March 3, 1942. G. A. BEE ET AL 2,275,244

STEEL MILL CONVEYER

Filed May 25, 1938 4 Sheets-Sheet 1

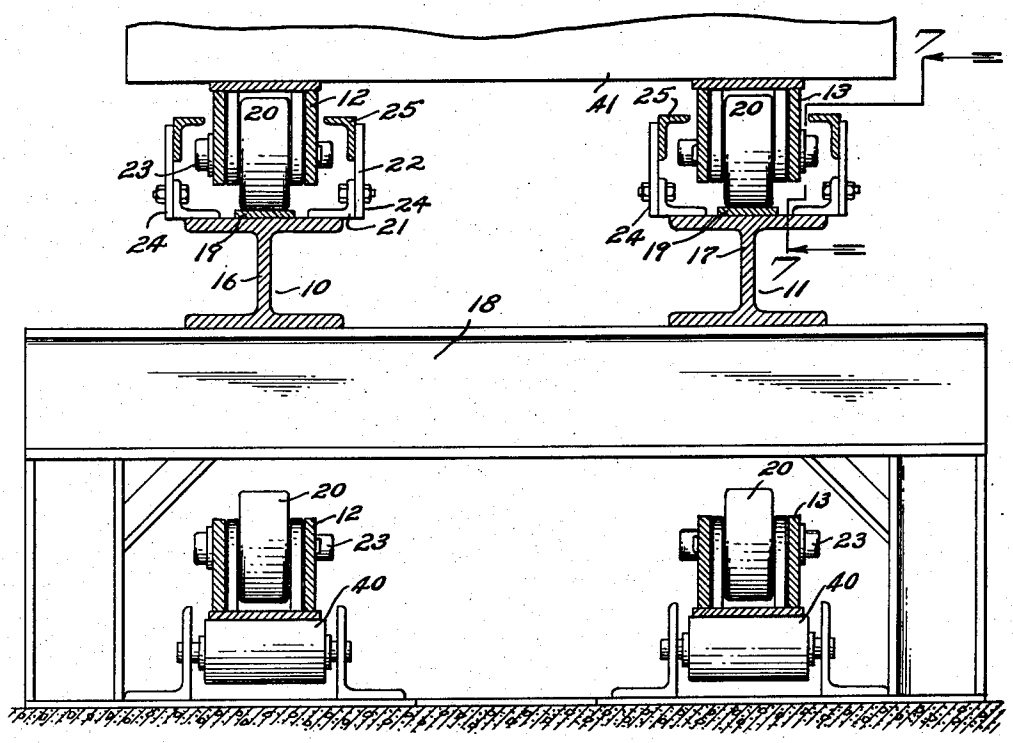

FIG. 1.

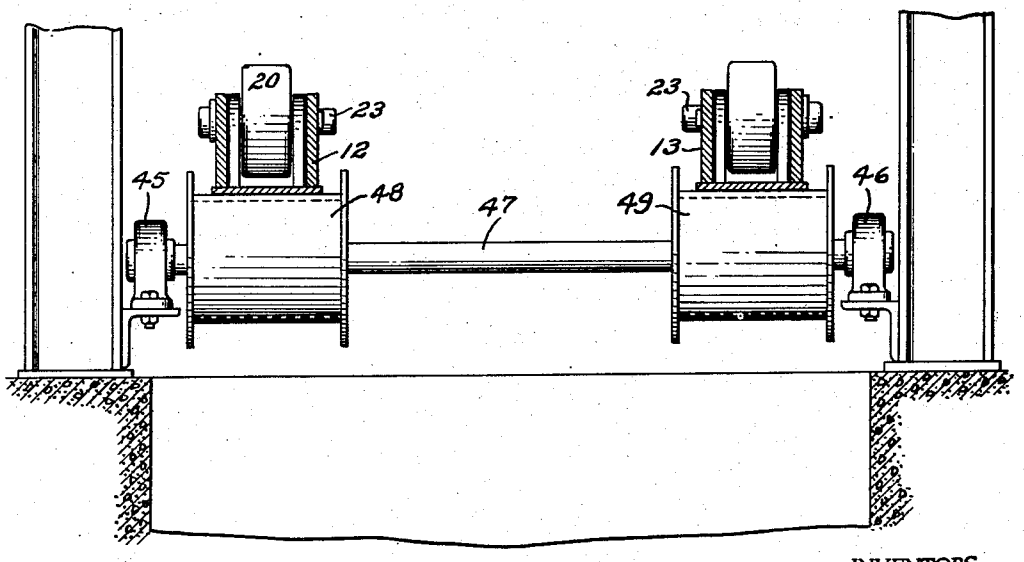

FIG. 2.

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Filed May 25, 1938 4 Sheets-Sheet 2

Fig. 3.

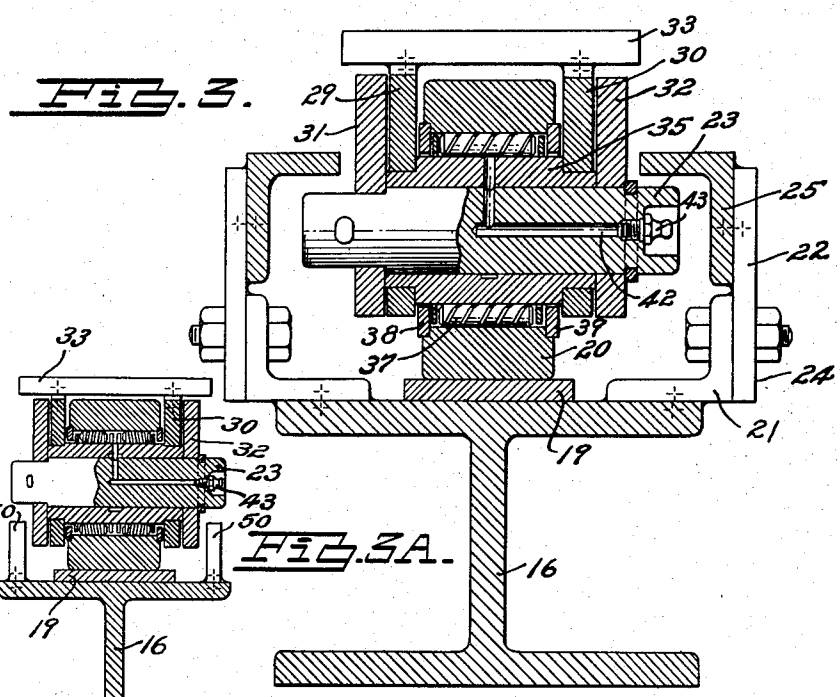

Fig. 3A.

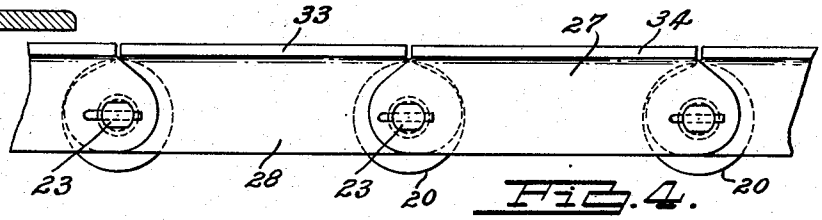

Fig. 4.

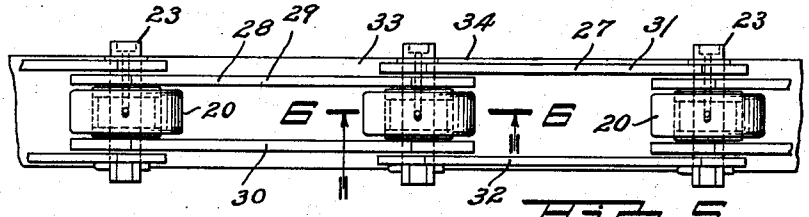

Fig. 5.

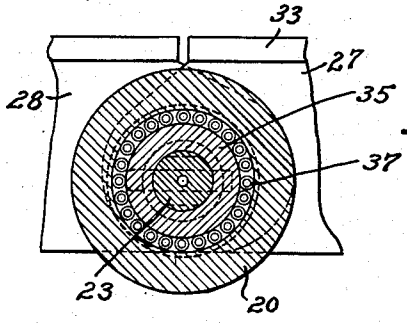

Fig. 6.

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STEEL MILL CONVEYER

Filed May 25, 1938 4 Sheets-Sheet 3

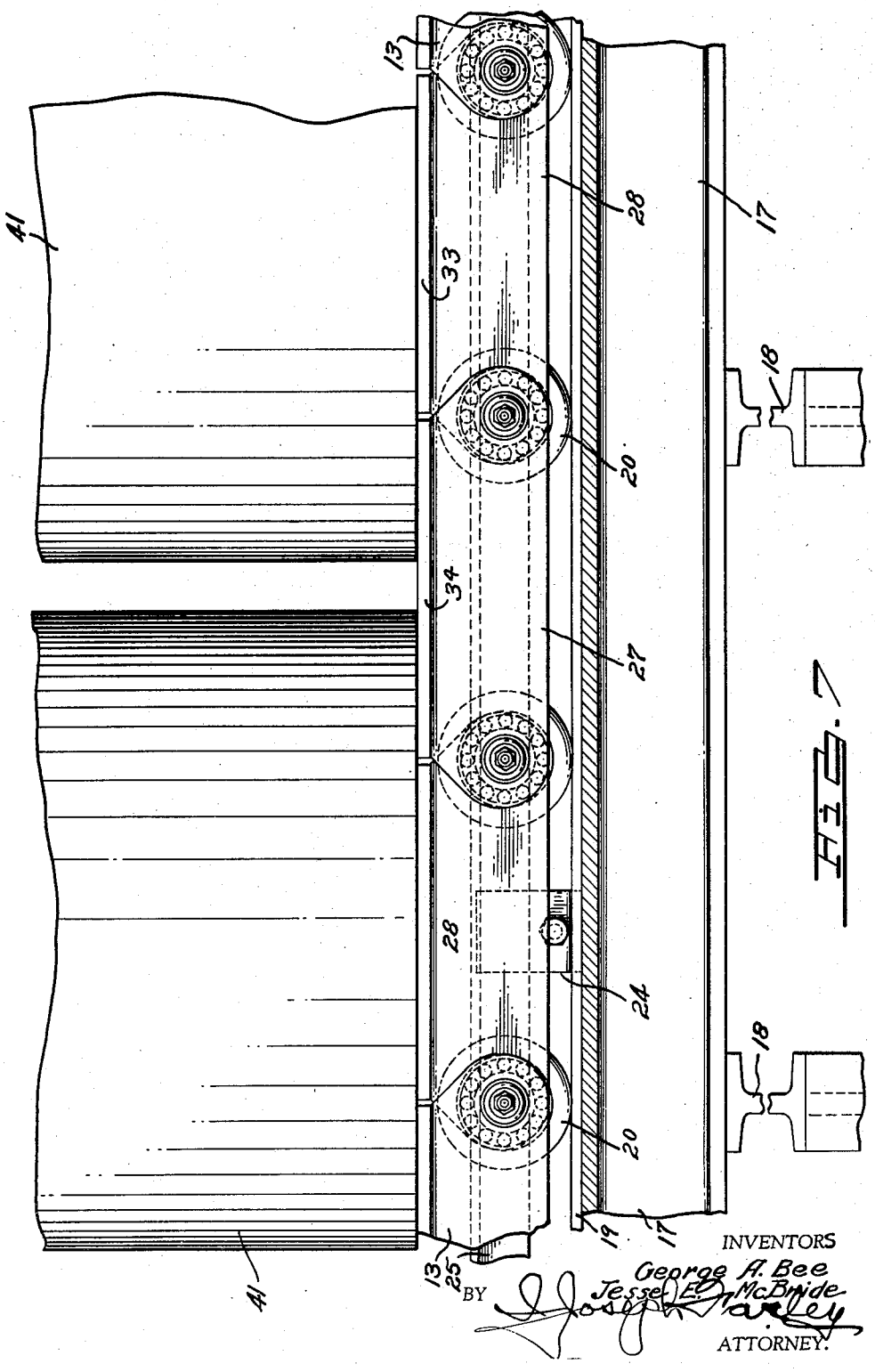

Fig. 3.

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STEEL MILL CONVEYER

Filed May 25, 1938 4 Sheets-Sheet 4

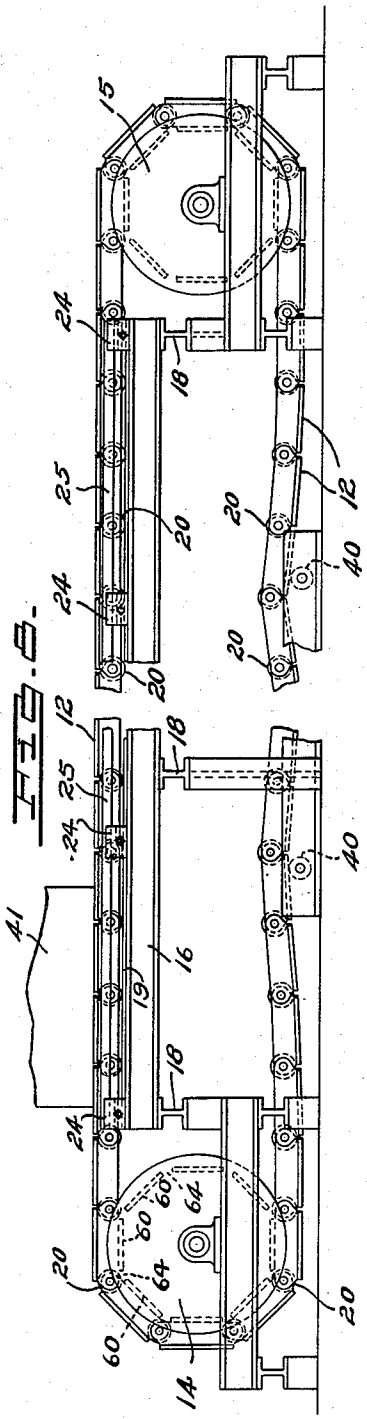

FIG. 8.

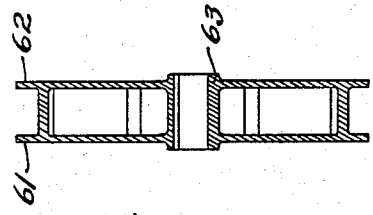

FIG. 10.

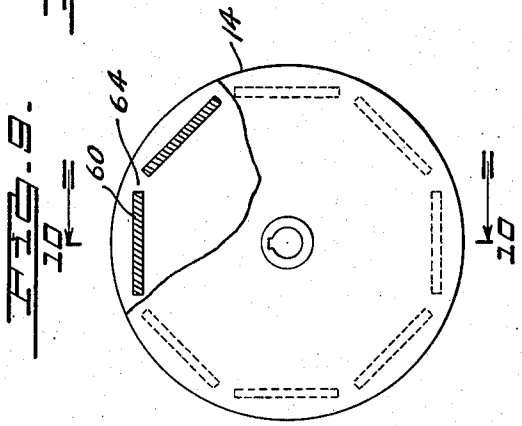

FIG. 9.

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UNITED STATES PATENT OFFICE

2,275,244

STEEL MILL CONVEYER

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Application May 25, 1938, Serial No. 210,012

5 Claims. (Cl. 198—203)

This invention relates to steel mill conveyers for use in transporting either hot or cold strip or plate steel in coils, such a conveyer being particularly useful in carrying strip or plate steel from the point in the manufacturing process where it is wound into coils to other departments of the plant.

The coils of strip steel which this type of conveyer is particularly adapted to carry are made up of sheet steel varying from very thin gauge up to #10 gauge, or $\frac{3}{16}$ inch in thickness. Various widths of this sheet steel are wound into coils starting at a core diameter of about 18 inches and winding into a coil of 54 to 60 inches in diameter. The widths of the sheets vary from about 18 to 100 or more inches and therefore the heighth of the coils will vary within this range. The weight of each of the coils varies from a few hundred pounds up to possibly 30,000 pounds and the temperature may also vary from cold or normal condition to 1500° F.

Conveying equipment for coils of strip steel usually starts at the reels where the strip is wound into a coil, the required transfer to be effected by the conveyor being anywhere from several hundred to a thousand feet depending upon the layout of the plant, the conveyer generally terminating at the coil storage.

The first conveyers for the above outlined purpose consisted of two parallel strands of block type chain sliding on a track with the coils resting directly on the top of the chain strands. This type of installation was limited to very short lengths because of the excessive friction load produced by the sliding of the chains on the track. It has been estimated that the friction load produced by the sliding chains in such an installation might be as high as 50% of the total load, an excessive amount of power therefore being required.

Although the sliding chain type of coil conveyer had not been entirely satisfactory for the short length conveyers used in the older installations it was reasonably successful. However, with changes in steel mill equipment, particularly in the use of so-called continuous strip mills, the distance of transportation increased to such an extent that the sliding chain type of equipment was very impractical. In order to decrease the friction between the sliding chains and the tracks various forms of antifriction devices were used. Most of these have been confined to a construction on which a plurality of rollers are provided to replace the track on which the chain operates. Such a construction necessitates a great number of mounting brackets and an elaborate lubrication system for the rollers, all of which must be distributed over the entire traverse of the chain, the lubrication systems in themselves entailing considerable expense for installation.

It is an object to provide a roller of large load carrying capacity at each chain joint, having an anti-friction bearing and joint construction suitable to take the superimposed load resting on the chain, and so designed that the chain side bars or links, only, engage a polygon shaped driving sprocket to transmit the full chain pull load. This construction will permit the anti-friction rollers to be free from contact with the sprocket, and the anti-friction bearings are thereby relieved from the chain pull.

It is another object to provide a construction for a conveyer carrying heavy loads and extending over a line of travel of material length mounted upon roller units with anti-friction bearings for supporting the vertical load carried on the conveyer chains, such construction being made practical by the provision of driving sprockets of such construction as to relieve the anti-friction bearing units from the chain pull load and further made practical for use by provision of inexpensive means cooperating with the chain during its travel for electively lubricating the roller units.

Reference is hereby made to our co-pending application, Serial No. 317,060 filed February 3, 1940, a division of this application.

The above and other objects of the invention will appear more fully from the following more detailed description and by reference to the accompanying drawings forming a part hereof and wherein:

Fig. 1 is a cross-section through the upper and lower runs of a conveyer of the type disclosed in this application and showing the general arrangement of the several parts.

Fig. 2 shows a proposed variation in the construction used for supporting the return run of the chain.

Fig 3 is an enlarged cross-section through the chain at one of the bearings and also includes a section through the load carrying track.

Fig. 3a is a cross-section similar to Fig. 3 but showing a modified construction for the chain guides adjacent the track.

Fig. 4 is a side view of the chain showing two complete links and portions of two other adjacent links and includes sufficient detail to indicate the relative position of the supporting rollers, the

joints of the chain and the load supporting portions thereof.

Fig. 5 is a view taken from the under side of the chain shown in Fig. 4 and shows the further details of the construction of the rollers and their assembly with the chain.

Fig. 6 is a section taken on the line 6–6 of Fig. 5 and shows the interior construction of the roller and the use of the bore of the roller as an outer race of a supporting bearing and also the use of a bushing of the chain as an inner race of said bearing.

Fig. 7 is a side view of one of the load carrying chains and its supporting track.

Fig. 8 is a side view of one of the chain strands showing the means of support for the upper and lower runs of the chain and the manner of contacting the driving sprockets.

Fig. 9 is a side view partly in section showing the details of construction of one of the sprockets used to carry the conveyer chain.

Fig. 10 is a section taken on the line 10–10 of Fig. 9.

Referring to the drawings, and particularly to Figs. 1 and 8, two tracks 10 and 11 are provided, suitably supported along a desired path of travel for the conveyer. The two chains 12 and 13 are carried on the tracks 10 and 11, such chains being of the endless type and are carried on sprockets 14 and 15, as shown in Fig. 8.

The upper load carrying tracks previously designated as 10 and 11 are preferably constructed with standard structural steel members and, as shown in Fig. 1, two extra heavy wide flanged beams 16 and 17 are used as the main supporting members of the track and are supported on suitable frames 18 of conventional construction, a sufficient number of such frames 18 being provided to adequately support the track, as shown in Fig. 8. On the top of each flanged beam track section 16 and 17 there is secured a hardened steel track member 19 to support the load by contact with downwardly projecting rollers 20 which rotate on each joint of the chain. As shown in both Figs. 1 and 3, an angle 25 with one of its legs projecting inwardly toward the chain is supported on each side of the chain above the projecting ends of the pins 23 of the chain. This support is effected by a plurality of supports 24 each comprising a clip angle 21 welded to the flanged beam 16 or 17 and a plate 22 here shown bolted to the clip angle 21 and welded to the angle 25. These supports are spaced along the chain travel at each side thereof at intervals of approximately five feet and thereby provide a support for the angles 25 while leaving an open space between the supports which in the construction shown is approximately four and one-half feet (see Figs. 7 and 8). This open space between the supports 24 makes it possible to easily clean the track and prevent the accumulation of material in and around the track which might interfere with its satisfactory operation. It is to be noted the provision of a construction which enables the track to be kept clean and free from clogging is very important with the type of conveyer particularly used for illustrating the application of this invention. The coils of strip steel, or any steel which may be transported by a conveyer of this type, invariably carry a certain amount of scale or other small particles which will fall into the track and unless provision is made to keep the track clear it will often become clogged. In fact, this has been a very troublesome problem in connection with many installations.

The coils of strip steel for the transportation of which the conveyer is primarily designed are carried by resting upon the top of the two parallel chain runs. Representative coils 41 are shown in Figs. 7 and 8.

As shown in Fig. 1, the lower return runs of the chains are supported on rolls 40 positioned so that the chains will ride thereon, the rollers 20 projecting upwardly in this reverse position of the chain. In Fig. 2 there is shown a modified form of construction for supporting the return runs of the chain, a pair of pillow blocks 45, 46, supporting a rotatable shaft 47 on which two flanged drums 48, 49 are mounted to support the chain. It is understood that a plurality of supporting units such as shown in Figs. 1 and 2 are distributed along the chain travel.

The angles 25 supported by the spaced clip angles 21 have inwardly projecting portions, as shown in Figs. 1 and 3, which overlap the projecting ends of pins 23. These inwardly projecting ends of the angles 25 extend close to but do not touch the side bar members of the chain when the chain is running substantially in the center of the track 19. The overlap of the ends of the guides as previously noted, prevents the chains from being lifted off the track, a construction which is particularly useful when magnets are used to lift the load on and off the chains. This feature of construction is also important in preventing tipping of the chains as the guides are only a short distance above the normal position of the ends of the projecting pins 23.

As shown in Fig. 3*a*, there is provided an alternate construction in which short upwardly projecting members 50 are welded or otherwise secured to the flanged beam 16 or 17 at each side of the chain to serve as retaining members to hold the chain from sliding off the track. This construction would be used when there was no requirement of preventing the lifting of the chain by a magnet and the spaced positioning of the members would assure easy cleaning of the track as in the preferred construction.

The chains 12 and 13 are of identical construction, which construction is shown in detail in Figs. 3, 4, 5 and 6. There are two types of links in the chain as used in this construction—a wide link such as is shown at 27 in Fig. 5 and a narrow link such as is shown at 28 in Fig. 5. Each of the narrow and wide links has two side bar members and except for their spacing are substantially identical in construction, the side bar members in the narrow link being spaced at a shorter distance than those in the wide link. This construction is evident on inspection of Fig. 5, the side bar members for the narrow link being indicated at 29 and 30, while the corresponding members for the wide link are shown at 31 and 32. These side bars are also shown in Fig. 3.

On top of each of the links there is secured a load carrying plate designated as 33 for the narrow link and 34 for the wide link, these plates being of similar construction for each of the links. It will be apparent from Figs. 3, 4 and 5 that with the provision of suitable openings in the ends of the side bar members the narrow and wide links may be connected together by the pin 23 previously mentioned. These pins are of greater length than the spacing of the wide link side bar members 31 and 32 so that the pins project outwardly from the chain, as shown in Figs. 3 and 5. A bushing 35 is used at each chain joint and extends into the end openings of the narrowly spaced side bar

members 29 and 30 and serves as the inner race of a bearing for supporting the roller 20.

The detailed construction of the bearing for supporting the downwardly projecting roller 20 on each joint of the chain is shown in cross-section in Figs. 3 and 6 wherein the bushing 35, which is the same shape as the bushing generally used on this type of chain, here serves as the inner race of a roller bearing for supporting the roller 20 on the chain joint. The anti-friction bearing here shown is of the roller type and a plurality of rollers 37 are shown retained between the bushing 35, which forms an inner race, and the bore of the roller 20, which serves as the outer race of the bearing.

As shown in Fig. 3, annular shaped bronze or cast iron end plates 38 and 39 are fastened into the ends of the bore of the roller 20 between the roller and the inner surfaces of the adjacent side bar members 29 and 30. A small clearance is provided between the inner circumference of the end plates 38 and 39 and the outer circumference of the bushing member 35 so as to allow the roller 20 to be entirely supported upon the plurality of rollers 37, but the said clearance is sufficiently small so that lubricant is retained within the bearing by the end plates. The thickness of the end plates 38 and 39 is such that only a small clearance is allowed between the surfaces of the end plates and the adjacent side bar members thereby providing a suitable thrust bearing between the ends of the roller and the side bar members.

As will be noted by reference to Fig. 1, the two chains are mounted parallel to each other and are enabled to roll on a hardened track member 19 by provision of the roller units at each joint of the chains. There is no connecting member between the two parallel chains, the space between the chains being free from interfering members to provide room for mechanism to load the coils onto the conveyer and also to allow space for automatic transfer mechanism which is sometimes used to effect transfer of the coils from one conveyer line to another.

As previously noted and as shown in Fig. 8, each of the chains is carried around a pair of sprockets 14 and 15, one of which is located at each end of the line of travel of the chain. In designing the anti-friction bearings of the rollers which project downwardly from each joint of the chain and support it upon the track, consideration is given only to the vertical load imposed by the coils of steel 41 or other material which is to be carried by the conveyer. It has been found impractical to design the anti-friction bearings of the rollers to withstand a maximum load which might be imposed upon them if they were to contact the driving sprocket and therefore be subjected to the large chain pull load imposed by a conveyer of considerable length. In order to fulfill this requirement of design it is imperative that some part of the chain, other than the rollers, contact the driving sprocket. Such a result is accomplished, as shown in Figs. 8, 9 and 10, by the provision of a special type of sprocket 14 which may be descriptively designated as a polygon sprocket. The construction of this sprocket is shown in Figs. 9 and 10 where a plurality of rectangular flat plates 60 are shown welded or otherwise secured between two circular plates 61 and 62, these latter plates being suitably secured to a central hub member 63. The plates 60 are of such length and so positioned as to leave a space 64 between the ends of adjacent plates the space being of such size and position that the roller 20 at each chain joint positions itself in a space 64 without contacting either of the adjacent plates. The manner of contact of the chain is best understood by reference to Fig. 8 where it will be noted that each of the links of the chain has its side bar members resting upon a straight plate section 60, this plurality of contacts with the sprocket taking the entire driving load between the chain and the sprocket, the spaces 64 providing means to prevent rollers 20 from contacting the sprocket. It is obvious that the pins of the chain take the chain pull load in exactly the same manner as would be the case if the roller members were not provided. By the use of this polygon type of sprocket it is therefore possible to design the anti-friction bearings for the rollers of the chain with consideration only for the vertical load to be carried, which load has been found in actual practice to be materially less than the chain pull loads on conveyers of a length such as now used in modern manufacturing establishments.

The problem of construction of a conveyer for carrying heavy loads over long paths of travel with a minimum of friction is solved in the disclosure of this application by a combination of several features. First of all, the chain is mounted for rolling movement on a plurality of rollers with anti-friction bearings which eliminates a considerable amount of friction in the chain. However, it would not be practical to use this construction on a conveyer of great length if the anti-friction bearings had to withstand the chain pull load imposed upon them when the rollers contacted a driving sprocket at the end of the conveyer travel. Therefore, the provision of the polygon type of sprocket which transfers the chain pull load directly through the side bars of the chain without contacting the rollers is a very important element in the combination which makes this conveyer unit a practical construction for use in modern steel mills.

Although we have described our invention as applied to a particular conveyer unit found practical in operation, we do not desire to limit ourselves to the specific details disclosed herein, but rather to the scope of the following claims.

We claim:

1. In a conveyer, a pair of transversely spaced parallel supporting tracks, a pair of load carrying chains one on each of said tracks, each of said chains being supported and driven upon its respective track, rollers mounted on and projecting below said chains for support thereof entirely on said tracks and for reducing the friction between said chains and said tracks, a driving sprocket for each of said chains having a plurality of straight sections so positioned as to provide spaces between the ends thereof whereby contact of said sprockets is made only with portions of said chains between said rollers.

2. In a conveyer of the type employing a pair of parallel load supporting chains mounted on parallel tracks each independently supporting one of said chains for carrying a load on both of said chains, each of said chains having anti-friction rollers projecting below the chain joint pins thereof, sprockets for each of said chains having a plurality of spaces positioned to contact the chains independently of said rollers, whereby said chains are supported on said roller members during their travel on said tracks and on said chains independently of said rollers during the travel around said sprockets.

3. In a conveyer, a track, a chain, rollers

spacedly mounted on and projecting below said chain to support said chain for rolling support on said track and for reducing the friction between said chain and said track, a driving sprocket for said chain having a plurality of straight sections so positioned as to provide spaces between the ends thereof whereby driving contact of said sprocket is made only with portions of said chain between said rollers.

4. In a conveyer of the type employing a load supporting chain, a track, roller members spacedly mounted on and projecting below said chain to support said chain for rolling support on said track, a driving sprocket for said chain, contacting members on said sprocket so spaced relative to said spacedly mounted roller members as to provide spaces to receive said roller members and to assure driving contact on portions of said chain independently of said roller members, whereby said chain is supported on said roller members during travel on said track and driven by said sprocket by contact with portions of said chain independently of said roller members.

5. In a conveyer, a track, a load carrying chain comprising a plurality of links, chain joint pins connecting said links, roller members mounted on said chain joint pins and projecting below said links to support said chain for rolling support on said track, a driving sprocket for said chain having a plurality of spaced driving sections so positioned as to provide spaces between the ends thereof and of such length as to contact said chain links independently of contact with said roller members, whereby said chain is supported on said roller members during travel on said track and driven by said sprocket solely by contact with said links independently of said roller members.

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