LEG SYSTEM FOR MOBILE HOMES OR OTHER MOBILE BUILDINGS

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ABSTRACT

Legs are anchored to a mobile building and preferably also to the ground, concrete, or other supporting surface, so that the building cannot be blown or shaken off of the legs, the legs preferably cannot slide/skid along the ground, and the legs preferably cannot twist or collapse. Each leg may be hinged and/or clamped to a girder of the building. A leg upper portion is an open, generally triangular, box-like case, which resists deformation, tilting, and twisting, and which includes an abutment plate for abutting against and supporting the girder. A leg stem is slidable in the upper portion, wherein upper and lower locking members such as threaded nuts lock the leg stem in place relative to the upper portion to make the leg a single, rigid unit. A foot, having a multiple-direction pivot connection, may be fixed to the ground or to a block or other supporting surface. In a preferred embodiment, a u-joint is provided between the leg and the foot of the system, and a generally horizontal clamp attaches the foot to a footing block provided on or in the ground. Multiple legs may be pivotally attached to, and folded up against, the underside of a mobile home during transport. When the home is ready to be installed at its permanent site, the legs may then be folded down to their support position, adjusted to level the home at a desired elevation, anchored to the ground or concrete block, and cross-braced by tightened diagonal cables. Optionally, a rigid bar may be installed between the feet of each pair of legs to further limit or prevent the legs of a pair from pivoting out away from each other.
LEG SYSTEM FOR MOBILE HOMES OR OTHER MOBILE BUILDINGS

[0001] This application claims benefit of Provisional Application 60/954,503, filed Aug. 7, 2007, the entire disclosure of which is incorporated herein by this reference.

BACKGROUND OF THE INVENTION

[0002] 1. Field of the Invention

[0003] The present invention relates generally to support systems for a mobile home or other mobile building, and, more specifically, to a leg system comprises pairs of legs that are anchored to the building and connected to each other during use, and that remain anchored to, but are pivotal against, the building in transport mode.

[0004] 2. Related Art

[0005] Mobile homes, office, and storage buildings are popular because they can be positioned and used quickly, while still preserving the possibility for moving said mobile buildings to new locations at a later date. Conventional mobile buildings have no foundation, and, instead, are typically set on concrete blocks, cinder blocks, or metal frame structures, but are not attached to said blocks or said frame structures.

[0006] A typical conventional metal frame structure is a pyramidal frame with a bottom about 5-6 inches square set on a concrete block and with an adjusting screw in the peak of the pyramid on which screw is set the mobile home. Thus, said metal frames each may be thought of as a pyramid-shaped “jack” for leveling or supporting a mobile home. Multiple of said frames are placed under the mobile home, and then each screw is adjusted up or down to level the home. Consequently, mobile buildings cannot resist damage caused by high winds or earthquakes as well as can homes that are built on foundations. Wind or earthquake forces can push a mobile home off of its proper position on its supporting blocks or metal frames, whereafter the blocks or metal frames typically burst up through the floor to do major damage to the mobile home. Alternatively, wind forces can move the mobile home even a greater distance, which typically results in total demolition of the mobile building.

[0007] The present inventor was granted U.S. Pat. No. 3,367,614 (hereafter ‘614) in Feb. 6, 1968, which patent disclosed legs that may support a mobile home. The ‘614 legs were placed between the main frame girders of the mobile home and the ground, and had an adjustment system for changing each leg length in order to level the mobile home. Straps were provided between the two legs of each set of legs, for stabilizing the legs relative to each other. The leg system of U.S. Pat. No. 3,367,614 was an after-market product that had to be installed at the mobile home site after the mobile home had already been positioned in place. After the ‘614 legs were installed, they supported the weight of the mobile home, but they were not physically attached to the mobile home and were not physically attached to the supporting surface, such as the ground or a concrete slab, underneath the legs. Thus, the ‘614 legs, while very solid and stable, may not have always prevented the mobile home from overturning in a strong wind or an earthquake.

[0008] Other patent literature discloses systems for stabilizing mobile buildings, trailers, or recreational vehicles. For example, Hendon (U.S. Pat. No. 3,933,372), Delager (U.S. Pat. No. 4,429,851), Arnold (U.S. Pat. No. 6,095,474), and Holly (U.S. Pat. No. 6,695,348) all disclose leg systems, with a common feature being a connector or tie between the right and left legs of each leg set. Further, in another approach, such as disclosed in Cusimano (U.S. Pat. Nos. 5,873,679 and 6,591,564) and Moreno, Jr. (U.S. Pat. No. 6,622,439), mobile or manufactured houses are set on braces or legs that include multiple spikes/pins that are driven into the ground. Still, there is a need for an improved mobile building stabilization system for anchoring said mobile buildings to the ground for protection against wind and earthquake forces. Still, the inventor believes that there is a need for such a system that may be installed on the mobile building at the place and time of manufacture of the building, and that is easy to deploy and anchor to the ground or other support surface at the resting place of the mobile building. Still, the inventor believes that there is a need for a leg system that is so solid and secure that it may be grant benefits similar to those of a conventional concrete foundation at much lower cost, and that may be included in a mortgage for said mobile building. These and/or other objects and benefits may be provided by various embodiments of the invention, as will be further described in the following description.

SUMMARY OF THE INVENTION

[0009] The invented leg system for a mobile building comprises multiple legs that are placed underneath a mobile building in pairs, preferably all along the length of the building as needed to support the weight of the building. Each of the legs is anchored both to the mobile building it supports and also to a supporting surface underneath the legs. Each leg is preferably pivotal from a retracted position against the bottom of the building to an employed position reaching from the mobile building toward the ground. Thus, the leg system may be installed at the time of manufacture of the building, and simply unfolded and anchored to the ground or supporting surface when the building is brought to its installation site. Alternatively, the leg system may be installed after manufacture of the building, for example, by clamping the legs to the building before or during deployment at the installation site. The foot of each leg may be anchored to the ground or other supporting surfaces by various means, for example, soil nails or screws or other soil anchors that secure the foot to the ground, and/or bolts or clamps that secure the foot of each leg to concrete, block, or other man-made structure.

[0010] Each leg preferably comprises an upper portion that comprises hinges and is specially adapted in shape for increased strength and stability. Each leg preferably also comprises an improved length adjustment system comprising a multiple-nut system on a leg stem. Each leg also preferably comprises a multiple-direction pivot joint between the leg and the foot, for improving leg positioning on uneven or slanted ground or supporting surfaces. A connection of each leg to the other leg of the pair may be adjusted, preferably by cable, strap, or chain, for preventing unwanted spreading of the legs.

[0011] The term “mobile building” herein includes mobile or manufactured homes, mobile office and storage units, recreational trailers or other units that are typically delivered in a pre-manufactured state and set on top of supporting blocks or metal frames, as described in the Related Art section. Therefore, the use of the building/unit that the invented leg system supports is not necessarily important, as security and stabilization and anchoring are desirable for all of these units. The invented system is typically used for units wherein
the building is not to be connected in conventional manner to a conventional concrete foundation.

BRIEF DESCRIPTION OF THE DRAWINGS AND THE PHOTOGRAPHS

[0012] In the drawings and Detailed Description, each preferred embodiment of the invention is described having a front side, back side, right side, left side, top, and bottom, wherein the “front” of each leg is the side that faces inward toward another of a pair of the legs when a pair of legs is located underneath a mobile building. Typically, therefore, the front of each leg will face toward the centerline of an elongated mobile building. The use of the term “front” is not intended to imply that the legs will face in the leading direction as the building is transported down a road. Further, for ease of description, mobile buildings are described as having two ends, two sides, a top, a bottom, and a longitudinal axis between said two ends; this is not to limit the term “mobile building” to a simple rectangular shape or any other particular shape, size, or configuration. Legs according to embodiments of the invention could be used underneath mobile buildings or pieces of mobile buildings of different shapes and sizes.

[0013] FIG. 1 is a front perspective view of one embodiment of a leg of the invented leg system.

[0014] FIG. 2 is a front view of the leg embodiment of FIG. 1.

[0015] FIG. 3 is a left side view of the embodiment of FIGS. 1 and 2.

[0016] FIG. 4 is a front, exploded perspective view of the embodiment of FIG. 1-3.

[0017] FIG. 5 is a left side, cross-sectional view of the leg of FIGS. 1-4, but with the foot anchored to bolts in concrete.

[0018] FIG. 6 is a schematic end view of a mobile home wherein one set of legs according to the embodiment of FIGS. 1-4 is visible, wherein said legs are attached to the underside of one embodiment of a mobile home and fully deployed, that is, with the legs unfolded and length-adjusted for leveling of the building, with soil screws installed into the ground, and with diagonal cables installed and tightened.

[0019] FIG. 7 is a schematic view of the combined legs-plus-mobile-home embodiment of FIG. 6 wherein the embodiment is viewed from a side of the mobile home.

[0020] FIG. 8 is a schematic bottom, perspective view of the embodiment of FIGS. 6 and 7.

[0021] FIG. 9 is a schematic end view of the embodiment of FIGS. 6-8, with the legs pivoted upward and the feet fastened to the building underside (typically, the underside of the floor) for transport or storage. This is generally how this embodiment would appear after manufacture and transport to the intended installation site but before unfastening the legs from the underside of the building for deployment.

[0022] FIG. 10 is a detail end view of a leg on the mobile home of FIG. 9 in its position wherein it is folded and fastened in a raised position, the detail being that part of the embodiment that is within the circle in FIG. 9.

[0023] FIG. 11 is a detail bottom perspective view of the leg of FIGS. 9-10.

[0024] FIGS. 12A and B are side views of two examples of members that may be used to anchor each leg to the ground. FIG. 12A is a side view of one embodiment of a soil screw that may be used in embodiments of the invented leg system. FIG. 12B is a side view of one embodiment of a soil nail that may be used in embodiments of the invented leg system.

[0025] FIG. 13 is a front perspective view of an alternative embodiment of leg according to the invention, wherein an apparatus for tightening the diagonal wire/cable is used.

[0026] FIG. 14 is a front perspective detail view of the apparatus for tightening the diagonal wire/cable of FIG. 13.

[0027] FIG. 15 is a perspective view of a leg system according to yet another embodiment of the invention having an alternative upper portion top wall, a chain apparatus at each lower end of the diagonal wire/cable for gross tightening adjustment of each wire/cable, and a connector at each upper end of the diagonal wire/cable that may be used for fine-adjustment of each wire/cable.

[0028] FIG. 16 is a top view of one of the legs, and a part of the chain apparatus, of the embodiment of FIG. 15.

[0029] FIG. 17 is a cross-sectional, left side view of the embodiment of FIGS. 15 and 16, viewed along the line 17-17 in FIG. 16.

[0030] FIG. 18 is a front, exploded perspective view of the embodiment of FIGS. 15-17.

[0031] FIG. 19 is a schematic left side view of the top end of a leg attached by one embodiment of a pivotal clamp system, which clamps to a girdar of a mobile home but also allows pivoting of the leg relative to the building for easy transport of the building with the legs remaining clamped onto the girdar.

[0032] FIGS. 20-24 schematically illustrate alternative embodiments of the leg system, wherein a 1-shaped rearward extension from the top wall and/or case is used as the anchor location or connection point for upper end of the diagonal cable (FIG. 20), a multiple-direction pivot is used to connect the leg stem to the foot (FIG. 21), a footing clamp is used to square the leg system to a footing block (FIG. 22), and a strut may be optionally used to anchor the lower ends of a pair of legs together in a rigid condition to prevent the two legs swinging outward from each other when in use (FIGS. 23 and 24).

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0033] Referring to the Figures, there are shown several, but not the only, embodiments of the invented leg system. FIGS. 1-4 illustrate one embodiment of a leg according to the invention portrayed with screws for attachment to the ground. FIG. 5 illustrates the leg embodiment of FIGS. 1-4 with a bolt system for attaching the leg to concrete (rather than ground screws). FIGS. 6-11 illustrate the embodiment of FIGS. 1-4 attached to a mobile building. FIGS. 12A and 12B illustrate examples of ground screw and a soil nail that may be used in some embodiments for securement to the ground. FIGS. 13 and 14 illustrate an alternative system for connecting and tightening diagonal cables. FIGS. 15-18 illustrate an alternative embodiment of a leg according to the invention, which uses an alternative system for cable connectors and tightening system. FIG. 19 portrays one embodiment of a clamping system for attaching a leg to the underside of a mobile building. FIGS. 20-24 portray yet other embodiments with alternate top wall and upper cable end attachment, a footing clamp for fixing each leg to a footing block, and an optional rigid strut between lower ends of the pair of legs.

[0034] The preferred leg system comprises pairs of legs that may be installed on a mobile building, by anchoring the legs to the building in a secure and reliable manner. The installation may occur during or immediately after manufacture of
the building, or later, for example, at a sales site or a building installation site as desired by the retailer or buyer. Once attached to the building, the legs may be folded and fastened against the building so that they are generally out of the way during transport or storage of the building.

[0035] At the time of deployment at the building installation location, the attached legs are unfolded to rest on the ground and are anchored to the ground or another supporting surface in a secure and reliable manner, so that the building is anchored to the ground/surface by means of the legs being anchored to the ground/surface and the legs being anchored to the building. This differs greatly from conventional mobile building installations wherein the building is merely set, unattached, upon blocks or metal frames, which are also set, unattached, upon the ground or a concrete pad. Unlike legs that have been provided in the past for placement underneath mobile buildings, the preferred legs according to the invention are attached to, rather than just in contact with, the mobile building. Also, if the legs are attached to the building before being brought to the installation site, it is relatively easy to unfold the legs compared to trying to insert prior art legs underneath the building. The legs remain connected to the building, and, during use underneath the building, they also remain connected to the ground or supporting surface.

[0036] Each leg is pivotally connected to the building, preferably by hinged connection to a girder beam of the building on the underside of the building. Each leg may be pivoted up toward the underside of the building, so that it is generally out of the way during transport to its permanent or semi-permanent site. At the permanent or semi-permanent site, the leg may be folded down to the deployed position and adjusted to support the building at its intended elevation and to level the building. Each of the legs is preferably anchored to the ground or to a concrete pad, slab, or block by one or more soil nails, soil screws, bolts, clamps, or other members that are pounded, pushed, screwed, or clamped into/onto the ground or concrete, or that are built into the ground or concrete.

[0037] Therefore, the invented system comprises anchoring/fixing the legs both to the building that is being supported and to the ground or other surface upon which the building is being placed for use. This complete anchoring feature is more stable and safe than the conventional systems wherein the building is merely set upon support legs that are merely set upon the ground (the foot rests and is anchored. Threaded stem 14 makes it possible to adjust the height of each leg unit to generally whatever elevation is desired, and transmits the load from the upper portion 16 of the leg to the foot 12. The upper portion 16 transmits the weight of the building to the stem 14 and also braces the leg 10, especially in the longitudinal direction (parallel to the longitudinal axis/length of the building) to prevent the leg 10 from tipping over in response to longitudinal forces such as might be created by wind or earthquake.

[0040] As shown to best advantage in FIGS. 1 and 4, the foot 12 comprises a base plate 18, a bracket 20 utilized for connecting the foot to the stem 14, and a connector 30 for the cross-tying mechanism between the two legs of a pair of legs, such as diagonal cables 32, 32'. The foot 12 connects to threaded leg stem 14 by nut and bolt 24, 26, wherein bolt 26 extends through holes 23 in the ears 22 of the bracket 20 (FIG. 4). An alternative pin, axle shaft, or fastener may be used besides nut and bolt 24, 26, as long as the alternative member(s) cooperate with bracket 20 or other structure of the foot to provide a connection and a pivotal axis for the stem 14. Bolt 26 has threads (not shown) at its distal end for Cooperating with threaded nut 24.

[0041] As shown to best advantage in FIGS. 1, 2, and 4, the threaded leg stem 14 runs through a generally vertical sleeve 40 (FIG. 4) in bracket 42 that is rigidly connected to the upper portion 16 of the leg. The sleeve 40 may be a pipe, or tube, that is rigidly attached in a vertical position to the triangular upper portion 16 of the leg 10 so that the adjusting stem can slide up or down through that pipe/tube. A nut 44, which is on the stem and below the vertical sleeve 40, makes it possible to adjust the overall length of the leg, so that each leg fits snugly between the mobile home and the ground or other supporting surface while determining the height of the mobile home above the supporting ground and leveling the building. Note that, upon screwing nut 44 downward on the threaded stem, the upper portion 16 may move downward toward the foot 12 and the overall length of the leg 10 is shortened. Another nut 46 (FIGS. 1, 2, and 4), which is on the stem and above the vertical sleeve 40, can be tightened down against the upper end of the sleeve 40, which in turn locks the upper portion 16 against lower nut 44. In this procedure, after the lower nut 46 has been lowered or raised to perform leg length adjustment, it may be convenient to adjust the upper nut 44, by hand, down against the sleeve 40, and then to perform a final tightening of lower nut 46, by wrench, upward against the sleeve 40.

[0042] The sleeve 40 provides bearing surface for the upper nut 46 to hold the stem rigidly within the leg structure, locking the above-described height adjustment and fixing the stem 14 rigidly to the upper portion 16 to make the three portions (12, 14, 16) act as a single rigid unit. It is this double-locking-nut system that captures and locks the stem relative to the upper portion 16, allowing the supporting leg to be used as a hold-down apparatus for the mobile home. For example, if tensile force had been applied to the leg, such as might occur when uplift is caused by wind, the stem cannot slide out of the leg.

[0043] Still referring to FIGS. 1-4, the upper portion 16 comprises a generally triangular case 50 with a rear wall 52, left and right side walls 54, 56, and a top wall 58. These walls form an open-front, generally triangular box shape wherein left and right side walls 54, 56 and top wall 58 are of significant width (dimension extending outward from the rear wall 52, preferably in the range of 2-5 inches) and are generally perpendicular to rear wall 52.

[0044] The case 50 forms an enclosure, preferably open at the front, to which other members of the leg 10 are attached. Sleeve 40 and bracket 42 are housed within, and rigidly fixed,
to case 50 near its bottom end, for example by welding. Two hinge bars 60 are parallel to each other and are pivotally connected to the hinge tab 61 of case 50 via pivot axle 62, and may be fixed to a girdler G of the building, for example, by use of rivets, bolts, welding, clamps, or by other permanent or semi-permanent means. With the hinges fixed to the mobile home, the mobile home will not be separated from the support legs unintentionally. Both hinge bars 60 are preferably long enough that they provide substantial surface area and/or length for a strong weld or other connection, to provide a durable and permanent or semi-permanent connection between the leg and the building.

[0045] The top wall 58 of the case 50 has a flat, upper surface 64 that is the abutment plate that abuts against a girdler of the building when the leg is unfolded and in the deployed position. The abutment plate (surface 64) serves as a limit to the pivoting of the leg, and becomes the main support surface of the leg against the building while the leg is in use. The case 50, by virtue of its broad, flat surface 64 positioned against the building girdler and its rigid box-like structure, serves to stabilize the leg relative to the building, and is very unlikely to deform, twist, tip, or tilt from its shape and its preferred position.

[0046] Rear wall 52 comprises a recess 66 (conceal recess when viewed generally from the front as in FIGS. 1, 2, and 4, and a convex mound when viewed from the rear or the outside of the case 50 as in FIG. 3). This recess provides room for adjustment of the upper nut 46 and also may serve to strengthen the rear wall 52 against twisting and the case 50 from buckling or collapsing.

[0047] The foot 12 of each leg 10 is connected to the top of the opposite leg of the pair by a diagonal cable 32 or strap that can be adjusted in length. Thus, in the leg shown FIGS. 1-4, ends of two cables 32, 32' are shown, wherein cable 32 is understood to extend from the foot 12 of the leg being shown to the top of another leg of a pair of legs, and wherein cable 32' is understood to extend from the foot of the other leg of the pair to the top of the illustrated leg. The two feet of the pair of legs are spaced farther apart than the tops of the legs, as shown to best advantage in FIG. 6. Thus, the legs slope downward and outward from each other (about 10 degrees from vertical), which causes the weight of the structure to tend to make the feet slide outward. The diagonal cables 32, 32' or straps prevent this outward sliding movement, and each pair of legs thus connected to each other to act as a truss to carry the weight of the structure. The truss action of each pair of legs also thus resists lateral movement that might be caused by wind or earthquake.

[0048] The lower cable connector 30 of the embodiment illustrated in FIGS. 1-4 may comprise a hook with two prongs 33 for receiving a transverse bar provided at an end of a tensioning bolt or turnbuckle-type mechanism 34 on cable 32 near the foot. Turnbuckle 34 may be used for tightening of the cable, as will be understood by one of skill in the art after viewing the drawings. The upper cable connector 70 may comprise a single hook, extending from the generally triangular top wall extension 59 (that is preferably at a slight, downward angle from the plane of the top wall upper surface 64), which hook captures a loop or other member on the other diagonal cable 32. The opposite end of cable 32 preferably will also have a turnbuckle connection to the opposite leg, so that both of the crossing, diagonal cables 32, 32' are adjustable in length to tighten their respective pair of legs relative to each other.

[0049] Other cables, straps, or lines may be used besides the ones shown in FIGS. 1-4. Other cable connectors and cable-length-adjustment systems may be used other than the ones shown in FIGS. 1-4, including those shown in FIGS. 13-18, which will be discussed later in this disclosure. FIGS. 15-18 illustrate alternative cable connectors and an alternative cable-length-adjustment system. Other attachments from the legs to the ground or other supporting surface, besides the ground screws shown in FIGS. 1-4, may be used. For example, the bolt system shown in FIG. 5, the soil nail shown in FIG. 12B, the foot clamp system shown in FIGS. 22-24, and/or other bolts, screws, nails, hooks, latches, clamps, or other members may be used.

[0050] The foot base plate 18 of each leg has holes 80 that may receive soil screws 84 (see FIG. 12A) or soil nails 85 (see FIGS. 123) or anchor bolts 86 (see leg system 10 in FIG. 5), for anchoring the leg pairs to the ground GR, or to a concrete slab C or concrete pad on the ground below the structure, respectively. Helical screws, nails, stakes, pins, or bolts other than those shown may be used. The legs may be anchored directly to the ground, preferably via soil screws 84 or soil nails 85, as this enables installation and anchoring of the mobile home in places wherein no concrete is provided. Alternatively, the legs may be anchored to a relatively large concrete slab/pad or to individual pads or blocks under each foot. The pads/blocks, especially the small ones for individual feet, are preferably anchored to the ground by some means as will be understood by those in the field of concrete construction. In either of these approaches (direct anchoring to the ground or anchoring to concrete that is preferably anchored to the ground) the structure can be tied down to the earth to prevent it from moving in response to force, such as wind, or earthquake, or any other force that might be applied to the structure. Concrete or cinder blocks that are small and/or not anchored to the ground, and metal frames such as are discussed in the Related Art Section, are not desirable and not needed, as the preferred legs eliminate the need for the stacked-block approach or the “pyramid jack” approach to support or level a mobile building.

[0051] FIGS. 6-11 illustrate the preferred use of the invented leg system, by portraying the embodiment of FIGS. 1-4 attached by hinges to a mobile home, with ground screws 84 and diagonal cables 32, 32' in use. In FIG. 6, the end of the mobile home M is shown, with one pair of legs 10 visible in fully-deployed condition. In FIGS. 7 and 8, four pair 100 of legs 10 are visible, spaced along the length of the mobile home. In FIGS. 9-11, legs 10 are shown in folded, retracted condition, with feet 12 attached to the bottom of the building, preferably to the underside of the floor F, by one or more fasteners 90 through holes 80 in the feet.

[0052] FIGS. 13 and 14 illustrate an alternative apparatus 91 for tightening the diagonal cables that may be used with legs of the invention. A shaft 92 may be rotatably received in a U-shaped bracket 93, and cable 32' may be wound on said shaft 92. A pin 94 may extend through a sleeve 95 that extends (integally or fixedly) from the U-shaped bracket 93 and into a bore (not shown) through the shaft 92, in order to stop rotation of the shaft 92 in the bracket 93, and, hence, lock the cable in its tightened condition. The bore may extend all the way through the shaft 92, so that the pin 94 may be inserted into the bore from each end, with the result being that the shaft may be locked in position relative to the bracket 93 each 1/2 turn, making this adjustment fairly sensitive and accurate.
FIGS. 15-18 portray an alternative embodiment of leg 110, which comprises an alternative cable connection and tightening system. One may see from FIGS. 15-18 that the leg 110 is substantially the same as the legs portrayed in FIGS. 1-11, with the exceptions being that the top wall 158 of the case 150 has a somewhat different shape and the connectors 130 and 170 for the diagonal cables are different. The preferred features and structures of the leg system discussed above are still applicable to the embodiment of FIGS. 15-18.

Not all of the pieces-parts of the leg 110 in FIGS. 15-18 are called-out, so that the viewer may more accurately and clearly see the embodiment, but those that are have been given the same numbers plus 100 (for example, stem 114).

Case 150 includes top wall 158 with top wall extension 159, wherein extension 159 is not triangular, as was extension 59 in the earlier embodiment, but instead is generally rectangular. Extension 159 (as is extension 59) is slightly downwardly-angled compared to the plane of abutment surface 164; this gives case 150 additional strength for preventing deformation or collapse and twist/tilt resistance. The generally triangular shape of the preferred upper portion of each leg, both in this embodiment and in the embodiments of FIGS. 1-11, not only transmits the weight of the structure down through the stem and the foot to the surface that supports it, but it also braces the leg against tipping over in the longitudinal direction of the building. If a strong longitudinal force (hurricane or earthquake, for example), causes the structure to move in the longitudinal direction (for example, if the longitudinal force overcomes the attachment between the foot and the ground or supporting surface, or pulls up or slides the supporting surface itself), the triangular bracing provided by the said preferred upper portion might force the foot pad to skid on its bearing surface or force the foot pad plus supporting surface to skid along, but it will not allow the leg to tip.

Connector 130 is adapted to receive chain link connector 131 between any two of its chain links, so that the length of the cable 132 is adjustable in increments of a single chain link, thus providing a rough or “gross” adjustment for the length of the cable 132. As shown to best advantage in FIGS. 17 and 18, connector 170 on the upper portion 116 may comprise a tab 172 that captures an end piece 135 of the diagonal cable. Threaded member 173 extends through bar 171, at the rear of the case 150, to threadably connect to tab 172, thus, adjustably connecting tab 172 to the upper portion 116. Thus, connector 170 provides a fine adjustment for the length of the cable 132 by pulling the end piece 135 of the cable toward, or letting it out from, the rear of the case 150.

Referring to FIG. 19, there is portrayed an alternative system for attaching legs according to the invention to a mobile building. This alternative system comprises clamping of the legs to girders G underneath the mobile building, preferably so that the legs are still pivotally attached to the building. Such a clamping system allows the legs to be attached at any time, for example, during many different stages in the manufacture of the building, after manufacture of the building, at a retail site, or at the building installation site. Many manufacturers, if they were to weld the leg hinges onto the girders, would prefer to do said welding at or near the beginning of the building manufacturing process, but the legs being attached to the girders throughout the rest of the manufacturing process might be awkward or inconvenient for the manufacturer. Therefore, a clamping system may eliminate altogether the need to weld the hinge bars to the girders of the building, may be more convenient or economical for the manufacturer, and may eliminate any damage or modification of the girders. Further, if legs according to the invention are not attached at the time of delivery of the building to the building site, or if building owners wish to retrofit legs onto their building, building owners and/or handymen charged with the task of attaching the legs will find clamping easier and safer than trying to attach the legs by welding.

Referring to FIG. 19, one may see a girder G that is understood to be at the underside of a mobile home. Clamp 200 is one, but not the only, embodiment of a clamp that may be attached to the girder G. Leg 110 is pivotally attached to the clamp 200 by means of a pivotal connection between the clamp 200 and the upper unit 116 of the leg. In the embodiment shown in FIG. 19, the clamp 200 comprises two clamp jaws 201, 202 comprising clamping portions 205, 206 that may be at opposing sides of the girder and tightened together by nut and bolt 204 or other fastener(s) to engage/clamp to the girder G. Each of the two clamp jaws 201, 202 further comprises a hinge bar 260 that is fixed, by welding for example, to the clamping portions 205, 206 and that extends downward generally perpendicular to the clamping portions and perpendicular to the bottom surface of the girder G, and transverse to the length of the girder G. A hinge tab 161 of the leg 110 (see FIG. 4) pivotally connects to one of said hinge bars 260 by means of a nut and bolt 208 or other fastener that allows at least some pivotal movement. In the embodiment portrayed in FIG. 19, the bolt 208 serves as the pivot axle.

While only one clamp 200 is shown in the side view of FIG. 19, it will be understood that preferably two clamps 200 are provided for each leg 110, with one being provided on each side of the leg 110 and pivotally connected to its respective hinge tab 61. The top wall 58 of the leg 10, and particularly the upper surface 164 (see FIGS. 1 and 3) will abut against the bottom surface of the girder G in between two of the clamps 200. Thus, instead of the welding hinge 60 of FIGS. 1-4 directly to the girder G, the clamps 200 (particularly, the clamping portions 205, 206) attach to the girder G, and the hinge bars (60, 260) are welded or otherwise fixed to the clamping portions 205, 206. This way, clamps serve to securely, and permanently or semi-permanently, connect the leg to the girder without modifying the girder or welding any object to the girder.

The preferred clamp 200 has two hinge bars 260, one on each clamp jaw 201, 202. Each hinge bar may be made with a hole for receiving a nut and bolt 208 or other fastener. This way, the clamp jaws 201, 202 are mirror images of each other, and a leg’s hinge tab 161 may be attached to either of the jaws, enabling a set of jaws 201, 202 to be used on either the left or right side of a leg 110, or at any location on the mobile building, for example, on the girder either on the right side or the left side of FIGS. 6 and 10.

In alternative embodiments, a clamping system may be used to clamp the upper portion of the leg to the building, without the use or presence of hinges. In other words, a clamp may be bolted or otherwise attached directly to a leg without any pivotal or hinge connection. In much less-preferred embodiments, the leg may be directly welded to a girder, without any pivotal or hinge connection in between the leg and the girder. The invention is, therefore, not necessarily limited to a particular type of connection or attachment means for securing the legs to the building.

FIGS. 20-24 illustrate yet another embodiment, leg system 310, which is further adapted for strength and convenience of use. Leg system 310 comprises an alternative top
wall 358, an alternative connection between the foot 312 and the stem 314, and an alternative system for anchoring the foot to a supporting surface.

Top wall 358 is provided for the same general purpose as top wall 58 in FIGS. 1-5, and top wall 158 in FIGS. 15-18. Top wall 358 is formed from a generally rectangular plate, which serves as the abutment plate for contact and supporting the girder G or other building portion, as discussed above for other embodiments. See FIG. 20.

L-shaped top wall rearward extension 371 extends from top wall 358, and, together, top wall 358 and extension 371 form the top end or cover of the upper portion 316 and may be called the “cap plate” for the upper portion 316. The L-shaped rearward extension 371 preferably comprises two bars 371', 371" at about 90 degrees to each other, or a single plate that is bent at about 90 degrees, so that the extension 371 extends downward and then outward from the abutment plate (top wall 358). Alternatively, top wall 358 and extension 371 may be integral portions of a single plate that is bent into the preferred Z-shaped cap plate (as seen in end view, wherein the angles of the “Z” are preferably 90 degrees). See FIG. 20.

A hole H1 is provided through the downwardly-extending bar 371' of extension 371, for receiving a connector that captures an end piece of the diagonal cable. This connector may be similar to tab 172 shown to best advantage in FIGS. 15, 17, and 18, or may be a turnbuckle or other finely-adjustable connector. This connector preferably holds the cable end, and is adjustable, in a direction generally perpendicular and slightly downward relative to the rear wall 352. The hole H1 is provided slightly to one side relative to the centerline of the bar 371' and the upper portion 316, so that the diagonal cables extending between the legs of a pair of legs will not contact each other but, instead, will each pass slightly offset from each other.

Hinge tabs 361 are attached to the rearward extension 171, for example, by welding one edge of hinge tab 361 to the downward-extending bar 371', and another edge (90 degrees from said one edge) to the outwardly-extending bar 371". This arrangement of L-shaped extension 371, with hinge tabs 361 at each end, fixed and perpendicular to the two bars of the extension 371, is extremely strong and buckle- and twist-resistant. A large amount of tension may be applied to the cable, and a large amount of lateral or longitudinal force may be applied to the upper portion 316 and the cap plate, with little or no chance that the top wall 358 or its extension 371 will buckle or twist to release or loosen the cable. The top wall 358 need not have a forward extension, such as extension 59 or 159, as sufficient strength and rigidity is provided by the preferred arrangement of top wall 358, rearward extension 371, and the hinge tabs 361. As described above for other embodiments, hinge tabs 361 will pivotally connect to hinge bars 360, which are fixed to adjustable clamp members 305, 306 for attachment to girder G.

In the leg system 310 of FIGS. 20-24, the case 350 has a recess 366 that extends from near the top, to near the bottom, of the rear wall 352 of the case 350. Most preferably, the recess 366 extends from a location 1 inch from the top of rear wall 352 to a location 1 inch from the bottom of rear wall 352. Recess 366, like recesses 66 and 166, are concave when viewed generally from the front, and convex when viewed from the rear or the outside of the case 350. The recess 366 provides room for adjustment of the upper nut and also may serve to strengthen the rear wall 352 against twisting and the case 350 from buckling or collapsing.

The stem 314 is connected to the foot 312 by a pivot connection that allows the stem 314 to pivot in at least two directions relative to the foot 312. For example, a U-joint connection 322 may be provided, so that the stem 314 may pivot forward and rearward, and also sideways (left and right), relative to the foot 312. This will be particularly beneficial when the ground or other support surface is not even and/or is slanted. See, for example, FIG. 21.

The foot 312 preferably includes bracket 320, comprising ears 322 upending for connection to the U-joint 325, and two-pronged cable connector 330. The two-pronged cable connector operates, typically for connection to, and gross adjustment of, the lower ends of the cables, as described earlier for connectors 30, 130.

An alternative system is provided in leg system 310 for anchoring the foot to a supporting surface, as shown in FIGS. 22-24. Bracket 320 is fixed, for example by welding, to a footing clamp 400, which may be secured to a concrete footing block or other block. The footing block is preferably about 16 inches by about 16 inches by about 4 inches. The footing block may lie on the ground, may be fixed to the ground by ground screws or other attachment means, may be buried substantially immovably in the ground, or may be otherwise provided in/on the ground, for example, as would be a concrete footing for a foundation. Whether the footing block lies on the ground, is fixed to the ground, or is otherwise anchored, retained, or embedded by other means, will be determined by the local requirements and the chance of hurricanes or earthquake in that area. In any event, such footing blocks are expected to provide the benefit of being much less expensive than a complete foundation and/or a complete concrete platform.

The footing clamp 400 comprises two clamp jaws 401, 402, which are adjustably connected for being tightened to grasp opposite edges of a concrete footing block B. In describing the footing clamp 400, the center of the footing clamp 400 will be considered the proximal region and the outer, opposing ends will be considered distal regions. The footing block B may be of various dimensions, and footing clamp 400 will be made to fit the block B with some adjustment of the two clamp jaws 401, 402 relative to each other. Clamp jaw 401 holds the bracket 320 on its generally flat body, has a downwardly-depending tooth 403 on its distal end, and an upending bar 404 on its proximal end. Clamp jaw 402 comprises arms 405 between which the proximal end of clamp jaw 401 slides, an upending bar 406 that is parallel to bar 404, and a downwardly-depending tooth 407 on its distal end. By sliding the two jaws 401, 402 together, and threadably connecting upending bars 404 and 406, the distance between the jaw 401, 402, and, hence, between tooth 403 and tooth 407, may be adjusted. This adjustment allows a tight and secure locking of the clamp 400 onto the concrete footing block B, with the clamp 400 preferably extending in the direction parallel to the cables, that is, with jaw 401 generally horizontal and pointing to the other leg system 300 in its pair of leg systems 300, which is typically toward the interior of a building. Jaw 402 will also be generally horizontal and pointing out away from the building, for example, toward “street-side.”

The tooth 403 of jaw 401 further may be equipped with ears 409 that protrude at right angles to the tooth 403. Ears 409 may be used for receiving a rigid, adjustable strut 500 between the footing clamps 400 of a pair of two leg systems 300. Strut 500 is preferably adjustable at one end, by
a rod 501 threadably connected to square strut member 502 and preferably being capable of about a 6 inch adjustment. The strut 500 extends between the teeth 403 of the footing clamps 400 of the two leg systems of a pair, and is generally at the level of the footing blocks B. Such a strut 500 enhances the strength of the leg pair, and is particularly effective in preventing the two legs of a pair from sliding/pivoting away from each other, and, thus, are effective in preventing collapse of the building. See, especially, FIG. 24.

[0072] In use, the legs of the preferred leg system are installed in pairs under the mobile home at spaced intervals preferably not to exceed ten feet. At the homesite, the mobile home must be positioned and adjusted to a level position. In embodiments wherein the legs are pre-attached to the building and folded and fastened to the underside of the building, the foot end of each leg is then released from its temporary connection to the mobile home floor and each leg is folded/pivoted down until the abutment surface of the upper portion of the leg is seated against the bottom of one of the main girder beams of the mobile home, thus, stopping the leg from further pivoting and placing the legs in position underneath the mobile building in the desired slanted position. Next, the stem nuts are loosened to allow the stem and foot pads to slide downward until the foot pads of the legs are resting on the supporting ground or pad. If the leg is to be anchored to the supporting surface, which is desirable but not absolutely necessary, one or more of the following techniques, or others, may be used: a) soil nails or screws can be pounded/turned through the holes in the foot pad and into the ground, b) holes can be drilled through the holes in the foot pad and into a concrete block or slab for anchor bolt installation, or c) feet may be connected to bolts previously placed in the concrete when it was poured, or d) a footing clamp system, such as footing clamp 400, may be tightened to a footing block B. After the feet are securely anchored by these or other methods, the stem nuts are turned by hand until they fit snugly against the sleeve through which the riser stem passes. Then, the lower nut should be turned upward with a wrench to jam the nuts against both ends of the sleeve to lock the leg length adjustment. Wire rope or cable diagonals are then attached to the foot of one of the legs and to the hook at the top of the opposite one of the pair. The tension in the wire rope/cable is then adjusted by adjusting the tensioning bolt, turnbuckle, chain, or other adjustment mechanism until the wire rope/cable is taut. A further connection, such as strut 500, may be installed between the legs or feet of each pair, for further stabilization and prevention of the legs/feet sliding or otherwise moving away from each other. A skirt or other shielding may be installed around the mobile building to hide the legs from sight and to provide a more permanent appearance for the mobile building. Other methods and steps of installation and deployment may be used.

[0073] Many objects are met by the preferred embodiments of the invention shown in the drawings. By providing a complete anchoring system, that is, anchoring of the legs to the mobile building and anchoring of the legs to the ground or a supporting surface, the preferred system resists uplift caused by high winds, and resists overturning or other damage in earthquakes. The preferred leg system may be an integral part of the mobile home and may be included in the manufacturing process. The preferred leg system may be part of the purchase price of the mobile building paid for by the mortgage loan for the building, so that the system need not be an after-market product that the homeowner will have to pay for all at once. The leg system is significantly less expensive than a concrete foundation. The preferred leg system may lower insurance rates on mobile homes and other mobile buildings. The leg system may enhance sales of mobile homes, as it may give mobile home occupants a feeling of security and safety that typically comes only with a solid foundation. When exposed, the leg system, which is an engineered structure rather than a stack of blocks, appears much more sophisticated and attractive than a stack of blocks. Further, the preferred leg system simplifies and standardizes mobile home set-up process.

[0074] Although this invention has been described above with reference to particular means, materials and embodiments, it is to be understood that the invention is not limited to these disclosed particulars, but extends instead to all equivalents within the broad scope of the following claims.

1. A leg system for a mobile building, the leg system comprising:

a case having a rear wall, side walls, and a top wall, and at least one clamp for clamping onto a girder of a mobile building, the at least one clamp being hinged to the case so that the leg system is pivotal relative to said girder and building to a stored position against the bottom of the building and to an in-use position extending down from the building, wherein the case further comprises a rear bar with a first connector;

a sleeve in said case, a threaded leg stem extending through said sleeve so that a portion of the leg stem extends down from the case, the leg system further comprising an upper nut and a lower nut on the threaded leg stem above and below the sleeve so that the upper and lower nuts are tightenable against upper and lower surfaces of the sleeve to retain the leg stem at multiple positions relative to the sleeve to lengthen or shorten the portion of the leg stem extending down from the case;

the leg system further having a foot attached to the leg stem and comprising a hook;
a first cable and a second cable, wherein said first cable is adjustably held by said first connector, and wherein said second cable is adjustably held by said hook, wherein the first cable position in the first connector is finely-adjustable by a threaded member of the first connector, and wherein the second cable position in the hook is grossly-adjustable by means of the cable having multiple chain links that are hookable by said hook.

2. The leg system as in claim 1, wherein the foot is connected to the leg stem by a u-joint so that the leg stem pivots in forward and rearward and also sideways relative to the foot.

3. The leg system as in claim 1, further comprising a footing clamp attached to the foot, the footing clamp comprising first and second jaws on a generally horizontal plane, the first jaw having a first tooth extending generally vertically downward from said plane and the second jaw having a second tooth extending generally vertically downward from said plane, wherein the first jaw and second jaw are slidable and adjustably connected to each other to move the first tooth and second tooth closer together and farther apart to clamp onto a footing block by said first tooth and said second tooth extending down along, and gripping, side surfaces of the footing block.

4. The leg system as in claim 3, wherein the foot and the hook of the foot are fixed to said first jaw.

5. The leg system as in claim 1, wherein said rear bar extends integrally from said top wall and is an L-shaped bar extending downward and outward from the top wall, the
L-shaped bar having a hole offset from the centerline of the L-shaped bar that receives the first connector.

6. The leg system as in claim 5, wherein hinge tabs are fixed to opposite ends of the L-shaped bar, wherein hinge bars are pivotally connected to the hinge tabs, and wherein said at least one clamp comprises two clamps hinged to the case by means of being fixed to said hinge bars that are pivotally connected to the hinge tabs.

7. The leg system of claim 1, wherein said foot is adapted to receive bolts for temporarily connecting the foot to the bottom of the building in the stored position.

8. The leg system of claim 1, wherein the case is triangular.

9. The leg system of claim 8, wherein the case has an elongated recess in the rear wall extending from near the top wall to near the sleeve and concavely extending outward from a centerline of the case.

10. A system for supporting a mobile building, the system comprising at least one pair of legs, the at least one pair comprising a first leg and a second leg, each leg comprising: a case having a rear wall, side walls, and a top wall, and at least one clamp for clamping onto a girder of a mobile building, the at least one clamp being hinged to the case so that the leg is pivotal relative to said girder and building to a stored position against the bottom of the building and to an in-use position extending down from the building, wherein the case further comprises a first connector at an upper region of the case; a sleeve in said case, a threaded leg stem extending through said sleeve so that a portion of the leg stem extends down from the case, the leg further comprising an upper nut and a lower nut on the threaded leg stem above and below the sleeve so that the upper and lower nuts are tightenable against upper and lower surfaces of the sleeve to retain the leg stem at any of multiple positions relative to the sleeve to lengthen or shorten the portion of the leg stem extending down from the case; the leg further having a foot attached to the leg stem, and the foot being fixed to a footing clamp having two jaws for gripping sides surfaces of a generally horizontal concrete block; and the system further comprising a first diagonal cable and a second diagonal cable extending diagonally between and connecting the first and the second legs, the first cable and second cable crossing past each other generally midway between the first leg and the second leg but not touching each other; and wherein the foot is connected to the leg stem by a u-joint so that the leg stem pivots in forward and rearward and also sideways relative to the foot.

11. The system as in claim 10, wherein upper ends of said first and second diagonal cables are adjustably held by hook systems on the feet of the first leg and the second leg, wherein the positions of the upper ends of the cables in the first connectors are finely-adjustable by threaded members of the first connectors, and wherein the positions of the lower ends of the second cable in the hooks are grossly-adjustable by means of the cable having multiple chain links that are hookable by said hooks systems.

12. The system as in claim 10, wherein the footing clamp comprising two jaws comprise First stand second jaws on a generally horizontal plane, the first jaw having a first tooth extending generally vertically downward from said plane and the second jaw having a second tooth extending generally vertically downward from said plane, wherein the first jaw and second jaw are slidably and adjustably connected to each other to move the first tooth and second tooth closer together and further apart to clamp the footing block.

13. The leg system as in claim 12, wherein the foot and the hook system of each leg system are fixed to the first jaw of the respective footing clamp.

14. The leg system as in claim 11, wherein said rear bar extends integrally from the top wall of case of the respective leg, and said rear bar is an L-shaped bar extending downward and outward from the top wall, the L-shaped bar having a hole offset from the centerline of the L-shaped bar.

15. The leg system as in claim 14, wherein hinge tabs are fixed to opposite ends of the L-shaped bar, wherein hinge bars are pivotally connected to the hinge tabs, and wherein said at least one clamp for clamping to a girder comprises two clamps hinged to the case by means of being fixed to said hinge bars pivotally connected to the hinge tabs.

16. The system of claim 10, wherein the case of each of the first leg and the second leg is triangular.

17. The system of claim 16, wherein the case of each of the first leg and the second leg has an elongated recess in the rear wall extending from near the top wall to near the sleeve and concavely extending outward from a centerline of the case.

18. The system of claim 10, further comprising a rigid strut connected to and extending between the footing clamp of the first leg and the footing clamp of the second leg, said strut being generally at ground level.

19. The system of claim 12, further comprising a rigid strut connected to and extending between the first tooth of the footing clamp of the first leg and the first tooth of the footing clamp of the second leg, said strut being generally at ground level and generally parallel to a top surface of the footing block.

20. The system of claim 19, wherein the strut is adjustable in length to provide tension between the footing clamps of the first leg and the second leg to prevent the first leg and the second leg from pivoting outward relative to each other.

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