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(56) Documents cited **GB 1520196 GB 1213630 GB 900776 EP 0002595 A**
(58) Field of search **G1G G4N H4D**
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(54) Electronic alarm device

(57) Apparatus, such as a theft alarm, comprises an electronic system for providing a warning signal when a transmitter unit 10 and a receiver unit 14 are moved more than a predetermined distance apart. The transmitter 10 emits r.f. pulses of a particular duration and interval which are received by the receiver 14 which will emit a warning tone through a buzzer 28 if the amplitude, duration or interval of the pulses fall below predetermined levels. Ultrasonic, magnetic or light signals may be utilised.

Fig. 1.

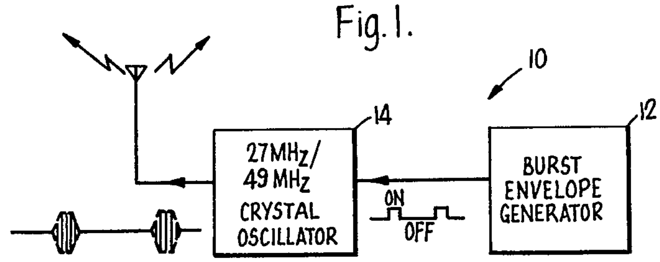
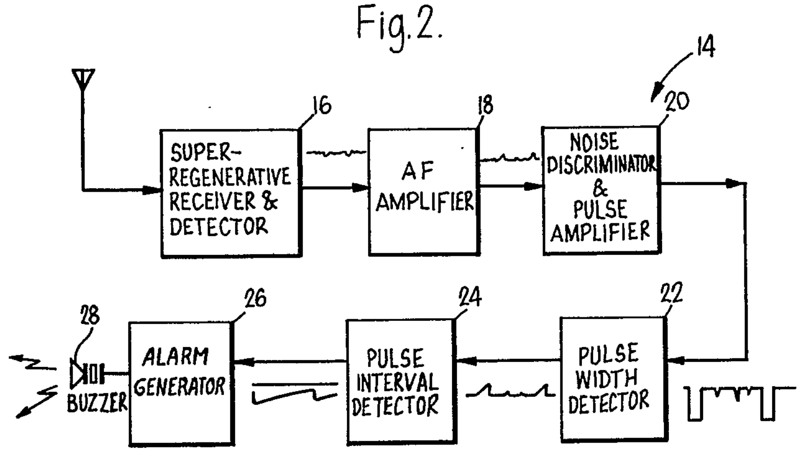


Fig. 2.



The drawings originally filed were informal and the print here reproduced is taken from a later filed formal copy.

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Fig. 1.

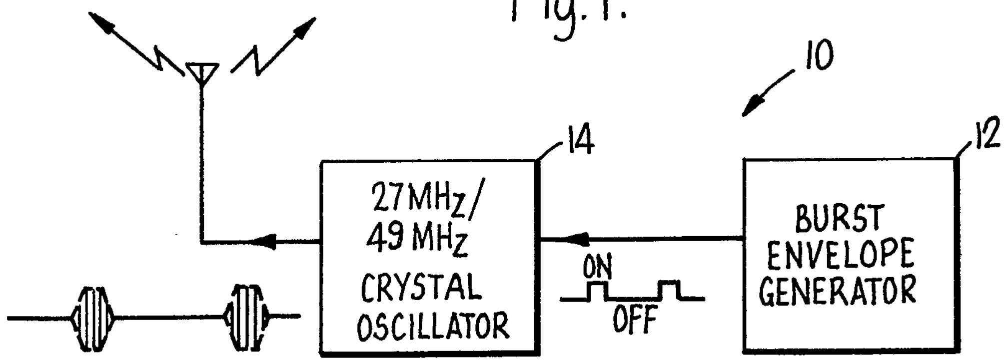

10
14
12
27MHz/
49 MHz
CRYSTAL
OSCILLATOR
ON
OFF
BURST
ENVELOPE
GENERATOR

Fig. 2.

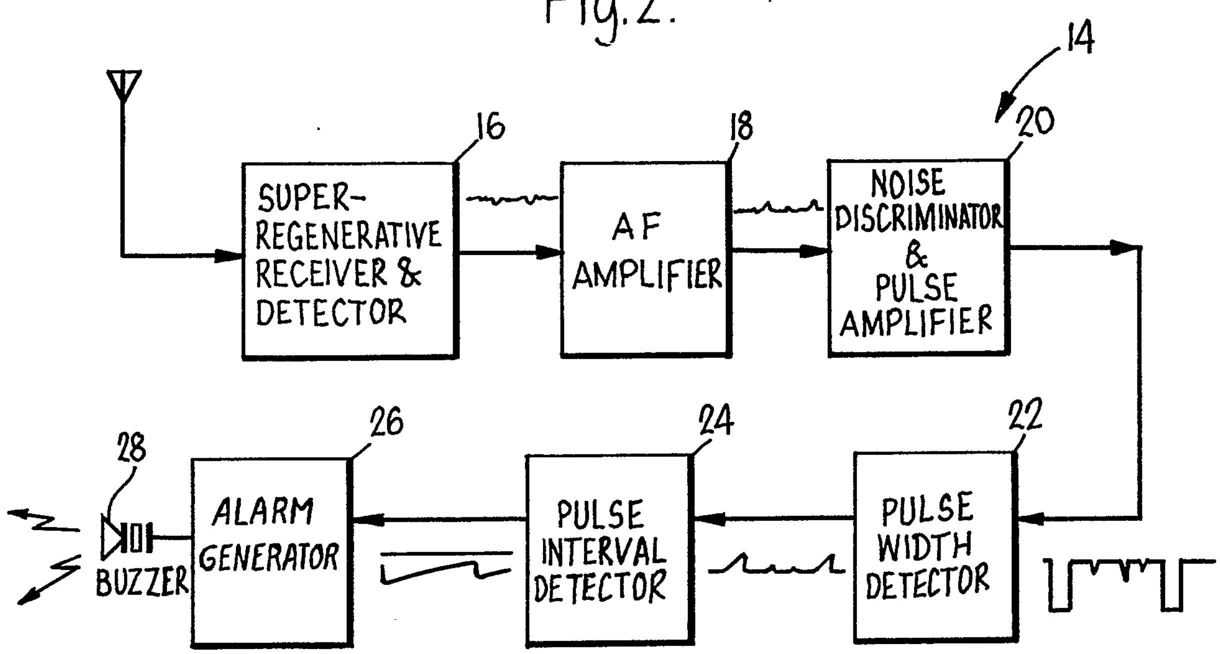

14
16
18
20
SUPER-
REGENERATIVE
RECEIVER &
DETECTOR
AF
AMPLIFIER
NOISE
DISCRIMINATOR
&
PULSE
AMPLIFIER
28
26
24
22
BUZZER
ALARM
GENERATOR
PULSE
INTERVAL
DETECTOR
PULSE
WIDTH
DETECTOR

Fig. 3.

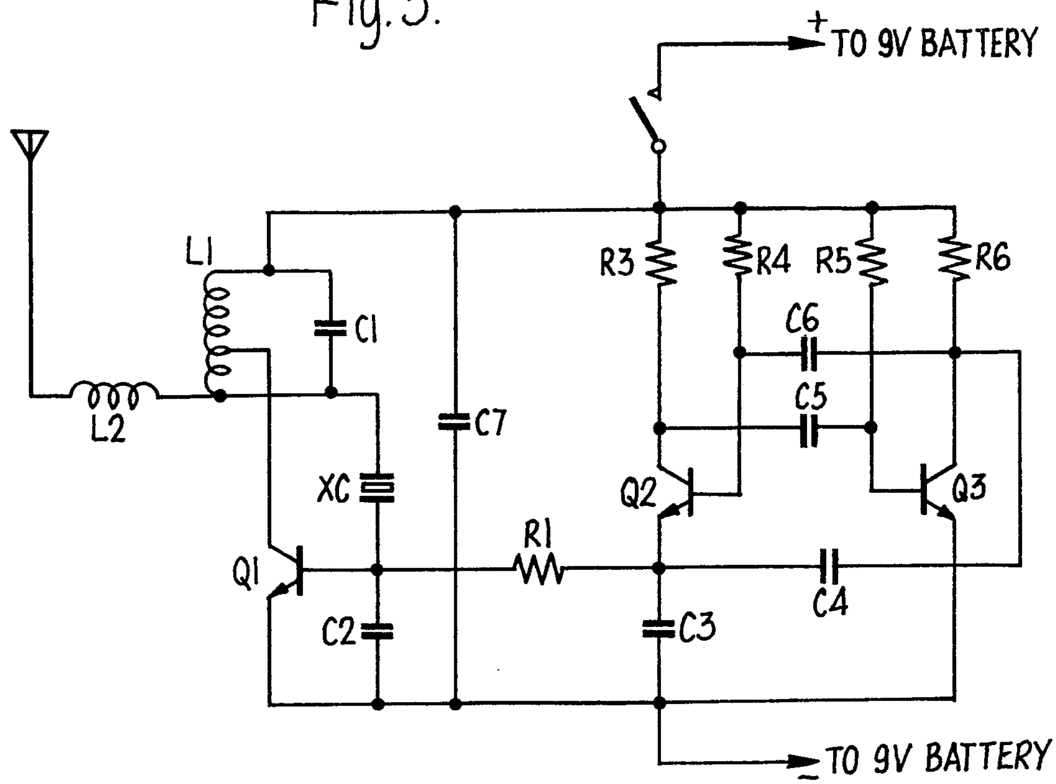
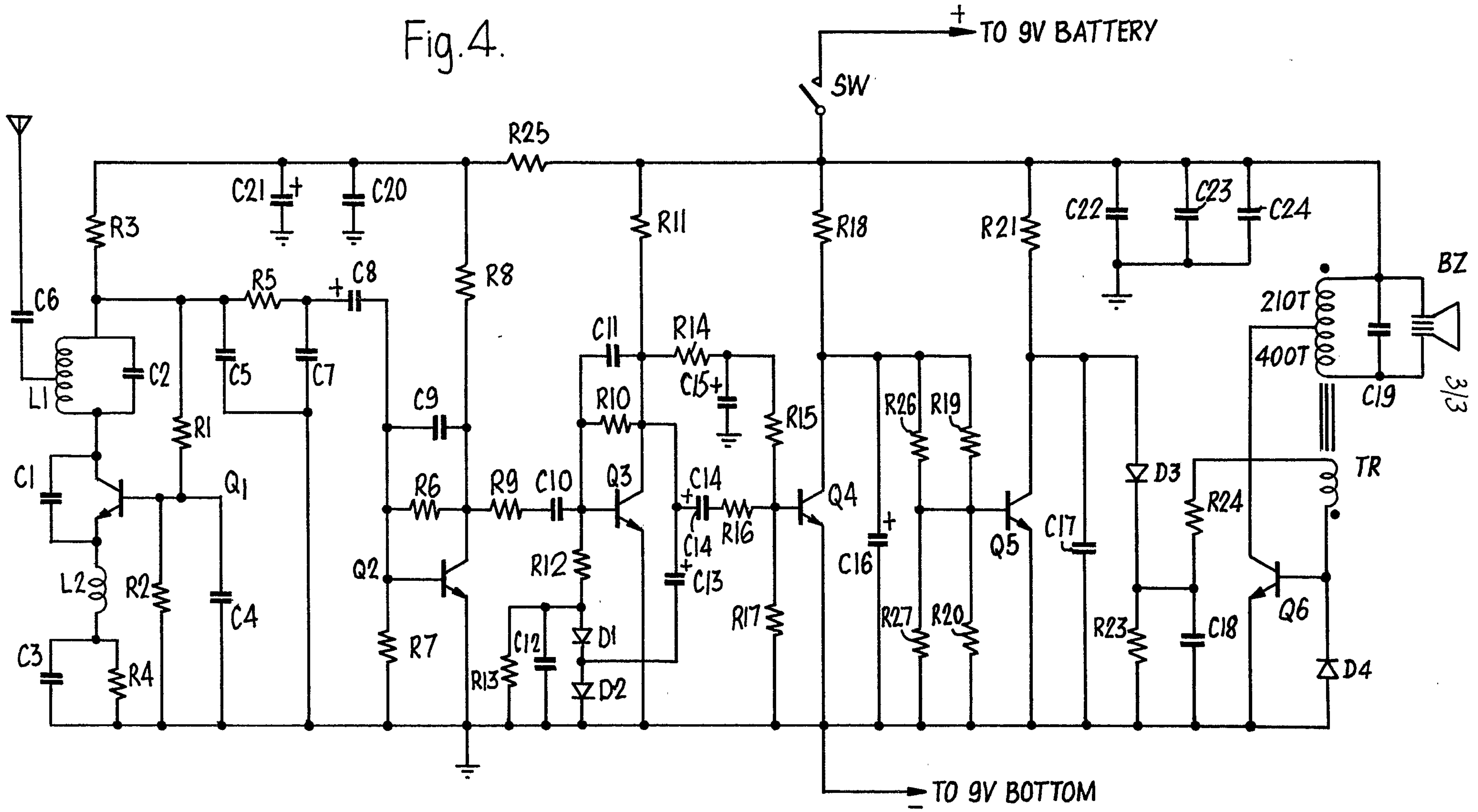

+ TO 9V BATTERY
L1
C1
L2
C7
R3
R4
R5
R6
C6
C5
Q2
Q3
XC
R1
Q1
C4
C2
C3
– TO 9V BATTERY

Fig.4.



+ TO 9V BATTERY
SW
R25
C21
C20
R3
R11
R18
R21
C22
C23
C24
BZ
3/3
C6
R5
C8
R8
210T
400T
C19
L1
C2
C5
C7
C11
R14
C15
C9
R10
R15
R26
R19
R1
C1
Q1
R6
R9
C10
Q3
C14
R16
Q4
Q5
D3
R24
TR
C17
C16
Q2
L2
R2
C4
R12
C13
R17
R27
R20
R23
C18
Q6
C3
R4
R7
C12
D1
R13
D2
D4
TO 9V BOTTOM

SPECIFICATION

Electronic device

This invention relates to electronic devices and in particular to transmitter and receiver systems.

According to the present invention there is provided an electronic system comprising a signal transmitter and a signal receiver, the receiver being arranged to generate an audible or visual alarm when the distance between the transmitter and receiver is greater than a predetermined distance.

A system in accordance with the present invention can be applied to any situation in which the user would like to know when he becomes separated from his property by more than a certain distance. Examples are as follows. (1) The user may have responsibility for a baby, for instance a baby located in a perambulator. By placing the transmitter in the perambulator and carrying the receiver on his person, the user would receive an alarm indication if the perambulator user distance exceeds the set limit. Alternatively the transmitter could be attached to the baby, in which case the user would also be "informed" if the baby is taken from the pram.

(2) By placing the transmitter on or in a particular piece of property, the user may be informed if that piece of property is stolen.

(3) If the user wishes to ensure that he does not have a particular piece of property behind when, for instance, he leaves his house to go to his place of work, he can position the transmitter on or in the piece of property, for instance, the evening before he is to leave for his place of work. Accordingly if, on the following morning, if forgets the piece of property he can be reminded by receiving an alarm signal when he has moved a few yards away from his house. Of course the transmitter does not actually have to be placed on or in the piece of property. The user can operate it as a pure reminder system, the transmitter being It, for instance, anywhere in the house and this will remind him that he has to do something unless he has switched off the receiver having perhaps already carried out the action for which he required the reminder.

(4) The positioning of the transmitter and the receiver could, in appropriate circumstances, be reversed. For instance, the receiver could be placed on a particular piece of property so that, if this piece of property is stolen, the property generates the alarm when the thief has moved more than a predetermined distance from the transmitter.

The determination of the distance between the transmitter and the receiver can be accomplished by, for instance, a system which measures the time for the signal to be transmitted from one unit to the other unit. For instance, the transmitter can generate a short ultrasonic wave and radio wave simultaneously. The delay of the ultra-sonic wave with respect to the radio wave at the receiver end will give the distance measurement. Another approach is the receiver generates an ultra-sonic wave to the transmitter. The transmitter, on receiving the signal, will retransmit a signal back to the receiver. Then, the time difference between transmission and reception will give the distance. Another possible method involves an assessment of the strength of the signal received by the receiver.

The transmitted signal could be, for instance, a radio wave signal, an ultra-sonic signal, a magnetic signal or a light beam, especially the former; and each unit could be made so as to be used as transmitter or receiver as desired. Reference has been made above to the system comprising two units. However, an alternative embodiment could involve more than two units, an example being a single transmitter and a plurality of receivers, or vice versa, a single receiver with a plurality of transmitters. For the second case, identifications between transmitters and means to avoid transmitters signal jamming each other are required. One solution is each transmitter radiates signal at different frequency, or have different modulated signal. The other solution is by time division. The receiver send out a synchronised signal to all transmitters. The transmitter, on receiving the signal, will retransmit a signal back to the receiver after a certain time delay. The delay is set to be different for different transmitter. In an alternative form, each unit can function as transmitter, receiver or both. A unit or any of the units can give an alarm when the distance between a unit and other units is greater than a predetermined distance.

The invention will be described further, by way of example, with reference to the accompanying drawings, in which:-

Figure 1 is a block diagram of a transmitter unit;

Figure 2 is a block diagram of a receiver unit;

Figure 3 is a circuit diagram of the unit of Figure 1; and

Figure 4 is a circuit diagram of the unit of Figure 2.

Referring to the drawings, from Figures 1 and 3 it can be seen that the transmitter, or "escort", unit 10 comprises a burst envelope generator 12 and a radio frequency (v.h.f.) oscillator 14. From Figure 3 it can be seen that the generator 12 is an astable "flip-flop" circuit which is connected to the r.f. oscillator, transistor Q1. Q1 will only oscillate when Q2 is ON and thus the transmitter 10 emits bursts of r.f. radiation of duration and interval determined by the parameters of the astable generator 12, for example, burst width: 30 ms; burst interval: 120 ms. The rise and fall rate of the burst is suppressed so as to maintain the radiated s.f. signal within a bandwidth of $\pm 5KH_z$.

In the particular example of escort unit illustrated in Figure 3, the various components were as follows:-

Q1	r.f. transistor CS 9013
Q2 & Q3	a.f. transistor CS 9014
C1	20 pf capacitor
C2	100 pf capacitor
C3	0.02 µf capacitor
C4	200 pf capacitor
C5	0.047 µf capacitor
C6	0.1 µf capacitor
C7	0.4 µf capacitor
R1	240 Ohms. resistor
R3	39 K Ohms resistor
R4	2 M Ohms resistor
R5	1 M Ohms resistor
R6	39 K Ohms resistor
XC	27 M Hz crystal

The receiver, or "monitor", unit 14 is illustrated in Figures 2 and 4 and comprises a super-regenerative receiver and detector stage 16 feeding a detected signal to an audio frequency amplifier 18. The output from the audio amplifier 18 passes to a noise discriminator and pulse amplifier stage 20 which, using negative feedback through C_{13}, D_1 and R_{12}, ensures that only a pulse from the escort unit and not random noise will be fed into the next stage. Thus, under noisy conditions, a stronger pulse signal from the escort unit is required to give proper discrimination from the background noise.

The discriminated signal now passes to a pulse width detector 22 (Q4 in Figure 4). Each pulse turns Q4 OFF and in this condition C16 is charged up by R18. If the pulse is of sufficient duration C16 will charge up to the point where Q5 turns ON; if not Q5 will remain OFF. Thus only pulses of predetermined duration will turn Q5 ON. Q5 forms the next stage, pulse interval detector 24. When Q5 is ON C17 will be charged; when Q5 turns OFF again C17 will recharge. If the interval between pulses is too great, C17 will charge up sufficiently to turn Q6, in the alarm generator stage 26, ON and an alarm tone will be sounded. Q6 is an audio oscillator, e.g. a frequency 2000 Hz, and sounds a tone through a ceramic buzzer 28 (BZ). The output of the stage 26 is inductively coupled to the receiver stage 14 so that operation of the alarm causes a pulse to turn Q6 OFF again, thus making the alarm tone intermittent. This has the twin advantages that it is more noticable and uses less power.

In the particular monitor unit illustrated in Figure 4, the various components were as follows:-

Q1	r.f. transistor CS 9018
Q2 to Q5	a.f. transistor CS 9014
Q6	output transistor CS 9013
C1 & C2	30 pf capacitor
C3	1000 pf capacitor
C4	0.04 μf capacitor
C5	1000 pf capacitor
C6	30 pf capacitor
C7	0.01 μf capacitor
C8	4.7 μf capacitor, 25 volt d.c. working
C9	1000 pf capacitor
C10	4.7 μf capacitor, 25 volt d.c. working
C11	1000 pf capacitor
C12 & C13	0.47 μf capacitor, 25 volt d.c. working
C15	10 μf capacitor, 10 volt d.c. working
C16, C14	1 μf capacitor, 25 volt d.c. working
C17	3.3 μf capacitor, 25 volt d.c. working
C18	47 μf capacitor, 10 volt d.c. working
C19 & C20	0.04 μf capacitor
C21 & C22	47 μf capacitor, 16 volt d.c. working
C23 & C24	0.04 μf capacitor
R1	39 K Ohm resistor
R2	10 K Ohm resistor
R3	6.8 K Ohm resistor
R4	2.7 K Ohm resistor
R5	3 K Ohm resistor
R6	1.3 M Ohm resistor
R7	270 K Ohm resistor
R8	15 K Ohm resistor
R9	1.5 K Ohm resistor
R10	270 K Ohm resistor
R11	15 K Ohm resistor
R12	30 K Ohm resistor
R13	30 K Ohm resistor
R14 & R15	100 K Ohm resistor
R16	10 K Ohm resistor
R17	51 K Ohm resistor
R18	68 K Ohm resistor
R19	180 K Ohm resistor
R20	100 K Ohm resistor
R21	510 K Ohm resistor
R23	180 K Ohm resistor
R24	4.7 K Ohm resistor
R25	470 Ohms resistor
D1, D2, D3, D4	Diode IN 4148
BZ	Ceramic Buzzer
TR	Transformer

Thus if the amplitude or duration of pulse, or interval between pulses, as received by the receiver 14 go beyond the preset levels, the warning tone will sound indicating that the escort and monitor units have become separated by more than the desired distance.

CLAIMS

1. An electronic system comprising a signal transmitter and a signal receiver, the receiver being arranged to generate an audible, visual or other alarm when the distance between the transmitter and receiver is greater than a predetermined distance.
2. A system as claimed in claim 1 in which the signal is a radio frequency signal.
3. A system as claimed in claim 2 in which the signal has a frequency of 27 or 49 MHz.
4. A system as claimed in any one of claims 1 to 3 in which the receiver generates an audible alarm in the

form of an intermittent tone.

5. A system as claimed in any one of claims 2 to 4 in which the transmitter transmitts bursts or pulses of predetermined duration and interval.

6. A system as claimed in claim 5 in which the receiver generates the alarm when the amplitude or duration of the pulses, or the interval between the pules, exceed preset limits.

7. A system as claimed in any one of claims 1 to 6 in which the transmitter comprises a radio frequency oscillator stage actuated by an astable flip-flop burst envelope generator.

8. A system as claimed in any one or claims 1 to 7 in which the receiver comprises a super-regenerative receiver and detector stage coupled to an audio frequency amplifier, a noise discriminator and pulse amplifier, pulse with detector, a pulse interval detector and an alarm generator.

9. A system as claimed in claim 1 in which the signal is a magnetic field, light beam or ultrasonic wave.

10. A system as claimed in claim 1 in which both ultra-sonic and radio frequency signals are generated.

11. A system as claimed in claim 10, in which the distance is determined by measuring the delay between the ultra-sonic waves and the radio waves.

12. A system as claimed in claim 11 in which the same unit transmits the ultra-sonic wave and the radio wave, and the receiver is capable of receiving both the radio wave and the ultra-sonic wave.

13. A system as claimed in claim 11 in which the transmitter transmits a radio frequency signal and the radio frequency receiver transmits an ultra-sonic signal, the radio frequency transmitter being a receiver for the ultra-sonic wave.

14. A system as claimed in claim 11 in which the receiver sends out a a radio wave, the transmitter on receiving the radio wave emitts an ultra-sonic wave back to the receiver, distance being measured by the time delay between transmission and reception at the receiver.

15. A system as claimed in any one of claims 1 to 14 in which there are more than two units, and in which transmitter units are identified by having different frequencies or different modulation frequencies.

16. A system as claimed in any one of claims 1 to 14 in which there are more than two units, and in which the receiver units send out a synchronised signal to a transmitter unit and the latter on receiving the signal retransmit the signal back to the receiver unit, each transmitter transmitting back at a different predetermined time delay to avoid interference.

17. An electronic system according to claim 1 substantially as hereinbefore described with reference to and as illustrated in the accompanying drawings.

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