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OVERHEAD CRANE RUNWAY STRUCTURES

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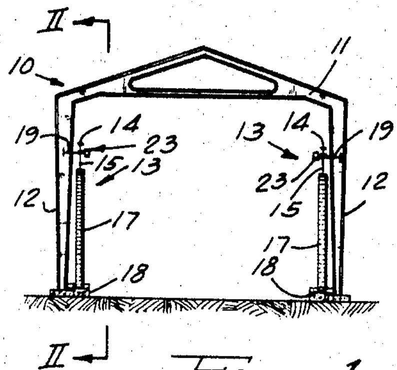

Fig. 1

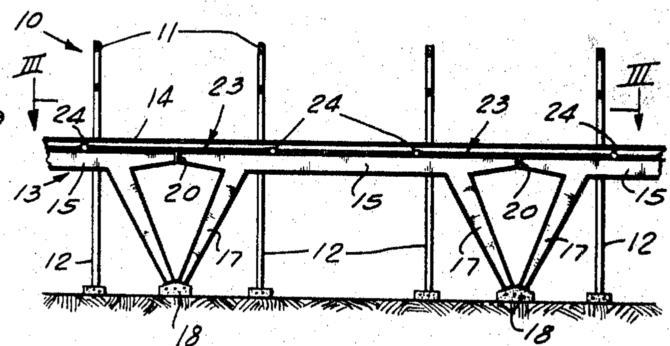

Fig. 2

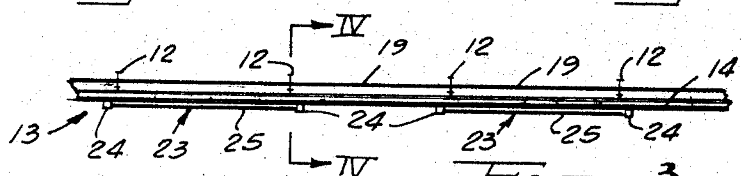

Fig. 3

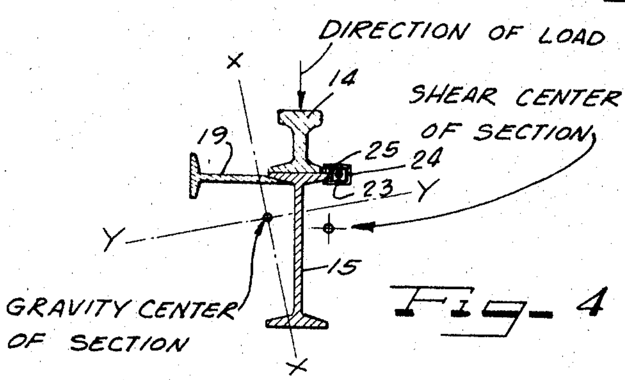

Fig. 4

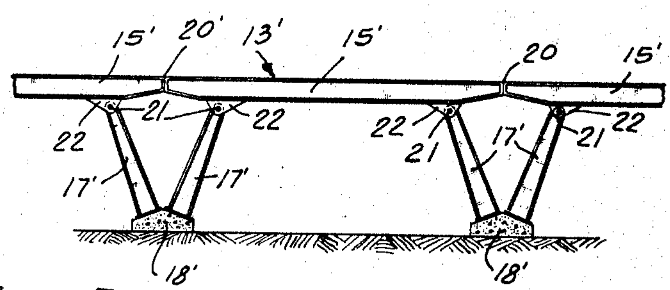

Fig. 5

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OVERHEAD CRANE RUNWAY STRUCTURES

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ABSTRACT OF THE DISCLOSURE

An overhead crane structure has a longitudinally extending supporting frame, a rail mounted on the frame, and prestressing means acting on the frame and located eccentrically relative to the gravity center of the frame and operative to neutralize lateral and torsional deflecting forces imposed by service loads in the operation of a crane on the rail.

This invention relates to overhead crane runway structures, and more particularly concerns the elimination of deflection-induced track width variations.

Overhead crane runway structures are required to support the weight of the crane mechanism as well as the lifted load. As the crane moves along the runway track longitudinal and lateral dynamic thrusts are exerted on the supporting structure through the crane wheels riding the rails forming the track on the supporting frame.

Customarily crane runway structures consist of horizontally and vertically lying longitudinally extending girders combined into a generally unsymmetrical section. The girder assemblies are supported on vertical columns with substantial span between columns. As the crane travels along the track, especially under load, vertically downward load thrusts are imposed on the track rails, causing deflection of the girders along inclined rather than vertical principal respective bending axes. Such deflections cause variations in the width of the track along which the crane is travelling. Furthermore, deflectional deformations of the frame girders and changes in crane track width are caused by twisting of the girders, because the imposed loads do not pass through the shear centers of the frame sections. In consequence, serious maintenance problems and high costs are involved in crane operations due to excessive and rapid wearing and deterioration of the runway as well as the crane wheels. Heretofore, in order to minimize excessive changes in track width and to reduce the excessive twisting of the girders, the ratio of girder span to depth has been specified much lower than required for resistance to bending moment. Crane runway girders have been proportioned for maximum allowable deflection rather than maximum allowable stresses in girder material, so that full strength of the material has not been utilized.

An important object of the present invention is to provide a novel continuous crane runway structure capable of resisting bending moment and shear at any point along its length, enabling the provisions of longer spans between vertical supports.

Another object of the invention is to provide novel prestressing means to reduce or eliminate torsional twistings of the crane runway girder frames under crane loads.

A further object of the invention is to provide novel prestressing of crane runway frames enabling more

economical splicing together of individual frame sections.

Still another object of the invention is to provide novel supporting means for crane girder frames whereby to reduce the unsupported length of horizontal girder span, whereby to aid in reducing load deflections.

A still further object of the invention is to provide a novel crane girder frame structure in which crane load deflections are efficiently neutralized and the strength of materials employed in the frame structure may thus be efficiently utilized.

Other objects, features and advantages of the present invention will be readily apparent from the following detailed description of certain preferred embodiments thereof taken in conjunction with the accompanying drawing, in which:

FIGURE 1 is an illustrative and elevational view showing an overhead crane runway structure embodying principles of the present invention;

FIGURE 2 is a side elevational view taken substantially along the line II—II of FIGURE 1;

FIGURE 3 is a top plan view taken substantially along the line III—III of FIGURE 2;

FIGURE 4 is an enlarged vertical sectional view taken substantially along the line IV—IV of FIGURE 3; and

FIGURE 5 is a side elevational view similar to FIGURE 2 but showing a modification.

In FIGURES 1 and 2 a craneway **10** is depicted including inverted generally U-shaped frame elements **11** having vertical columns **12** through which they are mounted at suitable spaced intervals. The resulting construction may provide a skeleton for a shed, warehouse, dock cover, or may be simply an open framework for the craneway, as may be preferred for any particular situation.

Along the inner side of each row of columns **12** is a respective complementary track assembly **13** which cooperate to provide a runway for any suitable or preferred overhead crane. Each of the track assemblies **13** includes a rail **14** mounted at a suitable common elevation on a longitudinally aligned series of vertically lying girders **15**, each of which is supported by a pair of legs **17** anchored at their lower ends on a suitable foundation which may be an anchor block or short pillar **18** to which the legs are secured in any suitable fashion such as by means of conventional anchor bolts (not shown). In addition, horizontally lying girders **19** are secured to the upper portions of the outer sides of the girders **15** in preferably welded, monolithic relation. For lateral stability, each of the frames thus provided for the runway assemblies **13** is attached as by welding to the columns **12** adjacent thereto.

Advantageously, each of the girders **15** and its two legs **17** are constructed and related to afford efficient resistance to vertical deflections under crane load. For this purpose, the legs **17** are respectively attached to the lower edge of the girder **15** spaced substantially from the adjacent end of the girder. Thereby the girder **15** may be of maximum workable, convenient length and since the legs **17** afford support intermediate the longitudinal center and the adjacent end in each instance, the unsupported length of the girder **15** is substantially reduced. Further, by the fixed splicing of the contiguous ends of the cantilever end portions of the girders **15**, as at **20**, the girders mutually cooperate with one another in resisting vertical deflections not only in the joined cantilever end portions but in the span of each girder between its legs **17**. Additionally, by having the horizontal girders **19** in sections between the pillars **12** and spliced together end to end and to the pillars, while the girder splices **20** are located between pairs of the pillars, an excellent mutually reinforced and what may be termed a monolithic runway frame is afforded.

Longitudinal stability in the track assemblies **13** is substantially enhanced by alternately opposite diagonal orientation of the frame legs **17**. To this end, the legs **17** of each of the girders **15** are diagonally directed downwardly and in the direction of the adjacent end of the girder and desirably in such relation to the girder end as to enable mounting of the adjacent legs **17** of the girders joined at each splice **20** on the same or common foundation block **18**. Through this mounting of the legs they mutually oppose shifting of the foundation block **18** under longitudinal stress in the track assembly. Further, each of the girders **15** is efficiently buttressed by its legs **17** against longitudinal stress in either lengthwise direction. Accordingly, great longitudinal stability is inherent in the track assemblies **13**.

Where due to liability of shifting foundation conditions, wide temperature variables and thus expansion and contraction problems, and the like, it would not be practical to secure the supporting frame legs of the track assemblies fixedly to the girders, the arrangement depicted in FIGURE 5 may be employed in which the track assembly **13'** includes the longitudinal horizontal girders **15'** supported by the legs **17'** suitably anchored to foundation blocks **18'**, but the upper ends of the legs **17'** are attached as by means of respective connecting pins **21** to attachment ears **22** on the undersides of the girders **15'**. Through this arrangement all other advantages described in respect to the track assembly **13** are attained in the track assembly **13'**, but the latter has the relatively self-adjustable connection of the girders **15'** with their supporting legs **17'**.

Due to the generally L-shaped cross section of the track girder structure, typically illustrated in FIGURE 4, principal bending axes *x—x* and *y—y* are normally encountered. Under vertical crane load, as indicated by directional arrow, deflection of the frame section follows generally the line *x—x*. Under such deflection the crane rail **14** would normally have vertical and horizontal components of movement. The horizontal component of movement would tend to change the distance between the rails **14** at the opposite sides of the runway and thus the width of the crane track. Additional deflection would be caused for the reason that the crane load applied through the rail **14** does not pass through the shear center of the section, so that a torsional or twisting deflection would be encountered.

According to the present invention changes in track width under crane load are obviated or neutralized or at least substantially reduced by prestressing the track frame. For this purpose, advantageous prestressing means are provided comprising a plurality of sections each including a member such as a rod or cable **23** spanning across each of the joints or splices **20** and connected to the contiguous track frame units. Location of the prestressing members **23** is eccentric relative to the gravity center of the section, and more particularly on or adjacent to the elbow of the inverted L-shaped section defined by the frame girders **15** and **19**. At its opposite ends each of the prestressing members **23** is anchored by means of suitable anchoring structures **24** to the respective girders **15**. In length, the prestressing members **23** are desirably such as to extend from the ends of the respective girders **15** beyond the respective frame legs **17** which are adjacent to the splice **20** spanned by the prestressing member. Each of the prestressing members **23** is preferably protectively enclosed in a tubular guard casing **25**. The prestress tension of the prestressing members **23** transfers into the L-shaped track frame section and tends to produce a bending and torsional reaction in the section opposite to the direction of service

load. As a result, lateral and torsional deflections which would normally occur under the service load are at least substantially neutralized so that the crane track width remains substantially constant under crane loads.

It will be understood that variations and modifications may effected without departing from the spirit and scope of the novel concepts of this invention.

I claim as my invention:

1. An overhead crane runway structure comprising:
a longitudinally extending supporting frame;
a rail mounted on said frame;
and elongated prestressing means longitudinally along said frame and having means anchoring the same thereto and located eccentrically relative to the gravity center of the frame and operative to neutralize lateral and torsional deflecting forces imposed by service loads in the operation of a crane on the rail.

2. The structure defined in claim **1**, in which said frame comprises a rail-supporting girder section of generally inverted L-shaped defining an elbow adjacent to the rail, and said prestressing means being located longitudinally along the section adjacent to said elbow.

3. The structure of claim **1**, in which said frame comprises a series of girders underlying the rail and joined end to end, and said prestressing means comprises a plurality of sections respectively spanning the junctures between contiguous joined girders.

4. The structure of claim **1**, in which said frame comprises a series of longitudinally extending girders joined end to end, each of said girders having a supporting leg adjacent to each of its ends, said prestressing means comprising elongated sectional prestressing members spanning the respective end joints between girders and being anchored to the respective joined girders inwardly from said legs.

5. The structure of claim **4**, wherein each of said girders has a pair of supporting legs directly therebeneath and said legs are angled divergently relative to one another on each of the girders.

6. The structure of claim **5**, in which the adjacent legs of the joined girders are mounted on common anchoring blocks.

7. The structure of claim **4**, wherein the upper ends of the legs are pinned to the respective girders.

8. The structure of claim **1**, wherein said prestressing means comprises a plurality of elongated prestressing members anchored in longitudinally spaced relation on said frame and each of said prestressing members having thereabout a tubular protective enclosure.

9. A structure according to claim **1**, including a craneway comprising a skeleton including columns, said frame including horizontally lying girders attached to said columns.

10. The structure of claim **1**, including a craneway comprising a series of generally inverted U-shaped frame members having supporting columns spaced at predetermined intervals along the way, said frame and its rail being connected as one track assembly along the inside of one of the rows of columns and a second like track assembly being attached to the inner sides of the opposite row of columns, each of said track assemblies including a vertically lying longitudinally extending girder spaced from the adjacent columns and a horizontally lying elongated girder structure providing the attachment to the columns, said prestressing means comprising a longitudinally extending series of spaced elongated prestressing members anchored at their opposite ends to the inner sides of the respective vertically lying girders adjacent to said rails and acting to produce bending and torsion in the girder sections opposite to the direction of downward service load on the rails whereby to neutralize lateral and torsional load deflections and thereby maintain the track afforded by said rails of substantially the same width under crane load throughout the length of the track.

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