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E. E. CLEMENT

SECRECY SYSTEM OF RADIO BROADCAST DISTRIBUTION

Original Filed May 21, 1925 5 Sheets-Sheet 1

Fig. 1.

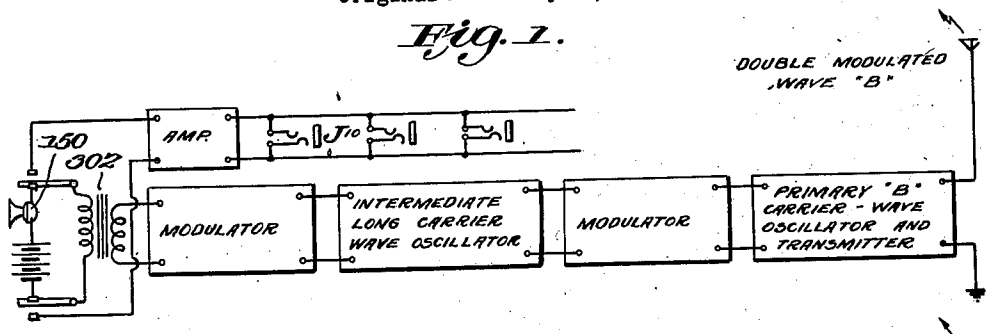


Fig. 2.

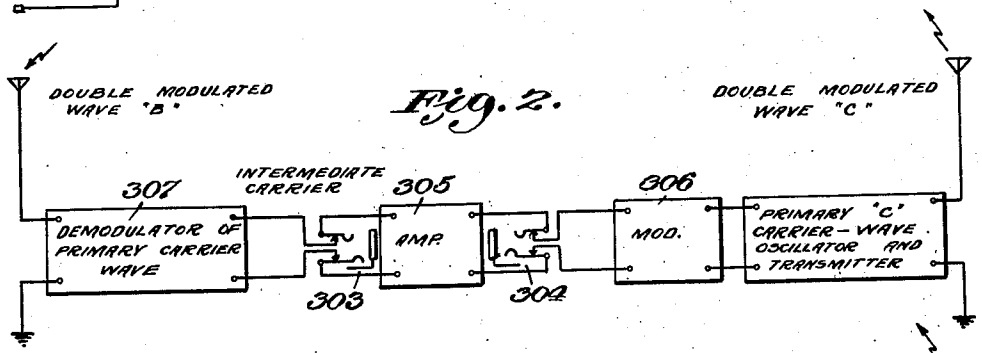


Fig. 3.

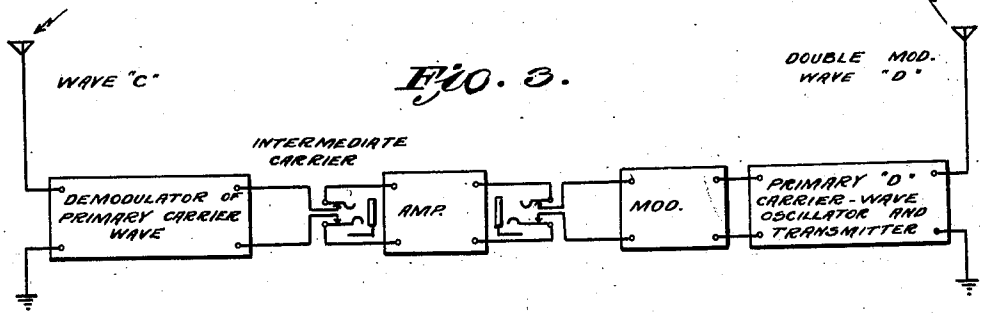
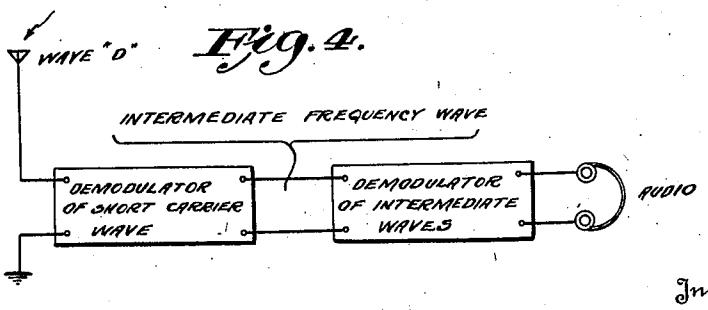


Fig. 4.



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Fig. 6.

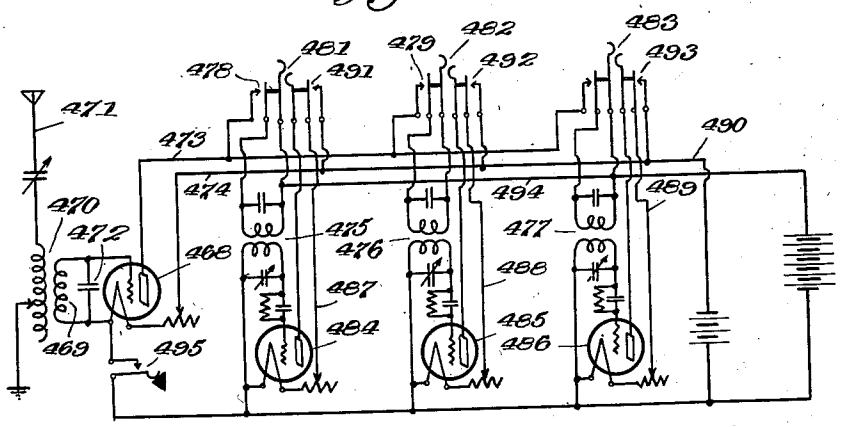
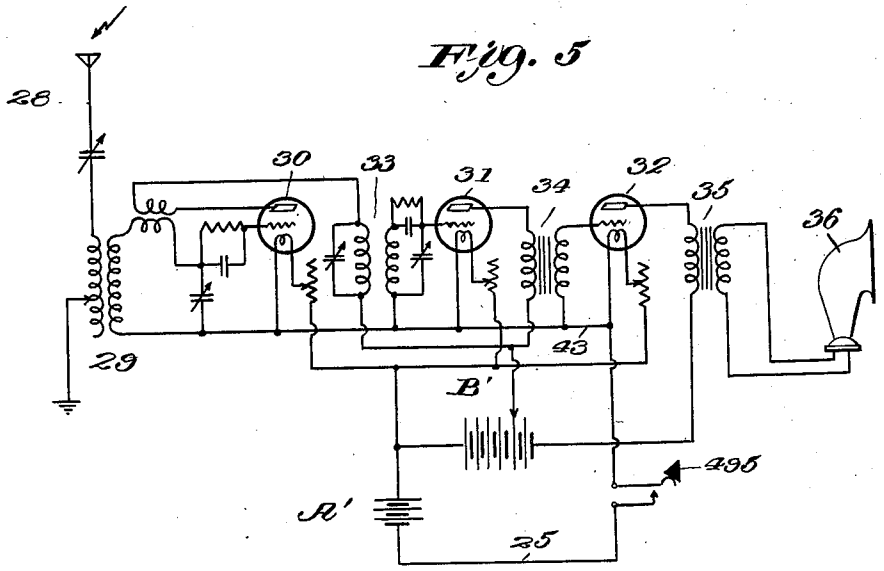


Fig. 5



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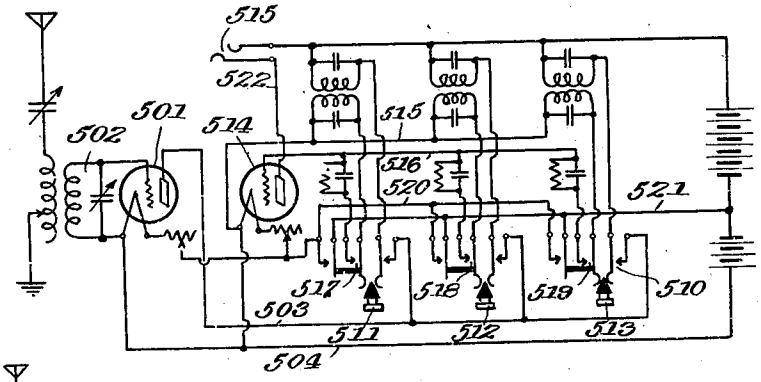
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SECRECY SYSTEM OF RADIO BROADCAST DISTRIBUTION

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Fig. 9.



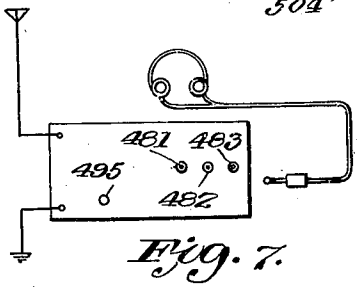


Fig. 7.

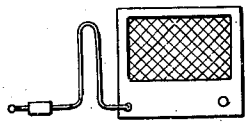


Fig. 8.

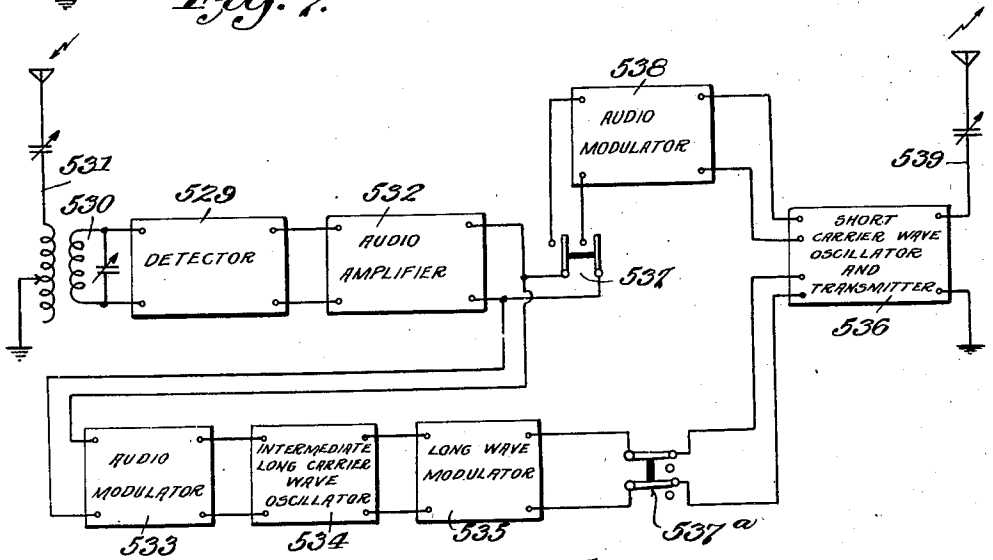


Fig. 15.

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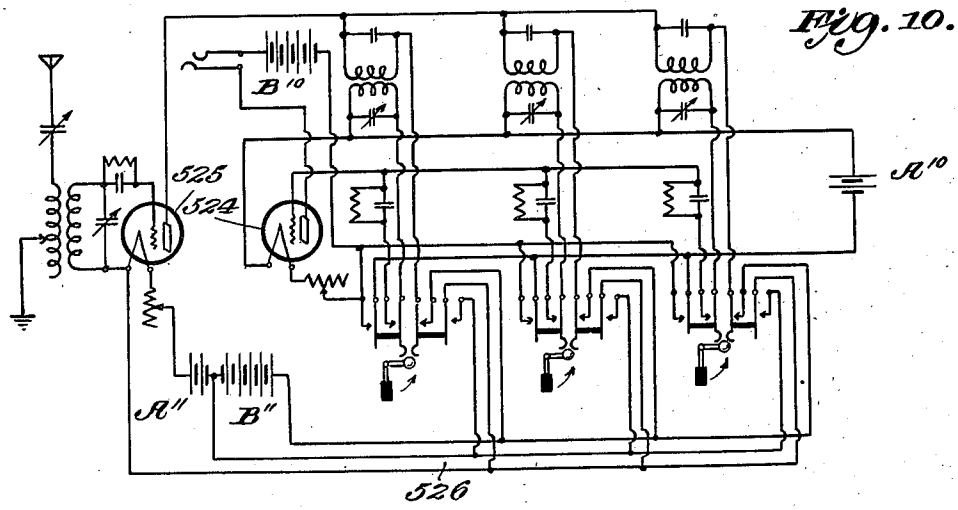
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Fig. 10.



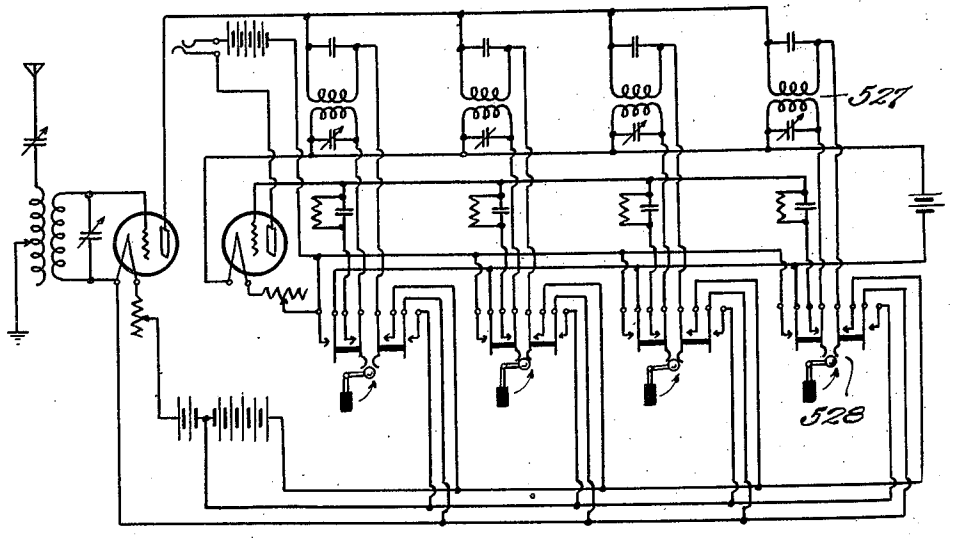


Fig. 11.

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DAILY DESPATCH SHEET STATION "A" DATE

N.B. ALL TIME ENTRIES HEREON ARE BASED ON EASTERN STANDARD TIME

ITEM No.	REMARKS	TIME REC'D	ALL DIVISIONS ORIGIN STATION	ORIGIN FREQ.	DESTINATION STATION	DESTINATION FREQ.	ROUTE	RATE	DURATION START	DURATION STOP
			D-L	KC	D-L	KC				
2743	Capitol Quartette	7:30p	3-3	2500	½	1330 & 1500	All radio freeno	Free	7:30p	7:45p
1700	Assoc. Press	Conv.	All	2500	½	1330 & 1500	" " "	Free	7:30p	7:45p
28	National Lyceum Lect.	orig.	orig.		All	All	All radio	Free	7:30p	8:15p
1860	Phila. Symphony Orch.	8:15p	1-2	2500	All	All	All radio	10	8:15p	8:45p
**	President's Speech N.Y.	8:45p	1-2	2500	All	All	Radio & Wire & Rec.	Free	8:45	9:15p
1860	Phila. Sym. Orch. (cont'd)	9:15p	1-2	2500	All	All	All radio	10	9:15p	9:45p
1700	Assoc. Press (repeat)	Conv.	All	2500	All	All	All radio	Free	9:50	10:15p
2743	Capitol Quartette (repeat)	7:00p	Recrd		½	1330 1500	All radio	Free	10:45	11 P
1111	Honolulu Ukelele Club	11:30p	4B1	2500	All	All	All radio IF 53KC	10	11:30p	12 P
2222	Special Night program	12P	All		All	All	All radio	Free	12P	8:0A

Fig. 12.

DAILY DESPATCH SHEET STATION "B" DATE

ITEM No.	REMARKS	TIME REC'D	EASTERN DIVISION ORIGIN STATION	ORIGIN FREQ.	DISTRICT No. 1. TRANSMISSION P. F.	TRANSMISSION P. F.		RATE	DURATION START	DURATION STOP
				K.C.	K.C.	K.C.				
182	Eastern Mfg. Conv.	3P	Original		1000	25	All radio	5	3P	4P
2743	Capitol Quartette	7:30p	A-1	1200	1000	25	" "		7:30p	7:45p
1700	Assoc. Press	7:30p	A	1200	1000	29	" "	Free	7:00	7:45p
1860	Phila. Symphony Orch.	8:15p	A	1200	1000	33	" "	10	8:15p	8:45p
**	President's Speech N.Y.	8:45	A	1200	1000	41	" "	Free	8:45	9:15p
1860	Phila. Sym. Orch. (cont'd)	9:15p	A	1200	1000	33	" "	10	9:15	9:45p
1922	Maryland Hotel Pasadena Cal.	10P	4B1/2	1200	1000	41	" "	10	10P	1 A
1111	Honolulu Ukelele Club	11:30p	A	1200	1000	53	" "	10	11:30p	12P
2222	Night Specials	12P	A	1200	1000	All	" "	Free	12P	8 A

Fig. 13.

DAILY DESPATCH SHEET STATION "C" DATE

ITEM No.	REMARKS	TIME REC'D	EASTERN DIVISION ORIGIN STATION	ORIGIN FREQ.	DIST. 1. LOCAL 1. SUB-SETTING I.F.	SUB-SETTING DIAL No.		RATE	DURATION START	DURATION STOP
				KC	KC.					
182	Eastern Mfg. Conv.	3P	B-1	1000	25	1	All radio	5	3P	4P
777	Stock Market Reports	3:30	A	1000	29	2	" "	Free	3:30	4:15p
101	Rolling Stones	6:00p	Local		25	1	" "	Free	6P	6:30p
102	Mothers Corners	6:15p	Local		33	5	" "	Free	6:15p	7:00p
123	Olympic Concerts	6:00p	Local		33	3	" "	Free	6:00p	7P
124	Lecture Night	7P	Local		41	4	" "	Free	7:00	7:30p
1288	Assoc. Press	7:30p			29	2	" "	Free	7:30	7:45
127	Cafe de Lisette	8:15	Local		53	5	" "		8:15	11 P
1860	Phila. Sym. Orch.	8:15p	B-1	1000	41	4	" "	10	8:15	8:45p
**	President's Speech N.Y.	8:45	B1	1000	25	1	" "	Free	8:45	9:15
1860	Phila. Sym. Orch. (cont'd)	9:15	B1	1000	41	4	" "	10	9:15	9:45p
1925	La Scala Del Opera	10:30	Local		29	2	" "	5	10:30	12P
1655	Intimate Love Scenes	10P	Local		25	1	" "	10	10P	12P
1926	Love Songs Trio	10:00	Local		33	3	" "	5	10:30	12P
1922	Mt. Hotel Pasadena Cal.	10P	4B1/2	1000	41	4	" "	10	10P	1A
1111	Honolulu Ukelele Club	11:30	A1	1000	53	5	" "	10	11:30	12P
2222	Night Specials	12P	A	1000	All	Any	" "	Free	12P	8A

Fig. 14.

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Patented Dec. 11, 1928. 1,695,180

UNITED STATES PATENT OFFICE.

EDWARD E. CLEMENT, OF WASHINGTON, DISTRICT OF COLUMBIA, ASSIGNOR TO EDWARD F. COLLADAY, OF WASHINGTON, DISTRICT OF COLUMBIA.

SECRECY SYSTEM OF RADIO BROADCAST DISTRIBUTION.

Original application filed May 21, 1925, Serial No. 31,928. Divided and this application filed October 30, 1925. Serial No. 65,861.

My invention relates to methods of radio broadcast distribution, and the present application is a division of my prior copending application, filed May 21, 1925, Serial No. 31,928. This invention has for its object to provide an organization for the broadcasting of intelligence and an operating method therefor in which orderly distribution may be secured, with maximum efficiency

Very briefly stated, my invention includes subdivision of the ultimate units or subscriber's stations into local groups in local areas, each group related to a local or regional distributing station; the grouping of these regional stations according to districts and relating each district group of regional stations to a district master station; the grouping of districts into divisions, which may conveniently coincide with the geographical standard time divisions of the country; and finally the relation of the district master stations to a central master station. There may be more intermediate steps or stations interposed between the subscriber's control or regional station and the central master station and there may be direct connection between the said regional stations and the central master station, but these possible variations will be apparent from the detailed description and do not change the principle involved. In any case, for purpose of distribution, the central master station broadcasts to the district master stations on district carrier wave frequencies, each of the district master stations broadcasts to its constituent regional central stations on a fixed carrier wave frequency, permanently allotted thereto, and each local or regional central station broadcasts to the subscribers in its local area on a common fixed carrier wave frequency permanently allotted thereto.

Thus it will be apparent that the first characteristic feature of the method is that of sending from each center to the class or order of centers next above or below it, on a fixed carrier wave frequency or frequencies allotted permanently to said next higher or lower order of stations. If we call the central master station of the entire system, A, and call the district master stations B, the local or regional distributing stations C; and the subscribers' instruments in general D, then we may say that A transmits to B on B frequency, B transmits to C on C frequency, and C transmits to D on D frequency, of the respective carrier waves. For information that goes through from A to D, or that goes through from B to D, as well as information originating with C, the original modulations are actually reproduced in the instruments at D, by means which will be described. The simplest way to do this is by double modulation, which also enables easy change of primary carrier wave frequency at the intermediate or relaying stations without changing the intermediate carrier frequency, whereon and whereby the original modulations are preserved

By means that will be described, it is contemplated to have national, district and local programs made up day by day, from which any subscribers may select. Selection by the subscriber is determined by frequencies, which by the use of double modulation may be frequencies of the envelope or intermediate wave transmitted.

The great benefit of double modulation as will be hereinafter pointed out, is that a great range of selection can thereby be afforded any local station and any local exchange, which will be the same for all parts of the country and for every exchange down to the smallest hamlet, or the most distant station. In oher words, every subscriber in this system may have access to the entire program available to any other subscriber without regard to location, distance, time or circumstances. For this purpose it will be necessary to provide a plurality of receiving and transmitting instruments at each of the relay stations to be described, whereby any relay station can pick up and transmit items that are not in the regular program ordinarily allotted to it. The subscribers have permanently turned selective circuits for the intermediate frequencies allotted to them, in each local area, and they also have tunable means for picking up the special items referred to.

One form of apparatus by means of which my invention may be practiced is illustrated in the accompanying drawings, in which

Fig. 1 shows symbolically an arrangement

of double modulating and transmitting equipment at the A or master station of the system for matter original there.

Fig. 2 shows symbolically equipment for the B stations, by means of which the primary carrier waves transmitted from the apparatus of Fig. 1 may be demodulated and the intermediate frequency waves or envelope modulated upon a new carrier wave C.

Fig. 3 shows symbolically apparatus similar to that in Fig. 2, but intended to be located at the local or regional distributing stations C, receiving, therefore, on the C wave frequency, transmitting on the D or subscriber's frequency.

Fig. 4 shows symbolically a subscriber's set adapted to receive on the D frequency, to demodulate the short carrier wave, and then to demodulate the intermediate frequency carrier wave, so as to produce audio waves as its output.

Fig. 5 is a circuit diagram of a subscriber's receiving set arranged for selection through double modulation.

Fig. 6 is a circuit diagram of a subscriber's receiving set with fixed selective circuits.

Fig. 7 is a view indicating the general outside appearance of a receiving set having the circuit of Fig. 6.

Fig. 8 is a view indicating the outside appearance of an amplifier and loud speaker unit for use with the set of Figs. 6 and 7.

Fig. 9 is a circuit diagram of a further simplified form of the subscriber's receiving set using two tubes only.

Fig. 10 is a further modification of a subscriber's set using separate sets of batteries for each of the two tubes.

Fig. 11 is a modification of the receiving set of Fig. 10 using the fourth or special, adjustable filter circuit for the second detector.

Figs. 12, 13, and 14 show the daily dispatch sheets for the master station, a B station, and a C station respectively.

Fig. 15 is a schematic diagram of a relay circuit for combined secrecy and public broadcast service.

Referring now to Figs. 1 to 4 inclusive, and turning to Fig. 1, I have shown therein an arrangement of originating broadcast transmitters which may be at the head or master station A, or at any other originating station whose program is to be made available to the subscribers for the time being. The operation is by double modulation, first modulating as by means of a microphone upon a long or intermediate frequency wave, and then modulating the long wave upon a short radio carrier wave of a frequency permanently allotted to and to be received at the stations B. The same arrangement of apparatus will be found at each of the other central stations B and C. In order that this apparatus may also be employed for radio broadcasting of material brought into the stations over wired trunks, I show a jack J^{10} connected through an amplifier to switch contacts which may be connected through amplifier switch arms to the primary of the transmitter induction coil 302, the secondary of which is connected to the modulator of the generating and transmitting set. Thus a trunk line or even a subscriber's wire may be plugged on to the modulator through the amplifier by means of jack J^{10}. It is to be understood that the function of this transmitting set at any station A, B, or C is primarily to enable local matter to be put into the programs which would be by modulating one particular intermediate frequency or long wave allotted for that purpose. Similarly, each of the stations A, B and C will have its own intermediate frequency for such originating use, and these three or more intermediate frequencies, carrying the items originating at the A, B and C stations respectively, are normally modulated on the same short carrier wave at each station C and radiated therefrom to its subscribers. The subscribers may then select the items originating at stations A, B, or C, as desired by first detecting off the intermediate frequency waves, and then selecting the particular intermediate frequency desired. By multiplying the number of transmitting and receiving apparatuses at the several originating and relay stations, and by enabling each one of them to bring in material over wires and add it to the program, as indicated by jacks J^{10} and 303 in Figs. 1 and 2, it is obvious that a very flexible method of operation is rendered possible, by which each of the stations A, B and C can determine its own contribution to the final program which is radiated from station C, and can also substitute if desired items of its own or from other originating stations, for those in the regular allotment. This is possible by means of the jack arrangement 303—304, and the multiplication of relays before referred to. This particular feature of my method will be further described hereinafter.

The function of the apparatus of Fig. 2 is to take double modulated waves at the frequency allotted to the receiving station B, demodulate the short wave carrier so as to produce the original modulated intermediate frequency waves unchanged from their production in station A, which then without demodulation are passed through a tuned amplifier 305 to a modulator 306, by means of which they are modulated on a primary or short wave carrier of a frequency suitable for the next lower order of receiving stations, in this case C stations. The short waves thus modulated are then radiated.

By means of the jack 303, intermediate

frequency or long waves modulated may be taken off a trunk or off a jack 304 of another relay set and passed through the amplifier 305 to the modulator 306 and thence radiated as before. Also, by means of the jack 304 intermediate frequency or long waves modulated which have passed through the demodulator 307 and the amplifier 305 may be forthwith placed upon the wire trunk lines for transmission to other stations, or may be passed through the jack 303 of another relay set and thereby carried through the amplifier 305, the modulator 306 and finally radiated on another short carrier wave. These extensions should be available at each stage in the system, and I consider it original with me to provide means for effecting these combinations of super-audio frequency modulated waves transmitted either from wires to radio carrier or from radio carrier to wires and thence if desired back to radio carrier without change either in the intermediate frequency waves or in their modulations, and shall claim the same accordingly. This is one essential feature of my present method, which is believed to be original with me and will be claimed accordingly, i. e., that when an original modulation is once made, the wave train carrying that modulation is preserved unchanged throughout its entire course from point of origin to the listener's ears. As described herein, I accomplish this by means of double modulation, with super-audio modulated waves modulated upon the high frequency radio carrier.

Referring to Fig. 4, this shows typically a subscriber's apparatus for taking double modulated waves sent out from the stations of any of the preceding there figures, and demodulating the same so as to recover the original audio modulations and make them apparent. There are two units, one a demodulator of the short carrier wave, which produces the long intermediate frequency wave carrying the original audio modulations, and passes these to the second demodulator, which demodulates the intermediate waves and passes the audio waves to the telephone receiver shown at the right of the figure. This method is shown in detail in my copending application referred to above, where the circuit arrangement of such a double demodulator is illustrated in full.

The apparatus shown in Figs. 2 and 3, is intended to receive a double modulated carrier wave such as that radiated from the antenna in Fig. 1, demodulating the same and reimpose the long wave or intermediate frequency, with its modulations, upon another short wave carrier which in the apparatus of Fig. 2 is supposed to be the carrier wave of a frequency allocated to stations C, while in the apparatus of Fig. 3 this is supposed to be the carrier wave of a frequency allocated to the subscriber's stations D. Glancing at the four figures, 1, 2, 3, and 4, it will be observed that from the original modulation due to the transmitter 150 to the final demodulation by the intermediate wave demodulator in Fig. 4, the same intermediate long wave carrier, and the same audio modulations thereof, are maintained intact and unmodified, being merely passed along by relaying from station to station on short carrier waves, or on wires as equivalent of the carrier waves.

The apparatus in Fig. 2 and that in Fig. 3 is identical except for the tuning of the transmitted carrier wave. The description of one therefore will suffice for both.

A simple form of circuit arrangement for the subscriber's receiving set symbolized in Fig. 4, is that shown in Fig. 5. This comprises a receiving antenna 28 coupled to the input circuit of a detector tube 30 having its circuit tuned to the primary wave and a second detector tube 31 having its input circuit coupled through a filter coupler 33 to the output or plate circuit of the first detector 30, the filter coupler 33 being tuned to the desired intermediate frequency of which there are several, preferably four, carried by the primary wave. To afford the subscriber selection of one of several programs, the filter coupler 33 is arranged to be tuned to the different intermediate frequencies. In the interest of simplicity of control and uniformity of service, it is desirable to transmit and receive one standard primary frequency to which the input circuit of the first detector 30 may be set in tune, but where greater variety and flexibility are desired, the broadcasting may be done on several primary carrier waves of different wave lengths, each carrier being modulated with several intermediate frequency waves. Such a method of operation will be necessary where it is desired to afford subscribers access to the various programs in the different parts of the system. The district station B may have a plurality of relay sets, as already mentioned, and instead of all of these sets having their input circuits or wave collectors tuned to the same single radio carrier frequency, some of them may be tunable to other frequencies in order to pick up other programs, and in such case the cross connection between jacks 303 and 304 of the different sets enable items from the different programs to be transferred from one to the other. It is understood of course that filter couplers of any known and suitable form, which may be such as that disclosed in Fig. 5, are employed to select the desired intermediate frequency carriers which are to pass through. The second detector 31 of the subscriber's set has its output circuit coupled through an audio transformer 34 to the input circuit of an ampli-

fier tube 32 whose output circuit is coupled through a transformer 35 to a loud speaker 36. The usual "A" and "B" batteries are provided as indicated at A_1 and B_1, respectively, the "A" battery lead 25 being connected to the filament bus 43 through a filament switch h.

To enable the subscribers to receive on a standard, fixed wave length and at the same time have selection of three different programs, and without the necessity of tuning, the receiving set shown in Fig. 6 is provided, which in effect is a selective, fixed tuned receiving set. This consists of a first detector tube 468 having its input circuit 469 coupled through the coupling 470 to a receiving antenna 471, the input circuit 469 being tuned to the standard fixed wave length by suitable adjustment of its electrical constants as by adjustment of the condenser 472 which, while shown in the drawing as a variable condenser may be of any suitable form capable of being given a fixed adjustment, instead of the usual wide range variable condenser. The output circuit of the detector 468 is connected to a pair of intermediate frequency bus conductors 473—474 to which the primary side of any of a set of three filter couplers 475—476—477 may be connected through different spring contacts 478—479—480 of the program jacks 481—482—483, respectively. The different filter couplers 475—476—477 are tuned respectively to the three different intermediate frequencies. Separate second detector tubes, 484—485—486 are also provided, one for each frequency with their input circuits connected permanently and individually to the primary sides of the filter couplers 475—476, respectively. Thus there is a filter coupler, program jack and detector tube for each program. The individual branches 487—488—489 of the filament circuits of the different tubes are arranged to be connected with the filament battery supply bus 490 through the spring contacts 491—492—493 of their respective program jacks. The main or central springs of each program jack are connected in circuit between plates of the detector tubes and the plus, plate battery bus 494. The filament of the first detector tube 468 is controlled through a filament switch 495.

In outside appearance the set of Fig. 6 will be generally as indicated in Fig. 7, that is, with no dials or other variable tuning control devices, the only apparatus elements appearing on the face of the instrument being the usual antenna and ground binding post, the control button of the filament switch 495 and the three program jacks 481—482—483. In connection with this the telephone headset 496 and cord circuit therefor terminating in a plug 497, is used, the plug 497 being arranged for engagement with any one of the program jacks so that a subscriber desiring broadcast service need only push the starting or filament control button 495 and insert the plug 497 in the program jack corresponding to the program desired. Where a loud speaker service is wanted the loud speaker unit shown in Fig. 8 may be substituted for the headset 496. This unit consists, preferably of a cabinet 498 having an opening for a loud speaker horn 499 and housing a loud speaker unit and amplifying devices not shown but which may be of any known or other suitable form arranged with the terminals and its input circuit connected with the cord and plug connection 500 for coupling to the receiver set in Fig. 7 through any of the program jacks.

To further simplify the subscriber's receiving set, it may be arranged as shown in Fig. 9 where only one second detector tube is used for the several different programs instead of one for each program as shown in Fig. 6. In this arrangement one jack is used and the selection of program is effected through the use of program keys, one for each program. Referring to the circuit arrangement of Fig. 9 in detail, it comprises a first detector 501 having its input circuit 502 adjusted to the standard primary frequency and its output or plate circuit connected to the intermediate frequency bus conductors 503—504 which are arranged to be connected with the primary side of any one of the filter couplers 505—506—507 through the contact 508—509 or 510 of the corresponding program key 511, 512, or 513. The second detector tube 514 has its input, or filament-grid circuit connected to the filament grid bus conductors 515—516 to which the primary sides of the filter couplers are arranged to be connected through the contacts 517, 518 and 519 of the respective program busses. The common filament circuit of the first and second detectors is also jointly controlled by the several program keys through the extreme left hand contact of each which operates upon closure of the key to connect the common filament wire or bus 520 to the minus "A" battery bus 521. The plate lead 522 of the second detector 514 connects through the common jack 515 to the plus "B" battery bus 523. As the filter couplers 505, 506 and 507 are tuned to the three different intermediate frequencies carrying as many different programs, the user of the set desiring any one program, need only insert the plug of his telephone receiver or loud speaker in the jack 515 and actuate one of the program keys 511, 512 or 513 corresponding to the program desired.

In Fig. 10 the circuit arrangement is the

same as that of Fig. 9 except that each of the detector tubes is provided with a separate, individual set of "A" and "B" batteries. The batteries A^{10} and B^{10} are connected in the filament and plate circuits of the second detector 524 exclusively, while the batteries A^{11}—B^{11} are connected in the filament and plate circuits of the first detector tube 525 exclusively. It will be noted that to effect the separations of battery supply the only additional wiring and apparatus connections required are the common control wires 526 and the extra contacts, one pair in each of the program keys, operable upon actuation of the key to bridge the wires 526 and close the circuit of the filament of the detector tube 525 through its individual filament battery A^{11}.

In Fig. 11 is shown a modification of the receiving set of Fig. 10 which is the same as that of Fig. 10 except that the fourth filter coupler 527 and program key 528 is provided for the reception of any one of a group of special programs transmitted on a group of special intermediate frequency waves, the filter coupler 527 differing from the three preceding couplers in that it is arranged to be variably tuned to any one of the different special wave lengths by the listener, which tuning may be effected in any known or suitable manner as by adjustment of the variable condenser shown. Thus for reception of one of the standard programs the subscriber has simply to actuate the program key corresponding to that program and to receive a special program the key 528 is actuated to connect the special filter coupler 527 in circuit after which it is tuned to the desired program. This provides means in the system enabling a subscriber to make request for a special program to be put on one of the special intermediate frequencies, so that special programs may be had by certain subscribers without interfering with the regular programs. These special programs would most usually be programs originating at distant stations and not of general public interest, and for such service the requesting subscriber will be charged a fee commensurate with the value of the service given.

To supply the subscribers with special programs picked up from other stations on a single modulated wave, the relay system of Fig. 15 is provided which consists, as shown, of a detector 529 arranged with its input circuit 530 coupled to a short wave receiving antenna 531 and tuned to receive matter broadcasted on a single modulated wave. The output circuit of the detector 529 is connected to the input end of an audio amplifier the amplified audio output of which is connected through an audio modulator 533 to an intermediate or long wave oscillator 534 to modulate the audio current onto the long waves produced thereby. The output end of the oscillator 534 is connected through a long wave modulator 535 to the short wave oscillator, transmitter 536, to modulate onto the short waves produced by the oscillator 536 the long waves of the oscillator 534 which are in turn modulated with the audio waves. The oscillator transmitter 536 will therefore retransmit, on a double modulated wave, matter picked up by the detector 529. By throwing the switch 537 to the left a multiple connection is made from the output circuit of the audio amplifier 532 to the audio modulator 538, the output circuit of which is connected to the short wave oscillator 536 for direct modulation of the output thereof with the audio waves. This results in the primary wave transmitted from the antenna 539 of the oscillator 536 being modulated in both the audio modulations and the superaudio or long wave modulations which in turn are modulated with the same audio modulations, so that any one with an ordinary receiver capable of receiving on the usual single modulated wave may receive the matter being thus broadcasted as well as the authorized subscribers. Thus, a program or portions of the program may be donated to the public when so desired. Switch 537^a may control the connection of the long wave modulator, in a manner similar to that of 537, so that either singly or doubly modulated waves can be transmitted at will. It should be noted that by proper adjustment a double demodulating receiver can receive single modulation, which makes the system elastic.

What I claim is:

1. A broadcasting system comprising a primary station, a plurality of intermediate relay distributing stations, and a pluralty of local receiving stations related to each relay station and all in permanent tune therewith, means at the primary station for imposing signal modulations on a wave of fixed intermediate frequency, means also at said stations for imposing said modulated intermediate frequency wave as a modulation upon a high frequency radio carrier wave of fixed frequency permanently alloted to the succeeding relay station or stations, means at said relay station to receive said double modulated waves from the primary station, means to detect off the intermediate frequency waves and to relay and redistribute the same in its own area by double modulation on a primary wave of the standard wave length to which its receiving stations are tuned, means at the local receiving stations for selecting said programs by first demodulating the high frequency carrier wave received, in order to strip off the intermediate frequency wave or waves and thereafter selectively detecting the signals modulated on an intermediate frequency wave, the said

intermediate frequency with its signal modulations being maintained the same from its original modulation at the primary station through the relay station or stations, to and through the subscriber's selectors.

2. The method of radio broadcast distribution which consists in modulating signals on a wave of predetermined and fixed intermediate frequency, then modulating said modulated wave on a radio carrier wave, also of a predetermined and fixed frequency, relaying the signal modulations by receiving and demodulating the primary carrier wave and reimposing the same modulated intermediate wave without demodulation on a second radio carrier wave of a fixed and predetermined frequency allotted to the respective relay stations and different from the received frequency, and finally receiving and demodulating said second carrier wave and thereafter demodulating said intermediate frequency wave to obtain the signals, said intermediate frequency remaining unchanged from its first modulation at the primary sending station to its final reception and demodulation by the subscriber or ultimate receiver.

3. The method of radio broadcast distribution which consists in initially modulating signals upon a carrier wave of predetermined and fixed intermediate frequency, then modulating said modulated carrier wave upon a high frequency radio carrier, and thereafter transmitting said modulated intermediate frequency wave unchanged through one or more relay stations to an ultimate receiver by removing it at each relay station from the radio carrier wave upon which it is received and remodulating it upon a radio carrier wave of different frequency, and receiving the latter and demodulating it at an ultimate receiving station so as to preserve the original characteristics unchanged of both the intermediate frequency carrier and the signal modulated thereupon.

In testimony whereof I hereunto affix my signature.

EDWARD E. CLEMENT.