July 16, 1946. F. H. RUPPEL 2,404,097

GROUND MAT

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Fig. 1

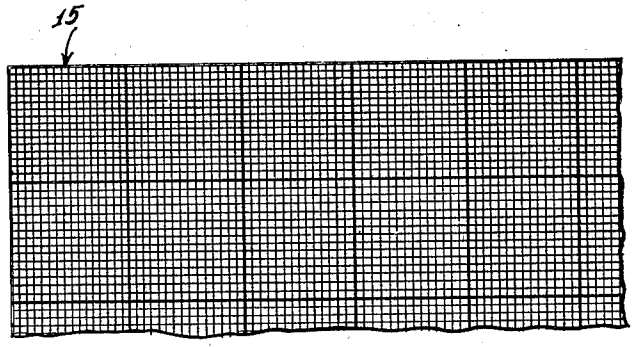


Fig. 4

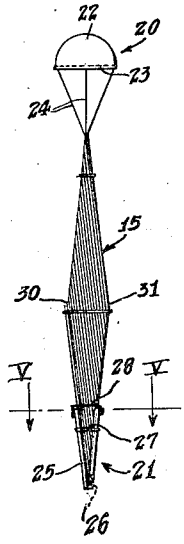


Fig. 2

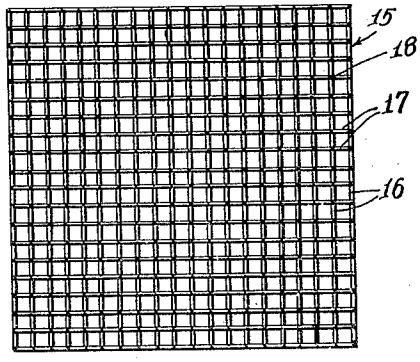


Fig. 3

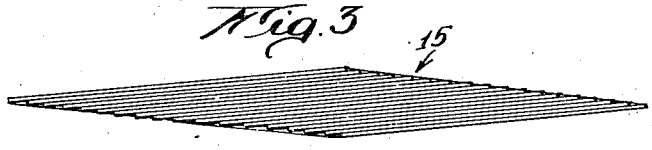
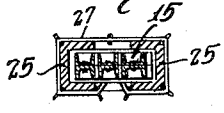


Fig. 5



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Fig. 6

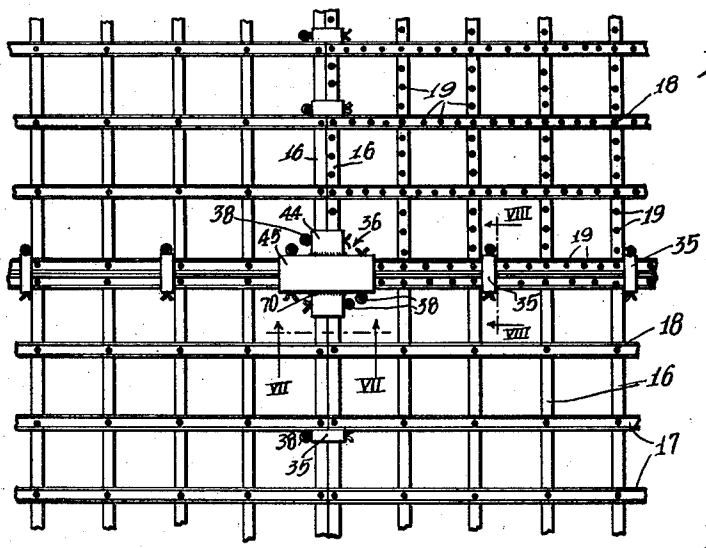


Fig. 7

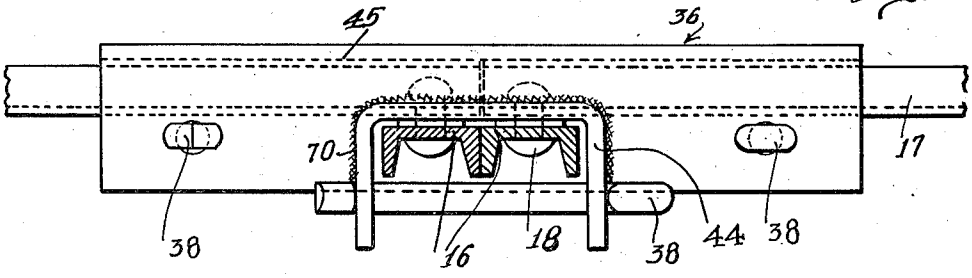
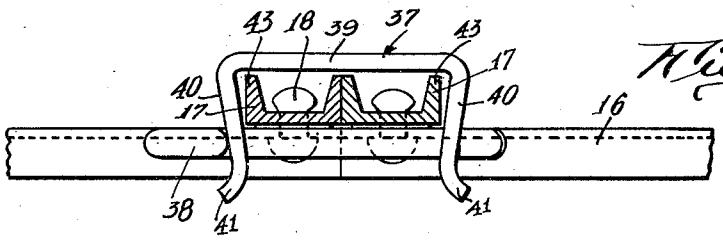


Fig. 8



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Fig. 9

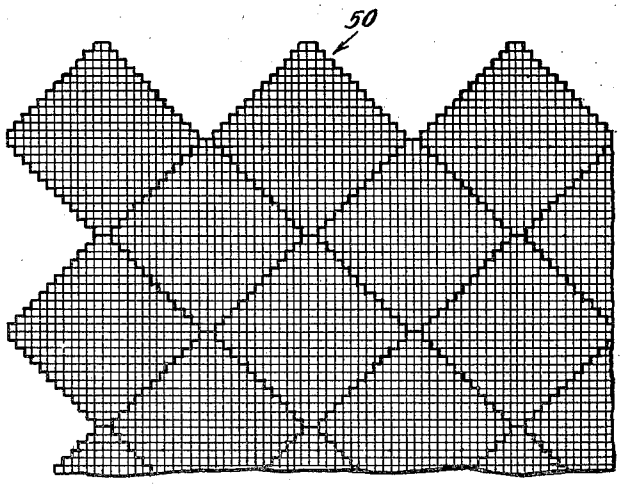
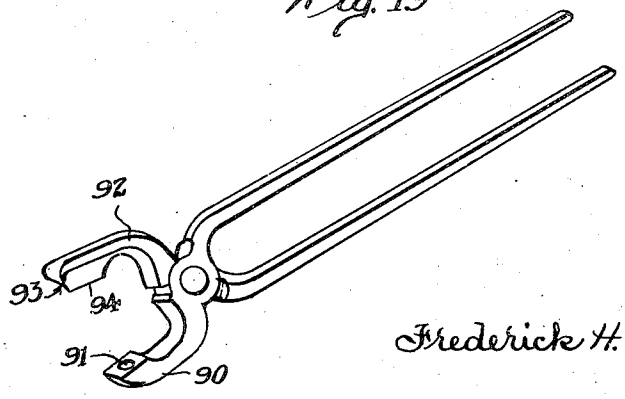


Fig. 10



Fig. 19



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Fig. 11

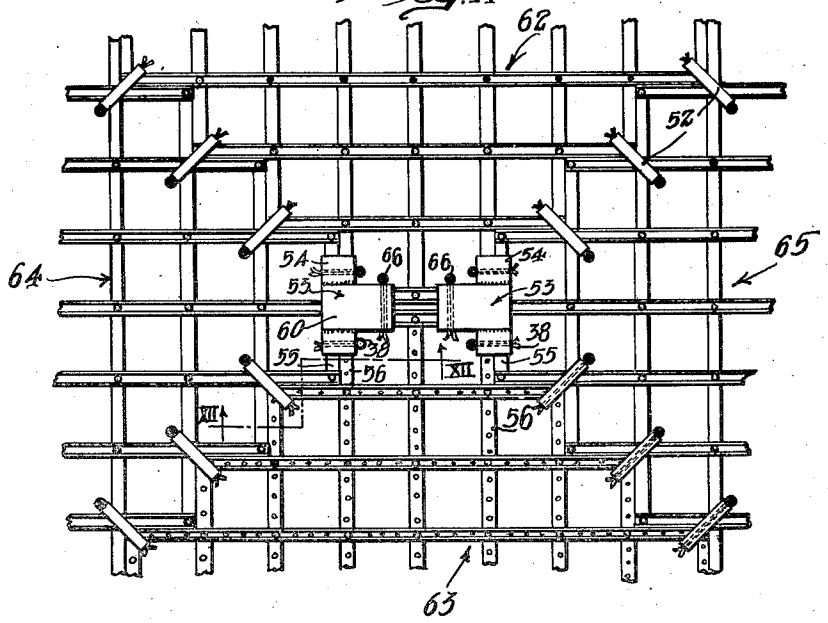


Fig. 12

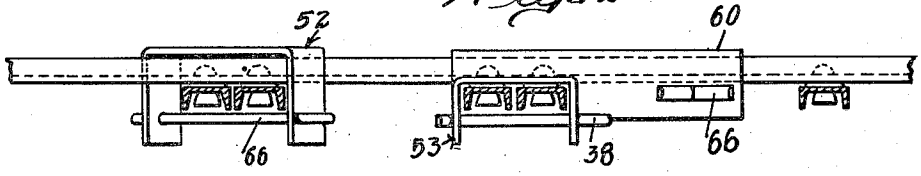


Fig. 13

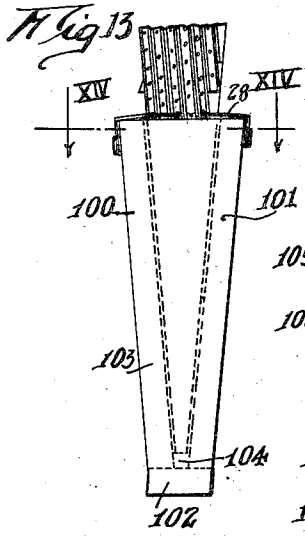
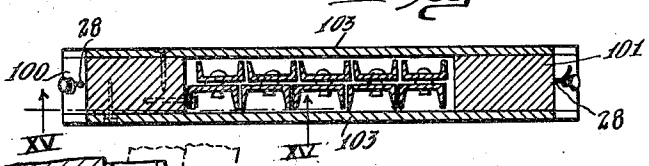


Fig. 14



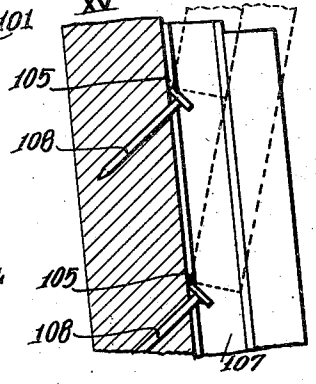


Fig. 15

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Fig. 16

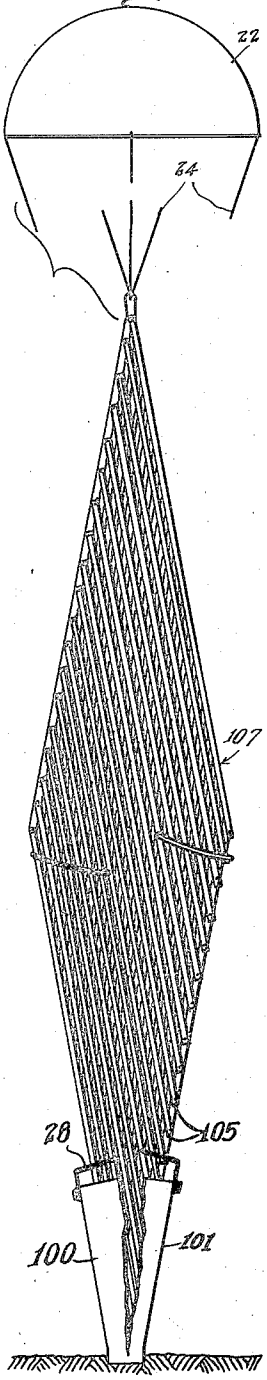


Fig. 17

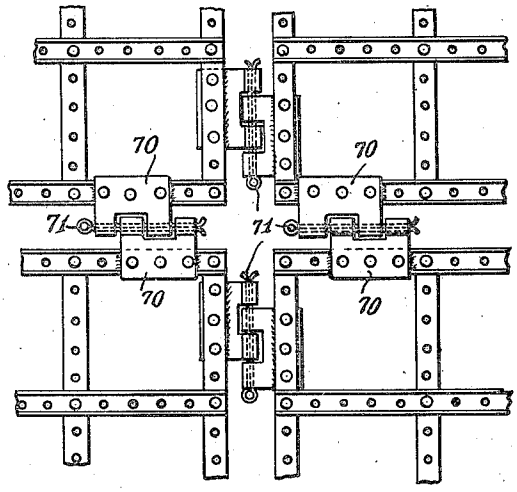
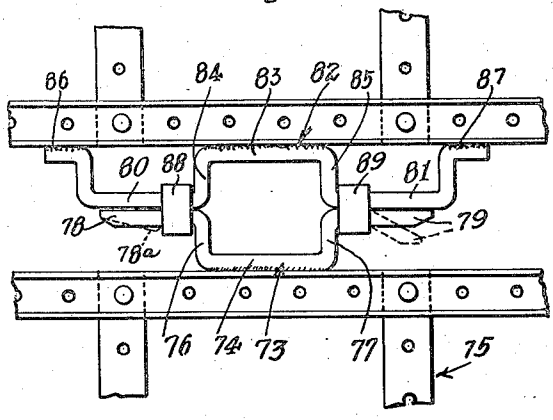


Fig. 18



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Patented July 16, 1946 2,404,097

UNITED STATES PATENT OFFICE

2,404,097

GROUND MAT

Frederick H. Ruppel, Pasadena, Calif.

Application November 17, 1942, Serial No. 465,859

14 Claims. (Cl. 94—13)

1

This invention relates to uniplanar metal mats formed from a large number of collapsible lattice type mats of convenient size for handling, the composite mat being laid on the ground for forming airplane runways, roads, gun foundations and for similar purposes.

An object of the invention is to provide a satisfactory joint construction for rapidly and strongly interconnecting a plurality of small lattice mats to form a composite mat suitable for use as a landing field, roadway, or the like.

Another object is to provide an individual lattice mat of such construction and with such accessories as to permit the mats to be dropped to the ground from aircraft.

Other more specific objects and features of the invention will appear from the description to follow of certain specific embodiments of the invention.

I have disclosed in my copending application Serial No. 452,681, filed July 29, 1942, now Patent No. 2,369,412 and entitled Lattice mat, the use of open work steel mats adapted to be laid directly on soft or uneven ground and form a suitable base for airplanes to land on and take off from. Each individual mat, as disclosed in that application, is made up of two sets of channel bars, with the bars of each set parallel to each other but at right angles to the bars of the other set. The two sets of bars are laid back to back so that the flanges of the lower set of channel bars dig into the surface of the earth and the flanges of the upper set of channel bars provide a nonskid surface for engagement with the wheels of the airplane or other vehicle used thereon. At each intersection the upper and lower bars are pivotally connected together so that an individual mat of substantially square shape can be collapsed into a relatively compact long narrow package for shipment and handling.

The present invention relates to the same general type of mat disclosed in my first application, as described above, but incorporates a different and stronger structure for interconnecting individual mats to each other to form a large landing field or roadway. It also incorporates a mat construction and accessory equipment which permits the unit mats to be dropped in folded condition from an airplane and automatically opened in response to impact with the ground.

In the drawings:

Fig. 1 is a plan view showing a portion of a landing mat, in accordance with the invention, consisting of a plurality of individual mats of

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rectangular shape having bars running parallel to the sides of the mat;

Fig. 2 is an enlarged plan view of one of the individual mats shown in Fig. 1, the mat being shown in extended condition;

Fig. 3 is a plan showing the individual mat of Fig. 2 in contracted or folded condition;

Fig. 4 is an elevation view showing a folded mat of the type illustrated in Fig. 3 with accessory equipment whereby it may be dropped from an airplane;

Fig. 5 is a detail cross section taken in the plane V—V of Fig. 4;

Fig. 6 is an enlarged plan view of a portion of the composite mat of Fig. 1 showing the details of the joint constructions between the individual mats;

Fig. 7 is a cross section in the plane VII—VII of Fig. 6;

Fig. 8 is a cross section in the plane VIII—VIII of Fig. 6;

Fig. 9 is a plan view of a composite mat composed of individual mats in which the bars extend diagonally with respect to the edges of the individual mats;

Fig. 10 is a plan view of one of the individual mats of Fig. 9 in collapsed or folded condition;

Fig. 11 is an enlarged plan view of a portion of the composite mat shown in Fig. 9 showing the joint construction for interconnecting the individual mats;

Fig. 12 is a detail section taken along the line XII—XII of Fig. 11;

Fig. 13 is a detail side elevation showing a modification of the impact cushioning structure shown in Fig. 4;

Fig. 14 is a cross-section taken in the plane XIV—XIV of Fig. 13;

Fig. 15 is a detail vertical section taken in the plane XV—XV of Fig. 14;

Fig. 16 is a view similar to Fig. 13 but showing how the structure may rupture at time of impact;

Fig. 17 is a plan view similar to Fig. 6 but showing hinge type connecting means between the mats;

Fig. 18 is a detail plan view showing the marginal bars of two unit mats joined together with a fastening structure composed of bar and sleeve elements; and

Fig. 19 is a perspective view of a tool that may be employed to spread the cotter pins employed in my construction.

Referring first to Fig. 1, there is depicted a portion of an airplane landing field or runway

of rectangular shape and having smooth edges. It is composed of a plurality of unit mats 15 suitably joined together by joint construction to be described later. As shown in Fig. 2, each of the individual mats 15 consists of a lower set of parallel bars 16 and an upper set of parallel bars 17, the bars of the upper set crossing the bars of the lower set at right angles and each bar of the upper set being pivotally connected to each bar of the lower set by rivets 18 (Fig. 6). The bars are preferably of channel section with the channels of the two sets positioned back to back. The web of each channel bar may be perforated at intervals as shown at 19 in Fig. 6.

The type of individual mat disclosed in Fig. 2 has the advantage that a plurality of the mats can be joined together to form a rectangular field in which the edges of the individual mats are parallel to the outer edges of the field and the bars extend parallel to either the sides or the ends of the field. It has been found desirable in practice to have one set of bars extend parallel to and the other set of bars extend at right angles to the direction of traffic instead of having both sets of bars extending diagonally to the direction of traffic. The mat of Fig. 2 is, therefore, desirable for this reason.

The mat of Fig. 2 is also desirable for another reason, namely, that it facilitates the delivery of the mats by airplane in that the mats can be dropped from an airplane in flight without destruction. In fact the energy of the falling mat can be used to open it.

Thus referring to Fig. 3, it will be observed that when the mat of Fig. 2 is collapsed or folded to bring the bars of each set in contact with each other, the mat is shaped like a thin diamond and if it is dropped point downward so that the point strikes the earth, the impact tends to open it. The exact extent of opening depends, of course, on a number of variable factors, such as the velocity of the mat at time of impact and the tightness of the rivets 18 which interconnect the bars to each other.

Accessories for use in dropping collapsed mats as shown in Fig. 3 are shown attached to a falling mat in Fig. 4. These accessories include a small parachute 20 connected to one end of the mat and a protective cradle 21 connected to the other end of the mat. The parachute 20 may consist of a canopy 22 of cloth or other similar material secured to a hoop 23 of some resilient material such as flat spring steel. The hoop in turn may be secured by three or more shroud lines 24 to the upper end of the mat. During shipment and prior to the release of the mat from an airplane, the parachute may be laid against one of the flat sides of the mat and secured thereto by any known form of tie wire or band. Because of the fact that the hoop 23 is elastic or resilient, it may be flattened against the side of the mat by the tie wire or band and will resume its circular shape when the tie wire or band is removed prior to tossing the mat overboard from an airplane.

The cradle 21 on the lower end of the mat functions as a shock absorber to reduce the force of impact on the relatively small tip of the collapsed mat. It can be made in various forms but as shown in Figs. 4 and 5 it consists of a metal channel member 25 folded into the shape of a narrow V and fitting over the edges of the mat adjacent the lower point thereof. As best shown in Fig. 5, the width of the channel member 25 is just sufficient to easily receive the edges of the

mat 15. A small block 26 of yieldable material such as soft wood, fiber, or the like, is positioned between the point of the mat and the bend of the V shaped cradle 21. The upper ends of the cradle are secured in place against the edges of the mat by a circumferential band 27 of metal strip or wire, which is of sufficient strength to maintain the cradle in position during handling and shipment but sufficiently weak to rupture in response to the forces created upon impact with the ground after the assembly is dropped from an airplane. To prevent the cradle from slipping downwardly off the end of the mat, the band 27 may be wired as by one or more short tie wires 28 to the mat. Thus the wires 28 may have their upper ends hooked into some of the holes 19 (Fig. 6) in the channel bars of the mat.

When the assembly shown in Fig. 4 strikes the ground, the lower point of the mat is stopped whereas the remaining portion of the mat rearwardly (above) thereof tends to continue its downward motion by virtue of its inertia. These forces tend to reverse the diamond shape of the collapsed mat; in other words, bring the lower tip and the upper tip close together and spread the other two tips, indicated at 30 and 31 in Fig. 4, far apart. It is conceivable that the force may be such, in some instances, as to completely reverse the mat, moving it through the fully open position in Fig. 2 in the process. However, by employing a parachute 20 of sufficient size to limit the rate of fall of the assembly, and making the rivets 18 fairly tight so as to offer substantial frictional resistance to opening movement, the impact forces can be caused to open the mat into substantially its normal form shown in Fig. 2.

However, even if the force of the impact opens the mat only partly, or opens it and then partly collapses it in the other direction, the manual labor of placing the mat in proper open position, as shown in Fig. 2, is greatly reduced. When one of the mats has been in folded condition for a substantial length of time, it is often very difficult to break the rivet joints from their initial position, although further movement may be relatively easy. Even if the shock of impact serves only the function of loosening the rivet joints, it greatly facilitates the further opening of the mat.

It is essential in a composite mat of the type shown in Fig. 1 that the individual or unit mats 15 be firmly connected together because the tensile forces produced in the mat when it is supporting a heavy vehicle on soft ground is very great. Furthermore, it is desirable that the joint construction be such as to permit rapid assembly of the mats.

A superior joint construction in accordance with the present invention is disclosed in Figs. 6, 7 and 8. As shown in Fig. 6, a plurality of small connectors 35 are employed at intervals along the adjoining edges of each pair of mats and a large connector 36 is employed at each intersection of the four corners of four mats.

As best shown in Fig. 8, each small connector 35 comprises a clip 37 of approximate U shape and a cotter pin 38 which is extended through apertures provided therefor in the opposite legs 40 of the clip 37, the projecting ends of the cotter pin being spread to retain it in position and resist separating movement of the legs of the clip. The cotter pin 38 may be made of relatively hard steel so as to be capable of withstanding substantial straightening forces.

The clip 37 preferably has a base member 39

slightly longer than twice the width of the bar members 17 so as to insure ready placement of the clip. However, the legs 40 are preferably bent inwardly so as to form angles of less than ninety degrees with the base 39 and have their tip portions 41 turned outwardly. In practice, it is often necessary to force two bars 17, which are to be connected, into engagement by means of the clips 37. It is found that this can be easily done by slipping one of the legs 40 into place with the outwardly turned tip 41 of the other leg resting on the flange 43 of the other bar 17 and then stepping on the base 39 of the clip to force it home.

The large connectors 36 each consist of two connected inverted channel members 44 and 45, respectively, the channel member 44 being lower than the channel 45 and fitting over the lower bars 16 of the mats, and the channel 45 fitting over the upper bars 17 of the mats. The lower channel 44 is cut out so as to fit over the upper bars 17, and the sides of the upper channel 45 are cut out to receive the lower channel 44. The two members 44 and 45 are preferably jointed together, as by welding 70, at their intersections. Each of the channel members 44 and 45 has apertures in its side walls for receiving cotter pins 38 identical with the cotter pins employed with the clips 37 and functioning in the same manner in channel members 44 and 45 as they do with the clips 37.

Although the type of individual mat shown in Figs. 2 and 3 has special advantages, as described, when the mats are to be transported by airplane and dropped from the airplane to the ground, they are of irregular shape and are not as convenient to ship and handle as are mats in which the bars extend diagonally with respect to the sides of the mat. Thus, there is shown in Fig. 9 a portion of an air field consisting of individual mats 50 in each of which the bars extend diagonally with respect to the sides of the mat and in which the bars are of varying length. Such an individual mat 50 collapses to the shape shown in Fig. 10, forming a bundle or parcel of less length than the mats 15 and of substantially uniform width from end to end instead of being diamond shaped as is the case with the mats 15. The mats shown in Figs. 9 and 10 have the disadvantage that because the bars extend diagonally with respect to the edges of the mat, the mats must be arranged diagonally with respect to the direction of traffic if the latter is to be parallel to one set of bars and at right angles to the other set. Hence the landing field shown in Fig. 9 has serrated edges resulting in loss of efficiency since the outer half of each mat along the border of the field is useless for traffic purposes. This disadvantage is, however, more than compensated for in some instances by the better shipping and handling characteristics of the collapsed mat shown in Fig. 10 as compared to that shown in Fig. 3.

Because of the different arrangement of the bars, the mats shown in Fig. 9 require a somewhat different connecting structure than that disclosed in Figs. 6, 7 and 8. Such a different connecting structure is shown in Figs. 11 and 12, which incorporates four individual mats 62, 63, 64 and 65, joined together by a plurality of small connectors 52 and two large connectors 53.

The small connectors 52 are employed intermediate the corners of the individual mats and are identical in structure with the small clips 37 shown in Figs. 6 and 8 except that they are

slightly longer since they must extend diagonally across the marginal bars of two adjacent mats (Fig. 11).

Each of the large connectors 53 comprises a lower inverted channel member 54 which fits over the shortest lower end bar 55 of the mat 64 or 65 and one of the longest bars 56 of each of the adjacent mats 62 and 63. It is secured in place by cotter pins 38 identical with the pin 38 of Fig. 8 and having its ends spread after insertion to prevent separation of the side walls of the channel member 54. Connected to the lower channel member 54, as by welding, is an upper inverted channel member 60 which is slightly wider than three times the width of the bars employed in the mats so that it fits over the parallel but spaced-apart short bars 55 of the juxtaposed mats 62 and 63, respectively. The sides of channels 60 are secured together by long cotter pins 66 identical with the cotter pins 38 of Fig. 8 except for their greater length.

Two alternative fastening structures for interconnecting adjacent unit mats are disclosed in Figs. 17 and 18. In the structure of Fig. 17 hinge members are employed including identical hinge leaves 70 welded to the marginal bars of different mats, each associated pair of hinge leaves being detachably connected together with a hinge pin 71, which pin as shown in Fig. 17 consists of a cotter pin. The hinge leaves 70 may be welded to the bars of their associated mats. This construction slightly spaces the marginal bars of adjacent unit mats, thereby increasing the coverage afforded by a given number of units. The eyes of the hinge leaves 70 are preferably large as compared to the diameter of the hinge pins so that there is substantial freedom of movement of the different mat units relative to each other.

In the alternative connecting structure of Fig. 18, a U-shaped bar 73 has its base portion 74 welded to the outer edge of the marginal bar of one mat unit as indicated at 75, and has its legs 76 and 77 extending outwardly from the mat but in the plane thereof. The outer portions 78 and 79 of the legs 76 and 77, respectively, are bent parallel to the base 74 in opposite directions, and they lie against similar parallel portions 80 and 81 of a cooperating bar member 82 on the next adjacent mat unit. Thus the member 82 includes a U-shaped part having a base 83 and legs 84 and 85 extending outwardly therefrom and merging at their outer ends into the sections 80 and 81. However, whereas the outer sections 78 and 79 of the member 73 are open-ended, the sections 80 and 81 of the member 82 have their outer ends bent back against the marginal bar of the associated mat unit and are preferably welded thereto as indicated at 86 and 87.

The two adjoining parallel bar sections 78 and 80 are interconnected by a sleeve 88, and the bar sections 79 and 81 are interconnected by a sleeve 89, which sleeves are mounted on the members 80 and 81, respectively, before the bar member 82 is secured to its associated mat. At the time the mats are assembled, the bar sections 78 and 79 are moved against the bar sections 80 and 81 while the sleeves 88 and 89 are adjacent the outer end portions of the member 82, after which the sleeves are slipped inwardly over the legs 78 and 79 into the position shown in Fig. 18. If desired, the sleeves may then be locked in position by bending the ends of the portions 78 and 79 outwardly, the bent position of portions 78

and 79 being indicated in dotted lines. To facilitate the locking of the sleeves 88 and 89 in the position shown, the portions 78 and 79 may have shoulders formed thereon as indicated by the dotted line showing at 78—*a*. When such a shoulder is provided, it is necessary to bend the bar out only slightly to lock the sleeve in position.

The structure of Fig. 18 has the advantage that all the connecting parts are permanently attached to the mat units so that no auxiliary fastening means have to be shipped.

Where cotter pins are employed as a part of the fastening elements, as shown in Fig. 17 and other figures, it is desirable to make the cotter pins of relatively hard steel, and such cotter pins are naturally relatively difficult to spread. It is therefore desirable to employ a special tool in accordance with the invention and illustrated in Fig. 19 for this purpose. This tool consists of a pair of pliers, one jaw 90 of which is provided with a recess or dimple 91 for receiving the head of a cotter pin and having its other jaw 92 provided with a wedge 93 adapted to enter between the two portions of the split end of the cotter pin and spread them apart. The wedge 93 is preferably hollow-ground so that the entering edge 94 of the wedge is relatively sharp.

It has already been mentioned that the hinge pins 71 of Fig. 17 fit loosely in the eyes in the hinge leaves 70 so that there is considerable freedom of movement between the interconnected unit mats. This relatively free movement is usually desirable to transfer stresses from one mat unit to another without permanently deforming the mats. Similar freedom of movement can be and is preferably obtained with the connector structures of Figs. 6, 7, 8, 11 and 12, by making the channels of the members 36 (Fig. 6) and 53 (Fig. 11) substantially larger than the bars that they overlap.

The success of the present invention is due in large measure to the fact that it combines light weight with great strength. The construction involving the use of channel bar members pivotally secured together by rivets appears to provide the greatest possible load-carrying capacity for the amount of metal employed. It has been found in practice that the non-rigid pivotal connection of the bars to each other facilitates the distribution of strains among all of the bars so that no single bar is apt to be stressed beyond its yield point. Thus, although a mat unit may become dished (concave on the upper side) by passage of a heavy load over the mat, when the mat overlies a depression, it is found that the deformation is not permanent and that the individual bars are not permanently bent. Such a mat can be restored to its normal flat position by inverting it and rapping it with a hammer or by merely rapping the rivet joints to loosen them. It appears that the deformation slightly rotates the bars relative to each other about their rivet connections, and the friction of the riveting connection is the only force that prevents the mat from straightening out when the load is removed.

A modification of the cradle structure shown in Fig. 4 is illustrated in Figs. 13, 14, 15 and 16. Whereas the main frame structure of the cradle of Fig. 4 is a V-shaped channel member of metal, the cradle of Figs. 13 to 16 is made of wood, and consists of two side members 100 and 101 of rectangular cross section (see Fig. 14) and a bottom member 102 which are joined to each other by front and rear walls 103 of plyboard, the plyboard being nailed directly to the members 100, 101 and 102. The cradle is so dimensioned that the bottom member 102 is spaced from the lower end of the mat on which it is attached and a bumper block 104 of fibrous material is inserted to reduce the impact on the lower end bars of the mat.

The strain on the lower end bars is further reduced, and the automatic opening of the mat by the impact is facilitated, by providing shoulders on the inner face of the frame member 100 juxtaposed to the ends 105 of some of the bars of that set of bars which are not extending parallel to the frame member 100. Thus, referring back to Fig. 4, it will be observed that if the diamond-shaped mat 15 is compressed between its upper and lower ends, the corner 31 will move downwardly relative to the corner 30. In fact, the marginal bar 107 extending downwardly from the point 30 to the lower point of the diamond will remain practically stationary during the opening movement, and likewise the ends of all the bars that are riveted to the marginal bar 107 will have no downward movement. Hence, if the lower ends 105 of these bars can be supported at the time of impact, the total force of impact does not have to be sustained by the lower tip of the diamond-shaped mat. As shown in Figs. 14 and 15, the shoulders for supporting the lower ends 105 of the bars riveted to the marginal bar 107 may consist of nails 108 driven into the member 100 so that their heads lie under the bar ends 105.

The manner in which the mat construction opens itself by impact is shown in Fig. 16. Thus it will be observed that the bars of the mat are separating from each other and the spreading force has ruptured the plyboard walls 103 of the cradle. Of course it is not necessary that the plyboard walls be so constructed as to rupture in the particular manner shown in Fig. 16. They might yield at the nails joining them to the frame members 100, 101 and 102.

Although for the purpose of explaining the invention certain embodiments thereof have been described in detail, it will be obvious to those skilled in the art that modifications can be made in the specific structure shown without departing from the invention, which is to be limited only to the extent set forth in the appended claims.

I claim:

1. A composite mat of the type described, consisting of a plurality of similar unit lattice-work mats connected together in which each unit mat is rectangular in shape and comprises a lattice work consisting of a lower set of parallel spaced-apart bars, all of equal length and extending parallel to one side of said unit, and an upper set of parallel spaced-apart bars overlying said lower set, the bars of the upper set being all of equal length and crossing the bars of the lower set at right angles, means pivotally securing each bar to the bars of the other set at its intersections therewith, each unit mat having smooth edges, each constituted by one of said bars constituting a marginal bar, and means for securing the marginal bars of one unit to the marginal bars of adjoining units.

2. A composite mat as described in claim 1, in which said securing means comprises an inverted U clip having its base extending across the two marginal bars of two mats and overlying said bars and having its legs extending downwardly past said marginal bars, and means tying together the lower ends of said legs below said bars.

3. A mat as described in claim 1, in which said fastening means comprises an inverted U clip having a base overlying the adjoining marginal bars of two mat units and extending beyond said bars, said clip having legs extending downwardly and inwardly from the ends of said base to a point below said bars, the lower tips of the legs diverging below said bars, and means tying together the lower ends of said legs below said bars.

4. A mat as described in claim 1, in which said fastening means comprises an inverted U clip having a base overlying said marginal bars and legs extending downwardly past said bars, said legs being apertured below said bars, and pin means extending through said holes in said legs, said pin means being deformed beyond said legs to prevent retraction through said holes.

5. A composite mat as described in claim 1, in which said securing means includes a corner fastener for connecting the adjacent corners of four mat units, said corner fastener comprising a pair of inverted channel members secured together in crossed relation and dimensioned to fit over the adjacent marginal bars of four mat units, and means for tying together the side walls of said channel members below said bars.

6. A composite mat as described in claim 1, in which said securing means includes a corner fastener for connecting the adjacent corners of four mat units, said corner fastener comprising a pair of inverted channel members secured together in crossed relation and dimensioned to fit over the adjacent marginal bars of four mat units, and means for tying together the side walls of said channel members below said bars, one of said inverted channel members fitting over the four upper bars of said mat units and having its base portion continuous from end to end, and the other channel member being formed in two sections extending from the sides of said first channel member at a lower level, each section thereof fitting over two marginal lower bars of one pair of unit mats.

7. A composite mat comprising two sets of parallel bars, one set of bars overlying the other and all of the bars of each set being of equal length, and each of one set being pivotally connected to all the bars of the other set at its points of intersection therewith whereby each unit is deformable by a lazy tongs action from a rectangular to a diamond shape, parachute means connected to one end of the diamond for causing said unit to strike the ground end on when unloaded from a height above the ground.

8. A unit as described in claim 7 in said diamond shape including frangible means for releasably retaining said unit in diamond shape.

9. A unit as described in claim 7 in said diamond shape, including cushion means on the opposite end of said diamond for reducing the impact on that end.

10. A unit as described in claim 7 in said diamond shape, including cushion means on the opposite end of said diamond for reducing the impact on that end, said cushion means comprising a V-shaped channel member having its channel side facing inwardly and dimensioned to fit over the edges of said diamond shaped unit adjacent the lower end thereof, with means interposed between the apex of said V-shaped member and the lower end of said mat and means for releasably securing said V-shaped member in engagement with said mat.

11. A composite mat as described in claim 1, in which said securing means comprises a pair of cooperating hinge leaves, one permanently affixed to one unit mat and the other permanently affixed to the other mat, and detachable hinge pin means for interconnecting said hinge leaves.

12. A composite mat as described in claim 1, in which said securing means comprises two hinge leaves on each unit mat closely adjacent a corner of the mat, each permanently affixed to and parallel to a marginal bar, and detachable hinge pin means for interconnecting each of said hinge leaves on one unit mat to a hinge leaf of another adjacent mat.

13. A composite mat as described in claim 1, in which said securing means comprises a pair of cooperating bar members secured to respective unit mats to be joined together, one bar member of each pair comprising a U-shaped member lying in the plane of the mat and having its base portion joined to the marginal bar of its associated mat unit, and having extensions on its leg portions, said extensions extending in opposite directions from each other parallel to said base portion, the other bar member of said pair comprising a U-shaped member juxtaposed to said first mentioned U-shaped member and having its base portion secured to the marginal bar of the adjacent mat unit, and having oppositely extending extensions on its leg portions lying alongside said extensions of said first mentioned member, the outer ends of said extensions being bent back against the marginal bar of its associated unit, and sleeve means encircling the outward extensions of both bar members of each pair for hingedly securing them together.

14. A unit as described in claim 7 in said diamond shape, including means on the opposite end of said diamond for cushioning the impact on that end and promoting the opening of said unit in response to impact with the ground, said last mentioned means comprising a V-shaped receptacle fitting over the lower end of said diamond unit and having shoulders located in one interior edge wall thereof, said shoulders being so located as to abut against the lower ends of some of the bars of one of said sets of bars in said unit mat whereby part of the force of impact is transmitted by said shoulders to said lower ends of said bars, and means for retaining said receptacle on the end of said mat unit.

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