July 2, 1963 R. F. DEHN 3,095,829

TRAVELING CRANE

Filed Dec. 3, 1959 2 Sheets-Sheet 1

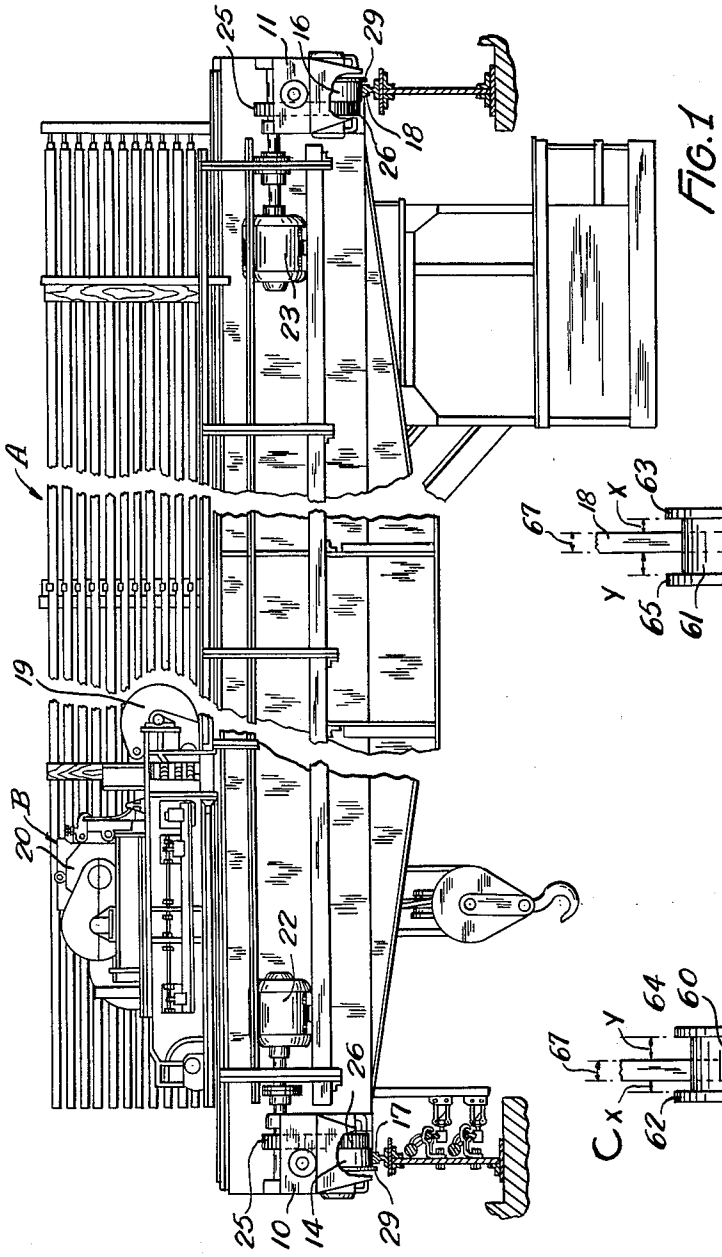


FIG. 1

FIG. 6

INVENTOR.
ROY F. DEHN
BY Hudson, Boughton, Williams, David & Hoffmann
ATTORNEYS

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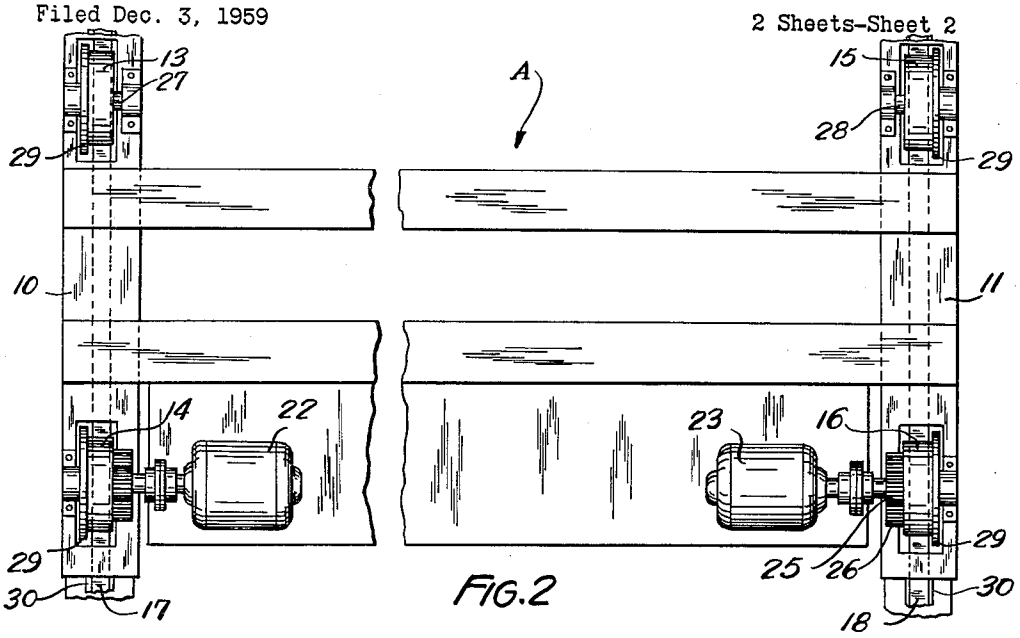


FIG. 2

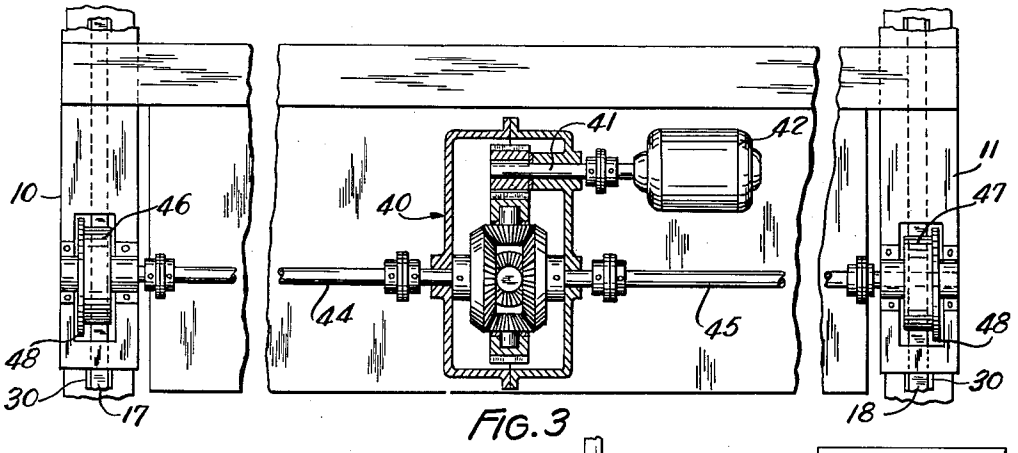


FIG. 3

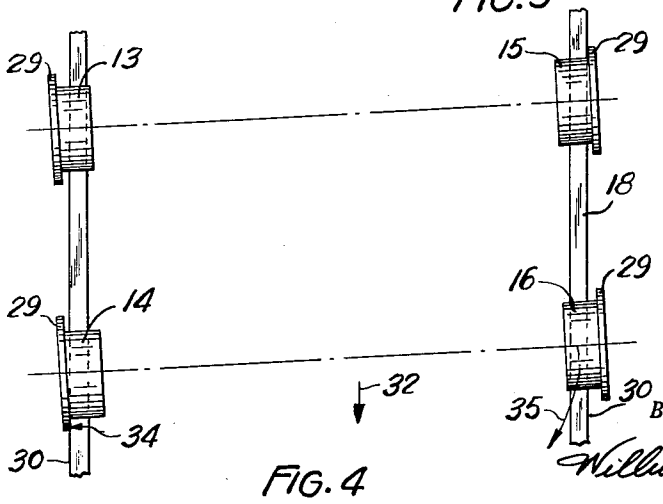


FIG. 4

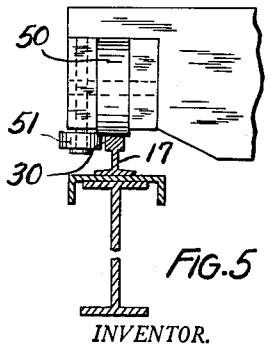


FIG. 5

INVENTOR.
ROY F. DEHN
BY Hudson, Boughton, Williams, David & Hoffmann
ATTORNEYS

United States Patent Office 3,095,829 Patented July 2, 1963

3,095,829

TRAVELING CRANE

Roy F. Dehn, Wickliffe, Ohio, assignor to The Cleveland Crane & Engineering Company, Wickliffe, Ohio, a corporation of Ohio

Filed Dec. 3, 1959, Ser. No. 857,067
6 Claims. (Cl. 105—163)

The present invention relates to traveling cranes of the type which operate on runway tracks, such as, overhead traveling bridge and gantry type cranes, etc.

The principal object of the invention is the provision of a novel and improved crane of the type referred to including a bridge supported at both ends for movement along runway tracks, and having each end driven independently by differential drive means, such as a single electric motor connected to the runway wheels through differential gearing or discrete electric motors connected to the runway wheels at opposite ends of the bridge, so that one end thereof can move ahead of the other end and including means for frictionally retarding whichever end of the bridge moves ahead of the other end so as to align or tend to align the bridge with respect to the runway.

The present invention relates to certain crane constructions, combinations and arrangements of parts and further objects and advantages of the invention will be apparent to those skilled in the art of which it relates from the preferred embodiment described with reference to the accompanying drawings forming a part of this specification and in which:

FIG. 1 is a side elevational view with portions broken away of an overhead traveling crane of the bridge type embodying the present invention;

FIG. 2 is a diagrammatical plan view of the crane shown in FIG. 1, showing the bridge, bridge runway, the runway wheels at opposite ends of the bridge and the drive therefor;

FIG. 3 is a view similar to FIG. 1 but showing an alternative construction;

FIG. 4 is a diagrammatical illustration of the positions of the wheels of the bridge when skewed out of alignment with the trackway;

FIG. 5 illustrates a modified form of wheel construction; and

FIG. 6 illustrates a further modification of wheel construction.

While the invention is susceptible of embodiment and practice in various types of traveling cranes, it is particularly applicable to overhead traveling bridge-type cranes and is herein described with reference to such a crane.

The crane shown in the drawings comprises a bridge designated generally by the reference character A, the opposite ends of which are supported by bridge trucks **10**, **11** having wheels **13**, **14** and **15**, **16** respectively, adapted to travel upon a pair of relatively widely spaced rails **17**, **18** which form the bridge runway. The rails **17**, **18** may be supported in any suitable manner as by being fixed to the side walls of a building within which the crane is housed. The crane also comprises a trolley B supported upon the bridge for movement lengthwise thereof by a reversible electric motor **19**, commonly referred to as the trolley motor. The trolley B comprises a suitable hoisting mechanism driven by a reversible electric motor **20**.

In the embodiment of the invention shown in FIGS. 1 and 2, the bridge A is adapted to be traveled along the rails **17**, **18** forming the bridge runway by discrete reversible electric motors **22** and **23**, each driving one of the bridge truck wheels **14** and **16** at opposite ends of the bridge, which wheels may be referred to as driving wheels. The motors **22** and **23** are mounted near opposite ends of the bridge A and independently drive the wheels **14**

and **16** connected therewith such as through suitable reduction gearing including pinions **25** and gears **26**. The other bridge truck wheels **13**, **15**, are individually supported on separate axles **27** and **28** for independent rotation.

In the preferred embodiment the motors **22** and **23** which independently drive the wheels **14**, **16** are alike and preferably of the series wound type, and are electrically connected in series.

The torque developed by each of the like motors **22**, **23**, connected in series, will necessarily be substantially the same even though operating at different speeds, because the torque developed by a series motor is substantially proportional to the current flowing therethrough and, because the motors are electrically connected in series, the current flow must necessarily be the same through each motor. The series connected motors **22**, **23** will therefore develop driving torque in one of the wheels **14**, **16** even though the other of the wheels is stalled for some reason. In this the motors **22**, **23** are the equivalent of a single motor driving separate wheels through mechanical differential gearing.

The wheels **13**, **14**, **15** and **16** preferably have straight or cylindrical tread surfaces, as distinguished from tapered treads, and are provided with guide means such as flanges or the like for preventing the wheels from slipping off the runway rails **17**, **18** and to otherwise aid in maintaining proper alignment therewith. In this instance the wheels are provided with outer flanges **29**, which flanges are disposed adjacent to and adapted to co-operate with the outer side surfaces **30** of the rails **17**, **18** to overcome skewing and to assure smooth travel of the bridge A with a minimum of slip and wear of the wheels and rails in a manner more fully explained hereafter.

In practice, the span of the trackway is made as nearly uniform as possible but will vary somewhat throughout its length. Therefore, the span of the wheels is chosen so that the widest span of the outside surfaces **30** of the rails **17**, **18** is slightly less than the distance between the inner surfaces of the flanges **29** of each aligned pair of wheels. Of course, the wheel treads are sufficiently wide, and the rails are so spaced, that the wheels on one end of the bridge A will be adequately supported even though the flanges **29** of the wheels on the other end of the bridge are against the outside surface **30** of their supporting rail.

When the bridge A skews or turns with respect to the runway due to such conditions as uneven wheel diameters, uneven loading of the crane, slippery runways or runways varying in span, etc., or when one end of the bridge tends to lag behind the other end for any reason, the bridge advance will follow a curve of large radius.

Referring to FIG. 4 there is shown therein positions assumed by the wheels **13**, **14**, **15** and **16** of the bridge A in the instance where the left hand end of the bridge, that is the end to which the wheels **13**, **14** are connected, moves ahead of the other end with the bridge traveling in the direction of the arrow **32**. The angular positions of the wheels with respect to the rails are exaggerated in FIG. 4 to illustrate the direction of skewing of the bridge A and the manner in which the flanges **29** cooperate with the rails **17**, **18** to assist in aligning or to realign the bridge with the runway.

It will be observed that the leading end of the bridge A has run toward the center of the trackway so that the flange **29** of the driving wheel **14** contacts the outer surface **30** of the rail **17** as at a point **34**. The contact between the flange **29** of wheel **14** and the rail **17** creates a cramping or binding action therebetween tending to stall the wheel **14** and to retard the movement of the leading end of the bridge.

The driving wheel **16**, however, will continue to ad-

vance the lagging end in the direction of the arrow **35** because the differential action of the series connected motors **22, 23** will provide independent rotation of the wheel **16**. When the lagging end of the bridge A advances sufficiently to relieve the binding condition at point **34**, the wheel **14** will begin to advance its end of the bridge at substantially the same rate as the end advanced by the wheel **16**.

The bridge A will continue to travel along the rails **17, 18** under the influence of both driving wheels **14, 16** until one end of the bridge leads the other a sufficient amount to again slow down or stall a wheel in the manner referred to above. It also will be recognized that the self-aligning function of the independently driven flanged wheels will come into play in a similar manner when the bridge is traveling in a direction opposite to the arrow **32**.

The binding of the flanges against the rails, such as at point **34**, will always occur in a manner tending to stall the leading wheel of the truck at the leading end of the bridge, thereby tending to retard that end, and the combination of differential drive means and wheels having outside flanges running adjacent the outer surfaces of their supporting rails, is a combination the elements of which cooperate to result in a particularly effective bridge drive construction capable of overcoming skew and assuring substantially self-aligning operation.

An alternative drive construction, illustrated in FIG. 3, includes as the differential drive means thereof a mechanical differential means generally indicated at **40**. The differential means **40** may conveniently be of a gearing construction well known in the art and is connected through input shaft means **41** to a single reversible electric motor **42**. A pair of drive shaft means **44, 45** connect the differential means **40** to drive wheels **46, 47** respectively, provided with exterior or outside flanges **48** which are adapted to cooperate with the outside surfaces **30** of the rails **17, 18** in the same manner as has been described with respect to the embodiment of FIGS. 1 and 2.

When stalling and retarding of the leading end of the bridge through binding or cramping of one of the wheels **46, 47** occurs, the wheel at the lagging end will continue to be driven through the action of the differential means **40**. The wheel which had been lagging will advance its end of the bridge A until the retarded stalled wheel can again move freely, at which time both ends of the bridge will advance at or substantially at the same rate.

A modification of the driving wheels is illustrated in FIG. 5 which comprises wheels **50** having straight treads and no flanges. Adjacent each wheel **50** there is mounted a guide roller **51** supported for rotation about a vertical axis.

When a wheel **50** at one end of the bridge A advances ahead of the wheel at the opposite end, the roller **51** associated therewith will engage the outer surface **30** of the rail **17** or **18** and serve to maintain the alignment of the bridge with the trackway. The engagement of the roller **51** against the rail **17** or **18** acts to retard that end of the bridge and cause the differential drive means, such as the series connected motors **22, 23** or the mechanical differential means **40**, to advance the lagging end of the bridge.

Wheels having flanges both on the inside and outside thereof may be used in combination with differential drive means in constructions embodying this invention if desired. FIG. 6 illustrates a pair of wheels **60, 61** having outside or outer flanges **62, 63** and inside or inner flanges **64, 65** respectively. In order to assure the self-aligning characteristics of the invention when wheels having both outer and inner flanges are used, the wheels must bear a certain relationship with respect to their supporting trackway rails **17, 18**.

As has been mentioned heretofore the trackways usually exhibit some variations in span throughout their length, hence it is necessary to have the treads **66** of the wheels **60, 61** somewhat wider than the widths **67** of the track **17, 18**. Also it is necessary for the sum of the dimensions X between the outer flanges **62, 63** and the outer surfaces **30** of the respective rails **17, 18**, to be less than the sum of the dimensions Y between the inner flanges **64, 65** and the inside surfaces **70** of their respective rails, throughout the length of the trackway.

It will be recognized that if the above relationship is maintained, the inner flanges **64, 65** will not contact the rails **17, 18** even though the bridge A skews or turns due to uneven speeds of advance of the respective ends thereof, and that the outer flange **62** or **63** of the leading wheel will come into binding or retarding engagement with an outer rail surface **30**. The differential drive means such as the series connected motors **22, 23**, or the mechanical differential means **40**, will then cause the lagging wheel to continue to drive independently until the skewing or turning of the bridge A is overcome and alignment with respect to the rails **17, 18** is achieved permitting both ends of the bridge to advance at substantially the same rate.

From the foregoing description, and from the accompanying sheets of drawings, it will now be apparent that there has been provided by this invention improved crane drive constructions which enable the driving of a bridge or gantry type crane in a manner which overcomes skew and misalignment with respect to trackways, the constructions including means for independently driving the wheels in combination with means for retarding the leading end of the crane bridge or gantry. Furthermore, it will be appreciated that the attendant slippage and wear of the wheels, flanges and rails will be at a minimum since the invention contemplates driving the wheels independently. Accordingly a particularly effective, smoothly operating and long lasting crane construction has been provided by this invention.

Although the invention has been described with detailed reference to specific embodiments it is understood that the invention is not limited thereto, but rather the invention includes all such changes, adaptations and modifications as are reasonably embraced by the scope of the claims hereof.

Having described my invention, I claim:

1. In an elongated generally rectangular traveling crane or the like having at each end a plurality of wheels arranged in spaced tandem relationship with respect to one another for movably supporting the crane on a runway formed by two widely spaced generally parallel rails, differentially connected power means for driving at least one of said wheels at each end of said crane for moving said crane by power along said runway, and discrete means adjacent to each of the leading corners of the crane for respectively engaging the vertical side of the rail adjacent thereto which side is farthest from the other rail when the corner of the crane adjacent to which said respective means is located leads all other corners to frictionally retard the movement of said leading corner and in turn the end of the crane of which it is a part.

2. A traveling crane as defined in claim 1 wherein said discrete means comprises flanges on said wheels.

3. A traveling crane as defined in claim 1 wherein said discrete means comprises rollers mounted for rotation about vertical axes.

4. A traveling crane as defined in claim 1 and wherein said differential drive means comprises discrete electric motors connected to one or more of said wheels at each end of said crane, said motors being electrically connected for series operation.

5. A traveling crane as defined in claim 1 and wherein said differential drive means comprises a single motor and a mechanical differential gear means, said motor being connected to rotate said drive wheels independently through said differential gear means.

6. A traveling crane as defined in claim 1 and wherein

said differential drive means comprises discrete electric motors connected to one or more of said wheels at each end of said crane.

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