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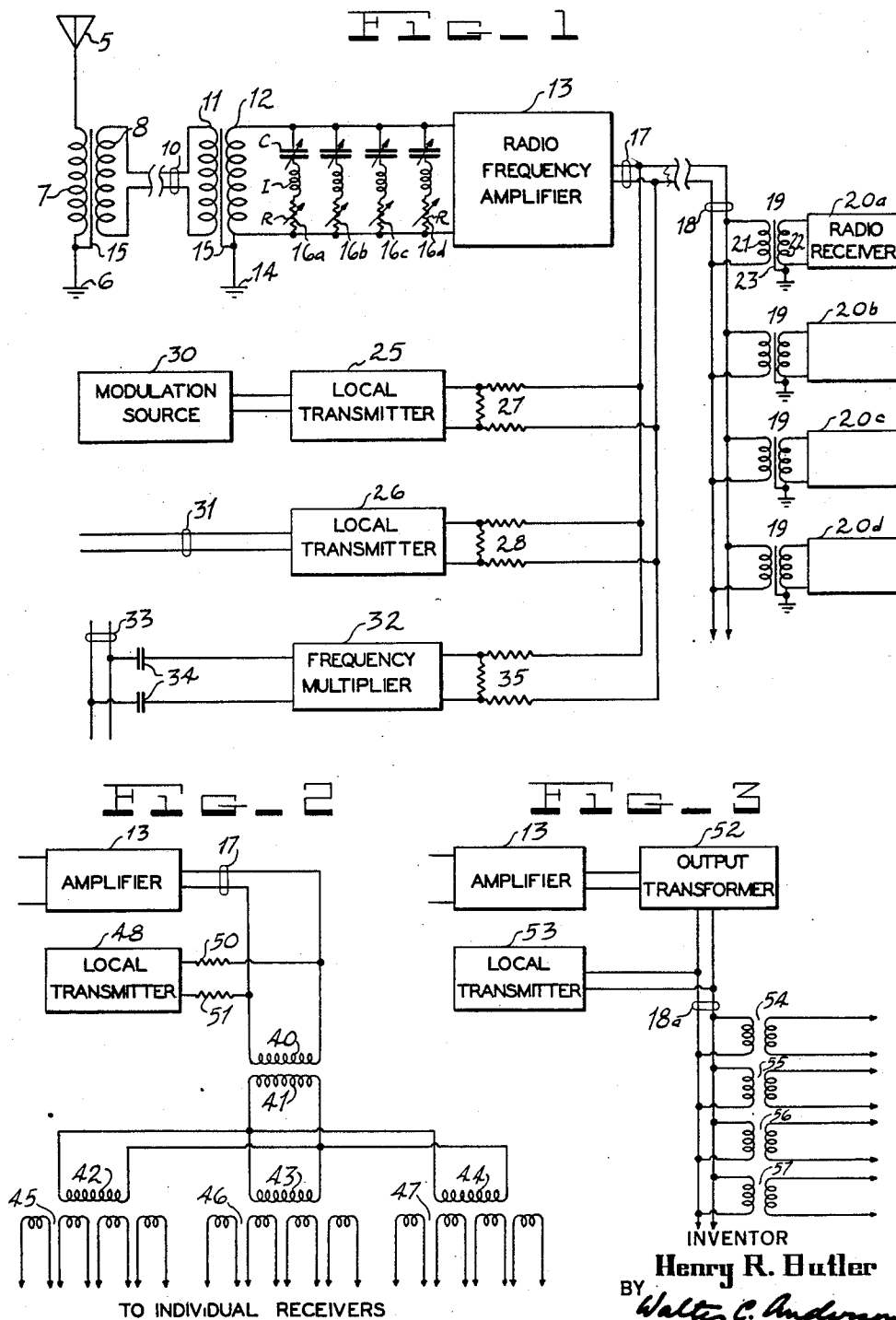
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RADIO RECEPTION SYSTEM

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RADIO RECEPTION SYSTEM

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This invention relates to receiving systems for supplying radio frequency signal energy to a number of receivers and particularly to such a system covering the broadcast band of frequencies and comprising a common antenna for all receivers in one or more buildings or a restricted area.

The principal object of the invention is to provide local radio frequency signals for selective reception by ordinary receivers within their tuning range and without interfering with their normal selective reception of space radio signals.

Another object is to improve common antenna systems so as to supply strong, uniform signals from broadcasting stations which are weakly received, as well as from stations strongly received.

Other and related objects will be apparent from the following description in connection with the accompanying drawing in which:

Fig. 1 is a diagram of a preferred embodiment of the invention; and

Figs. 2 and 3 illustrate modified arrangements for distributing local and space radio signals to many receivers according to the invention.

Referring to Fig. 1, an antenna 5 for receiving space radio signals is grounded at 6 through primary 7 of a radio frequency transformer, the secondary 8 of which is connected to a radio frequency transmission line 10. The other end of the transmission line is connected to primary 11 of another radio frequency transformer which has a secondary 12 connected to a wide-range, radio frequency amplifier 13. One end of secondary 12 may be connected to ground as at 14, and grounded electrostatic shields 15 may be disposed between windings 7 and 8, and 11 and 12, respectively. A plurality of tunable circuits or wave traps, such as 16a, 16b, 16c, 16d, each comprising capacity C, inductance I and adjustable resistance R, are connected across the secondary 12 and the input of amplifier 13.

The output 17 of amplifier 13 is connected to a distributing system 18 for carrying the amplified signals to each radio receiver 20a, 20b, 20c, 20d, etc. within the building or area to be supplied from antenna 5. Coupling transformers 19 may be provided to prevent interaction among the receivers. Each transformer 19 preferably comprises a primary 21 connected to system 18 and a grounded secondary 22 connected to a receiver. A grounded electrostatic shield 23 may be disposed between the primary and secondary windings. While only four receivers are shown, it is to be understood that there may be several hundred or several thousand receivers connected to the distributing system.

One or more local transmitters 25, 26 are connected to the amplifier output 17 through resistance networks 27 and 28, respectively. Transmitters 25 and 26 preferably are located near amplifier 13 and within the building containing the receivers, each said transmitter comprising the usual radio frequency oscillator and audio frequency modulator circuits and tubes. The output power of the transmitters may be low and preferably is sufficient to give a signal level at 17 about equal to the maximum output of amplifier 13. The source of modulation energy for the transmitters may be local as indicated at 30, which may be a microphone, phonograph pick-up or other device for supplying audio frequency modulations to transmitter 25. Alternatively, the modulation energy may be received from a distant point over a telephone line 31, such as shown connected to transmitter 26.

Another arrangement, if wired radio is available, is to couple a frequency multiplier or converter 32 to a power line 33 on which wired radio signals have been impressed at a distant point. The coupling means may comprise condensers 34. The output of the frequency multiplier passes through a resistance network 35 which is connected in parallel with the networks 27 and 28.

The transmitters 25, 26 and frequency multiplier 32, with their associated apparatus, may be employed separately or in combination as one or more sources of local signals which are added to the space signals collected by antenna 5.

In the drawing, an ellipse surrounding a pair of wires (such as 10 or 18) indicates that they may be shielded or concentric.

The operation of the system shown in Fig. 1 is as follows:

Space radio signals at various frequencies are collected by the antenna 5 and carried to the individual receivers 20a to d, etc. by the transmission line 10 and distributing system 18 in a manner known in the art. The receivers are the usual type having arrangements to select any carrier within their tuning range and to reproduce the modulations carried thereby.

In accordance with one feature of the invention, amplifier 13 increases the strength of weakly received signals to such a level that the modulations may be reproduced with ample volume by moderately sensitive receivers. Inasmuch as only one amplifier is required for the entire installation, it may be of very high quality and as sensitive as desired, thereby saving the expense of providing such quality and sensitivity in each of a large number of receivers. In order to avoid unnecessary am-

plification of the signal received from a nearby or a high power broadcasting station, one of the wave traps, for instance 16a, is tuned to the carrier frequency of such station by means of variable capacity C and the degree of attenuation of such signal is adjusted by variable resistance R. Certain of the other wave traps may be tuned to other strong broadcasting stations so that approximately uniform signal strength for all space radio signals will be obtained at the output 17 of amplifier 13. Such multiple arrangement of wave traps may be called an equalizer.

With the present allocation of broadcasting frequencies there are, in any locality, several frequencies for which the assigned stations are either too far away or are of too low power to be received by ordinary radio sets. In accordance with the principal object of the invention, such frequencies are selected for the local sources 25, 26 and 32. The frequency of source 32 should be a multiple of the wired radio frequency received over line 33, for instance, 550 kilocycles which is the eleventh harmonic of a 50 kilocycle wired radio signal. In some cases, the frequency selected for a local source may be the same as the frequency of a broadcasting station which is not received satisfactorily but nevertheless produces a beat note by heterodyning with the local frequency. In such event one of the wave traps, such as 16d, is tuned to such frequency and its resistance R made zero, whereby the broadcast signal is short-circuited before it reaches amplifier 13 and the beat note is thus eliminated.

The radio frequency oscillations generated by sources 25 and 26 are modulated by audio frequencies representing programs from modulation source 30 and telephone line 31. The wired radio oscillations received over power line 33 are already modulated so it is necessary only to step up their frequency by the multiplier or converter 32. It should be understood, however, that all the local sources may be alike, except as to frequency, and may be any of the three types illustrated in Fig. 1 or of other known types. The modulated outputs of sources 25, 26 and 32 are paralleled at 17 with the output of amplifier 13. In this manner programs are made available at points on the dials of receivers 20a to 20d which otherwise would not be used. Such local programs can be of very high quality and are not subject to fading or other disturbing influences, inasmuch as they are not transmitted through space, but instead are fed directly into the distributing system 18.

The quality of local programs may be further improved by arranging the sources 25, 26 and 32 to deliver one side band only. For example, assuming that receivers 20 have a pass-band width of 8,000 cycles and that they receive the usual double side band signals, the audio frequency output would be cut off at 4,000 cycles. However, with single side band transmission from local sources 25, 26 and 32, the full width of 8,000 cycles would be available for one side band and therefore the audio frequency cut-off would be raised to 8,000 cycles, thereby providing higher quality programs from the local transmitters.

The function of the resistance networks 27, 28 and 35 is to prevent interaction or feed-back among the transmitters 25, 26, 32 and amplifier 13. Inasmuch as the signal level required at 17 is very small, such resistance networks may pass as little as 10% of the transmitter outputs and still provide ample signal strength, even though the transmitters contain low power radio tubes.

Fig. 2 shows a modified arrangement for dis-

tributing the output of amplifier 13 when there are a large number of connected receivers. In this modification, the output 17 of the amplifier is connected to primary 40 of a main transformer, the secondary 41 of which is connected in parallel to primaries 42, 43 and 44 of a number of auxiliary transformers. Each auxiliary transformer has multiple secondaries, 45, 46 and 47, the respective sections of which may be connected to individual receivers. If desired, however, each section of secondaries 45, 46 and 47 may be connected to the primaries of additional auxiliary transformers having multiple secondaries connected individually to the respective receivers. The degree of sub-division may be carried as far as necessary to provide most economically for the number of receivers in the building.

Fig. 2 also shows a modified arrangement for feeding in the local radio signals from a single transmitter 48 by connecting the transmitter in parallel with the amplifier output 17 through suitable resistance 50 and 51, in the connecting leads.

Fig. 3 shows another modification wherein the output of amplifier 13 is made to have very low impedance, such as by transformer 52 having a low impedance secondary winding. The proper impedance depends upon the number of branch transmission lines to receivers and on the characteristic impedance of each line. For instance, if there were only one line with one receiver connected thereto the output impedance of transformer 52 might be 70 ohms, whereas if there are 700 branch lines, each connected to a receiver, the output impedance would be approximately 0.1 ohm. Such impedance does not depend upon how many of the connected receivers happen to be in operation. In a low impedance system the output of the local transmitter 53 should also have a low impedance and may then be directly connected to the output of transformer 52 and to the distributing system 18a. This system may comprise transformers 54, 55, 56, 57, etc., all connected in parallel. Each transformer may supply one floor or section of a building by connecting their secondaries to individual transformers in the receivers on that floor or section, or by interposing auxiliary transformers as in Fig. 2.

While a preferred embodiment and certain modifications have been described above and illustrated in the accompanying drawing, it is to be understood that various changes may be made without departing from the spirit and scope of the invention.

What I claim as new and original to be secured by Letters Patent of the United States is:

1. In combination, an antenna for receiving space radio signals, throughout a given frequency range, means connected to said antenna for distributing the signals to several radio receivers at the frequencies received, a local transmitter coupled directly with said distributing means for supplying additional signals to said receivers within the given frequency range, and means connected between said antenna and said distributing means for eliminating received signals having substantially the frequency of said local transmitter and for preventing radiation of said additional signals from the antenna.

2. In combination, an antenna for receiving space radio signals throughout a given frequency range, means connected to said antenna for amplifying said signals, means for distributing the amplified signals to several radio receivers at the frequencies received, each receiver being individually selective to desired signals, a local radio fre-

quency transmitter coupled between said amplifying means and said distributing means for supplying additional signals to said receivers within the given frequency range, and a wave trap connected between said antenna and said amplifying means, said wave trap being tuned to the frequency of said local transmitter.

3. In a system for collecting space radio programs transmitted on assigned carrier frequencies and for distributing the same without change of frequency to a multiplicity of connected radio receivers, the method which comprises, feeding an additional program directly into the distributing system at a carrier frequency such that space radio programs assigned to that frequency are not receivable, making the energy level of the fed-in program comparable to the energy level of the strongest carrier among the received space radio programs, and eliminating from the collecting system any extraneous signals and static having substantially the frequency of the fed-in carrier.

4. In a system for collecting space radio programs transmitted on assigned carrier frequencies and for distributing the same without change of frequency to a multiplicity of connected radio receivers, the method which comprises trapping out a weak undesired program and substituting therefor a local program on substantially the same carrier frequency by feeding said local program directly into the distributing system at an energy level about equal to the strongest of the received programs.

5. The combination defined by claim 1 in which said local transmitter is arranged to suppress one side band and to deliver single side band signals to said distributing means.

6. The combination defined by claim 1, and an equalizer also connected between said antenna and said distributing means, said equalizer comprising a plurality of tuned circuits and adjustable resistances for making the energy levels of the received space radio signals approximately uniform.

7. A radio reception system for a restricted area containing a multiplicity of radio receivers, said system comprising, an antenna for collecting space radio signals, circuit means connecting said antenna to said receivers, an untuned radio frequency amplifier forming part of said circuit means, a plurality of sources of local radio frequency signals connected to the output of said amplifier, at least one wave trap connected across the input of said amplifier and tuned to the frequency of one said source, and at least one additional wave trap connected across the input of said amplifier and tuned to a strong space radio signal collected by said antenna.

8. A radio reception system as defined by claim 7 in which at least one of said local sources produces radio frequency signals in the form of a carrier with single side band.

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