Title: WEB-FORMING MACHINE EQUIPPED WITH SERVICE PLATFORMS

Abstract: The invention relates to a web-forming machine equipped with service platforms, which includes a frame structure (16) and means (17), arranged consecutively in the longitudinal direction of the web-forming machine, for manufacturing a web. The height of which frame structure (16) is more than 2.5 metres measured from the machine level (15) of the web-forming machine. Above the machine level (15) at the side of the frame structure (16) are arranged service platforms (18), for reaching the desired means (17) and/or the components of the frame structure (16). At least some of the service platforms (18) are arranged to be movable and their location is arranged to be adjustable in both the height direction and the longitudinal direction of the web-forming machine.
WEB-FORMING MACHINE EQUIPPED WITH SERVICE PLATFORMS

The present invention relates to a web-forming machine equipped with service platforms, which includes a frame structure and means, arranged consecutively in the longitudinal direction of the web-forming machine, for manufacturing a web, the height of which frame structure being more than 2.5 metres measured from the machine level of the web-forming machine, and above which machine level at the side of the frame structure are arranged service platforms, for reaching the desired means and/or the components of the frame structure.

In web-forming machines presently in use, there are service platforms above the machine level at at least one height. Often the service platforms are at two or even three different heights, due to the large size of a modern web-forming machine. Generally, the service platforms are grating constructions, which are supported on special catwalk brackets at the side of the frame structure of the web-forming machine. On the service platforms, there are usually also handrails to increase work safety. The operating and maintenance personnel can observe the web production process from the service platforms and reach desired parts of the web-forming machine, particularly during maintenance. WO publication 9429547 discloses one kind of service platform construction.

The placing of the service platforms on a web-forming machine is always a compromise, as the means of the web-forming machine and the components of the frame structures are located at different point vertically. In other words, only some of the means and components can be reached from the service platform without stretching or crouching. The area of the side with such good servicability accounts for only about one-tenth of the entire side area of the web-forming machine. Access to the other parts already demands additional effort and means. Thus maintenance is prolonged and work safety is endangered. Often
the service platforms can even cover some part requiring maintenance. In such cases, the servicing or replacement of the part in question requires at least part of the service platform to be dismantled. In other ways too, service platforms hinder the monitoring of the production process and require regular cleaning. For example, during a washing shutdown of a wire or press section or after running down the machine, washing of the fixed service platforms accounts for up to 40% of the total washing time. In addition, the washing of fixed service platforms during running leads to a risk of a web break. In practice, dirt accumulates on top of the service platforms despite washing, which leads to a risk of slipping. Particularly the service platforms inside the hood of the drying section of a web-forming machine are in hot conditions, which promote the accumulation of dirt on the service platforms and their handrails.

The invention is intended to create a new type of web-forming machine equipped with service platforms, the construction of which is simpler than previously and the operation and servicing of which is easier and safer than previously. The characteristic features of the present invention are stated in the accompanying Claims. In the web-forming machine according to the invention, service platforms of a new type are utilized, in which both the structure and the support are novel and surprising. A possibility of movement is arranged in the service platform according to the invention, so that the desired means and frame-structure components can be reached more easily than previously. At the same time, nearly the entire side surface area of the web-forming machine is an area of good serviceability. This improves work safety and accelerates maintenance. In addition, fixed structures are avoided and the service platforms can, if necessary, be moved to a location where they will not become very dirty, or where they may be needed at the time. The movable service platforms can be implemented in different ways, but preferably they can be moved in at least two differ-
ent directions. Though the movement possibilities can be implemented in different ways, the service platforms are preferably moved independently and separately from each other. This will give access to the means and components that are required at the time while leaving the frame structure of the web-forming machine as open as possible from the side. This will improve monitoring of the production process and facilitate maintenance and cleaning. By means of the solution according to the invention it is also possible to shorten the washing time, thus simultaneously reducing water consumption. In other words, this avoids the washing of extensive areas tight against the frame structure, there being no fixed catwalk structures. On the other hand, the movable service platforms can be washed from farther away even during running. The known purchase and operating costs of a web-forming machine are also reduced. By means of suitable accessories a service platform according to the invention can also be used for operating and monitoring a web-forming machine.

In the following, the invention is examined in detail with reference to the accompanying drawings showing some applications of the invention, in which

Figure 1a shows a side view of a web-forming machine that is, as such, known,

Figure 1b shows a side view of one sub-totality of a web-forming machine equipped with service platforms according to the invention,

Figure 2 shows a side view of a second sub-totality of a web-forming machine equipped with second applications of the service platform according to the invention,

Figure 3 shows a side view of a third sub-totality of a web-forming machine equipped with a third application of the service platform according to the invention,
Figure 4a shows a partial top view of the service platform shown in Figure 3.

Figure 4b shows a top view of two service platforms of Figure 2 arranged against each other.

Figure 5 shows a control-room application of the service platform according to the invention.

Figure 1a shows schematically a partial side view of a web-forming machine, that is as such known. Web-forming machines are, for example, paper and board machines, and other corresponding machines. In fact, Figure 1a shows only about one half of the entire production line. Here are shown as consecutive sub-totalities the wire section 10, the press section 11, and the drying section 12. These are usually still followed by the finishing section with a coating unit and calendering, the production line ending in reeling (not shown). The total length of such a production line can be as much as 300 metres. The web-forming machine also includes a frame structure, the width of which nowadays is often more than ten metres. Beneath the frame structure there are massive foundations 13, which are cast on top of a sturdy base. The foundations also delimit the so-called basement 14, which covers the floor on both sides of the frame structure. The floor is shown in Figure 1a by a thick solid line and is also referred to as the machine level 15. Most of the frame structure and its components, as well as the means available for web forming are thus located above the machine level. In the basement are mainly auxiliary devices, for example, pulpers and fabric tensioners.

The web-forming machine thus includes a frame structure 16 and means 17, arranged consecutively in the longitudinal direction of the web-forming machine, for manufacturing a web. Such means are, for example, rolls and fabrics fitted around them to form endless loops, supported by which the web, formed of a fibre suspension, is processed and transported through the production line. Usually, in modern web-forming machines the height of the
frame structure is more than 2.5 metres, measured from the machine level of the web-forming machine. In practice, the height is several metres. Thus, the known practice is to arrange service platforms at the side of the frame structure above the machine level, in order to be able to reach the desired means and/or components of the frame structure. The web-forming machine of Figure 1a is shown without service platforms, which in practice extend at least over the length of the wire, press, and drying sections 10–12.

Figure 1b shows the wire section 10 of the web-forming machine, equipped with service platforms 18 according to the invention. According to the invention, at least some of the service platforms are arranged to be movable and their location is arranged to be adjustable both vertically and in the longitudinal direction of the web-forming machine. In the application of Figure 1b, all of the fixed service platforms on the side of the frame structure 16 have, in fact, been replaced with moveable service platforms 18 according to the invention. Of course, there can be transverse fixed catwalks in the web-forming machine, to which there is easy access from the movable service platforms. The service platforms are principally on the front side of the web-forming machine, but movable service platforms can also be located on the drive side.

The service platforms according to the invention can be supported only on the machine level. This avoids both uneven loading of the frame structure and protrusions that collect dirt. In addition, if required, alterations can be made to the frame structure without altering the service platforms. In Figure 1b, there are rails 19 embedded in the floor forming the machine level, on top of which the service platform 18 moves in the longitudinal direction of the web-forming machine. By using service platforms according to the invention, the operating and maintenance personnel can reach nearly all the means and the components of the frame structure, without stretching and
without auxiliary devices. Only in the vicinity of the machine level is it necessary to crouch, but these locations can be reached even without a service platform. In addition, due to the absence of fixed service platforms, the locations in question are easier to reach than previously. At the same time, it is possible to utilize gantry cranes, for example, more freely than before. On the other hand, the service platforms can be supported both on the machine level and on the web-forming machine. This would involve, for example, a kind of L-shape frame that could be moved in the longitudinal direction of the web-forming machine, which would be supported on both the frame of the web-forming machine and on the machine level. In this application too, the frame of the web-forming machine would remain simple with no detrimental protrusions, without being excessively stressed, however. In addition, a console-like frame could be supported on the frame of the web-forming machine, on which the service platform could be supported to be vertically movable. The service platform could also be supported on other structures above the machine level, such as the roof or support structures of the machine hall. The applications described above are sturdy and only lightly stress the frame of the web-forming machine. In addition, energy transmission is easy to implement, so that the use of batteries, for example, can be avoided.

According to the invention, the service platform 18 is arranged to be movable in the vertical direction of the frame structure 19 by means of a frame 21 equipped with moving elements 20. In Figure 1b, the frame 21 is in the form of a column and wheels 22 suitable for the aforementioned rails 19 are in its lower part. In the frame, there are also suitable guides belonging to the moving elements, for moving the service platform relative to the frame (not shown). In other ways too, the frame includes the components necessary for moving the service platform relative to the frame structure and for moving the frame relative to the web-forming machine. In practice, a service platform of
this kind can be, for example, electromechanical or electrohydraulic. In the application of Figure Ib, the rails 19 are essentially parallel to the longitudinal direction of the web-forming machine at least at the position of the frame structure 16. However, at suitable points the rails can, for example, curve farther from the frame structure, so that a service platform that is not in use can be guided away from the vicinity of the web-forming machine. In this way the dirtying of the service platform can be avoided and the side of the web-forming machine can be kept free. If necessary, cover plates can be placed on top of the rails, so that normal movement in the vicinity of the web-forming machine will be possible. The rails preferably extend on the entire length of the web-forming machine, so that the service platforms can be driven freely to different locations on the web-forming machine. Movability can be implemented without the aforementioned rails, for example, by fitting conventional wheel solutions to the frame, using at the same time fixed control structure or electrical positioning means, which are as such known. At the left-hand side of Figure Ib a service platform 18 that has been driven to the storage position is shown, onto which it is easy to climb from the machine level 15. To ensure work safety, there are also hand-rails 23 on the service platform 18.

In addition, the service platform 18 also includes control means 24 for altering the position of the service platform 18 and/or the frame 21 relative to the frame structure 16 of the web-forming machine. The control means are preferably located in connection with the service platform, so that the personnel can give the necessary control commands while on the service platform. The control means can also include, for example, warning means for avoiding collisions. The control means 24 also preferably include auxiliary means 35 for controlling and/or monitoring the web-forming machine. Thus it is possible, if necessary, to replace at least some of the fixed control consoles, which are usually spread along the length of the web-
forming machine. At the same time, the web-forming machine can be controlled from a service platform, from which there is an unobstructed view of the web-forming machine. In practice, the service platform 18 according to Figure Ib is arranged to be an independent device 25, separate from the web-forming machine. Thus the device can be driven to a suitable location and the service platform moved to the desired height. According to the invention, the control devices can also include position database for recording the locations of the desired means and/or components of the frame structure and for guiding the service platform to the locations in question. In other words, the device can be taught the desired, often repeated locations, to which the service platform moves automatically. The service platform is preferably first of all driven manually to the desired location, after which the location is recorded in the position database. On the other hand, especially in a new web-forming machine, the important positions can be programmed beforehand and if necessary the settings updated in the real situation. The control means preferably include a display device, which can also be used in controlling the service platform. In the display device there can be, for example, in the background the service points of the frame structure and the fixed catwalks, at which when the display device is pressed the service platform moves to the position in question. At the same time, the display device can open the most important data on, or the maintenance instructions for the position in question.

It is impossible for service platforms on the same rails to pass each other without complicated switch arrangements. In addition, the location of the frame in the longitudinal direction of the web-forming machine is fixed. Thus, in addition to the lower degrees of freedom, it is preferable according to the invention to arrange each independent device to be separate from the other independent devices. In addition, the location of the service platforms that are arranged to move is arranged...
to be adjustable in the transverse direction of the web-forming machine. Thus the service platforms can be controlled very freely independently of each other and of the web-forming machine. Such a service platform is shown in Figure 2, in which the independent device 25 has the basic construction of a fork-lift truck. In the application shown, the frame 21 belonging to the service platform is, in addition, arranged as a telescopic construction. Thus the centre of gravity of the service platform will remain as low as possible. The device like a fork-lift truck can also be guided freely to the desired location and if necessary also in the transverse direction relative to the frame structure of the web-forming machine. In addition, there is sufficient space on the service platform for several people. The frame 21 of the Figure 1b can also have a telescopic construction. The same reference numbers are used for parts that are functionally similar. In addition to, or instead of rails and wheels, it is possible to use, for example, air cushions or other constructions that permit movement.

Generally, there are from one to three service platforms according to the invention to each web-forming machine. Thus most service and inspection situations can be performed already using a few service platforms. On the other hand, in service shutdowns, several sub-totalities are serviced simultaneously, in which case it is preferable for there to be from one to three service platforms for each sub-totality of the web-forming machine. In any event, using even ten movable service platforms according to the invention it is possible to replace hundreds of metres of traditional service platforms. In addition, the cleaning of the fixed service platforms is avoided. Particularly the hood 26 that covers the entire drying section 12 can be made considerably narrower than known hoods if there are no catwalks (Figure 1a). During maintenance, the necessary number of side doors in the hood are opened and the service platforms are run close to the frame structure. Door and wall structures that can be opened and closed can be arranged over
the entire height and length of the hood, with dimensions
suiting the service points. In addition, in connection with the
invention, the door and wall construction can easily also
extend to the wire and press section, as a totality forming the
wall of at least one sub-totality. For example, a wall covering
even only the press section is advantageous, as nowadays the
noise in the press section is considerable. The door and wall
structures act as an effective noise barrier and prevent dirt
and moisture from spreading into the surroundings of the web-
forming machine and onto the movable service platforms accord-
ing to the invention, arranged outside them. The door and wall
material is preferably transparent. Thus the monitoring of the
production process will succeed without opening the door and
wall structure. In Figure 1a, the door and wall structure is
shown with broken lines. For example, in the drying section one
wall structure can be as long as one drying group. The wall
structure can be divided into different door elements in the
height and length directions, arranging them to move to the
side, or upwards or downwards. The door elements can even be
arranged to open away from the wall plane, after which the
service platforms are moved next to the frame structure. The
substantial improvement in work safety and acceleration of
maintenance are also significant. Additional savings can be
achieved, for example, in paper mills, in which there are
several paper machines. In that case, especially service plat-
forms based on fork-lift trucks can be moved from one paper
machine to another, so that the number of service platforms
required for each paper machine can be reduced.

According to the invention, in the height direction of the
frame structure the service platform extends for at least three
metres from the machine level. Thus, even the highest service
points of web-forming machines can be reached. In practice,
service platforms according to the invention extend clearly
even higher than this. The changeover to service platforms
according to the invention is easy, as the loadbearing capac-
ity, straightness, and surface roughness of present machine levels permit fork-lift trucks to be driven on them either immediately or with small changes. Figure 2 also shows the directions of movement of the service platform 18, as well as an edge barrier 27 that guides the device 25 like a fork-lift truck. In addition to the directions of movement shown, the device can also be driven in the transverse direction of the web-forming machine. It is impossible to drive the service platform closer to the frame structure than this edge barrier, thus avoiding collisions with the components of the frame structure and other means. Otherwise the service platform can be driven very freely.

In practice, the independent device 25 according to the invention is controlled from the service platform 18, the control means 24 being in connection with it (Figure 4a). The service platform 18 also includes handrails 23, which can, if necessary, be moved outwards to improve reach. In the handrails 23 there are also openable gates 28, permitting movement from one service platform 18 to another. In connection with the telescopic construction frame, in this case telescopic ladders 29 are also fitted, so that a person can climb up to, or down to the service platform 18 while it is raised. A service platform of the dimensions shown cover an area of about ten square metres, of which about eight square metres are useful area. Thus even three people can easily fit onto a single service platform. Auxiliary devices, such as washing means, a tool chest, or a first-aid cabinet can also be fitted to the service platform.

Figure 3 shows a third application of the service platform according to the invention. In this case, two frames 21 are used, on which a service platform 18 of the same length as the entire sub-totality is supported. Thus when servicing the sub-totality in question it is unnecessary to move the frames. Even two service platforms can also be fitted on top of each other
on the two frames. On the other hand, the service platform can be in two parts, in which case the individual frames can be moved independently of each other. In other words, the service platforms supported on one frame can be connected to each other to form a unit comprising two frames. Thus the desired means and/or components of the frame structure can be reached with the smallest possible movements and work can continue simultaneously on several levels, for example, during shutdowns. At the same time, the ergonomics of the work position will be good, as will work safety. In this case, there are rubber wheels 30 on the lower part of the frame 21, making it easy to move the service platforms 18. If necessary, support legs (not shown) are used to preserve stability. In this application too there are ladders 31, making it possible to move from one service platform 18 to the other (Figure 3). At the same time, the need to move the service platforms is further reduced. In Figure 4b a manhole 32 permitting access is shown schematically with broken lines. In this case, the frame is formed of lattice-construction components, in which there are toothed rods (not shown). In the parts of the service platform surrounding the frame, there are the necessary moving means connected to the toothed rods, for moving the service platform. The construction in question permits the height of the frame to be increased. Preferably the service platform too is formed of parts, so that the size and reach of the service platform can be altered easily and rapidly. In this application too, at least some of the handrails can be movable, in order to increase reach according to Figure 4a.

Figure 5 shows an additional application of the service platform. In this case, the service platform 18 includes a roof 33 and walls 34 to form a thermally and acoustically insulated room. In addition, the a considerable part of at least the walls 34 are transparent, so that there is an uninterrupted view from the service platform despite the walls. In Figure 5, the walls 34 and roof 33 are of thick glass plate. Part of the
service platform too can be transparent. According to the invention, the room preferably also includes auxiliary means for controlling and/or monitoring the web-forming machine. In Figure 5, the auxiliary means include control monitors and equipment. In other words, a control room for the web-forming machine is created from the service platform. In the control room there are the same functions, equipped with wireless links, as in known fixed control rooms. A production line can be equipped with one or more control rooms according to the invention. On the other hand, it is possible to use both a fixed and a movable control room. In Figure 5, there is also a door in the wall on the web-forming machine side, from which it is possible if necessary to move to the web-forming machine. The door can also be on some other wall and there can be more than one door. On the other hand, it is possible to operate with only one door, as the control room can be freely rotated to different positions. The door can open on hinges or a sliding door can be used. According to the service-platform application, the frame 21 of the device 25 can extend through the control room and its floor. In the position of Figure 5, the floor of the control room is entirely flat, but farther downwards the frame 21 protrudes through the floor into the control room (not shown). The construction of the control room is, however, arranged in such a way that despite the frame the control room remains thermally and acoustically insulated. Thus the control room can be kept at the height required at the time.

Like the service platform, the control room can be driven to the desired location and very close to the web-forming machine. There are suitable control means in the control room for driving. The control room can be driven in the machine, cross, and height directions. The web-forming machine can be even more easily monitored from a movable control room, which makes process management easier. At the same time, unforeseen breaks are reduced and production efficiency increases. In practice,
the control room can be driven close to the location of problems that arise, with the process-monitoring tools being available in it the whole time. In the insulated control room there is good work safety and comfortable working conditions, which can be maintained, for example, with air conditioning. At the same time, movement back and forwards between a fixed control room and the production line is avoided. In addition, the control room can be moved away from in front of the web-forming machine for the duration of maintenance. Particularly at the so-called wet end of a web-forming machine, water mist and splashing lead to the dirtying of the control room, which can be avoided, for example, by treating the walls to shed water and dirt. Suitable washing devices can also be arranged outside the control room. Monitoring can be further facilitated by placing working lights in the control room to light a desired location. In the control room, there can also be control cameras to facilitate monitoring. Camera monitoring can be continuous, or the camera can be directed manually to the desired location.
CLAIMS

1. Web-forming machine equipped with service platforms, which includes a frame structure (16) and means (17), arranged consecutively in the longitudinal direction of the web-forming machine, for manufacturing a web, the height of which frame structure (16) being more than 2.5 metres measured from the machine level (15) of the web-forming machine, and above which machine level (15) at the side of the frame structure (16) are arranged service platforms (18), for reaching the desired means (17) and/or the components of the frame structure (16), characterized in that at least some of the service platforms (18) are arranged to be movable and their location is arranged to be adjustable in both the height direction and the longitudinal direction of the web-forming machine.

2. Web-forming machine according to Claim 1, characterized in that the location of the service platforms (18) that are arranged to move is arranged to be adjustable in the transverse direction of the web-forming machine.

3. Web-forming machine according to Claim 1 or 2, characterized in that the service platforms (18) are supported only from the machine level (15).

4. Web-forming machine according to Claim 1 or 2, characterized in that the service platforms (18) are supported on both the machine level (15) and on the web-forming machine, or only on the web-forming machine, or on some other of the structures above the machine level (15).

5. Web-forming machine according to Claims 1 - 4, characterized in that the service platform (18) is arranged to be movably in the height direction of the frame structure (16) on frame (21) equipped with moving elements (20).
6. Web-forming machine according to Claim 5, characterized in that the service platform (18) includes control means (24) for altering the location of the service platform (18) and/or the frame (21) relative to the frame structure (16) of the web-forming machine.

7. Web-forming machine according to Claim 6, characterized in that the control means (24) include auxiliary means (35) for controlling the web-forming machine and/or monitoring it.

8. Web-forming machine according to Claim 5 or 6, characterized in that the frame (21) is arranged as a telescopic construction.

9. Web-forming machine according to any of Claims 5 - 8, characterized in that the service platform (18) together with its frame (21) is arranged as an independent device (25) separate from the web-forming machine.

10. Web-forming machine according to Claim 9, characterized in that each independent device (25) is arranged to be separate from the other independent devices (25).

11. Web-forming machine according to Claim 6 or 7, characterized in that the control means (24) include a position database for recording the locations of the desired means (17) and/or the components of the frame structure (16) and for guiding the service platform (18) to the locations in question.

12. Web-forming machine according to any of Claims 1 - 11, characterized in that there are from one to three service platforms (18) for each web-forming machine, preferably for each sub-totality of the web-forming machine.
13. Web-forming machine according to any of Claims 1 - 12, characterized in that in the height direction of the frame structure (16) the service platform (18) extends to at least three metres from the machine level (15).

14. Web-forming machine according to Claim 10, characterized in that the independent device (25) has the basic construction of a fork-lift truck.

15. Web-forming machine according to any of Claims 1 - 14, characterized in that the service platform (18) includes a roof (33) and walls (34) for creating a thermally and acoustically insulated room, at least the walls (34) being transparent over a significant area.

16. Web-forming machine according to Claim 15, characterized in that the room includes auxiliary means (35) for controlling the web-forming machine and/or for monitoring it.
INTERNATIONAL SEARCH REPORT

International application No
PCT/FI2006/050569

A. CLASSIFICATION OF SUBJECT MATTER

See extra sheet

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)

IPC8: D21 G, D21 F

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

Fi, SE, NO, DK classes as above

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

EPDOC, WPI

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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☐ Further documents are listed in the continuation of Box C ☒ See patent family annex

"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 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 novelty 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


Date of the actual completion of the international search
01 March 2007 (01.03.2007)

Date of mailing the international search report
27 March 2007 (27.03.2007)

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CLASSIFICATION OF SUBJECT MATTER

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