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ULTRASHORT WAVE REFLECTOR

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Fig. 1

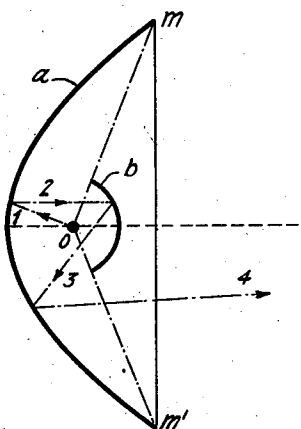


Fig. 2

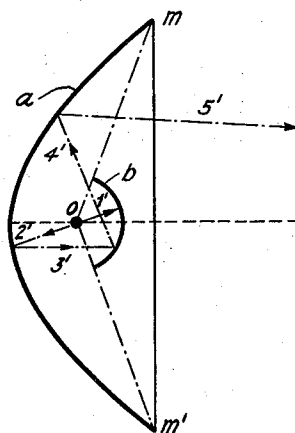


Fig. 3

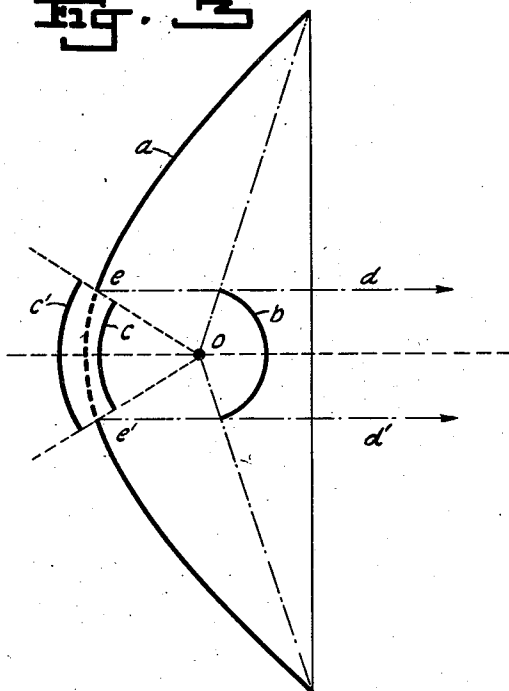
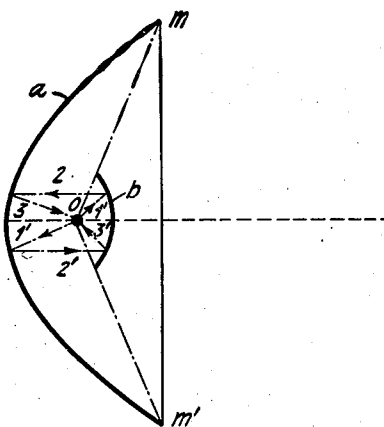


Fig. 4



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ULTRASHORT WAVE REFLECTOR

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In the transmission of news and intelligence and in navigation signalling by means of beamed ultrashort electromagnetic waves the beams of waves must be bounded or contoured as sharply as possible. In order to insure such sharper bounding of beams it has been suggested in the prior art to screen off the part of the radiation sent out from the oscillator which is not reflected by the reflector by the aid of a screening diaphragm reflector mounted in front of the oscillator.

Well known arrangements of this type are shown in Figures 1 and 2. Figures 3 and 4 illustrate the present invention.

Referring to Figure 1, *o* is an oscillator mounted exactly in the focus of a reflecting mirror *a* which is a solid of rotation, or in the focal axis or line of a cylindrical reflector, or nearly so. If after reflection the rays constituting the beam or pencil should be strictly parallel, then reflector *a* for all around bounding of the beam should be a paraboloid and for only lateral bounding of the beam a parabolic cylinder. But if the rays of the beam are to diverge slightly, as may be required, for instance, for what has been called "electric lighthouses" or beacons, then the preferable plan probably will be to make the reflector of a form slightly departing from a paraboloid or the parabola according to the desired angle of divergence. To diaphragm or screen off the direct radiation of the oscillator embraced by the angle *mom'* there is used a spheric or cylindrical dimming reflector *b*.

Now, the present invention forms an improvement upon this known scheme, and it is based upon a proper understanding of this fact that the diaphragm reflector *b* fails to eliminate all undesirable rays and rays travelling in the wrong direction. In fact, in prior arrangements rays still remain which after repeated reflection from the two mirrors are finally sent out into space still in the wrong direction by the reflector *a*. For instance, the ray *l* emitted from the oscillator will be reflected first in directions 2 and 3 and finally by the mirror *a* in the undesired direction 4. Similarly as illustrated in Figure 2, the ray *l'* after repeated reflection is finally reflected from mirror *a* into space in the undesired direction 5'. This harmful stray, of course, tends to blur and vitiate the boundaries of the beam.

Now, according to one embodiment of the present invention this harmful dispersion may be precluded by suppressing the effect of that part of the major mirror *a* which participates in the production of harmful stray and replacing it by the

effect of a spheric reflector or a reflector of circular cylindricity.

This particular embodiment is shown in Figure 3. The portions of the major reflector *a* which take part in the production of harmful stray are indicated at *e'*, *e*, the liminal elements thereof reflecting the rays issuing from *o* just towards the liminal elements of the screening reflector *b* so that the elements of the major mirror *a* directly consecutive or adjacent thereto (that is to say, consecutive in reference to the direction from the center of the mirror towards the marginal portions thereof) will reflect the rays emanating from *o* in such a way that they will just skirt the edges of the screening reflector *b*. These are the boundary rays *e*, *d*, and *e'*, *d'* which according to the distribution of divergency of the rays travel inside the pencil of rays issuing from the reflector *a* almost parallel to the reflector axis, though most preferably under a very small converging angle thereto. Now, if the central portion *e'*, *e* of the major mirror *a* be removed and if inside the angle of the aperture *coe'* there is disposed a spherical (or circular-cylindrical) reflector or mirror *c* whose center or axis, as the case may be, coincides with the oscillator, then all such rays as would normally or otherwise constitute the harmful stray will be reflected back from the two mirrors *b* and *c* towards the oscillator *o*, with the result that they will not be able to leave the space inside the angle of aperture of these mirrors. In order that these radiations after reflection may reach the oscillator again at the proper phase and may not tend to weaken it, the radii of the reflectors *b* and *c* must be

$$n_b \frac{\lambda}{4} \text{ and } n_c \frac{\lambda}{4}$$

where n_b and n_c are odd numbers suitably chosen, and where λ is the wave length of the emitted radiations. In fixing the quantity n_c there is fairly much leeway allowed inasmuch as the mirror in question may be mounted both in position *c'* in the rear of the main reflector *a* as well as in position *c* in front of this mirror and also in a number of intermediate positions.

Figure 4 illustrates another embodiment of the present invention wherein stray radiations can be eliminated if the screening mirror is given a form so that the rays emitted from the oscillator which after reflection in one mirror (either main or screening mirror) will strike the respective other (screening or main) mirror and then be returned towards the oscillator by the latter. If the main

mirror, for instance, is paraboloidal (or parabolic), then also the screening reflector or diaphragm mirror should be of the same shape.

Referring to Figure 4 *a* is the main mirror being of either of the two shapes before mentioned. In the focus or on the focal line of the main mirror is mounted the oscillator *o*. The angle of aperture *mom'* of the main reflector is covered or masked by the screening mirror *b* which is of the same form as the one chosen for the main reflector, and the focus or focal line thereof coincides with that of the main reflector. It will be seen that each ray *l* which falls from the oscillator upon the screening reflector *b* is reflected by the latter in a sense parallel to the parabola axis as indicated by 2 and thence reflected from the main mirror *a* towards the oscillator in direction 3. Similarly the rays *l'* after first reflection from the main mirror in direction 2' and after repeated reflection from the screening reflector in direction 3' return to the oscillator. In order that the reflected rays may reach the oscillator under proper phase conditions, i. e., in order that no reducing action may be produced, but rather a boost, the distances between oscillator *o* and the apices of the two mirrors should be equal to odd multiples of $\lambda/4$.

I claim:

1. A reflector for ultrashort electromagnetic waves of the type wherein direct radiation of an oscillator mounted on the focal line of a main reflector is screened off by a conveniently large segment of a screening reflector mounted coaxially in reference to the oscillator and facing said main reflector, with this characteristic feature that the central portion of the main reflector is disposed coaxially with respect to the oscillator, the angle of aperture of said central portion looked at from the oscillator being so chosen that the radiations directly adjacent to this angle and emitted from the oscillator, after reflection by the main reflector, just skirt the edges of the screening reflector, the radii of the screening reflector and central portion of the main reflector being equal to a suitably chosen odd multiple of one-quarter the length of the communication wave.

2. The combination with an ultra short wave reflector comprising a main parabolic reflector adapted to have a radiating element disposed along its focal line, and a screening reflector of substantially spherical form coaxially mounted with reference to said radiating element and arranged to screen off outward direct radiation from said radiating element and to reflect the screened radiation back toward said main reflector, of a third segmented reflector of substantially spherical form disposed near the central portion of said main reflector and facing said screening reflector to receive the reflected radiated energy from the latter, said third reflector being also disposed coaxially with reference to said radiating element and so arranged as to prevent undesired dispersion of waves, the radii of the screened and third reflectors being each an odd multiple of one-quarter the length of the communication wave.

3. The combination with an ultrashort wave reflector comprising a main parabolic reflector adapted to have a radiating element disposed along its focal line, and a screening reflector coaxially mounted with reference to said radiating

element and arranged to screen off outward direct radiation from said radiating element and to reflect the screened radiation back toward said main reflector, of a third segmented reflector disposed near the central portion of said main reflector and facing said screening reflector to receive the reflected radiated energy from the latter, the center of said main reflector being between said screening reflector and said third reflector whereby there is prevented undesired dispersion of waves.

4. A mirror system for ultra-short waves, comprising a main mirror, an ultra-short wave antenna at the focus of this mirror and a confocal counter-mirror, the apex of which is separated from the focus by a space equal to an integral multiple of one-fourth of the wave length used, and an additional mirror in that portion of the main mirror directly opposite the counter-mirror.

5. A mirror system for ultra-short waves, comprising a main mirror, an ultra-short wave antenna at the focus of this mirror and a confocal counter-mirror, the apex of which is separated from the focus by a space equal to an integral multiple of one-fourth of the wave length used, and an additional mirror in that portion of the main mirror directly opposite the counter-mirror, said additional mirror being arranged confocal and coaxial to the main mirror.

6. A mirror system for ultra-short waves, comprising a main mirror, a source of ultra-short wave energy at the focus of this mirror and a confocal counter-mirror, the apex of which is separated from the focus by a space equal to an integral multiple of one-fourth of the wavelength used, the main mirror being parabolic and the counter-mirror and part of the main mirror opposite thereto consisting of two mirrors of circular cross-section concentric to the focus of the main mirror.

7. In combination, a main parabolic reflector, a short wave oscillation generator disposed along the focal line of said main reflector, a screening reflector of smaller size than said main reflector and of circular cross section mounted coaxially with reference to said oscillation generator and arranged to screen off outward direct radiation from said generator and to reflect the screened radiation back towards the main reflector, and a third segmented reflector disposed near the central portion of said main reflector and facing said screening reflector to receive the reflected energy from the latter, said third reflector being also disposed coaxially with reference to said oscillation generator, said main reflector being located between said screen and third reflectors.

8. In combination, a main reflector, a generator of short waves disposed along the focal line of said main reflector, a screening reflector mounted coaxially with reference to said generator and arranged to screen off outward direct radiation from said generator and to reflect the screened radiation back towards the main reflector, and a third segmented reflector disposed near the central portion of said main reflector and facing said screening reflector to receive the reflected energy from the latter, said third reflector being also disposed coaxially with reference to said oscillation generator, said main reflector being located between said screen and third reflectors.

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