

Dec. 19, 1950

T. KAHAN ET AL
DIRECTIONAL AERIAL

2,534,451

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2 Sheets-Sheet 1

Fig. 1.

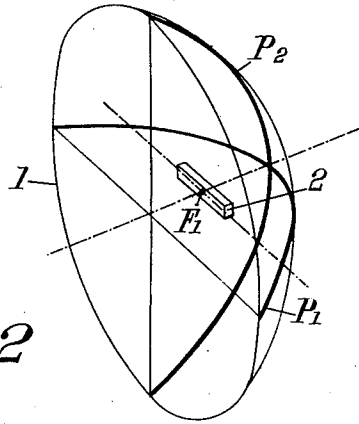


Fig. 2.

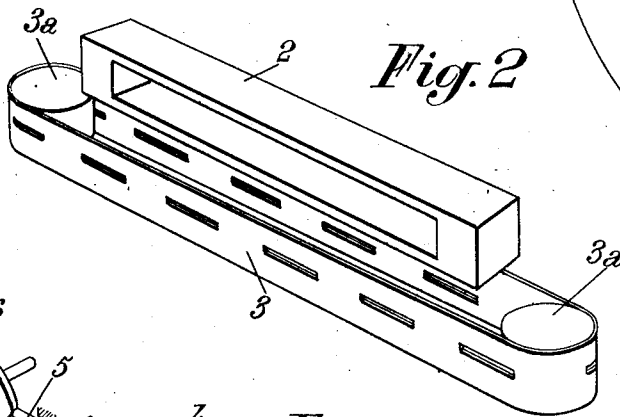


Fig. 3.

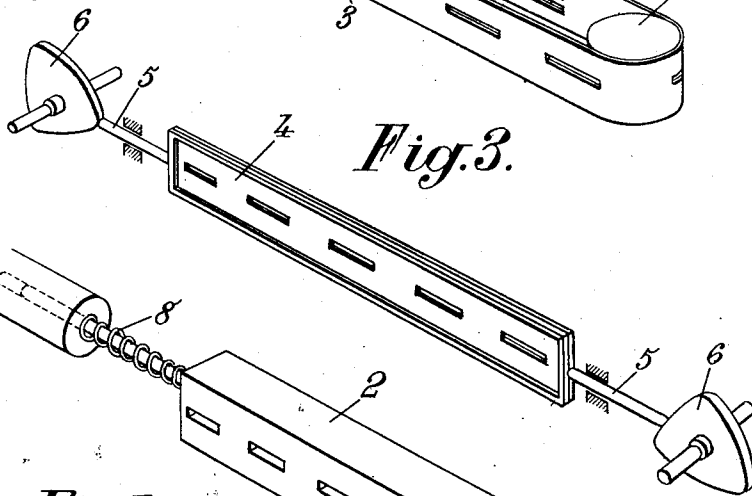
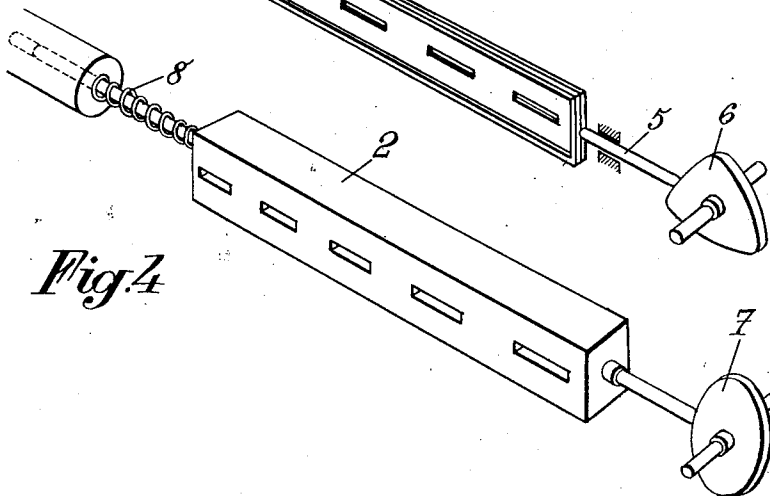


Fig. 4.



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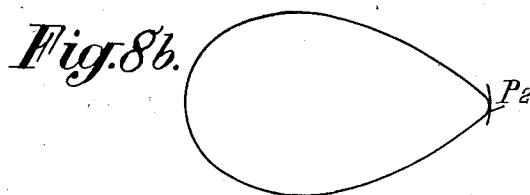
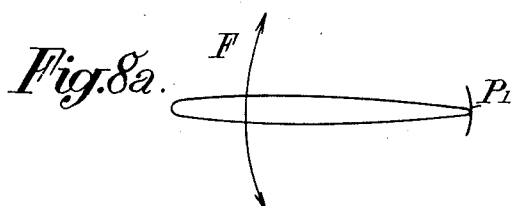
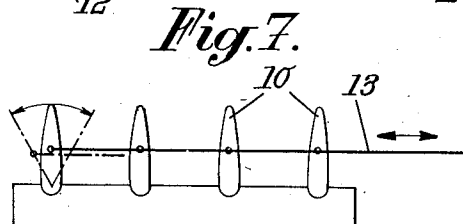
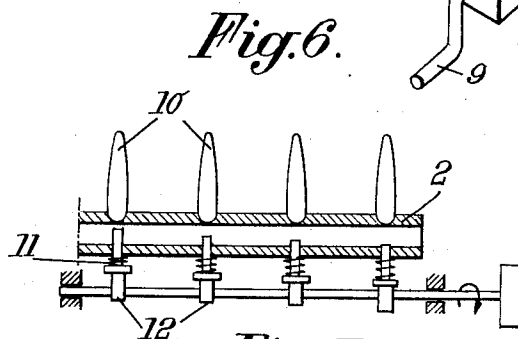
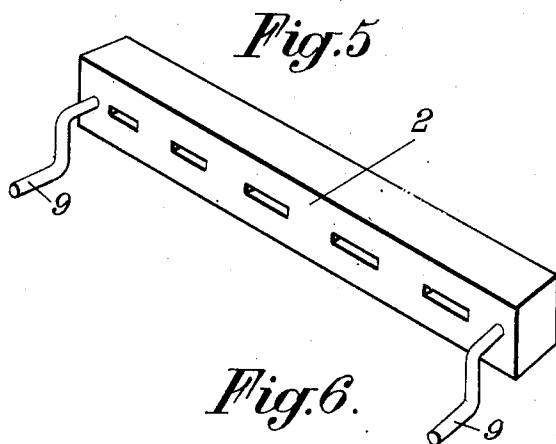
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2 Sheets-Sheet 2



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2,534,451

DIRECTIONAL AERIAL

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3 Claims. (Cl. 250—33.63)

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Our invention relates to scanning directional
aerials for very short electromagnetic waves.

The object of our invention is to provide an
aerial of this type which is better adapted to
meet the requirements of practice than those
used for the same purpose up to the present time.

Preferred embodiments of our invention will
be hereinafter described with reference to the
accompanying drawings, given merely by way of
example and in which:

Fig. 1 is a general view of the mirror included
in an aerial according to our invention;

Fig. 2 is a diagrammatic perspective view of a
wave guide and the system of slotted screen asso-
ciated therewith according to our invention, the
wave guide being shown raised above the position
it normally occupies with respect to the slotted
screen;

Fig. 3 is a diagrammatic perspective view of a
slotted screen to be used in connection with our
invention;

Fig. 4 is a diagrammatic perspective view of a
reciprocating slotted wave guide for use in con-
nection with our invention;

Fig. 5 shows a modification of the device of
Fig. 4;

Fig. 6 is a diagrammatic sectional view of a
portion of a wave guide provided with wave radi-
ating elements;

Fig. 7 shows a modification of the device of
Fig. 6;

Figs. 8a and 8b are explanatory diagrams.

The aerial according to our invention includes
a reflecting mirror 1 (Fig. 1), a wave guide 2
adapted to emit at least one electromagnetic
wave beam, suitably located with respect to this
mirror, and means for periodically modifying the
wave beam issuing from said wave guide toward
said mirror so as to obtain a directional wave
beam of substantially plane shape which scans
a given dihedral angle of space.

The mirror shown by Fig. 1 has its surface
generated by a parabola P_1 which remains always
parallel to a given plane and is displaced so that
its vertex is always located on another parabola
 P_2 fixed in space and the plane of which is at
right angle to every parabola P_1 , parabola P_2
and the parabola P_1 that passes through the
vertex thereof having coinciding axes, along
what will be called the axis of the mirror. The
focal length of P_2 is greater than that of P_1 .

A wave guide is adapted to transmit electro-
magnetic waves to be reflected by mirror 1.
Therefore this wave guide has an open lateral
face turned towards this mirror and it is located

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in such manner that its axis is at right angle to
the plane of parabola P_2 and intersects the axis
of mirror 1 at the focus of the parabola P_1 that
passes through the vertex of P_2 . This wave
guide is supplied with high frequency electro-
magnetic waves through any suitable means not
shown on the drawing.

Means are interposed between said wave guide
and said mirror so as to control the distribution
of the electromagnetic flux issuing from said
wave guide so as to obtain, after reflection on the
mirror, a flat beam which scans a desired angle
of space.

Said means may be constituted by a screen
adapted to stop electromagnetic waves and pro-
vided with suitably disposed slots.

In the embodiment of Figs. 2 and 3, said screen
is independent of the wave guide and is movable
with respect thereto. In the modification of
Fig. 2, the screen is constituted by a continuous
strip 3 of metallized rubber passing around drums
3a and driven with a continuous movement, for
instance by one of said drums. The two parallel
portions of said strip run on either side of wave
guide 2 (which, in Fig. 2 is shown above its actual
level for the sake of clarity but is in fact located
at the level of drums 3a). Thus the slots pro-
vided in strip 3 travel along the open face of wave
guide 2 between said guide and mirror 1 toward
which this open face is turned. The slots pro-
vided in strip 3 are so dimensioned and spaced
with respect to one another that the wave beams
passing through said slots are reflected from the
mirror in the form of scanning flat beams turn-
ing always in the same direction about an axis
at right angles to the wave guide, each beam that
reaches the end of its scanning angle being re-
placed by a new beam starting from the other
end of said angle.

In the embodiment of Fig. 3, the screen is con-
stituted by a plate 4 carried on sliding rod 5
operated by cams 6 (such as Tregold cams)
which impart a reciprocating sliding movement
to said screen. With this arrangement, scanning
takes place alternately in one direction and in
the opposed one.

In the embodiment of Fig. 4, the screen is con-
stituted by the face of the wave guide that is
turned toward the mirror, this face being pro-
vided with suitable slots for the passage of elec-
tromagnetic wave beams. In this case a re-
ciprocating sliding movement is imparted to
wave guide 2 by a cam 7 acting on a push rod
rigid with said guide. A spring 8 urges said guide
in the opposed direction.

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In the modification of Fig. 5, the movement of guide 2 is imparted thereto by means of cranks 9. Thus guide 2 is given reciprocating movement not only in the direction of its axis, but in a direction perpendicular to this axis, thus ensuring a scanning in a perpendicular direction.

In the embodiments of Figs. 6 and 7, the wave guide is provided with dielectric elements 10 for radiating electromagnetic waves and said rotating means are operated to ensure the desired scanning.

In the modification of Fig. 6, the radiating elements 10 are fixed with respect to wave guide 2 on one face thereof and the opposed face of said guide is provided with rods 11 slidable therein and subjected to the action of cams 12 cooperating with suitable springs to control the depth of engagement of rods 11 in the wave guide.

The periodical law of displacements of said rods 11 with respect to guide 2 controls the variation of distribution of the field and therefore the scanning of the electromagnetic beams.

In the modification of Fig. 7, radiating elements 10 are pivotally mounted with respect to guide 2 and they are oscillable simultaneously by means of a rod 13.

With any of these arrangements we obtain a flat wave beam the approximate shape of which is shown by Figs. 8a (projection on the plane to which all parabolas P_1 are parallel) and 8b (projection on a plane parallel to that of parabola P_2), this flat beam rotating about an axis located in the plane of Fig. 8b so as to scan an angle represented by double arrow F (Fig. 8a).

In a general manner, while we have, in the above description, disclosed what we deem to be practical and efficient embodiments of our invention, it should be well understood that we do not wish to be limited thereto as there might be changes made in the arrangement, disposition and form of the parts without departing from the principle of the present invention as comprehended within the scope of the accompanying claims.

What we claim is:

1. In combination, a fixed wave guide of the hollow type, provided with a plurality of slots in its wall, said slots being positioned to ensure di-

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rectional radiation of electromagnetic waves and means for periodically displacing the whole of said slots in a direction parallel to said wall physically relative to said wave guide.

2. An antenna according to claim 1 in which said wave guide includes a fixed portion consisting of a prismatic box having three solid walls forming three faces of a rectangular prism and open along the fourth face of said prism, and a strip movable longitudinally along said fourth face, said strip forming the fourth wall of the wave guide and being provided with longitudinal slots in line with one another, the means for periodically displacing said slots including two drums disposed on either side of the ends of said box and about which said strip is wound in an endless manner.

3. An antenna according to claim 1 in which said wave guide includes a fixed portion consisting of a prismatic box having three solid walls forming three faces of a rectangular prism and open along the fourth face of said prism, and a strip movable longitudinally along said fourth face, said strip forming the fourth wall of the wave guide and being provided with longitudinal slots in line with one another, the means for periodically displacing said slots consisting of means for periodically displacing said strip along said open face of said box.

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