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DESCRIPTION

[0001] This invention relates to improvements in mining screening panels used in the separation and grading of materials in the mining and quarrying industries.

Background to the invention

[0002] Australian patent 482212 proposed a modular screening panel system for ore screening decks which is now widely used by the mining industry and replaced the earlier screening cloths, and large wire screening frames. The screening panels were all of the same size [eg. 300mm] and made of reinforced polyurethane and/or rubber. The panels are adapted to be secured to an underlying support frame using dependent spigots which are a force fit into corresponding apertures in the support frame. Patent 517319 provided an alternative method of securing the panels to the frame using a pin expanded fastening concept.

[0003] For narrow frame members in the screening machine patent 662683 provided a rail design that enabled panels to be secured while avoiding blocking of the screening area by the support frame. Australian patent application 2002300432 discloses a simplified attachment arrangement for this type of support frame. These fixing systems need a workman to hammer the fixing pins in order to fasten the panels to the support frame.

[0004] The installation and removal of panels is a physically intensive and strenuous task for personnel within the confines of a screen. This is due to various current fixing systems that require force by hammering and levering of either the panels or fixing systems.

[0005] Both current and historical use of modular design screening media panels has required intensive manual labour for panel changeovers. This involves using hammers and tools for the installation and removal of panels and the fixing accessories. Despite continuous innovations in fixing system designs to reduce the intensive manual labour, it has not eliminated the need for the service crew to enter inside the confined spaces of a screen and use tools that strains the person's body. This result in OHSE hazards and risks and this system should provide a solution that eliminates these hazards.

[0006] US3980555 describes a wear resistant element for releasably mounting a screen, moulded in a synthetic plastics material. Compressible protrusions are adapted to clip into corresponding openings to releasably secure the element to the screen. US8727127 describes a screening apparatus in which a screen is mounted to a pair of beams by projections that extend through openings provided in the beams. Each projection is engaged by a locking clip. US2010006481 describes a screening mounting in which a screen is provided with legs that are inserted into apertures in a support frame. The legs are made from durable but elastomeric material.

[0007] It is an object of this invention to provide a means of fastening screening panels that ameliorates these problems.

Brief description of the invention

[0008] The present invention provides a mining screening assembly according to claim 1.

[0009] To address the problem of safety and ease of installation of panels it is proposed to provide a system where panels can be placed in position and then locked using a mechanical or electrical actuation. The lugs of the screen panels may be locked using a slidable strip. The strip includes a slot having two portions and one portion has a larger diameter than the other, that allow the panels to be placed and then locked by sliding the strip. The strip preferably contains keyhole apertures. The actuation mechanism is preferably enclosed in a beam below the panel. Various actuation methods may be used.

[0010] An alternative arrangement uses a gripping mechanism to grip the lugs when the locking mechanism is actuated. The gripping mechanism may be a pair of hoses or cables housed within the support beam below the panel.

[0011] When a hose is used, the fixing hose is pressurized with a gas or fluid the hoses expand and apply a gripping force to the lugs located between them. The surrounding beam enclosure restricts the hose's expansion and redirects it to compress the panel lugs. The two hoses run parallel within the cavity of the support rail beam, into which the panel lugs extend. The two hoses are pressurized via a pressurizing mechanism.

[0012] When a cable is used, two parallel cables run within the cavity into which the lugs extend. The two cables extend a long a zigzag (overlapping) patent across each panel lug. When the cables are tensioned the two cables move toward each other gripping each lug. the compression on the panel lugs causes a downward force on the lug and secures the panel to the deck rails. The cables in each support rail may be connected between adjacent deck rails using a cable connection. When the tension is released the panels and lugs can be moved vertically.

[0013] The new fixing system of this invention does not require use of hand tools and additional consumables to install panels on a deck and decrease the panel change out time. This is beneficial for the health and safety of the panel change out crew, reduce parts and improve the efficiency of the process.

[0014] The fixing system uses an automated or actuated mechanism to lock and unlock the panels on the deck rails of a screen. The mechanism may be controlled remotely, whether utilizing a mechanical, wired or wireless connection, from outside the internal confines of the screen. Multiple panels may be controlled simultaneously, to allow for most efficient manner of installation and removal of panels from the deck.

Detailed description of the invention.

[0015] Preferred embodiments of the invention will be described with reference to the drawings in which:

Figure 1 is a schematic view of a panel, support rail and fixing strip of this invention;

Figure 2 is a schematic view of the panel of figure 1;

Figure 3 is a detail view of the fixing lugs of the panel of figure 2;

Figure 4 is a detailed view of the support rail and fixing strip of figure 1;

Figure 5 is a view of the reinforcing used in the fixing strip used with the rail of figure 4;

Figure 6 is a cross sectional end view of a panel on the support rail showing the fixing strip and lug;

Figure 7 is a perspective cross section of figure 6 with the panel lug unlocked;

Figure 8 is a perspective cross section of figure 6 with the panel lug locked;

Figure 9 is a view of the panel, fixing rail assembly and locking mechanism;

Figure 10 is a cross sectional end view of figure 9;

Figure 11 shows an alternative gripping mechanism;

Figure 12 is an end section view of the embodiment of figure 11;

Figure 13 is a perspective section view of figure 11.

[0016] The fixing system comprises a sliding component that is used to engage and disengage the fixing of the panels on the deck rails. The sliding component is housed within the deck rail arrangement and under the rail member that is the bed that the panels are placed on. The sliding component is controlled and connected directly to the actuating system, and has the ability to slide along the length of the deck rails.

[0017] The sliding component is referred to as the "fixing strip or slide, and is made up of a steel reinforcement that is enclosed within a hard wearing polymer, rubber or other similar hard wearing material. The reinforcement provides the structural strength of the Fixing Strip whereas the surrounding material provides the surface contact both on the panel and the rail for reduced friction. The surrounding material also provides the unique thickness profile of the Fixing Strip for the correct amount of engagement between the fixing strip and the panel. The

fixing strip contains purpose made through slots at specific intervals along the length of the fixing strip that corresponds to the deck rail hole spacing. These slots are to have the purpose made panel spigots inserted into the slot at the installation of the panels. The slot is shaped so that once the fixing strip is moved horizontally, the slot shape changes and as a result it secures the purpose made panel lug which restricts the panel from being able to be removed from the deck. The thickness of the surrounding material of the fixing strip changes across the profile of the slots to enable a tolerance in the location of the panel lug prior to engaging. The change in thickness also provides additional downwards force on the panel lug to secure the panel firmly on the deck rail and to restrict vibration of the panel during screen operation.

[0018] The preferred panel lug is referred to as "T-Lug" which is designed specifically for this fixing system. Unlike other panel lugs that are inserted into deck rail holes, the T-Lug does not have a cavity internally due to the elimination of fixing pins and other accessories that were used to install panels previously. The T-Lug shape is semi-circular from the vertical axis and has 2 step changes in its profile. The step change profile on the T-Lug is to be able to accommodate the fixing strip slot profile when the fixing strip is in the engaged position. Hence the step change profile on the T-Lug provides the ability to transmit vertical force between the fixing strip and the panel, which is used to secure the panels on the deck rails. When the fixing strip is in the disengaged position, the T-Lug is free to move on the vertical position, allowing the panel to be installed and removed from the deck rails without resistance.

[0019] As shown in figure 1 the components of the screen deck of this invention are screening panel 10 and a rail 30 for supporting the panel.

[0020] The rail 30 has the conventional shape of web 31 and flange 32 with holes 33 but is modified by incorporating a cavity 35 to accommodate a slidable fixing strip 40.

[0021] The panel 10 is of the conventional type except for the dependent lugs 20 as shown in figures 2 and 3. The lugs are sized to fit through the holes 33 in the support rail 30. Each lug has a base 21 integral with the panel body 10, a central portion 23 of smaller diameter than the base and a head 25 remote from the panel, which is of a larger diameter but able to pass into the holes 33 of the rail 30. Intermediate chamfered portions 22 may be provided at the junction of the base 21 with the central portion 23 and between the head 25 and the central portion 23. A flat land 24 may be provided between the chamfers 22 and the outer diameter of the base 21 and head 25. The outer edge 26 of the lug 20 at head 25, is tapered to assist in leading the lug into the hole 33 of the rail 30.

[0022] As shown in figures 4 to 8 the rail 30 has a conventional cover 34 to protect the rail 30 and cavity 35. The fixing strip or slide 40 is located within the cavity 35. The fixing strip or slide 40 consists of a polymer coating 42 covering the metal reinforcing strip 43. The slide incorporates keyhole slots 44 that align with the holes 33 of the rail. The key hole slots have a wide portion 45 which corresponds to the diameter of the holes 33 and the lugs 20 and a narrower portion 46 which corresponds to the diameter of the central portion 23 of the lug 20. By sliding the slide 40 the narrower portion of the slot will lie above the head 25 and abut the

land 24 of the lug 20 to lock the panel 10 onto the rail 30.

[0023] To toggle the fixing system from a disengaged position to an engaged position and vice versa, an actuating system is used. The motion of the "fixing or slide strip is horizontal along the length of the deck rails and the actuator is physically connected to the slide strip. The motion of the actuator is linear and also along the length of the deck rails. The linear actuators apply the forces required to move the slide inside the deck rail assembly and apply the forces required to engage and disengage the slide from the panels.

[0024] The linear actuators are located below every individual deck rail and control their respective slide on that deck rail. The linear actuators are controlled and powered via cables running along underneath the deck rails and are connected to a central control unit. Each linear actuator is supported and enclosed underneath the deck rails to protect them from material flow, ingress and water damage. The cabling for the linear actuators is also protected from material flow whilst they are connected underneath the deck rails. The linear actuators preferably have the appropriate fail- safe mechanism to restrict movement after the panels have been engaged and the vibrating screen is operating.

[0025] The control unit may operate the linear actuators as a group or individually, so the user may remotely engage and disengage the panels from the deck as required. The control unit may also identify any faulty linear actuators and any linear actuators that have improperly engaged or disengaged the slide. The information from the control unit may be transmitted via mobile connection for further monitoring and management of the system.

[0026] The linear actuator 50 is able to reciprocate the slide 40 between two positions under the hole 33 of the rail. This is best seen in figures 9 and 10. The linear actuator is connected to the slide 40 by connection bracket 51. The actuator 50 is preferably enclosed in a cover 53 attached to rail 30. The actuator may be coupled to other actuators and to a power supply by cable 54.

[0027] In figures 11 to 13 a gripping mechanism is disclosed. The gripping mechanism may either be a pair of hoses 60 or cables 60 located in the cavity 35.

[0028] When a hose is used, the fixing hose 60 is pressurized with a gas or fluid. Under pressure hoses 60 expand and apply a gripping force to the lugs 20 located between them. The surrounding beam enclosure forming the cavity 35, restricts the hose's expansion and redirects it to compress the panel lugs 20. The two hoses 60 run parallel within the cavity 35 of the support rail beam, into which the panel lugs 20 extend. The hoses 60 are made of a rubber compound to provide grip and traction along the outer surface that engages the lugs 20. The two hoses 60 are pressurized via a pressurizing mechanism (not shown).

[0029] When a cable is used, two parallel cables 60 run within the cavity 35 into which the lugs 20 extend. The two cables 60 extend a long a zigzag (overlapping) pattern across each panel lug 20. When the cables 60 are tensioned the two cables move toward each other gripping

each lug 20. The compression on the panel lugs 20 causes a downward force on the lug 20 and secures the panel 10 to the deck rails. The cables in each support rail may be connected between adjacent deck rails using a cable connection (not shown). When the tension is released the panels 10 and lugs 20 can be moved vertically.

[0030] The benefits of this invention include:

- Eliminates requirement of hammers, removal tools and consumables in installation and removal of panels from a deck
 - This new fixing system will allow the personnel to place the panels on their respective positions within the deck without the need to use any form of hammering or levering panels and accessories, whereby the panels would lock and unlock from the deck rails remotely.
- Reduction of overall panel change out time
 - The efficiency in installation and removal of panels are improved as a result of the new fixing system. This is a result of the elimination of hammering individual fixing pins in and/or out, and completely removing the requirement of pins, and does not require hammering the panels into the fixing as is common with other clip-on and snap-in fixing systems.
- Reduces OHSE hazards and risks in panel change outs
 - The fixing system reduces the hazards and risks involved with physically intensive and strenuous activities of personnel during panel changeovers.
- The locking engagement of the panels to the deck is controlled remotely. This allows for more safe, controlled and targeted selection of the panels in which the user wants to have secured or unsecured from the deck.
- The locking engagement of the panels to the deck is monitored remotely. The feedback from the actuating system alerts the user whether there have been any problems with the installation of the panels prior to the screen going into operation.
- Is retrofittable to existing screens with only minor modification
 - To expand the application of the new fixing system and allow mine sites to upgrade their existing screens as well as to purchase for new screens, the equipment is retrofittable on existing screen designs and components with only minor modifications. The fixing and actuating system is secured on the individual deck rails, which are able to be replaced.

[0031] Those skilled in the art will appreciate that the arrangement of this invention has the advantage that installation time can be reduced because manual installation is minimized.

REFERENCES CITED IN THE DESCRIPTION

Cited references

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Patent documents cited in the description

- [AU482212 \[0002\]](#)
- [AU517319 \[0002\]](#)
- [AU662683 \[0003\]](#)
- [AU2002300432 \[0003\]](#)
- [US3980555A \[0006\]](#)
- [US8727127B \[0006\]](#)
- [US2010006481A \[0006\]](#)

PATENTKRAV

1. Afskærmningsanordning til minedrift, der indbefatter

a) en flerhed af afskærmningspaneler (10), hvor hvert panel har afhængige fremspring (20)

5 b) en støtteramme (30), hvori der er inkorporeret et hulrum (35) til modtagelse af de afhængige fremspring, og **kendetegnet ved** en mekanisme (35, 40, 50, 51, 60) inde i hulrummet, der kan aktiveres til at gå i indgreb med fremspringene.

2. Afskærmningsanordning til minedrift ifølge krav 1, der indbefatter hulrummet (35) i støtterammen (30), hvori et glidestykke (40) kan bevæge sig, hvor der i glidestykket er inkorporeret en nøglehulsåbning (44) med én del (45) med en større diameter end den anden del (46).

3. Afskærmningsanordning til minedrift ifølge krav 2, hvor de afhængige fremspring (20) kan gå gennem delen (45) med den større diameter af nøglehulsåbningen (44), men efter bevægelse af glidestykket (40) holdes fremspringene inden for den del af åbningen, der har en mindre diameter (46).

4. Afskærmningsanordning til minedrift ifølge krav 2, hvor støtterammen (30) omfatter skinner (30) og to tilgrænsende paneler (10) ligger over hver skinne, således at tilgrænsende, afhængige fremspring (20) går ind i hulrummet (30) i en skinne.

5. Afskærmningsanordning til minedrift ifølge krav 2, hvor en aktuator (50) er forbundet med glidestykket (40) og tilpasset til at bevæge glidestykket frem og tilbage.

6. Afskærmningspanel til minedrift ifølge krav 1, hvor mekanismen indbefatter et par parallelle slanger (60) på hver side af de afhængige fremspring (20), og som, når slangerne sættes under tryk, går i indgreb med fremspringene.

7. Afskærmningspanel til minedrift ifølge krav 1, hvor mekanismen indbefatter et par parallelle kabler (60), der overlapper hinanden omkring hvert afhængigt fremspring (20), og når kablerne er spændt, komprimerer de fremspringene.

DRAWINGS

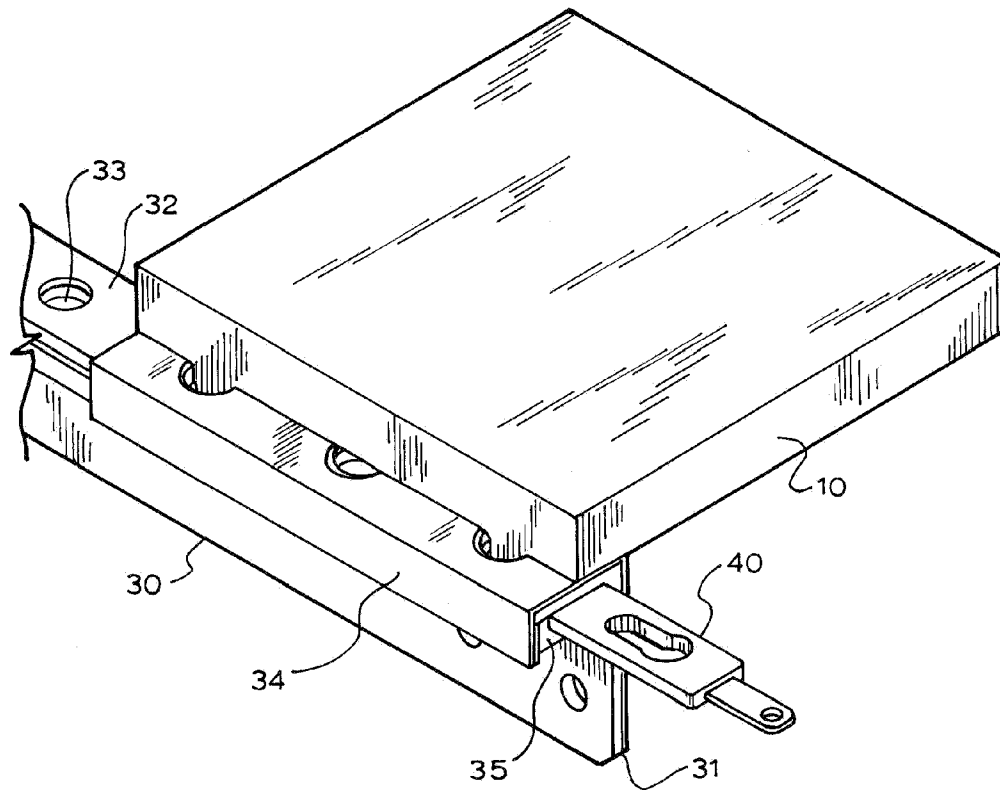


FIG.1

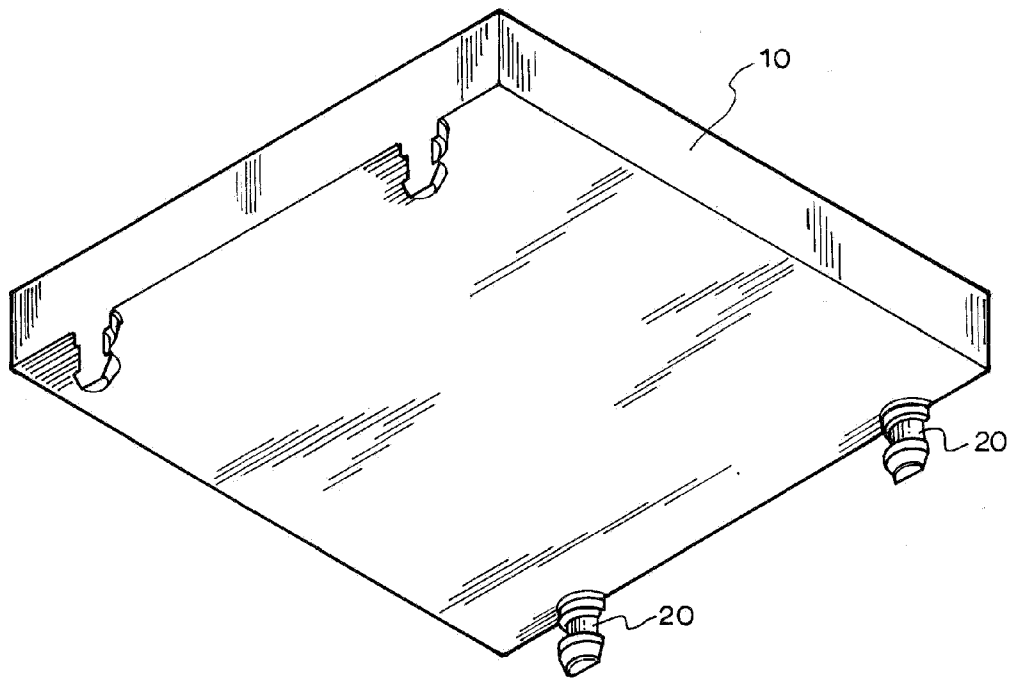


FIG. 2

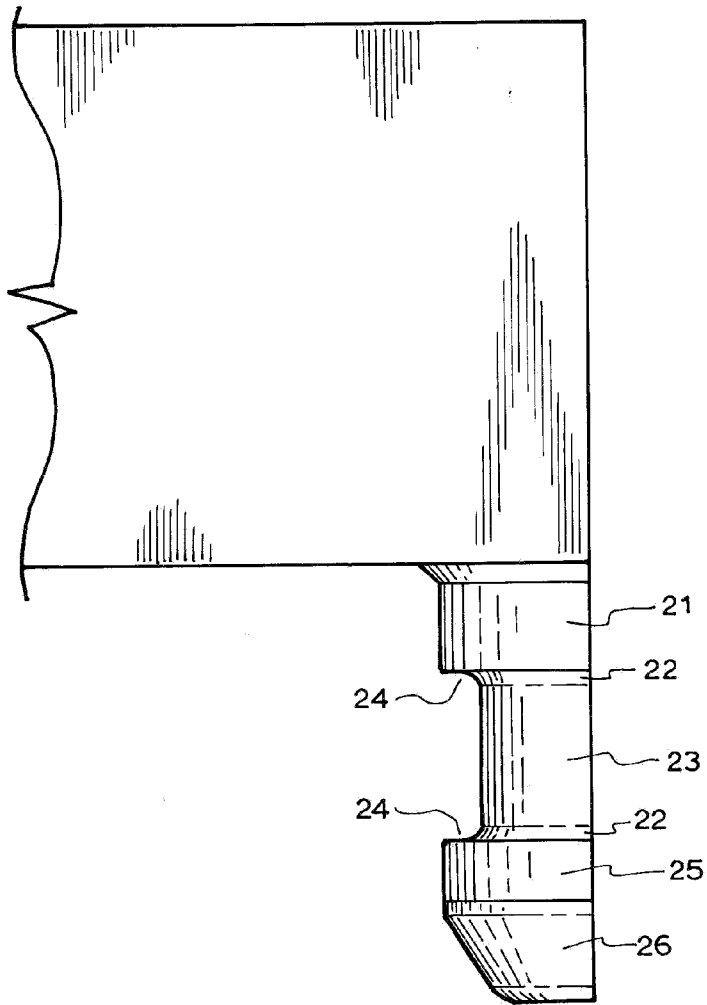


FIG.3

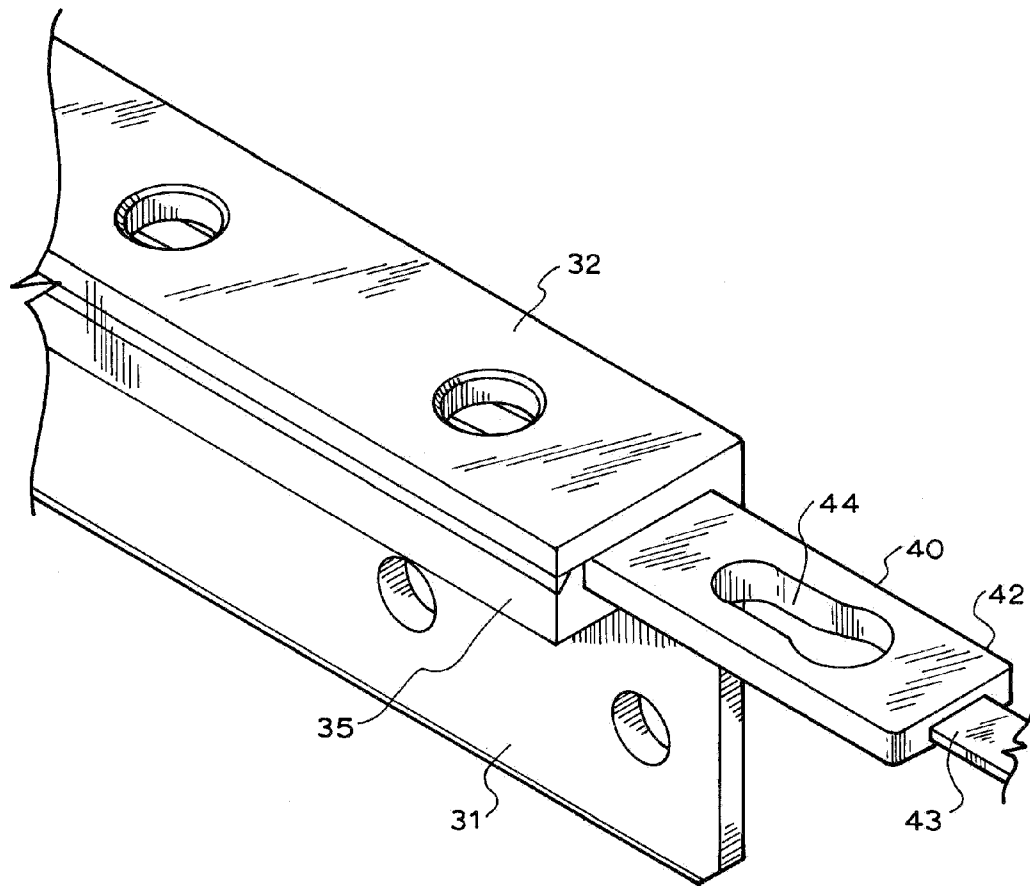


FIG.4

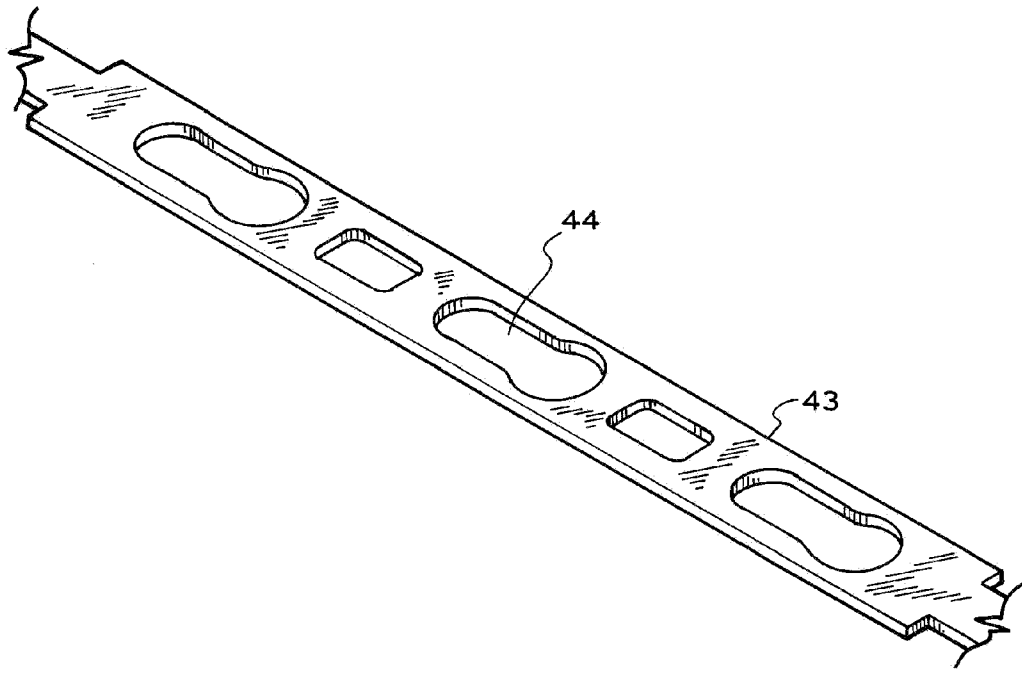
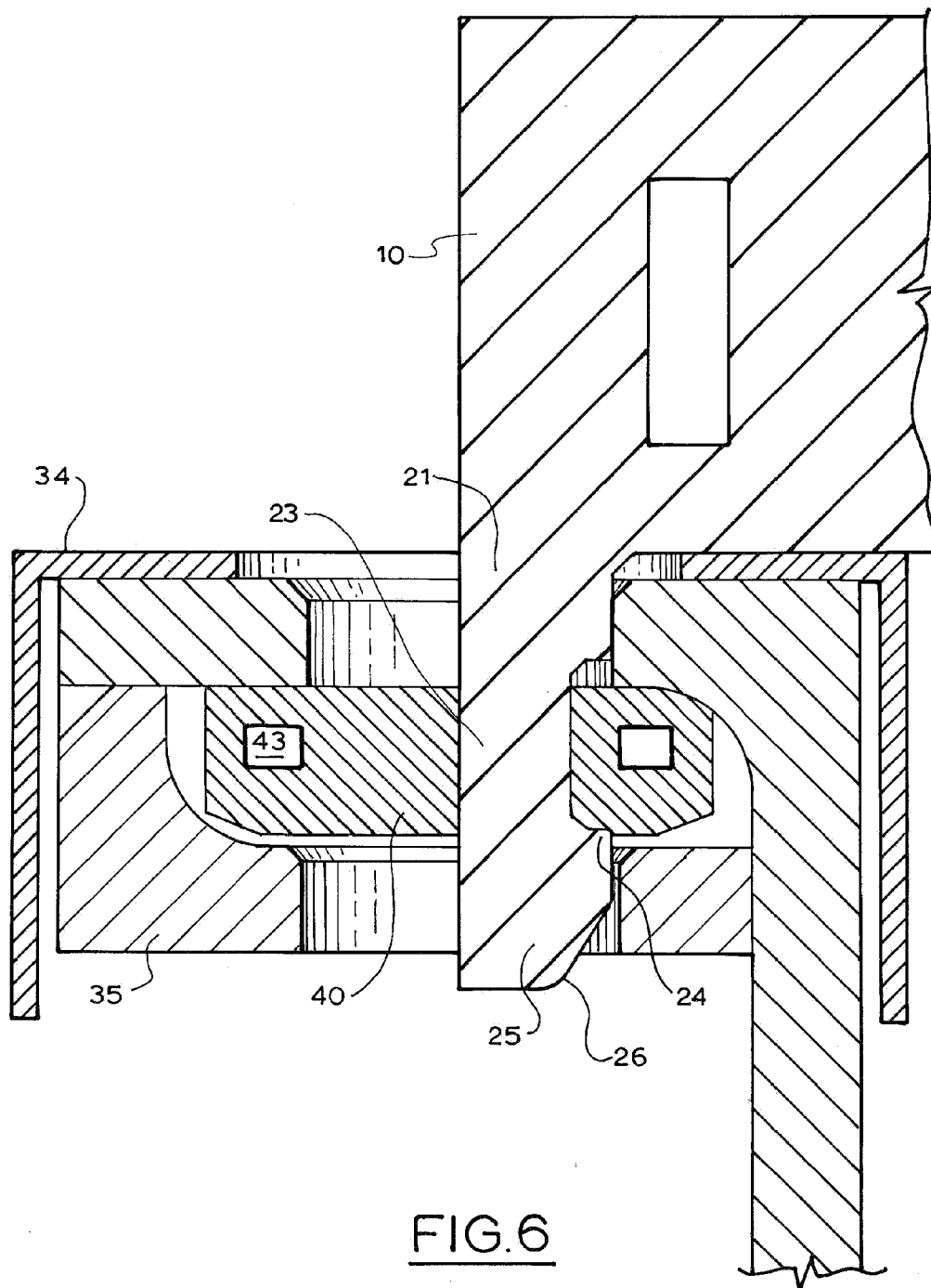


FIG.5



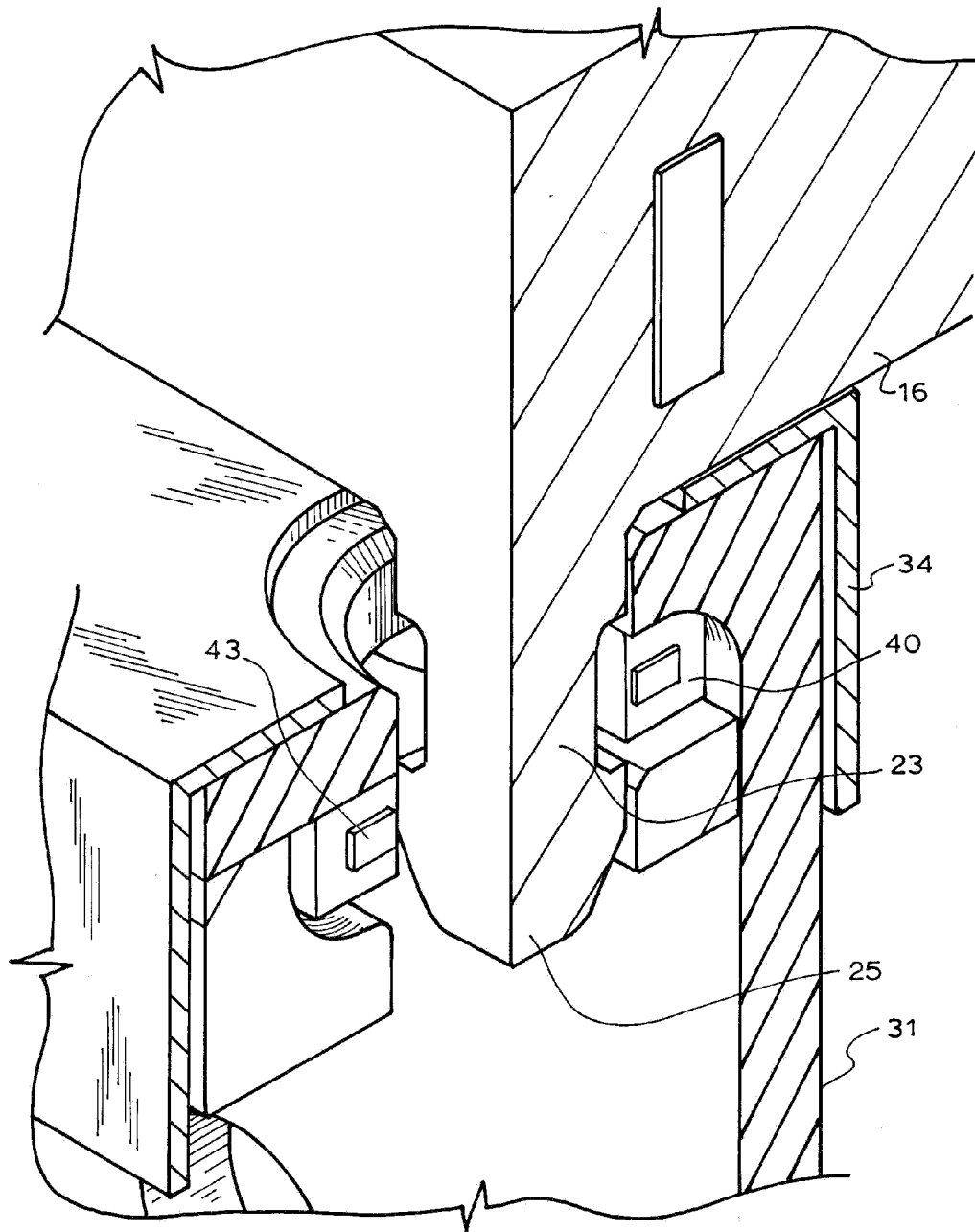


FIG. 7

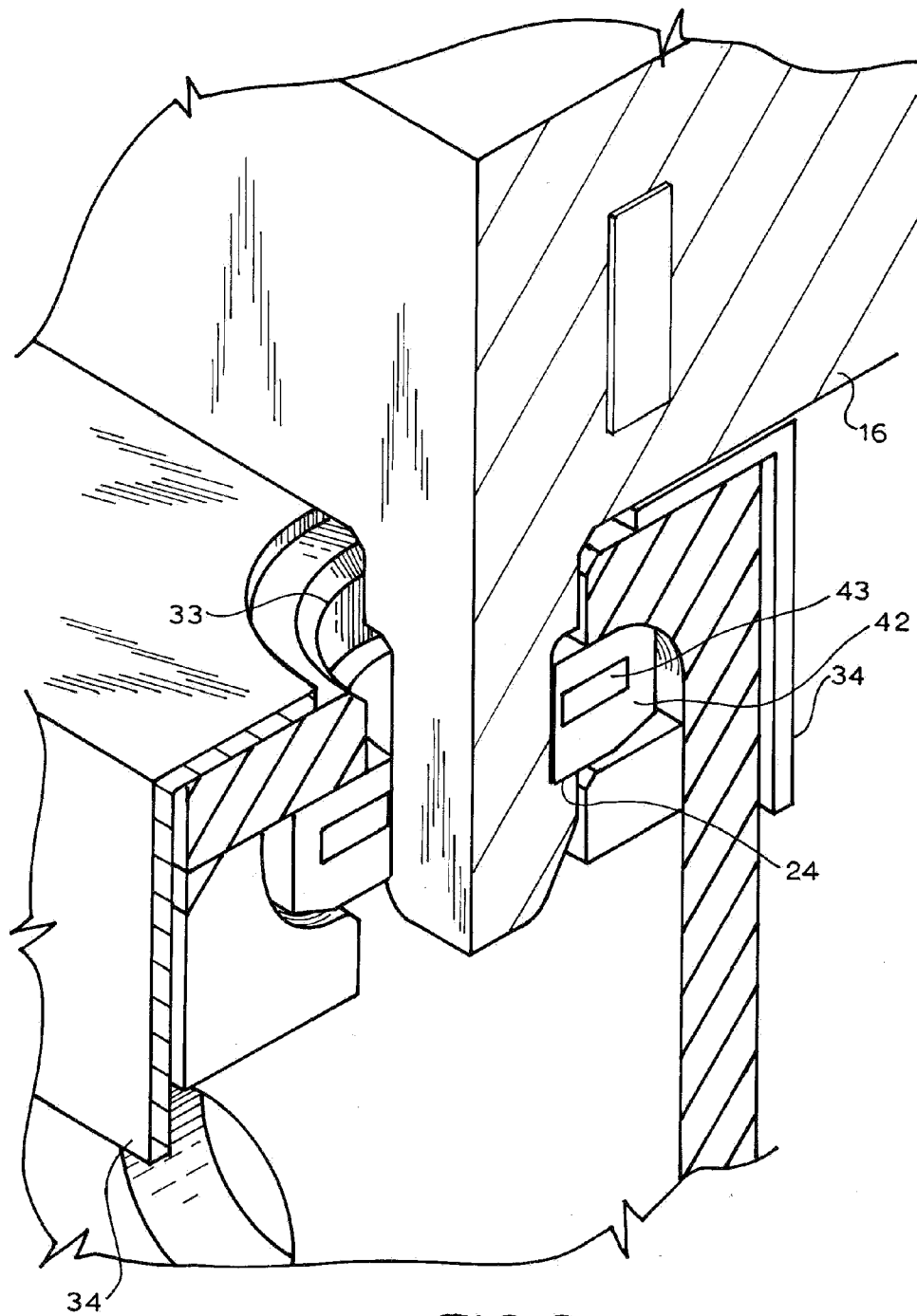


FIG.8

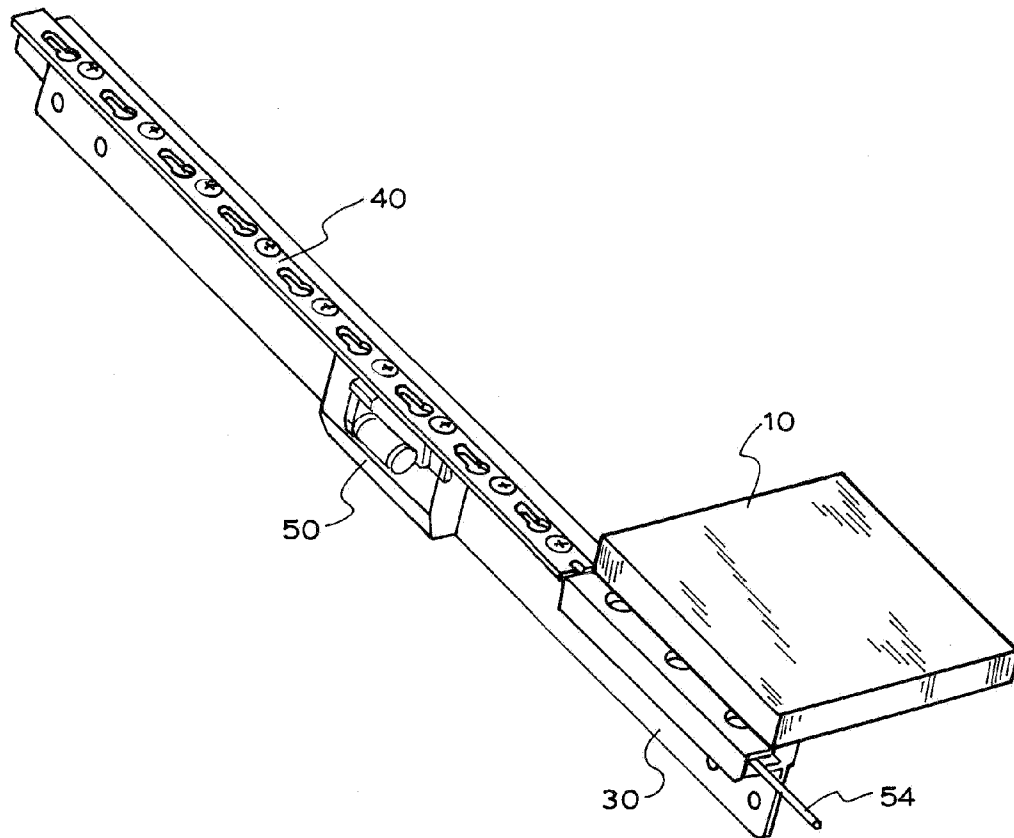


FIG.9

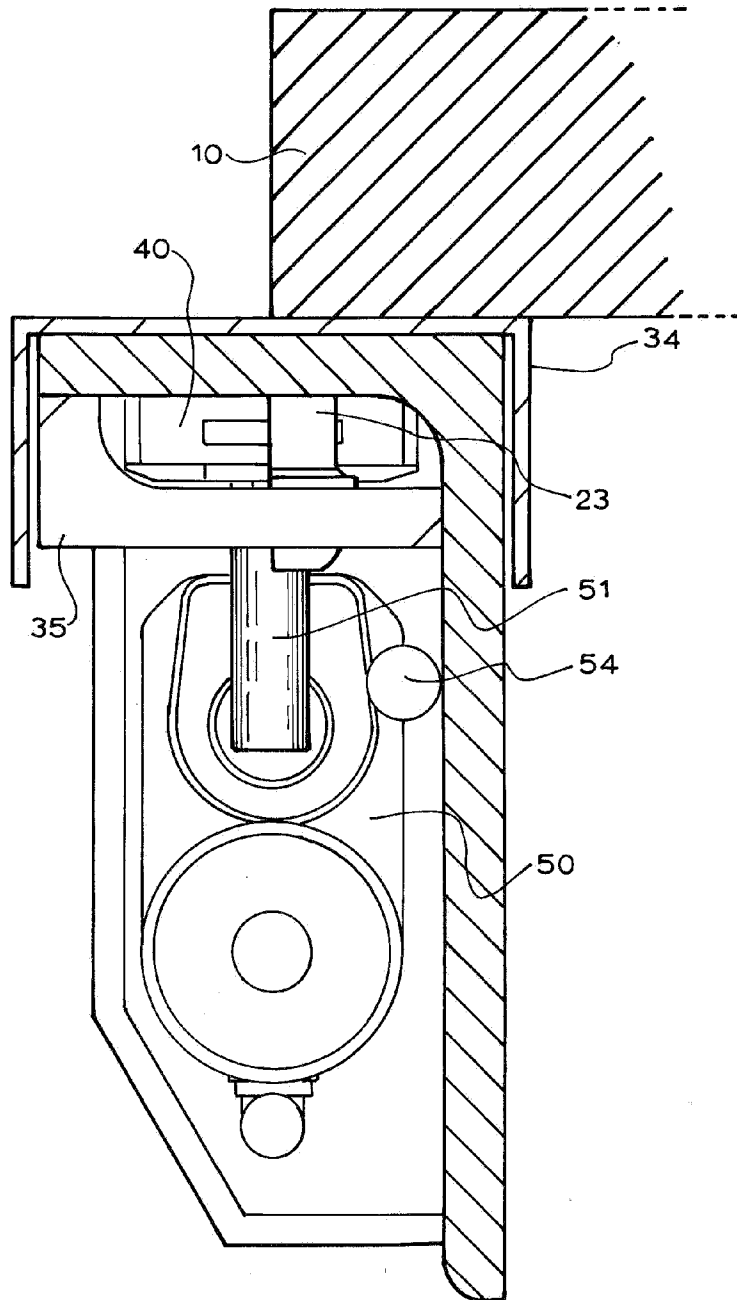


FIG.10

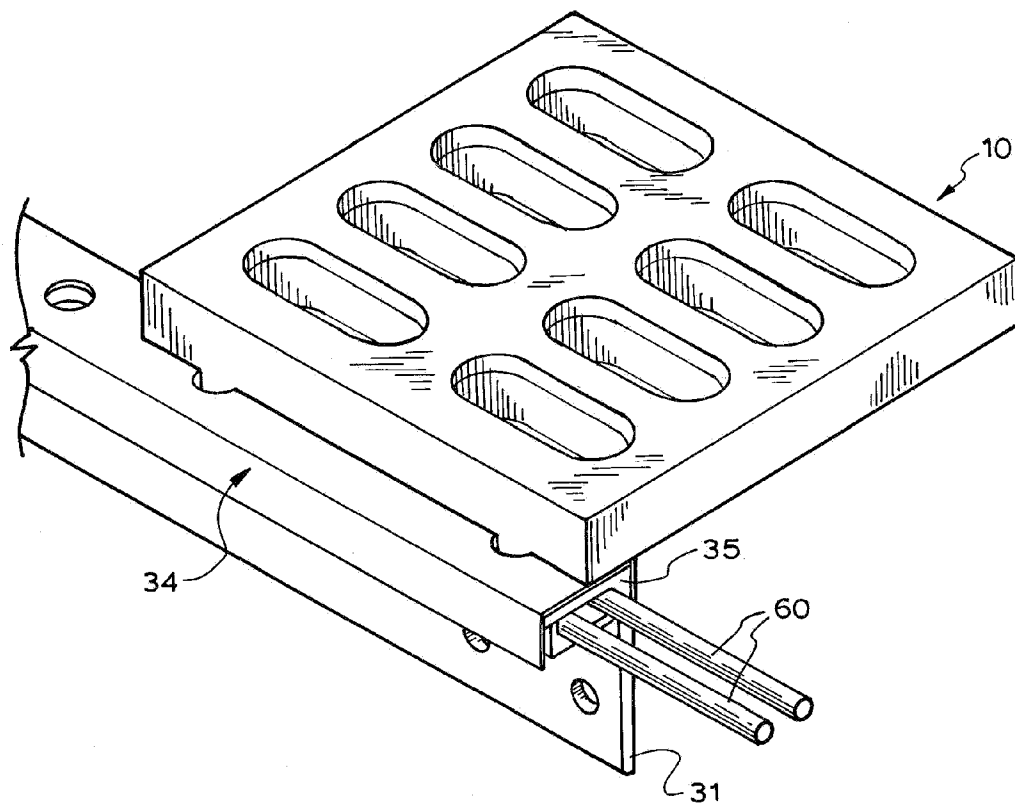
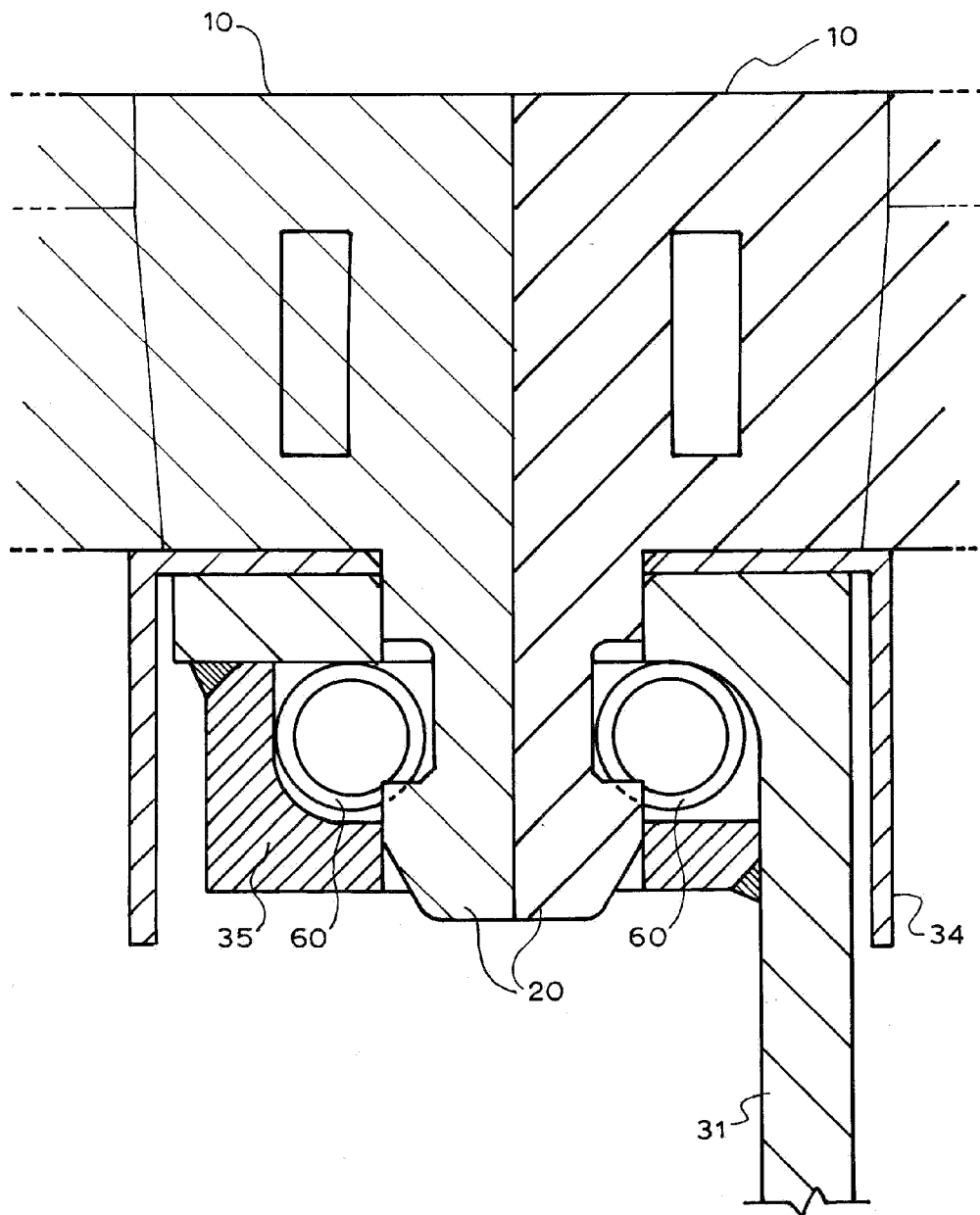


FIG.11

FIG.12

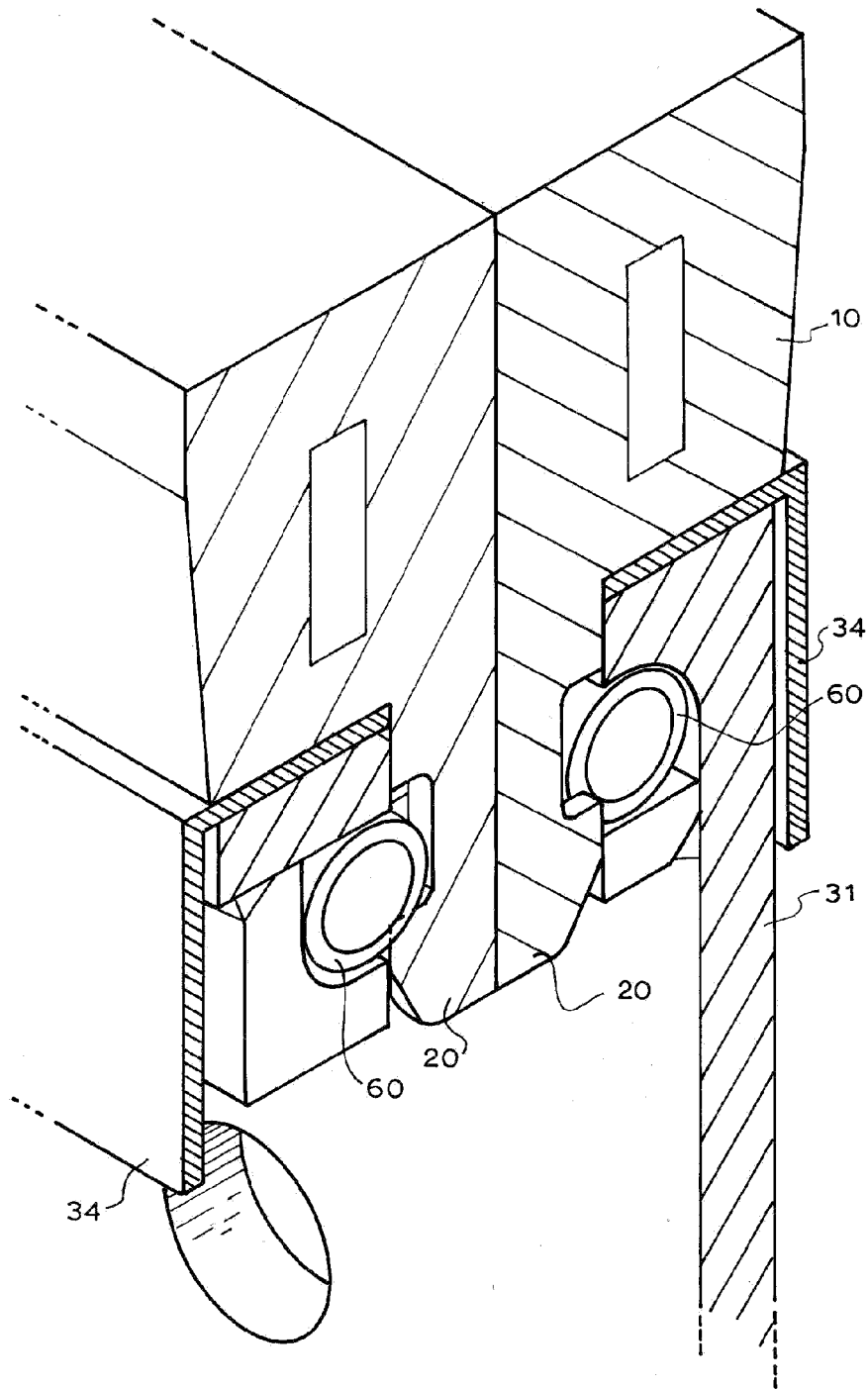


FIG.13