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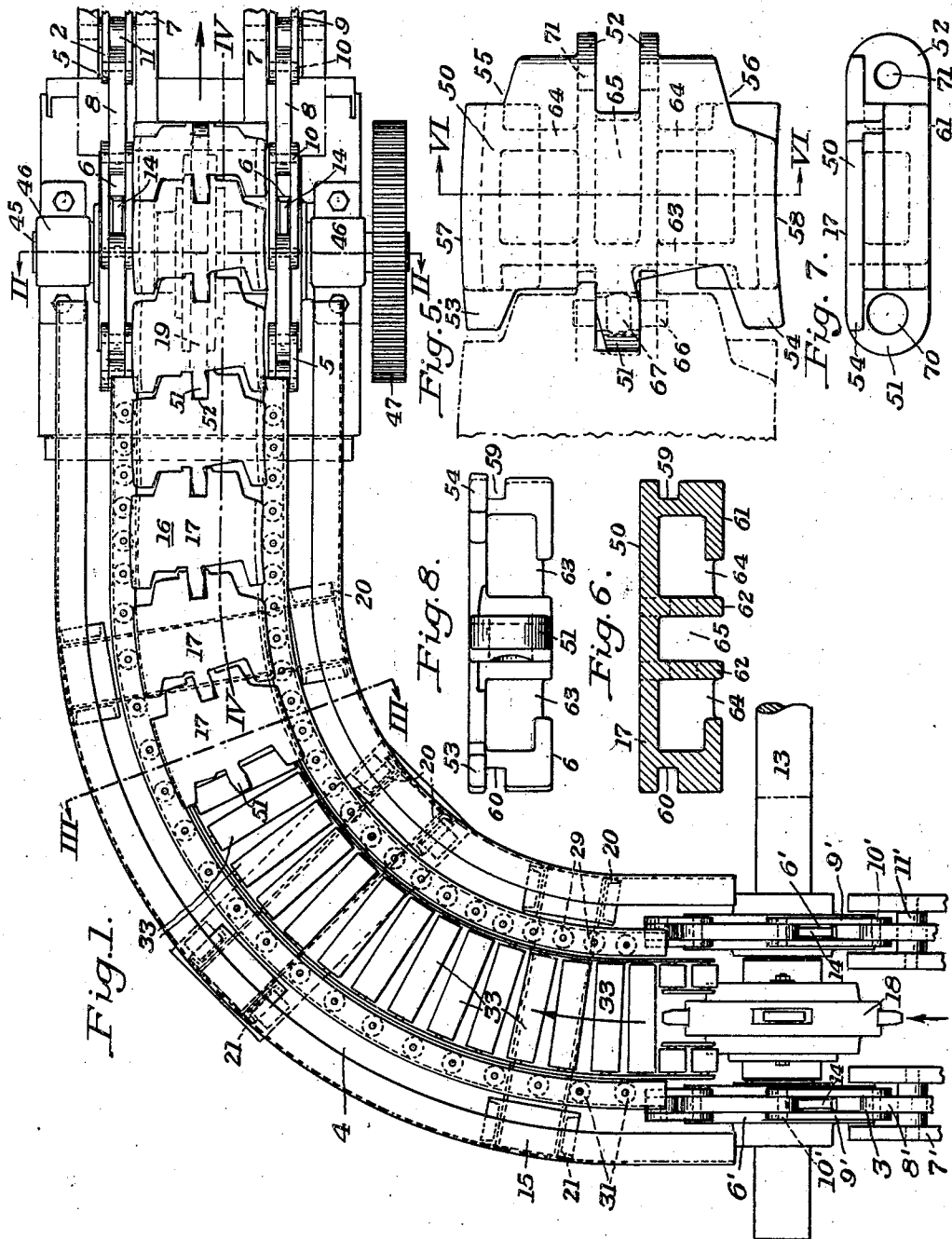
C. J. KLEIN ET AL

2,114,146

CONVEYER

Filed Dec. 23, 1936

3 Sheets-Sheet 1



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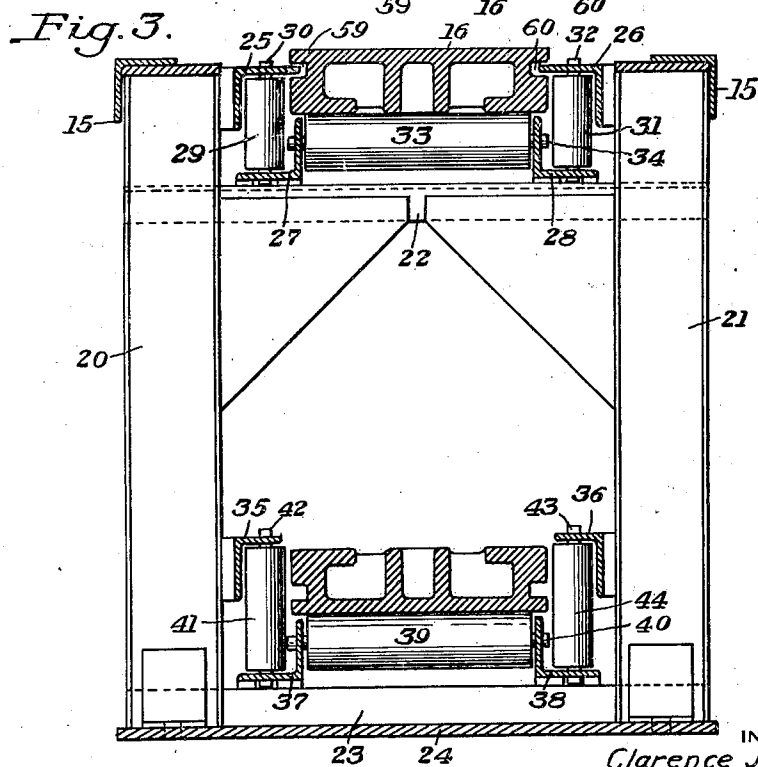
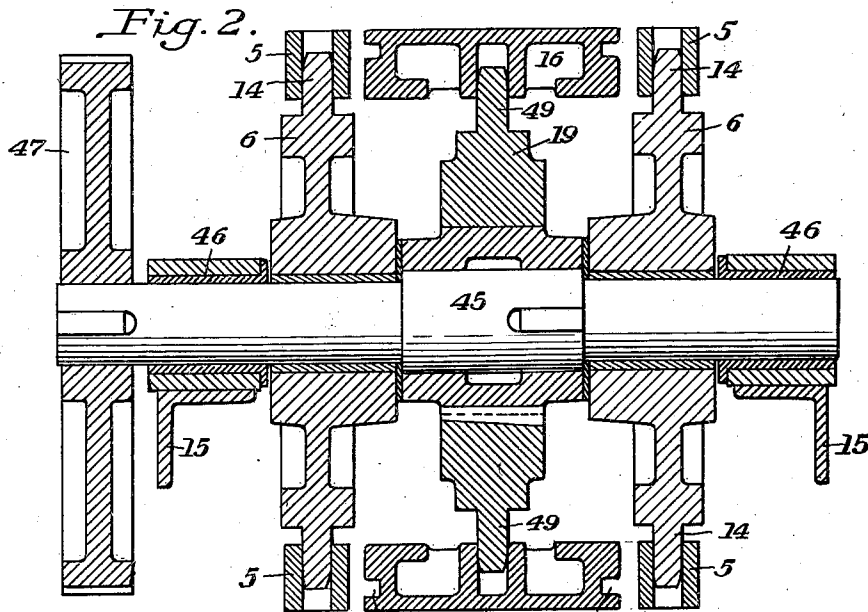
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CONVEYER

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CONVEYER

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3 Sheets-Sheet 3

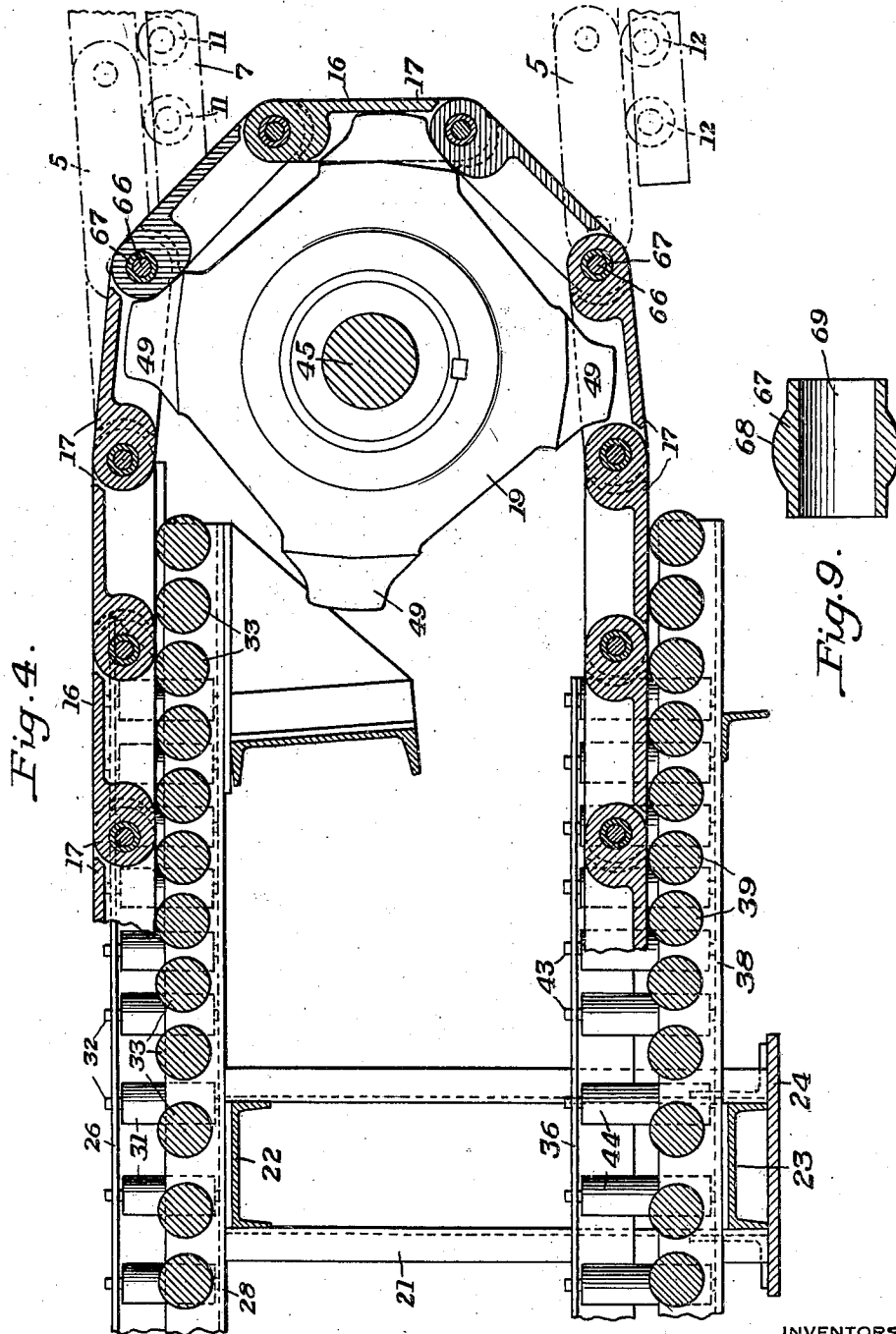


Fig. 4.

Fig. 9.

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UNITED STATES PATENT OFFICE

2,114,146

CONVEYER

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12 Claims. (Cl. 198—182)

This invention relates to improvements in or relating to conveyers of the type commonly known as drag chain conveyers, that is, of the type which carries the articles along by means of a moving endless belt-like structure or chain. It is especially directed to curved sections of conveyers for carrying articles around a curve, such as, for instance, where it is necessary to clear an obstruction or otherwise be adapted to existing conditions. It is the principal object of the present invention to provide a conveyer of the drag chain type adapted to follow a path which does not lie in a single plane. It consists essentially in arranging a trackway with curved portions that are provided with guideways for the sides of the chain and having antifriction structures for guiding the sides of the chain and antifriction structures upon which the chain is supported and over which it is moved. The drag chain links are so constructed that they may be pivotally connected for pivotal movement about axes disposed at an angle to each other, and a joint is provided which permits abrupt bending in planes angularly disposed to each other and at the same time ample bearing surfaces are provided. Thus, the chain may be bent lengthwise and also transversely of its length.

Apparatus constructed according to our invention is particularly suitable for use in connection with rolling mill systems, where heavy material such as coils of strip or sheet material are to be transported from the mill to a suitable storage space. When hot coils or strip are discharged from the strip mill, it is customary to let them stand on end and to slowly transfer them to another part of the mill, allowing the coils to wholly or partly cool during the transfer. Roller tables slightly inclined so that the coil will run over them by gravity have been generally used for this purpose, but such tables tend to damage the edges of the strip by contact with the rolls and bend the edges of the strip out of their normal plane, thus interfering with subsequent operations. To prevent this damage, we provide a carrier chain on which the coil is supported. In the straight flights of the conveyer, the chains may be of any known type and are preferably carried on rollers, but on the curved portions of the conveyer we prefer to use curved chains of the roof top type with suitable antifriction guide surfaces and supporting surfaces. Chains of this type have their links formed with closed tops and the links are connected with one another pivotally. We prefer to use links having a tongue-like projection from one end of the body and spaced

elements projecting from the opposite end of the body, said projections and elements being relatively so arranged that when the links are in assembled relation the tongue-like projection from one link is received in the space between the spaced elements at the end of the adjacent link. The links are rotatably secured to one another by pivot pins which extend through the elements and through the tongue-like projections.

The carrier chain formed from a multiple of these links passes between guide channels. The surfaces of the links engage rollers on the bottoms of the guide channels and the sides of the chains engage rollers associated with the guide channels. Formed in each of these links is a groove into which projects a member from the guide channels so as to prevent buckling of the carrier chain. The mating ends of the adjacent links are curved in order that there shall be free pivotal movement of said links relative to one another, which is necessary when the chain is going around a bend or curve or over a sprocket wheel at the end of a flight.

At each end of the curved flight a sprocket wheel is provided which cooperates with suitable openings or projections on the chain links, whereby the carrier chain is moved when the sprocket wheel is driven. It is the usual practice to drive only one of the sprocket wheels, namely, the one at the exit end of the conveyer, the sprocket wheel at the inlet end of the conveyer serving merely as a guide and an idler, although both wheels could be synchronously driven.

Due to the great weight of the coils to be transported, coils weighing ten thousand pounds not being unusual, and due to the heat of said coils preventing effective lubrication of the side guides, it has heretofore been found impracticable to build a chain conveyer with bends or curves therein for use under these conditions. Space requirements in modern mills are frequently of such nature that curves in the conveyer lines are highly essential and in some cases, it may be necessary for the finishing coils to follow a path that does not lie in a single plane. By our invention, it is possible to take care of such conditions and thus the mill designers are able to lay out the mill conveyer line as desired.

The important features of our invention reside in the design of the links and the provision of means for taking care of the great side thrust and friction encountered when the conveyer is turning a bend, and at the same time, provide antifriction bearing surfaces over which the chain plates are drawn, so that the amount of force

necessary to move the chain belt, even when a number of heavy coils are thereon, is at a minimum.

In the accompanying drawings, illustrating a present preferred embodiment of our invention and wherein like numerals denote like or similar parts throughout:

Figure 1 is a plan view of a section of a conveyer showing a portion of a carrier chain of the roof top type;

Figure 2 is a cross sectional view along the line II—II of Figure 1;

Figure 3 is a cross sectional view along the line III—III of Figure 1;

Figure 4 is a partial longitudinal sectional view along the line IV—IV of Figure 1, but on a larger scale;

Figure 5 is a plan view of the chain link;

Figure 6 is a cross sectional view along the line VI—VI of Figure 5;

Figure 7 is a side elevation of a chain link.

Figure 8 is an end elevation of a chain link looking from the left-hand end of Figure 1; and

Figure 9 is a view of a suitable link-connecting bushing.

In the drawings there is illustrated a conveyer consisting of flights 2 and 3 which may be straight flights, and a curved flight 4 connecting flights 2 and 3. The direction of movement of the conveyer is indicated by arrows. Flight 2 consists of two chains 5 arranged in parallel and spaced apart to a desirable distance depending on the size of the articles to be transported, a sprocket 6 and a conveyer frame 7. Each chain 5 consists of center links 8 of generally rectangular shape and having rounded ends and side links 9 also of generally rectangular shape with rounded ends. The side links 9 are disposed on the outside of the center links and are connected to successive links by pins 10 adjacent the ends. The upper flights of chains 5 are carried on spaced apart transverse rollers 11, which are received in a support by conveyer frame 7. The lower return flight may also be supported on transverse rollers 12, supported on frame 7. The ends of flight 2 are supported on and turn about sprocket wheels 18 keyed to shaft 13 which is mounted on conveyer frame 7. Flight 3 is similar in construction to flight 2 and the same numerals with a prime affixed thereto are used to designate like parts.

Curved flight or conveyer section 4 consists, in general, of a conveyer frame 15, a chain 16 formed of connecting plate links 17, and sprocket wheels 18 and 19 at the ends of the flight. Conveyer frame 15 (see Figures 1, 3 and 4) which is aligned at its ends with and connected to the frames 7 of the straight flights 2 and 3, consists of uprights or columns 20 and 21, cross pieces 22 adjacent the upper ends of the columns and cross pieces 23 adjacent the lower ends of the columns. The columns are supported on a suitable base 24. Mounted on the upper ends of the columns 20 and 21 are longitudinally extending guide members 25 and 26. These guide members are formed from angle bars shaped so as to conform to the desired curve of flight 4. One leg each of guides 25 and 26 extends downwardly and the other leg of the angle extends toward the center line of flight 4. Secured to cross member 22 are supporting members 27 and 28 which are formed from angle bars which run longitudinally of flight 4 and are shaped to the desired curve. One leg of each of members 27 and 28 extends upwardly and the other leg ex-

tends away from the center line of the flight. Between guide member 25 and supporting member 27 rollers 29 are rotatably secured on pins 30. Between guide 26 and supporting member 28, rollers 31 are likewise secured by pins 32. Between the upwardly projecting legs of members 27 and 28, supporting rollers 33 are rotatably supported by means of pins 34. It will be observed that the inwardly projecting legs of members 25 and 26 project beyond the circumference of guide rollers 29 and 31. The purpose of this will be apparent later. Supporting rollers 33 extend above the supporting legs of members 27 and 28.

Toward the bottom of columns 20 and 21, guide members 35 and 36 are secured. These guide members are conveniently formed from angle bars and run longitudinally of the lower flight and are bent to conform to the curve of the flight. The angles are so disposed that one leg projects horizontally toward the center line of the flight. Received on cross member 23 are longitudinally disposed supporting members 37 and 38. These members are conveniently formed from angle bars which run parallel to the center line of the flight 4 and have one leg each of the angle bars projecting upwardly, the other leg extending away from the center line of the flight. Between the upwardly projecting legs of members 37 and 38, rollers 39 are received and rotatably supported on pins 40.

Received between members 35 and 37 are a series of guide rollers 41 which are rotatably secured to members 35 and 37 by pins 42. Rotatably secured between members 36 and 38 by means of pin 43 are a series of guide rollers 44. It will be observed that the inwardly extending legs of members 35 and 36 do not extend beyond the inner surface of rollers 41 and 44, and that the upwardly extending legs of members 37 and 38 do not extend beyond the upper side of rollers 39. All of the aforementioned rollers extend to a point just short of the full length of curved flight 4.

Sprocket wheels 18 and 19 are disposed adjacent the ends of curved flight 4 and chains 16 are disposed around these sprocket wheels. Sprocket wheel 19 is keyed to shaft 45, which shaft is supported in suitable bearings 46 on conveyer frame 15. Shaft 45 is rotated by gear wheel 47 driven by means of a suitable prime mover, not shown. Sprocket wheel 19 has a plurality of spaced apart teeth 49, which contact with suitable portions of plate links 17, as will hereinafter be described, and thus drives chain 16. Chains 5 of flight 2 are disposed around sprocket wheels 5, which are journaled on shaft 45. Sprocket 6 has teeth 14 which project between side links 9 and contact the ends of central links 8 and are driven by movement of chains 5. Sprockets 6' and 18 are similarly arranged on shaft 13, which is journaled on frame 7', the only difference in the arrangements being that the sprockets 6' are keyed to shaft 13 and sprocket 18 is rotatably journaled on the shaft. Thus, when shaft 13 is turned by a prime mover, not shown, chain 5' of flight 3 will be driven in the direction of the arrow, and sprocket 18 will be free to support and be turned by chain 16.

Sprocket wheel 6 and chain 5', and sprocket wheel 19 and chain 16 are so arranged that the chains 5 and 16 may be driven at the same lineal speed so that there will be no strain or slipping when an article is transferred from chain 16 of flight 4 to chain 5 of flight 2. So also, sprockets

6' and 18 are arranged so that their associated chains will have the same lineal speed, thus facilitating transfer of the article from flight 3 to flight 4.

The various sprockets may be arranged so that they may be driven synchronously all at one time, or any desirable combination may be effected by suitable control of the driving members. We prefer to provide arrangements whereby all the flights may be driven separately as desired, as in normal operation this arrangement is in general the most suitable. Of course, when a coil is being moved from flight 3 to flight 4 or from flight 4 to flight 2, each pair of flights should be driven at the same lineal speed.

Each of the plate links 17 comprises a body portion 50, a longitudinal tongue 51, projecting from the mid-portion of one end of the body portion 50, and longitudinal spaced side members 52 projecting from the other end of the body. Tongue 51 and members 52 are curved vertically at their outer ends to form runner-like surfaces so that the connected links will pass easily in either direction over the guideways. The surface of body portion 50 which faces the sprocket wheel over which the chain belt turns is referred to as the "bottom" and the outside surface is referred to as the "top" of the link. The portions of the links which come in contact with the side rollers are called "sides" and the portions of the links which face adjacent links are referred to as "ends". The top of the link is substantially flat and the plane extends close to the end of tongues 51 and side members 52, which tongues and members are rounded on their outer ends, see Figures 5, 7 and 8. I prefer to make the projections 51 and 52 of substantially the same vertical depth, but the tongue 51 is wider than projections 52. Thus the tongues have about the same effective cross sectional area as the sum of the cross sectional areas of projections 52 so that they are of approximately equal strength. It will be observed that the top and bottom of each link are parallel.

The ends of the links from which tongues 51 project have two projecting lips 53 and 54, one on each side of tongue 51. The opposite end of the link has recessed portions 55 and 56 adjacent the sides into which the lips 53 and 54 of an adjacent link are received. The lips and recesses are so proportioned that there is no interference between the ends of adjacent plates when the plates are traversing the sharpest portion of the curved flight or when the chain is bending over the sprocket wheels.

The sides 57 and 58 of links 17 are curved to the same degree of curvature as the adjacent surfaces of the guide members 25 and 26, along which the links are moved. Formed in the sides 57 and 58 of the links are longitudinal grooves 59 and 60, into which grooves the inwardly projecting legs of members 25 and 26 are received, see Figures 3 and 6. The cooperation of members 25 and 26 and grooves 59 and 60 prevents buckling of the chain and insures that the links travel in a definite horizontal path. The bottoms 61 of the links are in the same plane as the ends of the longitudinal ribs 62 and are connected thereto by a continuous cross web 63 and discontinuous web 64. A hollow space 65 is formed beneath the top of link 17 into which space the teeth 49 of the sprocket wheels are received. The teeth 49 of driving sprocket 19 contact the end portion of tongue 51, as shown in Figure 4.

In order that there may be a range of hori-

zontal movement between adjacent connecting plates, the outer face of tongue 51 is beveled and the tongue is somewhat narrower adjacent the intersection with body portion 50. It will thus be seen that the projecting tongue 51 is shaped somewhat like a gear tooth. The inner sides of members 52 are approximately parallel, although they may be slightly flared outwardly, if desired.

Adjacent plate links 17 are connected together by a pivot pin 66 and associated bushing 67, arranged to allow relative movement between adjacent plate links. The bushing 67 has spherical surfaces 68 and a hole 69 into which pin 66 closely fits. The bushing is received in a hole 70 in the end of tongue 51. Passing through the hole 69 in the bushing 67 is the pivot pin 66, which pivot pin passes through holes 71 in side members 52 and projects slightly beyond the side members and is held in place by appropriate pins. The pivot pin 66 and bushing 67 are shown in enlarged scale in Figure 9.

We have described the curved flight 4 of the conveyer as being used in connection with straight flights of chain conveyers, but this is by way of description and not by way of limitation since the curved flight which we have illustrated and described can be used also with flights of conveyers of the types such as the ordinary roller conveyer where the article to be handled would not be injuriously affected by movement over roller conveyers.

It will be apparent to those skilled in the art that we have provided a structure which is eminently suitable for the purpose of transporting heavy materials, and particularly heavy materials which are in a heated condition and have physical characteristics such that there should be no relative movement between the portion of the conveyer with which the articles are in direct contact. By a structure made according to our invention, the heavy articles may be transported around any curve or from one horizontal plane to another and with a minimum expenditure of power.

While we have illustrated and described certain preferred embodiments of our invention, it will be understood that the same is not limited thereto, but may be otherwise embodied and practiced within the scope of the following claims.

We claim:

1. A conveyer section comprising a succession of plate links forming a substantially continuous load-supporting surface and connected to one another for deflection relative to one another in a horizontal and vertical plane, said links having curved side edges, the curvature of which corresponds to the horizontal curvature to which the conveyer section is subjected, and fixed curved guideways where the plates follow a curved path.

2. A conveyer section comprising a succession of plate links forming a substantially continuous load-supporting surface and connected to one another for deflection relative to one another in a horizontal and vertical plane, said links having curved side edges, the curvature of which corresponds to the horizontal curvature to which the conveyer section is subjected, and fixed curved guideways where the plates follow a curved path, which guideways cooperate with the links to restrain vertical movement of the links.

3. In a conveyer chain, a plurality of connected curve sided links forming a substantially continuous load-supporting surface, each link comprising a plate-like body having a pair of spaced members projecting from one of its ends and a

tongue projecting from its opposite end, said tongue being adapted to be received into the space between the aforementioned members of the adjacent link, said tongue and members being arranged to permit angular movement and vertical movement of adjacent links with respect to each other, said tongue having an opening therein, said members having an opening therein aligned with the opening in said tongue when the links are in operative position, and a pivot pin for connecting adjacent links extending through said openings and having midway of its ends a bushing with spherical segments, the opening in the tongue being of a size to receive said bushing and the opening in the members being of a size to receive the pin.

4. In a conveyer, a guideway, a plurality of connected links, each link comprising a plate-like body having a pair of spaced members projecting from one of its ends and a tongue projecting from its opposite end, said tongue being adapted to be received into the space between the aforementioned members of the adjacent links, said tongue and members being adapted to permit angular movement and vertical movement of adjacent links with respect to each other, means on said guideway cooperating with means on said links to prevent upward vertical movement of the chain, and rollers mounted on the guideways in contact with the sides and bottoms of each of the links.

5. In a conveyer for carrying articles around a curve, curved guide members, a plurality of connected plate-like links forming a substantially continuous load-supporting surface, the sides of said links being curved to fit the curve of the guides, each link comprising a body having a pair of spaced members projecting from one of its ends and a tongue projecting from its opposite end, said tongue being adapted to be received into the space between the aforementioned members of the adjacent link, said tongue and members being arranged to permit angular movement and vertical movement of adjacent links with reference to each other, said tongue having an opening therein, said members having an opening therein aligned with the opening in said tongue when the links are in operative position, and a pivot pin for connecting adjacent links extending through said openings and having midway of its ends a bushing with spherical segments, the opening in the tongue being of a size to receive said bushing and the opening in the members being of a size to receive the pin.

6. A drag link conveyer for carrying heavy articles around a curve comprising an endless conveyer chain of connected successive plate-like links forming a substantially continuous load-supporting surface, guideways for supporting the upper and lower reaches of said chain, portions of said guideways being curved, said guideways being provided with upstanding members having guide rollers in position for the sides of the chain to bear against, rollers for supporting the upper and lower reaches of the chain, at least one side of the links being curved and being always in contact with at least one of each of the guide rollers.

7. In a conveyer for carrying articles around a curve, a plurality of curved guideways parallel to each other, an endless conveyer chain of connected plate-like links forming a substantially continuous load-supporting surface arranged between said guideways, antifriction bearing sur-

faces on the guideways upon which said conveyer chain is supported and over which it is moved, antifriction surfaces on the guideways for guiding said conveyer chain around the curve, a sprocket wheel for driving said chain, and a sprocket wheel for supporting said chain, each of said links being always in contact with at least one of the anti-friction surfaces on the guideways for guiding said conveyer chain around the curve.

8. In a conveyer for carrying articles around a curve, an endless conveyer chain of connected plate links forming a substantially continuous load-supporting surface and having upper and lower reaches, upper and lower guideways for supporting the upper and lower reaches of the chain and for confining said chain to a definite path, substantially vertical rollers on both of said guideways for guiding said chain, and substantially horizontal rollers on both of said guideways for supporting the upper and lower reaches of said chain.

9. In a conveyer for carrying heavy articles around a curve, a chain composed of a plurality of links, each link having a plate-like body portion, a tongue projecting from the mid portion of one end of the body portion, projecting lips extending generally in the same direction as the tongue, longitudinally spaced side members projecting from the other end of the body and in line with the tongue, recessed portions in said latter ends adjacent the sides and of sufficient size to permit the projecting lips of an adjacent link to be operatively received therein, the tongue, side members, lips and tops of the links being in substantially the same plane, and longitudinal grooves in the sides of the links, the outer ends of the tongue and of the side members being rounded.

10. In a conveyer for carrying heavy articles around a curve, a chain composed of a plurality of links, each link having a plate-like body portion, a tongue projecting from the mid portion of one end of the body portion, projecting lips extending generally in the same direction as the tongue, longitudinally spaced side members projecting from the other end of the body and in line with the tongue, recessed portions in said latter ends adjacent the sides and of sufficient size to permit the projecting lips of an adjacent link to be operatively received therein, the tongue, side members, lips and tops of the links being in substantially the same plane, the outer ends of the tongue and of the side members being rounded, and the top and bottom of the body being substantially parallel.

11. In a conveyer for carrying heavy articles around a curve, a sprocket, a chain composed of a plurality of links forming a substantially continuous load-supporting surface and adapted for movement by the sprocket, each link having a plate-like body portion, a tongue projecting from the mid portion of one end of the body portion, projecting lips extending generally in the same direction as the tongue, longitudinally spaced side members projecting from the other end of the body and in line with the tongue, recessed portions in said latter ends adjacent the sides and of sufficient size to permit the projecting lips of an adjacent link to be operatively received therein, the tongue, side members, lips and tops of the links being in substantially the same plane, longitudinal grooves in the sides of the links, and a hollow space extending upwardly from the bottom of the link into which the tooth of the

sprocket is received and permitting said sprocket teeth to bear against the projecting tongue of the adjoining link.

5 12. In a conveyer chain, a guideway, a plurality of successive links forming a substantially continuous load-supporting surface, each link comprising a plate-like body having a pair of spaced members projecting from one of its ends and a tongue projecting from its opposite end,
10 said tongue being adapted to be received into the

space between the aforementioned members of the adjacent link and said tongue and members being adapted to permit angular movement and vertical movement between adjacent links, a groove in each side of the links, and a projecting
6 portion of said guideway extending into said groove to prevent upward vertical movement of the chain.

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