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APPARATUSES, METHODS, AND SYSTEMS FOR VIBRATORY SCREENING

Abstract

Disclosed embodiments include a screen deck assembly that can be mounted on a vibratory screening machine. The screen deck assembly includes a plurality of elongated support members that extend in a first direction. A plurality of support rods are mounted to the elongated support members. The support members and support rods form a screen support surface. The support rods extend in a direction that is transverse to the support members.

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Background/Summary

CROSS-REFERENCE TO RELATED APPLICATIONS [0001] This application is a continuation of U.S. application Ser. No. 18/412,140, filed Jan. 12, 2024, which claims the benefit of U.S. Provisional Patent Application No. 63/438,899, filed Jan. 13, 2023, the disclosure of which is incorporated herein by reference in its entirety.

BRIEF DESCRIPTION OF THE DRAWINGS
[0002] FIG. **1** is an isometric view of a screening deck having screen assemblies mounted thereon, according to an embodiment of the present disclosure.
[0003] FIG. **2** is an enlarged partial isometric view of the screening deck shown in FIG. **1**, without screen assemblies mounted thereon, incorporated into a vibratory screening machine, according to an embodiment of the present disclosure.
[0004] FIG. **3** is an isometric view of a screening deck having a screen assembly mounted thereon, according to an embodiment of the present disclosure.
[0005] FIG. **4**A is a partial cross-section view of a portion of a screen element, according to an embodiment of the present disclosure.
[0006] FIG. **4**B is an enlarged view of a portion of the screen element illustrated in FIG. **4**A, according to an embodiment of the present disclosure.
[0007] FIG. **5** is a perspective view of a screen element that incorporates reinforcing members, according to an embodiment of the present disclosure.
[0008] FIG. **6** is a perspective view of a screen deck that includes supporting rods mounted on stringers, according to an embodiment of the present disclosure.
[0009] FIG. **7** is a perspective view of a screen deck like the one illustrated in FIG. **6** with a screen mounted over the stringers and support rods, according to an embodiment of the present disclosure.
[0010] FIG. **8** is a cross-sectional view illustrating how a support rod of a first embodiment of a screen deck is mounted on the top of a stringer, according to an embodiment of the present disclosure.
[0011] FIG. **9** is a perspective view of a support rod that can be incorporated into a screen deck assembly, according to an embodiment of the present disclosure.
[0012] FIG. **10** is a cross-sectional view illustrating how a support rod of a second embodiment of a screen deck is mounted on the top of a stringer, according to an embodiment of the present disclosure.
[0013] FIG. **11** is a cross-sectional view illustrating how a support rod of a third embodiment of a screen deck is mounted on the top of a stringer, according to an embodiment of the present disclosure.
[0014] FIG. **12** is a cross-sectional view illustrating how a support rod of a fourth embodiment of a screen deck is mounted on the top of a stringer, according to an embodiment of the present disclosure.
[0015] FIG. **13** is a perspective view of a screen deck that having stringers forming a part of the screen deck, according to an embodiment of the present disclosure.

Description

DETAILED DESCRIPTION
[0016] Disclosed embodiments generally relate to screen decks assemblies for screening materials and for separating materials of varying sizes. Disclosed embodiments include one or more screen decks and supported screen assemblies for use with vibratory screening machines.
[0017] Exemplary vibratory screening systems are disclosed, for example, in U.S. Pat. Nos.

6,431,366 B2 and 6,820,748 B2, which are incorporated herein by reference.

[0018] In an embodiment, a screen deck assembly that can be mounted on a vibratory screening machine is provided. The screen deck assembly includes a plurality of elongated support members that extend in a first direction. A plurality of support rods are mounted to the elongated support members. The support members and support rods form a screen support surface. The support rods extend in a direction that is transverse to the support members.

[0019] In an embodiment, a vibratory screening machine includes a vibratory motor assembly secured to and configured to vibrate an inner frame of the vibratory screening machine. At least one screen deck assembly, is configured to receive one or more replaceable screen assemblies. The screen deck(s) include a plurality of stringers arranged substantially parallel to one another. A plurality of support rods are mounted to the stringers. Each support rod extends between and is coupled to at least two of the stringers. The stringers and support rods are configured to support one or more overlying screen assemblies. The screen assemblies may be secured to the screen deck assemblies by tensioning the screen assemblies, for instance, in a direction that a material to be screened flows across the screen assemblies or in a direction transverse that the material to be screened flows across the screen assemblies. An undersized material-discharge assembly may be configured to receive materials that pass through the screen assemblies, and an oversized material-discharge assembly may be configured to receive materials that pass over a top surface of the screen assemblies.

[0020] FIGS. **1** and **2** illustrate various views of an exemplary screening deck or screen deck assembly **100**. More specifically, FIG. **1** illustrates an isometric perspective view of screen deck assembly **100** while FIG. **2** illustrates the screen deck assembly attached to a screening machine. Screening deck assembly **100** includes a first screening deck **110**, a second screening deck **120**, side channels **130** and **130′**, a wash tray **140**, and tensioning devices **150**. As is shown in FIG. **1**, first screening deck **110** and second screening deck **120** are covered by a first screen assembly **109** and a second screen assembly **119**, respectively. Portions of screens **109**, **119** have been cutaway to show aspects of decks **110**, **120** below the screens. First screen assembly **109** and second screen assembly **119** are replaceable screen assemblies which are attached to first and second screening decks **110** and **120**. When in operation, material to be screened **50** by a vibratory screening machine is discharged from feed outlet ducts of a feed assembly (not shown) to an elevated side of first screen assembly **109**, along feed end **109**A of first screen assembly **109**, and is vibrated across first screen assembly **109** of first screening deck **110**, over discharge end **109**B of first screen assembly **109**, and into wash tray **140**.

[0021] In the exemplary embodiment, vibration carries material **50** over wash tray **140**, where material passes over feed end **119**A of second screen assembly **119**. Material **50** hits second screen assembly **119** in screen impact area **148**, then vibrates across second screen assembly **119** of second screening deck **120**, and over discharge end **119**B of second screen assembly **419**. First screen assembly **109** and second screen assembly **119** are configured such that undersized materials fall through first screen assembly **109** and second screen **119** into undersized material collecting pans (not shown) and are funneled into undersized collection assembly (not shown). Oversized materials do not pass through screens **109** and **119** and are vibrated off discharge end **119**B and funneled through an oversized collection assembly. Direction of the flow of material **50** is represented with arrows.

[0022] FIG. **2** illustrates a partial side perspective view of screening decks **110** and **120**, wash tray **140**, side channel **130**, and a portion of a tensioning device **150**. As is shown in FIG. **2**, first screening deck **110** and second screening deck **120** do not include screens **109** and **119**, but it will be appreciated that first and second screening decks **110** and **120** are covered by screens **109** and **119** when employed to separate materials of varying sizes, and these screens can be replaced when worn or damaged.

[0023] Referring to FIG. **2**, first screening deck **110** includes an underlying rib **112**, stringers **114**

(e.g., support structures), an upper end plate **116** and a lower end plate **118**. Second screening deck **120** includes an underlying rib **122**, stringers **124**, an upper end plate **126** and a lower end plate **128**. Opposite ends of ribs **112** and **122** extend from side channel **130** and **130′** at each of the midpoints between upper end plate **116** and lower end plate **118** of first screening deck **110**, and upper end plate **126** and lower end plate **128** of second screening deck **120**, respectively. A plurality of stringers **114** and **124** extend from upper end plates **116** and **126** to lower endplates **118** and **128**, respectively. A midpoint **115** of each stringer **114** and a midpoint **125** of each stringer **124** traverses the top surface of ribs **112** and **122**. Midpoints **115** and **125** may be elevated with respect to opposite ends of stringers **114** and **124** such that stringers **114** and **124** may, but need not, create a "crown" or convex curvature across first and second screening decks **110** and **120**. Alternatively, the stringers **114** and **124** may form a concave profile or flat profile across the first and second screening decks. Though first screening deck **110** and second screening deck **120** are shown with a single rib **112** and **122** respectively, it will be appreciated that first screening deck **110** and second screening deck **120** may include other configurations. First screening deck **110** and second screening deck **120** may include, respectively, a first plurality of ribs and a second plurality of ribs, as long as the additional ribs provide the functionality as described herein. In some embodiments at least one (or, in some embodiments, each one) of the first plurality of ribs and the second plurality of ribs can be assembled similarly to rib **112** or rib **122**. Stringer **114** and **124** may be fixed (e.g., welded) to the underlying ribs **112**, **122**. Alternatively, stringers **114** and **116** may be replaceable units and may be fastened to the ribs using various fasteners, such as bolts.

[0024] FIG. **3** is an isometric view of a screening deck **200** having a screen assembly **202** mounted thereon, according to one or more embodiments of the present disclosure. In this embodiment, screening deck **200** may employ a tensioning mechanism that holds screen assembly **202** by providing side-to-side tension, in contrast to the end-to-end embodiments shown, for example, in FIGS. **1** and **2** that provide front-to-back tensioning. In this example, a tensioning mechanism provides tension to screen assembly **202** from above, as described in greater detail in U.S. Pat. No. 9,010,539, the disclosure of which is incorporated by reference herein in its entirety. The tensioning mechanism in screening deck **200**, in which tension is applied from above, is also in contrast to the embodiments of FIGS. **1** and **2** in which tension is applied from below via a ratcheting mechanism.

[0025] Screening deck **200** includes screen assembly **202** in a first screening portion of screening deck **200**. A second screening portion of screening deck **200** is shown without a screen assembly to reveal a plurality of ribs **204** that provide structural support for a plurality of stringers **206**. As described above with reference to FIG. **2**, stringers **206** provide structural support of a screening assembly such as screening assembly **202**. In this example, ribs **204** extend between side channels **208***a* and **208***b*. Stringers **206** extend from end plate **210***a* to **210***b*. A midpoint **212** of each stringer **206** traverses a top surface of a central rib of ribs **204**. In this example, midpoints **212** are elevated with respect to opposite ends of stringers **206** such that stringers **206** create a "crown" or convex curvature across screening portions of screening deck **200**.

[0026] Stringers **206** may be replaceable units and may be fastened to ribs **204** rather than welded to ribs **204**. Stringers **206** may be fastened to ribs **204** using various fasteners such as bolts. This configuration eliminates closely spaced weld joints between ribs **204** and stringers **206** that are commonly found in welded screening decks. This arrangement eliminates the shrink, heat distortion, and drop associated with closely spaced weld joints, and enables rapid replacement of worn or damaged stringers **206** in the field. Replaceable stringers **206** may include plastic, metal, and/or composite materials and may be constructed by casting and/or injection molding. Other embodiment screening systems may include removable and replaceable stringers.

[0027] FIG. **4**A illustrates a fragmented cross-sectional view of a portion of a screen **400** that can be used with a screen deck assembly like the ones disclosed above. The screen **400** includes first members **402** that extend parallel to one another across the screen. Second members that extend in a direction perpendicular to the first members **402** form a grid structure with the first members **402**.

The screen **400** further includes third members **404** that extend in a direction parallel to the first members **402** and which are formed periodically along the screen **400**. The third members **404** are thicker in both width and height than the first members **402**. As illustrated in the enlarged view in FIG. **4**B, a stiffening rod **406** is encapsulated in the material of each of the third members **404**. The stiffening rods **406** are provided to help the screen **400** maintain a uniform, substantially flat shape when the screen **400** is laying on the ribs and/or stringers of a screen deck. In other words, the stiffening rods **406** help to prevent the screen from sagging between adjacent stingers or ribs of a screen deck. The stiffening rods **406** may also provide additional strength to the screen **400**.

[0028] FIG. **5** illustrates an alternate embodiment of a screen **410** that could be used in a screen deck assembly like the ones described above. In this embodiment, the screen **410** includes first members **412** that extend parallel to one another in a first direction. Second members **414** extend parallel to one another in a second direction that is perpendicular to the first direction, thereby forming a grid array with the first members **412**. Stiffening elements **416** are molded into the material of the first members **412** and similar stiffening elements **418** are molded into the material of the second elements **414**. Here again, the stiffening elements **416**, **418** are provided to help the screen **410** maintain a uniform, substantially flat shape when the screen **400** is laying on the ribs and/or stringers of a screen deck. Typically, at least a portion of such stiffening elements **416** and/or **418** are oriented transverse or perpendicular to the stringers. Thus, the stiffening elements help to prevent the screen **410** from sagging between adjacent stringers or ribs of a screen deck. The stiffening elements **416**, **418** may also provide additional strength to the screen **410** to help resist stretching or lengthening of the screen **410**. In other embodiments, one set of stiffening elements **416** or **418** may be omitted. Further, such stiffening elements **416** or **418** may not be included in each first member **412** or second member **414**, respectively. For instance, stiffening elements **416** or **418** may be included in every other or every third first member **412** or second member **414**, respectively.

[0029] Details of screens as depicted in FIGS. **4**A, **4**B and **5** can be found in U.S. Pat. No. 9,908,150, the entire content of which is incorporated herein by reference.

[0030] In the examples described above, the stiffening rods or stiffening elements may be molded into the material of the screen itself. This could be done in connection with molding of screens formed of thermoset materials, such as polyurethane. However, other types of screens, such as those formed by injection molding of a thermoplastic also can incorporate stiffening rods or stiffening elements. Further, separate stiffening rods or stiffening elements may be attached to screens by adhesives, welding, fusing and other attachment techniques. Thus, screens that are used in vibratory screening machines can include various different types of stiffening rods or stiffening elements, and the stiffening rods or stiffening elements can be incorporated into or attached to screens in a variety of different ways.

[0031] Regardless of how a screen that includes stiffening rods or stiffening elements is formed, the inclusion of the stiffening rods or stiffening elements adds cost and complexity to the screens. The manufacturing processes which are required to create such screens are necessarily more complex and expensive than if the screens did not include stiffening rods or stiffening elements. Also, once the stiffening rods or stiffening elements have become a part of a screen, their existence in the screen constrains how the screens can be packaged and shipped. In most instances, it is desirable for the stiffening rods or stiffening elements to retain their general shape, which can make it impossible to roll or fold a screen in certain ways to reduce its dimensions for packaging and shipping. Further, inclusion of such stiffening rods or elements results in additional waste when screens are discarded.

[0032] FIG. **6** illustrates a screen deck **420** of a vibratory screening machine which includes support rods **424** that are installed across the top edges of the stringers **422** of the screen deck. The support rods **424** are provided to support the screen that is mounted on top of the screen deck **420** so that the screen does not sag between adjacent stringers **422**. Thus, the support rods **424** perform

some of the same functions as the stiffening rods or stiffening elements that are provided in or on the screens described above. When support rods **424** are installed on the stringers **422** of a screen deck **420** as illustrated in FIG. **6**, screens that do not include stiffening rods or stiffening elements can be mounted on the screen deck **420** without fear of the screen sagging between adjacent stringers **422**. The screen deck **420** may additionally include one or more optional ribs **440** that extend across lower portions of the stringers **422**. Such ribs **440** may provide support between. Incorporation of such rods **420** into the screen deck **420** allows the rods **420** to be reused when overlying screens are replaced.

[0033] FIG. **7** illustrates a screen deck **420** that includes support rods **424** mounted across the top of stringers **422** of the screen deck **420** with a screen **430** mounted over the screen deck **420**.

[0034] FIG. **8** is an enlarged cross-sectional view illustrating how a support rod **424** is installed in a mounting aperture **426** located on a top edge of a stringer **422**. A screen **430** overlays the stringer **422** and support rod **424**. As illustrated in FIG. **8**, a depth of the mounting aperture **426** is such that a top surface of the support rod **424** is substantially flush with the top edge of the stringer **422**. FIG. **8** also depicts that a contour of the mounting aperture **426** may match an exterior profile of the support rod **424**.

[0035] The support rods **424** could be formed from a variety of different materials. The support rods **424** could be formed of metal, synthetics, fiberglass, carbon fiber and resin and a variety of other similar materials.

[0036] Each support rod **424** could be a single monolithic structure, or each support rod could have a composite structure. For example, FIG. **9** illustrates an embodiment of a support rod **434** that includes a core **435** surrounded by a cover **437**. The core **435** could be made of a relatively stiff material such as metal, fiberglass, carbon fiber or a hard plastic or synthetic material. The cover **437** could be made of a softer material such as a plastic or synthetic material.

[0037] The cover **437** could be somewhat deformable to facilitate the insertion of the support rod **434** into a mounting aperture **426** of a stringer **422**. The cover **437** could also be sized to substantially or completely fill the mounting apertures **426** into which the support rod **434** is mounted. This could help to prevent the support rod **434** from moving with respect to the stringers **422** into which the support rod **434** is mounted, which in turn can help to prevent vibration and wear of the support rod **434** and stringers **422**.

[0038] The support rods **424** can have various different cross-sectional shapes or profiles. In the embodiments illustrated in FIGS. **6-12** the support rods **424**/**434** have a circular cross-sectional shape. In alternate embodiments, the support rods **424**/**434** could have a square, triangular, oval, polyhedron or some other cross-sectional shape. Also, the support rods **424**/**434** could be flat or straight, or have a curved, arched or bent shapes depending on how the screen deck to which they are attached is shaped. In other words, the shape of the support rods **424**/**434** can vary to accommodate the shape or profile of the screen deck to which they are attached.

[0039] Similarly, the mounting apertures **426** in the stringers **422** can have different shapes. In some embodiments, the profile of the mounting apertures **426** can match the exterior profile of the support rods **424** that are mounted in the mounting apertures **426**. In other instances, the profile of the mounting apertures **426** can be different from the exterior profile of the support rods **424**.

[0040] FIG. **8** illustrates an embodiment where the depth of the mounting apertures **426** and the diameter of the support rods **424** are selected so that the top surface of the support rod **424** is substantially flush with the top surface of the stringers **422**. This allows a screen **430** with a substantially flat lower surface to lay flat on the supporting surface formed by the stringers **422** and support rods **424**.

[0041] In alternate embodiments, such as the one shown in FIG. **10**, the screens **430** may be formed so that the lower surface of the screen **430** includes locating grooves **428**. The locating grooves **428** are designed to lay over and engage with corresponding support rods **424**. For this reason, the depth of the mounting apertures **426** in this embodiment are such that the top surfaces of the

support rods **424** protrude above the top edges of the stringers **422**. This allows the top surfaces of the support rods **424** to be received in the grooves **428** on the bottom surface of the screen **430**.
[0042] In the embodiment illustrated in FIG. **10**, the support rods **424** have a circular cross-sectional shape and the groove **428** on the bottom surface of the screen **430** has a corresponding rounded profile. In alternate embodiments, the support rods **424** could have different cross-sectional shapes, and the profile of the grooves **428** on the bottom surface of the screen **430** could have a correspondingly different shape.
[0043] FIG. **11** illustrates an embodiment where the mounting apertures **426** on the top edges of the stringers **422** are shaped to help hold the support rods **424** in the mounting apertures **426**. In the embodiment illustrated in FIG. **11**, the mounting aperture **426** has a generally circular cross-sectional shape to match the cross-sectional shape of the support rod **424**. However, the dimension of the opening of the mounting aperture **426** along the top edge of the stringer **422** is smaller than the diameter of the support rod **424**. As a result, inserting the support rod **424** into the mounting aperture **426** will require a temporary elastic deformation of the material of the stringer **422** and/or the support rod **424**. Once the support rod **424** is seated in the mounting aperture **426**, the material of the stringer **422** and/or the support rod **424** substantially returns to its original shape, which results in the support rod **424** being held in the mounting groove **426**.
[0044] FIG. **12** illustrates an alternate embodiment where the dimensions of the opening at the top of the mounting aperture **426** is also smaller than a diameter of the support rod **424**. Here again, inserting the support rod **424** into the mounting aperture **426** will require a temporary elastic deformation of the material of the stringer **422** and/or the support rod **424**. Once the support rod **424** is seated in the mounting aperture **426**, the material of the stringer **422** and/or the support rod **424** substantially returns to its original shape, which results in the support rod **424** being held in the mounting groove **426**.
[0045] FIG. **12** also provides an example of how the profile of the mounting aperture **426** need not match the exterior cross-sectional shape of the support rod **424**. Indeed, the profile of the mounting groove **426** and the cross-sectional shape of the support rod **424** can be deliberately selected to be different for various reasons, such as helping to keep the support rod **424** trapped inside the mounting aperture **426**.
[0046] In the embodiments described above, the stringers **422** can be formed from a variety of different materials. In some instances, wear protective covers may be mounted over top of the stringers. When wear protective covers are provided, mounting grooves **426** may be formed in both the top edge of the stringer and in the covers. Alternatively, the top edge of a stringer could lack mounting grooves for support rods, and the mounting grooves for the support rods could be provided only in the cover mounted over top of the stringer.
[0047] FIG. **13** shows an alternate embodiment in which metal stringers **432** form a part of the screen deck **420**. Here again, mounting apertures are formed in the top edges of the stringers **432**, and support rods **434** are mounted in the mounting apertures. Thus, in some embodiments, the stringers **432** could be formed of a metal material and lack any sort of wear protective covers.
[0048] In the foregoing embodiments the support rods are mounted in mounting apertures in the top edges of the stringers. In alternate embodiments, the support rods **424** could be attached to the stringers **422** via fasteners, adhesives, welding, fusing and a variety of other ways. In some embodiments, the support rods **424** are removably attached to the stringers **422** so that individual support rods can be replaced, and so that individual stringers can be replaced. In alternate embodiments, the support rods **424** may be affixed to the stringers in a more permanent fashion, such as by fusing, adhesives and/or welding.
[0049] In the embodiments described above, the support rods extend in a direction that is substantially perpendicular to the direction in which the stringers extend. In alternate embodiments, the support rods could extend in directions that are not perpendicular to the direction in which the stringers extend. For example, the support rods could form a 30° or 45° angle with respect to the

stingers, or some other angle that is other than 90°.
[0050] In the embodiments described above, the plurality of stringers may have a mid-point between first and second ends that is elevated relative to the first and second ends. In such an embodiment, the stringers may create a “crown” or convex curvature across the screen deck. In alternate embodiments, the plurality of stringers may have a mid-point between first and second ends that is depressed relative to the first and second ends. In such an embodiment, the stringers may create a concave curvature across the screen deck. In further alternate embodiments, the plurality of stringers may have a linear profile between first and second ends forming a substantially a flat surface across the screen deck.
[0051] Conditional language, such as, among others, “can,” “could,” “might,” or “may,” unless specifically stated otherwise, or otherwise understood within the context as used, is generally intended to convey that certain implementations could include, while other implementations do not include, certain features, elements, and/or operations. Thus, such conditional language generally is not intended to imply that features, elements, and/or operations are in any way required for one or more implementations or that one or more implementations necessarily include logic for deciding, with or without user input or prompting, whether these features, elements, and/or operations are included or are to be performed in any particular implementation.
[0052] While embodiments of this disclosure are described with reference to various embodiments, it is noted that such embodiments are illustrative and that the scope of the disclosure is not limited to them. Those of ordinary skill in the art may recognize that many further combinations and permutations of the disclosed features are possible. As such, various modifications may be made to the disclosure without departing from the scope or spirit thereof. In addition or in the alternative, other embodiments of the disclosure may be apparent from consideration of the specification and annexed drawings, and practice of the disclosure as presented herein. The examples put forward in the specification and annexed drawings are illustrative and not restrictive. Although specific terms are employed herein, they are used in a generic and descriptive sense only and not for purposes of limitation.

Claims

1. A vibratory screening device, comprising: a screen deck having: a frame that is configured to be mounted to a vibratory screening machine; a plurality of stringers mounted on the frame and arranged substantially parallel to one another; a plurality of support rods mounted to the stringers, wherein each support rod extends between and is coupled to at least two of the stringers; a screen assembly overlying a grid formed by the plurality of stringers and the plurality of support rods; and a tensioner for tensioning the screen assembly over the grid and securing the screen to the screen deck.
2. The device of claim 1, further comprising: at least one rib that extends between and is coupled to at least two of the stringers, wherein the rib is disposed below top edges of the stringers in which they are coupled.
3. The device of claim 2, wherein the stringers are removably coupled to the at least one rib.
4. The device of claim 1, wherein the plurality of stringers extend in a first direction and wherein at least some of the plurality of support rods extend in a second direction that is transverse to the first direction.
5. The device of claim 1, wherein the second direction is substantially perpendicular to the first direction.
6. The device of claim 1, wherein each of the plurality of stringers has an upper surface defining a convex profile.
7. The device of claim 1, wherein each of the plurality of stringers has an upper surface defining a linear profile.

8. The device of claim 1, wherein the screen assembly has a substantially flat lower surface.
9. The device of claim 1, wherein the screen assembly overlies the grid free of mechanical engagement with the grid.
10. The device of claim 1, wherein the screen assembly comprises a flexible screen free of stiffening elements.
11. The device of claim 1, wherein each stringer includes at least one mounting aperture provided on an upper portion of the stringer, wherein each support rod is at least partially located within mounting apertures of two or more stringers.
12. The device of claim 11, wherein a depth of the mounting apertures and a cross-sectional dimension of the support rods are such than when the support rods are located within corresponding ones of the mounting apertures, top edges of the support rods are at or below the top edges of the stringers in which they are mounted.
13. The device of claim 1, wherein a depth of the mounting apertures and a cross-sectional dimension of the support rods are such than when the support rods are located with corresponding ones of the mounting apertures, top edges of the support rods are above top edges of the stringers in which they are mounted.
14. The device of claim 1, wherein an opening is formed at the top of each mounting aperture, and wherein a width of the opening of each mounting aperture is smaller than a diameter of the support rod located in the mounting aperture.
15. The device of claim 1, wherein each of the plurality of support rods comprises a core and a cover surrounding the core, and wherein the cover of each support rod is formed of a deformable material such that the cover can be at least partially deformed when the support rod is inserted into corresponding mounting apertures of stringers.
16. A vibratory screening machine incorporating the screen deck of claim 1.
17. A method for use with a vibratory screening machine, comprising: providing a screen deck having a plurality of stringers mounted on a frame and arranged substantially parallel to one another and having a plurality of support rods mounted to the stringers, wherein each support rod extends between and is coupled to at least two of the stringers; placing a screen assembly over a grid formed by the plurality of stringers and support rods; tensioning the screen assembly of the grid to secure the grid to the screen deck.
18. The method of claim 17, wherein tensioning the screen assembly comprises tensioning a substantially flat surface of a screen assembly over the grid.
19. The method of claim 17, wherein tensioning the screen assembly comprises tensioning a flexible screen assembly free of stiffening elements over the grid.
20. The method of claim 18, wherein tensioning the screen assembly comprises tensioning the screen assembly over a convex surface defined by the stringers.
21. The method of claim 17, wherein the grid prevents sagging of the screen assembly between adjacent stringers.