

Nov. 23, 1937.

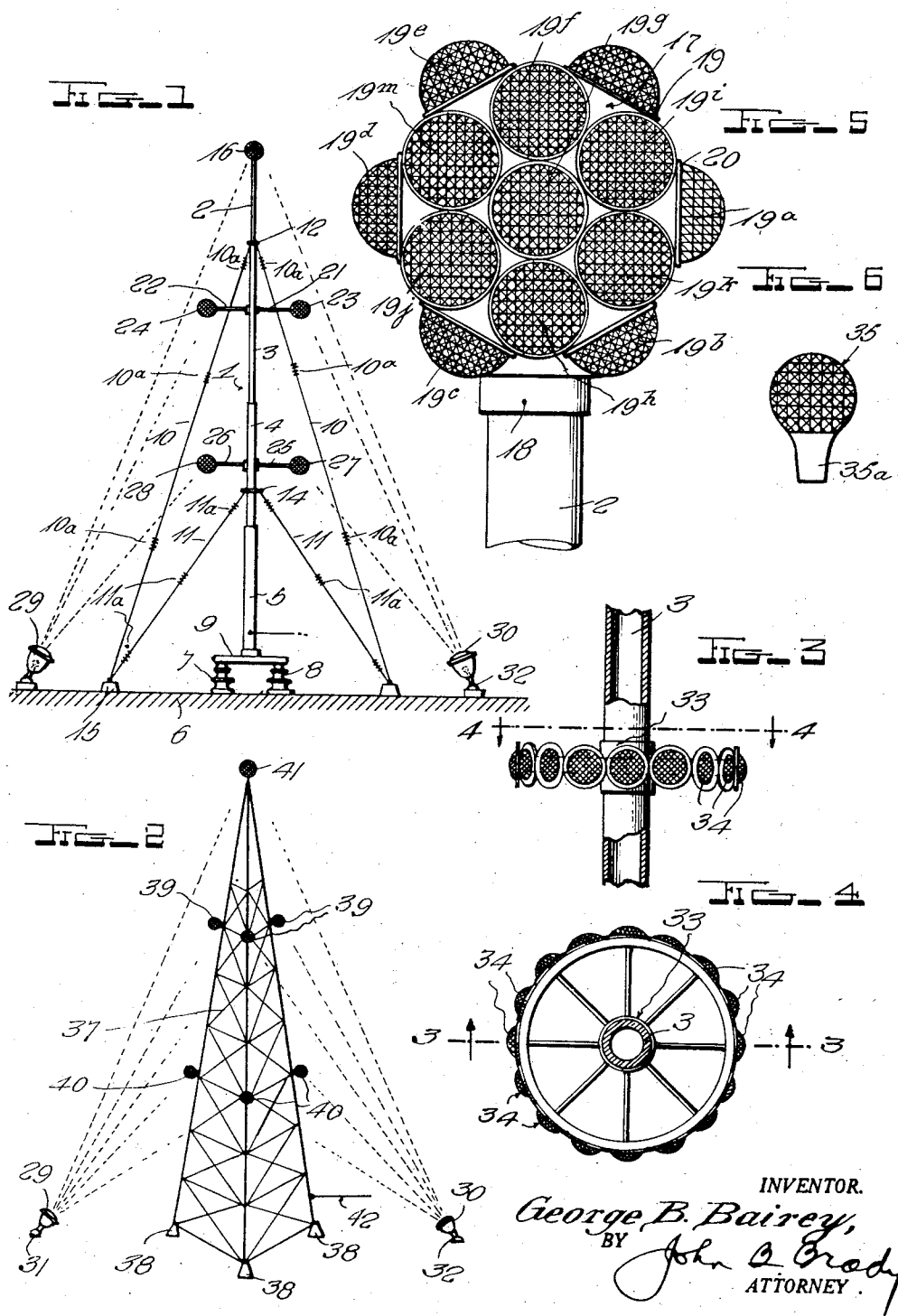
G. B. BAIREY

2,099,671

ANTENNA SYSTEM

Filed Sept. 20, 1935

2 Sheets-Sheet 1



INVENTOR.

George B. Bairey,
BY John A. Gredy
ATTORNEY.

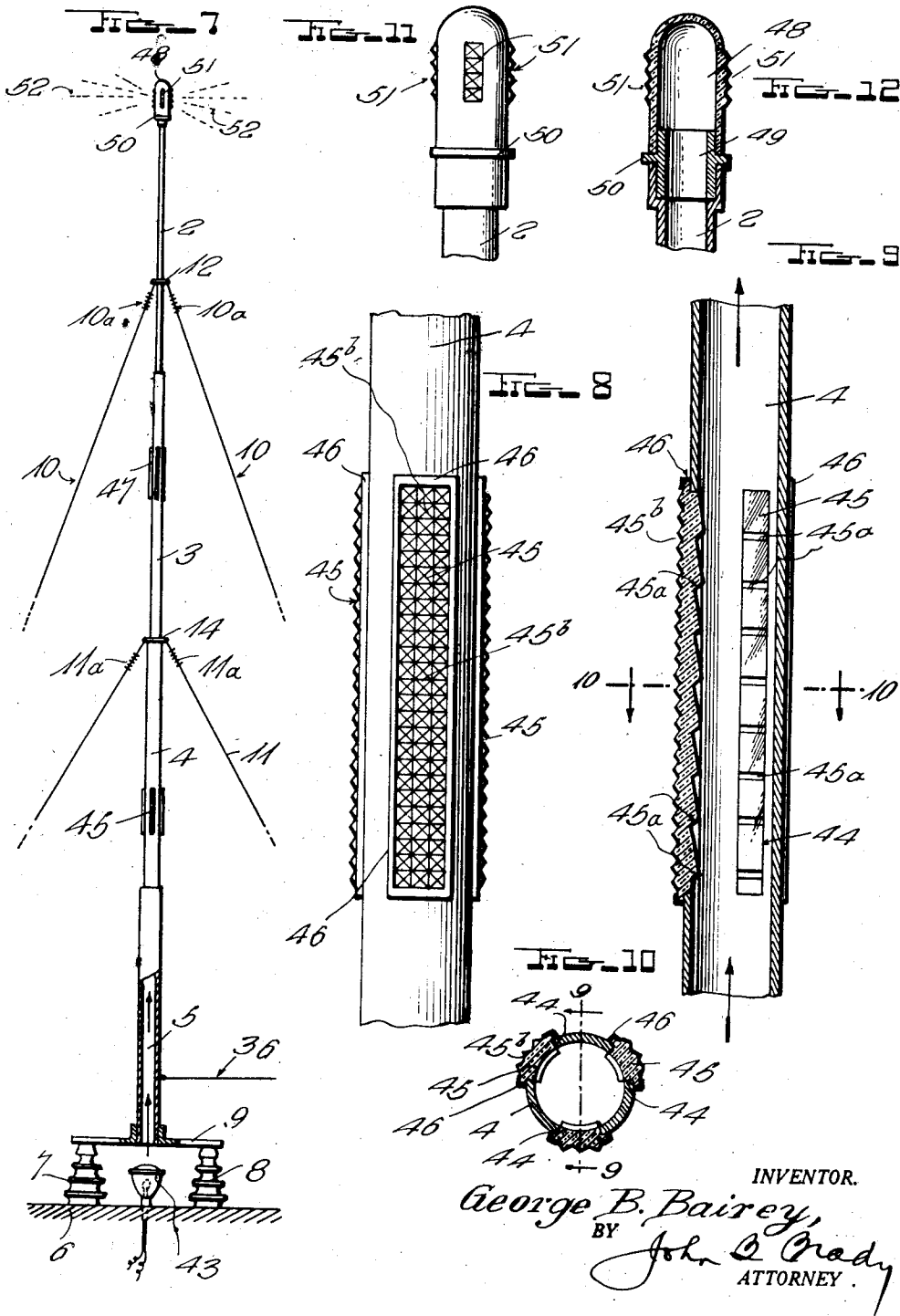
Nov. 23, 1937.

G. B. BAIREY
ANTENNA SYSTEM

2,099,671

Filed Sept. 20, 1935

2 Sheets-Sheet 2



UNITED STATES PATENT OFFICE

2,099,671

ANTENNA SYSTEM

George B. Bairey, Wolf Point, Mont., assignor, by
mesne assignments, to Collins Radio Company,
a corporation of Iowa

Application September 20, 1935, Serial No. 41,474

18 Claims. (Cl. 250—33)

My invention relates broadly to high frequency signaling systems and more particularly to a construction of antenna for radio signaling.

One of the objects of my invention is to provide a construction of antenna system which is efficient in operation and which is substantially removed from the power wiring heretofore required for the energization of lights used in the illumination of the antenna structure for reducing the hazards of the antenna to aerial navigation.

Another object of my invention is to provide a construction of radio transmitting antenna having means for illuminating the antenna without the employment of power wiring heretofore necessary adjacent the effective portions of the antenna.

Still another object of my invention is to provide an arrangement of light reflection means mounted in selected positions with respect to different portions of the antenna structure and subjected to direct light rays from light sources distributed in predetermined positions about the antenna structure for rendering the antenna structure visible to approaching aircraft at night or under conditions of fog.

A further object of my invention is to provide a construction of self-radiating antenna mast having light reflecting means disposed at intervals along the length thereof and at the top thereof, and arranged in a path of directed light rays for illuminating the mast without employing power supply lines and incandescent lights mounted directly on the antenna mast.

A still further object of my invention is to provide a construction of self-radiating pipe mast having illuminating means carried by the pipe mast which do not require renewal or replacement from time to time as is necessary in the case of incandescent lamps associated with power wiring on the mast, thereby avoiding necessity of climbing the mast for renewal or replacement of illuminating means from time to time and permitting the use of lighter and less expensive material in the mast construction.

Another object of my invention is to provide a self-radiating antenna mast having means for illuminating portions of the mast from a light source arranged to direct light rays axially through the mast.

Still another object of my invention is to provide a construction of illuminating means for a pipe-type antenna mast wherein light rays may be directed vertically through the pipe-type mast for rendering the illumination means effective

to light the antenna mast for reducing the hazards of the mast to aerial navigation.

Other and further objects of my invention reside in the construction of a self-radiating pipe mast, as set forth more fully in the specification hereinafter following, by reference to the accompanying drawings, in which:

Figure 1 is an elevational view of the pipe mast of my invention; Fig. 2 illustrates a self-supporting antenna mast equipped with illuminating means according to my invention; Fig. 3 illustrates a modified form of light reflective means which may be carried by the antenna mast of my invention at predetermined intervals along the length thereof, the view being taken partially in cross section through the mast on line 3—3 of Fig. 4; Fig. 4 is a lateral cross sectional view taken on line 4—4 of Fig. 3 showing the light reflective means in top plan view; Fig. 5 is an elevational view of a cluster of light reflective means which may be employed for illuminating the antenna mast in the system of my invention; Fig. 6 is a view of a modified form of the light reflecting member which may be employed at the extremity of the pipe mast or at the extremities of the brackets; Fig. 7 is an elevational view of a modified form of pipe mast self-radiating antenna illustrating the illuminating means employed for directing light rays vertically through the pipe antenna; Fig. 8 is a side elevational view of a portion of the antenna mast illustrated in Fig. 7 showing one arrangement of illuminating plates therefor; Fig. 9 is a cross sectional view through a portion of the antenna mast showing the arrangement of lighting means therein, the view being taken on line 9—9 of Fig. 10; Fig. 10 is a lateral cross sectional view taken on line 10—10 of Fig. 9; Fig. 11 is an elevational view of the upper extremity of the pipe mast illustrated in Fig. 7; and Fig. 12 is a cross sectional view through the illuminating head at the upper extremity of the pipe mast.

My invention is directed to a construction of self-radiating antenna which is not subject to undesirable influences of power lines heretofore introduced by the running of power leads along the antenna mast for the operation of incandescent lights at different points along the mast for purposes of illumination. The power wires inherently introduce capacity effects which are undesirable in securing maximum efficiency in the operation of an antenna. In the mast of my invention I remove and isolate the mast from all power wiring. Illumination of the mast, how-

ever, is essential to reduce the hazards to aerial navigation.

I provide light reflective means disposed at predetermined intervals along the length of the antenna mast and in the path of light rays which are directed upon the light reflective means to render the light reflective means brilliant at night or through fog. The light reflective surfaces are disposed at such angles with respect to the propagated light rays, that the light reflective means are rendered visible at very substantial distances sufficient for all practical purposes in warning aircraft of the obstruction. The light reflective means may be constructed in various forms and the embodiments of my invention which I have selected for purposes of illustration are not intended as limitations upon my invention. I may mount the light reflective means on brackets extending laterally from the mast or the light reflective means may be mounted immediately adjacent the mast.

I may arrange the light reflective means upon a circular frame surrounding the mast. The pipe-type mast of my invention may be constructed of relatively small size pipe for the reason that it is unnecessary for a man to climb the mast for renewing lights on the mast. The light reflective means which I employ are permanent in construction and do not require renewal. Accordingly, the material of the pipe mast may be relatively light in weight and small in cross section.

My invention is equally applicable to a self-supporting antenna mast where the light reflective means are distributed at intervals along the length of the mast and are arranged in the path of projected light rays for reflecting the light in horizontal planes as a warning to approaching aircraft. In some instances I arrange the light source at the base of a pipe-type mast and project the light rays vertically through the pipe-type mast for illuminating the various portions of the mast or the head of the mast from the interior. The light rays are propagated from the interior of the mast in substantially horizontal planes of such distances as will warn approaching aircraft of the hazard to navigation. In no instance is it necessary to carry power wires up the mast for thereby putting the power circuits into capacitive relation to the high frequency radiator.

Referring to the drawings in more detail, reference character 1 designates a pipe mast direct radiator constituted by sections 2, 3, 4 and 5 secured one with respect to the other and in gradually diminishing diameters from a relatively large base diameter in section 5 to a relatively smaller diameter in section 2. The sections are secured one with respect to the other by any suitable means such as through reducing couplings. The pipe mast is supported in insulated relation with respect to the earth or other supporting surface indicated at 6 by means of pedestal insulators indicated at 7 and 8. The pedestal insulators indicated at 7 and 8 support a substructure 9 on which the pipe mast is erected. The pipe mast is thus wholly insulated from the ground and constitutes a capacity area with respect to the ground. The pipe mast is supported and stabilized by means of sets of guy wires indicated at 10 and 11. The sets of guy wires 10 are secured to the upper portion of the pipe mast by connection to a suitable connecting ring 12. The set of guy wires 11 are connected to an intermediate portion of the pipe mast through a connecting member 14. The sets of guys 10 are

broken at intervals by means of insulators indicated at 10a. The sets of guys 11 are broken at intervals by means of insulators indicated at 11a. Suitable anchors 15 are provided in which the sets of guy wires 10 and 11 are secured for maintaining the pipe mast in a vertical position. Connection is established with the pipe mast radiator from the high frequency signal transmitter through suitable lead which I have indicated at 36. The pipe mast radiator of my invention is particularly desirable for radio broadcast transmission because of the uniform field power which is created by the electromagnetic waves radiated from the antenna for thereby serving the listening public with broadcast reception uniformly in all directions from the broadcast antenna. The upper extremity of the pipe mast is provided with a cluster of reflective members indicated at 16. The structure of the cluster of reflective members is more clearly shown in Fig. 5 as comprising a polygonally shaped body 17 carried by the cap member 18 which fits over the end of the upper pipe section 2 and carries thereon a multiplicity of light reflective members indicated generally at 19. The light reflective members each consist of preformed buttons of glass having reflecting surfaces disposed at various angles and adapted to receive light from a source of light erected adjacent the base of the mast and propagate light in various directions to provide a warning signal for approaching aircraft. The preformed buttons 19 having light reflective surfaces are arranged to mutually coast for reflecting light in various directions from a light source which may be directed upon the light reflective surfaces. That is to say, the light reflective surfaces 19 are disposed at intervals around the polygonally shaped body structure 17 as represented at 19a, 19b, 19c, 19d, and 19e, in one plane, and at 19f, 19g, and 19h, in another plane, and again at 19i, 19g, and 19j, and again at 19k, 19g, and 19m in still another plane extending around the periphery of the polygonally shaped body structure 17. Each preformed button 19 is retained in position through a suitable rim member 20 secured to the polygonally shaped body structure 17. The cluster of light reflective members which I have described may also be mounted on bracket arms which extend laterally from the pipe mast, as shown in Fig. 1. In this arrangement, the bracket arms 21 and 22 near the upper portion of the mast carry light reflective clusters represented at 23 and 24. Similarly, bracket arms projecting from the pipe mast intermediate the aforementioned bracket arms at the base of the mast may be provided as indicated at 25 and 26 for supporting the light reflective clusters 27 and 28. Sources of light are provided adjacent the base of the mast as represented at 29 and 30 erected on suitable adjustable supports indicated at 31 and 32 for directing light rays upon the light reflective surfaces. That is to say, the source of light 29 is directed upon the light reflective surfaces in clusters 16, 24, and 28. The source of light 30 is directed upon the light reflective surfaces in clusters 16, 23 and 27. Due to the many different angular positions in which the individual portions of the light reflective surfaces of buttons 19 are placed, the light rays from sources 29 and 30 are reflected in various directions. The buttons are brilliantly colored so that the rays reflected from the reflective surfaces pierce darkness and fog and serve as a warning to aircraft

of the hazard offered by the vertically extending mast.

In lieu of the arrangement of clusters for the light reflective surfaces, I may provide a circular frame 33 on which light reflective members may be supported. I have shown an arrangement of this kind in Figures 3 and 4 wherein the circular frame 33 is mounted on the section of the mast indicated at 3 and provides a peripheral support for the light reflective surfaces 34. The light reflective surfaces 34 comprise preformed glass buttons similar in character to the buttons provided in the cluster illustrated in Fig. 5. These buttons are provided with angularly cut faces brilliantly colored and serve as light reflecting means for light rays which may be projected upon the light reflective buttons from the sources of light adjacent the base of the mast.

In lieu of the cluster of light reflective surfaces, I may provide a solid glass member indicated at 35 in Fig. 6 having a multiplicity of angularly disposed light reflective surfaces adapted to direct light rays in various directions from the source of light used for illuminating the glass member. The glass member 35 may be provided with a supporting portion 35a providing an attaching means for securing the member to the top of the upper pipe section or in the laterally extending brackets heretofore described.

The method of illuminating the antenna mast of my invention may be applied to direct radiators of the self-supported type as illustrated in Fig. 2 wherein the steel frame 37 is erected on insulated piers 38 and substantially braced by suitable angularly disposed reinforcing members. At predetermined intervals along the length of the radiator, I arrange sets of light reflective members as indicated at 39 and 40. At the top of the self-supported radiator, I provide a light reflective member indicated at 41. The sources of light 29 and 30 are trained on the light reflective surfaces 40, 39, and 41 as described in connection with Fig. 1. The light reflective surfaces illuminate the radiator for substantial distances without the employment of power wires and incandescent lights. Connection is made to the self-supported radiator through lead 42 which connects with the high frequency transmitter for impressing upon the mast the high frequency oscillations which are radiated from the mast.

I may provide in combination with the exterior lighting of the light reflective surfaces or independently thereof means for illuminating the mast from the interior thereof. In Figs. 7-12, I have shown a form of my invention in which a light source 43 is arranged beneath the pipe mast and directs light rays upwardly through the pipe mast in the directions which I have indicated by the solid arrows. The light rays pass through pipe sections 5, 4, 3 and 2. In section 4 of the pipe mast, I may provide relatively narrow vertical slots which I have indicated at 44 which serve as windows in the sides of the pipe mast for emitting light rays in a substantially horizontal position. I provide means for increasing the effectiveness of propagation of the light in a substantially horizontal direction such as the light reflective means which projects through the slots 44 as indicated by members 45. The members 45 each comprise longitudinally extending plates of glass having offset inwardly directed faces 45a which gather the upwardly projecting light rays through the pipe mast and direct the light in a substantially horizontal direction through the faces 45b of the members 45. The

members 45 are confined in position by means of frame-like devices 46 which secure the members 45 in the slots 44. The pipe section 3 is provided with a similar set of light projecting members which I have indicated at 47 in Fig. 7. The light projecting members 47 are constructed in a manner similar to the construction of members 45 and serve to give warning at the position of the mast when sighted in various horizontal planes from a line of flight distant from the antenna mast.

In lieu of the light projecting windows in the sides of the antenna mast, I may attach strips of light reflective material which are brilliantly colored to the exterior side walls of the antenna mast in the relative positions shown in 45 and 47 and employ in cooperation therewith exterior sources of light by which light rays are directed upon the light reflective surfaces. The brilliant reflective action obtained from the reflective plates insures a complete warning to aircraft approaching the antenna mast.

It is possible to employ the window construction illustrated in Figs. 8, 9 and 10 as a light reflective means inasmuch as the exterior faces of the members 45 are shaped at 45b to provide light reflective surfaces which will become brilliant when illuminated from the exterior as well as when illuminated from the interior.

At the extremity of the mast, the upper pipe section 2 is provided with a tubular bulb 48, the lower portion of which fits over coupling member 49 which is secured in the upper end of pipe section 2. Coupling member 41 is secured in the upper end of pipe section 2 by means of laterally extending flange 50. The bulb 48 is brilliantly colored and is provided with lenses or light reflective surfaces at 51 through which light rays may be propagated in a substantially horizontal direction as represented at 52 in Fig. 7. Any desired form of reflector may be employed at the top of the pipe mast and the construction I have illustrated is not intended as limiting my invention. Suitable gaskets may be employed for rendering all joints between the bulb and plates and the pipe mast water-tight.

It will be observed that there are no power leads carried up the mast for connection to incandescent lights for illuminating the mast. This has a desired advantage in an antenna of the direct radiating type inasmuch as precision operation may be obtained without influence of capacity effects introduced between the power line and the direct radiator. I completely isolate the direct radiator from proximity to any power lines and secure thereby a construction of direct radiator which does not change in its characteristic. The pipe mast of my invention need not be climbed for the renewal of lamps or lighting devices as the lighting means provided by my invention are permanent. This enables the pipe mast to be constructed of lighter and less expensive materials which is an important advantage in the erection of a broadcast station where heretofore the lighting of an antenna of the direct radiator type has necessitated the use of self-supported types of towers with all of the expense incident thereto.

I have disclosed preferred embodiments of my invention but I realize that modifications may be made in the construction and arrangement of parts of the antenna mast and lighting means therefor and I intend no limitations upon my invention other than may be imposed by the scope of the appended claims.

What I claim as new and desire to secure by Letters Patent of the United States is as follows:

1. An antenna system comprising a direct radiator consisting of a plurality of aligned pipe members connected one to the other and maintained in a vertically erect position, light directing means carried by the aligned pipe members, and a source of light disposed beneath said aligned pipe members for projecting light rays upon said light directing means and effecting substantially uniform distribution of spectral rays about said direct radiator.

2. An antenna system comprising a direct radiator consisting of a plurality of pipe sections connected with each other and substantially isolated from all potentials other than the high frequency energy supplied thereto, means for insulatingly supporting the direct radiator from the earth, light directive elements carried by the said pipe sections, and means for directing light rays through said pipe sections and upon said light directive elements for rendering said direct radiator visible in fog or darkness without introducing power currents adjacent said radiator.

3. An antenna system comprising a direct radiator consisting of a plurality of pipe sections connected with each other and substantially isolated from all potentials other than the high frequency energy supplied thereto, means for insulatingly supporting the direct radiator from the earth, light directive elements carried by the said pipe sections, a light source disposed beneath said pipe sections for projecting light rays through said pipe sections and through said light directive elements for illuminating said antenna in fog or darkness without the introduction of lighting currents adjacent said direct radiator.

4. An antenna system comprising a direct radiator consisting of a plurality of pipe sections connected with each other and substantially isolated from all potentials other than the high frequency energy supplied thereto, means for insulatingly supporting the direct radiator from the earth, light directive elements carried by the said pipe sections, a light source disposed adjacent the base of said direct radiator for directing light rays through said pipe sections in a vertically upward direction, and means carried by said pipe sections at predetermined intervals along the length thereof and transparent to light rays for illuminating said direct radiator without the introduction of lighting currents adjacent to said pipe sections.

5. An antenna system comprising a direct radiator formed by a plurality of pipe sections connected one with the other and substantially isolated from all potentials other than the high frequency energy supplied thereto, means for insulatingly supporting the direct radiator from the earth, a light directing cap on the top pipe section of the direct radiator, light directive apertures in the side walls of certain of said pipe sections, and a light source disposed adjacent the base of said radiator for directing light rays vertically upwardly through said pipe sections and through said light directing cap and said light directive apertures in the sides of certain of said pipe sections.

6. An antenna system comprising a direct radiator consisting of a plurality of interconnected pipe sections, means for maintaining said pipe sections in a vertically erect position, means for insulatingly supporting said pipe sections from the earth, light directive members carried by cer-

tain of said pipe sections, and a light source disposed adjacent said last mentioned means for directing light rays upwardly through said pipe sections, the light rays being distributed in substantially horizontal planes radially about said direct radiator through said light directive members.

7. An antenna system comprising a direct radiator substantially isolated from all potentials other than the high frequency energy supplied thereto, means for insulatingly supporting the direct radiator from the earth in a substantially vertical position, means carried by said radiator and extending in substantially horizontal planes, light reflective means carried by said last mentioned means, and means for rendering said light reflective means luminous in planes substantially normal to the vertical axis of said direct radiator for effecting substantially uniform distribution of spectral rays about said antenna.

8. An antenna system comprising a direct radiator substantially isolated from all potentials other than the high frequency energy supplied thereto, means for insulatingly supporting the direct radiator from the earth, light reflective means carried by the direct radiator, bracket members carried by said direct radiator and extending in substantially horizontal planes, light reflective means carried by said bracket members, and means for directing light rays upon said light reflective means for rendering said direct radiator visible through fog or darkness.

9. An antenna system comprising a direct radiator substantially isolated from all potentials other than the high frequency energy supplied thereto, means for insulatingly supporting the direct radiator from the earth, light reflective means disposed adjacent the extremity of the direct radiator and symmetrically arranged on opposite sides of the direct radiator, and means for directing light rays upon said light reflective means for rendering said direct radiator visible through fog or darkness without supplying lighting potentials adjacent said direct radiator.

10. An antenna system comprising a direct radiator consisting of a plurality of interconnected pipe sections, means for insulatingly supporting the direct radiator from the earth, arms carried by said direct radiator and disposed at intervals along the length thereof, and light reflective means carried by said arms and disposed adjacent the extremity of said direct radiator, and means for directing light rays upon said light reflective means for rendering said direct radiator visible under conditions of fog or darkness.

11. An antenna system comprising a direct radiator consisting of a plurality of interconnected pipe sections, means for insulatingly supporting the direct radiator from the earth, arms carried by said direct radiator and disposed at intervals along the length thereof, and a cluster of light reflective surfaces carried by each of said arms and disposed adjacent the extremity of said direct radiator, and means for directing light rays upon said clusters of light reflective surfaces for rendering said direct radiator visible under conditions of fog or darkness.

12. An antenna system comprising a direct radiator including a plurality of interconnected pipe sections, means for supporting said pipe sections in a substantially vertical position insulated from the earth, bands of light reflective elements disposed at intervals along the length of said direct radiator, and means for directing light rays upon said bands of light reflective elements for

rendering said direct radiator visible under conditions of fog or darkness without introducing lighting currents adjacent said direct radiator.

13. An antenna system visible through fog or darkness comprising a radio frequency conductor, means for insulating said conductor from the earth, a multiplicity of light reflecting devices mounted at spaced intervals along said conductor, and an electrically energized light ray projecting device having power conductors connected therewith and mounted in a position remote from said radio frequency conductor and continuously focused on said light reflecting devices for rendering the position of said radio frequency conductor visible during fog and darkness.

14. An antenna system visible through fog and darkness comprising a vertically extending radio frequency conductor, means for insulating said conductor from the earth, a multiplicity of light reflecting devices supported at spaced intervals along said conductor and uniformly distributed around said conductor, and electrically powered light ray projecting devices having power conductors connected therewith and mounted in positions remote from said radio frequency conductor and continuously focused on said light reflecting devices for rendering the position of said radio frequency conductor visible from substantially any position within 360° about said conductor.

15. An antenna system visible through fog or darkness comprising a vertically extending radio frequency conductor, means for insulating said conductor from the earth, light reflecting devices carried by said conductor at different levels, electrically powered light ray projecting devices having power conductors connected therewith and mounted in positions remote from said radio frequency conductor and focused upon said light

reflecting devices for rendering the position of said radio frequency conductor visible and marking the different levels thereof.

16. An antenna system visible through fog or darkness comprising a vertically extending radio frequency conductor, means for insulating said conductor from the earth, a light reflecting marker device mounted adjacent the top of said conductor, said light reflecting marker device including means for substantially uniformly reflecting light over an area of substantially 360°, and an electrically energized light ray projecting means having power conductors connected therewith and mounted in a position remote from said conductor and focused on said marker device for rendering said marker device luminous from substantially all directions.

17. The method of illuminating an antenna structure without introducing power currents adjacent the antenna structure, comprising mounting light reflective devices on the antenna structure focusing remotely located light ray projectors upon the light reflective devices and energizing the projectors through power conductors remote from the antenna structure for effecting substantially uniform distribution of spectral rays about the antenna structure.

18. Means for lighting a vertical antenna characterized by having applied thereto only power of the order required for high frequency radiation, comprising means including reflectors mounted at spaced intervals along the antenna and electrically excited light projectors having power conductors connected therewith and remotely disposed with respect to the antenna and focused on said reflectors for effecting substantially uniform distribution of spectral rays about the antenna.

GEORGE B. BAIREY.