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'Overhead conveying device having a self-supporting supporting framework'

15 The invention relates to an overhead conveying device for integration in an assembly plant for transporting vehicle components in accordance with the preamble of claim 1.

In assembly plants for manufacturing vehicles, a great variety of types of conveying devices and overhead conveying devices are employed. Based
20 on the fact that assembly plants are individually adjusted to each type of vehicle to be manufactured and that the conveying devices are correspondingly configured, the overhead conveying devices under consideration are correspondingly individually designed and manufactured. Here, an overhead conveying device of the type at hand
25 relates to those conveying devices below which at least enough free movement space remains to allow a person to freely walk below them. Usually, free headroom of 2.5 m or more is the aim so that forklift trucks or other transport vehicles are also able to cross below the overhead conveying device. Overhead conveying devices of this kind are also
30 employed in order to obtain additional assembly space, wherein, standing

on the ground, another conveying device or another kind of assembly plant is arranged underneath the overhead conveying device.

To integrate overhead conveying devices of this kind into a complete assembly plant in a building, it is common in the state of the art to put a supporting framework together from steel girders or the like for erecting the actual conveying device on-site in the building, wherein the struts and pillars are usually welded together. This allows for the best possible adaptation to the conditions at hand both with regard to the assembly plant and with regard to the possibilities of the building, and assembly plants or building facilities already present can in particular be taken into account.

The commonly found practice of putting the supporting framework together on site on the basis of the local conditions leads to structural calculations or a previous detailed construction of the supporting framework of the overhead conveying device usually not being carried out. Due to said calculations of the supporting framework not being carried out, said supporting framework, for safety reasons, is usually designed with a significant oversize (however, without having a guarantee that sufficient safety is given).

However, the design of an overhead conveying device known from the state of the art is particularly disadvantageous in the light of the high amount of time that is required for setting up the corresponding overhead conveying device in the assembly plant. During such setup works, the assembly plant is inevitably unavailable for other purposes in the area of the overhead conveying device to be constructed. In particular when making structural alterations to the assembly plant, switching from one design, for example for manufacturing a particular vehicle model, to a new design of the assembly plant for manufacturing a changed vehicle model, this leads to undesired production downtimes while the overhead conveying device is set up.

Therefore, it is the object of the invention at hand to accelerate the procedure of setting up of an overhead conveying device in an assembly plant as compared to previously known techniques.

Said object is attained by an inventive embodiment according to claim 1.

- 5 Advantageous embodiments are the subject-matter of the dependent claims.

For a start, the generic overhead conveying device is intended for integration in an assembly plant for transporting vehicle components. The type of the vehicle components is irrelevant in this case. The
10 substantial feature is that the overhead conveying device is integrated in a complete assembly concept, making it possible here to manufacture a vehicle by transporting the assigned vehicle parts. For this purpose, the overhead conveying device has a supporting framework and at least one conveying device.

- 15 In accordance with the generic nature of the invention, the supporting framework has a length of more than 5 m and a width of more than 2 m. The height at which the supporting framework of the overhead conveying device is arranged above the ground of the designated building is irrelevant for the invention at hand, but the free headroom below the
20 supporting frame has to be at least 2 m so as to guarantee a suitable useful height below the supporting framework. The supporting framework itself is realized by longitudinally and/or transversely oriented and/or diagonally interconnected supporting beam elements. Said supporting beam elements are usually designed in the shape of rods
25 and can have tubular profiles, T-girder or other shapes and they can be designed as traction girders, pressure girders or as girders under a bending moment.

The associated conveying device is mounted on the supporting framework and allows transporting corresponding vehicle components,

the transport usually taking place along the longitudinal direction of the overhead conveying device.

Furthermore, the supporting framework comprises bearing means on which the overhead conveying device is borne in the assembly plant. It is initially irrelevant whether said bearing means are fixed bearings, mobile bearings or other types of bearings. The supporting framework is at least substantially supported on the bearing means in the direction of gravity and on counter bearings being provided by the assembly plant or by the building.

In accordance with the invention, the integration of the overhead conveying device in an assembly plant is achieved with little idle times as a result of erecting the overhead conveying device by a self-supporting design of the supporting framework and by preassembly of the supporting framework. The supporting framework can be transported in preassembled form from the place of manufacture to the place of use.

However, it is particularly advantageous if both the supporting framework and the conveying device are preassembled on the supporting framework before being erected at the place of use. Here, the supporting framework, along with the conveying device that is arranged thereon, can be transported in preassembled form from the place of manufacture to the place of use.

It is obvious that, for integrating the conveying device in the assembly plant, it is necessary to connect several interface connections, whether they are power connections, data connections or process lines, such as pressurized air or hydraulic oil, between the preassembled overhead conveying device and the rest of the assembly plant.

It is at least required in accordance with the invention that the actual supporting framework is already preassembled and, furthermore, that the conveying device is advantageously mounted on the supporting

framework prior to erection at the place of use. Thus, all that is needed for realizing the overhead conveying device in the assembly plant is clearing corresponding space and creating corresponding counter bearings for receiving the bearing means, wherein the preassembled overhead conveying device then has to be erected only by means of a crane. Hereby, the assembly time for erecting the overhead conveying device is drastically reduced in comparison to all known devices. Even though this is associated with a slight disadvantage with regard to flexible adaptation to the local realities, the advantages with regard to little idling of the assembly plant prevail.

It is particularly advantageous if the supporting framework is designed in the manner of a spatial truss. This means that the self-supporting supporting framework is formed by longitudinally oriented, transversely oriented, diagonal and upright interconnected supporting beam elements. This truss structure can ensure high stiffness of the supporting framework while weight is low, which in particular facilitates the transport of the preassembled overhead conveying device.

Furthermore, it is particularly advantageous if the supporting framework is formed by a welded structure. This means that the self-supporting supporting framework is substantially formed by steel struts and, if need be, by other steel elements, such as gusset plates, which are welded together. If the conveying device is light or if saving weight is generally very important, it is also conceivable to manufacture the supporting framework from aluminum, for example, and to similarly weld together the individual elements, such as struts and gusset plates.

As compared to a screwed design, a welded structure has, among other things, the advantage that there is no risk that an inadmissible change to the supporting framework can later be made by the plant operator. In designs from the state of the art, this might not be critical because of the oversize that is usually present. In a specific configuration of the supporting framework to fit the conveying device to be supported, a

manipulation of the supporting framework can cause extensive damage, which is counteracted by a welded structure.

Furthermore, it is particularly advantageous if a maintenance walkway is present along at least one longitudinal side of the conveying device. Said
5 maintenance walkway is to be designed in such a manner that it is accessible on foot without any risk. To this end, the maintenance walkway is arranged at a longitudinal side of the supporting framework and is connected thereto. The maintenance walkway and the supporting framework can be connected during preassembly of the overhead
10 conveying device, while it is also conceivable to fix the maintenance walkway to the supporting framework on site as a per se preassembled attachment part.

It is particularly advantageous if maintenance walkways are present on both sides of the conveying device. To increase the stiffness of the entire
15 arrangement and in particular the stability of the maintenance walkways, the maintenance walkways present on both sides along the conveying device are connected to each other via connecting girders.

In case maintenance walkways are present on both sides and the conveying device is disposed in-between, the maintenance walkways
20 being connected at their ends via connecting girders, it is furthermore particularly advantageous if at least one vertical transport opening is provided. The latter is to be arranged between the supporting framework, the maintenance walkways and the connecting girders. The vehicle components can then be transported from the conveying device, which is
25 located above the supporting framework, in a largely vertical direction from above the supporting framework to a location below the supporting framework through said vertical transport opening. Thus, vehicle components transported above the supporting framework can be transferred to another conveying device or to an assembly device below
30 the overhead conveying device.

In this context, it is correspondingly particularly advantageous if corresponding vertical transport openings are provided at both ends of the conveying device so that vehicle components can be transferred from below the overhead conveying device at one end of the overhead
5 conveying device. Then, the vehicle component can be transported along the overhead conveying device by the conveying device located thereon and can subsequently be transferred again from above the supporting framework down to below the supporting framework through the other vertical transport opening at the other end of the overhead conveying
10 device.

If maintenance walkways are present at both sides having the vertical transport opening disposed between them at the end of the supporting framework, it is furthermore particularly advantageous if a closing means is present that can be adjusted between an open position and a
15 closed position. The closing means is to be designed such that it is accessible on foot and that in the open position it releases the required vertical transport opening for use of the overhead conveying device and that in a closed position it allows passage, advantageously without steps, between the two maintenance walkways. Thus, in case of maintenance
20 usually being carried out at a standstill of the conveying device, the latter can be accessed substantially circumferentially on foot by way of the maintenance walkways and of the connecting closing means.

Since the overhead conveying device is preassembled and the stiffness of the supporting framework is suitably configured to fit the weight of the
25 overhead conveying device and its weight distribution, it is possible in a particularly advantageous fashion to allow a variable changeable erection of the supporting framework in the assembly plant. In this way, in particular the disadvantage is compensated that, unlike in the state of the art, an adaptation to the realities encountered on site is impossible,
30 but that instead there has to be a suitable possibility of erecting the

overhead conveying device in the assembly plant in its completely preassembled state with defined positions of the bearing means.

Here, it is particularly advantageous if the number N_L of bearing means is higher than the number N_E being required for bearing. This means that
5 a number N_L of bearing means on each of which erection in the assembly plant can take place is present at the supporting framework, while it is actually unnecessary for erection of the overhead conveying device in the assembly plant that each of these present bearing means is used. Instead, it is sufficient if only the required number N_E of counter
10 bearings is present. In this context, it is furthermore envisaged that those bearing means to be used among the available bearing means when erecting the overhead conveying device in the assembly plant can be selected arbitrarily in the required number N_E . This obviously means that the overhead conveying device can still be borne at all available bearing
15 means in the assembly plant on counter bearings.

A design that has at least six bearing means is particularly advantageous, the required number N_E being smaller than/equal to the number N_L of present bearing means multiplied by 0.72 and rounded up. This means that in case of six available bearing means, erection is to take place on at
20 least five counter bearings. In case of seven or eight available bearing means, erection is to take place by means of at least six of the available bearing means. In case of nine available bearing means, seven bearing means are accordingly to be used, and so on. It is particularly advantageous if the stiffness of the supporting framework is selected
25 such that in particular the number N_L of the available bearing means multiplied by 0.6 and rounded up is necessary as the required number N_E .

Furthermore, it is advantageous if the overhead conveying device has support elements on each of which a bearing means is arranged. In this
30 regard, an advantageous design requires a number of support elements that corresponds to the required number N_E of bearing means, while in an

advantageous design a support element is still associated with each bearing means. The support elements can be free-standing support pillars and/or wall brackets and/or freely suspended traction elements. It is at least provided that the overhead conveying device rests with the
 5 supporting framework at the bearing means on counter bearings of the support elements, which in turn are connected within the assembly plant or the building.

Here, it is particularly advantageous if the number of support elements is higher than the number N_E being required for bearing, wherein any one
 10 of the present support elements can be removed and/or replaced at the place of use without limiting the usability of the overhead conveying device. Thus, a support pillar can be removed in particular in case of damage if a transport vehicle collides with a support pillar, for example, without limiting the functionality of the overhead conveying device
 15 either with respect to the transport of vehicle components by way of the conveying device or with respect to ensured sufficient statics. In case of damage, an uncomplicated replacement can thus take place without assembly having to stand still.

In the following figures, an exemplary overhead conveying device is
 20 outlined in a roughly sketched way, having a supporting framework standing on support pillars and a circumferential maintenance walkway, wherein the illustration of the conveying device belonging to the overhead conveying device has been omitted.

In the figures:

25 Fig. 1 shows an exemplary overhead conveying device in a perspective view leaving out the conveying device;

Fig. 2 shows a lateral view of Fig. 1;

Fig. 3 shows a half-section of the view of Fig. 1;

Fig. 4 shows the supporting framework of Fig. 1;

Fig. 5 shows the maintenance walkway of Fig. 1.

In **Figure 1**, a perspective illustration of an overhead conveying device 01 is outlined in an exemplary embodiment. However, illustration of the conveying device belonging to the overhead conveying device 01 has
5 been omitted. As the person skilled in the art can easily appreciate, the conveying device is located centrally in the supporting framework 03 and depending on the embodiment it projects beyond the supporting framework 03. Herein, the supporting framework 03 is designed in the
10 manner of a truss and comprises a plurality of supporting beam elements 04-07 that are welded together. As can be taken from **Figure 3** in this regard, the supporting framework 03 is formed by longitudinally oriented supporting beam elements 04, transversely oriented supporting beam elements 05, upright supporting beam elements 06 and diagonal
15 supporting beam elements 07. The supporting framework 03 with its supporting beam elements 04, 05, 06 and 07 is designed such that there is a sufficient self-supporting inherent stiffness when the conveying device is mounted thereon so that a transport of the entire overhead conveying device 01 or at least of the supporting framework 03 having
20 the conveying device mounted thereon in its entirety is possible. For this purpose, it is imperative that the supporting framework 03, in view of stiffness, in particular bending stiffness, is to be configured to the effect that bearing on the associated bearing means 08 is possible in a substantially deformation-free manner both in case of transport and for
25 later erection.

In correspondence to the static configuration of the overhead conveying device 01, which has to be ascertained in each case, the supporting framework 03, on its underside, has a plurality of bearing means 08.1
to 08.6, on which the overhead conveying device is mounted on support
30 pillars 21.1 to 21.6. Furthermore, in this embodiment example, the statics of the supporting framework 03 are configured and the stiffness is

selected in such a manner that the stability of the entire arrangement is ensured even if one support pillar 21.1 to 21.6 is omitted. Thus, it is conceivable on the one hand to use only five of the illustrated six support pillars 21 in case of erection in the assembly plant, and on the other hand it is also possible to use six support pillars, in which case a support pillar can be replaced in case of damage resulting from a collision with a vehicle, for example, without limiting the functionality of the overhead conveying device.

Furthermore, the maintenance scaffold 11 belonging to the overhead conveying device 01 is visible, having maintenance walkways 12a and 12b, see also Fig. 5, which extend at both sides of the overhead conveying device. At their ends, said maintenance walkways 12 are connected to connecting girders 14, providing increased stability of the entire arrangement together with the maintenance scaffold 11 and of the maintenance walkways 12a, 12b. A surrounding safety railing 13 ensures the safety of maintenance personnel when accessing the maintenance walkway 12. Access to the maintenance walkway 12 is provided by ladders 23 arranged on the maintenance scaffold 11.

Furthermore, the two vertical transport openings 16 present at the end sides are visible, through which the vehicle component to be transported can be passed. To permit risk-free passage from one maintenance walkway 12a to the other maintenance walkway 12b, closing means 15 are further present at the vertical transport openings 16. Said closing means 15 can be brought from an outlined open position into a closed position, thus providing a level passage from one side to the other side.

Claims

1. An overhead conveying device (01) for integration in an assembly
plant for transporting vehicle components, having a supporting
5 framework (03) and at least one conveying device, wherein the
supporting framework (03) has a length of more than 5 m and a width
of more than 2 m and comprises longitudinally and/or transversely
oriented and/or diagonal interconnected supporting beam
elements (04, 05, 07), wherein the conveying device is mounted on
10 the supporting framework (03) and can implement transport of
vehicle components, wherein the supporting framework (03) has
bearing means (08) for bearing the overhead conveying device (01) in
the assembly plant,
characterized in that
15 the supporting framework (03) is designed to be self-supporting and
can be transported in preassembled form from the place of
manufacture to the place of use.
2. The overhead conveying device (01) according to claim 1,
characterized in that
20 the conveying device, disregarding interface connections, is
preassembled on the supporting framework (03) in an operative
condition.
3. The overhead conveying device (01) according to claim 1 or 2,
characterized in that
25 the supporting framework (03) is designed in the manner of a spatial
truss, which comprises longitudinally and transversely oriented and
diagonal and upright interconnected supporting beam elements (04,
05, 06, 07).

4. The overhead conveying device (01) according to claim 3,
characterized in that
the supporting framework (03) is formed by a welded structure.
5. The overhead conveying device (01) according to any of the claims 1
to 4,
characterized by
a maintenance walkway (12a, 12b) along at least one longitudinal
side of the conveying device, in particular along both longitudinal
sides, the maintenance walkway being arranged at the supporting
framework (03) and being accessible on foot substantially without
any risk.
6. The overhead conveying device (01) according to claim 5,
characterized in that
maintenance walkways (12a, 12b), which are present on both sides of
the conveying device, are connected to each other at both ends of the
overhead conveying device (01) via connecting girders (14).
7. The overhead conveying device (01) according to claim 6,
characterized by
at least one vertical transport opening (16) between the supporting
framework (03) and maintenance walkways (12a, 12b) being present
on both sides as well as the connecting girders (14), through which
transport opening vehicle components can be transported from the
conveying device above the supporting framework (03) to a location
below the supporting framework (03).

8. The overhead conveying device (01) according to claim 7,
characterized in that
the maintenance walkways (12a, 12b) being present on both sides, in
the region of the vertical transport opening (16), can be connected to
each other with a closing means (15) being adjustable between an
open position and a closed position so as to be accessible on foot.
9. The overhead conveying device (01) according to any of the claims 1
to 8,
characterized in that
the number N_L of bearing means (08) is higher than the number N_E
being required for bearing, wherein the overhead conveying
device (01) can be borne at bearing means (08) being selected
arbitrarily in the required number N_E .
10. The overhead conveying device (01) according to claim 9,
characterized by
at least six bearing means (08), wherein the required number N_E is
smaller than/equal to the number N_L of present bearing means (08)
multiplied by 0.72 and rounded up, in particular multiplied by 0.6.
11. The overhead conveying device (01) according to any of the claims 1
to 10,
characterized by
support elements as free-standing support pillars (21) and/or wall
brackets and/or freely suspended traction elements, at each of which
one bearing means (08) is arranged.

12. The overhead conveying device (01) according to claim 11,
characterized in that
the number N_S of support elements (21) is higher than the number N_E
being required for bearing, wherein any one of the present support
5 elements (21), for example in case of damage, can be removed and/or
replaced without limiting the usability of the overhead conveying
device (01).