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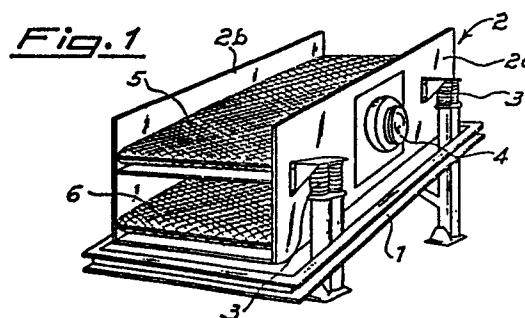
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54 **Simple or multiple type vibrating screen.**

57 An improved simple or multiple type vibrating screen is disclosed herein.

The subject screen including a single one or a plurality of screening meshes vertically stacked and mounted on a support frame connected to means adapted to subject it to an oscillating motion, provides among the basic features thereof, that of fastening said mesh or meshes at the inlet and outlet ends of the materials to be processed by the screen. In this way, in particular for multiple screens, replacement of a mesh can be performed without requiring complete disassembly of the meshes starting with the uppermost one down to the one needing to be replaced.

Furthermore, mesh support means, cooperating with tensioning means thereof, enable the meshes to shape up according to a transversally flat and longitudinally upwards convex configuration whereby screening can be performed over the whole surface of the meshes, which results in a reduction of process time and improved mesh selectivity.



SIMPLE OR MULTIPLE TYPE VIBRATING SCREEN

This invention relates to an improved simple or multiple type vibrating screen.

Simple or multiple type vibrating screens are known, and
5 they comprise in general a single screening mesh in the case of a simple screen or a plurality of screening meshes in the case of a multiple screen. Said mesh or meshes are supported by a frame connected to means adapted to subject it to an oscillating motion. In the
10 case of a multiple screen, the meshes are stacked one above the other, whereby it has been possible to reduce the overall dimensions of this equipment.

In conventional screens, the meshes may comprise metal mesh or perforated metal sheet, and they are fastened to
15 the support frame at their side edges, i.e. at the longitudinal edges thereof parallel to the forward moving direction of the materials to be handled. In general, clamping of said edges is performed by means of rectangular metal sections which are in turn fastened to the
20 frame by means of a plurality of clamping screws.

The above screening mesh arrangement involves non negligible drawbacks, which have a strong bearing both on the screening process per se, and on the amount of maintenance regularly required by the screen, concerning in
25 particular the replacement of one or more meshes.

Concerning the screening process, the latter is performed in remarkably far from optimum conditions since said meshes do not allow for a uniform distribution of the materials to be processed over the whole area of the
5 meshes.

In fact, the meshes of conventional screens, in a direction perpendicular to the advancing direction of the materials to be processed have a cross sectional configuration which rather than being rectilinear arches
10 upwards taking a maximum deflection relative to a horizontal line in the intermediate portion. This configuration is acquired by the meshes of the known type screens just because the screen side edges are clamped, and the distance therebetween cannot be varied,
15 whereby, when the mesh is fastened to the support frame it adapts with no exception to the shape mentioned above. A further drawback encountered in the screening by means of the known type screens derives from the mesh upwards "convex" configuration, as it has been mentioned
20 above, which is responsible for generating a higher concentration of the materials to be processed at the mesh side edges rather than at the central portion thereof.

Therefore, the material density is non-uniform over the whole mesh area, whereby the material concentrates most-
25 ly at the mesh side edges.

The "convex" configuration taken up by the meshes raises a further problem due to the fact that there is a portion of said meshes working at a much higher rate than the remaining mesh areas, said portion being comprised, as it has been mentioned herein above of the areas corresponding to the side edges. In general, in order to overcome this drawback, it is necessary to provide additional structures on the screen, which in addition to fastening the mesh or the meshes in the longitudinally median portion thereof, allow for a uniform distribution of the material on the mesh to be obtained.

As it is understood, all of the above involves further screen cost increases, with design complexities that have prevented up to now a solution to the problem of reaching an optimum screening efficiency to be found.

Concerning mesh replacement, it is known that this operation, in particular for multiple screens, i.e. for overlaying mesh screens, involves a complete disassembly of the meshes, starting from the uppermost one, down to the one that has to be replaced. In fact, it is apparent that in order to take one mesh out and install a new one, it is compulsory to proceed to unclamping of the sections which fasten the mesh side edges to the support frame, and that requires reaching manually the whole extent of said sections. Such operation, already

complicated and time consuming in itself for single screens, proves clearly impossible in overlaying mesh screens. In fact, it is difficult to replace a mesh other than the first, since the vertical distance a mesh is apart from another is generally small. In addition, 5 disassembly and re-assembly of meshes located above the one to be replaced, involves further drawbacks, as it will be pointed out hereinafter.

The above conditions take place as well in the case of a 10 simple maintenance operation on the screen, when there is a need to temporarily take out one mesh that has to be subsequently re-installed. In fact, in this case the operations of taking one mesh out and installing it again, as it is the case for the instance mentioned above 15 for meshes overlaying the one to be replaced, may result in possibly terminal damages to said mesh. In fact, in the majority of cases, these meshes operate in a high humidity environment, generally outdoors, and they handle usually wet materials. The stresses developing 20 at the side edges thereof during unclamping and subsequent new clamping by means of screws may result in tears in a structure whose mechanical strength is unsatisfactory in that it has been weakened both by the above mentioned operating conditions, and by the 25 continuous vibrations. Eventually, a mesh which has been

disassembled and re-assembled obviously cannot be stretched in tension to the same extent as a new one.

It has now been devised, and it makes the subject of this invention, an improved vibrating screen, whereby
5 all the drawbacks we have complained about above can be overcome.

One of the main objects of this invention is to provide an improved vibrating screen, in particular an overlaying mesh type screen, whereby an optimum
10 screening efficiency is obtained in that said operation is performed uniformly over the whole surface of the meshes.

Another object of this invention is to provide a screen of the type mentioned above wherein all the various
15 meshes can be fastened to the support structure in such a way that, when the screen starts operating, said meshes are securely clamped to the support frame, whereby the stresses endured by said multiple meshes during equipment operation are reduced to a minimum.

20 A further object of this invention is to provide a screen of the type mentioned above, wherein the mesh replacement and maintenance operations can be performed without requiring disassembly of additional overlaying meshes, whereby said meshes do not get damaged. Another
25 important feature of the subject screen resides in that

every single mesh, once it has been put into operation, is no longer disassembled, until it has completely worn out.

A further noteworthy feature of the screen of this invention is the possibility to controllably tension every single mesh along one end thereof, and the fact that the same, owing to suitable support means thereof, arranges itself according to a longitudinally upward convex configuration, while remaining perfectly flat in a transverse direction.

The features as well as the advantages of the improved vibrating screen of this invention will appear more clearly from the following detailed description of an exemplary embodiment thereof, made in reference to the attached drawings wherein one of the prototypes in operation at the Applicant's is shown. In particular:

Figure 1 is a perspective view of the screen according to this invention;

Figure 2 is a partially cut away plan view of the same;

Figure 3 is a sectional view of the screen along line III-III of Figure 2;

Figure 4 is a sectional view of the screen according to this invention, along line IV-IV of Figure 2;

Figure 5 is a sectional view of the screen along line V-V of Figure 2; and,

Figure 6 is a perspective view of the back end of the screen as shown in Figure 1, wherein only a single screening plane has been shown, without the associated mesh, to show the clamping thereof in the above mentioned end.

Referring first to Figure 1, the screen according to this invention includes, according to a known construction, a screening mesh support frame comprising a stationary structure 1 and a moving frame 2, connected together in a conventional way by means of intervening resilient means 3, in this particular case comprising helical springs.

Moving frame 2 is the part of the screen frame where the screening meshes will be fastened by means of a particularly simple hooking system, and said frame will be subjected to an oscillating vibratory motion whereby said meshes can perform their screening process.

To that end, to one of the walls of moving frame 2, i.e. the right hand wall of Figure 1, there is fastened a device adapted to subject the moving frame 2 to said vibrations. Said device, shown at 4, in the subject embodiment comprises a crankshaft motor which could also be made in the form of any other device suitable to subject moving frame 2 to an oscillating motion. In fact, everything reported up to this point about the subject screen is no

part of this invention.

Referring now to Figures 2 to 6, the part of the screen frame making the subject of this invention, will be described hereinafter.

5 Referring to the above drawings, moving frame 2 comprises substantially two side walls 2a, 2b, connected to the stationary structure 1 as described above. On the outer side of each of the side walls 2a, 2b there is fastened a longitudinal side member 3a, 3b respectively, having
10 a double-T shaped cross section. However, this cross sectional shape should not be considered binding in that the main function of said two longitudinal side members is to support , at the ends thereof, a moving cross beam and a stationary cross beam where the screening mesh
15 will be hooked, said cross beams being further described in the followig. To this end, the longitudinal side members 3a, 3b, could be more simply replaced by support brackets for said cross beams, but the cross sectional double-T shape was chosen, in the exemplary embodiment considered
20 herein, in order to strengthen the screen structure which is severy stressed dynamically, and also because the lower horizontal side of this double T can be used as a bearing support area if the screen has to be moved whereby clamping of the same to suitable transportation
25 means becomes necessary.

The screen according to this invention is a multiple screen and in particular it comprises two screening planes, therefore it is provided with two meshes, shown at 5 (the upper one) and at 6 (the lower one) respectively. As it should be understood, as a multiple screen it could comprise more than two screening planes. In this disclosure, the term "mesh" is used to designate the member performing the material screening function and said definition should be taken as inclusive of the two main types of screening means in use, i.e. the metal mesh and the perforated metal sheet. The screen according to this invention may be built using either of said means, and alternatively other types of materials available on the market, as well.

15 In the following, there will be described in particular how the upper mesh 5 is fastened to the moving frame 2 and it is tensioned thereupon; clamping of mesh 6 being identical, is not described. In fact, Figures 2 to 6 refer to the upper mesh 5 only.

20 Before going any further in describing the fastening of mesh 5 it should be stated, for sake of clarity only, which one is the materials inlet end, and which the outlet end thereof. The materials inlet end is the one on the right hand side of Figures 2 and 3, shown more particularly in

25 Figures 4 to 6, while the outlet end is the one on the

left of said Figures 2 and 3. This introductory statement, as it was pointed out hereinbefore, should be taken only as explanatory, and non limiting of this invention since, as it will become more apparent in the following,
5 clamping of mesh 5 to the moving frame 2 does not depend upon the position of the materials inlet and outlet ends of the screen.

At the inlet end of the materials to be processed mesh 5 is fastened to a moving cross beam, as it will be
10 explained hereinafter while, at the outlet end thereof, mesh 5 is fastened to a stationary cross beam. As it is understood, fastening of mesh 5 might also be performed in an opposite fashion. The description of the clamping to the stationary cross beam will now be started, this
15 being simpler also from an operation point of view. At the materials outlet end there is provided a stationary cross beam 7 having a double T shaped cross sectional shape as it appears in particular from Figure 3, and from the enlarged detail thereof.

20 The horizontal lower side of stationary beam 7 is fastened, at the cross beam ends, onto the ends of longitudinal side members 3a, 3b, for instance by means of welding or any other known fashion.

The horizontal upper side of stationary cross beam 7
25 allows for hooking of mesh 5, as it is more clearly

shown in the enlarged detail of Figure 3. In fact, mesh 5 is provided, at the edge thereof that has to be fastened to the materials outlet end, with a substantially V-shaped section 8, for instance made integral with mesh 5, which hooks up to a portion of the horizontal upper side of stationary cross beam 7, in the instant case the left half of said side. The V-shaped section 8 is easy to procure associated to a mesh, and this further reduces the screen manufacturing cost.

10 It should be apparent from the above description that hooking of mesh 5 at the materials outlet side is extremely simple and substantially simplified compared to conventional screens, and it should be noted that said clamping simplicity should be considered not only
15 in terms of simplification of the mesh 5 assembly, but in particular in view of an improvement in the screening process.

Fastening of mesh 5 at the inlet end of the materials to be processed is performed by using a moving cross beam
20 in turn cooperating with a further stationary cross beam for the clamping and tensioning of mesh 5.

As it is apparent in particular from Figures 3 to 6, but referring also to the enlarged detail of Figure 3, mesh 5 is provided, also at the edge thereof located at the
25 inlet end of the materials to be processed, with a sub-

stantially V-shaped section 9, similar to V-shaped section 8, which is hooked up to an extended edge 10 of a moving cross beam 11. The latter comprises a tubular metal section of substantially rectangular cross section
5 whose length is larger than the distance between the two screen side walls 2a, 2b.

In that fashion, moving cross beam 11 extends outwards from said walls and the extending ends of said cross beam are each received within a substantially C-shaped
10 metal section 12 which is fastened, for instance by welding, on top of the horizontal upper side of longitudinal side members 3a, 3b. Sections 12 have the concave sides thereof facing towards the materials forward moving direction, shown by arrow F in Figure 6. Moving cross
15 beam 11, whose ends are freely and slidingly supported upon the inner face of the lower side of sections 12, can slide back and forth in that the ends thereof extend through openings 13, 14 formed through wall 2a and through wall 2b respectively.

20 Openings 13 and 14 are provided, to that end, with a larger width compared to that of the moving cross beam 11, thereby establishing the maximum stroke the latter can move.

As it should be noted in particular from Figure 6,
25 moving cross beam 11 is provided with two position

control screws 15 and 16 cooperating with the additional stationary cross beam to be described in the following, in order to provide for clamping and tensioning of mesh 5.

As it is apparent in particular from Figure 4, position control screw 15 (and similarly position control screw 16) which is freely rotatable within openings 19 of moving cross beam 11, can be threaded through a nut 17 (18 for position control screw 16) retained within a locking section 17a (18a) welded to moving cross beam 11 in order to prevent both rotations of nut 17 (18) and longitudinal or transverse displacements of nut 17 (18) relative to moving cross beam 11. To this end, outline of sections 17a and 18a may be complementary to that of nut 17, 18, for instance U-shaped, and provided with a small radial projection, to prevent longitudinal displacements of said nuts.

In that way, when screws 15 and 16 are turned in one direction, they will move according to the materials forward moving direction (arrow F of Figure 6) while if they are turned in the opposite direction, they will move opposite to the former direction, since nuts 17, 18 associated therewith are locked relative to cross beam 11. As it was anticipated above, position control screws 15 and 16 cooperate with a further stationary cross beam shown at 20 comprising, similarly to moving cross beam 11 a substantially rectangular cross section tubular

metal section which is fastened, at the ends thereof, on top of upper side of longitudinal side members 3a, 3b. Said fastening, similarly to the other cases, can be made for instance by welding or bolts, or any other known fashion.

- 5 On top of stationary cross beam 20 are applied two strengthening angle sections 21, 22 against which the ends of position control screws 15, 16 abut when mesh 5 has to be tensioned.

It should now be apparent that when position control
10 screws 15, 16 are screwed in and made to move forward, as it has been described above, according to the direction of arrow F of Figure 6, as soon as they come into abutment against strengthening members 21, 22 of stationary cross beam 20, they will cause moving cross
15 beam 11 to move apart from stationary cross beam 20 thereby tensioning mesh 5 which will then be clamped by means of two jam nuts 15a, 16a, locking screws 15, 16 to moving cross beam 11. On the contrary, when said screws are unscrewed and made to move in a direction opposite
20 to the former one, they will disengage from stationary cross beam 20 setting moving cross beam 11 free. In this fashion the latter can be moved according to arrow F, and cause slackening of mesh 5 whereby the same can be unhooked from moving cross beam 11 without requiring any
25 other further operation, since it can be drawn out

in the longitudinal direction.

One of the features of this invention is that position control screws 15 and 16 enable the tensioning of mesh 5 to be controlled at the centerline portion thereof. In order to obtain a uniform tensioning of mesh 5 over the whole width thereof, the inventive screen provides, as it will now be described in the following, additional means to control said tensioning at the ends of moving cross beam 11, so that mesh 5 can be subjected to a uniform tension over the whole width thereof in order to cooperate in providing that said mesh is subjected to minimum stress during the screening process, while the same screening process can be uniformly carried out over the whole surface of the mesh.

For said purpose, the screen according to this invention is provided, at the end of moving cross beam 11, with an additional pair of position control screws 23, 24, cooperating with C-shaped metal sections 12, besides cooperating with moving cross beam 11.

Referring now in particular to Figure 5, there will be disclosed how screw 23 acts on moving cross beam 11, where screw 24 acts in a thoroughly identical fashion. Referring now to the above Figure, it can be seen that screw 23 extends freely rotatable through the vertical sides of moving cross beam 11, and in particular it is

received in openings 40 thereof. A control nut 25 (shown at 26 for screw 24 in Figure 4) is threaded upon screw 23, said nut being mounted on screw 23 after the same has been engaged freely rotatable through an opening 27 of the C-shaped section 12 vertical side.

Therefore, screws 23 and 24 as well can provide for the tensioning of mesh 5 once the V-shaped section 9 of the same has been applied upon extending portion 10 of moving cross beam 11. To that end it is sufficient to screw position control nuts 25 and 26 around respective screws 23 and 24, so that they proceed out of the screen, i.e. in a direction towards the right in Figures 4 and 5, dragging along moving cross beam 11 therewith, due to the engagement against their heads 23a and 24a.

If position control nuts 25 and 26 are turned in an opposite direction, said nuts can move apart from the vertical side of sections 12, thereby enabling moving cross beam 11 to move, and mesh 5 to be unclamped.

Tension control of mesh 5, as it has been described above, is therefore particularly effective, since it is possible to control said tension in several points of obtaining moving cross beam 11, thereby/perfect flatness of mesh 5 in a transverse direction and a consequent uniform distribution of the materials to be processed over the whole surface of the mesh.

The screen according to this invention is completed by a stiffening structure , located underneath mesh 5, and substantially comprising a pair of stringers 28, 29 seen more particularly in Figure 2, and partially in Figure 6, fastened at their ends to the stationary cross beams 7 and 20 in particular to keep a constant distance therebetween. However, stringers 28, 29 may very well be missing where longitudinal side members 3a, 3b are made stronger. According to a basic feature of this invention mesh 5, in addition to being perfectly flat in a transverse direction, perpendicular to direction F, is shown to have a longitudinally upwards convex profile (Figure 3) in a forward moving direction F of the materials to be processed, as shown in Figure 3. The above configuration of mesh 5 is provided through suitable support means thereof, longitudinally positioned at the edges thereof, and transverse thereto.

The longitudinally positioned means comprise, for each of the side walls 2b and 2a, a rectilinear section, 2c, 2d respectively, which is fastened in any known fashion to the corresponding wall, e.g. by welding and, as it is particularly apparent from Figure 3 for section 2c, has an upwards convex shape whose radius of curvature will be a function of the type of mesh 5 (or 6) used. Sections 2c, 2d have a constant width, they are substan-

tially perpendicular to walls 2b, 2a, and they perform the function of effective support means for the longitudinal side edges of mesh 5 which upon being tensioned takes the same configuration of said sections 2c, 2d, at the side edges thereof.

The transverse means enabling mesh 5 (or 6) to fold over the whole length thereof according to the shape of the side edges thereof, while keeping said mesh perfectly flat in a transverse direction, comprise substantially tubular sections 30 extending in a transverse direction, between the two walls 2b and 2a, and located at different heights as it is apparent in particular from Figure 3, and more particularly at increasing heights starting from the materials inlet and outlet ends, with a maximum height at an intermediate transverse section. The height increase going from a tubular member 30 to the next is properly calculated in order to obtain said mesh 5 upwards convex configuration having an elliptical or similarly shaped longitudinal cross section. Tubular sections 30 whose ends are fastened to the inner surface of walls 2b and 2a in any known fashion, have been chosen with a circular cross section in order to avoid sharp edged transverse folds of mesh 5, or undesirable stresses therewithin. However, they could have a T-shaped cross section as well, on top of which a rubber

U-shaped section is applied.

From the above disclosure the advantages of the screen according to this invention are apparent, concerning both the screening process per se, and the replacement
5 or maintenance of one or more meshes.

In fact, concerning the screening process, mesh 5 is tensioned in an extremely simple nevertheless effective fashion, which consists in longitudinally clamping the same to a stationary cross beam at any one of the mesh
10 ends, while the opposite end is fastened to a moving cross beam whereby tensioning of mesh 5 can be performed and controlled as needed, over the entire mesh length.

Therefore, said mesh in addition to laying perfectly flat in a transverse direction and longitudinally convex
15 with a preferred elliptical shape, is effectively clamped also by means of the aforementioned support means. Thus, it becomes particularly stable and therefore free of parasitic vibrations which could terminally damage the equipment when summing up to the normal
20 vibrations found in this type of equipment. In addition, said configuration enables the materials to spread more uniformly over the whole mesh surface, whereby optimum screening conditions are established.

Furthermore, replacement of one mesh can be performed
25 without taking apart additional meshes, in that it is

only required that the mesh end connected to the moving
cross beam 11 is unfastened, whereby said mesh can be
longitudinally drawn out from the opposite end of the
screen. Installing a new mesh is performed in an opposi-
5 te sequence, being equally easy. In practice, no mesh
has to be removed until it has completely worn out.
It should eventually be understood that variations and
/or modifications can be made to the improved vibrating
screen according to this invention, without exceeding
10 the protection scope thereof.

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CLAIMS

1. An improved simple or multiple type vibrating screen including a plurality of vertically stacked screening meshes carried by a support frame connected to
5 means adapted to subject it to an oscillating motion, characterized in that said mesh or meshes 5 (6) are fastened to said support frame 2 at the inlet and outlet end of the materials to be processed, the meshes 5 (6) being connected at one of said ends thereof to a moving
10 cross beam 11 provided with position control means so that the tensioning induced into meshes 5 (6) can be controlled, there being eventually provided support means 2c, 2d, 30 for said meshes 5 (6) cooperating with said mesh tensioning means 11 and being shaped and
15 arranged in such a way that said meshes are given a perfectly flat transverse shape and a substantially upward convex longitudinal shape in a direction parallel to the forward moving direction of the materials.

2. The improved screen of Claim 1, characterized in
20 that meshes 5, 6 at the opposite ends thereof adapted to be mounted at the materials inlet and outlet ends are provided with a section 8, 9 adapted to be hooked up to an extending portion of a stationary cross beam 7 and of a moving cross beam 11.

25 3. The improved screen of Claim 1, characterized in

that moving cross beam 11 comprises a metal section extending transversally of the forward moving direction F of the materials to be processed, whose ends extend through openings 13, 14 having a larger width than the beam cross section and located on the side walls 2a, 2b of the screen, the length of the section comprising moving cross beam 11 being larger than the distance between screen side walls 2a, 2b so that the beam ends extend outside of said walls.

4. The improved screen of Claim 2, characterized in that it is provided with a moving cross beam 11 position control means for tensioning mesh 5 (6), a part of said position control means being mounted on moving cross beam 11 internally of said screen side walls 2a, 2b, while the remaining part is mounted outside said walls 2a, 2b, at the ends of moving cross beam 11 extending outwards from walls 2a, 2b.

5. The improved screen of Claim 4, characterized in that the moving cross beam 11 position control means mounted on said beam, internally of said screen side walls 2a, 2b, comprise at least a pair of position control screws 15, 16 extending freely rotatable through openings 19 of moving cross beam 11 after having passed in a similar freely rotatable fashion through an opening of a vertical wall of a C-shaped section 12 wherein one of the ends

of moving cross beam 11 is freely and movingly received,
each of said screws 15, 16 having a respective nut 17,
18 threaded thereon , said nut being fastened to moving
cross beam 11 whereby the turning of said screws 15, 16
5 and the resulting screwing forward through nuts 17, 18
result in a translational motion of said screws in the
direction F of forward motion of the materials to be
processed, or viceversa.

6. The improved screen of Claim 4, characterized in
10 that moving cross beam 11 position control means mounted
outside of screen side walls 2a, 2b include at least a
23, 24
- pair of position control screws/extending in a direction
opposite to that of position control screws 15, 16
through moving cross beam 11 within openings 40 thereof,
15 and through C-shaped section 12 within openings 27
thereof, on the outer side of said screws there being
threaded a position control nut 25, 26 whose turning in a
direction or the other results in a corresponding
forward motion of screw 23, 24 in the direction F of
20 forward motion of the materials to be processed with an
ensuing slackening of mesh 5 (or 6), or in an opposite
direction with an ensuing tensioning of mesh 5 (or 6)

7. The improved screen of Claim 5, characterized in
that screws 15, 16 located internally of screen side
25 walls 2a, 2b, cooperate with a second stationary cross

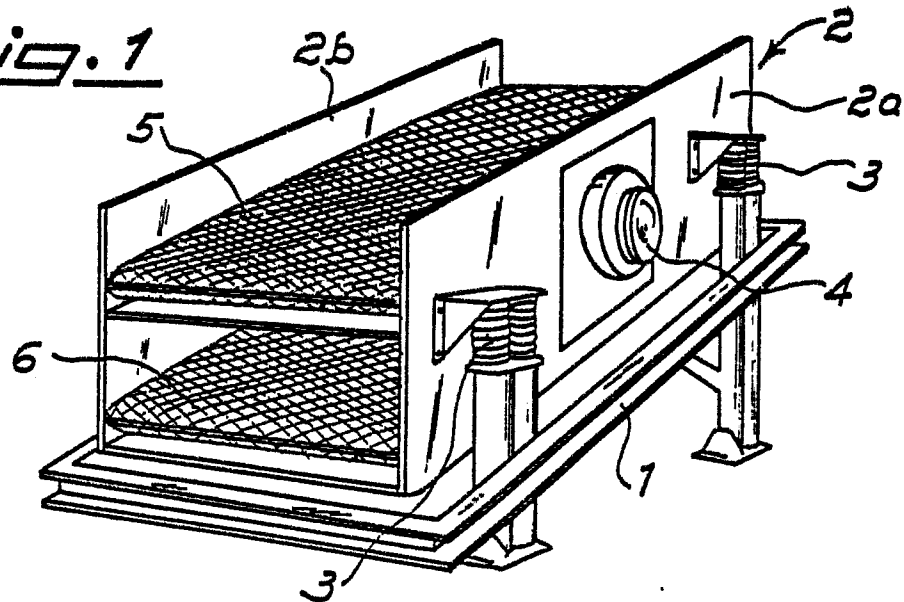
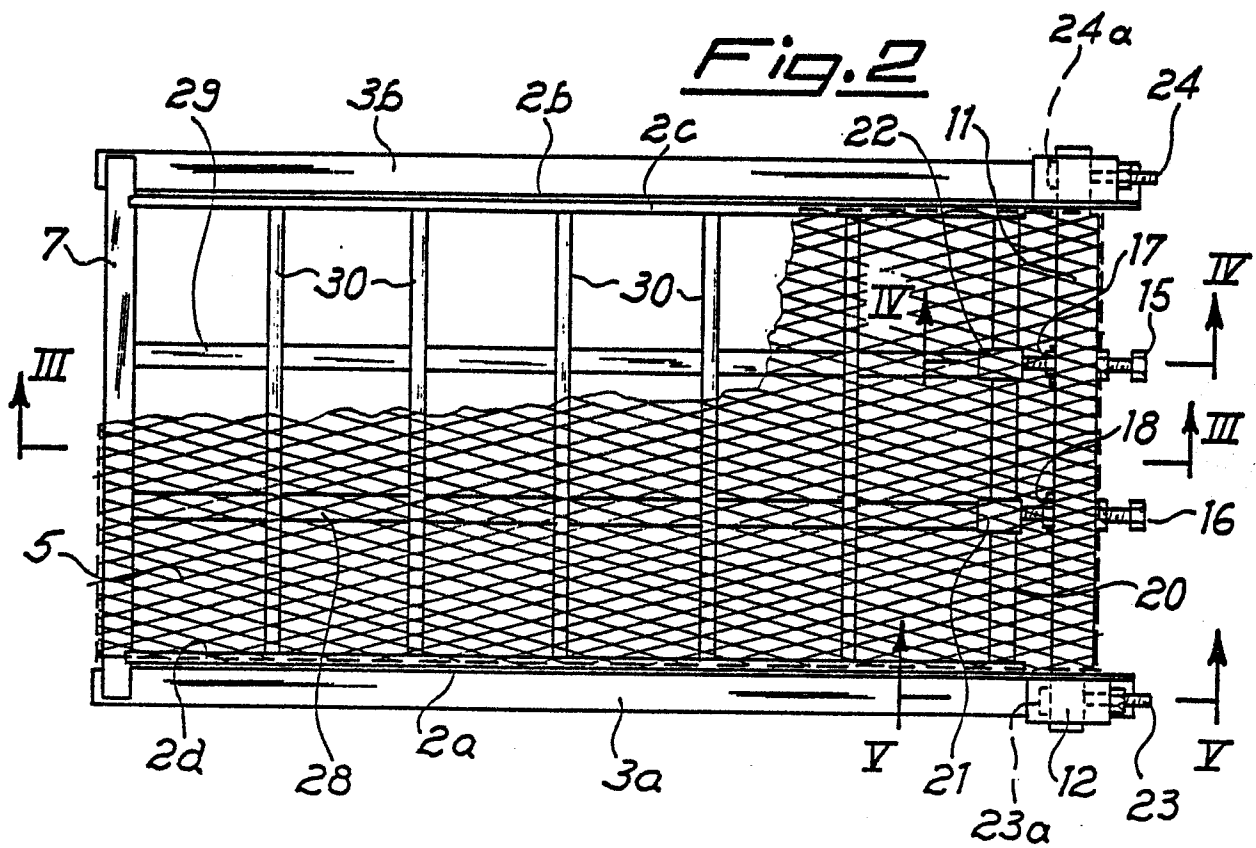
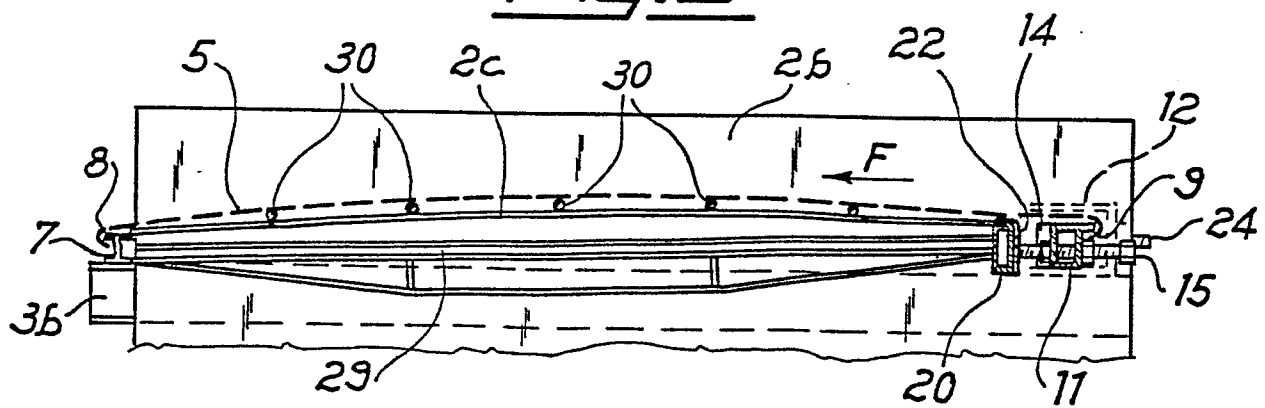
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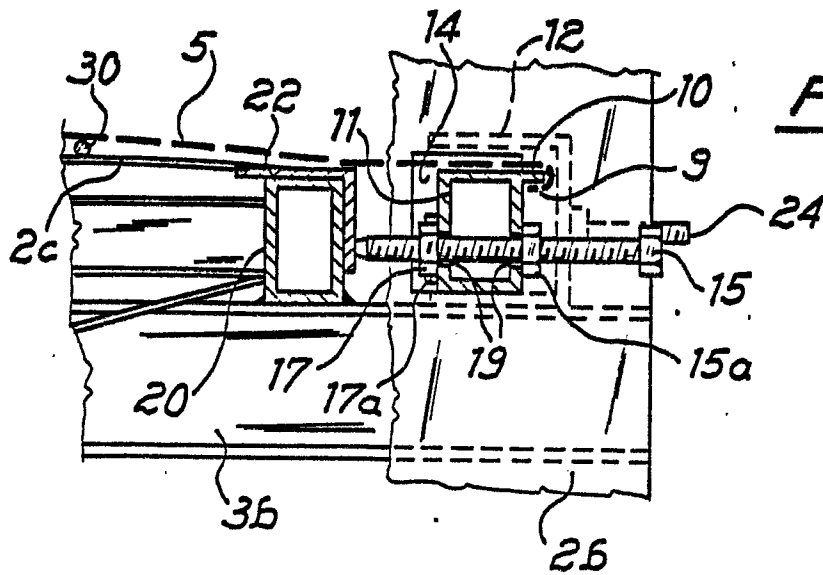
beam 20 located near moving cross beam 11.

8. The improved screen of Claim 1, characterized in that the mesh 5 (or 6) support means cooperating with mesh tensioning control means, include at least a longitudinal section 2c, 2d fastened inside screen side walls 2a, 2b which is substantially rectilinear and at the same time has a longitudinal cross section arching upwards, and a plurality of transverse members 30 fastened at the ends thereof to the inside face of screen side walls 2a, 2b, said transverse members leaving said walls 2a, 2b at heights corresponding to the shape of said sections 2c, 2d.

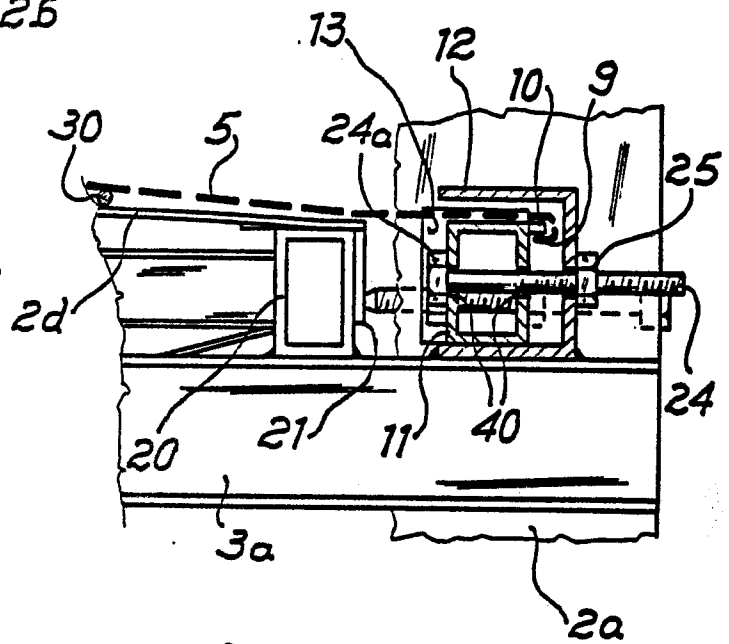
9. The improved screen of Claim 8, characterized in that transverse members 30 are straight.

10. The improved screen of Claim 8, characterized in that transverse members 30 have a cross section where the contour contacted by mesh 5 is substantially an arc of a circle.

Fig. 1Fig. 2Fig. 3

Fig. 4

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Fig. 5Fig. 6