

May 26, 1970

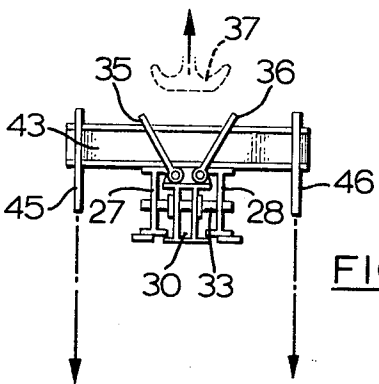
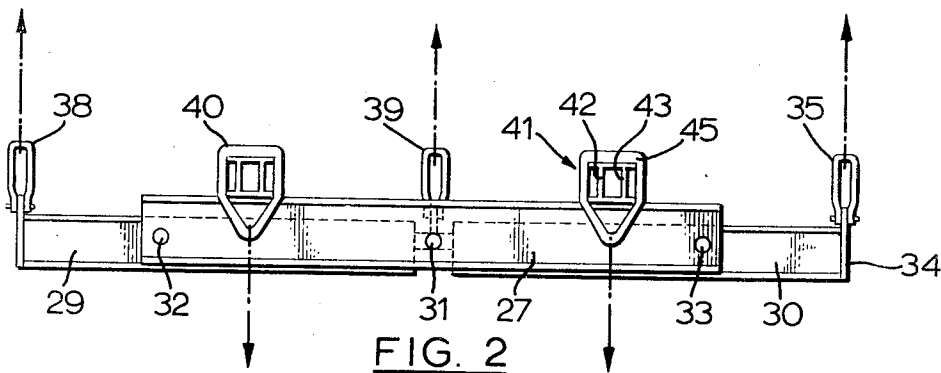
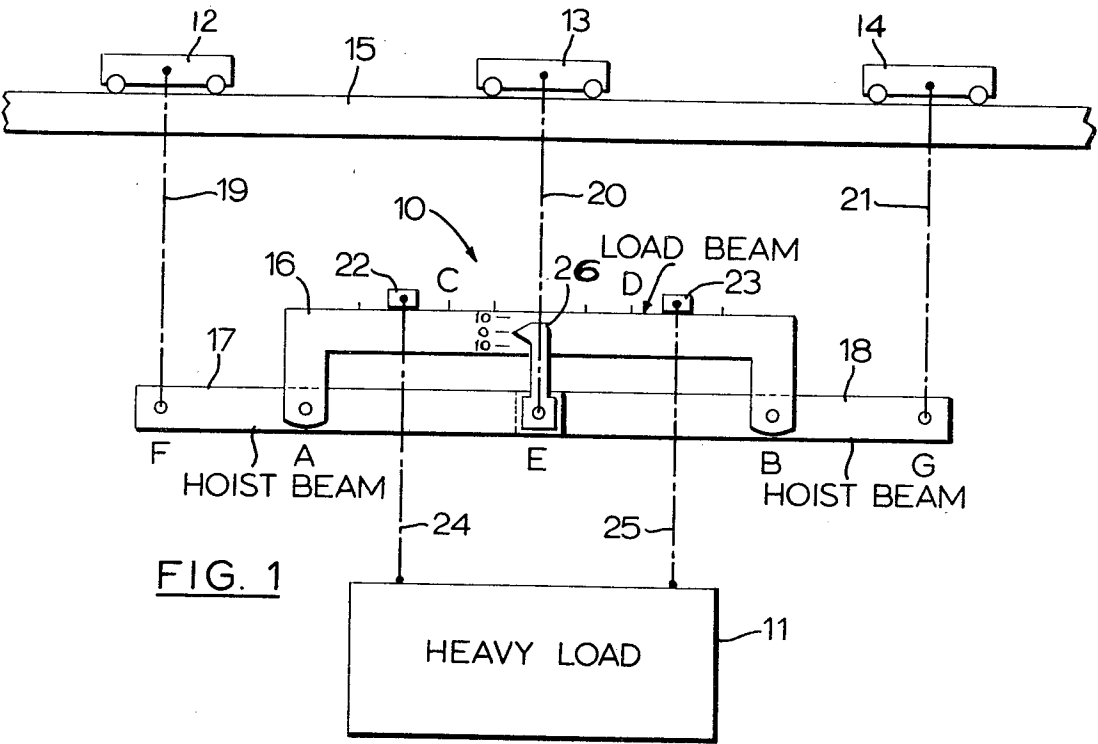
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3,513,987

THREE-CRANE LIFTING BEAM

Filed Aug. 21, 1968

2 Sheets-Sheet 1



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THREE-CRANE LIFTING BEAM

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2 Sheets-Sheet 2

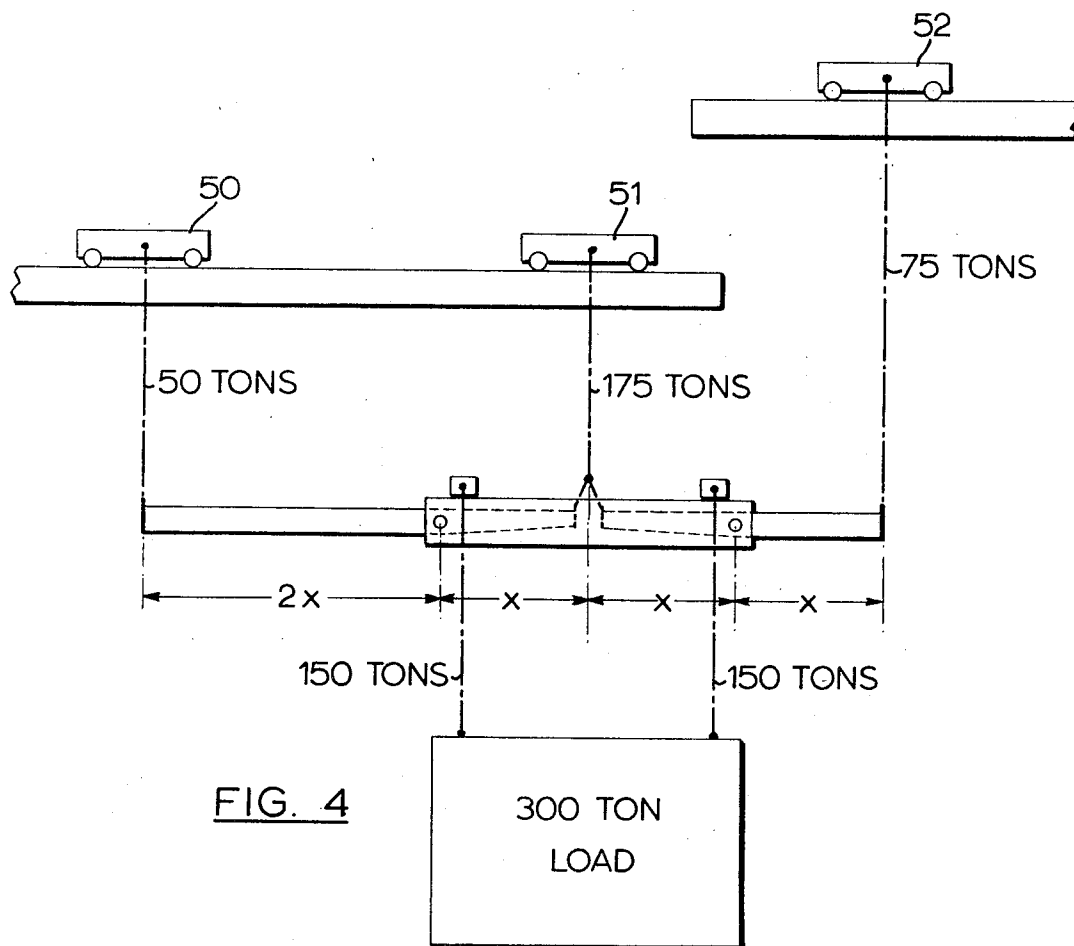


FIG. 4

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THREE-CRANE LIFTING BEAM

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6 Claims

ABSTRACT OF THE DISCLOSURE

A load, which is too heavy for a single overhead crane, is lifted by three cranes through the medium of a beam assembly which causes the load to be shared between the cranes according to crane capacity and allows the cranes to be spaced well apart so that the load is distributed over the crane supporting structure.

This invention relates to a beam assembly for distributing a load between three cranes.

There is a general trend in the manufacture of heavy industrial equipment to build units of ever increasing size and weight. This introduces handling problems in the factory, particularly the problem of adequate load carrying capacities of the existing overhead cranes. If the structure for supporting the cranes is strong enough, then a new crane of increased carrying capacity can be added, or one of the existing cranes replaced by a heavier unit. However, in many instances the structure will not take a heavier load on a single crane, and it now becomes necessary to either reinforce the structure at great expense or approach the problem in another way, such as the way proposed by this invention. According to the invention, the load is distributed between a number of smaller cranes which distribute its weight over the structure rather than concentrating it in one place as with a single crane. This invention is directed to a beam assembly for distributing the weight of the load between three cranes, and in particular equally between the three cranes.

The invention will now be described in detail with reference to the following drawings, in which:

FIG. 1 is a diagram illustrating the principle of the novel beam assembly used for dividing a load equally between three overhead cranes;

FIG. 2 is a view in side elevation of a beam assembly of the type illustrated in FIG. 1;

FIG. 3 is a view of the right end of the assembly shown in FIG. 2; and

FIG. 4 is a diagram similar to FIG. 1 illustrating an assembly for dividing the load unequally between three cranes.

Referring now to FIG. 1 where there is illustrated a beam assembly 10 for dividing a load 11 equally between three overhead cranes 12, 13 and 14. The three cranes share the combined weight of the load and the beam assembly equally between them, and are spaced equally and well apart on the track 15 so the total weight is distributed along the track and between the columns which support the track. This enables three small cranes to carry a load comparable to that possible with a single large crane, i.e., a load three times that of the smallest one of the three cranes.

Assembly 10 consists essentially of a relatively long beam 16 which will be referred to hereinafter as the load beam as the load is slung from it and a pair of like beams 17 and 18 which will be referred to hereinafter as the hoist beams as they are suspended from the three cranes. Load beam 16 has pivotal points A and B at its

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ends and a number of loading points C and D spaced equally along the beam from a point midway of AB. Beams 17 and 18 are located end-to-end alongside the load beam, are pivotally interconnected at their adjoining ends at a point E midway of AB and have a combined length greater than the distance from A to B. Beam 17 is pivotally attached intermediate its length to the load beam at point A, and beam 18 is attached to the load beam in the same way at point B. In addition to point E, the two hoist beams have hoisting or crane attachment points F and G respectively at their outer ends located at a distance from E equal to three quarters the length AB. In the symmetrical beam assembly illustrated in FIG. 1, E is midway of AB, $EF=EG=\frac{3}{4}AB$, and $EA=EB=\frac{1}{2}EF=\frac{1}{2}EG$.

The hook of the middle crane 13 is attached to the pivotal point E interconnecting the hoist beams, and the hooks of the other two cranes 12 and 14 are attached to pivotal points F and G respectively. Dashed lines 19, 20 and 21 represent the tension members used for suspending the beam assembly from the three cranes. The means used for suspending the load from the load beam may consist of a pair of cross beams 22 and 23 secured to the load beam at a corresponding pair of loading points C and D determined by the size and shape of the load, and four tension members connecting the load to the respective ends of the cross beams so its center of gravity is located directly below point E. These tension members are indicated at 24 and 25. During the lifting and transporting of load 11, the crane operators will attempt to maintain the load beam as near horizontal as possible. This they will do by having one operator act as a captain who observes a level indicator 26 on the beam assembly and directs the other two operators by means of suitable command signals. The pivotal connections between the beams allow for very significant departures from the horizontal, and therefore considerable freedom of crane mobility.

As the space between the cranes and the load is usually limited, the vertical height of the beam assembly must also be limited. Hence the assembly shown in FIG. 1 for purposes of illustrating the principle of the invention is not well suited for practical use. An actual design of a beam assembly for use in lifting a 400 ton power transformer by means of three 125 ton cranes will now be described in connection with FIGS. 2 and 3. It is to be noted that the cranes will carry a 14% overload because the total load will be the 400 ton load plus a 26.5 ton beam assembly.

In the assembly shown in FIGS. 2 and 3, the load beam consists of two long, deep webbed I-beams fabricated from high strength steel plates welded together. They are located with their webs side-by-side in spaced, parallel relation, leaving room for the hoist beams between them. The hoist beams are long, box-type beams 29 and 30 fabricated from high strength steel plates welded together. They are located end-to-end between the I-beams spaced a little therefrom, are pivotally connected together at their adjoining ends by means of a pin 31, and are pivotally connected to the ends of the I-beams by means of pins 32 and 33, which pins also hold the I-beams in place. A plate 34 welded to the outer end of beam 30 has a portion projecting above the beam containing a hole for the pin of each of the clevises 35 and 36 which receive the hook 37 of crane 14. In order to expose pin 33 and its connection with the beams, only a portion of plate 34 is shown in FIG. 3. Similar means 38 is provided on the outer end of beam 29 for the hook of crane 12. The hook of crane 13 is hooked into a pair of clevises 39 pivotally attached to one of the hoist beams directly above pin 31 or to the pin itself.

The load is suspended from a pair of cross beams 40

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and 41, each of which consists of two I-beams standing on one flange on the upper flanges of I-beams 27 and 28 as indicated at 42 and 43 for member 41. Beams 42 and 43 are located side-by-side transverse to beams 27 and 28 and are bolted thereto at a pair of loading points selected to suit the load so as to project equally from both sides of the load beam. The load is suspended from the cross beams by means of four cables attached at one end thereof to the load and at the other thereof to the cross beams by means of a shackle on each cable hung over an end of the beam such as illustrated at 45 and 46.

Some of the main specifications met in the design shown in FIGS. 2 and 3 are as follows:

(1) The distance between pins 31 and 32 or 31 and 33 is 18 feet 10 inches.

(2) The combined length of the hoist beam is 56 feet 8 inches.

(3) Shackles 45 and 46 are adjustable on the cross beam from 16 feet to 6 feet apart.

(4) The cross beams are adjustable on the load beam at six inch intervals from 36 feet to 10 feet apart.

(5) The overall height of the assembly is approximately 7 feet 3 inches.

(6) The assembly weighs 26.5 tons and will handle a 400 ton load.

Although the beam assembly generally used will be one which divides the load equally between three cranes, the invention is not necessarily so limited. The assembly may be designed for load sharing other than equally, as for example, in the proportions illustrated in FIG. 4. In this figure, a 300 ton load is shared between the three cranes 50, 51 and 52 as follows: 50 tons for crane 50; 175 tons for crane 51; and 75 tons for crane 52. The location of the crane attachment points and the pivotal points between the load and the hoist beams will be in the proportions indicated in the drawing by the small letter x.

FIG. 4 shows one crane 52 at a higher level than the other two cranes. This is done to show that the cranes can be on different levels and not necessarily on the same level as shown in FIG. 1.

FIGS. 2 and 3 show the hoist beams in the inside position; this can be reversed and the load beam placed on the inside and the hoist beams on the outside.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. A beam assembly for lifting a heavy load by means of three overhead cranes spaced apart with the crane holding the assembly close to a horizontal position, each of said crane having a cable and load hook suspended therefrom, said beam assembly comprising a load beam having pivotal points near its ends; two hoist beams placed end-to-end alongside said load beam and having a combined length greater than the length of said load beam means for pivotally securing the adjoining ends of the two hoist beams; means for pivotally supporting one hoist beam at a point intermediate its length on the load beam, and other means for pivotally supporting the other hoist beam at a point intermediate its length on the load beam; means for attaching the hook of the middle crane to the two hoist beams at their adjoining ends; means for attaching the hooks of the two outer cranes to the respective outer ends of the two hoist beams; and means for attaching the load to the load beam so its center of gravity is located directly below the adjoining ends of said hoist beams when the load is being lifted.

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2. A beam assembly for lifting and sharing a heavy load equally between three overhead cranes spaced apart with the cranes holding the assembly close to a horizontal position, each of said crane having a cable and a load hook suspended thereby, said beam assembly comprising a load beam having pivotal points at its ends and adjustable loading points spaced along the beam; two hoist beams located end-to-end alongside said load beams; means for pivotally interconnecting the adjoining ends of the two hoist beams at a hoisting point midway of said load beam pivotal points, said hoist beams having hoisting points at their outer ends located at a distance from their interconnected ends equal to three quarters of the distance between said pivotal points; means for pivotally supporting the two hoist beams on the load beam at said pivotal points; means for attaching the hook of the middle crane to the two hoist beams at their adjoining ends; means for attaching the hooks of the two outer cranes to the two hoist beams at their hoisting points; and means for attaching the load to the load beam so its center of gravity is located directly below the adjoining ends of said hoist beams when the load is being lifted.

3. The assembly defined in claim 2 wherein said load beam has a pair of relatively broad side members overhanging the sides of the hoist beams and to which the hoist beams are pivotally secured at said pivoted points, each by means of a pin passing transversely through the members and the hoist beam.

4. The assembly defined in claim 3 wherein the means for attaching the load to the load beam comprises a pair of cross beams secured midway thereof to the load beam at said loading points; and a pair of tension members attached to the ends of each cross beam for attaching the load to the cross beams, said cross beams being adjustable along the length of the load beam for accommodating loads of varying physical sizes.

5. The assembly defined in claim 2 wherein said load beam is a pair of spaced, parallel, I-beams placed with their webs forming the sides of the load beam, the hoist beams are box-type beams located between the I-beams and pivotally secured thereto at said pivotal points by means of a pin for each passing through the sides of the box-type beam and the webs of the I-beams, and the means for attaching the load to the load beam is a pair of cross beams secured midway thereof to the upper flanges of the I-beams at said loading points, each one of said cross beams having a pair of tension members depending from its ends for attachment to the load, and said cross beams being adjustable along the length of the I-beams for accommodating loads of varying physical sizes.

6. The assembly defined in claim 4 wherein a level indicator is mounted on the beam assembly for observation by at least one of the three crane operators, said indicator indicating to the operator the extent that the load beam deviates from a horizontal attitude.

References Cited

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HARVEY C. HORNSBY, Primary Examiner

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