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POLARIZED WAVE TRANSMITTING SYSTEM

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Fig. 1

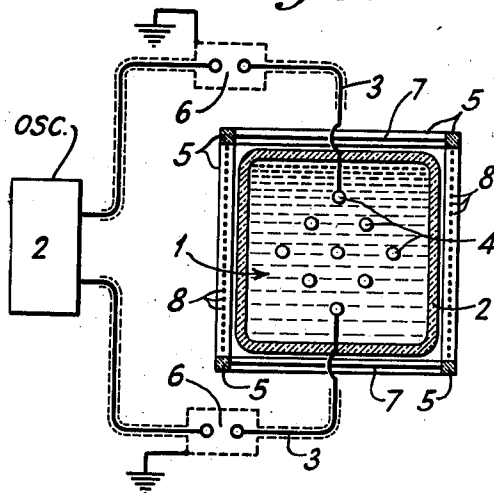


Fig. 2

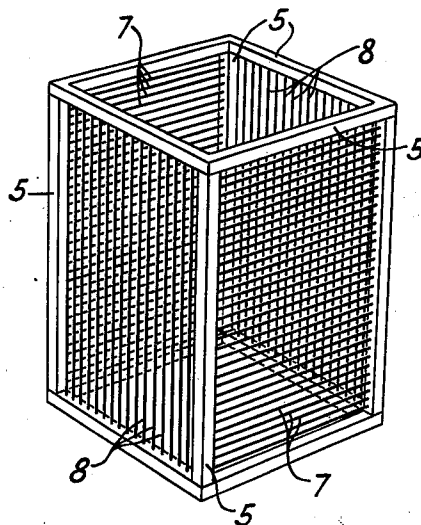


Fig. 3

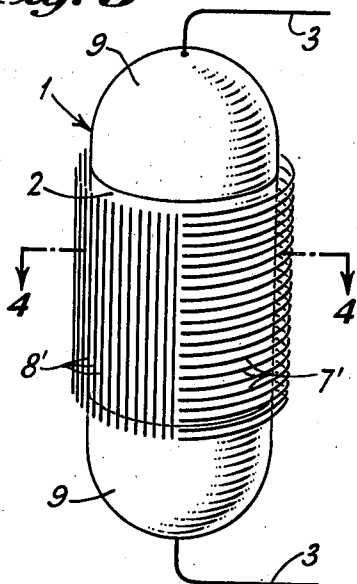
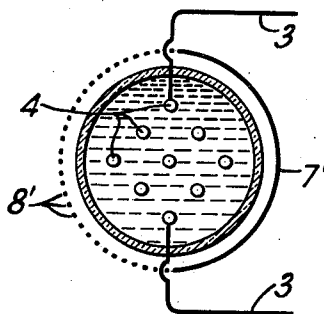


Fig. 4



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POLARIZED WAVE TRANSMITTING
SYSTEMCharles H. Brown, Baldwin, N. Y., assignor to
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12 Claims. (Cl. 250—11)

In its broadest aspect, the present invention relates to a signalling system for transmitting polarized ultra short waves, particularly waves having lengths appreciably below one meter. In a more specific aspect, the invention relates to a radio beacon or signalling device for transmitting centimeter or millimeter waves of different polarizations from a single space discharge device.

In accordance with the invention, it is proposed to provide within a single envelope means for generating oscillations of very short wavelength, and to surround the envelope or the oscillation generating means with one or more fine wire polarizing screens for polarizing the emitted waves in one or more different senses. To accomplish this result, the oscillations produced within the envelope are made to have a wavelength which is short compared to the lengths of the wires forming the polarizing screens. The oscillation generator can be of the electron discharge device type or of the spark gap type, and if the latter, preferably of the kind wherein the spark occurs within a compressed gaseous container or in a colloidal solution of fine metallic particles.

A more complete description of the invention follows in conjunction with a drawing, wherein:

Fig. 1 illustrates, by way of example only, a signalling system in accordance with the invention for generating short waves having differently polarized characteristics in different directions of travel;

Fig. 2 is a structure which fits over the short wave oscillation generator space discharge device of Fig. 1 for polarizing the waves produced by the generator in two different senses;

Fig. 3 is a modification of the wave polarizing device of the invention, which is arranged to emit differently polarized waves from opposite sides of the oscillation generator space discharge device; and

Fig. 4 is a cross-section view of the device of Fig. 3 along the line 4—4.

Referring to Fig. 1 in more detail, there is shown, in cross-section, an ultra short wave polarizing space discharge device 1 arranged to be energized from a source of oscillations 2, here indicated conventionally in box form, over shielded conductors 3, 3. Source 2 may produce oscillations of any suitable audio or superaudible frequency. In circuit with shielded conductors 3, 3 there are shown two shielded series arranged auxiliary spark gaps 6, 6 which make it possible to supply an over-voltage to the device 1.

Device 1 consists of a plurality of spaced metal balls immersed in a colloidal suspension contain-

ing finely divided metal particles (filings), all disposed within an envelope 2. The liquid of the suspension may be kerosene or other suitable material. The balls 4 constitute, in effect, a spark gap across which a spark is produced by the energy delivered over conductors 3, 3. The purpose of the metal filings is to produce a whole series of sparks between them as the discharge from the balls 4, 4 grapevines itself, so to speak, through the solution. Since the particles in solution vibrate electrically at a frequency corresponding to their natural wavelength, the oscillations produced by device 1 will be very small, of the order of fractions of centimeters. The auxiliary spark gaps 6, 6 make it possible to supply an over-voltage to the spark gap balls in solution. Surrounding the envelope 2 there is provided a wire screen affair, shown more clearly in Fig. 2, comprising a multiplicity of parallel wires arranged vertically and horizontally to polarize the waves generated within the envelope 2. These wires should form as fine a screen as is mechanically practical, it being understood that the effectiveness thereof will vary with the spacing of the wires and the diameter. The wires, furthermore, are preferably relatively long compared to the length of the wave to be transmitted, i. e., a multiple of approximately one-half the length of the operating wave, although wires of a length equal to only one-half a wavelength will also function. They are shown supported in insulating mounts 5, 5, in such manner that wires 7, 7 or 8, 8 appearing on opposite sides of the tube or device 1 are parallel to each other. In this manner, the ultra short electromagnetic waves produced by device 1 will be polarized vertically by horizontal wires 7, 7 and horizontally by vertical wires 8, 8 thus providing two bidirectional beams polarized 90° with respect to each other, it being understood that vertical polarization occurs when the electric vector is vertical, and similarly, horizontal polarization occurs when the electric vector is horizontal. Since the present invention is concerned with polarizing screens, in contradistinction to reflectors, the spacing of the polarizing wire screen 5, 5, 7, 8 from the envelope 2 will not be critical.

Although the device or tube 1 has been described as containing a colloidal suspension, it should be understood, of course, that this is not essential since compressed air can be used instead. Also, the screen affair is not limited to the construction shown in the drawing, since it can form part of the glass envelope 2 by being embedded therein, or if compressed air be employed within the envelope, the polarizing screen

can also be located within the envelope 2. Where the wires are embedded in the glass envelope 2, it is preferred that they be drawn or stretched very fine in the manner described in my co-pending application Serial No. 182,039, filed December 23, 1937.

Fig. 3 shows an arrangement for producing two relatively wide, unidirectional beams of different polarizations from opposite halves of the device or tube 1, instead of the bi-directional beams of Fig. 1. The tube or device 1 is here shown as being round instead of square, as in Fig. 1. To achieve uni-directionalism of travel of each beam, the polarizing screen consists of two groups of curved wires 7' and 8', one horizontal and the other vertical, each group curving around one-half of the device 1. In order to prevent those portions of tube 1 which are not surrounded by polarizing screens from emitting non-polarized waves, the ends of the tube or device 1 are encased in metallic covers 9, 9. Of course, where the longitudinal dimension of the envelope is entirely surrounded by the screen structure, and it is not deemed objectionable to radiate non-polarized waves from the extreme ends of the device, then such ends which are not surrounded by the screen need not be encased in metallic covers.

Fig. 4 shows a cross-section of the device of Fig. 3 along the line 4-4.

One advantage of the invention is that the polarizing device and screen can be made to be compact and of light weight, thus enabling it to be used as a portable instrument to be carried by a person or on a fast moving vehicle, such as an airplane or a boat. The polarizing system can also be used as a radio beacon on the top of a tall tower.

It will be understood, of course, that the invention is not limited to the precise circuits or structures shown in the drawing since various modifications can be made therein without departing from the spirit and scope of the invention. Device 1, for example, may comprise an evacuated electron discharge device (vacuum tube), a gaseous tube, or any other suitable ultra short wave tube for producing millimeter or centimeter waves of suitable length. Consequently, the term "space discharge device" used in the specification and appended claims is to be construed very broadly as including any wave producing device wherein carriers of elemental electric charges traverse a space.

What is claimed is:

1. In a signalling system having a space discharge device for producing and radiating ultra short electromagnetic waves appreciably below one meter, the method of signalling which includes radiating from two different portions of said device plane polarized waves whose planes of polarization are always substantially at 90° relative to each other and which travel in different directions.

2. In combination, a space discharge device for producing and radiating ultra short electromagnetic waves, and a frame surrounding the envelope of said device, said frame having a polarizing screen comprising a plurality of spaced parallel wires relatively long compared to the length of the operating wave surrounding at least a portion of the envelope of said device through which said waves must pass, said frame having another polarizing screen also comprising a plurality of spaced parallel wires relatively long compared to the length of the operating wave sur-

rounding another portion of the envelope of said device through which said waves must pass, said polarizing screens being angularly disposed relative to each other.

3. In combination, a space discharge device for producing and radiating ultra short electromagnetic waves, said device comprising an airtight envelope enclosing a plurality of spaced metallic balls immersed within a colloidal solution containing metallic particles, means for producing discharge across said balls through said solution, a plane polarizing screen of horizontally positioned wires disposed adjacent one portion of said device and along one of the dimensions of said device, and another plane polarizing screen of vertically positioned wires disposed adjacent another portion of said device and along said same dimension, the wires of both screens being relatively long compared to the length of the operating wave, whereby waves of different polarizations are radiated in different directions from said device.

4. In combination, a space discharge device for producing and radiating ultra short electromagnetic waves, a plane polarizing screen of horizontally positioned wires disposed adjacent one portion of the longitudinal dimension of said device, and another plane polarizing screen of vertically positioned wires disposed adjacent another portion of the longitudinal dimension of said device, both of said screens comprising wires which are relatively long compared to the length of the operating wave, whereby waves of different polarizations are radiated in different directions from said device.

5. In combination, a space discharge device for producing and radiating ultra short electromagnetic waves, a semi-circular polarizing screen comprising a plurality of spaced parallel wires which are relatively long with respect to the operating wave surrounding one-half of said device, another semi-circular polarizing screen comprising a plurality of spaced parallel wires which are relatively long with respect to the operating wave oppositely disposed with respect to and surrounding the other half of said device, the wires of said first screen being angularly disposed with respect to the wires of said second screen, whereby there are radiated from said device two unidirectional beams of different polarizations.

6. A system in accordance with claim 5, characterized in this that the wires of said first screen are disposed at 90° with respect to the wires of said second screen.

7. In combination, a space discharge device for producing and radiating ultra short electromagnetic waves, a polarizing screen comprising a plurality of spaced parallel wires surrounding one portion of said device, another polarizing screen comprising a plurality of spaced parallel wires surrounding another portion of said device, the wires of said first screen being curved and located in parallel planes and disposed at an angle relative to the wires of said second screen, whereby waves of different polarizations are produced by said screens.

8. In combination, a space discharge device for producing and radiating ultra short electromagnetic waves, said device comprising a spark gap contained within an envelope, an auxiliary spark gap external of said envelope in series with said first gap, means for supplying said auxiliary gap with high frequency energy of high voltage, a polarizing screen of parallel wires which are relatively long compared to the length of the

operating wave disposed adjacent a portion of said envelope for plane polarizing the waves traveling in a particular direction, and another polarizing screen of parallel wires which are also relatively long compared to the length of the operating wave disposed adjacent another portion of said envelope for plane polarizing in a different sense the waves traveling in another direction, both of said polarizing screens extending along the longitudinal axis of said device.

9. Signalling apparatus comprising, in combination, a colloidal solution within an envelope, said solution containing metallic particles, means for producing a discharge through said solution, and a plurality of plane polarizing screens, each screen being disposed adjacent to and externally of a different portion of said envelope, said polarizing screens extending along opposite sides of one of the dimensions of said apparatus and having their polarizing axes angularly disposed relative to one another.

10. Signalling apparatus having a space discharge device for producing ultra short electromagnetic waves of the order of fractions of centi-

meters, and a plurality of plane polarizing screens surrounding different portions of the same dimension of said device, said screens comprising wires which are long relative to the length of the operating wave, at least two of said screens being angularly disposed to each other.

11. Signalling apparatus having a space discharge device for producing ultra short electromagnetic waves below one meter, and a plurality of polarizing screens surrounding different portions of the same dimension of said device, said screens comprising wires which are long relative to the length of the operating wave, at least two of said screens having their polarizing axes angularly disposed to each other.

12. Signalling apparatus comprising means for radiating ultra short electromagnetic waves below one meter, and a plurality of plane polarizing screens surrounding different portions of said means, said screens comprising wires which are long relative to the length of the operating wave, at least two of said screens being angularly disposed to each other.

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