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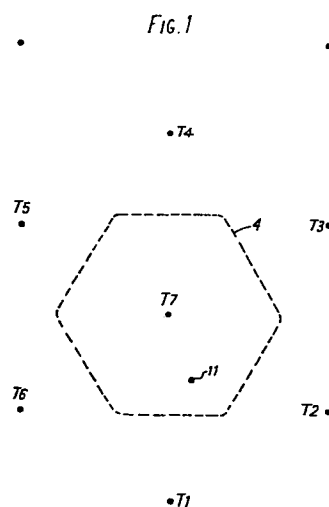
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54 **A message broadcasting and/or receiving system.**

57 In a message broadcast and receiving system, a receiver 11 allows the reception of a message from a master transmitter T7 if, prior to the message, an unmodulated carrier burst, from the master transmitter T7, is received before an unmodulated carrier burst, of a different frequency, from any of a ring of slave transmitters R1 to T6. This defines an area of reception 4 around the master transmitter. The method is applicable to FM broadcasts as well as AM. One carrier burst can be $f_0 + 100$ kHz and the other $f_0 - 100$ kHz where the message is broadcast on a carrier f_0 with frequency deviation of ± 50 kHz.



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A MESSAGE BROADCASTING AND/OR RECEIVING SYSTEM

The present invention relates to a selective message-broadcasting system.

5 Selective message broadcasting systems are used to broadcast interrupting messages, e.g. traffic information messages, to specific geographical areas, whereby listeners hear only those messages relevant to the area within which they are situated.

10 In this specification, the invention is described largely in relation to a motoring service but the invention would be applicable to other services, such as selective paging systems or aircraft or other speech or data communications, where it is desirable to direct messages to particular areas.

Known selective message-broadcasting systems can either be frequency-division multiplex systems (FMD), in which a number of messages are broadcast each having a different carrier frequency, or time division multiplex systems (TDM), in which the messages have a common carrier frequency and are broadcast one at a time.

20 We have already proposed (in an as yet unpublished British Patent Application No 49919/76) to compare the levels of signals coming from a master station in the area of desired reception and from one or more inhibiting or slave stations outside the area. If the ratio of the master level to the or each slave level is high enough, the receiver will respond to the message: if the ratio is not high enough, the receiver will not respond. A disadvantage of this system is that any obstructions or differences in the propagation paths, which cause one signal to be attenuated more than the others, will cause variations in the relative signal levels, resulting in a displacement of the expected service boundary. Although the displacement is negligible when operating in the low to medium frequency range, this is not the case when using very high frequencies where propagation effects will cause large and random variations in the levels of the received signals.

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The need to use a system which operates at very high frequencies may occur if an acceptable channel in or near the medium frequency broadcast band is not available or if sky-wave interference at night, possibly from other transmissions, results in incorrect operation of the broadcasting system.

The object of the present invention is to provide a system which is suitable for use, inter alia, at very high frequencies.

According to the present invention there is provided a message broadcasting and receiving system comprising a network of transmitters, control means arranged to select a master transmitter or transmitters to transmit a message signal and to cause the or each selected transmitter to preface its message signal with a master code signal, and to cause one or more other transmitters of the network to radiate a slave code signal which is distinct from the master code signal, and a fixed or mobile receiver including a detecting circuit which detects whether the master code signal is received before or after an instant determined by the reception of a slave code signal and allows the reception of the message signal, if, and only if, the master code signal is received before the said instant.

According to the present invention there is also provided a message-broadcasting system comprising a network of transmitters which, in operation, transmit messages in time division multiplex, a control means arranged to select a master transmitter or transmitters to transmit a message signal and to cause the or each selected transmitter to preface its message with a master code signal and to cause one or more other transmitters of the network to radiate a slave code signal, wherein the master code signal and slave code signal are carrier signals displaced by different amounts from the carrier frequency of the message signal.

The receiver is able to determine whether or not it is in the master service area by recognising whether or not the code signal which it receives first originated from the or a master transmitter or from the or a slave transmitter. If the master code signal, originating from the nearest master transmitter, is the first signal to be received, the receiver is inside or on the boundary of the master service area and will be demuted, i.e. it will respond to the message following the master signal; if the

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slave code signal, originating from the nearest slave transmitter, is the first signal to be received, the receiver is outside the master service area and will remain muted, i.e. it will not respond to the message following the master signal. Subsequent arrivals from more distant transmitters during the period in which the code signals are evaluated will have no further effect on the receiver. Such receivers may be fitted in vehicles or may be at fixed locations such as in the homes or elsewhere.

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10 The present invention further provides a message broadcast receiver comprising a detecting circuit arranged to detect whether

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a first signal, having a given frequency, is received before an instant determined by the reception of a second signal, having a frequency different to that of the first signal, and allows the reception of a message signal if, and only if, the first signal
 5 is received before the said instant.

After the message signal has been received the receiver is muted, i.e. it is prevented from receiving further messages. This may be accomplished by using the master transmitter to transmit a signal at the frequency of the slave signals, after the message
 10 signal.

The invention will be described in more detail, by way of example, with reference to the accompanying drawings, wherein:-

Figure 1 illustrates a network of transmitters indicating a master service area of a particular master transmitter when
 15 surrounded by six equally spaced slaves,

Figure 2 is a diagram showing one possible format of the transmitted signals,

Figure 3 is a block diagram of a receiver-decoder,

Figure 4 is a block diagram of a master controller and one
 20 of the transmitters, and

Figure 5 is a circuit diagram of a basic decoder showing voltage and timing comparator circuits.

Referring to Figure 1, a network of transmitters T1, T2 etc., are arranged on an idealized equilateral triangular lattice. A
 25 practical transmitter to transmitter spacing may be 50km, although the lattice will be distorted to allow for the geographical attributes of + region served by the network.

In this particular embodiment T7 is selected as a master transmitter and T1 to T6 are selected as slave transmitters,
 30 defining a master service area 4. The master transmitter T7 transmits a master signal, one possible format of which is shown in Fig. 2a, consisting of an initial burst of an unmodulated carrier 6 at a frequency f_0 -100 kHz. The message signal 8, following the initial burst, uses a carrier frequency f_0 which is frequency
 35 modulated by ± 50 kHz. The slave transmitters T1 to T6 (Fig. 1) transmit a slave signal, one possible format of which is shown in

Figure 2b, consisting of an initial burst of an unmodulated carrier 10 at a different frequency, i.e. $f_0 + 100$ kHz, to that of the initial burst of the master signal 6.

5 The duration of the master and slave transmission bursts 6 and 10 is made longer than the time taken for a signal to travel between the master transmitter T7 and the slave transmitters T1 to T6, e.g., a transmission burst of 2ms for a master/slave transmitter separation of 60 km. This prevents erroneous operation of the receiver.

Referring now to Figure 3 a receiver 11 includes an aerial 12 and V.H.F. crystal controlled RF stages 14 which receive the transmitted signals 6, 8 and 10. The output from the RF stages 14 is applied to an FM discriminator 16. The discriminator 16 is so designed that, on receiving the master transmission burst 6 (Figure 2a), at a frequency of $f_0 - 100$ kHz, it will produce a positive
15 d.c. voltage shift of say 1 volt whereas, on receiving the slave transmission burst 10 (Figure 2b), at a frequency of $f_0 + 100$ kHz, it will produce a negative d.c. voltage shift of similar amplitude. The presence of the message signal 8 at the input to the discriminator 16 will not cause the discriminator output to vary by more than
20 say ± 0.5 volts.

The output of the FM discriminator 16 divides along two separate paths 30 and 36. The path 36 forms the input to a voltage comparator 18 which recognises the ± 1 volt shifts of the FM discriminator 16 but ignores the ± 0.5 volt variations caused by
25 the message signal 8. Referring now to Figure 5 the voltage comparator 18 receives an input from the discriminator 16. The input is applied to one terminal of two comparator amplifiers 38 and 40. The other terminal of each comparator amplifier 38 and 40 is connected to a potentiometer 42 and 44 respectively.
30 Transistor amplifiers 46 and 48 are connected to the respective outputs of the comparator amplifiers 38 and 40.

The potentiometer 42 is so adjusted that the master code signal $f_0 - 100$ kHz produces a logic 1 level on the output 50 of the transistor amplifier 46. The potentiometer 44 is so adjusted that
35 the slave code signal $f_0 + 100$ kHz produces a logic 1 level on the output 52 of the transistor amplifier 48.

The output 50 is connected through cascaded inverters 54 and 58 to the D input of a D-type flip-flop 62 in a timing comparator 20. The outputs 50 and 52 are connected to a NOR gate 56 whose output is connected through an inverter 60 to the clock terminal CK of the flip-flop.

When a logic 1 level appears first on the master output 50, the D input gives true early enough for the flip-flop to set on the rising edge on CK provided by gate 56 and inverter 60. If the slave output 52 goes true first, CK is strobed while the D input is still false and the flip-flop remains un-set.

The Q output of the flip-flop is applied to an audio switch 22 (Fig. 3) and, when the flip-flop is set, the switch completes the audio path 30 between the discriminator 16 and AF stages 24 connected to a loudspeaker 32. The receiver is thus demuted. The switch 22 can simultaneously mute an alternative audio source normally feeding the speaker 32.

In an experimental system it was found that the flip-flop 62 set provided that the master code signal was received about 5 μ s before the slave code signal.

After the message signal 8 (Fig. 2) has been received, the receiver 11 is muted, i.e. the audio switch 22 is turned off. To do this the flip-flop 62 is reset, by broadcasting a transmission burst 13 (Fig. 2), from the master transmitter T7, at the frequency of $f_0 + 100$ kHz after the message signal 8, i.e. the frequency normally considered to be that of the slave transmitters T1 to T6. The flip-flop is therefore clocked with the D-input false.

Thus the slave transmitters T1 to T6 provide a simple means for defining the service area 4 of the master transmitter T6. In addition, the shape of each service area 4 may be varied by delaying the switch-on of the master or slave transmission bursts 6 and 10. By delaying the switch-on of master transmission burst 6, the boundary will be moved towards the master transmitter, i.e. the master service area will be reduced. By delaying the switch-on of a slave transmission burst 10, the boundary will be moved towards the slave transmission in question, thus increasing the master service area. The system has the further advantage that,

should a particular transmitter fail, the service areas of the transmitter surrounding it automatically expand and thus tend to take its place. Furthermore, since the system relies on the fact that the receiver 11 makes its decision on the first signal to arrive at its input and ignores subsequent arrivals, multipath reception at the receiver is unlikely to cause difficulties.

This invention does not preclude the use of additional codes by which receivers may distinguish between various types of message. Additional coded signals may be transmitted either immediately before or immediately after the start code or could form the start code signal that could indicate, for example, particular classes of recipient for whom the message that follows is intended, and/or whether the message is a repeat of one that has previously been broadcast, or other features of the message. Such additional signals would enable receivers to disregard irrelevant messages.

In the present state of the art, it is a relatively straightforward matter to control the code transmissions of the various transmitters. The transmitter network could be controlled by a single master controller or by several interconnected controllers. However, an example will be given for operating the network of Figure 1 which uses a single master controller. A master controller 64 (Fig. 4) is able to communicate with all the transmitters in the network by means of land lines, or the equivalent, but is here shown linked to only one of the transmitters. The master controller distributes the messages which the different transmitters are to broadcast, in conjunction with a prefixed digital address code which selects the transmitter which is to broadcast the message. The address code is followed by a master transmission burst 6 (Fig. 2), then the message signal 8 (Fig. 2) itself and finally the second transmission burst 12 (Fig. 2). The controller 64 may be simply a preset device which emits the digital codes and messages to a predetermined time schedule or it may utilize a computer to determine the scheduling of transmitters in accordance with requirements.

Each transmitter (Fig. 4) includes a control demodulator 66 which demodulates the digital codes in a manner well known in data communication. The digital codes are fed to a control decoder 68

which recognises, from the address code, whether its transmitter is to radiate the master transmission burst 6 and the message 8, or the slave transmission burst 10, or to remain quiescent.

Assuming that frequency modulation is used for the message 8,
5 the transmitter comprises a drive stage 70 feeding RF output stages 72 and an aerial 74 through an FM message modulator 76, an oscillator 77 providing the carrier frequency f_0 to the drive circuits 70.

A 100 kHz oscillator 88 and a mixer 85 modulate f_0 with 100 kHz to provide sidebands $f_0 \pm 100$ kHz which are separately filtered out
10 by lower and upper sideband band-pass filters 84 and 86.

The control decoder 68 is used to control various switches as follows, as commanded by demodulated control signals. If the transmitter is to transmit, switch 78 is closed. If the transmitter is selected as master transmitter, a switch 80 is then closed for
15 2 ms to radiate the master code signal $f_0 - 100$ kHz. A switch 82 is then closed to enable the message sent over the land line to be applied to the modulator 76. At the conclusion of the message, a switch 83 is closed for 2 ms to radiate the slave code signal $f_0 + 100$ kHz, which re-mutes the receivers which were de-muted by
20 the master code signal.

If the transmitter is selected as a slave, only the switch 83 is closed for 2 ms to radiate the slave code signal.

The correct relative timings can be established by the times at which commands are sent to the different transmitters or the decoder
25 68 can incorporate say monostable circuits to establish such relative delays as may be required.

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CLAIMS

1. A message broadcasting and receiving system comprising a network of transmitters, control means arranged to select a master transmitter or transmitters to transmit a message signal and to cause the or each selected transmitter to preface its message signal with a master code signal, and to cause one or more other transmitters of the network to radiate a slave code signal which is distinct from the master code signal, and a fixed or mobile receiver including a detecting circuit which detects whether the master code signal is received before or after an instant determined by the reception of a slave code signal and allows the reception of the message signal if, and only if, the master code signal is received before the said instant.

2. A message broadcasting system comprising a network of transmitters which, in operation, transmit messages in time division multiplex, a control means arranged to select a master transmitter or transmitters to transmit a message signal and to cause the or each selected transmitter to preface its message with a master code signal and to cause one or more other transmitters of the network to radiate a slave code signal, wherein the master code signal and slave code signal are carrier signals displaced by different amounts from the carrier frequency of the message signal.

3. A system according to claim 2, wherein the said different amounts are positive and negative displacements of the same magnitude.

4. A system according to claim 2 or 3, wherein the code signals start from their respective transmitters at different times.

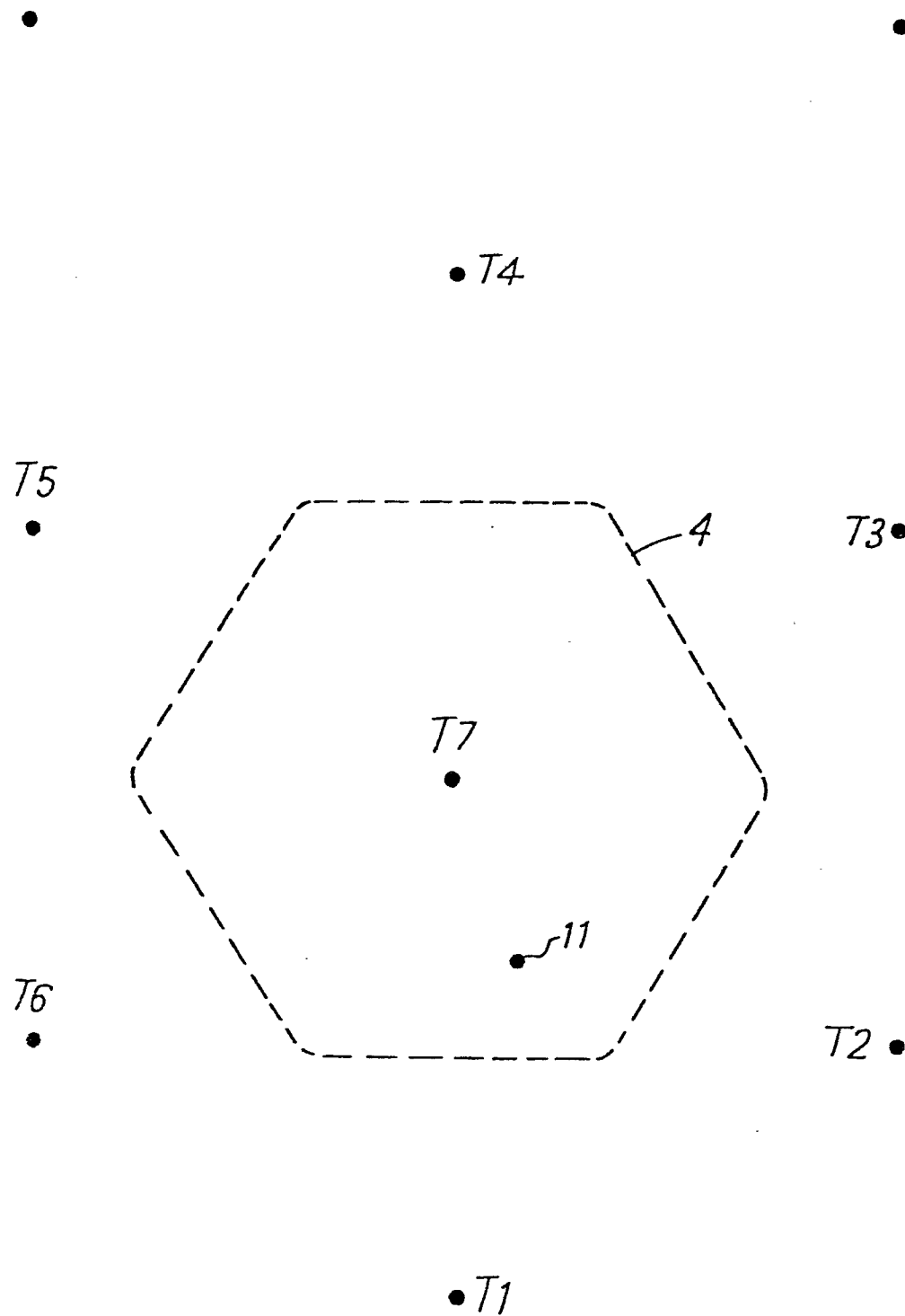
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5. A message broadcast receiver comprising a detecting circuit arranged to detect whether a first signal, having a given frequency, is received before an instant determined by the reception of a second signal, having a frequency different to that of the first signal, and allows the reception of a message signal if, and only if, the first signal is received before the said instant.

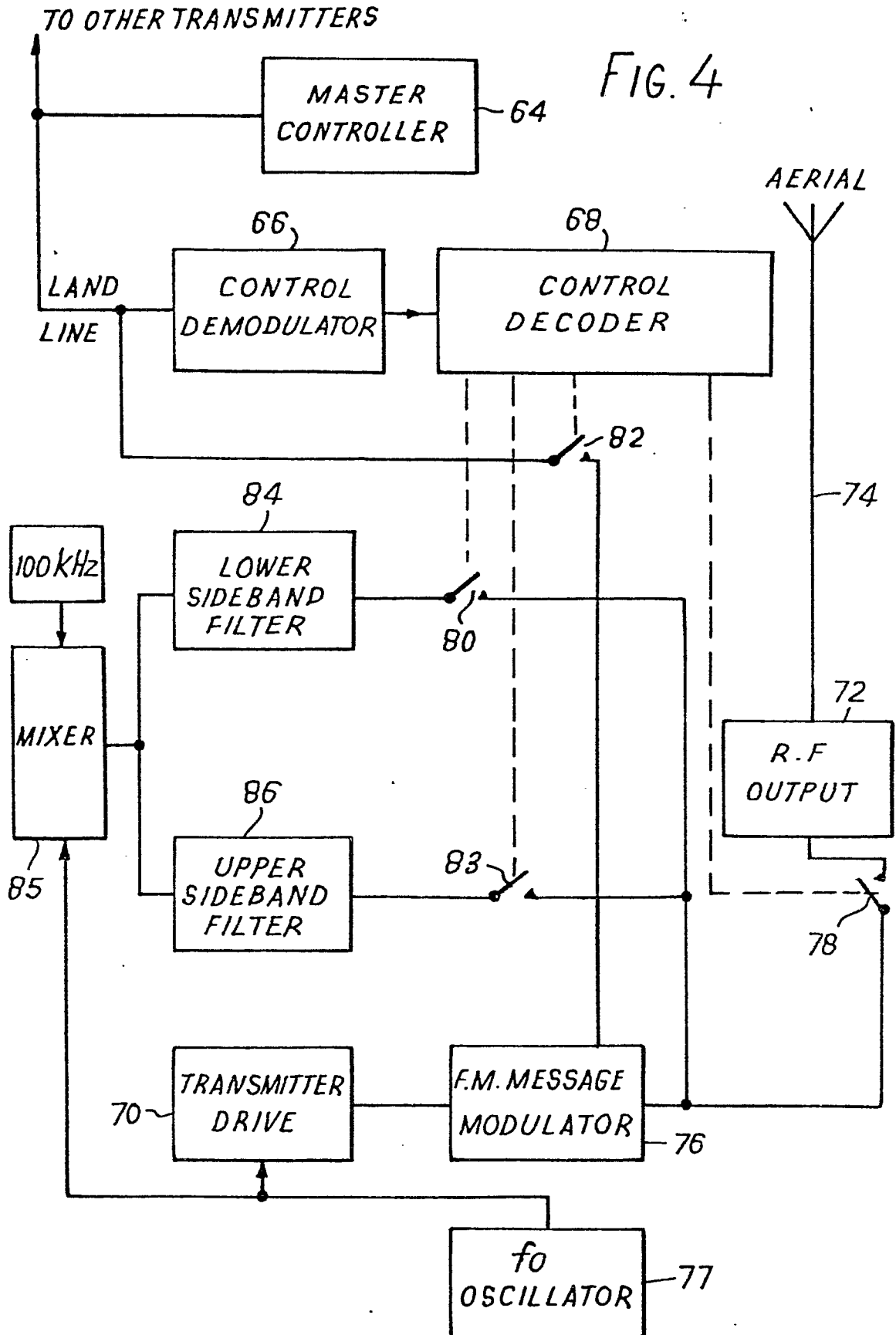
6. A message broadcast receiver according to claim 5, for use with signals such that the message signal is a frequency modulated carrier with frequency deviations restricted to a predetermined range, one of the first and second signals is a carrier signal at a frequency above the said range and the other of the first and second signals is a carrier signal at a frequency below the said range, wherein the detecting circuit comprises an f.m. discriminator which produces first and second voltage levels in response to the first and second signals respectively, and a timing comparator which determines, from the appearance of the first and second voltage levels, whether the first signal is received before or after the said instant.

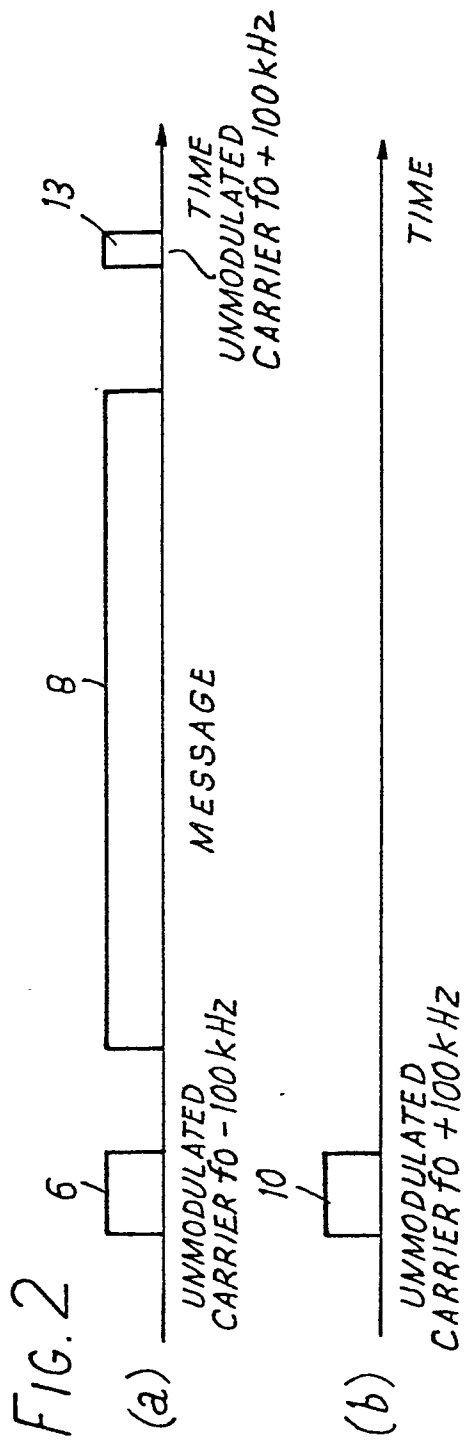
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FIG. 1

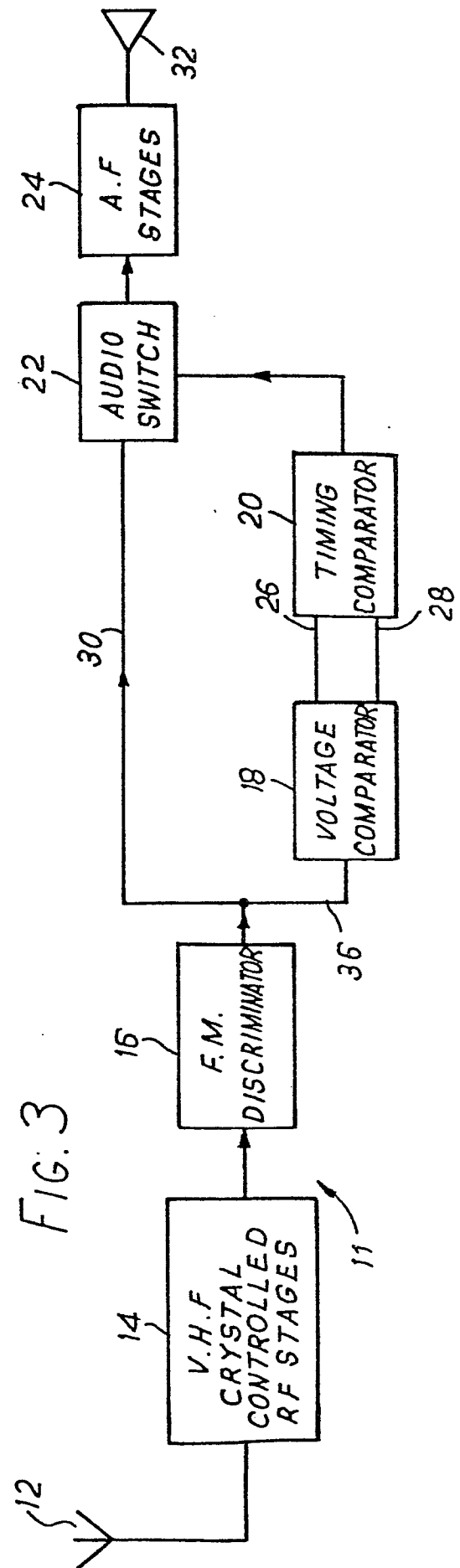


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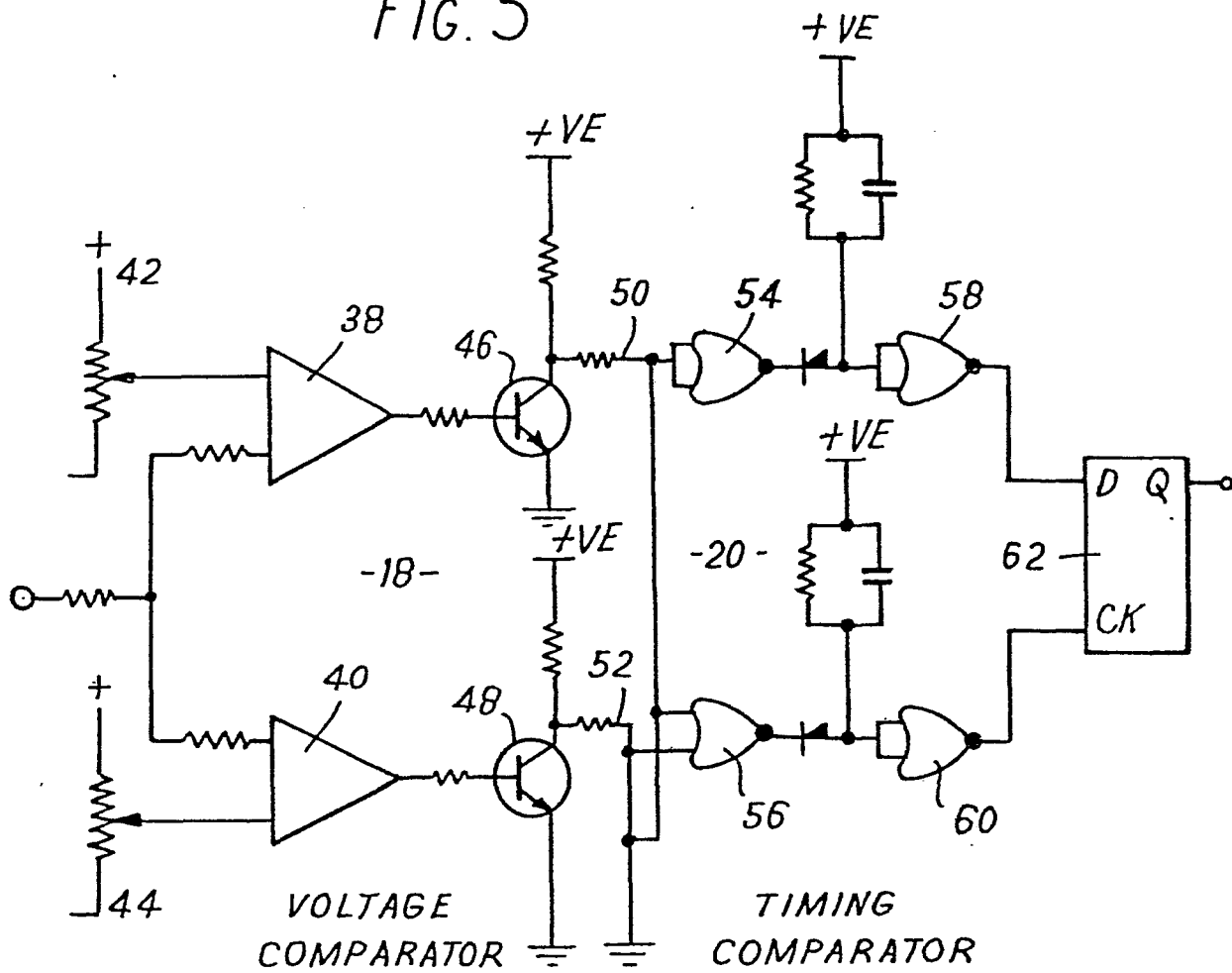


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FIG. 5





European Patent
Office

EUROPEAN SEARCH REPORT

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EP 81300264.9

DOCUMENTS CONSIDERED TO BE RELEVANT			CLASSIFICATION OF THE APPLICATION (Int. Cl. 7)
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	
P	WIRELESS WORLD, Vol 84, January 1978, London, Dorset House S.M. EDWARDSON "Traffic information broadcasting", pages 28-32 + Page 29, left column, line 52 - right column, last line + --	1,2	H 04 H 1/00 G 01 S 5/10 H 04 B 7/26
	DR. INGO WILMANNS "RADAR UND FUNKNAVIGATION", 1973, Vogel-Verlag, Würzburg, pages 105-114 + Totality + --	1,2,4,5	TECHNICAL FIELDS SEARCHED (Int. Cl. 7)
	FUNKSCHAU, Heft 14, Juli 1980, Franzis Verlag, München ING. PETER ADVIAN "TI-9 900 - ein Loran-C-Navigationsautomat", pages 50-53 + Totality + --	1,2,4,5	H 04 H 1/00 H 04 H 3/00 H 04 B 5/00 H 04 B 7/00 G 01 S 1/00 G 01 S 5/00 G 01 S 11/00 H 04 Q 7/00
	DE - B1 - 2 801 142 (WEISSER) + Claims 1,2; column 2, lines 21-29 + & GB-A-2 013 062 --	1	CATEGORY OF CITED DOCUMENTS
	DE - B - 1 183 556 (NIHON MUSEN KABUSHIKI KAISHA) + Fig. 1-3; claims 1,2 + ----	1,5	X: particularly relevant A: technological background O: non-written disclosure P: intermediate document T: theory or principle underlying the invention E: conflicting application D: document cited in the application L: citation for other reasons
X	The present search report has been drawn up for all claims		&: member of the same patent family, corresponding document
Place of search VIENNA		Date of completion of the search 23-04-1981	Examiner DRÖSCHER