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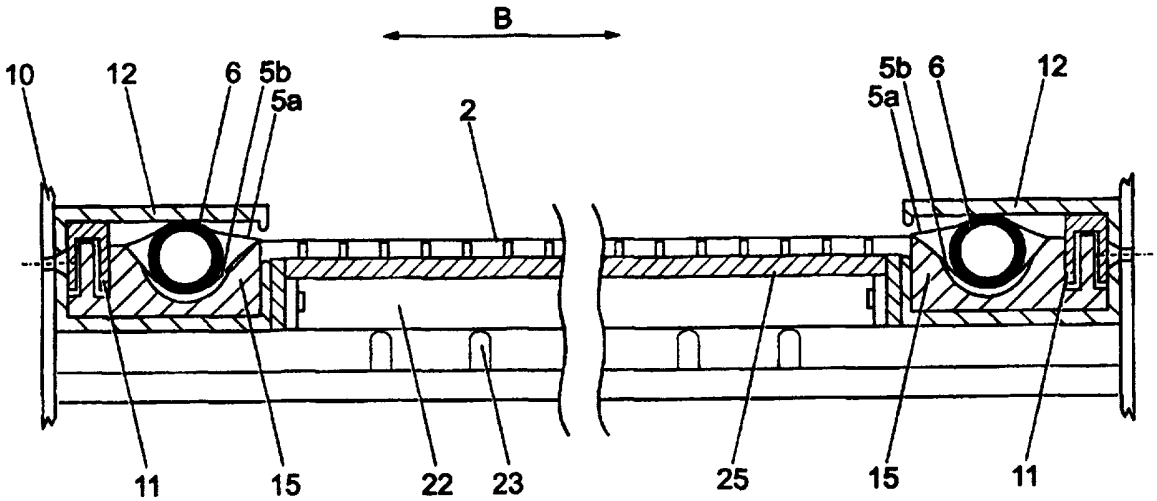
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(54) Title: APPARATUS FOR ATTACHING FILTER MEANS TO A FRAME



(57) Abstract

Apparatus for clamping filter means to a frame, particularly for filtering particles from drilling fluid recovered from oil wells. The apparatus has means to clamp the filter to a frame, and tensioning means such as a hose which expands to press the filter or a portion thereof into a groove adapted to receive the hose.

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Apparatus for attaching filter means to a frame.

This invention relates to improvements to filter screens, typically those used in the oil industry to filter particles from drilling fluid.

It is generally known that woven screens of single, double or triple meshes can be mounted within vibratory units by means of fixing hooks and/or bolts to tension the screens over cambered support frames. The frames with the screen(s) attached thereto are located on cradles disposed within a basket of the vibratory apparatus. Also, single, double or triple meshes which are pretensioned can be fixed to four-sided frames which are attached, by any suitable means, within a vibratory unit. In both instances the screens must be slid into and out of the vibratory unit's basket. It is essential to remove the screens periodically for servicing and replacement, and the efficiency and simplicity of the clamping and tensioning is important in minimizing down times.

Frames formed of an inflatable material are also known to clamp and apply tension to the screen. However, this has the disadvantage that the tensioning and

clamping forces are often incompatible. The incompatibility can be increased in screens of double, or triple meshes and/or of differing mesh specifications and/or material dimensions), and excessive wear can result. Further disadvantages with frame-tensioned screens include weight, cost and size, and the premature failure of an existing pneumatic frame-clamping system requires the replacement of both the screen and the clamping system. Further, there is no universal screen available that can readily be adapted or fitted to the various models of vibratory unit.

According to the present invention there is provided apparatus for attaching filter means to a frame, the apparatus comprising a bladder member adapted to change the conformation of its cross-section upon ingress of fluid into the bladder member, and a groove adapted to receive the bladder member, wherein a conformational change in the bladder member moves the filter means into the groove, thereby securing the filter means to the frame.

The groove may be disposed on the frame or on the apparatus.

The conformational change of the bladder member preferably tensions the filter means in addition to securing it to the frame. The apparatus or the frame may be provided with additional clamping means to clamp the filter means to the frame.

The clamping means may likewise be disposed on the frame or on the apparatus.

The filter means may comprise one or more layers of

filter material, not all of which need be tensioned by the tensioning means.

Preferably, the apparatus is configured such that at least part of the filter means is disposed between the bladder member and the groove, and change in the conformation of the bladder member forces the filter means into the groove thereby tensioning at least said part of the filter means.

The bladder member may be provided by any member which may change conformation upon ingress of fluid into it, for example, to adopt a conformation having a generally circular cross-section. Bladder members having resilient and non-resilient walls are within the scope of the invention. The bladder member may be closed or open ended, for example a conduit through which the fluid flows or a tube having a closed end.

The bladder member can operate to apply force across the filter means. The direction of applied force can be lateral, and/or longitudinal. The bladder member(s) can be provided at one or more lateral edges of the filter means, eg, at opposing lateral edges, so as to apply force laterally across the filter means.

The apparatus may additionally comprise tensioning means in the form of other devices such as pneumatic or hydraulic rams or gas springs etc, disposed to tension the filter member in a longitudinal direction. A preferred variant of longitudinal tensioning means comprises a bladder member disposed between the attachment points of the filter means to the frame (eg between two support frames), so that it can inflate and extend at least part of the apparatus along its longitudinal axis.

The filter means can incorporate resilient areas (eg around the edges).

The filter means is preferably stretched longitudinally before being stretched laterally.

While further modifications and improvements may be made without departing from the scope of this invention, the following description is of one or more examples of the invention, with reference to the accompanying drawings, in which:

Fig. 1 shows a plan view of a single mesh screen;
Fig. 2 shows an end view of clamping apparatus according to the invention;
Fig. 3 shows an end view of further clamping apparatus;
Fig. 4 shows two cradles of a shale shaker adapted with an embodiment of the invention;
Fig. 5 shows a hose support groove of the Fig. 2 and 3 apparatus;
Fig. 6 shows a plan view (a) and a side view (b) of a support frame of the Fig. 4 cradle; and
Fig. 7 shows a piston assembly holding a cradle in place in the Fig 2 and 3 apparatus.

Referring now to the drawings, Fig. 1 shows a screen 1 for use in the apparatus shown in Figs. 3, 4 and 5. The screen 1 comprises a woven stainless steel mesh 2, although the mesh can be of other material, for example plastics or other metals, and can be single, double or another multiple of meshes. The mesh 2 has attached at each longitudinal side a hose assembly 4 comprising a sleeve 5 surrounding a hose 6 and having a dowel 7 at its peripheral edge. The sleeve 5 is divided into an upper layer 5a and a lower layer 5b. The hose 6 is

preferably of the lay flat type assuming a flattened shape when not inflated. The hose 6 and dowel 7 are preferably of thermoplastic material.

The transverse edge of the mesh 2 can be provided with (optionally thermoplastic) hooks 8 which are bonded or otherwise attached to the mesh 2.

The screen 1 can be fitted to existing cradles 10, 20, 40 by providing hose support grooves 15 (Fig. 5) at the longitudinal edges of the cradles 10, 20, 40. The hose support grooves 15 each comprise moulded (eg PVC) strips (see Fig. 4) having a shoulder 16 and a groove 17 for receiving the hose 6. When fixed in place at the longitudinal edges of the cradles 10, 20, the shoulder 16 defines a pair of wells 18a and b of approximately equal width and depth.

A wedge wire frame 25 spans the breadth of the cradle 10, 20 between the two grooves 15, and supports the mesh 2. The screen 1 is stretched over the breadth of the assembled cradle and grooves and the dowels 7 are inserted into the outermost wells 18a on the support grooves 15. A clip 11 having a general C-shaped cross section is then pushed over the shoulder 16 and the two arms of the clip 11 extend into the wells 18a and 18b, pushing the dowel 7 into well 18a, and the sleeve at 5b in to the well 18b, thereby applying tension to the mesh 2 across the breadth of the cradle 10, 20 in the direction of arrow B in Figs. 2, 3. The clip 11 is fixed at a suitable height by lips 12 or guide rails 22 so that the mesh 2 is subject to some tension, and the hoses 6 are located in the grooves 17 of the hose support grooves 50.

When the screen 1 is suitably positioned in the cradle

10, 20, and the hoses 6 are deflated, the two faces of the sleeve 5a, b, will be lying substantially close to one another, and the hose 6 will be substantially flat. Further, there will be a space between the deflated hose 6 and the face of the groove 17. Upon inflation of the hose, faces 5a and b of the sleeve 5 will be pushed apart by the laterally expanding hose 6; face 5a will be pushed up against the lip 12 (or guide rail 22) whereas face 5b will be pushed down into the groove 17. The diameter of the hose 6 and/or the depth of the groove 17 can be chosen to press the faces 5a, b against the respective boundaries to a greater or lesser extent, depending on the tension required.

Therefore, by inflation of the hose, the screen 1 is stretched laterally across the breadth of the cradle 10, 20 in the direction of arrow 13 in Fig. 2, 3, and at the same time is clamped in position by the same force of the hose 6 against the faces 5a, b and groove 17 and lip 12/guide rail 22.

The screen 1 can be fitted to existing models of square or rectangular vibratory units in conventional shale shakers. For example, the existing clamping on conventional shale shakers can be removed and guide rails/lips and hose support grooves 15 can be fitted. Indeed, one embodiment of the invention comprises a conversion kit for conventional shale shakers comprising one or more screens and means to attach the screen to the shaker and to tension the screen across the shaker, for example by means of the wells 18, groove 17 and lip 12/guide rail 22. All of the materials can be formed with plastics or metal, preferably ferrous metals such as stainless steel. The conversion kit may also comprise screen cradles to fit the shale shakers.

An optional variation to the support frame 25 comprises a frame 26 made up of two sections a and b (Fig. 6). 26a and b are movable in the direction of arrow A in Fig. 6 which, in use, is parallel to the long axis of the hose assembly 4, and perpendicular to arrow B in Figs. 2 and 3. Arrow A is also marked in Fig. 1.

Hooks 8 on the screen 1 can be attached to nose plates 27 at the transverse edges of the frame 26 so that the screen 1 is fixed at each end. Sections 26a and b are split at 28 and have two spaced-apart arms 28 a, b extending perpendicularly from the plane of the frame 26 and below its upper surface. The split 28 can be at any point on the frame 26, but is preferably at one end; notably, in the embodiment of Fig. 4 at opposing ends of each frame 26. One of the arms 28a located on 26a has a leg which extends towards arm 28b, thereby defining a channel between arms 28a and b and the leg. A hose 3 is located in the channel between arms 28a and b, and upon inflation, it forces the arms a and b apart, thereby sliding portions 26a and b further apart in the direction indicated by arrow A, and tensioning the screen 1 attached to the frame 26 in the same direction. The hose 3 can optionally be inflated from the same air supply as hose 5, or can be inflated from an entirely separate air supply.

The cradles can be flat 40f or wedge-shaped 40w, and a multiple of the same or different cradles 40f/w can be used in tandem, according to the design of shale shaker required.

Each cradle 10, 20, 40 can be fitted with an air line running longitudinally along it, and each hose assembly 4 can be provided with a stem connector in communication with the air line, to which the hoses 6

are connected at cartridges 6a on end blocks 6b.

The or each rear cradle 10, 20, 40 can be provided with connectors for the ring main, and the rear ends of both front cradles can have co-operating stem connectors such that when the cradles are fully inserted in to the vibratory units basket, the front and rear ring main air lines are linked, and by connecting the left hand front cradle inner air line to the right hand inner air line, the ring main is primed for connection to the main air supply.

The screen 1 can be loaded onto a vibratory unit by removing the cradles 10, 20, 40, and securing the screen 1 over the support frame 25/26 with hooks 8 attached to nose plates 27. The frame 25/26 and screen 1 are then located on the cradle 10, 20, 40 the hose assembly 4 located in the hose support grooves 15 and anchor dowels 7 located in wells 18 as previously described.

Inflation of the hose 4 then clamps the screen 1 and tensions it in direction B as previously described. The screen 1 is preferably tensioned in direction A before being tensioned in direction B, but this can be reversed, or tension can be applied in both directions at the same time.

Disconnection of the apparatus air supply unclamps the screen and relieves the tension to allow withdrawal of the cradles from the basket and removal of the screen from the support frame 26.

In the embodiment shown in Fig. 2, a transverse framework 22 is used to support the frame 26, and in turn is supported by the existing camber

bars 23 of the cradle 10.

The screen 1 is preferably earthed to a ferrous metal portion of the cradle 10, 20, 40 so as to earth any static electricity generated through operation of the vibrator unit.

The hose support grooves 15 can optionally include an air supply line 30 in a recess 31 closed by a keeper plate 32. The supply line 30 connects the main air supply to a stem connector in the rear end of the groove 17 for connection to the cartridge 6a in the end block 6b of the hose 6.

In use, the dowels 7 and sheaths 5b are pressed into wells 18 by the clip 11 as previously described, and the stem connectors are pressed into the hose end blocks 6b. The screen 1 is then stretched over the support frame 26 and the transverse hooks 8 are hooked over the nose plates 27 of the frame 26.

In the Fig. 2 embodiment, the hoses 6 are expanded to press the faces of the sleeve 5 into the groove 17 and against the lip 12. These are held pressed against the peripheries of the groove and lip so as to keep the mesh 2 in tension in direction B on top of the support frame 26.

The hose 3 can be inflated at the same time and from the same air supply as that which inflates the hoses 6, or alternatively, can be inflated from a different air supply source at a different time. In any event, inflation of the hose pushes apart the arms 28a, b and applies tension in the direction of arrow A to the screen 1.

Fig. 7 shows an optional piston assembly 45 attached to a cradle transverse bar 40t which extends, in the assembled apparatus, in the direction of arrow B at the rear end of the cradle 40. The cradle 40 abuts against the basket cross-member 50, again extending in the direction B. The piston assembly 45 has a piston 45p with a bevelled end which abuts against the corner of the basket cross-member 50, and when the piston 45p is extended, it exerts a force on the cradle 40 in the direction of arrow C, thereby securing the cradle 40 in the basket 50 and allowing for a variance in the dimensions of the basket 50 or cradle 40.

Embodiments of the invention have the advantages that the tensioning and clamping force can optionally be provided from the same air supply source. The screen 2 can also be retro-fitted to existing vibratory apparatus, optionally with the provision of hose support grooves 15.

The screen of the invention can be provided on a lighter and less bulky construction, and can additionally be rolled up for storage and transport. This is particularly beneficial for use on oil rigs, where weight and space is at a premium. The lower weight achievable by embodiments of the invention is also an advantage in view of the vibratory forces which will be applied to the apparatus when in use, thereby reducing the load on the vibratory apparatus. The screen 1 can be manufactured from synthetic plastics materials to provide rust free embodiments. In addition, the hose tensioning assembly of the screen 2 can absorb air pressure and incompatibilities from differing screen mesh sizes.

Claims:

1 Apparatus for attaching filter means to a frame, the apparatus comprising a bladder member adapted to change the conformation of its cross-section upon ingress of fluid into the bladder member, and a groove adapted to receive the bladder member, wherein a conformational change in the bladder member moves the filter means into the groove, thereby securing the filter means to the frame.

2 Apparatus as claimed in claim 1, wherein the groove is disposed on the frame.

3 Apparatus as claimed in claim 1, wherein the groove is disposed on the apparatus.

4 Apparatus as claimed in any preceding claim, wherein the conformational change of the bladder member tensions the filter means in addition to securing it to the frame.

5 Apparatus as claimed in any preceding claim, including additional clamping means to clamp the filter means to the frame.

6 Apparatus as claimed in claim 5, wherein the clamping means is disposed on the frame.

7 Apparatus as claimed in claim 5, wherein the clamping means is disposed on the apparatus.

8 Apparatus as claimed in any preceding claim, wherein the filter means comprises a single layer of filter material.

9 Apparatus as claimed in any one of claims 1-7, wherein the filter means comprises a two or more layers of filter material.

10 Apparatus as claimed claim 9, wherein not all of the two or more layers of filter material are tensioned by the apparatus.

11 Apparatus as claimed in any one of the preceding claims, wherein the apparatus is configured such that at least part of the filter means is disposed between the bladder member and the groove, and change in the conformation of the bladder member forces the filter means into the groove thereby tensioning at least said part of the filter means.

12 Apparatus as claimed in any preceding claim, wherein the bladder member has a generally circular cross-section.

13 Apparatus as claimed in any preceding claim, wherein the bladder member includes resilient walls.

14 Apparatus as claimed in any preceding claim, wherein the bladder member includes non-resilient walls.

15 Apparatus as claimed in any preceding claim, wherein the bladder member comprises a tube having a closed end.

16 Apparatus as claimed in any one of claims 1-14, wherein the bladder member comprises a conduit in a ring circuit.

17 Apparatus as claimed in any preceding claim,

wherein the bladder member(s) are provided at one or more lateral edges of the filter means.

18 Apparatus as claimed in any preceding claim, including tensioning means disposed to tension the filter member in a longitudinal direction.

19 Apparatus as claimed in claim 18, wherein the tensioning means comprises a bladder member disposed between the attachment points of the filter means to the frame.

20 Apparatus as claimed in claim 18, wherein the tensioning means comprise pneumatic or hydraulic rams or gas springs.

21 Apparatus as claimed in any preceding claim, wherein the filter means incorporates resilient areas.

22 Apparatus as claimed in any one of claims 18-21, wherein the filter means is stretched longitudinally before being stretched laterally.

23 Apparatus as claimed in claim 18 or 19, wherein the bladder members are inflated from the same source as the additional tensioning means.

24 Apparatus as claimed in claim 18 or 19, wherein the bladder members are inflated from a different source than the additional tensioning means.

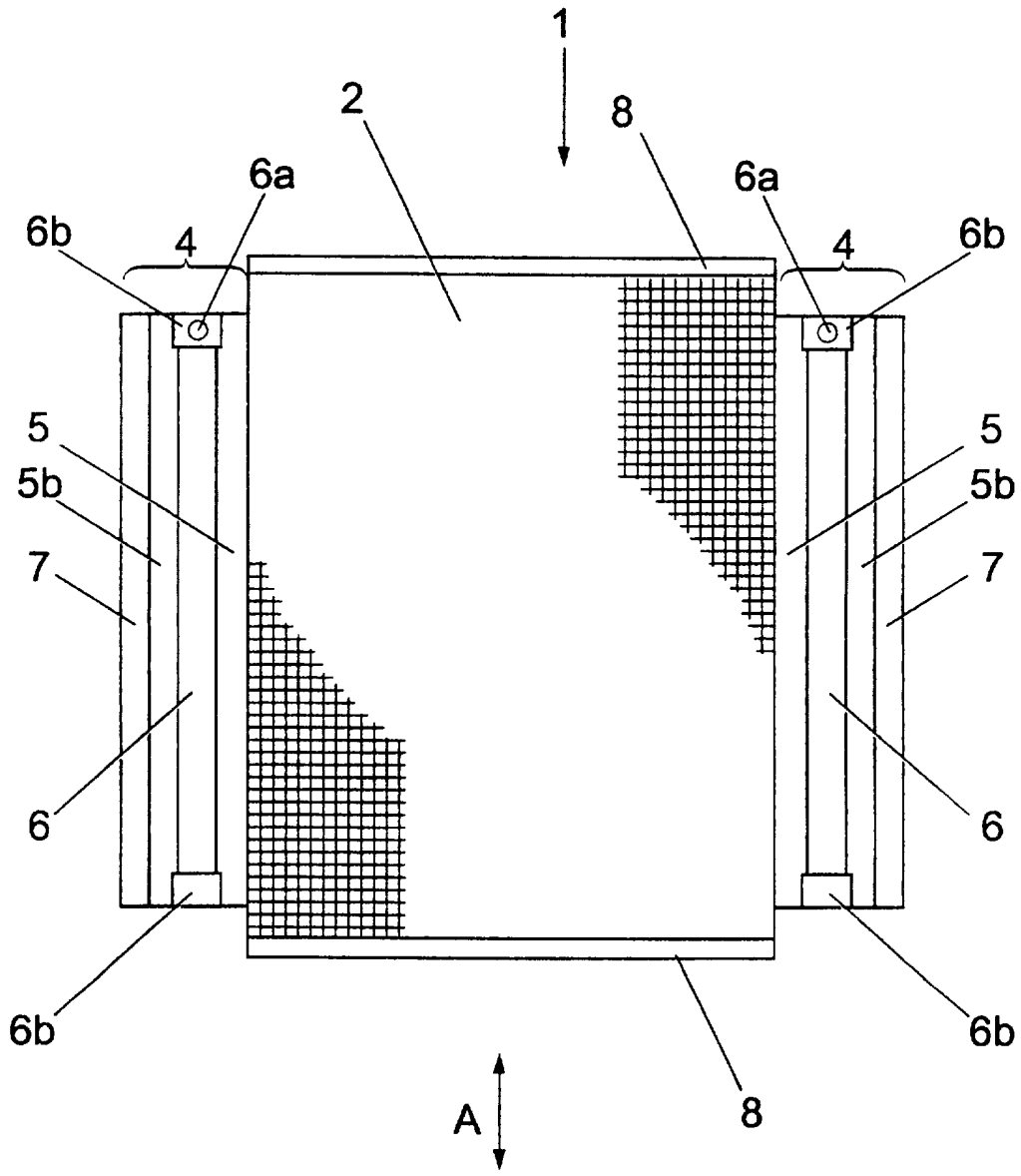


Fig. 1

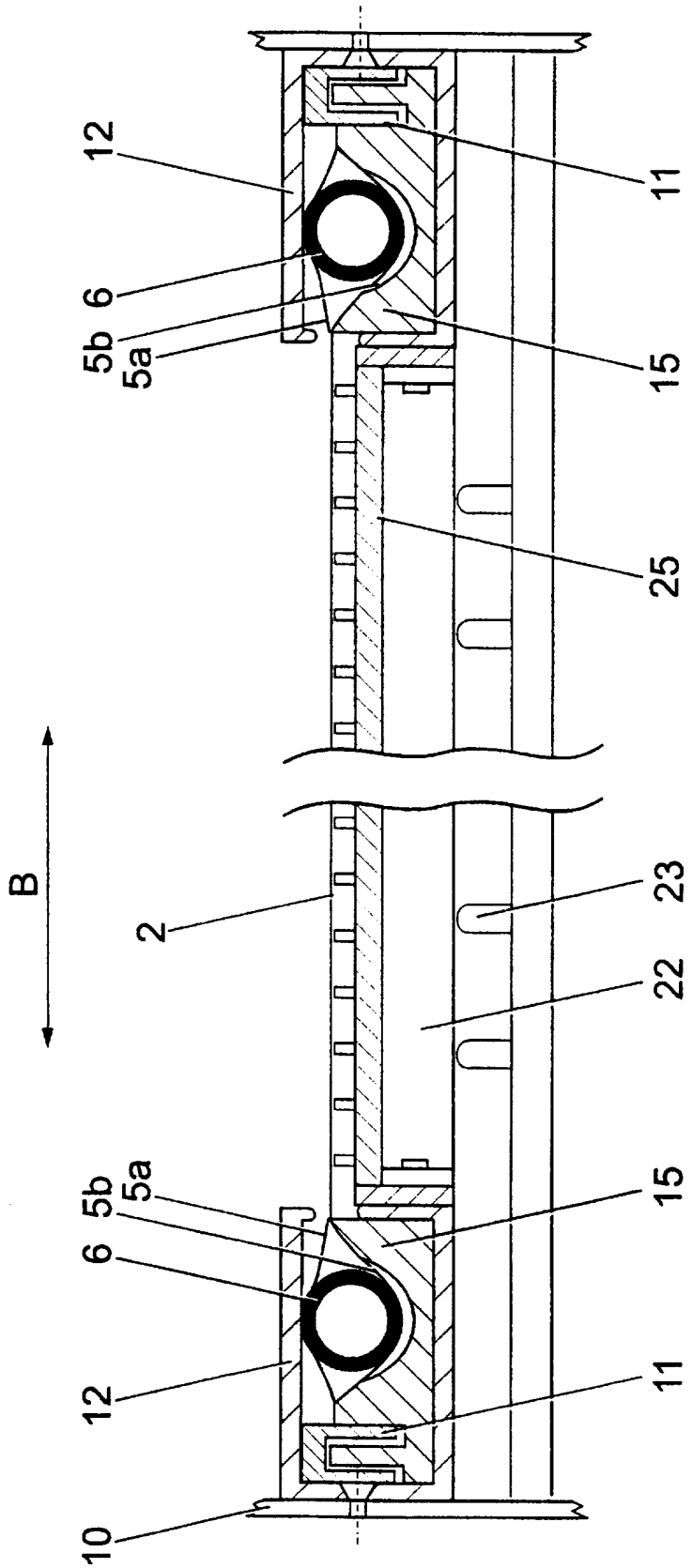


Fig. 2

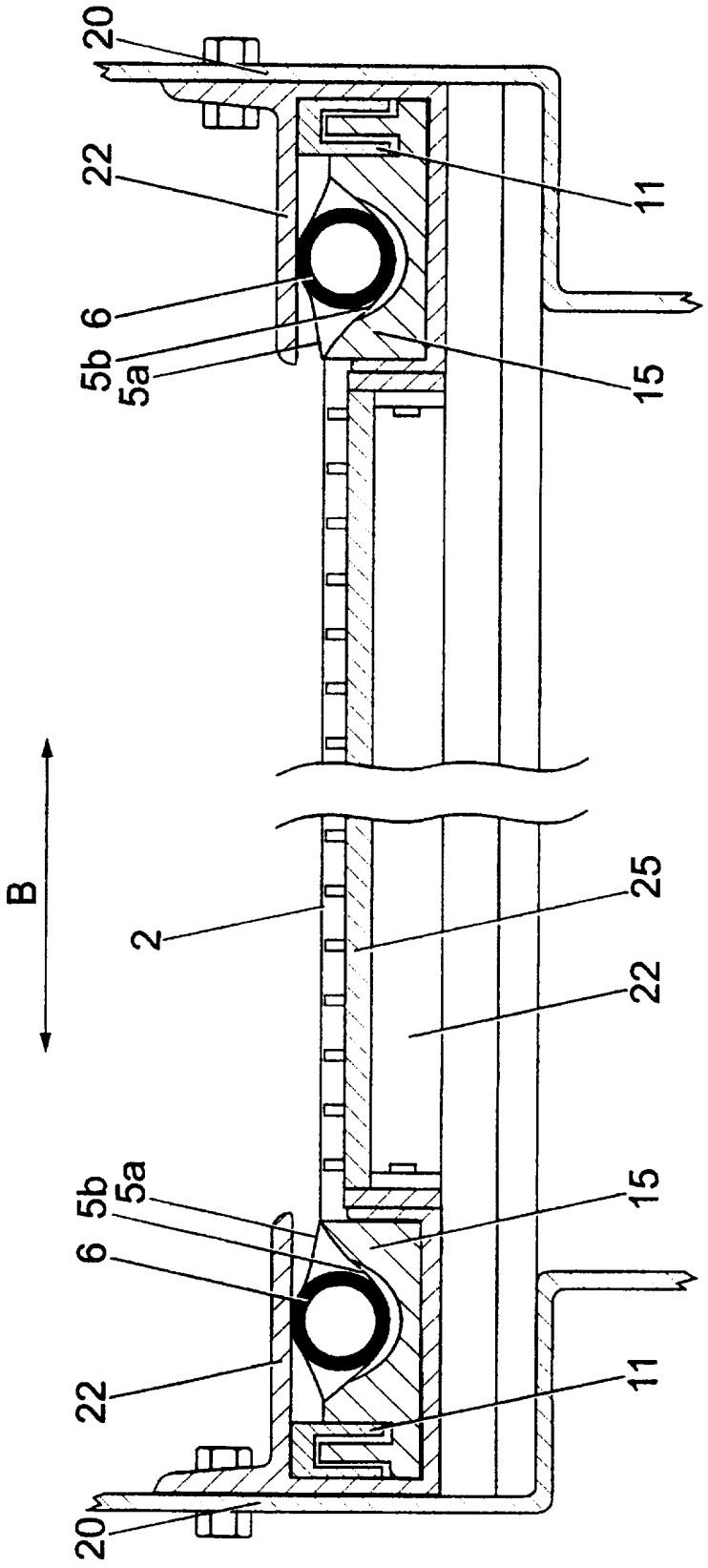


Fig. 3

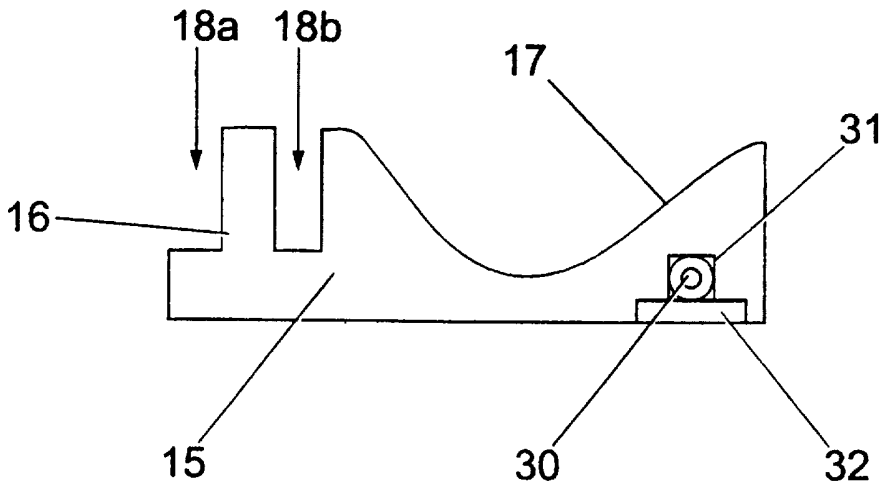


Fig. 5

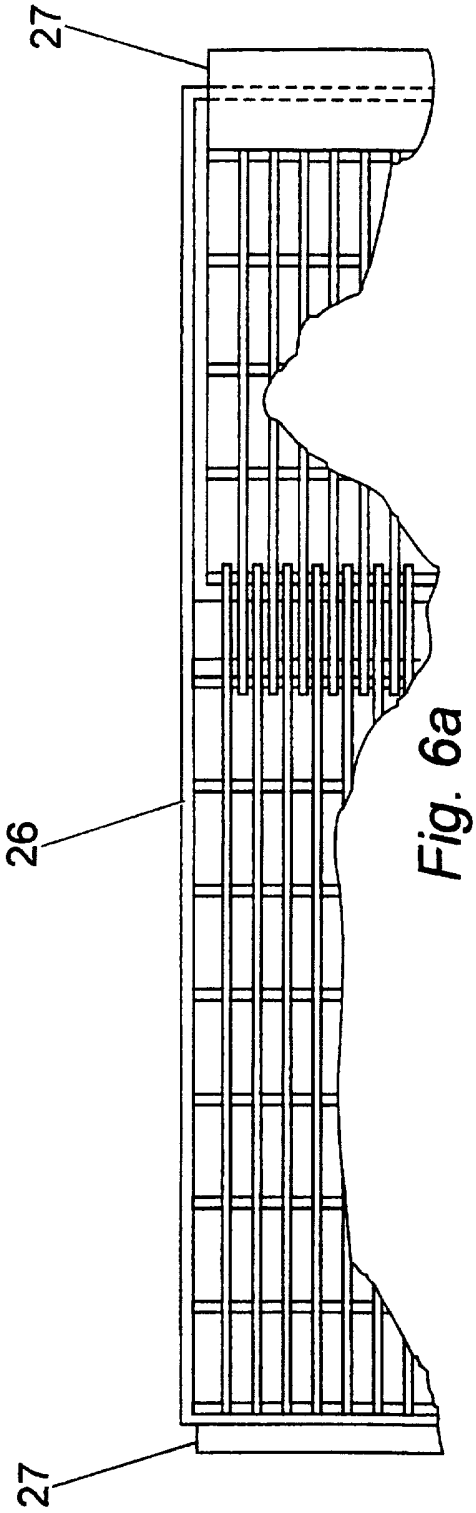


Fig. 6a

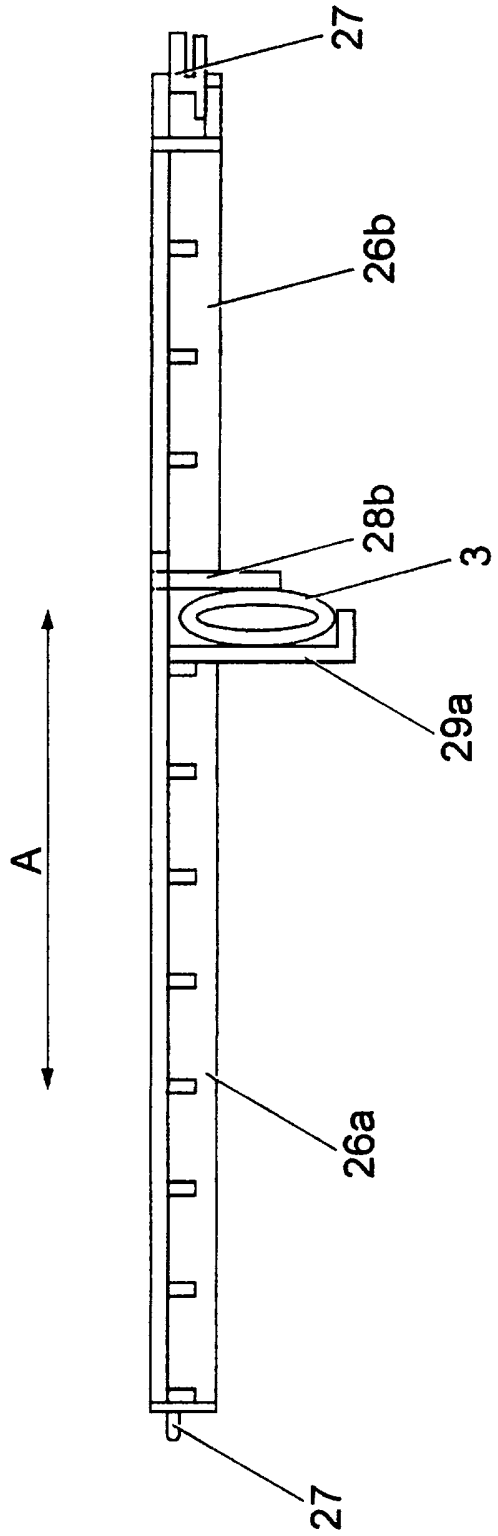


Fig. 6b

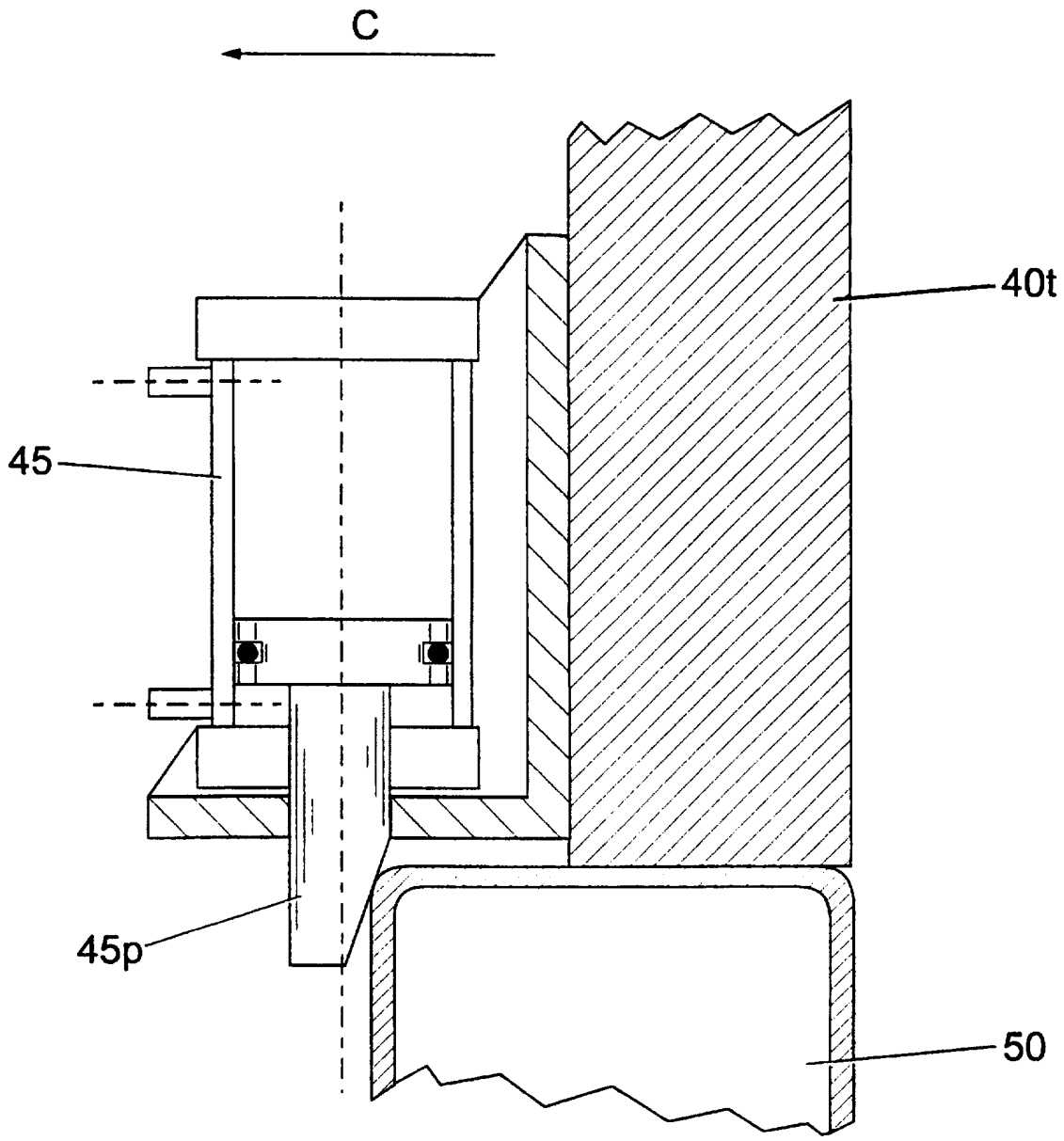


Fig. 7

INTERNATIONAL SEARCH REPORT

Intern nal Application No
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A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 B07B1/48

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 B07B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	FR 2 564 338 A (KANZAKI PAPAER MANUFACTURING CO. LTD.) 22 November 1985 see page 2, line 26 - page 3, paragraph 1 see page 3, line 28 - page 7, line 6; figures	1,2,4-8, 11,12
A	US 4 846 352 A (BAILEY) 11 July 1989 see column 3, line 1 - column 4, line 26; figures	1,11,13, 17,18

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☒ Patent family members are listed in annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
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Information on patent family members

Intern ial Application No
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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
FR 2564338 A	22-11-85	DE 3517592 A	21-11-85
US 4846352 A	11-07-89	AU 583127 B	20-04-89
		AU 5856786 A	18-12-86
		CA 1304718 A	07-07-92
		EP 0218315 A	15-04-87
		GB 2176425 A,B	31-12-86