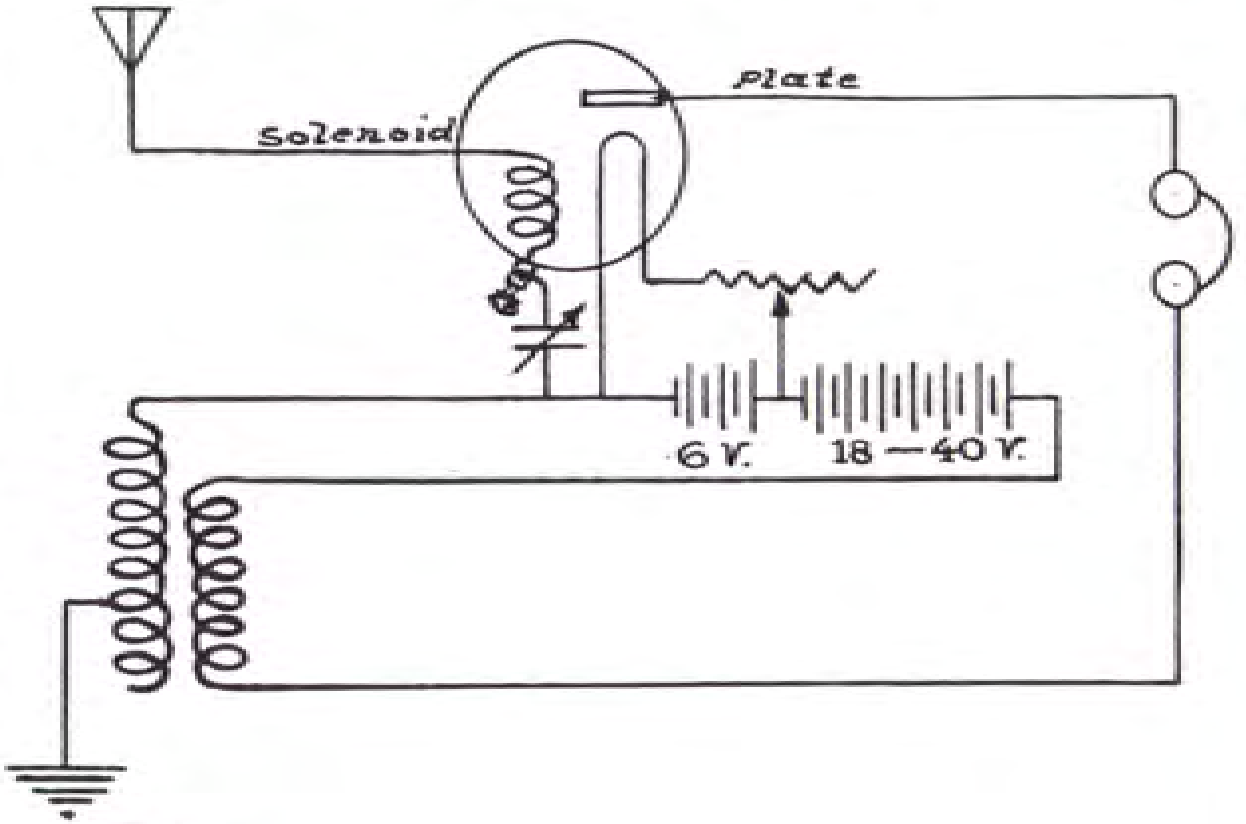
648 Mission Street San Francisco, Cal., U.S.A.

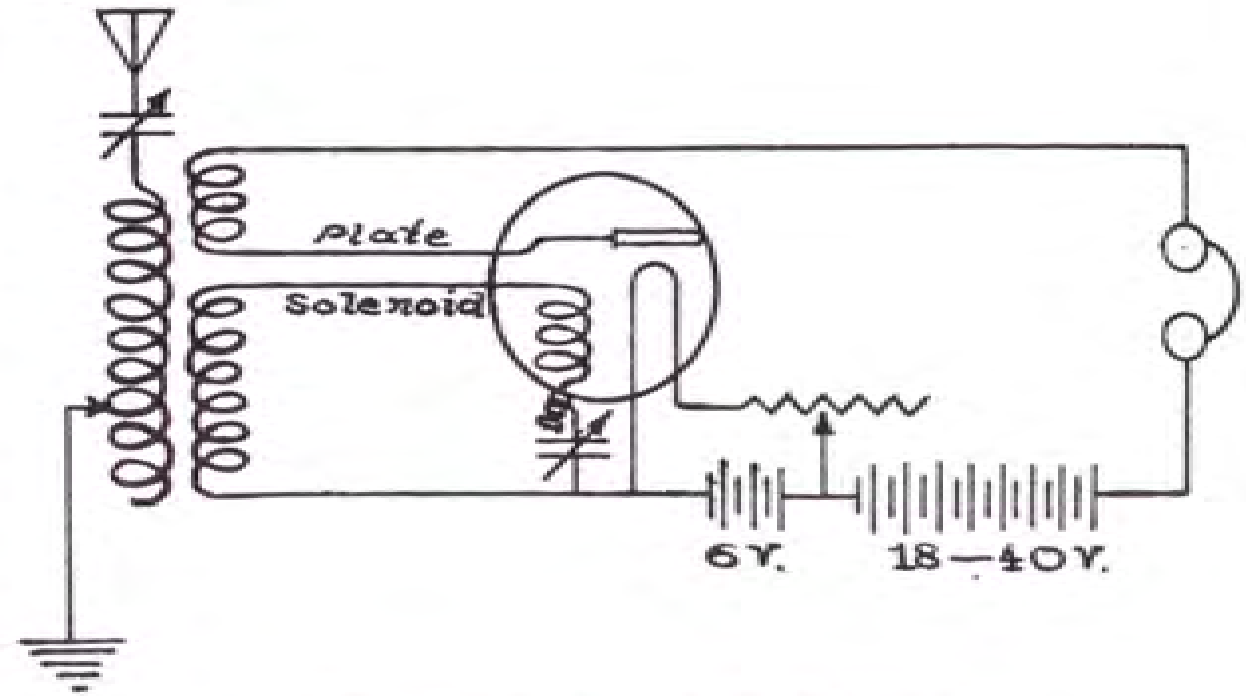
The A. P. Solenoid Radio Vacuum Tube

This Detector Tube operates best in any good regenerative, reflex or any circuit where a maximum current flows thru the solenoid.

There are five leads on this tube, the filament and plate are connected in the usual manner. One lead of the solenoid is connected to the usual grid peg and the other to the base of the tube, to assure the best contact on this lead use a metal socket and solder a binding post to it.

The following circuits have been used with good results.





Filament Voltage 6	3-10 to 5-10 Amp.
Plate Voltage 15-40	1-4 M. Amp.