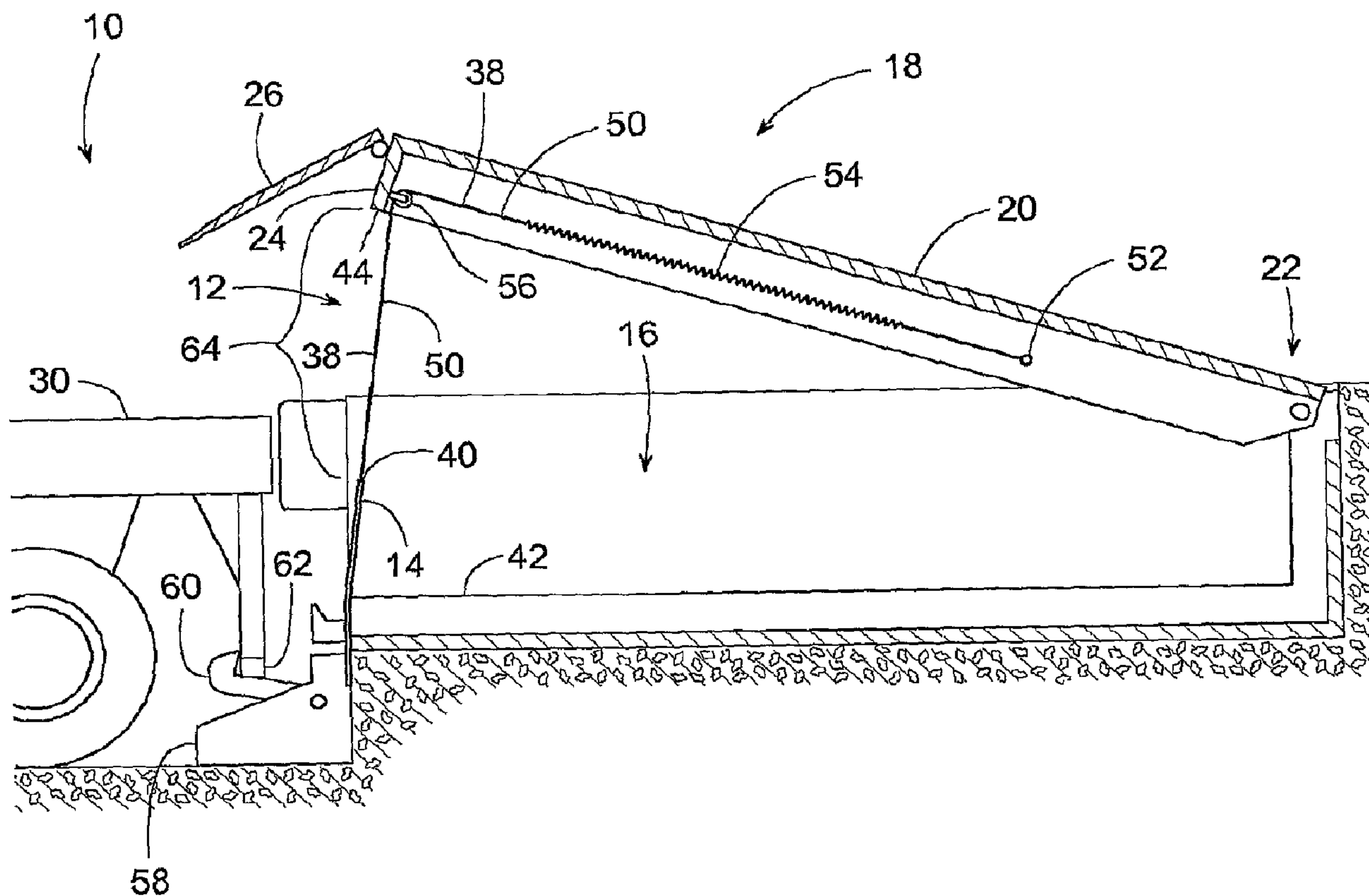




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 (54) Title: WEATHER SHIELD FOR UNDERNEATH A DOCK LEVELER



(57) **Abrégé/Abstract:**

A shield system (12) for shielding the area (16) underneath a dock leveler(18) allows a gap to be created either above or below the shield when the deck (20) rises, whereby a shield of a given height dimension can be used on dock levelers of various lift heights. In some embodiments, the shield is a pliable curtain (14) that a tensioner (38) holds taut during some operations of the dock leveler(18) , yet the curtain (14) can collapse for below-dock operation. The shield system can be used on horizontally storing dock

(57) **Abrégé(suite)/Abstract(continued):**

levelers or vertically storing ones. In some cases, the system includes a pliable web that extends between a front face of the deck and a lip extending from the deck. The web can help seal the area adjacent to a pair of dock bumpers.

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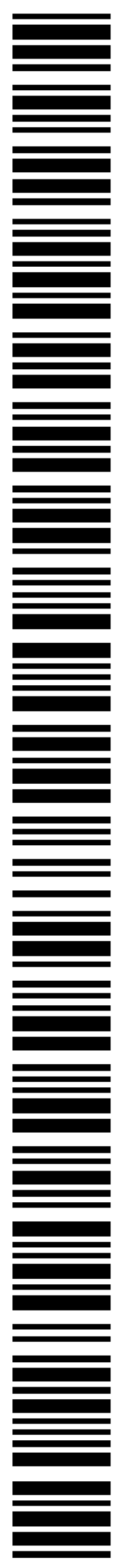
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(54) Title: WEATHER SHIELD FOR UNDERNEATH A DOCK LEVELER

(57) Abstract: A shield system (12) for shielding the area (16) underneath a dock leveler(18) allows a gap to be created either above or below the shield when the deck (20) rises, whereby a shield of a given height dimension can be used on dock levelers of various lift heights. In some embodiments, the shield is a pliable curtain (14) that a tensioner (38) holds taut during some operations of the dock leveler(18), yet the curtain (14) can collapse for below-dock operation. The shield system can be used on horizontally storing dock levelers or vertically storing ones. In some cases, the system includes a pliable web that extends between a front face of the deck and a lip extending from the deck. The web can help seal the area adjacent to a pair of dock bumpers.



**WO 2007/056744 A1**

## **WEATHER SHIELD FOR UNDERNEATH A DOCK LEVELER**

### **Field of the Disclosure**

[0001] The present disclosure generally pertains to loading docks and more specifically to a shield system for sheltering an area underneath a dock leveler.

### **Background**

[0002] A typical loading dock of a building includes an exterior doorway with an elevated platform for loading and unloading vehicles, such as trucks and trailers. To compensate for height differences between the loading dock platform and an adjacent bed of a truck or trailer, many loading docks have a dock leveler. A typical dock leveler includes a deck or ramp that is pivotally hinged along its back edge to vary the height of its front edge. An extension plate or lip extends outward from the deck's front edge to span the gap between the rear of the truck bed and the front edge of the deck.

[0003] The deck and lip are usually moveable between a stored position and an operative position. When in the stored position, the deck may be either vertical or horizontal, depending on the style of dock leveler. U. S. Patent 6,502,268 shows an example of a horizontally storing deck, and U. S. Patent 5,396,676 discloses a dock leveler with a vertically storing deck. In either case, the lip in the operative position extends from the deck's front edge and rests upon the truck bed to form a bridge between the two. This allows personnel and material handling equipment to readily move on and off the vehicle during loading and unloading operations.

[0004] To help shield against weather while a vehicle is being serviced at the dock, usually some type of seal is installed around the perimeter of the doorway. Such seals are typically installed along the upper and side edges of the doorway to help seal any air gaps that may

otherwise exist between the face of the building and the rear of the vehicle. The dock leveler lip resting upon the rear of the vehicle is often relied upon to seal most of the doorway's lower edge.

[0005] The area or pit underneath a dock leveler's deck, however, is usually exposed to outside air. This can create problems, particularly when there is a significant temperature differential between the indoor and outdoor air. Warm outside air, for example, may condense underneath a relatively cool deck of a dock leveler used in a cold storage warehouse. The condensation can promote corrosion of various parts of the dock leveler. Conversely, a heated building during the winter may lose a significant amount of heat by thermal conduction through the deck, as cold outside air cools the ramp from underneath. Thus, regardless of whether the outside air is colder or warmer than the inside air, it may be beneficial to shield the underside of a dock leveler from outside air, as proposed in U. S. Patent 4,682,382 and the abovementioned '268 and '676 patents. These patented shields, however, have their limitations.

[0006] The '382 patent suggests using a rectangular panel to help shield the area underneath a dock leveler. A lower edge of the panel is coupled to the dock, while the panel's upper edge has a resilient sealing strip for sealing against the rear of a vehicle. The effectiveness of that seal, however, may depend on how squarely a vehicle backs into the dock and may further depend on the shape or contour of the vehicle's rear surface. Moreover, in the absence of a vehicle, it appears that the dock leveler lip, rather than the rectangular panel, is relied upon to shield the underside of the ramp from the outside air. Also, to move the lip from a stored, pendant position to an extended, operative position, the ramp apparently must lift the lip up and over the upper edge of the panel before the lip can be set back down atop the truck bed. As the lip travels over the top of the sealing strip, the underside of the ramp may be momentarily exposed to an inrush of outside air.

[0007] The '268 patent discloses a shield that is connected to both the underside of the deck and the foundation surrounding the pit. Although such a design works well for new dock leveler installations, such a shield can be difficult to custom fit to an already-existing dock leveler. The shield, for instance, may need to be sized for the deck's degree of opening and may need special cutouts to accommodate various components and operating mechanisms of the dock leveler.

[0008] The '676 patent discloses a shield that flexes inward or farther underneath the deck as the deck descends. Since dock levelers typically have a lip actuator and/or other operating mechanisms near the front edge of the deck, a shield flexing inward may interfere with such mechanisms. Moreover, the '676, '268, and '382 patents fail to disclose an effective way of sealing the area between the underside of an extended lip and adjacent dock bumpers, which are often installed at the dock to establish a predetermined minimum distance between the rear edge of a truck and the face of the building or front edge of the dock leveler.

[0009] Consequently, a need exists for an under leveler seal system that overcomes the limitations of current systems.

### Summary

[0010] In some embodiments, a shield system includes a curtain that can be maintained in vertical tension without the curtain having to span the entire vertical gap between a fully raised deck and the pit.

[0011] In some embodiments, the curtain is attached to the deck and can lift away from the pit.

[0012] In some embodiments, the curtain is attached to the pit and the deck can lift away from the curtain.

[0013] In some embodiments, the curtain is held in tension by way of a tensioner that is attached to the deck.

[0014] In some embodiments, the curtain is held in tension by way of a tensioner that is coupled to the pit.

[0015] In some embodiments, the tensioner includes a spring.

[0016] In some embodiments, the tensioner includes a pliable elongate member, such as a cable, strap, cord, chain, or the like.

[0017] In some embodiments, the tensioner includes a wheel such as a pulley, sheave or the like.

[0018] In some embodiments, a seal system includes a flexible web suspended from a lip of a dock leveler, wherein the web can seal against a front edge of the deck and/or the side a dock bumper.

[0019] In some embodiments, a seal system includes a curtain supported by the toe guards of a dock leveler.

[0020] In some embodiments, the sealing curtain is closer to the upper end of the toe guard than the lower end so that curtain can remain generally planar.

[0021] In some embodiments, the sealing curtain and the toe guard can both collapse to facilitate below-dock end loading.

[0022] In some embodiments, a collapsible sealing member is supported in a generally fixed orientation relative to the deck, so that as the deck pivots the seal avoids interfering with operating mechanisms underneath the deck.

[0023] In some embodiments, a weather shield for a dock leveler includes an environmental barrier with two stages of compression.

[0024] In some embodiments, a weather shield includes an environmental barrier that is held taut both vertically and horizontally.

[0025] In some embodiments, a weather shield includes overlapping curtains, wherein one of the curtains helps shield a deck that is void of any significant front header.

[0026] In some embodiments, the gaps between a deck's support beams are filled with a foam pad.

### **Brief Description of the Drawings**

[0027] Figure 1 is a perspective view of a loading dock with shield system for shielding the area underneath a dock leveler.

[0028] Figure 2 is a side view of the shield system of Figure 1, wherein the dock leveler is at a stored position.

[0029] Figure 3 is side view similar to Figure 2 but with the deck raised and the lip partially extended.

[0030] Figure 4 is a side view similar to Figure 2 but with the lip resting on the truck bed.

[0031] Figure 5 is a side view similar to Figure 2 but with the dock leveler in a below-dock position.

[0032] Figure 6 is similar to Figure 1 but showing another embodiment of a shield.

[0033] Figure 7 is similar to Figure 2 but showing the embodiment of Figure 6.

[0034] Figure 8 is similar to Figure 3 but showing the embodiment of Figure 6.

[0035] Figure 9 is similar to Figure 4 but showing the embodiment of Figure 6.

[0036] Figure 10 is similar to Figure 5 but showing the embodiment of Figure 6.

[0037] Figures 11 is similar to Figure 2 but showing another embodiment of a shield system.

[0038] Figures 12 is similar to Figure 3 but showing the embodiment of Figure 11.

[0039] Figures 13 is similar to Figure 4 but showing the embodiment of Figure 11.

[0040] Figure 14 is similar to Figure 5 but showing the embodiment of Figure 11.



- [0041] Figure 15 is similar to Figure 2 but showing another embodiment of a shield system.
- [0042] Figure 16 is similar to Figure 3 but showing the embodiment of Figure 15.
- [0043] Figure 17 is similar to Figure 4 but showing the embodiment of Figure 15.
- [0044] Figure 18 is similar to Figure 5 but showing the embodiment of Figure 15.
- [0045] Figure 19 is similar to Figure 2 but showing another embodiment of a shield system.
- [0046] Figure 20 is similar to Figure 3 but showing the embodiment of Figure 19.
- [0047] Figure 21 is similar to Figure 4 but showing the embodiment of Figure 19.
- [0048] Figure 22 is similar to Figure 5 but showing the embodiment of Figure 19.
- [0049] Figure 23 is similar to Figure 2 but showing another embodiment of a shield system.
- [0050] Figure 24 is similar to Figure 3 but showing the embodiment of Figure 23.
- [0051] Figure 25 is similar to Figure 4 but showing the embodiment of Figure 23.
- [0052] Figure 26 is similar to Figure 5 but showing the embodiment of Figure 23.
- [0053] Figure 27 is a perspective view similar to Figure 1 but showing another embodiment of a seal system.
- [0054] Figure 28 is a partial cutaway perspective view similar to Figure 1 but showing another embodiment of a seal system.
- [0055] Figure 29 is a perspective view of a weather shield installed on a dock leveler that has its deck in a raised position.
- [0056] Figure 30 is a side view of Figure 29 but with the deck at a cross-traffic position.
- [0057] Figure 31 is a side view of Figure 29.
- [0058] Figure 32 is a side view of Figure 29 but with the deck at an intermediate position.
- [0059] Figure 33 is a side view similar to Figure 32 but with the deck at another intermediate position.

- [0060] Figure 34 is a side view of Figure 29 but with the deck in a lowered position.
- [0061] Figure 35 is a side view similar to Figure 31 but showing a different embodiment.
- [0062] Figure 36 is a side view similar to Figure 32 but showing the embodiment of Figure 35.
- [0063] Figure 37 is a side view similar to Figure 34 but showing the embodiment of Figure 35.
- [0064] Figure 38 is a perspective view similar to Figure 29 but showing another weather shield embodiment.
- [0065] Figure 39 is a side view of Figure 38.
- [0066] Figure 40 is a side view similar to Figure 39 but with the deck at an intermediate position.
- [0067] Figure 41 is a side view similar to Figure 40 but showing the deck at a lowered position.
- [0068] Figure 42 is a side view similar to Figures 33 and 40 but showing a deck that does not include any significant front header.
- [0069] Figure 43 is a cross-sectional front view taken along line 43-43; however, one pad is shown in the process of being installed.

### Detailed Description

[0070] Figures 1 – 5 show a loading dock 10 with of a shield system 12 that includes a pliable curtain 14 for shielding a pit area 16 underneath a dock leveler 18. By blocking out weather and other elements, curtain 14 helps protect pit area 16. By using a pliable curtain rather than a thicker, more rigid structure, shield system 12, and alternate embodiments thereof, can be readily adapted to fit a wide variety of dock levelers and pits. A curtain, for instance, can be custom cut to size at the installation site, and various cutouts can be made so that the curtain does not to interfere with the operation of the dock leveler.

[0071] Such trimming is not readily accomplished with thicker foam seals, especially if they are encased within a fabric covering. Moreover, a thick foam seal takes up more space underneath a dock leveler than does a relatively thin curtain.

[0072] A pliable curtain, however, is not self-supporting, so shield system 12 and various other embodiments herein include some sort of tensioner or supporting structure that helps support the curtain. Although, such supporting structure consumes additional space, the supporting structure can be installed wherever it is most convenient.

[0073] With the versatility of curtain 14 and its supporting structure, shield system 12 can be applied to a wide variety of dock levelers, such as those whose structure and operation are described in U. S. Patents 6,502,268; 3,137,017; 4,293,969, 5,396,676; 4,776,052; and 6,205,606; all of which are specifically incorporated by reference herein.

[0074] For sake of example, dock lever 18 may include a deck 20 that can pivot about its rear edge 22 to raise and lower its front edge 24. A lip 26 can be pivotally attached to front edge 24, as explained in the background. The deck of some dock levelers store horizontally, as shown in Figures 2, 11 and 15 and disclosed in U. S. Patents 6,502,268; 3,137,017; and 4,293,969. Other decks store vertically, as shown in Figures 19 and 23 and disclosed in U. S. Patents 5,396,676; 4,776,052; and 6,205,606. The mechanisms for pivoting deck 20 and lip 26 has not been shown so as not to interfere with the illustration of other features of the invention; however, such mechanisms are well known in the industry.

[0075] The operating sequence of dock leveler 18 and shield system 12 may begin with deck 20 in its stored, cross-traffic position, as shown in Figure 2. In this position, lip 26 may be supported by a set of lip keepers 28 so that lip 26 and keepers 28 can help hold deck 20 in its generally horizontal position. With dock leveler 18 in its stored position, a vehicle 30, such as a

truck, trailer, or the like, can back into dock 10 until the rear end of vehicle 30 engages or is adjacent to a set of bumpers 32.

[0076] To help shield pit area 16, curtain 14 has a lower edge 34 attached to the loading dock's front face 36, just below pit 16. A tensioner 38 attached to an upper edge 40 of curtain 14 applies vertical tension to curtain 14. The tension helps keep curtain 14 generally upright in front of pit area 16, i.e., between an upper surface 42 of pit 16 and a lower surface 44 of deck 20.

Curtain 14 can be made of any pliable or semi-flexible material including, but not limited to, nylon, canvas, HYPALON (Dupont trademark), canvas duck, rubber impregnated fabric, foam, etc. Curtain 14 may include various notches 46 or cutouts 48 to accommodate lip keepers 28, vehicle restraints, or other components.

[0077] Tensioner 38 represents any structure that can create vertical tension in curtain 14. In one example, tensioner 38 comprises one or more pliable elongate members 50 (e.g., cable, strap, chain, cord, etc.) extending between the curtain's upper edge 40 and an anchor point 52 on deck 20. In some embodiments, a spring 54 (e.g., helical spring, elastic cord, gas spring, etc.) coupled to member 38 can be used to maintain tension in member 38 as deck 20 pivots up and down, and a wheel 56 (e.g., pulley, sheave, etc.) allows the tension to be applied to curtain 14 in a generally vertical direction. In other embodiments, a deadweight or counterbalance can be used for creating the vertical tension in curtain 14.

[0078] After vehicle 30 engages or is sufficiently close to bumpers 32, a vehicle restraint 58 may raise its barrier 60 to engage the vehicle's ICC bar 62, thereby helping hold vehicle 30 in position. The use of a vehicle restraint to engage a vehicle's ICC bar is well known in the industry and is disclosed in U. S. Patents 4,560,315; 5,702,223; and 6,106,212; all of which are specifically incorporated by reference herein.

[0079] Once vehicle 30 is in the position shown in Figure 3, deck 20 rises so that lip 26 can be extended and subsequently lowered back down to rest upon the vehicle's truck bed, as shown in Figure 4. When deck 20 is raised, as shown in Figures 1 and 3, upper edge 40 of curtain 14 and lower surface 44 of deck 20 define a gap 64 therebetween. Gap 64 has a height 66 that varies with the pivotal movement of deck 20. Being able to create gap 64 while still maintaining tension in curtain 14 allows a curtain of a given height to fit various dock levelers even though their decks may rise to different levels. Moreover, being able to create gap 64 means that curtain 14 does not have to extend fully up to the maximum lift height of deck 20, thus curtain 14 can be shorter than if upper edge 40 were directly attached to deck 20.

[0080] In comparing Figures 2 and 3, it should be noted that as deck 20 rises, spring 54 stretches to accommodate the increased distance between wheel 56 and the curtain's upper edge 40.

[0081] With dock leveler 18 in the position of Figure 4, vehicle 30 can be loaded and unloaded of its cargo while curtain 14 provides an effective barrier that helps keep pit area 16 clean and dry, as the height of gap 64 is now minimal or nonexistent.

[0082] For end-loading or other below-dock operations, dock leveler 18 can be positioned as shown in Figure 5. In this position, deck 20 lowers lip 26 below its lip keepers 28. Even though the vertical distance between the deck's lower surface 44 and the upper surface 42 of pit 16 is less than the full height of curtain 14, below-dock operation is still possible due to the flexibility of curtain 14, which allows curtain 14 to collapse under pressure from deck 20.

[0083] Figures 6 – 10 illustrate an alternate shield system 140 where pliable curtain 14 is supported by a collapsible supporting structure 142. With this design, curtain 14 can be trimmed at the installation site to fit any pit, dock leveler and associated hardware. Once cut to size, any

number of supporting structures 142 can be mounted to the pit floor or other anchor point and attached to curtain 14 at any suitable location that does not interfere with the operation of dock leveler 18. Structures 142 can be fastened to curtain 14 by any suitable means including, but not limited to, threaded fasteners, VELCRO, adhesive, straps, rope, and clamps. Structure 142 is schematically illustrated to represent any body that can be collapsed under pressure and later resiliently recover its original shape. Examples of structure 142 include, but are not limited to, a foam block or column, a helical or leaf spring, a telescoping member (e.g., piston/cylinder, air spring, shock absorber, etc.), rubber or other polymeric rod, and various combinations thereof. In some cases, structure 142 may be encased within a protective fabric jacket.

[0084] The operation of shield system 140 is comparable to that of system 12 with Figures 6, 7, 8, 9 and 10 corresponding to Figures 1, 2, 3, 4 and 5 respectively. When deck 20 is in a cross-traffic position, as shown in Figure 7, the upper edge of curtain 14 and supporting structure 142 is adjacent to the lower surface of deck 20. Supporting structure 142 holds curtain 14 relatively taut in front of pit 16 so that system 140 can effectively shelter the area under deck 20. Since deck 20 is not attached to system 140, deck 20 is free to pivot to a raised position, as shown in Figure 8. The collapsibility of curtain 14 and structure 142 allows deck 20 to descend to a below-dock position, as shown in Figure 10.

[0085] Figures 11 – 14 illustrate an alternate shield system 68 that includes curtain 14. Shield system 68 is similar to system 12 with Figures 11, 12, 13 and 14 corresponding to Figures 2, 3, 4 and 5 respectively. Shield system 68 has a curtain tensioner 70 comprising a spring 72, an elongate member 74, and a wheel 76 that are similar to corresponding items of tensioner 12; however, wheel 68 and an anchor point 78 can be attached to any convenient point of the loading dock rather than having to be attached to deck 20. Wheel 76, for instance, could be attached to a

sidewall of pit 16, and anchor point 78 could be attached to the floor of the pit. By allowing the separation of tensioner 70 and deck 20, tensioner 70 can be shorter because the tensioner does not have to span the maximum lift distance of the deck. The flexibility of curtain 14 still allows below-dock operation as shown in Figure 14. Although curtain tensioner 70 comprises spring 72, elongate member 74 and wheel 76 to apply vertical tension in curtain 14, a wide variety of other spring loaded mechanism mounted within pit 16 and separated from deck 20 could be used for holding curtain 14 taut.

[0086] In another embodiment, shown in Figures 15 – 18, a shield system 80 includes a flexible curtain 82 suspended from deck 20. Curtain 82 is held vertically taut by way a tensioner 84 that includes two spring-loaded arms 86, an upper arm 86a and a lower arm 86b. Each arm 86a and 86b has a distal end attached to curtain 82, and the two arms are joined at a central pivot point 88. A torsion spring can be used to urge the distal ends of arms 86a and 86b apart so that they impart vertical tension in curtain 82. Figures 15, 16, 17 and 18 correspond to Figures 2, 3, 4 and 5 respectively. The flexibility of curtain 82 and arms 86 being able to pivot about point 88 under the urging of the torsion spring allow below-dock operation as shown in Figure 18.

[0087] In another embodiment, shown in Figures 19 – 22, a shield system 90 includes a flexible curtain 92 suspended from a vertically storing pivotal deck 94 and supported by one or more foam blocks 96. Figures 19, 20, 21 and 22 correspond to Figures 2, 3, 4 and 5 respectively. Although shield system 90 is shown mounted to a vertically storing dock leveler 98, system 90 could also be installed on horizontally storing dock levelers, such as dock leveler 18. In Figures 19 – 21, foam block 96 helps keep curtain 92 in a generally fixed orientation relative to deck 94. In Figure 22, however, the flexibility of curtain 92 and foam block 96 allow below-dock operation.

[0088] Shield system 90 also includes flexible webs 100 that help seal the gap that may otherwise exist between lip 26 and bumper 32. In some installations, web 100 has one edge 102 (Fig. 21) attached to the underside of lip 26 and another edge 104 attached to curtain 92 and/or deck 94. Web 100 is sufficiently flexible to collapse as lip 26 pivots toward deck 94, as shown in Figures 19, 20 and 22. Figure 21 shows how web 100 can deform in reaction to vehicle 30 backing into the dock. Although web 100 is shown installed to dock leveler 98, web 100 could be installed on a wide variety of dock levelers including, but not limited to, all of the dock levelers disclosed in Figures 1 – 28. Moreover, web 100 could be installed on dock levelers that have additional seals other than those disclosed herein or installed on dock levelers that have no additional seals whatsoever. Figure 27 shows a perspective view of two webs 100 installed on a dock leveler 106.

[0089] Figures 23 – 26 show a shield system 108 similar to shield system 90 with Figures 23, 24, 25 and 26 corresponding to Figures 19, 20, 21 and 22 respectively. With shield system 108, curtain 92 is held taut by one or more leaf springs 110 (bands of spring steel) instead of being supported by foam blocks 96. Otherwise, shield systems 108 and 90 operate in basically the same manner.

[0090] Figure 27 shows a shield system 118 that includes a curtain 120 or flexible shield attached to a right toe guard 122 and a left toe guard 124 of dock leveler 106. Curtain 120 has an upper edge 126 attached to deck 20. A lower edge 128 can be directly attached to toe guards 122 and 124, as shown in Figure 27, or an extension bracket 130 can couple lower edge 128 of curtain 120 to a lower segment of the toe guards, as shown in Figure 28. The toe guards help prevent someone from accidentally getting their foot pinched between the deck and the dock as the deck moves down to a cross-traffic position. As the deck descends, the toe guards can



collapse, for each toe guard 122 and 124 comprises a plurality of segments 132 and 134 that can move relative to each other. Although their actual structure may vary, some examples of toe guards and how they function are disclosed in U. S. Patents 3,456,274; 4,928,340; 4,557,008; and 4,110,860; all of which are specifically incorporated by reference herein.

[0091] Referring to Figure 28, flexible fingers or tabs 136 can be attached to web 100 to improve the sealing between web 100 and bumper 32.

[0092] In another embodiment, shown in Figures 29 – 34, a weather shield system 144 comprises a tensioner 146 that holds an environmental barrier in vertical tension. While a single structure may result in the most cost effective tensioner, the term tensioner can also refer to one structure or multiple structures, wherein a multi-structure tensioner may be desirable to accommodate certain pit or leveler configurations. Irrespective of the specific structure that makes up the tensioner, the tensioner is intended to apply a vertical tensioning force to the environmental barrier. In the current embodiment the term environmental barrier is used to refer to a structure that may provide an environmental barrier between an area under a dock leveler and an area outside of the loading dock. In the embodiments of Figs. 1-29 the environmental barrier was illustratively shown as a curtain, although it may also be desirable to utilize other structures for said environmental barrier. In the current embodiment, the environmental barrier is illustratively shown as curtain structure 148, where tensioner 146 holds curtain 148 in vertical tension. To prevent the entire curtain from losing tension and potentially losing its sealing effectiveness as soon as curtain 148 becomes slightly compressed between deck 20 and a forward edge 150 of pit 16, curtain 148 includes a first curtain section 152 and a second curtain section 154 that begin to lose tension at different deck elevations.

[0093] When deck 20 is at a raised position (e.g., Figs. 29 and 31), both sections 152 and 154 are in significant vertical tension. When deck 20 is at a lowered position (e.g., Fig. 34), sections 152 and 154 are both relieved of tension, or at least, under much less tension than when deck was at its raised position of Figure 31. When deck 20, however, is at some intermediate position (e.g., Figs. 30, 32 and 33), first section 152 is in appreciably greater tension than second section 154, whereby there is a discrete incremental difference in the vertical tension of sections 152 and 154.

[0094] To accomplish this, tensioner 146 has one structure (or a part thereof) 156 that applies tension to first section 152 and another structure (or a part thereof) 158 that applies tension to second section 154. In this particular example, structure 156 is an arm 160 pivotally coupled to an anchor 162 so that arm 160 can pivot about a point 164, for the purpose of applying tension to first section 152. A front end 166 of arm 160 is attached to curtain structure 148 at a point between sections 152 and 154. In this case, curtain structure 148 is one continuous curtain with a lower edge 168 fastened to some convenient structure near front edge 150 of pit 16. A spring 170 urges front end 166 of arm 160 upward so that arm 160 pulls first section 152 taut.

[0095] To tighten second section 154, structure 158 may illustratively be a leaf spring 172 that has one end 176 attached to arm 160 and an opposite end 174 attached to an upper edge 178 of curtain structure 148 so that second section 154 is between end 174 of spring 172 and end 166 of arm 160. Leaf spring 172 urges the curtain's upper edge 178 upward away from end 166 of arm 160, which applies vertical tension in section 154 as long as deck 20 does not obstruct the upward movement of leaf spring 172.

[0096] In some cases, an additional leaf spring 180, similar to spring 172, can be installed between spring 172 and arm 160. Spring 180 can be attached to an intermediate point 182 on

second section 154 to prevent the entire section 154 going being relieved of tension as soon as deck 20 begins compressing curtain structure 148. Figure 32, for instance, shows an upper portion 154a of section 154 losing tension while a lower portion 154b of section 154 is still taut.

[0097] Figures 29 – 34 illustrate the curtain's various stages of compression. Figure 29 and 31 show deck 20 in a raised position where both sections 152 and 154 are held taut by tensioner 146. Figure 34 shows deck 20 in a lowered position where deck 20 forces tensioner 146 and curtain 148 downward to an extent that leaves both sections 152 and 154 substantially vertically untensioned. Figures 30, 32 and 33 illustrate various intermediate positions. When deck 20 is in its cross-traffic position, as shown in Figure 30, portions 154a and 154b of section 154 are substantially vertically untensioned, while arm 160 keeps section 152 taut. Figure 32 shows deck 20 lowering its lip 26 upon vehicle 30, and in this intermediate position, only portion 154a of section 154 is vertically untensioned while spring 180 keeps portion 154b taut, and arm 160 keeps section 152 taut. Figure 33 shows lip 26 resting upon vehicle 30, and when deck 20 is at this elevation, portions 154a and 154b of section 154 are vertically untensioned, and section 152 is held taut by arm 160.

[0098] Although tensioner 146 is shown mounted to the base of pit 16, and the curtain's lower edge 168 is fixed while its upper edge 178 can move, other physical arrangements are well within the scope of the disclosure. Curtain 148, for instance, could be attached and suspended from deck 20, while a tensioner similar to tensioner 146 could urge the curtain downward in a manner similar to the embodiment of Figures 23 – 26. Also, with minor modification, a tensioner similar to tensioner 146 could be attached to the underside of deck 20 rather than being anchored to the pit floor. Regardless of the specific configuration, the system includes a means for providing

multi-phase tensioning force to the curtain, or to the individual sections thereof, to help keep it, or them, taut.

[0099] In the embodiment of Figures 35 – 37, the application of multi-phase tensioning force to the curtain is achieved by an alternate tensioner 184 attached to the underside of deck 20. Alternate tensioner 184 applies vertical tension to a curtain structure 186. Again, although a curtain structure may be a desirable form for an environmental barrier, the environmental barrier need not be limited to a curtain. In this case, one end 188 of a pivotal arm 190 is attached to an upper edge of curtain 186. A spring 192 urges arm 190 to pivot about a point 194 so that end 188 of arm 190 pulls upward on curtain 186. This maintains vertical tension in curtain 186 when arm 190 is unobstructed by deck 20 being in a raised position, as shown in Figure 35. When deck 20 is in the lowered position of Figure 37, both an upper section 186a and a lower section 186b of curtain 186 are relieved of tension in response to deck 20 pushing end 188 of arm 190 down.

[0100] When deck 20 is in an intermediate position, as shown in Figure 36, deck 20 pushes end 188 of arm 190 down, which relaxes upper section 186a of curtain 186. Lower section 186b, however, remains taut due to a cable and spring assembly 196 attached to arm 190. Assembly 196 comprises one anchor point 198 attached to arm 190 and another anchor 200 attached to a point between sections 186a and 186b of curtain 186. Assembly 196 includes a tension spring 202 with one end connected to anchor 198. A cable 204 connects an opposite end of spring 202 to anchor 200 on curtain 186. Cable 204 feeds through a cable guide 206 on arm 190 so that cable 204 transmits the tension in spring 202 to lower section 186b of curtain 186, thereby keeping section 186b taut, provided deck 20 does not push arm 190 so far down that arm 190 also forces anchor 200 down (compare Figs. 36 and 37).

[0101] In another embodiment, shown in Figures 38 – 41, a tensioner 208 applies both vertical and horizontal tension to a curtain 210. In this case, tensioner 208 includes two springs 212 that urge two rods 214 and 216 upward and outward. Rod 214 connects to an upper left-hand corner 218 of curtain 210 to pull curtain 210 upward and outward, and rod 216 connects to an upper right-hand corner 220 of curtain 210 to pull curtain 210 upward and outward as well. Depending on the length and flexibility of rods 214 and 216, lower ends 222 and 224 of rods 214 and 216 may be rigidly attached or pivotally connected to anchor points 226 and 228 respectively. If rods 214 and 216 are rigidly attached to anchor points 226 and 228, and the rods have sufficient flexibility and resilience, the springiness of the rods themselves may be enough to exert the needed upward and outward force on curtain 210, thus springs 212 could be eliminated.

[0102] In operation, rods 214 and 216 hold curtain 210 taut when a deck 20' is in a raised position (Figs. 38 and 39) or in an intermediate position (Fig. 40). However, when deck 20' is in a lowered position (Fig. 41), curtain 210 deflects in response to deck 20' pushing down against the rods and the upper edge of curtain 210. The difference between decks 20 and 20' is that deck 20 has a front header that extends across the deck's width in front of the deck's stringers or support beams (floor joists), and deck 20' does not have a front header of any significant size.

[0103] To provide additional sealing near a front edge 230 of deck 20', a curtain 234 can be suspended from an area near a hinge 236 that connects lip 26 to deck 20'. Curtain 234 is particularly useful for decks that do not include a significant front header plate that might otherwise shield the open spaces between adjacent beams of a series of beams 238 supporting deck 20'. As such, curtain 234 would find use with any of the embodiments of underleveler seal disclosed herein, because the underleveler seal may not adequately address the open regions that may exist in the leveler's front header structure. When deck 20' is at an intermediate position

(Fig. 40) or its lowered position (Fig. 41), curtain 234 overlaps the upper edge of curtain 210 or overlaps some other type of weather shield installed underneath the deck. When lip 26 is in its pendant position, as shown in Figure 41, curtain 234 lies generally between lip 26 and the plurality of beams 238.

[0104] In some cases, the gap between adjacent beams 238 can be filled by inserting a foam pad 240 between the beams, as shown in Figures 42 and 43. If pads 240 are slightly wider than the beam spacing, then pads 240 can be held in place by compression. Alternatively, or in addition, to the compressive force, pads 240 could also be held in place with other attachment means (e.g., straps, Velcro, tape, fasteners). Pads 240 include a water impervious skin or protective cover 242. Whether pads 240 or curtain 210 is used in combination with a weather shield installed underneath the deck, the overall goal of providing a consistent seal for the open areas underneath a leveler deck plate is achieved.

[0105] Although the above examples are described with respect to various embodiments, modifications thereto will be apparent to those of ordinary skill in the art. The various curtains, for example, are shown as being attached to the pit and separated from the deck or vice versa; however, it is conceivable and well within the scope of the invention to have a split curtain comprising two curtain sections with one section attached to the deck and the other section attached to the pit. With a split curtain design, the two sections would separate as the deck rises and would overlap or come together when the deck returns to its lowered position. Therefore, the scope of the invention is to be determined by reference to the following claims.

**CLAIMS:**

1. A shield system for shielding an area underneath a pivotal deck of a dock leveler installed at a loading dock, the shield system comprising:

a curtain disposed underneath the pivotal deck, wherein the curtain includes an upper edge that is spaced apart from the pivotal deck to define a gap between the pivotal deck and the curtain, and the gap has a height that varies as the pivotal deck moves; and

a tensioner coupled to the curtain, wherein the tensioner is coupled to the pivotal deck and the tensioner creates vertical tension in the curtain.

2. A shield system for shielding an area underneath a pivotal deck of a dock leveler installed at a loading dock, the shield system comprising:

a curtain disposed underneath the pivotal deck, wherein the curtain includes an upper edge that is spaced apart from the pivotal deck to define a gap between the pivotal deck and the curtain, and the gap has a height that varies as the pivotal deck moves; and

a tensioner coupled to the curtain, wherein the tensioner includes a spring and the tensioner creates vertical tension in the curtain.

3. A shield system for shielding an area underneath a pivotal deck of a dock leveler installed at a loading dock, the shield system comprising:

a curtain disposed underneath the pivotal deck, wherein the curtain includes an upper edge that is spaced apart from the pivotal deck to define a gap between the pivotal deck and the curtain, and the gap has a height that varies as the pivotal deck moves; and

a tensioner coupled to the curtain, wherein the tensioner includes a pliable elongate member and the tensioner creates vertical tension in the curtain.

4. A shield system for shielding an area underneath a pivotal deck of a dock leveler installed at a loading dock, the shield system comprising:

a curtain disposed underneath the pivotal deck, wherein the curtain includes an upper edge that is spaced apart from the pivotal deck to define a gap between the pivotal deck and the curtain, and the gap has a height that varies as the pivotal deck moves; and

a tensioner coupled to the curtain, wherein the tensioner includes a wheel and the tensioner creates vertical tension in the curtain.

5. The shield system of any one of Claims 2, 3, or 4, wherein the tensioner is spaced apart from the pivotal deck.

6. The shield system of any one of Claims 1, 2, 3, or 4, wherein the curtain includes a lower edge that is substantially stationary, a distance between the upper edge and the lower edge is substantially constant when the pivotal deck is pivoting along an upper range of movement, and the distance between the upper edge and the lower edge varies when the deck is pivoting along a lower range of movement.

FIG. 1

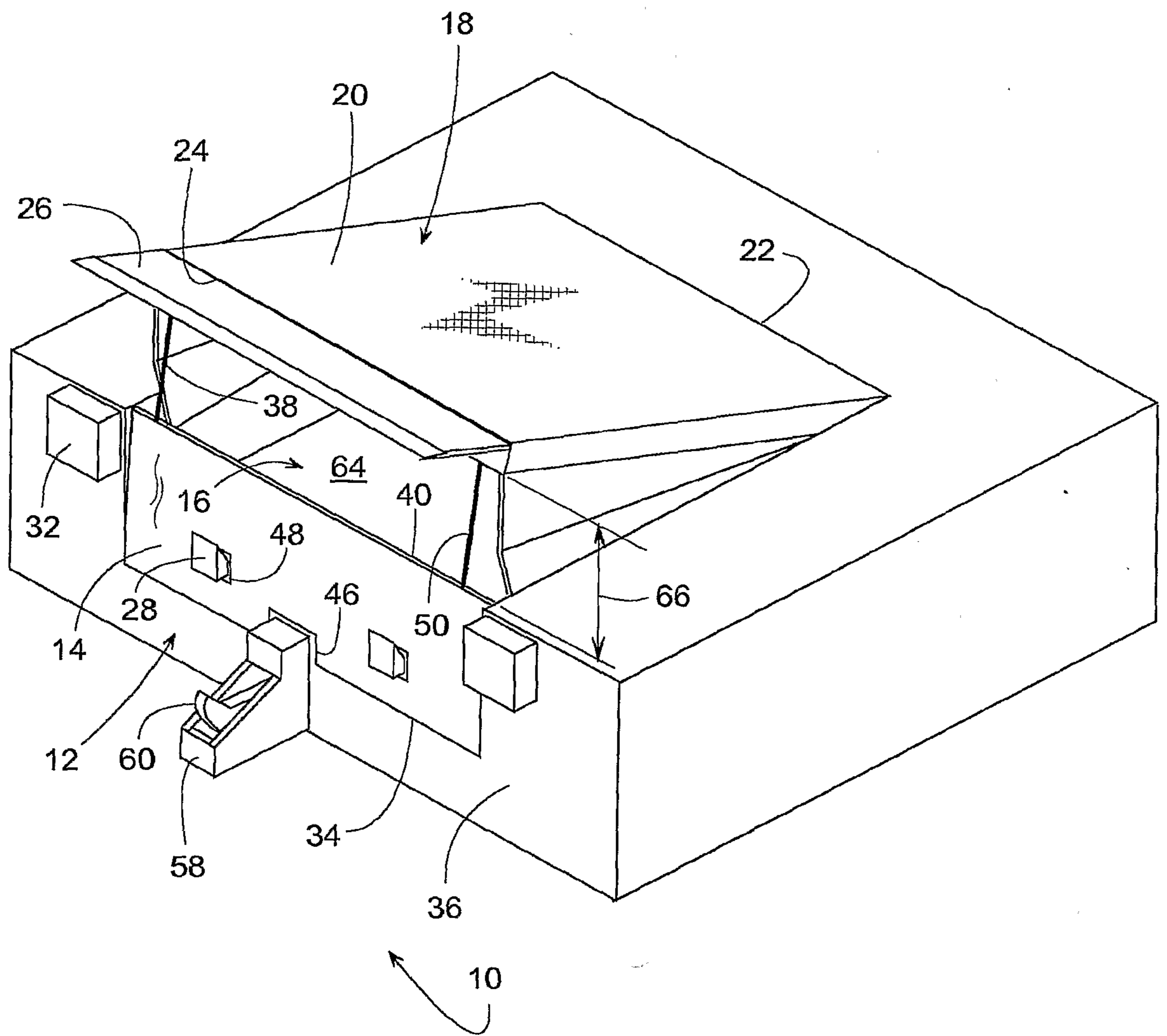




FIG. 2

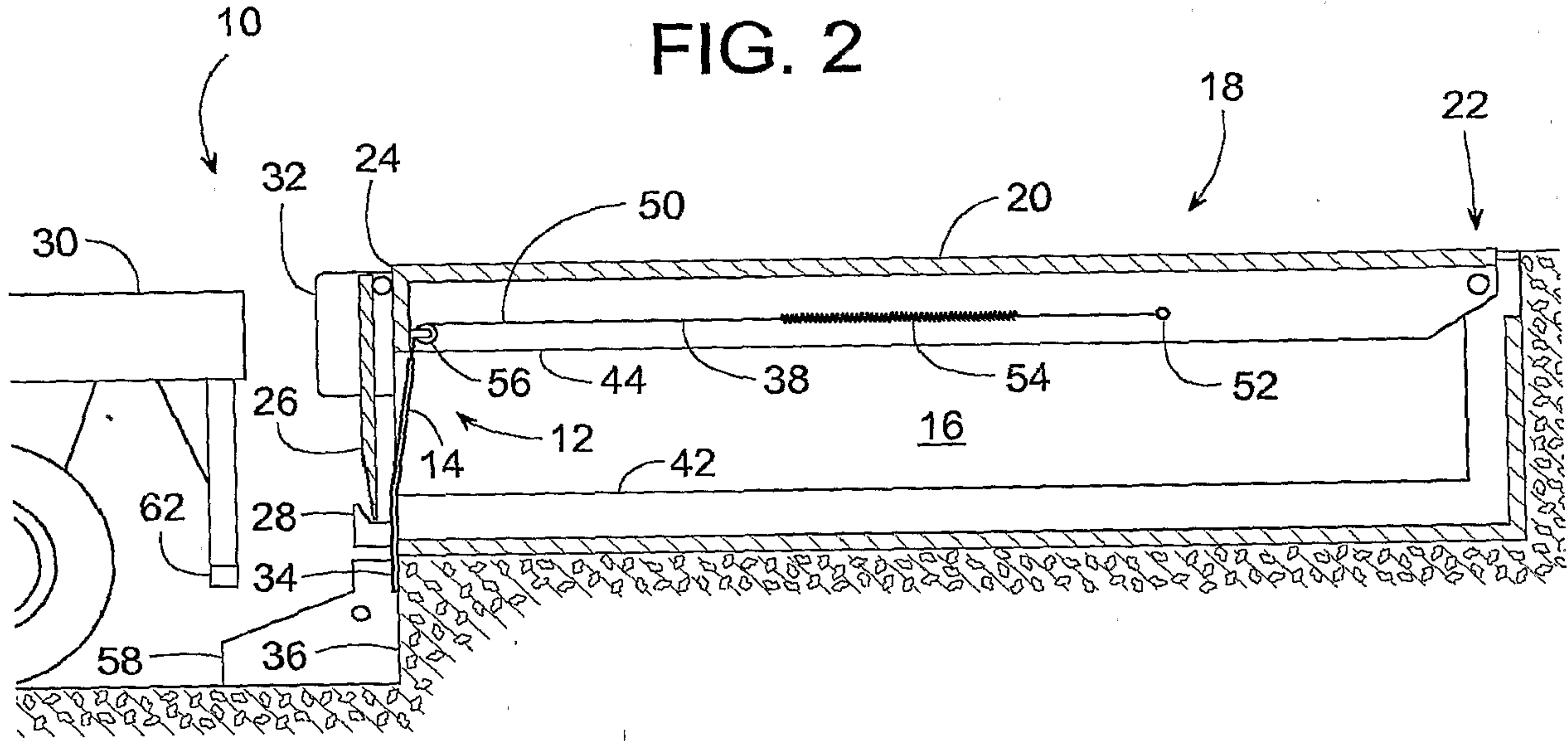
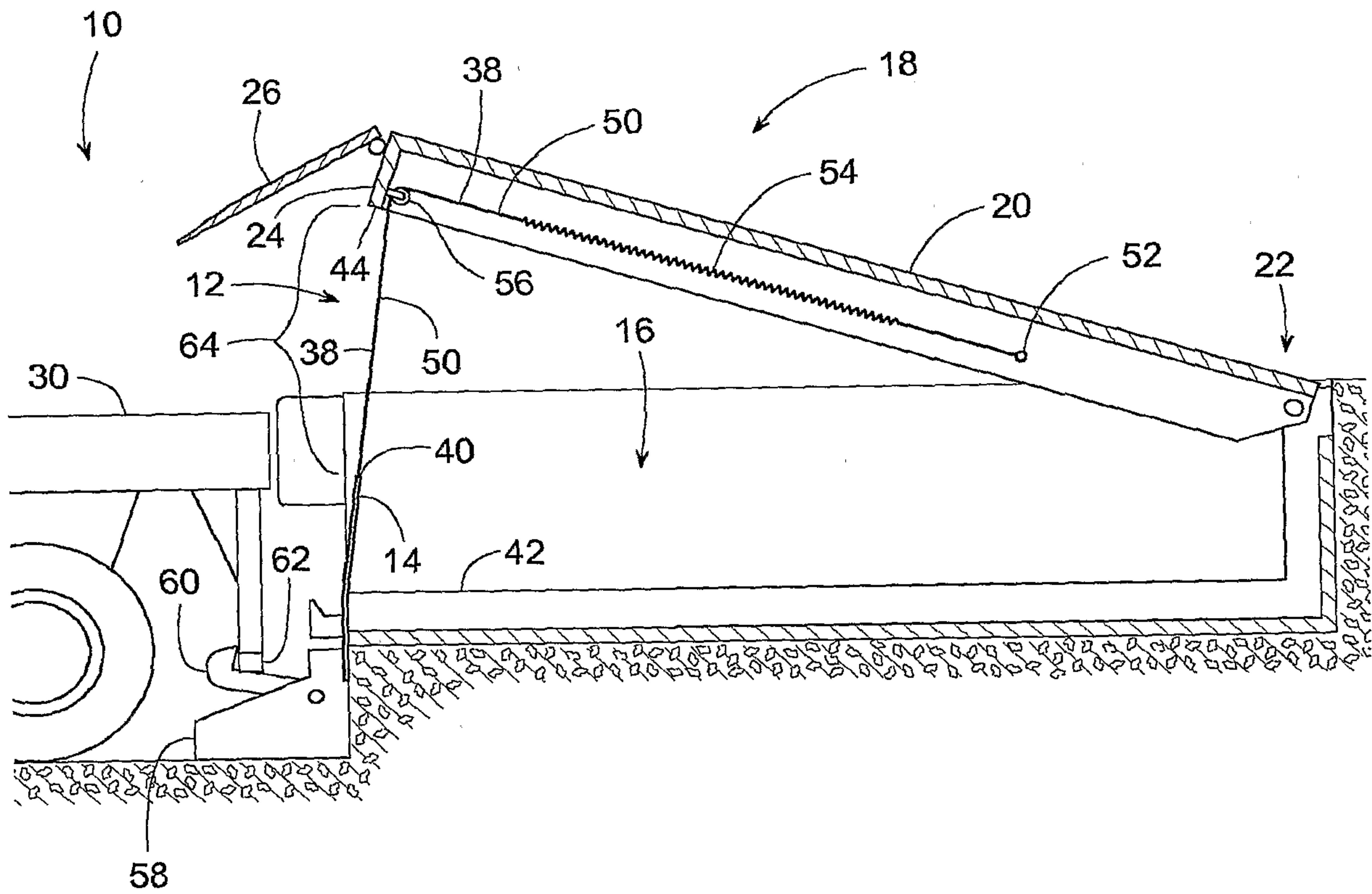


FIG. 3



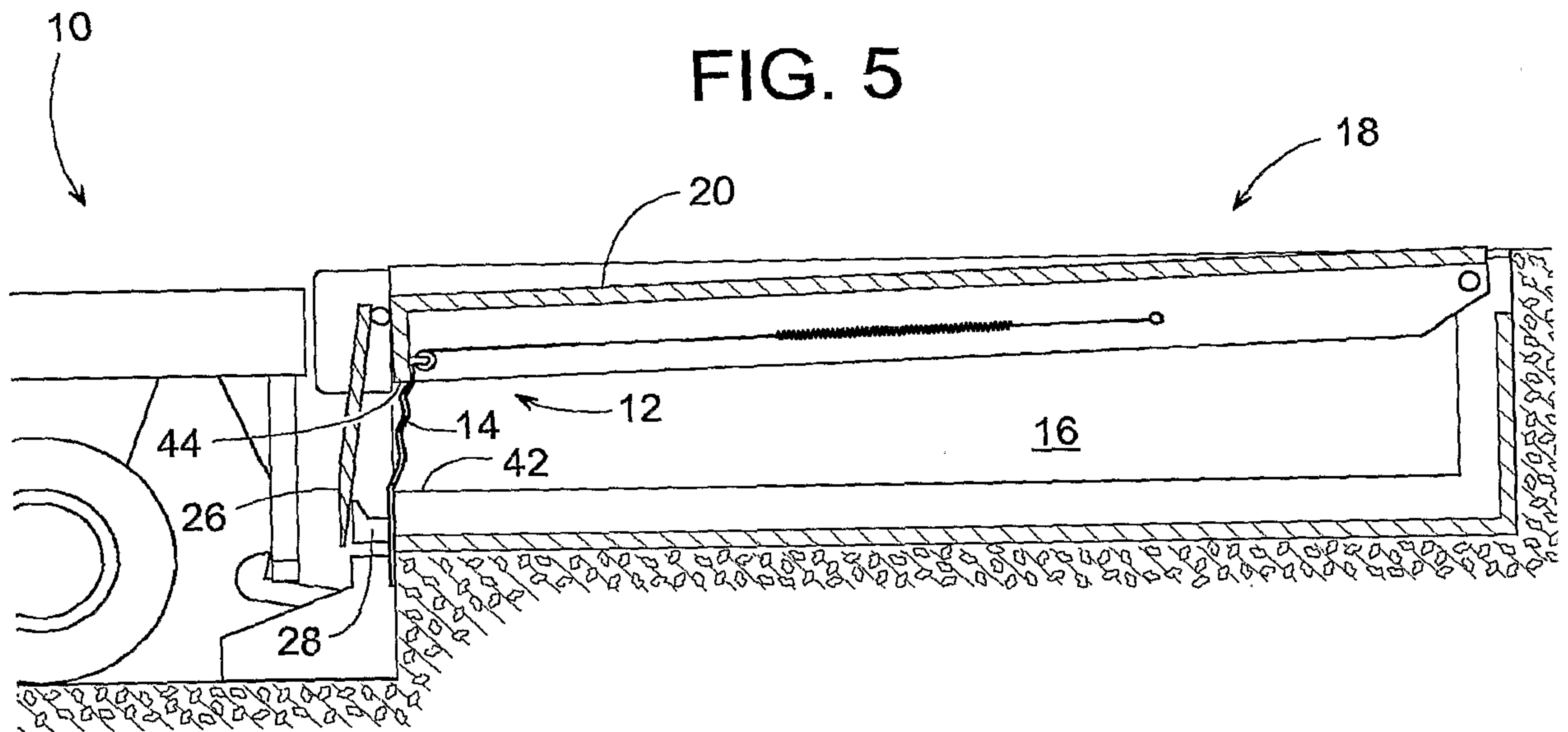
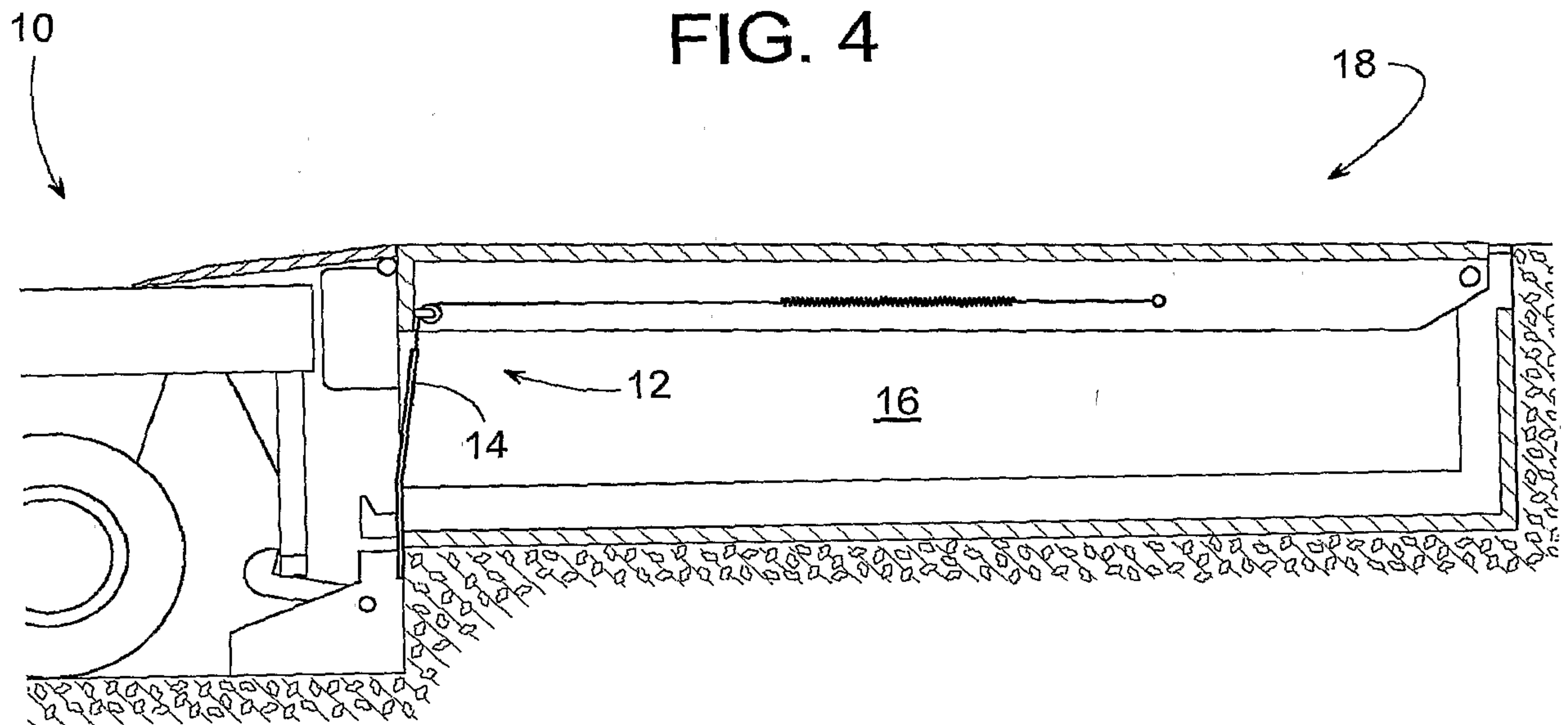


FIG. 6

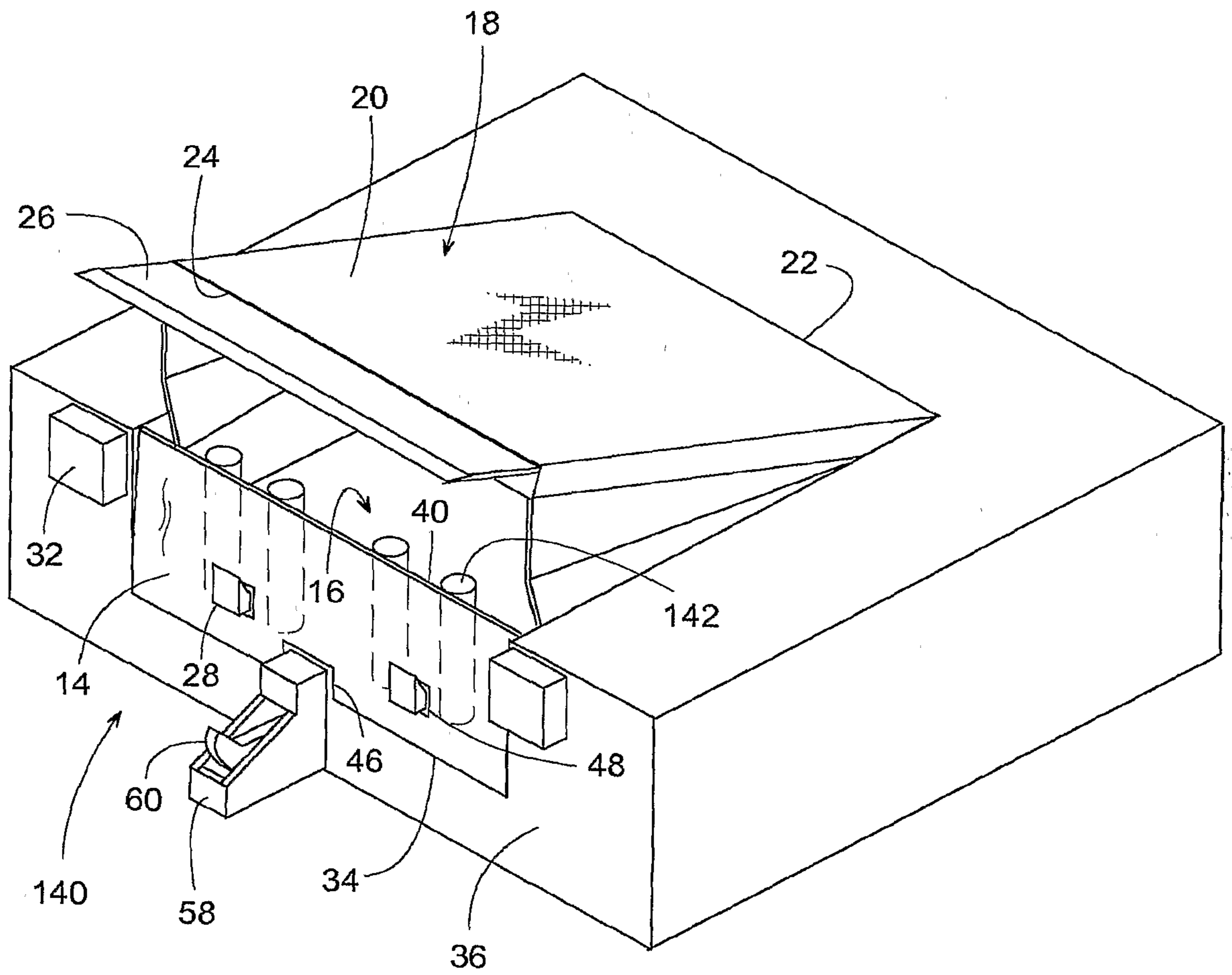


FIG. 7

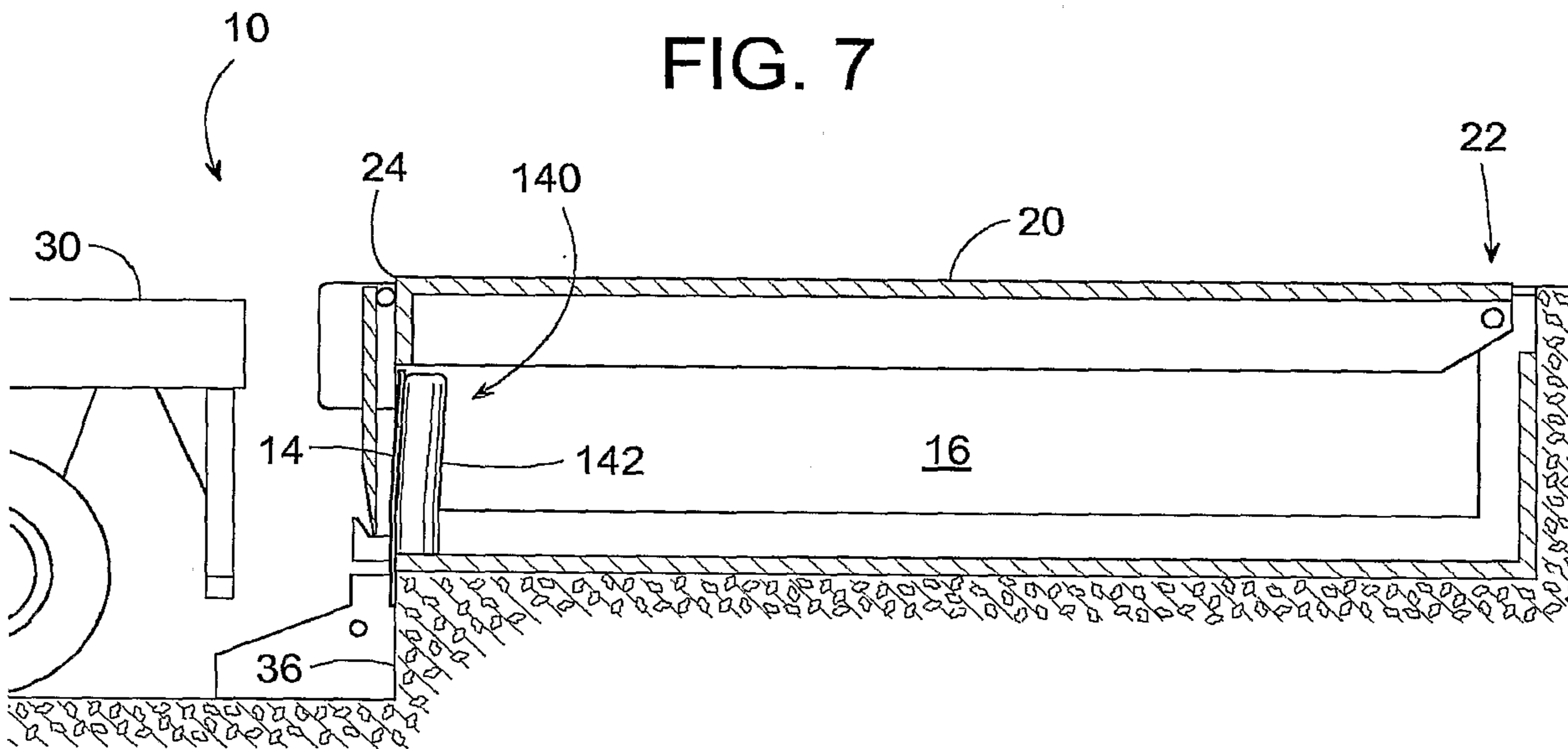
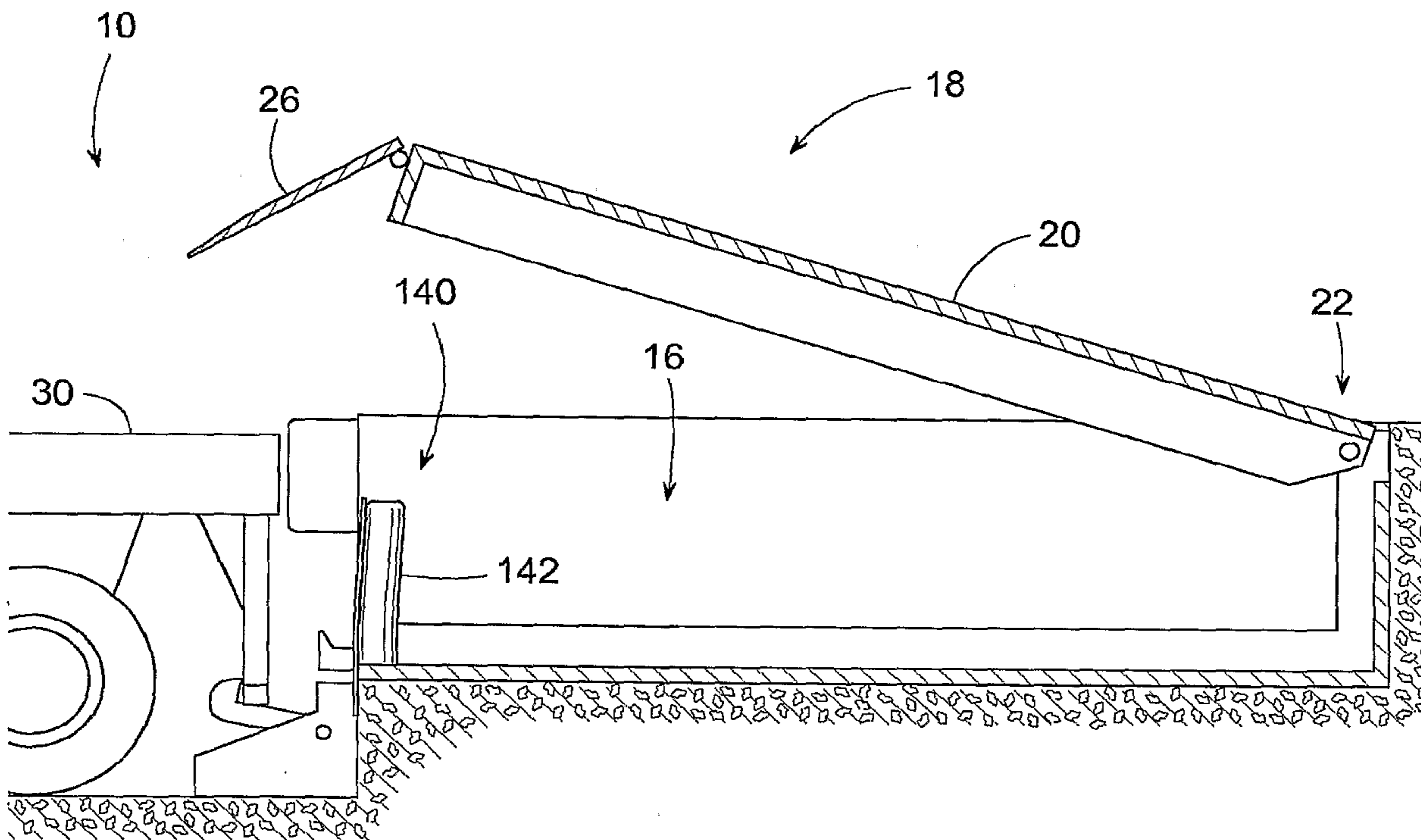
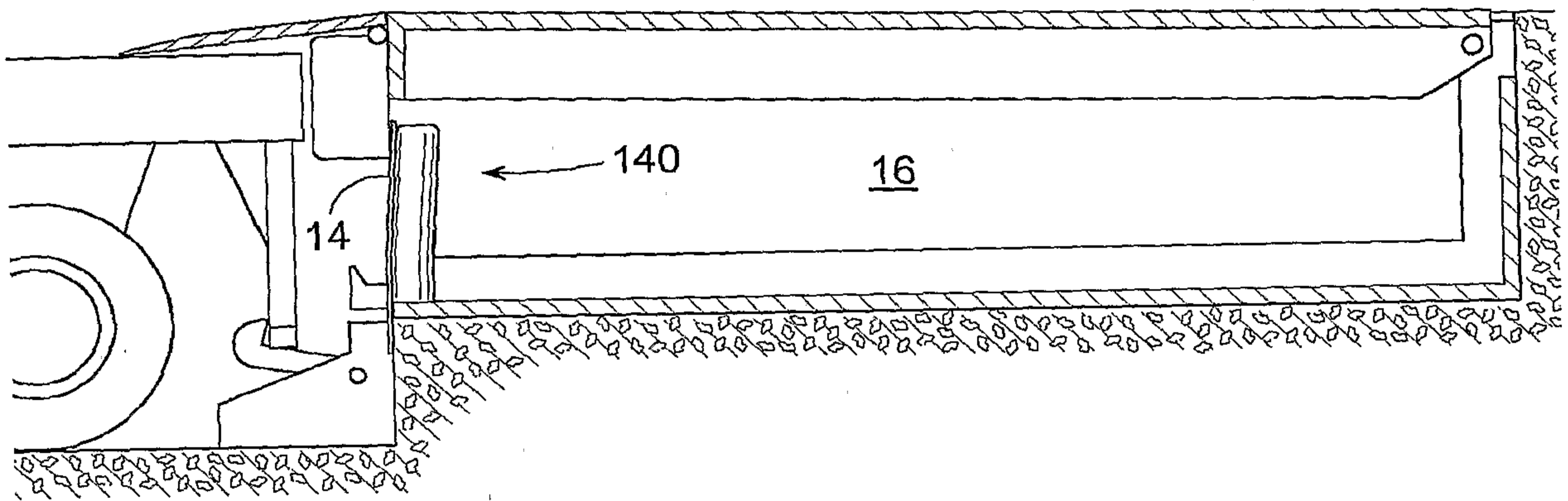


FIG. 8



10  
↓

FIG. 9



10  
↓

FIG. 10

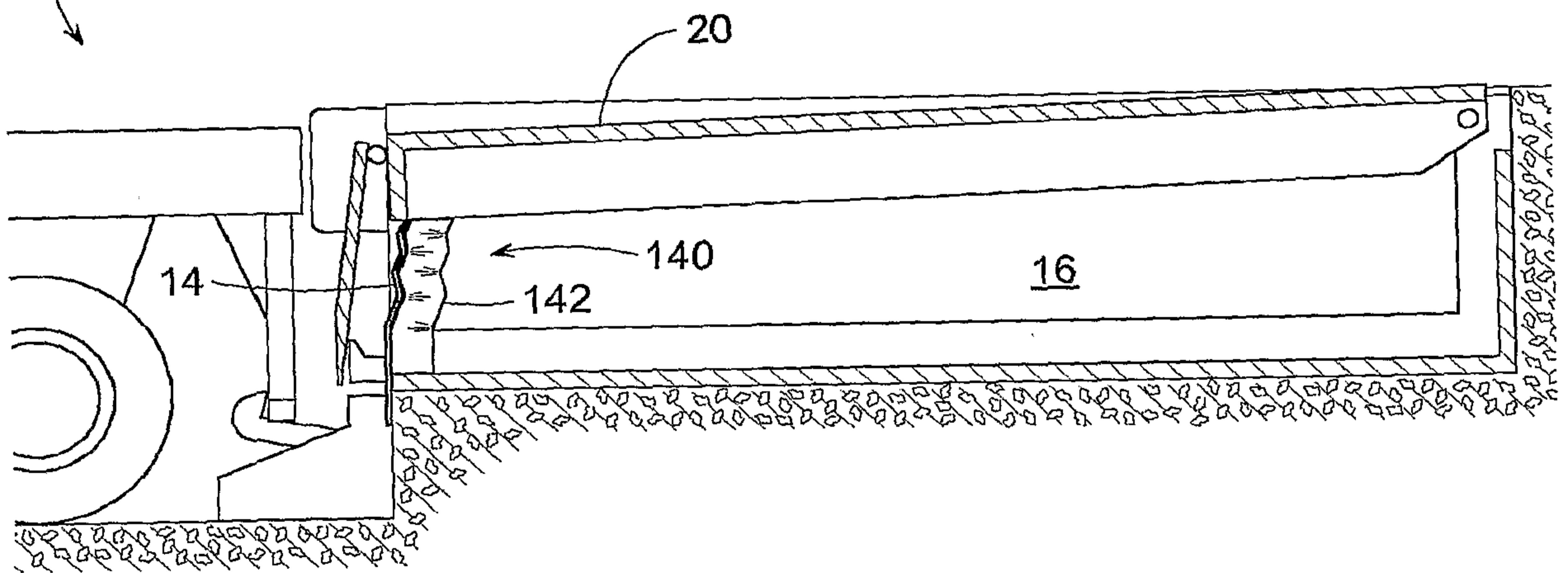


FIG. 11

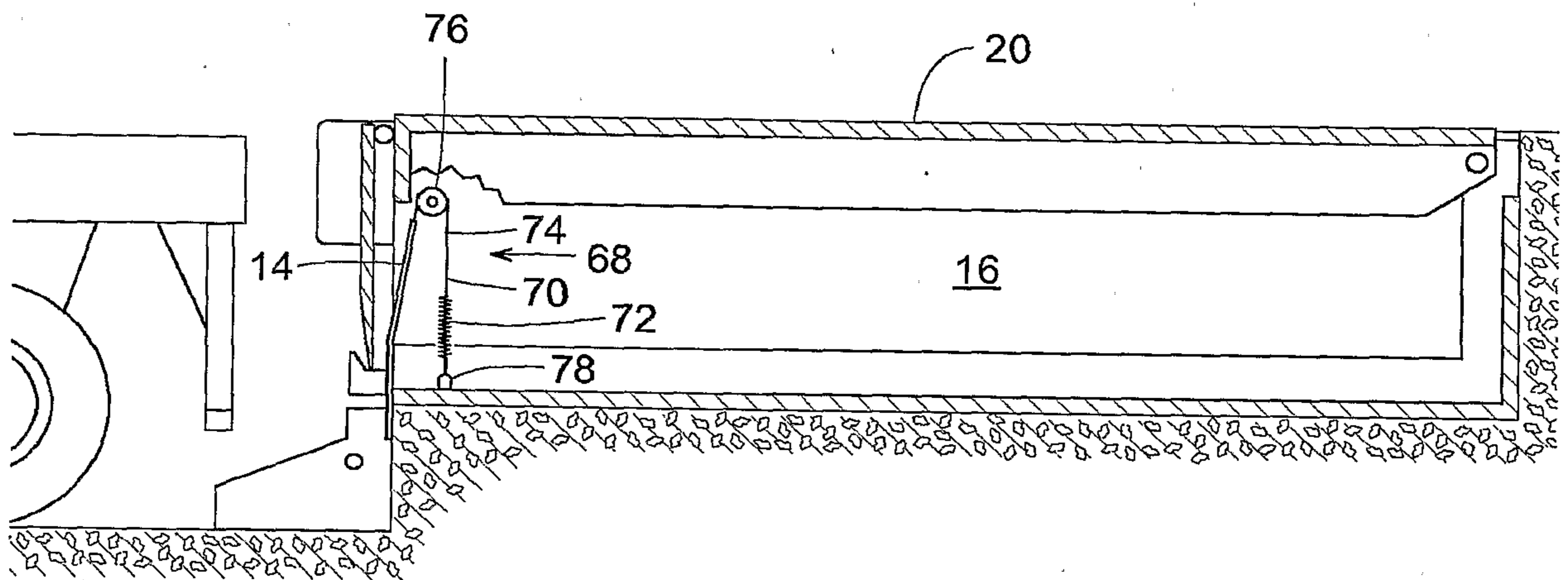


FIG. 12

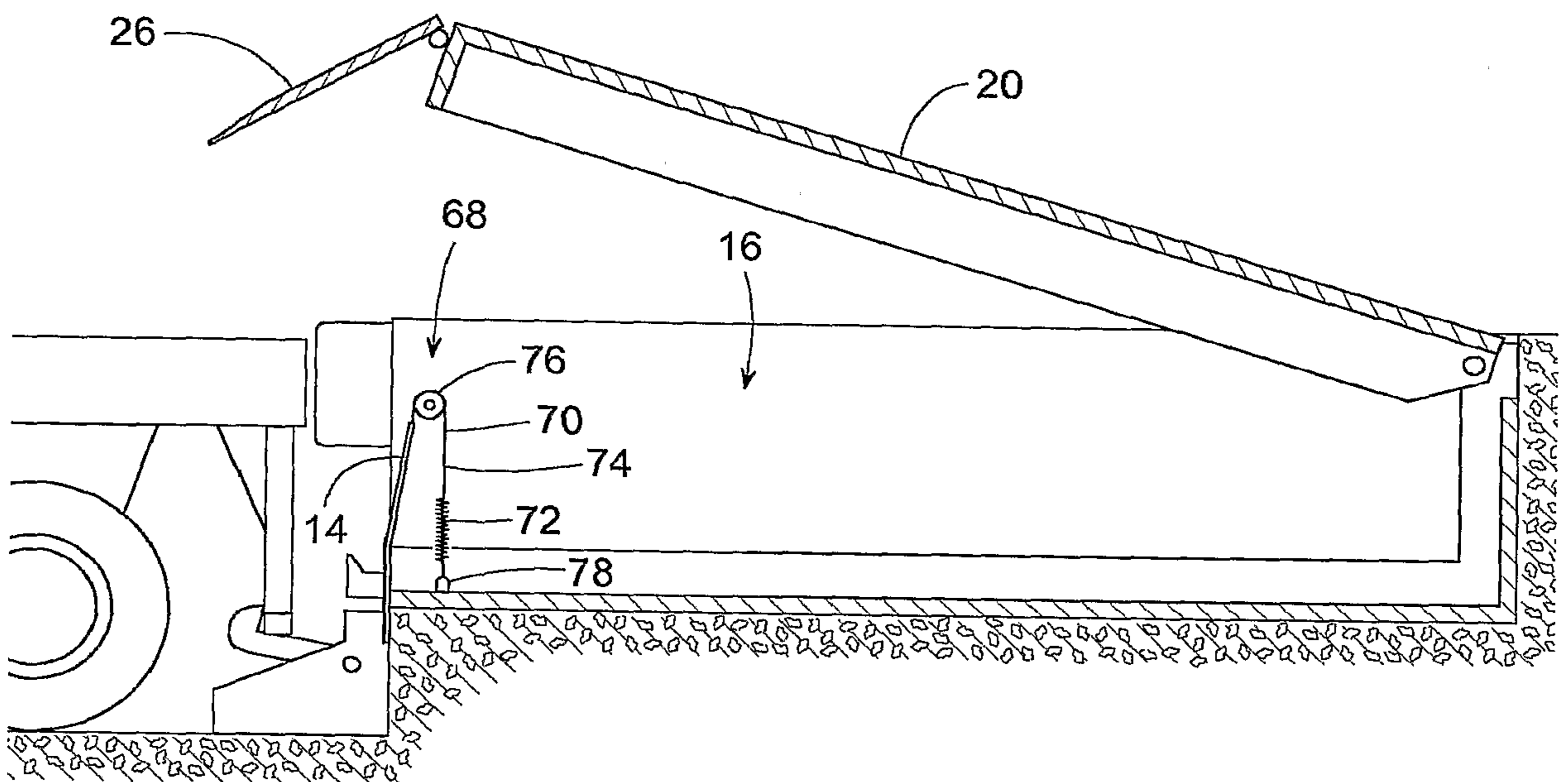


FIG. 13

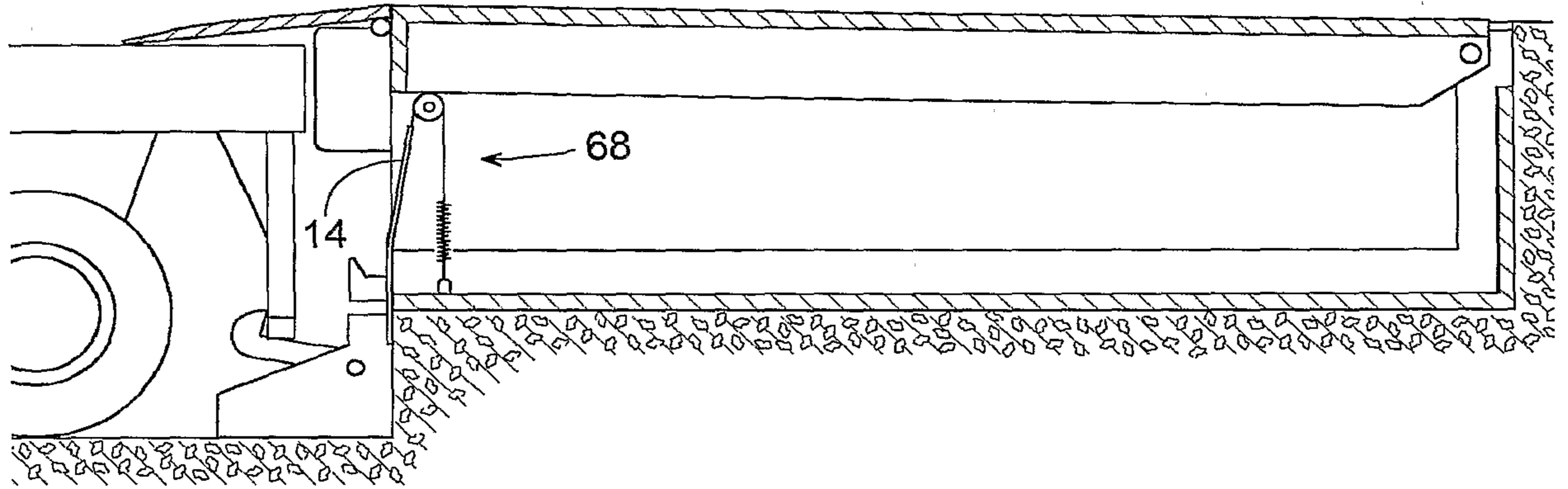


FIG. 14

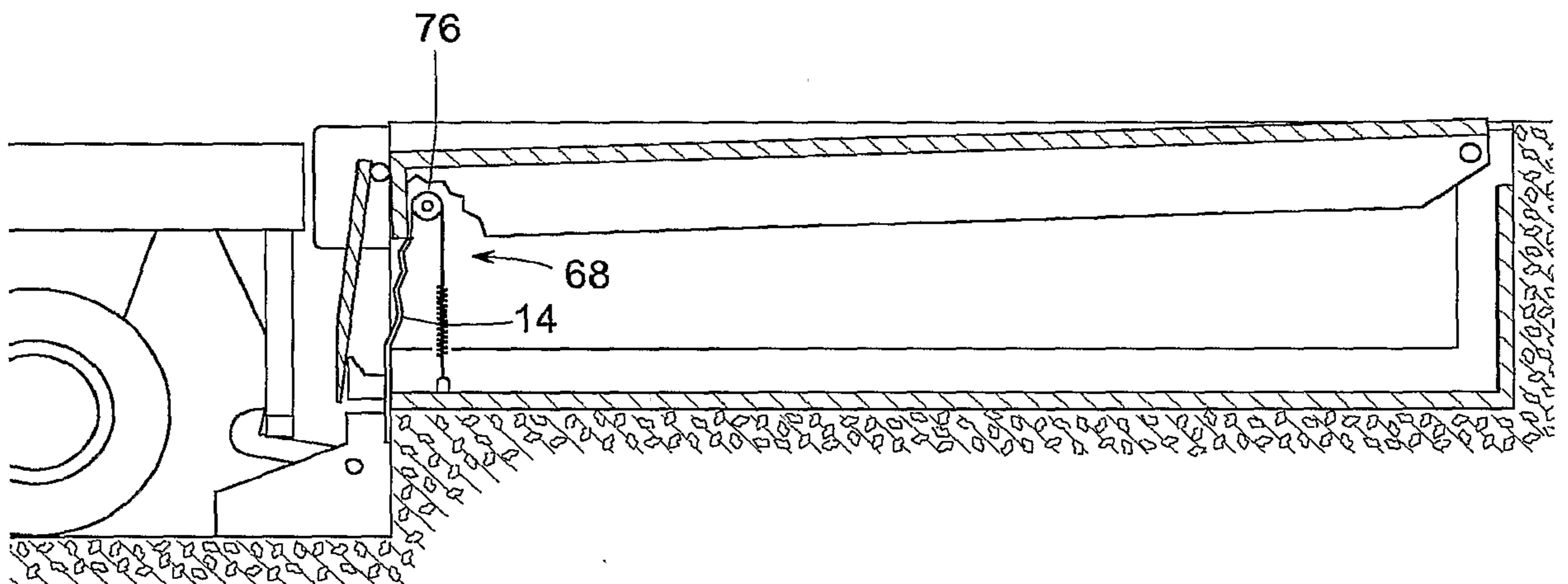


FIG. 15

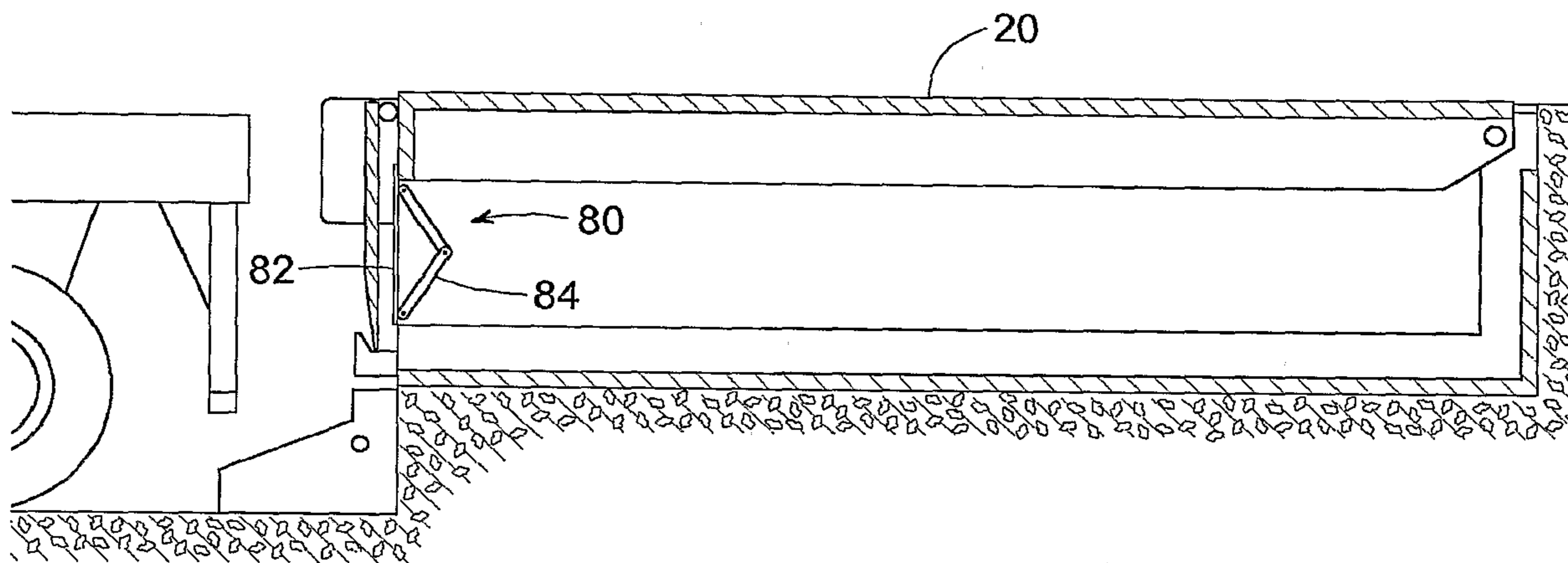


FIG. 16

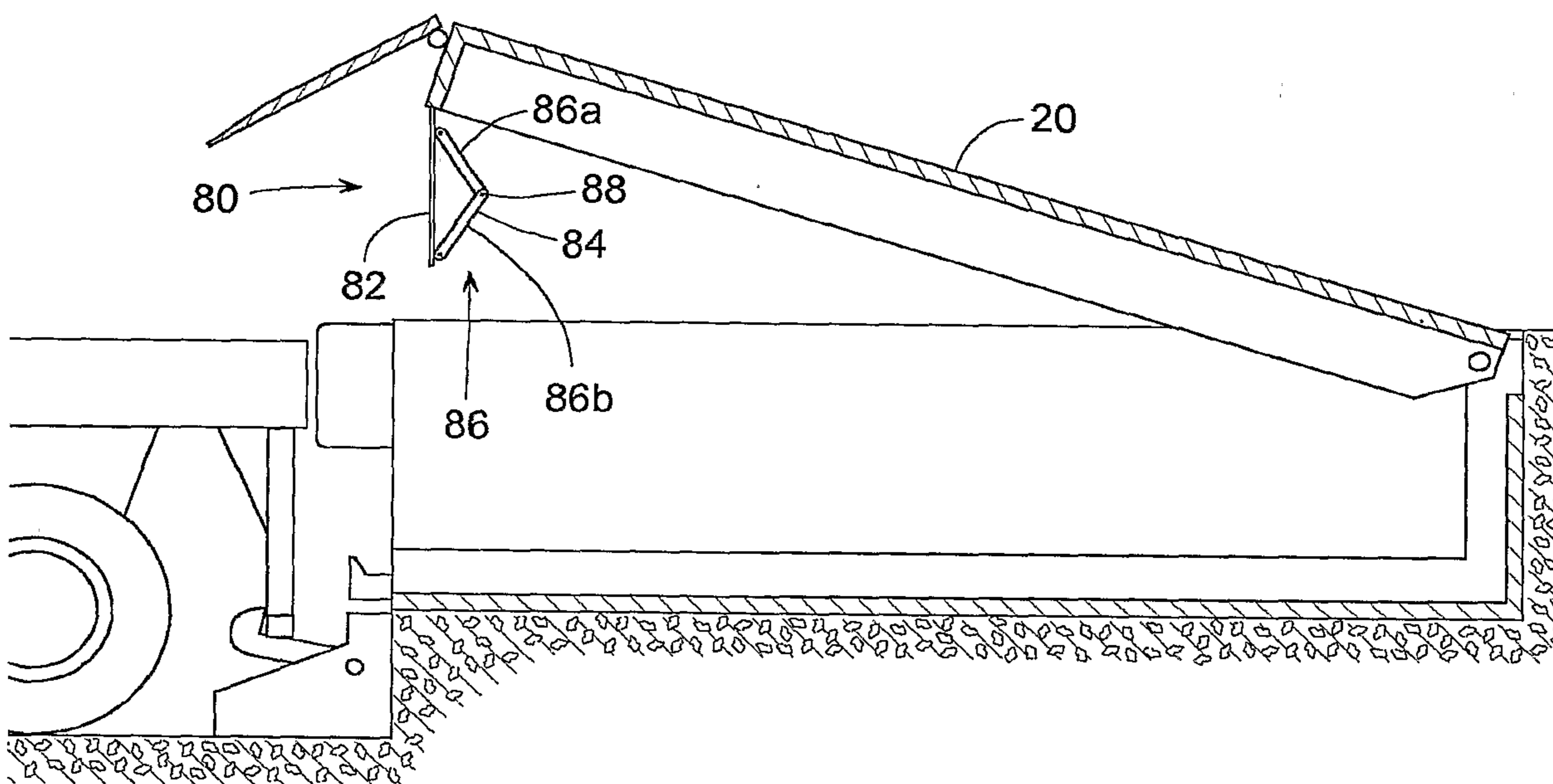




FIG. 17

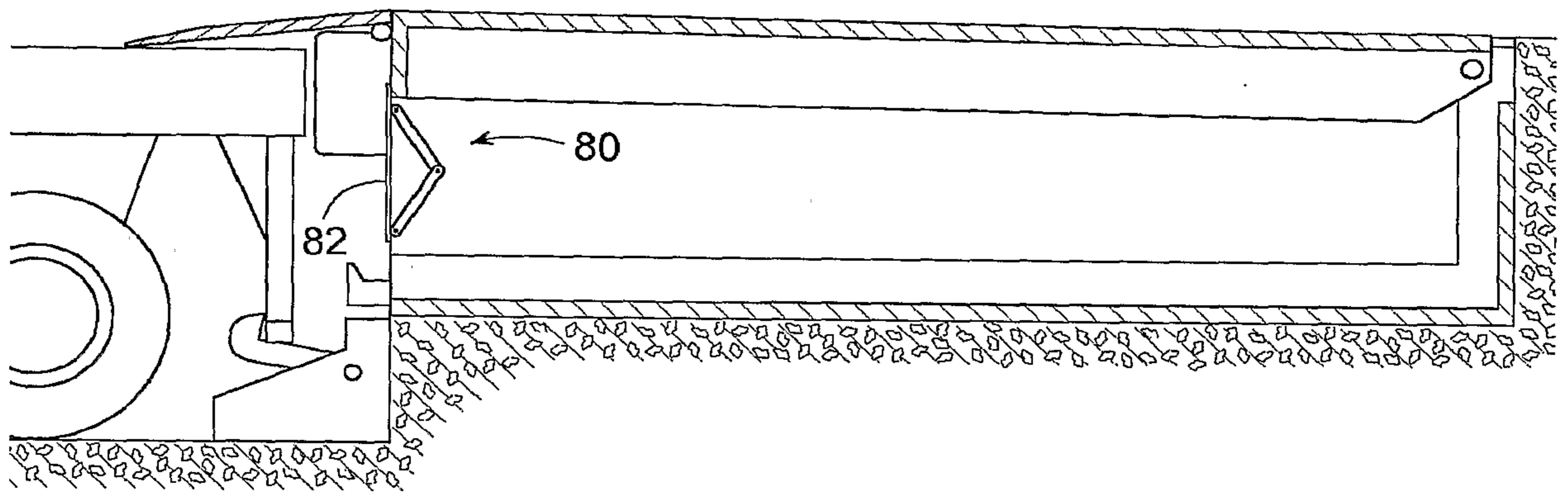


FIG. 18

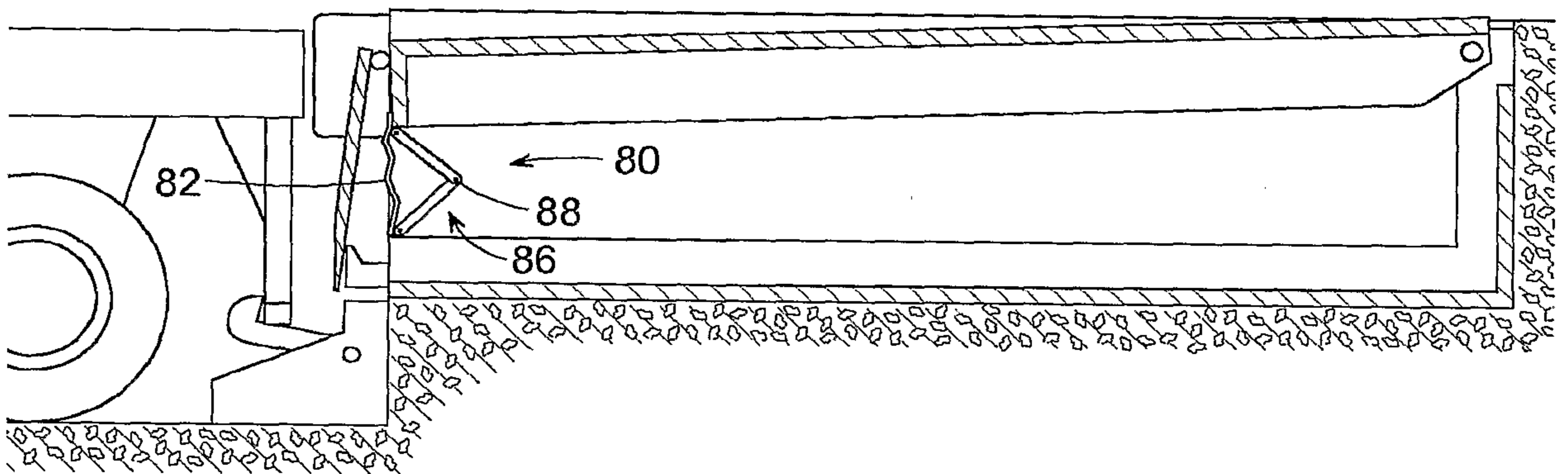


FIG. 19

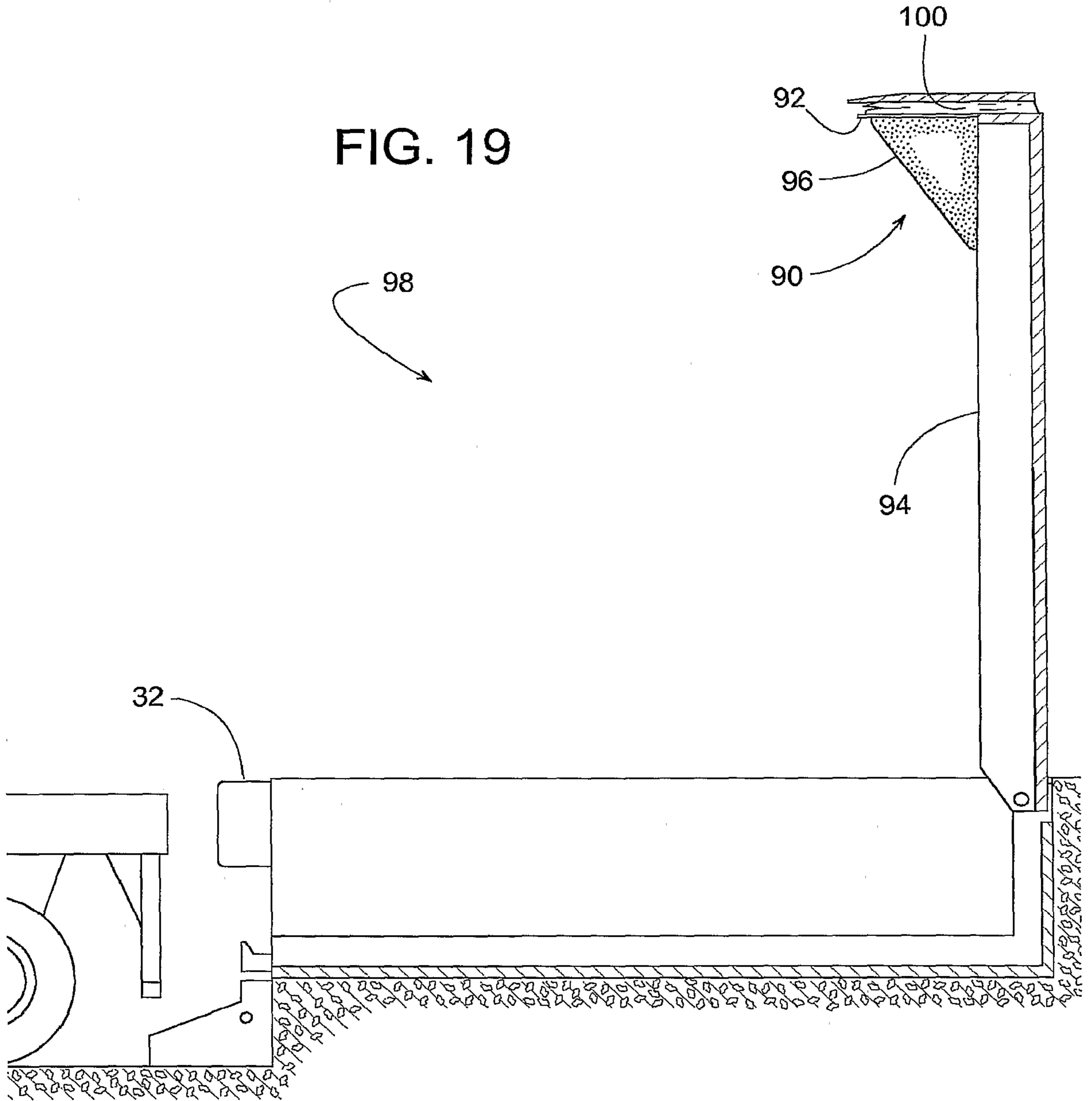


FIG. 20

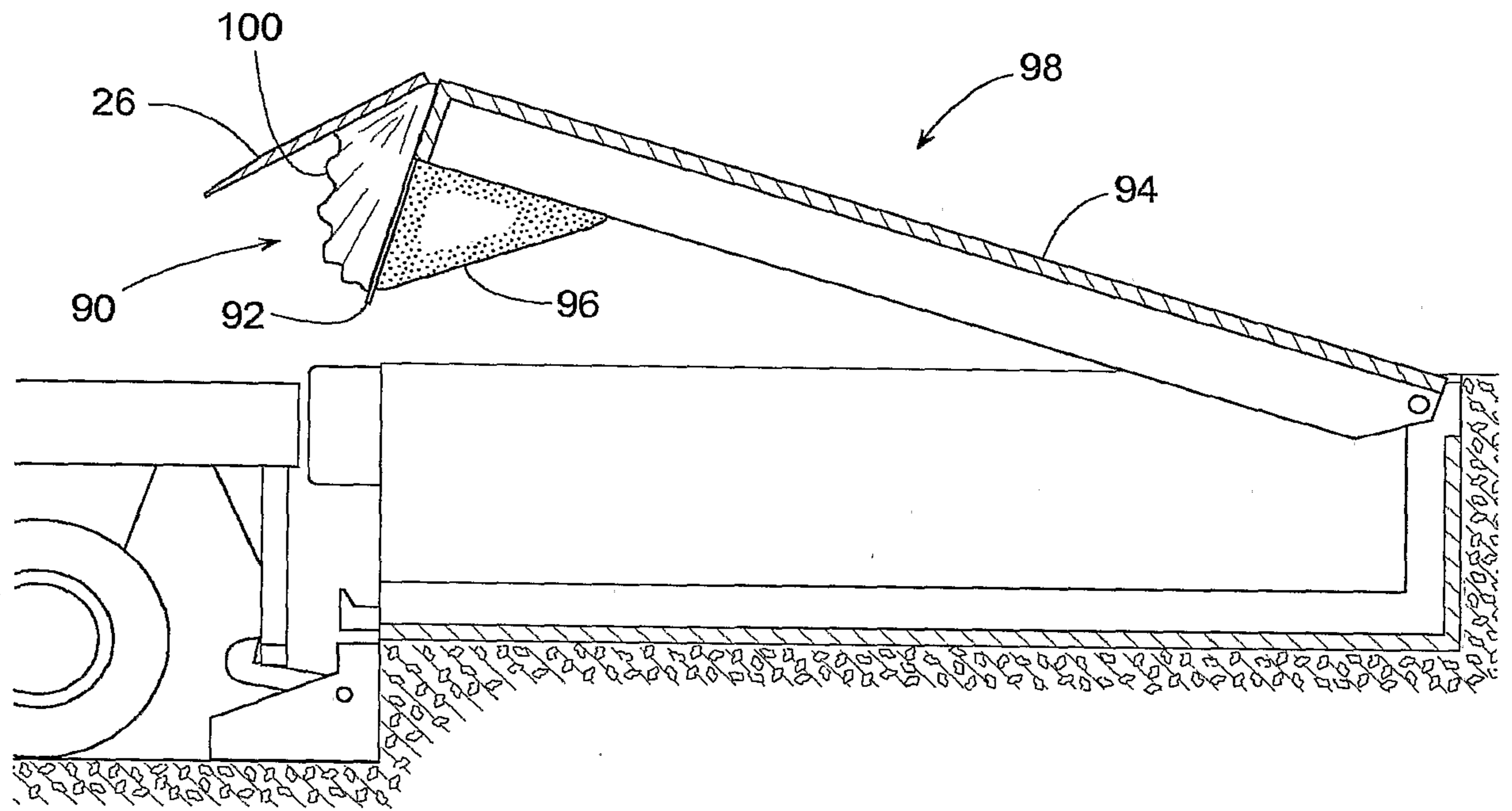


FIG. 21

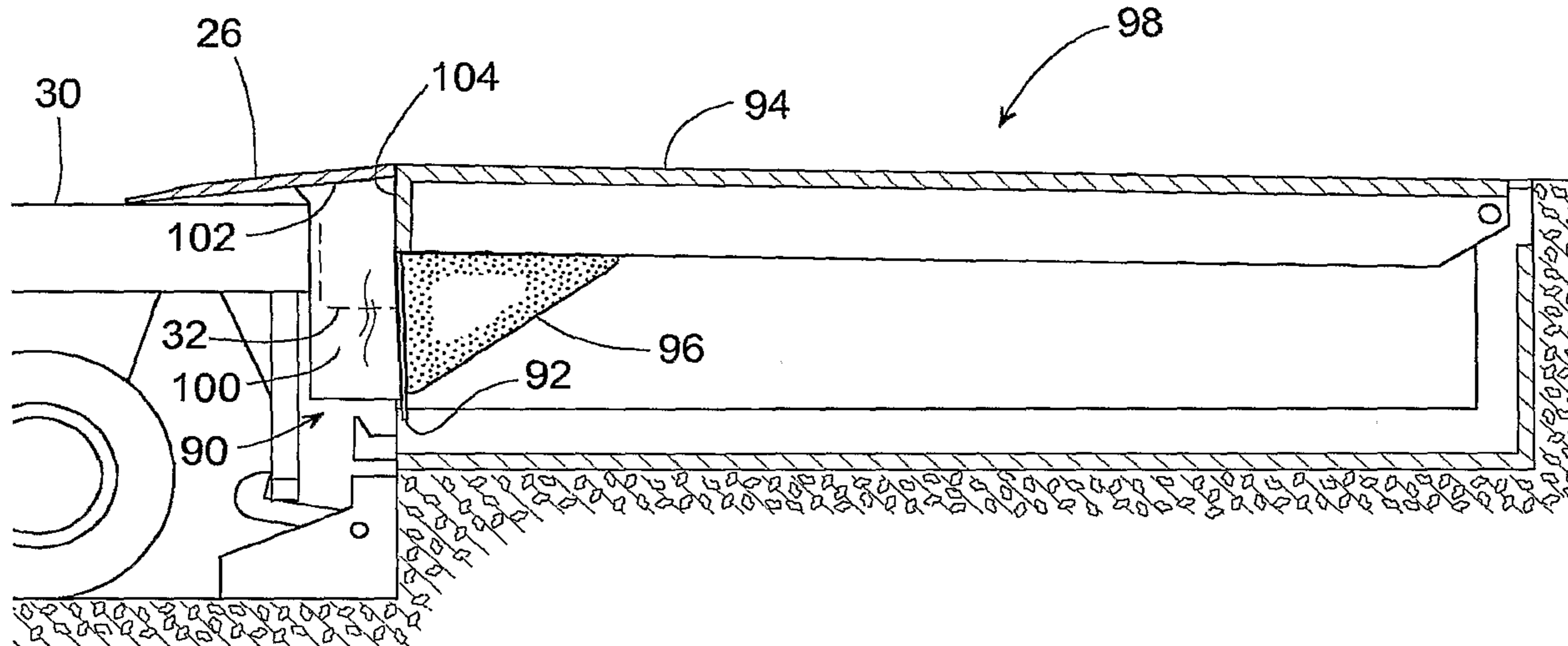


FIG. 22

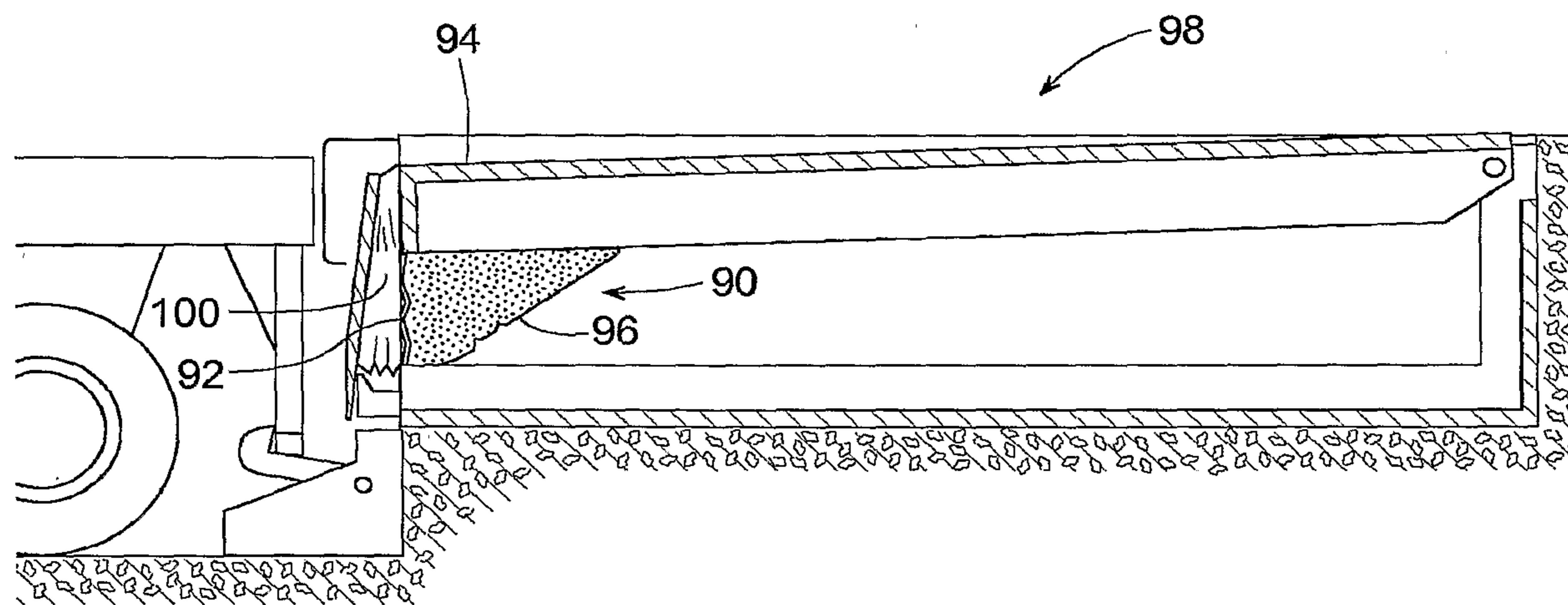


FIG. 23

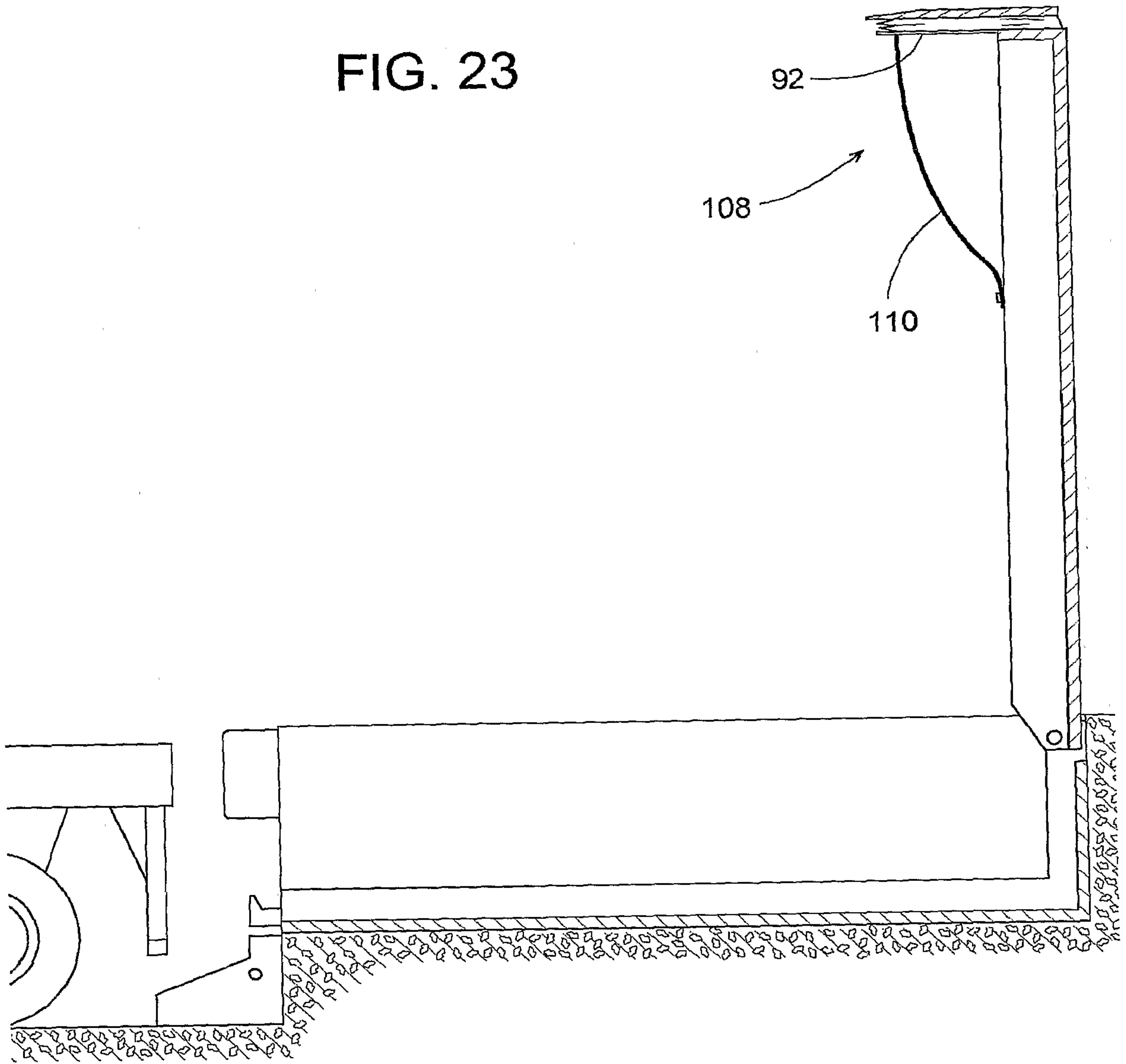


FIG. 24

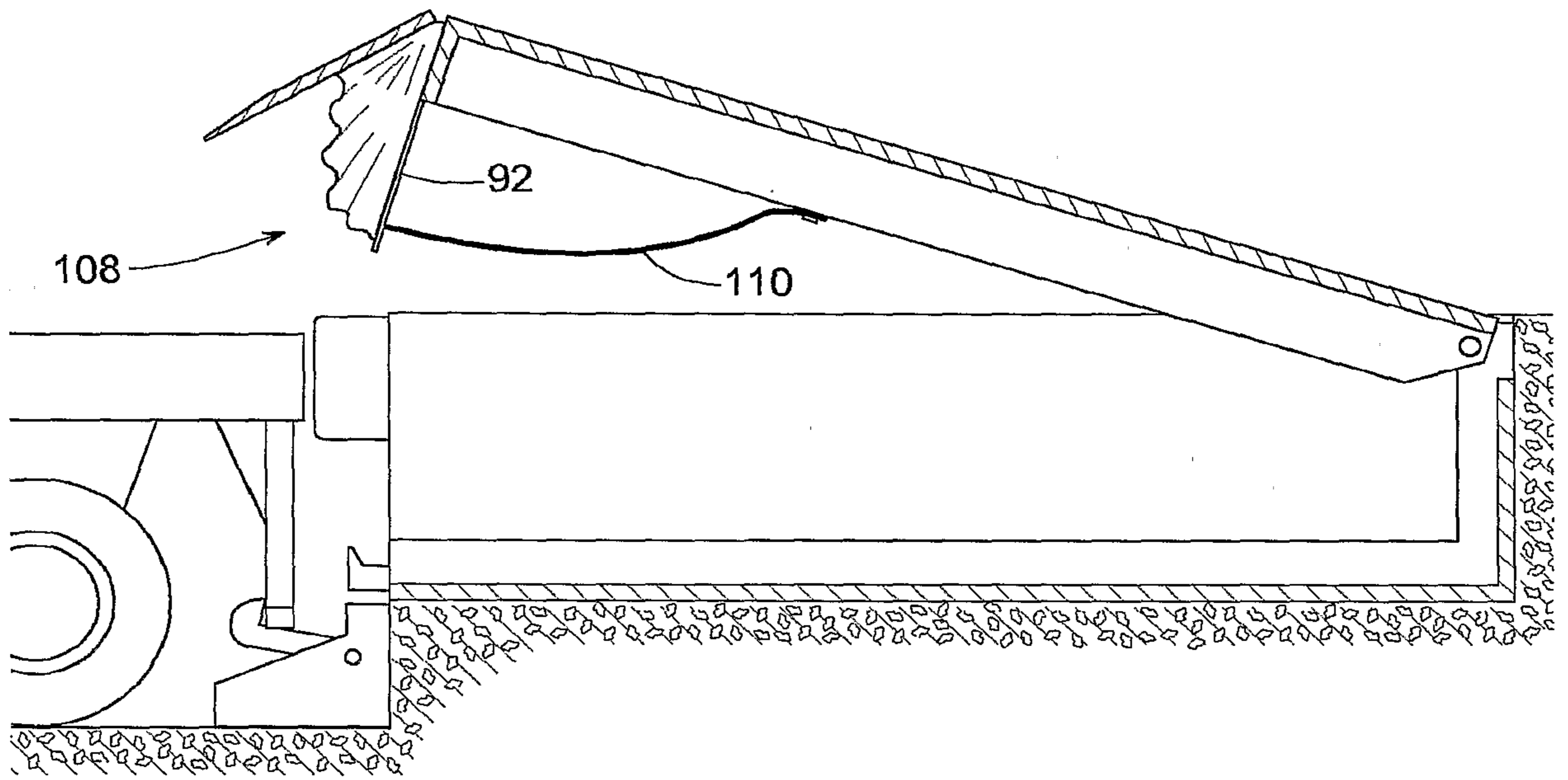


FIG. 25

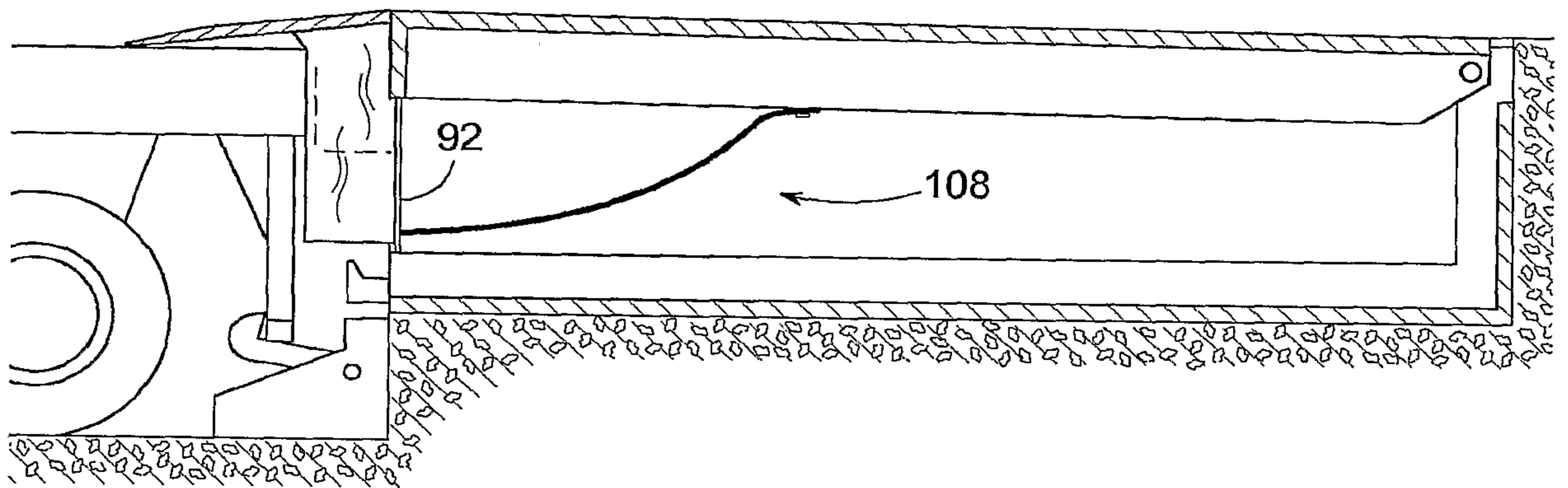


FIG. 26

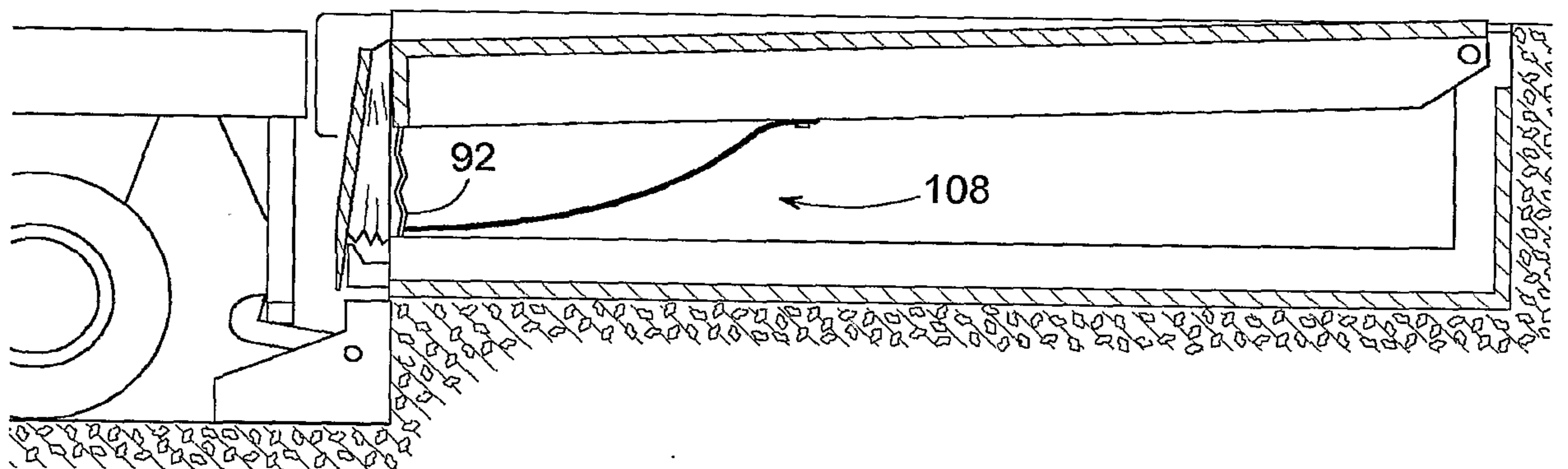


FIG. 27

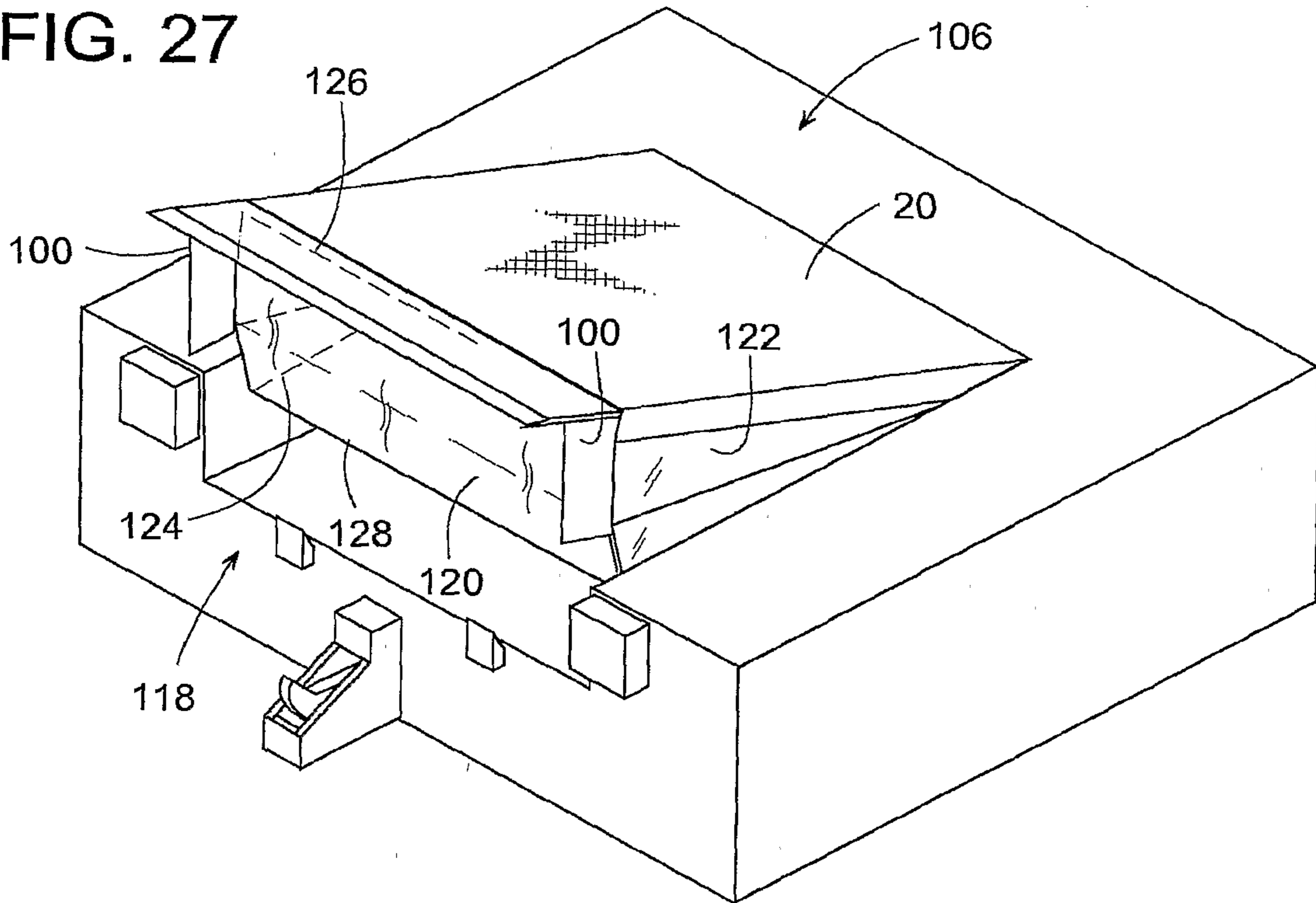


FIG. 28

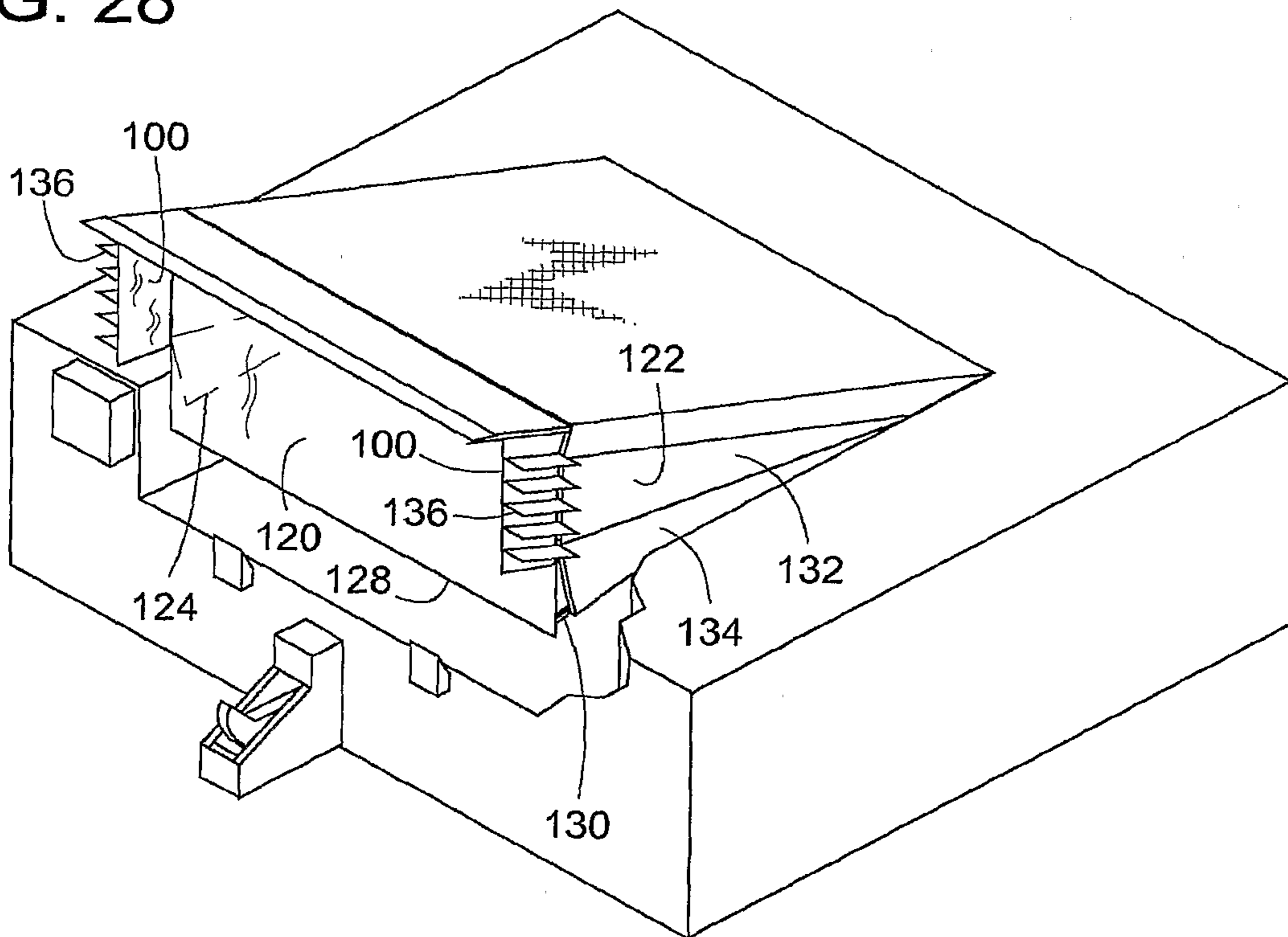




FIG. 29

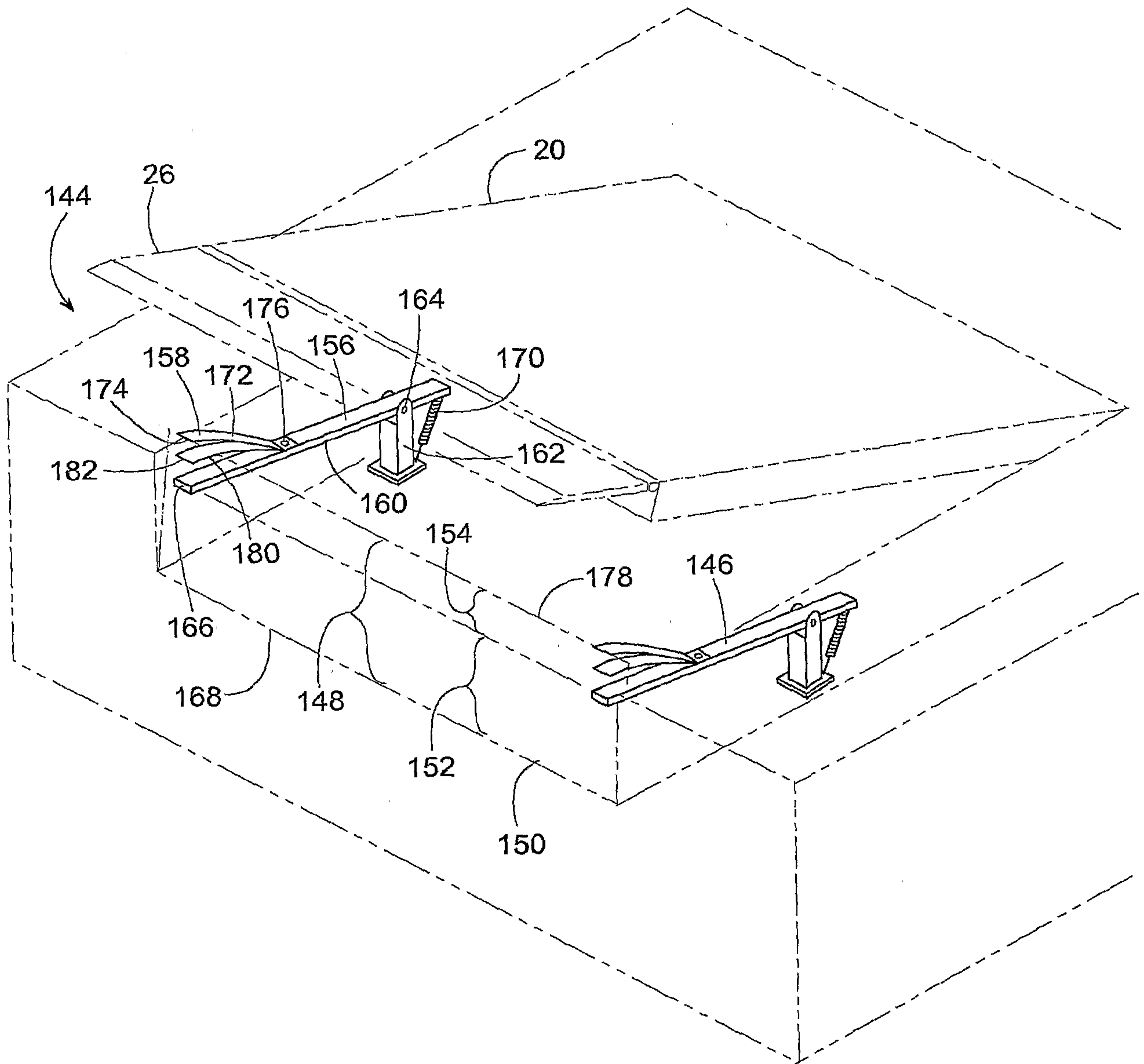


FIG. 30

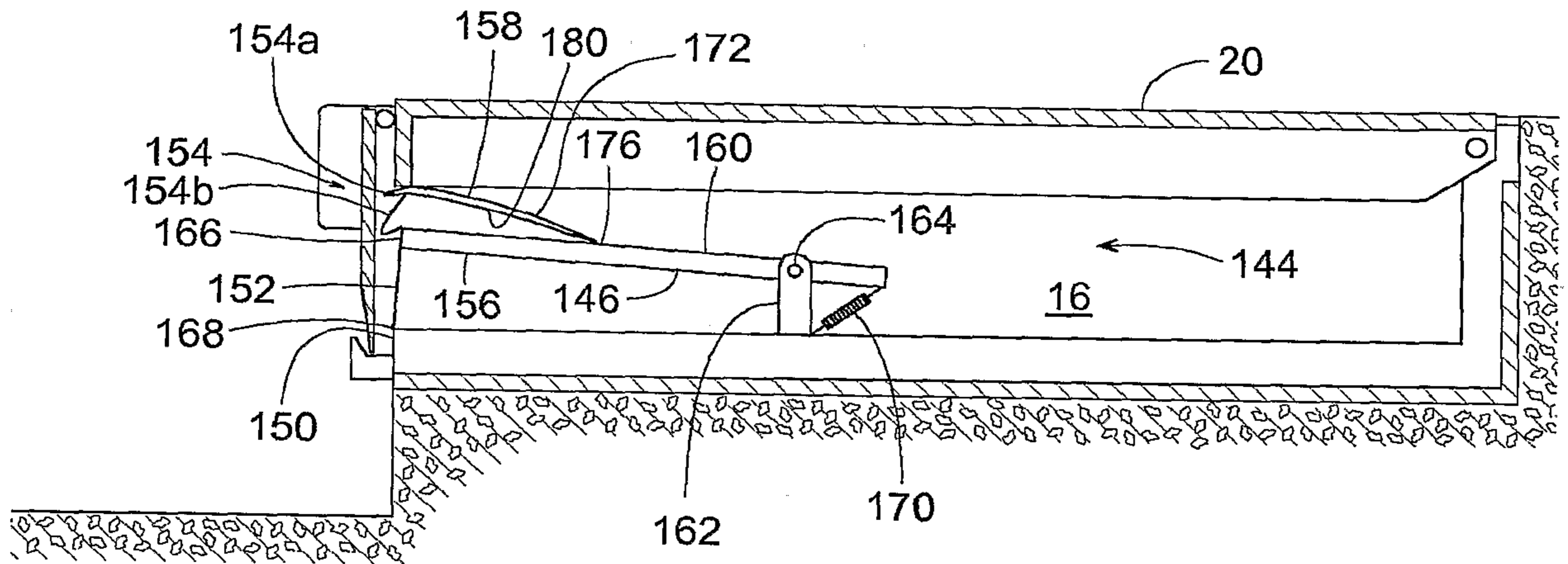


FIG. 31

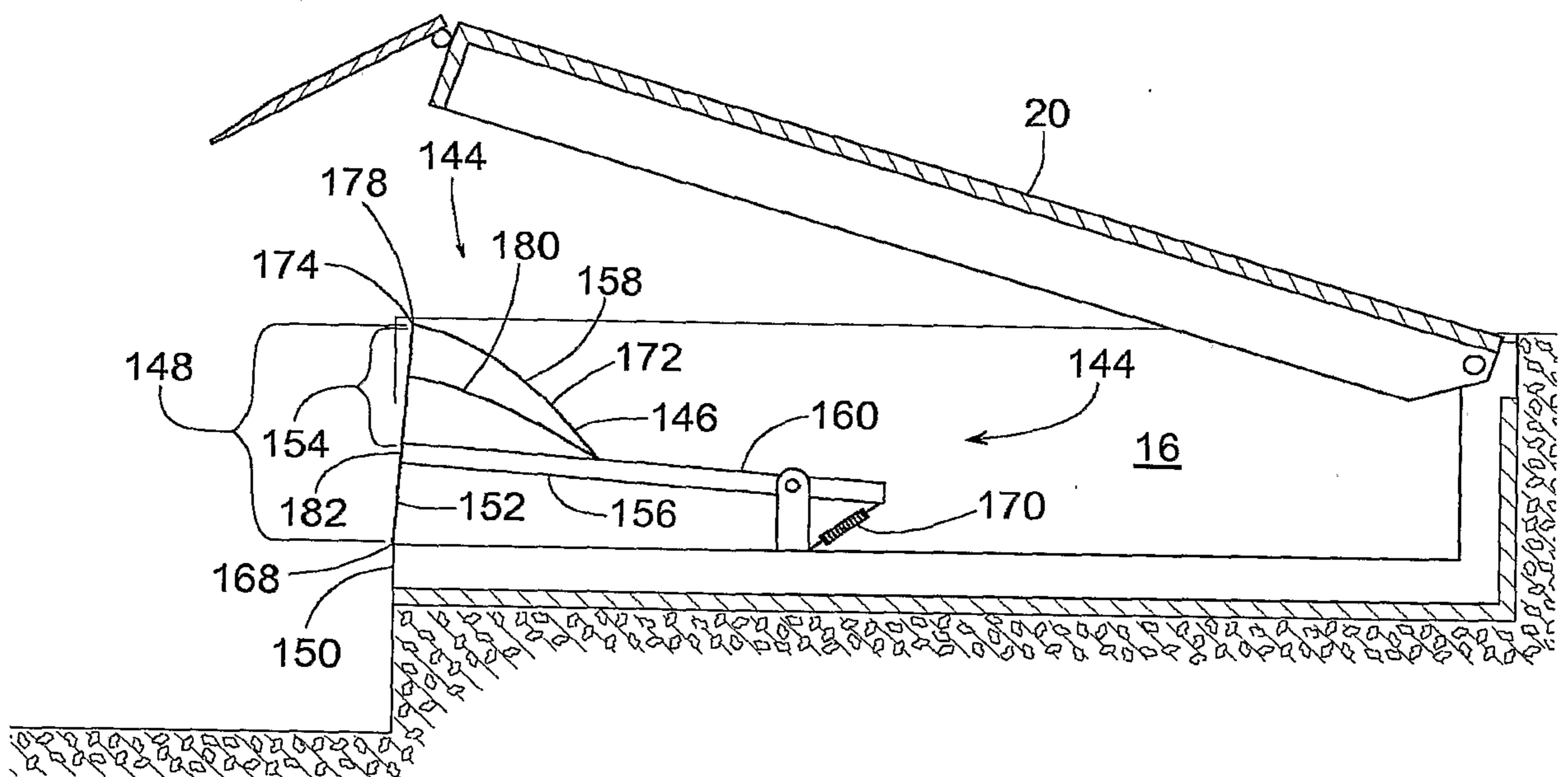


FIG. 32

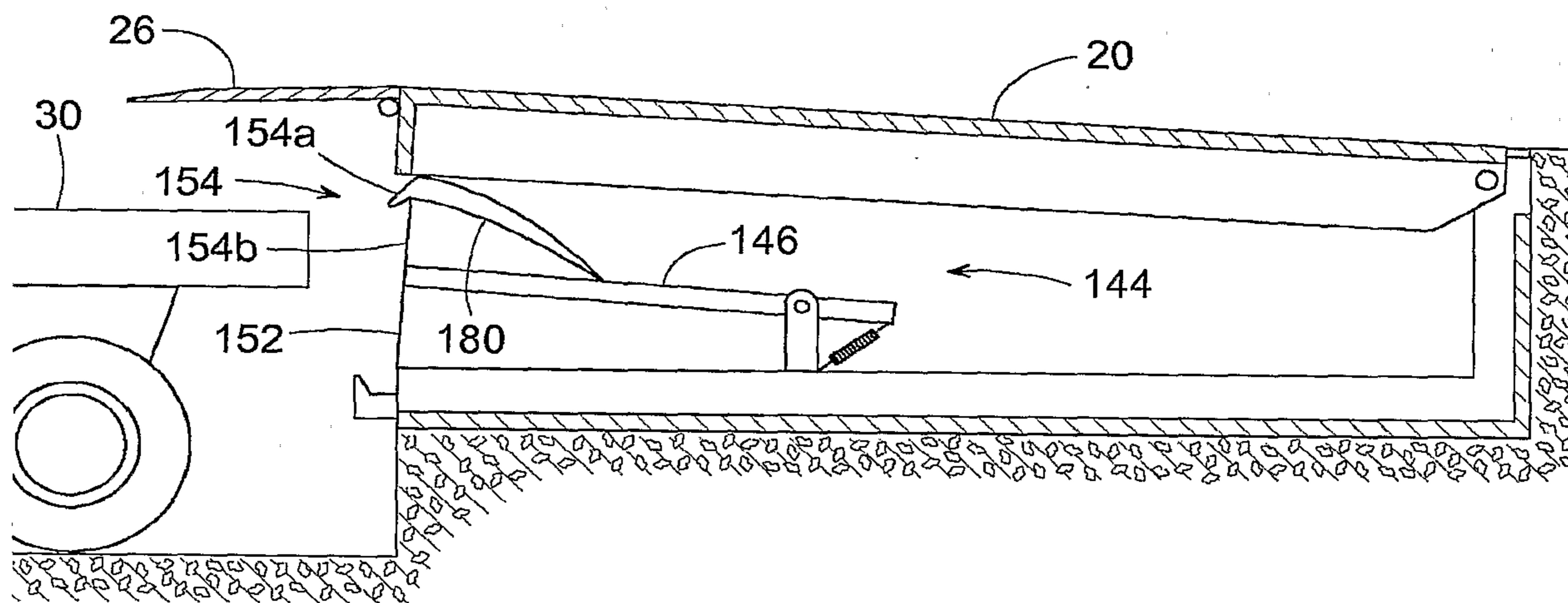


FIG. 33

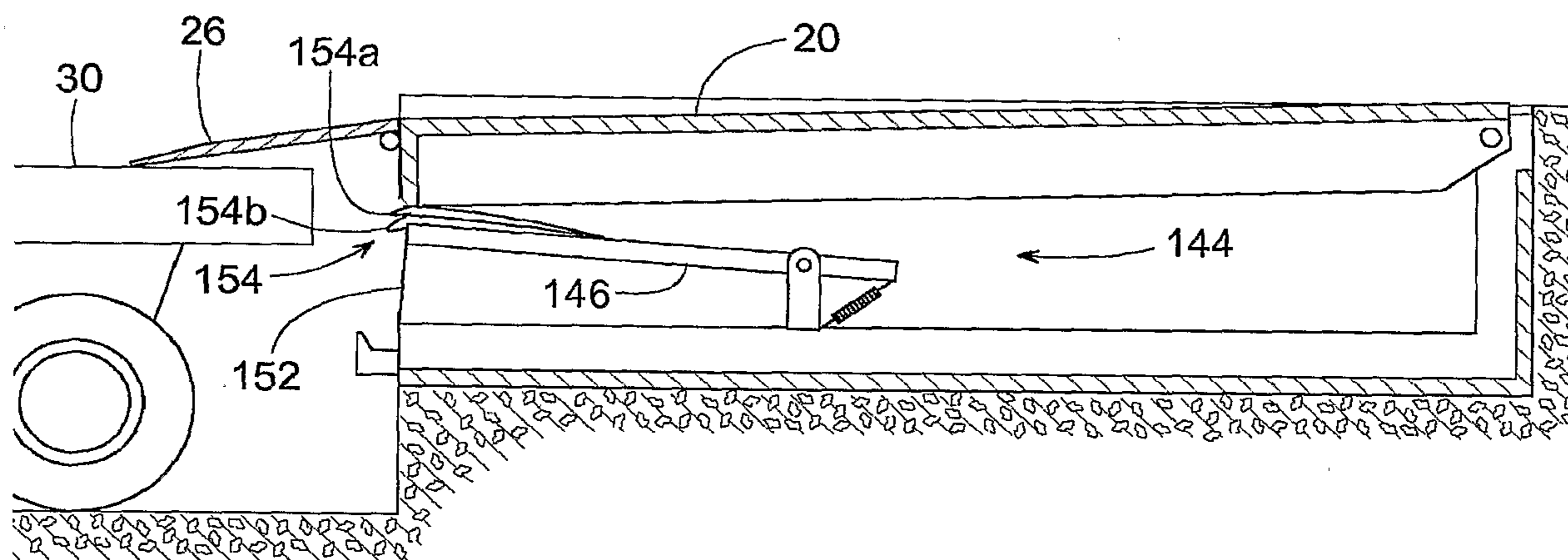


FIG. 34

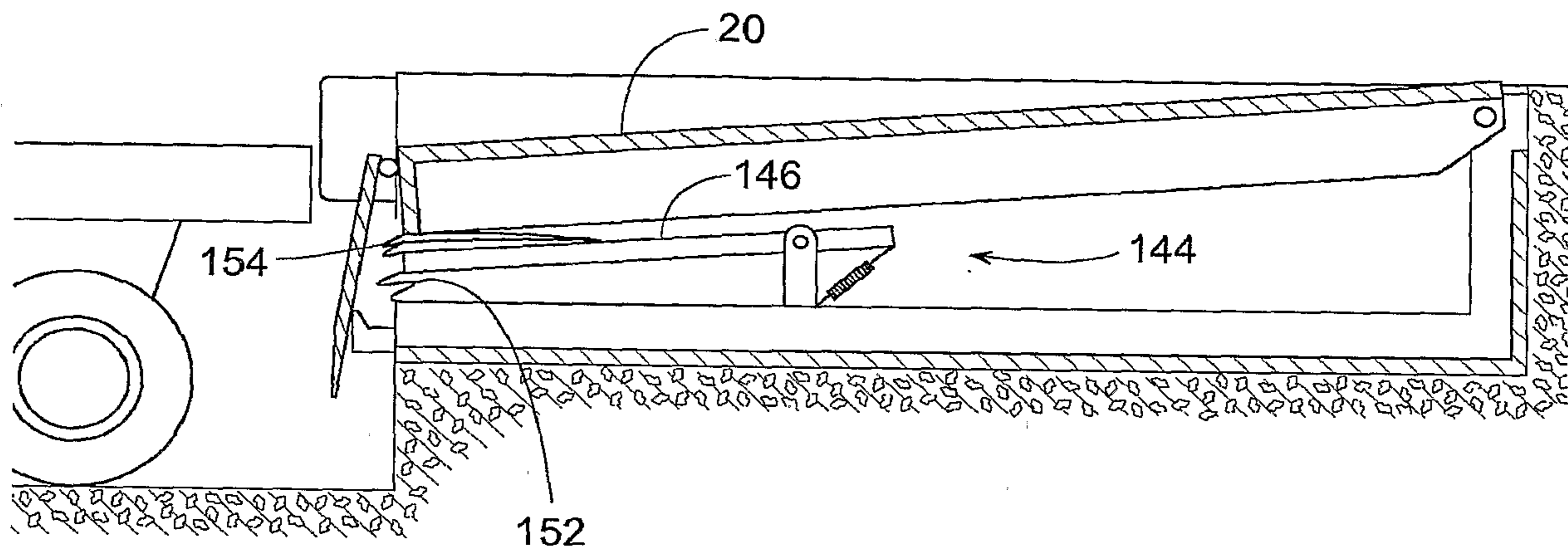


FIG. 35

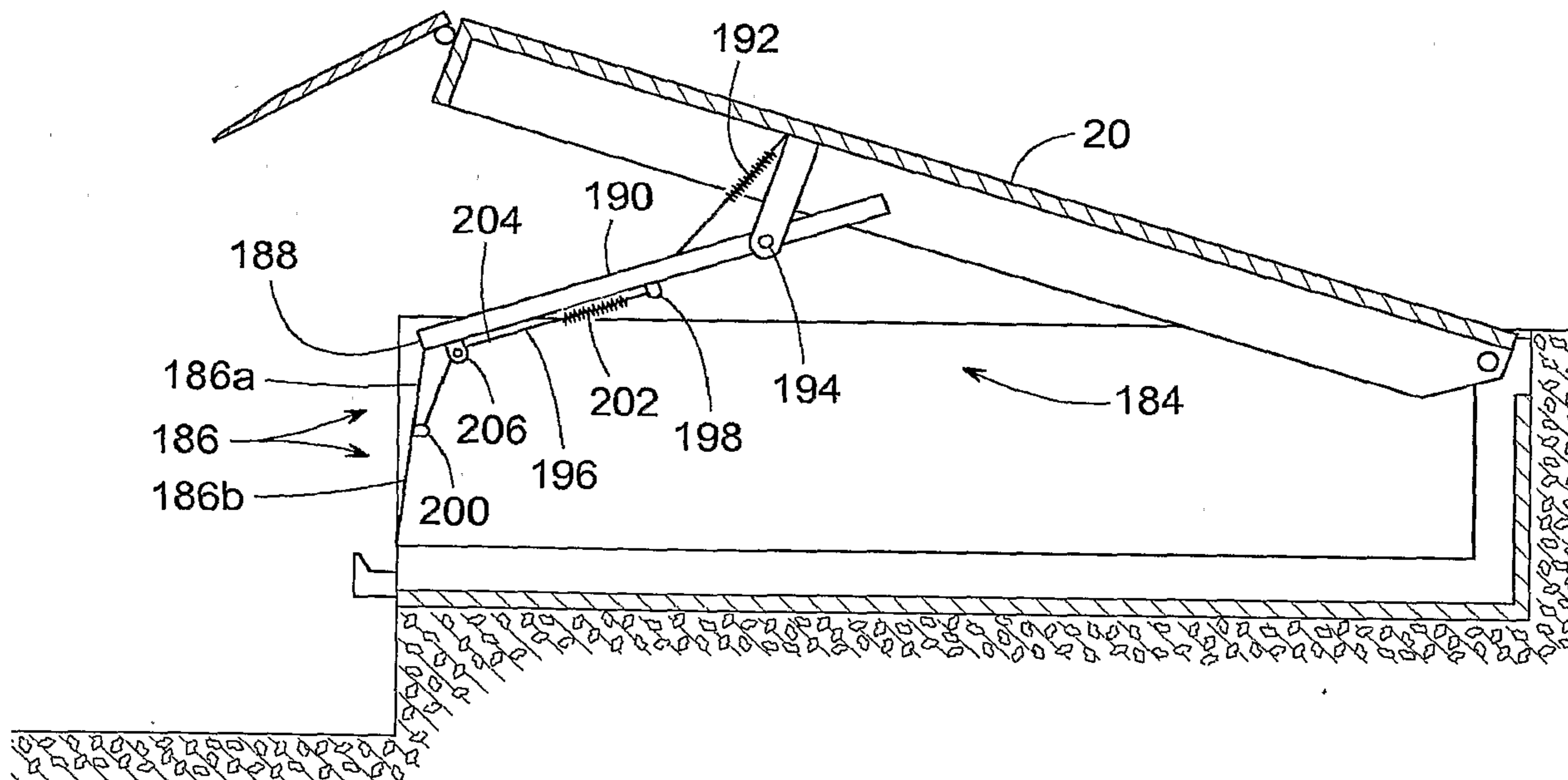


FIG. 36

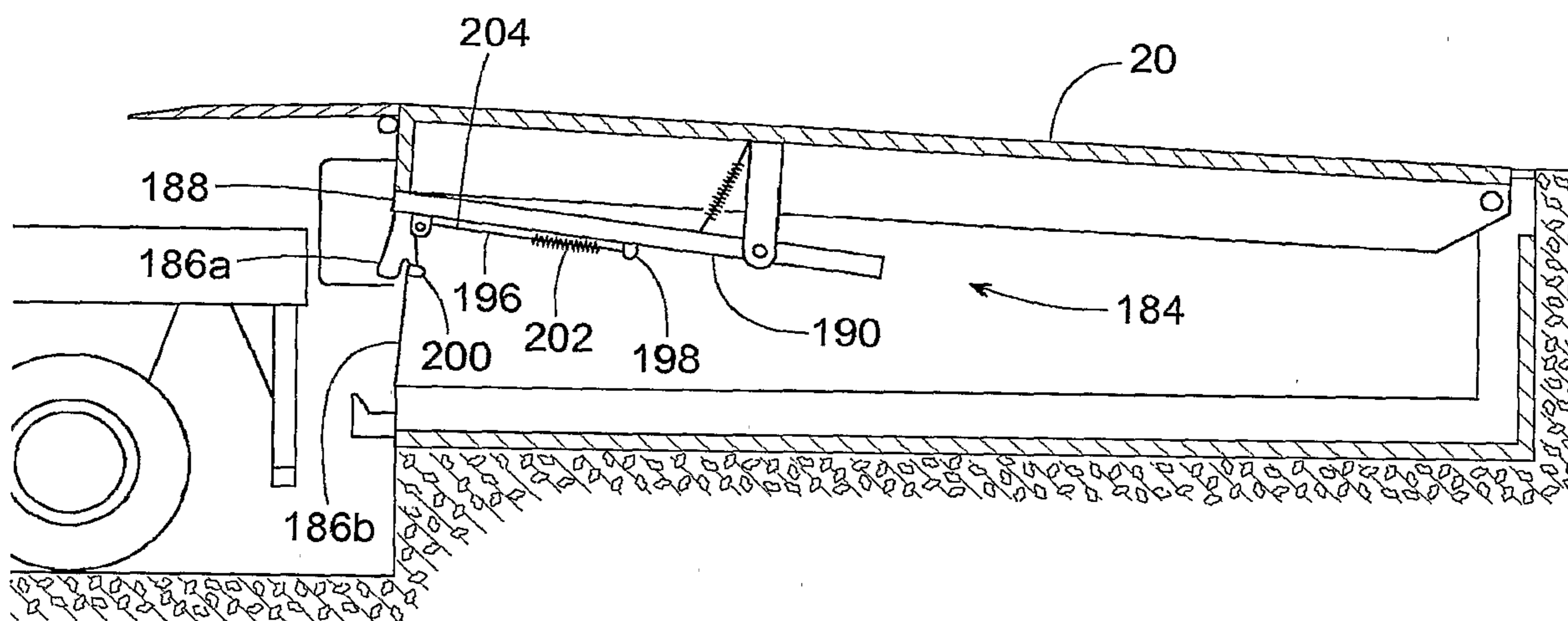


FIG. 37

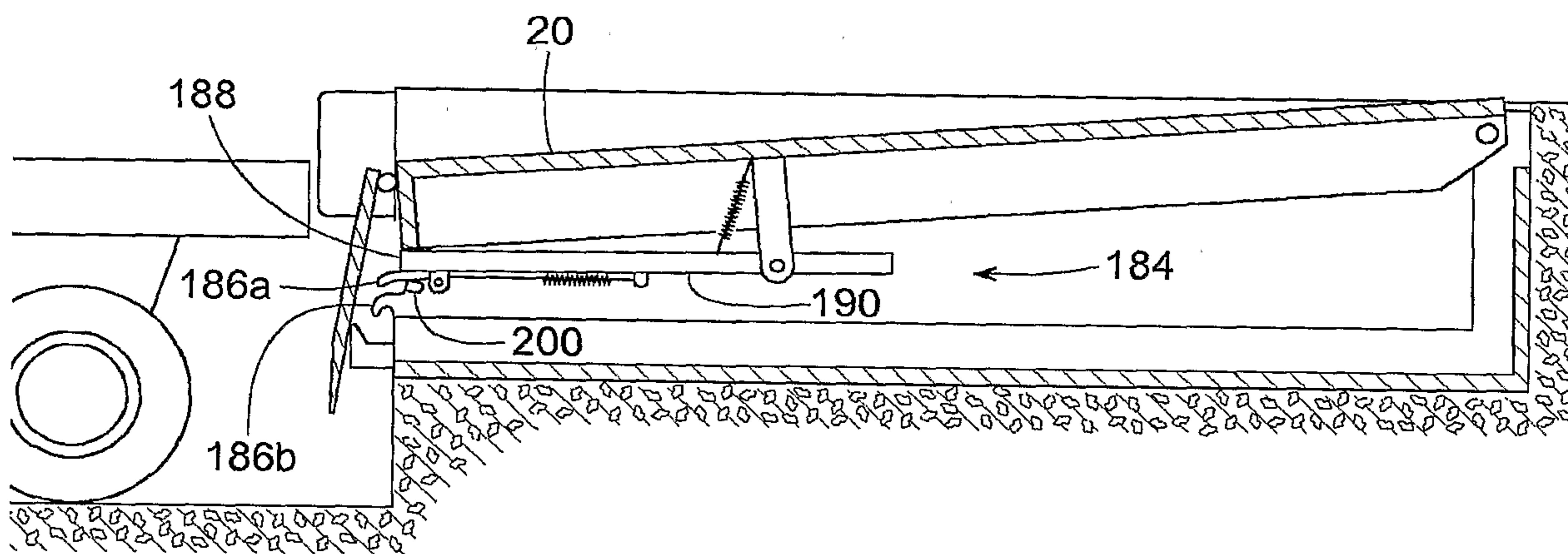


FIG. 38

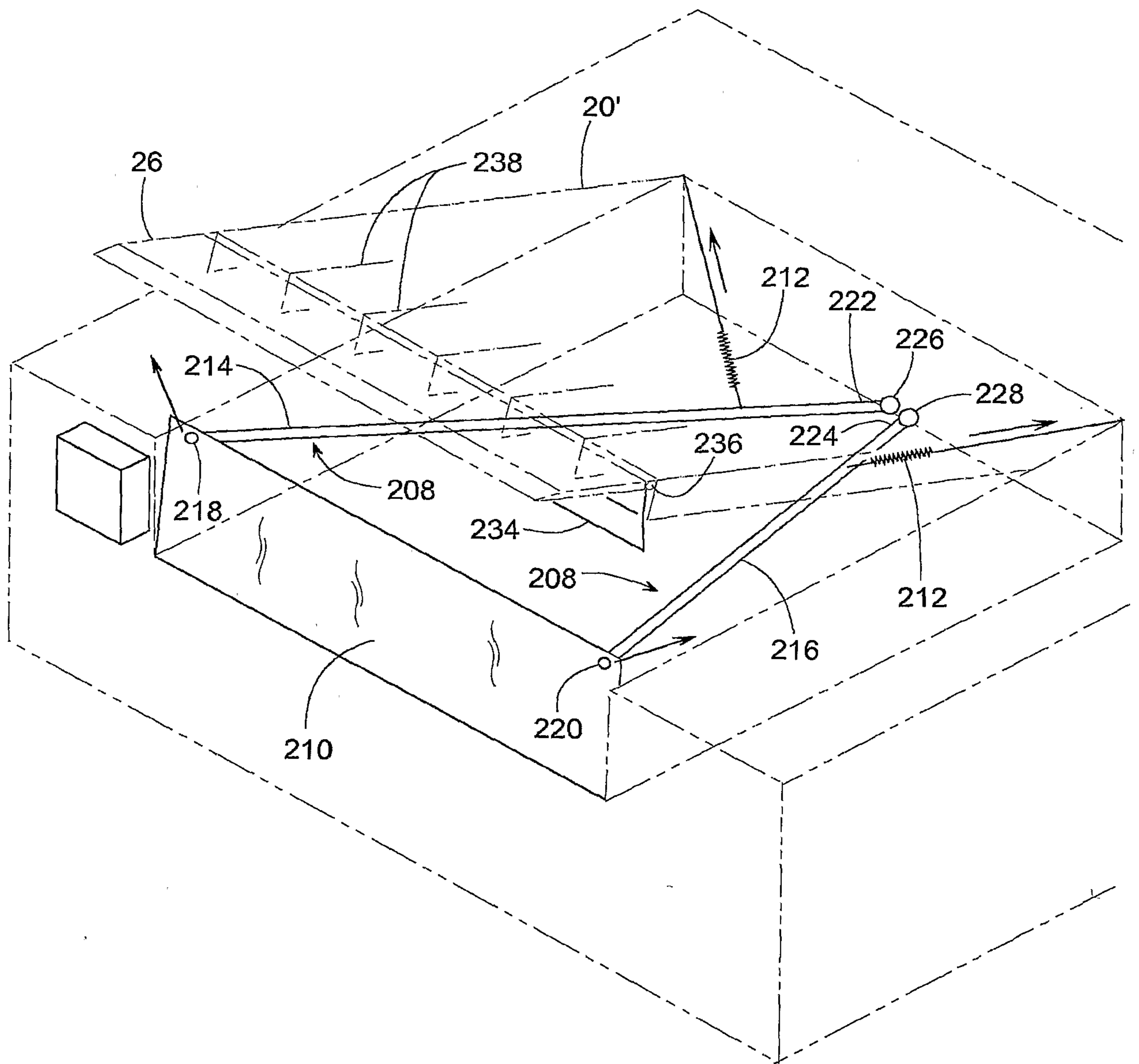


FIG. 39

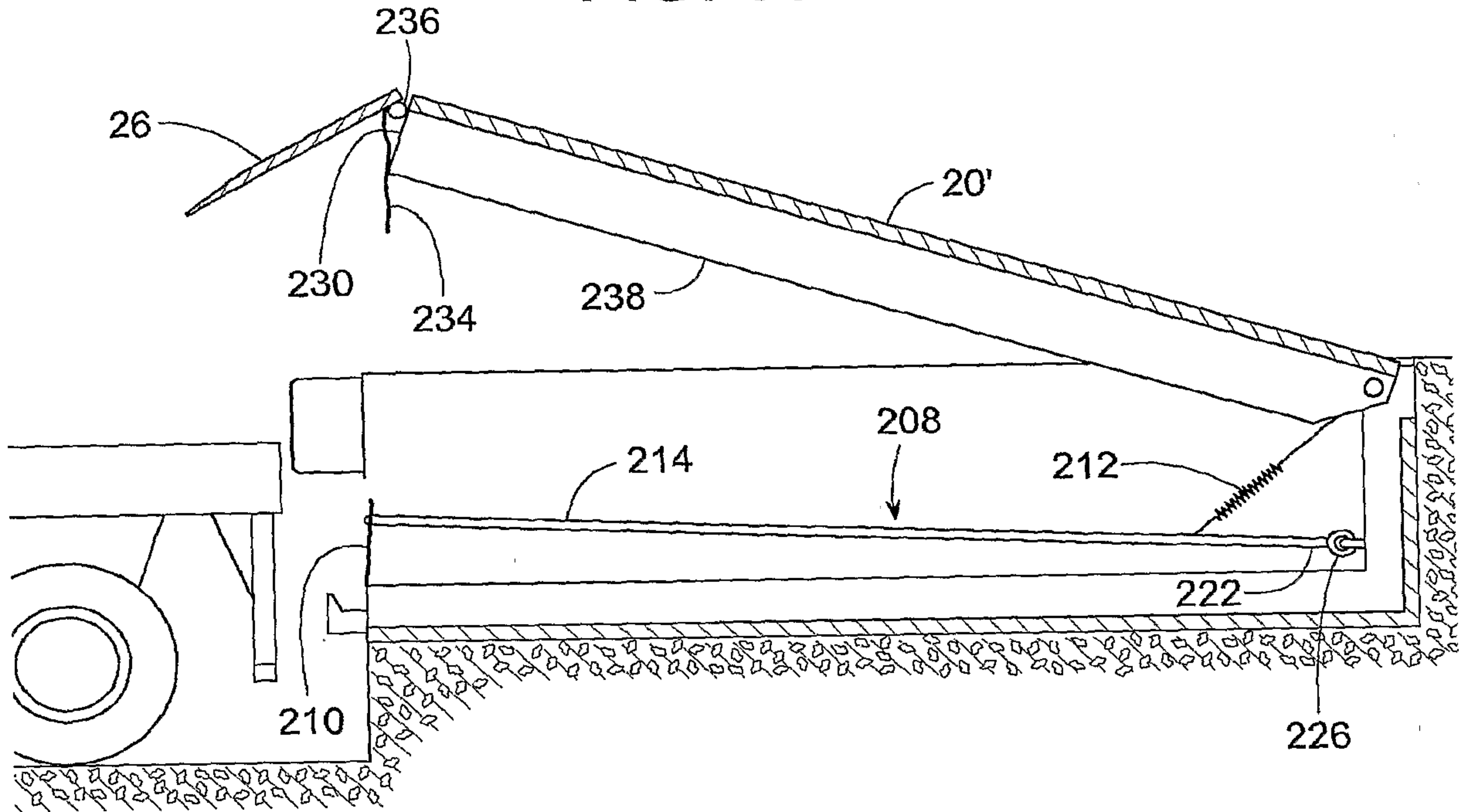


FIG. 40

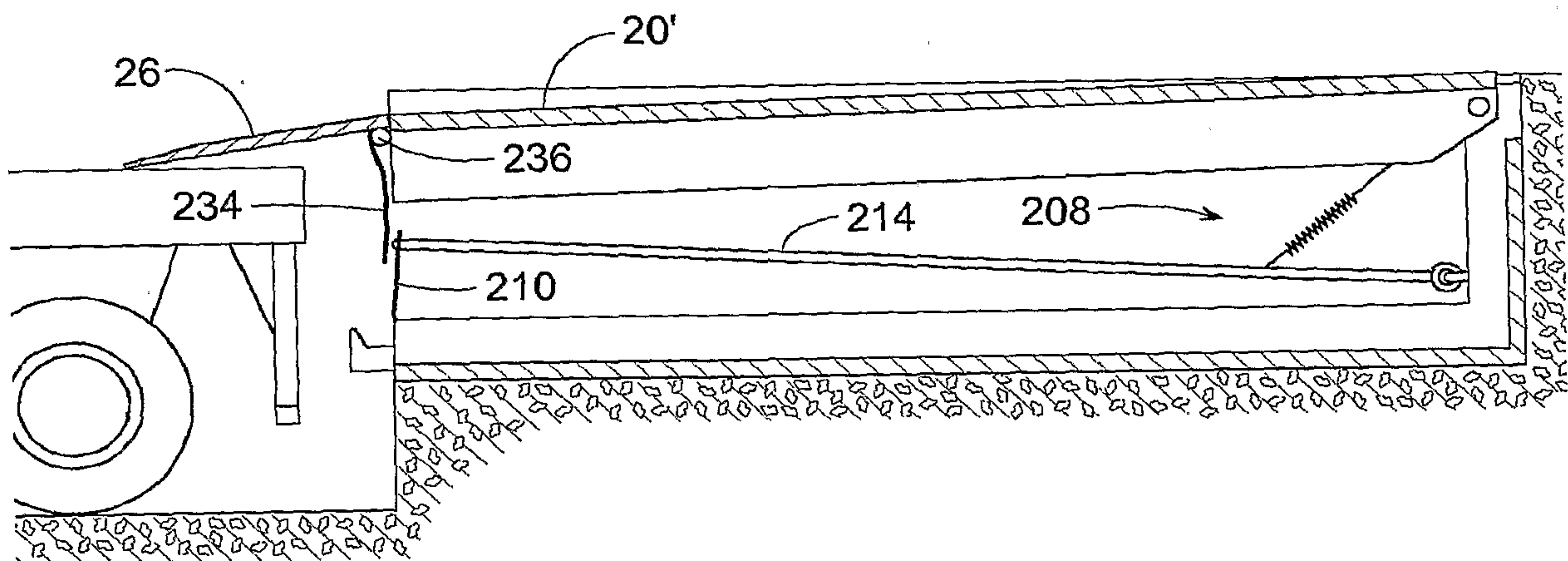


FIG. 41

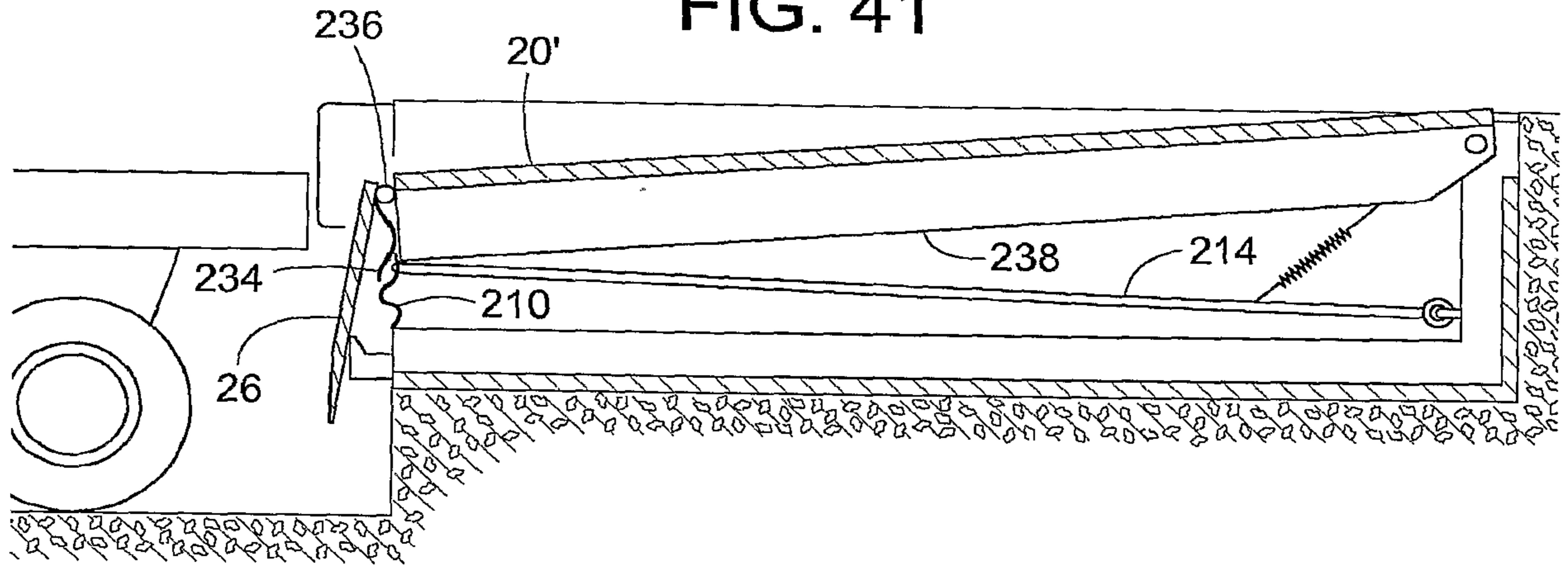


FIG. 42

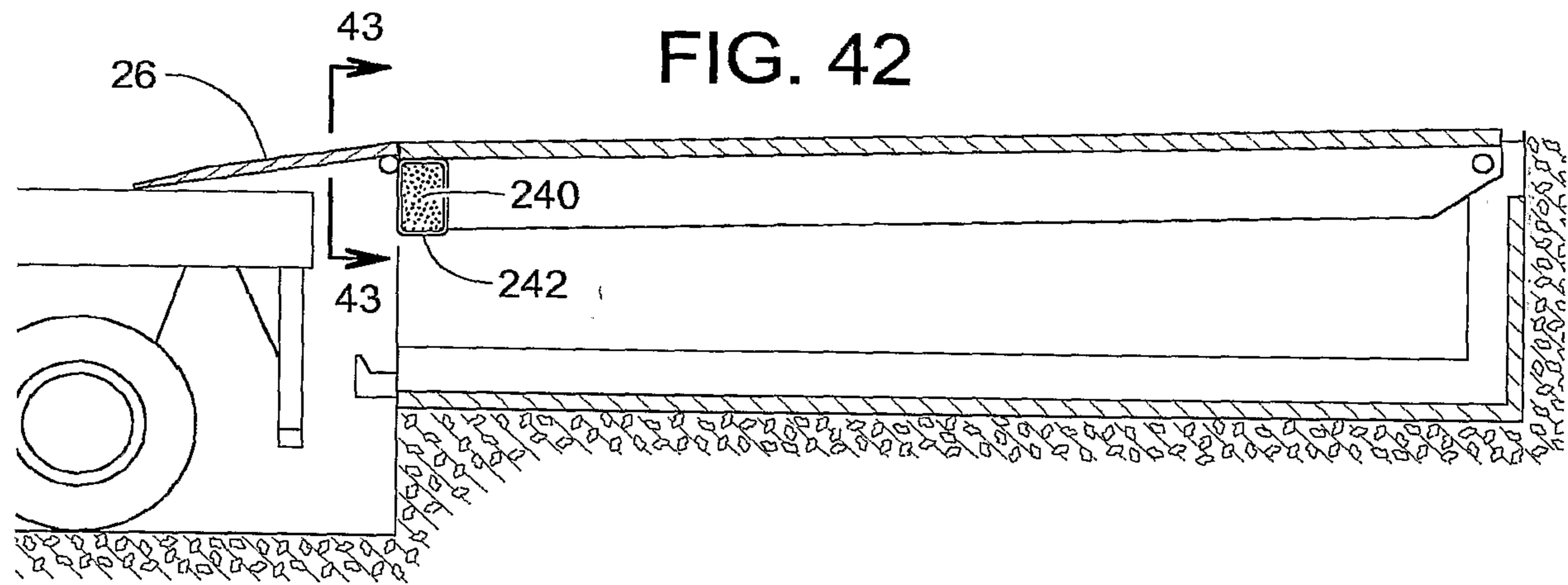


FIG. 43

