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(54) **SYSTEM FOR TIGHTENING FABRIC PANELS**

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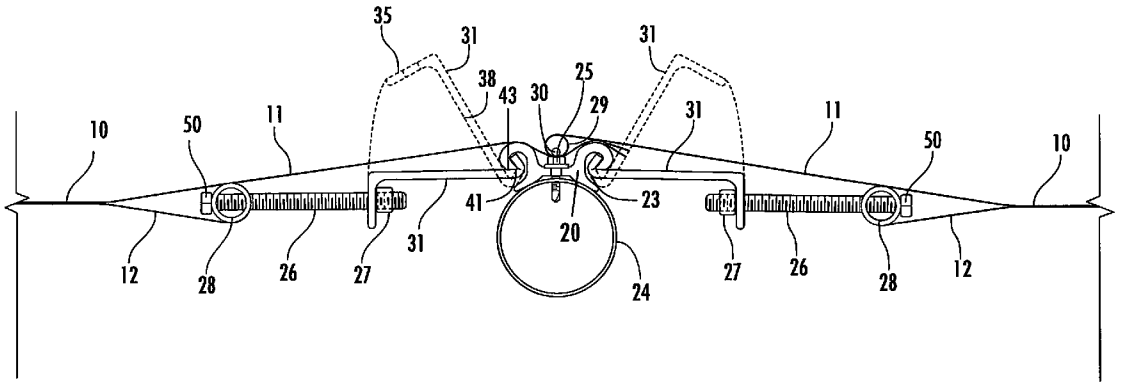
(57) **ABSTRACT**

A system for tightening panels between two fixed structural members. The system includes a mechanism which can selectively loosen or tighten the panels between the structural members. The system can also include flaps to conceal any gaps between the panels as well as conceal certain structural elements. A series of these systems can be used to create a covering for a frame made of a plurality of fixed structures.



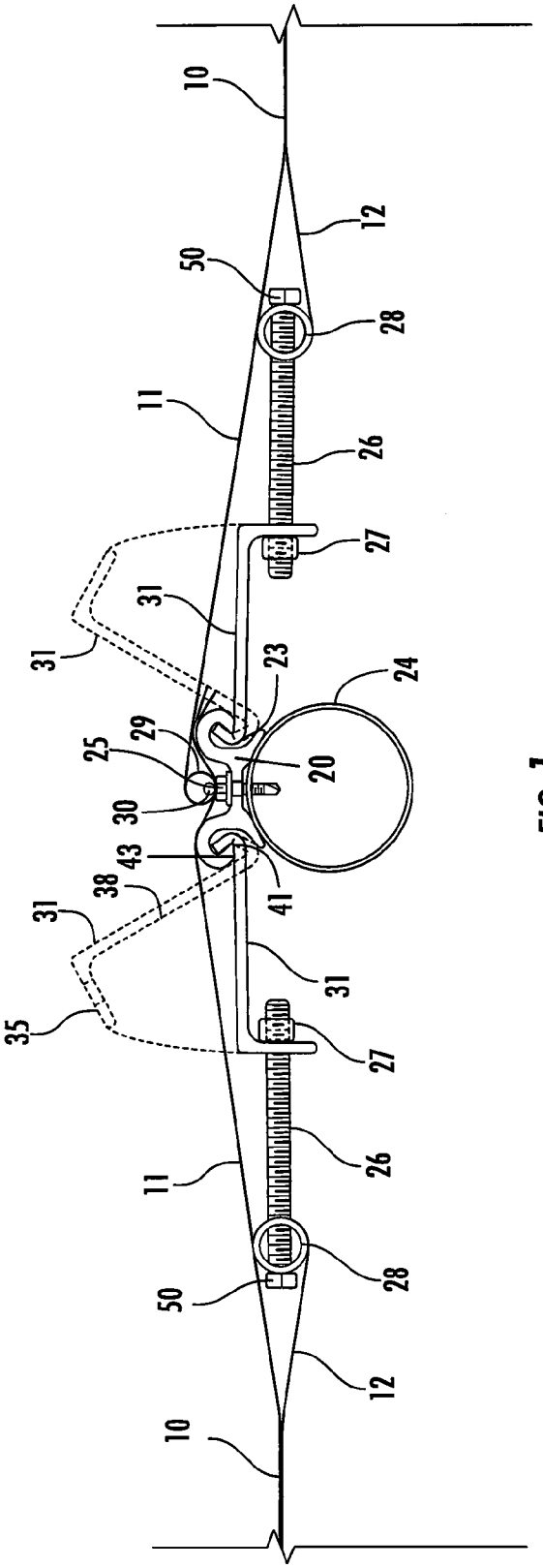

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FIG. 1

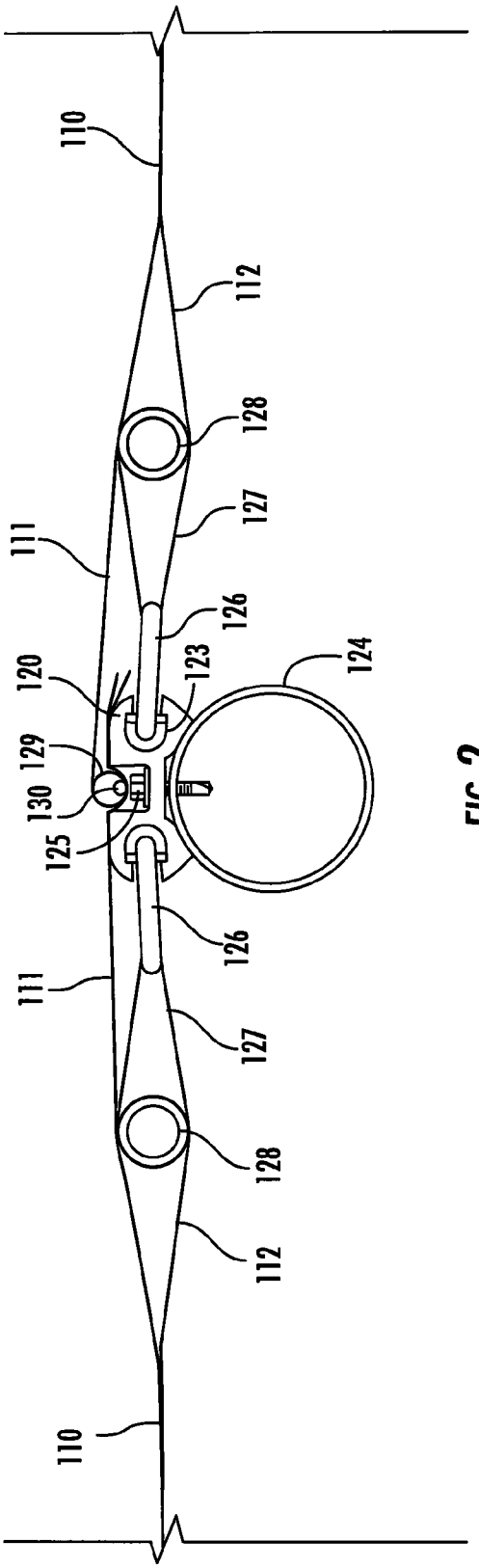
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FIG. 2

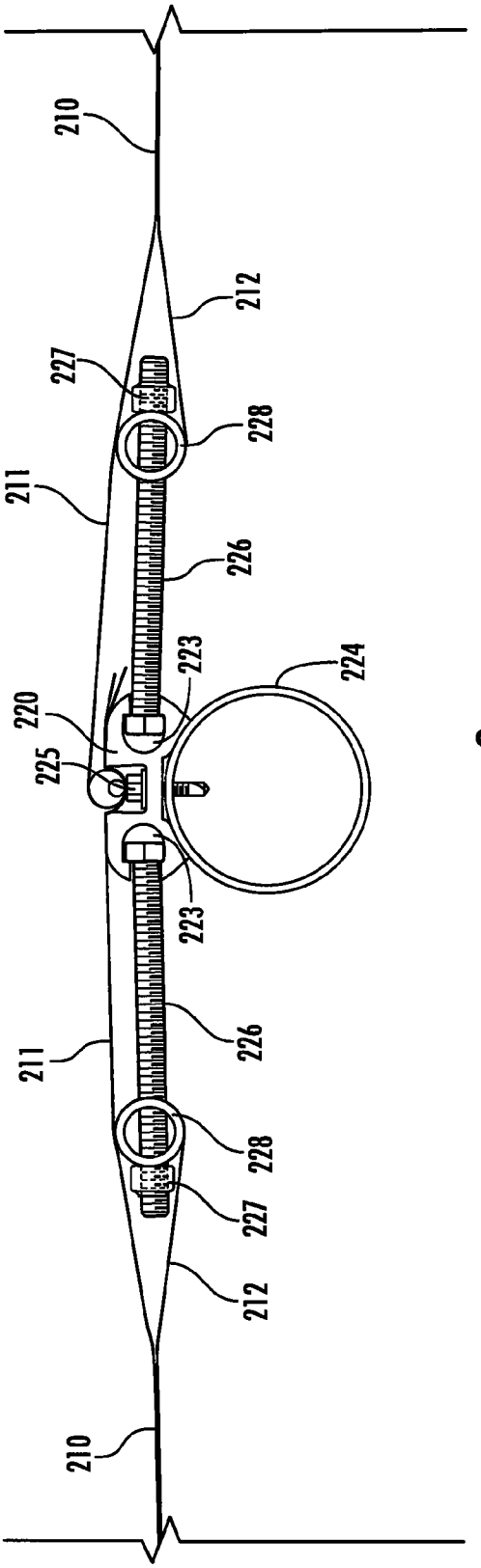
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FIG. 3

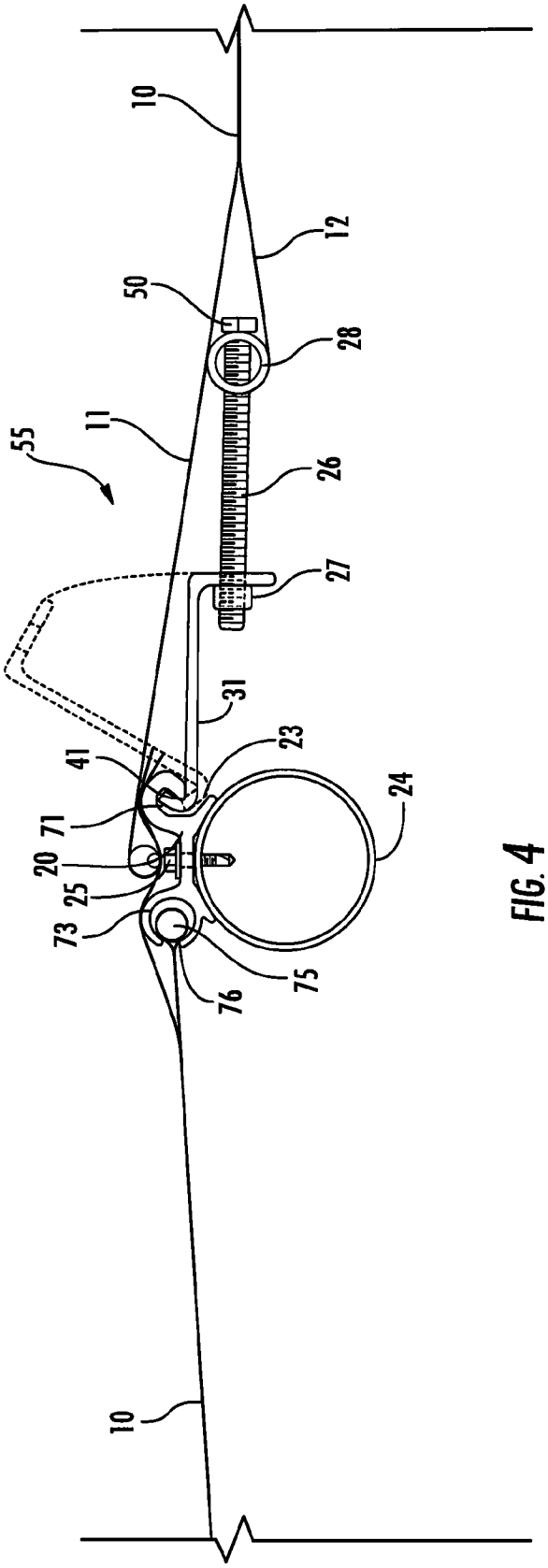

FIG. 4

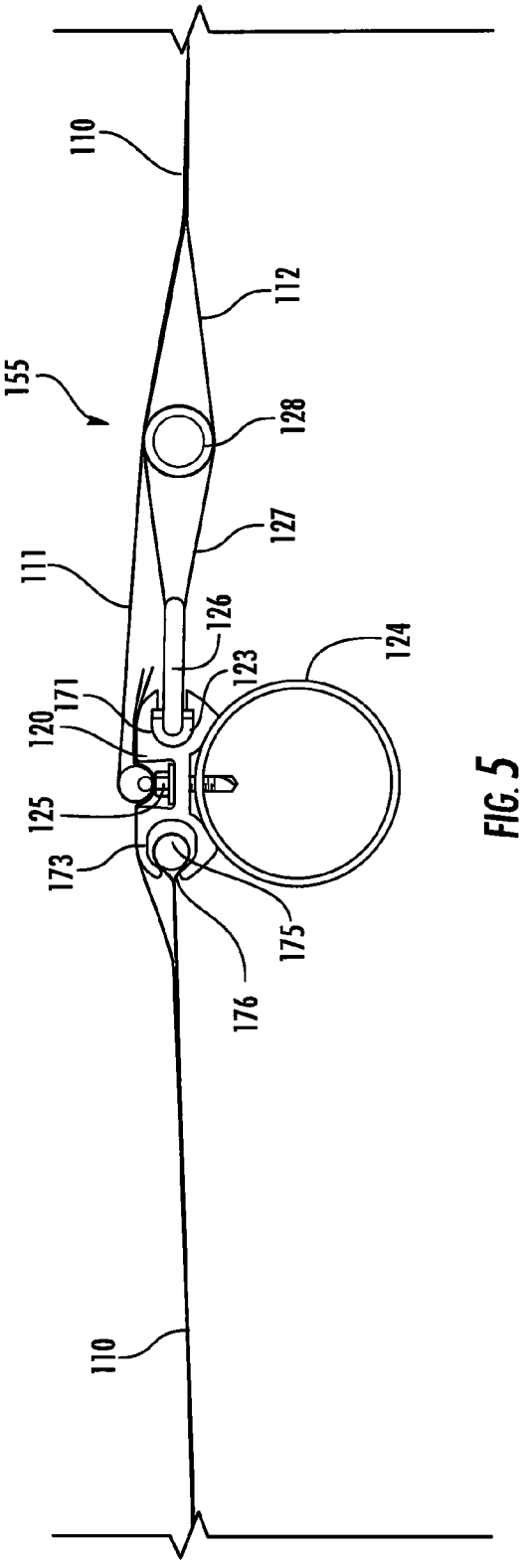

FIG. 5

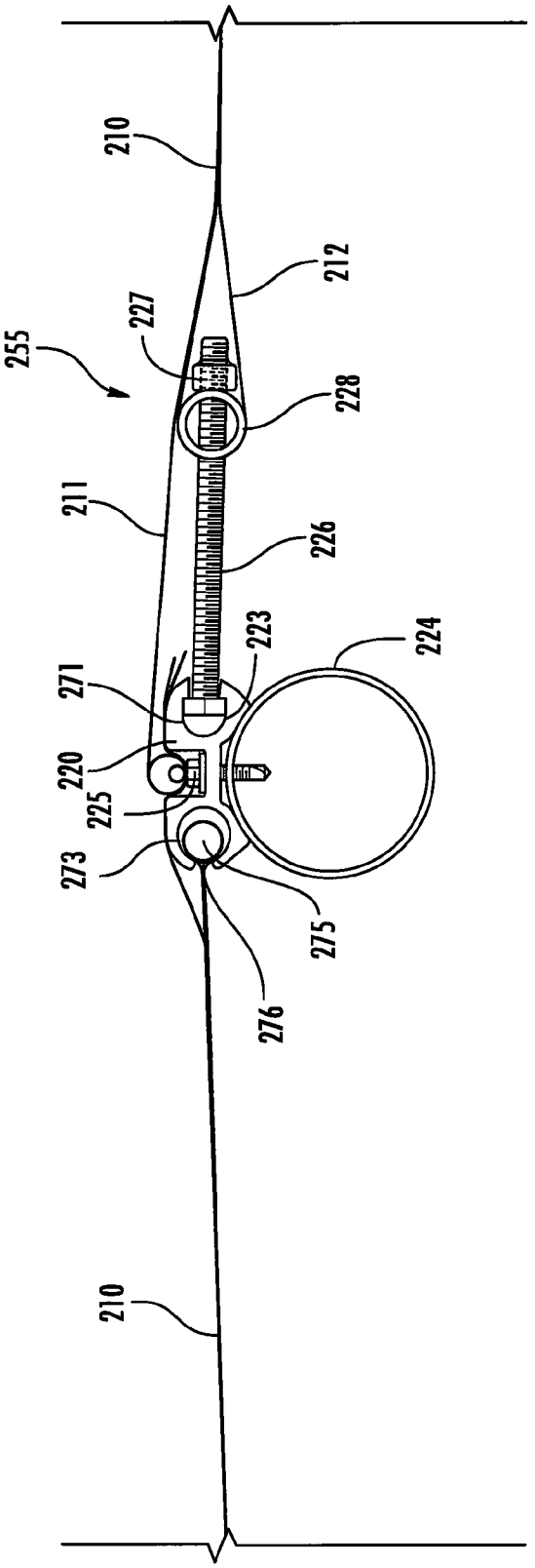

FIG. 6

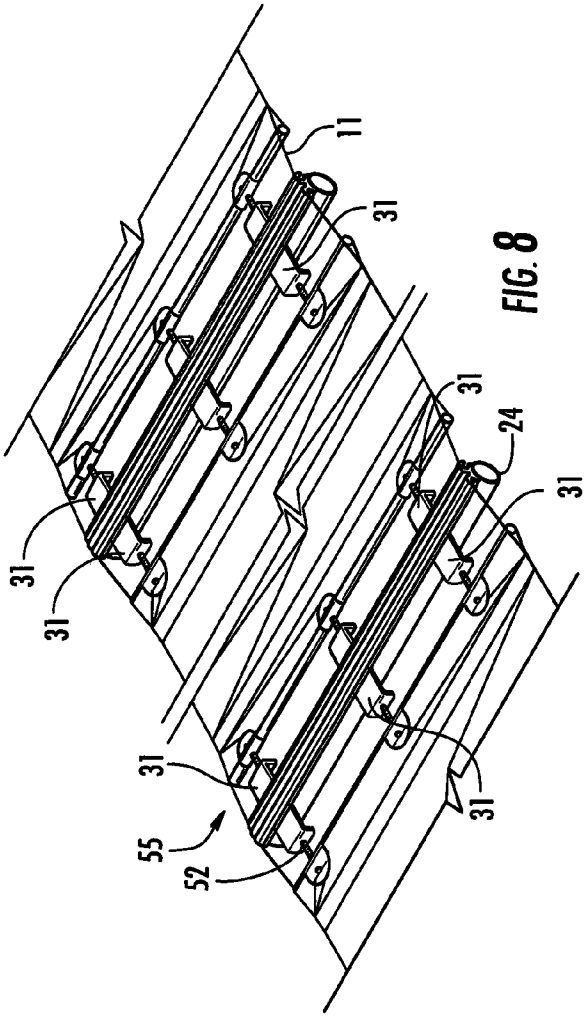
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FIG. 8

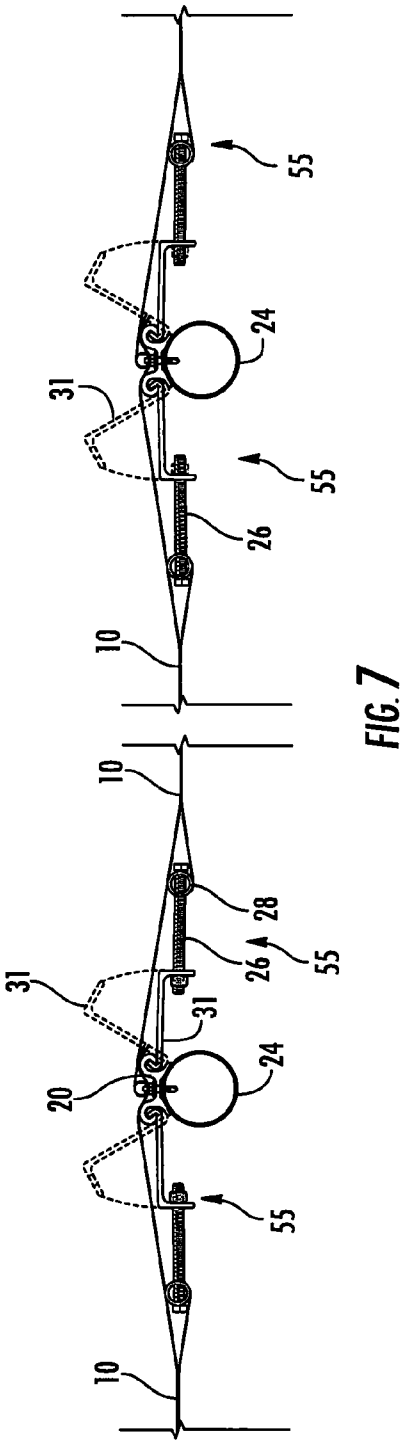
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FIG. 7

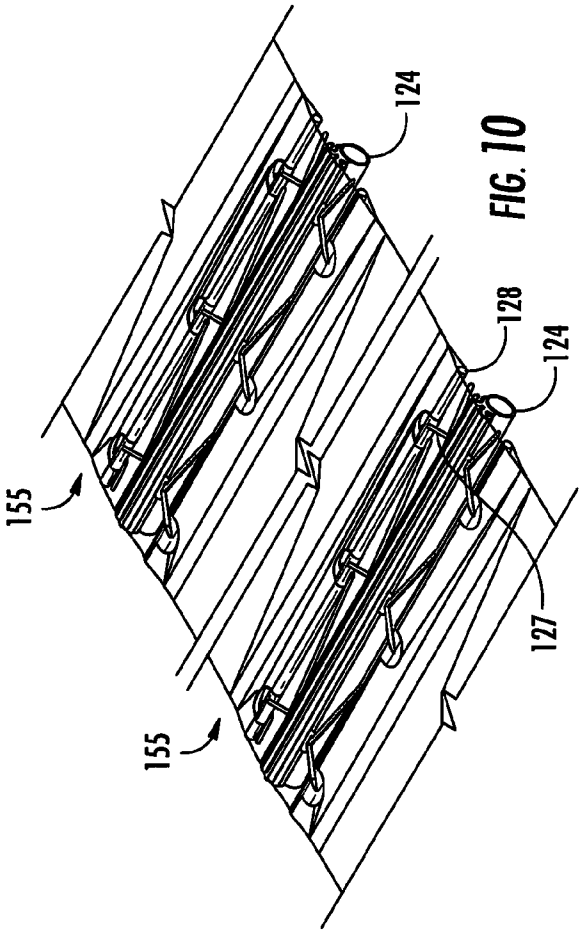
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FIG. 10

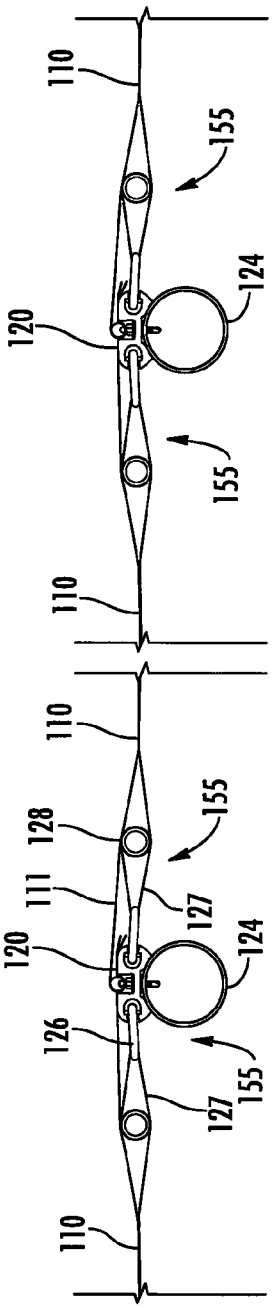
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FIG. 9

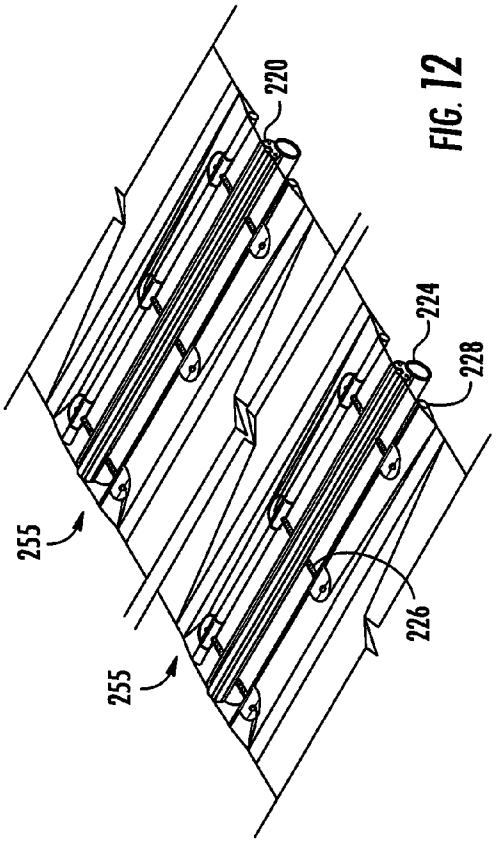
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FIG. 12

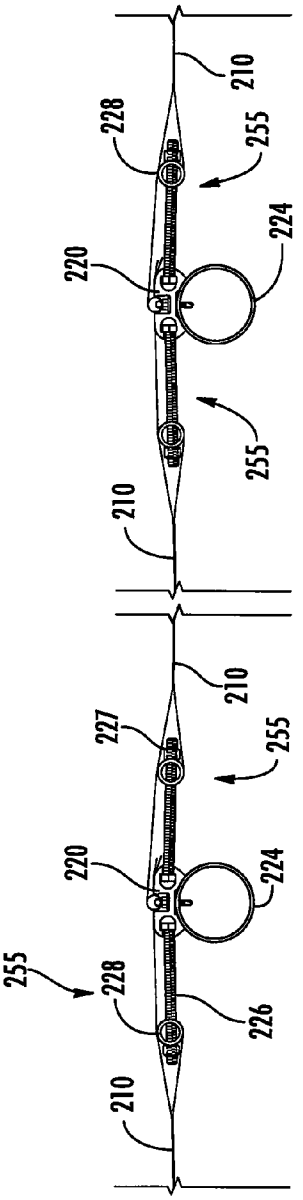
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FIG. 11

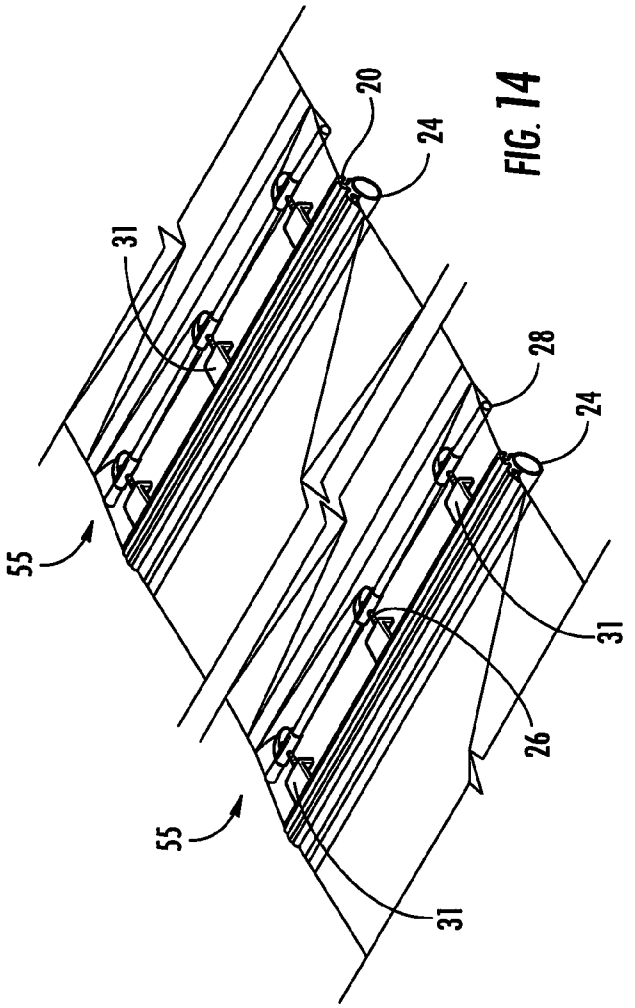

FIG. 14

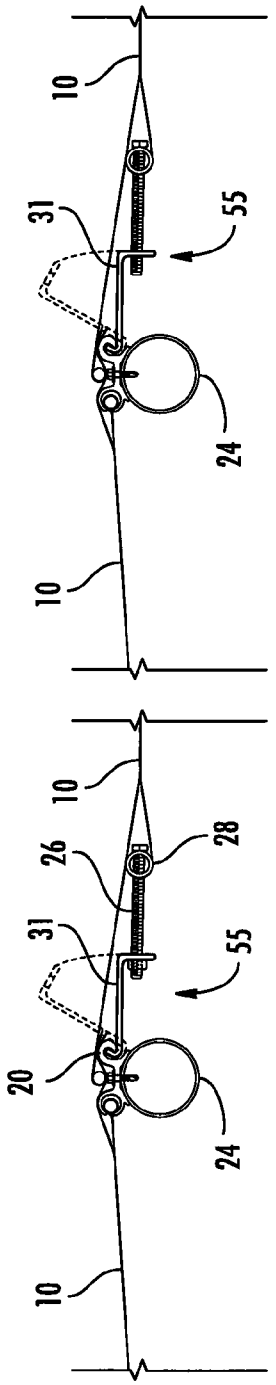

FIG. 13

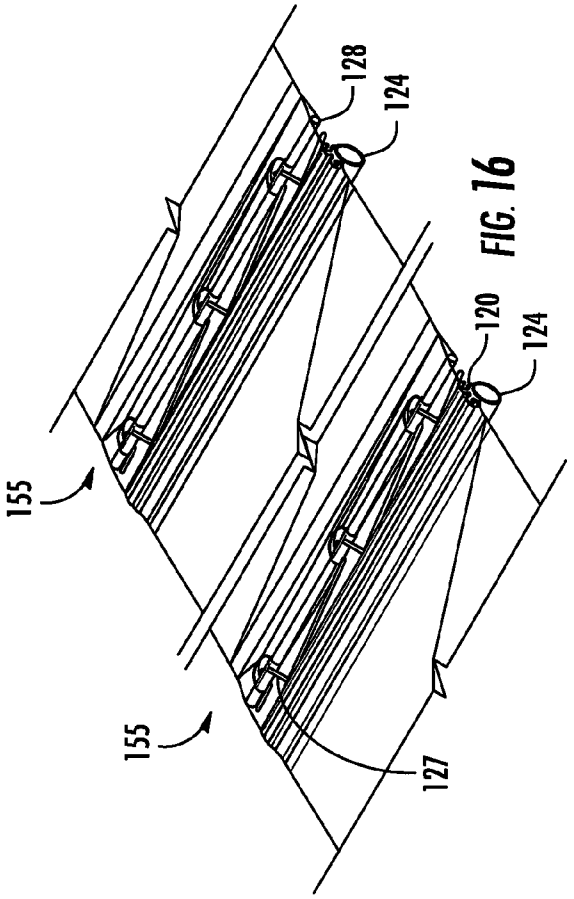
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FIG. 16

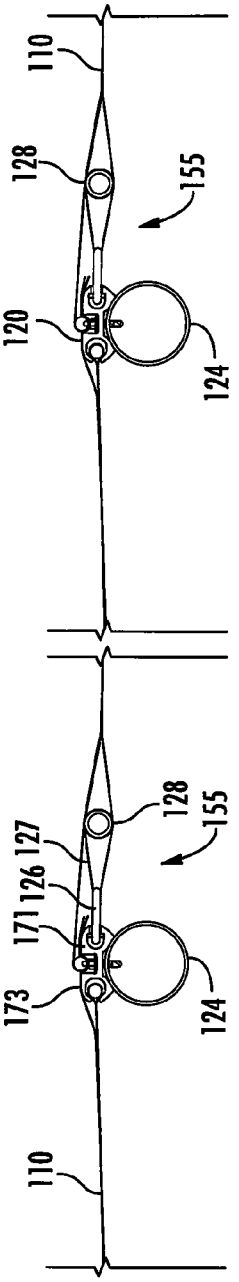
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FIG. 15

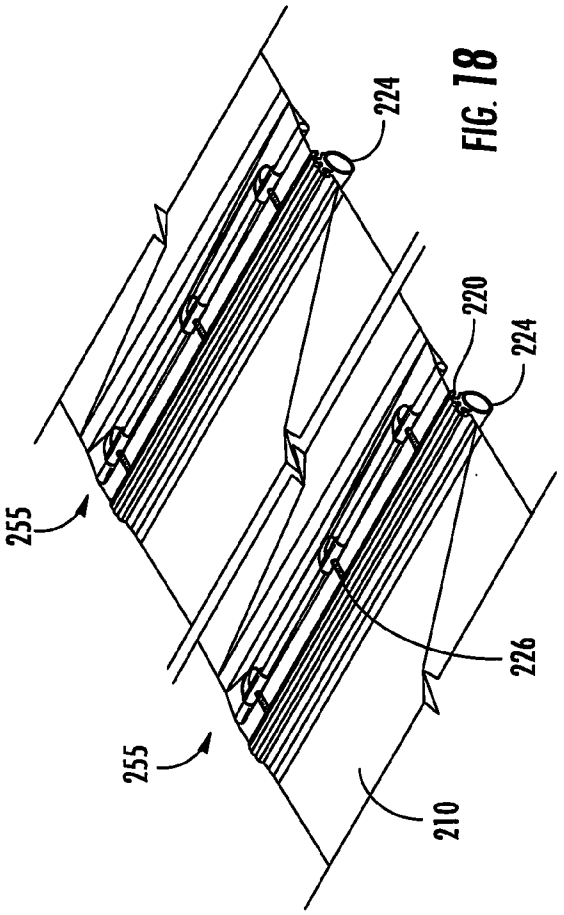
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FIG. 18

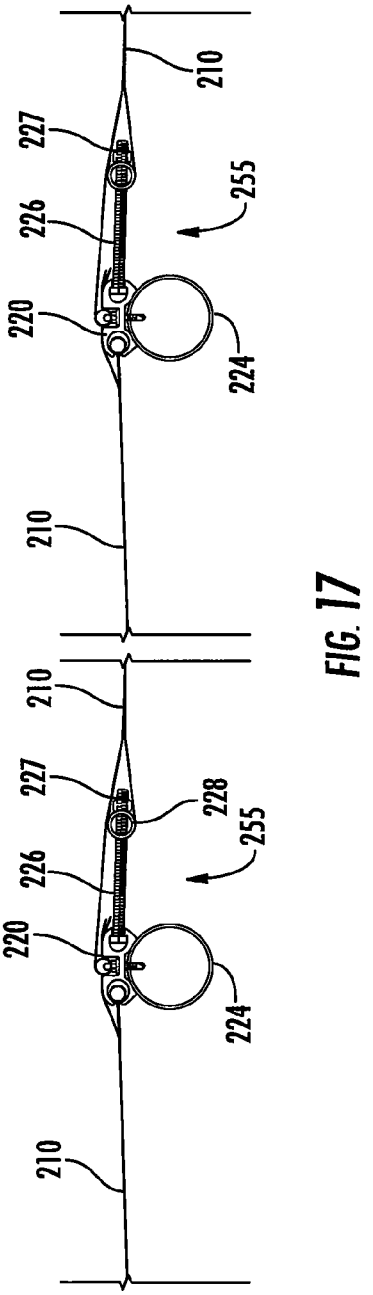
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FIG. 17

SYSTEM FOR TIGHTENING FABRIC PANELS

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] The present application claims priority to provisional patent application 61/756,531 which was filed on Jan. 25, 2013, and is hereby expressly incorporated by reference in its entirety.

BACKGROUND

[0002] In recent years, a structure or building consisting mainly of some type of fabric has been utilized for commercial, industrial and agricultural uses. The name most commonly associated with this structure is a 'fabric building.' These fabric buildings typically include structural elements such as a series of vertical beams, horizontal beams, and/or trusses to form a frame for the structure or building. The material used to cover the frame including the roof and/or the sides of the building is a fabric instead of steel panels. Fabrics can be utilized in a variety of applications other than buildings including awnings and boat canopies.

[0003] In smaller buildings, the cover is typically one piece and is pulled over the entire structure. In some larger buildings, however, an individual section of fabric is attached between each of the appropriate structural elements using a keder system. In order to stretch the fabric tight between each structural element, the structural elements are placed in a first position wherein one or more of the structural elements can be manipulated until each section of fabric becomes tight. The structural elements are then secured to one another, which may require cables or perlongs to be cut to length at the location of the structure. The manipulation of the structural elements is complicated, takes a relatively long time to achieve the desired tautness in the fabric panels, and adds costs to the construction of these panel fabric buildings.

[0004] It is an object of the invention to provide a system for tightening fabric between structural elements without manipulating the structural elements.

[0005] It is a further object of the invention to provide a system far covering any gaps between the fabric and the structural elements.

SUMMARY OF THE INVENTION

[0006] A system for tightening panels of fabric between structural elements in which the structural elements have been previously positioned. Several embodiments are possible, including ones with different tightening mechanisms and the number of mechanisms per structural element.

[0007] The first embodiment is a mountable system on a structural member such as a vertical, horizontal, or truss-like beam. The system includes dual mechanisms for tightening fabric panels between beams. The mechanisms are tensioning bracket systems which are opposite one another. Through manipulation of the tensioning brackets and the tightening of bolts, one or more pieces of fabric, or panels, can be stretched tight between metal structures such as beams.

[0008] A second embodiment achieves similar results to the first embodiment but utilizes a webbing or ratchet strap mechanism. The system includes dual mechanisms for tightening fabric between metal structures such as beams.

[0009] A third embodiment achieves similar results to the first embodiment but utilizes a nut and bolt mechanism. The system includes dual mechanisms for tightening fabric between metal structures such as beams.

[0010] A fourth embodiment utilizes a similar mechanism to the first embodiment, however, there is only one mechanism on each beam. When there is a plurality of beams, each section between beams will contain one tensioning bracket mechanism instead of the dual systems of the first embodiment.

[0011] A fifth embodiment utilizes a similar mechanism to the second embodiment, however, there is only one mechanism on each beam When there is a plurality of beams, each section between beams will contain one webbing or ratchet strap mechanism instead of the dual systems of the second embodiment.

[0012] A sixth embodiment utilizes a similar mechanism to the third embodiment, however, there is only one mechanism on each beam. When there is a plurality of beams, each section between beams will contain one nut and bolt mechanism instead of the dual systems of the second embodiment.

[0013] All six embodiments can contain at least one flap in connection with a tube and cable which can used to conceal any gaps between the fabric panels and the structural elements.

BRIEF DESCRIPTION OF THE DRAWINGS

[0014] FIG. **1** is a top view of a first embodiment of a tensioning bracket based mechanism wherein there are dual mechanisms;

[0015] FIG. **2** is a top view of a first embodiment of a webbing or ratchet strap based mechanism wherein there are dual mechanisms;

[0016] FIG. **3** is a top view of a first embodiment of a nut and bolt based mechanism wherein there are dual mechanisms;

[0017] FIG. **4** is a top view of an alternate embodiment of the tensioning bracket mechanism wherein there is one mechanism;

[0018] FIG. **5** is a top view of an alternate embodiment of the webbing or ratchet strap mechanism wherein there is one mechanism;

[0019] FIG. **6** is a top view of an alternate embodiment of the nut and bolt based mechanism wherein there is one mechanism;

[0020] FIG. **7** is a top view of two dual tensioning bracket mechanisms, one on each side of a structural element;

[0021] FIG. **8** is a perspective view of the systems of FIG. **7**;

[0022] FIG. **9** is a top view of two dual webbing or ratchet strap mechanisms, one on each structural element;

[0023] FIG. **10** is a perspective view of the systems of FIG. **9**;

[0024] FIG. **11** is a top view of two nut and bolt mechanisms, one on each structural element;

[0025] FIG. **12** is a perspective view of the systems of FIG. **11**;

[0026] FIG. **13** is a top view of two nut and bolt mechanisms, one on each structural element;

[0027] FIG. **14** is a perspective view of the systems of FIG. **13**;

[0028] FIG. **15** is a top view of two dual webbing or ratchet strap mechanisms, one on each structural element;

[0029] FIG. **16** is a perspective view of the systems of FIG. **15**;

[0030] FIG. **17** is a top view of two nut and bolt mechanisms, one on each structural element;

[0031] FIG. **18** is a perspective view of the systems of FIG. **17**.

DETAILED DESCRIPTION

[0032] Now referring to the drawings, FIG. **1** shows a preferred embodiment of a system for tightening panels between structural beams. Panels **10** are in connection with a housing member **20** similar in purpose to what is known as a keder channel. The housing member **20** comprises at least one tensioning channel **23**. The housing member **20** is secured to a structural member **24**, typically with a fastener **25** such as a self-drilling screw.

[0033] A tensioning bracket **31** is placed in the tensioning channel **23**. The shape of the tensioning bracket **31** is preferably one that assists in sliding the tensioning bracket **31** into the tensioning channel **23**. The preferred shape of the bracket **31** is an L-shape with a hook **41** at one end. The L-shape is comprised of a first elongated member **35** and a second elongated member **38** wherein the second elongated member **38** is the longer of the two members **35**, **38**. The hook **41** can be slid in at any location of the channel **23** and is slid in at a high angle such that the tensioning bracket **31** will be secured once the panels have been installed. Additionally, the hook **41** preferably has a flat portion **43** which corresponds to a flat portion of the tensioning channel **23**, so that it is less likely to rotate upward within the tensioning channel **23** in forces such as wind events. Once the panel **10** reaches a particular tautness, the tensioning bracket **31** cannot be disengaged from the channel **23**. The bracket **31** is held in place in the channel **23** during both compression and/or tensioining events that cause force on the overall structure.

[0034] A lateral tightening pocket **12** is attached to a fabric panel **10**, one on either side of the structural member **24**. Each of the lateral tightening pockets **12** is attached on the other end to a lateral tightening tube **28**. The lateral tightening tube **28** has openings **52** that allow the connecting member **26** to be inserted into and through the lateral tightening tube **28**. One end of the connecting member **26** has a stop **50**. The connecting member **26** and stop **50** are typically one piece and can be a standard bolt.

[0035] A second end of the connecting member **26** is inserted into an opening **52** of the tensioning bracket **31**. A fastener **27** which can be a standard nut sized to fit the connecting member **26** is tightened until the panels **10** achieve the desired tautness. The more the fastener **27** is tightened, the tauter the panels become.

[0036] A pair of panel flaps **11** can then be manipulated to cover the structural member **24** and the tensioning brackets **31**. A fabric panel flap tie down tube **29** can have a cable **30** housed inside the tube **29**. The tube **29** is placed on an outside edge of the housing member **20**. The panel flaps **20** is then wrapped around or put underneath the tube **29**. Once the flaps **11** are secured and tightened, the cable **30** can be tightened to a foundation. The flaps **11** serve both a functional purpose as the flaps seal off the gap and the structural elements from the weather; and an aesthetic purpose as the flaps **11** conceal the structural elements of the invention and any open gaps.

[0037] FIGS. **7** and **8** further depict the first embodiment of the invention wherein there are dual tensioning bracket mechanisms **55**, one on either side of each structural member **24**. These figures further show the openings **52** of the tensioning bracket **31** as well as the ability of the invention to have more than one tensioning bracket **31**. Furthermore, these figures demonstrate how the invention can be utilized in tandem with a number of units of the invention.

[0038] FIGS. **4**, **13**, and **14** show an embodiment of the invention wherein only one side of the housing member **20** utilizes a tensioning channel **23** that has a tensioning bracket **31** secured in the tensioning channel **23**. This embodiment works in much the same way as the first embodiment, however, with certain differences. First the housing member **20** has two distinctly shaped channels. A first side **71** has a channel that is shaped similar to the first embodiment and can be used in conjunction with the L-shaped tensioning bracket **71**. The second side **73** has a channel preferably of a circular shape and can be used to house a circular cord **75** known as a keder cord. The cord **75** is attached to a cord pocket **76** which extends to a panel **10**. FIGS. **13** and **14** show several embodiments used in conjunction with one another.

[0039] FIGS. **2**, **9** and **10** show an embodiment of the invention wherein there are dual mechanisms, however, the mechanisms are webbing or ratchet strap mechanisms. Panels **110** are in connection with a housing member **120**. The housing member **120** comprises at least one tensioning channel **123**. The housing member **120** is secured to a structural member **124**, typically with a fastener **125** such as a self-drilling screw.

[0040] The tensioning channel **123** houses at least one slidable member **126** which can be a structure such as a D-ring. The slidable member **126** is connected to the panel **110** through a webbing **127**. Each panel **110** is connected to a lateral tightening pocket **112** which in turn each house a lateral tightening tube **128**. The webbing **127** is manipulated around the D-ring and lateral tightening tube **128** such that each panel **110** can be drawn closer or farther from the tensioning channel **123**. As the panels **110** can be connected to two structural members **124** (one on either side of the panels **110**), the panel **110** is either stretched tighter between the two structural members or loosened.

[0041] Due to the width of the D-rings (or the bolts in another embodiment) and the need to tighten the panels, a gap may exist between the tensioning channel **123** and the panels **110**, therefore, exposing certain structural elements or having openings in the overall building design. In order to conceal the gap, flaps **111** are connected to panels **110**. A pair of panel flaps **111** can then be manipulated to cover the structural member **124** and member **120**. A fabric panel flap tie down tube **129** can have a cable **130** housed inside the tube **129**. The tube **129** is placed on an outside edge of the housing member **120**. The panel flaps **20** is then wrapped around or put underneath the tube **29**. Once the flaps **111** are secured and tightened, the cable **130** can be tightened to a foundation. The flaps **111** serve both a functional purpose as the flaps seal off the gap and the structural elements from the weather; and an aesthetic purpose as the flaps **111** conceal the structural elements of the invention and any open gaps.

[0042] FIGS. **9** and **10** further depict the embodiment of the invention wherein there are dual webbing or ratchet strap mechanisms **155** one on either side of each structural member **124**. These figures further show the attachment of the webbing **127** to the D-ring and lateral tightening tube **128**, as well as the ability of the invention to have more than one webbing mechanism **155**. Furthermore, these figures demonstrate how the invention can be utilized in tandem with a number of units of the invention.

[0043] FIGS. **5**, **15** and **16** show an embodiment of the invention wherein only one side of the housing member **120** utilizes a tensioning channel **123** that is attached to a D-ring.

This embodiment works in much the same way as the dual webbing mechanism, however, with certain differences. First, the housing member **120** has two distinctly shaped channels. A first side **171** has a channel that is shaped similar to the dual embodiment and can be used in conjunction with the webbing or ratchet strap mechanism **155**. The second side **173** has a channel that is preferably circular and can be used to house a circular cord **175** known as a keder cord. The cord **175** is attached to a cord pocket **176** which extends to a panel **110**. FIGS. **15** and **16** show several embodiments used in conjunction with one another.

[0044] FIGS. **3**, **11**, and **12** show an embodiment of the invention wherein there are dual mechanisms, however, the mechanisms are bolt mechanisms. Panels **210** are in connection with a housing member **220**. The housing member **220** comprises at least one tensioning channel **223**. The housing member **220** is secured to a structural member **224**, typically with a fastener **225** such as a self-drilling screw.

[0045] The channel **223** houses at least one slidable member **226** which a bolt sized to fit and be secured within the channel **223**. A lateral tightening pocket **212** is attached to a fabric panel **210**, one on either side of the structural member **224**. Each of the lateral tightening pockets **212** is attached on the other end to a lateral tightening tube **228**. The lateral tightening tube **228** has an opening that allows the connecting member **226** to be inserted into and through the lateral tightening tube **228**. One end of the connecting member **226** has a free end which allows a fastener **227** to be connected.

[0046] The fastener **227** which can be a standard nut sized to fit the connecting member **226** is tightened until the panels **210** achieve the desired tautness. The more the fastener **227** is tightened, the tauter the panels become.

[0047] Due to the width of the bolts and the need to tighten the panels, a gap may exist between the tensioning channel **223** and the panels **210**, therefore, exposing certain structural elements or having openings in the overall building design. In order to conceal the gap and structural elements, flaps **211** are connected to panels **210**. A pair of panel flaps **211** can then be manipulated to cover the structural member **224** and member **220**. A fabric panel flap tie down tube **229** can have a cable **230** housed inside the tube **229**. The tube **229** is placed on an outside edge of the housing member **220**. The panel flaps **220** are then wrapped around or put underneath the tube **229**. Once the flaps **211** are secured and tightened, the cable **230** can be tightened to a foundation. The flaps **211** serve both a functional purpose as the flaps seal off the gap and the structural elements from the weather; and an aesthetic purpose as the flaps **211** conceal the structural elements of the invention and any open gaps.

[0048] FIGS. **11** and **12** further depict the embodiment of the invention wherein there are dual bolt mechanisms **255**, one on either side of each structural member **224**. These figures further show the attachment of the bolts **226** and lateral tightening tube **228**, as well as the ability of the invention to have more than one bolt mechanism **255**. Furthermore, these figures demonstrate how the invention can be utilized in tandem with a number of units of the invention.

[0049] FIGS. **6**, **17** and **18** show an embodiment of the invention wherein only one side of the housing member **220** utilizes a tensioning channel **223** that is attached to bolt **226**. This embodiment works in much the same way as the dual bolt mechanism, however, with certain differences. First the housing member **220** has two distinctly shaped channels. A first side **271** has a channel shaped similar to the dual embodiment and can be used in conjunction with bolt mechanism **255**. The second side **273** has a channel that is preferably circular and can be used to house a circular cord **275** known as a keder cord. The cord **275** is attached to a cord pocket **276** which extends to a panel **210**. FIGS. **17** and **18** show several embodiments used in conjunction with one another.

[0050] A summary of the process involved in any embodiment wherein there are dual mechanisms is as follows. Once the frame which will contain any of the embodiments is erected, the housing member containing the channels is attached using self-drilling screws or bolts to the structural member. The applicable connecting members are slid into or placed within the keder channel. Location and length of keder channel, bolts, and/or d-ring inserts are based on documentation provided by manufacturer. The tube for the fabric panel flap tie down and cable are then installed loosely in the top part of the keder channel. The cable is secured on each side of the foundation. The fabric panels are rolled out. The necessary hardware is installed to the fabric panel, the fabric panel is then pulled over the structure. Once over the structure and temporarily secured at the sides, the lateral tightening tube is inserted into the lateral tightening pocket (welded to the fabric panel) on each end. If tensioning brackets, the bolts are slid through openings in the lateral tightening tube and tensioning bracket, a nut is placed on the end and is then tightened. If bolts, the bolts are slid through openings in lateral tightening tube, a nut is placed on the end and is then tightened. If d-ring inserts along with webbing and ratchet straps are weaved around the d-ring and lateral tightening tube. This is done on at all locations where the keder channel is present. The fabric panel flap (welded to the fabric panel), is then either wrapped around or put underneath the tube for the fabric panel flap tie down. The fabric panel flaps are tightened. The cable is then tightened down to the foundation.

[0051] A summary of the process involved in any embodiment wherein there is one mechanism is as follows. Once the structure is erected, the keder channel is attached using self-drilling screws or bolts to the structural member. Tensioning brackets, bolts or d-ring inserts are slid into the non-circular side of the keder channel. Location, length and direction of keder channel, bolts, and/or d-ring inserts are base on documentation provided by manufacturer. The tube for the fabric panel flap tie down and cable are then installed loosely in the top part of the keder channel. The cable is secured on each side of the foundation. The fabric panels are rolled out. The necessary hardware is installed to the fabric panel. The fabric panel is then pulled over the structure, simultaneously the keder cord and keder cord pocket are slid into the circular side of the housing member. Once over the structure and temporarily secured at the sides, the lateral tightening tube is inserted into the lateral tightening pocket (welded to the fabric panel). If tensioning brackets, the bolts are slid through openings in the lateral tightening tube and tensioning bracket, a nut is placed on the end and is then tightened. If bolts, the bolts are slid through openings in lateral tightening tube, a nut is placed on the end and is then tightened. If d-ring inserts, webbing or ratchet straps are weaved around the d-ring and lateral tightening tube. The fabric panel flap (welded to the fabric panel), on the keder cord side is put underneath the tube for the fabric panel flap tie down. The fabric panel flap (welded to the fabric panel) on the lateral tightening pocket side is wrapped around the tube for the fabric panel flap tie down. The fabric panel flaps are tightened. The cable is then tightened down to the foundation.

[0052] Having thus described the invention in connection with the several embodiments thereof, it will be evident to those skilled in the art that various revisions can be made to the several embodiments described herein with out departing from the spirit and scope of the invention. It is my intention, however, that all such revisions and modifications that are evident to those skilled in the art will be included with in the scope of the following claims. Any elements of any embodiments disclosed herein can be used in combination with any elements of other embodiments disclosed herein in any manner to create different embodiments.

What is claimed is:

1. A system for tightening panels between structural members, comprising:
a housing member;
a connecting member;
a tensioning bracket;
the tensioning bracket and connecting member are connected;
at least one mechanism for selectively changing the tautness of the panel wherein the panel can be stretched to a desired tautness between the structural members.

2. The system of claim **1**, wherein:
the at least one mechanism is a tensioning mechanism.

3. The system of claim **2**, wherein:
the housing member comprises a first channel and a second channel;
the tensioning bracket is placed in the first channel and a second tensioning bracket is placed in the second channel.

4. The system of claim **3**, further comprising:
the connecting member attachable to the tensioning member;
the connecting member attachable to a receiving member;
the receiving member connected to the panel.

5. The system of claim **4**, further comprising:
a fastener at a first end of the connecting member whereby the fastener can be tightened;
the tightening of the fastener corresponding to a greater tautness of the panel between the two structural members.

6. The system of claim **5**, wherein:
the receiving member is a tube;
the tube has at least one opening wherein the connecting member passes.

7. The system of claim **6**, further comprising:
a panel flap;
the panel flap attachable to the panel;
the panel flap attachable to the housing member;
wherein the flap covers at least a portion of the housing member.

8. They system of claim **7**, wherein:
the tensioning member comprises a hook;
the hook engageable within the first channel;
the tensioning member is L-shaped, whereby the hook will not disengage from the first channel once the fabric reaches a particular tautness.

9. A system for tightening panels between structural members, comprising:
a housing member;
the housing member having a first side and a second side;
a first panel;
a second panel;
the first side having a channel;
the second side having a channel;
a tensioning bracket having a first end and a second end;
a second tensioning bracket having a first end a second end;
wherein the first end of the tensioning bracket is secured in the first channel;
wherein the first end of the second tensioning bracket is secured in the second channel;
the second end of the tensioning bracket is connected to a connecting member;
the second end of the second tensioning bracket is connected to a second connecting member;
the tensioning bracket slidable on the connecting member;
wherein the further the tensioning member moves relative to a first end of the connecting member, the greater the tautness of the first panel.

10. The invention of claim **9**, wherein:
the second tensioning bracket slidable on the second connecting member;
wherein the further the second tensioning member moves relative to a first end of the second connecting member, the greater the tautness of the second panel.

11. The invention of claim **10**, further comprising:
a panel flap;
the panel flap attachable to the first panel;
the panel flap attachable to the housing member;
wherein the flap covers at least a portion of the housing member.

12. The invention of claim **11**, wherein:
the tensioning member comprises a hook;
the hook engageable within the channel on the first side of the housing member;
the tensioning member is L-shaped;
the hook has a flat portion whereby the hook is biased in a position that limits rotation of the hook within the channel.

13. The invention of claim **12**, further comprising:
a second panel flap;
the second panel flap attachable to the housing member;
wherein the second panel flap covers at least a second portion of the housing member.

14. A system for tightening panels between structural members, comprising:
a housing member;
the housing member having at least one channel;
a panel;
a connecting member;
a tensioning member;
the tensioning member receivable within the at least one channel;
the tensioning member connected to the tensioning member;
wherein a distance between the housing member and the connecting member can be selectively changed and a lesser distance corresponds to the panel having a greater tautness between structural members.

15. The system of claim **14**, further comprising:
a panel flap;
the panel flap attachable to the panel;
the panel flap attachable to the housing member;
wherein the flap covers at least a portion of the housing member.

16. The system of claim **15**, wherein:
the tensioning member is a bracket;
the bracket has a first end and a second end;

the first end within the channel;
the connecting member slidable through the second end.
17. The system of claim **16**, wherein:
the first end of the tensioning member comprises a hook;
the tensioning member is L-shaped.
18. The system of claim **7**, wherein:
a plurality of tensioning members housed within the channel;
each tensioning member connected to an individual connecting member.
19. The system of claim **18**, further comprising:
a receiving member;
the receiving member connected to each of the connecting members.
20. The system of claim **19**, wherein:
each of the connecting members distance from the housing member can be independently changed to adjust the tautness of the panel.

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