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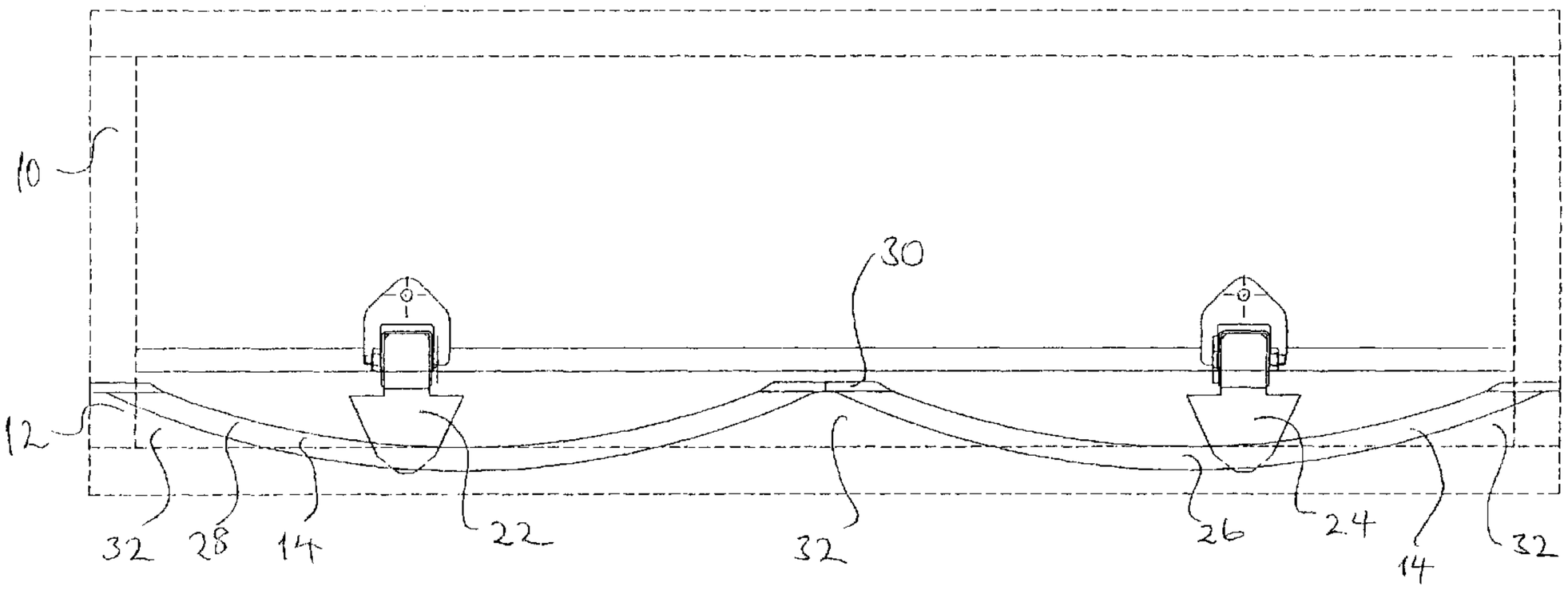
(54) Title: UP-FLOW RAKE BAR SCREEN ASSEMBLY



SECTION

(57) Abrégé/Abstract:
The present invention relates to an up-flow rake bar screen having a multiplicity of bars which are parallel to one another and which are spaced from one another across the screen. At least a portion of each bar is curved so that, when that portion is viewed from a position at which, when the screen is in use, fluid has not yet passed through the screen, that portion of the bar appears convex.

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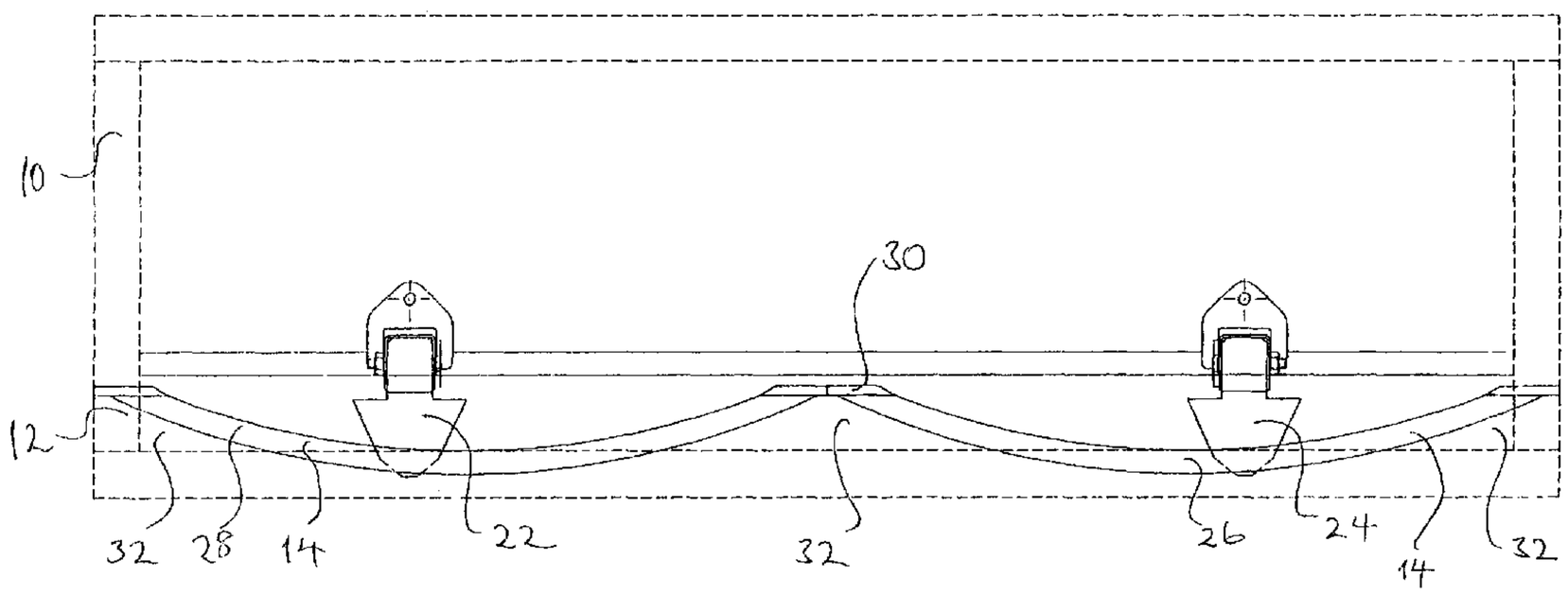
(54) Title: UP-FLOW RAKE BAR SCREEN



SECTION

(57) Abstract: The present invention relates to an up-flow rake bar screen having a multiplicity of bars which are parallel to one another and which are spaced from one another across the screen. At least a portion of each bar is curved so that, when that portion is viewed from a position at which, when the screen is in use, fluid has not yet passed through the screen, that portion of the bar appears convex.

WO 01/75240 A1

Up-flow rake bar screen assembly

The present invention relates to an up-flow rake bar screen assembly having a multiplicity of bars which are parallel to one another and which are spaced from one another across the screen, together with a rake having a multiplicity of blades which extend between the bars of the screen, in which the rake is provided with drive means to move the blades to and fro longitudinally of the bars, in which at least a portion of each bar is curved so that, when that portion is viewed from a position at which, when the screen is in use, fluid has not yet passed through the screen, that portion of the bar is convex.

WO 98/31882 and EP 0582542 A1 each describe a screen provided with a multiplicity of blades which extend between straight parallel bars and which are moved longitudinally therealong by drive means to and fro to shift debris out of the spaces between the bars thereby to ensure that an adequate through-flow of the sewage is maintained.

DE 19755588 A1 describes a screen, in which the rake is moved about a pivot axis so that parts of it sweep about bars which are part circular.

One disadvantage of screens with straight bars is their relatively low strength and stability of the bars.

The present invention seeks to provide a remedy.

Accordingly, the present invention is directed to an up-flow rake bar screen having the construction set out

in the opening paragraph of the present specification, in which the rake is track guided, and in which the drive means are arranged above the screen and the rake extends downwardly from the drive means.

The curvature of the bars increases their strength to resist the forces to which they are subjected in storm conditions, and also provides voids or pockets at the ends of the curves where the debris or screenings can be accommodated until the storm conditions subside. The curvature on the bars also increases the effective area of the screen.

Preferably, the cross-section of each bar is a rectangle, but other cross-sections are possible such as square sections, truncated triangular sections, or even round sections.

The bars may be so formed as to have a tapering cross-section, in which case the tapering is preferably in an intended downward direction, although it may be in an intended upward direction. Either way, such a construction reduces the likelihood of jamming of the rakes and also reduces the amount of friction between the rakes and the bars. Wire is readily available which has such features.

If the bars have a tapered cross-section, the extent to which they will wear the rakes can be reduced by having the corners where the side faces of each bar meet its top surface, rounded. It is preferable to have the upper corners rounded if the cross-section of the bar is

rectangular or square.

The rakes may each be provided with flat blades which extend between the bars.

The blades may be tapered in an intended downward direction.

Preferably, the blades have rounded lowermost ends.

Each bar may have at least two curves spaced apart longitudinally of the bar with voids or open spaces or pockets provided at the ends of the curves.

Each bar may be curved everywhere along its length.

Instead, each bar may have a straight portion between two curved portions of the bar. The progress between a curved portion and the straight portion may be without discontinuity, so that there is a smooth transition from a straight portion to a curved portion. The curved portions may be at the respective ends of the bar.

In another construction of bar, it may be curved in a central portion thereof, with its end portions being straight.

The present invention extends to a sewage system overflow installation comprising an up-flow rake bar screen assembly in accordance with the present invention.

The present invention also extends to a method of filtering sewage during storm overflow conditions in which the sewage is passed through an up-flow rake bar screen comprising a multiplicity of bars which are parallel to one another and which are spaced from one

another across the screen, at least portions of the bars being curved so that those portions are convex to the approaching sewage, and moving a rake having a multiplicity of blades which extend between the bars of the screen so that the blades move to and fro longitudinally of the bars, in which the rake is guided by track, and in that the rake is moved by drive means arranged above the screen and the rake extends downwardly from the drive means.

An example of an up-flow rake bar screen assembly made in accordance with the present invention is illustrated in the accompanying drawings, in which:

Figure 1 shows a plan view of the screen assembly;

Figure 2 shows a side view of the rake bar screen assembly shown in Figure 1;

Figure 3 shows an end view of the rake bar screen assembly shown in Figures 1 and 2;

Figure 4 shows on a larger scale component parts of the screen assembly shown in Figures 1 to 3;

Figure 5 shows on a larger scale a cross-sectional view of one of the bars of the screen assembly shown in Figures 1 to 3;

Figure 6 shows on a smaller scale an end view of a sewage system overflow installation including a screen assembly as shown in Figures 1 to 3; and

Figure 7 shows a plan view of the installation

shown in Figure 6.

The up-flow rake bar screen 10 shown in Figures 1 to 3 comprises a generally rectangular frame 12, across which, parallel to the longer sides, extends a multiplicity of bars 14 which are all parallel to one another and uniformly spaced apart in the direction of the shorter sides of the frame 12. Also mounted on the frame 10 are drive means 16 and two rakes 18 and 20 guided by tracks and interconnected by a strut. Each rake 18 and 20 is provided with a multiplicity of blades 22 and 24 spaced apart in a direction parallel to the shorter lengths of the frame 12, with one blade for each space between the bars 14. The drive means 16 is arranged to move the rakes 18 and 20, and with them the blades 22 and 24 to and fro longitudinally of the bars 14.

Each bar 14 is formed with two successive arcuate portions 26 and 28 spaced apart along its length. Each arcuate portion 26 or 28 is curved so as to be convex as viewed from a position at which, when the screen is in use, fluid has not yet passed through the screen. The centre portions of the bars, between their respective arcuate portions, are supported by a central strut 30 of the frame 12.

It will thereby be seen that voids or pockets 32 are defined at positions between and at the outer ends of the arcuate portions 26 and 28.

Each bar 14 comprises a strip of bar having a

rectangular, square, round or wedge-shaped cross-section, as shown in Figure 5. Thus the section of each bar 14 may comprise an inverted truncated triangle, with an upper horizontal boundary 24a, two side boundaries 24b and 24c which extend downwardly from the upper boundary 24a and converge towards a lower horizontal boundary 24d. The corners 24e between the upper boundary 24a and the side boundaries 24b and 24c are rounded, to reduce friction between the bars 14 and the rakes 18 and 20. It would also be preferable for the corresponding corners to be rounded in the case of rectangular or square sectioned bar.

The manner in which a screen, as shown in Figures 1 to 3, may be installed is shown in Figures 6 and 7. In these Figures, there are shown a main sewer pipe 40, a storm overflow pipe 42, and a storm overflow chamber 44. The sewer 40 is connected to opposite ends of the chamber 44, at the bottom of that chamber. A passageway for the sewage as it passes through the chamber 44 is provided at the bottom thereof by a channel 46. Extending parallel to this channel and to one side thereof is a storm overflow weir 48, which extends generally parallel to the channel 46.

Along the bottom of the chamber 44 and generally parallel to the weir 48, on the side thereof opposite to that of the channel 46 is a further channel 50 which communicates with the storm overflow pipe 42.

A screen 10 as shown in Figures 1 to 3 is secured to

that side of the weir 48 on which channel 46 extends. The screen 10 is held in place by means of brackets or other fastenings (not shown), and is oriented so that the bars 14 run generally horizontally and generally parallel to the channels 46 and 50.

Vertically extending side plates 52, 54, 56, 58 and 60 extend upwardly from the weir 48 and around the sides of the frame 12.

When the installation shown in Figures 6 and 7 is in use, under normal conditions sewage flows through the sewer 40 including the channel 46 where it flows through the chamber 44. In the event of storm conditions, so that the sewage level rises, its level may ultimately rise above the top of the weir 48. In these conditions, there is an upward component of the flow through the screen 10 between the bars 14 and then a sideways flow out and over the weir 48 into the channel 50 and away through the sewage storm overflow pipe 42. Whilst this occurs, the drive means 16 operate to move the blades 22 and 24 to and fro longitudinally of the bars 14. In doing this, the blades 22 and 24 shift the debris or screenings which are trapped between the bars 14 into the pockets 32.

The convex curvature of each bar, as viewed from a position at which fluid has not yet passed through the screen, strengthens the bar against the forces exerted on it by the storm flow.

When the storm subsides, and the level of water in

the chamber 44 drops, the debris or screenings are then free to fall away from the pockets 32 and ultimately be carried along the channel 46 and out in the sewer.

During this process, it will be appreciated that the side wall of the weir 48, and the opposite side wall of the chamber 44 effectively define a shaft for the up-flow of sewage from the channel 46 to the top of the weir 48.

Numerous variations , and modifications to the illustrated screen assembly and installation may occur to the reader without taking the resulting construction outside the scope of the present invention. For example, the screen may be installed so that its bars 14 are perpendicular to the weir 48 rather than parallel to it. The screen may comprise only a single arcuate portion and may be provided with only one rake instead of two. Or, alternatively, each bar of the screen may have three or more arcuate portions, each provided with a respective rake.

As already stated, the convex arcuate shape of each bar 14 strengthens it against the forces of storm flow. This enables less material to be used for each bar 14 to give it the required strength, which effectively increases the total space available between bars 14 for storm flow, so as to reduce the resistance to flow by the screen 10. It also increases the effective size of the pockets 32.

Another aspect of the present invention is directed to an up-flow rake bar screen having a multiplicity of

bars which are parallel to one another and which are spaced from one another across the screen, in which the bars are each so formed as to have a tapering cross-section.

Claims:

1. An up-flow rake bar screen assembly comprising an up-flow rake bar screen (10) having a multiplicity of bars (14) which are parallel to one another and which are spaced from one another across the screen (10), together with a rake (18 or 20) having a multiplicity of blades (22 or 24) which extend between the bars (14) of the screen (10), in which the rake (18 or 20) is provided with drive means (16) to move the blades (22 or 24) to and fro longitudinally of the bars (14), in which at least a portion of each bar (14) is curved so that, when that portion is viewed from a position at which, when the screen is in use, fluid has not yet passed through the screen (10), that portion of the bar (14) is convex, **characterised in that** the rake (18 or 20) is track guided, and in that the drive means (16) are arranged above the screen (10) and the rake (18 or 20) extends downwardly from the drive means (16).

2. An up-flow rake bar screen assembly according to claim 1, **characterised in that** the bars (14) are each so formed as to have a rectangular cross-section.

3. An up-flow rake bar screen assembly according to claim 1, **characterised in that** the bars (14) are so formed as to have a tapering cross-section.

4. An up-flow rake bar screen assembly according to

claim 3, **characterised in that** the tapering is in a downward direction.

5. An up-flow rake bar screen assembly according to claim 3 or claim 4, **characterised in that** the bars (14) are made of wire.

6. An up-flow rake bar screen assembly according to any one of claims 3 to 5, **characterised in that** the cross-section of each bar (14) is a truncated triangle.

7. An up-flow rake bar screen assembly according to any one of claims 2 to 6, **characterised in that** the corners (24(e)) of each bar (14) at the upper end of its cross section are rounded.

8. An up-flow rake bar screen assembly according to any preceding claim, **characterised in that** each bar (14) has at least two curves spaced apart longitudinally of the bar (14) with voids or open spaces or pockets provided at the ends of the curves.

9. An up-flow rake bar screen assembly according to any one of claims 1 to 7, **characterised in that** each bar (14) is curved everywhere along its length.

10. An up-flow rake bar screen assembly according to any one of claims 1 to 7, **characterised in that** each bar (14) has a straight portion between two curved portions of the bar (14).

11. An up-flow rake bar screen assembly according to claim 10, **characterised in that** the progress between

a curved portion and the straight portion is without discontinuity, so that there is a smooth transition from the straight portion to each curved portion.

12. An up-flow rake bar screen assembly according to claim 10 or claim 11, **characterised in that** the curved portions are at the respective ends of the bar (14).

13. An up-flow rake bar screen assembly according to any one of claims 1 to 7, **characterised in that** each bar (14) is curved in a central portion thereof, with its end portions being straight.

14. An up-flow rake bar screen assembly according to any preceding claim, **characterised in that** the blades (22 or 24) are tapered in a downward direction.

15. An up-flow rake bar screen assembly according to any preceding claim, **characterised in that** the blades (22 or 24) have rounded lowermost ends.

16. A sewage system overflow installation comprising an assembly in accordance with any preceding claim.

17. A method of filtering sewage during storm overflow conditions in which the sewage is passed through an up-flow rake bar screen (10) comprising a multiplicity of bars (14) which are parallel to one another and which are spaced from one another across the screen (10), at least portions of the bars (14) being curved so that those portions are convex to the approaching sewage, and moving a rake (18 or 20) having a multiplicity of blades (22 or 24) which

extend between the bars (14) of the screen (10) so that the blades (22 or 24) move to and fro longitudinally of the bars (14), **characterised in that** the rake (18 or 20) is guided by track, and in that the rake (18 or 20) is moved by drive means (16) arranged above the screen (10) and the rake (18 or 20) extends downwardly from the drive means (16).

AMENDED SHEET

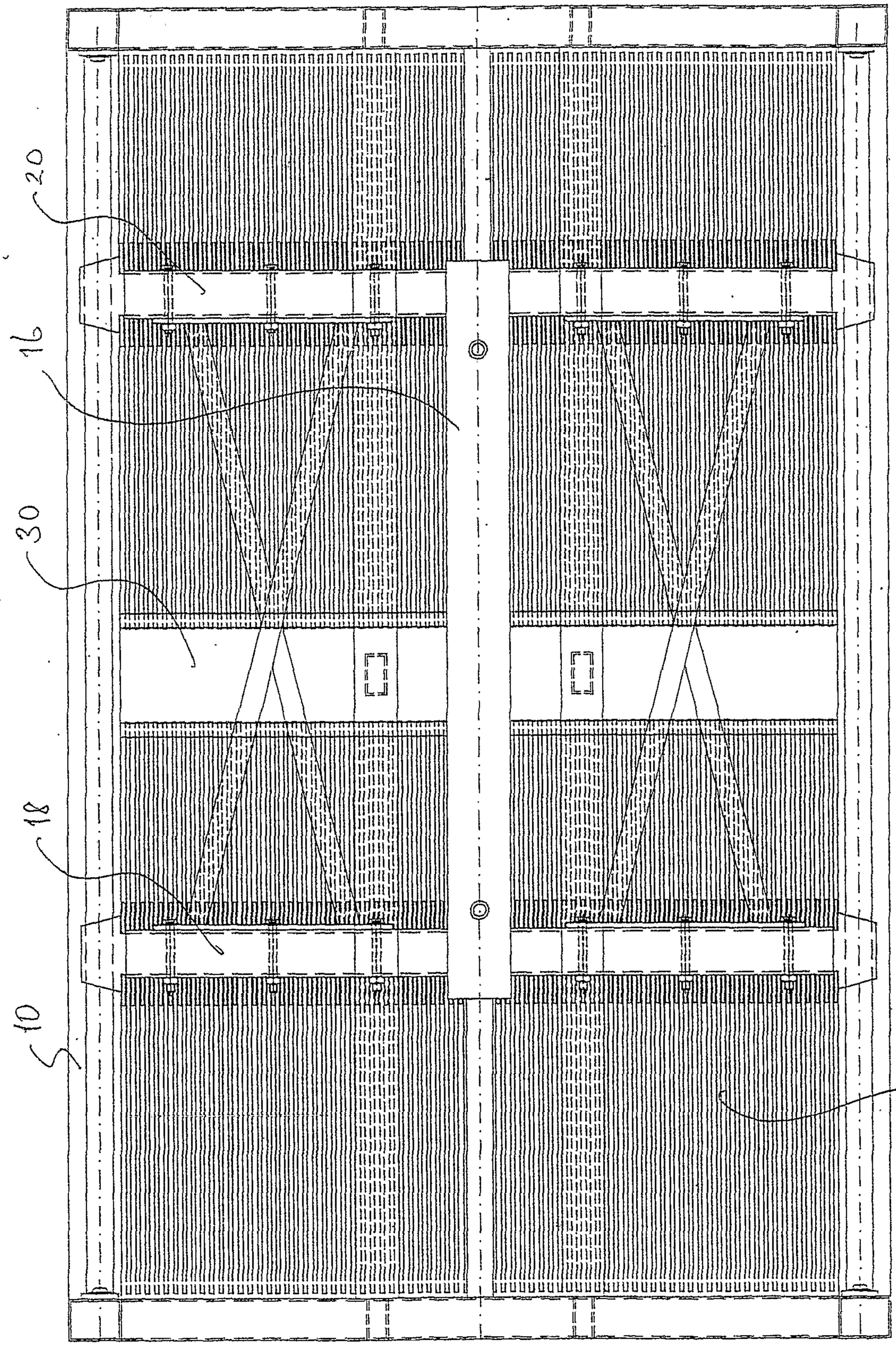
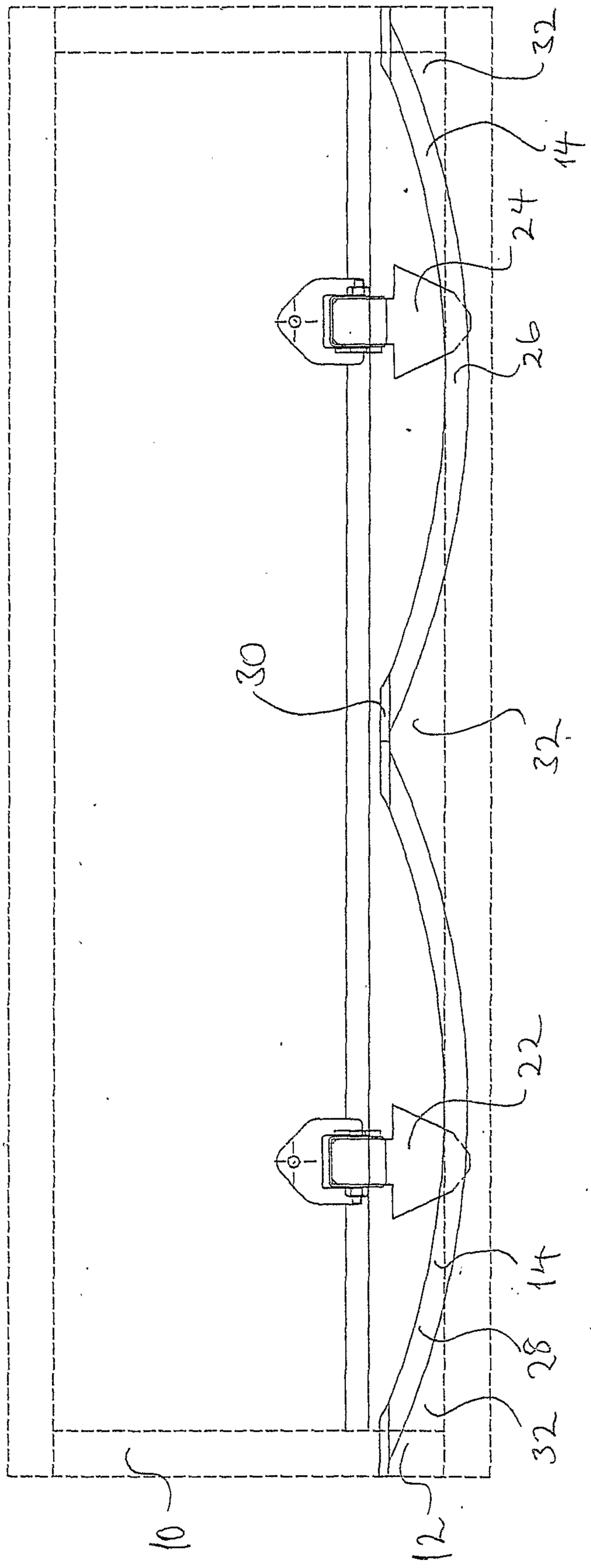


FIGURE 1 — PLAN VIEW



SECTION – FIGURE 2

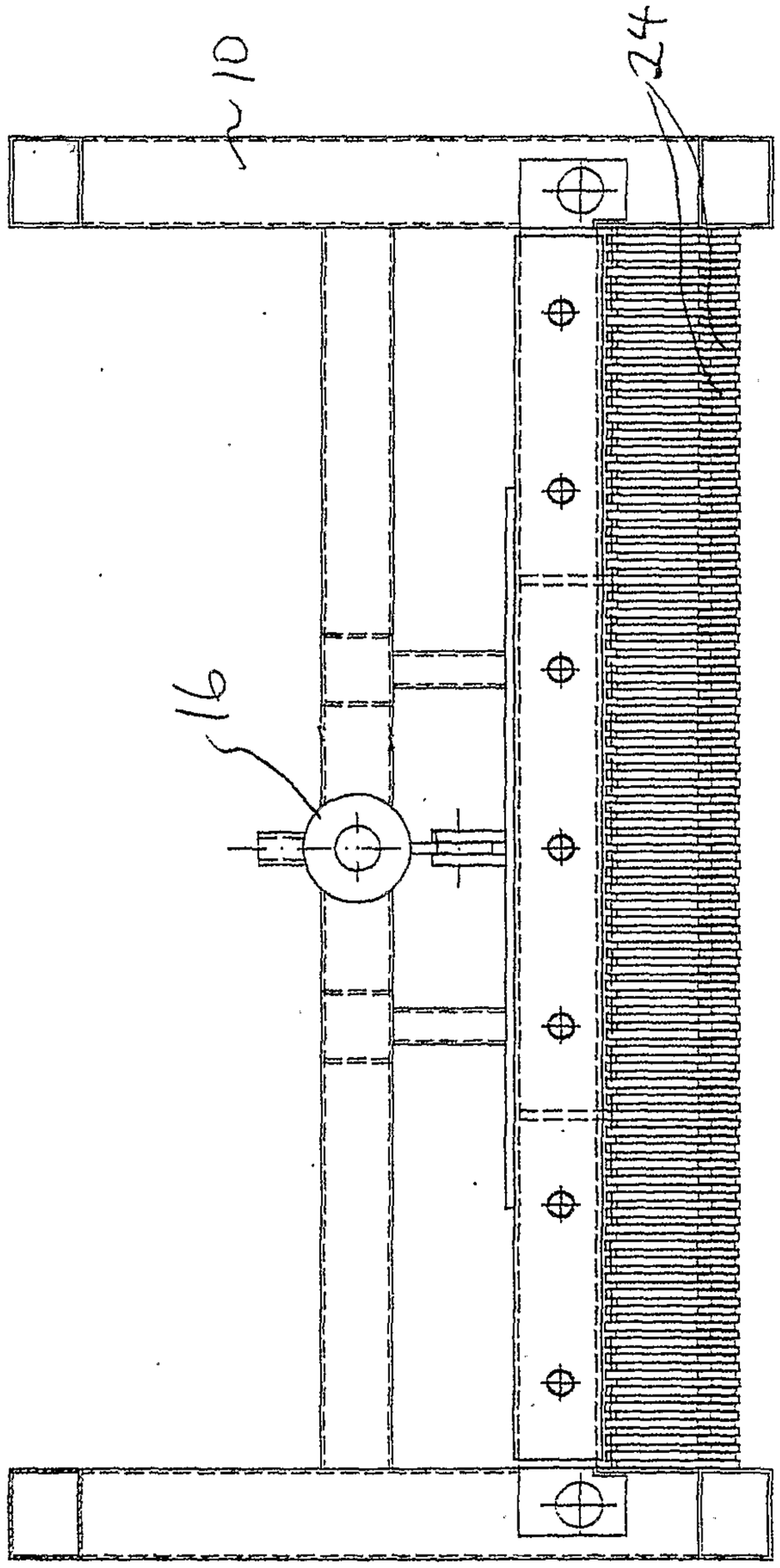


FIGURE 3 — END ELEVATION

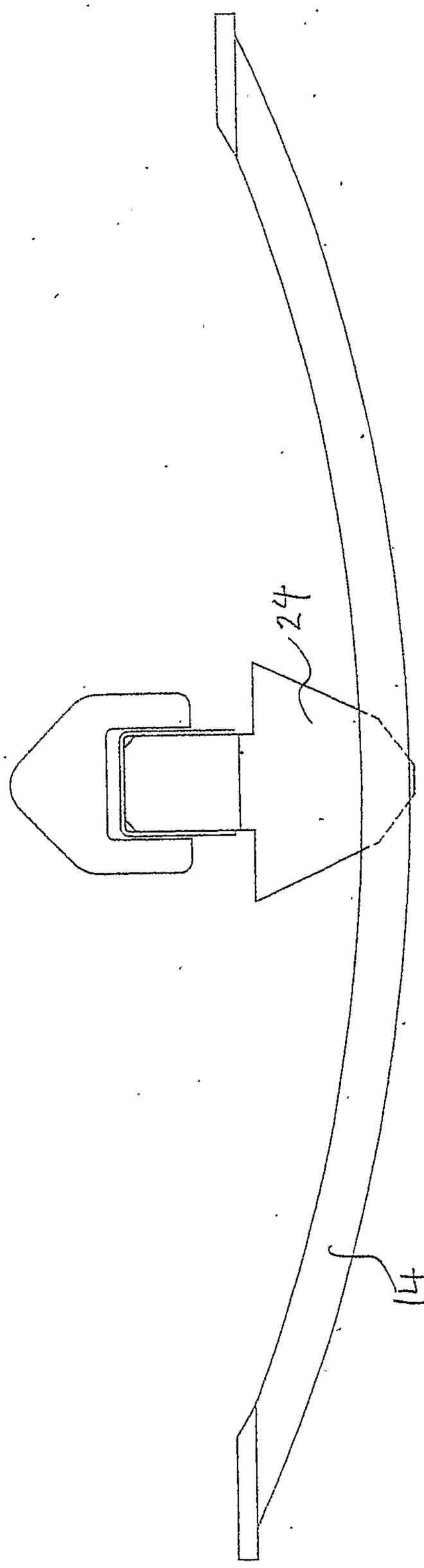
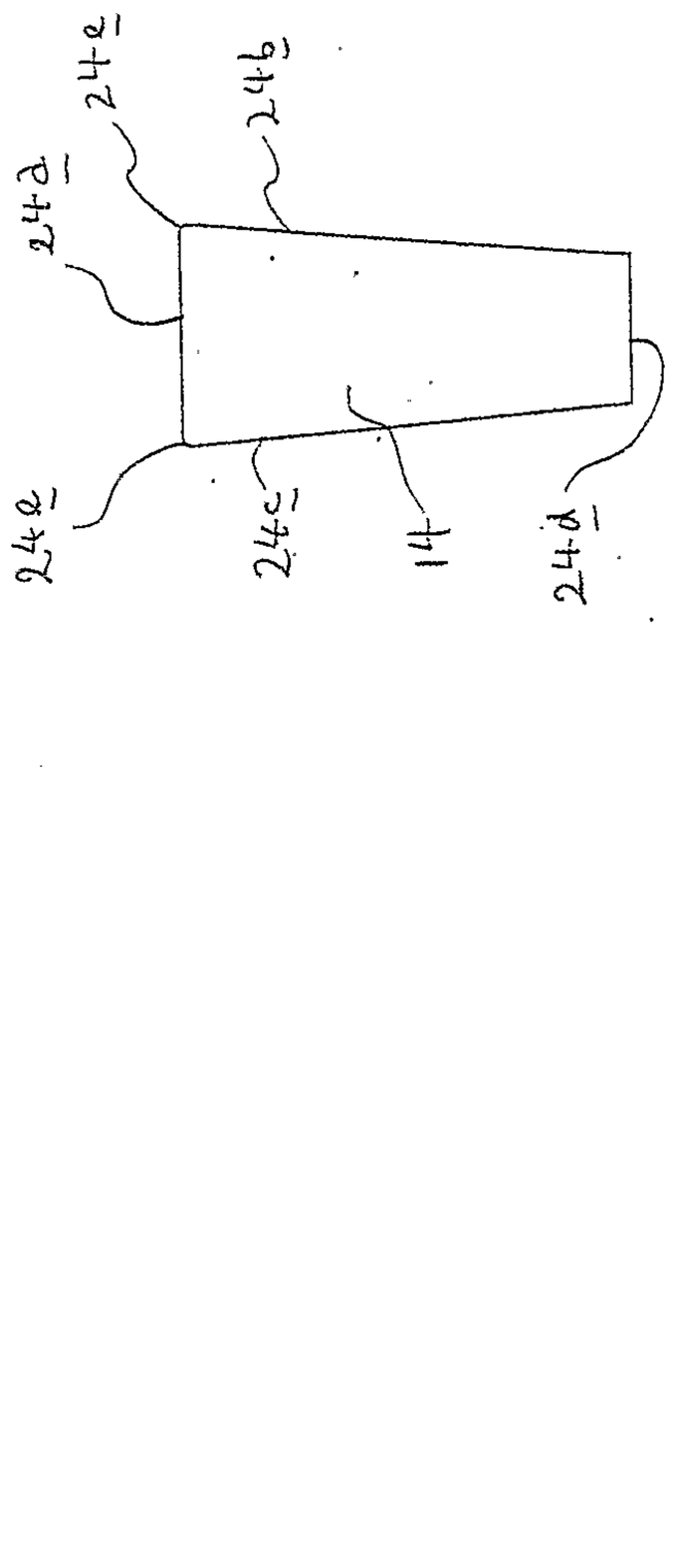


FIGURE 4



SECTION OF WEDGE WIRE — FIGURE 5

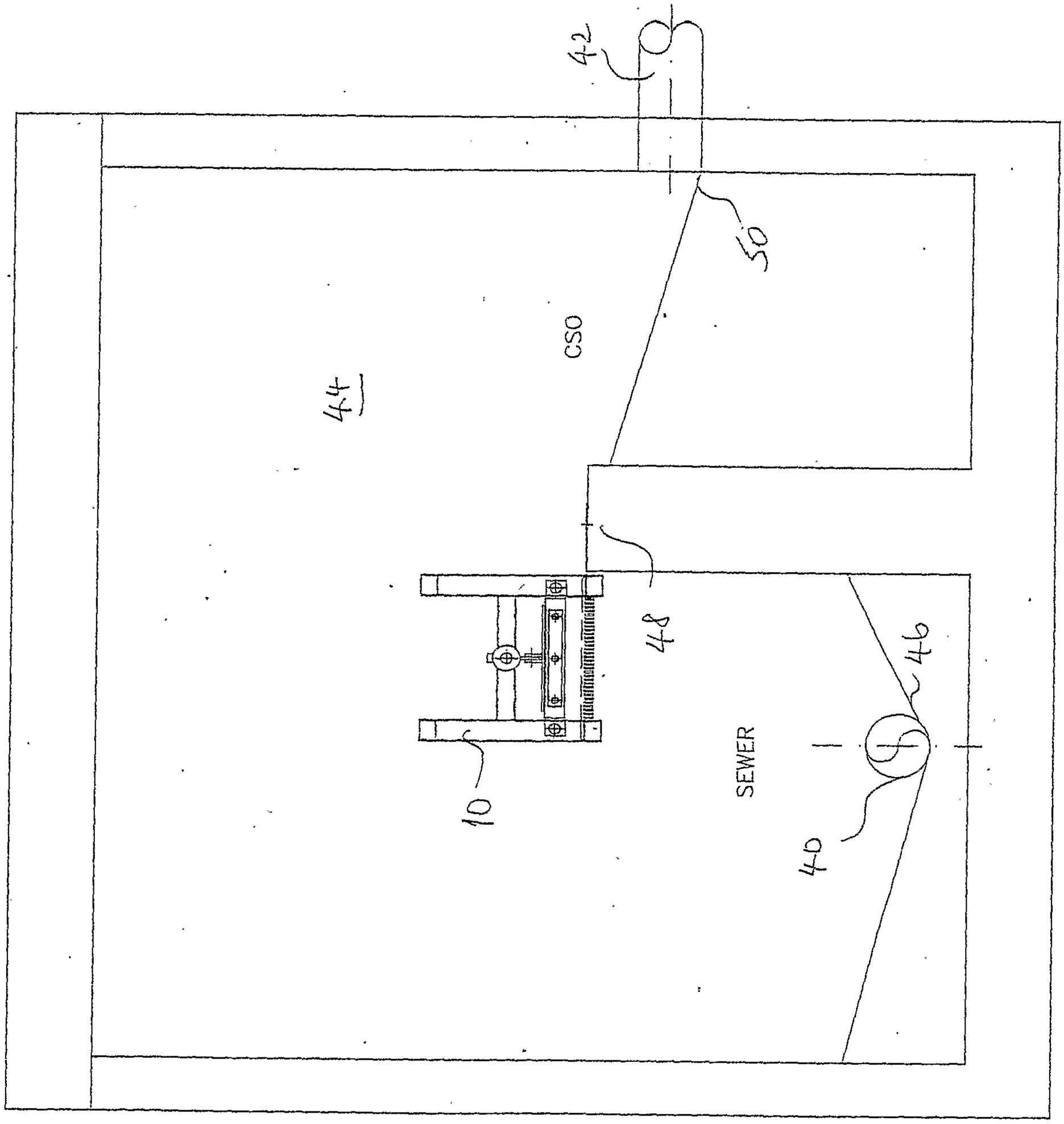


FIGURE 6

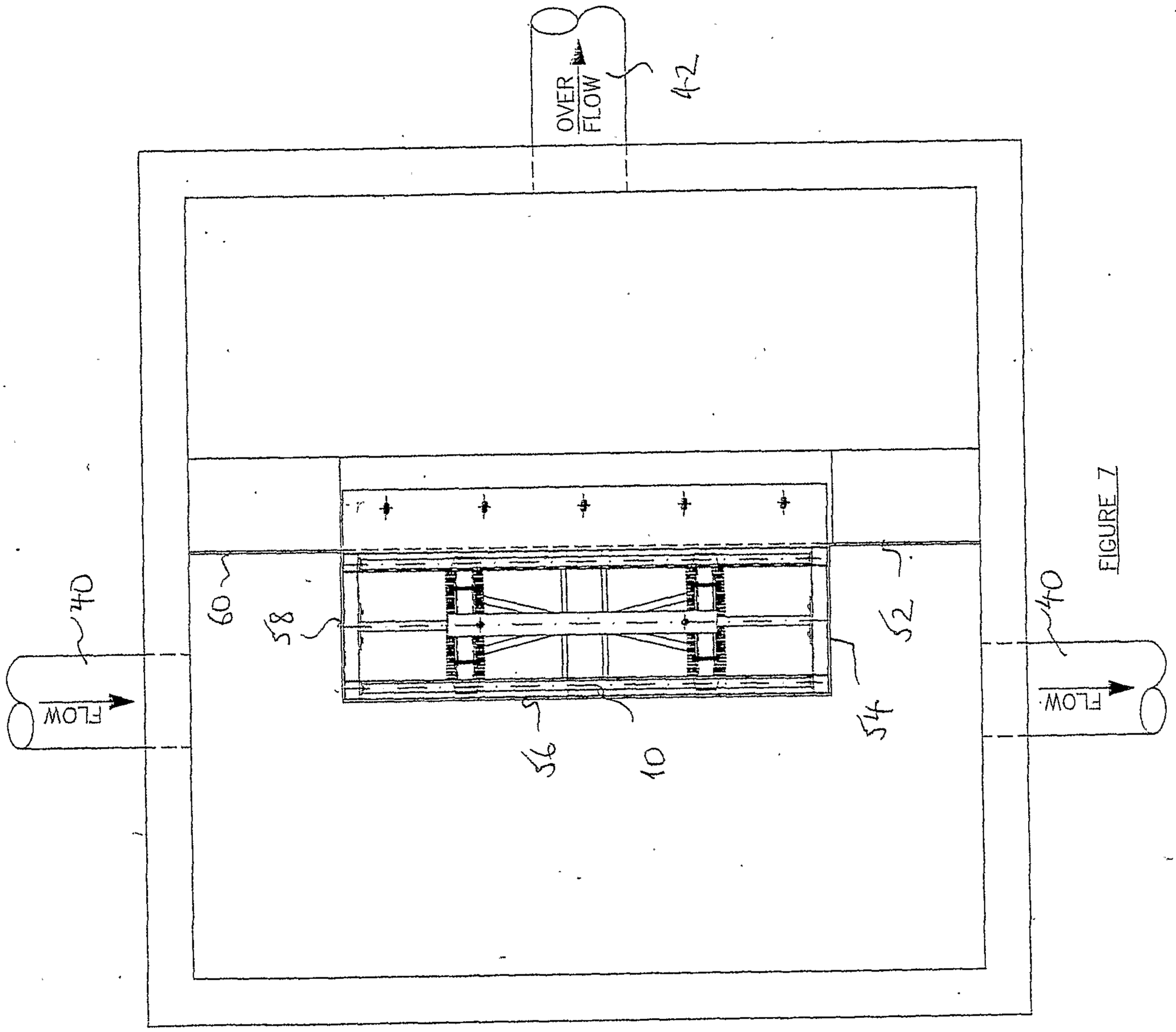
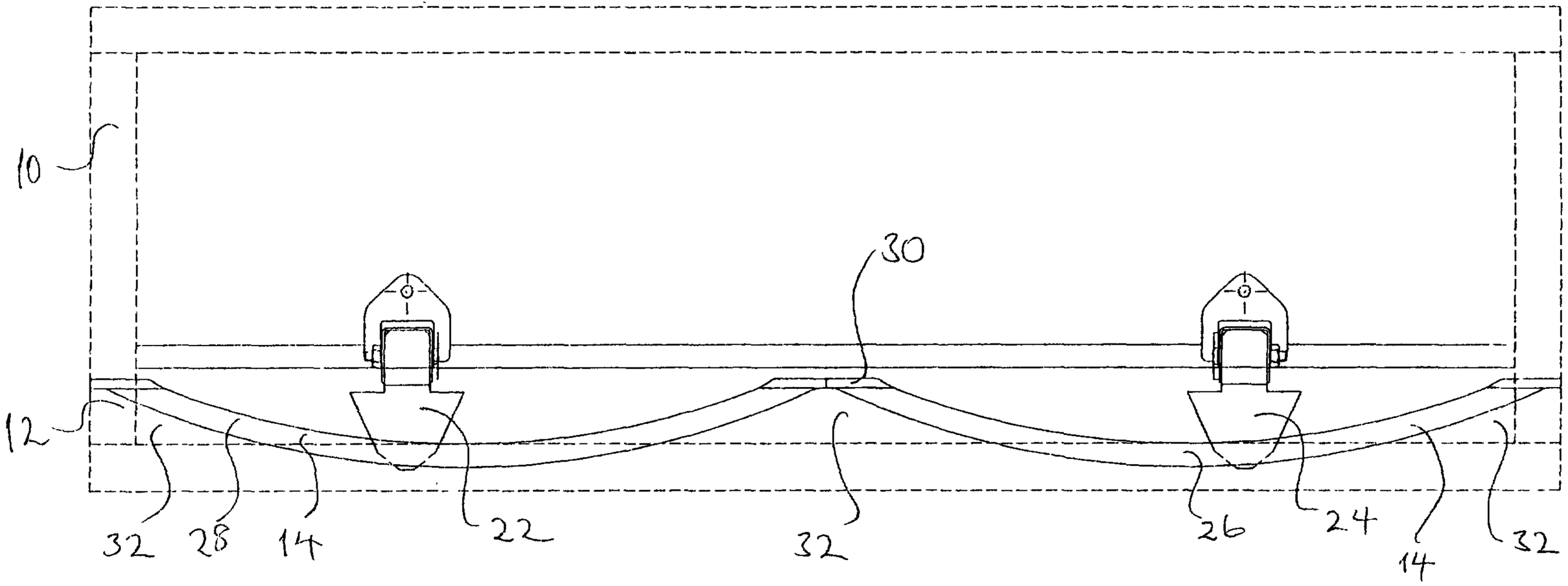


FIGURE 7



SECTION