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(54) Benævnelse: **Præfabrikeret nivelleringssegment under en trafikbarriere ovenpå et jordstøttevægsystem**

(56) Fremdragne publikationer:
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DESCRIPTION

Background

[0001] Precast concrete earth retaining walls are commonly used for architectural, site development and roadway/highway construction applications. When roadways are located above or rest on top of the completed earth retaining wall, a traffic barrier segment is required to prevent vehicles from falling off of the retaining wall. Therefore, a traffic barrier segment is required to contain the impact from vehicles to keep them from falling over the retaining wall.

[0002] US 2011/0318100 relates to an earth retaining wall system including courses of modular blocks, each block having a front face portion and a web portion extending behind it. A traffic barrier is included in the top course of blocks.

Brief Description Of The Drawings

[0003] Many aspects of the invention can be better understood with reference to the following drawings. The components in the drawings are not necessarily to scale, emphasis instead being placed upon clearly illustrating the principles of the present invention. Moreover, in the drawings, like reference numerals designate corresponding parts throughout the several views.

FIG. 1 is a view of the exemplary precast traffic barrier segment in accordance with a first comparative example of the disclosure;

FIG. 2 is a cross sectional view of an earth retaining wall with the exemplary precast traffic barrier segment of FIG. 1 sitting on top of an earth retaining wall;

FIG. 3 is an elevation view of an earth retaining wall with the exemplary precast traffic barrier segment of FIG. 1 making up the top row of precast concrete segments;

FIG. 4 is a side view of the exemplary precast traffic barrier segment of FIG. 1;

FIG. 5 is a top view of the exemplary precast traffic barrier segment of FIG. 1;

FIG. 6 is a back view of the exemplary precast traffic barrier segment of FIG. 1.

FIG. 7 is a view of the exemplary precast traffic barrier segment that interact with adjacent segments in accordance with a second comparative example of the disclosure;

FIG. 8 is a cross sectional view of an earth retaining wall with the exemplary precast traffic barrier segment of FIG. 7 that interact with adjacent segments sitting on top of an earth retaining wall;

FIG. 9 is an elevation view of an earth retaining wall with the exemplary precast traffic barrier

segment of FIG. 7 that interact with adjacent segments making up the top row of precast concrete segments;

FIG. 10 is a side view of the exemplary precast traffic barrier segment of FIG. 7 that interact with adjacent segments;

FIG. 11 is a top view of the exemplary precast traffic barrier segment of FIG. 7 that interact with adjacent segments;

FIG. 12 is a back view of the exemplary precast traffic barrier segment of FIG. 7 that interact with adjacent segments

FIG. 13 is a view of the exemplary precast leveling segment in accordance with a third example being an embodiment of the invention;

FIG. 14 is a cross sectional view of an earth retaining wall with the exemplary precast leveling segment of FIG. 13 sitting as the top course of an earth retaining wall and just underneath the traffic barrier course;

FIG. 15 is an elevation view of an earth retaining wall with the exemplary precast leveling segment of FIG. 13 making up the second from the top row of precast concrete segments;

FIG. 16 is a side view of the exemplary precast leveling segment of FIG. 13.

Detailed Description

[0004] Disclosed herein various embodiments of precast traffic barrier segments that are designed to rest above an earth retaining wall of precast segments to prevent traffic from falling over the retaining wall. The objective of the current invention as defined by claim 1 is to allow a uniform height precast traffic barrier be installed parallel and to the alignment grade of the proposed roadway grade above the wall even though the supporting retaining wall is constructed and installed in parallel uniform height segments along courses of modular precast units. In order to provide a differing height required to follow a roadway grade that varies along the wall length especially in vertical curves of the changing roadway grade, a leveling or variable height course of modular concrete segment block units is required. The current invention, with the use of a tilting table to cast the leveling units at various heights/angles, modifies the immediate course below the uniform height traffic barrier course to allow the traffic barrier to follow the changing vertical grade of the roadway.

[0005] When roadways, driveways or vehicle access is planned above an earth retaining wall, a barrier to prevent traffic from falling over the walls leading edge is typically required. Traditionally, a guard rail or poured in place concrete traffic barrier segment is installed above the retaining wall to contain vehicles above the earth retaining wall in the planned drive isle or

roadway. The exemplary embodiments expedite installation of the traffic barrier segment by making it a part of the earth retaining wall system where the barrier segment can act as the top row of modular precast retaining wall system and provide resistance to overturning by using the
backfill soil weight resting on the horizontal triangular stem. The downward pressure of the soil backfill beside and on top of the horizontal stem provides the resisting pressure to have the exemplary precast traffic barrier segment act as a cantilever foundation/vertical wall and resist impact loads from vehicles on the portion of the barrier segment extending above grade.

[0006] Generally speaking, the portion of the traffic barrier segment extending above grade has a shape that varies depending upon a state's rules and regulations (promulgated by the Department of Transportation), which define certain acceptable geometries and dimensions for barrier segments installed along roadways/highways of the state. Therefore, the geometry of the traffic barrier segment's vertical portion extending above roadway grade may vary from state to state.

First Comparative Example(s)

[0007] Referring to FIG. 1, an exemplary precast traffic barrier segment 100 has a vertical face 130 that extends above roadway grade and a face 120 extending below roadway grade that consists of the upper portion of the underlying earth retaining wall. The top of the barrier segment portion 140 above roadway grade is typically 32 inches above the roadway or driveway surface elevation. The back face of the barrier segment extending above grade is 180 where the vehicular impact would occur as well as the slanted portion 150. The overall stability of the exemplary precast traffic barrier segment is prevented from overturning by a counterweight from backfill soil resting beside and above the rear stem 190. A triangular portion 110 of the rear stem helps capture the surrounding backfill soils weight to add resisting force by means of downward weight on the exemplary traffic barrier segment stem 190. The top of the stem 160 is approximately 30 inches below the drive or roadway grade to allow the installation of utilities and pavement section not obscured by the precast traffic barrier segment piece or segment.

[0008] FIG. 2 shows a cross section 200 of the elevated roadway grade 220 sitting on top of the earth retaining wall. The stem 190 of the exemplary precast traffic barrier segment sits well below the pavement grade 220 to prevent interference. To keep the exemplary precast traffic barrier segment from sliding on top of the retaining wall, two protruding lugs 170 extend below the exemplary traffic barrier segment to lock into the top concrete precast segment of the earth retaining wall. For installation of the exemplary precast traffic barrier segment, a square hole 240 is cast into the exemplary precast traffic barrier segment to facilitate lifting and hoisting into place. A diagonal portion of the stem 210 is required to transfer the downward cantilever pressure on the stem 190 to the vertical portion of the exemplary precast traffic barrier segment to prevent impact on the face 120 of the barrier segment facing vehicular traffic.

[0009] In looking at an elevation view, FIG. 3, of the front face of the earth retaining wall, the exemplary precast traffic barrier segment 100 makes up the top row of the concrete earth retaining wall to complete or top out the earth retaining wall soil retention requirements. The grade of the proposed roadway 220 is below the barrier segment portion of the precast traffic barrier segment but above the stem portion 190 of the traffic barrier segment.

[0010] In FIG. 4, the exemplary precast traffic barrier segment 100 is shown to illustrate the unique features. The lower locking lugs 170 extend below the bottom of the stem 190 to lock into the earth retaining wall system below. The front face 120 of the precast traffic barrier segment is in vertical alignment with the underlying retaining wall face to complete the earth retaining wall vertical plane alignment. FIG. 5 shows the top view to illustrate the triangular sides 110 of the stem 190 cover approximately 50% of the overall counterweight area of backfill soil that is available to provide weight for overturning resistance. The triangular stem portions 110 allow the reduced horizontal coverage area and hence save precast concrete area/volume.

[0011] FIG. 6 is a rear view of the exemplary precast traffic barrier segment 100 which shows the diagonal connection arm 210 from the top of the stem 160 up to the vertical portion of the traffic barrier segment 180 and 150.

[0012] It should be emphasized that the above described invention of the present disclosure is to implement an arching effect within the earth retaining wall backfill soils by the triangular stem to take advantage of the soil backfill vertical weight to provide resisting force from horizontal vehicular impact on the portion of the stem above the drive isle or roadway grade. The dimensions of the portion of the barrier segment above grade may vary depending upon various Department of Transportation guidelines for impact barrier segments along roadways.

Second Comparative Example(s)

[0013] When roadways are located above or rest on top of the completed earth retaining wall, a traffic barrier segment may be required to handle large impact loads from trucks or other large vehicles. The results may be more pressure than the individual segments can resist from overturning and sliding. Therefore, the attachment of one segment to the next horizontally in order to share the impact load may be required. In this instance, a groove is cast in the side of the segment with a slip joint to allow the segments to work together in resisting the impact.

[0014] The exemplary embodiment allows the individual segments to carry more impact load by interacting with the adjacent segments to provide more resistance than any one segment can exhibit alone. Also, the grove is such that when setting the segments in place, the adjacent segment slides down over the top to expedite installation of these traffic barrier segments. Also, the groove allows the alignment of the segments to be kept in line so the segments do not protrude out from one another that could snag a vehicle that comes in contact with the wall and slides down the traffic barrier segment impacting several segments in series.

[0015] Referring to FIG. 7, the exemplary precast traffic barrier segment 300 has a vertical face 330 that extends above roadway grade and a face 320 extending below roadway grade that consists of the upper portion of the underlying earth retaining wall. The top of the barrier segment portion 340 above roadway grade is typically 36 inches above the roadway or driveway surface elevation. The back face of the barrier segment extending above grade is 380 where the vehicular impact would occur as well as the slanted portion 350. The overall stability of the exemplary precast traffic barrier segment is prevented from overturning by a counterweight from backfill soil resting beside and above the rear stem 390. A triangular portion 310 of the rear stem helps capture the surrounding backfill soils weight to add resisting force by means of downward weight on the exemplary traffic barrier segment stem 390. The top of the stem 360 is approximately 30 inches below the drive or roadway grade to allow the installation of utilities and pavement section not obscured by the precast traffic barrier segment piece or segment. A vertical node 430 protrudes out the side of the segment to fit into the adjoining segments groove 440 to allow interconnectivity. The groove does not extend all the way to the top of the segment but terminates at 450 to not expose the joint and hide from view.

[0016] FIG. 8 shows a cross section 400 of the elevated roadway grade 420 sitting on top of the earth retaining wall. The stem 390 of the exemplary precast traffic barrier segment sits well below the pavement grade 420 to prevent interference. To keep the exemplary precast traffic barrier segment from sliding on top of the retaining wall, two protruding lugs 370 extend below the exemplary traffic barrier segment to lock into the top concrete precast segment of the earth retaining wall. For installation of the exemplary precast traffic barrier segment, a square hole 420 is cast into the exemplary precast traffic barrier segment to facilitate lifting and hoisting into place. A diagonal portion of the stem 410 is required to transfer the downward cantilever pressure on the stem 390 to the vertical portion of the exemplary precast traffic barrier segment to prevent impact on the face 380 of the barrier segment facing vehicular traffic. The vertical slot 440 receives the adjacent vertical node 430 to interlock and allow connectivity and shared resistance when impacted.

[0017] In looking at an elevation view, FIG. 9, of the front face of the earth retaining wall, the exemplary precast traffic barrier segment 300 makes up the top row of the concrete earth retaining wall to complete or top out the earth retaining wall soil retention requirements. The grade of the proposed roadway 420 is below the barrier segment portion of the precast traffic barrier segment, but above the stem portion 390 of the traffic barrier segment. The segments connect horizontally by a node and vertical channel 460 to share impact loads from vehicles.

[0018] In FIG. 10, the exemplary precast traffic barrier segment 300 is shown to illustrate the unique features. The lower locking lugs 370 extend below the bottom of the stem 390 to lock into the earth retaining wall system below. The front face 320 of the precast traffic barrier segment is in vertical alignment with the underlying retaining wall face to complete the earth retaining wall vertical plane alignment. The vertical slot 440 is to receive the vertical node from the adjacent segment. FIG. 11 shows the top view to illustrate the triangular sides 310 of the stem 390 cover approximately 50 % of the overall counterweight area of backfill soil that is

available to provide weight for overturning resistance. The triangular stem portions 310 allow the reduced horizontal coverage area and hence save precast concrete area/volume. The vertical node 430 extends out the side of the segment to fit inside the adjacent segments vertical slot 440.

[0019] FIG. 12 is a rear view of the exemplary precast traffic barrier segment 300 which shows the diagonal connection arm 410 from the top of the stem 360 up to the vertical portion of the traffic barrier segment 380 and 350. The vertical node 430 is shown as well as the receiving vertical slot or channel 440.

[0020] It should be emphasized that the second embodiment implements an arching effect within the earth retaining wall backfill soils by the triangular stem to take advantage of the soil backfill vertical weight to provide resisting force from horizontal vehicular impact on the portion of the stem above the drive isle or roadway grade. The dimensions of the portion of the barrier segment above grade may vary depending upon various Department of Transportation guidelines for impact barrier segments along roadways. The vertical node on one side and vertical slot or channel on the opposite side allows horizontal interaction of adjacent segments to share vehicle impact loads.

Third Example(s) being Embodiment(s) of the Invention

[0021] Referring to FIG. 13, shown is an exemplary precast leveling segment 500. The precast leveling segment 500 has a front portion 320, horizontal stem 590, and an alignment seat 165. The front portion 320 comprises a front surface 530, a rear surface 535, a top surface 540, and a bottom surface 545. The top surface 540 may slope in parallel to an above roadway. The bottom surface 545 is parallel to an underlying earth retaining wall. For example, the top surface 540 may run parallel to a roadway above the precast leveling segment 500 that slopes from the left side 560 to the right side 550 whereas the bottom surface 545 may run parallel to an underlying earth retaining wall that does not slope. In this example, the top surface 540 is not parallel to the bottom surface 545 but the bottom surface 545 is perpendicular to the front surface 530. Continuing the example, the height of the left side 560 is greater than the height of the right side 550 to facilitate the top surface 540 running parallel to the roadway above. Allowing the top surface 540 to run parallel to the roadway and the bottom surface 545 to run parallel to the underlying earth retaining wall prevents the need to slope the underlying earth retaining wall.

[0022] The horizontal stem 590 extends outwardly from a rear surface 535 of the front portion 320. The horizontal stem 590 comprises a triangular portion 310 extending left and right from the top surface 570 of the horizontal stem 590. The triangular portion 310 of the horizontal stem 590 helps capture the weight of the
surrounding backfill soil to add resisting force by means of downward weight on the precast leveling segment 500. Two open boxed cavities 520 are cast into the lower section of the precast leveling segment 500 to allow lifting for placement. The alignment seat 165 has right

and left aligning elements 370 that align the leveling segment to an underlying earth retaining wall.

[0023] Figure 13 depicts an isometric view to illustrate that the triangular portion 310 of the horizontal stem 590 covers approximately 50% of the overall area of backfill soil that is available to provide weight for overturning resistance. The triangular portion 310 allows a reduced horizontal coverage area and saves precast concrete area and/or volume.

[0024] In reference to FIG. 14, a cross section 600 of a sloping elevated roadway grade 420 is shown sitting on top of an earth retaining wall. The elevated roadway grade 420 slopes toward the viewer of FIG. 14. The top surface 540 of the front portion of the precast leveling segment 500 slopes toward the viewer of FIG. 14 parallel to the elevated roadway grade 420. One of two protrusions 170 is shown. The protrusion 170, along with the other, nonvisible protrusion, locks into the precast segment below. A horizontal stem 590 comprises at least a triangular portion 310 and square holes 240. For installation of a precast leveling segment 500, two square holes 240 are cast into the precast leveling segment 500 for lifting and hoisting the precast leveling segment 500 into place. A horizontal stem 590 parallel to the traffic barrier above is required to transfer downward vertical pressure from a traffic barrier above to the horizontal stem 590 below the precast leveling segment 500.

[0025] FIG. 15 depicts an elevation view of the front face of the earth retaining wall. A leveling course 505 of precast leveling segments 500a, 500b, and 500c makes up the designated row below the elevated roadway grade 420. Although many precast leveling segments are depicted, the leveling course 505 may comprise one or more precast leveling segments. The top surfaces 540a, 540b, and 540c of the precast leveling segments 500a, 500b, and 500c slope parallel to the sloping elevated roadway grade 420. Thus, the front surface heights of left edges 560a, 560b, and 560c and right edges 550a, 550b, and 550c of each of the precast leveling segments 500a, 500b, and 500c may increase or decrease relative to the precast leveling segments 500a, 500b, and 500c immediately to the left or right as the elevated roadway grade 420 increases or decreases. The precast leveling segments are in an order that maintains a predefined distance between the elevated roadway grade 420 and the top surfaces 540a, 540b, and 540c. For example, the distance between a point at the top of the left edge 560a and a point 422a on the roadway that is on a line parallel to the left edge 560a equals the distance between a point at the top of the right edge 550a and a point 422b on the roadway that is on a line parallel to the right edge 550a. In one embodiment, the first front surface height of the right edge 550a of a first precast leveling segment 500a is greater than a second front surface height of the right edge 550b of a second precast leveling segment 500b. Therefore, the top surfaces 540a and 540b slope parallel to the elevated roadway grade 420 above the leveling course 505. The precast leveling segments 500a, 500b, and 500c are aligned such that the height of the right edge 550a of the first precast leveling segment 500a is within a predefined delta of the height of the left edge 560b of the second precast leveling segment 500b to ensure a gradual slope parallel to the elevated roadway grade 420 above. In alternative embodiments, the height of the left edge 560b may be greater than the height of left edge 560a when the elevated roadway grade 420 increases slope or the height of the left edge

560b may be less than the height of left edge 560a when the elevated roadway grade 420 decreases slope.

[0026] In FIG. 16, a side view of a precast leveling segment 500 is shown. Shown is a front portion 520, horizontal stem 590, and alignment seat 515. The front portion 530 comprises a front surface 525, a top surface 540, a rear surface 535, and a bottom surface 545. The horizontal stem 590 attaches to the rear surface 535 of the front portion 520. The top surface 540 slopes downward, with a greater height of the left edge 560 than the height of the right edge 550. The horizontal stem 590 comprises a top surface 570 and a triangular portion 310. Two square holes 520 are cast into the horizontal stem 590 of the precast leveling segment 500 for lifting and hoisting the precast leveling segment 500 into place. The alignment seat 515 comprises at least lower aligning elements 370 that extend below the horizontal stem 310 to lock in to the earth retaining wall system below. The lower aligning elements 370 may be locking lugs.

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

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PATENTKRAV

1. System omfattende:

et præfabrikeret vejbanebarrieresegment (100);
en i det væsentlige plan underliggende jordstøttevæg; og
et nivelleringsforløb (505) placeret under det præfabrikerede vejbanebarrieresegment og over den i det væsentlige plane underliggende jordstøttevæg, hvilket nivelleringsforløb omfatter i det mindste ét præfabrikeret nivelleringssegment (500),
hvor det i det mindste ene præfabrikerede nivelleringssegment omfatter i det mindste:

en øvre overflade (540) parallel med en skrånende vejbane (420) placeret over nivelleringsforløbet;
en nedre overflade (545) parallel med et øvre præfabrikeret segment i den i det væsentlige plane underliggende jordstøttevæg placeret under nivelleringsforløbet;
et horisontalt skaft (590), som strækker sig udad fra bagsiden (535) af en forreste del (520) af det i det mindste ene præfabrikerede nivelleringssegment, hvor det horisontale skaft strækker sig fra den øvre overflade til den nedre overflade, idet en nedre del af det horisontale skaft omfatter en trekantet del (310), som strækker sig udad fra en venstre side og en højre side af det horisontale skaft, og den trekantede del af det horisontale skaft omfatter to hulrum (520) placerede langs en overflade af i det mindste én side af den trekantede del; og
et opretningssæde (165), som strækker sig langs i det mindste en del af det horisontale skaft,
hvor den i det væsentlige plane underliggende jordstøttevæg er ikke-parallel med den skrånende vejbane.

2. System ifølge krav 1, hvor den øvre overflade (540) på det præfabrikerede nivelleringssegment (500) er tilsvarende ikke-parallel med den nedre overflade (545).

3. System ifølge krav 1, som yderligere omfatter adskillige højder svarende til en afstand imellem adskillige punkter på den øvre overflade og respektive enkelte af adskillige punkter på den nedre overflade (545) af det præfabrikerede nivelleringssegment (500).

4. System ifølge krav 3, hvor hver enkelt af de adskillige højder svarer til en afstand imellem den nedre overflade ved et nedre overfladepunkt svarende til et respektivt enkelt af de adskillige punkter langs den øvre overflade og den skrånende vejbane ved et vejbanepunkt svarende til det respektive enkelte af de adskillige punkter på den øvre overflade.

5. System ifølge krav 1, hvor opretningssædet sammenlåser det i det mindste ene præfabrikerede nivelleringssegment med i det mindste ét præfabrikeret segment i jordstøttevæggen.

6. System ifølge krav 1, hvor en forreste overflade af den forreste del af det præfabrikerede nivelleringssegment (500) har en venstre kant (560) og en højre kant (550).

7. System ifølge krav 6, hvor:

den venstre kant af den forreste del er vinkelret på den nedre overflade;
den højre kant på den forreste del er vinkelret på den nedre overflade;
den venstre kant er ikke vinkelret på den øvre overflade; og
den højre kant er ikke vinkelret på den øvre overflade.

8. System ifølge krav 6, hvor nivelleringsforløbet omfatter adskillige af de præfabrikerede nivelleringssegmenter.

9. System ifølge krav 8, hvor en respektiv forreste del af et første præfabrikeret nivelleringssegment blandt de adskillige præfabrikerede nivelleringssegmenter er oprettet med en respektiv forreste del af et andet præfabrikeret nivelleringssegment blandt de adskillige præfabrikerede nivelleringssegmenter.

10. System ifølge krav 1, hvor i det mindste en del af det præfabrikerede vejbanebarrieresegment er over den skrånende vejbane.

DRAWINGS

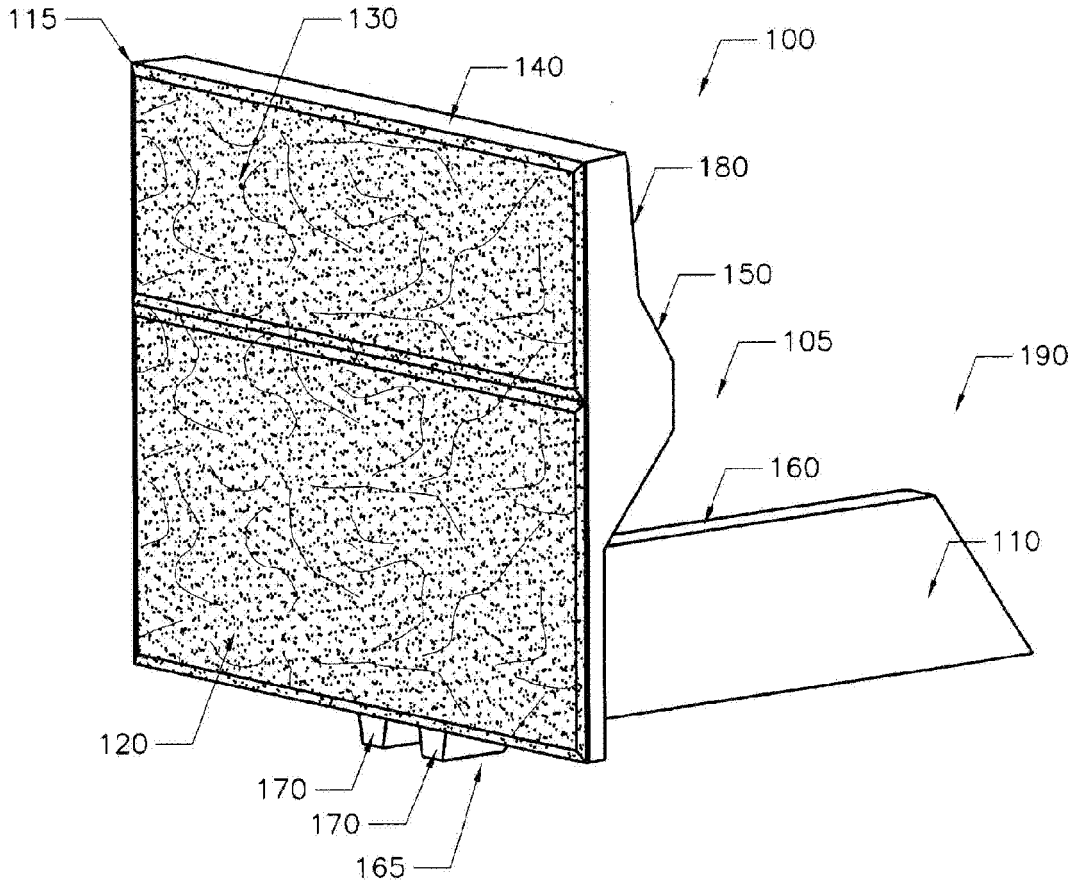


FIGURE 1

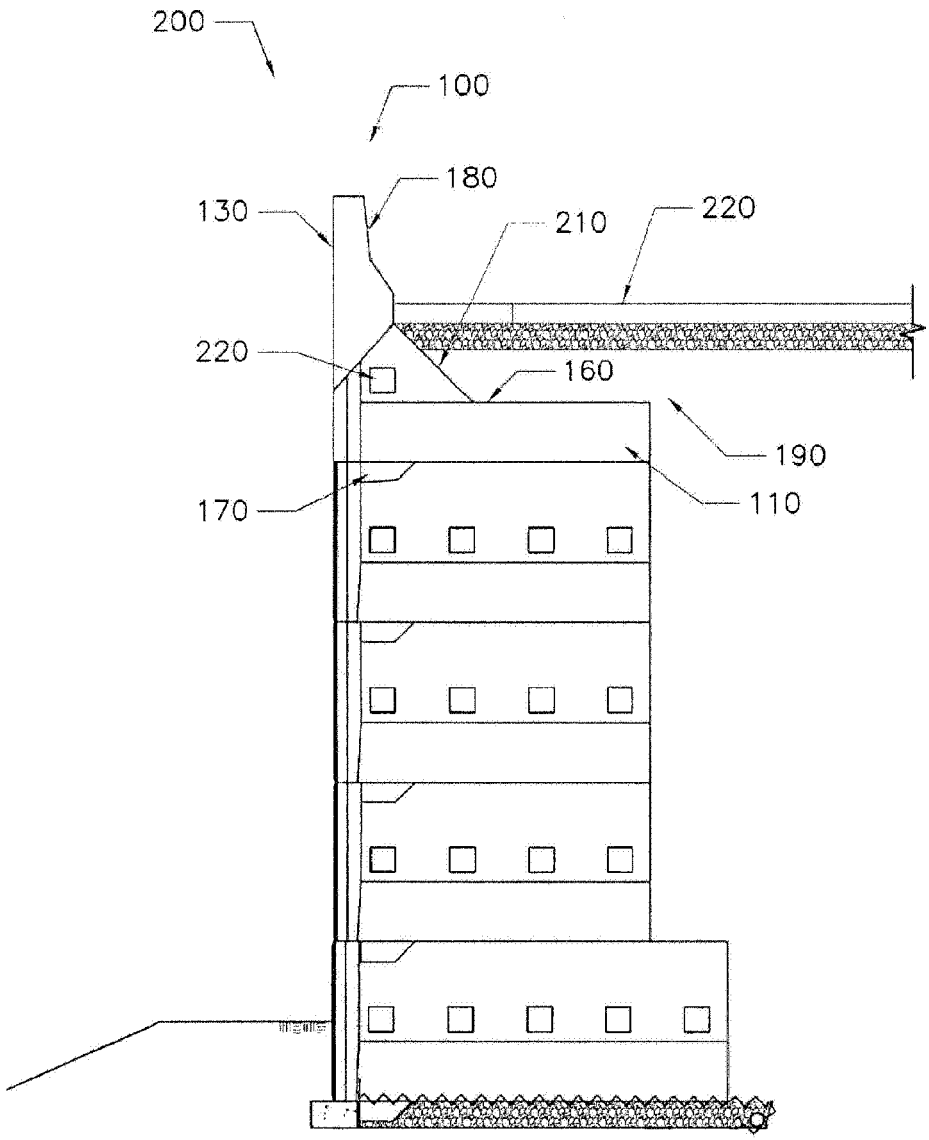


FIGURE 2

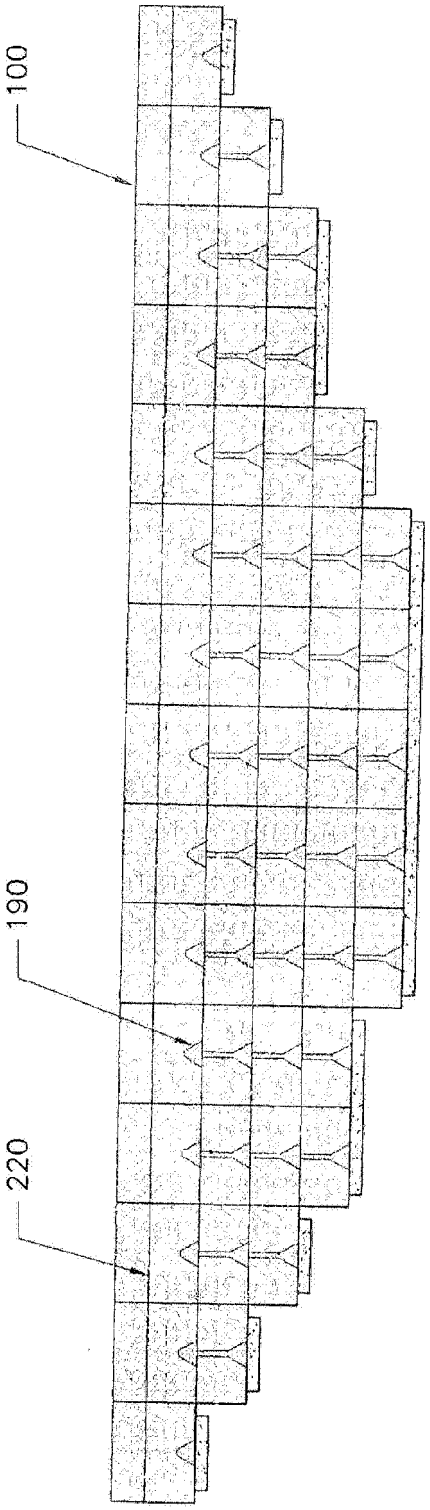


FIGURE 3

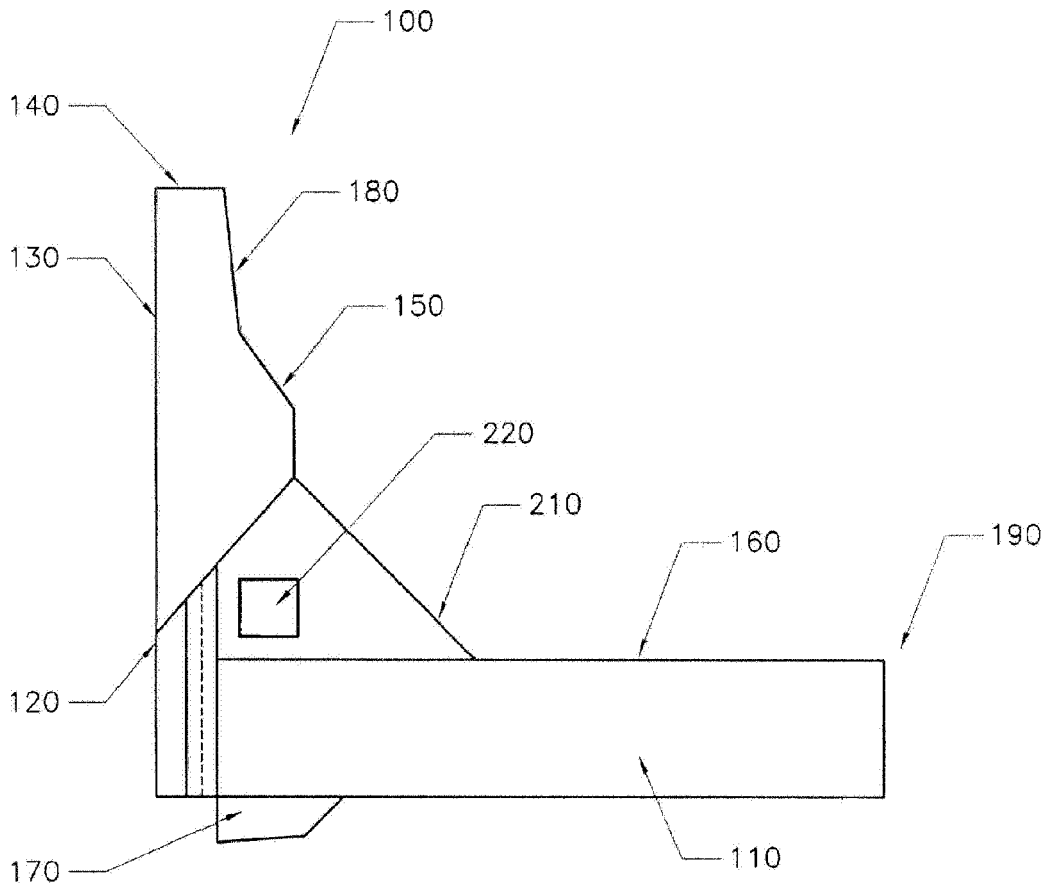


FIGURE 4

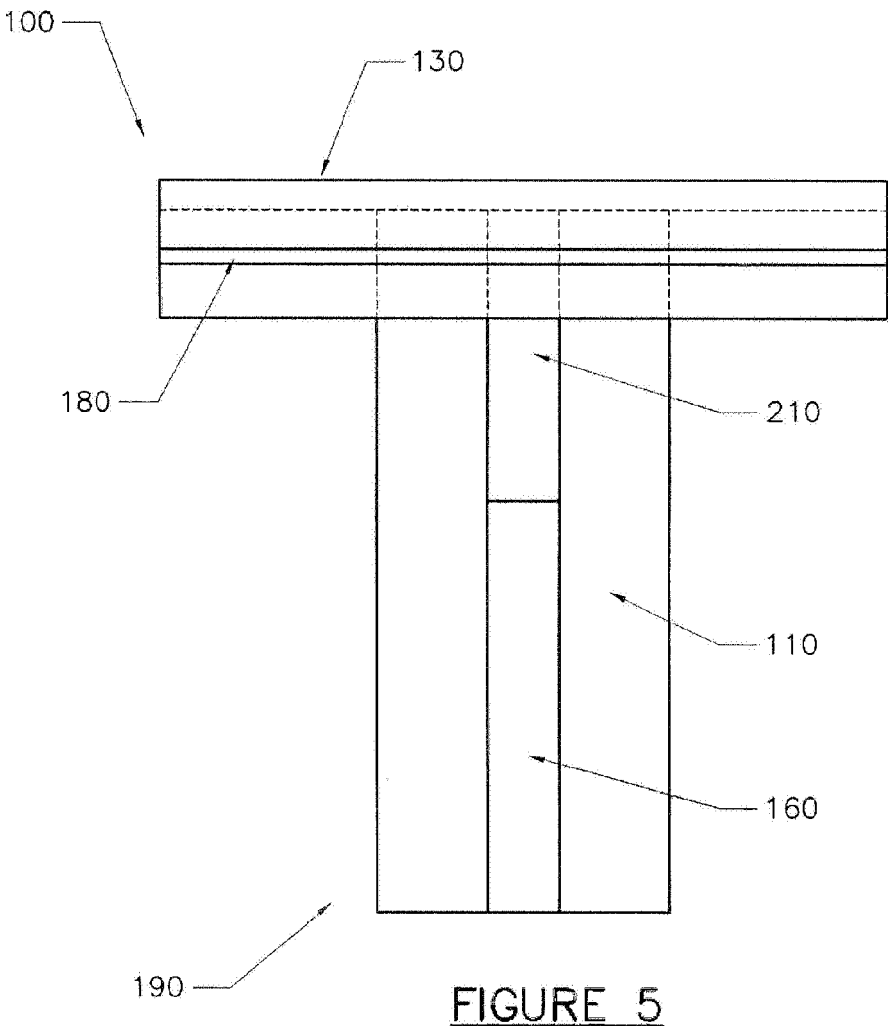


FIGURE 5

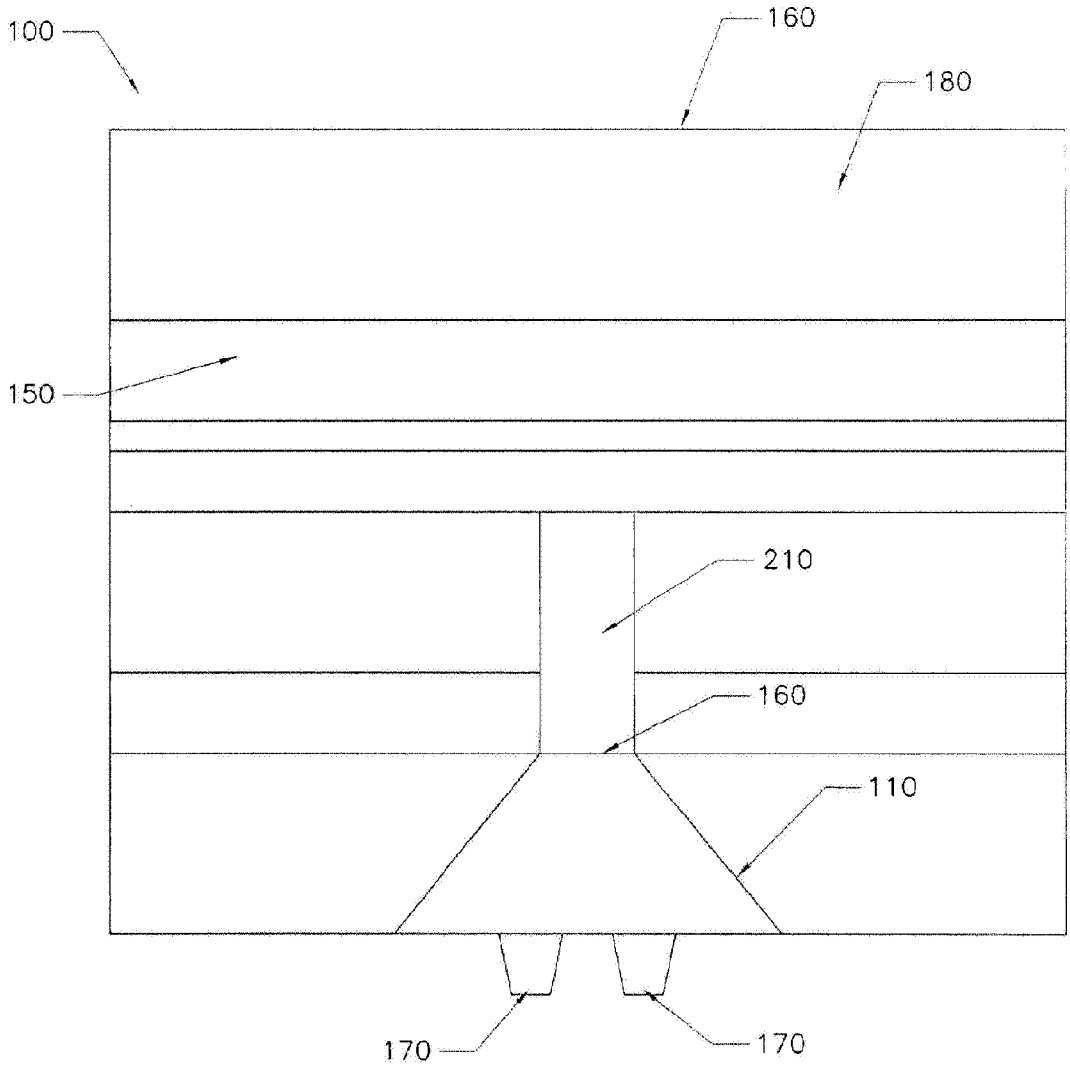


FIGURE 6

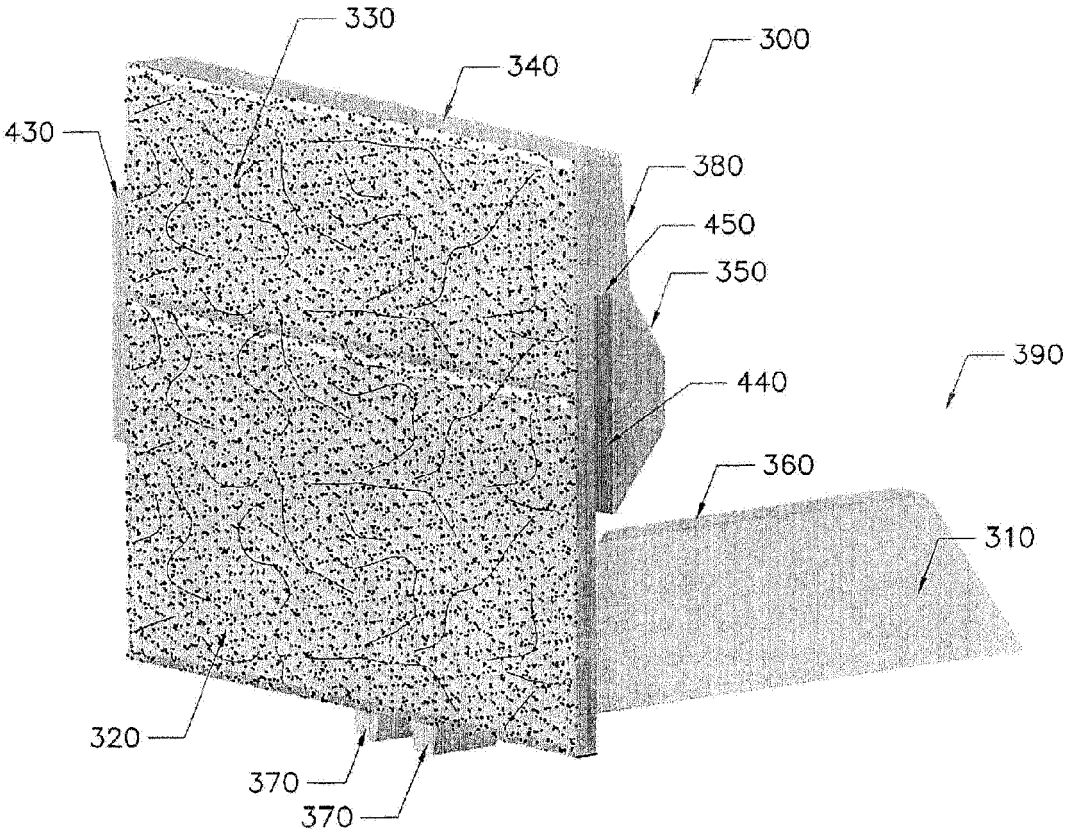


FIGURE 7

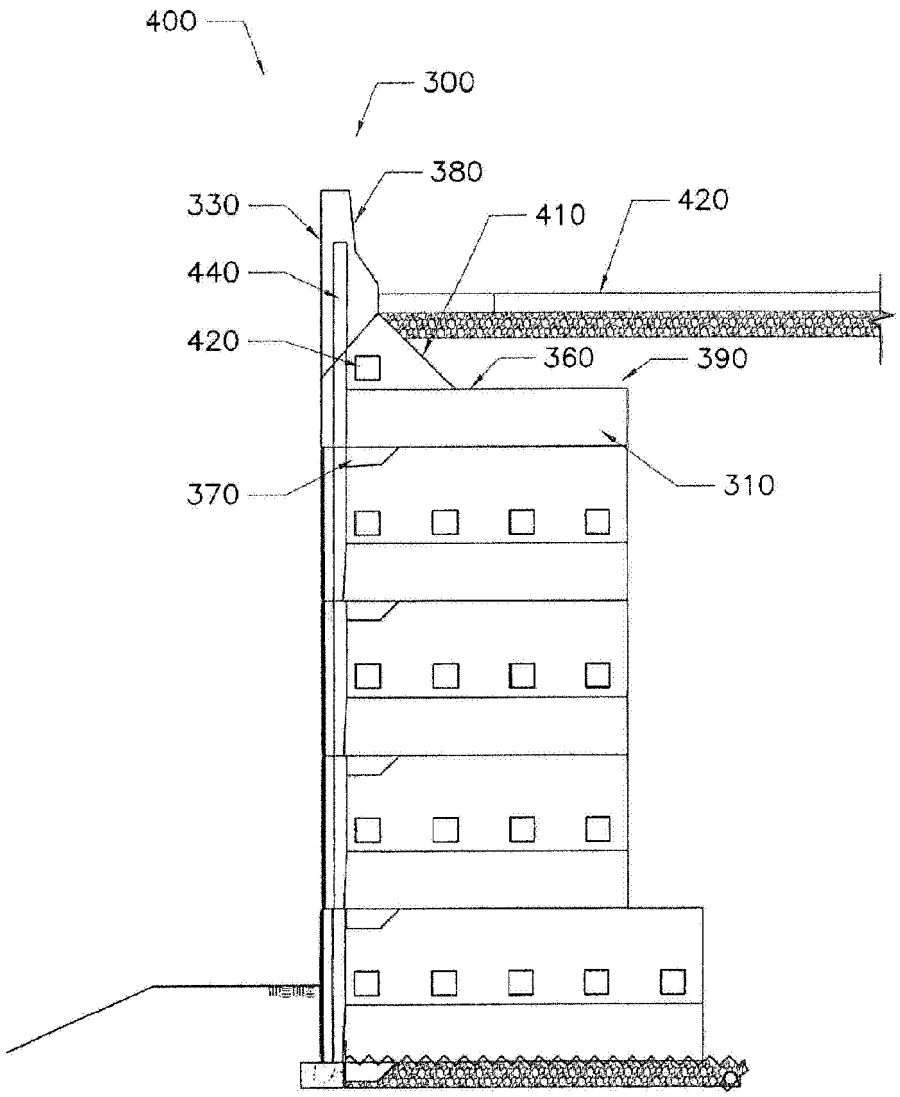


FIGURE 8

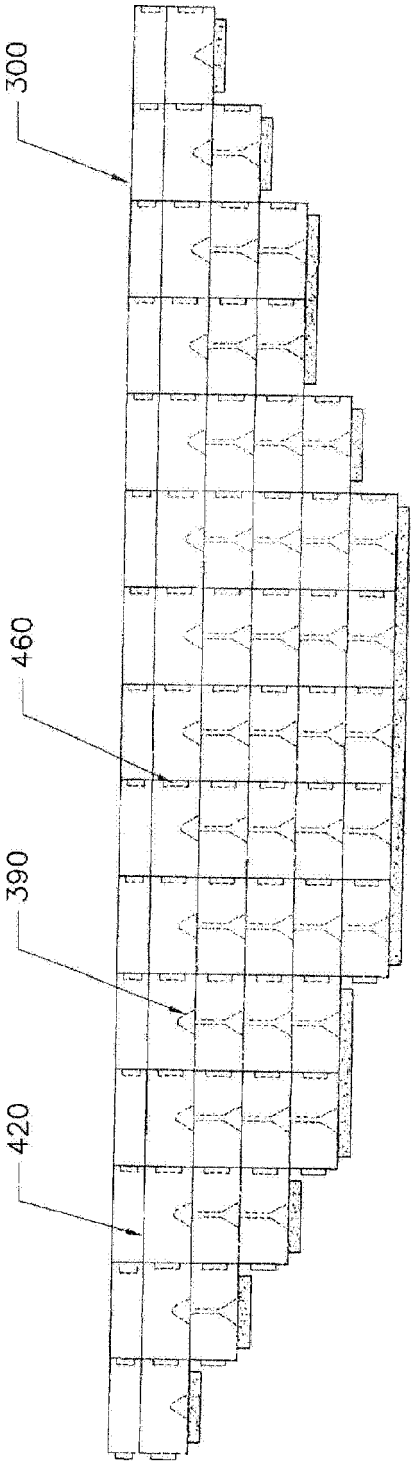


FIGURE 9

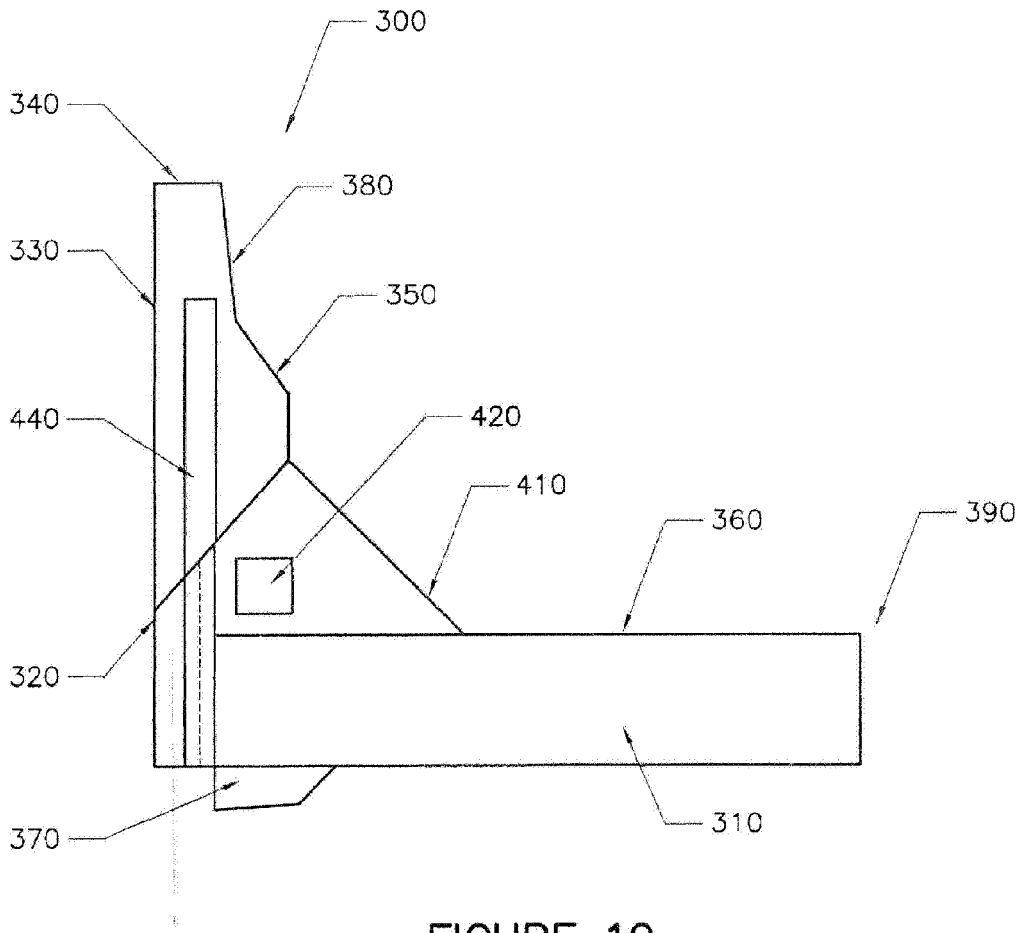


FIGURE 10

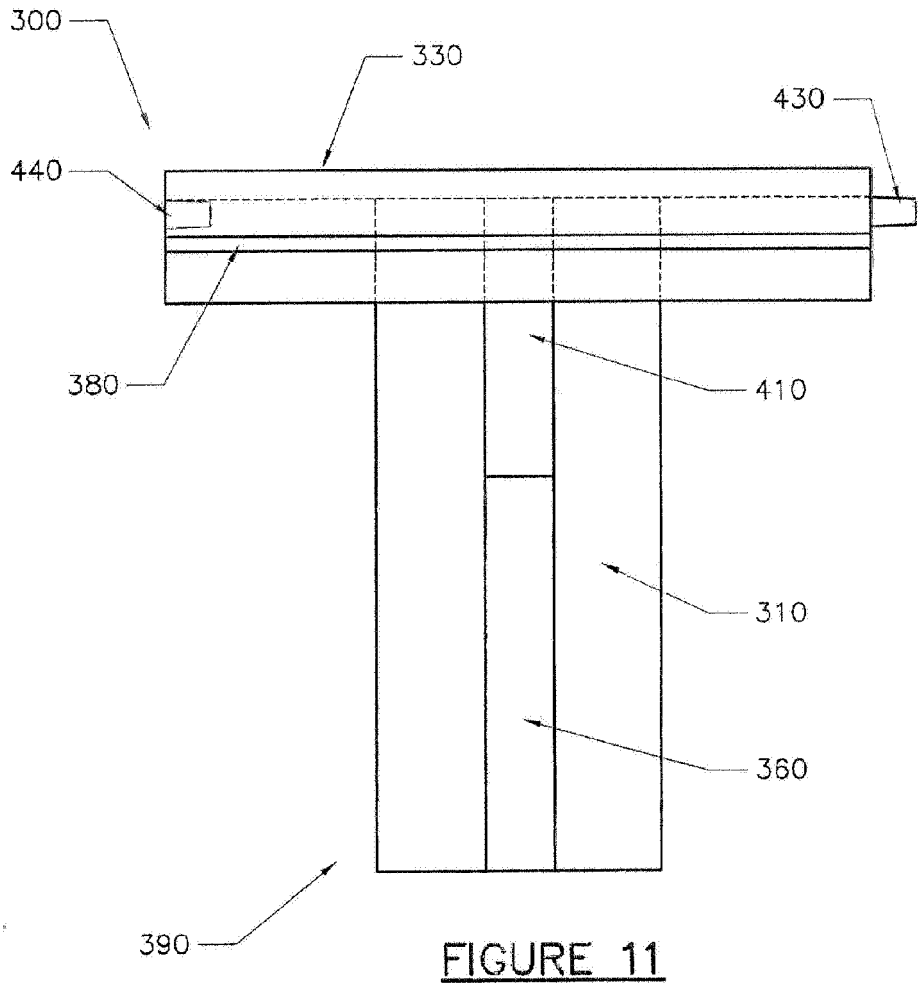


FIGURE 11

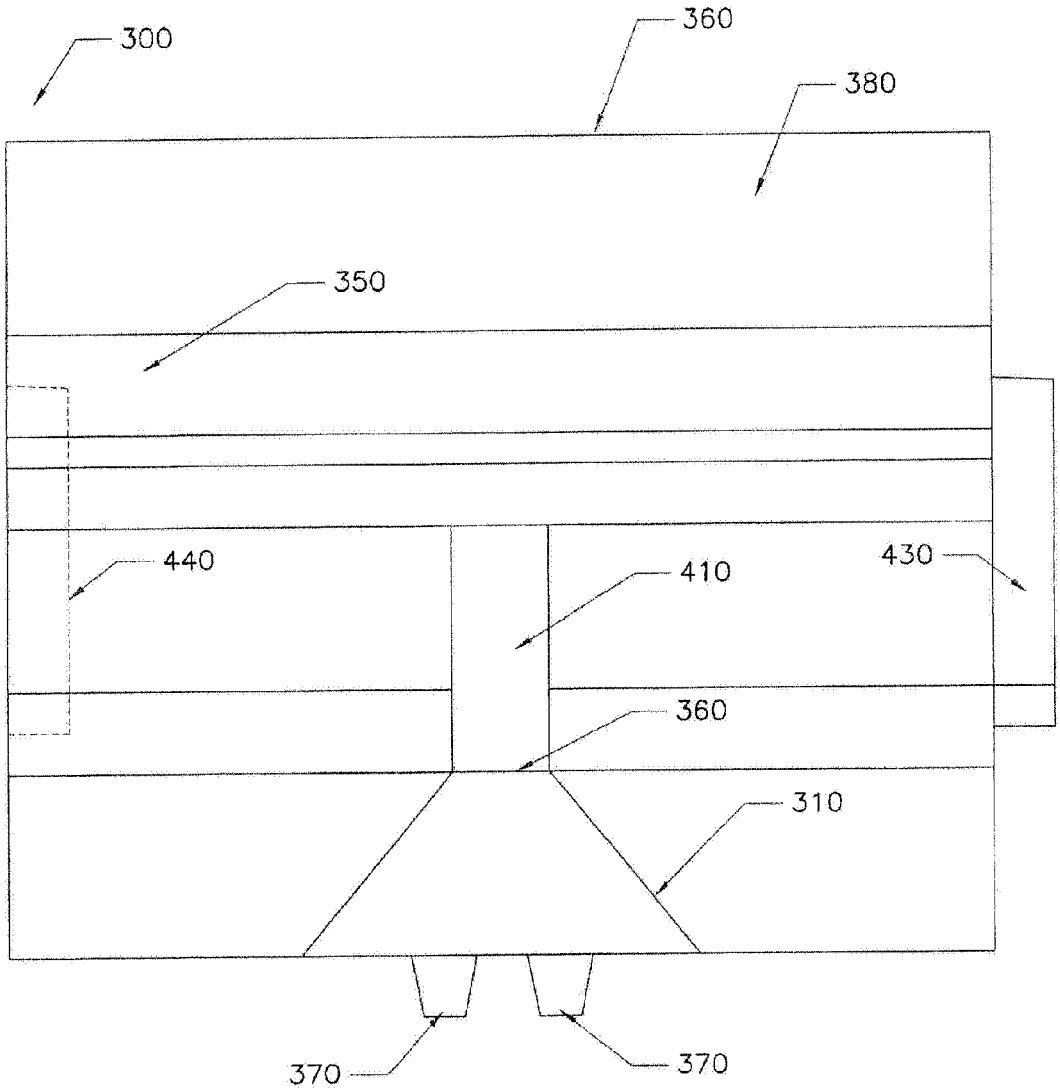


FIGURE 12

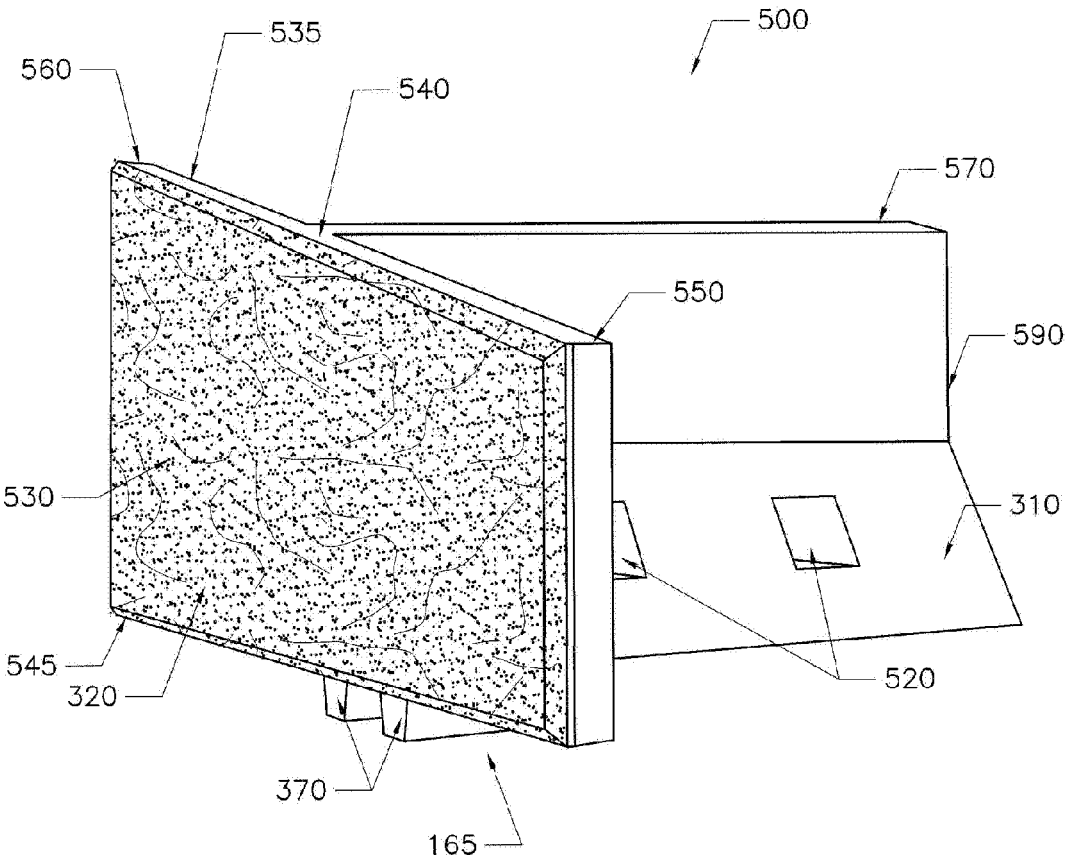


FIGURE 13

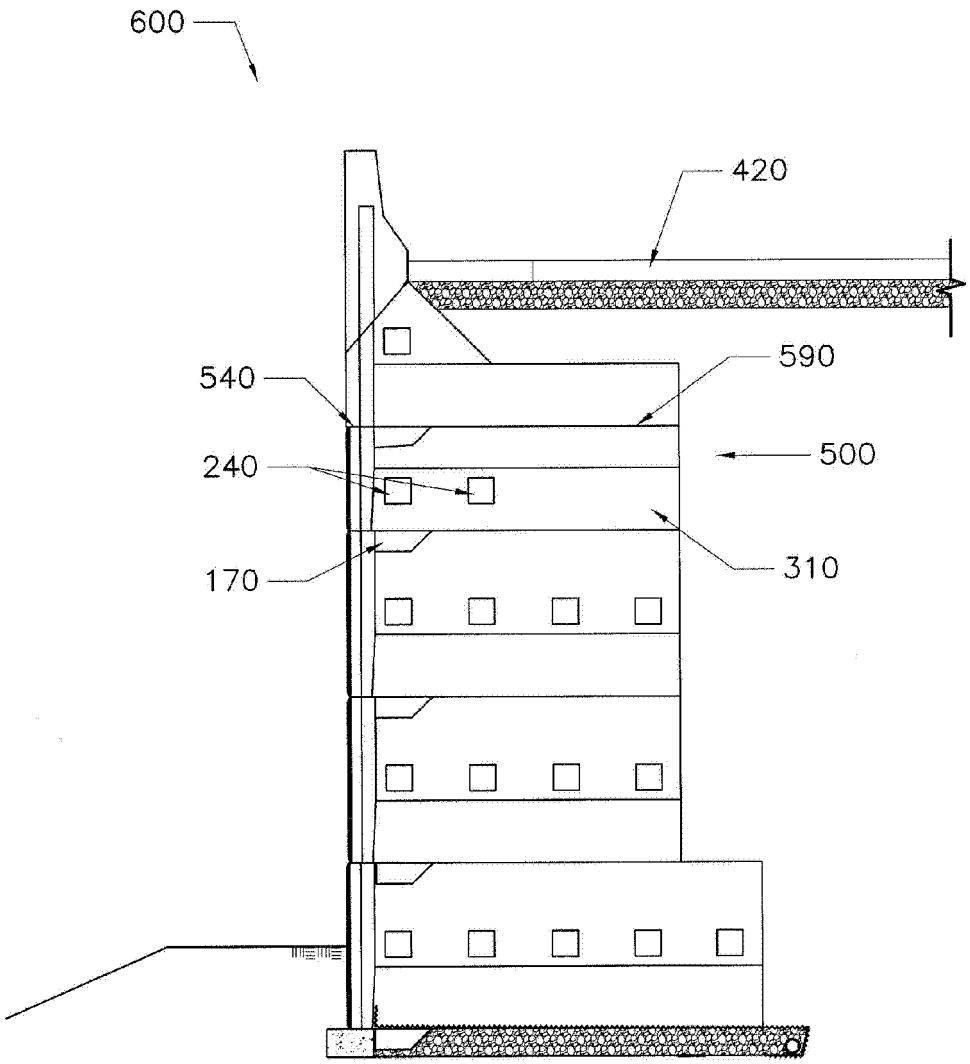


FIGURE 14

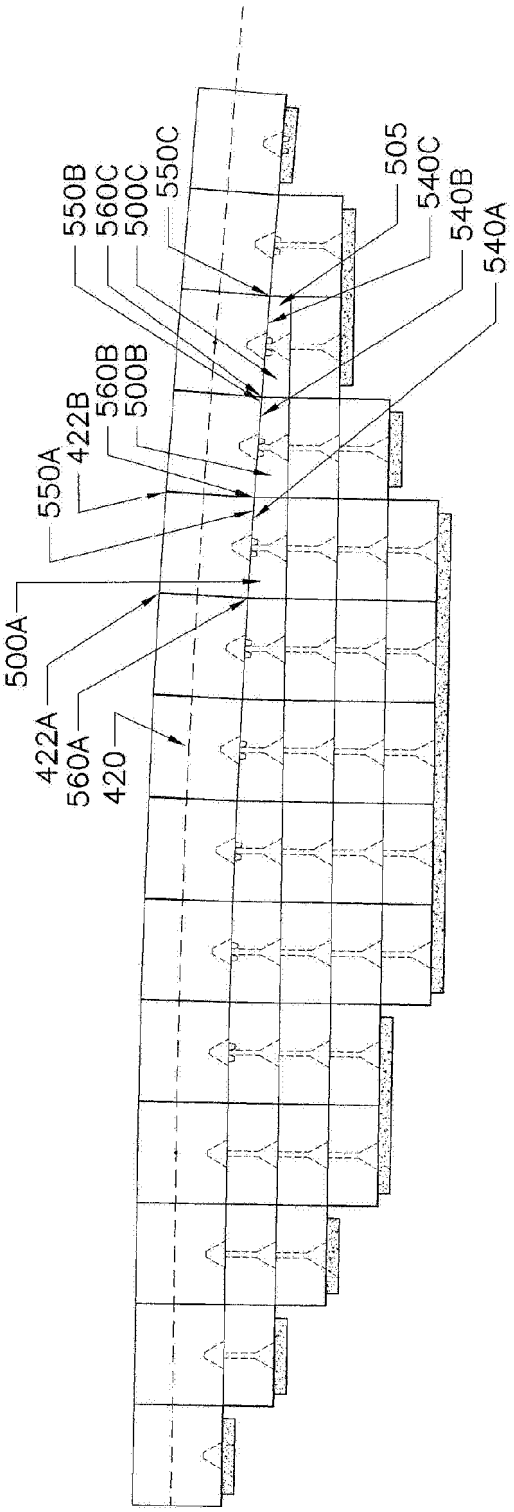

550B
560C
500C
550C
505
540C
540B
540A
560B
500B
422B
550A
500A
422A
560A
420

FIGURE 15

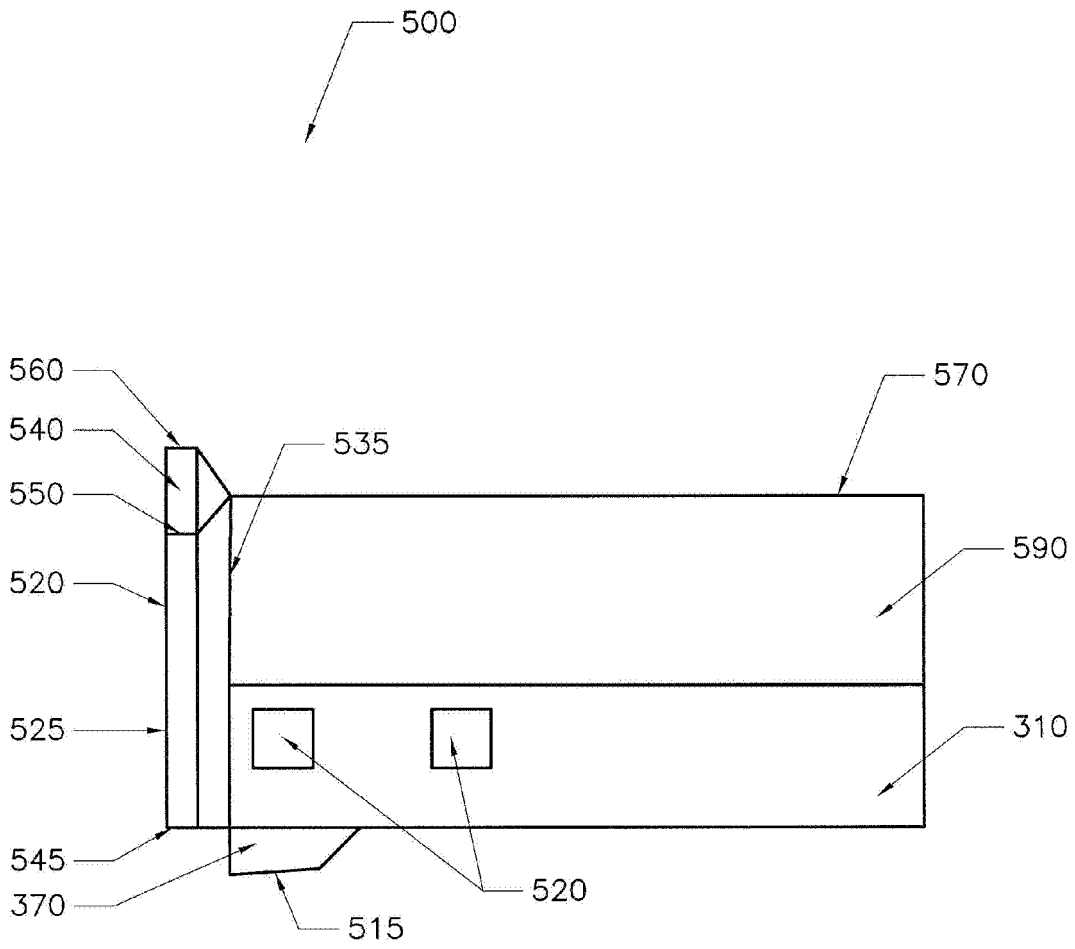


FIGURE 16