

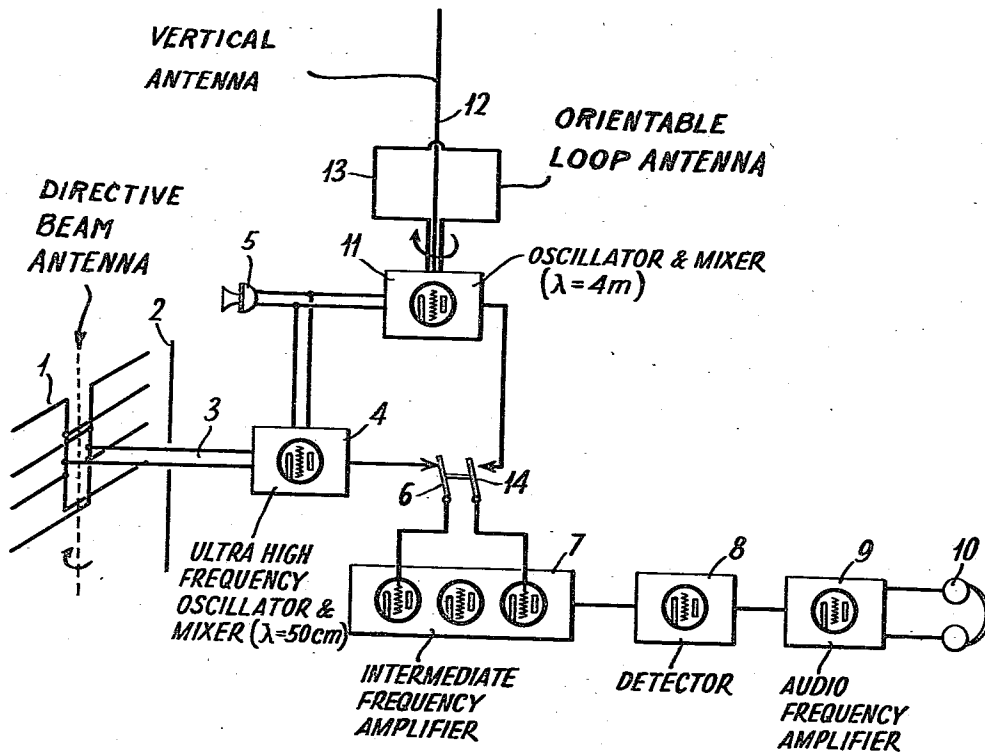
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ULTRA SHORT WAVE SYSTEM FOR TWO-WAY COMMUNICATION

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ULTRA SHORT WAVE SYSTEM FOR TWO-WAY COMMUNICATION

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The present invention is concerned with an arrangement for two-way communication on short and ultra-short waves for installations comprising at least one mobile station, and for the use of which the location of the correspond-
5 station must be ascertained prior to actual signal transmission.

The locating and the calling of a mobile station which works with directional or beam radiators for sending and reception is very difficult
10 in the absence of optical visibility, that is, at night time and in foggy weather.

It has already been suggested in the prior art to furnish beam equipment for this purpose with means adapted to enlarge and widen the aper-
15 tural angle. However, it has been found that even by steps of this kind the problem in question can not always be solved in a satisfactory manner, least of all when two mobile stations
20 alter their positions all the time and in an uncontrollable or unforeseeable manner, as, for instance, in making expeditions. Directional radiators in order to locate the correspondent station must, therefore, be turned. It may then
25 happen quite easily that both stations rotate their directional radiators just at such a rate and rhythm that their directional characteristics can not come to register. The arrangement and working scheme here disclosed is designed to
30 remedy this condition. Moreover, the present invention discloses ways and means adapted to maintain a signal communication or connection once it has been established, and further to preclude listening in by unauthorized parties or at
35 least to make such an attempt more difficult.

The duplex or two-way communication system here disclosed comprises short or ultra-short wave equipment operating between two stations,
40 one at least of which is a mobile station. Since directional beams are employed, the position of the correspondent has to be determined prior to the actual transmission of ultra-short wave signals. For purposes of orientation, therefore, I
45 have found it to be a convenience to radiate longer waves from each of two omni-directional antennae located at stations between which a short wave two-way communication is to be
50 established. This longer wave is picked up at the receiving end by a directional antenna arrangement. The signals so received serve to orient the beam antenna both for transmission and reception of ultra-short wave signals.

The idea of utilizing two dissimilar waves one for calling and the other for transmission of a
55 message is fundamentally known in the prior

art. In the present connection, however, there is an added advantage in that some unauthorized station, which may accidentally have picked up the call and which happens to have its receiver
5 tuned to the calling wave, will probably be unable to listen in on the conversation for the reason that it is not tuned to the other wave, and it may not be located in the sector of the sharply focussed beam.

The chances of unauthorized persons listening
10 in may be diminished still further, while at the same time a technical advantage is secured, by resorting to heterodyne reception, and by suitable choice of carrier frequencies used in the two
15 corresponding stations so that they differ a definite amount, that is, the amount of the intermediate frequency wave. The identical step may be adopted for the oscillator tubes of the transmitting portion of the equipment.

As a matter of economy and simplicity of
20 equipment, the frequencies of the oscillators at the two stations can be so chosen that the same beat frequency is always produced by heterodyning the received wave with the output of the
25 local oscillator. Hence one fixedly tuned intermediate frequency amplifier at each station is sufficient for the ultra-short wave reception as well as for reception of the longer calling wave.

My invention will now be described in more
30 detail, reference being made to the accompanying drawing in which the sole figure thereof represents schematically a preferred arrangement of components of a transmitting and receiving station, which components are essential
35 to the successful operation of the device.

For signal transmission an ultra-short wave directional antenna 1 is provided. The antenna system preferably includes a plurality of dipoles
40 disposed in a plane. The energy radiated by the antenna may be sharply focussed in a beam by means of a reflector 2.

The radio apparatus unit 4 is designed for two-way communication and has leads 3 intercon-
45 necting this unit with the antenna system 1. The unit 4 includes an oscillator which generates the energy to be transmitted and which during reception serves for heterodyning with the incoming energy. Preferably the oscillator
50 generates a wave of approximately 50 cm. The outgoing signal may be modulated by means of a modulator 5, while the incoming energy upon heterodyning with the output of the oscillator 4
55 to produce an intermediate frequency, may be fed across the switch 6 to an intermediate frequency amplifier unit 7. This amplifier unit

may consist, for example, of three stages. The output from the amplifier is then fed to a detector 8 and finally through an audio frequency amplifier 9 to any suitable responsive device

5 such as a telephone instrument 10.
To locate the position of and to call a correspondent station, another radio frequency unit 11 is provided which works, for instance, on a 4-meter wave length. The call wave is sent out
10 non-directionally, assuming that the location of the desired correspondent station is unknown. The calling wave is produced by an oscillator which is comprised in the unit 11, and is sent out, for example, by way of a vertical rod-type antenna 12. To locate an answering station, a
15 small directional antenna 13 is provided, say, in the form of a frame or loop. If desired, for the locating of a correspondent station, the vertical antenna 12 and the loop antenna 13 may be made to act conjointly and simultaneously. What
20 then results is an unilaterally directional field strength characteristic or cardioid. The call oscillator of the unit 11 furnishes oscillations as also required for forming the intermediate frequency which is fed to a receiver by way of a
25 switch 14. As above pointed out it is advisable to choose a frequency difference between the signal waves and the call waves such that in either case the same intermediate frequency will be obtained. If this condition is satisfied then an all-
30 purpose receiver and amplifier may be employed for reception. Inasmuch as the efficiency of a long-wave system, say, working with 4-meter waves, is greater than that of an ultra-short-wave
35 system, it will be seen that in a great many instances the intermediate frequency gain that is necessary in the call part of the equipment may be smaller. Hence the 4-meter wave receiving unit 11 is connected only to the second or the
40 third stage of the intermediate frequency amplifier 7. The preceding stages of the intermediate frequency amplifier may be disconnected at will in order that the batteries of the equipment may be relieved of load during the call and search
45 period.

The modulator means 5 may be separate or joint. In order to insure rapid change-over of connections of the radio frequency units 4 and 11 during the process of orienting the ultra-short-
50 wave antenna 1, it may be advantageous to interlock the change-over switches 6 and 14 so that one switch closes as the other opens. In many instances it will be found to be difficult in the first setting of the directional antennae to orient
55 them toward the correspondent station with exactness. In fact, to insure this condition it will prove necessary to change several times from call to signal wave in order that the correspondent station may be given suitable instructions.
60 The inter-lock between the switches 6 and 14 offers the following further advantage:

If for one reason or another the ultra-short-wave receiver fails or the signal is disturbed for some extraneous cause, it is possible immediately
65 to switch over to the call or ringing wave and to continue intelligence transmission on this wave or at least to advise the opposite station that there is trouble. Also in such a case it will again be found especially convenient to adopt a single intermediate frequency amplifier which is tuned to a frequency obtainable by heterodyning with
70 either of the two carrier waves.

The details of suitable circuit arrangements for enabling the unit 4 to be used alternatively
75 for transmission and reception have not been

shown since devices of this sort are well known in the art. For example, United States Patent No. 1,598,26 to Paul Ware shows one such duplex system as applied to radio telegraphy.

It will be understood that the idea underlying the present invention is not confined to the exemplified embodiment as herein described, nor do the exact details as shown in the appended drawing need to be followed by those skilled in the art.

I claim:

1. A system for radio communication between two stations, one of said stations comprising two carrier wave generators, modulation mixer means
operatively associated with each of said generators, means including an omni-directional antenna
15 connected to one of said generators for radiating a call-signal wave, means including a second antenna connected to the other of said generators for radiating in any desired direction a focussed beam of ultra-high frequency signalling energy, means in circuit with each of
20 said mixer means for modulating the output energies of their associated generators, means including an orientable directional antenna in cooperation with said omni-directional antenna for obtaining an indication of the direction in which the other station lies, means for enabling
25 said generators and said mixer means to deliver a common intermediate frequency output by heterodyning with incoming waves of two different frequencies, receiving apparatus comprising an amplifier tuned to said common intermediate frequency, a detector, an audi frequency amplifier and a responsive device, all serially connected to
30 said intermediate frequency amplifier, and means for connecting said intermediate frequency amplifier alternatively to the generator-mixer means associated with said second antenna or to the combination of omni-directional and orientable antennae.

2. A system for duplex radio communication comprising radio frequency transmitting and receiving equipment disposed at each of two stations one at least of said stations being a mobile
45 station the position of which is to be determined at the other of said stations prior to the transmission of traffic signals therebetween, each of said stations comprising omni-directional and orientable antennae and a combining circuit connected to said antennae and suitably arranged
50 for obtaining an indication of the direction in which a call-signal initiated by the other station is brought in, each of said stations comprising further an ultra-short wave directive beam antenna and ultra-short wave transmitting and receiving apparatus operatively associated therewith, an intermediate frequency amplifier, switching means for connecting said amplifier
55 alternatively to said ultra-short wave apparatus or to the combining circuit of the other two antennae, and apparatus for deriving an intelligible response from said intermediate frequency amplifier.

3. A system in accordance with claim 2 and further characterized in that said combining circuit associated with the omni-directional and orientable antennae includes oscillator means for delivering signalling energy to be modulated and transmitted, said oscillator means being further
65 adapted to heterodyne with an incoming signal whereby said combining circuit is enabled to produce an intermediate frequency acceptable to said intermediate frequency amplifier.

4. A system in accordance with claim 2 and

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further characterized in that said ultra-high frequency apparatus includes an oscillator and mixer circuit constituting means for transmitting and receiving ultra-high frequencies, said frequencies when received being heterodyned with the output of the oscillator for delivering an intermediate frequency acceptable to said intermediate frequency amplifier.

said ultra-high frequency apparatus and at least one of said stages being connectable to the combining circuit which is associated with said omnidirectional and orientable antennae.

6. A system in accordance with claim 2 and having interlocking switching means for obtaining the alternative connections of said intermediate frequency amplifier with said ultra-high frequency apparatus and with said combining circuit, respectively.

5. A system in accordance with claim 2 and having said intermediate frequency amplifier constituted by a plurality of stages, all of said stages being connectable in cascaded relation to

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