

April 19, 1966

I. D. ROHN ETAL

3,247,516

MICROWAVE REFLECTOR

Filed Aug. 27, 1963

4 Sheets-Sheet 1

Fig. 1

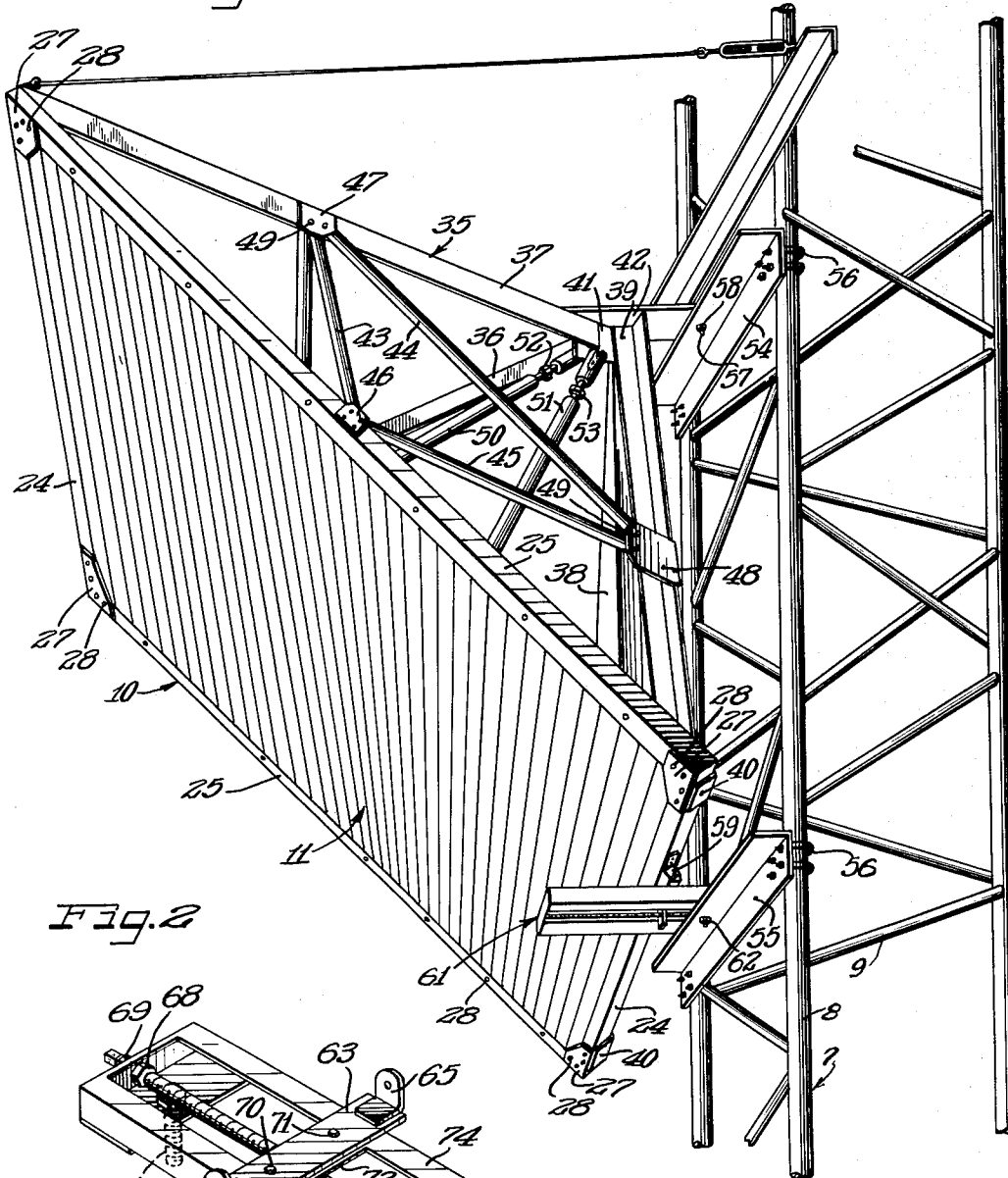
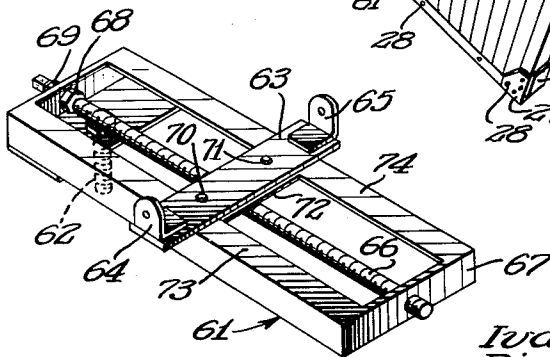


Fig. 2



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4 Sheets-Sheet 2

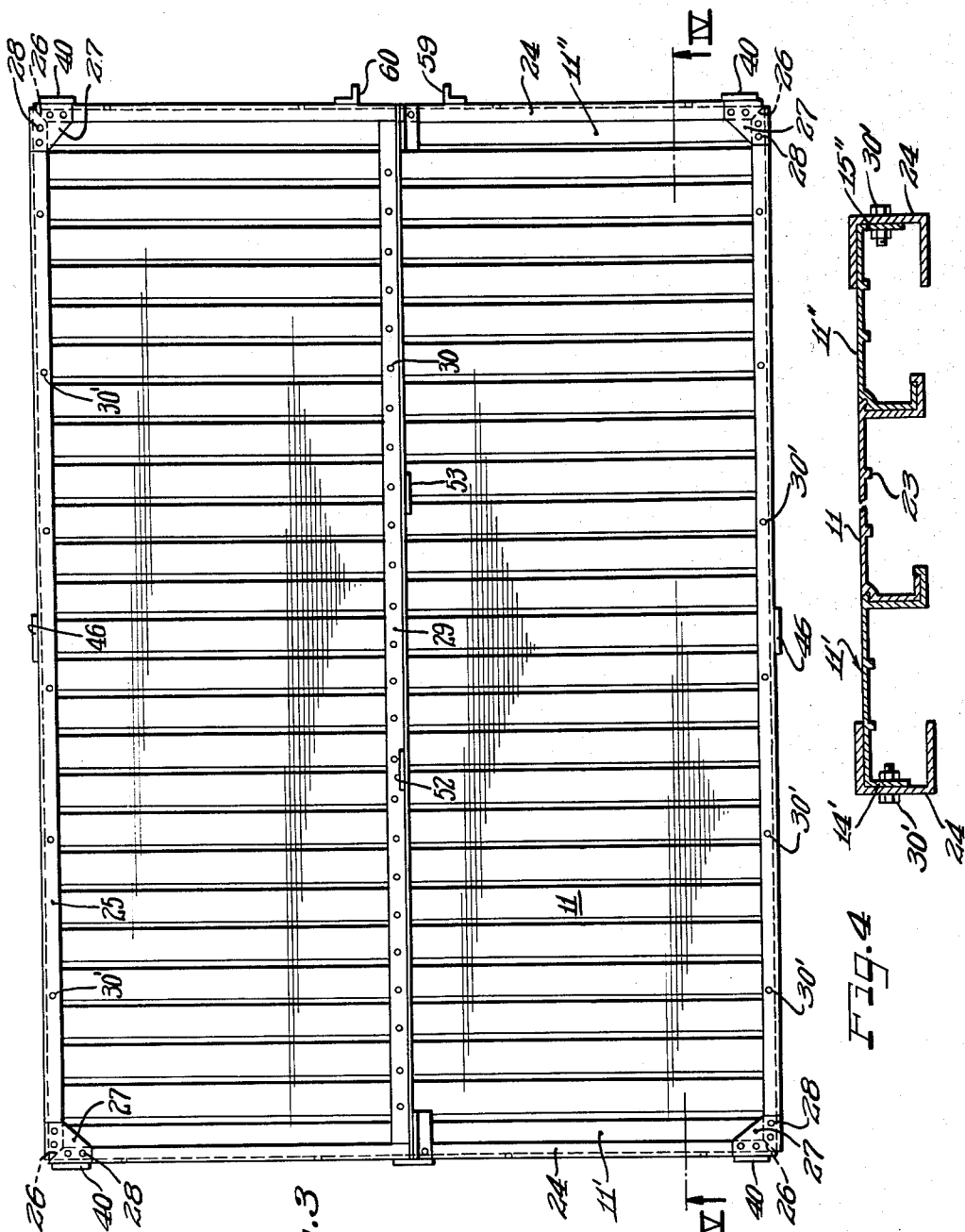


Fig. 3
Fig. 4
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Fig. 5

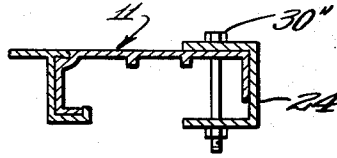


Fig. 6

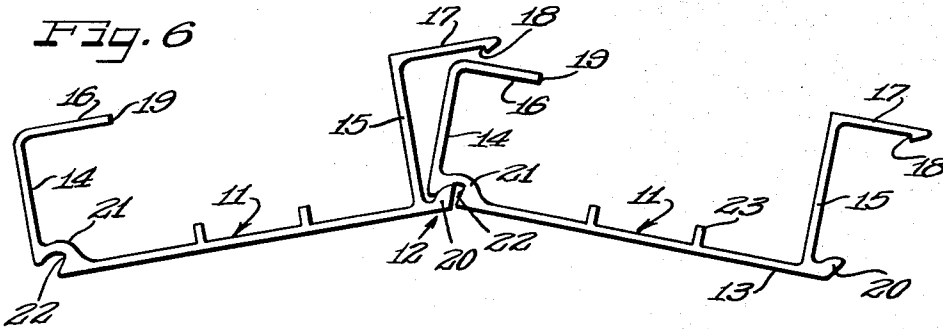


Fig. 7

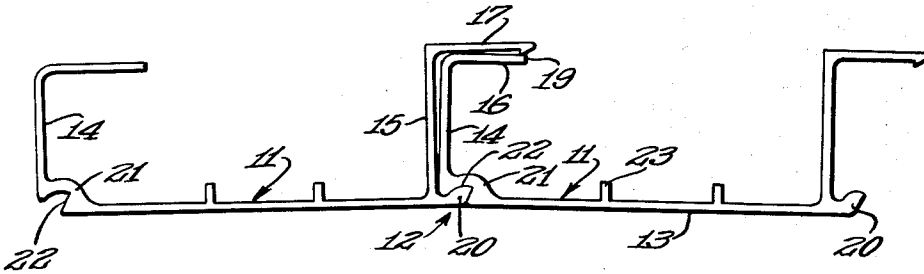
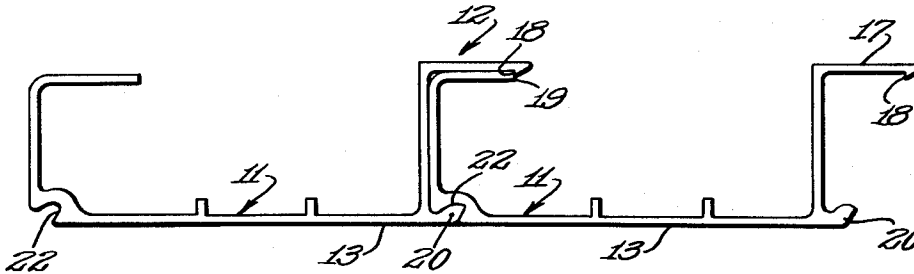


Fig. 8



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Fig. 9

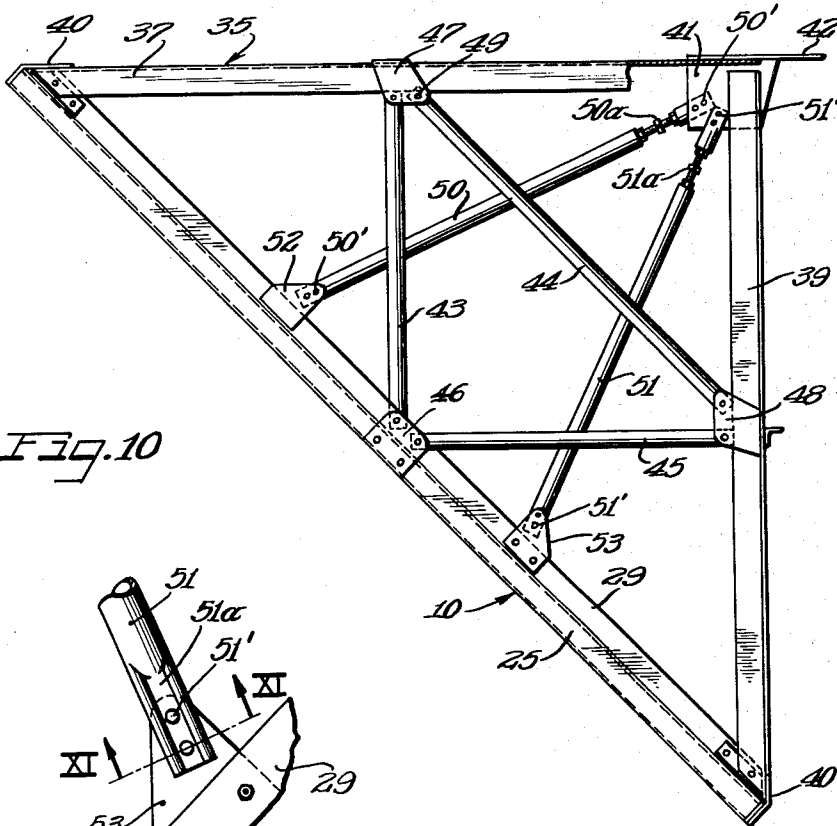


Fig. 10

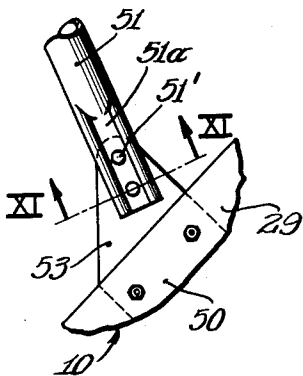
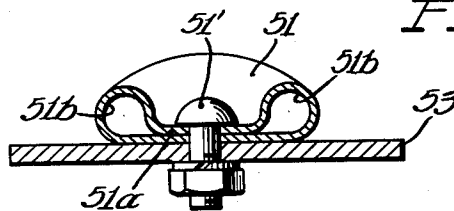


Fig. 11



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3,247,516

MICROWAVE REFLECTOR

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Filed Aug. 27, 1963, Ser. No. 304,800

8 Claims. (Cl. 343—890)

The present invention relates generally to a microwave reflector and method of manufacture. This invention is more particularly concerned with a new and improved type of reflector which can be manufactured from a series of light-weight metal extrusions. Our new reflector can be shipped in knock-down form, and can be more economically assembled and installed with a minimum of effort.

In the past, various types of microwave reflectors have been used. These reflectors have been of different sizes such as 6' x 8', 8' x 12' and 10' x 15'. These reflectors were fabricated of one solid piece and have been packed in large crates and frequently shipped on railroad cars. These prior types of reflectors have been frequently damaged in shipping and have been difficult to handle because of the bulky nature of the large crates carrying such reflectors.

According to the present invention, we have developed a new and improved microwave reflector comprised of a series of strip-type panels which can be shipped in knock-down form and quickly and conveniently snapped together at the places of installation. Excellent results have been obtained where the strip-type panels are formed as extrusions having means for permitting the extrusions to be snapped together in locked assembly. Where the reflector is formed from a series of our extrusions, we have found that the reflector has a number of superior characteristics. This reflector has a reflection face which is free of rivet and bolt heads. The reflection face is flatter than prior types of microwave reflectors. By forming the reflector from interlocking extrusions, the reflector is of a more rigid construction which insures longer life and decreases maintenance cost. Still another important advantage of our knock-down type reflector is that the consumer cost is substantially reduced as the reflector can be shipped in knock-down form at a substantially reduced freight cost.

In view of the foregoing, an important object of this invention is to provide a new and improved microwave reflector having superior microwave reflecting characteristics over prior types of reflectors.

Yet another important object of this invention is to provide a new and improved microwave reflector which can be economically shipped, installed, and maintained as compared to prior types of reflectors.

Another object of this invention is to provide a new and improved method for installing a microwave reflector.

According to other features of this invention, the microwave reflector is comprised of a series of extruded channel-shaped panels of essentially identical cross-sectional configuration which panels have means disposed adjacent from faces in a common plane. These panels also have means at outer ends of panel legs permitting the panels to be snapped into assembly in side-by-side relation. The panels are further provided with means for securing them

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to prevent longitudinal movement of the panels relative to one another.

Other objects and features of this invention will more fully become apparent in view of the following detailed description taken in conjunction with the accompanying drawings illustrating therein several embodiments and in which:

FIGURE 1 is a fragmentary perspective view of a tower having our new microwave reflector thereon;

FIGURE 2 is a detailed perspective view of a vernier adjustment mechanism;

FIGURE 3 is an enlarged rear view of the microwave reflector;

FIGURE 4 is a fragmentary cross-sectional view taken substantially on the line IV—IV looking in the direction indicated by the arrows as seen in FIGURE 3;

FIGURE 5 is an enlarged fragmentary view similar to FIGURE 4 only illustrating a modified type of reflector;

FIGURES 6, 7, and 8 are enlarged end views of a pair of reflector panels illustrating the manner of assembly;

FIGURE 9 is an enlarged side view of the reflector;

FIGURE 10 is an enlarged detailed view of a portion of the structure of FIGURE 9; and

FIGURE 11 is an enlarged cross-sectional view taken substantially on the line XI—XI looking in the direction indicated by the arrows as seen in FIGURE 10.

As shown on the drawings:

The reference numeral 7 indicates a vertical-type tower having a series of vertical tower legs 8 which may be braced in any suitable manner by brace straps 9. According to this invention, we have provided a new type of microwave reflector 10 that is adapted to be mounted on the tower 7 or any suitable supporting structure. The reflector is comprised of a series of strip type intermediate panels 11 and end panels 11' and 11'' (FIGURE 4). These panels are preferably formed as extrusions from a light weight metal such as aluminum and are each of a channel-shaped configuration. Excellent results may be obtained by forming each of the panels so as to have a width no longer than 6 inches and a length of 8 or 12 or 15 feet, depending upon the required size of the reflector.

The panels 11, 11', and 11'' are formed with means permitting the panels to be snapped into assembly together in side-by-side relation as indicated at 12 in FIGURES 6-8. To this end, the channels each include a face or face portion 13 having shorter and longer end channel legs 14 and 15 at opposite ends of the face portion 13. These legs extend rearwardly generally at right angular relation with respect to the face portion 13. At the inner ends of the legs 14 and 15, the legs are provided with shorter and longer deflectable terminal snap-lock legs 16 and 17. The legs 16 and 17 are disposed in right angular relation with respect to the legs 14 and 15 and in generally parallel relation with respect to the face portion 13. The shorter deflectable leg 16 is formed on the inner end of the shorter end channel leg 14 while the longer deflectable leg 17 is formed on the longer end channel leg 15. The legs 16 and 17 extend away from the channel legs 14 and 15 in the same general direction so that when the panels 11 are joined together, the channel legs 14 and 15 are disposed in side-by-side relation while the terminal legs 16 and 17 are also dis-

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posed in side-by-side relation with the shorter leg 16 underlying the longer leg 17.

The means 12 includes a retaining or locking shoulder 18 on the longer leg 17 and a retaining or locking shoulder 19 on the shorter leg 16. When the channels are engaged in assembly together, the shoulders 18 and 19 are engaged in confronting relation. In order to maintain the shoulders 18 and 19 in locked engagement for locking the panels 11 together, each panel has a hook or hook-shaped pivot leg 20. The pivot leg 20 is disposed generally in the plane of the front face 13 and in generally parallel relation with respect to the longer deflectable terminal leg 17. The pivot leg extends away from the longer channel leg 15 in the same direction as the terminal leg 17 and is also disposed in generally right angular relation with respect to the channel leg 15. The opposite end of the panel 11 is formed with a thickened metal mass 21 at the juncture between the face portion 13 and the shorter channel leg 14. A pivot groove 22 is provided in the thickened metal mass 21 which is preferably of a configuration corresponding to the shape of the portion of the pivot leg 20 to be nestingly engaged in the pivot groove. As illustrated, the pivot groove 22 is of a hook-shaped configuration. After the panels 11 have been formed to shape, they may be joined together by engaging the hook-shaped pivot leg 20 in the pivot groove 22 as shown in FIGURE 6. The end channel legs 14 and 15 are then pushed together until the shorter end channel legs 14 and 16 are brought into engagement with the longer channel legs 15 and 17 whereupon the locking shoulder 19 is caused to be snapped over and behind the retaining or locking shoulder 18 on the longer leg 17. As the legs 14 and 15 are brought together, the panels being joined are pivoted at the area of the hook-shaped leg 20 and the groove 22.

The locking shoulders 18 and 19 may be brought into engagement by the application of manual force to the opposite ends of the panels 11 being joined. With some types of panels 11, such as where the panels have a relatively long length, channel-lock pliers (not shown) or any other suitable tool may be employed for pressing the legs 14 and 15 into engagement together. Where pliers are used, wood blocks are preferably disposed on opposite sides of the legs 14 and 15 so that the legs 14 and 15 may be pressed together without damaging the panels. After the shoulders 18 and 19 have been engaged in locked relation, it will be appreciated that the hook-shaped leg and the groove 22 cooperate with the interengaged shoulders 18 and 19 in securing the adjacent contiguous panels together. The panels may be disengaged from one another by sliding them lengthwise in opposite directions with respect to one another until the hook-shaped leg 20 is disengaged from the groove 22 and the shoulder 19 is disengaged from the shoulder 18. In order to reinforce the panels 11 and to insure that the panels will afford a flat reflective face when assembled, the underside of the face portion 13 is provided with reinforcing ribs 23 which extend the length of the panels 11.

The end panels 11' and 11'' differ from the intermediate panels 11 so that portions of the channel legs and terminal legs are omitted. With respect to the end panel 11', the panel only has a relatively short channel leg 14' and is not provided with any terminal leg. This panel 11' is otherwise the same as the panel 11. The other end panel 11'' has a shortened channel leg 15'' and the terminal leg is entirely omitted. Means is provided for securing the panels 11, 11' and 11'' against endwise longitudinal movement with respect to one another. This means includes a pair of end frame members or channels 24, 24 and a pair of side frame members or channels 25, 25 as shown in FIGURES 3 and 4. The frame members or channels 24 and 25 are disposed in engagement about the four sides of the interengaged panels 11, 11' and 11'' and mitered corner joints 26 are

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disposed at the juncture of the frame members. Corner plates 27 are mounted on opposite sides of the reflector 10 over the corner joints 26 and connecting fasteners or bolts and nuts are provided to attach the panels 11, 11' and 11'' with the associated frame members 24 and 25 and with the associated corner plates 27. The panels 11, 11' and 11'' may extend transversely or longitudinally of the reflector 10, as desired. In order to further reinforce the reflector 10, an intermediate angular frame brace 29 is mounted at the rear side of the reflector 10 and secured by fasteners 30, which may comprise bolts and nuts, to the respective panels. The fasteners may be engaged with the terminal legs 16 and 17.

A series of fasteners 30' which may comprise nuts and bolts is provided for securing the end channels 24, 24 with legs 14' and 15'' of the end panels 11' and 11''. Either of the fasteners 30' are provided to secure the side channels 25, 25 with opposite ends of the panels 11.

Mounted at the rear side of the reflector 10 is a cone-shaped reinforcing structure 35. This reinforcing structure not only serves to brace the panels 11, 11' and 11'', but also is adapted to coact with the tower in the suspension of the reflector from the tower as will be described in further detail hereafter. The structure 35 includes four reinforcing angular braces 36-39, inclusive. These braces extend from the four corners of the reflector 10 and are secured with the four corners of the reflector 10 by means of attachment straps 40. The opposite ends of the braces 36-39 are joined at the apex of the cone-shaped reinforcing structure with plates 41 and 42 which comprise a one piece T-shaped structure. The braces may be bolted or otherwise suitably secured with the plates 41 and 42. In order to reinforce the braces 36-39, sets of tubular truss straps 43, 44 and 45 are provided on opposite sides of the structure 35 with one set of straps reinforcing the braces 37 and 39 and the other set of straps reinforcing the other set of braces 36 and 38. Each set of straps is joined with the reflector 10 and with associated braces by means of truss strap brackets 46, 47 and 48 and by means of fasteners 49 such as bolts and nuts. The straps have flat ends, according to other features of this invention, which are hereafter described in further detail.

In order to further reinforce the reflector 10, a pair of adjustment tubular arm assemblies 50 and 51 are joined with attachment plates 52 and 53 on the intermediate frame brace 29 by suitable fasteners 50' and 51' as are illustrated in FIGURE 9. Opposite ends of the adjustment arm assemblies 50 and 51 are suitably attached with the plate 41 at the apex of the cone-shaped reinforcing structure 35 (FIGURE 1), by the nuts and bolts 50' and 51' according to other features of this invention, tubular arms 50 and 51 have flat tubular ends 50a and 51a at opposite ends as do the straps 43, 44 and 45 to facilitate attachment and to permit proper drainage of the tubes. The flat end detail for the arm 51 is shown in FIGURES 10 and 11 and it will be appreciated the flat ends on the other arms and straps are the same. The laminated flat tube end 51a has tubular portions 51b, 51b at opposite sides to permit water drainage as shown in FIGURE 11. Adjustable nuts 50a and 51a are provided to secure the adjustable arm assemblies in adjusted position to firmly connect the central area of the reflector 10 with the apex of the cone-shaped reinforcing structure.

A pair of angular reflector mounting brackets 54 and 55 are mounted on the tower 7 by means of C-clamp fasteners 56. The cone-shaped reinforcing structure 35 has a pivot pin 57 that extends through the plate 42 generally at the cone apex and through the upper reflector mounting bracket 54 for suspending the reflector from this bracket. A nut 58 is mounted on the pivot pin 57 to firmly attach the pivot to the mounting bracket 54 after the reflector 10 has been moved into its desired adjusted position.

At an underside of the reflector 10 and more particu-

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larly on one face of the frame channel 24, a pair of mounting angles 59 and 60 is mounted. A vernier adjustment mechanism 61 is pivotally mounted and secured at one end by means of a bolt and nut fastener 62 to the lower reflector mounting bracket 55. A slidable carriage 63 is mounted on the vernier adjustment mechanism 61 which has a pair of angular plates 64 and 65 that are joined with the mounting angles. A lower end of the reflector 10 is adapted to be moved on the carriage 63 back and forth along the vernier adjustment mechanism in order to vary the ground angle of the reflector face. The face may be adjusted from 35 to 51 degrees and is commonly disposed in a 45° position. The carriage 63 is attached to a threaded steel rod 66 which is supported at opposite ends on a rectangular vernier frame 67. Bolts 68 and 69 are provided for securing the rod 66 with the frame 67. The carriage 63 may be moved longitudinally of the bolt 67 by adjustment of the fasteners 70 and 71. A carriage plate 72 is mounted on the underside of the carriage 63 and is engaged against an underside of frame flanges 73 and 74. When the fasteners 70 and 71 are loose, the carriage 63 and the carriage plate 72 may be moved longitudinally along the length of the rod. After the carriage 63 has been moved into its desired position, the fasteners 70 and 71 can be drawn tight to secure the carriage 63 and the carriage plate 72 into tight engagement with opposite sides of the frame flanges 73 and 74.

The method features of our invention have already been described for the most part in connection with the description of the reflector components and the manner in which such components are assembled. Summarizing briefly, the tubes 44, 45, 46, 50 and 51 are all formed from a metal mass and the ends of the tubes are then shaped to press intermediate portions of the tube ends flat forming the laminated flat portion 51a while contemporaneously shaping or holding the shape of the side portions of the tube ends so that the side portions will be tubular and in communication with the remainder of the tube to permit water drainage therethrough. The tubular side portions are identified at 51b, 51b in FIGURE 11. In connection with the method of forming the reflector 10, the panels 11 are individually formed preferably in an extrusion process with the snap locking means 18 and 19 and the pivoting and locking means 20 and 22 being formed during the extrusion process. The panels are then snapped together and the side or panel margin reinforcing structure comprising channels 24, 24 and 25, 25 is mounted at the margins of the panels to resist longitudinal movement of the panels. The aforesaid channels may be secured by means of the fastener 30' illustrated in FIGURE 4 or by means of the fastener 30'' as illustrated in FIGURE 5. The cone-shaped reinforcing structure 35 is then mounted at the rear side of the reflector. The structure is provided with a pivot 57 at its upper end and an adjustment mechanism 61 is mounted at a bottom end of the panels 11 whereby the reflector can be pivotally mounted on a tower and the adjustment mechanism 61 can be employed to vary the angle of the front reflective face of the reflector 10.

The reflector disclosed herein has a number of advantages over prior types of reflectors among which are: (1) greater face flatness, (2) more rigid construction which insures longer life and decreases maintenance cost, (3) freight costs are substantially reduced and (4) the reflective face is free of rivet and bolt heads except at the margins thereof.

Although minor modifications might be suggested by those versed in the art, it should be understood that we wish to embody within the scope of the patent warranted hereon, all such modifications as reasonably and properly come within the scope of our contribution to the art.

We claim as our invention:

1. A microwave reflector including a reflective face that is of a knockdown construction and that is uniformly flat and free of welds and bolt heads and is comprised of a

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series of reflector channels having channel legs which are snapped together in side-by-side relation, a generally cone-shaped reinforcing structure projecting from a rear side of the reflector, and means for attaching the cone-shaped structure to a supporting structure such as a tower.

2. A microwave reflector including a reflective face that is of a knockdown construction and that is uniformly flat and free of welds and bolt heads and is comprised of a series of reflector channels having channel legs which are snapped together in side-by-side relation, a generally cone-shaped reinforcing structure projecting from a rear side of the reflector, and means for attaching the generally cone shaped structure to a supporting structure such as a tower, the reflector channels each having a length several times greater than its width and being of generally uniform size.

3. A microwave reflector including a reflective face that is of a knockdown construction and that is uniformly flat and free of welds and bolt heads and is comprised of a series of reflector channels having channel legs which are snapped together in side-by-side relation, a generally cone-shaped reinforcing structure projecting from a rear side of the reflector, means for attaching the generally cone-shaped structure from its apex to a supporting structure such as a tower, and a vernier adjustment mechanism mounted on a supporting structure such as a tower and supporting a lower end of the reflector enabling a lower end of the reflector to be moved relative to the apex of the generally cone-shaped structure for adjusting the reflective face.

4. A microwave reflector including a reflective face that is of a knockdown construction and that is uniformly flat and free of welds and bolt heads and is comprised of a series of reflector channels having channel legs which are secured together in side-by-side relation, a generally cone-shaped reinforcing structure projecting from a rear side of the reflector, and means for attaching the generally cone-shaped structure to a supporting structure such as a tower.

5. A microwave reflector including a reflective face that is of a knockdown construction and that is uniformly flat and free of welds and bolt heads and is comprised of a series of reflector channels having channel legs which are secured together in side-by-side relation, a generally cone-shaped reinforcing structure projecting from a rear side of the reflector, means for attaching the generally cone-shaped structure to a supporting structure such as a tower, framing means comprising marginal frame channels about the perimeter, and means joining said frame channels with the reflector channels.

6. A microwave reflector including a reflective face that is of a knockdown construction and that is uniformly flat and free of welds and bolt heads and is comprised of a series of reflector channels having channel legs which are secured together in side-by-side relation, a generally cone-shaped reinforcing structure projecting from a rear side of the reflector, and means for attaching the generally cone-shaped structure to a supporting structure such as a tower, the reflector channels each having a length several times greater than its width and being of generally uniform size.

7. A microwave reflector including a reflective face that is of a knockdown construction and that is uniformly flat and free of welds and bolt heads and is comprised of a series of reflector channels having channel legs which are secured together in side-by-side relation, a generally cone-shaped reinforcing structure projecting from a rear side of the reflector, means for attaching the generally cone-shaped structure to a supporting structure such as a tower, and adjustable means connected between an apex of the cone-shaped reinforcing structure and a back side of said channels.

8. A microwave reflector including a reflective face that is of a knockdown construction and that is uniformly flat and free of welds and bolt heads and is comprised

of a series of reflector channels having channel legs which are shaped together in side-by-side relation, a generally cone-shaped reinforcing structure projecting from a rear side of the reflector, means for attaching the generally cone-shaped structure to a supporting structure such as a tower, framing means comprising marginal frame channels about a perimeter of the reflector, corner brackets at corners of the reflector, and knockdown means joining the brackets with the frame channels and the reflector channels in unitary assembly.

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