

Dec. 27, 1955

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2,728,276

SHEET METAL AIR FIELD DECK MATS

Filed March 11, 1952

3 Sheets-Sheet 1

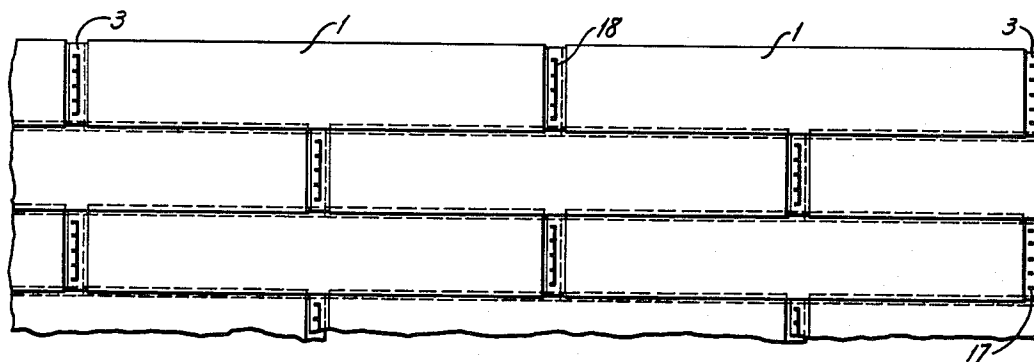


Fig. 1

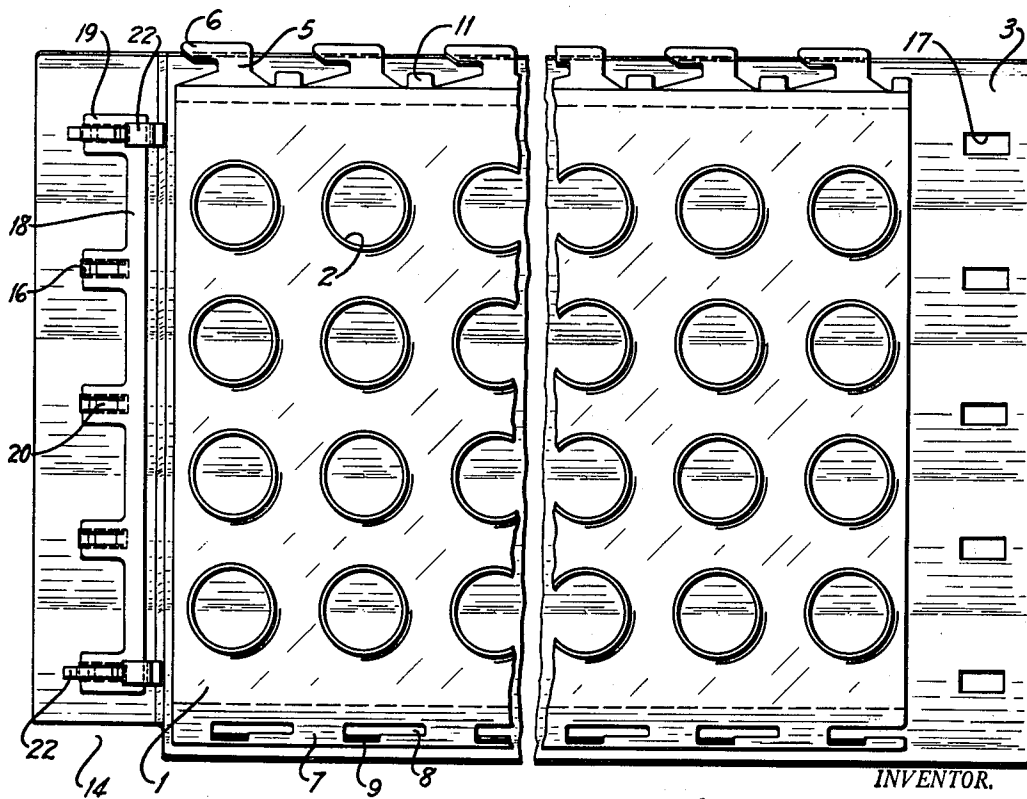


Fig. 2

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3 Sheets-Sheet 2

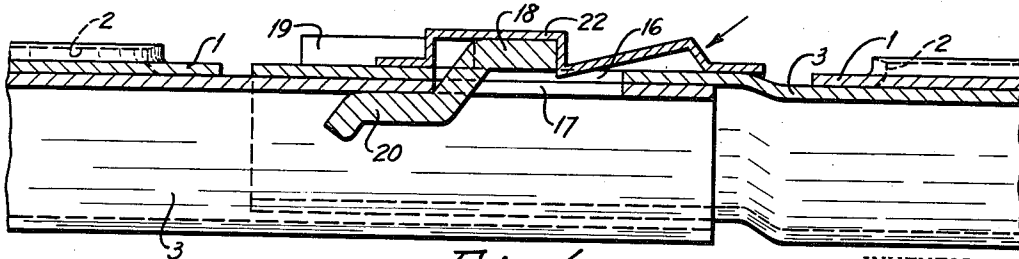
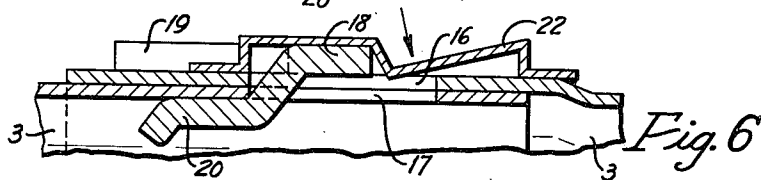
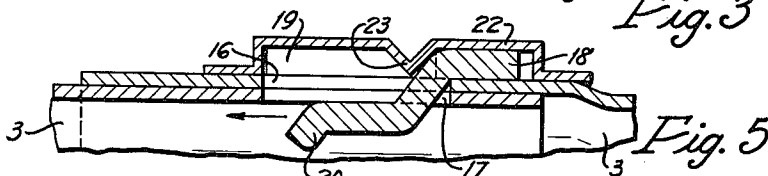
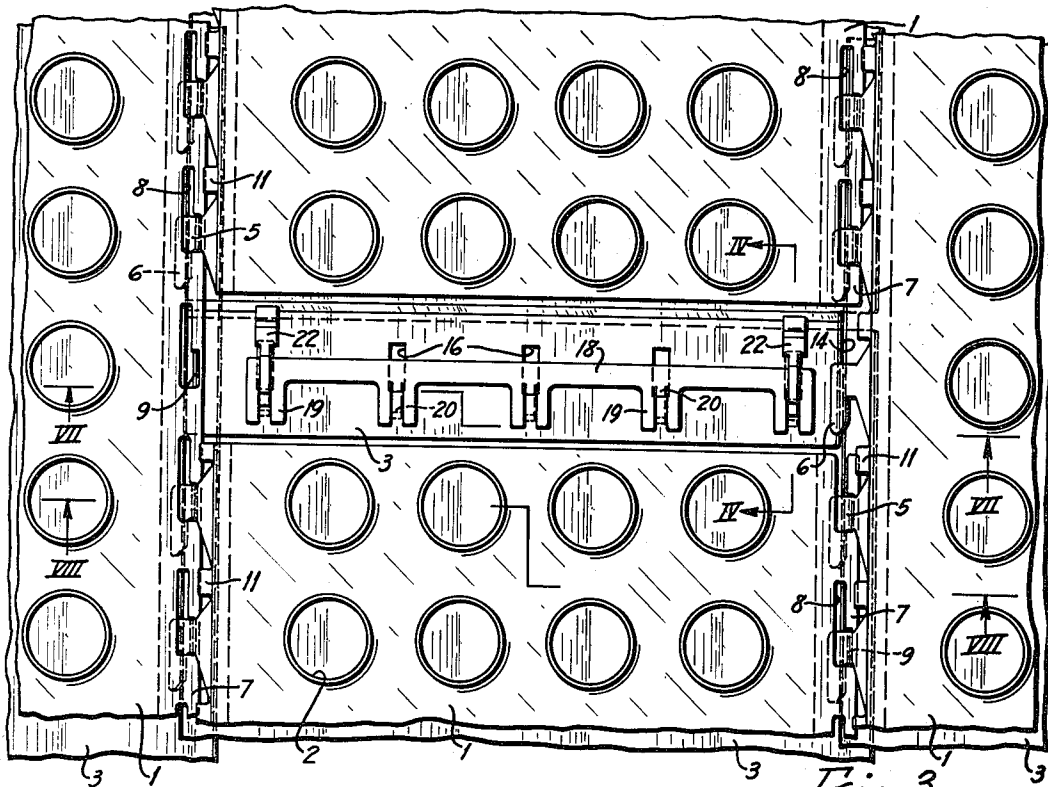


Fig. 4

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3 Sheets-Sheet 3

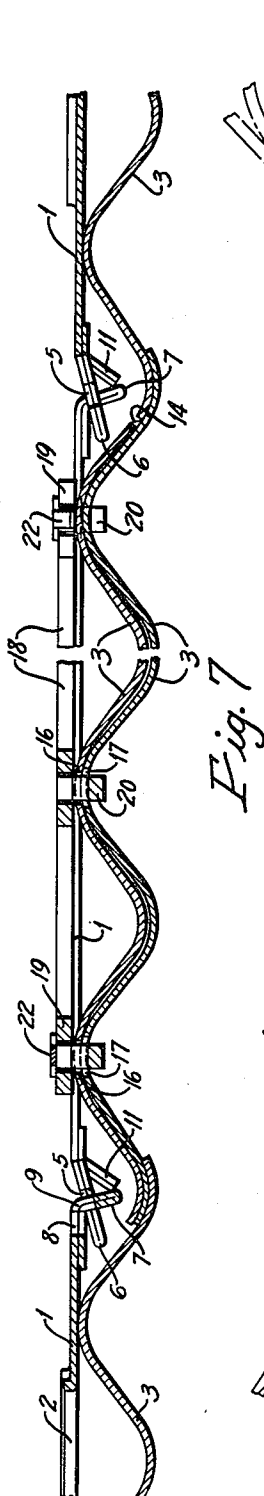


Fig. 7

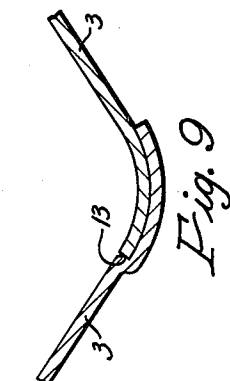


Fig. 9

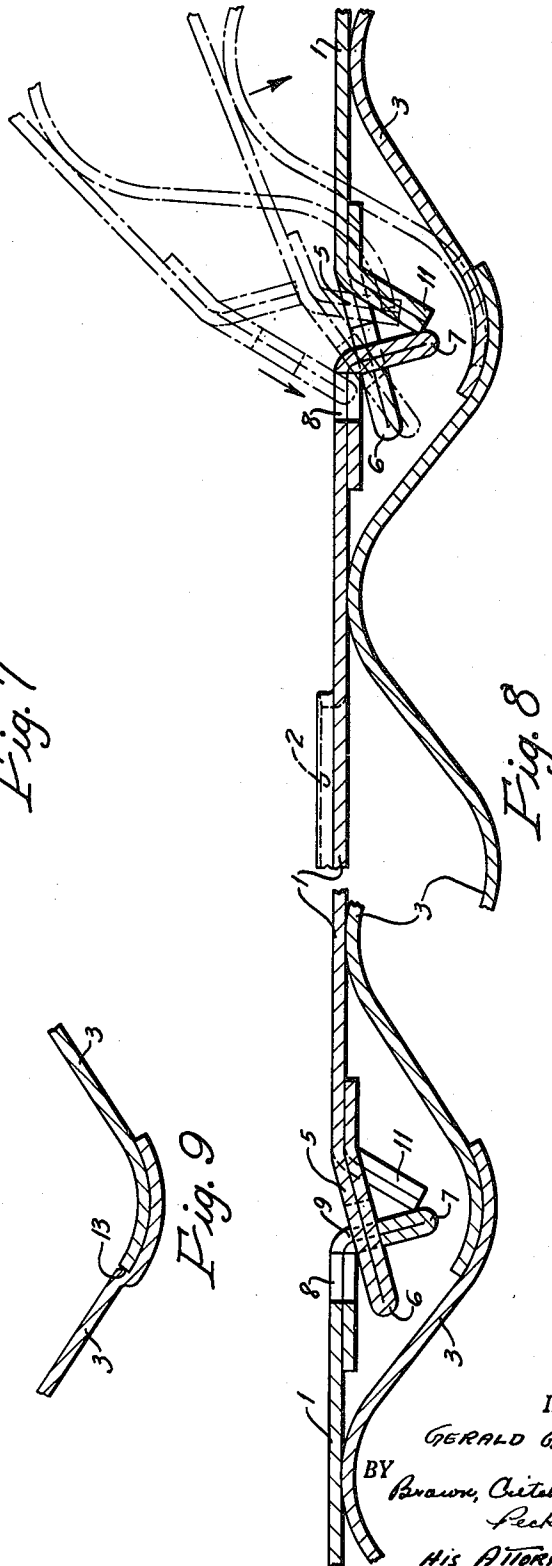


Fig. 8

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SHEET METAL AIR FIELD DECK MATS

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7 Claims. (Cl. 94—13)

This invention relates to sheet metal mats which are assembled to form air field decks, and more particularly to a mat that is formed from upper and lower metal sheets.

Air field decks or runways constructed from metal mats are used principally in war time to cover unstable soil so as to form firm foundations for the landing, taxiing and standing of airplanes. Not only have airplane sizes constantly become larger and wheel loads heavier, but in addition great increases in speeds and the blasts from the exhausts of jet propelled planes have introduced a new set of operating requirements. From the standpoint of portability and military logistics, the deck weights have already reached their upper practical limits. On the other hand, certain performance features of such decks and their effect in increasing the fundamental bearing capacity of the ground leave much to be desired. Some recent expedients have been used to secure better bearing power from the soil. Water-proofed elements, such as flexible membranes, have been laid on the ground under the deck in order to exclude rain water and also to prevent soil erosion and serious dusting from jet exhaust blasts. To take out all initial slack from the connecting means between the mats, they have been stretched during the placing operation by prime movers attached to their leading edges. However, such stretching does not prevent a great deal of play or slack from developing after the conventional single sheet mat is in service, due to the straightening of bends at the edges and in the bodies of the mats. Thus, there may be slight straightening of the connecting hooks, and opening up of the channels or ribs in the bodies. This developed slack permits greater sag or depression of the deck as a whole, with the development of a wave motion in the soil surface as the plane wheels roll over the deck. This wave motion tends to rework the soil and reduce its bearing power.

It is among the objects of this invention to provide air field deck mats which have inherently great beam strength combined with light weight, which secure the inherent strength and low weight resulting from the combination of two elements forming a ribbed box girder construction, which provide a safe and substantially flat deck with a maximum amount of solid metal surface, which can be made of standard commercial metal sheets, which are low in cost, which require only a small amount of shipping space, which can be assembled at an air field at a rapid rate by ordinary labor, which can be readily dismantled and transported to another location for reassembly, which require no loose separate connecting members, which cover the ground with a continuous unbroken surface, which have no projections on the bottom surface to cut or otherwise damage a flexible water-proofed membrane used as a ground cover, which have tight no-slack connections between their sides, which have an extra thickness of metal in the side connecting means, and which have permanently attached end connecting members.

In accordance with this invention, the air field deck is formed from a plurality of sheet metal mats which are laid with overlapping sides and ends. Each mat is formed

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from a flat deck plate secured to the top of a ground plate that has corrugations extending lengthwise of the mat. One side of the deck plate is provided with downwardly inclined integral fastening members having head portions extending lengthwise of the plate and connected by neck portions to the rest of the plate. The opposite side portion of the deck plate is turned downward. The top of the deck plate is provided with slots extending horizontally along the top of its downturned portion for receiving the fastening members on an adjoining inclined mat. The downturned portion of the deck plate also is provided with notches that open into the adjoining sides of the slots for receiving the neck portions of the fastening members in the slots when the inclined mat is swung down to the ground. The head portions of the fastening members extend under the top of the adjoining deck plate to interlock the plates. Preferably, the fastening members are hooks whose head portions extend lengthwise of the mats. The hook side of each deck plate is provided between its hooks with downwardly inclined spacing lugs adapted to engage the lower portion of the downturned notched portion of the adjoining deck plate. By also having the head portions of the hooks engage the opposite side of the adjoining downturned notched portion, side play between the connected mats is prevented. Also, by having the hooks engage simultaneously the bottom of the notches and the bottom of the notched deck plate at the upper end of its downturned portion, vertical play between the connected mats is prevented. The foregoing connections between the sides of deck plates are useful even if ground plates are not mounted below the deck plates.

The ground plate of each double plate mat projects outward from beneath a side edge of the overlying deck plate and overlaps the edge of the ground plate of the adjoining mat. The outwardly projecting portion of the ground plate engages either the upper or the lower surface of the ground plate that it overlaps, but preferably the lower surface when the projecting portion projects from the flange side of the mat. The ends of the ground plate also project from beneath the deck plate for overlapping the ends of the ground plates of adjoining mats. Consequently, the overlapping ground plates form a continuous surface over the ground, with all connections between the sides of the mats located above the ground plates. The projecting end portions of the ground plates are provided with laterally spaced openings aligned lengthwise of each mat. Locking members are slidably mounted on top of one end portion of each ground plate and have bars which extend down through the slots therein and then lengthwise of the slots. These bars also extend down through the slots in the overlapped end portion of an adjoining ground plate and are movable along the slots to engage the lower surface of the overlapped end portion in order to hold the overlapping ends tightly together.

The sheet that forms the deck plate may have marginal portions at its opposite sides folded under and up against the lower surface of the sheet, to which they are rigidly secured, such as by welding. Double thickness portions thereby are formed at opposite sides of the deck plate, and when the side hooks and slots are formed in these double thickness portions great strength and long life are assured.

The preferred embodiment of the invention is illustrated in the accompanying drawings, in which Fig. 1 is a plan view, somewhat diagrammatic, of a portion of an air field deck formed from my mats; Fig. 2 is an enlarged fragmentary plan view of a single mat; Fig. 3 is an enlarged fragmentary plan view of a portion of the deck shown in Fig. 1; Fig. 4 is a still further enlarged vertical section of an end locking detail taken on the

line IV—IV of Fig. 3; Fig. 5 is a view similar to the preceding figure, but showing the locking member in its retracted or shipping position; Fig. 6 is a view similar to the preceding figure, but showing the locking member in the process of being locked in place; Fig. 7 is an enlarged vertical transverse section taken on the line VII—VII of Fig. 3, with its central portion broken out; Fig. 8 is a still further enlarged section taken on the line VIII—VIII of Fig. 3, with the central part broken out; and Fig. 9 is a detail of a modification.

All of the sheet metal mats shown connected together in staggered relation in Fig. 1 are made in the same way. One of them is illustrated in detail in Fig. 2. It is of general rectangular shape with a rectangular notch at one corner, so that one end portion is narrower than the rest of it. All of the mats are the same width, and all but half length end mats are the same length. Each mat is formed from relatively thin upper and lower metal sheets that are secured together rigidly, such as by spot welding. The upper sheet forms a deck plate 1 which is substantially flat, except for circular holes 2 with which it may be provided for decreasing the weight of the unit. The edges of the holes preferably are turned upward to increase the anti-skid properties of the deck. The lower sheet forms a ground plate 3 that rests directly on the ground or on a flexible water-proofed membrane that may be spread over the ground. The ground plate is provided with corrugations that extend lengthwise of the mat to give it strength and depth. The corrugated plate will not flatten under load, even though it is made of thin stock, because the straight deck plate welded to the tops of the corrugations forms a tension member that prevents them from spreading apart and flattening. By combining these two plates, great bending strength and toughness is provided at a practical weight.

One side of the deck plate is cut to provide it with fastening members, preferably hooks that extend lengthwise of the plate. As shown in Figs. 7 and 8, the hooks also are bent downward a short distance so that they are inclined relative to the top of the plate, generally not more than 15 degrees. Each of the hooks has a neck portion 5 which connects its head portion 6 to the rest of the plate. The opposite edge portion of the deck plate is bent downward at a steep angle to form a flange 7 perpendicular to the hooks on the mat beside it. The top of the deck plate along the top of this flange is provided with slots 8 that extend horizontally lengthwise of the plate. They are positioned to receive the hooks on an adjoining mat of like construction. In order to insert the hooks into such slots, the mat having the hooks that are to be inserted has to be inclined rather steeply, as indicated in the upper broken line position in Fig. 8, so that the hooks can be pushed down through the slots in the mat resting on the ground. The inclined mat then is moved lengthwise to slide the head portions of its hooks under the adjoining deck plate between its slots to interconnect the plates. Following this, the inclined mat is allowed to swing down to the ground beside the first one. This occurs without bending the hooks, because the flange of the first deck plate is provided near one end of each of its slots and directly opposite to the neck portion of a hook on the opposite side of the same deck plate, with a notch 9 that opens into the adjoining side of the slot for receiving the neck portion of the hook in that slot after the hook has been moved lengthwise into locking position. When the neck portions of the hooks are disposed in these notches, the adjoining horizontal mats can not be moved lengthwise to unlock them. The depth of the notches is such that the hooks in them engage their lower walls and also the bottom of the deck plate at the upper end of the flange. This prevents the hooks from moving up and down in the slots and notches and thereby virtually eliminates slack or slap between adjoining mats.

Another feature of this invention is that side play or slack between adjoining mats likewise is eliminated. This

is done by providing the hook side of each deck plate with downwardly inclined spacing lugs 11 located between the hooks. These lugs are bent downwardly more sharply than the hooks and are of such length that they will tightly engage the lower portion of the outer surface of the notched flange 7 of the adjoining deck plate and force the two mats apart until the hooks tightly engage the opposite side of the flange. In fact, the hooks are put under tension by the pressure of the spacing lugs against the flange of the deck plate. The lugs also prevent the flange from being bent upward by the pull of the hooks against its inner surface. Due to the only slight inclination of the hooks from the horizontal, the interconnected deck plates exert a substantially straight line pull on one another which does not bend the hooks upwardly and thereby create slack.

To keep the weight and cost of the mat as low as possible, the deck plate is made of thin stock but it is stiffened by the corrugated ground plate which supports it. The hooks, spacing lugs and slotted and notched portion of the deck plate are greatly strengthened, and the life of the mat as a whole is increased materially, by providing the deck plate with side portions having double thickness, thereby making the hooks and lugs double thickness. As shown in Figs. 7 and 8, this is done by folding the opposite marginal portions of the sheet, from which the deck plate is made, down and back under the sheet and welding them to its lower surface. These double thickness side portions have substantially the same strength as a solid plate of like thickness. They also provide bearing surfaces of increased area, which help prevent the hooks from tearing out of the slots.

Since it is highly desirable to keep the ground beneath the deck from being softened by rain water, and to prevent jet engine exhaust from raising clouds of dust or blowing sloppy mud from beneath the deck, the mats are constructed so that they will completely cover the underlying ground with a continuous unbroken metal surface. For this purpose, as shown in Figs. 2 and 8, one side of each corrugated ground plate 3 projects laterally from beneath an edge of the overlying deck plate, preferably the slotted edge. The projecting portion of the ground plate should be the lower part or valley of one of the corrugations, so that it will present a curved surface to the ground. The opposite edge portion of the ground plate should be curved in the same manner to nest with the projecting portion of an adjoining ground plate in overlapping engagement with it, most suitably with its upper surface. It will be seen that the overlapping curved portions of adjoining ground plates are located beneath the joints between the sides of the mats, and space those joints from the ground.

To keep a vertical load on the joints from possibly causing sagging, due to the underlying overlapping edges of the ground plates sliding transversely on each other and becoming flattened, the construction shown in Fig. 9 may be used. In this construction at least one edge portion of each ground plate is offset vertically relative to the adjoining portion of the plate to form a shoulder 13 extending lengthwise of the plate. This shoulder is substantially in engagement with the edge of the overlapping ground plate and prevents the two plates from sliding any farther toward each other when a heavy load is placed on them.

Airfield runways nowadays often are constructed with a slight transverse or one way slope for drainage. By laying these mats with the corrugations of the ground plates and their overlapping ends extending down the slope, the ground plates will drain the field during rains like a corrugated metal roof.

If the ground is covered by a water-proofed cloth backed or fibrous membrane, the dust preventing and drainage features of the mats are not so important, but it is important that the mats not cut, punch, or tear the membrane. The ground plates keep the hooks, lugs and

flanges of the deck plates from touching such a membrane, and the smooth, unbroken lower surfaces of the ground plates, which are free of projections, will not injure the membrane.

Each ground plate also projects a short distance from the opposite ends of the overlying deck plate so that the ends of adjoining ground plates can overlap between the ends of adjacent deck plates. To allow all ground plates to lie in the same plane, the end of the plate which rests on top of the next plate is offset upward the thickness of the metal, as shown in Fig. 4. Also, the side of this offset end adjacent flange 7 is cut away to form a corner notch 14 (Fig. 2), so that the laterally projecting portions of the ground plates whose ends overlap will both be disposed at the same level and will be engaged flat by a third ground plate spanning the end joint.

The deck is strengthened and made more of an integral unit by clamping the overlapping ends of adjoining ground plates together. For this purpose each end of each ground plate is provided with a row of laterally spaced slots extending lengthwise of the mat. Each slot is formed in the top of a corrugation. The bottoms of corrugations are left intact to permit the mat deck to conduct water transversely down a slight slope. The slots 16 in one end of a ground plate are in alignment with the slots 17 in the opposite end of the plate, so that slots 16 in one plate will register with slots 17 in the plate it overlaps. Means are provided for extending through the registering slots and engaging the upper and lower surfaces of the overlapping ends to lock or clamp them tightly together. These means consist primarily of a locking member that is slidably mounted on top of the upwardly offset end of the ground plate. The locking member is formed from a horizontal bar 18 that extends most of the way across the top of the ground plate at the inner end of slots 16 and that has an integral fork 19 straddling each slot and a prong 20 extending down through the inner end of the slot and then outward a short distance. This outwardly extending portion of each prong is spaced from the lower surface of the supporting ground plate a distance substantially equal to the thickness of the metal of the lower ground plate. Consequently, when the cross bar is slid outward, it slides the forks along the top of the upper ground plate and slides the prongs along the lower surface of the lower ground plate in front of its slots 17, as shown in Fig. 4. The overlapping portions of the two ground plates are therefore clamped between the forks and prongs.

To hold the locking member on its ground plate, a pair of metal straps 22 are secured to the plate at the outer ends of a pair of slots 16 and in back of cross bar 18. The cross bar can slide back and forth beneath these two straps, but at the factory the straps are bent down to form a projection 23 in front of the retracted cross bar to hold it there until after the mats have been assembled, as shown in Figs. 2 and 5. Then the cross bar is driven forward or outward into locking position, straps 22 giving enough to permit it to slide under projections 23. The portions of the straps behind the bar then are straightened by hammer blows, as shown in Fig. 6, and are driven forward against the cross bar as shown in Fig. 4, whereby to lock it in its outer clamping position.

Eliminating slack and increasing the strength and stiffness of the side connectors between the mats enables the deck as a whole to approach the action of a tightly stretched catenary. An appreciable amount of vertical thrust from wheel loads thus is transferred into lateral components, with a lower resultant load on and deformation of the soil. Transverse rocking of the individual mats also is reduced, thereby minimizing localized digging into and reworking and progressive softening of the soil, with deleterious effect on its total bearing capacity.

According to the provisions of the patent statutes, I have explained the principle of my invention and have illustrated and described what I now consider to represent

its best embodiment. However, I desire to have it understood that, within the scope of the appended claims, the invention may be practiced otherwise than as specifically illustrated and described.

I claim:

1. A metal mat adapted to be laid side by side with like mats to form an airfield deck, said mat comprising a ground plate having corrugations extending lengthwise thereof, and a substantially flat deck plate secured to the top of the ground plate, one side of the deck plate being provided with downwardly inclined integral hooks extending lengthwise of the plate, each of the hooks having a neck portion connecting a head portion with the rest of the plate, the opposite side portion of the deck plate being turned downward to form a flange, the top of the deck plate being provided with slots extending horizontally along the top of said flange and adapted to receive hooks on an adjoining inclined mat and permit relative longitudinal movement of the adjoining mats to interlock them, said flange being provided near one end of each slot with a notch that opens into the adjoining side of the slot for receiving the neck portion of the hook in that slot when the interlocked inclined mat is swung down to the ground, and the hook side of the deck plate being provided between its hooks with spacing lugs inclined downwardly more steeply than the hooks and having lower ends adapted to engage the lower portion of the notched flange of an adjoining deck plate, said ground plate extending downward from near one side of the deck plate and outward beyond that side, the opposite side of the ground plate extending downward from near the adjacent side of the deck plate and outward toward said adjacent side, whereby the ground plates of interconnected mats will overlap at the sides of the mats to form a continuous surface.

2. A metal mat adapted to be laid side by side with like mats to form an airfield deck, said mat comprising a ground plate having corrugations extending lengthwise thereof, and a substantially flat deck plate secured to the top of the ground plate, one side of the deck plate being provided with downwardly inclined integral hooks extending lengthwise of the plate, each of the hooks having a neck portion connecting a head portion with the rest of the plate, the opposite side portion of the deck plate being turned downward to form a flange, the top of the deck plate being provided with slots extending horizontally along the top of said flange and adapted to receive hooks on an adjoining inclined mat and permit relative longitudinal movement of the adjoining mats to interlock them, said flange being provided near one end of each slot with a notch that opens into the adjoining side of the slot for receiving the neck portion of the hook in that slot when the interlocked inclined mat is swung down to the ground, and the hook side of the deck plate being provided between its hooks with spacing lugs inclined downwardly more steeply than the hooks and having lower ends adapted to engage the lower portion of the notched flange of an adjoining deck plate, said ground plate extending downward from near one side of the deck plate and outward beyond that side, the opposite side of the ground plate extending downward from near the adjacent side of the deck plate and outward toward said adjacent side, whereby the ground plates of interconnected mats will overlap at the sides of the mats to form a continuous surface, an outwardly extending side portion of the ground plate being offset vertically relative to the adjoining portion of the plate to form a shoulder extending lengthwise of the plate for engagement by the edge of an overlapping ground plate.

3. A metal mat adapted to be laid side by side with like mats to form an airfield deck, said mat comprising a ground plate having corrugations extending lengthwise thereof, and a substantially flat deck plate secured to the top of the ground plate, one side of the deck plate

being provided with downwardly inclined integral fastening members, each of said members having a head portion extending lengthwise of the plate and connected by a neck portion to the rest of the plate, the opposite side portion of the plate being turned downward to form a flange, the top of the plate being provided with slots extending horizontally along the top of said flange adapted to receive fastening members on an adjoining inclined mat, said flange being provided with notches that open into the adjacent sides of the slots for receiving the neck portions of the fastening members in the slots when the inclined mat is swung down to the ground, said head portions being adapted to extend under the top of the deck plate whose slots they extend through to interlock the plates, and the side of the deck plate being provided between its fastening members with spacing lugs inclined downwardly more steeply than said members and having lower ends adapted to engage the lower portion of the notched flange of an adjoining deck plate, said ground plate projecting from the flange side and the opposite ends of the deck plate to form side and end portions adapted to be disposed in overlapping relation with other ground plates, one of said end portions being offset vertically the thickness of the plate material and having a recess at the flange side of the deck plate for receiving the overlapping portion of the ground plate of an adjoining mat.

4. A metal mat adapted to be laid side by side with like mats to form an airfield deck, said mat comprising a ground plate having corrugations extending lengthwise thereof, and a substantially flat deck plate secured to the top of the ground plate, one side of the deck plate being provided with downwardly inclined integral fastening members, each of said members having a head portion extending lengthwise of the plate and connected by a neck portion to the rest of the plate, the opposite side portion of the plate being turned downward to form a flange, the top of the plate being provided with slots extending horizontally along the top of said flange adapted to receive fastening members on an adjoining inclined mat, said flange being provided with notches that open into the adjacent sides of the slots for receiving the neck portions of the fastening members in the slots when the inclined mat is swung down to the ground, said head portions being adapted to extend under the top of the deck plate whose slots they extend through to interlock the plates, and the side of the deck plate being provided between its fastening members with downwardly inclined spacing lugs adapted to engage the lower portion of the notched flange of an adjoining deck plate, said ground plate projecting from opposite ends of the deck plate to form end portions adapted to be disposed in overlapping relation with like portions of other ground plates, said end portions being provided with laterally spaced slots aligned lengthwise of the mat, and a locking member slidably mounted on top of one of said end portions and having prongs extending down through the slots therein and then lengthwise of the slots, means for holding the locking member on said one end portion, said prongs being adapted to extend down through the slots in the overlapped end portion of an adjoining ground plate and to be moved along the slots to engage the lower surface of said overlapped end portion.

5. A metal mat adapted to be laid side by side with like mats to form an airfield deck, said mat comprising a ground plate having corrugations extending lengthwise thereof, and a substantially flat deck plate secured to the top of the ground plate, one side of the deck plate being provided with downwardly inclined integral fastening members, each of said members having a head portion extending lengthwise of the plate and connected by a neck portion to the rest of the plate, the opposite side portion of the plate being turned downward to form a flange, the top of the plate being provided with

slots extending horizontally along the top of said flange adapted to receive fastening members on an adjoining inclined mat, said flange being provided with notches that open into the adjacent sides of the slots for receiving the neck portions of the fastening members in the slots when the inclined mat is swung down to the ground, said head portions being adapted to extend under the top of the deck plate whose slots they extend through to interlock the plates, and the side of the deck plate being provided between its fastening members with downwardly inclined spacing lugs adapted to engage the lower portion of the notched flange of an adjoining deck plate, said ground plate projecting from opposite ends of the deck plate to form end portions adapted to be disposed in overlapping relation with like portions of other ground plates, said end portions being provided with laterally spaced slots aligned lengthwise of the mat, a bar slidably mounted on top of one of said end portions and extending transversely across it, means for holding the bar on said one end portion, locking elements extending forward from said bar along the top of said end portion between its slots, and prongs extending from the bar down through said last-mentioned slots and forward below the slots, said prongs being adapted to extend down through the slots in the overlapped end portion of an adjoining ground plate and to be moved forward along the slots with said locking elements to clamp said overlapping end portions together.

6. A metal mat adapted to be laid side by side with like mats to form an airfield deck, each mat comprising a ground plate having corrugations extending lengthwise thereof, and a substantially flat deck plate secured to the top of the ground plate, one side of the deck plate being provided with downwardly inclined integral fastening members, each of said members having a head portion extending lengthwise of the plate and connected by a neck portion to the rest of the plate, the opposite side portion of the plate being turned downward to form a flange, the top of the plate being provided with slots extending horizontally along the top of said flange adapted to receive fastening members on an adjoining inclined mat, said flange being provided with notches that open into the adjacent sides of the slots for receiving the neck portions of the fastening members in the slots when the inclined mat is swung down to the ground, said head portions being adapted to extend under the top of the deck plate whose slots they extend through to interlock the plates, and the side of the deck plate being provided between its fastening members with downwardly inclined spacing lugs adapted to engage the lower portion of the notched flange of an adjoining deck plate, said ground plate projecting from opposite ends of the deck plate to form end portions adapted to be disposed in overlapping relation with like portions of other ground plates, said end portions being provided with laterally spaced slots aligned lengthwise of the mat, a bar slidably mounted on top of one of said end portions and extending transversely across it near one end of its slots, forks integral with said bar and straddling the adjacent slots, prongs extending from the inner end of each fork down through said last-mentioned slots and toward the opposite end of those slots, said prongs being adapted to extend down through the slots in the overlapped end portion of an adjoining ground plate and to be moved forward along the slots with said forks to clamp said overlapping end portions together, and deformable metal straps extending across said bar and secured to the ground plate for holding the bar thereon, said straps being adapted to be bent down to hold the bar in locking position.

7. An airfield deck comprising a plurality of metal mats laid side by side on the ground, each mat comprising a deck plate, one side of the plate being provided with downwardly inclined integral fastening members having head portions extending lengthwise of the plate

and connected by neck portions to the rest of the plate, the opposite side portion of the plate being turned downward to form a flange, the top of the plate being provided with slots extending horizontally along the top of said flange and the flange being provided with notches opening at the top into the slots above them, the slots being longer than said head portions, the fastening members on the mat beside said flange having their neck portions extending through said notches and having their head portions extending under the top of said deck plate to interlock the mats, and one side of each deck plate being provided between its fastening members with spacing lugs inclined downwardly more steeply

than said members and having lower ends engaging the lower portion of the notched flange of an adjoining deck plate, said head portions on each plate engaging the under surface of the notched flange of the adjoining deck plate, whereby side play between connected mats is prevented.

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