(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
16 February 2012 (16.02.2012)

PCT

(10) International Publication Number
WO 2012/019929 A1

(51) International Patent Classification:
B07B 1/48 (2006.01)

(21) International Application Number:
PCT/EP2011/063144

(22) International Filing Date:
29 July 2011 (29.07.2011)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
1013373.4 9 August 2010 (09.08.2010) GB

(71) Applicant *(for all designated States except US)*: **CRS (NI) LIMITED** [GB/GB]; 136 Termon Road, Carrickmore, Omagh Tyrone BT79 9HW (GB).

(72) Inventors; and

(75) Inventors/Applicants *(for US only)*: **TAYLOR, Joseph** [GB/GB]; CRS (NI) Limited, 136 Termon Road, Carrickmore, Omagh Tyrone BT79 9HW (GB). **CONLON, Sean** [GB/GB]; CRS (NI) Limited, 136 Termon Road, Carrickmore, Omagh Tyrone BT79 9HW (GB).

(74) Agent: **WALLER, Stephen**; FRKelly, 4 Mount Charles, Belfast Antrim BT7 1NZ (GB).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PE, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— *with international search report (Art. 21(3))*

— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))*

(54) Title: SCREENING APPARATUS

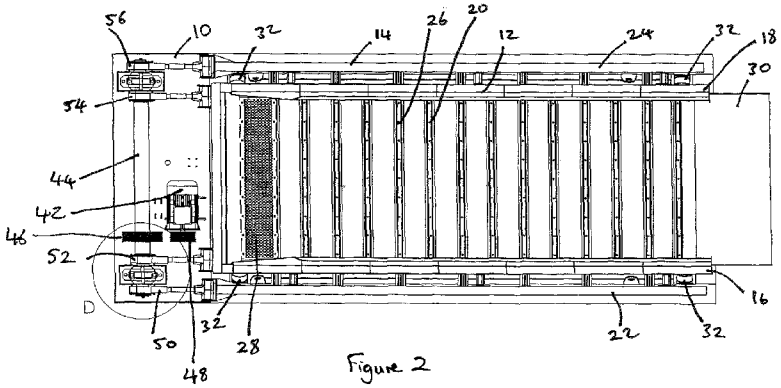

Figure 2

(57) Abstract: A screening apparatus comprising a base frame (10); a first support frame (12) comprising a pair of longitudinally extending frame members (16, 18) bridged by a plurality of mutually spaced apart first screen support members (20) extending transversely to the conveying direction of the material to be screened; a second support frame (14) having a pair of longitudinally extending frame members (22, 24) bridged by a plurality of mutually spaced apart second screen support members (26) extending transversely to the conveying direction of the material to be screened; said first and second support frames (12, 14) being arranged such that said plurality of first screen support members (20) are interposed in alternating relationship between said plurality of second screen support members (26); a flexible screen (28) being carried by said plurality of first and second screen support members (20, 26), said screen having apertures of predetermined size to allow particles smaller than said predetermined size to pass therethough whereby particles larger than said predetermined size are retained on the screen for screening material placed on the screen; a drive means (42, 44, 50, 52, 54, 56) being provided for imparting a substantially linear reciprocating motion to the first support frame with respect to the second support frame to effect relative movement between said first and second screen support members (20, 26), whereby adjacent pairs of said first and second screen support members alternately approach each other and recede from each other in such a way that the screen (28) between them is alternatively flexed and stretched to produce stationary waves.

WO 2012/019929 A1

Screening Apparatus

This invention relates to a screening apparatus for screening, grading and/or sorting granular and/or particulate material.

It is known to provide a screening apparatus comprising a frame and a flexible screen attached at intervals to parallel screen supports which are mechanically driven so that adjacent supports alternately approach each other and recede from each other in such a way that the screen between them is alternatively flexed and stretched to produce stationary waves.

Screening machines of this kind are known from US 4,600,506 and US 2,980,254. The formation of stationary waves by the alternate flexing and stretching of the screen at various positions applies very high accelerations to the material being screened, assisting in separating the material and allowing particles below a certain size to pass through the screen. This effect is particularly marked when the screen vibrates locally between a strongly convex shape and a moderately convex or substantially flat shape, that is to say between a slack or flexed state and a taut or stretched state. In this vibratory movement it is important to ensure that the openings in the screen repeatedly change shape, because this tends to prevent them from becoming clogged with the material being screened and thus helps to keep them clear. Typically the screen is mounted at an inclined angled so that material is conveyed down the screen under the action of gravity as it is agitated by the vibratory motion of the screen.

In the known screening machines this vibration of the flexible screen is obtained by mounting the screen on supports which are alternately mounted on two separate frame systems mounted to permit linear motion with respect to each other. At least one of the frame systems is typically provided with an oscillating or eccentrically mounted mass which is driven to impart a vibratory motion to the frame system. The frame systems are typically mounted on a base frame by means of resilient mounts so that the base frame is isolated from the vibratory motion of the frame systems. Such known systems generally rely on resonance to create the desired out of phase movement between the two separate frame systems to create vibratory movement of the screen. However, variations in the mass of the two frame systems due to the application of varying loads on the screen and due to

variations in the material to be screened makes it difficult to provide the required magnitude of relative movement between the two frame systems for a wide range of materials and often results in insufficient movement of the screen to ensure reliable operation of the screening apparatus.

According to a first aspect of the present invention there is provided a screening apparatus comprising a base frame;

a first support frame comprising a pair of longitudinally extending frame members bridged by a plurality of mutually spaced apart first screen support members extending transversely to the conveying direction of the material to be screened;

a second support frame having a pair of longitudinally extending frame members bridged by a plurality of mutually spaced apart second screen support members extending transversely to the conveying direction of the material to be screened;

said first and second support frames being arranged such that said plurality of first screen support members are interposed in alternating relationship between said plurality of second screen support members;

a flexible screen being carried by said plurality of first and second screen support members, said screen having apertures of predetermined size to allow particles smaller than said predetermined size to pass therethough whereby particles larger than said predetermined size are retained on the screen for screening material placed on the screen;

a drive means being provided for imparting a substantially linear reciprocating motion to the first support frame with respect to the second support frame to effect relative movement between said first and second screen support members, whereby adjacent pairs of said first and second screen support members alternately approach each other and recede from each other in such a way that the screen between them is alternatively flexed and stretched to produce stationary waves, wherein the drive means is coupled between the base frame and the first support frame to impart substantially linear reciprocating motion to the first support frame with respect to the base frame.

In one embodiment the second support frame may be coupled to the base frame to be fixed with respect to the base frame.

In an alternative embodiment the second support frame may be coupled to the base frame by means of a drive means to impart substantially linear reciprocating motion to the second

support frame with respect to the base frame. Preferably said drive means is arranged and/or controlled such that the motion of the second support frame is out of phase with the motion of the first support frame. A single drive means may be provided for imparting motion to both said first and second support frames. Alternatively a separate drive means may be provided for imparting motion to each of the first and second support frames.

The frame members of the first support frame may be arranged to lie between the frame members of the second support frame. The first support frame may be mounted on the base frame and the second support frame may be mounted on the first support frame. In one embodiment the second support frame is suspended from the first support frame via a plurality of elongate hanger members to allow relative movement between the first and second support frames in the normal conveying direction of the material to be screened on the flexible screen. Alternatively both the first and second support frames may be directly mounted on the base frame.

In one embodiment said drive means comprises a rotatably driven shaft having at least one eccentrically arranged bearing surface upon which is journalled a first end of a connecting rod, a second end of the connecting rod being connected to a respective one of said first and second support frames such that rotary motion of the shaft is translated into reciprocating motion of said respective support frame.

Preferably said second end of the connecting rod is connected to the respective support frame by a connection means comprising an outer polygonal member provided on one of said second end of the connecting rod and said respective support frame and an inner polygonal member provided on the other of the second end of the connecting rod and the respective support frame, said inner polygonal member being located within the outer polygonal member, said inner member being angularly offset with respect to the outer member to define a plurality of chambers between the walls of the inner and outer members, one or more resilient members, such as elastomeric blocks, preferably rubber blocks, being provided in said plurality of chambers, wherein said resilient members are placed under compressive strain during pivotal movement of the connecting rod with respect to a respective one of the first and second support frames to either side of a substantially central neutral position.

Preferably both of said first and second support frames are coupled to the base frame via respective connecting rod journalled on a respective eccentrically arranged bearing surface of the shaft for imparting reciprocating motion to said first and second support frames, preferably said respective bearing surfaces being angularly offset with respect to each other, preferably by 180° such that said first and second transverse members are linearly reciprocated in opposing directions.

Preferably said first support frame is mounted on the base frame via resilient mounting means permitting linear oscillating motion of said first support frame with respect to said base frame. Preferably said resilient mounting means comprise elastomeric blocks mounted between the base frame and the first support frame such that the elastomeric blocks are exposed to shear strain during said linear oscillating motion of the first support frame with respect to the base frame.

In one embodiment said second support frame is mounted on said first support frame via linkage means permitting substantially linear oscillating movement of said second support frame with respect to said first support frame. Preferably said linkage means comprise a plurality of elongate hangers extending between the longitudinally extending frame members of the first support frame and the longitudinally extending frame members of the second support frame, whereby the second support frame is supported by the first support frame.

Upper and lower ends of each elongate hanger may be pivotally connected to respective first and second support frames by connection means permitting pivotal movement about a respective axis extending transverse to the longitudinal frame members of the first and second support frames. Preferably each connection means comprises an outer polygonal member and an inner polygonal member, said inner polygonal member being located within the outer polygonal member and member being angularly offset with respect to the outer member to define a plurality of chambers between the walls of the inner and outer members, one or more resilient members, such as elastomeric blocks, preferably rubber blocks, being provided in said plurality of chambers, wherein said resilient members are placed under compressive strain during pivotal movement of the respective hanger member with respect to the first and second support frames to either side of a substantially central neutral position.

Embodiment of the present invention will now be described, by way of example only, with reference to the accompanying drawings, in which:-

Figure 1 is a side view of a screening apparatus in accordance with an embodiment of the present invention;

Figure 2 is a plan view of the screening apparatus of Figure 1;

Figure 3 is an end view of the screening apparatus of Figure 1;

Figure 4 is a detailed view of the region marked "D" in Figure 2;

Figure 5 is a further side view of the screening apparatus of Figure 1;

Figure 6 is a sectional view on line A-A of Figure 5;

Figure 7 is a detailed view of the region marked C on Figure 5;

Figure 8 is a detailed sectional view of the region marked B on Figure 6;

Figure 9 is a plan view of a screening apparatus in accordance with a further embodiment of the present invention;

Figure 10 is a sectional view of the screening apparatus of Figure 9 on line C-C;

Figure 11is a detailed view of region F of Figure 10; and

Figure 12 is a detailed view of region E of Figure10.

A screening apparatus in accordance with a first embodiment of the present invention is s illustrated in Figures 1 to 8 and comprises a base frame 10 upon which is mounted first and second screen support frames 12,14. The first support frame 12 comprises a pair of parallel longitudinally arranged side beams 16,18 bridged by a plurality of mutually spaced apart first screen support members 20 extending transversely to the normal conveying direction of the material to be screened. The second support frame 14 comprises a pair of parallel longitudinally arranged side beams 22,24 spaced to be located on either side of the first support frame 12, said side beams 22,24 being bridged by a plurality of mutually spaced apart second screen support members 26 extending transversely to the normal conveying direction of the material to be screened, wherein the first and second support frames 12,14 are mounted on the base frame 10 such that said plurality of first screen support members 20 are interposed in alternating relationship between said plurality of second screen support members 26.

A flexible screen 28 is attached to and carried by said plurality of first and second screen support members 20,26, said screen 28 having apertures of predetermined size to allow particles smaller than said predetermined size to pass therethough whereby particles larger than said predetermined size are retained on the screen for screening material placed on the screen.

A discharge shoot 30 is mounted on a downstream end of the first support frame 12 for receiving material from the screen 28.

The first support frame 12 is mounted on the base frame 10 via four rubber mounting bushes 32 respectively located adjacent each end of the each side beam 16,18 of the first support frame 12 whereby the first support frame 12 is permitted to reciprocate in a linear fashion with respect to the base frame 10, the bushes 32 being exposed to a shear strain during displacement of the first frame 12 with respect to the base frame 10 thus providing a biasing force towards a neutral central position of the first support frame 12 and absorbing the kinetic energy of the first support member 12 as it approaches its limits of movement with respect to the base frame 10.

The second support frame 14 is suspended from the first support frame 12 by means of four elongate hanger members 34 respectively located adjacent each end of the side beams 16,18,22,24 of the first and second support frames 12,14. The ends of the hanger members 34 are pivotally connected to the side beams 16,18,22,24 of the first and second support frames 12,14 by connection means permitting relative movement between the first and second support frames 12,14 in the normal conveying direction of material to be screened, parallel to the longitudinal side beams 16,18,22,24 of the support frames 12,14, such that the second support frame 14 effectively swings from the first support frame 12.

As shown in Figure 7, each connection means comprises concentrically mounted outer and inner member 36,38, each outer member being mounted on a side beam of a respective support frame 12,14 and each inner member being mounted on an end of a respective hanger member 34. Both the outer and inner members 36,38 of each connection means have a square cross section and said inner member 38 being located within the outer member 36 and member being angularly offset with respect to the outer member by 45° to define a plurality of chambers between the walls of the inner and outer members 36,38, a rubber

block 40 being provided in each chamber, wherein said rubber blocks are placed under compressive strain during pivotal movement of the respective hanger member 34 with respect to the first and second support frames 12,14 to either side of a substantially central neutral position during reciprocating motion of the support frames 12,14 relative to one another. Such connection means are similar to those used in simple trailer and caravan suspension arms and provide a reliable, robust and hard wearing pivot function while providing a resilient biasing action and good shock absorption.

A drive motor 42 is mounted on the base frame 10, preferably at a first end of the base frame 10 comprising an upstream end of the screening device in relation to the normal direction of travel of the material to be screened. An elongate shaft 44 is rotatably mounted on said first end of the base frame 10 to extend transversely across the width of the base frame 10, a drive belt (not shown) extending between respective pulleys 46,48 respectively mounted on the drive motor 42 and shaft 44 whereby the drive motor 42 can be driven to rotate the shaft 44.

A pair of spaced apart eccentrically arranged bearing surfaces are provided at each end of the shaft 44 upon which are journalled respective connecting rods 50,52,54,56 via suitable bearings. An inner pair of connecting rods 52,54 are connected to respective side beams 16,18 of the first support frame 12 while an outer pair of connecting rods 50,56 are connected to respective side beams 22,24 of the second support frame 14. The bearing faces associated with the outer pair of connecting rods 50,56, are offset from those of the inner pair of connecting rods 52,54 other by 180° so that the first and second frame 12,14 are moved in reciprocating manner with respect to the base frame 10 in opposite directions as the shaft 44 is rotated, causing the first and second screen support members 20,26 to move relative to one another so that adjacent pairs of first and second screen support members 20,26 alternately approach each other and recede from each other in such a way that the screen 28 between them is alternatively flexed and stretched to produce stationary waves.

Each connecting rod 50,52,54,56 is connected to a respective one of the first and second support frames 12,14 by a resilient connection means 58 similar to those used to connect the hanger members 34 to the first and second support frames 12,14. Each connection means 58 includes concentrically mounted inner and outer members defining chamber therebetween containing rubber blocks whereby the rubber blocks are placed under compressive strain

during pivotal movement of the respective connecting rod 50,52,54,56 with respect to the first and second support frames 12,14 to either side of a substantially central neutral position during rotation of the shaft 44.

The rubber bushes 32 act to absorb the forces applied to the base frame 10 by the first support frame 12 due to the acceleration and deceleration of the first support frame 12 under the action of the connecting rods 42,44 while the rubber blocks of the connection means of each hanger member absorb the forces applied to the first and second frame members by the connecting rods and bias the frame members towards a central neutral position.

In use, the base frame 10 is mounted at a suitable inclined angle with the discharge chute 30 lowermost and positioned so that material to be screened is delivered onto an upstream end of the screen 28. Rotation of the shaft 44 causes the connecting rods 50,52,54,56 to drive the first and second support frames 12,14 backwards and forwards with respect to one another, causing adjacent first and second screen support members 20,26 to alternately approach each other and recede from each other in such a way that the screen 28 between them is alternatively flexed and stretched to produce stationary waves.

The rubber bushes 32 and resilient connection means of the hanger members 34 and connecting rods 50,52,54,56 act as shock absorbers, reducing the vibrations transmitted to the base frame 10 and preventing excessive loading on the components of the screening apparatus.

A screening apparatus in accordance with a further embodiment of the present invention is illustrated in Figures 9 to 12. The screening apparatus is very similar to that of the first embodiment, comprising a base frame 10 upon which is mounted first and second screen support frames 12,14. The screening apparatus of the second embodiment differs from the first embodiment in that it includes two vertically stacked flexible screens comprising an upper screen 28A and a lower screen 28B. The upper screen 28A is provided with apertures of a first predetermined size to allow particles smaller than said first predetermined size to pass therethrough, while larger particles are retained on the upper screen 28A, while the lower screen 28B is provided with apertures of a second predetermined size, smaller than said first predetermined size, to allow particles smaller than said second predetermined size to pass therethrough. As such, the stacked upper and lower screens 28A,28B provided a

three stage separating process, larger particles being retained on the upper screen 28A to be collected from an upper discharge chute 30A, intermediate particles being retained on the lower screen 28B to be collected from a lower discharge chute 30B and the remaining smallest particles being collected below the second screen 28B.

The first support frame 12 comprises a pair of parallel longitudinally arranged side beams 16,18 bridged by upper and lower rows of mutually spaced apart first screen support members 20A,20B extending transversely to the normal conveying direction of the material to be screened. The second support frame 14 comprises a pair of parallel longitudinally arranged side beams 22,24 spaced to be located on either side of the first support frame 12, said side beams 22,24 being bridged by upper and lower rows of mutually spaced apart second screen support members 26A,26B extending transversely to the normal conveying direction of the material to be screened, wherein the first and second support frames 12,14 are mounted on the base frame 10 such that each of the upper and lower rows of first screen support members 20A,20B are interposed in alternating relationship between respective upper and lower rows of second screen support members 26A,26B.

The upper screen 28A is attached to and carried by said upper rows of first and second screen support members 20A,28A while the lower screen 28B is attached to and carried by said lower rows of first and second screen support members 20B,28B.

The screening apparatus of the second embodiment operates in the same way as that of the first embodiment, an electric drive motor 42 being mounted on the base frame 10 coupled to the support frames 12,14 to impart reciprocating motion to the support frames 12,14 relative to one another to produce stationary waves on each of the upper and lower flexible screens 28A,28B.

The invention is not limited to the embodiment(s) described herein but can be amended or modified without departing from the scope of the present invention.

Claims

1. A screening apparatus comprising a base frame;
a first support frame comprising a pair of longitudinally extending frame members bridged by a plurality of mutually spaced apart first screen support members extending transversely to the conveying direction of the material to be screened;
a second support frame having a pair of longitudinally extending frame members bridged by a plurality of mutually spaced apart second screen support members extending transversely to the conveying direction of the material to be screened;
said first and second support frames being arranged such that said plurality of first screen support members are interposed in alternating relationship between said plurality of second screen support members;
a flexible screen being carried by said plurality of first and second screen support members, said screen having apertures of predetermined size to allow particles smaller than said predetermined size to pass therethough whereby particles larger than said predetermined size are retained on the screen for screening material placed on the screen;
a drive means being provided for imparting a substantially linear reciprocating motion to the first support frame with respect to the second support frame to effect relative movement between said first and second screen support members, whereby adjacent pairs of said first and second screen support members alternately approach each other and recede from each other in such a way that the screen between them is alternatively flexed and stretched to produce stationary waves, wherein the drive means is coupled between the base frame and the first support frame to impart substantially linear reciprocating motion to the first support frame with respect to the base frame.

2. An apparatus as claimed in claim 1, wherein the second support frame is coupled to the base frame to be fixed with respect to the base frame.

3. An apparatus as claimed in claim 1, wherein the second support frame is coupled to the base frame by means of a drive means to impart substantially linear reciprocating motion to the second support frame with respect to the base frame.

4. An apparatus as claimed in claim 3, wherein said drive means is arranged and/or controlled such that the motion of the second support frame is out of phase with the motion of the first support frame.

5. An apparatus as claimed in claim 4, wherein a single drive means is provided for imparting motion to both said first and second support frames.

6. An apparatus as claimed in claim 4, wherein a separate drive means is provided for imparting motion to each of the first and second support frames.

7. An apparatus as claimed in any preceding claim, wherein the frame members of the first support frame are arranged to lie between the frame members of the second support frame.

8. An apparatus as claimed in any preceding claim, wherein the first support frame is mounted on the base frame and the second support frame is mounted on the first support frame.

9. An apparatus as claimed in claim 8, wherein the second support frame is suspended from the first support frame via a plurality of elongate hanger members to allow relative movement between the first and second support frames in the normal conveying direction of the material to be screened on the flexible screen.

10. An apparatus as claimed in any of claims 1 to 7, wherein both the first and second support frames are directly mounted on the base frame.

11. An apparatus as claimed in any preceding claim, wherein said drive means comprises a rotatably driven shaft having at least one eccentrically arranged bearing surface upon which is journalled a first end of a connecting rod, a second end of the connecting rod being connected to a respective one of said first and second support frames such that rotary motion of the shaft is translated into reciprocating motion of said respective support frame.

12. An apparatus as claimed in claim 11, wherein said second end of the connecting rod is connected to the respective support frame by a connection means comprising an outer

polygonal member provided on one of said second end of the connecting rod and said respective support frame and an inner polygonal member provided on the other of the second end of the connecting rod and the respective support frame, said inner polygonal member being located within the outer polygonal member, said inner member being angularly offset with respect to the outer member to define a plurality of chambers between the walls of the inner and outer members, one or more resilient members, such as elastomeric blocks, preferably rubber blocks, being provided in said plurality of chambers, wherein said resilient members are placed under compressive strain during pivotal movement of the connecting rod with respect to a respective one of the first and second support frames to either side of a substantially central neutral position.

13. An apparatus as claimed in claim 11 or claim 12, wherein both of said first and second support frames are coupled to the base frame via respective connecting rod journalled on a respective eccentrically arranged bearing surface of the shaft for imparting reciprocating motion to said first and second support frames, preferably said respective bearing surfaces being angularly offset with respect to each other, preferably by 180° such that said first and second transverse members are linearly reciprocated in opposing directions.

14. An apparatus as claimed in any preceding claim, wherein said first support frame is mounted on the base frame via resilient mounting means permitting linear oscillating motion of said first support frame with respect to said base frame.

15. An apparatus as claimed in claim 14, wherein said resilient mounting means comprise elastomeric blocks mounted between the base frame and the first support frame such that the elastomeric blocks are exposed to shear strain during said linear oscillating motion of the first support frame with respect to the base frame.

16. An apparatus as claimed in any preceding claim, wherein said second support frame is mounted on said first support frame via linkage means permitting substantially linear oscillating movement of said second support frame with respect to said first support frame.

17. An apparatus as claimed in claim 16, wherein said linkage means comprise a plurality of elongate hangers extending between the longitudinally extending frame

members of the first support frame and the longitudinally extending frame members of the second support frame, whereby the second support frame is supported by the first support frame.

18. An apparatus as claimed in claim 17, wherein upper and lower ends of each elongate hanger are pivotally connected to respective first and second support frames by connection means permitting pivotal movement about a respective axis extending transverse to the longitudinal frame members of the first and second support frames.

19. An apparatus as claimed in claim 18, wherein each connection means comprises an outer polygonal member and an inner polygonal member, said inner polygonal member being located within the outer polygonal member and member being angularly offset with respect to the outer member to define a plurality of chambers between the walls of the inner and outer members, one or more resilient members, such as elastomeric blocks, preferably rubber blocks, being provided in said plurality of chambers, wherein said resilient members are placed under compressive strain during pivotal movement of the respective hanger member with respect to the first and second support frames to either side of a substantially central neutral position.

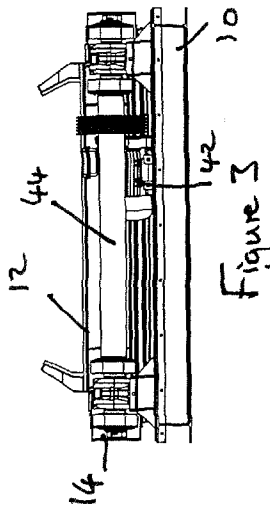

Figure 3

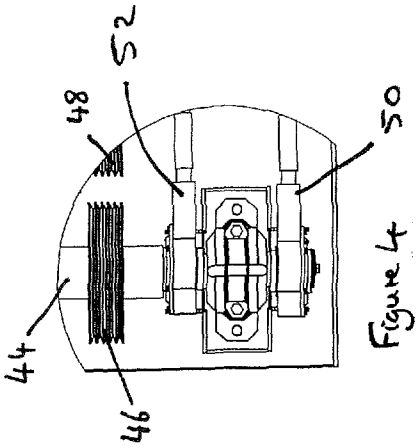

Figure 4

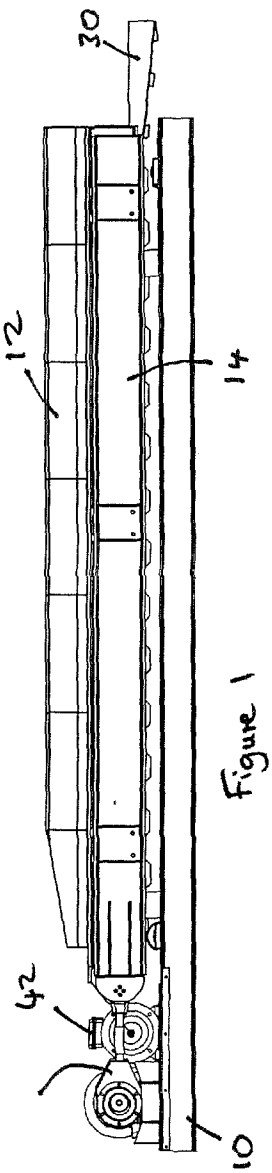

Figure 1

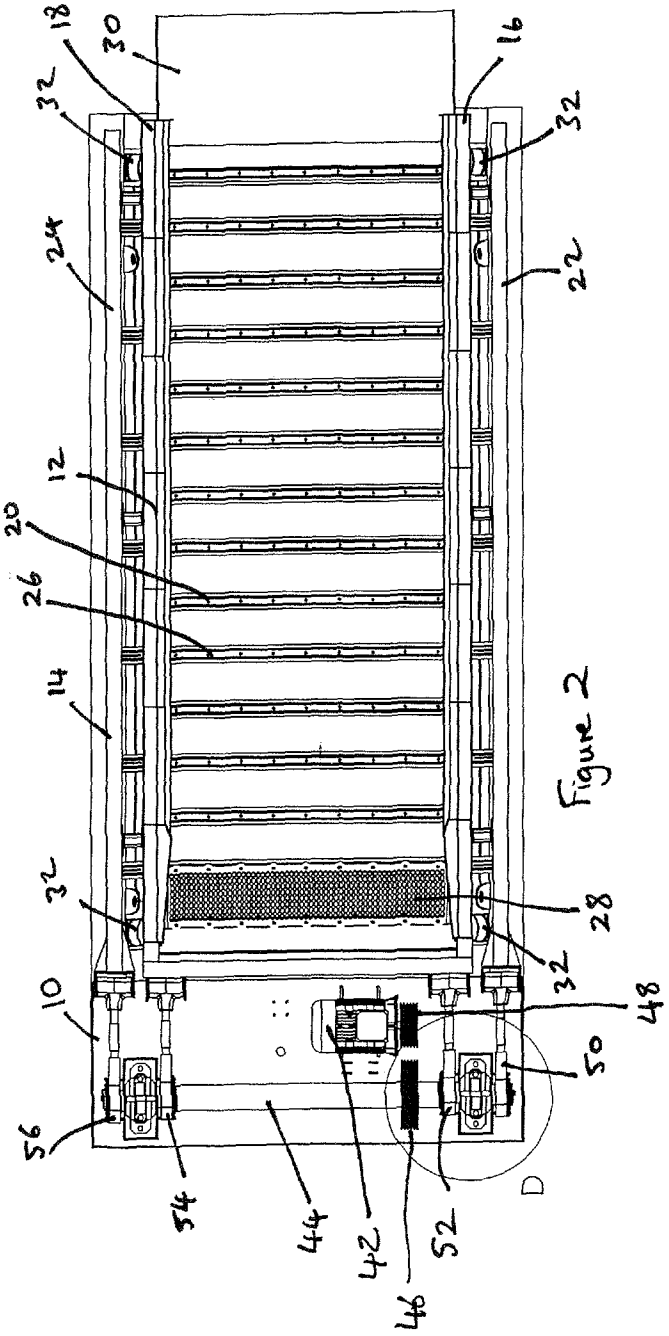

Figure 2

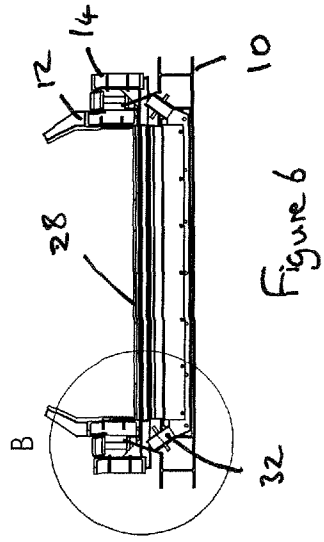

Figure 6

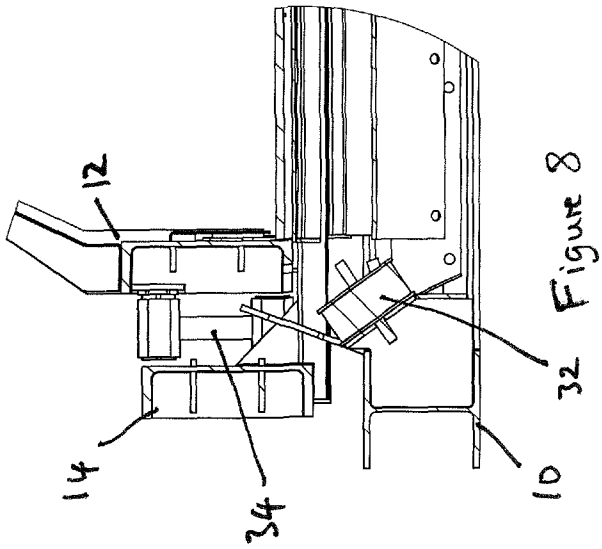

Figure 8

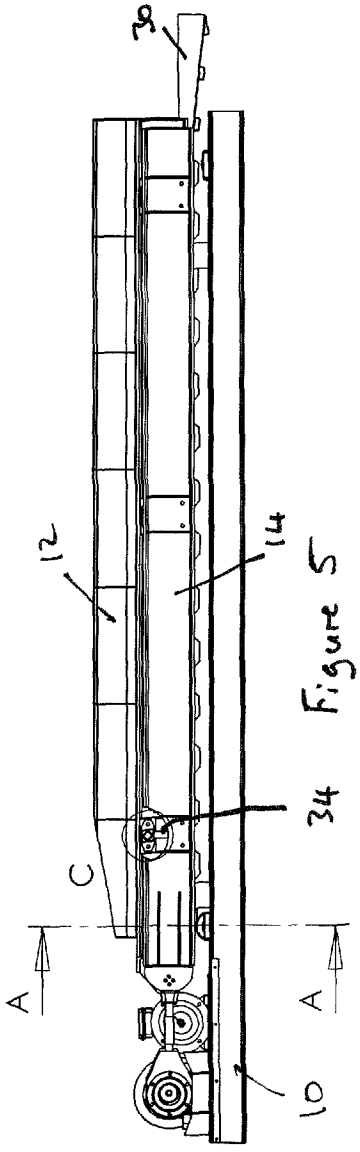

Figure 5

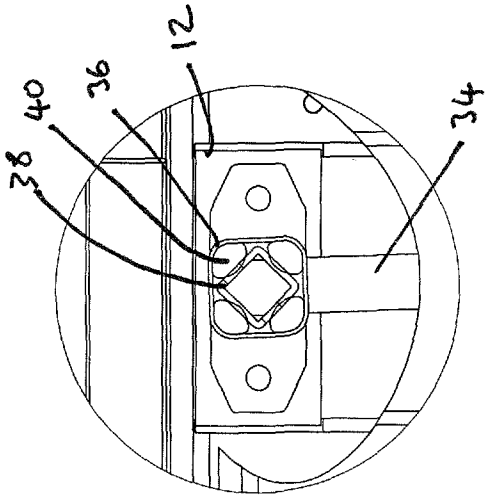

Figure 7

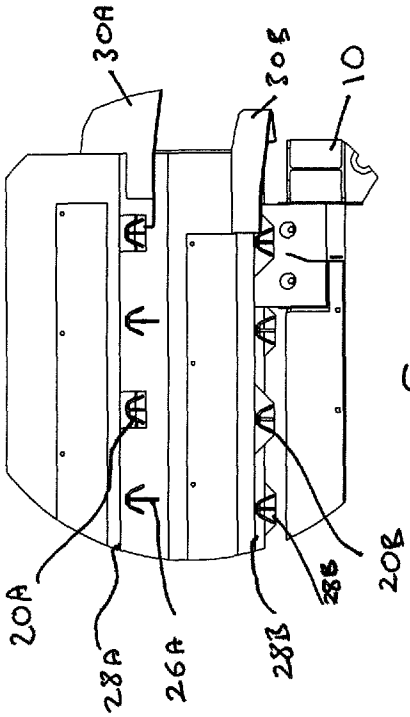

Figure 12

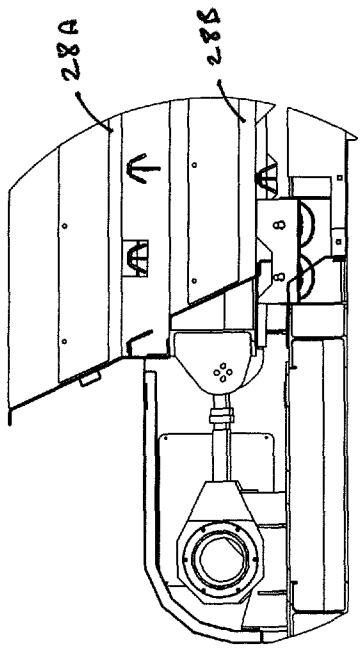

Figure 11

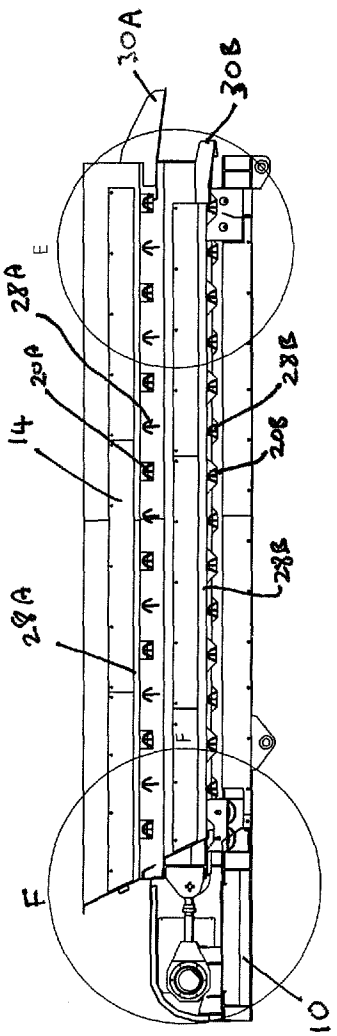

Figure 10

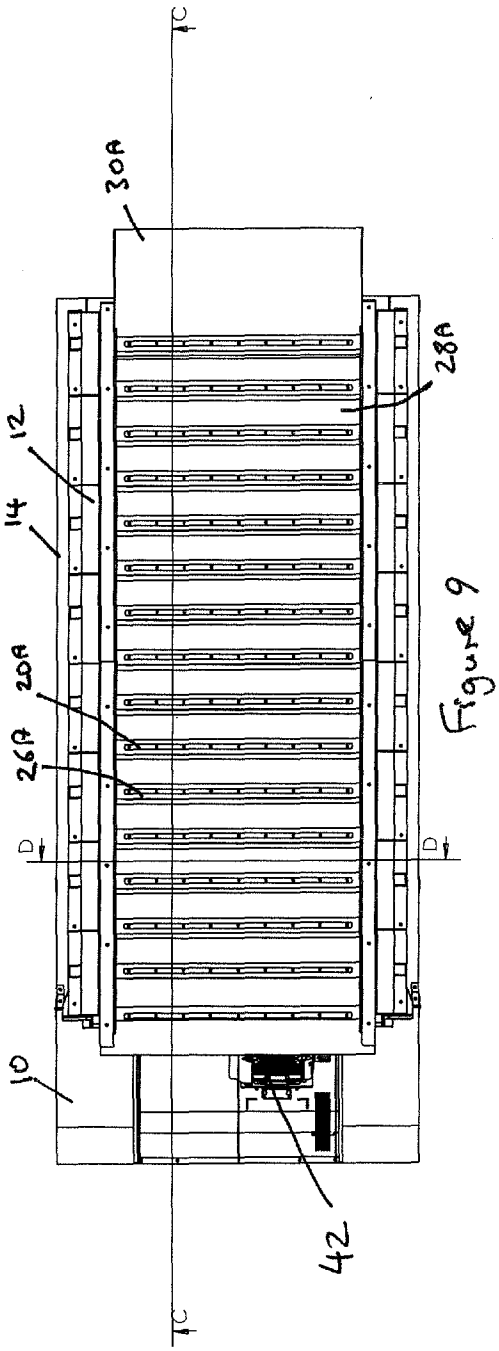

Figure 9

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2011/063144

A. CLASSIFICATION OF SUBJECT MATTER
INV. B07B1/48
ADD.

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)
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)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4 188 288 A (WEHNER ALBERT [DE]) 12 February 1980 (1980-02-12) column 3, line 29 - column 4, line 66	1-7,10, 11,13, 14,16
X	US 3 378 142 A (ALBERT WEHNER) 16 April 1968 (1968-04-16) column 2, line 66 - column 3, line 33	1,3,5-7, 10,12,14
X	DE 22 16 130 A1 (WEHNER ALBERT) 4 October 1973 (1973-10-04) page 3, line 25 - page 5, line 28	1,3-7, 10,14
A	US 2008/011652 A1 (TAKEV DIETER [CA] ET AL) 17 January 2008 (2008-01-17) figures 5-7A,7B	1,12,15, 19

-/--

[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
21 December 2011	02/01/2012

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Militzer, Ernest

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2011/063144

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2 980 254 A (JOHANNES BRUDERLEIN ERNST ET AL) 18 April 1961 (1961-04-18) cited in the application figure 3 -----	1,8,9, 17,18

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/EP2011/063144

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 4188288 A	12-02-1980	NONE	
US 3378142 A	16-04-1968	DE 1204920 B	11-11-1965
		GB 1035711 A	13-07-1966
		US 3378142 A	16-04-1968
DE 2216130 A1	04-10-1973	NONE	
US 2008011652 A1	17-01-2008	US 2008011652 A1	17-01-2008
		WO 2008035214 A2	27-03-2008
US 2980254 A	18-04-1961	NONE	