Nov. 22, 1927. 1,650,037

H. PHILLIPS ET AL

FLEXIBLE CONVEYER

Original Filed Nov. 1, 1923 4 Sheets-Sheet 1

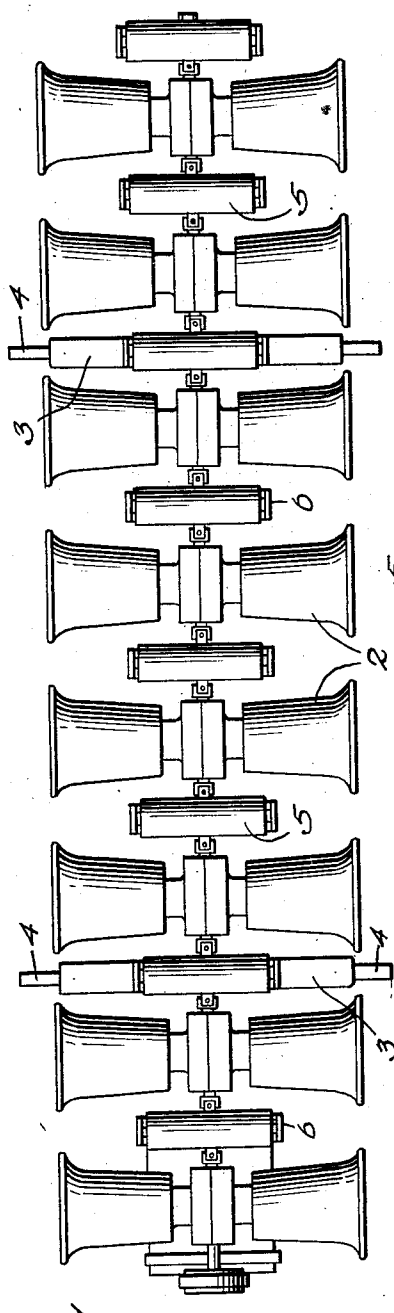


Fig. 1

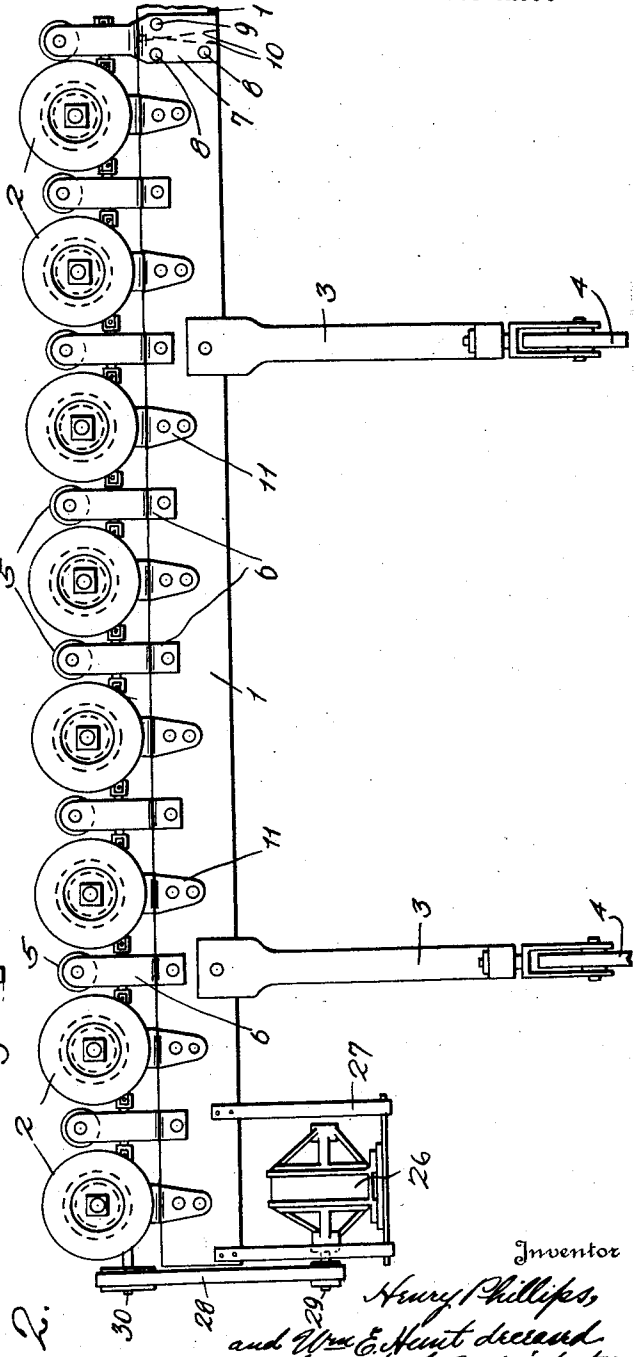


Fig. 2.

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Original Filed Nov. 1, 1923 4 Sheets-Sheet 2

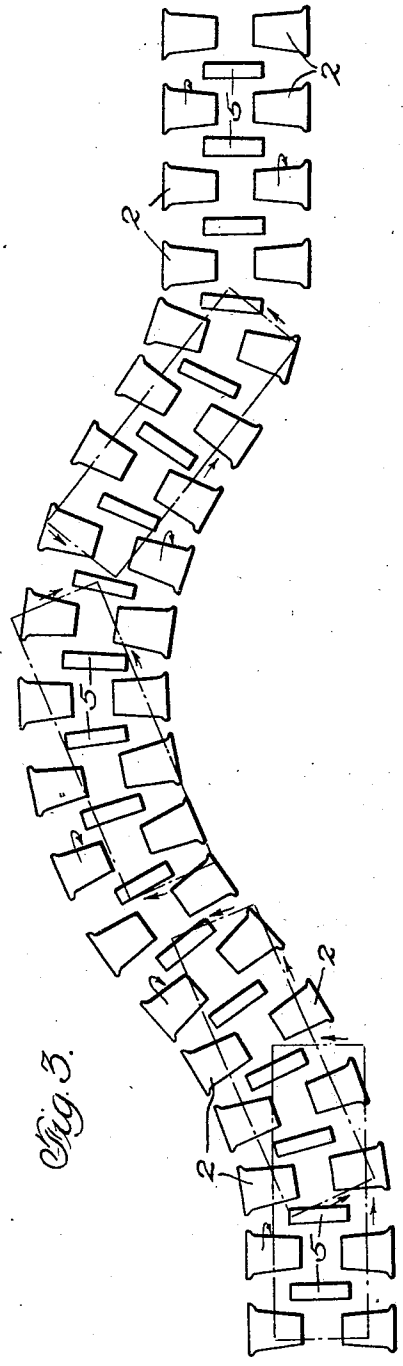


Fig. 3.

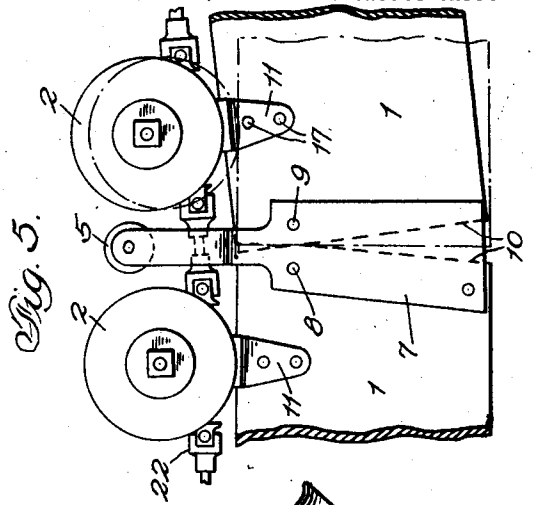


Fig. 5.

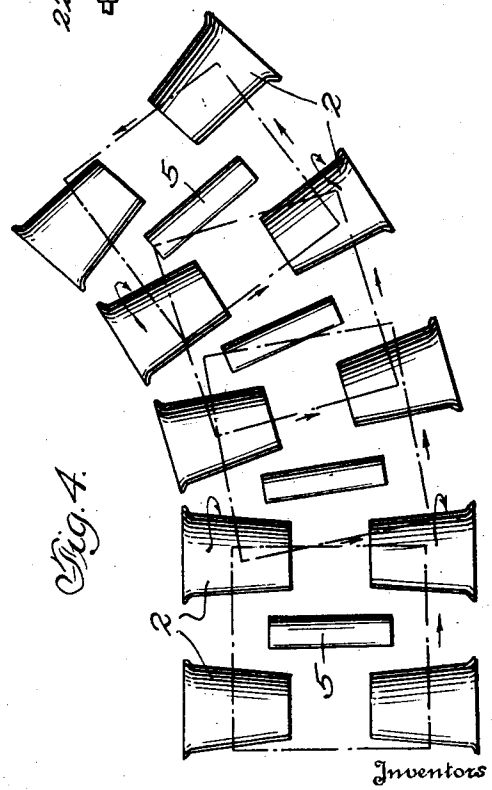


Fig. 4.

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FLEXIBLE CONVEYER

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Fig. 6.

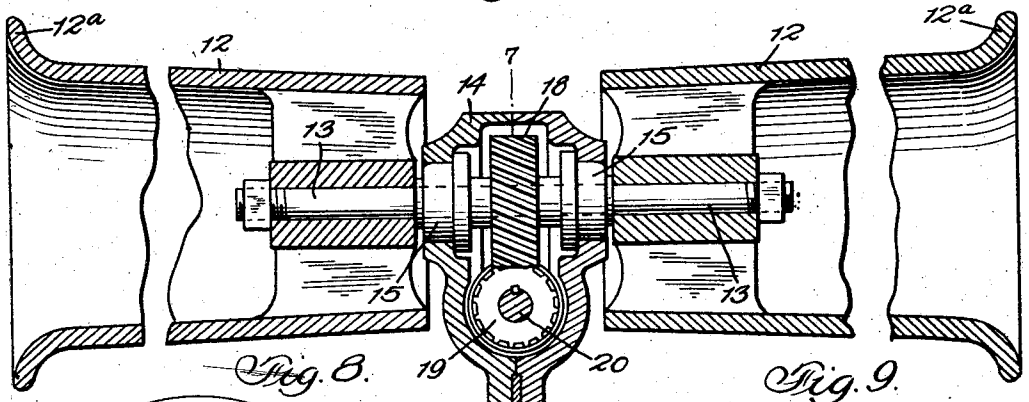


Fig. 8.

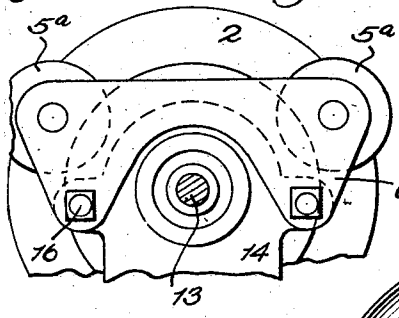


Fig. 9.

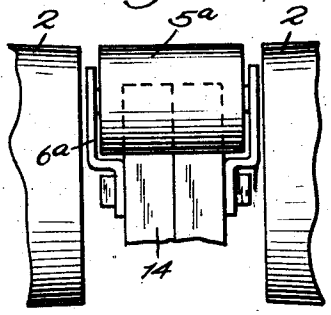
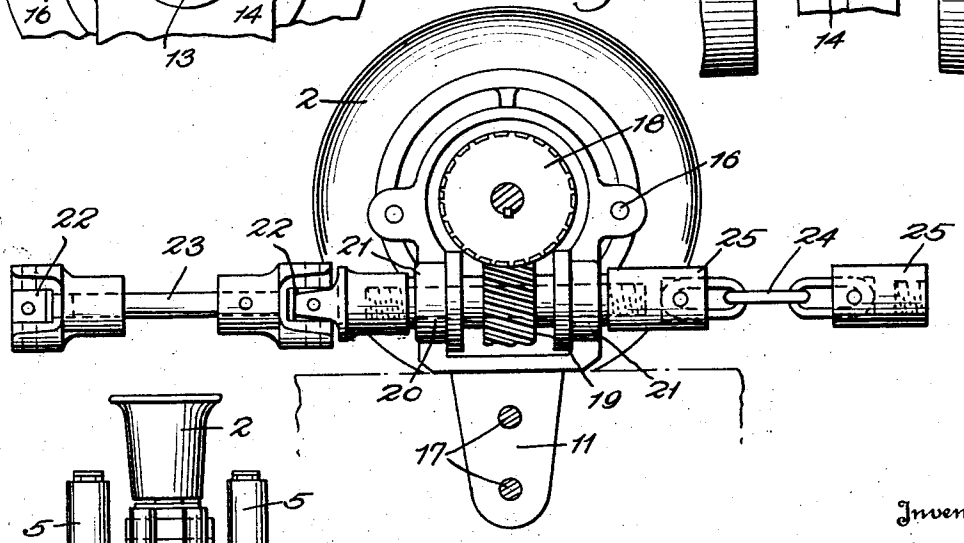


Fig. 7.



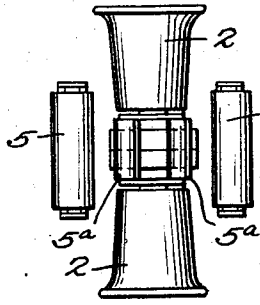


Fig. 10.

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FLEXIBLE CONVEYER

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Fig. 11.

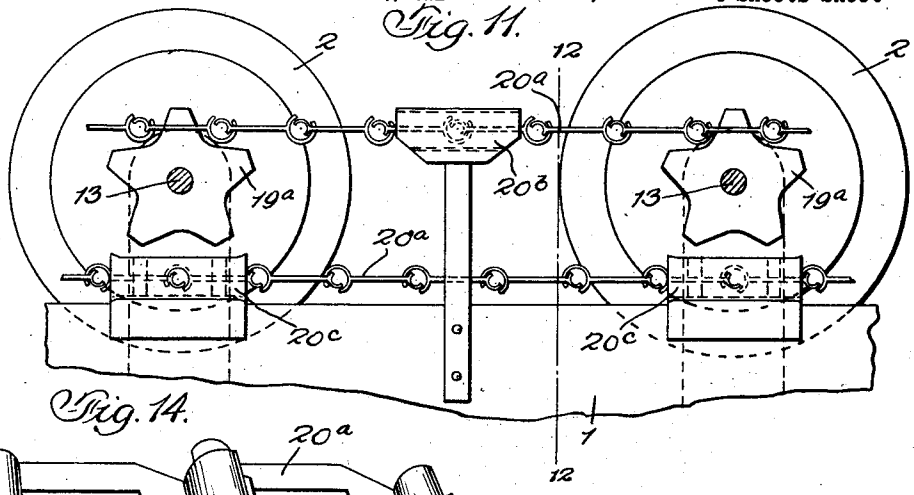


Fig. 14.

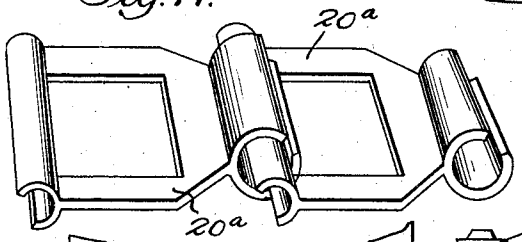
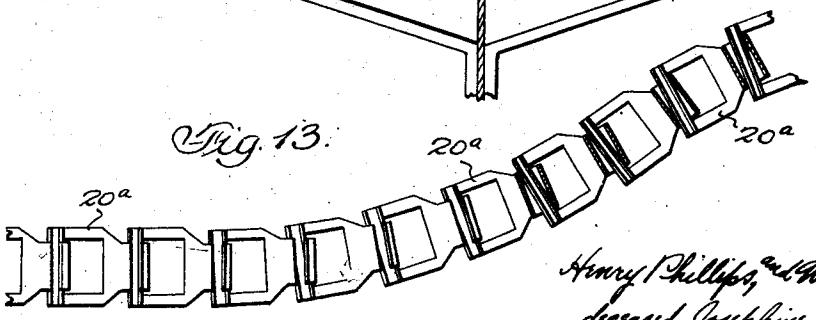


Fig. 12.

Fig. 13.



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Patented Nov. 22, 1927. 1,650,037

UNITED STATES PATENT OFFICE.

HENRY PHILLIPS, OF OTTUMWA, AND WILLIAM E. HUNT, DECEASED, LATE OF OTTUMWA, IOWA, BY JOSEPHINE HUNT, ADMINISTRATRIX, OF OTTUMWA, IOWA; SAID HENRY PHILLIPS AND WILLIAM E. HUNT ASSIGNORS TO OTTUMWA BOX CAR LOADER COMPANY, OF OTTUMWA, IOWA, A CORPORATION OF IOWA.

FLEXIBLE CONVEYER.

Substitute for application Serial No. 672,166, filed November 1, 1923. This application filed January 25, 1926. Serial No. 83,697.

The present invention relates to improvements in conveyers and its primary object is to provide a novel and improved conveyer which is adapted for use generally for moving or transporting articles or objects of various kinds from one point to another, incident to the loading of the same into or the unloading thereof from railway box cars, steamships or other transportation vehicles, the transfer of articles or objects of various kinds into or out of warehouses and the like, the conveying of articles or objects from one pile to another and for a variety of other uses, it being particularly useful in situations where the ordinary straight or rigid conveyer is unsuitable.

To accomplish these results the conveyer, according to the present invention, is flexible so that it may be bent, curved or otherwise shaped and thus caused to assume various forms to accommodate it to the different paths of travel of the articles or objects as may be required or determined by the various situations in which the conveyer is used. Also, the conveyer, in its preferred embodiment, is portable to enable it to be easily and quickly placed in position for use in a variety of situations. Furthermore, the conveyer is so constructed that it will efficiently guide and conduct the articles or objects along its length without danger of the same dropping therefrom, the construction of the conveyer being such that it acts automatically to retain the articles or objects thereon and to guide the same so that they will be properly advanced along the conveyer, irrespective of the curvature or other shape which the conveyer may be caused to assume.

To these and other ends, the invention consists in certain improvements and combinations and arrangements of parts, all as will be hereinafter more fully described, the features of novelty being pointed out particularly in the claims at the end of the specification.

In the accompanying drawings:—

Figure 1 is a top plan view of a section or portion of a portable flexible conveyer constructed in accordance with the preferred embodiment of the invention;

Figure 2 is a side elevation of the structure shown in Figure 1;

Figure 3 is a diagrammatic view of the conveyer in top plan showing an example of a form which the conveyer may assume and illustrating the manner in which the articles or objects are maintained on and advanced along the conveyer, notwithstanding the curve or curvatures thereof;

Figure 4 is a diagrammatic view showing a portion of the conveyer in bent or curved form and illustrating the action of the conveyer rollers in guiding and maintaining the articles or objects on the conveyer and for advancing them;

Figure 5 is a detail view in side elevation of the joint between adjacent sections of the conveyer, the full and dotted lines indicating the different angular positions in a vertical plane which the conveyer sections may occupy.

Figure 6 represents on an enlarged scale a section taken axially through one of the roller elements and its driving means;

Figure 7 represents a section on the line 7—7 of Fig. 6;

Figures 8, 9 and 10 are detail views showing supplemental idler rollers which may be interposed between the inner ends of the component sections of each conveyer roller to support small articles or objects when such are being handled;

Figure 11 represents a longitudinal vertical section through a portion of the conveyer embodying the present invention and equipped with a modified form of driving connection between the conveyer rollers;

Figure 12 represents a transverse section through the structure shown in Figure 11 on the line 12—12; and

Figures 13 and 14 are detail views of the driving chain showing diagrammatically the lateral flexibility thereof to accommodate it to lateral bending or flexing of the conveyer.

Similar parts are designated by the same reference characters in the several views.

The present invention provides a conveyer which is applicable to a variety of uses where articles or objects, such as boxes, sacks, packages, bricks, slabs or the like are to be conveyed or transported from point to point, and it is particularly applicable to situations where obstructions or other conditions require the run of the conveyer to

make one or more turns in order to accommodate the conveyer to the receiving and delivery points for the articles or objects. For example, in the loading or unloading of railway box cars through the usual door in the side thereof, it is necessary for the conveyer to extend through the door and to then bend toward one or the other end of the car, and, furthermore, the opposite end of the conveyer may require bending to bring it into substantial parallelism with a loading platform along one side of the car or to extend it into a warehouse, factory or other structure adjacent to the car. A conveyer capable of meeting these conditions and a variety of other conditions where the usual conveyer of fixed form is unsuitable, is shown in the accompanying drawings and will be hereinafter described in detail. It is to be understood, however, that the invention is not restricted to the particular construction shown, as equivalent constructions are contemplated and such will be included within the scope of the claims.

In the present instance, the conveyer comprises a plurality of sections, one of which is shown in Figures 1 and 2, the number of sections used depending upon the length of the conveyer. Each conveyer section embodies a main or supporting member 1, conveying rollers 2 supported thereon and over which the articles or objects are adapted to travel, driving means for causing the conveyer rollers to revolve in unison and at uniform speed and suitable supporting means 3. The member 1 is flexible transversely, it consisting, for example, of a strip of flexible or resilient steel which is capable of being bent or curved in a direction transversely of the length of the conveyer, in order to shape the conveyer to suit the requirements of any situations in which the conveyer is used, the laterally flexible strip or member 1 being so arranged that it stands edgewise in a vertical direction. The supporting means 3 comprises preferably legs which are secured to the member 1 and preferably carry rollers 4 to facilitate movement of the conveyer from place to place. These rollers 4 may advantageously be of the caster type so that they will automatically accommodate themselves to movement of the conveyer, or the portion of the conveyer to which they are attached, in any direction.

The conveyer rollers 2 are mounted on the same plane as the member 1 of the respective conveyer section and these rollers are supported on the laterally flexible member 1 at intervals in its length. Furthermore, the conveyer rollers are spaced apart at suitable intervals longitudinally of the conveyer. Therefore, when the member 1 of the conveyer flexes or bends laterally incident to bending or curving of the conveyer, the axes of the conveyer rollers will assume corresponding angular relations, as, for example, is shown in Figures 3 and 4. Intermediate idler rollers 5 may be interposed between the conveyer rollers and arranged on the same level therewith in order to bridge the spaces between the conveyer rollers and thus prevent dropping or lodging of small articles or objects between the conveyer rollers, these idler rollers being mounted on brackets 6 which are secured to the laterally flexible member 1 at points between the respective pairs of conveyer rollers. The idler rollers, however, are preferably shorter than the conveyer rollers so that they will not touch the adjacent conveyer rollers when the conveyer is bent or curved on a short radius. Also, supplemental idler rollers 5^a, as shown in Figures 8, 9 and 10, may be interposed between the inner ends of the component sections of each conveyer roller to bridge the space between the inner ends of the roller sections and thus provide ample support for small articles or objects when such are being handled by the conveyer, these idler rollers being, for example, supported by brackets 6^a.

The ends of the laterally flexible members 1 of the different sections making up the conveyer are joined to bring the conveyer sections into longitudinal alignment. As shown in the present instance, the adjacent ends of the members 1 of the conveyer sections are joined by a plate 7 which may be fixed to one of the sections 1 by the rivets or bolts 8 and pivotally connected to the other member 1 by a bolt 9 or the like which serves as a pivot which permits a hinging action between the members 1 of the adjacent conveyer sections, as indicated diagrammatically in Fig. 5, thus enabling the conveyer to accommodate itself to unevenness in the ground or supports on which it rests. The adjacent ends 10 of the members 1 are preferably bevelled, as shown, in order to provide ample clearances for the relative hinging movement between the members 1 of the adjacent conveyer section.

The conveyer rollers are fixed on the laterally flexible member 1 by suitable brackets 11. The rollers may be constructed and driven in different ways, whereby the entire series of conveying rollers will be driven in unison and the driving means will accommodate itself to lateral bending or flexing of the conveyer. It is preferable, however, to construct each roller in sections 12 which are fixed to the respective ends of a shaft 13 which projects from the opposite sides of a casing 14, the shaft being supported in the casing 14 by suitable bearings 15, ball bearings or other anti-friction bearings being generally preferable and the casing 14 is preferably split but clamped together by bolts 16, and the bracket portions 11 which are formed on the lower portions of the casing straddling the upper edge of the lateral-

ly flexible member 1 and being firmly secured thereto by suitable means such as bolts 17. The driving means for the conveyer rollers may be constructed in different ways. As shown in the present instance a spiral gear 18 is fixed on each conveyer roller shaft 13 at or near its center and this gear meshes with a similar driving gear 19 which is arranged beneath it and keyed or otherwise fixed to a driving shaft 20. The driving shaft 20 extends through the casing 14 and is supported therein by suitable bearings 21, ball bearings or other suitable anti-friction bearings being preferably used which are held in place by the clamping together of the sections of the casing 14. The casing 14 is preferably oil tight so that it is adapted to contain a lubricant for the gears and bearings. The driving shafts 20 for the different conveyer rollers extend longitudinally of the conveyer and they are connected to one another in such a way that they may be driven in unison, notwithstanding that the conveyer may be bent or curved laterally, thus causing the axes of the shafts 20 to be out of alignment. For example, a well known form of knuckle type universal joint 22 may be connected to each end of each shaft 20, the universal joints of the adjacent shafts being connected by driving bars 23; or lengths of chain 24, each having a suitable number of links, may be attached to couplings 25 threaded on or otherwise fixed to the ends of the shafts 20 or flexible rope or cable or other flexible connections may be employed. In either case, an uninterrupted driving connection will be maintained throughout the series of shafts 20, the connections between these shafts accommodating themselves to variations in the angular relationship between the shafts 20 incident to lateral flexing or bending of the member 1. Moreover, by locating the driving shafts 20 and their driving connections in the same plane with the member 1, or substantially so, the conveyer may be flexed or bent laterally in either direction without varying the distance between the adjacent shafts 20 to a material extent. It will be understood that the longitudinal shafts 20 for the series of conveyer rollers on each conveyer section will be joined by universal joints of any suitable type, such as one or the other of those above described and that the driving shafts 20 on the terminals of adjacent conveyer sections will be similarly joined. Power may be applied in any suitable way. For example, an electric motor 26 or a gasoline engine or other motive power may be employed for the purpose, it being convenient to mount the motor on the member 1 of the conveyer, by a suitable bracket 27 and to drive the end shaft 20 by a belt 28 which cooperates with sprockets 29 and 30 on the motor shaft and the shaft 20 respectively. One motor may be used to drive the entire series of conveying rollers throughout the length of the conveyer, or if desired a plurality of driving motors may be installed at different points in the length of the conveyer.

Instead of driving the conveyer rollers by longitudinal shafts having flexible connections therein, as hereinbefore described, other driving means may be employed for these rollers. For example, in Figures 11 to 14 inclusive, a chain 20^a is shown for the purpose. This chain may be of any suitable type which is capable of bending to a sufficient degree in a lateral or edgewise direction, as is indicated diagrammatically in Figure 13, a link chain of a common well known form being therein shown. In using a chain drive for the conveyer rollers, the shaft 13 of each roller has a sprocket wheel 19^a fixed thereon preferably at a point midway between the component sections of the roller and the shaft 13 of each roller may be extended at its ends and supported by exteriorly arranged brackets 14^a, the latter being secured to the opposite sides of the longitudinally-extending laterally flexible member 1. The chain 20^a extends longitudinally of the conveyer and it preferably lies in the same vertical plane with and is located above the member 1. The chain may be driven continuously by an electric motor, gasoline engine or any other suitable source of motive power. The upper stretch of the longitudinally extending chain meshes with the sprocket wheels 19^a on the shafts of the respective conveyer rollers and the travelling movement of the chain is transmitted to the conveyer rollers, causing the latter to be driven in unison in the same direction and at the same speed. A guide 20^b may be located between adjacent conveyer rollers to guide those portions of the chain which span the space between them, and guides 20^c may be located beneath the respective sprocket wheels to guide the lower stretch of the chain as it passes beneath the sprocket wheels. These guides 20^b and 20^c may be supported on the laterally flexible member 1, as shown. In using a chain drive for the conveyer rollers, the latter operate in substantially the same way as hereinbefore described with respect to the longitudinal flexible shaft drive. Lateral flexing or bending of the conveyer to accommodate it to different situations or uses may take place without interfering with the correct operation of the chain, as the latter possesses sufficient looseness in its pivots or other lateral flexibility to enable it to bend or flex to conform with the bending or flexing of the conveyer, as is indicated diagrammatically in Figure 13, the guides 20^b and 20^c serving to control or position the chain so that it maintains proper cooperative relationship with the sprocket wheels.

By mounting the series of conveyer rollers 2 on the laterally-bendable or flexible member 1, the axes of these rollers will be caused to assume angular positions convergent inwardly toward the center or inside of the bend or curve in the conveyer. In consequence, when an article or object travelling along the conveyer reaches such angularly or convergently arranged rollers, the roller on which the forward portion of the article rests will act to shift this portion of the article inwardly or toward the inner side of the curve in the conveyer while the roller in rear thereof will act to swing the rear end of the article outwardly or toward the outer side of the curve in the conveyer, thereby turning the article so that it will take a curved path conforming with the curvature of the conveyer. This action will take place automatically irrespective of the direction in which the conveyer is bent or flexed, and, moreover, this action will occur, first in one direction and then in another direction when the conveyer has a reverse curve or curves therein, as shown, for example, in Figure 3. This automatic guiding of the articles or objects by the action of the conveyer rollers can be obtained by the use of conveyer rollers which are cylindrical, or substantially so, in form, and it is to be understood that such rollers are comprehended within the scope of this invention. It is generally preferable to employ conveyer rollers which are tapered so that they flare or increase in diameter toward the respective sides of the conveyer and having flanges projecting from their peripheries at or adjacent to their outer ends. Such rollers are shown in the present instance, the section 12 of each roller being tapered so that it flares or increases in diameter toward its outer end, and provided with a circumferential flange 12^a at or adjacent to its outer end, the component sections of each roller being assembled so that the tapers thereof are in opposite or reverse relation. By tapering the conveyer rollers as above described, the action of the rollers tending to swing or turn the articles or objects and thus direct them in the proper course is augmented, as compared with cylindrical rollers, particularly when the articles or objects lie on the conveyer toward the end thereof which is at the outer side of a bend or curve therein, and hence the articles or objects will receive sufficient action from the rollers to compel them to follow the direction of run of the conveyer; and furthermore, by arranging the tapers or flares of the component sections of the rollers in reverse relation, an automatic centering action is produced by the rollers on the articles or objects which serves to maintain the latter in a course located about midway between the longitudinal sides of the conveyer, the tapers or flares on the opposite ends of the rollers acting in opposition to each other to maintain the articles or objects centered between the sides of the conveyer. The flanges on the outer ends of the conveyer rollers serve as abutments to prevent lateral displacement of the articles or objects from the conveyer, especially at the bends or curves therein. It is to be understood that when the conveyer is in operation, the entire series of conveyer rollers in each section may be driven continuously at uniform speed and in the same direction by their longitudinal driving shafts, the articles or objects resting on these rollers being thus propelled along the conveyer, the connections between the driving shafts of the series of conveyer rollers allowing and compensating for lateral curves or bends in the conveyer.

Conveyers embodying the present invention are particularly applicable to a variety of situations where the usual conveyers of fixed form are unsuitable, and, furthermore, they are capable of rapidly and efficiently transporting articles of various kinds and forms, such as boxes, packages, sacks, bricks, slabs, boards and planks, as well as objects of various kinds, the articles or objects being conducted with certainty along the conveyer, notwithstanding that the conveyer may have one or more lateral bends therein in order to accommodate it to the conditions or requirements of the situation in which it is used, and that the conveyer may be inclined upwardly or downwardly at different inclinations, the driving means in the latter case acting to control the descent of the articles or objects under the influence of gravity.

In the present instance, the conveyor, as shown, embodies means for driving the conveyer rollers, but it is to be understood that the invention also comprehends a conveyer in which the conveyer rollers are not driven but act as idlers to support and guide articles or objects as they travel along the conveyer, in which case the driving means for the rollers will be omitted the movement of the articles or objects along the conveyer being affected by gravity, pushing by hand or in any other suitable way. In either case, however, the conveyer rollers will act to properly guide and conduct the articles or objects along the conveyer and they will accommodate themselves to lateral bends of any form in the conveyer.

This application is a substitute for application Serial No. 672,166 filed jointly November 1, 1923, by Henry Phillips and William E. Hunt.

We claim:

1. A conveyer comprising a supporting member capable of being bent laterally, a series of conveyer rollers mounted at intervals along the length of said member and adapted to assume different angular relations in conformity with the form of said member, and means for driving said rollers

to propel articles or objects resting thereon along the conveyer.

2. A conveyer comprising a member capable of being curved laterally, a series of conveyer rollers mounted centrally on said member at intervals in its length and adapted to assume different angular relations to conform with bends in said member, and driving means for said rollers extending longitudinally of the conveyer and located substantially in the same vertical plane with said member.

3. A conveyer comprising a member capable of lateral bending, a series of conveyer rollers fixed on said member at different points in its length whereby the axes of said rollers will be capable of assuming different angular relations in conformity with lateral bending of said member, and means for driving the series of conveyer rollers in unison, said means extending longitudinally of the conveyer and embodying connections between the rollers which compensate for lateral flexing of said member.

4. A conveyer comprising a longitudinally extending vertically rigid, laterally flexible strip which constitutes a supporting member, a series of conveyer rollers fixed on said strip at intervals in its length and having their axes arranged transversely of said strip, the axes of the rollers accommodating themselves to lateral bending of the strip, and driving means for the rollers extending longitudinally of the conveyer substantially in the same vertical plane with said strip and embodying driving connections between the rollers which compensate for lateral flexing of the strip.

5. A conveyer comprising a longitudinally extending laterally bendable supporting member, a series of brackets fixed on said member at intervals in its length, a series of conveyer rollers each embodying roller sections mounted at opposite sides of the respective bracket, the sections of each roller being connected to revolve in unison, and means for driving the series of rollers in unison.

6. A conveyer comprising a longitudinal supporting member, a series of bearing brackets mounted thereon at intervals in its length, a shaft journaled in each bracket and projecting from the opposite sides thereof, roller sections fixed to the respective ends of each shaft, a driving shaft journaled in each bracket and operatively connected to the roller shaft, and driving connections between the ends of the driving shafts.

7. A conveyer comprising a plurality of sections joined end to end by pivoted joints which allow adjacent sections to assume different angular relations in its vertical plane, each section being laterally flexible and embodying a series of conveyer rollers the axes of which are variable in the horizontal plane to conform with lateral flexing of said section.

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