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SUPPORT

Description

The present invention concerns a support (hereinafter, a beam) for a travel-way of a track guided vehicle, especially a magnetically levitated railway, said beam being constructed of concrete, especially being of precast concrete, having in its longitudinal extension a continuously running first flange connected to likewise longitudinally running webs and at the end of each web, remote from the said first flange, having second flanges, whereby, on the said flanges of one of the beams, which flanges, as seen in cross-section, are distanced one from the other, add-on fixtures for the guidance of the vehicle can be placed, and the invention concerns itself also with a mold for the casting of the said beam.

For example, WO 01/11142 has disclosed a beam for magnetically levitated travel-ways with an first flange possessing webs, onto which first flange are placed consoles to fasten the said add-on fixtures for the vehicle. The consoles are screwed onto the first flange or are so placed during the original pour. The said fixtures affixed to the console include the frames along with the horizontal and vertical guides for the vehicle. The beam itself comprises one solid concrete body or, in an advantageous embodiment the beam is made of sections of hollow cross-section.

For an economical construction of the travel-way for the magnetically levitated vehicle track, the beams are, in part, more than 30 meters long. The requirements of the beam are very severe in connection with exactness of form and stability of shape, in order that the functionality of the magnetic levitated travel-way is to be in any way assured. Consequently, it has always been foreseen in the mode of construction for this component, that the beam

must be very rigid and torsion free. In order to effect a still better behavior of the beam in relation to the guidance of the magnetic levitation track, even multi-compartmentalized beams have been employed. Beams of this type are made either of one piece, or mostly, based on transport considerations, made in multiple sections and subsequently coupled together on the site. These components are indeed optimal for the usage of beams for magnetic levitation railways, although the manufacture thereof, because of mold-release work, is very expensive in time and labor costs, because, after the mold releasing of the hollow bodies, the end closure plates must be inset or openings must be provided in the end plates, which would necessitate a complicated inner mold pattern.

Thus, it is the purpose of the present invention, to create a beam for a travel-way of a magnetic levitation track, which can fulfill the high requirements of such a magnetic levitation track and in spite of this, can be quickly and economically manufactured.

This purpose is achieved by a beam with the features of the independent claims.

In accord with the invention, at the edge of the web(s) remote from the first flange of the beam, are placed second flanges, these extending essentially transversely away from the beam. By means of this flanging, a beam has been made, which, for most cases of its application, has a sufficient rigidity against torsional stresses, since each second flange, which generally serves as a lower flange, is so designed, that it contributes by means of its marked transverse extension to the torsional structural strength of the beam.

In the case of a particular advantageous embodiment of the invention, there exists between the webs a hollow space, which is open at the side of the second flange. The webs in the area of the second flanges are further spaced from each other than they are in the area of the first flange. This allows the beam to be at least partially released from a mold along the second flange. On this account the beam can be quickly and economically made. A expensive disassembly of an inner mold structure, in order to

remove it from the end faces of the beam, or the placing of slanted construction for demolding in the central interior of the considerably small hollow space is thus avoidable.

It is advantageous, in regard to the flexural stiffness of the beam, when the first flange is an upper flange and the second flange is a lower flange. In special cases, this can be reversed.

If the center of gravity of the cross-section be located in the area of an average cross-sectional height, then, by means of no increase in weight of the beam, or by substantially less increase, a greater flexural rigidity of the beam can be achieved. The consequence of this is an increase in the first natural frequency and simultaneously a reduction in deflection upon loading, both of which react positively on the dynamics of the travel motion. In particular the flexural rigidity and the torsional rigidity are increased clearly.

In the course of the manufacture of the beam, it is not necessary, following the fashioning of the hollow space, to cast on an additional plate on the ends of the beam, in order to bring about a connection if compartmentalization is to be carried out. By means of this extra concrete procedure, the manufacture of the entire beam in accord with the state of the technology is clearly extended timewise as compared with the present invented formation of the beam, since in the case of the present invention, these closure plates, if they are required, can be immediately provided. Waiting for the concrete of the beam to set, until finally the closure plates can be concreted in, is no longer necessary.

The beam is, in this respect, so designed, that the demolding operation can be executed along the longitudinal sides and largely without the destruction of the molds. The beam exhibits no closed hollow spaces, but can, because of its design, especially that of the lower flange, which extends itself outward of the beam, supplies sufficient torsional rigidity. Thus the beam is appropriate for magnetically levitated railways and in spite of this, possesses the length-of-span which has already proven functional up to this time.

A further advantage of the invented beam upon the manufacture, is found in that, the beam reinforcing rod structure can be prefabricated before the pour of the beam. The extensive prefab reinforcement can then, for example, be set caplike on the inner mold structure. Moreover, it is possible, because of the shape of the beam and its molding, to mix a stiffer consistency of the concrete during the pour. This has a positive effect on the concrete quality and favors lower costs. Beyond this, a high strength concrete or a high strength lightweight concrete can be employed.

Advantageously, at the ends of the beam, the webs are connected together by means of closure plates. The closure plates serve on the one hand for increasing torsional rigidity, and on the other hand they enable providing a connection to the neighboring beam. The connection to the adjacent beam can be of such a kind, that a considerably strong connection is created, whereby two or more beams act in common as a compartmentalized beam.

It is particularly of advantage, if the beam-end closure plates are so designed, that they accept an underpinning for the beam. By this means an advantageous force-flow path is created from the beams into the pillar supports upon which they are held in place.

A further increase of the torsional stiffness of the beam is achieved, wherein in the hollow space, at least one bulkhead is placed which binds the webs together. By the use of the bulkhead, a movement of the web and the lower flange toward one another is avoided. The said bulkhead is a means of increasing the torsional stiffness of the beam. In accord with the need, more bulkheads can be provided, whereby the torsional stiffness of the beam is correspondingly increased. The bulkheads are, advantageously, predominately placed at equal distances from one another. To be a particularly torsion resistant beam, a beam would be provided with three bulkheads. The bulkheads, in this case, occupy the entire cross section of the beam hollow space. In other embodiments, provision can also be made, that the bulkheads exhibit openings or function principally as struts, so that

openings are present, allowing service lines and/or tension apparatuses to be run through the open spaces.

It is of particular advantage, if the bulkheads are placed in the area of a transverse pretensioning member for the beam, and/or in the area of the said add-on components, this latter especially being consoles for the guidance of the vehicle. In such a case, the beam is reinforced in those areas, in which, for example, the accessory components are affixed to the beam by means of consoles. A closed flow of force would in this case result without an essential increase of the total weight of the beam.

It can frequently be sufficient to obtain an adequate structural strength of the beam, if the bulkheads connect a portion of the webs together. In this case also, both weight and material for the beam is saved.

In order to achieve an extraordinarily high torsional rigidity, it can be of advantage, if the second flanges, especially the lower flanges, in the area of the hollow space, are connected with each other, following the manufacture of the beam, by a base plate. The base plate can completely close off the hollow space, so that once again a closed hollow body is created. In many cases of application, however, it can be sufficient if the base plate is principally placed in sequential sections along the beam.

This can produce a sufficient torsion rigidity, whereby the manufacture of the base plate is made simpler.

Advantageously the base plate is incorporated in concrete. In this matter, provision can be made, that at the webs, i.e. at the connection of the lower flanges, steel connections extend outside of the concrete of the beam, on which the base plate is mounted, that is to say, is concreted in. This connection is of such a manner, that once again a torsion resistant form of the beam is achieved, which is particularly justified by the high requirements in the construction of beams for magnetically levitated railways.

Alternatively, the base plate can be of metal or plastic, especially fabricated as a frame. This enables a simplified mounting and demounting of the base plate.

If the base plate is at least partially designed to carry load, then the torsion resistance is further increased. If prestressing elements are placed in the beam, then a sufficient resistance to bending for the foreseen applications of the beam may be achieved

It is of particular advantage, if a tensioning reinforcement is placed in the outer area of the flanges. By means of such a tension reinforcement, especially when it can be readjusted either before or after the mounting of the beam and is not restrained, the beam can be deformed in the y and z directions and thereby be very accurately trimmed. For the readjustment, it is of advantage, if even after the mounting of the beam, the tension adjustments, for instance in the hollow spaces of the beam are accessible.

Advantageously the hollow space of the beam is put to use for the placement of central tensioning members. The tensioning members are longitudinally arrayed in an advantageous manner. Further, the central tensioning members therein are thermally insulated in a simple manner so that the temperature gradient of the beam can be advantageously controlled and the thermal distortion of the beam clearly reduced in comparison with conventional beams. For the stressing of the pretensioning elements, provision has advantageously been made, that in at least one of the closure plates, tensioning recesses have been placed, especially in the area of the hollow space.

In order to make possible an abutment for the tensioning pressure of the pretensioning elements, advantageously, the closure plates, especially in the area of the hollow space, exhibit steel plates.

If the beam is a part of a compartmentalized beam system, wherein a plurality of trued-up beams are connected with one another, then a construction system particularly capable of load carrying and exact in its tolerance accuracy has been created.

If upper and lower flanges, in relation to the vehicle, are favorable from a streamlined standpoint, with a predominate avoidance of the cross-sectional changes attributable to the said vehicle, then the beam is not only, inventively bend and torsion resistant, but in this way makes possible that the

magnetically levitated vehicles traveling at extreme velocities on the beam can be operated comfortably with the least possible flow disturbances or flow impacts. Moreover such a construction contributes to energy savings during the operation of the said vehicle.

If a beam is designed in such a manner, that those surfaces exposed to the radiation of the sun and/or the weight of the beam on the first flange and such radiation and loading on the second flanges are similar to one another, then, in a particularly advantageous manner, a goal has been reached, that a lower temperature gradient obtains within the beam. This means that the heating of the beam in the neighborhood of the first flange as well as in the area close to the second flanges is done very evenly, and thus it is avoided that the first flange or the second flanges experience greater expansion than do the other beams. A bending of the beam because of uneven heating is thus, generally speaking, avoided to a great extent.

For the creation of a state of equal heating and corresponding expansion of the beam, provision has been made, that at least parts of the outside of the beam possess a heat absorbing or reflecting surface. In this way, for instance, a varying radiation of the sun on the individual parts of the beam can be compensated for, which results in an equalized expansion throughout.

A heat absorbing and/or reflecting surface on a beam can also be created by a coat of paint. In this way, the different thermal characteristics of the beam are very simply controlled.

If, at least, parts of the outer side of the beam are subject to shading elements, then, again through this measure a lower temperature gradient of the beam is attained. The operating characteristics of the beam can be regulated in this way against the most varying radiation of the sun.

Because of the fact, that the second flanges extend themselves relatively far beyond the accompanying webs, they can be put to use as a travel-way for additional vehicles, especially inspection or service vehicles. The vehicles can, in such a case, ride on the upper side of the second flanges and for example monitor or measure the add-on fixtures for the magnetically

levitated track. Again, it is possible that the first flange (i.e. upper flange) can be employed for the same function.

1. In a manner in accord with the invention, with a beam of the above described kind, between a first flange and a second flange, provision has been made for means for heat compensation, in particular, employing heat exchange. If the beam, is unevenly heated, for example, by radiation from the sun, then, because of the thereby arising temperature gradients, undesirable deformation occurs. The exact aligned structural elements no longer possesses the required precision, so the operation of, for example, a magnetically levitated track could not be safely assured. By means of the arrangement of heat compensation or heat exchange means, it now becomes possible, that, in the case of a more strongly heated first flange, the heat, which thereby arises, is conducted to the second flanges, whereby these flange are also heated and expand in the same manner as the first flange. The heat can be specifically conducted into those areas of the beam, which apparently are heated to a lesser degree or which possess more mass of material and thus require a longer time for warming/cooling. For this purpose, advantageously, a control or regulating system, particularly with sensors and pumps can be provided.

Lines circulating a heat transfer fluid, particularly oil, have proven themselves as a means for heat equalization. By means of these lines the heat from the more strongly heated areas of the beam is transported to the less heated areas. The transport through the lines can be effected by pumps or passive means based on gravity.

As an effective means for the heat compensation, cooling and/or heating elements are of advantage. These cooling/heating elements, which, for instance, can be operated by means of solar cells, can likewise, upon need

hold the temperature gradients within the beam at a low level and thus, to a large extent, avoid deformation of the beam.

In accord with the invention, in the following, for the manufacture of a beam of a travel-way for beam of a track guided vehicle, in particular for a magnetically levitated track, a mold is proposed, which is a combination of individual modules, so that, by the exchange of a single module, a plurality of different beams can be made. Especially in the construction of magnetically levitated railways, then the travel way could be made out of a multiplicity of beams combined together. These beams have, in general, the same shape. In accord with the particular surrounding conditions, in which the beams are to be erected or the special course of the proposed rail line, individual differences in the beams are necessary. By means of the proposed mold construction, it is now possible, that beams, which fundamentally have the same shape, can still be individually characterized by the switching of individual modules. By means of the mode of modular construction, a rapid manufacture of the carrier is possible, since the alteration of the mold construction from one form to another can be carried out in a very short time. The modular mode of construction of the mold concerns both the longitudinal and cross-sectional formation of the beam.

It has proven itself as advantageous, that the mold be comprised of a basic framing, a therewith connected, exchangeable core piece, and a movable side piece. Further elements of the mold can be provided for the projecting consoles and surfaces as well as for the casting at the beam ends. With these individual elements, which, if required, can be subdivided into partial modules, a very flexible, individual manufacture of altered shape beams can be obtained.

It is of particular advantage, if the modules for the compensation of length upon the stress release of the tensioning elements, during the mold release of the beam, are connected together in a sliding manner. If, at the time of the demolding of the beam, the tension of the tensioning elements is released, then the concrete of the beam is compressed and beam is thereby shortened. This action can lead to a jamming of the concrete part in the

mold. In order to avoid this, the modules are slidingly connected, one to the other, so that a release of the mold module even with released tension members is still possible.

By means of the insertion of different modules for different consoles, a beam can be adapted for the specified course of the track line. Beams, which are borne on different underpinnings can be erected by means of different consoles in optional positions.

The support consoles, which, in accord with the requirements, incorporate load bearing plates which are horizontal, inclined, or offset to one another, can be custom made very quickly.

Advantageously, the modules in the area of the base consoles have recesses for the acceptance of the mounting connections, said plates being provided with openings for grouting or ventilating purposes.

By means of , for example, long cores or side pieces, different beam lengths can be produced by the invented modular construction manner of the mold without any substantial rework costs for the said mold. Especially, when the core pieces are comprised of additional subdivided modules, then, under certain circumstances, it is a requirement, to remove single inner module pieces and the set the end pieces together. By this means, and in a very simple manner, beams which are alterable in length can be made.

Through different formulations of the core pieces, it is possible to very simply manufacture different shapes of the said hollow spaces. In this way, for instance, according to need, different radii or reinforcement elements can be provided in the hollow space, whereby, in various cases of loading, very individual beams can be created.

It is very advantageous, if the module, in regard to number, shape, and size make possible the formation of individual bulkheads. Even in this case, an individual adaptation to the beam to different conditions is very easily created.

Further advantages of the invention are to be found in the following embodiment examples. There is shown in:

LIST OF DRAWINGS

- Fig. 1 a cross-section of a beam;
 Fig. 2 a longitudinal section of a beam without the bulkhead;
 Fig. 3 a longitudinal section of a beam with a bulkhead;
 Fig. 4 a longitudinal section of a beam with two bulkheads;

 Fig. 5 a longitudinal section of a beam with stub bulkheads;
 Fig. 6 a cross-section of another beam;
 Fig. 7 a cross-section of another beam;
 Fig. 8 a sketched mold with a beam;
 Fig. 9 an alternative core piece;
 Fig. 10 a longitudinal section of a beam with its mold;
 Fig. 10a a longitudinal section of a beam with an alternative mold;
 Fig. 11 a cross-section of a beam with its mold;
 Fig. 11a a cross-section of a beam with an alternative mold;
 Fig. 12 a cross-section of a further beam;
 Fig. 13 a longitudinal section of the beam of Fig. 12; and in
 Fig. 14, 15 a cross-section of another beam.

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In Fig. 1, is presented a cross-section of a beam in accord with the invention. The beam possesses an upper flange 2 as well as two lower flanges 3 and 3'. Upper flange 2 and lower flanges 3, 3' are respectively bound together with webs 4, 4'. On the upper flange 2, attachment plates can be placed, but are not shown. Functional elements can be attached to these said attachment plates. The functional elements are affixed for the guidance of a track-traveling vehicle. The beam 1 is a concrete manufactured component, which essentially, is of precast concrete, and, when needed, is delivered to the construction site in a ready state, that is, prefabricated.

The lower flanges 3, 3' extend themselves outward in a direction away from the connecting webs 4, 4' toward the outside. By this means, a

relatively high, torsional rigidity is achieved for the open beam 1. The lower flanges 3, 3' are designed to be very heavy, so that the torsional rigidity is also increased by this means. On the ends of the beam 1, the webs 4, 4' are connected with a closure plate 5.

In spite of a beam 1 being of considerable length, the closure plate 5, with the aid of laterally extended lower flanges 3, 3', and with the connection of webs 4, 4' above the lower flange, prevents unreliable twisting of the beam during passage of a vehicle.

In the area of the closure plate 5 a basic load bearing plate 6 is provided, which coacts with (not shown) bearings and fittings. The beam 1 can, with this, be located in exact alignment on a corresponding underpinning.

In order to create a particularly torsion resistant beam 1, which possesses a hollow space between the webs 4, 4', and which, in spite of this advantage, is very simple and easily made, the beam 1 of Fig. 1 possesses an additional bottom reinforcement plate 7. The bottom reinforcement plate 7 extends itself between the lower flanges 3, 3' and is bound with these by means of reinforcing bars 8. The bottom reinforcement plate 7, which, likewise, is made of concrete, is encapsulated in concrete with a reinforcement 8 which extends into the open space of beam 1. This can, for example, also be done after the installation of various built-in construction components in the beam 1, whereby accessibility of the hollow space of the beam 1 for mounting purposes is improved. The bottom reinforcement plate 7, for instance, can be screwed in or otherwise bound to the beam 1, either releasably or non-releasably. It is important in any case, that the bottom reinforcement plate 7 strengthen the beam 1 in regard to its resistance to twist.

For increasing the structural strength of the beam 1, reinforcing bars 9 are placed in the upper flange 2 and in the lower flanges 3, 3'. The beam 1 can, moreover, for instance be made of steel-fiber impregnated concrete, whereby yet additional structural strength can be obtained.

Further, the closure plate 5 has in place preparatory fittings for the connection of the beam 1 with additional beams. Beyond this, recesses for

pretensioning elements are also provided. The closure plates 5 serve for the anchorage of projections for the said pretensioning elements, by means of which the beam 1 is brought into the pre-specified shape in regard to its deflection behavior. In the tension niches 11 are, in like manner, elements for the tensioning of the beam 1 or for the connection of several beams 1.

In Fig. 2 is shown a partially section profile view of the beam 1. The upper flange 2 and the web 4 are of one piece with the closure plates 5, 5'. On the closure plates 5, 5' the load bearing plates 6, 6' are placed. The closure plates 5, 5' as well as the plates 6, 6' are designed of different thickness. On the thinner closure plate 5, the beam 1 is coupled with another beam, whereby, by corresponding jointing, a multicompartment beam is created. In the area of the lower flange 3, the base plate 7 is located. In the embodiment example of Fig. 2, the base plate 7 completely closes off the intervening space between the webs 4, 4' and reaches from one end closure plate 5 to the other end closure plate 5'. In this way, for the first time since the manufacture of the actual beam, a closed hollow space is created therein. A beam of this type possesses a torsion rigidity, which corresponds, essentially, to the rigidity of conventional beams.

In Fig. 3 a beam 1 is presented again in a profile view, which has no base plate 7. For the acquisition of rigidity of this beam 1, a bulkhead 13 is provided which is placed in the middle of the beam 1. The bulkhead 13 binds the webs 4, 4' as well as the lower flanges with one another, whereby a displacement of the webs 4, 4' and the lower flanges 3, 3' in relation to one another is predominately avoided. A beam 1 of this type, as far as its torsional rigidity is concerned, is adequate in many cases for the foreseen installation as a beam for a magnetically levitated railway.

In Fig. 4 is presented a further embodiment example of the invention. In this case the beam possesses two bulkheads 13. Between the two bulkheads 13 is placed a bottom reinforcement plate 7'. This bottom reinforcement plate 7' reaches, principally, from one bulkhead 13 to the other bulkhead 13. The zone between the bulkhead 13 and the closure plates 5, 5' are, on the contrary, made without a bottom plate. A beam 1 of this kind

possesses, contrary to the beam of the Fig. 3, an increased torsional rigidity. As an alternative, it is always possible to place the bottom reinforcing plate 7 in the areas between the bulkhead 13 and the closure plates 5, 5', or even to insert this independent of the position of the bulkheads 13.

Fig. 5 exhibits a part of a longitudinal section of a beam with stub bulkheads 13. These bulkheads are principally placed in the upper area of the hollow space. At the ends of the upper flange 2, and in the area of the stub bulkheads 13, consoles 14 are provided, on which the (not shown) appurtenant fixtures for the guidance of the vehicle are affixed. The consoles 14, which are anchored in the concrete by means of reinforcing rods, bring about, by means of the stub bulkheads 13, an excellent introduction of force into the beam 1. The stub bulkheads 13 in this arrangement cause, besides an increase in the rigidity of beam 1, also furnish an optimized fastening for the vehicle guidance fittings onto the beam 1.

In Fig. 6 is presented a further embodiment example of a beam 1. The lower flanges 3 and 3' of the beam 1 are so designed, that their upper sides serve as a travel-way for an inspection vehicle or a construction vehicle. On this upper side of the lower flanges 3, 3', sufficient room is available to place a running track for the said vehicle.

The bulkheads 13, which, in the presentation of Fig. 5 are represented in sectional view, are generally found in the upper part of the hollow space and receive, for this reason, the flow of force which is inwardly conducted by the consoles 14 into the beam 1 and thus into the webs 4, 4' and the lower flanges 3, 3'.

In accord with Fig. 6, solar cells 20 are installed on the webs 4'. This mode of construction assumes, that the web 4' is more exposed to the radiation of the sun than is the web 4. Thus, it is to be expected, that that the side of the web 4' is more heated and thus contributes to a deformation of the beam 1, if no heat equalization is carried out. This compensating for the heat is effected by the solar cells 20 and a conductor 21 which is associated therewith. The conductor 21 conveys a heat transfer fluid from the sunshine impacted side of the beam 1 to that side which lies in the shade. By the

means noted above, the web 4 and the lower flange 3 are likewise now heated. This, in turn, lead to the fact, that the heat expansion on both sides of the beam 1 is similar, and thus the deformation of the beam 1 remains in a tolerable range. A like heat equalization can occur between the upper flange 2 and the lower flanges 3, 3', if a transport of heat, is carried out, for instance from the upper flange 2 to the lower flanges 3, 3' by a corresponding routing of the conductor 21. Alternative to the presented solar cells 20, it is possible, to carry out the insulation or the heat absorption of the beam 1 by means of coatings, thermal insulation elements, cooling or heating elements, as well as shading apparatuses.

In Fig. 7 a further alternative of a beam 1 is shown in cross section. In the case of this beam, the lower flange is comprised of a single construction component, while the upper flange 2, 2' is separated into two sections. The open space, in this arrangement, is accessible from the top of the beam 1. By means of a plate 7, the hollow space of the beam 1 is closed. In the flanges 2, 2' and 3, tension reinforcement rods 9 are respectively incorporated in the outer areas. By the placement of these reinforcement rods 9 in the outer area of the flanges 2, 2', 3, the special aspect is, that the said reinforcement rods 9 are still accessible after the installation of the beam 1, and adjustments of the beam 1 in the y and z directions is possible. This adjustment in the y and z directions is done through a corresponding post-tensioning of the individual tensioning rods 9, whereby the beam 1 is aligned in a specified manner. In this way, for instance, upon the sinking of footings at the ground, or other changes in the stretch of travel, an exact adjustment of the beam 1 to the requirements of the travel-way can be undertaken. The adjustment can be accomplished in an especially delicate and exact manner by the installation of temperature dependent, controlled compression, which, for the compensation of the deformation of the beam 1 by one sided heating of the relevant tensioning members 9, correspondingly apply more or less stress. The compression means can be connected to corresponding solar cells.

Fig. 8 shows the sketch of a modularly built up type of mold for a beam 1 in cross- section. The mold is consists of a basic frame 31, on which the rest of the mold module is constructed. The final mold module comprises the core parts 32a and 32b as well as t side mold parts 33a, 33'a and 33b and 33'b. The individual modules are set, one on the other, and can be exchanged for another type of module with very little effort. Moreover, it is possible, to insert filling pieces, which recesses in the beam 1 can hold.

In Fig. 9 is shown an alternative core piece 32'a for the mold of Fig. 8. By means of exchange of the core pieces 32a by the core piece 32'a, a beam is obtained which exhibits stub bulkheads. The short (stub) bulkheads, which were obtained by means of recesses in the core piece 32'a (indicated by the dashed line), represent, essentially, a formation similar to that of the presentations of the Figs. 5, 6.

In Fig. 10 is a longitudinal section of a beam with its mold sketched in. On the base framing 31 are built the core pieces 32c and 32d, as well as the end mold parts 34 and 34'. With a construction of this kind of individual mold module, a beam 1 of a defined length can be made. If a shorter beam 1 is required, then, in accord with Fig. 10a, the core piece 32d is displaced by the core piece 32'd and the end moldings 34', representing the desired length of the beam 1 are placed offset on the base framing 31.

It is quite plain to see, that by means of two very simple erection operations, it is possible to create different beams 1. This possesses the substantial advantage, that in the construction of a multiplicity of beams 1 for a specific stretch of travel-way, in a very simple way individual beams 1 can be prefabricated, without undertaking any great rework measures on the molds.

In order to avoid bracing and the like between the cores 32c and 32d during the relieving of the tension of the reinforcing bar for the beam 1, provision has been made, that the core pieces 32c and 32d are placed movable to one another. By this means, a jamming of the core pieces 32c and 32d in the relieved beam 1 need not be feared.

Fig. 11 and 11a show a section of a mold in the area of the load bearing console plates 6. In order to make possible an inclination of the beam 1 onto

prefabricated fittings, provision can be made that the load bearing plate 6 does not run orthogonally to the axis of the beam 1. In order to attain this, once again, a mold module 31a of the basic framing 31 is provided. As seen in the Fig. 11 regarding Module 31a, a slight inclination of the beam 1 is desired. In the load bearing plate 6 bearing fittings are placed on which the beam 1 is to rest. The bearing plates 16 are anchored in the concrete of the load bearing plate 6 with setbolts.

In accord with the embodiment as shown in Fig. 11a, the module 31'a is so designed, that the bearing plates 16 run parallel, but considerably offset in height to one another. Even this is, again, to be brought about by a simple exchange of a module on the base frame 31.

Alternative to, or in addition to the embodiments of the mold presented here, it is also possible, that on one base framing 31, a plurality of beams 1 can be placed. Thus it is also possible that on one base frame 31 either a longer beam 1, or two short beams 1 can be made. This can be effected, in that different core pieces 32 and additional end mold parts 34 can be used, which are setup on the said base framing 31.

In Fig. 12 is presented an additional embodiment of the invented beam 1. On the upper flange 2, which runs transverse to the longitudinal axis of the beam 1, and on the ends of said upper flange, where, in a manner not shown, consoles for the fastening of the function planes for the magnetically levitated railway are placed, are two webs 4, 4' spaced apart from one another. Between the two webs 4, 4', there is formed a hollow space of the beam 1, which runs essentially throughout the entire length of said beam 1. This hollow space, in any case, could be interrupted for additional reinforcement of the beam 1 by means of bulkheads. On the ends remote from the upper flange 2 of the webs 4, 4', are the lower flanges 3, 3'. The lower flanges 3, 3' extend themselves toward the outside of the beam 1. The lower flange 3, 3' show somewhat the same thickness as the webs 4, 4'. Because of the outspread shape of the lower flanges 3, 3', a greater rigidity of the beam 1 is achieved. By means of an appropriate slanted construction of the outer surface of the lower flanges 3, 3', the effect is gained that snow

and ice are less apt to cling to the structure. Winter operation then become possible. The lower flanges 3, 3' are connected to each other by bulkheads 13. This also contributes to an increased structural strength of the beam 1. The bulkheads 13 are individually apportioned along the longitudinal extent of the beam 1.

The bulkheads 13 are installed in one of the operational steps following the actual manufacturing procedure of the beam 1. Alternatively, it can be provided, that by an appropriate subdivisioning of the mold, individual modules of the mold locate above the bulkheads 13 in the hollow space of the beam 1. Upon release of the beam from the mold, these move in the longitudinal direction of the beam 1 and thus migrate into the hollow space between the individual bulkheads 13 from whence they can be withdrawn from the beam 1. By means of the invented separation of the of the mold into individual modules, this longitudinal sliding of the corresponding mold modules is very easily carried out. A further work step for the making of the beam 1 with the bulkheads 13 is, on this account, not necessary. The manufacture of the beam 1 can then be carried out quickly and economically. The same methods using mold subdivision into modules, can be applied to the installation of base plates 7 (not shown), which are only installed on a part of the beam 1. In a relation operation, by means of a longitudinal sliding of the mold, the hollow space above the base plate 7 can be retained and the corresponding mold module removed from the beam laterally, beside the base plate 7. Here again is a very rapid and economical manufacture of a beam with an integrated base plate 7 made possible.

Fig. 13 shows a section through the beam, along the dashed line of Fig. 12. It is obvious from this illustration, that the bulkheads 13, are principally located in the lower part of the beam 1, in the area of the lower flanges 3, 3'. In the area of the webs 4, 4', a hollow space is formed inside the beam 1. The effect of this hollow space is, that for the manufacture of the beam 1, principally, there is less need for consumption of material. Moreover, because of the hollow space, room is provided in which supply lines can be laid. The beam 1 is closed off by closure plates 5, 5' at the longitudinal ends.

In the closure plates 5, 5' an anchorage for tensioning members or connection members to additional beams 1 can be provided. These connections are not shown.

In the Figs. 14, 15 are shown further embodiments of beams, which can be made very quickly and economically by means of modular construction. By the exchange of individual mold areas, it is possible to create a multitude of different beams 1, which resemble one another. This is done by the application of changed mold modules. Thus, in accord with Fig. 14, a lower beam 1 can be made, which principally has an upper flange 2 and lower flange 3,3'. This kind of beam, for instance, can be employed for construction work where bridges are concerned.

For the laying of a travel-way without pillars, it is frequently convenient, if the beam 1 is constructed of minimum height. For this purpose, it is advantageous if the beam 1 is poured without a hollow space. This is easily a possibility with the invented mold, since corresponding mold modules can be removed from the mold and this a lower, by full volume beam 1 can be made.

Further, not shown embodiment examples are likewise within the scope of the invention. Thus it is entirely possible, that more bulkheads 10 than are shown here are installed with and without bottom plates 7. The bulkheads 10 can either be full wall thickness or provided with penetrative openings. It is of advantage, if the bulkheads 10, even like the closure plates 5, 5' exhibit demolding slopes, so that a mold part in the inlay work of the beam 1 can be removed from below out of the said beam 1. The base plate 7 can be of concrete or metal, and can also possess openings, especially for inspection purposes or for the removal of the mold or mold parts. The said base plate can be concreted in or, for example, fastened in place with screws. By means of an appropriate shaping of the connection points, a thrust resistant connection between the base plate 7 and the beam 1 can be made. The base plate 7 can be so installed, that a mold can be applied from the outside, and, by means of hoses, concrete can be injected into the hollow space and so build the bottom plate. The base plate 7 can, for example, also be made,

wherein the beam 1 is set into a concrete bed , which by means of the reinforcing rods extending out of the beam 1, after the setting of the concrete, is bound fast with the beam 1 and closes off the hollow space.

For the deformation of the beam, a targeted heating of the tensioning elements can be carried out, whereby the necessary, reliable tolerances of the beam can be adhered to.

CLAIMS:

1. A support (hereinafter "beam") for a travel-way for a track guided vehicle, in particular a magnetically levitated railway, of concrete, in particular a pre-cast concrete component, having a first flange (2) placed thereon, running in the longitudinal direction of the beam (1), also webs (4, 4') likewise running in the longitudinal direction of the beam (1) and, on that end of the webs (4, 4') remote from the first flange (2) are located second flanges (3, 3'), whereby, added construction parts for the guidance of a vehicle can be placed on the ends of the flanges (2; 3, 3'), which ends are distanced from one another, therein characterized, in that on each end of the webs (4, 4') remote from the first flange (2), respectively, a second flange (3, 3') is placed, whereby this second flange (3, 3') extends itself outward from the end of the webs (4, 4') essentially to the outside of the beam (1).
2. A beam in accord with Claim 1, therein characterized, in that the webs (4, 4') in the area of the second flanges (3, 3') are further distanced from one another than in the area of the first flange (2) so that the beam (1), of this manufacture, can be released from the mold at least partially from the side of the second flanges (3, 3').
3. A beam in accord with any one of the foregoing claims, therein characterized, in that the first flange (2) is an upper or lower flange (2) and the second flanges (3,3') are lower or upper flanges (3, 3') of the beam (1).
4. A beam in accord with any one of the foregoing claims, therein characterized, in that the cross sectional center of gravity of the beam (1) is to be found at the mean height of the cross section.

5. A beam in accord with any one of the foregoing claims, therein characterized, in that closure plates (5, 5'), which bind the webs (4, 4') with one another are placed on the ends of the beam (1)
6. A beam in accord with any one of the foregoing claims, therein characterized, in that on the closure plates (5, 5') are placed bearing console plates (6, 6') for the beam (1).
7. A beam in accord with any one of the foregoing claims, therein characterized, in that in the hollow space at least one bulkhead (13) is placed, which binds the webs (4, 4') together.
8. A beam in accord with any one of the foregoing claims, therein characterized, in that the bulkheads (13) are placed in the area of a transverse pretensioning member of the beam (1), and/or in the area of the add-on fixtures, especially the console (14) for the guidance of the vehicle.
9. A beam in accord with any one of the foregoing claims, therein characterized, in that the bulkheads (13) principally bind together a part of the webs (4, 4').
10. A beam in accord with any one of the foregoing claims, therein characterized, in that after the manufacture of the beam (1), the second flanges (3, 3') in the area of the hollow space, are at least partially connected together, by means of a bottom plate (7).
11. A beam in accord with any one of the foregoing claims, therein characterized, in that the bottom plate (7) is encased in concrete.

12. A beam in accord with any one of the foregoing claims, therein characterized, in that the bottom plate (7) consists of metal, plastic, or concrete, especially in the shape of a
framelike construction.
13. A beam in accord with any one of the foregoing claims, therein characterized, in that the bottom plate (7) is designed as at least partially a load bearing plate.
14. A beam in accord with any one of the foregoing claims, therein characterized, in that the bottom plate (7) is so connected to the beam (1) as to resist torsion therewith.
15. A beam in accord with any one of the foregoing claims, therein characterized, in that in the beam (1) pretensioning elements are present.
16. A beam in accord with any one of the foregoing claims, therein characterized, in that, in the outer zones of the flanges (2; 3, 3') is placed a tension reinforcement rod (9) without connection.
17. A beam in accord with any one of the foregoing claims, therein characterized, in that the central tension member is placed in the hollow space..
18. A beam in accord with any one of the foregoing claims, therein characterized, in that the central tension member is thermally insulated.
19. A beam in accord with any one of the foregoing claims, therein characterized, in that, in at least one of the closure plates (5, 5'),

especially in the area of the hollow space, tension recesses (11) are provided.

20. A beam in accord with any one of the foregoing claims, therein characterized, in that in at least one of the closure plates (5, 5'), especially in the area of the hollow space, steel plates (10) for the anchorage of the tension bars for the pretensioning elements are provided.
21. A beam in accord with any one of the foregoing claims, therein characterized, in that the beam (1) is a part of a multicompartment beam, wherein a plurality of precisely aligned beams (1) are connected together in a pretensioned manner.
22. A beam in accord with any one of the foregoing claims, therein characterized, in that the first flange and/or the second flanges (2; 3,3') are designed to be airflow favorable in regard to the vehicle, with predominant avoidance of cross-sectional changes attributable to the vehicle.
23. A beam in accord with any one of the foregoing claims, therein characterized, in that the surfaces and/or the bulk of the beam (1) on the first flange (2) and on the second flanges (3, 3') which are exposed to sun radiation are similar to have a low temperature gradient.
24. A beam in accord with any one of the foregoing claims, therein characterized, in that at least parts of the outside of the beam (1) possess a heat absorbing and/or reflecting surface.
25. A beam in accord with any one of the foregoing claims, therein characterized, in that at least parts of the outside of the beam (1) possess a coat of paint.

26. A beam in accord with any one of the foregoing claims, therein characterized, in that at least, to parts of the outside of the beam (1) shading elements have been furnished.
27. A beam in accord with any one of the foregoing claims, therein characterized, in that the first flange or second flanges (2; 3, 3') is/are designed to be a travel-way for further vehicles, especially vehicles for construction, inspection or assistance.
28. A beam in accord with any one of the foregoing claims, therein characterized, in that between a first flange and a second flange, means for heat compensation, in particular means for heat transfer is provided.
29. A beam in accord with any one of the foregoing claims, therein characterized, in that for heat equalization a control and regulatory system, in particular with sensors and pumps is provided.
30. A beam in accord with any one of the foregoing claims, therein characterized, in that the means for heat equalization are lines with heat transfer liquids, especially oil, which circulate either actively or passively through the said lines.
31. A beam in accord with any one of the foregoing claims, therein characterized, in that the means for heat equalization are cooling and/or heating elements.
32. A beam in accord with any one of the foregoing claims, therein characterized, in that by means of temperature dependent controlled compression, especially by single side warming of the relevant tensioning members (9), the beam (1) is deformable.

33. A beam in accord with any one of the foregoing claims, therein characterized, in that the compression is connected with appropriate solar cells and/or sun collectors.
34. A mold for a support (1) (hereinafter, "beam") for a travel-way for a track guided vehicle, in particular a magnetically levitated railway, of concrete, in particular being a pre-cast concrete component, having a first flange (2) placed thereon, running in the longitudinal direction of the beam (1) also having webs (4, 4') placed thereon, likewise running in the longitudinal direction of the beam (1) and with second flanges (3, 3') on those ends of the said webs (4, 4') distal from the first flange (2), whereby, on one of the mutually distanced ends of the flanges (2; 3, 3') auxiliary add-on fixtures for the guidance of the vehicle can be placed, especially for the making of a beam (1) in accord with one of the foregoing claims, therein characterized, in that the mold is composed of individual modules (31, 32, 33, 34), so that by the exchanging of individual modules a plurality of differing beams (1) can be manufactured.
35. A mold in accord with the foregoing claim, therein characterized, in that the modules for the compensation of length upon the release of the tension members during the demolding are slidably connected with one another.
36. A mold in accord with one of the foregoing claims, therein characterized, in that the module make possible various load bearing, projecting consoles.
37. A mold in accord with one of the foregoing claims, therein characterized, in that the module in the area of the load bearing plates is equipped with bearing plates (16).

38. A mold in accord with one of the foregoing claims, therein characterized, in that the module in the area of the projecting consoles possesses recesses with grout and aeration openings for the reception of the bearing plate.
39. A mold in accord with one of the foregoing claims, therein characterized, in that the modules make possible differing beam lengths.
40. A mold in accord with one of the foregoing claims, therein characterized, in that the modules make possible different formulations of hollow space.
41. A mold in accord with one of the foregoing claims, therein characterized, in that the modules, make possible differing bulkheads (13) in regard to number, shape, and size.

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