



G00002

Arrangement of a working platform

The present invention relates to an arrangement of a working platform which is suspended from an overhanging support construction, such as a ceiling construction, a tier of beams or the like, as the working platform is connected to the support construction via a mounting in a yoke construction, and that the platform is arranged so that it can be raised and lowered in relation to the yoke construction.

The invention is particularly related to a platform system for internally suspended access to carry out various jobs in large tanks, ashore and in ships and cargo holds in ships, and for example, under the deck on off-shore installations. According to the invention the arrangement will in this way represent an alternative to scaffolding for such tasks.

In large tanks and the like it is today necessary to erect scaffolding to carry out even the simplest safety inspections and/or performing normal maintenance. This leads to wasted production time with associated loss of income in addition to the expenses for the scaffolding and the work itself. Total costs are often not in relation to what is achieved by the work carried out.

Regarding the state of art, reference is made to US Patent No. 3.602.335 and European Patent No. 3.982.

US Patent No. 3.602.335 describes a platform from which one can carry out work on a construction, in this case an aeroplane. The platform is suspended from a superjacent construction with the aid of a strengthened vertical central arm. The suspension of the construction itself is achieved by a double set of rail pairs, so that the platform can be moved horizontally both in the X and Y directions. Since the platform also can be raised and lowered vertically, an operator on the platform will have access to all parts of a relevant workspace, such as around an aeroplane that is placed in a hanger etc. as indicated by the drawings in the patent.



European Patent 3 982 shows a working platform 20 which is suspended by wires or ropes. The platform itself can be raised or lowered and rotated around a central axis. However, there is nothing which can prevent the working platform from tipping over if the weight load becomes too large on one side, e.g. on the side where the person is standing, as the figure indicates.

With the present invention, it is aimed to provide a completely new construction for suspension of working platforms, and which remedies the above mentioned disadvantages.

Furthermore it is an aim of the invention to provide a construction which makes it possible to alter or extend the anchoring devices in the ceiling beam construction, without the operator having to leave the platform or basket.

Thus, it is also an aim of the invention that the suspension is such that the rail in the ceiling construction which supports the whole construction can be added on (extended) by the operator without him having to leave the working basket.

According to the invention there is consequently developed a platform system which gives full access to all areas, for example in tanks and cargo holds, and which is also very effective for use under rigging decks. The platform can rotate 360°. It can be driven horizontally and raised and lowered. Contrary to traditional scaffolding, the platform system can according to the invention be assembled quickly without any detriment to safety.

According to the invention the platform system comprises in its basic form at least one suspension rail for fastening of a yoke construction via a suspension device around which the yoke construction can be rotated in the horizontal plane. Below, and secured to this yoke construction, the platform itself is suspended, in this way it can also be rotated horizontally 360° around the suspension arrangement. The suspension arrangement comprises a runner for movement along the suspension rail.

The flexible access in the vertical direction is made secure and simple by equipping the platform with a means of elevation for it to be raised/lowered with respect to the suspension point on the suspension rail. According to the invention the yoke construction comprises a stabilisation device in the form of one or more extendable supporting devices, which, at a given force, can be brought to abut the superjacent support construction. In this way the yoke is stabilised and prevented from tilting vertically when the operator moves to one of the ends of the suspended platform.

According to the invention the platform system is easy to assemble, it can easily be transported and is ideal for working operations such as inspections, sandblasting, hydro jetting and painting, repair work and regular maintenance operations as carried out down in cargo holds or the like.

In the following, the invention shall be more closely described with the help of some preferred embodiments. This description is not intended to limit the extent of the invention, which only can be seen in the enclosed claims. One skilled in the art can implement the invention with modifications which are appropriate, for the different conditions at different workplaces, without these modifications taking it beyond the scope of the claims.

The invention shall be described in greater detail with reference to the figures following, in which

Figures 1 and 2 illustrate a schematic longitudinal elevation and side elevation of an implementation of the invention.

Figure 3 illustrates a schematic perspective elevation of a yoke construction.

Figures 4, 5, and 6 show an actual implementation of the invention, in which the working platform is adjusted from, for example, a position mounted in parallel to the rail to a working position across the rail after which the stabilising device is activated.

The figures 7 and 8 show a side and cross-section elevation, respectively, of an alternative construction for suspension of the yoke construction.

Figure 1 shows a form of implementation of the platform system with a suspension rail 10 for fastening to a ceiling construction (tier of beams etc.) 12,14, above the workplace. Below, and attached to, this suspension rail 10, the platform 16 itself is hung from a suspension point with the aid of a simple suspension arrangement 18. The suspension arrangement 18 is formed from a housing part 18, the upper section 21 of which includes a set of wheels for mounting to a superjacent rail 10 (or rail pair) in the superjacent ceiling/beam construction, while the lower section 23 includes devices to rotate the lower section in relation to the upper section, and furthermore a yoke construction is mounted to the lower section 23.

In the illustrated embodiment, the suspension arrangement 18 can be rotated in a horizontal plane. Thus, the platform can be rotated horizontally 360° around the suspension point on the rail around an axis 20. The suspensor arrangement 18 comprises an in-built motoring drive (preferably operated by remote control by the operator on the working platform) to perform the mentioned rotation. The suspension rail 10 and suspension arrangement 18 can also be slanted when required, but horizontal or approximately horizontal mounting will be most common and preferred.

As it can be seen from figure 1, the suspension arrangement 18 comprises a runner 22 for movement along the suspension rail 10.

In the illustrated embodiment, the ceiling construction comprises a support beam 24 to which the suspension arrangement 18 is secured.

A yoke construction 26 is mounted on, or suspended from, the suspension arrangement 18. The yoke construction 26 comprises, as can be seen as an example in figure 3, a basically rectangular trusswork frame construction of longitudinal and cross-ways frame- or beam parts 28,30,

respectively, and a middle central seat 32 where the suspension arrangement 18 for the upper anchoring point for the rail unit 10 is secured. Additionally, the yoke construction can be formed into many other shapes than the rectangular. Thus, it may be in the form of an I or H shaped beam or similar.

On each end of the frame construction (i.e. adjoining each of the 4 corners), the suspension arrangement 34 (wires, cables, etc.) for the working platform 16 is fastened. The suspension arrangements 34 are comprised of preferably steel rope or wires, but may also include strong ropes, rods or similar tensile devices. The suspension arrangements 34 have the task of carrying the floor part 36 of the platform 16 itself as this is secured via a lifting mechanism 38. As shown in figure 3, the yoke construction includes 4 cables 34, one in each corner, from which the platform is suspended.

In an alternative embodiment, the floor part can be secured by a simple mechanism for permanent anchorage at a fixed height. The anchoring mechanism can furthermore be in the form of a pulley or simply as fixed knots or ears.

Consequently, a flexible access is secured in the vertical direction by the platform being equipped with the mentioned hoisting mechanism 11 which is arranged with a known method (motor driven) for it to be raised/lowered. In this way a vertical movement in relation to the suspension point on the suspension rail is achieved. The lifting arrangement for raising and lowering of the working platform can possibly be arranged in connection with the working platform itself.

According to the invention, to the upside of the yoke construction 26 there is mounted stabilising devices in the form of one or more upward extendable (such as telescopic) rods, 40,42,44,46, as shown in figures 4-6. The rods are arranged to push, with their respective ends, up against the ceiling construction with a given force such that the yoke construction is stabilised in an

approximately horizontal position, and is thus prevented from tilting vertically.

The pushing rods include preferably piston/cylinder units. With the aid of a hydraulic fluid, the cylinder chamber can, in each unit, be put under pressure such that the piston of the unit is pushed outwards until it abuts a superjacent ceiling construction. The pressure in the fluid is regulated such that a given pushing pressure is obtained and satisfactory stabilisation of the yoke construction is obtained.

As shown in the figures, the pushing rods 40,42,44, 46 may, according to an optional solution, be changed between a basically horizontal, collapsed, inactive position, according to figure 5, and a vertical, raised, active position according to figure 6. The figures show only two of the pushing rods 40 and 44. The change between collapsed and raised rod positions can be brought about by two additional piston/cylinder units mounted on the yoke frame itself, with only two being shown by the reference numbers 52 and 54 in the figures 4-6. Furthermore, the lower part of each support rod can be hinged, such that it can be folded in a satisfactory way so that it does not take up too much space on the yoke itself.

The extendable pushing rods can be of any type that can be driven with the aid of a hydraulically, pneumatically or electrically driven power unit. It is also possible to use inflatable support pads and the like. Furthermore, the end of the rods can comprise wheels 66 which can roll along the superjacent surface, e.g. a plane ceiling surface. In this way, it will be possible, if necessary, to displace the construction without relieving the pushing force from the pushing rods, as the rods can roll along the ceiling surface and maintain the abutment force against the ceiling.

The figures 4-6 illustrate, according to an alternative, how the arrangement, according to the invention, is utilised. These figures show the rail 10 which is secured to a superjacent (not shown) tier of

ceiling beams, the yoke construction 26 which is suspended from the rail 10 through the suspension arrangement 18 and the platform 16 suspended downwards from the yoke construction 26. The person, who will work from the working platform, is not shown.

Figure 4 shows the constructions where the yoke construction 26 and the platform 16 are positioned parallel to the rail 10 in the ceiling. The support rods 40-46 are collapsed in their inactive position with aid of the devices 52,54,56,58.

The drive unit in the suspension arrangement 18 is activated and the whole of the construction is rotated ca. 90° around a horizontal plane such that it takes up the position shown in figure 5, said position corresponding to the actual position for the working operation which will be carried out by an operator.

As indicated in figure 6, the devices 52,54,56,58 are now activated by pressurising their cylinder chambers such that the supporting rods 40-46 are raised to an approximately vertical position. Thereafter, the cylinder chambers of the rods are put under pressure such that the rods are pushed outwards and upwards until they abut the superjacent ceiling. As each extension occurs independently, the rods can be pushed towards part of the ceiling at different heights. The pressure in the fluid in each individual unit 40-46 is regulated such that a given pushing pressure is obtained and a satisfactory stabilisation of the yoke construction is obtained. Now, one person can stand at one end of the platform 16 without the suspension arrangement 18 (which is the only anchoring point to the rail 10) being exposed to damaging momentum loads.

As can be seen in figures 1 and 2, the floor part 36 of the platform can be equipped with 4 runners 48 which are used for movement in connection with transport, and for movement of the floor part 36 during assembly or disassembly. Furthermore, the floor part is equipped with railings 50.

The assembly of the platform system is simple and it will take two fitters around 4 hours to do it. In a tank on board a ship, the assembly starts at the bottom of the tank, with the platform parts floor 36 and railing 50, and the equipment with cables 34 and lifting mechanisms 38, including yoke construction 26 with crossbeams 30, being put together. The suspension rail 10 is hoisted up under the deck of the ship and fastened through a threaded rod 60 which is fed through a manhole 62 or similar and secured by the use of a wing nut 64. The threaded rod 60 is secured to the lower edge of the suspension rail 10 by a known method.

The supporting beam/yoke construction 26 is, in advance, secured together with the suspension arrangement 18 which in its upper edge comprises a crossbolt 19 which runs through two ears, which are spaced apart, and in the upper edge of the lower part of the suspension arrangement. From the outer edge of the crossbolt 19, two carrier-arms stand perpendicular to the crossbolt and on their outer edges each supports a runner 22. Beyond the embodiment which is shown here, the suspension arrangement 18 can be equipped with an associated motorised drive unit which, with a known method, is arranged for motorised movement along the suspension rail 10.

During assembly the platform is lifted up to the suspension rail 10 where the runners 22 are inserted into the side members of the rail 10. For more extensive work along a larger part of a tank wall or the like, it is possible from the floor part 36 of the platform 16 to fit further lengths of the suspension rails 10 as an extension of the first fitted rail and up under the deck.

An alternative anchoring arrangement not shown for the suspension rail 4 can be in the form of a set of fastening brackets with through going bolt or the like, where the uppermost brackets are placed in advance, or, as they are needed, are welded or bolted down underneath the deck. Another alternative anchoring arrangement (not shown) for the suspension rail can be in the form of a

hoop with a hole in either end, which hangs in an existing ring, hook or the like, and which, via a through going pin or bolt with clamps fastened onto it for this purpose, anchors the suspension rail in position. The yoke construction is arranged to be raised and lowered in relation to the superjacent support construction.

According to an alternative solution, the yoke construction can be raised and lowered in relation to a given suspension point in the superjacent support construction. In this way, the stabilising devices 40,46 (see figures 7 and 8) can, in their raised position, by the mentioned controlled raising action, with a given force be brought up against the superjacent support construction. According to this solution, which is shown in the figures 7 and 8, the yoke construction can include its own drive unit/engine unit 70 and cable 72 by means of which the yoke 26 suspended from the cable 72 can be hoisted up towards the ceiling construction 12,14 to its working position, and thereafter, the engine can by remote control be driven by the operator to secure or loosen the yoke 26. As the cable 72 is suspended from the ceiling construction through a rotating/swivelling construction (not shown specifically), the horizontal rotation itself can be carried out manually by the operator, also because the yoke construction, including the platform, can be a lightweight construction with a total weight, for example, of 500 kg.

The supporting devices 40,44,46 include special upward-facing supporting feet which can be folded or taken down from a vertical to a horizontal position relative to the yoke construction. The different height positions of the yoke with its supporting feet 40,46 are illustrated in figure 7 at two different height levels A and B. By using this elevation mechanism to clamp the yoke 26 against the ceiling or beam construction, the supporting feet do not need to have any mechanism that clamps them outwards and upwards, as explained earlier. Instead, the lifting mechanism of the yoke is used for the mentioned

clamping. But even with this suspension, the supporting feet themselves may be extendable for clamping, as mentioned in the beginning. If the whole of the construction is to be moved, this can easily come about by it being lowered down to the floor, and new cables being secured to another anchoring point in the ceiling/beam tier, said anchoring point being displaced in relation to the former. With this solution, illustrated in the figures 7 and 8, the construction can be operated without the use of rails in the ceiling.

As shown in the figures 1-6, the arrangement can, according to a preferred embodiment, be supplied with an extension of the floor part of the platform, stretching beyond the hanging or suspension devices 34 to secure access to tank surfaces or the like, which may be a distance (indicated as 4-7 m in the shown embodiment) from the suspension point. This give greater flexibility and possibilities to work along surfaces which are a corresponding distance from the closest point of the suspension rail. As the suspension rail 10 can also stretch some beyond the anchoring point in the deck, it is difficult to visualise working situations where the working surface cannot be reached with this platform system according to the invention.

For safety reasons the suspension rail should be equipped with a stop mechanism in both ends. Furthermore, optional motorised equipment, for use in tasks with fire-hazards such as in oil tanks, should be spark proof and fireproof otherwise.

Even if the description given above is adapted mainly for work inside a ship's tank, a person skilled in the art will easily see that the same system can be used in a number of other work situations, such as in large tanks ashore, under platform decks on rigs (drilling and production rigs) at sea, within carrying columns or legs for oilrigs etc.

C L A I M S

1. Platform system comprising a working platform (16) and a superjacent support structure (12,14), the working platform (16) being suspended from the support structure of a ceiling construction, tier of beams or the like, through a frame structured yoke (26), wherein the platform (16) can be raised and lowered in relation to the yoke construction (26), characterised in that
- 10 the yoke construction (26) comprises one or more extendable support devices (40-46) which with a given force can be brought to abut the superjacent support structure (10) to stabilize the yoke construction (26) and the working platform (16).
- 15
2. Arrangement according to claim 1, characterised in that the each extendable support device is:
- a telescopic extendable rod (40,42,44,46), or
an inflatable support pad,
- 20 and said stabilising resulting in the yoke construction (26) and the platform (16) maintain an approximate stabilizing horizontal position.
3. Platform system according to claim 1-2, characterised in that
- 25 the upper part of each extendable support device (40-46) includes a support foot, or one or more wheels (66) which can roll in abutment along the support construction (12,14), or
- 30 the upper part of the supporting device (40-46) is arranged to glide along the superjacent support construction (10).
4. Platform system according to claims 1-3, characterised in that the yoke construction (26)
- 35 comprises a rectangular structure each end which comprising said number of support devices (40-46), and

most preferably one support device in each corner of the yoke structure (16).

5. Platform system according to claims 1-4,
5 characterised in that each support device (40-46) comprises a foot which can be folded or taken down from a vertical position to a horizontal position relative to the yoke construction (26).

10 6. Platform system according to any of claims 1-5, characterised in that each extendable support device (40-46) is operated by a hydraulically, pneumatically or
11 electrically driven power unit.

15 7. Platform system according to any of claims 1-6, characterised in that
the yoke (26) structure is, via a housing device (18), connected to a suspension rail or pair of rails (10) in the superjacent support structure (12,14),
20 said housing device (18) comprising an upper section (21) including a pair of wheels (22) for mounting and movement along the rail (10), while the yoke (26) is anchored to the lower section (22).

25 8. Platform system according to any of claims 1-7, characterised in that the housing part comprises means for rotating the lower section (23) in a horizontal plane, in relation to the upper section (21) thereby rotating the yoke (26) around a basically vertical axis (20).

30 9. Platform system according to any of claims 1-8, characterised in that the mid-point of the yoke construction is connected to the suspension rail (10) via said housing device (18).

35 10. Platform system according to any of claims 1-9, the yoke (26) is arranged to be raised and lowered in relation to the superjacent support construction.

11. Platform system according to any of the preceding claims, characterised in that the working platform is suspended from the yoke construction (26) via a number of
5 cables, wires, or rods or similar tensile devices (34), and the means for raising and lowering of the working platform (16) is arranged in connection with the yoke construction (26) and/or in the working platform (16).

10 12. Platform system according to claims 1, characterised in that the support devices (40-46) of the yoke construction (26) can be brought to abut the
- superjacent support construction (12, 24) by a controlled
raising of the yoke construction (26).