Feb. 4, 1941. M. F. PETERS ET AL 2,230,261

RADIO SHIELDING

Filed March 16, 1938 2 Sheets-Sheet 1

FIG. 1

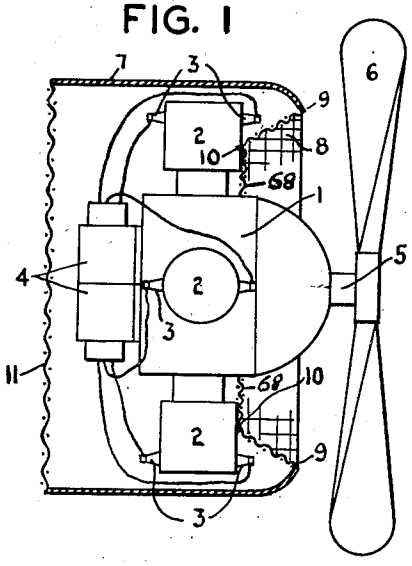


FIG. 2

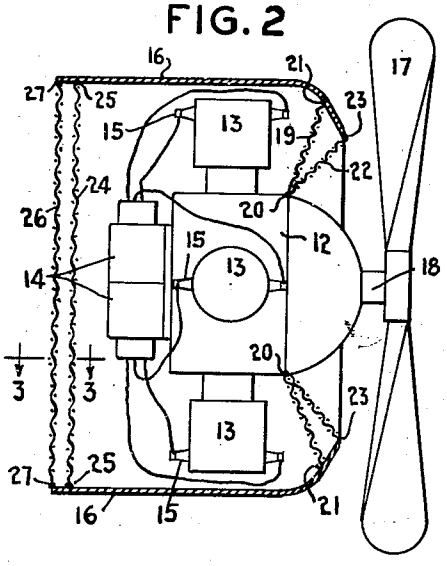


FIG. 5

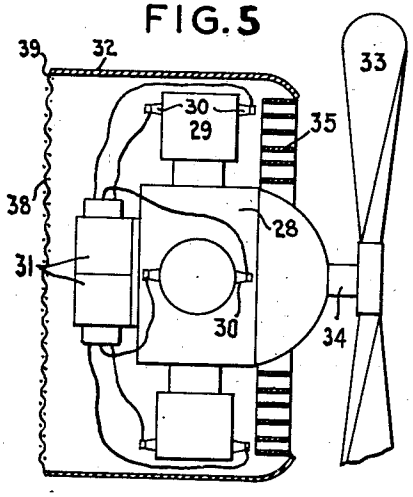


FIG. 6

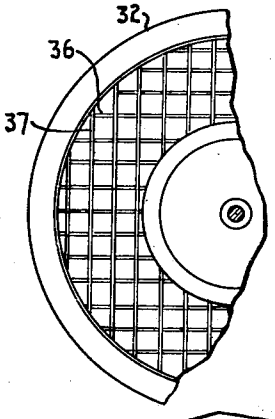


FIG. 3

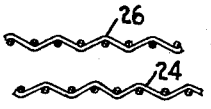


FIG. 4

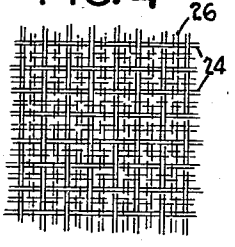


FIG. 7

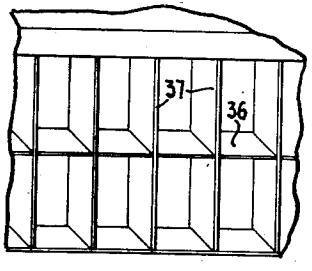
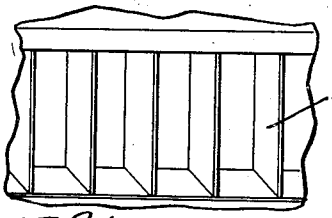


FIG. 10



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Feb. 4, 1941. M. F. PETERS ET AL 2,230,261

RADIO SHIELDING

Filed March 16, 1938 2 Sheets-Sheet 2

FIG. 11

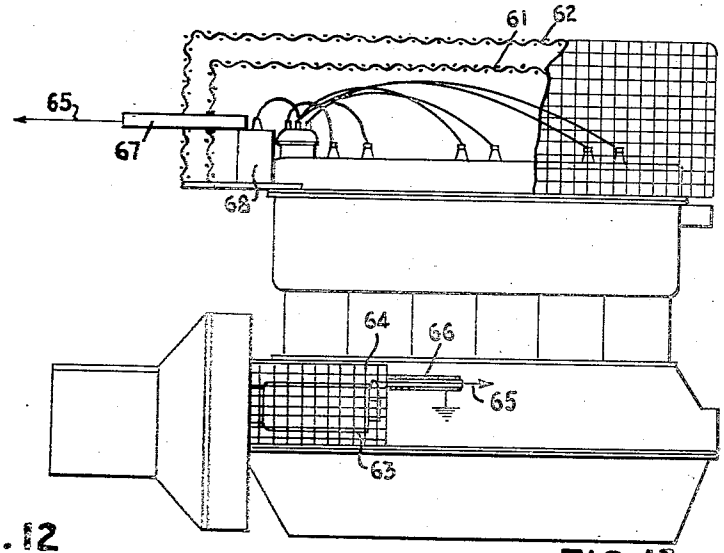


FIG. 14



FIG. 12

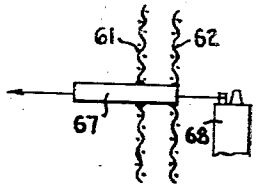


FIG. 13

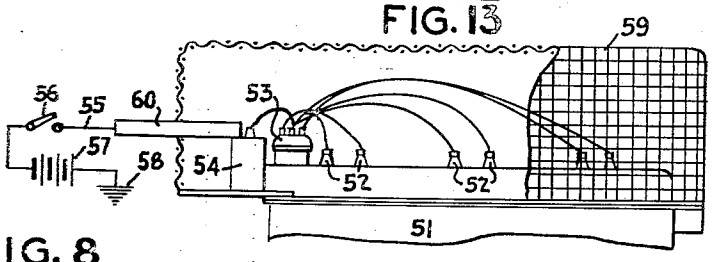
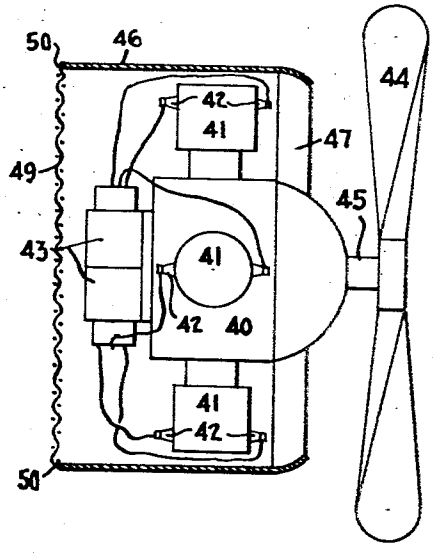
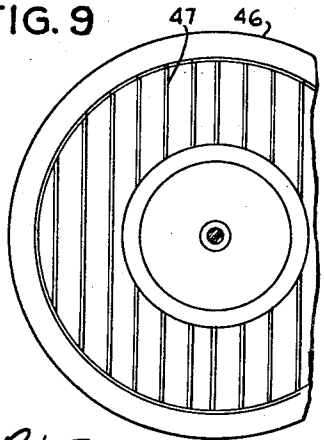


FIG. 8



48

FIG. 9



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UNITED STATES PATENT OFFICE

2,230,261

RADIO SHIELDING

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Application March 16, 1938, Serial No. 196,284

15 Claims. (Cl. 123—148)

This invention relates to the provision of means for shielding apparatus from which radio waves might emanate to possibly interfere with the operation of radio communication apparatus, such that radio waves from the first-mentioned apparatus may be prevented from such interference to any deleterious or undesired extent.

Such interference is particularly liable to occur in aeroplanes where the operation of the ignition system or systems of the internal combustion engine or engines ordinarily interferes to a serious extent with the radio communication apparatus on the plane especially as from the circumstances of the case the engine and the radio communication apparatus must be in relatively close proximity.

The main object of the invention is to provide improved radio shielding means which shall be simple in construction and efficient in operation.

In providing radio shielding heretofore the shielded parts have been so enclosed as to seriously interfere with the dissipation of heat from the parts and it has been a matter of extreme concern to avoid over-heating of the parts.

It is an object of this invention to provide improved radio shielding means which shall permit ready dissipation of heat from the shielded parts whereby danger of over-heating is easily avoided.

In connection with the radio shielding of internal combustion engines it has been customary to shield the conductor, magnetos and spark plugs of the ignition system by placing shielding conduits about the conductors and shielding housings about the magnetos and spark plugs. If the engine, including the ignition system, is enclosed within the shield, the desired radio shielding may be accomplished but the necessary ventilation, to keep down the heat of the engine parts, will be interfered with.

It is a further object of the invention to provide a radio shield about some or all of the engine parts while permitting ventilation of the parts.

The engine of an aeroplane is usually surrounded by a metal "cowling" through which the air is forced rearwardly about the engine, cooling it, by the forwardly located propeller for the aeroplane.

It is a further object of this invention to utilize the "cowling" as a part of the radio shield about the engine, and it is a further object to complete the shield without unduly interfering with the flow of air impelled backwardly by the propeller through the "cowling" and about the engine parts.

It is a further object of the invention, in accomplishing some or all of the foregoing objects, to make at least a part of the radio shield foraminous, and by foraminous is meant having a collection of openings whereby air is permitted to pass while the radio waves are interrupted whether the foraminous part is a meshed screen, formed of wires or slats, or is formed by slots or wires (without cross slats or wires) with openings between them.

A further object of the invention, if one foraminous part of a shield shall not provide the desired interception of radio waves, is to provide a plurality of such parts, one outside the other whereby the desired shielding will be secured.

A further object of the invention is to effect the desired radio shielding by placing a shield about certain of the parts and employing an electric current filter or filters for preventing unduly disturbing currents from passing outside the shield.

A further object of the invention is to so position the slats or wires in the foraminated part of the radio shield with relation to the radio communication apparatus that interference with the communication apparatus may be reduced or prevented.

A further object of the invention is to provide the desired radio shielding without increasing the electrical capacity of the shielded parts to an extent as was the case in former radio shielding. In radio shielding an ignition system for an internal combustion engine, the parts were customarily surrounded by metal shields in close association with the shielded parts, whereby the electrical capacity was very considerably increased. Such increase in capacity caused less efficient operation and required a larger power output (and so larger and heavier apparatus) of the source of ignition current and other parts. The present invention provides means for accomplishing the desired radio shielding without the necessity of closely associating the shield with the electrical parts shielded whereby the electrical capacity is reduced from what it formerly was with corresponding advantages as indicated.

Other and ancillary objects of the invention will appear hereinafter.

In the accompanying drawings which illustrate the invention:

Fig. 1 is a side elevation, partly in longitudinal section, of a radial internal combustion engine

such as is ordinarily used on aeroplanes equipped with the improved radio shielding means;

Fig. 2 is a similar view of a radial internal combustion engine with a modified form of radio shielding means;

Fig. 3 is a sectional view on the line 3—3 of Fig. 2, partly broken away, showing the relation of the meshes of a shield comprising a double screen;

Fig. 4 is a front elevation of the screen as shown in Fig. 3;

Fig. 5 is a side elevation, partly in longitudinal section, of a radial internal combustion engine to which a still further modified form of radio shield is applied;

Fig. 6 is a side elevation, partly broken away, of the apparatus of Fig. 5, with the propeller removed, the apparatus of Fig. 5 being viewed from the right hand side;

Fig. 7 is a perspective view of the form of screen as used in Fig. 6;

Fig. 8 is a side elevation, partly in longitudinal section, of a radial internal combustion engine, having a further form of radio shield together with an antennae for a radio receiving set;

Fig. 9 is an elevation, partly broken away, of the shielded engine of Fig. 8, viewed from the right hand side of Fig. 8, with the propeller removed;

Fig. 10 is a perspective view of the form of radio shield at the front of the engine as shown in Figs. 8 and 9;

Fig. 11 is a side elevation, partly in section, of an internal combustion engine having a number of cylinders in one or more straight lines and equipped with a radio shield in accordance with the present invention;

Fig. 12 is a fragmentary view showing a modified manner of relating the current filter of Fig. 11 to the radio shielding screens;

Fig. 13 is a view similar to Fig. 11, but showing the radio shield about the spark plugs as consisting of a single screen; and

Fig. 14 is a cross section, on an enlarged scale of a modified form of slat.

Referring to the drawings and first to Fig. 1, the radial aeroplane engine shown therein comprises the crank case 1 having the cylinders 2 extending radially therefrom. The cylinders are provided in the usual way with sparks plugs 3 which are supplied with ignition current from the magnetos 4. The engine shaft 5 has the propeller 6 fixed thereon and circumferentially surrounding the engine is the metal cowling 7. In the usual operation of the aeroplane the air thrown backward by the propeller passes through the cowling and about the engine thereby cooling the parts. To still permit this current of air through the cowling and about the engine meshed, metal, wire screen 8 is secured to the forward edge of the cowling at 9 and has its rear edge 10 secured to the engine. This screen extends entirely across the space between the cowling and the engine at all points about the engine and cowling. Also a metal wire mesh screen 68 extends from the edge 10 of the screen 8 to the engine crank case 1 entirely about the circumference and is in good and firm electrical connection with the screen 8 and the crank case 1. To permit the air to pass backwardly through the cowling there is a similar metal wire mesh screen 11 secured at its edges to the cowling 7 and extending across the entire space between the walls of the cowling. The meshed screen 8 should have a thoroughly grounded connection with the cowling at 9 and also with the metal of the engine cylinders at 10. Also the edge of the screen 11 should have a thoroughly good grounded electrical connection with the cowling 7.

The ignition system of the engine is entirely radio shielded because housed in a completely enclosing housing comprising the metal, such as for instance the cowling and metal engine parts and the metal screens referred to. As is well known the sheet metal and engine parts, without openings, will operate as a radio shield, and it has been discovered that radio shielding may be accomplished by meshed screens as described while permitting the ventilation of the engine parts as also referred to. The size of the screen mesh will depend upon the location of the screen with relation to the parts to be shielded. This can be readily ascertained by a few trials with screens of different sized meshes in any given location, the efficiency of the screen being tested by well known instruments in well known ways to ascertain the presence of undesirable radiations outside the screen. While, as stated, the size of the screen meshes will vary according to conditions, good shielding has been obtained under different conditions with screens having a width of mesh of from one-twentieth to one-quarter of the distance of the screen from the antenna, that is the part from which the radio emanations are to be intercepted.

It may be that the meshes of a single foraminous radio screen may be too large to intercept the radio emanations to the desired degree. Such large size of the meshes may be caused by the requirements for ventilation or for other reasons. Under such circumstances the desired radio shielding may be accomplished by placing a plurality of foraminous screens one outside the others and preferably spaced apart. Thus in Fig. 2 the aeroplane engine which, like that of Fig. 1, has the crank case 12, the radial cylinders 13, the magnetos 14 and the spark plugs 15, which engine is surrounded by the sheet metal cowling 16. The engine has the propeller 17 fixed upon the engine shaft 18 forwardly of the engine. The radio shielding in Fig. 2, like in Fig. 1, is accomplishing by enclosing the ignition system of the engine with the cowling and meshed metal wire screens at the forward (toward the propeller) portion of the cowling, and a similar screen rearwardly of the engine.

In the case of the apparatus of Fig. 2, however, the desired radio shielding may not be accomplished by a single foraminous screen and therefore a plurality of screens, one outside the other and spaced apart, is shown at the forward end of the cowling and also rearwardly of the engine. Thus referring to Fig. 2, there is at the forward portion of the cowling a meshed metal wire screen 19 which surrounds the crank case, and at its inner edge is in firm and good electrical connection with the crank case at 20, and its outer edge is in firm and good electrical connection with the metal cowling 16 at 21.

Outside of this screen 19 is another metal wire meshed screen 22 also extending about the crank case and its outer edge is in firm and good electrical connection with the cowling at 23, while its inner edge is in good and firm electrical connection with the crank case at 20. Each of the screens 19 and 22 extends across the entire space from the crank case to the cowling

at all points about the circumference of the cowling and the crank case.

At the rear of the engine is placed a metal wire meshed screen 24 which extends entirely across the space between the walls of the cowling at all points and has a firm and good electrical connection with the cowling at its circumferential edge 25.

In order to procure a greater interception of the radio waves a metal wire meshed screen 26 is spaced from and placed outside of the screen 24, which also extends across the space between the walls of the cowling at all points and is secured in good and firm electrical connection with the cowling at its circumferential edge 27.

It will now be seen that the engine ignition is entirely enclosed within a radio shield comprising the metal parts of the engine, the cowling and the metal wire meshed screens at the front and rear of the engine. It will further be seen that if, for any reason, either of the screens 19 or 22 is of such large mesh as to not in itself provide sufficient radio shielding, the presence of the other screen increases the radio shielding to the desired extent. If two screens, one outside the other, should not be sufficient, any desired number of screens might be placed one outside the other until the desired radio shielding effect was secured. Also with regard to the rearward meshed screens 24 and 26, they supplement each other in suppressing the undesired radio waves so that if for any reason one of the screens should be insufficient to constitute a radio shield to the desired extent, the other screen may furnish sufficient additional shielding. In some instances where desirable a greater number than two screens might be provided, one outside the other.

The construction and relationship of the screens 24 and 26 is shown in the fragmentary views of Fig. 3 and Fig. 4, it being observed (see particularly Fig. 4) that the meshes in the two screens are staggered with relation to each other, although this is not absolutely necessary.

Referring now to Figs. 5, 6 and 7, the aeroplane engine similar to that of Figs. 1 and 2 has the crank case 28 from which project radial cylinders 29 having the usual spark plugs 30 supplied with current by the magnetos 31, such engine having the usual metal cowling 32 enclosing the engine circumferentially. The propeller 33 is fixed upon the engine shaft 34.

In order to complete the radio shield about the engine ignition there is placed at the forward end of the cowling a metal foraminous screen 35 which, instead of being formed by wires as in the screens of Figs. 1 and 2, is formed by sets of flat slats 36 and 37 crossing each other to form openings surrounded by the flat slats, the greater dimension of the cross section of each of the slats extending in a forward and back direction substantially in line with the direction of the backward flowing air from the propeller. By thus elongating the mesh forming members by providing slats instead of wires, with the elongated dimensions of the cross section of the slats extending in a forward and back direction as described, the air resistance presented by the foraminated screen is greatly reduced. The outer edge of the foraminous screen 35 is in firm and good electrical connection about its entire circumference with the cowling 32, and at its inner circumference is secured in good and firm electrical connection with the crank case of the engine, the screen extending across the entire space between the crank case and the cowling at all points circumferentially of the cowling and the crank case.

Rearwardly of the engine the radio shield may be completed by means of the wire meshed screen 38 which extends entirely across the space between the walls of the cowling and is securd in good electrical connection with the cowling at 39 at its circumferential edge. In place of the wire formed foraminous screen 38, this screen could also be formed by slats the same as the screen 35 with the greater dimension of cross section of the slats extending forwardly and rearwardly as explained.

By providing the screen with the slats extending at right angles to each other as described, the screen will operate efficiently as a radio shield whatever may be the relationship of the antenna of the radio communication system to the position of the slats.

It has been found, however, that a suitable radio shield may be provided if a series of substantially parallel members as slats (without cross members) is employed which are substantially parallel to the antenna of the radio communication system which is to be shielded against interference.

Thus referring to Figs. 8, 9 and 10, the aeroplane engine, comprising the crank case 40 from which radially extend the cylinders 41 having the usual spark plugs 42 supplied with current by the magnetos 43, the propeller 44 being mounted upon the engine shaft 45, the engine being substantially the same as that of Figs. 1, 2 and 5, is circumferentially surrounded by the metal cowling 46 and the space between the cowling and the crank case of the engine is occupied by the spaced flat metal slats 47 which are each in good electrical connection with the cowling and with the crank case. It will be seen that these slats have their longer cross sectional dimension extending from front to rear as already referred to as reducing the air resistance, and these flat slats 47 are substantially parallel to each other and substantially parallel to the antenna 48 of a radio communication system.

It will be seen that there are no members crossing the slats 47 but on account of the fact that these slats are substantially parallel to the antenna 48, an efficient and satisfactory shielding is obtained.

Rearwardly of the engine is a metal wire meshed screen 49 extending entirely across the space between the walls of the cowling and having good electrical connection about its circumference with the cowling at 50. In place of the radio screen 49 at the rear of the engine a set of parallel slats like 47 parallel with the antenna might be substituted to form the radio shield at the rear as well as at the front of the engine.

The slats forming the slatted screens of Figs. 5 to 10, instead of being rectangular in cross section as in those figures, may each have a different shape of cross section calculated to reduce the air resistance or for other purposes, as for instance the slat cross section may be of a shape as shown in Fig. 14, the forward end (at right in Fig. 14) being broader and the section tapering rearwardly to a much narrower width at the rear end (left in Fig. 14) this construction of slat gives a very low air resistance.

In Fig. 13 is shown a manner of application of the foraminous screen as completing a radio shield about the ignition of an engine having

one or more straight rows of engine cylinders as is the practice in connection with automobiles. In the figure referred to the cylinders in the engine block 51 have the usual spark plugs 52 supplied with current through the distributor 53 and the usual spark coil 54 supplied with current through the conductor 55 in which is the dash board switch 56. The source of ignition current is the battery 57 having one terminal connected with the switch 56 and the other terminal connected with ground at 58.

In order to confine the unwanted radio waves set up by the ignition system, in other words to effect the desired radio shielding, a metal wire meshed screen 59 entirely covers the top of the engine block including the spark plugs, distributor and spark coil as before referred to, the edges of the screen 59 being secured in good electrical connection to the engine block.

In order to prevent the passage of disturbing variations of current outside the screen 59, a current filter 60 is provided, such filter may be as described in our application Serial No. 168,810, filed October 13, 1937, the exterior of such filter being mounted on the engine block by being secured in good and firm electrical connection with the screen 59.

It will now be seen that any radio disturbance by the ignition system of the engine will be shielded against by reason of the fact that the ignition subject to disturbing variations is entirely enclosed in a radio shield, such radio shield being the metal of the engine block and the meshed screen 59, any disturbing variations of current in the ignition circuit being prevented from passing outside by means of the filter. If the engine is sufficiently cooled as by a sufficient water jacket, so that ventilation through the screen 59 is not required, an imperforate sheet metal radio shield may be used in place of the screen 59, the filter 60 preventing the passage of disturbing variations to the outside of the shield.

In Fig. 11 is shown an arrangement similar to Fig. 13 for shielding the engine ignition except that instead of one meshed screen enclosing the ignition there are two meshed screens 61 and 62, one outside of the other and spaced from each other to provide satisfactory radio shielding in case the meshes of one screen should be so large for permitting the desired ventilation or for other reasons, as not to completely effect the desired radio shielding. The meshes of these two screens 61 and 62 are to be staggered with relation to each other as shown in Fig. 4, for the most efficient operation, and both of these screens 61 and 62 should be well grounded by securing their edges in firm and good electrical connection with the engine block. The current for the ignition system may be supplied by the usual engine driven generator 63 which is enclosed so as to be radio shielded by the metal wire meshed screen 64. Current is supplied from the generator by a conductor 65 passing through a current filter 66 as it passes out from the shield 64 and through a filter 67 as it passes into the spark coil 68 through the shields 61 and 62. These filters may be of the construction as shown in our prior application above referred to, the exterior of the filter being grounded on the engine block by having it in good and firm electrical connection with the metal screen 61.

It will thus be seen that an efficient shield is provided about the spark coil, distributor and spark plugs of the engine and that any current variations are prevented from passing outside the shield by means of the filter 67, also that the generator 63 is completely radio shielded and that any disturbing variations in current are prevented from passing outside of the screen 64 by the filter 66, the exterior of which is well grounded by good electrical connection with the engine body or crank case.

In Fig. 12 is shown a modification wherein the filter 67 is grounded on the engine block by having its exterior in good electrical connection with both the screens 61 and 62.

It will be understood that in the foregoing the metal wires or slats employed in the shielding devices may be of metal, as for instance steel, which metal may be suitably protected from deterioration by galvanizing or by covering with copper or in other ways.

While the invention has been illustrated in what are considered its best applications it may have other embodiments without departing from its spirit and is not, therefore, limited to the structures shown in the drawings.

What we claim is:

1. A radio shield comprising at least in part a foraminous screen comprising slats crossing each other, each of said slats being of a cross section having its longitudinal dimension greater than its lateral dimension.

2. A radio shield comprising at least in part a foraminous screen comprising slats crossing each other, each of said slats being of a rectangular cross section and having its longitudinal dimension greater than its lateral dimension.

3. The combination with a vehicle, of propelling means therefor including an internal combustion engine comprising an ignition, and a radio shield for said ignition comprising a foraminous screen including crossed slats, each of said slats having a cross section of a dimension greater in the line of direction of movement of said vehicle than laterally thereto.

4. A radio shield comprising at least in part a foraminous screen comprising slats, each of said slats being of a cross section having its longitudinal dimension greater than its lateral dimension.

5. A radio shield comprising at least in part a foraminous screen comprising slats, each of said slats being of a rectangular cross section having its longitudinal dimension greater than its lateral dimension.

6. The combination with a vehicle, of propelling means therefor including an internal combustion engine comprising an ignition, and a radio shield for said ignition comprising a foraminous screen including slats, each of said slats having a cross section of a dimension greater in the line of direction of movement of said vehicle than laterally thereto.

7. The combination with a vehicle, of propelling means therefor including an internal combustion engine comprising an ignition, and a radio shield for said ignition comprising a foraminous screen including slats, each of said slats having a cross section of greater width forwardly than rearwardly in relation to the direction of movement of the vehicle.

8. The combination with an internal combustion engine having an ignition, of metal cowling about said engine and a radio shield for said ignition comprising a foraminous screen cooperating with said cowling in the formation of said radio shield.

9. The combination with a vehicle, of propel-

ling means therefor comprising an internal combustion engine having an ignition, of metal cowling about said engine and a radio shield for the ignition comprising a foraminous screen forwardly of said engine with relation to the direction of movement of said vehicle, and another foraminous screen rearwardly of said engine with relation to the direction of movement of said vehicle, said foraminous screens cooperating with the said cowling in the formation of the said shield.

10. The combination with an internal combustion engine having ignition means mounted upon it, of a foraminous screen cooperating with the metal of the engine for forming a radio shield about said ignition means.

11. The combination with an internal combustion engine having ignition means, of a radio shield for said ignition means comprising at least in part a foraminous screen, there being space between said engine and said screen in which ventilating currents for said engine may circulate.

12. The combination with an internal combustion engine having ignition means, of a radio shield enclosing said engine, including said ignition means, and comprising at least in part a foraminous screen.

13. The combination with an internal combustion engine, of an ignition system therefor comprising spark plugs and a source of ignition current and a radio shield for said ignition system comprising at least in part a foraminous screen.

14. The combination with an internal combustion engine having ignition means, of a radio shield for said ignition means comprising at least in part a foraminous screen there being spaces within said screen and about parts of the engine wherein ventilating currents for said engine may circulate.

15. The combination with an internal combustion engine having ignition means, of a radio shield for said ignition means comprising at least in part a foraminous screen there being space between said ignition means and said screen.

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