Abstract: A screen cleaning device (10) has a motor drive unit (3), bevel gear (21) and lead screws (4) having flexible modular striking arms (2). Each arm (2) comprises standard units (8) assembled together like a garland on flexible wire rope (9) for flexibility. Standard units (8) have different hardness for flexibility of usage. The standard units (8) are made such that each such unit has a male (11) and a female part (12) arranged on a slightly long wire rope, to create small variable gaps in between the standard modules. The standard units (8) have four striking faces (8') to be used one after another. Together they enhance the service life of each modular unit (8) by four times. The striking arms (2) move bi-directionally on lead screws (4) and also move angularly about the axis passing perpendicularly through the centre of square threaded nut (16). The screen cleaning device is alternatively driven by a pneumatic system.
SCREEN CLEANING DEVICE WITH FLEXIBLE ARMS

FIELD OF THE INVENTION

The present invention in general relates to screening system for bulk, rocky, chunky and abrasive material handling, and in particular to a screen cleaning device with flexible arms which are used to prevent blocking or plugging of screen apertures by dense and moist material while screening.

BACKGROUND AND PRIOR ART

Screen decks of modular configuration are known to comprise of a plurality of panels, which are fixed to the screen frame by known fixing arrangements. Frequently, the apertures on the screen decks are blocked due to particles having sizes near to the screen aperture getting stuck in the apertures or build-up of fines due to increased moisture content in the material. In wet screens the water pushes the particles that get stuck, which is not the case in dry screens. This blocking of aperture makes fewer openings / apertures available for materials to pass through. Thus the screening efficiency goes down and the screening process is affected tremendously. This situation forces the operation to shut down so that the screens can be removed and the clogs are manually cleaned. Due to this problem, the users suffer a loss not only due to frequent down-times of the plant for maintenance, but also due to inefficient separation of mineral particles, causing overall reduction in quality of products of the plants. Moreover, the overall efficiency of the plant is affected resulting in loss of production and monitory losses.
An additional problem relates to the periodical visual inspection of the panel which causes shut down of the whole system. Precisely, the users have to be extremely vigilant to keep a watch whether severe clogging is happening and such personal watching results in loss of important man-hours.

These maintenance operations lead to loss of the machine's production capacity and such losses need to be kept at a minimum. Keeping this in mind, various users have come up with different solutions to keep the screen decks free of clogging.

Some available vibrating screens are equipped with screen unclogging or cleaning mechanisms which consist of a plurality of loose rubber balls disposed between the screen deck and a plate or tray positioned beneath the screen deck. However, in such screens the requirement of the lower deck not only adds an additional cost but also provides a second and may be an unwanted level of screening that slows down the screening process.

Other screens incorporate steel wire baskets attached to the steel girders below every screen panel. These steel wire baskets contain rubber or urethane balls placed within the basket so that when the mechanical action of the screening system is activated, the balls bounce repeatedly from the steel wire baskets and into the bottom surface of the screen panels to help prevent clogging. Such steel wire baskets wear out easily with abrasive materials being screened, and the frequent replacement of the baskets is time-consuming and expensive. These steel baskets also cannot be retrofitted to older screening systems, but can only be attached to new screening systems designed to incorporate the basket. Moreover, repeated bouncing of the balls from beneath the screen displaces the material on the screen.
Particularly when the material being screened is dry, it tends to escape from the screening area, resulting in loss of material.

Other types of screens utilize a number of sliders of varying size and/or configuration disposed between the underside of the screen deck and a tray or deck positioned there under. Here again, the slider support deck adds an extra cost and can interfere with the screening process. In addition, the sliders tend to rub and abrade the underside of the screen decks, accelerating their wearing out and thereby enhancing the total cost of replacement of the screen decks.

US patent 7,861,866B1 discloses knocking device made up of spherical shaped balls held by elastic arms connecting to the connector bars. When the screening system is activated by moving material onto the screen panels and vibrating the screen panel support, the knocking devices bounce around the undersurface of the screen panels and prevent the build-up of material blocking the openings / apertures in the screen panels.

In US patent 4,526,682 it is depicted that cleaning of the screen apertures has been effected through the use of screen impacting balls loosely supported underneath the screen in a container which is affixed or attached to the screening surface. The impacting balls are simultaneously agitated with the screen assembly. Through continual impact with the screen, the impacting balls function to loosen and dislodge debris from the apertures of the screen.

ES 1071015 discloses a plurality of polyurethane arms with a rigid steel end insert which moves laterally between the walls and above the screen. The vibration of the screen causes a wavy movement in each arm with a jolting effect that causes it to strike the screen in specified areas of the screen to prevent clogging. A two way pneumatic cylinder
transmits a reciprocating movement to the flexible arms so that the arms could move left and right up to a certain angle facilitating cleaning of clogs in a limited area on the screens. This type of cleaning mechanism has certain disadvantages namely, the arms are unable to clean all clogs uniformly in every area of the screen deck thereby resulting in appointment of person to watch whether deposition of materials happening in certain areas on the screen decks. In case of clogging happening in certain areas of the screen, they are cleaned by some other process.

US 6,422,394 discloses a continuous cleaning system to prevent clogging of screens in screening machines used to sort materials such as aggregates, such system comprising positioning a cleaning device such as a chain in line With the length of and on top of, a screen to be cleaned, and then using a motor assembly to rotate said cleaning device thereby moving it back and forth across the top of said screen, so that substantially the entire area of the top of said screen comes in contact With said rotating cleaning device, Which taps or otherwise contacts the surface of said screen as it moves back and forth across the top of a screen deck, thereby dislodging any dust or other material that might otherwise clog or block the openings in said screen.

Therefore there is a long standing need in the industry to have a cost effective mechanism of cleaning the screens and particularly the apertures on the screens in a continuous and non-obstructing manner, while the screening process is on. The present invention seeks to fulfill this need and mitigate above mentioned problems of the prior arts efficiently.
OBJECTS OF THE INVENTION

The principal object of the present invention is to provide a screen cleaner device which cleans the entire area of the screen.

Another object of the invention is to provide a screen cleaner device wherein the striking arms are built up with multiple standard units for easy assembly and maintenance.

Yet another object of the invention is to provide a screen cleaner device having standard units with four striking faces which are used one after another to enhance the service life of each modular unit by four times.

Yet another object of the invention is to provide a screen cleaner device wherein the striking arms are assembled like a garland on a flexible rope for additional flexibility.

A further object of the invention is to provide a screen cleaner device which can clean the screen continuously while in operation due to the bi-directional movement of the striking arms.

How the foregoing objects are achieved will be clear from the following description. In this context it is clarified that the description provided is non-limiting and is only by way of explanation.

SUMMARY OF THE INVENTION

A screen cleaning device with flexible arms comprises of a motor drive unit having a geared motor and bevel gear arrangement and a plurality
of lead screw shafts on which at least one or a plurality of flexible modular striking arms is connected. The motor bevel gear is attached to the motor shaft through power transmission plate and shear pin. Each flexible striking arm is built up of a plurality of standard units and is assembled together like a garland on a flexible wire rope for additional flexibility.

The flexible arms can undergo linear to-and-fro motion as well as angular dragging motion, both motions in conjunction with tapping actions to cover the entire area of the screen deck. The standard units are provided with different hardness in different zones for higher flexibility of usage.

The standard units are made such that each unit has a male and a female part. The wire rope passing through the entire striking arm is kept slightly longer than the total length of the standard modules in each striking arm so as to create small variable gaps in between the standard modules during operational condition. These variable gaps helps each standard unit to move freely during operation, and thus reducing the damage of the standard modules arising out of friction against each other and thereby reduces damage of the striking arms as a whole.

The standard units are provided with four striking faces which are used one after another to enhance the service life of each modular unit by four times.

Each modular striking arm is tied to a striking bar handle by means of said wire rope and an eye bolt. The striking bar handle is affixed on a square threaded nut which in turn is screwed to the main lead screw shaft. A limit switch striker, which is an integral part of the square threaded nut, strikes the roller of limit switch when the striking arms reach their extreme ends. At this point of time a signal for reversal of
motion is generated which goes to the motor of the drive unit by way of conventional means.

The striking arms thus move bi-directionally on lead screws and they are also subjected to an angular motion about the axis passing perpendicularly through the centre of the square threaded nut.

The screen cleaning device may also be driven by a pneumatic system.

BRIEF DESCRIPTION OF THE ACCOMPANYING DRAWINGS

The nature and scope of the present invention will be better understood from the accompanying drawings, which are by way of illustration of a preferred embodiment and not by way of any sort of limitation. In the accompanying drawings:-

Figure 1 is a plan view of Screen Cleaning Device along with the vibrating screen with clogged screening surface in static condition according to the present invention.

Figure 2A and Figure 2B show the side views of Screen Cleaning Device and vibrating screen along the line A-A of figure 1 for linear vibrating screen and inclined vibrating screen respectively.

Figure 3 shows the plan view of the Screen Cleaning Device with its different components and without the vibrating screen.

Figure 4 is the detail view of the portion marked B in figure 3, showing the mechanism by which power is transmitted from geared motor to the lead screw.

Figure 5 is the detail view of the portion marked C in figure 3, showing the cross sectional view of the modular striking arm.
Figure 5A shows the cross sectional view along the line XX of figure 5.

Figure 5B shows the cross sectional view along the line YY of figure 5.

Figure 5C shows the cross sectional view along the line ZZ of figure 5.

Figure 6A shows the fixing arrangement of the two modular standard units in cross sectional view.

Figures 6B and 6C show the fixing arrangement of the two modular standard units in two opposite directions in isometric view.

Figure 7 is the blown up view of portion marked D in figure 3.

Figure 7A is the view along line PP of figure 7.

Figure 8 shows the detail view of the portion marked E in figure 3.

Figure 8A shows the view along line QQ of figure 8.

Figure 9 shows the movement of the striking arms during operation in plan view.

Figure 10 is the blown up view of the portion marked F in figure 9.

Figure 10A shows the view along line RR of figure 10.

Figure 11 shows the front view of screen cleaning device along line BB of figure 1.

Figure 12 shows the side view of screen cleaning device along with the screening surface of the linear vibrating screen in operating condition.

Figure 12A is the blown up view of the portion marked G in figure 12 showing the principle of operation of the striking arm handle.
Figures 13A to 13C are the blown up view of the portion marked A in figure 2A.

DETAILED DESCRIPTION OF THE INVENTION

Having described the main features of the invention above, a more detailed and non-limiting description of a preferred embodiment will be given in the following paragraphs with reference to the accompanying drawings.

In all the figures, like reference numerals represent like features. Further, the shape, size and number of the devices shown are by way of example only and it is within the scope of the present invention to change their shape, size and number without departing from the basic principle of the invention.

Further, when in the following it is referred to "top", "bottom", "upward", "downward", "above" or "below", "right hand side", "left hand side" and similar terms, this is strictly referring to an orientation with reference to the apparatus, where the base of the apparatus is horizontal and is at the bottom portion of the figures. The number of components shown is exemplary and not restrictive and it is within the scope of the invention to vary the shape and size of the apparatus as well as the number of its components, without departing from the principle of the present invention.

All through the specification including the claims, the technical terms and abbreviations are to be interpreted in the broadest sense of the respective terms, and include all similar items in the field known by other terms, as may be clear to persons skilled in art. Restriction or limitation if any referred to in the specification, is solely by way of example and understanding the present invention.
The new improved design of the screen cleaning device according to the present invention consists of three significant improvements over the known prior arts, namely: mechanism, movement and shape.

As shown in figure 1, the Screen Cleaning Device (10) consists of a motor drive unit (3), a plurality of lead screw shafts (4) on which at least one or a plurality of flexible modular striking arms (2) is connected. The flexible modular striking arms (2) rest on the screening surface (18) of the vibrating screen (1) in static condition. The flexible striking arms (2) move in a linear motion bi-directionally on the screening surface (18). During the linear motion of a striking arm (2), the arm actually gets dragged along the screening surface (18) at an obtuse angle to the direction of the motion of the square treaded nut (16). During screening operation materials get clogged on the screening surface (18), thus reducing the efficiency of screening. The striking arms (2) create a tapping action on the entire screening surface (18). This action helps in removing clogged material from the screening surface (18).

Figures 2A and 2B show the side views of the screen cleaning device along the line A-A of figure 1 for horizontal vibrating screen and inclined vibrating screen respectively. The vibrating screen may either be in horizontal position in case of linear vibrating screen as shown in figure 2A or may be in an inclined position at a certain angle as shown in figure 2B. The screen cleaning device, which is located outside the vibrating screen (1), but its striking arms (2) rest on the screen panel in static condition.

Reference is now made to figure 3 which shows a plan view of the screen cleaning device with its operative parts but without the screen panel. The drive unit (3) consists of a geared motor (6) and bevel gear arrangement (21). The speed of the motor is regulated by using
variable speed regulator. This is crucial as by increasing or decreasing the motor speed, cleaning action can be controlled depending on variable working conditions and size of screen decks. This drive unit (3) is mounted on motor frame (19). The screen cleaning device is mounted on lower base structure (20). This whole assembly is covered by hood on the geared motor (25) and also by a hood on the screw assembly (26). Each lead screw shaft (4) is supported with bearing units (7) at either end. The counter bevel arrangement (21) is fixed on the lead screw (4) at the respective ends of each lead screw to impart the counter movement in conjunction to the motor bevel gear (21).

The system is made such as the mechanism makes the arms (2) that are attached to the lead screw (4), move to and fro from a certain point up to a desired distance.

Figure 4 is the detail view of the portion marked as B in figure 3, showing the mechanism by which power is transmitted from the geared motor (6) to the lead screw (4). The motor bevel gear (21) is attached to the motor shaft through power transmission plate (24) and shear pin (23). The motor bevel gear is interlocked with two similar bevel gears each of which is attached with the lead screw shaft (4) by key arrangement. During operation, the motor shaft rotates the motor bevel gear (21) which in turn rotates two similar bevel gears connected to it. Each lead screw shaft (4) is supported with bearing units (7) at either end. Each bearing unit (7) is held in position by means of bearing holding plate (22) which is mounted on the lower base structure (20). To avoid any damage of the system due to any mechanical overload in the system (jamming of screw), a shear pin (23) arrangement is incorporated. The shear pin (23) arrangement consists of a power transmission plate (24) which is keyed to the motor shaft. The bevel gear is not keyed to the shaft, but it is engaged
to the power transmission plate (24) with a shear pin (23) which is located at a calculated offset distance from the center of the motor shaft. The diameter of the shear pin (23) is also calculated based on the overload. In case of any jam on the lead screw shaft (4), to eliminate load on the motor, the shear pin (23) breaks down immediately and the lead screw shaft (4) stops rotating.

Figure 5 is the detail view of the portion marked as C in figure 3, showing a cross sectional view of the modular striking arm (2). Each flexible striking arm (2) is built up of a plurality of standard units (8), best shown in figures 5, 6A, 6B and 6C, and assembled together like a garland on a flexible wire rope (9) which gives it additional flexibility. Moreover, as the standard units are identical, the manufacturing and replacement becomes easier. The standard unit can be of different hardness for different zones, giving it more flexibility of usage. This unique shape makes the striking arms suitable for more impact and lesser wear. Also the flexible rope (9) provided inside the arm (2) acts as a spinal cord arrangement of the arm. It makes the arm more efficient and enables it to strike each and every area of the screen deck.

Figure 5A shows the cross sectional view along the line XX of fig. 5 i.e. it is the cross sectional view of the male part (11). The inner contour of the male part (11) is square with a hole for accommodating the flexible rope (9).

Figure 5B shows the cross sectional view along the line YY of figure 5 i.e. it is the cross sectional view of the modular standard unit (8). The inner contour of this unit is having a small hole for passing the flexible rope (9) through.
Figure 5C shows the cross sectional view along the line ZZ of figure 5 i.e. it is the cross sectional view of the female part (12). The inner contour of the female part (12) is exactly matching with the outer counter of the male part (11) for easy fixing.

The shape and the construction of the striking arm, which is made up of PL or flexible elastomer, plays a vital role in the operation of the device.

Figure 6A shows the fixing arrangement of two modular standard units (8) in cross sectional view.

The standard units (8) are made such that each unit is provided with four striking faces (8') and has a male (11) and a female part (12) for effective joining of a plurality of units on a flexible rope (9) to make up a complete striking arm assembly (2). The wire rope (9) passing through the entire striking arm (2) is kept slightly longer than the total length of the standard modules in each striking arm (2) so as to create small variable gaps in between the standard modules during operational condition. These variable gaps help each standard unit (8) to move freely during operation, thus reducing the damage of the standard modules arising out of friction against each other, and thereby reduce damage of the striking arms (2) as a whole.

Figure 6B shows the isometric view of the fixing arrangement of a modular standard unit (8), mainly focusing on the female part (12) with flexible rope (9) passing through the female part.

Figure 6C shows the isometric view of the fixing arrangement of modular standard unit (8) mainly focusing on the male part (11) with flexible rope (9) passing through the male part.
With the passage of time, one of the four striking faces (8') of the modular unit (8), which contributes to the striking effect, gets worn out and damaged. These four faces can be used one after another. During maintenance, each modular part is rotated so that an adjacent fresh striking face (8') of the modular unit is next subjected to impart the striking effect. As the inner contour of both male and female parts is square, each standard unit can be used more than once and at least four times to utilize the four faces (8') of the standard unit (8). By this process the service life of each modular unit is enhanced by four times.

In the present exemplary embodiment, two assembled units of modular flexible striking arms (2) are exhibited. The attachment of the striking arms (2) with the lead screw shaft (4) is best shown in figures 7 and 7A. The striking arm (2) is made of elastomeric material. In the feeding zone of the vibrating screen (1) the modular units (8) are hard in nature while at the discharge end softer modular units are used. This type of arrangement enhances the flexibility of the striking arm (2).

Figure 7 is the blown up view of the portion marked as D in figure 3 and figure 7A is the view along the line PP of fig. 7. Each modular striking arm (2) is tied to the striking bar handle (14) by means of wire rope (9) and eye bolt (15). The striking bar handle (14) is then affixed on a square threaded nut (16) which in turn is screwed to the main lead screw shaft (4). When the limit switch striker (17), which is an integral part of square threaded nut (16), strikes the roller of limit switch (13), (best shown in figure 10), a signal for reversal of motion is generated, which goes to the motor (6) of the drive unit (3) by conventional means (as best shown in figure 10 and figure 10A). At this point, the lead screw shaft (4) starts rotating in reverse direction,
so that the striking arm can now start cleaning in the opposite direction.

Each of Figures 7 and 7A shows that the striking bar handle (14) has an extended part (28) which is designed for fixing an alternate pneumatic drive arrangement.

Figure 8 shows the detail view of the portion marked as E in figure 3 and figure 8A shows the view along the line QQ of figure 8. The wire rope (9) passing through the entire striking arm (2) is kept slightly longer than the striking arm (2) itself to create a small gap (g). This gap (g) helps each modular unit (8) to move freely during operation, and thus restricts the damage of striking arms (2). The end portion of the rope is fixed with an eye bolt (15').

Figure 9 shows the plan view of the different positions of the striking arm during its movement in operation.

During operation the drive unit may rotate the motor bevel gear (21) either in direction D1 or D2. While the motor bevel gear unit rotates in direction D1, it drives the left lead screw to rotate in the direction D1' and simultaneously drives the right lead screw to rotate in the direct D1". This rotation makes the left and right striking arms move linearly in directions D1A' and D1A", i.e., they move away from the drive unit.

When the striking arms reach their extreme ends (30, 31), the limit switch striker (17) of the striking arm assembly (2) hits the roller of the limit switch (13) (best shown in figures 10 and 10A). At this point a signal goes to motor (6) of drive unit (3) by conventional means.
The drive unit now reverses its direction of rotation and starts to rotate in the direction D2. This rotation drives the left lead screw to rotate in the direction D2' and simultaneously drives the right lead screw to rotate in the direction D2". These rotations of the lead screws in turn force the left and right striking arms to move linearly in directions D2'A' and D2'A", i.e., towards the drive unit at the centre.

When the striking arms reach the extreme ends (30', 31') towards the centre, the limit switch striker (17) of the striking arm assembly (2) hits the roller of the limit switch (13) (best shown in figures 10 and 10A). At this point a signal for reversal goes to motor unit by conventional means.

By the process explained above, the striking arms (2) move bi-directionally on the lead screws (4).

Apart from the directions of the movement of the striking arm (2) as described above, is also subjected to angular movement about an axis passing perpendicularly through the centre of the square threaded nut (16).

This motion is evident when each of the striking arms (2) is moving in the reverse direction after reaching the extreme ends or the limit switches (13). During this combination of linear and angular motion the head end of the striking arm which is affixed to the striking bar handle (14) moves ahead but the tail end, where the wire rope (9) terminates in the eye bolt, trails behind as shown in figure 9. The striking arm orients itself at an angle with its centre line, perpendicular to the axis of the lead screw.

Figure 10 is the blown up view of the portion marked as F in figure 9 and figure 10A shows the view along the line RR of fig. 10. The limit
switches (13, 13') are mounted at the extreme positions of the path of striking bar assembly (2). As soon as the limit switch striker (17) hits the limit switch (13) located at the extreme end, a signal for reversal goes to motor unit (3) by conventional means. The geared motor (6) now starts rotating in the reverse direction. The rotation of the lead screw shaft (4) reverses, as a result of which the striking bars start cleaning the panel in reverse direction, thus covering the entire area of the screening surface (18).

The limit switches (13, 13') can be placed at any position depending on the total cleaning area.

Figure 10 also shows an extended part (28) of the striking bar handle (14), designed for fixing an alternate pneumatic drive arrangement.

Figure 11 shows the front view of screen cleaning device along the line BB of figure 1. The motor bevel gear (21) is attached to the motor shaft through power transmission plate (24) and shear pin (23). The motor bevel gear is attached to two similar bevel gears which are attached with the two lead screw shafts (4) by means of bearing units (7). Bearing unit (7) is mounted on the lower base structure (20) by means of bearing holding plate (22).

During operation, the drive unit may rotate the motor bevel gear (21) either in direction D1 or D2. While the motor bevel gear unit rotates in direction D1, it drives the left lead screw to rotate in the direction D1' and simultaneously drives the right lead screw to rotate in the direct D1". This rotation makes the left and right striking arms to move linearly in opposite directions D1A' and D1A", i.e., away from the drive unit.
When the striking arm reaches the extreme end, the limit switch striker (17) of the striking arm assembly (2) hits the roller of the limit switch (13) (best shown in figures 10 and 10A). At this point a signal goes to motor unit (3) by conventional means. The limit switches are mounted on the lower base structure (20) by means of limit switch mounting bracket (27), best shown in figure 10A.

The drive unit now reverses and starts to rotate in the direction D2. This rotation drives the left lead screw (4) to rotate in the direction D2' and simultaneously drives the right lead screw to rotate in the direction D2". These rotations of the lead screws in turn force the left and right striking arms to move linearly in directions D2A' and D2A", i.e., towards the drive unit at the centre.

Figure 12 shows the side view of the screen cleaning device along with the screening surface of the linear vibrating screen in operating condition and figure 12A shows the blown up view of the portion marked as G in figure 12 showing the principle of operation of the striking arm handle. During operation, the screening surface (18) vibrates as shown in figure 12. The frequent vibration of surface (18) allows the striking arm (2) to hit the surface (18) in a sequential manner. At the same time, the drive unit imparts linear bi-directional movement to the striking arm (2). This means the striking arm is subjected to a swinging motion (best shown in fig. 12A) about an axis passing through the axis of the lead screw shaft (4) and simultaneously to a bi-directional linear and angular motion perpendicular to the axis of the lead screw shaft (4). Thus this dual movement provides a total sweeping effect on the deck of the screen.

Figure 12 also shows the line for screening surface (18) and centre line of modular striking arm (29) in static condition and also their
respective displacement positions of the screening surface (18A, 18A') and the centre line of modular striking arm (29A, 29A') in operating condition.

Figure 12A also shows the swinging motion of the striking arm (2) in direction D3 and D4.

Figure 13A, 13B and 13C show the blown up views of the portion marked as A in figure 2A.

Figure 13A shows the material in clogged condition on the screening surface (18) before the striking arm has reached the line of contact. Figure 13B shows the material in clogged condition on the screening surface (18) just at the time the striking arm hits the material in the line of contact.

Figure 13C shows the screening surface (18) after cleaning operation wherein the clogged materials are removed.

The existing screen cleaning device can also be implemented using a different drive assembly or a driving unit i.e. the pneumatic system. The present invention has been described with reference to some drawings and a preferred embodiment purely for the sake of understanding and not by way of any limitation and the present invention includes all legitimate developments within the scope of what has been described herein before and claimed in the appended claims.
CLAIM

1. A screen cleaning device (10) with flexible arms comprises of a motor drive unit (3) having a geared motor (6) and bevel gear arrangement (21), a plurality of lead screw shafts (4) on which at least one or a plurality of flexible modular striking arms (2) is connected, said motor bevel gear (21) being attached to the motor shaft through power transmission plate (24) and shear pin (23), characterized in that each flexible striking arm (2) is built up of a plurality of standard units (8) and assembled together like a garland on a flexible wire rope (9) for additional flexibility, and in that said flexible arms (2) can undergo linear to-and-fro motion as well as angular dragging motion, both motions in conjunction with tapping actions to cover the entire area of the screen deck (1).

2. The screen cleaning device as claimed in claim 1, wherein said standard units (8) are provided with different hardness in different zones for higher flexibility of usage.

3. The screen cleaning device as claimed in claim 1, wherein said standard units (8) are made such that each such unit has a male (11) and a female part (12) arranged on a slightly long wire rope, to create small variable gaps in between the standard modules.

4. The screen cleaning device as claimed in claims 1 and 3, wherein said standard units (8) are provided with four striking faces (8') which are used one after another to enhance the service life of each modular unit by four times.

5. The screen cleaning device as claimed in claim 1, wherein each modular striking arm (2) is tied to a striking bar handle (14) by means
of said wire rope (9) and an eye bolt (15), said striking bar handle (14) being affixed on a square threaded nut (16) which in turn is screwed to the main lead screw shaft (4), a limit switch striker (17), which is an integral part of the square threaded nut (16), strikes the roller of limit switch (13) when the striking arms (2) reach their extreme ends (30, 31, 30', 31'), during which a signal for reversal of motion is generated which goes to motor (6) of drive unit (3) by conventional means.

6. The screen cleaning device as claimed in claims 1 and 5, wherein said striking arms (2) move bi-directionally on said lead screws (4) and are also subjected to move in an angular direction at an obtuse angle to the direction of movement of the square threaded nut (16).
INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER

INV. B07B1/52 B07B1/54

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 practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
<thead>
<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y</td>
<td>DE 12 75 340 B (DANO INGEN I0RFORRETI NIL NG) 05G MA 14 August 1968 (1968-08-14)</td>
<td>1-6</td>
</tr>
<tr>
<td></td>
<td>col umn 1, line 1 - col umn 3, line 5 col umn 3, line 44 - col umn 4, line 57; claims 2-6; figures 1-8</td>
<td></td>
</tr>
<tr>
<td>Y</td>
<td>DE 572 349 CI (BUCKAU WOLF MASCHF R) 15 March 1933 (1933-03-15)</td>
<td>1-6</td>
</tr>
<tr>
<td></td>
<td>page 2, line 1 - line 9 page 2, line 42 - line 56; figures 2-3</td>
<td></td>
</tr>
<tr>
<td>Y</td>
<td>US 2 540 997 A (SCHMITTER WALTER P) 6 February 1951 (1951-02-06)</td>
<td>1-6</td>
</tr>
<tr>
<td></td>
<td>col umn 1, line 5 - line 43 col umn 2, line 1 - line 12 col umn 4, line 10 - line 70; claim 2; figures 1-2</td>
<td></td>
</tr>
</tbody>
</table>

Further documents are listed in the continuation of Box C. 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 application or patent but published on or after the international filing date
• L* document which may throw doubts on priority claim(s) or on which the claimed invention cannot be considered to be novel or cannot be considered to involve an inventive step when the document is taken alone
• 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

Date of the actual completion of the international search

14 October 2015

Date of mailing of the international search report

23/10/2015

Name and mailing address of the ISA/

European Patent Office, P.B. 5816 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016

Lang, Xavi er
### DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
<thead>
<tr>
<th>Category*</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y</td>
<td>wo 96/30132 Al (MCIVER STEVEN JAMES [AU]) 3 October 1996 (1996-10-03) page 2, line 22 - line 29 page 4, line 4 - line 16 page 5, line 20 - page 6, line 9 page 9, line 27 - page 10, line 8; claims 1-3, 13-18; figures 8-10, 5, 3-4 page 10, line 18 - line 26</td>
<td>1-6</td>
</tr>
<tr>
<td>Patent document</td>
<td>Publication date</td>
<td>Patent family member(s)</td>
</tr>
<tr>
<td>-----------------</td>
<td>-----------------</td>
<td>--------------------------</td>
</tr>
<tr>
<td>DE 1275340</td>
<td>14-08-1968</td>
<td>NONE</td>
</tr>
<tr>
<td>DE 572349</td>
<td>15-03-1933</td>
<td></td>
</tr>
<tr>
<td>US 2540997</td>
<td>06-02-1951</td>
<td>NONE</td>
</tr>
<tr>
<td>WO 9630132</td>
<td>03-10-1996</td>
<td>NONE</td>
</tr>
</tbody>
</table>