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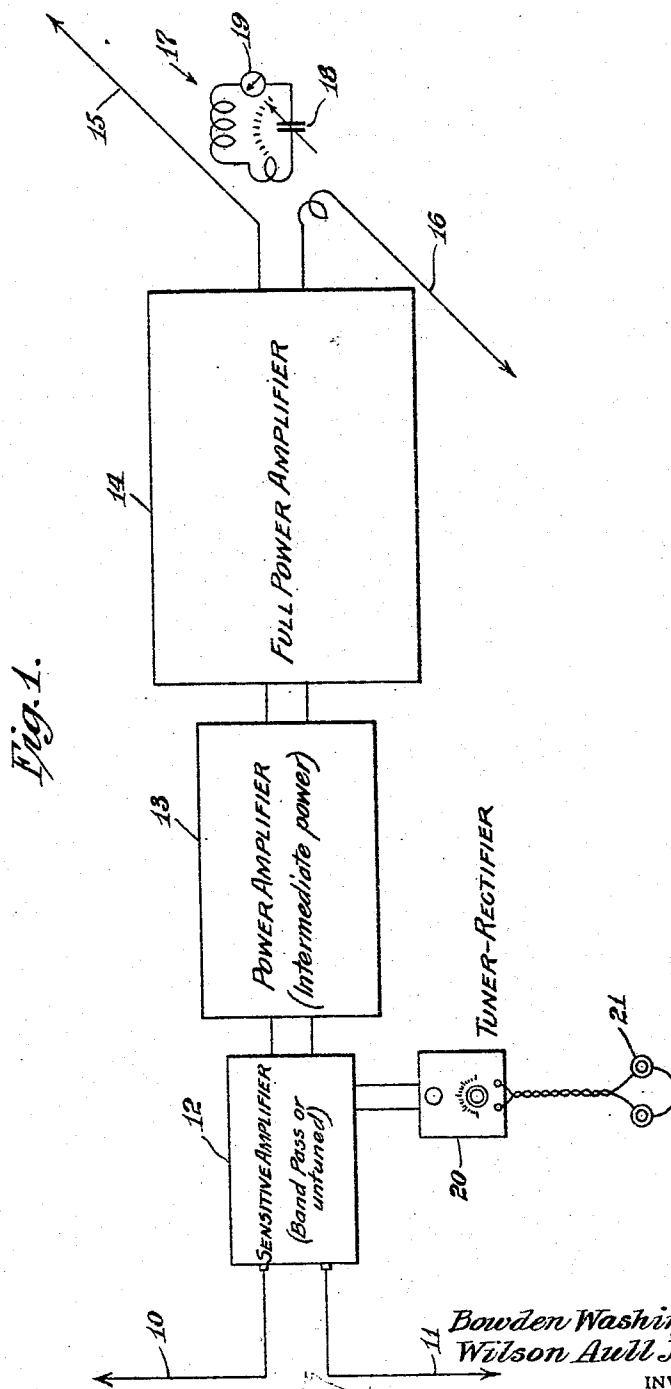
B. WASHINGTON ET AL

1,856,009

SIGNAL LEVEL RAISER

Filed Jan. 19, 1928

4 Sheets-Sheet 1



Bowden Washington
Wilson Auld Jr
INVENTORS

BY *Robert S. Allen* ATTORNEY

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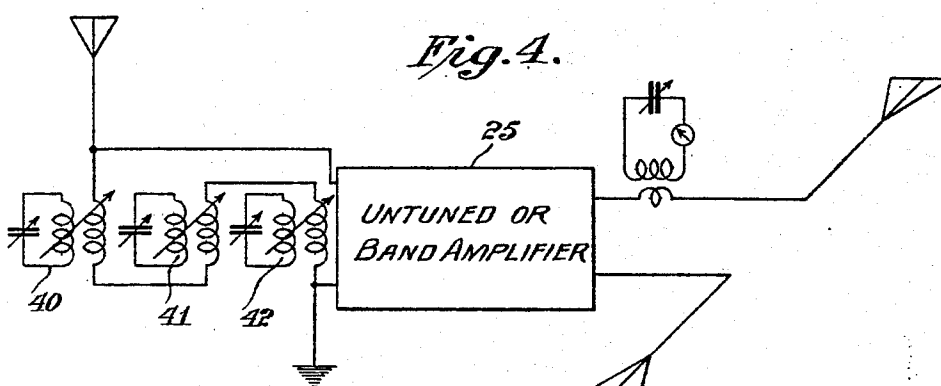
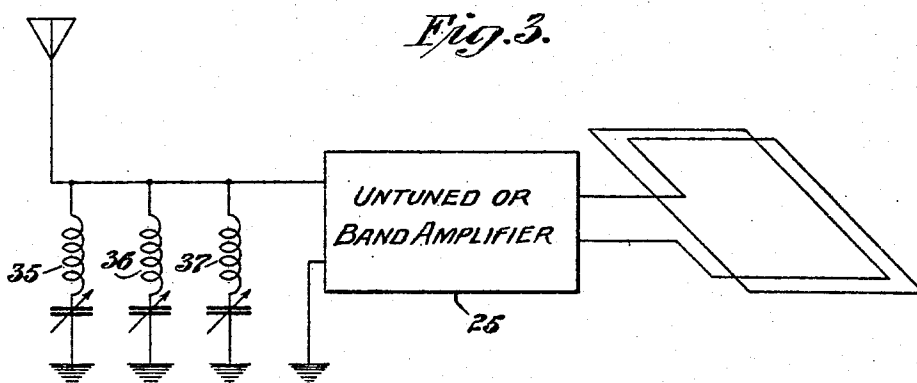
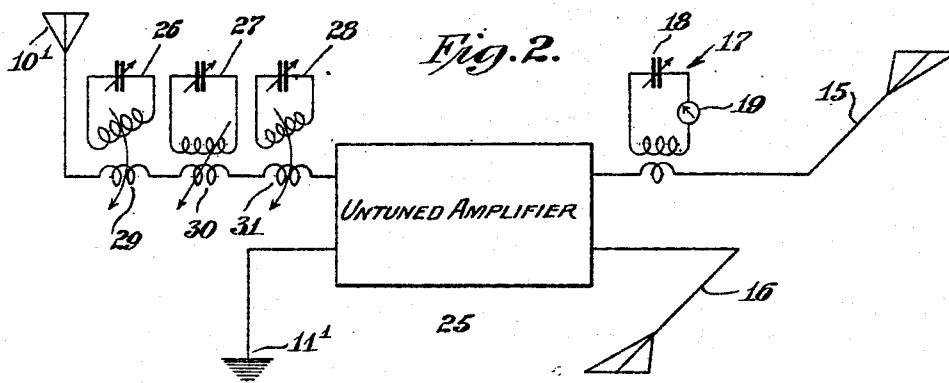
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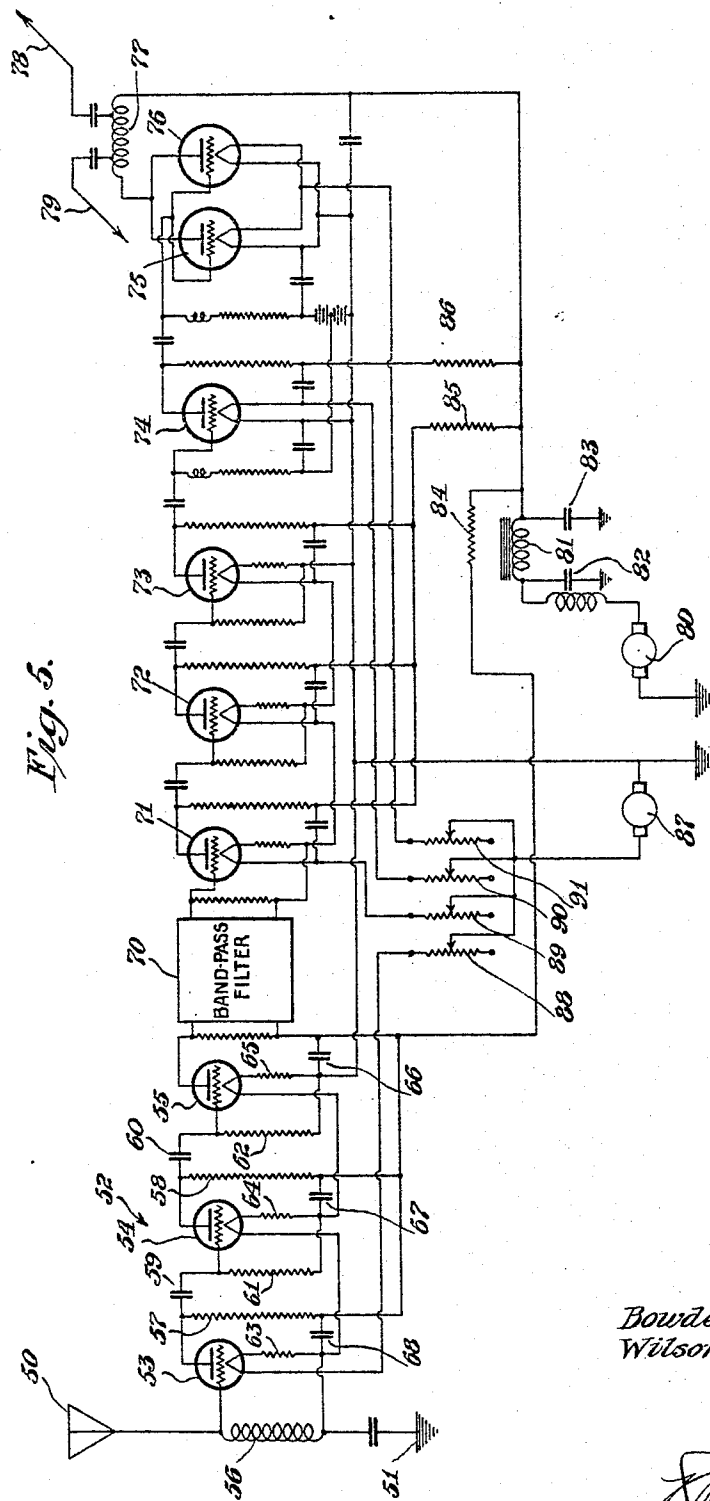
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SIGNAL LEVEL RAISER

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4 Sheets-Sheet 3



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4 Sheets-Sheet 4

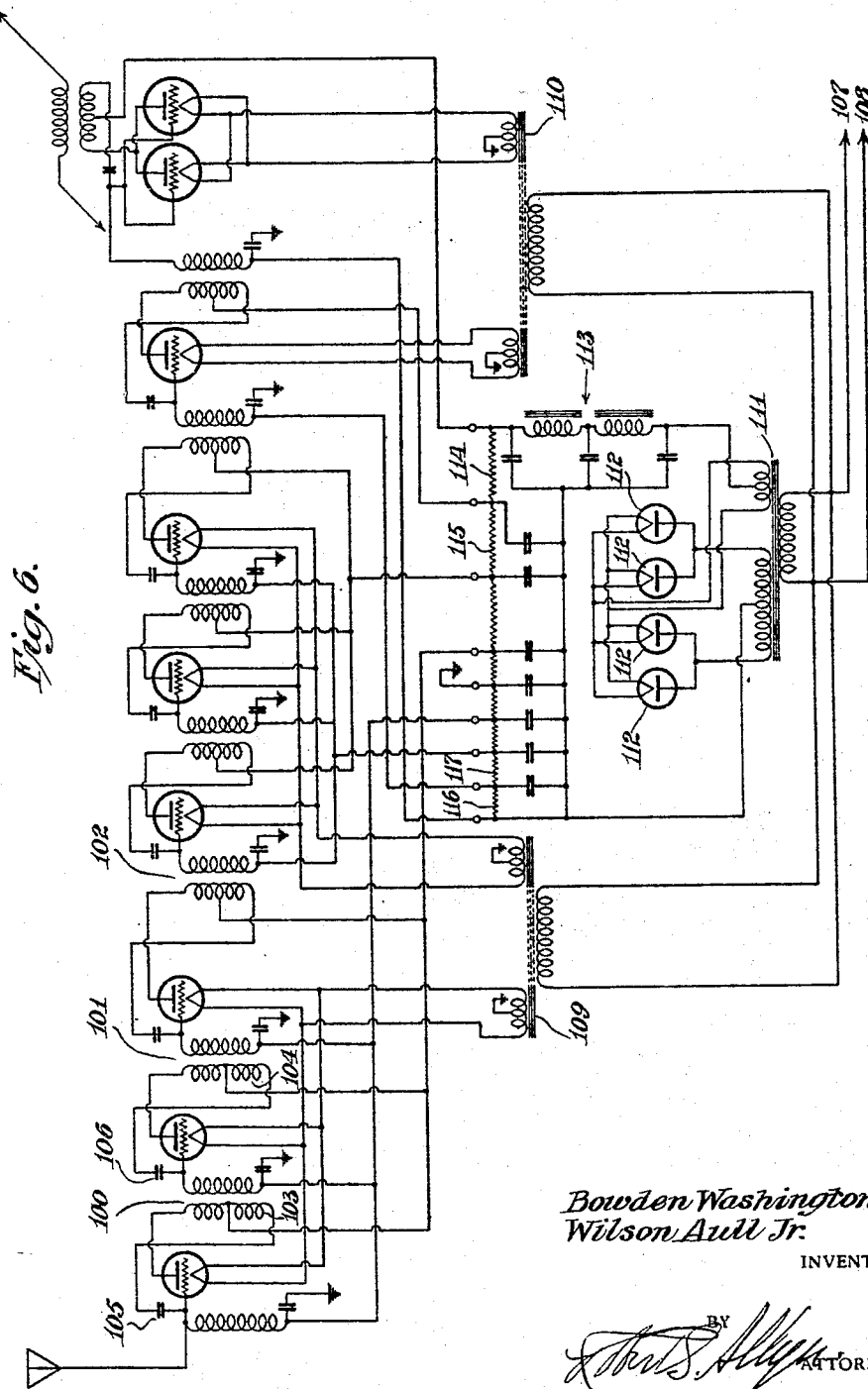


Fig. 6.

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Patented Apr. 26, 1932

1,856,009

UNITED STATES PATENT OFFICE

BOWDEN WASHINGTON, OF NEW YORK, AND WILSON AULL, JR., OF ASTORIA, NEW YORK; DOROTHY CLINTON WASHINGTON, ADMINISTRATRIX OF BOWDEN WASHINGTON, DECEASED, ASSIGNORS TO REMOTROLE CORPORATION, A CORPORATION OF NEW YORK

SIGNAL LEVEL RAISER

Application filed January 19, 1928. Serial No. 247,880.

One object of our invention is to raise the signal level of all signals within a given frequency band over a considerable area.

Another object is to produce a device which will enable residents of a hotel, apartment house, or community to enjoy a wide range of programs from both distant and local stations by the use of simple and inexpensive receivers.

Another object is to improve the reception of a large number of stations in an area where receiving conditions are ordinarily poor.

Broadly we propose to pick up all available signals within a predetermined band, regulate said signals so that their intensities are of the same order of magnitude, and rebroadcast them greatly amplified but without change in carrier frequency or side bands. These greatly strengthened signals may then be received over short to moderate ranges on simple and inexpensive receiving apparatus.

Referring to the drawings, Fig. 1 is diagrammatic view of one form of our invention.

Figs. 2, 3, and 4 show systems for regulating the sensitivity of our device to certain chosen frequencies.

Fig. 5 shows a schematic wiring diagram of one embodiment of our invention.

Fig. 6 shows a schematic wiring diagram of another embodiment.

In Fig. 1, 10 and 11 constitute a receiving antenna system. 12 is a sensitive amplifier preferably of the band-pass type designed to cover the frequencies it is desired to rebroadcast. 13 is an intermediate power amplifier whose input is connected to the output of 12 and whose output is connected to the input of the full power amplifier 14 which may use an anode power of the order of 1000 watts or more if desired. The amplifiers 13 and 14 should be of the untuned or band-pass type. The amplifier 14 is provided with the radiating means 15 and 16. It is preferable that this cascade of amplifiers be so designed that there is a 90° phase difference between the input and the output to prevent over-all regeneration or degeneration. This phase difference may be produced in any well known manner, for instance, by proper selection of

interstage coupling means. 17 represents a frequency meter having the variable condenser 18 and the quantitative current indicator 19. 20 represents a tuner and rectifier and may be provided with the head receivers 21. This tuner-rectifier may be loosely coupled with the amplifier 12 and may be used by the operator as means to check up the intensities of various incoming signals while the frequency meter 17 may be used to determine the relative amplitudes of rebroadcast signals.

All signals throughout a given predetermined band are thus received by the receiving antenna system 10 and 11 amplified by the amplifiers 12, 13 and 14 and without change of carrier frequency or side bands rebroadcast greatly strengthened by the antenna system 15 and 16.

It should be noted that experiment has shown that even though some of the received signals have a fairly strong field strength before amplification, the interference pattern between the signals proper and the rebroadcast signals changes at an inaudible rate so that no weak or dead spots will occur.

In Fig. 2, 25 indicates the entire amplification system having an antenna 10' and a ground 11'. 26, 27, and 28 indicate resonant circuits which may be variably coupled to the inductances 29, 30, and 31 which are included in series with the antenna. These are commonly known as coupled rejector systems and their purpose is by means of the well known anti-resonant effect to suppress to varying degrees signals of high intensity so that the rebroadcast signals shall all be of the same general order of magnitude.

Figs. 3 and 4 show other means of accomplishing the same result, in Fig. 3 by the direct by-pass circuits 35, 36, and 37 and in Fig. 4 by the variably coupled blocking circuits 40, 41, and 42.

In the system shown in Fig. 4 a circuit such as 40, 41, etc., is required for each frequency to be received and re-broadcast.

In Fig. 5, the input consists of the antenna 50 and the ground 51. 52 is a three stage resistance coupled amplifier having tubes 53, 54, and 55 whose input consists of the inductor

56 in series with the antenna system. These tubes are coupled by the resistors 57 and 58, and the condensers 59 and 60. The grid leaks 61 and 62 are also provided. A negative bias

of the grids is obtained by the resistors 63, 64, and 65. Radio frequency by-pass condensers of the anode circuits are shown at 66, 67, and 68.

A multi-cell band-pass filter may be provided at 70 being so designed as to pass the desired band of frequencies and having a high impedance to frequencies without this band so as to prevent the passage and amplification of unwanted signals and reduce to a minimum the amplification of static and other interference.

Following this band-pass filter is the three-stage resistance coupled amplifier employing the tubes 71, 72, and 73 which is similar to the amplifier 52 with the exception that tubes of higher capacity and a higher anode voltage may be employed. 74 is a resistance coupled radio frequency amplifying tube of still higher capacity while 75 and 76 represent two still larger tubes used in parallel for the final or output stage and having in their output circuit an inductance or resistance 77 used as a means of coupling the antenna system 78 and 79. The direct current generator 80 acts as a common source of anode power for all of the tubes and may be provided with a filter consisting of the inductance 81 and condensers 82 and 83. The anode voltage for the various tubes may be regulated by the insertion of suitable resistors as 84, 85 and 86. A direct current generator 87 acts as a common cathode heating source and the cathode current of the various tubes may be regulated by the variable resistors 88, 89, 90 and 91.

In Fig. 6, instead of resistance coupling, untuned inductive coupling by transformers such as 100, 101, and 102 is employed. Feed back due to intra-tube capacity is neutralized by means of the inductances as 103 and 104 and condensers as 105 and 106. In this amplifier the cathodes are heated by alternating current derived from the line 107—108 by means of the transformers 109 and 110. Anode power is derived from the transformer 111 in conjunction with the rectifiers 112 and the filter 113. The magnitude of the voltage applied to the various tubes is regulated by the resistors such as 114 and 115, while grid bias is obtained from the resistors such as 116 and 117.

By means of our invention satisfactory distribution of a large number of programs may be effected to any number of near-by individual listeners equipped with simple and inexpensive receivers. For "head phone" reception over moderate distances a receiver containing a single tube could be used, while loud speaker reception could be had with a detector and two audio frequency stages of amplification.

This means of distribution gives the listener a much larger choice of programs than could be had with a system employing wire lines, where, unless carrier currents and their attendant complications be employed, a separate line must be installed for each station whose program is attainable. Also if any considerable area is to be covered the expense of a large number of lines would be prohibitive.

By means of our invention a hotel could supply simple receivers to its guests at a nominal rental and thus pay for the upkeep of the band rebroadcaster.

It will be seen that our invention differs from what is commonly termed rebroadcasting for we amplify and retransmit a large number of frequencies without change of frequency. Rebroadcasting heretofore has consisted of receiving at one frequency and retransmitting the modulations of the received wave on another frequency, thus employing two channels, while in our system no additional channels are employed, and no interference is created.

We claim:

1. A method of simultaneously increasing the field strength of several radio channels over a continuous band of frequencies which consists in collecting said signals, amplifying them, and retransmitting them at their original respective frequencies but at such a phase as to prevent retroaction in the amplifier.

2. An apparatus for simultaneously increasing the field strength of all signals within a broadcast band of frequencies which consists of an untuned receiving antenna system, an untuned radio frequency amplifier system, whose input is associated therewith, an untuned radio frequency power amplifier system, having an untuned transmitting antenna system, and a band pass filter interposed between said radio frequency amplifier systems.

3. An apparatus for simultaneously increasing the field strength of all of the signals of various frequencies within a predetermined frequency band without change in the respective frequencies of said signals which consists of a broadly tuned signal collector associated with the input of a sensitive untuned radio frequency amplifier whose output is connected to the input of an untuned power amplifier, said latter amplifier having associated with its output an untuned radiating system.

4. As a means for simultaneously increasing the intensity of a number of radio signals of widely differing frequencies, a vacuum tube band-pass amplifier having receiving means sensitive to a predetermined band of frequencies, and radiating means adapted to radiate said predetermined band and means for equalizing the signal strength of

various signal frequencies, said amplifier employing vacuum tubes of higher power capacity at its output than at its input.

5 An apparatus whose object is to allow the choice and reception of a large number of broadcast programs at a number of receiving stations equipped with relatively simple apparatus which consists of a band-pass radio frequency amplifier having sensitive input stages and power output stages, said amplifier having a pick-up device capable of responding to all signals within a broad band of frequencies, and a radiating device capable of transmitting the same band with substantially uniform strength in all directions but with a 90° phase relation to the input.

6. A device for enabling a number of listeners to receive distant stations on relatively insensitive apparatus which consists of a pick-up device capable of being excited by any frequency within a predetermined broadcast band, means for equalizing the strength of the various received signals, an amplifier responsive to said band, and a radiator adapted to radiate said band at a substantial 90° phase relation to the input.

7. The method of radio reception which includes receiving all available signals within a predetermined band of frequencies equalizing the strength of the various received signals, then amplifying all of said signals without changing their respective frequencies retransmitting said amplified signals and selecting and detecting said retransmitted signals.

8. A broadcast signal strengthening system comprising means for picking up and amplifying all signals within the standard broadcast band, adjustable means for suppressing any undesired frequency and means for radiating all of said amplified signals at their received frequencies and in all directions.

9. A broadcast signal strengthening system comprising means for picking up and amplifying all signals within the standard broadcast band, means for modifying the relative intensities of selected signals, and means for radiating all of said amplified signals at their received frequencies but at such a phase relation with respect to the pick-up as to prevent interference.

10. Apparatus of the character described comprising means including an antenna system for picking up all available broadcast signals within a predetermined band of frequencies, means for regulating the received signals and bringing them to substantially the same order of magnitude, means for amplifying the received signals without change in carrier frequency or side bands and means including an antenna system for radiating all the amplified signals but with an approximately 90° relation between the electro-static

and electro-magnetic fields of the input and output antenna systems.

11. In a system as described, input means for receiving all the signals within the normal broadcast band, a multi-cell band pass filter for eliminating interference, a multi-stage amplifier, output means for radiating the output without change of frequency and means for preventing interference between the output and input.

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