



(19)

Europäisches Patentamt

European Patent Office

Office européen des brevets



(11)

EP 0 952 253 A1

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:
27.10.1999 Bulletin 1999/43

(51) Int. Cl.⁶: **E01B 26/00**

(21) Application number: **99106940.2**

(22) Date of filing: **08.04.1999**

(84) Designated Contracting States:
**AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU
MC NL PT SE**
Designated Extension States:
AL LT LV MK RO SI

(72) Inventors:
• Vincent, Jon R.
Lake Charles, LA 70605 (US)
• Gaudet, Richard C.
Sulphur, LA 70663 (US)

(30) Priority: **14.04.1998 US 59748**

(74) Representative:
Finck, Dieter, Dr.Ing. et al
v. Fünér Ebbinghaus Finck Hano
Mariahilfplatz 2 - 3
81541 München (DE)

(71) Applicant: **Century Group Inc.**
Sulphur, LA 70664 (US)

(54) System for collecting liquid spillage at rail facilities

(57) The system for collecting liquid spillage at rail facilities includes a plurality of center pans (10) and side pans (14) arranged in end to end relation. The pans (10, 14) are formed of a molded lightweight plastic material, preferably high density polyethylene. Each pan (10, 14) has a molded downward extending vertical drain pipe (54, 78) which fits within an elastomeric sleeve (60) about an upper drain opening (34) in a transverse drain

conduit (28) positioned between a pair of crossties beneath the pans (10, 14). Each center pan (10) has a resilient upwardly inclined side flange or lip (44) which fits in sealing relation against adjacent rail (12) at the juncture of the head (16) and the vertical web (18) of the rail (12).

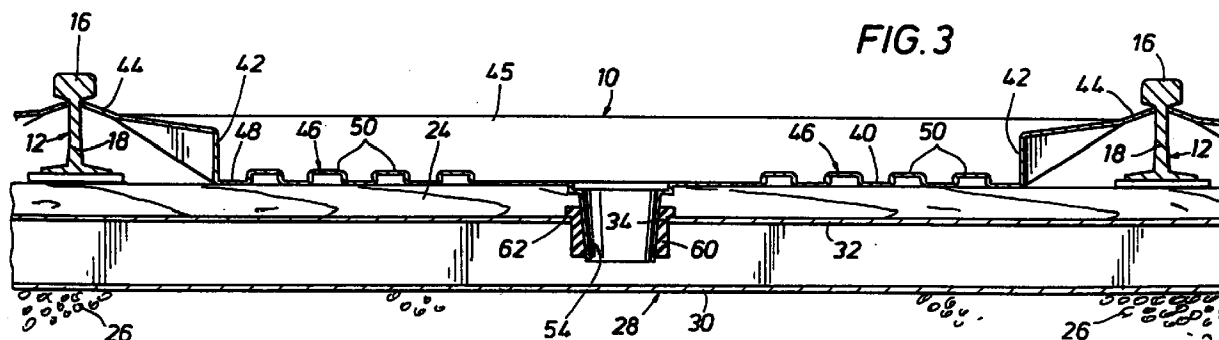


FIG. 3

EP 0 952 253 A1

Description

[0001] This invention relates to a system for collecting liquid spillage having a pair of rails supported on cross-ties, said system comprising a plurality of drain pans of plastic material which are positioned end to end along the sides of the rails and between the rails, which are supported on said crossties, and which end adjacent to the rails beneath their heads, enclosed transverse elongated drain conduits positioned between pairs of adjacent crossties below said drain pans and having an upper surface spaced vertically from said drain pans, pairs of associated spaced openings in said drain pans and said transverse drain conduits, and drain pipes mounted between each of the pairs of aligned openings to provide flow passages from said drain pans to said enclosed transverse drain conduits.

[0002] Such a system of the generic kind is described in US-A-4,300,721. This system for collecting liquid spillage has a plurality of center pans and side pans. Vertical drain conduits extend from the pans into an enclosed transverse drain conduit for drainage. The transverse drain conduit empties into a collection receptacle. While the pans are formed of a molded plastic material, separate vertical drains are connected to the bottom of the pans. Further, while side edges of the pans are positioned adjacent the vertical web of the rails, a separate caulking material is used to provide sealing against the rails. The rigid vertical drain conduits are threaded into openings in the pans and in the enclosed transverse drain conduit.

[0003] It is the object of the invention to provide a closed system for the collection of liquid spillage on a railroad track of the generic kind that may be installed in a minimum of time with sealing against the rails.

[0004] This object is achieved based on the system of the generic kind in that each drain pan is formed in one piece of a homogeneous lightweight resilient material, that each drain pan has a drain pipe integrally moulded therewith and extending downwardly therefrom for being inserted into the associated upper opening in a transverse drain conduit, that a resilient annular sealing member is positioned about each of said upper openings in said transverse drain conduits for receiving the associated drain pipe for providing a generally fluid tight seal thereat and permitting limited movement of the drain pans relative to the transverse drain conduit, and that each drain pan has one upwardly extending inclined resilient side flange or a pair of it for engaging the rail(s) beneath their head(s) in a snap-fit sealing relation.

[0005] The collection structure according to the invention includes a plurality of center and side pans molded to shape from a resilient plastic material, such as high density polyethylene. The resilient center pans between rails have a pair of upwardly extending inclined side flanges which fit beneath the heads of the rails in sealing relation with the rails without any additional sealing

members. A downwardly extending tubular drain pipe is molded onto each pan and fits within an enclosed transverse drain conduit positioned between a pair of cross-ties beneath the rails. The transverse drain conduit has an upper opening receiving each vertical drain pipe and a resilient annular seal about the upper opening receives the vertical drain pipe to provide a resilient sealing relation and to position the pans accurately.

[0006] The outer ends of the pans in one transverse row have outwardly extending end flanges which lap end flanges on an adjacent transverse row of pans arranged in end to end relation. Fasteners connect the lapping end flanges of adjacent transverse rows together to permit limited relative longitudinal movement which may result from temperature expansion or contraction, for example.

[0007] The pans forming this invention may be installed and assembled in a minimum of time. A preferred assembly method includes the insertion of center pans between the rails with one resilient side flange positioned beneath the rail against the vertical web of the rail under the head of the rail with the pan being inclined upwardly from the rail. The inclined pan is then pivoted downwardly with the bottom of the center pan resting against the crossties and the opposite resilient side flange in contact relation with the upper surface of the rail. Next, the opposite resilient side flange is forced by a suitable tool downwardly beneath the head of the rail where it snaps outwardly against the vertical web of the rail in sealing relation thereto. A downwardly extending integral drain pipe molded on each of the pans is vertically aligned with the lower receiving opening in the transverse drain conduit for initial positioning of the center pan accurately with the transverse drain conduit. An annular resilient seal is positioned within the opening of the drain conduit to receive the vertical drain pipe in sealing relation.

[0008] In some instances, it may be desirable to position the center pan on the crossties with the bottom of the center pan supported on the crossties and both of the resilient side flanges in engagement with the upper surface of the rails. Then, each of the resilient side flanges may be forced or pushed beneath the head of the adjacent rail for snapping beneath the head of the adjacent rail in sealing relation with the vertical web of the rail.

[0009] Each of the side pans has a resilient side flange in sealing relation with the vertical web of the adjacent rail. Fasteners are provided to secure the side pans to the crossties and to permit limited expansion and contraction thereof. Ballast on an outwardly extending lower flange or foot of the side flange assists in maintaining the side pan in sealing relation against the rail.

[0010] The arrangement of the rib sections in center panel and side panel provides longitudinal flow channels for the fluid and also solid particles carried by the fluid. Sand is oftentimes deposited into pans and the

arrangement of the longitudinally extending flow channels permits the sand to drain easily into the end drain tube. Heretofore, particularly for flat pans, sand has tended to deposit in various locations of the flat pans. The molded plastic pans formed preferably of polyethylene provides a substantial resilience and flexibility. Vertical drain pipes which are molded with the pans fit within resilient sleeves in the transverse drain conduit and this permits the track to move relative to the transverse conduit. The limited flexure or movement of the drain pans relative to the transverse drain conduit is important since the operation of a train on the rails causes a vertical pumping action which may be transmitted to the drain pans and cause some movement of the drain pans. As a result of the elastomeric sleeves and the resilient drain pipes received therein, movement of the drain pans and the track is not transmitted to the enclosed lower transverse drain conduit and a substantially liquid tight seal is maintained between the pans and the rails as well as the transverse drain conduit. While the drain conduit has been illustrated in the drawings as positioned at an end of the drain pans, it is apparent that the downward extending drain tube or pipe may be positioned at other locations such as the center of the drain pan, for example. Further, in some instances, it may be desirable to have a single transverse drain conduit for each row of pans. As the plastic material from which the pans are molded, such as high density polyethylene, may be of a thickness of around 6.3 mm (1/4 inch), the drain pans may be of a relatively long length, such as 4.5 m (15 ft) in length and yet be lightweight. This would permit the easy stacking of vertical pans and side pans for shipment or for storage. Other moldable materials may be suitable for the drain pans such as fiberglass.

[0011] Where a single transverse drain conduit is utilized for adjacent transverse pairs of side and center pans arranged in end to end relation as shown in the drawings, it may be desirable to remove a crosstie to permit a relatively wide transverse drain conduit to fit beneath the pans between a pair of adjacent crossties. It is desirable that the pans for installation and transport not be undesirably flexible and the ribbed construction provides reinforcement against bending or flexure particularly in a transverse direction. Likewise, the ends and sidewalls of the pans provide resistance against undue bending or flexure of the pans.

[0012] The steps for installing a resilient center pan having a pair of upwardly extending resilient side flanges beneath the heads of a pair of parallel rails supported on crossties of a railway track for mounting the center pan are

- inserting one side flange of the center pan beneath the head of one of the rails;
- pivoting the center pan downwardly against the crossties generally about said one side flange for supporting the bottom of the pan on the crossties

with the other resilient side flange extending over and supported on the head of the other rail; and

- then forcing said other resilient side flange beneath the head of the other rail for installation of the center pan.

[0013] Preferably, installing the resilient center pan having a pair of upwardly and laterally extending side flanges beneath the heads of a pair of parallel rails supported on crossties of a railway track comprises

- positioning the center pan on the crossties between the rails with the resilient side flanges extending above and supported on the upper surface of the heads of said rails; and
- forcing the resilient side flanges beneath the heads of the rails with the side flanges snapping into an installed position beneath the heads of the rails in contact with the vertical webs thereof for mounting of the center pan.

[0014] For installing a resilient center pan formed of a one piece homogeneous resilient material having an integral tubular drain pipe extending downwardly from the bottom of the pan and a pair of parallel side flanges extending outwardly in an inclined relation to the bottom of the pan, the center pan arranged for installation between a pair of rails supported on crossties of a railway track and for draining into an enclosed transverse drain conduit positioned between a pair of cross-ties and having an upper opening to receive the tubular drain pipe of the center pan, the following steps are preferably carried out

- positioning the resilient center pan on the crossties of the railway track with the downwardly extending tubular drain pipe received within said upper opening of said enclosed transverse drain conduit; and
- positioning said resilient side flanges against the web of said rails beneath the balls thereof for installation of said center pan between the rails.

[0015] The step of positioning the resilient side flanges beneath the balls of said rails may include first positioning one of said resilient side flanges beneath the ball of one rail, then pivoting the center pan downwardly into supporting relation on the crossties; and then forcing the other resilient side flange beneath the ball of the other rail for installation of the center pan.

[0016] In case the resilient outer pan has a laterally extending upper flange at each end of the center pan for lapping similar flanges on adjacent center pans in end to end relation, a further step of connecting the lapping flanges of adjacent center pans to each other to permit limited relative longitudinal movement between adjacent center pans may be included.

[0017] When a resilient annular sealing sleeve is positioned about said upper opening in said enclosed trans-

verse drain conduit, said step of positioning the resilient center pan on the crossties of the railway track may include positioning said downwardly extending tubular drain pipe within said resilient sealing sleeve to provide a substantially fluid tight relation between said pan and said enclosed transverse drain conduit.

[0018] Other features and advantages of the invention will be apparent from the following specification and drawings.

Figure 1 is a plan view of a pan system in accordance with the present invention,

Figure 2 is a transverse sectional view along line 2-2 of Figure 1,

Figure 3 is a transverse sectional view along line 3-3 of Figure 1,

Figure 4 is an enlarged longitudinal sectional view along line 4-4 of Figure 1,

Figure 5 is a longitudinal sectional view of a plurality of center pans shown in a vertically stacked relation for storage or transport,

Figure 6 is a section along line 6-6 of Figure 1, and

Figure 7 is a section along line 7-7 of Figure 1.

[0019] As shown particularly in Figure 1, two adjacent transverse rows of drain pans are shown including a pair of center pans 10 arranged in an end to end relation between rails 12 of the railroad track and a pair of side pans 14 arranged in end to end relation along the outer side of each rail 12. Each rail 12 as shown particularly in Figures 2 and 3 includes an upper head or ball 16, a vertical web 18, and a lower base 20. Lower base 20 is mounted on tie plates 22 supported on crossties 24. Crossties 24 are mounted on ballast 26 normally comprising crushed rock.

[0020] Pans 10 and 14 are formed of a molded lightweight plastic material, preferably high density polyethylene, having a thickness of preferably about 6.3 mm (1/4 inch) to provide flexibility and resilience. Pans 10 and 14 formed of a lightweight material may be easily stacked vertically for storage or transport prior to installation on a railroad track such as shown in Figure 5 for center pans 10. Also, relatively long length pans such as 4.5 m (15 ft) in length, function in a satisfactory manner. Thus, each row shown in Figure 1 may have a length of 4.5 m (15 ft).

[0021] For the collection of liquid spillage from pans 10 and 14, an enclosed transverse drain conduit 28 in Figures 3, 4, and 7 is positioned between a pair of crossties 24 beneath the drainage end of pans 10 and 14 to receive the liquid spillage from pans 10 and 14. Conduit 28 is of a rectangular cross section having a

sloping lower wall 30 and an upper wall 32. Upper wall 32 has an opening 34 for each of pans 10 and 14 to receive the liquid spillage from pans 10 and 14. The extending lower sloping end of transverse drain conduit 28 is connected to a catch basin 35 having a longitudinal drain pipe 36 which extends to a collection facility or container (not shown). If desired, catch basin 35 may be omitted with drain pipe 36 connected directly to an end of drain conduit 28.

[0022] Each center pan 10 of a molded plastic construction is resilient and includes a bottom 40, a pair of opposed sides 42, and a flexible resilient upper side flange or lip 44 extending laterally outwardly from each side 42. Pan bottom 40 is supported on the upper surface of crossties 24 and has a plurality of molded ribs to provide flow channels for pan 10 and to reinforce pan 10. As shown particularly in Figures 2 to 4, raised rib sections 46 at the upper end 45 of center pan 10 as shown in Figure 2 slope downwardly to the lower opposed end 47 of pan 10 for the drainage of liquid from upper end 45 to lower end 47. Main flow channels 48 along bottom 40 are provided adjacent raised rib sections 46. Rib sections 46 have ribs 50 defining shallow flow channels 52 therebetween. Rib sections 46 for pan 10 having a length of 4.5 m (15 ft) have a slope of between about 2.5 cm and 5 cm (1 and 2 inches) from upper end 45 to lower end 47. Flow channels 48 and 52 are effective in the drainage of solid particles, such as sand, from pan 10. Each molded center pan 10 has an integral downwardly extending drain pipe 54 defining an inset annular shoulder 56 to receive in supporting relation a metal grate 58. Drain pipe 54 tapers in a downward direction and is flexible to facilitate fitting within a vertically aligned opening 34 in transverse drain conduit 28.

[0023] To provide a fluid tight fitting between vertical drain pipe or tube 54 and transverse drain conduit 28, an elastomeric sealing sleeve 60 is mounted within opening 34 to receive in sealing relation the lower end of vertical drain pipe 54. Sleeve 60 has an annular shoulder 62 that fits about opening 34 and contacts in sealing relation the upper surface of to upper wall 32 of transverse drain conduit 28. The resilience of sleeve 60 and tapered drain pipe 54 provide an effective sealing relation.

[0024] In the installed position, resilient side flanges or lips 44 are positioned in sealing relation against vertical web 18 beneath head 16 of the adjacent rail 12 generally at the juncture of vertical web 18 with head 16. No additional separate sealing elements are required between center pan 10 and rails 12. As shown in Figure 4, each end 45, 47 has an extending upper end flange 64 which laps an adjacent flange 64 of an adjacent center pan 10. Aligned elongate slots 66 are provided in lapping flanges 64 and fasteners 68 having resilient washers fit within aligned slots 66 and are tightened to hold flanges 64 together at ends 45 and 47. Slots 66 permit limited temperature expansion and contraction of

adjacent center pans 10 of about 2.5 cm (1 inch).

[0025] Center pans 10 may be easily installed between rails 12 in a minimum of time. Transverse drain conduit 28 with sleeves 60 within openings 34 is positioned between a pair of crossties 24 with one crosstie 24 removed to provide adequate space for transverse drain conduit 28. A preferred installation method as shown partially in Figure 2 in broken lines comprises the positioning of one resilient side flange 44 beneath the head 16 of an adjacent rail 12 with pan 10 inclined upwardly at about a thirty degree angle to the adjacent rail 12. Vertical drain pipe 54 is initially aligned vertically with an associated opening 34 and sealing sleeve 60. Then, the center pan 10 is pushed downwardly with the bottom 40 of pan 10 supported on the upper surface of the crossties 24 and pipe 54 received within resilient sleeve 60 in sealing relation. In this position, the opposed resilient side flange 44 is in contact with the upper surface of head 16 of the other rail 12 as shown in broken lines in Figure 2 and is forced upwardly by the upper surface of head 16. Next, the opposed resilient side flange 44 is forced downwardly past head 16 by a workman with a suitable tool where it snaps outwardly into sealing engagement with vertical web 18 generally at the juncture of vertical web 18 with head 16. Elongate slots 66 in lapping end flanges 64 of adjacent center pans 10 as shown in Figure 4 are aligned and fasteners 68, such as suitable nut and bolt combinations with resilient washers, are installed to connect adjacent center pans 10 together in end to end relation. Another method of installing center pan 10 comprises the aligning of drain pipe 54 with sleeve 60 and the pushing or forcing of center pan 10 downwardly onto crossties 24 between rails 12 without inclining center pan 10 so that both side flanges 44 contact the upper surface of adjacent heads 16 and are held thereon. Both resilient side flanges 44 may then be forced beneath heads 16 by a workman with a suitable tool for snapping of side flanges 44 into sealing position beneath heads 16.

[0026] Side pans 14 shown in Figures 6 and 7 are installed after center pans 10 are installed. Each side pan 14 has a bottom 72 and raised rib sections 74. Main flow channels 76 are provided between raised rib sections 74 which slope downwardly from an upper end 77 shown in Figure 6 to a lower end shown in Figure 7. An integral drain tube or pipe 78 extends downwardly from bottom 72 for fitting within an elastomeric sealing sleeve 60 in a manner similar to outer pan 10. Grate 79 is supported on drain pipe 78.

[0027] An inner side 80 has an extending side flange 82 which fits beneath head 16 in sealing relation generally at the juncture of head 16 and vertical web 18. Drain tube or pipe 78 is positioned for urging side flange 82 into sealing relation with head 16 at the lower end of side pan 14 when drain pipe 78 is received within sealing sleeve 60. Also, bottom 72 has elongate slots 81 receiving lag screws 83 and washers which are secured to the crossties 24. An outer channel-shaped side 86 of

side pan 14 has an extending lower flange 88 covered with ballast to assist in maintaining side pan 14 in sealing position against head 16 of the adjacent rail 12.

[0028] Each side pan 14 has an upper end flange at each end thereof which is adapted to be positioned and secured in lapping relation to a mating end flange on an adjacent side pan 14 in a manner similar to lapping flanges 64 secured by fasteners 68 as shown in Figure 4 for center pan 10. Side pans 14 are arranged in transversely aligned position with center panel 10. For installation, resilient side flange 82 is pushed manually tightly against the junction of head 16 and vertical web 18 of adjacent rail 12 with drain pipe 78 aligned vertically with seal 60. Then, downwardly extending drain pipe 78 is lowered within elastomeric sealing sleeve 60 in transverse drain conduit 28. Ballast is then positioned over extending flange 88 and lag screws 83 with washers are inserted in the crossties through suitable elongate slots 81 in bottom 72 of side pan 14. The lag screws 83 are received within a relatively small elongated slot so that limited expansion and contraction of side panel 14 less than about 2.5 cm (1 inch) is provided. In some instances, lag screws 83 may be omitted. Spikes 85 are provided for flange 88 and are of a length of about 20 cm (8 inches) for extending within ballast 26 for securement of side pans 14.

Claims

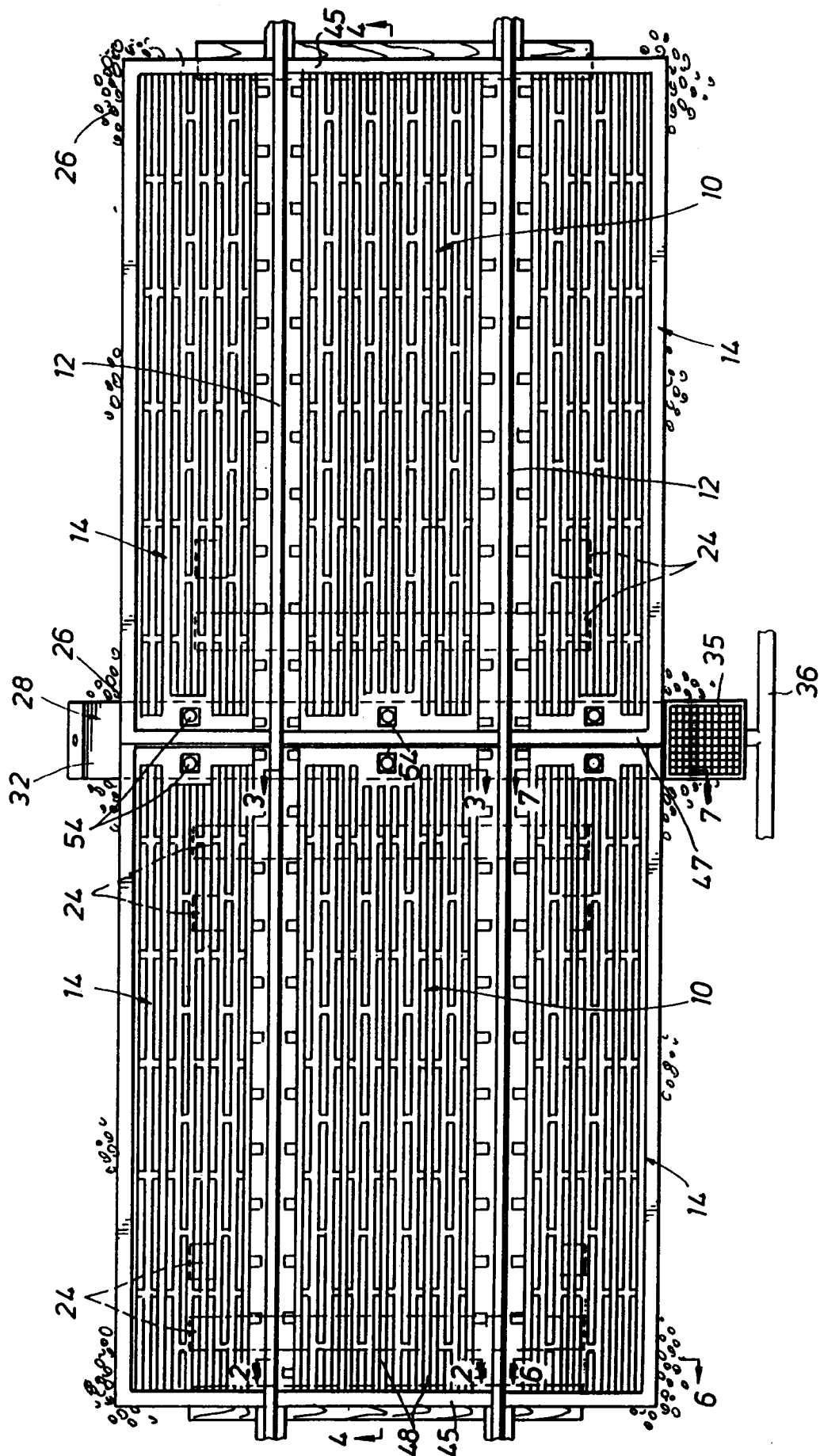
1. A system for collecting liquid spillage at rail facilities having a pair of rails (12) supported on crossties (24), said system comprising:
 - a plurality of drain pans (10, 14) of plastic material which are positioned end to end along the sides of the rails (12) and between the rails (12), which are supported on said crossties (24), and which end adjacent to the rails (12) beneath their heads (16),
 - enclosed transverse elongated drain conduits (28) positioned between pairs of adjacent crossties (24) below said drain pans (10, 14) and having an upper surface spaced vertically from said drain pans (10, 14),
 - pairs of associated spaced openings in said drain pans (10, 14) and said transverse drain conduits (28), and
 - drain pipes (54, 78) mounted between each of the pairs of aligned openings to provide flow passages from said drain pans (10, 14) to said enclosed transverse drain conduits (28), characterized in
 - that each drain pan (10, 14) is formed in one piece of a homogeneous lightweight resilient material,
 - that each drain pan (10, 14) has a drain pipe (54, 78) integrally moulded therewith and extending downwardly therefrom for being

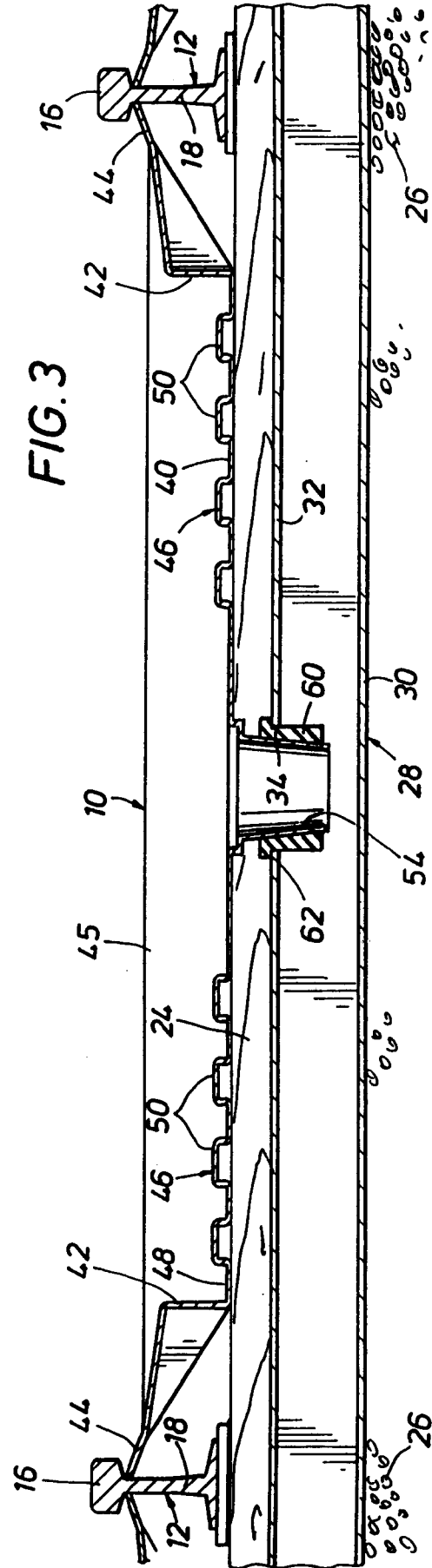
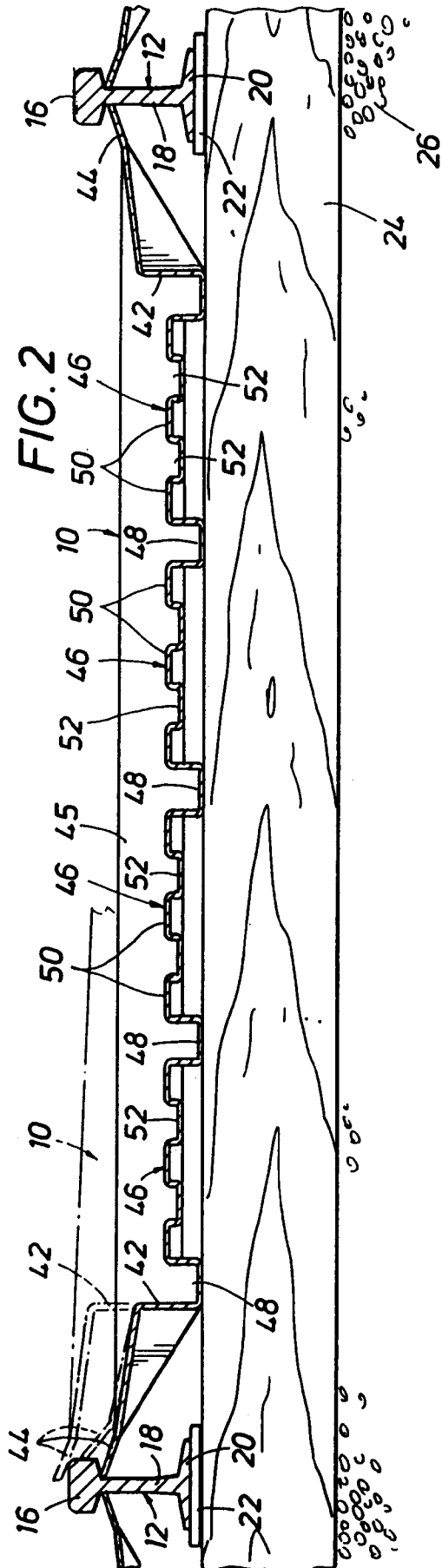
inserted into the associated upper opening in a transverse drain conduit (28),

- that a resilient annular sealing member (60) is positioned about each of said upper openings in said transverse drain conduits (28) for receiving the associated drain pipe (54, 78) for providing a generally fluid tight seal thereat and permitting limited movement of the drain pans (10, 14) relative to the transverse drain conduit (28), and
- that each drain pan (10, 14) has one upwardly extending inclined resilient side flange (82) or a pair (44) of it for engaging the rail(s) (12) beneath their head(s) (16) in a snap-fit sealing relation.

2. A system as set forth in claim 1 wherein said annular sealing member is an elastomeric sleeve (60).
3. A system as set forth in claim 1 or 2 wherein each drain pipe (54) has an upwardly facing shoulder (56) adjacent the bottom of said drain pan (10) and a grate (58) is positioned on said shoulder (52) over said drain pipe (54).
4. A system as set forth in one of the claims 1 to 3 wherein each drain pan (10) has a plurality of longitudinally extending ribs (50) along the bottom (40) of said drain pan (10) defining a plurality of flow channels (48, 52) between adjacent ribs (50) for directing liquid and solid materials toward the opening in the drain pans (10).
5. The system as set forth in one of the preceding claims wherein said drain pans (10, 14) are formed of high density polyethylene.
6. The system as set forth in one of the preceding claims wherein each drain pan (10, 14) has an upper surface sloping downwardly from one end (45, 77) to the other opposite end (47) thereof, and said opening in said drain pan (10, 14) is positioned in said opposite end (47).
7. The system as set forth in one of the preceding claims wherein each of said end to end positioned drain pans (10, 14) has an upper end flange (64) extending in a lapping relation to an adjacent upper end flange (64) on a contiguous drain pan (10, 14), and fasteners (68) are secured to said lapping end flanges (64) to permit limited longitudinal movement between adjacent drain pans (10, 14) resulting from ambient temperature changes.

FIG. 1





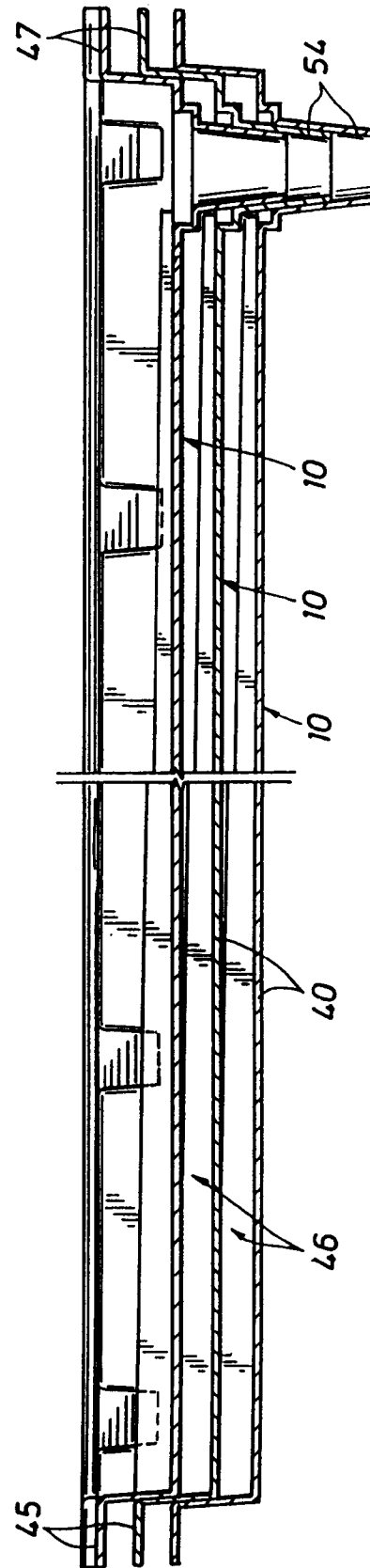
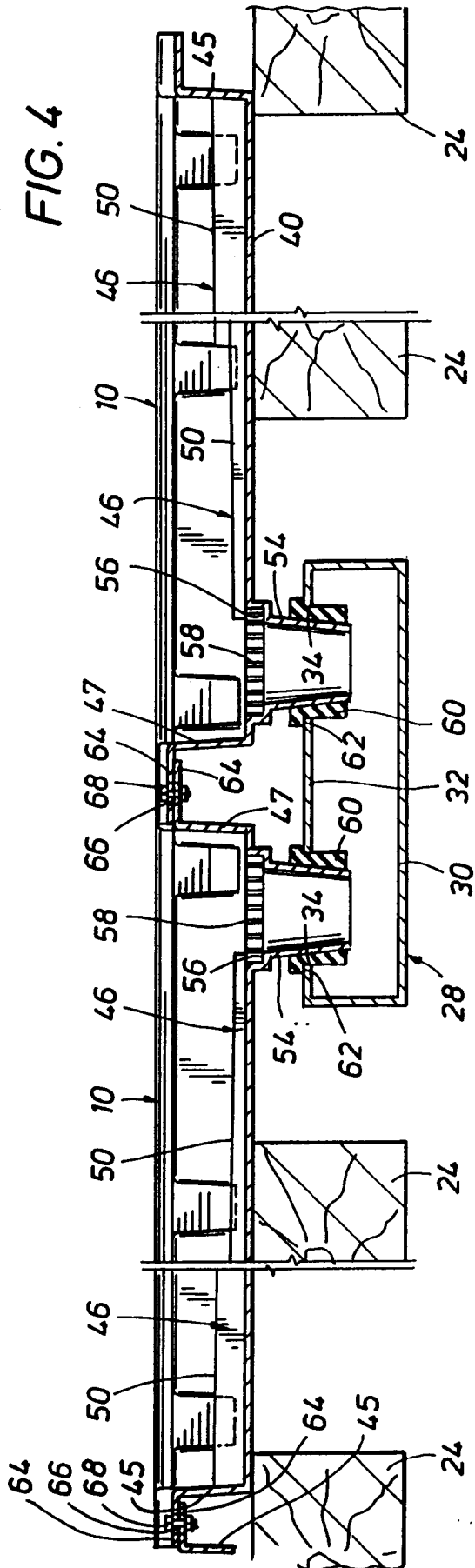


FIG. 6

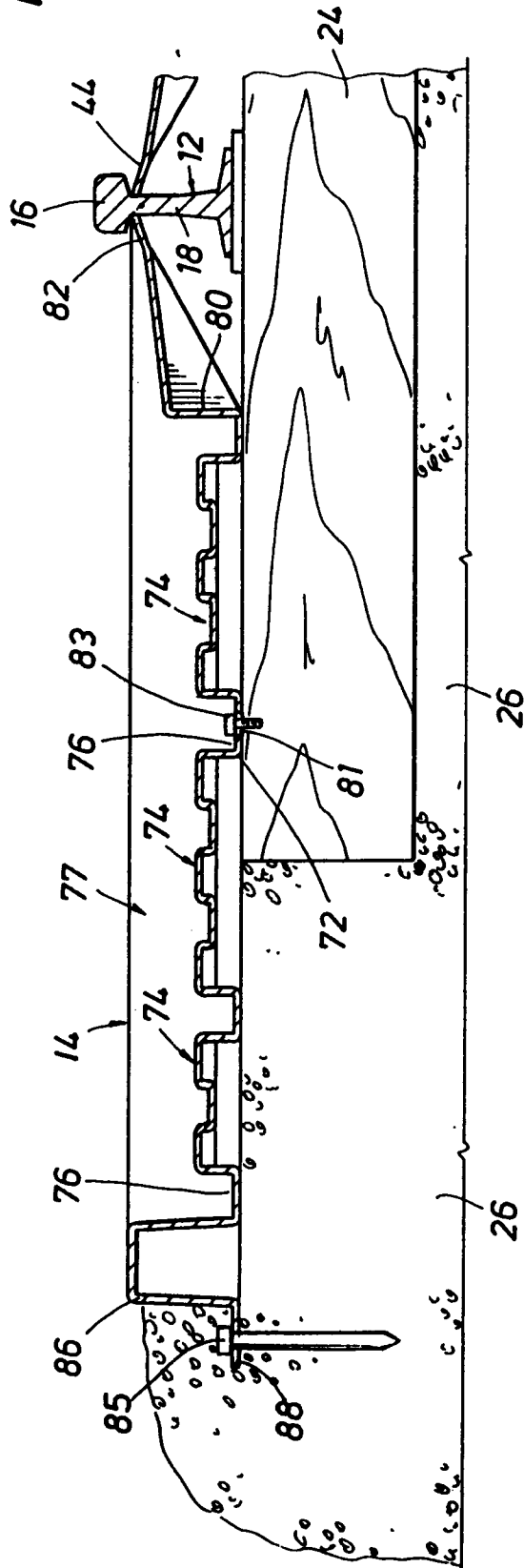
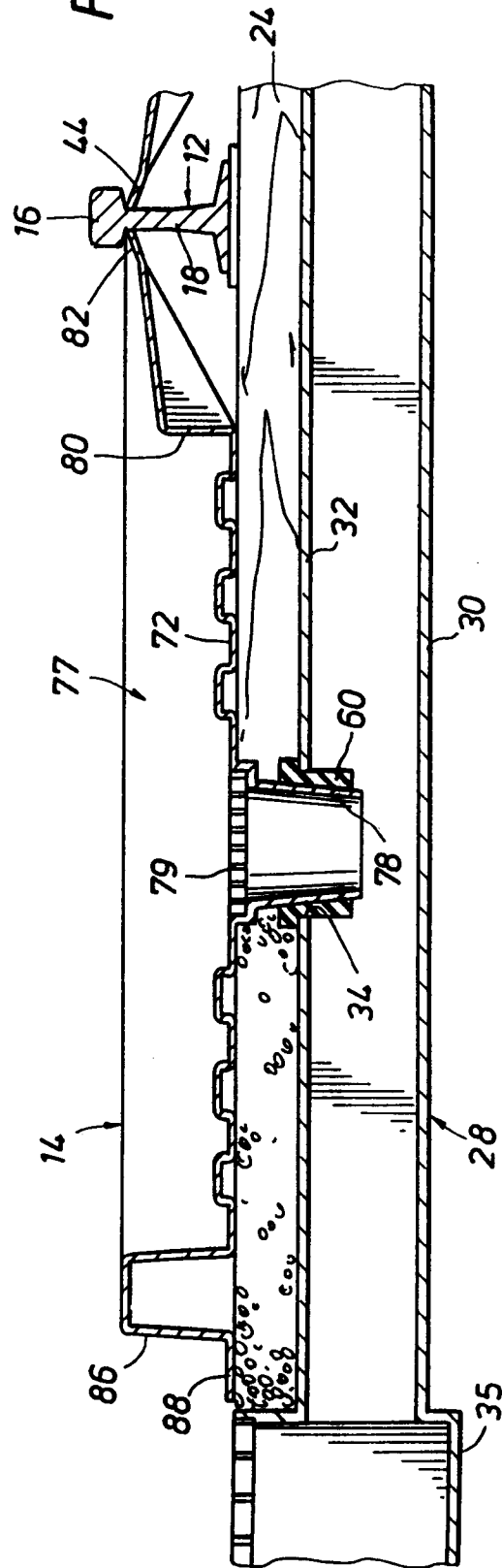


FIG. 7





European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 99 10 6940

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
A	EP 0 539 349 A (LINDINGER KLAUS JOHANN) 28 April 1993 (1993-04-28) * the whole document *	1,3-7	E01B26/00
A	EP 0 781 886 A (GEOTEC SYSTEME FUER SAUBERE UM) 2 July 1997 (1997-07-02) * the whole document *	1,3-7	
A	US 4 010 896 A (STOCKTON WILLIAM N) 8 March 1977 (1977-03-08) * the whole document *	1,3,4,6,7	
P,A	US 5 782 405 A (VINCENT JON R) 21 July 1998 (1998-07-21) * the whole document *	1-3,6,7	
D,A	US 4 300 721 A (RICH BRETT) 17 November 1981 (1981-11-17) * the whole document *	1-7	
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			E01B E01C
Place of search	Date of completion of the search	Examiner	
THE HAGUE	26 July 1999	Blommaert, S	
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 99 10 6940

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

26-07-1999

Patent document cited in search report		Publication date	Patent family member(s)		Publication date
EP 0539349	A	28-04-1993	AT	208991 A	15-05-1999
EP 0781886	A	02-07-1997	DE	19548857 A	10-07-1997
US 4010896	A	08-03-1977	NONE		
US 5782405	A	21-07-1998	NONE		
US 4300721	A	17-11-1981	NONE		